United Nations ECE/ENERGY/GE.3/2021/11

Economic and Social Council

Distr.: General
12 February 2021

Original: English

Economic Commission for Europe

Expert Group on Resource Management

Twelfth session
Geneva, 26-30 April 2021
Item 8(d) of the Provisional Agenda
Development, maintenance and implementation of the United Nations Framework Classification for Resources:
Nuclear fuel resources

Draft United Nations Framework Classification for Resources Supplemental Specifications for Nuclear Projects

Prepared by the Expert Group on Resource Management Nuclear Fuel Resources Working Group

Summary

The purpose of this document is to provide rules for the application of the United Nations Framework Classification for Resources (UNFC) to nuclear projects in alignment with the 2030 Agenda for Sustainable Development. Together with the UNFC Generic Specifications, these specifications and guidelines provide the foundation and keystones for consistent application of UNFC to nuclear projects. The development of this document will take into consideration comments received from the Technical Advisory Group of the Expert Group on Resource Management and feedback from the twelfth session of the Expert Group on Resource Management. This document incorporates the changes introduced by the recent update of UNFC (2019).

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Acknowledgements

This document was prepared by the Nuclear Fuel Resources Working Group of the Expert Group on Resource Management of the United Nations Economic Commission for Europe (ECE). The Technical Advisory Group of the Expert Group is thanked for reviewing the document and for the valuable comments provided.

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I. Introduction

1. The purpose of this document is to provide rules for the application of the United Nations Framework Classification for Resources (UNFC) to nuclear projects in alignment with the Sustainable Development Goals (SDGs). Together with the UNFC Generic Specifications, these specifications provide the foundation and keystones for consistent application of UNFC to nuclear projects. Supplemental specifications will evolve over time and be revised at regular intervals due to updates of UNFC, lessons learned and results from expert discussions during workshops and conferences. Any proposals for revisions can be addressed to: reserves.energy@un.org.

2. This document includes the application of UNFC to different steps of the nuclear fuel cycle: how this could be done in a consistent manner for different projects, each with different sets of sources and products; how to manage the risks of double-counting the same energy from different projects in the cycle and how to compare different types of projects requires further discussion and clarification. The specifications recommend the reporting of quantities in equivalent energy units (Exajoules (EJ)) for all products, which requires further discussions and clarification. The specifications include reporting on additional information related to projects according to environmental-socio-economic viability and technical feasibility, which are related to the sustainability of a project. Whether these aspects should be included in the main document or moved to an annex will require discussions and careful consideration in the next revision.

II. Scope

3. This document provides supplemental specifications as the context for classification and reporting of nuclear projects using UNFC and aligned to the SDGs. UNFC provides a unified classification scheme for nuclear projects, including raw material (uranium (U) and thorium (Th)) production, refining, conversion, enrichment, and spent fuel management.

4. Sustainable resource management and adequate resources are key to realisation of the 2030 Agenda for Sustainable Development. The relevant SDGs in this respect are 1, 2, 5, 6, 7, 9, 10, 11, 12, 13, 15 and 17. It should also be mentioned that SDG 13 mirrors the Paris Agreement to combat climate change. Energy is crucial for achieving the SDGs, from its role in the eradication of poverty through advancements in health, education, clean water supply and industrialisation, to combating climate change.

5. Accurate and consistent estimates of energy and raw material resources, though important for classification and management of resources, is not the only metric that is important. The estimates will have to be coherent with other scientific and socio-environmental-economic information, and together they provide the foundation for meaningful assessments and decision making according to local and regional needs and priorities.

6. These supplemental specifications provide instructions on using UNFC for classifying nuclear projects taking into consideration the full-cycle and service nature of the industry. Uranium and thorium and the associated fuel cycle steps in the front- and the back-end predominately operate as a service. The use of these specifications will ensure that maximum resource efficiency and progress towards circular economy in the fuel cycle are ensured as required by the SDGs.

III. Guidelines for the application of key instructions in UNFC

7. Part II Annex III of UNFC (Update 2019) (United Nations Economic Commission for Europe (ECE) Energy Series No. 61 and ECE/ENERGY/125) applies to this section. Text from UNFC (2019) is provided in italics.

8. The nuclear industry quantifies resources in terms of energy units (joules) not tonnes (or pounds) of metal, but the energy potential of nuclear projects can be quantified only if the full life cycle is understood. Certain countries consider nuclear power to be a sustainable,

low carbon source of electricity and intend to use it as part of their energy transition. The amount of nuclear technology used for energy generation determines the volumes of nuclear fuel that will be required. Also critical are the used-fuel management capacity and aspects of fuel recycle and reuse, all of which will shape the limits of nuclear energy use.

9. The nuclear fuel cycle is to be seen as a fully integrated system. Fragmenting it into discrete disciplines and activities – mining, processing, refining, conversion, enrichment, irradiation in reactors, waste management – will defeat the aspiration to be more resource-efficient. Policymakers and investors are demanding improved social and environmental performance as the purposes of measuring that performance evolve towards a new normal.

10. The traditional approach of dividing activities into different segments for operational ease has been common practice in the industry. The approach is changing rapidly, and nuclear companies are becoming more integrated vertically across the entire value chain, including their suppliers and customers. The additional specifications and context provided in this document are a first step towards sustainable and integrated management of nuclear fuel resources.

11. In these Supplemental Specifications, the following words have specific meanings:

- "Shall" is used where a provision is mandatory
- "Should" is used where a provision is preferred, and
- "May" is used where alternatives are equally acceptable.

12. Where a specification is defined in the next section, this sets a minimum standard/criterion for the classification and reporting of nuclear projects under UNFC.

IV. Normative references

13. Application of UNFC to nuclear projects is a package of documents with the following hierarchical levels:

(a) Principles: UNFC and Generic Specifications (2019);[1]

(b) Supplemental specifications for nuclear projects: This document (2021);

(c) UNFC generic guidelines;[2]

(d) Additional nuclear guidelines and best practices:

- Guidelines for the Application of United Nations Framework Classification for Resources to Uranium and Thorium Projects, UNECE Energy Series 55 (2017)[3]
- Redesigning the Uranium Resource Pathway: Application of the United Nations Framework Classification for Resources for Planning and Implementing Sustainable Uranium Projects (2019)[4]

[1] UNECE (2019) United Nations Framework Classification for Resources Update 2019 (ECE Energy Series No. 61) https://www.unece.org/energywelcome/areas-of-work/unfc-and-sustainable-resource-management/publications/unfc-and-sustainable-resource-management/2019/united-nations-framework-classification-for-resources-update-2019-ece-energy-series-no-61/docs.html

[2] See UNFC generic guidelines https://unece.org/sustainable-energyunfc-and-sustainable-resource-management/unfc-documents

[3] UNECE (2017). Guidelines for Application of the United Nations Framework Classification for Fossil Energy and Mineral Reserves and Resources 2009 for Uranium and Thorium Resources. United Nations Economic Commission for Europe (UNECE). Geneva. Retrieved from: https://www.unece.org/fileadmin/DAM/energy/images/pub/1734723E_WEB.pdf.

