SARA
Supervisory Authority for Regulatory Affairs

Mineral and Anthropogenic Resources Specifications

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KNOWLEDGE SHARING ON RESOURCE CLASSIFICATION AND ESTIMATION

Tbilisi, Georgia 11-12 October 2023

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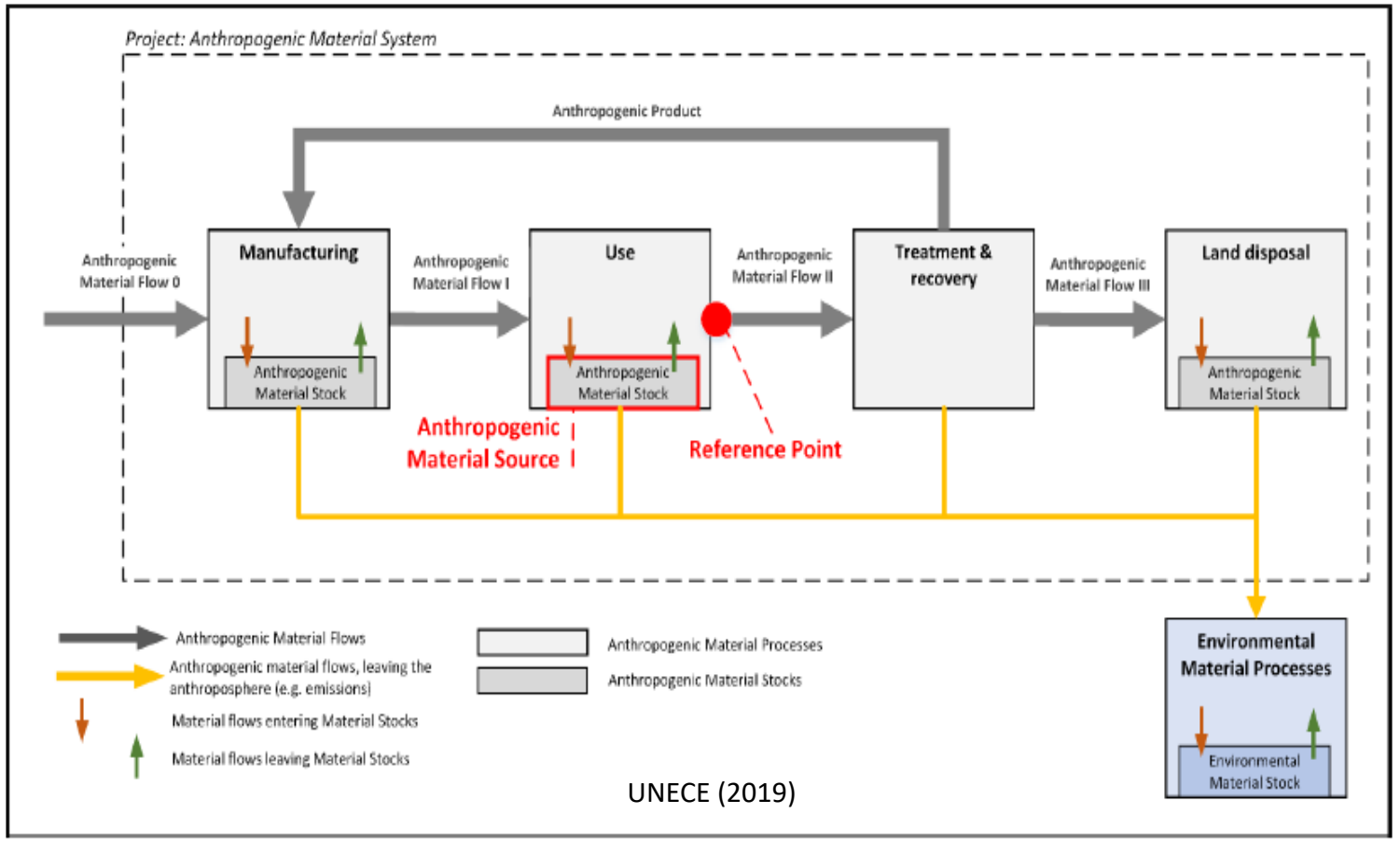
Mineral and Anthropogenic Resources Specifications

Basics

- For anthropogenic resources:
  - Guidance: UNECE Specifications for the application of the UNFC for Resources to Anthropogenic Resources (2019)
  - Basic concept: „Anthropogenic Material System" by the MINEA project is guide for further developments

