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REPORT ON METHODOLOGY AND GUIDANCE FOR EU-LEVEL DATA HARMONISATION WITH UNFC V2

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Executive Summary

The previous report on methodology and guidance for EU-level data harmonisation with UNFC (D2.1) provided a solid foundation for both GSEU project partners and interested professionals in the wider community to gain a broader understanding of the European possibilities and limitations of applying the internationally recognised UNECE United Nations Framework Classification for Resources (UNFC). This earlier work dealt in more detail with presenting the current available UNFC methodologies (if any) on national level in relation with the resource classification systems. National regulatory framework and raw material data management conditions strongly influence how UNFC is implemented locally. This report focuses on how best to support the preparation of GSEU partners for the implementation of the (EU) 2024/1252 Critical Raw Materials Act (CRM Act). An important result is the development of a UNFC data collection form in co-operation with the UNECE EGRM and FutuRaM project (www.futuram.eu) experts at the request of the European Commission Department General of Internal Market, Industry, Entrepreneurship and SMEs (EC DG GROW). This so called UNFC PDF template, explained in depth in this report, it is an appropriate tool for UNFC data collection and its inclusion of specific guiding text for practitioner experts enables it to act as a practical guide for UNFC application.

The UNFC PDF template can be considered a valuable guide because it includes detailed advice embedded in the individual data fields related to the UNFC, as well as an additional electronic guidance text accessible directly from the template. Moreover, it contains direct map visualisation and semi-automated UNFC classification algorithm functions. We tested the UNFC PDF template for both primary and secondary (mining waste) raw materials. Given the similarities with the structure and data content of the databases used by EC DG GROW based on data provision by the members of the Raw Material Supply Group (RMSG) and the EGS MIN4EU based on data provision by members of the EuroGeoSurveys, a longer-term, consistent and verifiable UNFC data collection can be realised by supplementing it with appropriate UNFC information.

In order to ensure integration of UNFC data adhering to UNFC requirements into both national and European raw materials databases, there had been close collaboration with GSEU WP7, which is responsible for IT infrastructure and database (EGDI) development. This has resulted in the completion of the Requirement Analysis concerning the UNFC, which was necessary for designing the content requirements of the EGDI in relation to the UNFC. It has also led to the successful extension of the MIN4EU database with the essential basic information required for UNFC classification leading to enhancing the MIN4EU database that is one of the background databases of EGDI. This allows for tracking and verifying the classification details both at national and at EU levels, thus improving data quality. The extension of the basic MIN4EU database code list also includes mining waste, thereby providing mineral resource data for various types of objects such as projects, prospects and mineral occurrences, and, where applicable, data on the presence or absence of studies or permits regarding the E, F, and G categories of an ongoing project. The experience with CRM data collection and UNFC classification of mining waste facilities shows that the joint European-level EGDI is an appropriate database for embedding mining waste related objects including relevant quality- and quantity-related data and the UNFC class.

The project partners, building on the results of the first D2.1 UNFC report, continued to examine the use of the UNECE UNFC Guidance for Europe (2022) at a national level. This was done by comparing the document with various regulatory environments, data management systems, and mineral resource classification systems. The existing or developing UNFC guidance-like documents at national level (from

the UK, Czech Republic, Finland, Poland, Hungary, Austria, Norway, Sweden, and Slovenia) were discussed and in some cases updated based on shared experiences, internal (UNFC trainers within the project) and external suggestions (UNECE EGRM), and the three-parts UNFC training. Experts from some countries (Hungary, Austria) updated their national guidelines, while a new bridging guideline was also developed (Cyprus). Many national geological service experts would directly use the UNECE UNFC Guidance for Europe (2022), but in the context of the CRM Act, additional internal or national UNFC guidelines will contribute to the more efficient implementation of the CRM Act. However, this requires national-level UNFC trainings and consultations with other authorities, ministries, and industry stakeholders, after which existing national UNFC guidelines can be updated, or, if necessary, the first guideline-like document can be developed from scratch.

For this purpose, GeoZS, with the active involvement of the partners, provided all the necessary knowledge, basic information, and educational materials within the GSEU ICE SRM framework. One of the key aspects of this has been “train the trainers” training events (April, May and June in 2024) which provided appropriate UNFC training materials that act as additional methodological guides to the UNFC Guidance for Europe (2022), to enable the requirements of the CRM Act for the common application of UNFC for critical raw materials in Europe.

This will enable significant progress towards the development of new and more precise national UNFC guidelines and coherence on the implementation of UNFC locally. This report outlines how the experiences of the UNFC training, the recommendations for contents that were developed by UNFC trainers in the GSEU project and by the UNECE EGRM support this. These recommendations offer practical advice for using the UNFC, considering the similar (e.g., environmental permitting) and different (regulation of mineral extraction and raw material data management) practices across European countries.

The sharing of experiences regarding historical estimates (archival data), appropriate handling of data gaps, CRIRSCO-UNFC bridging, regionally grouped raw material classification practices, and highlighting specific cases, along with tips to facilitate UNFC classification, all contribute to performing high-level, reliable, and consistent UNFC classification. This helps ensure that reliable, high-quality raw material UNFC data is included in EGDI.

The classification of secondary raw materials (in this case mining waste) under UNFC has been progressed. This is guided by the specifications (UNECE 2019) and supplementary specifications (in progress) prepared by the UNECE Anthropogenic Resources Working Group, along with the related case studies. The classification of mining waste containing critical raw materials according to UNFC can be approached in two ways:

1) A brief evaluation of data sources and information corresponding to the UNFC E, F, and G axes
2) A system-oriented approach with a detailed assessment

Both approaches have to result in similar or identical UNFC classifications; however, the more detailed assessment allows for more precise categorisation, including potential sub-classification within UNFC. Additionally, the site-specific analysis of individual mining waste management facilities enables a more realistic evaluation. This can support the development of *Initially Non-Viable Projects* into *Potentially Viable Project* statuses aimed at the recovery of critical raw materials. The data collection for these, including the UNFC classification, is planned (in progress) in an Access template (see chapter 2.2.7.3.)

in collaboration with GSEU WP7 and in co-operation with FutuRaM project partners. This template has been tested by GSEU partners for UNFC classification and data collection. Based on experience, this form is an appropriate UNFC data collection tool to build database for secondary raw materials. GSEU partners contributed to the building of database with UNFC information for CRM-bearing mining waste objects. For other secondary raw materials, the complex approach to classify anthropogenic material requires further adjustments to ensure coherency application imposed by waste sector specific terminology.

This report also includes description of the co-operation between GSEU WP2 on raw materials, WP3 on GeoEnergy and WP4 on groundwater resources in the context of possibilities of UNFC application. A questionnaire survey was prepared to understand the most recent situation on geothermal energy and groundwater resource management that influences the UNFC application. The aim is to contribute to the better understanding of real applicability of UNFC for GeoEnergy and groundwater resources based on facts (recent opportunities of responsible organisations in the context of resource management system and experience data management).

Abbreviations	
SRM	Sustainable Resource Management
CRIRSCO	Committee for Mineral Reserves International Reporting Standards
CRM	Critical Raw Materials
CRM Act	Critical Raw Material Act
DB	Database
EC DG DG GROW	European Commission, Directorate General for Internal Market, Industry, Entrepreneurship and SMEs and Hydrogen
EGDI	European Geological Data Infrastructure
EGRM	Expert Group on Resource Management
EGS	EuroGeoSurveys
EU	European Union
EU ICE ICE SRM	European Union's International Centre of Excellence on Sustainable Resource Management
FAIR	Findable Accessible Interoperable Reusable (data)
FutuRaM	Future Availability of Secondary Raw Materials (project)
GSE	Geological Service for Europe
GSEU	The Geological Service for Europe project
GSO	Geological Survey Organisation
H2020	Horizon 2020
IT	Information technology
JORC	Joint Ore Reserves Committee
MIN4EU	Mineral Intelligence for Europe
MREG	Mineral Resources Expert Group
MW	Mining waste
NoPE	Network of UNFC Practitioners - Europe
PERC	Pan European Reserves and Resources Reporting Committee
RM	Raw Materials
RMSG	Raw Materials Supply Group (EC DG GROW)
SDGs	Sustainable Development Goals
UNECE	United Nations Economic Commission for Europe
UNFC	United Nations Framework Classification for Resources
UNRMS	United Nations Resource Management System
WP	Work Package

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1. Introduction

The previous report (D2.1, Report on methodology and guidance for EU-level data harmonisation with UNFC) provided a solid foundation for both GSEU project partners and interested professionals outside the project to gain a broader understanding of the European possibilities and limitations of applying the internationally recognised UNECE resource classification framework (United Nations Framework Classification for Resources, UNFC). This detailed the resource classification systems of European partner countries that influence the application of the UNFC, the relevant regulatory framework, and raw material data management conditions. An important result was the development of a UNFC data collection form in co-operation with the UNECE EGRM and FutuRaM project experts at the request of the EC DG GROW. The UNFC PDF template, where recent developments have been detailed in chapter 2.12, is an appropriate document for UNFC data collection and it can also be considered as a joint practical guide for UNFC classification that includes specific guiding text for practitioner experts. The requirement of the CRM Act for reporting of data adhering to the UNFC necessitates the creation of such tools. This report also preliminarily addressed the classification of secondary raw materials (2RM), geothermal energy, and subsurface waters under the UNFC, as well as laying the groundwork for the development of a unified European resource database. D2.1 detailed how project partners had begun comparing national-level mineral resource classification methods with the recommendations of the UNECE UNFC Guideline for Europe (2022) via the results of a survey. In this report, the survey results are built on with the inclusion of around 10 more detailed UNFC methodological examples, which serve as models for other partner experts and organisations in developing their own UNFC methodologies, considering the UNECE UNFC Guideline for Europe (2022). These practical examples and case studies, alongside trainings organised by the developing EU International Centre of Excellence on Sustainable Resource Management (ICE SRM) supports the implementation of the first version of the EU Critical Raw Materials Act (CRM Act), published and launched in its final form that came in force on May 23, 2024.

In 2024, the digital UNFC PDF template continued to be improved to support data collection, by extensive stakeholder testing and feedback (for both primary and secondary raw materials). The template was discussed with experts from the UNECE EGRM and FutuRaM projects, and sent to EC DG GROW to facilitate the implementation of the CRM Act. Further improvement of the UNFC PDF template in 2024 aiming to be fit: a) to be used in UNFC trainings; b) to support data collection that is linked with the MIN4EU database, so data can be presented in EGDI (European Geological Data Infrastructure); and c) to serve as a guide including instructions that can act as one of the sources of UNFC guidance-type document on national level.

The UNFC PDF template has been improved by the inclusion of detailed advice embedded in the individual data fields related to the UNFC, as well as an additional electronic guidance text accessible directly from the template. Moreover, it contains direct map visualisation and semi-automated UNFC classification algorithm functions. Given the similarities with the structure and data content of the databases used by EC DG GROW within the RMSG and the EGS MIN4EU, a longer-term, unified, and verifiable UNFC data collection can be realised by supplementing with appropriate UNFC additional information. A unified form of this, which can also be applied to mining waste, is a template, which has been tested in collaboration with the GSEU WP7.

The collaboration with GSEU WP7, which is responsible for IT infrastructure and database development (EGDI), was pivotal for several reasons. Firstly, we finalised the Requirement Analysis, which was

necessary for designing the content requirements of EGDI in relation to inclusion of data adhering to the UNFC.
Secondly, we successfully identified essential elements to be added to the MIN4EU data model in order to improve UNFC related content both for primary and secondary resources.

This will allow tracking and verifying the classification details at both the national and EU levels, thus improving data quality. The extensions support the following new functionalities:

- adding permitting process stages
- adding UNFC classification for distinct commodities
- adding UNFC report citations to projects, prospects, occurrences
- Associating mining waste with anthropogenic mineral occurrence as secondary resource

Code list extensions are intended to support the above functionalities with terms previously missing.

The project partners, building on the results of the first D2.1. UNFC report, continued to examine the use of the UNECE UNFC Guidance for Europe (2022) at the national level. This was done by comparing the document with various regulatory environments, data management systems, and mineral resource classification systems. The existing or developing UNFC guidance-like documents at the national level (from Austria, Czech Republic, Finland, Poland, Hungary, Norway, Sweden, Slovenia and UK) were updated based on shared experiences. An important exchange of experiences was the UNFC “train the trainers” sessions that were organised by GeoZS in 2024. Here, internal (UNFC trainers within the project) and external suggestions (UNECE EGRM) helped participants to develop their national UNFC guidance document. Experts from some countries (Hungary and Austria) updated their national guidelines, while a new bridging guideline was also developed (Cyprus). The lack of national level guidance documents for many countries continues to be an issue for UNFC implementation.
For this purpose, GeoZS, with the active involvement of the partners, provided all the necessary knowledge, basic information, and educational materials within the EU ICE SRM framework. Thus, significant progress is expected in 2025 towards the development or further refinement of new and more precise national UNFC guidelines. This will be supported by the recommendations that were developed by UNFC trainers in the GSEU project and by the UNECE EGRM.

In addition to the project partners accepting and applying the UNECE UNFC Guidance for Europe published in 2022, as a common UNFC guideline, in this GSEU WP2 T2.4 report we are focusing on the implementation of this recognised UNECE document report on national level. We also provide some results on selected topics (development of database that relates to resource inventory, data valorisation, reference on training materials) that were discussed in more detail during experience sharing and UNFC training sessions. The geological surveys, and in some cases the mining authorities' UNFC experts, can provide significant support through their mission and role by sharing detailed, methodological recommendations in this report. These recommendations offer practical advice for using the UNFC, taking into account the partially shared (e.g., environmental permitting) but in many ways different (regulation of mineral extraction and raw material data management) practices across European countries.

The sharing of experiences regarding historical estimates (archival data), appropriate handling of data gaps, CRIRSCO-UNFC bridging, regionally grouped raw material classification practices, and highlighting specific cases, along with tips to facilitate UNFC classification, all contribute to performing

high-level, reliable, and consistent UNFC classification. This helps to ensure that reliable, high-quality raw material UNFC data is included in EGDI.

Data valorisation in the context of the UNFC classification is adding value to available data on raw materials. In order to valorise data, validation is necessary. It can be approached either by controlling data quality, or by the retention of the value of the data by ensuring it is up to date. UNFC classification is a dynamic classification process between project evaluations characterised by the date of the classification and the recording into the mineral resource inventory. Due to developments in the lifetime of a project (e.g. acquiring or withdrawal of permissions) UNFC classification may be changed.

Regarding the MIN4EU database, next to UNFC codes other UNFC related information is necessary to provide sufficient and supporting background data to control the compliance of the UNFC classification. Data on “mine status” or on “exploration activity”, and UNFC E, F and G related information (e.g. feasibility studies, technical operation plan, permissions) are basic data to UNFC classification. National level data validation starts with the responsible person (e.g. Qualified Expert) who evaluates the UNFC classification for a project. In private companies, Competent Person(s) or Qualified Expert(s) provide(s) the UNFC classification of a project with validation of data and the relevant report.

The EU ICE SRM and the application of the UNFC needs to be designed in such a way that it can incorporate resources other than minerals, for example groundwater resources (GW) and GeoEnergy (GE) (potential and storage). This questionnaire survey is in progress at the time of publication of this deliverable. The progress of the collaboration between GSEU WP2 T2.3. and T2.4. for EU ICE SRM and UNFC for raw materials and WP3 for GeoEnergy and WP4 for groundwater resources is detailed in Chapter 4. The following main topics were addressed in the questionnaire survey for GE and for GW: background of the legislative environment for these types of resources including strategic approach of responsible organisations for data collection and data management, the frequency of data collection with publicly available data; brief history of UNFC activity on organisation or regional or national level. Specific questions deal with UNFC data for E, F, and G axes in order to facilitate the identification of UNFC data sources for GeoEnergy and groundwater. Authors were also interested in if any organisation activity is foreseen in 2025 for UNFC trainings or capacity building that can significantly enhance the EU ICE SRM objectives.

The application of UNFC for secondary raw materials (2RM), with a focus on mining wastes, can also be done based on major similarities for UNFC application for primary raw materials. This is due to the fact that these materials are essentially reworked geological deposits on the surface with quantity and quality that can be determined by field and laboratory surveys, such as primary deposits recovery of target material (here: CRMs) by specific technology (even including processing or recycling) requires investments (e.g. feasibility study) and relevant permission (mainly environmental). As such, the UNFC E, F and G categories can be identified for mining waste CRM recovery projects. Existing inventories or datasets for mining wastes on national and regional levels have been mainly developed according to the implementation of the 2006/21 Mining Waste Directive but many mining waste inventories consist of geochemical data for CRMs. Within the Anthropogenic Working Group of the UNECE EGRM, the update of published specifications as the current ones precedes the UNFC generic principles document (UNECE, 2018). Updates will be available in the beginning of 2025 that will be useful to UNFC practitioners.

2. Establishment of the Methodology and Guidance for EU-level Data Harmonisation with UNFC

2.1. UNFC Data Collection Template for CRMs with Guidelines and Guidance

This chapter is a short description of the development of the UNFC PDF template with an introduction to the main data types captured by the template and useful functions (e.g. a guideline to the UNFC PDF template).

2.1.1. Introduction

The CRM Act (EU 2024/1252) of the EU calls for templates to be developed and used for (a) applications for the recognition of Strategic Projects, (b) progress reports related to Strategic Projects, and (c) reporting of Member States pertaining to mining projects, exploration, monitoring, strategic stocks and circularity. The draft document, called the UNFC Europe template, prepared primarily for primary raw materials, was developed into a UNFC PDF template within the framework of the GSEU project, which is also suitable for receiving information related to mining waste (developed version in 2024: see Appendix 1.) The initial UNFC Europe template version was developed as a concerted effort by the UNFC Coordination Team (UNECE, EC DG GROW, GSEU) with significant contributions from GSEU experts. The UNFC PDF template is supposed to become the designated tool for the systematic collection of comprehensive data and metadata on European mineral resource projects which have been classified according to UNFC.

The template defines a minimum set of criteria to be addressed when collecting the data. The template currently comes as a user-friendly PDF form, which allows data export to CSV format but could easily be further transferred into a web-based data collection form. Its use is expected for the provision of data on critical raw materials (CRM) in the frame of the CRM Act. However, it also represents a valuable basic data collection tool for serving data of different resource types to the database of the European Geological Data Infrastructure (EGDI) (development via a GSEU WP7 Requirement Analysis in progress). The purpose of the template is to ensure that the collected data is uniform and complete, ready to be entered into this database and to support CRM Act objectives.

Following a UNECE proposition, the initial data collection and UNFC classification shall be carried out by EU Members State administrations or mandated agencies to provide CRM data to EC DG GROW. At the same time, GSEU project partners can use this template for their own data keeping and management. It is preliminary recommended that data updating should be performed each year on March 1st using data from the end of the previous year (cut-off date December 31st).

An equivalent template for 2RM currently developed by the FutuRaM project consortium fits for the purpose of the recycling sector. Ultimately, GSEU and FutuRaM recommendations may be integrated into one unique template at least for GSEU CRM data collection, or two separated templates for primary and secondary raw materials data collection would also be a viable solution. This decision will be made in the first half of 2025.

GSEU partners who contributed to the UNFC PDF template for primary RM as part of the GSEU D2.1. report include Zoltán Horváth (SZTFH), Sebastian Pfleiderer (GSA, Austria), Tom Bide and Eimear

Deady (BGS), Antje Wittenberg (BGR), Meta Dobnikar (GeoZS), Guillaume Bertrand (BGRM), Pasi Eilu and Janne Hokka (GTK) and Francisco Javier González Sanz (IGME-Spain). The original template was tested on existing CRM projects in Hungary for barite (SZTFH), in Finland for lithium (GTK) and in the United Kingdom for lithium and tungsten (BGS). More details are provided in the "GSEU WP2 T2.4. Report on methodology and guidance for EU-level data harmonisation with UNFC". László Sőrés (SZTFH) contributed to the development of the UNFC PDF template from IT / database point of view.
In February 2024, an updated version of the UNFC template was developed and new tests were performed using (and classifying) Austrian, British and Hungarian CRM and Strategic Projects. The main goal was to finalise the template (at least for primary mineral resources and mining waste) to facilitate the appropriate UNFC classification and UNFC data collection. The current version still contains all the relevant fields for data input which were included in the previous (2023) version, and, which fit with the CRM data collection sheet of the EC DG GROW used for data collection within the Raw Material Supply Group (RMSG). It strikes a balance between including all the necessary and UNFC relevant data, but at the same time avoiding too much detail so the template remains practical to use.

2.1.2. Description of the UNFC PDF Template

The current version of the template is designed to be used for the reporting of below-ground and above-ground mining projects of primary resources, mining waste stockpiles, as well as tailings (Figure 1).

Figure 1. Applicability of UNFC PDF Template for Primary and Secondary Raw Materials (compiled by Sebastian Plfeiderer, GSA)

It is suitable for all project stages from exploration and extraction to post-closure monitoring. Even potential resources postulated by (predictive) mapping or investigated by research projects, where no exploration has started and no project has yet been defined, can be classified, if sufficiently detailed information on the resource exists. The template can be used for serving data to EC DG GROW (including confidential data) as well as to public databases (FAIR data). Currently, it is not designed to be used for all recycling projects, only for mining waste-related objects.

The template consists of sections on (a) resource metadata, (b) classification background information, (c) the classification results and (d) a reference to the person performing the classification.
Mandatory fields are marked with a star (*). At any stage of filling the form, the action button "Check missing mandatory fields" can be used to list all mandatory fields where data are still missing. Underlined words offer explanatory text at mouse-over.

a) Metadata

The project name, location and licence owner are mandatory fields provided a project already exists. For unexplored, potential resources without any project being defined, the deposit name and location are required. Coordinates (latitude, longitude) can be retrieved using using the "view map" action button. Spatial data (polygons such as exploration area, mining licence area) can be attached to reflect the

location and extent of the deposit. If the project already exists as a record set in a national database, a link to this database can also be provided.

Resource commodities are to be chosen from the INSPIRE code list (drop-down menu), to ensure the use of defined terms. If necessary (e.g. if a commodity is missing), commodities can be typed in manually.
Commodities included in the official list of strategic minerals do not automatically make a mining project a Strategic Project. CRMA is using Critical and Strategic Raw Materials (as not all of them are minerals). An the commodities for a Strategic Project are not limited to strategic minerals. The European Critical Raw Materials Board has the authority to declare a mining project as strategic. Even then, member states are not obliged to adopt and follow this declaration. Only if they do, is a project strategic.
Since project activities can be grouped according to project stage, they are combined here into one set of single choice selection buttons. The stages (and sub-stages) follow the classical phases of a mining project. The option of “no information available” is always included.

If the project stage / activities are different for different commodities or for different parts of the deposit (e.g. central part of deposit already under construction while expansion area still being explored), separate forms can be filled out for each commodity / part of the deposit. At the minimum, one form should be filled indicating the most mature or the most relevant stage of the project / part of the deposit.
As permitting status is important to the E-axis classification of UNFC, a comprehensive list of licences is provided and the status of each to be specified. Additionally, information on social contingencies can be given when available.

b) Classification Background Information

Resource classification according to UNFC can be achieved either by delving into base data and deriving the UNFC classes directly from these, or by taking an already existing classification result and mapping it to UNFC. The latter option is possible if a bridging document exists, as is the case e.g. for CRIRSCO-type international standards.
In the case of direct UNFC application, the base data used for the assessment have to be specified together with information on data confidentiality and quality. If, on the other hand, an already existing classification result, which used a national or international standard, is mapped to UNFC, the original classification report must be cited.

c) UNFC Classes of Resources

For each commodity, the derived UNFC class (or classes) should be specified. According to UNFC, detailing the resource quantities or metal contents is at the discretion of the author. If, e.g., company interests prevent the author from revealing this information, the fields can remain unfilled.

d) Information on the Person Performing the Classification

Specifying the name and affiliation of the author is mandatory. Equally, the date when the classification was performed needs to be given as projects develop and UNFC classes change over time.

The full GSEU UNFC PDF template is in the related Annex (Annex II).
Annex IV. contains more details about technical guidance on the use of UNFC PDF Template.

2.2. CRM UNFC Data Harmonisation within EGDI

This chapter presents the data model of the MIN4EU extension with UNFC based on Requirement Analysis and the discussions between resource and database experts within the GSEU project (WP2 and WP7). Results in this chapter serve as a technical solution for the UNFC data collection and data management based on rules of UNFC classification as discussed in the UNFC PDF template and relevant UNFC documents.

2.2.1. Introduction

The thematic UNFC website for CRMs within EGDI will contain short description of UNFC, CRMs and information on how to use the website. Publicly available data will allow users to obtain information about the status of a specific resource project, the exploration phase, and search by UNFC E, F, and G categories (Figure 2).

In the UNFC PDF template the ”*project stage*” / ”*activity*” is linked to the terms ”*ExplorationActivity*”, ”*Mine*” and ”*Mining Activity*” in the product 33 (number of the product in the Requirement Analysis by GSEU WP7; MIN4EU Critical Raw Material Extension for UNFC evaluation). In the MIN4EU Data Model ”*MineralOccurence*” is also an existing code, and permissions – as a new extension of the database (DB) can be linked to ”*MineralOccurence*”. Permission types among others: exploration, environmental, mining, waste, landuse, construction, extraction). “*Social contingencies*” are not indicated in the extended MIN4EU DB, this type of information can be found in the UNFC PDF template, and social permissions (e.g. public hearing) are integrated parts of the environmental permitting procedure in many cases.

The UNFC website will be finalised in parallel with the development of the EU ICE SRM IT Platform. This means that the thematic UNFC webpage will become an integrated part of the EU ICE SRM IT Platform, with a dedicated UNFC-specific link providing access to relevant UNFC data, including a map view. Filtering criteria can be set through thematic windows commonly used in EGDI.

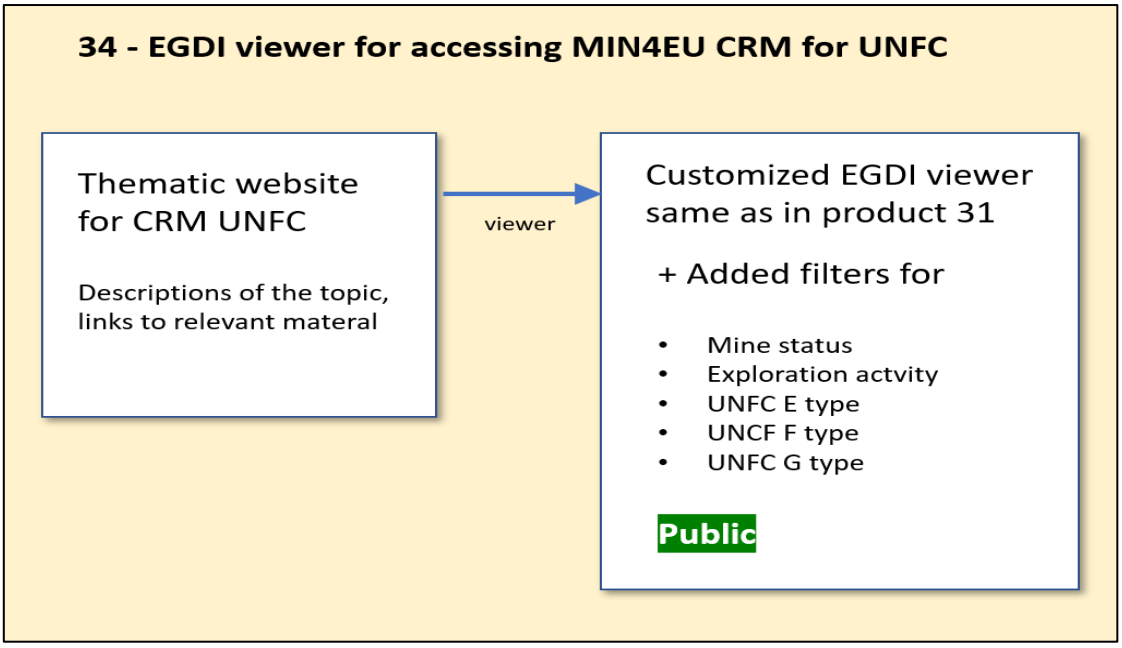


Figure 2. UNFC E,F,G Axis Type Information in the EGDI Viewer

2.2.2. Relation between the UNFC PDF Template and the MIN4EU Data Model

The Relationship between the UNFC PDF template and the MIN4EU data model is shown on Figure 10. During standard analysis the connection between the content of the UNFC PDF template and the existing MIN4EU data model was thoroughly examined. As EGDI is dedicated to public data, all sensitive information, contained in the UNFC PDF template, was excluded from the extension procedure. A significant part of the template overlaps with existing MIN4EU elements. This helped to minimise the requests for extensions that could otherwise generate an unreasonably large extra workload.
Overview of connections between template and data model are shown on Figure 3 Some information in the "*project stage*" part of the UNFC PDF template belongs to the "*Mine*", "*MiningActivity*" and "*ExplorationActivity*" data model elements. "*MineralOccurrence*" in the MIN4EU data model has been extended to store permission data from the stage of permitting process part of the template. The analysis also identified several terms that are subject to code list extensions.

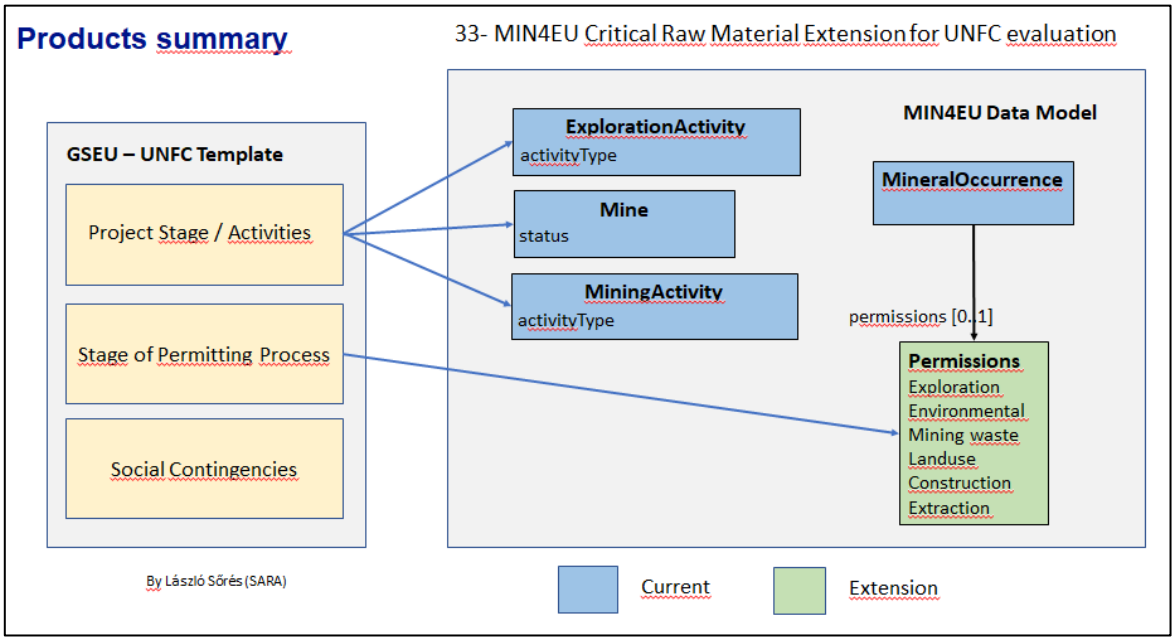


Figure 3. MIN4EU Data Model with UNFC-Related Information

Detailed list of corresponding elements is available in the table in the related Annex.

2.2.3. Code list Extensions

Proposed code list extensions are listed in Table 1, Table 2, Table 3, Table 4, and Table 5.

Table 1. Code List Extension for Stages of Permissions (PermitStageType)

Code	Name	Description
noRequestSubmitted	no request submitted	Permission is not yet submitted to authority.
requestSubmitted	request submitted	Permission is submitted to authority.
granted	granted	Permission is issued by authority.

declined	declined	Permission is suspended by authority.
notRequired	not required	Permission is not required from authority based on legislation.
noInformationAvailable	no information available	Information on permission status is not available.