[4] UNECE (2019) Redesigning the Uranium Resource Pathway: Application of the United Nations Framework Classification for Resources for Planning and Implementing Sustainable Uranium Projects; https://www.unece.org/index.php?id=52290

- Application of the United Nations Framework Classification for Resources and the United Nations Resource Management System: The Role of Nuclear Energy in Sustainable Development - Entry Pathways (2020).[5]

(e) Bridging Document: Application of the United Nations Framework Classification for Fossil Energy and Mineral Reserves and Resources 2009 to Nuclear Fuel Resources, Bridging Document between the Organisation of Economic Co-operation and Development Nuclear Energy Agency/International Atomic Energy Agency Uranium Classification and UNFC-2009 (2014);[6]

(f) Case studies:

- Application of UNFC-2009 to Nuclear Fuel Resources – Selected case studies (2015)[7]
- Application of UNFC: Case Studies (2019).[8]

V. Terms and definitions

A. Nuclear Sources, Products and Services

14. The current commercial generation of nuclear energy is based on nuclear fission of uranium- or thorium-based fuels. Plutonium (Pu) isotopes and other isotopes of uranium recovered from spent fuels also can be used as nuclear fuels. Various nuclear reactor designs are used to fission these isotopes and produce energy in the form of electricity or heat.

15. Uranium is an element that is widely distributed within the earth's crust. Its principal use is as the primary fuel for nuclear power reactors. Naturally occurring uranium is composed of about 99.3 per cent uranium-238 (^{238}U), 0.7 per cent uranium-235 (^{235}U) and traces of uranium-234 (^{234}U). In order to utilise the uranium that is recovered from the ground, it must be produced from the ore and converted into a form that can be used in the nuclear fuel cycle.

16. Thorium is considered as a potential fuel for present and future generation nuclear reactors. Most of the largest identified thorium deposits were discovered during the exploration of carbonatites and alkaline igneous bodies for uranium, rare earth elements, niobium, phosphate, and titanium. The primary source of the world's thorium is the rare-earth and thorium phosphate mineral, monazite. Monazite itself is sometimes recovered as a by-product of processing heavy-mineral sands for titanium and zirconium minerals.[9]

17. Fissile materials may undergo several steps before utilisation to produced nuclear energy. These steps are included in the nuclear fuel cycle, as described in the section below. Various nuclear products or services are delivered at the end of each step of the nuclear fuel

[5] UNECE (2021) Application of the United Nations Framework Classification for Resources and the United Nations Resource Management System: The Role of Nuclear Energy in Sustainable Development - Entry Pathways DRAFT https://www.unece.org/fileadmin/DAM/energy/se/pdfs/UNFC/UNFC_The_Role_of_Nuclear_Energy_in_Sustainable_Development_Public_Comment/The_Role_of_Nuclear_Energy_in_Sustainable_Development.pdf

[6] UNECE (2014) Bridging Document between the Organisation of Economic Co-operation and Development Nuclear Energy Agency/International Atomic Energy Agency Uranium Classification and UNFC-2009 https://www.unece.org/fileadmin/DAM/energy/se/pdfs/comm23/ECE.ENERGY.2014.6_e.pdf

[7] UNECE (2015) Application of UNFC-2009 to Nuclear Fuel Resources – Selected case studies https://www.unece.org/index.php?id=47682

[8] UNECE (2019) Application of UNFC: Case Studies https://www.unece.org/index.php?id=54350

[9] Van Gosen, B.S., and Tulsidas, Harikrishnan, 2016, Thorium as a nuclear fuel (Chapter 10), in Hore-Lacy, Ian, ed., Uranium for nuclear power—Resources, mining and transformation to fuel: Amsterdam, Elsevier Ltd., Woodhead Publishing Series in Energy, Number 93, p. 253–296. https://doi.org/10.1016/B978-0-08-100307-7.00010-7

cycle. For each product or service, the quantities shall be provided in units of weight in tonnes of heavy metal (tHM) (e.g., tU, tTh or tPu) and its energy equivalent in exajoules (EJ) (See Supplemental Specifications below for more details).

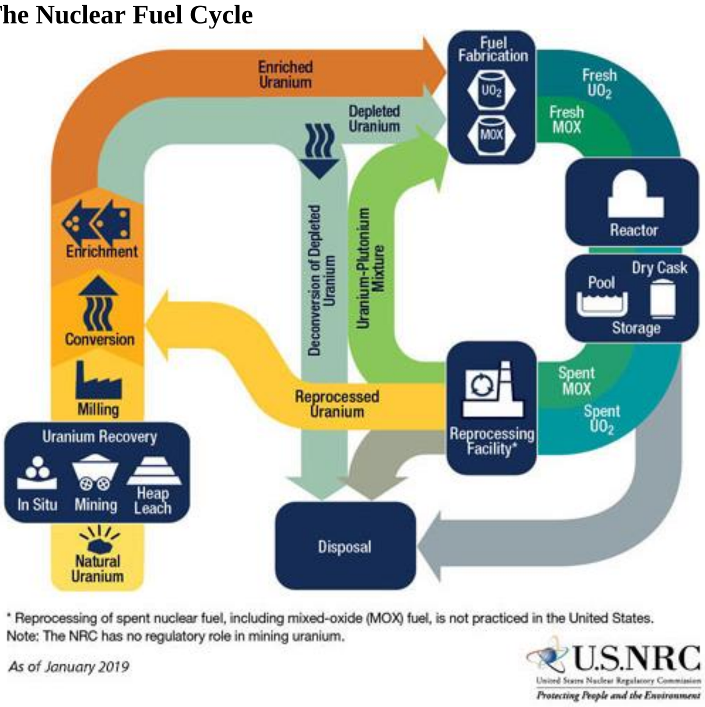
18. While reporting various products or services, care should be taken to avoid double counting.

B. Nuclear fuel cycle

19. Building and operating nuclear power plants is the main ultimate objective of a nuclear energy programme. Still, these achievements must be supported by a range of facilities and activities which, taken together, constitute the nuclear fuel cycle (Figure I). This includes:

- Front-end
  - Exploration: activities related to the finding and development of the uranium and thorium
  - Mining: activities related to the production of uranium and thorium
  - Processing: activities related to the milling and refining of the ore to produce concentrates including in-situ leaching
  - Conversion: activities related to the refining and conversion to the form which is suitable for any of the other processes
  - Enrichment: activities related to the isotopic enrichment of UF6 to obtain the appropriately enriched ^{235}U concentration
  - Fuel fabrication: activities related to the production of nuclear fuel to be inserted in the nuclear reactor.

