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Procedures leading to acquirement of mineral raw materials from anthropogenic deposits

Introduction

The economy of each country is strongly dependent on raw materials, among which mineral ones count as an important group. As resources of mineral deposits are, in general, exhaustible and non-renewable, it is necessary to seek other sources, including mineral waste, which can be processed into the equivalent of raw materials from naturally created deposits. Such activity is considered beneficial, now not only as it conserves scarce natural resources but increasingly because of its positive environmental impact. Waste mineral deposits, especially ones created in the distant past, often without adequate protection measures and care for landscape, not only destroy esthetic of neighborhood but also post a threat to environment.

In Poland, as in numerous other countries a significant amount of mineral waste was accumulated as result of mining works, minerals processing but mostly as a result of subsequent manufacturing processing. It is estimated that at the end of 2019, there was 1,795 million tons of accumulated waste in landfills (excluding municipal waste).

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Up to quite recent times waste had been considered useless, with exception of masses applied for terrain grooming. However, it must be admitted that already in 1950s the decree of May 6, 1953 – Mining Law (ML 1953) recognized the use of minerals accumulated in overburden dumps resulting from mining works. In subsequent regulations such provisions have been extended to also include accumulated waste from manufacturing (Nieć et al. 2018; Uberman Ry. 2021). However, in 1980s significant works were undertaken on stocktaking of manufacturing waste accumulations, focusing on the mining, energy, metallurgy and chemical sectors. They resulted in the preparation of a map presenting the locations of such accumulations and an estimation of the waste volume stored as well as their attractiveness for further use (Szczęśniak 1990).

Notable progress has been recorded since the introduction of the following bills: on the Act on the Protection and Management of the Environment (1980), the Act on Waste (1997, 2001, 2012) and the Act on Mineral Waste (2008).

An extensive evaluation of the current state of the accumulated accompanying minerals and mineral waste was presented in the author's previous work (Uberman Ry. 2017). Issues regarding defining, documenting and exploitation of already introduced anthropogenic mineral deposits were discussed there.

Apart from Poland, various multinational organizations and institutions have recently intensified efforts in the area of waste management, including mineral waste (Winterstetter et al. 2021; Suppes and Heuss-Aßbichler 2021; Salminen 2021). For several years activities have been carried out aimed at developing uniform terminology as a base for a planned EU directive on waste management (Pietrzyk-Sokulska et al. 2018) and within the framework of the UN European Economic Commission.

Unfortunately, despite formal and legal efforts undertaken and financial instruments applied, the current use of waste accumulations as a source of raw materials shall be considered unsatisfactory. One must indicate the following as reasons for this fact: diversity and fragmentation of legal regulations, dubious provisions, overlapping competences and chaos in terminology. First and foremost, the universal classification of waste accumulations with estimated volume and quality of material stored aimed at simplifying the evaluation of their potential use is missing. At present, in official documents on the demand for and resources of minerals, like the State Resource Policy, only natural deposits are considered (alongside with a potential import). Recycled mineral resources are not included. This fact calls for a clear reason for undertaking the issue of potential mineral waste use, the identification of reasons for the current state and the stipulation of adequate solutions.

1. Mineral recycled raw materials and their sources

As a starting point for the characterization of recycled mineral raw materials and the sources of their acquirement one shall use the definition of mineral raw material excerpted from the “Rules on Documenting Mineral Resources” (2002). It delineates “mineral

raw material” as “mineral lifted, aimed at further use, also usable components resulting from its processing (purification, enrichment) and usable by-products from its conversion”. This definition serves as a base for the chart below (Figure 1), presenting types and structure of mineral raw materials acquirement with consideration of recycled ones.