Table 2. Code List Extension for Status of Mines via Studies (MineStatusType)

Code	Name	Description
scopingStudy	scoping study	Scoping study completed.
preFeasibility	pre-feasibility	Technical and/or economic pre-feasibility study completed.
underClosure	under closure	Mine is under closure.
postClosureMonitoring	post closure monitoring	Post closure monitoring is ongoing.

Table 3. Code List extension for Type of Mining Related Activity (MiningActivityTypeType)

Code	Name	Description
processing	processing	The treatment of raw materials in order to recover minerals.
recycling	recycling	The process of treating waste or used products to recover minerals.

Table 4. Code List Extension for Type of Mining Waste Occurrence (OccurrenceType)

Code	Name	Description
miningWasteStockpile	mining waste stockpile	Storage of unused waste rock material from extractive industry
miningWasteOverburden	mining waste overburden	Storage of unused waste rock or other material that overlies an ore or mineral body and is displaced during mining without being processed.

Table 5. Code List Extension for a Case of No Environmental Impact (EnvironmentalImpactType)

Code	Name	Description
noImpact	no-impact	The environmental impact does not reach any threshold that is prescribed in the legislation.

2.2.4. Mapping Tests

To test mapping between different UNFC data sources and the MIN4EU system, four use cases were created. All of them are based on realistic data provider inputs. As a proof-of-concept data provider, input was converted to MIN4EU format and uploaded to the test database. Two use cases processing PDF templates are shown below.

Use case 1. UNFC PDF Template Mineral Occurrence

An old underground mine has been closed for several decades. Prefeasibility study for barite surface mining was completed. Permits for exploration and land use are granted. Environmental and mining waste permits are declined.

The template contains reporting elements in aggregated manner. The UNFC PDF template with related MIN4EU elements is shown on the Figure 4.
To store the content of the UNFC template into MIN4EU database the following entities are required:

MineralOccurrence: To store project name, geometry and permitting process stages a "MineralOccurrence" record (MO_5) is required. The UNFC PDF template describes a project, so the "*occurrenceType*" attribute is set to project.
Mine: Two different statuses are reported for status ("*closed*", "*preFeasability*"). It requires two Mine records (MI_1, MI_2) in the database.
MiningActivity: To store both "*surfaceMining*" and underground activity two "*MiningActivity*" records are needed. (MA_2, MA_4)
Commodity: To store barite and manganese ore two separate commodity records are required. (CO_6, CO_7)

UNFCClassification: UNFC estimates for barite and manganese ore are stored in UNFC classification records. (UN_13, UN_14). Though, ore and commodity amounts are not reported, these records cannot stand by themselves. They also require related "*CommodityMeasure"* and "*OreMeasure*" instances.

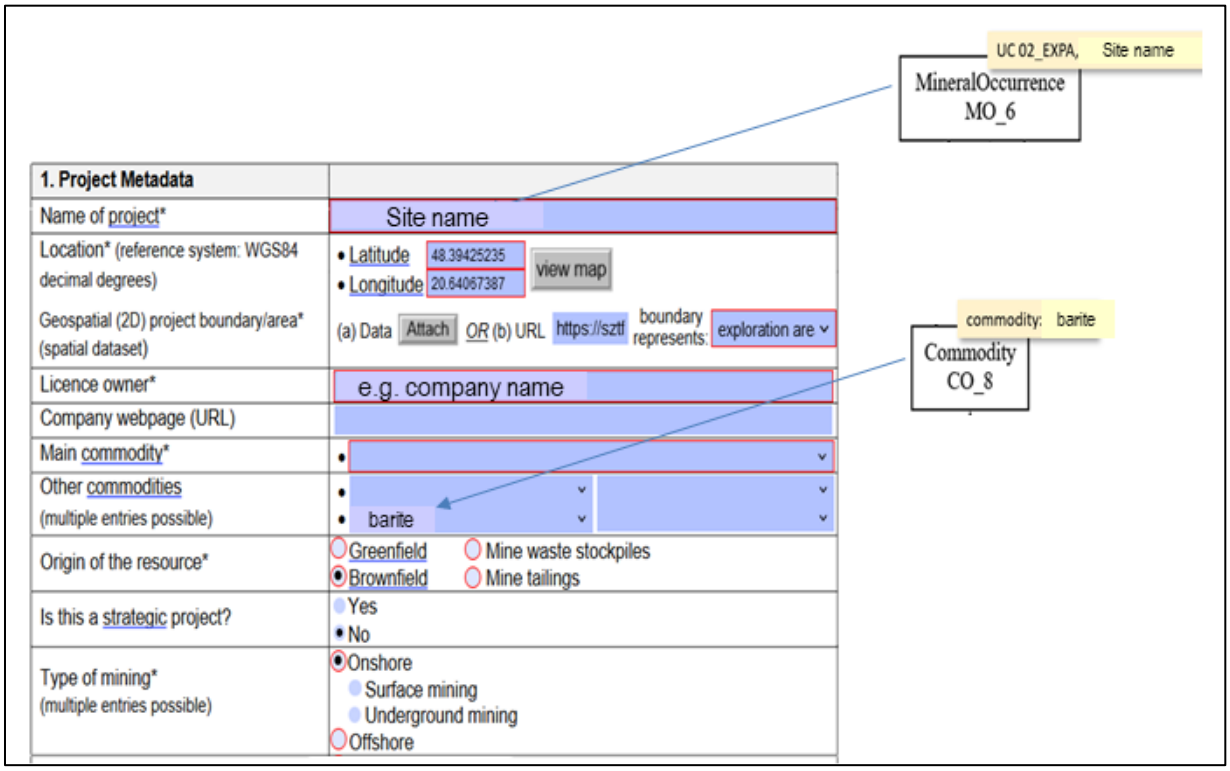


Figure 4. UNFC PDF Template with Related MIN4EU Elements. Blue arrows show connections between MIN4EU elements in the UML model and template attributes.

The UNFC PDF template content in relation with MIN4EU instances is shown on Figure 5.

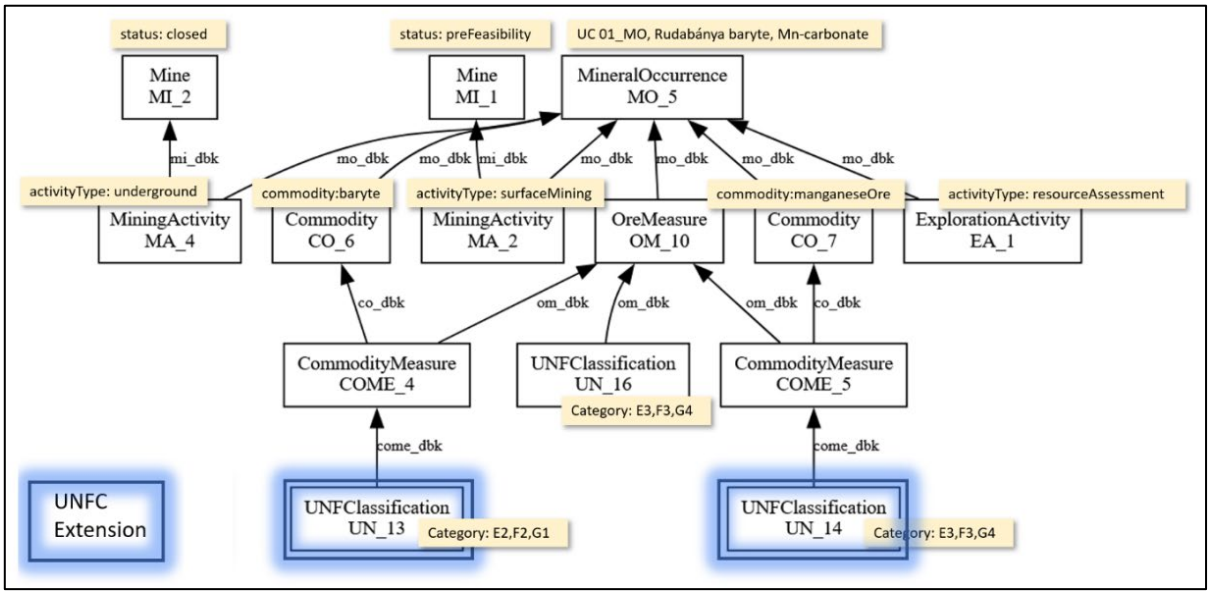


Figure 5. The UNFC PDF Template Content in Relation to MIN4EU Instances

Web Feature Service (WFS) output from the test PostreSQL database provided by Degree for use case 1 can be found here .

Issues to be solved:

"MineralOccurrence" classified in the PDF template may already be present in the MIN4EU database. To avoid duplication the template should be prefilled using the database. It also should contain the *"inspireID"* of the existing *"MineralOccurrence"*. Another option is to delete related features from the database and read them based on the template.
Commodity importance must be provided in the MIN4EU database, otherwise occurrences may not be shown in the EGDI viewer properly. If measures are not of public importance they must be added separately to commodity records.

Use case 2. UNFC PDF template Mineral Exploration

Subsurface exploration is carried out as a new prospect in an old mining area. The commodity in focus is barite with many other non critical raw materials (mainly construction raw materials). Exploration, land use, environmental and mining waste permits are granted.
To store the content of the UNFC template into MIN4EU database the following entities are required:
MineralOccurrence: To store project name, geometry, permitting process stages a "*MineralOccurrence"* record (MO_6) is required. This is a potential occurrence under exploration so "*occurrenceType"* is prospect. (see 2.2.6 for details)
ExplorationActivity: One record with "*activityType"*="*subsurfaceExploration"* (EA_2) is linked to the "*MineralOccurrence"* in the database.
Commodity: To store barite one commodity record is required. (CO_8)
UNFCClassification: UNFC estimate for barite is stored in the "*UNFCClassification"* record. (UN_21)
Though, ore and commodity amounts are not reported, this record can't stand by itself. It also requires related "*CommodityMeasure"* and "*OreMeasure"* instances. UN_17 is used for the overall classification.
UNFC PDF template content in relation with MIN4EU instances are shown on
Figure 6.

WFS output from the test PostreSQL database provided by Degree for use case 2 can be found here.

Issues to be solved:

"ExplorationActivity" must have some *"explorationResult"*. It is not part of the UNFC PDF template, so it must be added separately to the MIN4EU database.

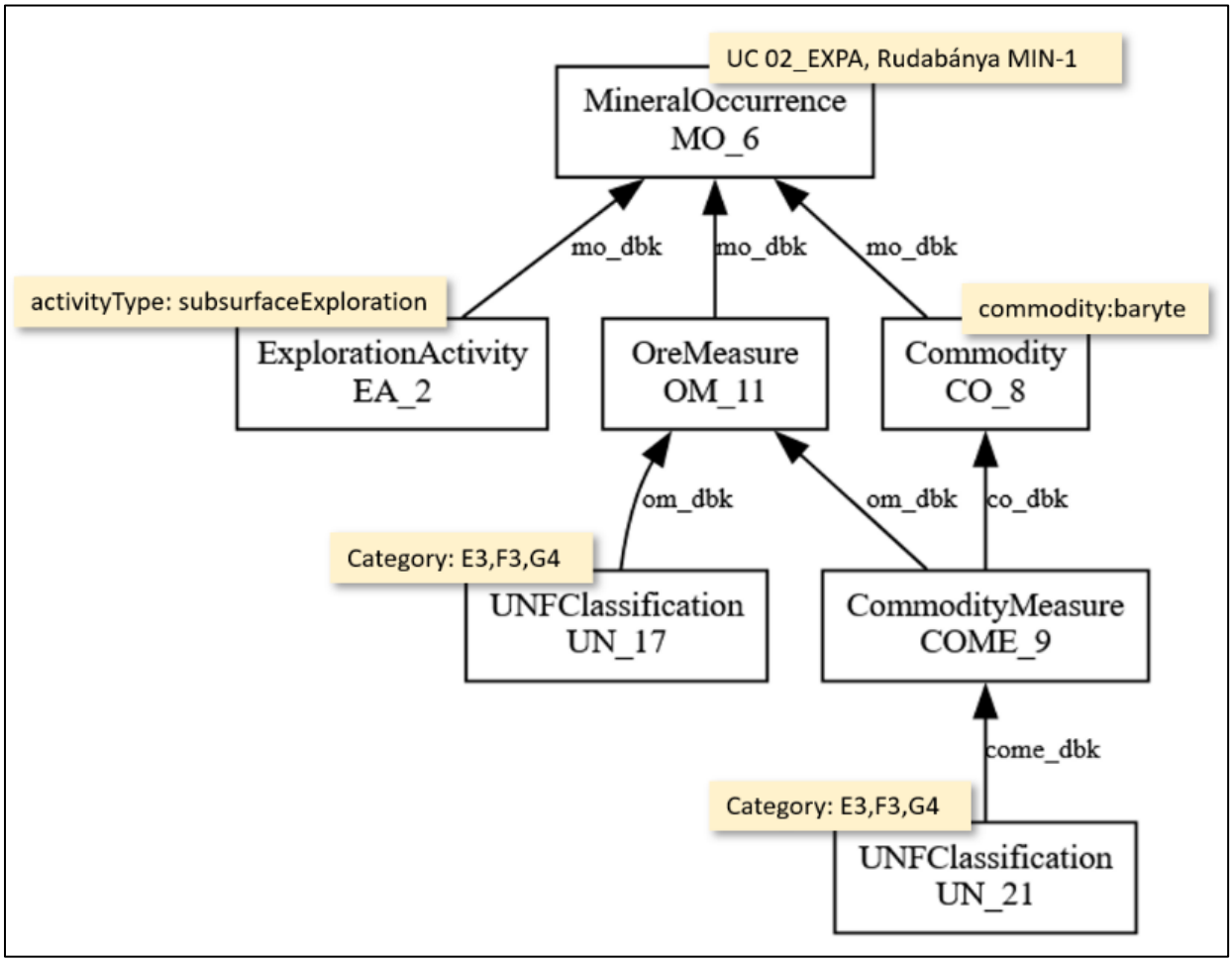


Figure 6. UNFC PDF Template Content in Relation to MIN4EU Instances

2.2.5. Data Flow

The UNFC PDF template is prepared for implementation of the UNFC classification based on appropriate UNFC E, F and G axis datatypes, and to support data collection by members of EuroGeoSurveys. CRM data collection that includes UNFC information can be done with the UNFC PDF template.

The public part of the data content must be transferred to EGDI. It can be done semi automatically by an application that reads the template and generates the required MIN4EU data records as described in the previous chapter. Such an application may also calculate importance from resource and commodity measures. Importance must be included in the database even if numbers are not published.

Generated MIN4EU records can be uploaded directly to the National Database (filter App1.) and harvested by the Central System, or to an MS Access database (filter App2.) from where data is copied into the central MIN4EU database later. The process is shown in Figure 7.

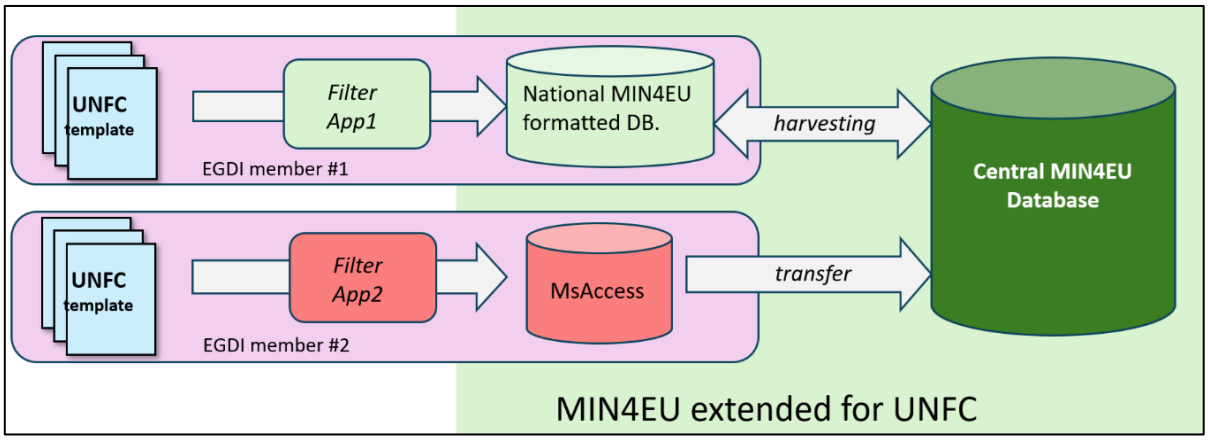


Figure 7. Two Potential Ways for Data Flow to the Central MIN4EU Database

EC DG GROW collects CRM data for European Commission purposes (e.g. monitoring, tendering, evaluation, selection and support of Strategic Projects) in the context of the CRM Act from different stakeholders such as Strategic Project Owner and Applicant. Members of the EC DG GROW Raw Materials Supply Group and Members of the CRM Board also contribute to the CRM data collection according to UNFC. EuroGeoSurveys Members, mainly Geological Survey Organisations (GSO) and some authorities that have a mission on mining inspectorates also have an important role in CRM data collection and data service using UNFC. The two databases do not necessarily contain the same data because the EC focuses on "*Viable"* and *"Potentially Viable Projects"*, while Member State Government Organisations have a wider overview and responsibility for data management of earth resources in the earth crust (i.e. "*Non-Viable Projects*" and raw material deposits).

2.2.6. Aggregated Reporting using Existing MIN4EU Elements

A homogeneous European registry for mineral resources is hard to achieve due to the independent and long-lasting individual developments in the EU Member States. Depending on the data provider measure, reports may be both detailed and aggregated. GSOs often provide detailed reports containing quantities estimated for resources such as mineral deposits, fields, occurrences based on geological knowledge. Exploration and mining companies usually provide aggregated data for informal grouping of physical resources. The following proposal tries to minimise ambiguities and handle the situation with low interferences in existing data structures.

A more conscious usage of "*occurrenceType"* values can help better understanding and modelling complex situations without extending the existing MIN4EU data model.
In MIN4EU "*MineralOccurrence"* are distinguished by type. (see: MineralOccurrenceTypeValue)
Types may be grouped to three main categories:

- management related categories
  - ***"project"*** - An informal grouping of mineral deposits that is commonly used by mining or exploration companies in reporting

- ***"prospect"*** - An area that is a potential site of mineral deposits, based on preliminary exploration, previous exploration

- waste related
  - ***"tailing"***
  - ***"miningWasteStockpile"*** (proposed extension)
  - ***"miningWasteOverburden"*** (proposed extension)
- geology related

  All other types in the code list such as "***occurrence"***, "***deposit"***, including aggregate terms like "***district"***, "***field"***, **"*province*"** etc.

For aggregated reports about informal groupings by mining or exploration companies use "***project"***.
For aggregated reports related to geological groupings use "***district"***, **"*field"*, "*province"*.**
For exploration areas use "***prospect"*.**
For secondary resources use "***tailing"*** and "***miningWasteStockpile"*, "*miningWasteOverburden"*.**
For detailed reports use the appropriate physical occurrence types: "***mineralDeposit*, "*mineralisedZone"*, "*occurrence"*, "*oreDeposit"***, etc.).

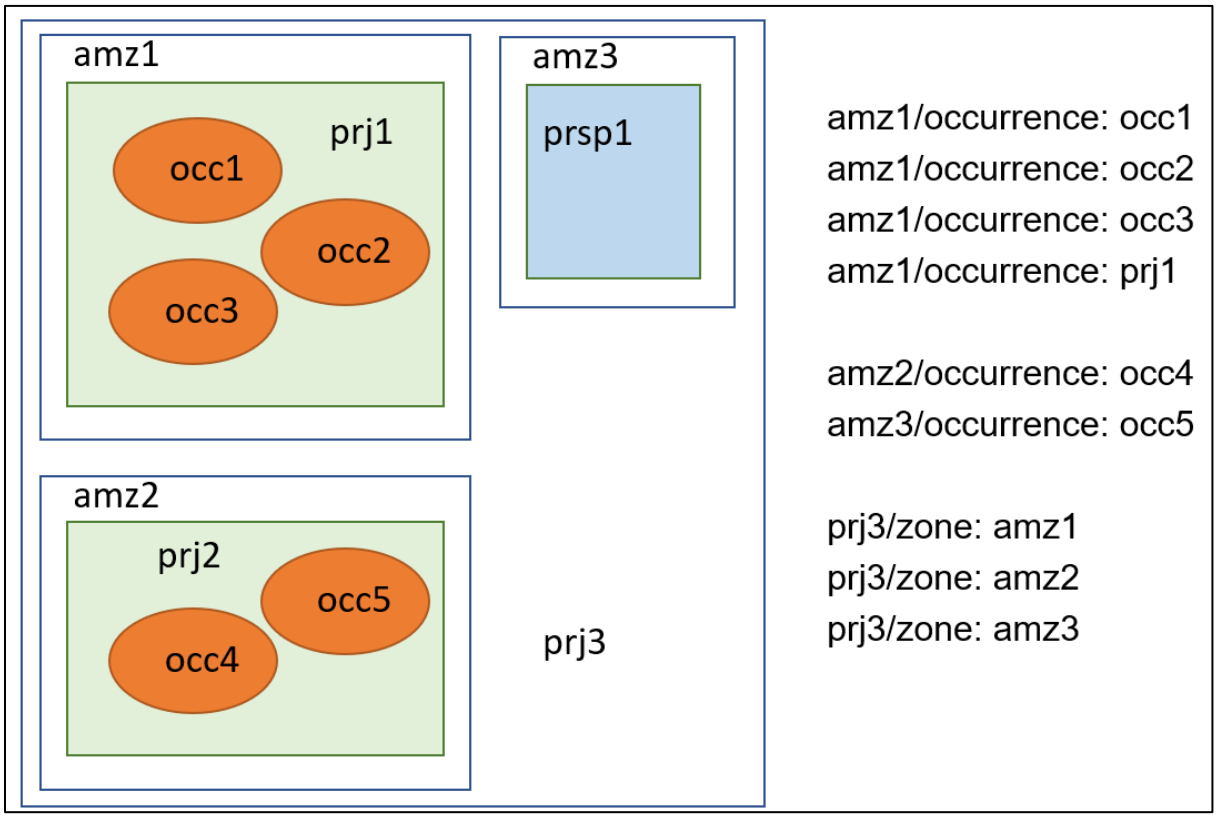


Figure 8. Complex hierarchy of Mineral Occurrences with 3 projects and 3 Area Management Zones

The following example describes a complex hierarchy of Mineral Occurrences:

- Project prj1 includes 3 occurrences: occ1, occ2, occ3
- Project prj2 includes 2 occurrences: occ4, occ5
- Prospect prsp1 is a potential mineral deposit under preliminary exploration

These projects overlap with the following Area; Management Restriction; and Regulation Zones:

- prj1 with mining permit area amz1,
- prj2 with mining permit area amz2,
- prsp1 with prospecting area amz3.

Project prj3 represents the entire mining complex.
In the MIN4EU data model "*MineralOccurrences*" and Area Management Zones can be linked together using the "***occurrence*"** and "***zone*"** properties as shown on the figure above (Figure 8).
A project is supposed to aggregate physical occurrences that belong to the same Area Management Zone. Super projects may aggregate more Area Management Zones. This 3-level hierarchy should cover all cases.

2.2.7. Mining Waste data and UNFC in the MIN4EU database

In the frame of professional co-operation between FutuRaM and GSEU projects and based on meetings and discussions on UNFC application for mining wastes, a UNFC Access Form was developed by FutuRaM project recently for internal use (more details will be available in FutuRaM reports). GSEU partners were asked to fill the UNFC Access Form and based on feedback on experience and iterations, a final version was prepared by GeoZS (in the frame of FutuRaM).

2.2.7.1. Data Model

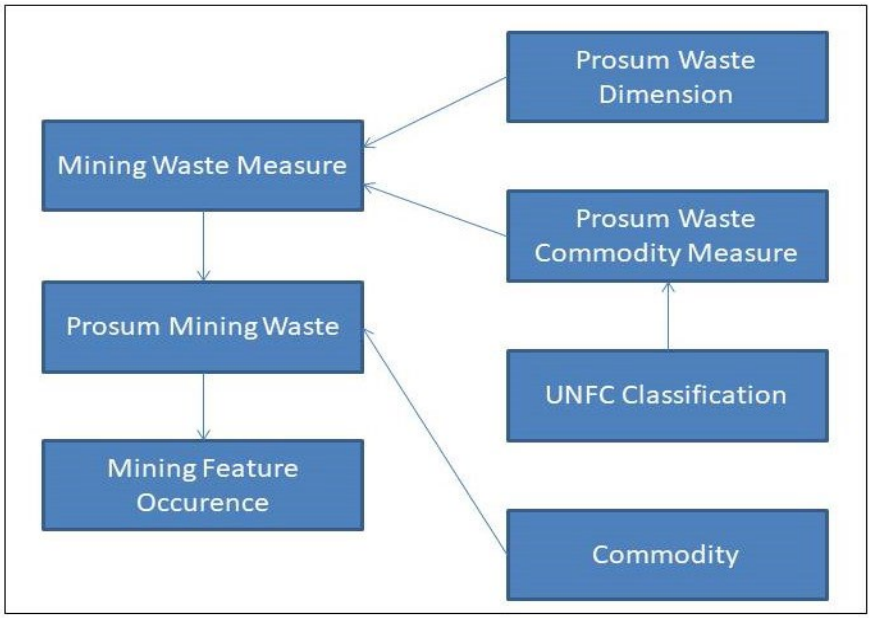


Figure 9. Draft Connections between Relevant Mining Waste Datatypes and UNFC Classification

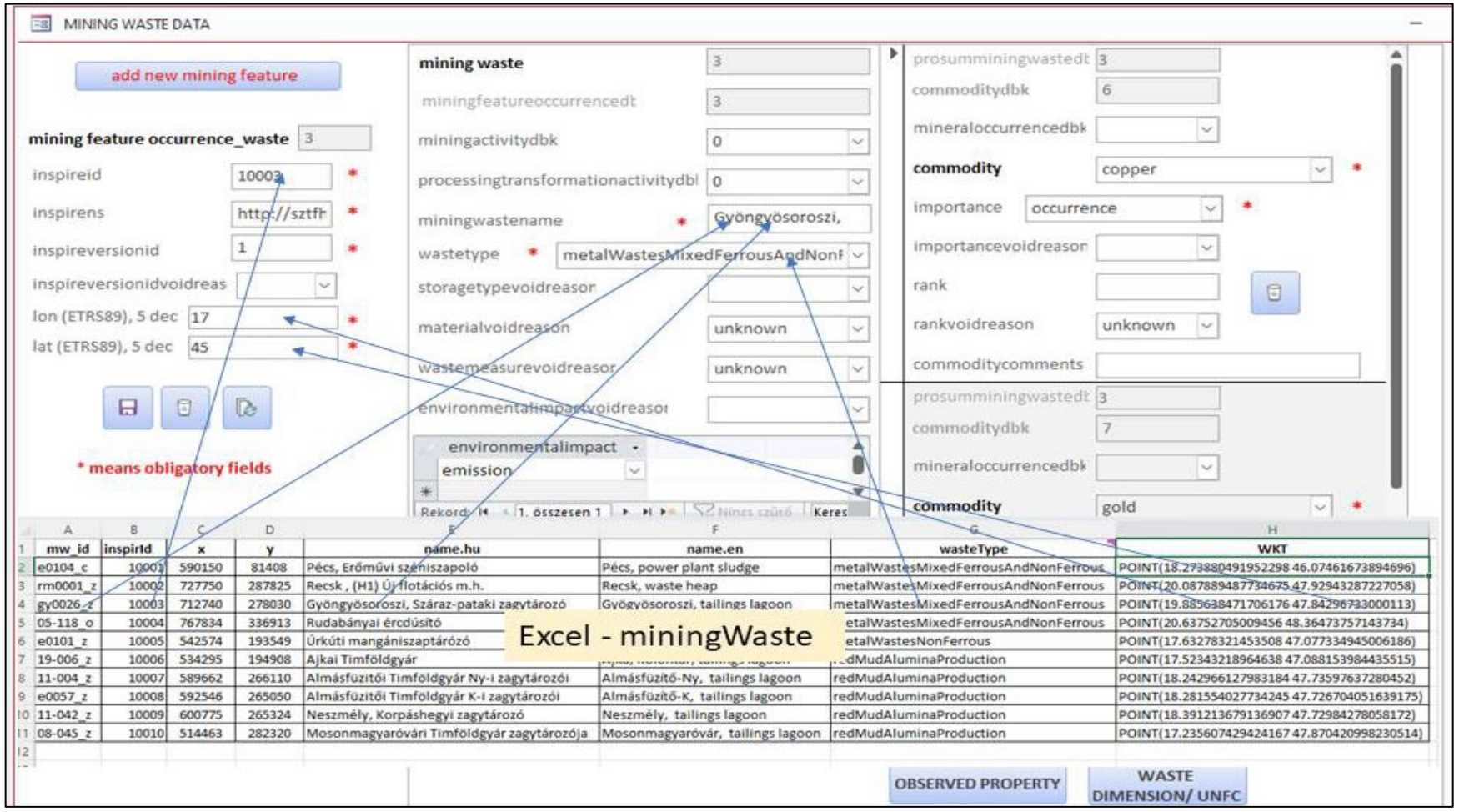
In the frame of the GSEU activity four UNFC PDF template test examples were prepared for primary and 2RM (use cases), and experience and results were integrated into the MIN4EU data model. It serves as an appropriate base to develop, via data collection, a coherent and comprehensive database within EGDI. The draft connections between relevant mining waste datatypes and UNFC classification is on Figure 9.

2.2.7.2. Experience with the Mining Waste Access Form

The Access Form consists of four tabs. Based on "Instruction for Mining Waste data Entry in MS Access (FutuRaM project)" by Katarina Hribernik (GeoZS, 2023) the following data must and can be integrated into the Access Form:
In the first tab, elementary data of mining wastes and commodities. Most relevant data are: "*mining waste feature occurrence_waste*" (identifications and coordinates in ETRS89 in five decimals), "*mining waste*" (data for mining and transformation activity, waste type, name of the site, environmental impact, waste storage type, commodities (multiple selection is allowed). Commodities are selected from the MIN4EU code list. There is a ranking opportunity between commodities including Critical Raw Materials.
On tab 1 a button for "*waste dimension/UNFC*" is linked to the form with e.g. following data: the date of measure for classification, the methodology that is used for classification of the mining waste (UNFC can be selected), information on estimation of composition (e.g. production), the volume of the mining waste (min. and max.), the amount of the commodity, if any (min. and max.).
In case of the selection of the *UNFC Classification,* further information can be provided for UNFC E, F and G categories, including the exact identification of each category and relevant comments, if any.
In the case that there are measurements for commodities (observed property), further details can be provided e.g. for sampling methodology and data for sample collection.
The second tab deals with mining activity in more details. It covers the starting and end time of the activity, and processing of ore.
The third tab is for the processing & transformation plant in general where, as well as providing data coordinates (probably different, because the transformation plant is generally not at the same location as the mining waste) and identification of the plant by country, name, status, the start and end times of the project can also be indicated.
The fourth tab was developed to provide information on processing & transformation activity itself that occurs at the location of the processing plant. Provision of data is similar to before (e.g. begin time and end time of the activity).
In case of all relevant data being available, with the above-mentioned instructions, the Access Form for mining waste can be filled easily and provide UNFC codes for E, F and G categories.
As with the UNFC PDF template (mainly for primary raw materials) a semi-automatic UNFC classification tool helps to decide for the evaluator, so in the Access Form for mining wastes the UNFC classification is based directly on the decision of the evaluator. In the case of appropriate UNFC classification, correct UNFC codes can be integrated into the MIN4EU database.
Figure 10 shows how data needs to be recorded into the Access Form from a national database.