Figure I
The Nuclear Fuel Cycle



- Irradiation/Nuclear reactor operation: The fuel is inserted in the reactor and irradiated. Nuclear fission takes place, with the release of energy
- Back-end

- At-reactor (AR) spent fuel storage: activities related to the storage of spent fuel in at reactor spent fuel storage facilities (wet type) for an interim period. The storage is by definition an interim measure
- Away from the reactor (AFR) spent fuel storage: activities related to the storage of spent fuel in away-from-reactor spent fuel storage facilities (wet or dry type) for an interim period
- Spent fuel reprocessing and recycling: activities related to the special treatment of spent fuel to be able to produce the usable materials and to recycle them in the reactors
- Spent fuel conditioning: activities related to the production of spent fuel packages suitable for handling, transport, storage and/or disposal
- Disposal of spent fuel: activities related to the emplacement of spent fuel/wastes in an appropriate facility without the intention of retrieval.

20. Naturally occurring nuclear sources such as uranium and thorium to date have been broadly and perhaps arbitrarily classified as either “conventional” or “unconventional”. These terms are largely coloured by whether uranium recovery is the core business of the mining company concerned or a (valued) co- or by-product of a different primary mineral target, e.g. phosphates. In an integrated system, all uranium resources may be better placed according to the quantity of energy units they provide.

21. A deposit of uranium or thorium is discovered by various exploration techniques, which is then evaluated to determine the amounts of uranium materials that are recoverable at specified costs. Uranium quantities are the amounts of material (either in U or U oxide (triuranium octoxide or U_3O_8)) that are estimated to be recoverable at stated costs.[10]

22. Conventional mining of uranium and thorium ores can be by open-cut and underground methods.[11] In some cases, uranium is recovered as a by-product, for example in the processing of some types of copper deposits. Mined uranium ores are normally processed by grinding the ore materials to uniform particle size and then treating the ore to recover the uranium by chemical leaching, typically with sulfuric acid. The milling process commonly yields dry powder-form material consisting of natural uranium, “yellowcake,” (approximately 75 per cent U), which is sold on the uranium market as U_3O_8.

23. Heap leaching and in-place leaching (also called stope or block leaching) are other commonly used methods of uranium production. Heap leaching involves the use of a leaching facility on the surface once the ore has been mined, whereas stope/block leaching involves the production of uranium from broken ore without removing it from an underground mine. Small amounts of uranium are also recovered from mine water treatment and environmental restoration activities.

24. Over the past two decades, in-situ leach (ISL) mining of uranium (also referred to as in-situ recovery ISR), which uses either acid or alkaline solutions to produce the uranium directly from the deposit, has become increasingly dominant. The uranium dissolving solutions are injected into and recovered from the ore-bearing zone situated at various depths using a system of production wells; typically, from 5-point or 7-point production cells. ISL technology is currently being used to produce uranium only from sandstone deposits, which are typically roll-front deposits, reaching 57 per cent of the total global uranium production in 2019.

25. Thorium is recovered mainly from the mineral monazite as a by-product of processing heavy-mineral sand deposits for titanium-, zirconium-, or tin-bearing minerals. At some operations, thorium minerals are stockpiled for future use.

[10] Organisation for Economic Co-operation and Development (OECD) Nuclear Energy Agency (NEA) and the International Atomic Energy Agency (IAEA) (2018). Uranium 2018: Resources, Production and Demand. OECD Report No. 7413, 459 p

[11] See Hore-Lacy, Ian, ed., Uranium for nuclear power—Resources, mining and transformation to fuel: Amsterdam, Elsevier Ltd., Woodhead Publishing Series in Energy, Number 93

C. Nuclear project

[This section will require additional inputs, which will be implemented in the next revision.]

26. A nuclear project is a defined operation in the nuclear fuel cycle that provides the basis for environmental, social, economic and technical evaluation and decision-making. In the early stages of evaluation, including verification, the nuclear project might be defined only in conceptual terms. In contrast, more mature projects will be defined in considerable detail.

27. With the exception of uranium mines upfront in the cycle, most fuel cycle facilities need to be adapted for specific reactor technologies.

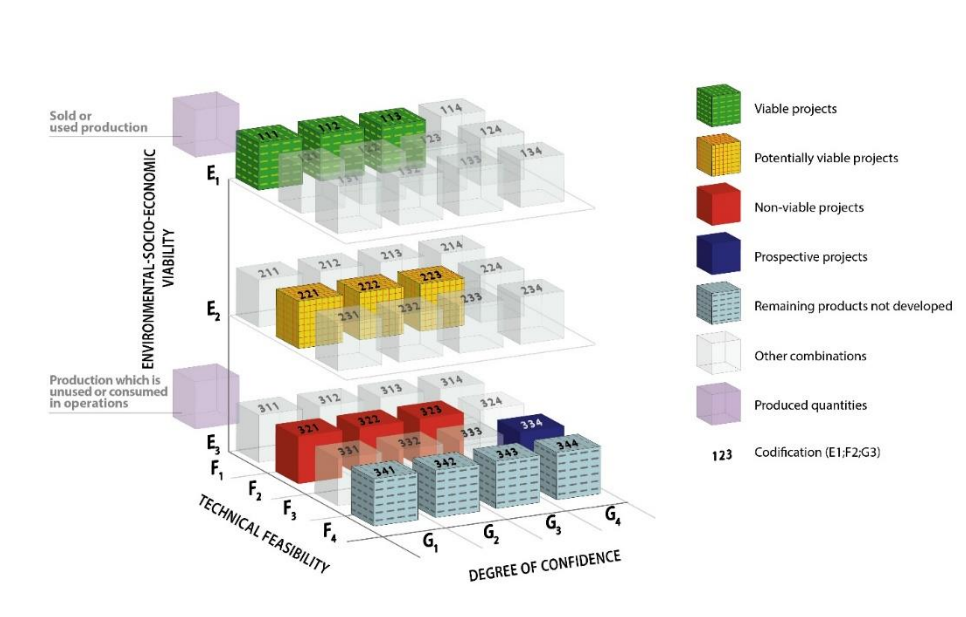
D. Categories and Sub-categories

28. UNFC is a generic principles-based system in which resources are categorised along three axes (Figure II)

- Environmental-Socio-Economic Viability (E Axis)
- Technical Feasibility (F Axis)
- Degree of Confidence (G Axis).