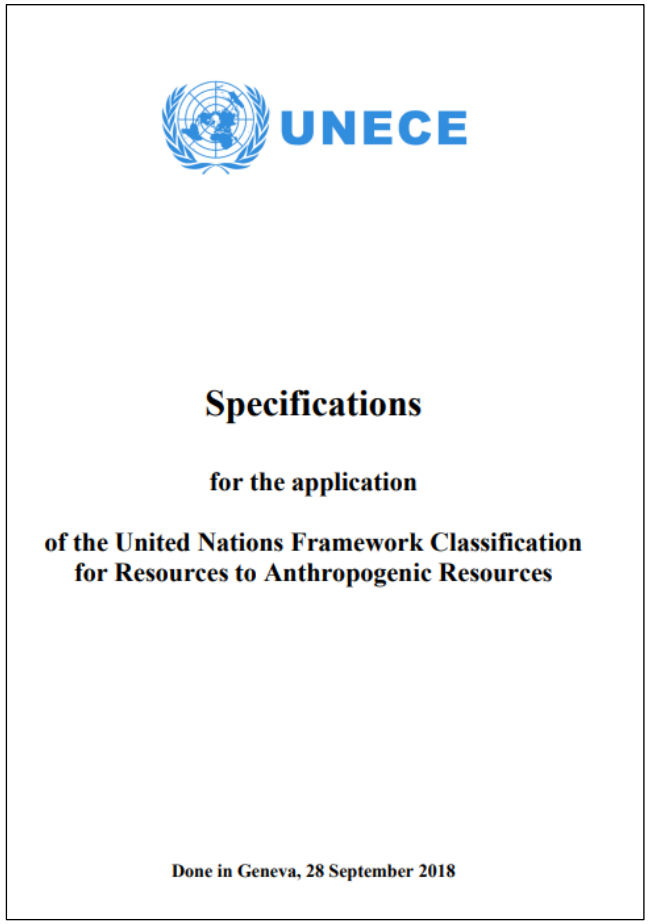


UNECE (2019)

Mineral and Anthropogenic Resources Specifications

Selected terms

- **Anthropogenic Resource** is a concentration or occurrence of Anthropogenic Material of intrinsic economic interest, in such form, quality and quantity that there are reasonable prospects for eventual economic exploitation. The term "Anthropogenic Resource" has been adapted from the term "Mineral Resource" as defined in CRIRSCO. Sources of AR: construction and demolition waste, landfills, waste incineration residues, electronic wastes, mining waste, other materials.
- **Anthropogenic Material System** locates Anthropogenic Material quantities inside the Anthroposphere and its surrounding environment. "It comprises Anthropogenic Material Processes, linked by Anthropogenic Material Flows within defined system boundaries. Residues from primary production and primary commodities will finally end up in Anthropogenic Material Stocks, from which Anthropogenic Materials quantities can be sourced.
- An anthropogenic material sourcing **Project** is a defined development or sourcing operation, which provides the basis for socio-economic and environmental evaluation and decision-making. UNFC is applied at the level of Projects, for which only relevant Anthropogenic Materials, Anthropogenic Material Processes, Anthropogenic Material Flows and system boundaries are considered.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Specifications

for the application

of the United Nations Framework Classification for Resources to Anthropogenic Resources