2.2.7.3. Preliminary Results using the Mining Waste Access Form within the GSEU Project

In the contest of the co-operation between GSEU and FutuRaM projects, GSEU partners contributed to the data collection by using the Access Form for mining wastes and UNFC initiated by the FutuRaM project. Basic information on mining waste facilities (identification of site, name and commodity) and quantity data were provided using the Access template. In the first data collection period several partners provided basic data and few partners provided quality data as well (geochemical).



	A	B	C	D	E	F	G	H
1	mw_id	inspirId	x	y	name.hu	name.en	wasteType	WKT
2	e0104_c	10001	590150	81408	Pécs, Erőművi szeniszapoló	Pécs, power plant sludge	metalWastesMixedFerrousAndNonFerrous	POINT(18.273880491952298 46.07461673894696)
3	rm0001_z	10002	727750	287825	Recsk , (H1) Új flotációs m.h.	Recsk, waste heap	metalWastesMixedFerrousAndNonFerrous	POINT(20.087889487734675 47.92943287227058)
4	gy0026_z	10003	712740	278030	Gyöngyösoroszi, Száraz-pataki zagytározó	Gyöngyösoroszi, tailings lagoon	metalWastesMixedFerrousAndNonFerrous	POINT(19.885638471706176 47.84296733000113)
5	05-118_o	10004	767834	336913	Rudabányai ércdúsító		etalWastesMixedFerrousAndNonFerrous	POINT(20.63752705009456 48.36473757143734)
6	e0101_z	10005	542574	193549	Úrkúti mangániszaptározó		etalWastesNonFerrous	POINT(17.63278321453508 47.077334945006186)
7	19-006_z	10006	534295	194908	Ajkai Timföldgyár		dMudAluminaProduction	POINT(17.52343218964638 47.088153984435515)
8	11-004_z	10007	589662	266110	Almásfüzitői Timföldgyár Ny-i zagytározói	Almásfüzítő-Ny, tailings lagoon	redMudAluminaProduction	POINT(18.242966127983184 47.73597637280452)
9	e0057_z	10008	592546	265050	Almásfüzitői Timföldgyár K-i zagytározói	Almásfüzítő-K, tailings lagoon	redMudAluminaProduction	POINT(18.281554027734245 47.726704051639175)
10	11-042_z	10009	600775	265324	Neszmély, Korpáshegyi zagytározó	Neszmély, tailings lagoon	redMudAluminaProduction	POINT(18.391213679136907 47.72984278058172)
11	08-045_z	10010	514463	282320	Mosonmagyaróvári Timföldgyár zagytározója	Mosonmagyaróvár, tailings lagoon	redMudAluminaProduction	POINT(17.235607429424167 47.870420998230514)
12								

Figure 10. Entering Mining Waste-related Datatypes into the Access Form from a National Database (Example from Hungary, SZTFH)

2.3. Data Validation

Data validation can be approached either through controlling data quality, or by the retention of the value of the data to ensure up to date data. With reference to the MIN4EU database, as well as UNFC codes other UNFC related information is necessary to provide sufficient and supporting background data to control the compliance of the UNFC classification. Data on "*mine status*", on "*exploration activity*", and UNFC E, F and G related information (e.g. feasibility studies, technical operation plan, permissions) are basic data for UNFC classification. Background data establish the fundament for a correct UNFC categorisation. National level data validation starts with the responsible person (e.g. Qualified Expert or expert who should pass UNFC training) who evaluates the UNFC classification for a project. In private companies, a Competent Person or Qualified Expert(s) provides the UNFC classification of a given project with validation of data and the relevant report.
The explanatory text within the UNFC PDF template and the algorithm based on UNFC (2019) and UNECE (2022) is a supporting tool that helps to validate UNFC classification.
In the case of use of the UNFC PDF template by all GSEU partners and relevant stakeholders at national level, a coherent and comprehensive UNFC database can be developed on EU-level.
The terms of the UNFC PDF template are harmonised with the MIN4EU code lists that are INSPIRE compliant.
UNFC classification is a dynamic classification process between project evaluations characterised by the date of the classification and its recording into the mineral resource inventory. Due to developments in the lifetime of a project (e.g. acquisition or withdrawal of permissions) UNFC classification may be changed. An up to date mineral resource inventory that contains information on UNFC classification depends on the raw material or resource data management by government bodies (geological survey organisations or authorities or ministries) and annual updates (at least) are recommended.

Suitable tools for the MIN4EU DB are under development, aiming to ensure UNFC data quality and the availability of relevant information for UNFC classification in CRM-bearing projects. Due to the technical aspects, close collaboration with WP7 partners created the plan of actions listed in Table 6.

Table 6. Plan of Joint Actions with WP7 in 2025 and 2026

Planned Action	Product Number	Specific Task	Planned Period for Implementation
MIN4EU Critical Raw Material Extension for UNFC evaluation	Product 3	R 1 - MIN4EU CRM Extension for UNFC evaluation	first half of 2025: Jan 25 - Jun 25 (M29-M34)
		R2: Data Harvesting Plan from MIN4EU.	first half of 2026: Jan 26- Jun 26 (M41-M46)
Customisation of EGDI viewer for accessing MIN4EU CRM for UNFC	Product 4	R1: Customisation of EGDI viewer for accessing MIN4EU CRM for UNFC	first half of 2026: Jan 26- Jun 26 (M41-M46)

3. UNFC Guidance/Type Documents at National Level

3.1. Introduction

This chapter outlines the purpose of the national level UNFC guidelines and highlights the specific progress made by project partners in developing such guideline-type documents. These documents may include finalised or updated guidelines, bridging documents, or initiatives such as mapping, training sessions, or consultations with stakeholders to share and discuss existing knowledge and experiences. They may also involve discussions on supplementing these documents to enable more efficient and accurate UNFC classification and appropriate data management in connection with the CRM Act. These guideline-type or UNFC methodological summary documents, available in English or national languages, contribute to a better understanding of the UNFC and its benefits and support the implementation of national-level UNFC training sessions.

3.1.1. Aim of the Guidance

The aim of UNFC guidance on national level is to support the work process of UNFC classification by an expert or a stakeholder who needs to provide and interpret UNFC information. A UNFC guidance document does not have obligatory content, but it needs to be based on UNFC rules according to the UNFC (2019) and needs to be aligned with the UNECE UNFC Guidance for Europe (2022). A guidance document can also help preparers to produce UNFC inventories and support users by clarifying how the UNFC (2019) can be used to facilitate policy and strategy formulation, government resources management, industry business processes and capital allocation.

In order to understand the importance of the UNFC within a national resource management system it is recommended that the UNFC methodology is placed into the context of the national legislative background for raw materials data collection and data management.

The application of the UNFC is prescribed in the CRM Act but a UNFC guidance document on national level contains voluntary recommendations on how to classify projects according to UNFC in line with the local legal requirements.

3.1.2. Why UNFC and Why National Mineral Inventory?

The United Nations Framework Classification for Resources (UNFC) is a resource project and principles-based classification system for defining environmental-socio-economic viability, technical feasibility and providing a measure of data confidence. The UNFC provides a consistent framework to describe the level of confidence of the future quantities produced by the project. Sources, such as solar, wind, geothermal, hydro-marine, bioenergy, injection for storage, hydrocarbons, minerals, nuclear fuels and water, are the feedstock to resource projects from which products can be developed. These sources may be in their natural or secondary state (anthropogenic sources, tailings, etc.) (UNFC 2019). However, the requirements, terminology and legal framework that apply to sectors from which CRMs could be sourced are often sector and region-specific. National guidelines can take these particularities into account and provide valuable assistance in the local implementation of the UNFC and for coherent information on the national inventory.
The UNFC supports the CRM Act and its objectives as it enables classification of projects along the value chain from exploration, mining, to processing and recycling. The UNFC is also a simple, applicable

tool to assess the environmental and social performance of projects, and to monitor development over time. Comparison of different resource types is also viable through the use of the UNFC.

National mineral resource inventories regarding critical raw materials need to be developed. Proper data in national level inventories can be bridged directly or indirectly to UNFC. The UNFC links to the 2030 Agenda for Sustainable Development and The Sustainable Development Goals and can facilitate sustainable resource management at national level.

3.1.3. Building Common Understanding at National Level

Based on GSEU project results (GSEU project D2.1. in 2023; WP2 T2.4. meetings and internal discussions) and the involvement of GSEU partners in national (projects, events) and international UNFC activities (e.g. UNECE events, Network of UNFC Practitioners) it can be stated that the uniform and consistent application of the UNFC in Europe can only be achieved if the data-providing institutions of the countries and other stakeholders (authorities, experts, enterprises) have access to a nationally accepted UNFC methodology, at least on a professional level. This methodology must align with UNFC rules, be based on national data management and resource management conditions (e.g., regulatory framework), and provide appropriate and specific instructions on the use of the UNFC.

3.1.4. Terminology, Definitions, Translations to National Languages and English

To ensure an adequate knowledge base and understanding for the appropriate application of the UNFC in each country, it is highly recommended that the relevant UNFC documents are translated into the national language and related concepts with the terminology used in national resource management practices are aligned. Translating the UNFC (2019) publication is essential, but a more in-depth study or even translation of the UNECE UNFC Guidance for Europe (2022), which contains more detailed instructions, could significantly support and enhance the precise application of the UNFC at national level. This process can be supported by providing UNFC training to stakeholders at national level and facilitating consultations among professionals from geological surveys, mining authorities, and other stakeholders (ministries, enterprises). This process can contribute to the common knowledge and acceptance of UNFC methodology on national level that may result in the preparation and publication of final UNFC guidance at national level. An English version of a UNFC guidance-type document at national level can facilitate the professional discussion and validation by international organizations (e.g. UNECE EGRM Technical Advisory Group or GSE International Centre of Excellence for Sustainable Resource Management, ICE-SRM).

3.1.5. Stakeholders /Practitioners, Users

Critical Raw Materials data providers and UNFC users as stakeholders were mapped and identified in the frame of the GSEU project WP2 T2.3. EU ICE SRM. Main stakeholders are ministries, mining authorities and geological survey organizations, while environmental, planning, financial authorities or agencies also play a role in identifying a project in the UNFC. Enterprises (entrepreneurs, companies) and individual experts (Competent Persons, Qualified Persons, Qualified Experts at both national and international levels) from the mining, environmental and financial sectors may also be interested in using the UNFC. This may be triggered particularly by applications for Strategic Projects in the context of the CRM Act, or to build a UNFC inventory in a sustainable project management environment, but also by the need to communicate the status of complex projects (over time). Universities are also important stakeholders by providing educational materials for the application of the UNFC.

3.2. Existing Documents and Structure

Based on GSEU WP2 T2.4. project activity and relevant results (D2.1. UNFC report), project partners continue to examine the use of the UNECE UNFC Guidance for Europe (2022) at national level. This was done by comparing the document to various regulatory environments, data management systems, and mineral resource classification systems. The existing or developing UNFC guidance-like documents at national level (from the Czech Republic, Finland, Poland, Hungary, Austria, Norway, Sweden, Slovenia and UK) were updated based on shared experiences from internal (UNFC trainers within the project) and external suggestions (UNECE EGRM), and the three-part UNFC training. Experts from some countries (Hungary, Austria) updated their national guidelines, while a new bridging guideline was developed (Cyprus). Many national geological service experts would directly use the UNECE UNFC Guidance for Europe (2022), but in the context of the CRM Act, additional internal or national UNFC guidelines will contribute to the more efficient implementation of the CRM Act. However, this requires national-level UNFC trainings and consultations with other authorities, ministries, and industry stakeholders, after which existing national UNFC guidelines can be updated, or, if necessary, the first guideline-like document can be developed from scratch.

In a UNFC guidance-type document at national level it is necessary to identify data sources for UNFC E, F and G axes. Instructions for UNFC practitioners or data provider organizations need to comply with the legislative environment of the resource management.

Where there is already harmonization between the national / regional CRM database or inventory using the instructions from the UNFC guidance-type document, the data collection, data flow and data provision are easier. Recently available UNFC guidance-type documents are on a map (Figure 11).

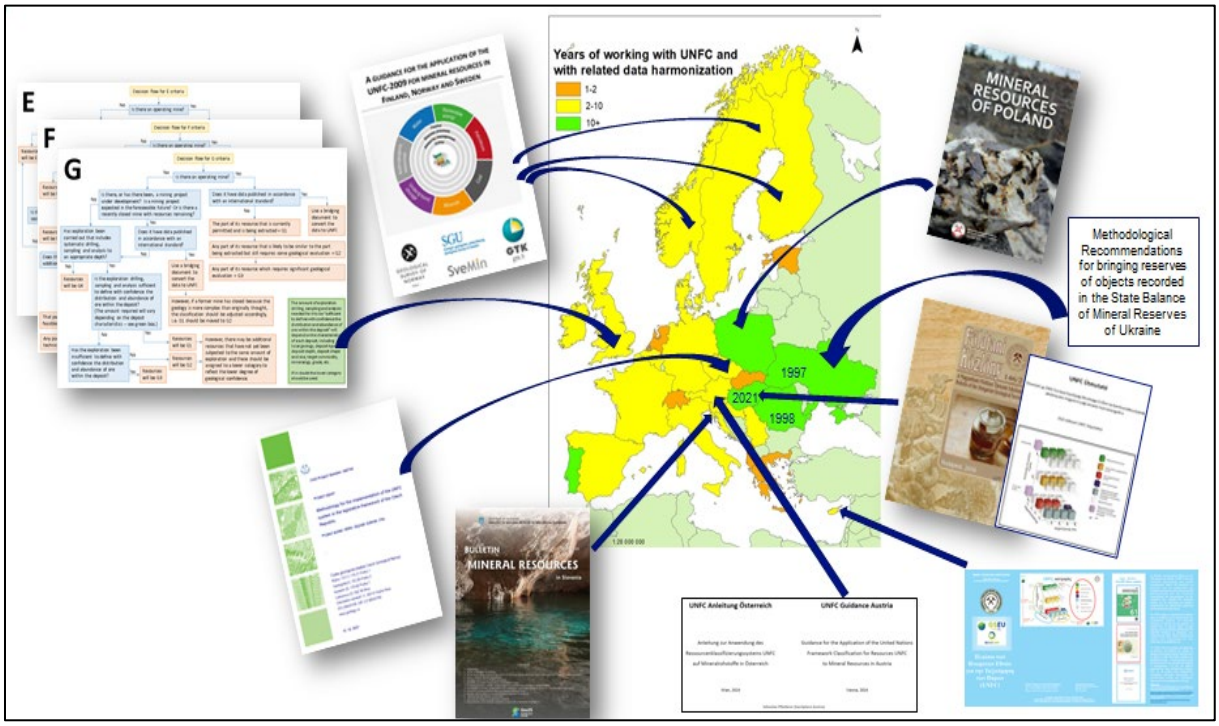


Figure 11. Selected UNFC Guidance-type Documents and Years of Experience with UNFC on Raw Materials Mainly by Geological Surveys and Mining Authorities (according to GSEU activities and previous results). The dates in 3 countries show when legislative documents entered into force with reference on UNFC.

Based on many physical and online conversations including UNFC “train the trainers” the following recommendations and good practices were made.
In order to harmonise the reporting of the status of CRM resources in the member states using UNFC, those countries that have their national system of classification of raw material deposits will need a procedure that will map this national system into the UNFC. This would be formalised in a Mapping Document. Generating a Mapping Document should be done by comparing the definitions and specifications of each category/class of one classification system to the definitions and specification of each of the categories/classes in another system to identify the similarities and differences between them.
Following this, it will be necessary to have a Guidance document that will also outline the principles of the actual application of the UNFC in the legislation framework of the respective country.
The objective is to harmonise the two systems so that they lead to comparable results. A system that is harmonised with UNFC can become an Aligned System through the development and endorsement (by the EGRM) of a Bridging Document.
For countries that do not have an obligatory national system of raw material deposit classification it may be beneficial to map the approval process and obligatory project advancement into decision (tree) maps. This methodology could eventually also be employed in providing guidance in countries with a national system; however, this should be handled with caution.
BGS has developed a decision tree for the UNFC classification that helps to identify appropriate E, F and G categories. This can be considered as a guidance-type document that is an appropriate supporting tool.

The three necessary steps in development of national guidance are:

1) Preparation Phase
- Learn about the UNFC (training of GSOs plus other stakeholders)
- Translate basic UNFC documents into national language
- Define working group for the mapping procedure
- Prepare a list of definitions of the national system categories (legislation)
- Identify sources of data for UNFC E, F and G axes at national level

2) Mapping Phase (see level 2)
- Compare definitions
- Identify thresholds between categories that fit the UNFC

3) Application Plan
- Must involve ministries, mining and other competent authorities and companies

There is a set of documents that will serve as source of information during the process of mapping any national system into the UNFC. These documents have a set order of prioritisation.

<u>Obligatory:</u>
- United Nations Framework Classification of Resources, Update 2019
- Supplementary Specifications for the Application of UNFC

<u>Recommended if relevant (in order of weight):</u>
- Bridging document between CRIRSCO Template and the UNFC
- Guidance Note on the use of the Bridging Document between the CRIRSCO Template and the UNFC
- UNFC Guidance Europe

- Other EGRM endorsed Bridging Documents
- Other national mapping documents

Hints for Translating the Documents

- Translation of the UNFC Guidance for Europe (2022) for all official EU and European languages may be useful for national purposes (e.g. trainings, national use of the UNFC), but it may require capacity
- Preparation of a shortened template for translations taking into account national and regional circumstances: Shortening may cause loss of information
- Minimum: identification of national and regional UNFC circumstances based on comparison with UNFC Guidance for Europe (preliminarily done by partners from Austria, Belgium, Czech Republic, Croatia, Cyprus, Greece, Finland, Hungary, Italy, Norway, Romania, Slovakia, Spain, Sweden, United Kingdom and Ukraine; see D2.1. as Deliverable 2.1 of the GSEU project, 2023).

As a summary it is important that UNFC guidance documents need to be aligned with INSPIRE codes and with UNFC principles (UNECE, 2020). The UNFC PDF Template can help in the development of this type of document. Introduction to the UNFC guidance on national level may be useful to UNFC application and need to be short and easy to understand.

3.2.1. Hungarian Guidance-type Document

The Hungarian UNFC guidance was prepared at the end of 2024. It is based on a previous guidance-type document that is a collection of mineral raw materials, specific publication for the application of the UNFC in a special volume of the Hungarian Geological Society (Horváth et al. 2016, Horváth and Sári 2016). The recent UNFC guidance is based on experience within a national project up to 2020 and from previous national (up to 2020) and EU-funded projects (e.g. GeoERA and ORAMA) under the coordination of EuroGeoSurveys. The most recent experience in the GSEU project with UNFC trainings in the frame of the developing ICE-SRM has contributed to updates to the UNFC methodology in Hungary.

As it was discussed with UNFC trainers and partners of the GSEU WP2 T2.3. and T2.4. on UNFC trainings in Ljubljana (spring and summer of 2024) the recent version of the UNFC guidance in Hungary covers the following topics:

1. Introduction
2. The United Nations Framework Classification for Resources (UNFC)
3. The application of the UNFC to mineral resources in Europe
4. National resource management system
5. Summary of the national data raw material data collection
6. Applied Mineral Resource classification terms

a. Terms of Hungarian mineral resource classification as compared with internationally recognised reporting codes (CRIRSCO 2018) and UNFC (2019)
b. Selected UNFC (2019) classes
c. Categories of Solid Mineral Raw Materials According to CRIRSCO (2019)

7. Summary of the link between the national and international mineral resource classification system
8. Detailed methodology to apply UNFC based on licences for exploration areas and mine plots

In 2025 the UNFC guidance will be introduced in the frame of UNFC training within the SZTFH. Hungarian UNFC trainers aim to observe the applicability of the UNFC guidance by considering different needs and interests within the Mining Inspectorate and the Geological Survey in Hungary within the

SZTFH, and, based on feedback, the final version for publication is planned for mid-2025. Depending on the need and interest by other potential UNFC practitioners e.g. from relevant ministries and other authorities, or from the industry (company and independent experts), stakeholder consultations may also contribute to the final publication of the UNFC guidance in Hungary.

Figure 12 shows that the first version of the UNFC guidance-type document was a special volume from the Hungarian Geological Society. Later, based on experience and GSEU project activity, the guidance-type was updated in English and in Hungarian. The English version is appropriate for sharing experience with international colleagues and professional organisations. The corresponding Hungarian version supports the dissemination of UNFC at national level, application and training.

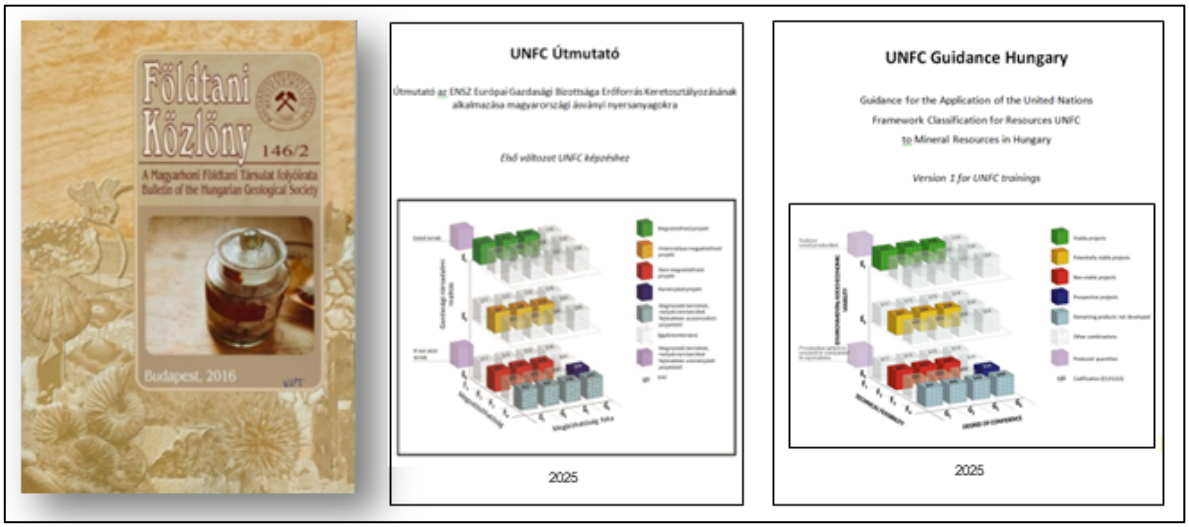


Figure 12. Covers of the UNFC Guidance-type Documents Developed between 2016-2025 According to Updates in the Context of the GSEU project

3.2.2. Czech Republic

The obligatory Czech national classification system of raw material deposits introduced in 1991 is not compatible with any other system, although it originally stemmed from the previously used ex-soviet ABC system. The work on a UNFC guidance document was started by establishing a joint industry group of experts (exploration and mining companies, ministries and the CGS) who were acquainted with the national classification and CRIRSCO compatible classifications (mostly PERC) and who had practical experience in applying these in real projects. The expert group was then trained by experienced GTK experts (Janne Hokka, Tuomas Leskelä). After the training phase, the Czech Ministry of Environment launched a project led by the Czech Geological Service with the objective of setting up a mapping document for bridging the national system to the UNFC. The document was elaborated within the trained expert group for deposits of reserved (state-owned) raw materials (Gabriel et al. 2023). Reserved raw materials include all CRM's identified by the CRM Act. The cover of the guidance-type document by CGS is in Figure 22.

Content of the Czech Mapping Document (Gabriel et al. 2023):

1. Project specification
2. Abstract
3. Introduction

4. Objectives of the project
5. Overview of mineral resource and reserve classifications
5.1. Czech national resources classification system – Description
5.2. UNFC classification - Description
5.3. CRIRSCO Standard Classification - Description
6. Methodology for conversion of mineral classification under the Czech Mining Act to the UNFC
6.1. Existing classification of deposits in the Czech Republic and the method of their conversion to the UNFC system
6.2. Classification conversion of the deposits classified under the Czech Mining Act to the UNFC
6.2.1. Category E
6.2.2. Category F
6.2.3. Category G
6.3. Conversion of the historic Czech ABC_1C_2 classification to UNFC 6.4. Active and non-active projects
7. Conclusion and next steps
8. References
9. Annexes – Conversion table, 2D Matrix, 3D Matrix

As a basis for conversion of the national system to UNFC, the expert group looked at the comparison of definitions of individual categories as set out in the Czech Mining Act and the description of categories in the UNFC core documents. The group was searching for the best match between the descriptions. As auxiliary criteria some principles from the CRIRSCO to UNFC Bridging Document and the INSPIRE code descriptions were also used.
For discrimination, relevant categories and sub-categories, the group identified thresholds stemming from the legal permitting and obligatory project development procedures. As an example, for E1 vs. E2 the approval of a Commissioning, Development and Mining Plan (the Czech abbreviation is POPD), sort of Mine Life plan, is essential and has many requirements including an approved EIA and positive land-planning decisions.
All national categories were then plotted in a table, which assigned the UNFC category and provided reasoning for the particular conversion (Figure 13).
What proved to be a very effective way of visualisation and in fact a great tool was a 2D plot, where the E and F sub-categories formed a table while the G categories are stated in each cell. The G axis determination was done on (1) expert judgement of G1 and G2, based on the Czech category of Explored Reserves in line with CRIRSCO Indicated and Measured Resources, and (2) the description of Prospected reserves as G3 in line with Inferred Resources. Finally, (3) the national categories were plotted into the 3D UNFC matrix (Figure 14).
To finalise the Czech Guidance document, it is necessary to have the UNFC incorporated into the Czech legal framework. This is currently under discussion among the stakeholders. The mapping document is available upon request from the Czech Geological Survey.

Czech Mining Law Categories	UNFC Category	UNFC Sub-category	Reasoning
Approved Mineable Reserves *Approved Commissioning, Development and Mining Plan* *In operation*	111, 112	E1.1 F1.1 G1,2	Mineable Reserves at an operated deposit that has all necessary approvals for mining activities. Czech Mining Law definition of "Mineable Reserves" is approximate to CRIRSCO definiton of "Reserves". In UNFC the CRIRSCO Reserves are E1F1G1,2.
Approved Mineable Reserves *Approved Commissioning, Development and Mining Plan* *In development*	111, 112	E1.1 F1.2 G1,2	Mineable Reserves at a deposit in commissioning/development that has all necessary approvals for mining activities. Czech Mining Law definition of "Mineable Reserves" is approximate to CRIRSCO definiton of "Reserves". In UNFC the CRIRSCO Reserves are E1F1G1,2.
Approved Mineable Reserves *Approved Commissioning, Development and Mining Plan* *Currently not operating*	111, 112	E1.1 F1.3 G1,2	Mineable Reserves at a deposit that has all necessary approvals for mining activities which is active but currently not operated. Czech Mining Law definition of "Mineable Reserves" is approximate to CRIRSCO definiton of "Reserves". In UNFC the CRIRSCO Reserves are E1F1G1,2.
Mineable Reserves *Commissioning, Development and Mining Plan not approved* *Currently not operating*	221, 222	E2 F2.1 G1,2	Active projects that do not have approved Commissioning, Development and Mining Plan, but have already calculated "Mineable Reserves". E2: "Development and operation are expected to become environmentally-socially-economically viable in the foreseeable future." F2.1: "Project activities are ongoing to justify development in the foreseeable future." G1 and G2 are aknowledged in the CRIRSCO template for Reserves and Measured and Indicated Resources.
Economic Explored Free Reserves *Established Mining Area*	221, 222	E2 F2.1 G1,2	Active projects that have Established Mining Area, but do not have approved Commissioning, Development and Mining Plan. E2: "Development and operation are expected to become environmentally-socially-economically viable in the foreseeable future." F2.1: "Project activities are ongoing to justify development in the foreseeable future." "Explored Reserves"

Figure 13. Excerpt from a List of Czech National Categories with Mapped UNFC categories and Reasoning

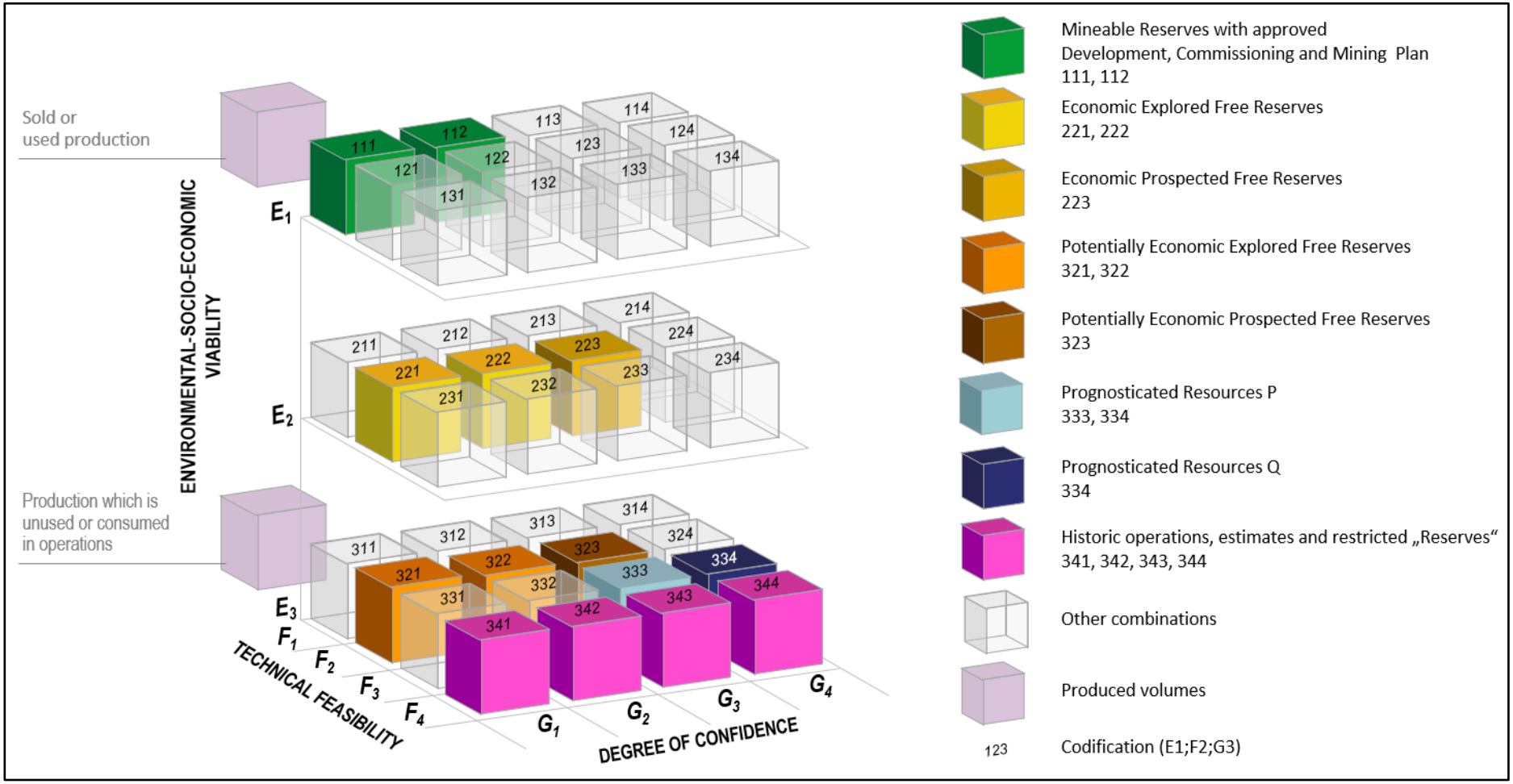


Figure 14. 3D Matrix of Czech National Categories as Mapped into the UNFC

3.2.3. Austria

A guidance document for the application of UNFC to mineral resources in Austria is currently being developed by representatives of the Austrian Geological Survey (GeoSphere Austria), as well as representatives of the Federal Ministry of Finance, the mining industry and academia. This guidance document will provide recommendations on how to implement UNFC in accordance with the Austrian legal framework, and how to map national mineral classification results to the UNFC.