29. Each axis is divided into categories (e.g. E1, E2, and E3) and subdivided into Sub-categories (e.g. E1.1, E1.2) (Figure III). The definitions of Categories and Sub-categories are provided in UNFC (2019) and Generic Specifications.[12]

Figure II
UNFC Categories and Examples of Classes



30. *UNFC is a principles-based system in which the products of a resource project are classified on the basis of the three fundamental criteria of environmental-socio-economic viability (E), technical feasibility (F), and degree of confidence in the estimate (G), using a numerical coding system. Combinations of these criteria create a three-dimensional system. Categories (e.g. E1, E2, E3) and, in some cases, sub-categories (e.g. E1.1), are defined for*

[12] UNECE (2019) United Nations Framework Classification for Resources Update 2019 (ECE Energy Series No. 61 and ECE/ENERGY/125) https://www.unece.org/energywelcome/areas-of-work/unfc-and-sustainable-resource-management/publications/unfc-and-sustainable-resource-management/2019/united-nations-framework-classification-for-resources-update-2019-ece-energy-series-no-61/docs.html

each of the three criteria. The first set of Categories (the E axis) designates the degree of favourability of environmental-socio-economic conditions in establishing the viability of the project, including consideration of market prices and relevant legal, regulatory, social, environmental and contractual conditions. The second set (the F axis) designates the maturity of technology, studies and commitments necessary to implement the project. These projects range from early conceptual studies through to a fully developed project that is producing and reflect standard value chain management principles. The third set of categories (the G axis) designates the degree of confidence in the estimate of the quantities of products from the project. The Categories and Sub-categories are the building blocks of the system and are combined in the form of "Classes".

E. Classes

31. *A class is defined by selecting a particular category or sub-category from each of the three criteria (E Axis; F Axis; G Axis). A class is uniquely defined by its codification (e.g. E1; F1; G1) (Figure III). Any combination of categories is possible, to form classes and sub-classes. Typically, Projects involve quantities in several classes or sub-classes.*

Figure III

UNFC Classes and Sub-classes defined by Sub-categories

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

F. Sub-classes

32. Sub-classes provide further granularity when classifying and reporting nuclear projects.

G. Definition of Categories and Sub-categories

33. The definitions of Categories and supporting explanations provided in UNFC (2019) Part I Annex I are generally applicable for the nuclear fuel cycle. The definitions of Sub-categories provided in UNFC (2019) Part I Annex II are also generally applicable for the nuclear fuel cycle.

34. Additional specifications and context for nuclear projects are provided in the following sections. The following Tables 1 to 5 provide the definitions of Categories and Sub-categories. Text from UNFC (2019) is provided in italics. In these tables, some terms with particular meanings are used:

Foreseeable Future: The period of time that a Project can make a reasonable projection of the occurrence of future conditions, events or other factors that determine the environmental-socio-economic viability or technical feasibility of a Project.

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.

Table 1
E-Axis categories (UNFC (2019) in *italics*)

Category	*Definition*	*Supporting explanation for nuclear*
E1	*Development and operation are confirmed to be environmentally-socially- economically viable.*	*Development and operation* in the nuclear fuel cycle *are environmentally-socially-economically viable on the basis of current conditions and realistic assumptions of future conditions. All necessary conditions have been met (including relevant permitting and contracts) or there are reasonable expectations that all necessary conditions will be met within a reasonable timeframe and there are no impediments to the delivery of the product to the user or market. Environmental-socio-economic viability is not affected by short-term adverse conditions provided that longer-term forecasts remain positive.*
E2	*Development and operation are expected to become environmentally-socially-economically viable in the foreseeable future.*	*Development and operation* in the nuclear fuel cycle *are not yet confirmed to be environmentally-socially-economically viable but, on the basis of realistic assumptions of future conditions, there are reasonable prospects for environmental-socio-economic viability in the foreseeable future.*
E3	*Development and operation are not expected to become*	*On the basis of realistic assumptions of future conditions, it is currently considered that there are not reasonable prospects for environmental-socio-economic viability of* nuclear

Category	Definition	Supporting explanation for nuclear
	environmentally-socially-economically viable in the foreseeable future or evaluation is at too early a stage to determine environmental-socioeconomic viability.	products *in the foreseeable future; or, environmental-socio-economic viability cannot yet be determined due to insufficient information (*e.g. production, conversation, enrichment, fuel fabrication *). Also included are estimates associated with projects that are forecast to be developed, but which will be unused or consumed in operations.*

Table 2
E-Axis Sub-categories (UNFC (2019) text in *italics*)

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

Table 3
F-Axis Categories (UNFC (2019) text in *italics*)

Category	Definition	Supporting explanation for nuclear projects
F1	*Technical feasibility of a development project has been confirmed.*	*Development or operation is currently taking place or, sufficiently detailed studies have been completed to demonstrate the technical feasibility of development and operation. A commitment to develop should have been or will be forthcoming from all parties associated with the project, including governments.*
F2	*Technical feasibility of a development project is subject to further evaluation.*	*Preliminary studies of a defined project provide sufficient evidence of the potential for the development and that further study is warranted. Further data acquisition and/or studies maybe required to confirm the feasibility of development.*
F3	*Technical feasibility of a development project cannot be*	*Very preliminary studies of a project indicate the need for further data acquisition or study in order to evaluate the potential feasibility or development.* Additional studies required to confirm or to assess the technical feasibility of the project.

Category	Definition	Supporting explanation for nuclear projects
	evaluated due to limited data.	
F4	*No development project* or nuclear operation *has been identified.*	*Remaining quantities of product not developed by any project* (not recoverable material, losses etc.).

Table 4
F-Axis Sub-categories (UNFC (2019) text in *italics*)

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

Table 5
G-Axis Categories (UNFC (2019) text in *italics*)

Category	*Definition*	*Supporting explanation for nuclear*
G1	*Product quantity associated with a project that can be estimated with a high level of confidence.*	*Product quantity estimates may be categorised discretely as G1, G2 and/or G3 (along with the appropriate E and F Categories), based on the degree of confidence in the estimates (high, moderate and low confidence, respectively) based on direct evidence.* *Alternatively, product quantity estimates may be categorised as a range of uncertainty as reflected by either (i) three specific deterministic scenarios (low, best and high cases) or (ii) a probabilistic analysis from which three outcomes (P90, P50 and P10) are selected. In both methodologies (the "scenario" and "probabilistic" approaches), estimates are then classified on the G Axis as G1, G1+G2 and G1+G2+G3 respectively. In all cases, the product quantity estimates are those associated with a project.* *The G axis Categories are intended to reflect all significant uncertainties (e.g. source uncertainty, geologic uncertainty, facility efficiency uncertainty, etc.) impacting the estimate forecast for the project. Uncertainties include variability, intermittency and the efficiency of the development and operation (where relevant). Typically, the various uncertainties will combine to provide a full range of outcomes. In such cases, categorisation should reflect three scenarios or outcomes that are equivalent to G1, G1+G2 and G1+G2+G3.*
G2	*Product quantity associated with a project that can be estimated with a moderate level of confidence.*	
G3	*Product quantity associated with a project that can be estimated with a low level of confidence.*	
G4	*Product quantity associated with a Prospective Project, estimated or postulated primarily on indirect evidence.*	*A Prospective Project is one where the existence of a developable product is based primarily on indirect evidence and has not yet been confirmed. Further data acquisition and evaluation would be required for confirmation.* *Where a single estimate is provided, it should be the expected outcome but, where possible, a full range of uncertainty should be calculated for the prospective project. In addition, it is recommended that the chance of success (probability) that the prospective project will progress to a Viable Project is assessed and documented.*

VI. Supplemental specifications

35. The following are the supplementary specifications and context for nuclear projects.

A. Project plan and definition

36. The nuclear project should be defined within one or more of the nuclear fuel cycle steps mentioned previously (Section IV B). The nuclear project provides the basis for environmental, social, economic and technical evaluation and decision-making.

