

# URBES project – Procedures adopted for the identification of extractive waste storage facilities from closed or abandoned mines and quarries

## INTRODUCTION

The objective of the URBES project is to identify, map and characterise, from a mining and environmental standpoint, extractive waste facilities with potential for the recovery of Critical Raw Materials (CRMs) and Strategic Raw Materials (SRMs), as defined in Regulation (EU) 2024/1232, currently located at closed or abandoned mines and quarries. The identification and characterisation process is inherently lengthy and complex and, for the reasons set out in the following sections, has necessarily entailed a degree of approximation, particularly during the current preliminary implementation phase.

## MINES

Waste materials from closed or abandoned metal ore mines constitute the primary and most realistic target for the potential recovery of CRMs. From the second half of the nineteenth century until 2008, the year in which Legislative Decree No 117/2008 was adopted, the vast majority of metal mining sites ceased operations, leaving in the affected territories millions of cubic metres of processing waste (extractive waste) without the implementation of restoration or remediation measures. These waste deposits have represented and, except for those that have been remediated, continue to represent a significant environmental concern, as they may constitute potential sources of release of various contaminants into environmental matrices, as referred to in Part Four, Title V, Annex 5 of Legislative Decree No 152/2006. At the same time, those same facilities are now of considerable economic interest as a potential secondary sources of supply of CRMs and SRMs.

Many of the raw materials currently classified as CRMs were present in ore deposits only as accessory minerals or trace elements. Until the first half of the twentieth century, such elements were not valorised, as they were considered economically irrelevant, treated as impurities to be removed, or their presence was not identified. However, advances in processing technologies, which are now more efficient and environmentally sustainable, have fundamentally altered this paradigm. Historical mining residues are

now regarded as potential sources of secondary raw materials with significant economic potential, in some cases exhibiting concentrations higher than those of primary deposits, although inherently limited by the volumes available.

The identification and characterisation of materials contained in closed or abandoned facilities constitute a strategically important first step in fostering industrial recovery activities within a fully circular economy framework. Such activities support the recovery of secondary raw materials while substantially contributing to the improvement of the environmental quality of the storage areas concerned.

More than 3 000 mines have operated in Italy since 1860, often resuming activities at sites that had already been exploited in previous centuries, the related information being held by the mining districts operating throughout the national territory. Following their abolition as a result of the transfer of mining competences to the Regions, the relevant data, where not lost, are now contained in the archives of the regional authorities or in the State Archives. Additional information, although not specifically relating to extractive waste, is also available in the RIMIN project database, managed by the Italian Ministry of the Environment and Energy Security (MASE).

For the recovery of detailed and structured historical data, the following approach was adopted during this preliminary phase:

1. With specific reference to the Sardinia Region, which alone accounts for more than one third of the total volume of extractive waste present in Italy, the polygons of the facilities were digitised using, as a baseline, information contained in various datasets, primarily heterogeneous and point-based, developed within the framework of other projects, agreements and national mineral resources databases, which are generally oriented towards the inventory of ore bodies rather than their associated waste deposits.
2. For the remainder of the national territory, two distinct procedures were implemented. For historically more significant mining sites, where bibliographic data were available or where waste deposits could be identified from aerial imagery, the facilities were manually delineated and subsequently associated with the mining sites recorded in the GeMMA GeoDatabase (Geological, Mining, Museum and Environmental), developed by the Department for the Geological Survey of ISPRA. Where precise data could not be derived or the facilities could not be identified from aerial imagery, a 250 metre buffer was applied to each point representing the individual mining site recorded in the database.
3. The analysis of the available databases makes it possible to reconstruct the paragenesis of the deposit, namely the systematic association of minerals formed together with the principal ore mineral. Knowledge of the paragenesis

enables a preliminary assessment of which CRMs may potentially be present within the waste volumes.

Once the polygons of the storage facilities and mining areas had been obtained, and following the correlation of all economically relevant minerals with the corresponding potential recoverable raw materials, the following layers were generated:

- Raw materials (commodities);
- Mining waste deposits containing CRMs and SRMs;
- Mining waste deposits by Region.