The document first provides a very brief general introductions to the UNFC, to the specifications for classifying mineral resources, to bridging documents mapping international resource classification standards to the UNFC, and to the European guidance document. It then outlines the legal framework for raw material extraction in Austria, in particularly the Austrian Mineral Resources Act, the Mining waste Regulation, as well as regulations regarding the environment, nature protection, water rights, forestry and land use.

Subsequently, the datasets required for UNFC classification are discussed and a list of Austrian data sets, their holders and their accessibility is provided. In the absence of an official or legal mandate for the implementation of UNFC in Austria, a proposal is developed as to which institutions could perform UNFC classifications based on their expertise and data access.

Finally, the Austrian Standard G 1050 for the “Classification of Resources and Occurrences for Solid Mineral Raw Materials” is summarised and a bridging scheme developed to map classification results to UNFC.

3.2.4. Progress on Development of UNFC Guidance at National Level - the Current Status in Germany

The Federal Republic of Germany is a federal democracy whose Basic Law defines the exercise of state power between the Federal Government and the 16 Federal States. In principle, the Basic Law assumes that the federal states are responsible (Art. 30, 70, 83 GG), particularly in the areas of education (schools, universities), culture and municipal administration. This also includes spatial planning and the exploration and extraction of natural resources. In addition to the requirements at EU level, the state administrations implement their own laws as well as those of the Federal Government, such as the Federal Mining Act (BBergG, Germany, Federal Mining Act of 13 August 1980).The federal structure thus reflects the traditional, decentralized cultural and economic structure of the state and takes regional peculiarities into account in line with the subsidiarity principles (https://www.tatsachen-ueber-deutschland.de). Several institutions are affected directly or indirectly, when it comes to implementing the UNFC at national level, hence BGR is building up a Deutsches Netzwerk der Interessierten (DeNI). Like the UNECE Network of Practitioners (NoPE), this network is on a voluntary basis and does not have legal mandates. However, DeNI pools experts from authorities such as ministries and mining authorities, State Geological Surveys, industry and the scientific community who are interested in understanding, applying and using the UNFC for their own needs and who see opportunities to overcome the shortcomings of the current state regarding national inventories. This network acts as a multiplier to ensure coherence in the application of the UNFC among the States and between different actors.

Training

Presentations, workshops and conferences have been held in recent years to promote the UNFC and establish a DeNI. The inclusion within the CRM Act has increased interest in UNFC, which the BGR has taken advantage of. In 2024, several online workshops were held for professional associations and industry, partly in cooperation with the BDG (Berufsverband Deutscher Geowissenschaftler). Further practical courses in collaboration with the BGD and its educational branch (DIE!BA: https://www.die-ba-bdg.de/) are in preparation for spring 2025 and during the 11th Meggen Raw Materials Days in September 2025. In addition, an online workshop on the topic of UNFC for recyclers was held in May 2024, which was conducted by the BGR's DERA.

Moreover, a two-day practical workshop was held in Hannover in December 2024 for representatives of public institutions from all 16 federal states, at which the training material developed by the GSEU partners with regard to the EU ICE-SRM, which is currently being set up, was also used. One group of 16 people took part in person, three others requested training material. The feedback was very positive. As a result, this group will continue to share experiences and collaborate on CRM Act requirements. Follow-up workshops have been requested and will be developed on the requirements identified, such as a common guide (recipe book) for users. Countries such as Brandenburg consider the UNFC to be an interesting tool for national resource inventory and spatial planning. Brandenburg wants to discuss a joint approach based on UNFC within the framework of corresponding Federal and State committees.

3.2.5. Development of UNFC Guidance at National Level in Norway

Since 2016, NGU has been actively engaged in the implementation of the United Nations Framework Classification for Resources (UNFC) through several EU-funded projects, including ORAMA and Mintell4EU. In 2018, NGU contributed to the publication of the Nordic Guidance, *'Guidance for the application of the UNFC for mineral resources in Finland, Norway and Sweden'*, together with the Geological Surveys of Finland (GTK) and Sweden (SGU), the Swedish Association of Mines, Minerals and Metal Producers (SveMin), Norwegian Mineral Industry and Petronavit a.s.

The Minister of Trade and Industry presented Norway's Mineral Strategy in June 2023 with the ambition to develop the mineral industry as the most sustainable in the world. According to the Mineral Strategy, several tasks have been assigned to the Geological Survey of Norway (NGU). Among these are prioritising the mapping of regions identified as having potential deposits of critical minerals and increase the availability of geological data from such areas. The work of the Geological Survey of Norway (NGU) will be strengthened in mapping critical metals and minerals, completing the geophysical mapping of Norway, and developing a dedicated mapping programme specifically focused on critical metals and minerals. NGU has also been tasked to implement the UNFC standard in national resource databases, to enhance the strategic knowledge base regarding the geological, social, and economic aspects of known mineral deposits (Norwegian Mineral Strategy, 2023)

Regarding the implementation of UNFC, NGU is undertaking an ongoing internal project entitled *UNFC Classification of Norwegian Mineral Resources*. The aim of the project is to classify Norwegian mineral resources according to the UNFC, including metals, industrial minerals, aggregates, and secondary resources. The project includes compiling, integrating, and interpreting existing relevant data for the UNFC classification. Another key task is to implement the UNFC classification of mineral resources into NGU's mineral resources database, in collaboration with the ongoing project "Modernising Resource Databases", with the aim of establishing services for UNFC data registration, storage, and display. In addition, the project focuses on aligning workflows with the ongoing EU-funded project, Geological

Service for Europe (GSEU), and on disseminating the UNFC system as well as exchanging experiences with other geological surveys through workshops and trainings.

The NGU is currently in the process of preparing the UNFC National Guidance to support the implementation of UNFC at the national level. The guidance will include the following main chapters: Introduction, Background, The United Nations Framework Classification for Resources (UNFC), Legal Framework, The Application of UNFC for Mineral Resources, Way Forward, and References.

3.2.6. Developing UNFC Guidance in Slovenia

Legal framework and relevant entities/institutions in Slovenia:

- All mineral resources (including energy resources) are State property in accordance with national Mining Act (ZRud-1)
- The Ministry responsible for mining performs activities and tasks aligned with legal framework, it is also responsible for licensing– with the strong support of GeoZS experts
- The Public Mining Service within the Geological Survey of Slovenia, is authorised by the national Government and Mining act
- The Republic Commission for determining mineral reserves and resources (within relevant Ministry) “elaborates on calculated reserves and resources”, it proposes that the Ministry issues a Confirmation of Reserves and Resources. The active role of GeoZS experts in the Commission is crucial
- The primary legal basis of mineral extraction activity is the Mining Act (ZRud-1) (Official Gazette of the Republic of Slovenia, No. 14/14 – official consolidated version, 61/17 – GZ, 54/22, 78/23 – ZUNPEOVE and 81/24)
- The Rules Book on classification and categorisation of solid mineral reserves and resources (Official Gazette RS, No. 3/20- ZRud-1) describes the principles of national resource classification for solid minerals
- The Rules Book on classification and categorisation of crude oil, condensates and natural gas reserves and resources (Official Gazette RS, No. 36/06 and 61/10 - ZRud-1) describes the principles of national resource classification for liquid energy resources

National data on mineral reserves and resources and some specifics of reporting in Slovenia:

- In Slovenia there is a ”national“ mineral reserves and resources systematisation (derived from ex-soviet one) in official use
- A ”Bridging document“ is needed with the aim of transforming data from national to the UNFC classification. GeoZS experts are authorised and relevant for that task
- Reserves and resources are reported only for areas under concessions
- Summarised data on production, reserves and resources are publicly available
- Reserves classification is an ongoing process; data are constantly updated

Classification and categorisation of mineral reserves and resources in Slovenia

Classification and categorisation of mineral reserves and resources are procedures, by which mineral reserves and resources are organised /systemised referring viability/feasibility and level of geological knowledge.

- Classification is systematised on the base of technical and economic viability into classes: economic, potentially economic and non-economic reserves (a)
- Categorisation is done systematically on the basis of the level of geological knowledge, the level of exploration of deposit and quality of raw material into categories: reserves categories A, B in C1 and resources categories C2, D1 and D2 (b)

Mineral classes:

- Economic reserves can be extracted using existing knowledge of techniques and technology (including excavation and industrial loss)
- Non-economic reserves cannot be extracted using existing knowledge of techniques and technology due to differing natural or technical-economic issues (e.g.: scarcity of mineral quantity or quality, too expensive mining/processing method, inconvenient market environment or potentially hight environmental risk).
- Potentially economic reserves cannot be mined currently, but in the future it is assumed that the situation will change to benefit mining, so they can become economic reserves
- Resources are resources in deposit, which are still under-explored, and are therefore not classified

Mineral categories:

- A: Proven reserves (probability is 85%)
- B: Proven reserves with lower level of exploration than A (probability is 70%)
- C1: Less explored reserves than A and B (probability is 50%)
- C2, D2, D: Prospective resources

“Elaborates on calculated reserves and resources” as geological project documentation in Slovenia deals with:

- Calculated and systemised mineral reserves and resources are designated in documentation titled: “Elaborates on calculated reserves and resources in mineral deposit”
- Elaborates are prepared every 5 years (with some exception every 10 years) for each mining area and every 5 years for exploration areas
- Reserves and resources are systemised (categorised and classified) only within mining areas with mining rights and /or with exploration permits

Table 7 shows the possibility of transformation of national reserves system into UNFC.

UNFC Promotion and Knowledge Dissemination in Slovenia

To disseminate UNFC knowledge and understanding of the advantages of using the UNFC global classification, GeoZS experts have already carried out certain activities for a selected target audience, namely:

- On October 12, 2023, a lecture on the UNFC classification compared to the national classification of reserves and resources was held. Introduction of the Slovenian classification and the possibilities of transferring data to the UNFC global 3D classification was presented to GeoZS employees.
- In December 2023 and December 2024, an invited lecture for 2nd year geology students entitled "National data on reserves and resources, classification of mineral reserves and harmonisation activities with the UNFC" was given.

Table 7. Possibility of Transformation of National Reserves System into UNFC

Classes	Economic Efficiency	Categories	UNFC E_{axis}	UNFC F_{axis}	UNFC G_{axis}
Economic	Proven reserves	**A, B, C_1, C_2**	**1**	**1**	**1, 2**
Potentially Economic		**A, B, C_1, C_2**	**2**	**1, 2**	**1, 2, 3**
Non-economic	Measured Resources	**A, B, C_1, C_2**	**3**	**1 - 4**	**1 - 4**

Papers/articles published in Slovenian publications and/or on web pages:

- Slovenian activities associated with “bridging” national mineral reserves classification into UNFC, Bulletin Mineral Resources in year 2023, GeoZS, 2023 - in English
- Activities related to harmonisation of national mineral resources system to UNFC, Bulletin Mineral Resources in year 2022, GeoZS, 2023-in Slovenian
- Report within GSEU, WP2, T2.3: Mineral data management and harmonisation to UNFC classification - Slovenia case as 1. draft of “bridging document” (spring 2023)
- Introduction to methodology of UNFC in Slovenia- upgraded version of 1. draft of bridging document, 2024
- Unofficial translation of document “United Nations Framework Classification for Resources -update 2019”, (up-loaded on UNECE website in autumn 2023)

GeoZS other references:

- GeoZS participates in: INSPIRE expert group, EGDI expert team, UNFC network of practitioners Europe (NoPE)
- GeoZS organised 3 trainings within GSEU (WP2, T 2.3)

GeoZS has already reported national mineral reserves and resources data in the UNFC coding system as part of various EU projects (e.g. Minerals4EU and Mintel4EU). The MIN4EU database is currently the most comprehensive and harmonised publicly available European mineral resources database, organised in accordance with the INSPIRE Directive and accessible via the European Geological Data Infrastructure (EGDI). It will express reserves data in the UNFC classification.

The European regulation CRM Act (2024) requires member states to report on reserves of critical /strategic minerals in the UNFC classification system in 2025.
According to the CRM Act provisions, GeoZS prepared training programme in the frame of EU International Centre of Excellence on Sustainable Resource Management - EU ICE SRM), which is being established within the EU-funded project Geological Service for Europe – GSEU, 3 training sessions were organised and performed with the aim of using UNFC. The final goal was sharing knowledge and build the capacity of experts from 26 countries' participants to how to use UNFC and how to harmonise the national systems into the UNFC global system. "Train the trainers" capacity building programme (from April to June 2024 in Ljubljana) was conducted as 3 level courses from basic level, from user level to expert level. The training programme was attended by more than 70 experts from 26 European countries.

Conclusions

In the context of the GSEU project, GeoZS is responsible for establishing an "EU International Centre of Excellence on Sustainable Resource Management - EU ICE SRM". The most important tasks are the promotion and education on the UNFC system and support to stakeholders in the field of sustainable mineral management (contact: euicesrm@geological.service.eu).

3.2.7. Cyprus UNFC Guidance-type Document

The Cyprus UNFC document is in the Greek language (based on UNFC documents posted on UN website) and is addressed to the public and to companies involved in mining and quarrying, energy and other resources activities, with the aim of providing quick and comprehensive information, for a first understanding of the UNFC. It includes a brief report on what the United Nations Framework Classification for Resources (UNFC) is and briefly describes the categories and subcategories of axes E, F and G (Figure 15).
In addition, the Geological Survey Department (GSD) is preparing a more detailed UNFC document in the Greek language, which is expected to be completed in 2025.
Furthermore, in the context of the implementation of the UNFC, GSD has been conducting a series of trainings on the UNFC, with trainees from the Cyprus Geological Survey Department and other Government Services, geologist and mining engineers from the private sector. Training sessions started in September 2024 and were completed in December of the same year. The training described the categories and subcategories of axes E, F and G, the Classes and Sub-classes of the projects. The training also included the history of the UNFC, the outcome of the ORAMA project, UNFC and CRM-Act, bridging with CRIRSCO family standards, required qualifications, differences between Competent Persons and Qualified Experts, examples of classifications, UNFC for underground water, Hydrocarbons and more.
The training revealed that some quarry companies are concerned about the implementation of the UNFC, as until now there was no mandatory implementation of any standard, but only the implementation of the instructions of the Competent Authority. It is expected that they will gradually understand the benefits of the implementation of the UNFC. The typical scheme and the lifecycle diagram of a project are in Figure 16.
Figure 16 details also the stages of development of the project from exploration to mining and production to the final closure of the mine and the remaining products (that cannot be mined).
It refers to the most important relevant UN documents and references with relevant links to support UNFC users in Cyprus. It also contains a basic table of categories (from UNFC Guidance Europe 2022). Figure 17 and Figure 18 show further details for Viable and Potentially Viable Projects.

Figure 15. Cyprus UNFC Guidance-type Document

Figure 16. Project Stages of Resource Development

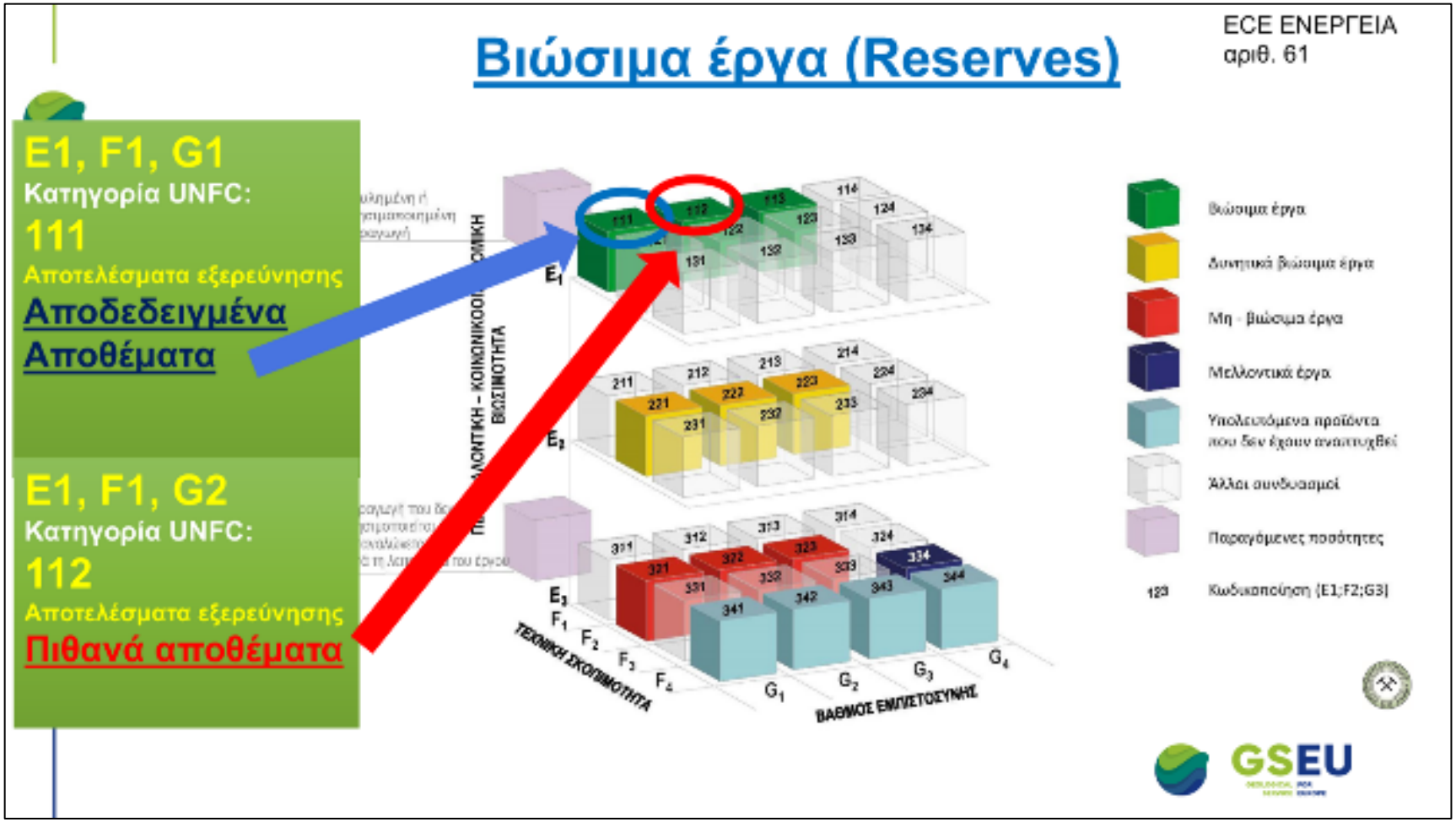


Figure 17. Viable Projects – Project in Production with Reserves Estimates

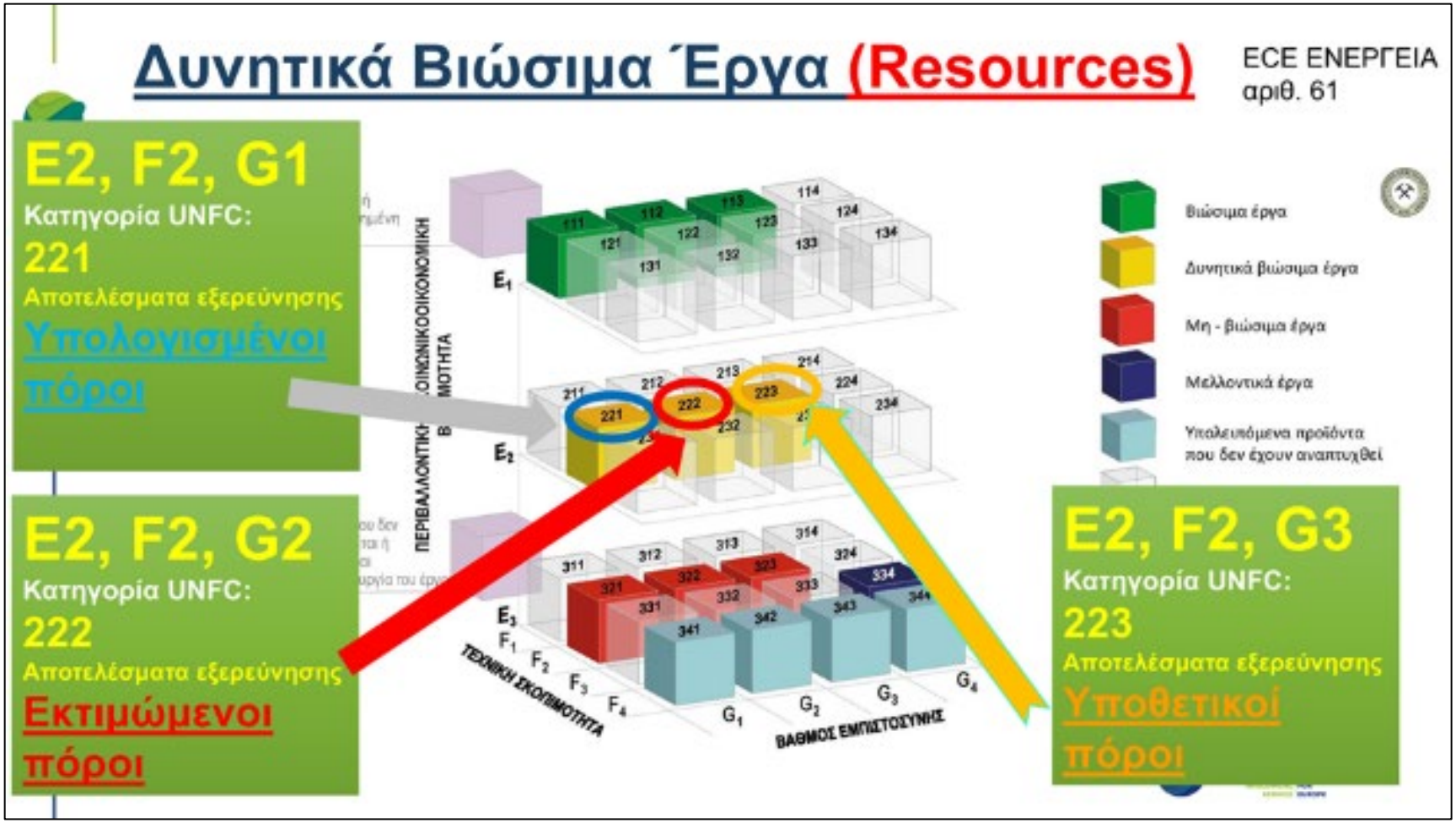


Figure 18. Potentially Viable Projects - Projects with Resource Estimates. Further feasibility studies are required to assess their viability.

3.2.8. Development of UNFC Guidance at National Level – Finland

In Finland, the UNFC system has been implemented following the methodology outlined in the national guidance document titled 'Application of the UNFC Resource Code in Finland – Practical Guidelines' (Hokka et al., 2020) and further detailed in 'Mineral Resources of Finland Classified According to the UNFC Code' (Eilu et al., 2022). The application methodology has been revised following the publication of the UNFC Guidance Europe document and the updated CRIRSCO-UNFC Bridging Document. An update to the national practical guidelines is planned.

Mineral resource and reserve data are stored into Finland's mineral deposit database as CRIRSCO, non-compliant and UNFC. Data bridging, mapping and aggregation is done through ETL-process (Extract, Transform and Load) and can be run regularly. As a result, Finland's total mineral resources can be presented consistently and in a harmonised manner, considering the geology of each deposit, the technical work completed, permits, and financial and societal aspects, regardless of when or how mineral resources and deposits have been reported. The aim of UNFC classification is not to re-assess or re-evaluate existing resources nor forecast changes in exploration and mining permitting, but only to harmonise the existing information under the UNFC in national mineral inventory purposes.

The databases contain both Active and Non-Active Projects which can be either Viable, Potentially Viable or Non-Viable. Non-Viable Projects are commodity endowments without consideration of economic viability in the foreseeable future (Non-Viable Projects: closed and/or historic). Mapping and harmonising all the resource and reserve estimates from the mineral deposit database to UNFC code was done with ETL-tool (Safe Software FME) (Eilu et al., 2022, Safe Software 2023). Basically, three different data types were processed) (Figure 19):

1. Active Project (Potentially Viable or Viable Projects) has Exploration Target, Mineral Resources or Mineral Reserves reported in accordance with CRIRSCO-style reporting standards (CRIRSCO, 2024). Hence, no reclassification is done, and the original resource (and reserve) categories are directly mapped by using the CRIRSCO–UNFC bridging document (UNECE 2024). Mapping of the pre-feasibility study phase reserves has been updated to reflect the most recent update of the CRIRSCO-UNFC Bridging Document.
2. If there is an active or a non-active Project with an old 'historic' resource or a resource otherwise not compliant with the CRIRSCO-family reporting standards, and the data density is low on the resource, we map the resource into UNFC class 334.
3. Active or non-active Projects reclassified according to the UNFC code by GTK: no mapping is needed. These Projects are cases specifically evaluated by the GTK experts following the UNFC documents and internal guidance document (see below).

As a result, an aggregated mineral resources tonnage table is created where all the resource and reserve information are mapped and harmonised to the UNFC code. This aggregating process is run regularly (currently once a month) to have an up-to-date table of the mineral resources of Finland.

Practically all public information on mineral deposits in Finland is available in the GTK Mineral Deposits and Exploration map service (Mineral Deposit Database of Finland, version 2021). The resource estimate of a deposit as stored in the database is shown in the 'Resources' and 'Calc_method' fields in the web map. 'UNFC_Classification' field shows the amounts of commodities mapped to UNFC categories. Each deposit is linked to a PDF report in the map service. This report contains all the information stored in the mineral deposit database for the deposit and links to original reports of data and information per deposit. UNFC information regarding active projects is not public in the map service, because the CRIRSCO-UNFC Bridging Document requires a sign-off from a Competent Person (CP) or

Qualified Expert (QE) to carry out bridging (UNECE 2024; UNECE 2022c). To avoid any possible legal liabilities, GTK experts do not publicly bridge the resource information of private companies.

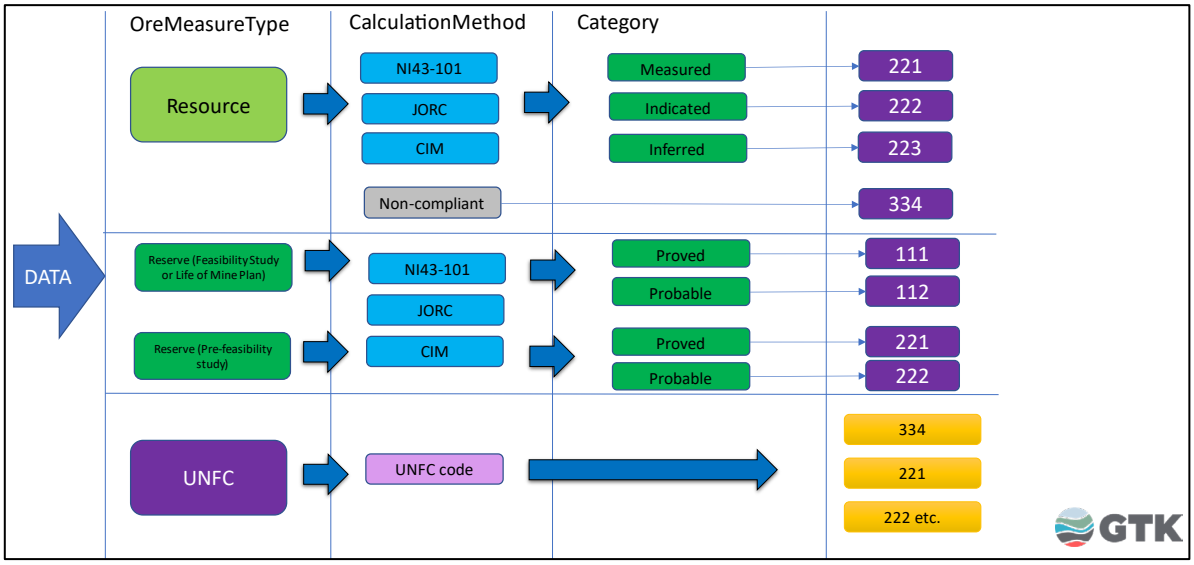


Figure 19. Simplified Mapping Process from the Mineral Deposit Database of Finland - Primary Data to UNFC Resource Categories

Mapping of specific projects (e.g. with complex permitting process) into UNFC is done following the 'UNFC Guidance Europe' and 'Application of the UNFC resource code in Finland - Practical guidelines' documents, such as in the cases of:

- Commodities reported within the previous estimate but excluded from the updated resource estimate
- By-products and co-products which a company has dropped from recent resource estimates
- Outdated Resource estimate ('Ownership change')
- Active Projects turned Non-Active
- Mapping 'historic' resources into UNFC
- Industrial Mineral Project with data gaps
- Mineral company reporting with data gaps

3.2.9. UNECE Perspectives

The UNECE is actively engaged in the development of the UNFC and UNRMS and the promotion of their applications through a globally extensive expert network. The UNECE EGRM provides professional support for achieving the objectives of the GSEU UNFC tasks. As part of this, in June 2024, Charlotte Griffiths, Slavko Solar, and Ghadi Sabra, representing UNECE EGRM, participated in the 3rd UNFC training. Additionally, Slavko Solar shared UNECE's recommendations with the participating project partners. The proposed content for UNFC guidance on national level is the following:

List of Figures
List of Tables
Executive Summary

Introduction
UNFC
National Classification System
Competency and Qualification Requirements
Bridging National Classification System to UNFC
Project
Overall mapping
- Detailed mapping of the E-axis
- Detailed mapping of the F-axis
- Detailed mapping of the G-axis
- Exploration
- Additional Considerations
- National UNFC-based Inventory
- CRM Act Template
- Exploration
- Monitoring Supply Risks

Recycling
Conclusions
References
Recommended Figures
- General Relationships between Exploration Results, Mineral Resources and Mineral Reserves, as set out in the National Template
- Diagrammatic representation of the UNFC classification

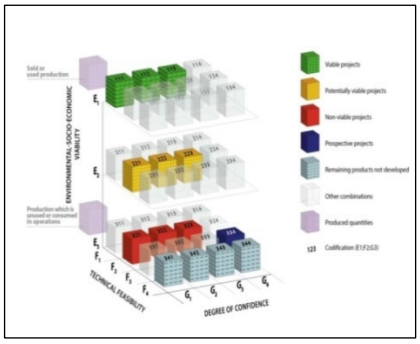
Recommended List of Tables
- UNFC Classes, Sub-Classes, Categories and Sub-Categories (from UNECE, 2021)
- Standard mapping of National Classification Template aligned estimates to UNFC categories
- Specification of the UNFC-E-axis and corresponding National Classification Template considerations
- Specification of the UNFC- F-axis and corresponding National Classification Template considerations
- Specification of the UNFC-G-axis and corresponding National Classification Template considerations

Recommended references:
- UNFC 2019
- CRIRSCO Template & UNFC Bridging document
- UNFC Guidance Europe
- Poland Mineral Book 2022
- Application of the UNFC resource code in Finland / Practical guidelines
- Minventory final report (Parker et al. 2015)
- United Nations Framework Classification for Resources Case Study from Austria - Sand and Gravel Resources in Greenfield Areas (Pfleiderer 2022).
- MINLAND: Deliverable 4.1: Existing valorisation and classification schemes and valuation methods for mineral land use practices (Kot-Niewiadomska and Galos 2019)

3.2.10. Links between UNFC Training and Development UNFC Guidance at National Level

UNFC training sessions at international and national/regional levels play an important role in spreading UNFC knowledge. They are led by experts who attended the GSEU ICE SRM UNFC “train the trainers” sessions, or by professionals from other UNFC training events, sharing experiences and debating realistic cases. Like stakeholder consultations, these sessions offer authorities and organizations involved in UNFC data collection, management, and reporting an opportunity to apply the principles and practical guidelines consistently, thereby enhancing UNFC data quality at both national and European levels. The EU ICE SRM initiative supports this process by leveraging the expertise of UNFC specialists to implement the goals of the CRM Act while considering UNRMS principles.
UNFC training sessions and stakeholder consultations also help users become familiar with guidelines developed by specific organizations. These guidelines clarify national regulatory and data access conditions and provide instructions for using the UNFC framework at the national or regional level.