B. Project evaluation

1. Environmental-socio-economic viability

37. The E Axis is labelled "Environmental-socio-economic viability". It expresses in varying degrees the necessity, sufficiency and favourability of social, environmental and economic conditions for establishing the viability of the nuclear project. These include consideration of market prices and relevant legal, regulatory, environmental and contractual

conditions. When nuclear projects are assessed using UNFC, attention should be paid to understand the impacts on the SDGs such as:

- Direct, indirect and induced high skilled and well-paying jobs (SDG 1)
- Support to sustainable food production (SDG 2)
- Support to the health infrastructure and improving public health by reducing the pollution levels (SDG 3)
- Support to science and technology education (SDG 4)
- Energy access to enhance labour emancipation and reduce jobs involving drudgery, which disproportionately affects women (SDG 5)
- Clean Water and Sanitation: Support to desalination facilities (SDG 6)
- Support to the green energy transition (SDG 7)
- Support to a diverse range of jobs, including various engineers, technicians, and other specialists (SDG 8)
- Enabling plants to operate at greater safety and performance levels (SDG 9)
- Engaging stakeholders including indigenous and marginalised groups (SDG 10)
- Support to urban development and improving e-mobility (SDG 11)
- Improving resource efficiency (SDG 12)
- Support to deep decarbonization of energy-intensive industry (SDG 13)
- Preventing ocean acidification or other chemical emissions (SDG 14)
- Enhancing biodiversity (SDG 15)
- Supporting the development of strong national institutions committed to human rights (SDG 16)
- Partnerships with governments, industry, NGOs, and educational institutes (SDG 17).

The following additional specifications are provided for defining the E-axis criteria.

Climate action

38. Nuclear fission is a reliable, high-capacity, high-load mode of electricity generation, that can complement various renewable energy technologies that are low-capacity, moderate-load, and intermittent operation. The potential climate mitigation benefit of a nuclear project – as a low-carbon energy source in its own right and as an enabler of other low-carbon technology – should be explained in the assessments.

Policy, regulations and governance

39. Nuclear projects should satisfy basic principles of peaceful use when applied to the classification and beneficial use of nuclear projects in the generation of energy:

- Benefits: Nuclear projects should be characterised by utilising best practices that contribute to long-term management of the nuclear fuel cycle. An understanding of the availability of nuclear sources is essential for the planning and development of all aspects of the utilisation of the nuclear fuel cycle
- Transparency: Information on nuclear technologies, good practices across the nuclear fuel cycle, and on the associated risks and benefits should be distributed and discussed, engaging stakeholders and the general public
- Protection of People and the Environment: Effective legislation, regulation, monitoring and technological provisions should be developed and implemented for the protection of people and the environment at all stages of the nuclear fuel cycle
- Security: Nuclear security measures should be addressed and implemented during all stages of the nuclear cycle

- Non-Proliferation: Non-proliferation requirements and procedures regarding nuclear fuel cycle operations should be implemented as required by the additional protocol in International Atomic Energy Agency (IAEA) Member States, where applicable
- Long-Term Commitment: Evaluation of nuclear projects should include assessments of long-term supply and availability of products and services
- Resource Efficiency: Nuclear fuel cycle processes should continue to develop in ways that are increasingly efficient, effective and economical
- Continual Improvement: The nuclear fuel cycle should continually benefit from and incorporates changes through lessons learned and information exchange.

Sustainability principles for uranium production

40. The World Nuclear Association (WNA) has published “Sustaining Global Best Practices in Uranium Mining and Processing”, which sets down a corresponding set of principles applicable to the worldwide uranium production industry.[13] The application of these principles for a project should be reported.

Legislation framework for sustainability and environmental protection

41. Reporting should provide details on protection to the environment and to local communities, considering both current operations and the long term, including post mine closure. Environmental assessment legislation is necessary and should be framed in a manner to allow all interested parties, in particular people and communities close to a proposed mine site, an opportunity to comment on and influence the direction of the proposed development.

International safeguards

42. Reporting on nuclear projects should include details of IAEA safeguard agreements as applicable.

Domestic laws and policy considerations

43. Reporting on nuclear projects should include the legal framework set out as in the internationally accepted principles of a civilian nuclear power programme as well as provide the structure and responsibilities of an independent Nuclear Regulatory Body (NRB). The reporting should include the licensing process depending on national legislation: siting and site evaluation, design, construction, commissioning, operation, and decommissioning.

New nuclear development

44. Reporting the development of projects under a new nuclear programme should include details of local industry, government agencies and research centres.

Project licensing and operation

45. Reporting on nuclear projects, according to the criteria for sustainable development, the following policy, legal and regulatory considerations should be included:

- Stable national government
- A coherent and transparent licensing strategy
- Stakeholder engagement
- A reasonable royalty scheme
- Appropriate land-use planning and legislation
- Complementary laws, permitting the rent or lease of the nuclear project facility site and associated lands

[13] See http://www.world nuclear.org/uploadedFiles/org/WNA/Publications/WNA_Position_Statements/PD-UraniumMining.pdf

- Fair resolution of any consequences for land ownership and/or use, which can include heavily populated areas where population displacement may be a serious social issue.

Human resources

46. Reporting on the nuclear project should include the necessary staff (particularly environmental and occupational health and safety agencies) with competent, properly trained personnel and should ensure that they have sufficient resources to carry out necessary inspections and enforcement.

Public consultations and Social Licence to Operate

47. Reporting on nuclear projects should include public and stakeholder consultation processes. Reporting on nuclear projects should include details of the social licence to operate (SLO). It is an intangible, unwritten but well-respected process a project should undergo, and continue, to win and keep the acceptance of the communities most directly affected by a given project, along with its many direct and indirect stakeholders.