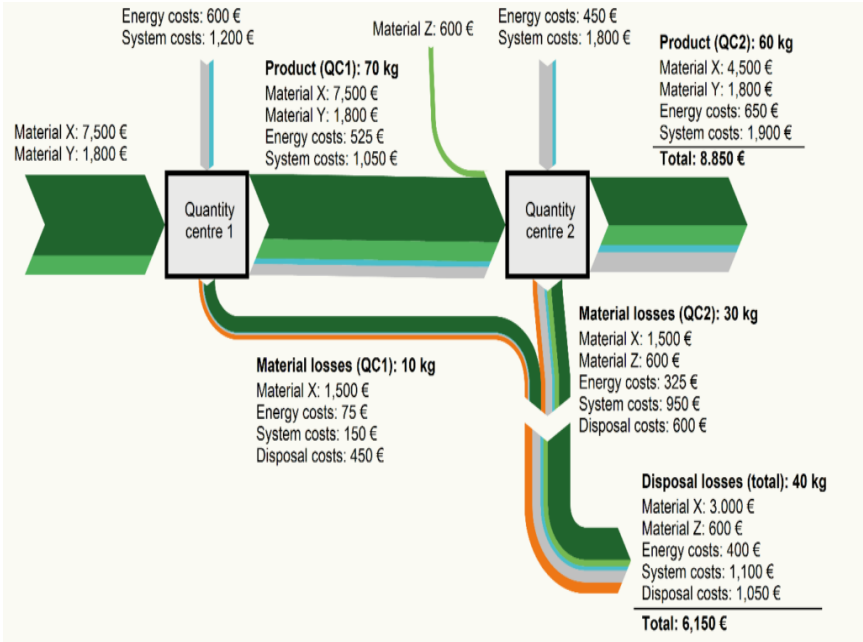
Done in Geneva, 28 September 2018

Mineral and Anthropogenic Resources Specifications

Selected terms

- An **Anthropogenic Material Stock** results from the accumulation of an Anthropogenic Material quantity in an Anthropogenic Material Process (Brunner and Rechberger, ECE, OECD).
- An **Anthropogenic Material Flow** is the movement of Anthropogenic Material between two Anthropogenic Material Processes and is measured in mass per time (Brunner and Rechberger).
- **Any Anthropogenic Material Stock or any Anthropogenic Material Flow can be an Anthropogenic Material Source. An Anthropogenic Material Source contains material quantities that can be converted to Anthropogenic Material Products.**
- **An Anthropogenic Material Product is a quantity that is saleable in markets.** The cumulative quantities are equivalent to "Sales Production" according to UNFC. It is noted that the term Anthropogenic Material Product does not necessarily correlate with legal product declarations.

Material flow (example)



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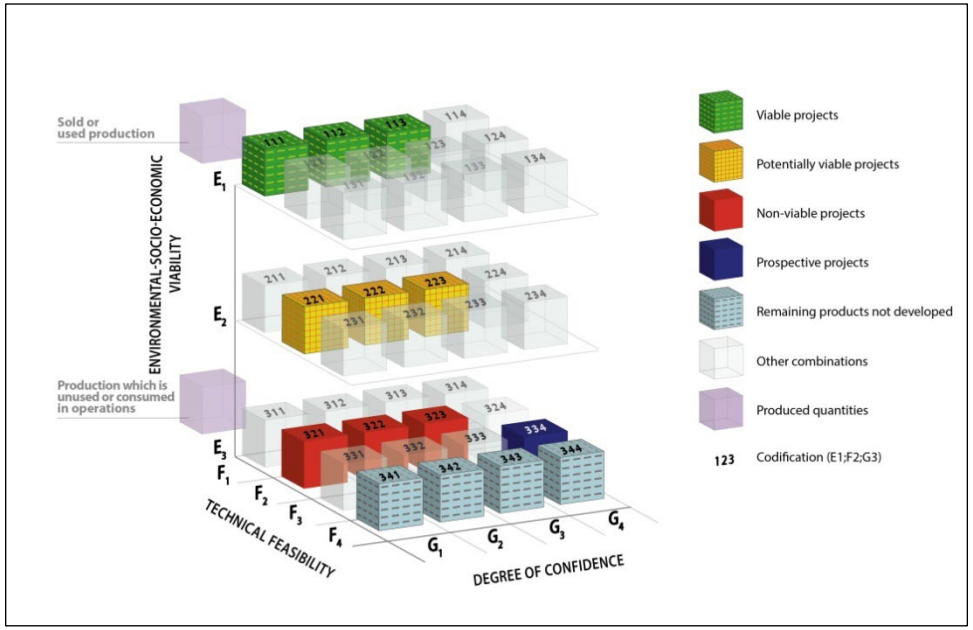
An abbreviated version of UNFC for AR



- UNFC categories are applied for Anthropogenic Resources based on Primary Raw Materials (UNECE 2019)

Cummulative quantities of Anthropogenic Material Product

Sales Production =

Past sourcing — *Non-sales Production*

Total material quantity initially in place	*Future sourcing*	*Class*	*Categories* E	F	G
Known Anthropogenic Material source	Future sourcing by commercial development projects or ongoing sourcing operations.	Commercial Projects	1	1	1, 2, 3
	Potential future sourcing by contingent development projects or ongoing sourcing operations.	Potentially Commercial Projects	2	2	1, 2, 3
		Non-Commercial Projects	3	2	1, 2, 3
	Additional quantities in place associated with known Anthropogenic Material Sources.		3	4	1, 2, 3
Potential Anthropogenic Material Source	Potential future sourcing by successful exploration activities from potential Anthropogenic Material Sources.	Exploration Projects	3	3	4
	Additional quantities in place associated with potential Anthropogenic Material Sources.		3	4	4