Table 8. Synergies between UNFC Training and Development of UNFC Guidance at National Level

GSEU and CRM Act objectives		
UNFC Training		**UNFC Guidance at National Level**
• Partners learned and practiced together • Skills were developed to use UNFC • NFC case studies were dicussed • Examples for itinerary to develop UNFC application (mapping, bridging) on national level were presented • Manual with UNFC training materials helps UNFC practitioners to apply UNFC	 	• Partners develop UNFC methodology based on national raw materials data management and experience of UNFC training sessions (skills, cases) • Topics addressed: • Introduction to resource management, legislation, raw materials data collection, resource classification

The Role of Stakeholder Translation of UNFC-related Documents to National Languages

Translation of UNFC-related documents to national languages may significantly support better understanding and implementation of the UNFC at both national and EU-levels.
Translation of UNFC related documents in many cases requires better and more detailed insight into national raw materials related legislation including terms that are used in daily life (research, exploration, official decisions). In the frame of UNFC training sessions and stakeholder consultations at national level, translated training materials and translated UNECE UNFC related basic documents allow participants and practitioners to exchange experience. Clarification of terms and identification of information and processes that are necessary to UNFC classification including relevant permitting stages and the related requirements support the development and finalization of UNFC guidance at national level. An example for translation of a UNECE document at national level is in Figure 20.

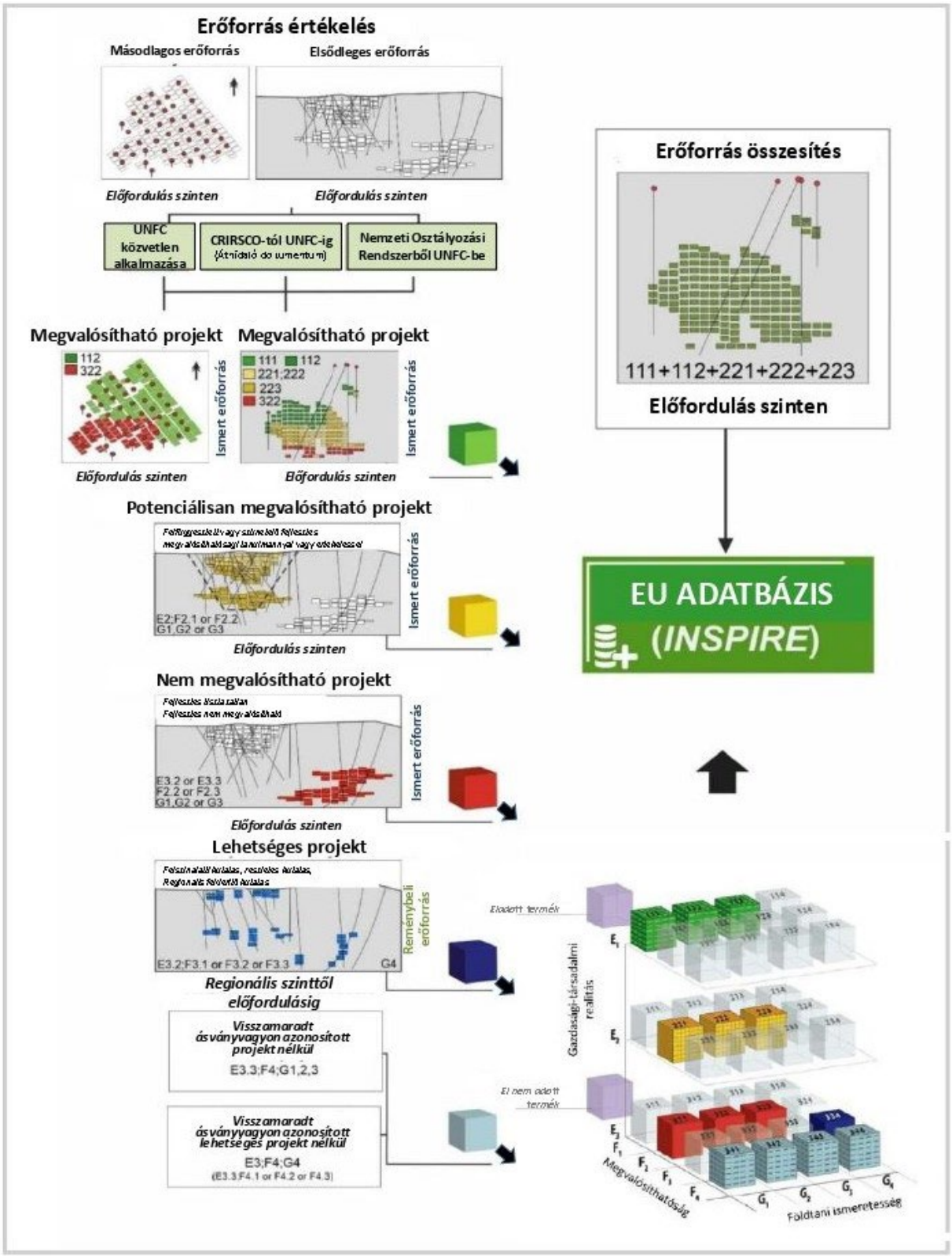


Figure 20. Excerpt from the Translated Version (Hungarian) of the UNECE UNFC Guidance for Europe (GSEU roject result, publication in 2025).

3.3. Progress with the Development of UNFC Guidance at National Level

In this chapter, we summarise the results of a questionnaire survey that aimed to reveal the circumstances of the development of UNFC guidance-type documents at a national/regional level by data provider organisations (GSO or Mining Authorities).

Main focuses were on the planning of co-operation with other stakeholders, the intention to share the UNFC guidance at national level with the public, the readiness level, the direct use of the UNECE UNFC Guidance for Europe (2022) and the usefulness of different approaches that were discuss on the 3rd level UNFC “train the trainers” training in Ljubljana (June 2024).

The following assessment and interpretation are based on answers by experts from CRM data provider organisations (mainly geological survey organisations and some authorities with mining inspectorate) from Austria, Croatia, Cyprus, Czech Republic, Finland, France, Germany, Hungary, Italy, Norway, Slovenia, Spain, Sweden, United Kingdom.

Figure 21 illustrates responses to the question of whether the UNFC guidance at a national or regional level (including updates, if applicable) will be developed in cooperation with other stakeholders. 43% of respondents answered, "I do not know." 22% confirmed that the guidance will be developed collaboratively with other stakeholders ("Yes"). 14% indicated it will be developed exclusively by their own organization ("No, it will be developed only by our organization"). Other options, such as the existence of a current document or a lack of intent to develop such guidance, are not significantly represented.

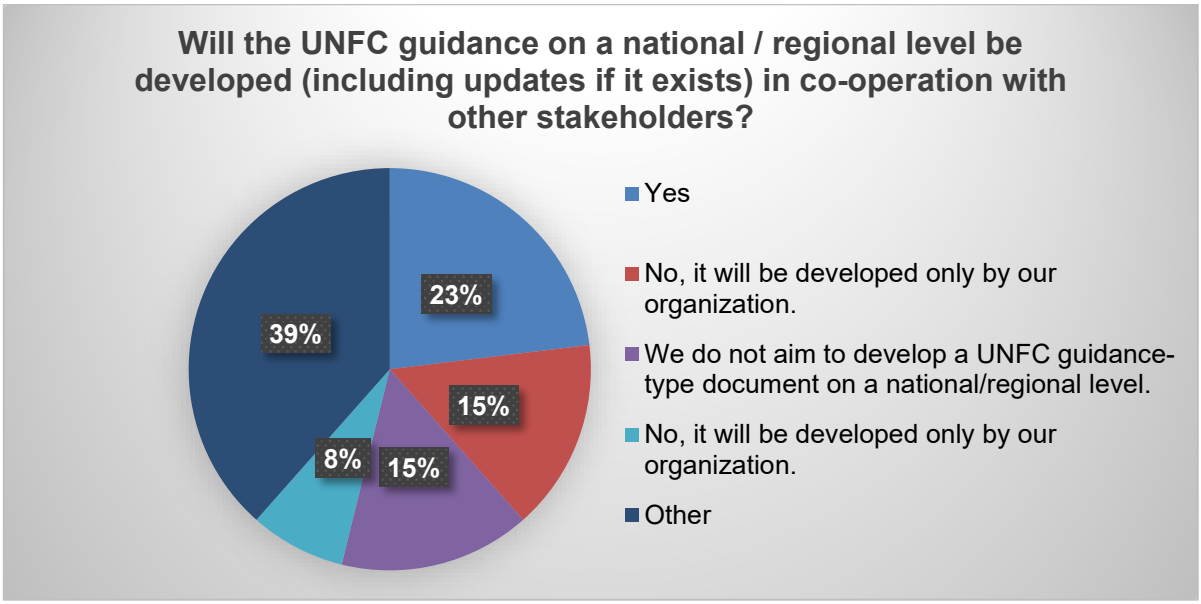


Figure 21. Co-operation with other Stakeholders in the Development of the UNFC Guidance at National Level

Figure 22 shows that most respondents, more than 60%, will publish it on their organization's website, 15% do not plan to, while about a quarter of them, 23%, do not know yet.

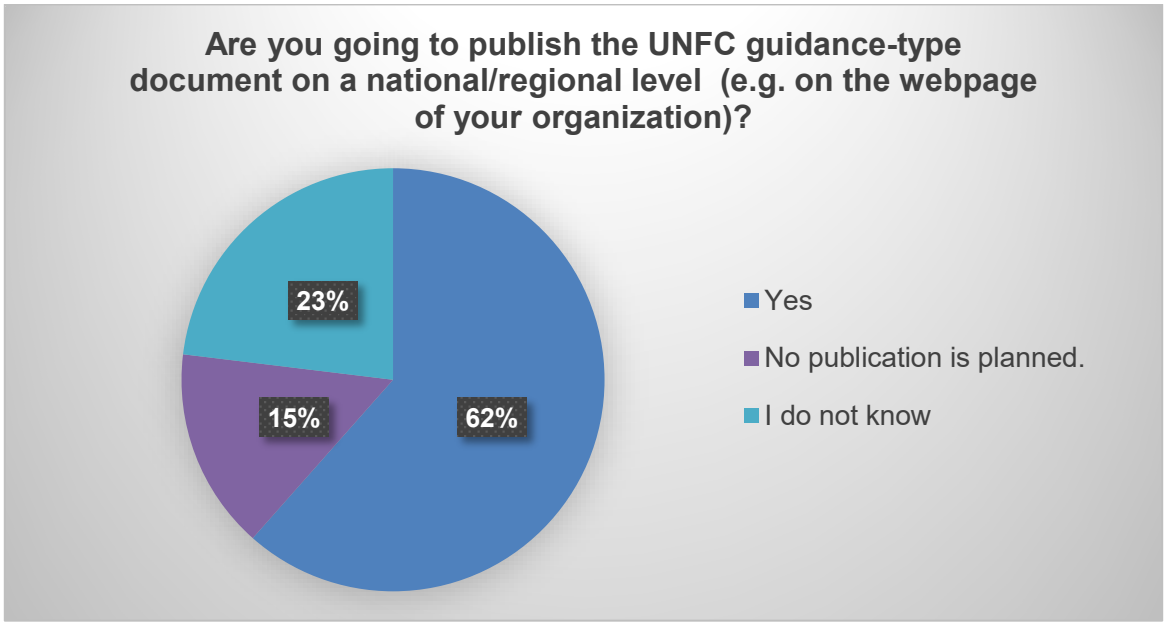


Figure 22. Intention for Publication of UNFC Guidance at national Level

The Figure 22 presents responses to the question of whether organizations will directly use the UNECE UNFC Guidance for Europe (2022). 69% of respondents answered "Yes", indicating direct adoption of the guidance. 16% stated that they would use their own UNFC methodology but apply it only in specific cases and 15% responded "No", meaning they do not intend to use the guidance directly. These responses show that there is a significant majority that plan to follow the guidance, while a smaller portion will either apply it selectively or not use it at all.

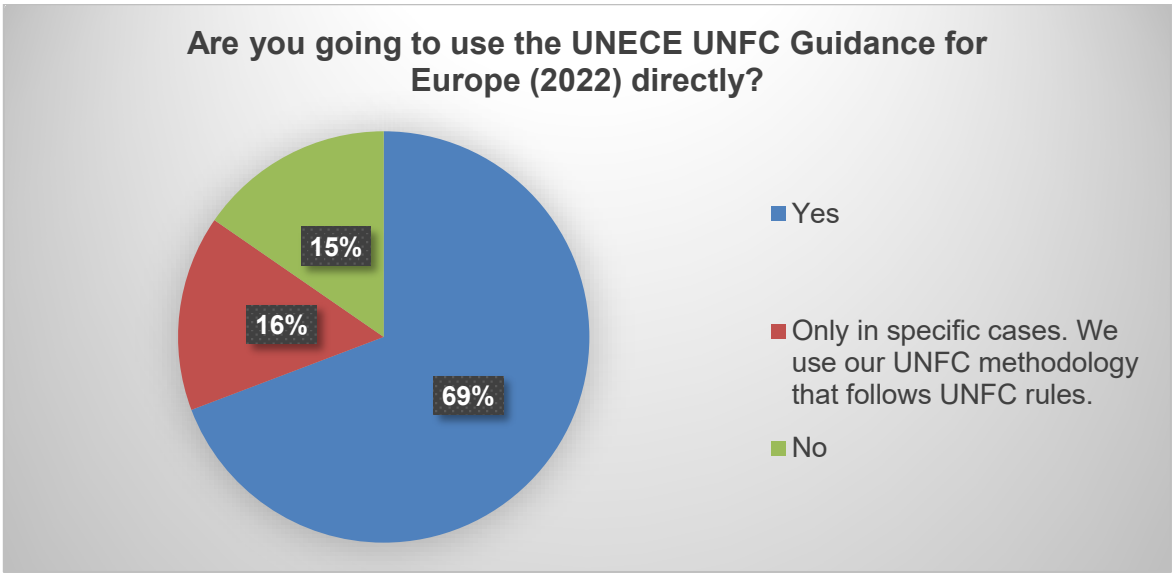


Figure 23. The Importance of Directly Using UNECE UNFC Guidance for Europe at National Level

Figure 24 displays responses to the question of whether there is any draft for the UNFC guidance-type document at the national/regional level. 43% of respondents answered "Yes", indicating that a draft exists. 57% responded "No", meaning no draft has yet been developed. The results suggest that while some progress has been made, most respondents indicate that no draft is currently available.

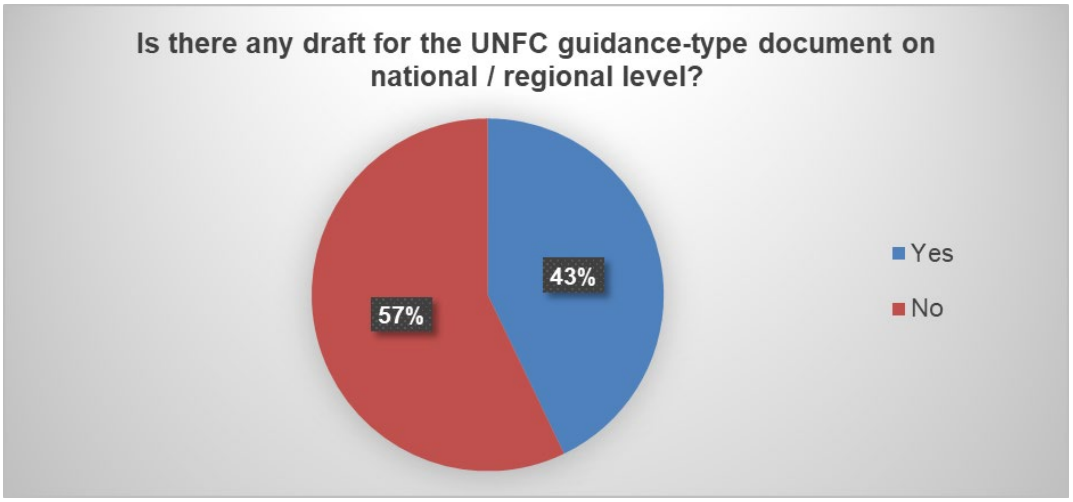


Figure 24. Readiness Level of UNFC Guidance at national Level

Below are illustrated the responses regarding the recommendations considered for the content of a UNFC guidance-type document at the national/regional level (Figure 25). 72% of respondents believe that both recommendations (UNFC trainers and UNECE) are useful, 21% indicated that specific content will be developed instead of following the recommendations. 7% stated that UNFC guidance at the national/regional level is not planned. The results show that a strong majority value both sets of recommendations, while a smaller group prefers to develop unique content or does not plan to create such guidance at all.

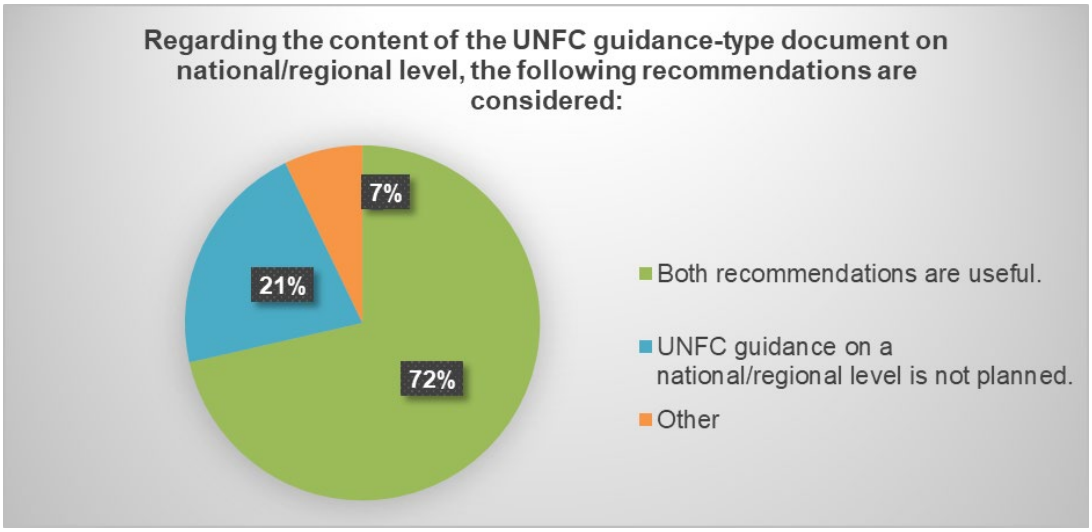


Figure 25. The Usefulness of Recommendations from Different Sources to the Development of UNFC Guidance at National Level

3.4. Summary of Experience of GSEU / EU ICE SRM UNFC Training

In this chapter we highlight the importance of the three levels UNFC training sessions organised by GSEU /EU ICE SRM (led by GeoZS) in the context of how these events contribute to the establishment and development of national and EU-level CRM-bearing mineral deposit inventories.

The detailed description of the GSEU EU ICE SRM UNFC "train the trainers" trainings is accessible on the EU ICE SRM webpage (https://www.geologicalservice.eu/events/gseu-unfc-training-level-1). Here we provide the most important five arguments to support European level UNFC data management:

1) Representatives or experts of GSOs within EGS from 20 European countries participated on the three level UNFC training sessions and all the participants received a certificate of attendance.
2) All relevant UNECE and related documents were presented and discussed whether they served as an appropriate base for UNFC practitioners to use UNFC principles and the related rules for bridging between different reporting and classification systems.
3) Some relevant cases studies were presented and discussed so that UNFC practitioners can see examples from the exploration phase to the mine closure in different reporting and classification systems.
4) Specific topics were discussed that are important for geological surveys and mining authorities (e.g. archive – historical data, data gaps, role of different permissions to the UNFC classification). Plans and ideas for the development of UNFC guidance at national level were also discussed and summarised to help participants in their own progress.
5) Specific sessions were dedicated to teaching principles and methods for experts to share knowledge of UNFC further at national level, including the preparation of a roadmap for UNFC implementation in their country.

The list of selected training materials with regards to the most important UNFC related topics are in Annex III. Links help readers to reach the results and recommendations for UNFC practitioners in the consistent use of UNFC for CRM projects.

As a summary, it can be concluded that CRM data managers and data provider organisations (mainly geological survey organisations or mining authorities) need to develop INSPIRE-compliant databases at national level that are part of the national MIN4EU database, from which results are harvested to the central MIN4EU database for incorporation into EGDI. These national level databases or inventories need to be compliant to the CRM Act requirements.

3.5. Other National Systems' Conversion to UNFC

In this chapter we present some additional UNFC methodologies at national level that were not presented in the previous UNFC report (GSEU D2.1.). These subchapters show how some GSEU WP2 T2.4. partners developed their UNFC application at national level based on earlier results on mapping and harmonisation between national classification systems with UNFC, and also thanks to UNFC activities within the GSEU project. The aim is to share knowledge with project partners and UNFC practitioners who read the report to facilitate the preparation and development of UNFC guidance documents at national level.

3.5.1. Croatia

Background

The exploration and exploitation of mineral resources are integral parts of the comprehensive economic activity of the Republic of Croatia. Expanding geological knowledge about mineral deposits is an ongoing task of geological surveys, conducted in collaboration with various stakeholders. In Croatia, the Croatian Geological Survey (HGI-CGS) plays a fundamental role in this process, operating as the national geological survey under the supervision of the Ministry of Science. The jurisdiction over solid mineral raw materials is governed by the Mining Act and managed by the Mining Authority (Mining sector within the Ministry of Economy). In the Republic of Croatia legislation, geological reserves are categorized into A, B, and C_1 categories based on the degree of exploration, overall knowledge of the deposits, and the accuracy of their calculation. Potential reserves are classified as mineral resources and are not officially confirmed by a decision from the national "Commission". Regarding their potential for exploitation, reserves of mineral raw materials are further categorized as off-balance, balance, and exploitation reserves. A similar classification method was used in previous regulations, which were based on the "Russian Code" for determining reserves.

The Division of Projects (Exploration and Exploitation) according to the Mining Authority (and Mining Act) as listed in the register of Exploitation Fields for Mineral Raw Materials is in Table 9.

Table 9. Division of Projects According to the Register of the Mining Authority

Project Type	Exploitation Field	Exploration Area
1	Active – valid concession	Active
2	Active – invalid concession	
3	Inactive	Inactive
4	Deleted	Deleted
5	Requested	Requested

Applied Methodology from ABC to UNFC Transition Includes:

1. Use of Bridging Documents from countries with similar current classification systems
2. Direct use of the UNFC Guidance for Europe (2022)
3. Previous multi-year experience in EU projects related to UNFC
4. Training Levels 1 – 3 within GSEU project
5. Case studies for each type of project
6. Experience of other Member States and data analogy
7. All classifications defined by the Mining Act and the table outlining exploitation fields and exploration areas have been tested
8. Use of UNFC template from WP2 within GSEU project
9. Presentation case studies at the Croatian Geological Congress held in 2023

Short Version of “Bridging” Process for Mineral Data Transformation

Based on the methodology described in chapter 4, mapping between national classification and UNFC codes for Croatia was developed (Table 10).

Benefits, Barriers and Potential Solutions

The United Nations Framework Classification for Resources (UNFC) offers numerous benefits for resource management, exploration, and investment. However, there are several barriers to the successful application of the UNFC. One significant challenge is the lack of standardized data, as resource data can often be unreliable or inconsistently collected, making it difficult to apply the framework effectively. Additionally, aligning UNFC with existing national or industry-specific classification systems can result in inconsistencies and complications. To address previous challenges, solutions such as the development of standardized data collection methods and technical support can help improve consistency and ease implementation. Integrating UNFC with existing systems through clear guidelines will ensure smoother transitions and greater acceptance. Building local capacity through education and training will create a skilled workforce capable of applying UNFC effectively. Additionally, international collaboration can streamline regulatory issues, foster investment in resource evaluation, and support global consistency in resource management.

Table 10. Mapping Between National Classification and UNFC Codes for Croatia

Project type		National categories	National classes	UNFC E axis	UNFC F axis	UNFC G axis	UNFC class	UNFC sub-class
Exploitation field	Active	Balance	A, B, C_1	1	1	1, 2	Viable Project	On Production
		Off-balance	A, B, C_1	3	4	1, 2	Remaining Products	
	Non active	Balance	A, B, C_1	2	2	1, 2	Potentially Viable Project	Development On Hold
		Off-balance	A, B, C_1	3	4	1, 2	Remaining Products	
	Erased	Balance	A, B, C_1	3	2	1, 2	Non-Viable Project	Development Not Viable
		Off-balance	A, B, C_1	3	2	1, 2	Non-Viable Project	Development Not Viable
	Requested	Balance	A, B, C_1	1	1	1, 2	Viable Project	Justified For Development
		Off-balance	A, B, C_1	3	4	1, 2	Remaining Products	
Exploration area	Active			2	2	1, 2, 3, 4	Potentially Viable Project	Development Pending
	Non active			3	2	3, 4	Non-Viable Project	Development Unclarified
	Erased			3	2	3, 4	Non-Viable Project	Development Not Viable
	Requested			3	3	4	Prospective Projects	

Legend: Exploitation fields are purple, and exploration areas are green. Darker shades to lighter shades indicate more matured project status.

3.5.2. Ukraine

Introduction

Ukraine has a long positive experience of using the UNFC harmonized classification of reserves and resources for more than 25 years. Since the beginning of independence, Ukraine used systems of accounting and management of mineral resources, which were widespread within the former USSR - the USSR Mineral Reserves and Resources Classification System (based on the Classification of 1981, the so-called "ABC system"). The main systematization feature was the level of geological knowledge and assessment probability. According to this system, mineral resources were accounted for until 1997.

Unlike other countries within the region, Ukraine did not continue to use the ABC system as a single tool but adopted the UNFC as a unified tool for accounting and managing all types of mineral resources and subsoil resources. In 1997, the internal Classification of Mineral Reserves and Resources of the State Subsoil Fund of Ukraine was developed and approved, which was harmonized with the UNFC.

The reasons for the choice and use of such a tool were the following:

- The presence of a large number of mining and exploration projects at different stages of the mining cycle. In Ukraine, there are 20,000 mineral deposits and ore occurrences, 10,390 explored deposits, 3,500 mining operations, 125 types of minerals. Each year, an average of ≈ 300 special permits for the use of the subsoil are granted, including: 30% - metallic minerals, 50% - non-metallic minerals, including construction materials, 20% - hydrocarbon fields and other types.
- There is a large amount of historical geological information accumulated during the USSR period, when thousands of deposits were explored. Data on Ukraine is maintained and databases are developed by Ukraine. There is a need to attract foreign investment in the further development of the Ukrainian mining industry.
- Improvement of mineral resource reporting systems.

Thus, harmonization with UNFC allows classifying and reporting for geological information by different types of subsoil use, by different types of minerals for different stages of exploration and development. This tool makes domestic geological information and mining potential understandable for foreign investors, companies and stakeholders. These requirements are met by the UNFC to which the classification has been harmonized in Ukraine.

Today the Classification of Mineral Reserves and Resources of the State Subsoil Fund, in accordance with the legislation, establishes uniform principles for calculating, geological and economic assessment, state reporting on the use of mineral resources according to the level of socio-economic and industrial significance (axis E), the degree of technological feasibility and maturity (axis F), as well as the degree of geological knowledge by probability assessments (axis G) according to the UNFC categories.

Resource Management System

In Ukraine, the mineral resources management system is formed by state authorities of general and special competence. According to the Constitution, all property rights for the subsoil and related resources belong to the people of Ukraine, who delegate to these authorities the rights to dispose of resources and control over their use (Table 11).

Table 11. Authorities of Resource Management System in Ukraine

Authorities of general competence have state executive power in the direction of socio-economic development of the state and regions; they are also entrusted with the functions of ensuring the study, effective use and protection of subsoil resources.	*Authorities of special competence* – state authorities in the field of subsoil use (exploration, mining, underground structures) and mining safety are the main or one of the main areas of their activity.
 Parliament - Verkhovna Rada of Ukraine https://www.rada.gov.ua/	Ministry of Environmental Protection and Natural Resources of Ukraine https://mepr.gov.ua/
 Government – Cabinet of Ministers of Ukraine https://www.kmu.gov.ua/	State Service of Geology and Subsoil https://www.geo.gov.ua/
 Regional and local authorities	State Labour Service (in terms of industrial safety) https://dsp.gov.ua/

The main regulatory act of subsoil use is the *Subsoil Code of Ukraine*[1], which provides all general requirements for exploration, mining and other type of subsoil use within the territory of Ukraine, including the shelf and the exclusive maritime economic zone (Figure 38).

In Ukraine the following Laws are the basic documents for geological exploration and extraction:

- Mining Law[2]
- Law on Oil and Gas[3]
- Law of Ukraine on Production-Sharing Agreements[4]
- Classification of reserves and resources of minerals of the state subsoil fund Resolution of the Cabinet of Ministers of Ukraine; Classification on May 5, 1997, No. 432[5]

Ukraine is one of the regions where systematic mineral resources reporting is conducted at the legislative level (balance of mineral deposits, Cadastre of deposits and ore occurrences).

The Subsoil Code provides for the realization of a single state electronic geoinformation system for subsoil use, including the following components

- the State Subsoil Fund of Ukraine, including the State Fund for Mineral Deposits and the reserve of this Fund, which is based on the State Cadastre of Mineral Deposits and ore occurrences and the State Balance of Mineral Reserves, taking into account information obtained from the State Land Cadastre
- the State Register of special permits for subsoil use
- the State Register of oil and gas wells
- the State Register of artesian wells
- the State water Cadastre (section "Groundwater")
- the State geological web portal
- the electronic office of individual subsoil users
- Reporting forms for mineral reserves reporting submitted by subsoil users
- information for obtaining, extending validity period, changes to special permits for subsoil use
- Catalogue of geological information, including primary (unprocessed) and secondary (processed) geological information
- Protocols of the State Commission of Ukraine on Mineral Reserves on state assessment of mineral reserves
- registration form for exploration
- information on subsoil areas proposed for obtaining special permits by auction (electronic bidding)
- information on subsoil areas for competitions announced with production sharing agreements
- information on exogenous geological processes (landslides, karsts, mudflows, flooding, shore abrasion)
- information on restrictions on the use of land plots for subsoil use purposes

The resource reporting system is regulated in accordance with Section 3 of the Subsoil Code of Ukraine “State Reporting of Deposits, Reserves and Minerals Occurrences as well as Subsoil Areas Provided

[1] https://zakon.rada.gov.ua/laws/show/132/94-%D0%B2%D1%80#Text
[2] https://zakon.rada.gov.ua/laws/show/1127-14#Text
[3] https://zakon.rada.gov.ua/laws/show/2665-14#Text
[4] https://zakon.rada.gov.ua/laws/show/1039-14#Text
[5] https://zakon.rada.gov.ua/laws/show/432-97-%D0%BF/ed20181002#Text

for Use Not Related to Mineral Extraction[6]", as well as by-law – Procedure for State Reporting of Deposits, Reserves and Minerals Occurrences[7].

State accounting of mineral reserves in Ukraine is conducted in accordance with the procedure fixed by the Resolution of the Cabinet of Ministers of Ukraine dated 31.01.95 No. 75 "Procedure for State Reporting of Mineral Deposits, Reserves and Occurrences". The purpose of state mineral reporting is to obtain systematized information about their quantity, quality, degree of geological and technical and economic study and level of industrial development and operation, as well as information of production and losses for decision making. The main task of mineral reporting is to obtain complete and reliable data on the state of the mineral resource base, industry and the country as a whole as of January 1 of each year.

All mineral reserves discovered in the subsoil and all useful components present in them are subject to state reporting according to a unified system. State reporting of deposits, reserves and occurrences is conducted in accordance with the Resolution of the Cabinet of Ministers of Ukraine dated 02.03.1993 No. 150 "On the State Fund of Mineral Deposits of Ukraine". The objects of accounting of the State Fund of Mineral Deposits of Ukraine are all explored and developed deposits of all types of minerals with estimated reserves.