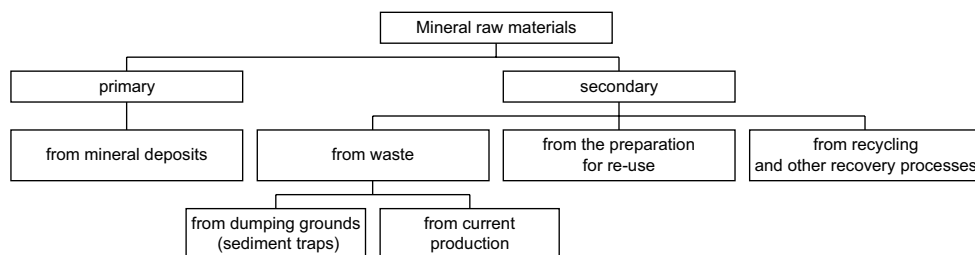


Fig. 1. Mineral resources by source
Source: [Uberman Ry. 2021](#)

Rys. 1. Surowce mineralne według źródeł pochodzenia

A subject of analyses presented herewith refers to recycled mineral raw materials acquired from waste accumulated in the past in various locations as well as currently constructed waste deposits. The key source is represented by waste containing high share of minerals, coming from minerals mining and processing but also from their conversion in manufacturing and construction. In the past these had been dumped predominately without selection, alongside with overburden rocks and soil and often, even with low quality mineral raw materials. At present, in view of regulations in force, sources of recycled mineral raw materials can be categorized as follows:

- ◆ waste deposits created under governance of the Act on Waste (2012),
- ◆ mining waste treatment facilities governed by the Act on Mineral Waste (2008).

Waste containing high share of minerals shall be considered as a potential main source of recycled mineral raw materials. These are represented by accumulations created by mining works, minerals processing and subsequent manufacturing processing. A major obstacle in their use results from a lack or deficiencies in information regarding the properties of such waste. As opposed to waste deposits governed by the Act on Waste (2012) mining waste treatment facilities are typically sufficiently documented enabling the evaluation of their prospectus use and lifting options.

It comes directly from the above presented analyses of the main sources of recycled mineral raw materials such activity is the subject of regulations resulting from three separate acts. Consequently, alongside establishing rules for volume and quality characteristics of mineral waste accumulation it is necessary to clearly delineate their subordination to a proper act.

2. Legal regulations in force governing the acquirement of recycled mineral raw materials from their deposits (accumulations)

Within the framework of the current regulations the acquirement of mineral raw materials is acceptable both from (1) waste deposits created under governance of the Act on Waste (2012) as well as from (2) mining waste treatment facilities governed by the Act on Mineral Waste (2008), after meeting the requirement stipulated in the appropriate act. However, it has to be noted that in both cases such an acquirement is allowed without notification of its purpose although various specific requirements have been stipulated in the above-mentioned regulations.

2.1. Acquirement of recycled mineral raw materials from waste accumulations

Regulations stipulated in the Act on Waste (2012) allow for the acquirement of waste from:

- ◆ waste deposits possessing a specific instruction (Art. 143, p. 1),
- ◆ closed waste deposits without a specific instruction (Art. 144, p. 1),
- ◆ waste dumps (Art. 144, p. 1).

Acquirement of material from waste deposits possessing a specific instruction is regulated by such instruction. It shall define among others (Art. 143, p.1):

- ◆ type and volume of waste to be obtained;
- ◆ technical characteristic of the process;
- ◆ prevention tools against the negative impact on human health and life and on the environment;
- ◆ description of the environmental impact resulting from lifting activities;
- ◆ description of the technical assurance of area remaining after waste lifting and, in the case of closed waste deposits, a plan for land reclamation activities.

The acquirement of mineral raw materials is also permitted from a closed waste deposit not possessing specific instruction as well as from a waste dump. A waste dump was defined as “a place of depositing manufacturing waste for which it is not required to obtain neither the localization decision nor the building permit” (Art. 144, p. 2). Carrying out this activity requires a special permit, which is issued as an administrative decision by a proper office, either by an appropriate voivodship marshal or by an appropriate regional director of the environment protection office. In the case of deposits listed under Art. 144 p. 1. a request for waste acquirement permission shall contain the specification of the applicant and waste deposit or dump address. It shall also include a professional report on waste lifting (Art. 155, p. 5) covering the following items:

- ◆ type and volume of waste to be obtained;
- ◆ technical characteristic of the process;
- ◆ prevention tools against the negative impact on human health and life and on the environment;

- ◆ description of environmental impact resulting from lifting activities;
- ◆ description of technical assurance of the area remaining after waste lifting and, in the case of closed waste deposits, a plan for land reclaim activities.