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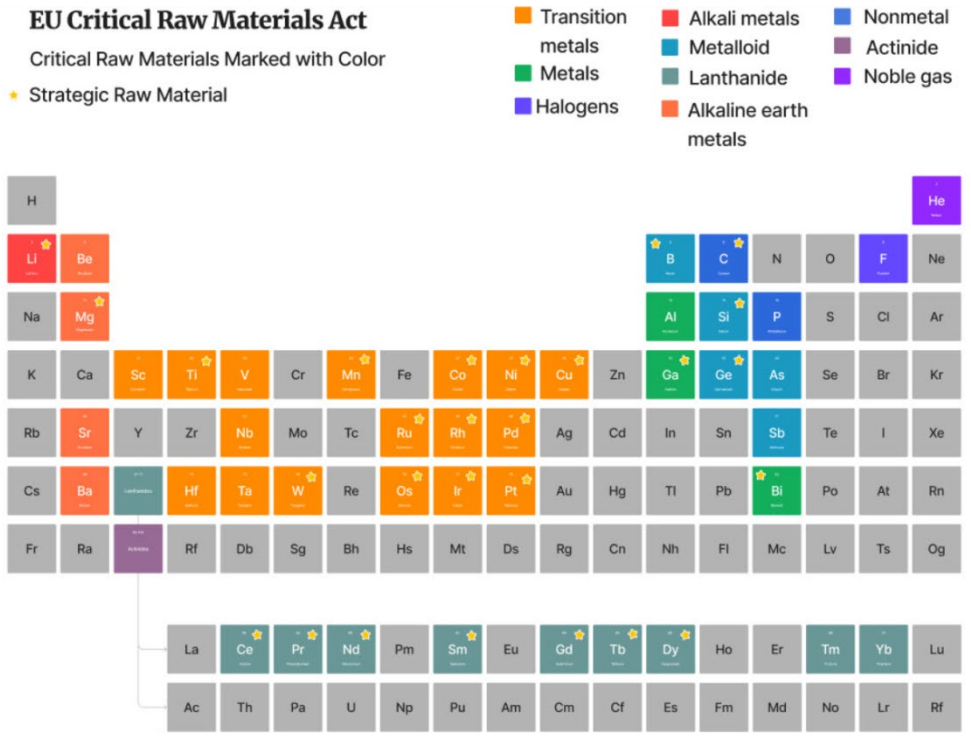
Experience with UNFC E,F and G categories for MWs

- The application of UNFC for secondary RM with a focus on mining wastes (MW) can be done based on similarities for UNFC application for primary RMs
- **G category**: separated exploration report on AR (e.g. CRM-bearing heaps and tailings), feasibility studies, data and information from resource inventory. In the EU many wining wastes diectories were developed as the implementation of the 2006/21 Mining Waste Directive (environmental risk based).
- **F category**: technical report, technical permissions (Technical Operation Plan), feasibility studies with a focus on MW, CRM content and its recovery, manufacturing, recycling opportunities (methods)
- **E category**: feasibility studies and other documents on economic, environmental and social considerations of the recovery, manufacturing, recycling opportunities of the AR (e.g. MW, CRM content)



https://mobilitynotes.com/european-critical-raw-materials-act/

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Additional elements to be considered

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- **Material Flow Analysis** (MFA): analytical tool to quantify flows and stocks of materials, substances or products in a well-defined system in time and space, i.e. industries, sectors or ecosystems (From: Renewable and Sustainable Energy Reviews, 2021)
- **Life Cycle Assessment** (LCA): Life cycle engineering is defined as the sustainability-oriented engineering technology which is focused on the technical, economic, and environmental impacts of the decisions within the life cycle of the product (Jamwal et al., 2020). From: Sustainable Manufacturing, 2021
- **To End of Life products**: Primary (mine), secondary (tailing and heaps) or end of life products (urban mines): resources are all complex, multi-element solid materials requiring a reduction in particle size (powdering), separation to concentrate the recoverable fractions and finally extractive metallurgy (for metals) to ensure their recovery and reuse.

Ulrich Kral and Slavko Solar, 2023

- **CRM-MSA in EU: Material System Analysis (MSA)** consists of a map of the flows of materials through the economy, as raw materials or as parts of basic materials, components or products, in terms of entry into the economy (extraction and import), movement through the economy (production, consumption, exports), additions to stock, and end-of-life through either disposal or recovery. https://rmis.jrc.ec.europa.eu/msa

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Thank you!

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