In Ukraine, there is one State enterprise Geoinform[8], which is responsible for most forms of mineral resources reporting and other types of information listed above. Today, Ukraine has regulatory restrictions on the openness of information in the field of subsoil use during the war period. State Enterprise Geoinform of Ukraine has temporarily suspended access to public state registers and databases posted on the Enterprise's website. "Some issues of ensuring the functioning of information and communication systems, public electronic registers under martial law".[9]

National Classification System

The national classification system in the form of a three-digit code has been used for mineral resources for many years, and for other types of resources and projects - in the initial stages of implementation (Figure 26 and Figure 27).

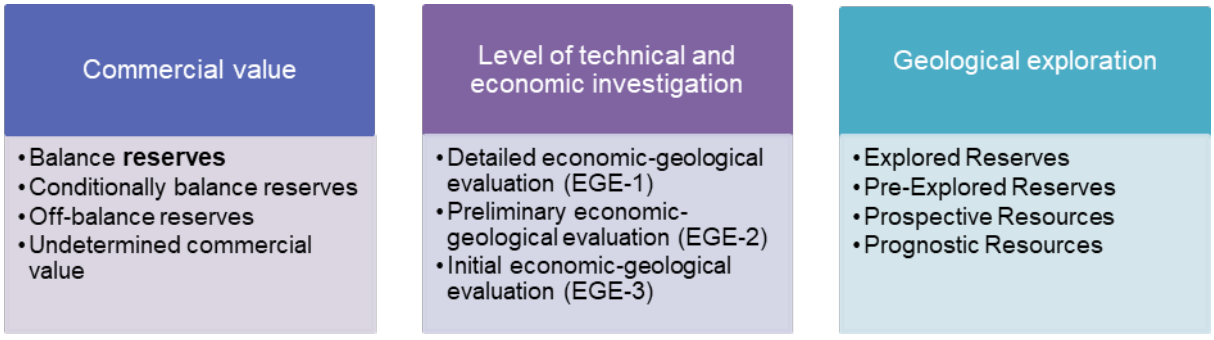


Figure 26. Criteria for Classification of the State Subsoil Fund.

6 [6] https://zakon.rada.gov.ua/laws/show/132/94-%D0%B2%D1%80#Text

7 https://zakon.rada.gov.ua/laws/show/75-95-%D0%BF#n14

8 https://geoinf.kiev.ua/

9 https://zakon.rada.gov.ua/laws/show/263-2022-%D0%BF#Text

Today, mineral resources are systematized in accordance with the Classification of Reserves and Resources of the State Subsoil Fund with a three-digit code and compliance with the UNFC, but in parallel, records are also kept under the old “ABC system”. This is due to the need to consolidate all old and current reserves and resources into one system. The systematization of objects according to the UNFC occurs in cases of geological and economic assessment in the current period. That is, objects that have been assessed since 1997 have the appropriate code, and reserves and resources estimated before 1997 are currently being reclassified. For this purpose, in 2023, the State Commission for Mineral Resources developed Methodological Recommendations for bringing reserves of objects recorded in the State Balance of Mineral Reserves of Ukraine that are not being developed into compliance with the requirements of the Classification of Mineral Reserves and Resources of the State Subsoil Fund. Below are the dynamics of changes in the Classification of Reserves and Resources of the State Subsoil Fund since 1997.

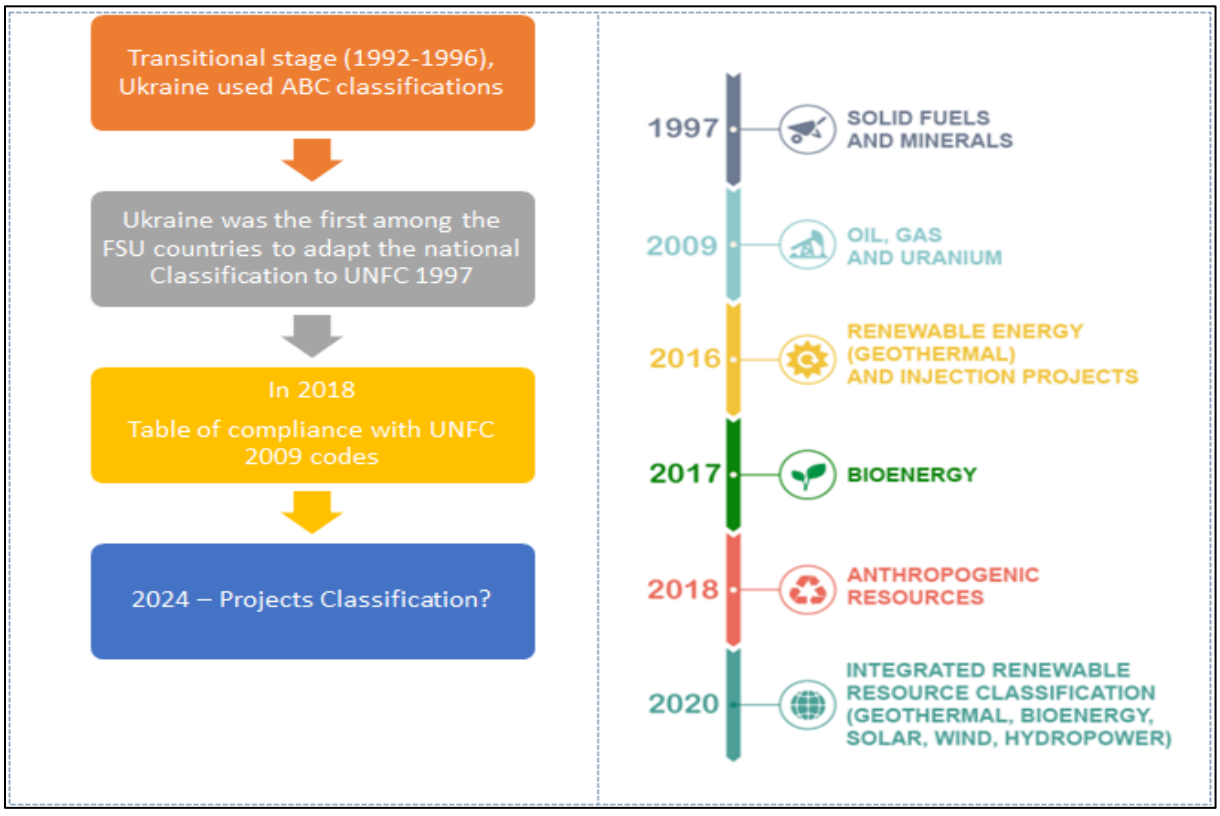


Figure 27. Changes in the Classification of Reserves and Resources of the State Subsoil Fund since 1997. Hisory of the UNFC applications in Ukraine on the right

Methodology: Bridging-Harmonisation

Currently, the national classification of reserves and resources has a three-digit code and is closely harmonized with the UNFC in terms of class definitions. Although the regulatory document itself does not contain a three-axis graph, the relationship between the Ukrainian classification codes and the UNFC classes is established in tabular form. This is illustrated in Figure 28.

One of the basic differences in the classification systems of Ukraine and UNFC remains the objects of systematization. Traditional objects of assessment in the domestic practice exploration are reserves and resources, which can be localized within deposits, prospective areas or license areas. In contrast, UNFC classifies not only reserves and resources, but projects. Current steps in the development of the

Ukrainian classification are the introduction of the term Subsoil Use Project as the basic object of classification and assessment.

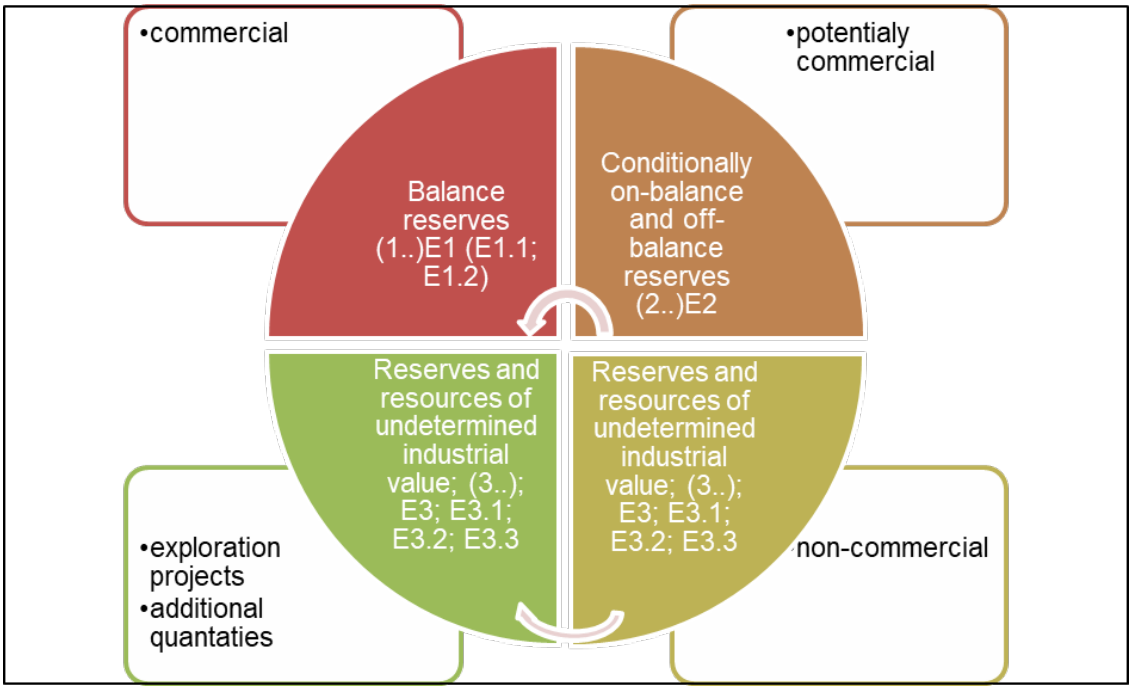


Figure 28. Relationships between the Classification Systems of Ukraine and UNFC Classes

Below is a SWOT analysis of positive and negative factors for the further development of UNFC in Ukraine (Figure 29).

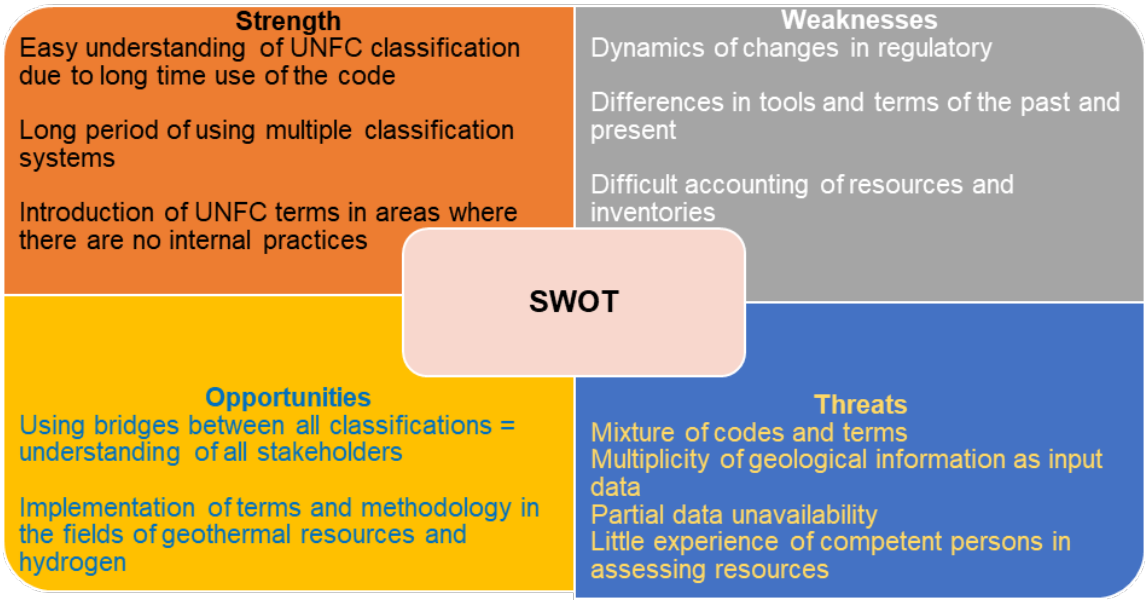


Figure 29. SWOT Analysis of Positive and Negative Factors for the Further Development of the UNFC in Ukraine

There is currently a proposal to use the project as a basic object of geological and economic assessment. Definitions of projects in various areas of economic activity can be divided according to individual cases of using one or more subsoil resources. The following can be distinguished: mining or exploration project, geothermal project, hydrogen project and complicated subsoil use project. The proposed definition of the project as a complex of processes related to the study or development of at least one of the subsoil resources, which ensures economic, environmental and social viability within the estimated period (life cycle). Depending on the stage of implementation, the project includes the amount of the resource with which the project is connected, the available assets and the main means for ensuring production activity.

Examples

The most typical cases in the experience of applying the Ukrainian classification and UNFC in Ukraine are the following:

- mineral resources and reserves for mining operation. As a rule, they have a significant share of reserves with the code 111,112,122 in their structure (Table 12)
- mineral resources and reserves for objects that are not developed but are explored. Compared to the previous case, there is a larger share of resources with the code 122 and 222, 333 and 334.

Table 12. Example of the Structure and Classification of Reserves for the Banded Iron Formation (BIF) Deposit on Operation Stage

Class Code UNFC	Category by National Reporting Code	M, kt	Grade, %	
			Fe total,%	Fe magn.,%
within the design outline of the quarry				
111	B	58 097	33.08	23.89
111	C1	130 957	32.67	22.49
112	C2	12 554	36.14	28.56
B+C1+C2		201 608	33.0	23.27
Out of the design outline of the quarry				
332	C2	377 399	31.63	19.66

Until now ‘not typical cases’ for classification in domestic practice were deposits that were not only assessed and classified according to the requirements of Ukrainian regulators, but according to international standards of the CRIRSCO template are shown in Table 13.

Table 13. Example of the Structure and Classification of Reserves for a Sulfide Copper-Nickel Deposit

Classification	Tonnage (Mt)	Ni %	Cu %	Co %	UNFC Class
Resources					
Indicated	14395	0,376	0,197	0,016	222
Indicated	3813	0,427	0,380	0,021	222
Inferred	20447	0,373	0,102	0,015	223
Inferred	1574	0,189	0,095	0,023	223

Summary

Ukraine has a positive experience of using UNFC as the main tool for classifying reserves and resources, which has formed the following advantages:

- Easy understanding of UNFC classification due to long-term use of the code
- Long period of using multiple classification systems
- Dynamics of changes in regulatory systems
- Using bridges between all classifications and understanding by all stakeholders

Further steps in the development of UNFC in Ukraine are the introduction of a subsoil use project as a basic object of assessment and classification, as well as the expansion of the UNFC tool to subsoil resources that are not typical for Ukraine. These are: hydrogen projects, geothermal projects, carbon capture, utilization, and storage (CCUS) projects. For the last point, Ukraine's positive experience also consists in using the relevant UNFC specifications to develop its own regulatory documents.

3.5.3. Poland

Polish Classification of Mineral Raw materials Resources in Comparison with UNFC

NOTICE: all information given in this report is based on the Polish Geological Institute-National Research Institute's (PGI-NRI) own work. For years PGI-NRI employees have been participating in the meetings of the Expert Group on Resource Management (EGRM) to facilitate a comparison between the national classification system and the UNFC Update 2019. Therefore, the presented report sums up all information covered in existing UNFC documents and all information and data – obligatory in the national system – collected by PGI-NRI. It should be emphasized that the elaboration is an attempt to compare both systems, but this is not an official position.

The latest publication – "Mineral Resources of Poland" – dedicated to e.g. the issue of the UNFC and Polish resources classification was issued by PGI-NRI in 2022. In the elaboration, there was a separated chapter included – connected with the UNFC's history and basic rules together with a description of the Polish classification system and a comparison with the UNFC. The comparison covered, e.g., all definitions used by the UNFC and the Polish national system; and included a table presenting the resources of selected mineral raw materials in Poland in comparison with UNFC as of 31 XII 2020. The publication is available in PDF format on the PGI-NRI website https://www.pgi.gov.pl/en/mineral-resources/home-page.html. Below, we summarize all information given in the above-mentioned publication with the resources update as of 31 XII 2023.

Regarding the needs of the state policy, the most important is information on the countries' mineral resources base, on the state of their development and on the potential and possibilities of exploiting them for the national economy. For an entrepreneur or institutions financing any mining project, the principal is the knowledge on: - the resources volume available for extraction (exploitable – foreseen for exploitation after taking into account losses and deposit impoverishment); - the accuracy of information on the possibility of use. Considering this, it should be kept in mind what elements differentiate the Polish classification from the UNFC. These are mainly:

- A mode of presentation of a mutual relationship of distinguished types (classes) of resources – in Poland hierarchical (within a total resource volume); in the UNFC and other internationally used systems complementary (with extractable (exploitable) resources distinguished separately and other resources)
- A strong attachment to the separation of economic resources in place in the Polish system; such resources type is generally not distinguished in other international systems
- A detailed division of resources that are not qualified for justified exploitation in Poland

- The lack of a formal designation in Poland (especially in the case of solid mineral deposits) for exploitable resources – these resources in Anglo-Saxon terminology are called “reserves”;
- Therefore, to attain full compatibility between the Polish system and the UNFC, data on Polish resources should be released separately:
    - in exploited deposits (deposits licensed for mining) – economic resources in place (21x according to the UNFC), sub-economic resources (31x), anticipated economic resources not qualified as economic, sub-economic resources (22x), and anticipated sub-economic resources (32x)
    - in non-exploited deposits (beyond concession areas) – anticipated economic resources (23x), anticipated sub-economic resources (33x), prognostic resources (234 or 334)

Taking the above-mentioned objections into account, economic resources in place (in Polish classification system) can be presented as:

economic resources (21x) = extractable resources (11x) + losses (31x).

It is also very important to use the terms: “reserves” and “resources” properly. The first refers to the resources that are exploitable in an economically justified way, omitting losses and taking into account an impoverishment. In the Polish classification system these are “exploitable resources” or “extractable resources” (when impoverishment does not occur). The second term – “resources” – covers the remaining geological resources, excluding “reserves”. Relations between resource classes distinguished in the Polish system and in international systems are presented below (Figure 30):

A. Resources division used in Poland

<table>
<tr><td colspan="4">Geological Resources</td></tr>
<tr><td rowspan="2">Anticipated sub-economic resources</td><td colspan="3">Anticipated economic resources</td></tr>
<tr><td>Sub-economic resources</td><td colspan="2">Economic Resources</td></tr>
<tr><td></td><td>Losses</td><td>Extractable and exploitable resources</td></tr>
</table>

B. Resources division used in international systems

Exploitable resources (extractable) Reserves	**+**	**Remaining resources not qualified as exploitable Resources**

Figure 30. The Resources in Poland (A. and B. black coloured) Compared to Terms (B. red coloured) of international reporting system (e.g. JORC) that are Bridged with UNFC (Nieć, 2009)

The above-mentioned differences are general. However, there are some other issues in the Polish system that have to be accounted for when trying to compare the classifications. These issues were described in detail in Chapter 6.2 of the “Mineral Resources of Poland”, in this report we would just like to point them out:

- In the Polish registry, some volumes of economic resources are estimated for deposits which are not treated as exploited. Such deposits have a valid exploitation concession but production has not yet started. Similarly, there are some volumes of these resources assessed in some abandoned deposits – with valid concessions but not exploited for years. Therefore, the above-mentioned parts of economic resources and sub-economic resources registered in the national system will not be

included in the UNFC. This applies to some deposits covered by preliminary exploration (marked as “P” in the national registry), detailed exploration (“R”) and abandoned deposits (“Z”)

- For some types of raw materials, exploitation is based on a concession issued by a county mayor. Deposits of such raw materials do not require an estimation of economic and sub-economic resources. Thus, anticipated economic resources of these deposits that are being exploited become, in fact, extractable resources plus losses. Therefore, it is difficult to include them in the UNFC
- In Poland, there is a legal possibility of estimating economic resources within anticipated sub-economic resources – according to the Regulation of the Minister of the Environment concerning the detailed requirements of the deposit development plan (dated 24th of April 2012 – Official Journal of 2012 Item 511). Therefore, the anticipated sub-economic resources (that – by definition – do not meet the limiting parameter values that define a deposit) may sometimes be qualified for further stages of resource estimation and may be the subject to production. Regarding 2023, such a situation occurred in the cases of a couple of natural gas fields, where exploitation was conducted from anticipated sub-economic resources. In contrast, one of the UNFC’s assumptions was to qualify anticipated sub-economic resources as not considered for future exploitation

Assuming all the above-mentioned objections, for now it seems appropriate that:

1. Deposits licensed for mining contain deposits marked in the national registry as “E” (exploited), “T” (exploited temporarily) and “B” (exploited during a building process or with trial exploitation) should be included in the UNFC
2. Deposits marked as “P”, “R” with economic resources are treated as outside concession areas (unlicensed for mining) and their economic resources should be omitted from the UNFC. Their anticipated economic and anticipated sub-economic resources remain equal in both systems
3. Deposits marked as “Z” should be omitted from the UNFC and not presented in the Polish system when comparing with the UNFC
4. Total anticipated economic resources for deposits with no assessed economic resources (concession issued by a county’s mayor) should be treated as extractable resources and losses. This prevents direct comparison between national data and the UNFC but can be performed for the needs of the UNFC only
5. For hydrocarbons, anticipated sub-economic resources in the UNFC (32x), which represent resources remaining after assignment of sub-economic resources, should be considered zero
6. The closest comparison between the Polish system and the UNFC can be made only for raw materials covered by mining ownership (state ownership – State Treasury). These include: hydrocarbons, hard coal, lignite, native metals, ores of radioactive elements, native sulfur, rock salt, gypsum and anhydrite, gemstones, rare earth elements and noble gases, metal ores (with the exception of soddy iron ores). Further details are in Table 15 (Annex).

Table 15 (Annex) presents the methodology for comparing the Polish classification system (resources as of the end of 2023) with the UNFC for selected raw materials, taking into account all the assumptions mentioned in this report. In the table, there is mainly the environmental-socio-economic viability aspect underlined (the E-axis in the UNFC). The number of raw materials is limited only to those where exploitation is being conducted. Data originates from the publication “The balance of mineral resources deposits in Poland as of 31 XII 2023” and from the System of Management and Protection of mineral resources in Poland (MIDAS) maintained by the Economic Geology Department at PGI-NRI. In order to make the data compatible with the UNFC, resources were divided into resources of deposits licensed for mining and resources of deposits unlicensed for mining (beyond concession areas). Due to the fact

that resources data collected in “The balance…” do not contain information on extractable resources (as PGI-NRI does not possess such information from concession holders), relevant factors were assumed for economic resources. It allows users to obtain an approximate volume of extractable resources. In the Polish mining sector, the relevant factors to the calculation for the following raw materials are:

- high nitrogenous natural gas, crude oil, natural gas, coalbed methane – 1.00
- copper and silver, zinc and lead ores – 0.75
- hard coal – 0.70
- lignite – 0.90
- rock salt – 0.35
- sulfur – 0.50
- diatomite rock and other raw materials – 0.75

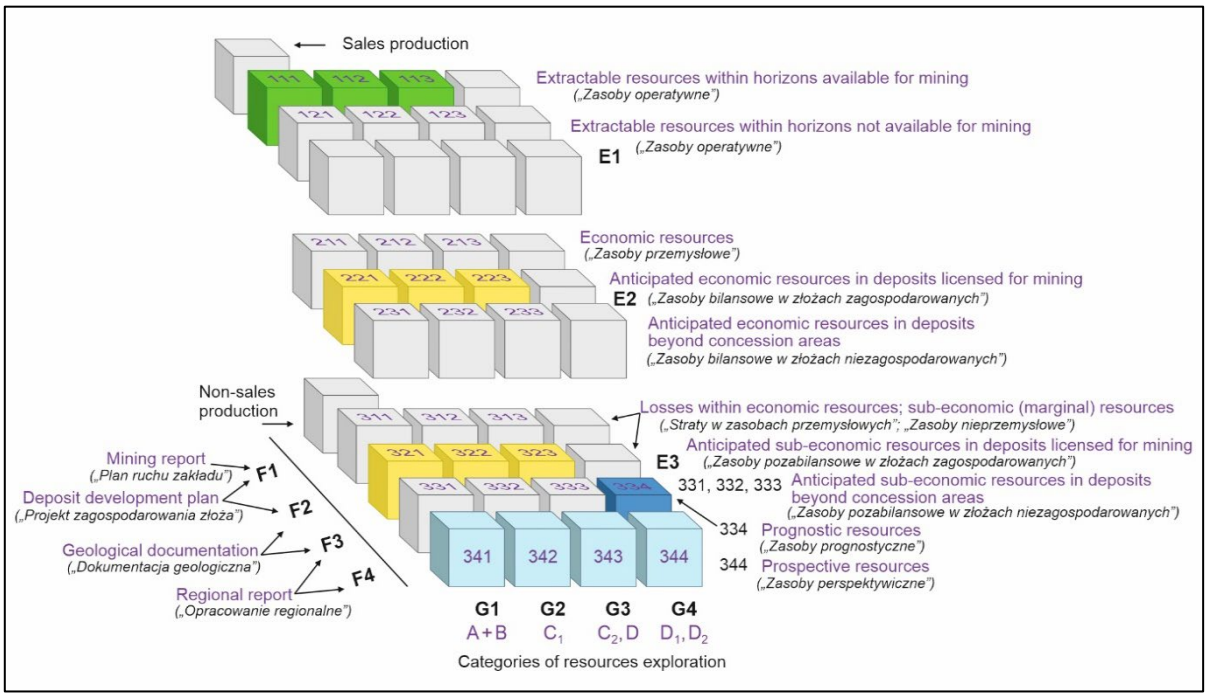


Figure 31. Correlation between the Polish Classification and the UNFC in a Three-Dimensional Layout (Nieć, 2010; with authors’ adjustments)

The table in the related annex presents the methodology for comparing the classification systems in the case of hard coal, but also takes into consideration the categories of resources (the G-axis in the UNFC) and technical feasibility (the F-axis in the UNFC). Regarding the G-axis, the most important is the degree of a deposit exploration (in Poland categories: A + B - G1; C1 - G2; C2, D - G3 and D1 – D2 - G4). As for the F-axis, the equivalents for field project status and technical feasibility in the Polish classification system are documents related to a particular deposit (regional reports on prospective and prognostic resources – F4; geological documentation – F3 or F2; deposit development plan – F2 or F1; mining report – F1). Data on prospective and prognostic resources comes from the latest publication on such resources elaborated in PGI-NRI (Szamałek et. al., 2020).

Figure 44 below presents the correlation between the Polish classification system and the UNFC, taking into account all the assumptions mentioned in this report. It shows all 3 axes (E, F, G) in a three-dimensional layout with all types of resources distinguished in the national system (the E-axis), all types of documents for a deposit (the F-axis) and all categories of resources (the G-axis). Colored boxes are the main categories and classes distinguished in the UNFC, whereas numbers are classes distinguished in the Polish system. There are also Polish names of documents and resource types given in brackets.

3.5.4. France

France did not have its own classification system for mineral resources. Current big mining projects (France mainland, Guyana and New Caledonia) use CRIRSCO templates to be visible to mining markets.

BRGM holds the national mineral occurrences database, which contains the dataset from big explorations programmes from the 1970s and 1980s as well as historical mines and mining wastes. After the 1990s exploration activity was reduced drastically. As result of those exploration programmes, resources were estimated and terms such as “inferred resources”, “estimated resources”, “measured resources” or “reserves” are used and stored in the database. However, those terms do not have any connection to any CRIRSCO or UNFC system. This national database is a database stores of deposits or resources, but it is not a database of mining projects. The maintenance of mining explorations permits is held and maintained by the Ministry of Environment.

The application of the UNFC system in France was initiated after the request of EC DG GROW, who required Member States to do a regular and annual update of the maturity of Critical Raw Materials projects in each country. Following this request the Ministry of Environment requested BRGM to provide a list of active and inactive CRM projects in France and evaluate them it in terms of UNFC. The decision tree from Bide et al (2022) on decision trees was adapted to the French context. Various historical and inactive projects in France were translated into the UNFC based on the degree of certainty regarding resource estimation. All the UNFC related documentation is available in Mineralinfo, the institutional mineral resources website in France (https://www.mineralinfo.fr/fr).

For active projects, UNFC is used to compile public data related to the projects coming from different sources: public information communicated by project owners and public information of mining cadastres. Information on the UNFC and its application in the French context is provided on the Mineralinfo web page:
https://www.mineralinfo.fr/fr/lunfc-un-outil-pour-une-production-durable-matieres-premieres-critiques

The situation of UNFC application for mineral resources in France is that it is only related to the CRM Act. After the approval of the CRM Act, BRGM held one webinar and one presentation in the French Mineral Industry Forum explaining UNFC, and its position into Strategic Project call was organised by BRGM.

Figure 32 illustrates the multi-source data collection.
As CRM can be metals (from mines) and minerals (from quarries) and French legislation differentiates between the two, there are two separate databases for the two activities.

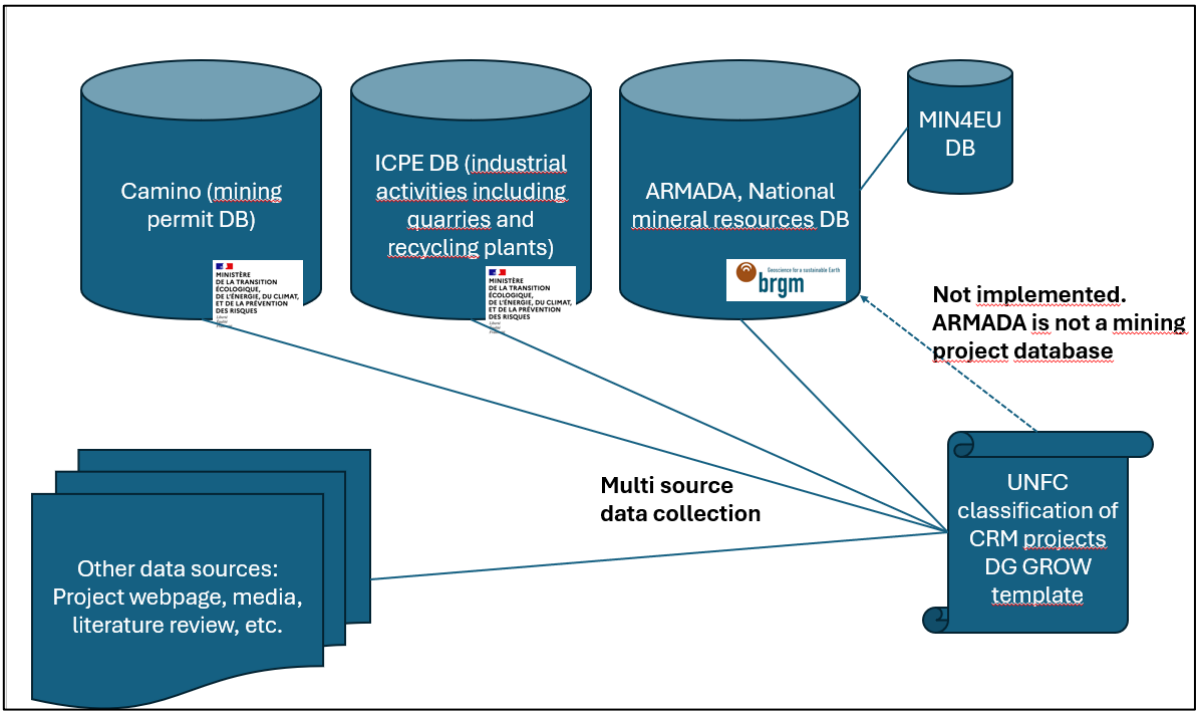


Figure 32. Data Sources used for UNFC Assessment in France

4. UNFC Application for Other Resources

4.1. UNFC Questionnaire Survey for Other Resources

The EU ICE SRM and the application of the UNFC needs to be designed in such a way, that it can incorporate other resources aside from minerals, for example GeoEnergy (GE) (potential and storage). The United Nations Resource Management System (UNRMS, building on UNFC) is also addressed in a questionnaire survey that was prepared and shared with GSEU-WP3 (GeoEnergy) of the GSEU project.