It has to be noted that as the above indicated waste deposits are classified as a kind of building/construction acquirement activities and are considered to meet definition of building/construction demolition, therefore the provisions of the construction must also be applied.

2.2. Acquirement of recycled mineral raw materials from mining waste treatment facilities

The acquirement of mineral raw materials is also permitted from mining waste treatment facilities governed by the Act on Mineral Waste (2008). Similarly, the related provisions of the Act on Waste (Act 2014), which define accumulations, from which recycled raw materials can be obtained, e.g. deposits and dumps the Act on Mineral Waste delineates which accumulation can be recognized as a mining waste treatment facility under its provisions. As stipulated in Art. 3, p. 1 item 5 of the aforementioned act, a mining waste treatment facility is defined as “a facility designed to store mineral waste in a solid, liquid, dilution or slurry form, including dumps and sedimentary reservoirs, with associated dunes or other constructions serving to hold, limit or strengthen such facility”. Procedures governing the applications for permits in the case of mineral waste are stipulated in Art. 18 (2008). Art. 18 p. 1 states that mineral waste can be lifted from mining waste treatment facilities only upon the receipt of an appropriate permit according to Art. 144 of the Act on Waste (2012). This regulation also applies to the facilities not meeting requirements of the receipt either the localization decision or the building permit (Art. 18, p. 2). Therefore, the issuance of a permit for recycled raw materials acquirement from a mining waste treatment facility is governed by the Act on Waste (Act 2012) not the Act on Mineral Waste (Act 2008). In a related application one must include:

- ◆ localization of the facility,
- ◆ indication of the facility class,
- ◆ information necessary to prepare an operational-rescue plan as stipulated by the Act on Environmental Protection (Act 2001).

The above presented analyses of potential sources of recycled mineral raw materials indicate a wide array of options for their acquirement. But in each case such activity is conditioned upon the receipt of a respective permit as stipulated by the appropriate acts of law. The regulations of the Act on Waste and the Act on Mineral Waste refer to all types of waste. They do not consider specific features and requirements of mineral waste management. Therefore, it is necessary to amend the existing regulations with requirements regarding information and documentation confirming volume and the quality of the accumulated waste in view of its applicability as a source of recycled mineral raw materials.

3. Proposal to amend legal regulations leading to the receipt of approval for the acquirement of raw materials from waste mineral deposits (accumulations)

Entrepreneurs interested in the acquirement of mineral waste for the production of recycled raw materials shall be obliged to carry out a research of volume and the quality of mineral content in such waste as well as of the feasibility to obtain desired mineral raw material before submitting an application for the relevant permit. Such information can be obtained only via carrying out activities similar to documenting a natural mineral deposit as prescribed by the geological regulations. In order to simplify such works, it would be useful to include certain implementations with their precise definition into relevant legal provisions. Considering the fact that not all waste but only mineral waste can constitute a source of recycled mineral raw materials, it is necessary to introduce the term “mineral waste”, to be understood as waste containing mineral substances. Mineral waste represents a potentially vast resource of recycled mineral raw materials, thus justifying dissemination and legal sanction for the notion of “anthropogenic deposits” already well established in scientific publications and in practice. According to the POLVAL Code (POLVAL 2021) a notion of “mineral anthropogenic resources” shall be understood as “storage on earth surface of accumulated mineral substances – waste resulted from mining and processing of mineral resources as well as their subsequent conversion”. It is also purposeful to introduce and legally recognize a notion of “anthropogenic resource”, which in the above-mentioned POLVAL code is defined as “an individualized basing on research part of anthropogenic mineral resources designated for economic use”. It comes directly from this definition that this notion is universal, and it encompasses all geomorphological forms of mineral waste accumulation listed both in the Act on Waste and the Act on Mineral Waste, such as storages, dumps, heaps, sedimentary reservoirs etc.

