

**MICA**

Minerals Intelligence Capacity Analysis

FACT SHEET

Mine Waste Characterization

An overview of waste from extractive operations (i.e. waste from extraction and processing of mineral resources).

Scope (conceptual model & main characteristics)

Waste from extractive operations (i.e. waste from extraction and processing of mineral resources) is one of the largest waste streams in the EU. It involves materials that must be removed to gain access to the mineral resource, such as topsoil, overburden and waste rock, as well as tailings remaining after minerals have been largely extracted from the ore.

Some of these wastes are inert and hence not likely to represent a significant pollutant threat to the environment save for smothering of river beds and possible collapse if stored in large quantities. However, other fractions, in particular those generated by the non-ferrous metal mining industry, may contain large quantities of dangerous substances, such as heavy metals. Through the extraction and subsequent mineral processing, metals and metal compounds tend to become chemically more available, which can result in the generation of acid or alkaline drainage. Moreover, the management of tailings is an intrinsically risky activity, often involving residual processing chemicals and elevated levels of metals. In many cases tailings are stored on heaps or in large ponds, where they are retained by means of dams. The collapse of dams or heaps may have serious impacts on environment and human health and safety. Other likely significant impacts relate to the physical footprints of waste disposal facilities and resulting loss of land productivity, effects on ecosystems, dust and erosion.

These impacts can have lasting environmental and socio-economic consequences and be extremely difficult and costly to address through remedial measures. Wastes from the extractive industries have therefore to be properly managed in order to ensure in particular the long-term stability of

disposal facilities and to prevent or minimise any water and soil pollution arising from acid or alkaline drainage and leaching of heavy metals.

The [ProSUM](#) project is currently creating a classification scheme for mine waste as a secondary raw materials source. Inefficient historic processing techniques can result in economic grades of specific commodities within waste stockpiles. Additionally, new demands for commodities overlooked historically can affect the economic significance of waste, e.g. [Činovec, Czech Republic](#).

Contexts of use, application fields

-> contexts (e.g., environmental, economic, social assessment)
 -> which types of stakeholder questions are concerned?
 -> link to published studies that implement the method

Mine waste characterization is important within environmental, economic and social contexts. It provides information on potential secondary raw materials, environmental hazards and can contribute to foresight studies and planning.

Input parameters

-> which parameters are needed to run the method

Type(s) of related input data or knowledge needed and their possible source(s)

-> which types of data are needed to run the method, from which sources could they come...
 -> could be qualitative data or quantitative data, and also tacit knowledge, hybrid, etc.

National mining waste inventories – ProSUM project

Model used (if any, geological mathematical, heuristic...)

-> e.g., geological model for mapping
 -> e.g., mathematical model such as mass balancing, matrix inversion, can be stepwise such as agent -based models, dynamic including time or quasidynamic specifying time series...
 -> can also be a scenario

Resource Estimation models based on chemical and volumetric analysis for secondary resources.
 Similar quantitative models created for environmental assessments

System and/or parameters considered

-> **the system can be described by its boundaries.** These can refer to a geographic location, like a country, or a city, the time period involved, products, materials, processes etc. involved, like flows and stocks of copper, or the cradle-to-grave chain of a cell phone, or the car fleet, or the construction sector, or the whole economy...
 -> **parameters** could possibly refer to geographic co-ordinates, scale, commodities considered, genesis of ore deposits and others...

Systems; the entire life-cycle of a mine, from initial production through to closure, the supply and demand chain for specific commodities, the water cycle in the vicinity of waste stockpiles.

Parameters; scale of stockpiles, composition, commodities, climate, natural hazards.

Time / Space / Resolution /Accuracy / Plausibility...

-> to which spatio-temporal domain it applies, with which resolution and/or accuracy (e.g., near future, EU 28, 1 year, country/regional/local level...)
-> for foresight methods can also be plausibility, legitimacy and credibility...

Temporal extent: Present to future

Temporal resolution: resolution for resources and environmental issues measured in years.

Spatial extent: Continental Europe scale

Spatial resolution: resolution of site specific waste stockpiles.

Accuracy/Plausibility: MR estimation and calculation is covered by the various international reporting codes for mineral resources, e.g NI 43-101, JORC and PERC. Environmental reporting is based on specific EU legislation for permitted contaminant levels.

Indicators / Outputs / Units

-> this refers to what the method is actually meant for. Units are an important part but that is most of the time not sufficient to express the meaning. For example, **the indicators used in LCA express the cradle-to-grave environmental impacts of a product or service**. This can be expressed in kg CO₂-equivalent. But also in €. Or in millipoints. Or in m²year land use.
-> for foresight methods the outputs are products or processes



Treatment of uncertainty, verification, validation

-> evaluation of the uncertainty related to this method, how it can be calculated/estimated

MR estimation and calculation is covered by the various international reporting codes for mineral resources, e.g NI 43-101, JORC and PERC. Environmental reporting is based on specific EU legislation for permitted contaminant levels.

Main publications / references

- > e.g. , ILCD handbook on LCA, standards (e.g. , ISO)
- > can include reference to websites/pages
- > references to be entered with their DOI

ProSUM : <http://www.weee-forum.org/prosum-0>

Related methods

- > List of comparable methods, their particularities...
- > link to one or several other existing fact sheet(s)

Some examples of operational tools (CAUTION, this list is not exhaustive)

- > e.g., software... Only give a listing and a reference (publication, website/page...)
- > **should be provided only if ALL main actors are properly cited**

Key relevant contacts

- > list of relevant **types** of organisations that could provide further expertise and help with the methods described above.

ProSUM, national geological surveys, Eurogeosurveys, national and European environmental agencies.