In this chapter we report on the progress of the collaboration between GSEU-WP2 T2.3. and T2.4. for EU ICE SRM and UNFC for raw materials and WP3 for GeoEnergy.

The following main topics were addressed in the questionnaire: background of the legislative environment for these types of resources including strategic approach, if any, responsible organisations for data collection and data management, the frequency of data collection with publicly available data; brief history of UNFC activity on organisation or regional or national level. Specific questions are dealing with UNFC data for E, F, and G categories to facilitate the identification of UNFC data sources for GeoEnergy and groundwater. Authors were also interested in whether any organisation activity is foreseen in 2025 for UNFC training sessions or other capacity building that can significantly enhance the EU ICE SRM objectives.

Preliminary results that can contribute to the better understanding of real applicability of UNFC for GeoEnergy and groundwater resources based on facts (recent opportunities of responsible organizations in the context of resource management system and experience data management) are expected in spring of 2025.

4.2. UNFC for Secondary Raw Materials

Similar to what has been outlined in the first version of this UNFC report (D2.1), the classification of 2RM under UNFC is guided by the specifications (UNECE 2019) and supplementary specifications (in progress) prepared by the UNECE Anthropogenic Resources Working Group, along with the related case studies. While mining waste can be considered as an unused resource of a primary project, it also can be seen as an anthropogenic resource. For that reason, mining waste has been used as a resource bridging two key motivations areas: economy and ecology that drive the guidance documents. The classification of mining waste containing critical raw materials according to UNFC can be approached in two ways:

1) A brief evaluation of data sources and information corresponding to the UNFC E, F, and G categories
2) A system-oriented approach with a detailed assessment (Heuss-Aßbichler 2014)

Both approaches result in similar or identical UNFC classifications; however, the more detailed assessment allows for the more precise categorisation, including potential sub-classification within UNFC. Additionally, the site-specific analysis of individual mining waste management facilities enables a more realistic evaluation. This can support the development of initially *Non-Viable Projects* into *Potentially Viable Project* statuses aimed at the recovery of CRM.

GSEU partners have tested an Access Form for UNFC classification and data collection on mining waste that was developed in co-operation between FutuRaM and GSEU project partners (see chapter 2.2.7.2.).

Countries with an historical mining activity maintain a national mining waste inventory as requested by the 2006 EU Extractive waste directive. With the implementation of MIN4EU database for mining waste, after the ProSUM project, a harvesting system is in place giving the opportunity to connect national databases to MIN4EU. However, currently there are only 14 agencies or entities representing 13 European countries with mining waste data connected to this harvesting system. Additionally, not all those countries deliver information in terms of commodity ore grades or tonnages, in some cases only general information of mining waste is available (name of the mine and associated commodities, coordinates). UNFC classification information can be included to mining waste data but for instance currently no surveys or countries are delivering UNFC classification of mining waste. The other countries still not connected to the harvesting system may be without a mining waste database or without a harvestable connection. During a collaboration between FutuRaM and GSEU projects, several countries worked and provided information about mining waste through an Access Form, in other words, without an automatised harvesting infrastructure. This manual option to harvest data into MIN4EU is pending for last achievements.

According to Point 4. of Article 27. in the CRM Act “Member States shall establish a database of the closed extractive waste facilities located on their territory, including abandoned extractive waste facilities, except for closed extractive waste facilities where the particular characteristics of the waste sites or geological conditions make the presence of potentially technically recoverable quantities of critical raw materials unlikely.” In Point 8. of the Article 27. in the CRM Act the UNFC is referred: “Where possible, the Member States shall include in the database a classification of the closed extractive waste facilities according to the United Nations Framework Classification for Resources.
Based on experience, the Access Form for mining waste is an appropriate UNFC data collection tool to build a database for 2RM. GSEU partners contributed to the building of the database with UNFC information for CRM-bearing mining waste objects. The complex approach to classify mining waste facilities with the aim of recovering CRMs is tested in co-operation between FutRaM and GSEU projects. It serves as a bridge to develop recycling sector specific adjustments in line with the more advanced standard code requirements and modifying factors that define the maturity of a project in the mining sector. GSEU and FutuRaM continue the exchange of experience and follow closely the discussions and developments on UNFC in the 2RM sector.

Existing inventories or datasets for mining waste on national and regional levels have been mainly developed according to the implementation of the 2006/21 Mining Waste Directive but many mining waste inventories consist of geochemical data for CRMs. The experience with CRM data collection and UNFC classification of mining waste facilities shows that the joint European-level EGDI is an appropriate database that can embed mining waste related objects and relevant quality and quantity data with the relevant UNFC classes.

The GSEU project aims to collect, store and serve mining waste facility data that has preliminary potential for CRM recovery, and GSO’s will have the opportunity to provide data on ongoing projects aimed at CRM recovery. The data model includes mining waste related attributes and UNFC-type information. The form was tested with experts within the GSEU, so the systematic UNFC data collection

for mining wastes is a realistic task in the next phase of the GSEU project. Based on the consideration of the FutuRaM results on the UNFC classification of secondary raw materials that specifically relate to mining waste and based on further discussion and collaboration of GSEU and FutuRaM experts, a harmonised UNFC classification and data collection approach will be developed and will support appropriate mining waste data and UNFC data provision in the EGDI.

Within the Anthropogenic Working Group of the UNECE EGRM, work is ongoing to update specifications as the current version was published two years before the UNFC generic principles document (UNECE, 2018, UNECE, 2020). Updates will be available at the beginning of 2025 that will be useful to UNFC practitioners.

5. Conclusions

In this report, we have outlined the direction in which we have developed the UNFC data collection methodology, building on UNFC principles while considering the data access capabilities of geological surveys and mining authorities. The UNECE UNFC Guidance for Europe is still the most acceptable, applicable guidance document that will be directly or indirectly used by all raw materials data provider organizations. Additionally, we have accounted for the requirement to store raw material data in an INSPIRE-compliant format within EGDI.

We successfully developed the UNFC PDF template to a level where it can be compatible with the MIN4EU database, and we have prepared and tested the data model plan for the necessary database extensions. Based on these results, the MIN4EU database will be supplemented with new data types related to the UNFC classification. These additions will enable data verification for both data providers and users and provide foundational information for advancing projects at different stages of readiness under the UNFC framework.

The UNFC PDF Template not only serves as a practical application tool for UNFC classification but also as a valuable training resource. Furthermore, it is anticipated that it could become the core of an Access-based data collection template, which is one of the most suitable tools for database integration prior to developing the automated harvesting mechanism for MIN4EU. The UNFC PDF Template also allows for marking basic information related to mining waste and offers excellent compatibility with the Access data sheet specifically developed and tested for mining waste. If necessary, it can be further developed into an integrated data collection Access Form in co-operation with GSEU WP7.

We clarified why it is essential to develop UNFC guidelines at the national/regional level, ensuring compliance with the CRM Act requirements while aligning with the legal frameworks and data management constraints of the member states. The GSEU UNFC activities, through tasks T2.3 and T2.4, contribute to enabling partner countries' data provider organizations to develop their own UNFC datasets and records. These datasets should not only be unified within their national context but also integrated into the shared European MIN4EU/EGDI database.

The knowledge and experience gained during UNFC training sessions with the related certifications after training, and the well-established MIN4EU DB extension with UNFC-related datatypes support the data validation and appropriate UNFC data management in the EGDI.

We have compiled the progress made in the development of national/regional UNFC guidelines. In addition to presenting the UNFC methodologies outlined in the first UNFC report (D2.1.), GSEU partners who continued to prepare or update UNFC guidelines at the national, regional, or survey/authority level to support the implementation of the CRM Act shared their experiences in greater detail with partners and readers. This was done to promote similar processes in various countries.

Among the UNFC trainers, colleagues from Austria, the Czech Republic, Germany, Hungary, Norway, and Slovenia shared their results regarding the development of these guidelines. Additionally, significant progress was made in Cyprus under the GSEU project framework. Not only was a UNFC methodology developed in Cyprus, but the UNFC training sessions conducted in 2024 also contributed to the successful development of a national UNFC guideline-like document, further supporting the effective process.

Based on the GSEU experience with UNFC over the last two years there has been a significant increase in knowledge in Europe regarding UNFC. This has been accelerated by the activity of EuroGeoSurveys (EGS) and by most of its members, as well as the GSEU project activity including both the WP2 T2.3. (EGS / EU ICE SRM) and T2.4. (UNFC) activities mainly in co-operation. The entry into force of the CRM Act has also contributed to the integration of the UNFC into national/regional resource management activity within the EU.

A common feature among the partner countries sharing national UNFC methodologies and developing national-level UNFC guidelines is their reliance on specific national UNFC project outcomes. They emphasize the importance of stakeholder consultations and have either already organized UNFC training or consultations for their own organizations or other stakeholders or are planning to conduct similar events during the GSEU project timeframe.
We also discussed the importance of providing access to fundamental UNFC documents in the respective national languages to facilitate knowledge transfer during UNFC training sessions held in various countries. Numerous examples are available on the UNECE website (e.g., Greek, German, Hungarian, Portuguese), and partners have introduced additional documents (e.g., the Hungarian translation of the UNECE UNFC Guidance for Europe 2022 prior to its publication in Hungary). This report supports partners by compiling and discussing the possible content structures of completed, ongoing, or updated national/regional UNFC guidelines.

Summary of the joint approach to develop UNFC guidance on national level:

1. Introduction: Why UNFC guidance is important on national level (CRM Act, UNECE-EGRM, GSEU objectives)
2. Background: Short description of national activities with UNFC (past and recent projects, etc.)
3. National resource management system: brief description with reference on the legislation and roles
4. UNFC: Short introduction to the UNFC with reference to basic UNECE UNFC related documents
5. UNFC methodology: data source for E, F and G categories
6. Project-based approach: Mining Projects, Viable Projects, Potential Viable Projects, Prospective Projects, Non-Viable Projects, Historic Estimates
7. References

A particularly significant outcome is that the UNECE EGRM leadership and experts personally shared their insights and recommendations with the T2.3 and T2.4 partners during a meeting in Ljubljana in June 2024. Based on the presented results, we prepared recommendations for the content for UNFC guidance-type documents at national level and presented good practices for the implementation.
Additional partners have shared the UNFC methodologies developed within their organizations, which adhere to UNFC principles while also considering the resource management context of their respective countries. Colleagues from Cyprus, Croatia, France, Poland, and Ukraine summarized the relevant national legislation and identified national data sources related to the UNFC E, F, and G axes. They also presented the applied UNFC methodologies in greater detail, both as best practice and to provide suitable educational and training tools for use in future national/regional UNFC training sessions or consultations with stakeholders.
We summarized the key insights from the three-level UNFC training organized by GeoZS for the GSEU T2.3 and T2.4 partners. We focused on the main points that contribute to the unified use of UNFC at the European level, the establishment and development of related databases or inventories, and the most effective support for the implementation of the CRM Act.

- Representatives or experts of most raw materials data provider organisations within EGS participated on the three levels UNFC training (all the participants received a certificate)
- All relevant UNECE and related documents were presented and discussed as serving as an appropriate base for UNFC practitioners to use UNFC
- Relevant cases studies were presented and discussed to give UNFC practitioners practical examples

- Specific topics were discussed that are important for geological surveys and mining authorities (e.g. archive – historical data, data gaps, role of different permissions to the UNFC classification)
- Specific sessions were dedicated to practice with case studies

To ensure that this report serves as a comprehensive collection not only of the shared UNFC methodologies and ongoing UNFC processes in partner countries but also of key topics relevant to UNFC classification that require increased attention from practitioners and experts, we curated specific subjects presented during the UNFC training sessions (e.g., data gaps, historical data, bridging, etc.). These topics, along with related accessibility links, were compiled from the EU ICE SRM website, allowing easy access to summaries and recommendations by UNFC trainers. The complete UNFC training materials are available here: https://www.geologicalservice.eu/events/gseu-unfc-training-level-1.

After the UNFC "train the trainers" event in 2024, based on discussions on the development of UNFC guidance at national level, UNFC experts in the GSEU project agreed that it is necessary to take note of different stakeholders that may have different purposes for the application of the UNFC. A quarter of respondents are sure that they will co-operate with other authorities, ministries or with companies.

The majority of respondents (62 %) aim to publish the UNFC guidance at national level, which is promising because publicly available UNFC documents with instructions on use at national level will significantly support the dissemination of the application and the implementation of SDGs at national/ regional level may also be more effective.

More than two-thirds of respondent partners (69 %) will directly use the UNECE UNFC Guidance for Europe (2022) at national level next to an UNFC guidance at national level with regional specifications and instructions.

Almost half of respondent organizations have a draft for UNFC guidance at national level. This means that a significant part of UNFC practitioners within the GSEU project are prepared for further developments in the frame of national level UNFC training, stakeholder consultations and for additional UNECE events for supporting this progress (e.g. UNECE RMW 2025).

Regarding the recommendations for the content of UNFC guidance on national level based on sharing experiences on the three level "train the trainers" UNFC training, most respondents (72%) think that advice from UNFC trainers and UNECE experts are useful. One-fifth (21%) of respondents aim to develop specific content for UNFC guidance at national level.

To support the activities of the GSEU WP3 (GeoEnergy) working group and align with the objectives of EGS/GSEU ICE SRM, we have prepared two separate questionnaires for each resource type. These aim to:

- Examine European GeoEnergy resource management practices (strategies, legislation)
- Assess data management practices related to the UNFC E, F, and G categories
- Evaluate knowledge levels within data-providing organisations

Results will enhance the sustainable resource management goals of GSOs and authorities dealing with earth resources. For GeoEnergy and UNFC, the questionnaire responses are currently being collected. The results will also benefit UNECE EGRM, as GSEU includes the largest number of European resource management organisations. Collaboration between EGS/GSEU and UNECE will be mutually beneficial in achieving their respective goals.

Regarding the application of UNFC to secondary raw materials, we have taken several steps:

- Enhancement of the UNFC PDF Template: We extended the UNFC PDF Template with data fields specific to mining waste. To support this, we designed and tested a data model for the MIN4EU database
- Consultation and collaboration with FutuRaM Experts: Through consultations and experience exchange GSEU partners tested the Access format provided by FutuRaM for mining waste projects or waste management facilities

The data collection template proved to be highly effective for capturing UNFC baseline information, identifiers, and data related to the UNFC E, F, and G categories. It also allows for recording qualitative data in addition to quantitative data, categorized according to the CRM list.
Several data providers contributed new datasets to the central MIN4EU database.

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7. Annex I – Consortium Partners

	Partner name	Acronym	Country
1	EuroGeoSurveys	EGS	Belgium
2	Nederlandse Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek	TNO	The Netherlands
3	Sherbimi Gjeologjik Shqiptar	AGS	Albania
4	Vlaamse Gewest	VLO	Belgium
5	Bureau de Recherches Géologiques et Minières	BRGM	France
6	Ministry for Finance and Employment	MFE	Malta
7	Hrvatski Geološki Institut	HGI-CGS	Croatia
8	Institut Royal des Sciences Naturelles de Belgique	RBINS-GSB	Belgium
9	Państwowy Instytut Geologiczny – Państwowy Instytut Badawczy	PGI-NRI	Poland
10	Institut Cartogràfic i Geològic de Catalunya	ICGC	Spain
11	Česká Geologická Služba	CGS	Czechia
12	Department of Environment, Climate and Communications - Geological Survey Ireland	GSI	Ireland
13	Agencia Estatal Consejo Superior de Investigaciones Cientificas	CSIC-IGME	Spain
14	Bundesanstalt für Geowissenschaften und Rohstoffe	BGR	Germany
15	Geološki zavod Slovenije	GeoZS	Slovenia
16	Federalni Zavod za Geologiju SZTFHjevo	FZZG	Bosnia and Herzegovina
17	Istituto Superiore per la Protezione e la Ricerca Ambientale	ISPRA	Italy
18	Regione Umbria	-	Italy
19	State Research and Development Enterprise State Information Geological Fund of Ukraine	GIU	Ukraine
20	Institute of Geological Sciences National Academy of Sciences of Ukraine	IGS	Ukraine
21	M.P. Semenenko Institute of Geochemistry, Mineralogy and Ore Formation of NAS of Ukraine	IGMOF	Ukraine
22	Ukrainian Association of Geologists	UAG	Ukraine
23	Geologian Tutkimuskeskus	GTK	Finland
24	Geological Survey of Serbia	GZS	Serbia
25	Ministry of Agriculture, Rural Development and Environment of Cyprus	GSD	Cyprus
26	Norges Geologiske Undersøkelse	NGU	Norway

27	Latvijas Vides, ģeoloģijas un meteoroloģijas centrs SIA	LVGMC	Latvia
28	Sveriges Geologiska Undersökning	SGU	Sweden
29	Geological Survey of Denmark and Greenland	GEUS	Denmark
30	Institutul Geologic al României	IGR	Romania
31	Szabályozott Tevékenységek Felügyeleti Hatósága	SARA	Hungary
32	Eidgenössisches Departement für Verteidigung, Bevölkerungsschutz und Sport	VBS (DDPS)	Switzerland
33	Elliniki Archi Geologikon kai Metalleftikon Erevnon	HSGME	Greece
34	Laboratório Nacional de Energia e Geología I.P.	LNEG	Portugal
35	Lietuvos Geologijos Tarnyba prie Aplinkos Ministerijos	LGT	Lithuania
36	Geologische Bundesanstalt	GBA	Austria
37	Service Géologique de Luxembourg	SGL	Luxembourg
38	Eesti Geoloogiateenistus	EGT	Estonia
39	Štátny Geologický ústav Dionýza Štúra	SGUDS	Slovakia
40	Íslenskar Orkurannsóknir	ISOR	Iceland
41	Instituto Português do Mar e da Atmosfera	IPMA	Portugal
42	Jarðfeingi	Jardfeingi	Faroe Islands
43	Regierungspräsidium Freiburg	LGRB	Germany
44	Geologischer Dienst Nordrhein-Westfalen	GD NRW	Germany
45	Landesamt für Geologie und Bergwesen Sachsen-Anhalt	LfU	Germany
46	Vlaamse Milieumaatschappij	VMM	Belgium
47	Norwegian Petroleum Directorate	NPD	Norway
48	United Kingdom Research and Innovation - British Geological Survey	UKRI-BGS	UK

8. Annex II – GSEU UNFC PDF Template

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UNFC EU Template for Mineral Resources Data Collection and Classification

(please open with Adobe Acrobat Reader) (for a guide and explanations on how to fill this template click *here*)

1. Project Metadata	
Name of project*	
Location* (reference system: WGS84 decimal degrees) Geospatial (2D) project boundary/area* (spatial dataset)	• Latitude • Longitude view map (a) Data Attach *OR* boundary represents: (b) URL
Licence owner*	
Company webpage (URL)	
Main commodity*	•
Other commodities (multiple entries possible)	• • • •
Origin of the resource*	○ Greenfield ○ Mine waste stockpiles ○ Brownfield ○ Mine tailings
Is this a strategic project?	○ Yes ○ No
Type of mining* (multiple entries possible)	○ Onshore ○ Surface mining ○ Underground mining ○ Offshore
Project stage / Activities*	○ Undiscovered resource ○ Exploration stage ○ Regional reconnaissance ○ Detailed surface exploration ○ Subsurface exploration ○ Resource assessment ○ Design, Planning, Evaluation stage ○ Scoping study completed ○ Technical pre-feasibility study completed ○ Economic pre-feasibility study completed ○ Competent person's report completed ○ Technical feasibility study completed ○ Economic feasibility study completed ○ Final mining / investment decision taken ○ Construction and Development stage ○ Construction is pending approval ○ Mine is under construction ○ Production Stage ○ Operation pending ○ Technical care and maintenance ○ On hold due to unfavourable economic conditions ○ Closure and Reclamation Stage ○ Shutting down ○ Decommissioning ○ Remediation / Rehabilitation / Restoration ongoing ○ Post-closure monitoring (technical / environmental surface monitoring, technical / environmental subsurface monitoring) ○ Closed without plans for potential future recovery ○ Abandoned without plans for potential future recovery ○ Historic without plans for potential future recovery ○ No information on project stage available
Type of production* (multiple entries possible)	○ Extraction ○ Processing ○ Recycling

* Mandatory fields are marked by an asterix & solid outline/shading.
Underlined words show explanatory text at mouse over.
To unselect a button, simply click on it again.

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1. Project Metadata (continued)	
Stage of permitting process*	Exploration permit ○ No request submitted ○ Request submitted ○ Permit granted ○ Permit declined ○ Permit not required ○ No information available Environmental permits (water, forests..) ○ No requests submitted ○ Requests submitted ○ All permits granted ○ Permits declined ○ Permits not required ○ No information available Mining waste permit ○ No request submitted ○ Request submitted ○ Permit granted ○ Permit declined ○ Permit not required ○ No information available Land use ○ Land owner agreement in place ○ Land owner agreement not in place ○ Land use for mineral extraction granted ○ Land use for mineral extraction declined ○ No information available Construction license ○ No request submitted ○ Request submitted ○ License granted ○ License declined ○ License not required ○ No information available Extraction permit ○ No request submitted ○ Request submitted ○ Permit granted ○ Permit declined ○ No information available
Social contingencies (multiple entries possible)	Social Impact Assessment ○ Assessment carried out / submitted for approval ○ Assessment approved ○ Approval declined ○ Assessment not carried out ○ No information available Engagement with stakeholders ○ No active engagement ○ Active engagement initiated but too early to assess outcome of conflict resolution ○ Conflicts resolved or likely to be resolved ○ Conflicts unresolved or unlikely to be resolved ○ Probability of conflict resolution unknown ○ No conflicts ○ No information available

* Mandatory fields are marked by an asterix & solid outline/shading.
Underlined words show explanatory text at mouse over.
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2. Classification Background Information

Classification system used*	○ Direct UNFC application ○ CRIRSCO-aligned standard bridged to UNFC JORC Please follow the *Guidance Note on the use of the Bridging Document between the CRIRSCO Template and UNFC 2024* PERC NI43-101 Other: ○ National system mapped to UNFC if yes, please specify:

In case of direct UNFC application:

Base data used for assessment *	Data confidentiality	Data quality
Data set 1: Source: Year: Holder:	○ Restricted access ○ Partial restriction ○ No restriction	○ adequate ○ inadequate
Data set 2: Source: Year: Holder:	○ Restricted access ○ Partial restriction ○ No restriction	○ adequate ○ inadequate
Data set 3: Source: Year: Holder:	○ Restricted access ○ Partial restriction ○ No restriction	○ adequate ○ inadequate
Data set 4: Source: Year: Holder:	○ Restricted access ○ Partial restriction ○ No restriction	○ adequate ○ inadequate

Comment:

In case a CRIRSCO-aligned standard was bridged, or a national system was mapped, to UNFC:

Citation of the original report *
- Author:
- Affiliation:
- Date:
- Title:

Type of original report *

Did the original report already include the bridging to UNFC * ○ yes ○ no

Comment:

Brief outline of mining history (previous activities / licenses / owners):

* Mandatory fields are marked by an asterix & solid outline/shading.
Underlined words show explanatory text at mouse over.
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3. UNFC Classes of Resources Please follow the definitions and explanations given in
(1) the *UNFC Update 2019*,
(2) the *Supplementary Specifications for the Application of UNFC to Minerals 2021*
(3) the *UNFC Guidance Europe 2022*

Possible E-axis categories: E1, E1.1, E1.2, E2, E3, E3.1, E3.2, E3.3
Possible F-axis categories: F1, F1.1, F1.2, F1.3, F2, F2.1, F2.2, F2.3, F3, F3.1, F3.2, F3.3, F4, F4.1, F4.2, F4.3
Possible G-axis categories: G1, G2, G1+G2, G3, G2+G3, G1+G2+G3, G4, G4.1, G4.2, G4.3

Main commodity*	UNFC class* E	F	G	Cut-off in %	Resource quantity in kt	Metal or product grade in %	Metal or product content in kt	Product (if different from commodity)

Other commodities	UNFC class E	F	G	Cut-off in %	Resource quantity in kt	Metal or product grade in %	Metal or product content in kt	Product (if different from commodity)

Comment:

4. Information on the person responsible for this UNFC classification

- Name*:
- Affiliation*:

Role*: ○ Qualified Expert ○ Competent / Qualified Person

Effective date of UNFC classification*

* Mandatory fields are marked by an asterix & solid outline/shading.
Underlined words show explanatory text at mouse over.
To unselect a button, simply click on it again.

show EFG | check missing mandatory fields | export to csv | save form

9. Annex III – Training Materials of the EU ICE SRM UNFC Training

Training materials from the UNFC training – level 1
(https://www.geologicalservice.eu/events/gseu-unfc-training-level-1)

Scene setter (Antje Wittenberg, BGR)
CRMA/UNFC (Lena Lundquist, SGU)
Basic information and Official documents (Antje Wittenberg, BGR)
Basics on UNFC (Tuomas Leskelä, GTK)
CRIRSCO-UNFC Bridging Document (Janne Hokka, GTK)
UNFC Guidance for Europe (Janne Hokka, GTK)
Estimation and uncertainty (Janne Hokka, GTK)
Historical Data principles (Tuomas Leskelä, GTK)
Data Gaps principles (Tuomas Leskelä, GTK)
Country Specific Systems to UNFC - Slovenia (Duška Rokavec, GeoZS)
Country Specific Systems to UNFC - Czech Republic (Zbyněk Gabriel, CGS)
Country Specific Systems to UNFC - Hungary (Zoltán Horváth, SZTFH)

Training materials from the UNFC training – level 2
(https://www.geologicalservice.eu/events/gseu-unfc-training-level-2)

Historic Estimates (Tuomas Leskelä, GTK)
CRIRSCO-UNFC Bridging Case Study (Janne Hokka, GTK)
Bridging methodology - Introduction and Czech National System to UNFC (Zbyněk Gabriel, CGS)
Bridging methodology - Slovenian ABC to UNFC (Duška Rokavec, GeoZS)
Bridging methodology - Bridging the Hungarian National System to UNFC (Zoltán Horváth, SZTFH)
Bridging methodology - Bridging the Austrian National System to UNFC (Sebastian Pfleiderer, GSA)
UNFC Case studies - Norway (Janja Knežević Solberg, NGU)
UNFC Case studies - Slovenia (Duška Rokavec, GeoZS)
UNFC Case Studies - Germany (Antje Wittenberg, BGR)
Experience of using and classification harmonizing UNFC in Ukraine (Mariia Kurylo, UAG)

Training materials from the UNFC training – level 3
(https://www.geologicalservice.eu/events/gseu-unfc-training-level-3)

Risks and efforts (Janne Hokka, GTK)
Development of UNFC guidance on national level (Zoltán Horváth, SZTFH)

10. Annex IV - Technical Guidance on the Use of the UNFC Template

a) Appearance of Required Fields

If required fields are not highlighted by a coloured line around the edge, you can set a color under "*Preferences*" in the "*Edit*" menu.

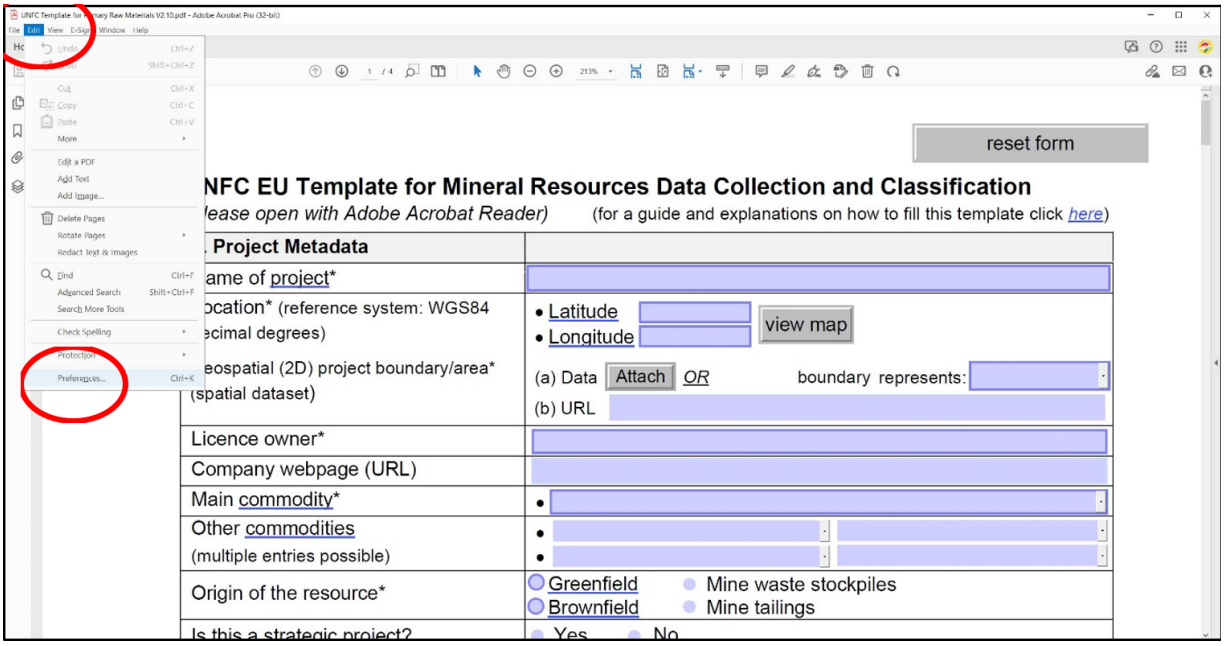

Figure 33. Coloured and Asterisk-marked Field in the UNFC PDF Template

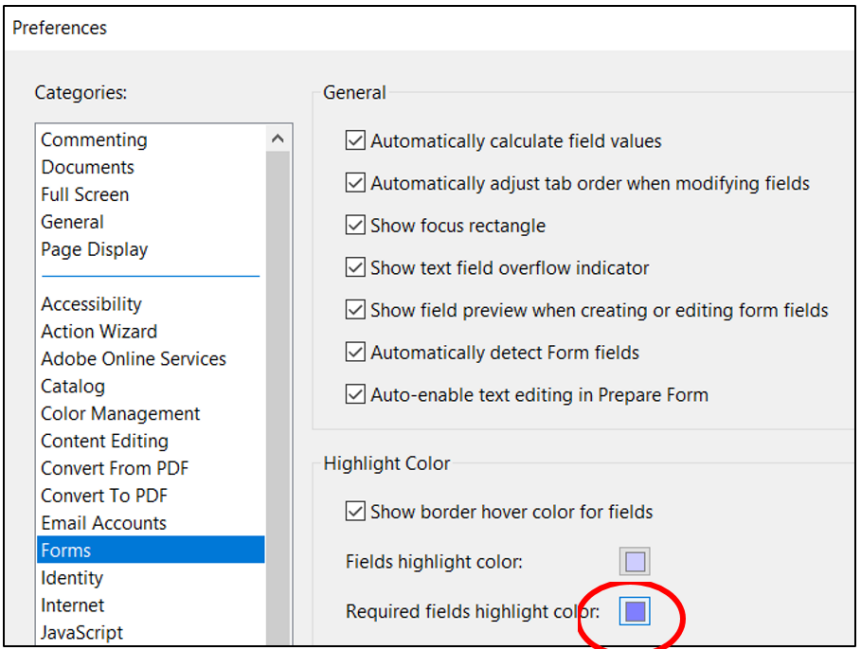

Figure 34. Setup Function in the UNFC PDF Template

b) Appearance of Comments

If the comments pane on the right is open, you can close it (at the top right), so that explanatory text only appears when you move the mouse over an underlined word.