Resource efficiency

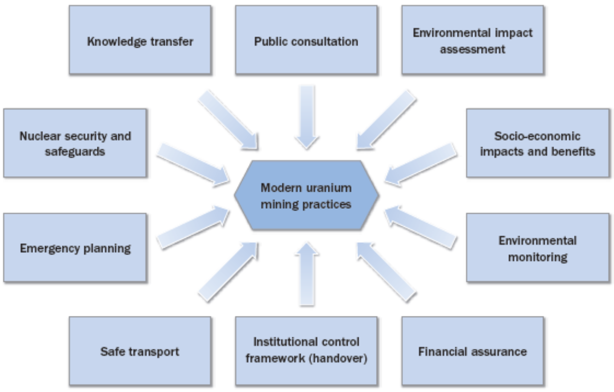
48. Reporting on nuclear projects should include details of improving efficiency in source utilisation in the fuel cycle should reduce demand, along with contributory factors such as fuel cycle length, burn-up, improved fuel design, and market-technical strategies employed to optimise the relationship between the price of natural uranium and enrichment services.

49. Reporting on nuclear projects may include details of comprehensive resource recovery. It describes methodologies that maximise resource efficiency. By adopting t comprehensive resource recovery, the source is opened up of recovering more than one product of value from a project.

Environmental and social impact assessment

50. Nuclear project reporting should include details of management of environmental impacts on local ecosystems including, but not limited to air, land, water quality, biodiversity or the health of workers and local communities. (See Figure IV for the example of uranium mining activities).

Figure IV
Holistic approach to managing environmental risks and stakeholder expectations



Rights of indigenous populations

51. Reporting on nuclear projects should include details of the rights of indigenous populations if applicable. Nuclear fuel cycle development can have complex social impacts related to displacement, land rights, cultural heritage, and other rights of indigenous populations. On broader terms, nuclear project development should be strictly based on free,

prior and informed consent, in line with the UN Declaration on the Rights of Indigenous Peoples.[14]

Radiation protection

52. Reporting on nuclear projects should include details of radiation protection. The "As Low As Reasonably Achievable" (ALARA) principle for worker radiation protection requires that exposure to risks arising from radiation shall be kept as low as reasonably achievable, with social and economic factors being taken into account. In addition, there is an absolute limit to the allowable exposure of any one individual, regardless of the benefit to society as a whole.

Closure and remediation

53. Reporting on nuclear projects should include details of site closure, decommissioning and remediation of nuclear facilities. Appropriate planning from the outset should be required for final disposal and monitoring of wastes and return of the site to a safe condition that minimises restrictions on future use.

End of life and wastes

54. Reporting on nuclear projects should include details of continued care and future-proofing of an operation post-closure to meet the requirements of sustainable development. This may consist of, but not be limited to, ongoing monitoring; collection and treatment of contaminated water; management and storage of water treatment sludges; and maintenance of facilities such as water diversion structures.

2. Technical feasibility

55. The F Axis is labelled "technical feasibility". It expresses the maturity of technology, studies and commitments necessary to implement the nuclear project.

Baseline data collection

56. Reporting on nuclear projects should include details of baseline data collection. Baseline information is required to characterise both the physical and social environment before project development and before project restart. Typically, baseline studies shall be required to understand the pre-development conditions and to integrate information into project supporting documents.

Milestones and decision gates

57. Reporting on nuclear projects should include details of milestones and decision- that facilitate smooth project planning and operation across the full project life-cycle, including eventual closure, decommissioning and site handover. The methodology used should align with the UNFC criteria, confidence of estimates, and technical feasibility. It should align with the environmental-social-economic viability focused on key milestones in project life.

3. Level of confidence

58. The G axis expresses the level of confidence in calculating or estimating the quantities of nuclear sources, and other products of the nuclear fuel cycle, such as conversion, enrichment, fuel manufacture, spent fuel management, reprocessing and waste management. Nuclear source quantities should be reported in energy units in exajoules (EJ) or in metric tonnes of uranium (tU), thorium (tTh) or heavy metal (tHM).

[14] See United Nations Declaration on the Rights of Indigenous Peoples https://www.un.org/development/desa/indigenouspeoples/declaration-on-the-rights-of-indigenous-peoples.html

Measurement of heavy metals

59. Reporting on nuclear projects should include methods for the measurement of heavy metals. Gamma-ray techniques are commonly used to measure the gamma radiation from radioactive daughter isotopes produced from the decay of U-238. Consequently, the uranium determination can be inaccurate due to the natural disequilibrium between uranium and its daughter isotopes. Therefore, the disequilibrium should be specified when gamma-ray techniques are used. Prompt Fission Neutron (PFN) techniques provide a direct measure of uranium, and these measurements are not affected by natural disequilibrium. Chemical analysis may be used to estimate uranium; such analyses often serve as a cross-check for the radiometric techniques.

Geologic type of uranium and thorium deposits

60. Reporting on nuclear projects should apply the IAEA classification of 15 major types for uranium sources [15,16,17].

(i) Sandstone;

(ii) Proterozoic unconformity;

(iii) Polymetallic Fe-oxide breccia complex;

(iv) Paleo-quartz-pebble conglomerate;

(v) Granite-related;

(vi) Metamorphite;

(vii) Intrusive;

(viii) Volcanic-related;

(ix) Metasomatic;

(x) Surficial;

(xi) Carbonate;

(xii) Collapse breccia-type;

(xiii) Phosphate;

(xiv) Lignite and coal;

(xv) Black shale.

61. Major types of thorium sources, which should be used in reporting are[18]:

(i) Igneous;

(ii) Metasomatic;

(iii) Metamorphic;

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[15] International Atomic Energy Agency (IAEA). (2018). Geological Classification of Uranium Deposits and Description of Selected Examples, IAEA-TECDOC-1842, IAEA, Vienna. URL. https://www.iaea.org/publications/12346/geological-classification-of-uranium-deposits-and-description-of-selected-examples

[16] International Atomic Energy Agency (IAEA). (2018). World Distribution of Uranium Deposits (UDEPO), IAEA-TECDOC-1843, IAEA, Vienna. URL. https://www.iaea.org/publications/12345/world-distribution-of-uranium-deposits-udepo

[17] International Atomic Energy Agency (IAEA). (2020). Descriptive Uranium Deposit and Mineral System Models. ISBN 978–92–0–109220–5, IAEA, Vienna. URL. https://www-pub.iaea.org/MTCD/Publications/PDF/DES_MOD_web.pdf

[18] International Atomic Energy Agency (IAEA). (2019). World Thorium Occurrences, Deposits and Resources IAEA-TECDOC-1877 https://www.iaea.org/publications/13550/world-thorium-occurrences-deposits-and-resources

(iv) Sedimentary;

(v) Residual;

(vi) Others.