A subsequent activity preceding the submission of the application for mineral waste acquirement permit shall consist of researching and documenting the quantity and quality of mineral substance in place. The presentation of its results shall take the form of documentation equivalent to the geological documentation prepared for natural mineral deposits with a scope and precision dependent on specific needs. A technical and economic feasibility study would also be necessary. Such study may result in the indication of a need to apply atypical mining techniques (like selective exploitation) as well as less or more complicated processing technologies. Requirements in the above-described areas shall be reflected in proper documentation which would amend the documents already required by the existing acts and would also be required to receive a respective permit. A list of documents to be included in the already existing procedures governing the receipt of permits for the acquirement of recycled mineral raw materials from waste accumulations, considering the specific nature of such process is given below:

- ◆ identification of mineral waste source under application;

- ◆ identification of the waste source usefulness for the acquirement of recycled mineral raw materials via;
 - ◆ geological documentation of an anthropogenic resource,
 - ◆ plan for mineral waste lifting and processing,
 - ◆ plan for decommissioning and reclamation activities and prevention tools against negative impact on human health and life and on environment,
 - ◆ valuation of the anthropogenic mineral deposit (if needed);
- ◆ preparation of documents and application for the permit (for acquirement of mineral raw materials) within the framework of the Act on Mineral Waste (Act 2008).

The development of an anthropogenic mineral deposit requires, in many cases, substantial financial outlays and it carries a significant risk, thus it needs to be prepared with care and caution. A necessary consideration shall be given not only to its technical but also economic aspects. Anthropogenic mineral deposits constitute part of mineral assets, typically are subject of various economic transactions and carry a monetary value. The methods of their valuation are defined by the POLVAL Code (POLVAL 2021).

As it has been indicated above, recycled mineral raw materials obtained from mineral waste already play an important role in raw material balances of numerous countries, including Poland. The current status of stocktaking of mineral waste accumulations is insufficient, it is necessary to undertake activities aimed at the stocktaking of existing facilities in order to establish their usefulness and feasibility for subsequent development. Such intentions are visible in the governmental document: “Strategy for Responsible Development” (Strategy 2016). Recycled mineral resources shall be included into the State Resource Policy, with a forecast of their acquirement. It would also be desirable to prepare and publish a Balance of Recycled Mineral Raw Materials similar to the already existing balances: the Balance of Mineral Resources (published annually) and the Balance of Perspective Mineral Resources (published incidentally). Such a set of publications would constitute a complex evaluation of all mineral resources in Poland.

Conclusions

Mineral waste accumulated for a long period of history constitutes a considerable resource base for recycled mineral raw materials. The development of waste accumulations is becoming a necessity in view of the deficits of various minerals and threats to the environment posted by non-reclaimed waste accumulations. Lifting waste from its accumulations is allowed conditioned upon the receipt of relevant permits as stipulated by the Act on Waste (2012) and by the Act on Mineral Waste (2008). These bills stipulate procedures governing process of awarding such permits. Hence regulations on waste refer to all types of leftovers therefore it is necessary to amend them in the area of mineral waste to satisfy the necessities resulting from their uniqueness. The proposal of such an amendment is presented in p. 3 of this paper. Above that, for the sake of terminology arrangement in the area of mineral waste,

recommendations are stated to introduce certain notions and their definitions to the existing legal regulations.

A need to continue activities leading to stocktaking accumulation containing mineral waste to allow for the evaluation of their usefulness for processing into mineral raw materials is underlined. Due to the significance for mineral resources management, it is endorsed to add a specific balance of recycled mineral raw materials to the already existing Balances of Mineral Resources (published annually) and the Perspective Mineral Resources (published incidentally). Information included in these reports is essential for the proper stipulation of the State Resource Policy.