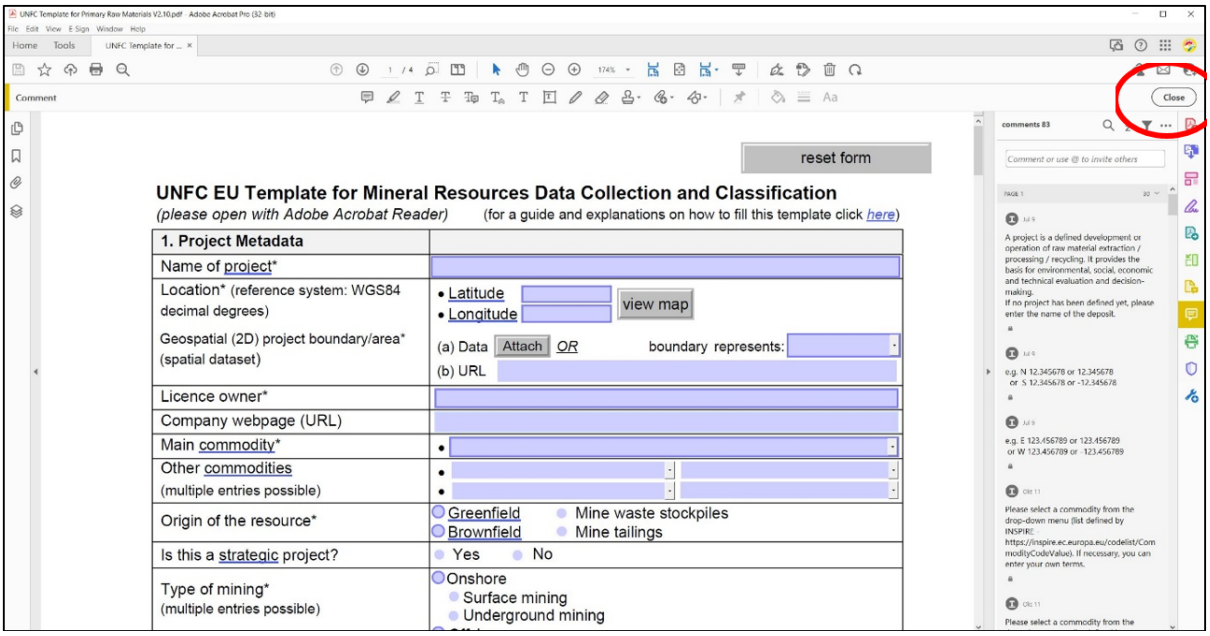

Figure 35. Explanatory Text (Instructions) in the UNFC PDF Template

c) Security Warning

If you click on the action buttons "*view map*" or "*show EFG*", you may get a security warning.

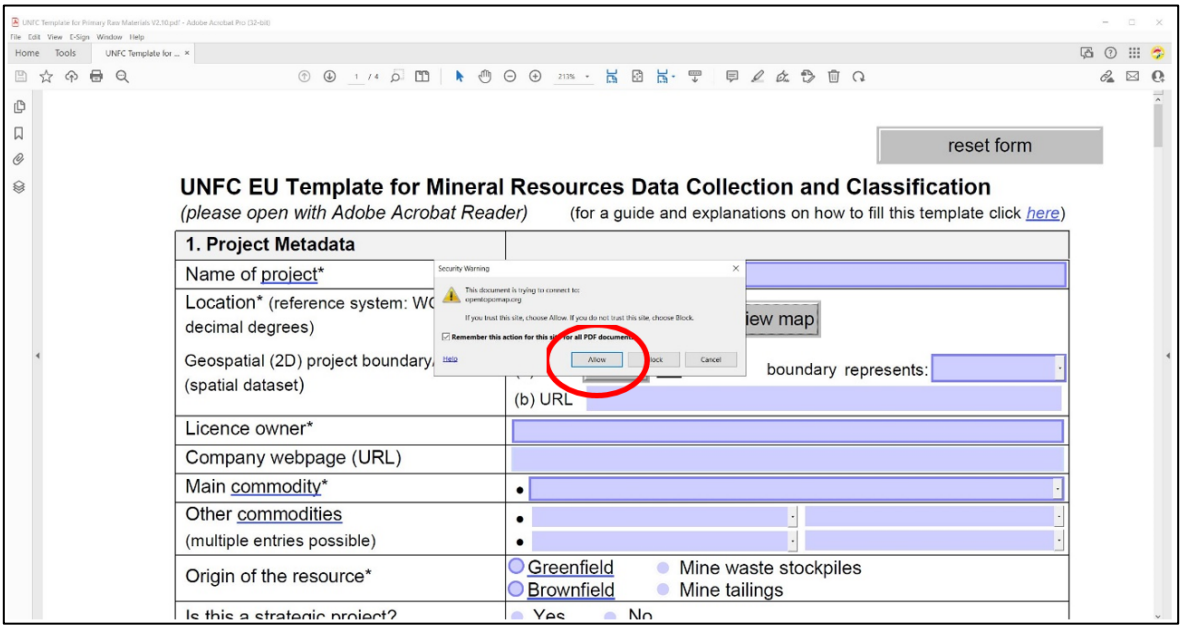

Figure 36. Security Warning in the UNFC PDF Template Helps with Correct Fill

You can safely click on "*Allow*". You will only be directed to *https://opentopomap.org*.

d) Fields "Latitude" and "Longitude"

If the fields "*Latitude*" and "Longitude" are filled, clicking on the action button "*view map*" will open https://opentopomap.org and the map will automatically zoom to the site and show a marker at the location. This can be used to check if the coordinates are entered correctly.

If "*Latitude*" or "*Longitude*" are NOT filled, the map will zoom to Europe. You can then navigate to the desired location and place a marker (using "Add marker to map" on the left).

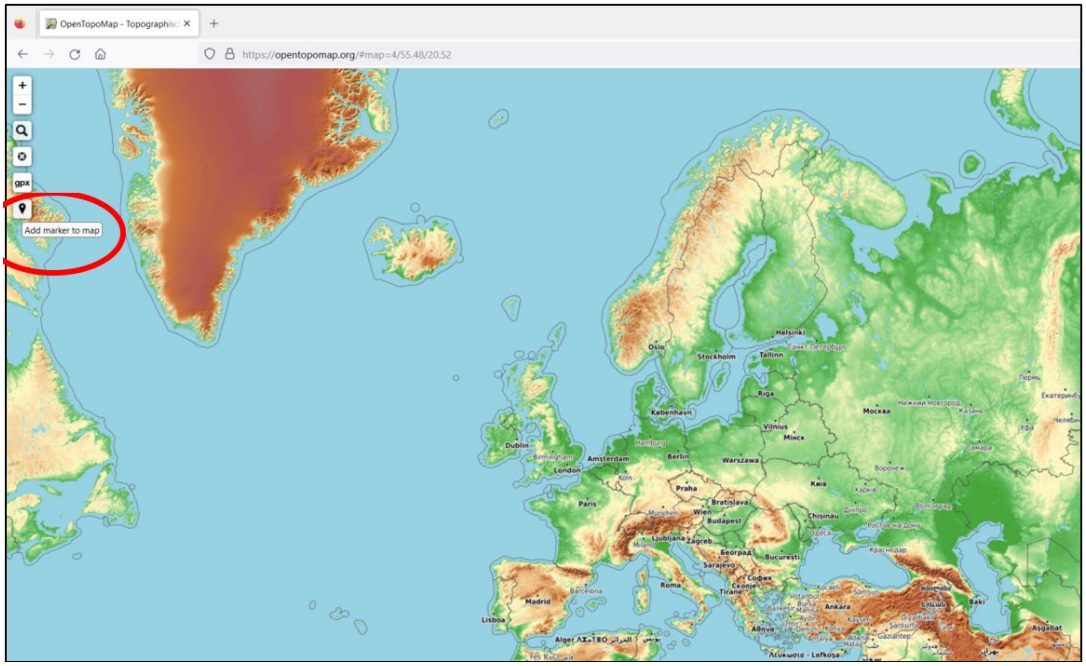

Figure 37. The Europe Map used for Visualisation of the Target Projects

Once the marker is placed, the coordinates (latitude and longitude) are then shown as part of the URL (50.9437/4.3705 in the example). This can be used if you know the location but not the coordinates.

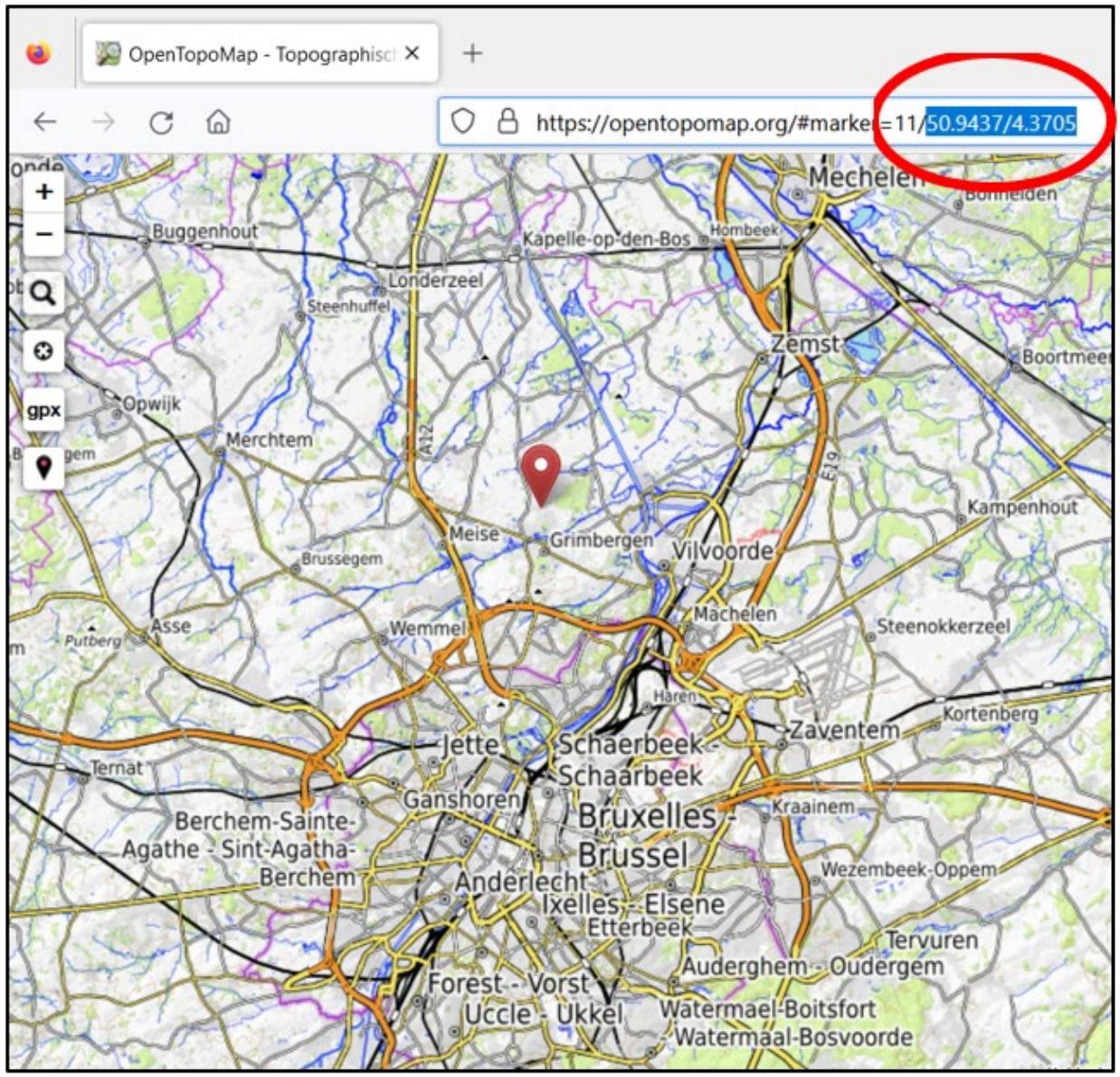

Figure 38. Indication of Location in the UNFC PDF Template

e) Project Stage

Once you select a project stage (and sub-stage), the number of possible UNFC classes will be narrowed down. This can be made visible by clicking on the action button “show EFG”. Table 1. shows the link between project stage and UNFC classes and EFG codes that were applied in the UNFC PDF template. The table shows the evolution of EFG classes during the mining cycle from potential source to closed or abandoned or historic mine. It provides explanation for the template’s button “Show EFG”. It vaguely corresponds to table 10. of the UNFC Guidance Europe, Guidance for the Application of the United Nations Framework Classification for Resources (UNFC) for Mineral and Anthropogenic Resources in Europe (UNECE,2022) but does not replace it.

Table 14. Links between Used Project Stages and UNFC Classes and EFG Codes

Project Stage	UNFC Class	EFG Code
closed or abandoned or historic mine	Non-Viable Project	E3 F4 G1-4*
closure and reclamation stage	Remaining products not developed from identified projects	E3 F4 G1-4
operation pending	Potentially Viable Project	E2 F2 G1-3
production project	Viable Project	E1 F1 G1-3
construction stage	Viable project	E1 F1 G1-3
design, planning, evaluation stage		
with feasibility study or final mining decision	Viable Project	E1 F1 G1-3
with scoping study or pre-feasibility study	Potentially Viable Project	E2 F2 G1-3
exploration stage	Prospective Project	E3 F3 G4
potential source	undiscovered resource	E3 F4 G4**

* Closure and reclamation stage also warrants to use E3 F2 G1-3.
** see UNECE (2022), page 26.:" For example, Potential Source or Potential Anthropogenic Material Source may be based on primary indirect evidence. This classification would be similar to "undiscovered resources" from undiscovered mineral deposits whose existence is postulated based on only indirect geological evidence."

The button "Show EFG" will suggest possible EFG classes based on the project stage. It does not consider sub-classes and does not reflect the actual UNFC classes entered on page 4 of the template, which may be different due to project specifics.

Further recommendations to the links between used project stages and UNFC classes and EFG codes:

- In accordance with the UNECE UNFC Guidance of Europe (UNECE 2022), the closure and reclamation stage also warrant the use of categories and sub-categories E3.3 and F2.2. And similarly for the closed and abandoned or historic mine stage E3.3; F2.3. In the current UNECE UNFC Guidance for Europe (UNECE 2022) E3; F4; G1-4 is allowed (Annex II, C. 1, 28 p.). Further details form the UNECE (2022):
  "C.1 A mine closed with no obvious prospects to be reopened. This is a non-viable, non-active, project, be the mine closed recently or decades ago. There is no permitting to mine in place, nor information on what would be the currently profitable extraction method. The confidence of geological information is variable, but mostly low, but a range may be estimated. If there is a remaining resource, it is classified as E3.3; F4; G1–G4. The value for the G- axis depends on quality of the available data – the older the data, the more probable that the range of uncertainty is large. Note that for many historic mines, the information for remaining resources is circumstantial only and not based on any direct evidence; this means that assumed resources should not be classified at all. On the other hand, such information is used in evaluating a regional resource potential, e.g., in the assessment of undiscovered resources (UNFC Class 3,4,4). But note that such a regional resource (UNFC Class 3,4,4) cannot be connected to any individual deposit."

- The remaining products not developed from identified projects are typically E3;F4;G1,2,3 (not G4; UNECE 2022, Annex II, Reported Resource Quantities and Quality). These are products, not quantities. Quantities are referred to as sources which are not yet developed.

Within the GSEU “train the trainers” courses these products were considered mainly as by-products or co-products which have been identified and may become developable in the future as technological or environmental-socio-economic conditions change.

At the UNFC “train the trainers” events, participants agreed that when information is not available for the stage of a project the correct UNFC classification is not recommended. If a project exists, so the development or operation of a mining activity is identifiable, and it is necessary to collect and find the related document (e.g. stage of one of the permissions) at any authorities, or via searching in publicly available databases or on webpages to establish the appropriate UNFC class.
“Potential resource” and “potential deposit” are typical objects that are managed by GSOs according to their mission regarding data collection for mineral raw materials and interpretation based on available geoscientific and exploration related information, if any. The interpretation covers the outline, the locality and shape and size of a mineral raw materials occurrence. Methodologies are different at each GSO but the common objective is to support further exploration and mining activities. In case of having appropriate geoscientific data, including (among others) sufficient geochemical data, a mineral resource estimation on low level can be provided. In these cases, the justification of an appropriate source of information or available documents (e.g. survey report or study) is important (source of information). The need for expertise on mineral resource assessment is being increased with the appropriate knowledge and qualification of an expert who provides data for mineral resources.

At the UNFC “train the trainers” events it was discussed that “potential resource” and “potential deposit” should definitely not be E3;F4;G4. This is reserved for “Remaining Products not developed from Prospective Projects” or used when assessment is done according to e.g. undiscovered resources or regional scenario-based assessment without direct evidence.

Exploration stage can be aligned with “Prospective Project” in UNFC terms.

11. Annex V – Compliance between UNFC PDF Template and MIN4EU D8 Elements

UNFC PDF Template		Corresponding MIN4EU Elements	
Field Name		**Code List**	**Proposed Value**
Type Of Mining			
onshore			
	surface mining	MiningActivityType	surfaceMining
	underground mining	MiningActivityType	undergroundMining
offshore			
Project Stage			
exploration stage			
	regional reconnaissance	ExplorationActivityTypeType	regionalReconnaissance
	detailed surface exploration	ExplorationActivityTypeType	detailedSurfaceExploration
	subsurface exploration	ExplorationActivityTypeType	subsurfaceExploration
	target assessment	ExplorationActivityTypeType	resourceAssessment
design planning evaluation stage			
	scoping study completed	MineStatusType	scopingStudy
	technical pre-feasibility study completed	MineStatusType	preFeasibility
	economic pre-feasibility study completed	MineStatusType	preFeasibility
	competent person's report completed		
	technical feasibility study completed	MineStatusType	feasibility
	economic feasibility study completed	MineStatusType	feasibility
	final mining / investment decision taken		
construction and development stage			
	construction is pending approval	MineStatusType	pendingApproval
	mine is under construction	MineStatusType	construction
production stage		MineStatusType	operating
operation pending			
	technical care and maintenance	MineStatusType	careAndMaintenance
	on hold due to unfavourable economic conditions	MineStatusType	retention
closure and reclamation stage			
	shutting down	MineStatusType	underClosure
	decommissioning		
	remedition / rehabilitation / restoration ongoing		
	post closure monitoring	MineStatusType	postClosureMonitoring
closed			
abandoned			

historic			
Type of Production			
extraction			
processing		MiningActivityType	processing
recycling		MiningActivityType	recycling
Stage of Permitting Process			
Exploration permit			
	No request submitted	PermitStageType	noRequestSubmitted
	Request submitted	PermitStageType	requestSubmitted
	Permit granted	PermitStageType	granted
	Permit declined	PermitStageType	declined
	Permit not required	PermitStageType	notRequired
	No information available	PermitStageType	noInformationAvailable
Environmental permits			
	No requests submitted	PermitStageType	noRequestSubmitted
	Requests submitted	PermitStageType	requestSubmitted
	All permits granted	PermitStageType	granted
	Permits declined	PermitStageType	declined
	Permits not required	PermitStageType	notRequired
	No information available	PermitStageType	noInformationAvailable
Mining waste permit			
	No request submitted	PermitStageType	noRequestSubmitted
	Request submitted	PermitStageType	requestSubmitted
	Permit granted	PermitStageType	granted
	Permit declined	PermitStageType	declined
	Permit not required	PermitStageType	notRequired
	No information available	PermitStageType	noInformationAvailable
Land use			
	Land owner agreement in place	PermitStageType	granted
	Land owner agreement not in place	PermitStageType	declined
	Land use for mineral extraction granted	PermitStageType	granted
	Land use for mineral extraction declined	PermitStageType	declined
	No information available	PermitStageType	noInformationAvailable
Construction licence			
	No request submitted	PermitStageType	noRequestSubmitted
	Request submitted	PermitStageType	requestSubmitted
	Licence granted	PermitStageType	granted
	Licence declined	PermitStageType	declined
	License not required	PermitStageType	notRequired
	No information available	PermitStageType	noInformationAvailable
Extraction permit			
	No request submitted	PermitStageType	noRequestSubmitted
	Request submitted	PermitStageType	requestSubmitted
	Permit granted	PermitStageType	granted
	Permit declined	PermitStageType	declined
	No information available	PermitStageType	noInformationAvailable

Table 15. The Resources of Selected Mineral Raw Materials in Poland in Comparison with the UNFC (Nieć, 2009)

National classification								UNFC Update 2019						
Deposits licensed for mining ("E", "T" and "B")						Deposits beyond concession areas ("P", "R")		Deposits licensed for mining					Deposits beyond concession areas	
anticipated economic resources (in Polish "bilansowe"), including: economic resources + sub-economic resources					anticipated sub-economic resources (in Polish "poza-bilansowe")	anticipated economic resources (in Polish "bilansowe")	anticipated sub-economic resources (in Polish "poza-bilansowe")	extractable resources **11x 12x**	economic resources **21x**	anticipated economic resources **22x**	sub-economic resources and losses **31x 32x**	anticipated sub-economic resources **32x**	anticipated economic resources **23x**	anticipated sub-economic resources **33x**
	economic resources (in Polish "przemysłowe"): extractable resources + losses			sub-economic resources (in Polish "nieprze-mysłowe")										
	extractable resources (in Polish "opera-tywne")	losses (in Polish "straty")												
High nitrogenous natural gas* [Mm^3]														
11,358.58	**772.48**	**772.48**	**-**	**10,586.10**	**-**	**3,300.00**	**-**	**772.48**	**0.00**	**0.00**	**10,586.10**	**-**	**3,300.00**	**-**
Natural gas*[Mm^3]														
104,644.80	**53,781.33**	**53,781.33**	**-**	**156,444.79**	**656.36****	**46,018.20**	**1,419.75**	**53,781.33**	**0.00**	**50,863.47**	**156,444.79**	**-*****	**46,018.20**	**1,419.75**
Crude oil* [Mt]														
19.00	**9.11**	**9.11**	**-**	**154.94**	**-**	**1.12**	**0.33**	**9.11**	**0.00**	**9.89**	**154.94**	**-**	**1.12**	**0.33**
Copper and silver ores [Mt], *Cu [Mt], Ag [kt]*														
1,487.46	**1,021.69**	**766.27**	**255.42**	**352.01**	**1.04**	**2,031.16**	**603.69**	**766.27**	**0.00**	**113.76**	**607.43**	**1.04**	**2,031.16**	**603.69**
27.05	***20.55***	***15.41***	***5.14***	***4.87***	***0.01***	***29.62***	***10.15***	***15.41***	***0.00***	***1.63***	***10.01***	***0.01***	***29.62***	***10.15***
78.06	***61.24***	***45.93***	***15.31***	***13.63***	***0.04***	***85.59***	***30.66***	***45.93***	***0.00***	***3.19***	***28.94***	***0.04***	***85.59***	***30.66***
Hard coal [Mt]														
28,376.22	**3,945.60**	**2,761.92**	**1,183.68**	**22,248.54**	**2,559.92**	**30,112.20**	**8,933.86**	**2,761.92**	**0.00**	**2,182.08**	**23,432.22**	**2,559.92**	**30,112.20**	**8,933.86**
Lignite [Mt]														
936.47	**772.88**	**695.59**	**77.29**	**146.11**	**19.98**	**22,063.55**	**3,447.62**	**695.59**	**0.00**	**17.48**	**223.40**	**19.98**	**22,063.55**	**3,447.62**
Rock salt [Mt]														
9,771.10	**1,809.62**	**633.37**	**1,176.25**	**5,443.96**	**-**	**96,739.10**	**10,214.18**	**633.37**	**0.00**	**2,517.52**	**6,620.21**	**-**	**96,739.10**	**10,214.18**
Sulfur – native [Mt]														
20.42	**14.84**	**7.42**	**7.42**	**5.58**	**0.71**	**256.69**	**14.64**	**7.42**	**0.00**	**0.00**	**13.00**	**0.71**	**256.69**	**14.64**
Diatomaceous rock [Mt]														
0.63	**0.19**	**0.14**	**0.05**	**0.44**	**-**	**-**	**-**	**0.14**	**0.00**	**0.00**	**0.49**	**-**	**-**	**-**
Bentonites [Mt]														
0.50	**0.34**	**0.26**	**0.08**	**-**	**-**	**2.33**	**0.25**	**0.26**	**0.00**	**0.16**	**0.08**	**-**	**2.33**	**0.25**
Dolomites [Mt]														
185.00	**117.10**	**87.83**	**29.27**	**-**	**6.53**	**260.21**	**0.55**	**87.83**	**0.00**	**67.90**	**29.27**	**6.53**	**260.21**	**0.55**
Gypsum and anhydrite [Mt]														
85.00	**61.65**	**46.24**	**15.41**	**9.53**	**-**	**142.02**	**18.88**	**46.24**	**0.00**	**13.82**	**24.94**	**-**	**142.02**	**18.88**
Whiteware ceramic clays [Mt]														
3.30	**0.30**	**0.23**	**0.07**	**-**	**-**	**57.62**	**-**	**0.23**	**0.00**	**3.00**	**0.07**	**-**	**57.62**	**-**
Stoneware ceramic clays [Mt]														
5.93	**4.98**	**3.74**	**1.24**	**0.10**	**5.10**	**57.52**	**8.40**	**3.74**	**0.00**	**0.85**	**1.34**	**5.10**	**57.52**	**8.40**
Refractory clays [Mt]														
3.78	**0.90**	**0.68**	**0.22**	**0.09**	**-**	**43.39**	**106.02**	**0.68**	**0.00**	**2.79**	**0.31**	**-**	**43.39**	**106.02**
Kaolin [Mt]														
52.50	**44.46**	**33.35**	**11.11**	**1.88**	**-**	**124.31**	**41.67**	**33.35**	**0.00**	**6.16**	**12.99**	**-**	**124.31**	**41.67**
Feldspar raw materials [Mt]														
5.74	**5.74**	**4.31**	**1.43**	**-**	**-**	**122.88**	**13.18**	**4.31**	**0.00**	**0.00**	**1.43**	**-**	**122.88**	**13.18**
Glass sand and sandstone [Mt]														
171.43	**92.33**	**69.25**	**23.08**	**12.95**	**28.11**	**441.49**	**100.59**	**69.25**	**0.00**	**66.15**	**36.75**	**28.11**	**441.49**	**100.59**
Magnesites [Mt]														
4.28	**3.21**	**2.41**	**0.80**	**-**	**-**	**5.92**	**2.18**	**2.41**	**0.00**	**1.07**	**0.80**	**-**	**5.92**	**2.18**
Backfilling sand [Mt – recalculated from Mm^3 according to the density 1.7]														
716.67	**56.78**	**42.59**	**14.19**	**37.67**	**67.01**	**2,996.71**	**319.45**	**42.59**	**0.00**	**622.22**	**51.86**	**67.01**	**2,996.71**	**319.45**

*** high nitrogenous natural gas, natural gas and crude oil – anticipated economic and anticipated sub-economic resources within exploitable resources**

**for natural gas, a small part of anticipated sub-economic resources is a subject of exploitation as the part of economic resources was allocated within anticipated sub-economic resources

***there are no anticipated sub-economic resources in the UNFC due to the fact that total magnitude was classified to sub-economic resources; sub-economic resources are estimated within geological resources (geological resources cover anticipated economic and anticipated sub-economic) and therefore contain also the total exploitable resources (anticipated economic and anticipated sub-economic)

The recalculation of resources from Polish classification to the UNFC – the case of hard coal:

UNFC class 33x = 8,933.86 Mt in Polish classification

(anticipated sub-economic resources in deposits beyond concession areas – "pozabilansowe")

no calculation needed

UNFC class 23x = 30,112.20 Mt in Polish classification

(anticipated economic resources in deposits beyond concession areas – "bilansowe")

no calculation needed

UNFC class 32x = 2,559.92 Mt in Polish classification

(anticipated sub-economic resources in deposits licensed for mining – "pozabilansowe")

no calculation needed

UNFC class 31x, 32x = 23,432.22 Mt in Polish classification

(sub-economic resources plus losses in deposits licensed for mining

"nieprzemysłowe" + "straty")

calculation: 22,248.54 Mt + 1,183.68 Mt = 23,432.22 Mt

UNFC class 22x = 2,182.08 Mt in Polish classification

(anticipated economic resources in deposits licensed for mining minus sub-economic minus economic

"bilansowe" - "nieprzemysłowe" - "przemysłowe")

calculation: 28,376.22 Mt – 22,248.54 Mt – 3,945.60 Mt = 2,182.08 Mt

UNFC class 21x = 0.00 Mt in Polish classification

(economic resources in deposits licensed for mining minus extractable minus losses

"przemysłowe" - "operatywne" - "straty")

calculation: 3,945.60 Mt – 2,761.92 Mt – 1,183.68 Mt = 0.00 Mt

UNFC class 11x, 12x = 2,761.92 Mt in Polish classification

(economic resources x appropriate factor – "operatywne")

calculation: 3,945.60 Mt x 0.7 = 2,761.92 Mt

Table 16. The Resources of Hard Coal in Poland in Comparison with the UNFC – with all 3 axis (E, F, G) considered (Nieć, 2010, with authors' adjustments)

Hard Coal				
Polish Classification		**UNFC**		
Exploited deposits (E, T, B)	Non-exploited deposits (P, R)	**Regional reports/Geological documentation**		**Deposit development plan/mining report**
		Exploited deposits	Non-exploited deposits (beyond concession areas)	
Resources (Mt) prospective D_2 – **26,914.19** prognostic D_1 – **17,004.82**			Resources (Mt) 344 - **26,914.19** 334 - **17,004.82**	
Anticipated sub-economic (Mt) A+B, C_1, C_2, D – **2,559.92** including: C_2 + D **1,051.65** C_1 **1,354.14** A+B **154.14**	Anticipated sub-economic (Mt) A+B, C_1, C_2, D – **8,933.86** including: C_2 + D **7,739.04** C_1 **1,174.29** A+B **20.53**	Anticipated sub-economic (Mt) 32x (323, 322, 321) - **2,559.92** including: 323 - **1,051.65** 322 - **1,354.14** 321 - **154.14**	Anticipated sub-economic (Mt) 33x (333, 332, 331) - **8,933.86** including: 333 - **7,739.04** 332 - **1,174.29** 331 - **20.53**	
Anticipated economic (Mt) A+B, C_1, C_2, D – **28,376.22** including: C_2 + D **10,079.80** C_1 **14,109.19** A+B **4,187.24**	Anticipated economic (Mt) A+B, C_1, C_2, D – **30,112.20** including: C_2 + D **22,317.00** C_1 **7,243.05** A+B **552.14**	Anticipated economic (Mt) 22x (223, 222, 221) – **2,182.08** (anticipated economic reduced by economic and sub-economic) including: 223 – **1,184.31** 222 – **850.61** 221 – **147.17**	Anticipated economic (Mt) 23x (233, 232, 231) – **30,112.20** including: 233 - **22,317.00** 232 - **7,243.05** 231 - **552.14**	
Sub-economic (Mt) A+B, C_1, C_2, D – **22,248.54** including: C_2+ D **8,124.75** C_1 **11,031.70** A+B **3,092.09**				Sub-economic and losses (Mt) 32x (323, 322, 321) 31x (313, 312, 311) **23,432.22**
Economic (Mt) A+B, C_1, C_2, D – **3,945.60** including: C_2 +D **770.74** C_1 **2,226.88** A+B **947.98**				Economic (Mt) 21x (213, 212, 211) – **0.00** (economic reduced by extractable and losses)
Losses (Mt) **1,183.68** (economic reduced by extractable) Extractable (Mt) A+B, C_1, C_2, D – **2,761.92** (economic converted by a factor 0.7)				Extractable (Mt) 12x (123, 122, 121) 11x (113, 112, 111) **2,761.92**

THE E-AXIS (SEEN AS CHANGES OF RESOURCES NAME)

THE G-AXIS (SEEN AS CHANGES OF RESOURCES CATEGORIES)

THE F-AXIS (SEEN AS CHANGES OF DOCUMENTS' TYPE)

THE F-AXIS (SEEN AS CHANGES OF DOCUMENTS' TYPE)