C. Project classification

1. Classification of projects based on the level of maturity

62. Where it is considered appropriate or helpful to sub-classify projects to reflect different levels of project maturity, based on the current status of the project, the optional Sub-classes shown in Figure 3 of UNFC (see Part I) may be adopted for reporting purposes. Additional guidance on the distinction between the Sub-classes of UNFC is provided in Annex III.[19]

2. Distinction of categories

Environmental-socio-economic viability [E1 E2 E3]

63. The distinction between quantities that are classified on the Environmental-socio-economic axis as E1, E2 or E3 is based on the phrase "reasonable prospects for environmental-socio-economic viable development in the foreseeable future". The determination of "foreseeable future" for a nuclear project should take into consideration continued availability of the source, technologies, market agreements, regulatory requirements and investments.

64. *The Environmental-socio-economic axis Categories encompass the non-technical issues that directly impact the viability of a project, including product prices, costs, legal/fiscal framework, environmental regulations and known environmental or social impediments, barriers or benefits. Any one of these issues could prevent 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. Where development or operation activities are suspended, but there are "reasonable prospects for environmentally, socially and economically viable production in the foreseeable future", the project shall be reclassified from E1 to E2. Where "reasonable prospects for environmentally, socially and economically viable production in the foreseeable future" cannot be demonstrated, the project shall be reclassified from E1 to E3.*

65. In some cases, the presence of positive social or environmental externalities, such as low carbon energy production, maybe a key driver for starting a project. The classification shall record the maturity of the social or environmental aspects and their impact on the project.

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

(a) The organisation responsible for the evaluation;

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

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

67. The basis for the assumptions (as opposed to the actual forecast) shall be disclosed. Where alternative assumptions are used, the alternative estimates shall be identified and accompanied by an explanation of the assumptions used.

[19] UNFC (2019) https://unece.org/fileadmin/DAM/energy/se/pdfs/UNFC/publ/UNFC_ES61_Update_2019.pdf

Technical feasibility [F1 F2 F3]

68. *Products quantity estimates are categorised as F1 to F3 as potentially developable using existing technology or technology currently under development or operation. There may be remaining quantities with no development project. The product quantity associated with these is categorised as F4. These are quantities which, if produced, could be bought, sold or used* (i.e. tHM, electricity, heat, etc.).

Level of confidence [G1 G2 G3 G4]

69. *Product quantity estimates may be categorised discretely as G1, G2 and/or G3 (along with the appropriate E and F Categories), based on the degree of confidence in the estimates (high, moderate and low confidence, respectively) based on direct evidence.*

3. Distinction of quantity types

70. The distinction between potentially produced quantities and undeveloped quantities.

71. *Quantities of products associated with projects are categorised as F1 to F3 as potentially developable using existing technology or technology currently under development or operation. There may be remaining quantities with no development project. The product quantity associated with these are categorised as F4. These are quantities which, if produced, could be bought, sold or used (i.e. electricity, heat, etc.).*

72. Estimates of quantities should be expressed in terms of recoverable tonnes of total heavy metals. Unrecoverable quantities correspond to E3 and F4.

73. Quantities should be "potentially recoverable" in order to be designated F3.

74. Remaining quantities of product not developed by any prospective project are assigned as F4 and G4. In some situations, these quantities could be sub-classified based on F4.1, F4.2 and F4.3.

Classification of quantities associated with Prospective Projects

75. Quantities of a product that may be produced in the future from prospective projects are assigned as G4. Technical and environmental-socio-economic evaluation studies based on prospective projects constitute the basis for the classification.

D. Project reporting

1. Basis for the estimate

76. *Estimates may be attributable to the project as a whole or may reflect the proportion of those estimates that is attributable to the reporting entity's environmental-socio-economic interest in* the nuclear project. This could include uranium or thorium exploration and evaluation, mining and processing operations, refining facilities, uranium conversion facilities, uranium enrichment facilities, fuel fabrication facilities, reprocessing facilitates and spent fuel storage facilities. *The reporting basis shall be clearly stated in conjunction with the estimate. 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 estimate may include the proportion attributable to the royalty obligation. Where the reported estimate excludes the proportion attributable to the royalty obligation, this shall be disclosed.*

2. Effective Date

77. *Reported estimates of product quantities are as at the Effective Date of the evaluation. The Effective Date shall be clearly stated in conjunction with the estimate. 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 reporting, that could have significantly changed the estimate as at the Effective Date, the likely effect of this information shall be included in the report.*

3. Product

78. *Estimates shall be classified separately for each product or service that will be sold, transferred, used, unused or consumed in operations.* For nuclear projects, it may include, uranium and thorium products, enriched uranium, fabricated fuel elements, reprocessed fissile materials, electricity or heat. *Where estimates for different products have been aggregated for classification, and separate estimates are not provided, the aggregated estimates should be accompanied by a statement clarifying which products have been aggregated and the conversion factor(s) used to render them equivalent for the purposes of aggregation.*

4. Reference point

79. *The Reference Point is a defined location within a development at which the reported estimate or measurement is made.* Reference point could include a mine site and its facilities, deliveries from uranium or thorium mining and processing operations, refining facilities, uranium conversion facilities, uranium enrichment facilities, fuel fabrication facilities, reprocessing facilitates and spent fuel storage facilities. *The Reference Point may be the sales, transfer or use point from the development or it may be an intermediate stage, in which case the reported quantities account for losses prior to but not subsequent to the delivery point. 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.*

5. Aggregation of quantities

80. *Estimates associated with projects that are classified in different Categories on the Environmental-Socio-Economic or Technical Feasibility axes shall not be aggregated with each other without proper justification and disclosure of the methodology adopted. In all cases, the specific Classes that have been aggregated shall be disclosed in conjunction with the classified quantity (e.g. 111+112+221+222), and a footnote added (Also see the use of numerical codes below). The footnote shall state how projects with different E and F categories have been aggregated to account for the likelihood that not all will mature to Viable Projects. It shall also state, if relevant, how quantities with different G categories have been aggregated (arithmetically or stochastically, and if stochastic aggregation is used, how).*

81. Where estimates have been aggregated from multiple projects, consideration should be given to sub-dividing the aggregated totals by product type and by location (e.g. tU, tHM manufactured fuel, tHM reprocessed uranium, etc.).

6. Use of numerical codes

82. *While the defined Classes and Sub-classes shown in Figures xx may be used as supplementary terminology, the relevant Numerical Code(s) shall always be reported in conjunction with the estimated quantity. For example, these may be documented in form 111, 111+112, or 1.1;1.2;1, as appropriate. (Reproduced from UNFC (2019).)*

7. Units and conversion factors

83. In order to facilitate global comparability of product estimates, the Système International d'Unités (SI units) shall be is used for reporting of estimates of nuclear sources. Heavy metal quantities (e.g., U, Th, Pu, etc.) shall be reported in metric tonnes (tHM). Energy equivalent may be provided wherever possible in exajoules (EJ).