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PROCEDURES LEADING TO ACQUIREMENT OF MINERAL RAW MATERIALS FROM ANTHROPOGENIC DEPOSITS

Keywords

mineral waste, anthropogenic mineral deposits, mineral resources, mineral recycled raw materials, legal regulations and procedures

Abstract

An importance of secondary mineral raw materials sources for economy was demonstrated as well as sources of its acquirement were outlined. Various aspects of waste use in economy were discussed, underlining importance of waste removal for improvement of environment. A related legal framework in Poland and European Union was outlined. Results of already carried works in research and stocktaking of mineral waste accumulations in Poland were reminded. Legal procedures aiming at exploitation of mineral waste deposits formally defined and similar facilities falling outside definition of mineral waste deposits were discussed. It was evidenced that a gap in the legal

framework exists, regarding particularity of waste acquirement from anthropogenic mineral deposits. Consequently, a need to require a preparation of equivalent of a resource report, feasibility study and a plan defining exploitation and conversion modes for material lifted from waste accumulations was demonstrated.

For the sake of a clear terminology applied it was recommended to incorporate terms of “anthropogenic mineral resources” and “anthropogenic mineral deposit” as an appropriate adjustment to the existing regulation. A need to intensify stocktaking efforts on mineral waste accumulations in Poland was emphasized. It was also suggested that its results should be recognized in the Balance of Mineral Resources and State Resource Policy.

In summary a recommended legal framework to regulate acquirement of mineral waste, recognizing particularities of such processes, was presented.

PROCEDURY POSTĘPOWANIA DLA POZYSKANIA SUROWCÓW MINERALNYCH ZE ZŁÓŻ ANTROPOGENICZNYCH

Słowa kluczowe

odpady mineralne, złoża antropogeniczne, surowce mineralne,
wtórne surowce mineralne, przepisy i procedury postępowania

Streszczenie

W artykule wykazano znaczenie wtórnych surowców mineralnych dla gospodarki oraz scharakteryzowano źródła ich pozyskania. Zwrócono uwagę na aspekty gospodarcze wykorzystania odpadów, podkreślono także znaczenie usunięcia składowisk dla poprawy stanu środowiska. W krótkim rysie historycznym wykazano ewaluację stanu prawnego dotyczącego gospodarki odpadami w Polsce i w UE. Przypomniano też wyniki dotychczasowych prac badawczych i inwentaryzacyjnych nad zagospodarowaniem odpadów mineralnych w Polsce. Omówiono procedury pozyskiwania wtórnych surowców mineralnych ze składowisk odpadów, a także z innych obiektów, niebędących w świetle przepisów prawa składowiskami odpadów. Zwrócono uwagę na konieczność uwzględnienia w procedurach postępowania na wydobywanie odpadów specyfiki pozyskiwania surowców mineralnych, w szczególności podkreślono konieczność wykonania odpowiednika dokumentacji geologicznej złoża, zaprojektowania sposobu eksploatacji i przeróbki wydobywanego materiału skalnego.

Dla uporządkowania terminologii i uzupełnienia obowiązujących procedur postępowania dla wydobywania odpadów przedłożono postulat usankcjonowania prawnego pojęć: „antropogeniczne zasoby mineralne” oraz „antropogeniczne złożo”.

Podkreślono konieczność zintensyfikowania prac nad kompleksową inwentaryzacją składowisk odpadów mineralnych w Polsce. Zasugerowano też konieczność podjęcia prac nad usankcjonowaniem roli i udziału wtórnych surowców mineralnych w Bilansie Zasobów Mineralnych Polski oraz ich znaczenia w polityce surowcowej kraju.

W podsumowaniu zaproponowano procedurę postępowania dla wydobywania odpadów mineralnych, uwzględniającą dodatkowe elementy specyficzne dla procedur pozyskiwania surowców mineralnych.