8. Documentation

84. *Estimates shall be documented in sufficient detail that would allow an independent evaluator or auditor to clearly understand the basis of the estimate and their classification. Note that this is an obligation for ensuring that appropriate internal documentation is generated and kept, but is not an obligation for external disclosure of such information.*

9. Avoidance of double counting

85. Quantities estimated shall be reported exclusive of each class or sub-class.

VII. Quality assurance and quality control

A. Evaluator qualifications

86. Evaluators shall possess an appropriate level of expertise and relevant experience in the estimation of the resource project under evaluation. The following should be read in conjunction with the Guidance Note on Competent Person Requirements and Options for Resources Reporting.[20]

87. A suitably qualified and experienced Competent Person is required to take the lead (sign-off) responsibility for certain types of reporting function, for example, in the disclosures mandated by financial institutions, lenders or investors. In such cases, the following definitions and requirements may apply.

1. Competent Person

88. A Competent Person for nuclear project reporting is one who is able to put relevant skills, knowledge and experience into practice to perform activities specific to nuclear project classification, management and reporting in an effective and efficient manner.

89. Classification, management and reporting of nuclear projects may commonly involve multiple technical disciplines, each of which is sector-specific. In consequence, the Competent Person function may be fulfilled by a suitably qualified team. In such cases, it is recommended that the various roles and responsibilities of each member of the Competent Person team be clearly described such that both individual team members and the team as a whole understand their duties. In cases where a multidisciplinary team is required but yet a single Competent Person accepts responsibility for the sign-off on the documentation for submission, he or she should be satisfied that the supporting work prepared in whole or part by other team members meets the standards set by the body to which the report is made.

2. Curriculum Vitae

90. The full name, professional qualifications, job title or institutional affiliation, education and experience of the Competent Person signing off on a Report or providing a formal resource estimation should be disclosed in a detailed curriculum vitae (CV). Curriculum vitae should be certified for each individual by a supervisor or equivalent professional with knowledge of the individual's current work, qualifications and experience.

91. In the case where a team fulfils the Competent Person role, the specific role and responsibility of each team member should be separately documented to accompany the set of individual CVs. Likewise, each member of the team should satisfy both the domain-specific requirements of the aspects of the nuclear fuel cycle for which the Competent Person team is individually and severally responsible together with the broader generic requirements of working in the nuclear industry.

3. Responsibility

92. The final responsibility for reporting should in all cases rest with the organization or entity reporting the nuclear source quantities or volumes.

[20] See Guidance Note on Competent Person Requirements and Options for Resources Reporting https://unece.org/fileadmin/DAM/energy/se/pdfs/UNFC/UNFC-Guidance-Notes/Guidance_Note_on_Competent_Person_Requirements_and_Options_for_Resource_Reporting.pdf

4. Competent Person requirements

93. Competent Person requirements for nuclear projects provided below are not in any particular order of priority.

5. Core competencies and principles

94. The core competencies and principles which inform a Competent Person's actions and judgements in regard to nuclear project reporting include but are not restricted to:

- Academic and professional qualifications and experience as applicable to provision, management and use of nuclear sources
- Nuclear energy regulations and laws: Shall have a thorough knowledge and understanding of the nuclear energy regularity regimes, including the international conventions on uses of nuclear energy, IAEA Basic Safety Standards and nuclear-specific standards on radiation for occupational, public and environmental health and safety, and applicable national regulations and laws
- Sustainable development: Shall endeavour to have the knowledge and understanding of sustainable development values, in particular, the 2030 Agenda for Sustainable Development (and the SDGs) and how they apply to management and use of nuclear projects including related reporting requirements
- Care for the Environment: Shall have a professional commitment to protect the environment and preserve the earth's natural resources, both for today and for generations into the future
- Safety and radiation protection: Shall demonstrate awareness, knowledge and understanding of all the nuclear safety and radiation protection requirements mandated by the regulations of the responsible jurisdiction within which they work and shall ensure that all design, planning and operations for nuclear project management fully satisfy these requirements.

B. Ethical standards

95. Nuclear source estimation and reporting, as well as project evaluation, can be the subject of unintentional or motivational bias. To ensure nuclear projects are evaluated in an unbiased manner, certain ethical standards shall be observed. These inform the Competent Person's compliance with the highest standards of professionalism and personal conduct in the performance of required duties.

96. These ethical standards include:

(i) Independence

- Declare any conflict of interest
- Disclose any outcome-related compensation plan
- Maintain the freedom to report any irregularities to an independent governance body.

(ii) Objectivity

- Objectively take into consideration all available data regarding the reporting task or issue in hand, including inadequate or unexpected results
- Use realistic, reasonable and justifiable commercial assumptions
- Maintain compliance with national or international accepted nuclear project evaluation criteria, definitions and guidelines:
- Document all assumptions and results; discuss, work through and resolve differences of opinion with team members and professional colleagues, documenting any unresolved matters in dispute and why:

- Submit draft findings and recommendations to independent peer review:
- Present results fully and openly.

(iii) Confidentiality

- Maintain confidentiality of data and analyses not in the public domain
- Comply scrupulously with any confidentiality or secrecy agreements such as non-disclosure agreements unless by doing so, there is a risk of non-compliance with applicable laws or pertaining ethical standards.

(iv) Respect for Diversity:

- Demonstrate respect for gender justice and diversity, and impartial commitment to professional standards and behaviours without bias towards race/ethnicity, culture, language, gender, age, sexual orientation or expression, religion and disability.

(v) Additional guidelines:

- Maintain records of all data and analyses in a secure place for an appropriate period as required by internal controls and compliance with requirements of regulatory authorities
- Conduct all work within health, safety and environmental regulations, guidelines good practices in place
- Accordingly, a Competent Person should:
    - Demonstrate skill, good judgement and mastery of nuclear subject matter
    - Demonstrate the values of impartiality, fairness, honesty and truthfulness, in all their daily activities and behaviours
    - Be capable of intervening and taking prompt remedial action in cases of unprofessional or unethical behaviour in others.

VIII. Bridging

97. A bridging document was developed and endorsed by the UNECE Expert Group on Resource Management for comparing the results between UNFC and the Organisation for Economic Co-operation and Development (OECD)-Nuclear Energy Agency (NEA)/IAEA resources reporting scheme.[21] It provides detailed instructions and guidelines on how to classify uranium resource estimates using the UNFC numerical codes. If the assessment is provided using this bridging document, it shall be mentioned in the report.

IX. Glossary

[To be prepared in the next version, aligned to the common UNFC glossary of terms that is under development.]

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[21] Bridging Document between the Organisation of Economic Co-operation and Development Nuclear Energy Agency-International Atomic Energy Agency Uranium Classification and UNFC-2009https://www.unece.org/fileadmin/DAM/energy/se/pdfs/comm23/ECE.ENERGY.2014.6_e.pdf