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## Exploitation of Mineral Resources for Sustainable Development on the Example of Poland

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### Abstract

Nuisance for the people living in areas covered by the direct or indirect impact of the mining industry is an important social problem. The development of the mining industry depends on high environmental requirements, in particular, it is closely related to the fulfillment of obligations of safety for human health and life. Through consultation with the local society and targeted actions degraded land can become attractive. In contrast, the lack of reclamation leads to the intensification of negative phenomena: erosion, surface mass movements, changes in the ecosystem, eutrophication of water tanks.

Maintaining balance in the natural environment is the basic criterion for the proper functioning of industrial facilities. Mining activity is a threat to the environment, including human health and life.

Use of the environment by mining is subject to adjustment to the legislation and carrying out mining activities in line with environmental requirements.

Mining activities and nature protection can operate in a sustainable manner. Appropriate selection of methods for mineral exploitation allows you to minimize the impact on the environment components. The positive impact of opencast mining is reflected in the creation of new habitats of plants and animals in post-mining areas, in the creation of new recreation places, in diversifying the landscape thanks to the construction of water reservoirs. Lakes formed after use of natural aggregates overgrown vegetation reed, acting as a convenient place to settle the water birds.

**Keywords:** moral education, educational environment, child development

## **Introduction**

In 1965 eminent Polish scientist Valery Goethel introduced the term *sozology*, meaning the science about the causes and consequences of the changes taking place in nature due to human activities. *Sozology* deals with complex changes in the natural environment under the influence of technical progress. It also indicates the ways to prevent or mitigate these effects (Dziewański, 1993). Primary energy carriers are organic fossil fuels, nuclear fuel, geothermal and unconventional sources. The fossil fuels include: coal, lignite, oil and natural gas. Forecasts of world mining of coal and lignite are promising. According to the currently identified resources of its sufficiency is estimated at 200 years, assuming a constant rate of consumption. Highly developed countries gradually bring to power a cleaner conventional fuels, e.g. natural gas, shale gas. Increasingly important role play alternative sources of primary energy. Poland is a leading coal producer and consumer of energy based on this medium. The high share of coal and lignite in domestic electricity production makes it an implemented economic development model that should be compatible with social acceptance.

## **The impact of mining on the environment**

The natural environment includes the external part of the Earth's crust and soil cover, part of the atmosphere, hydrosphere, fauna and flora. The environment is transformed by human activity through economic, industrial and human living. Mining activities cause transformations in the environment, which are called mining damage. On the negative change in the most vulnerable are the lithosphere and hydrosphere, and to a smaller degree, atmosphere and biosphere (Kulczycka, Pietrzyk-Sokulska, Uberman, 2015). According to the geological and mining law mining damage includes damage to objects on the earth's surface or underground and other damages caused by mining works. In fact, these are different kinds of deformation of the earth's surface and damages to buildings and infrastructure in mining areas, or in close proximity. The most common are: deformation of the land surface, pouring depressions, pollution of rivers of mine waters (especially salinity). The costs of removing the consequences of the damage are covered by special legislation.

In Poland three methods of mineral extraction are used:

- hole (sulfur and salt mining),
- pit (brown coal, minerals and rock materials common)
- underground (coal, copper ore, barite, zinc and lead).

Each of these methods has a negative impact on the environment.

Mining effects on the elements of the environment directly and indirectly. Direct impact is occupying agricultural land, forests and recreational activities at mines and landfills.

Indirect impact is the broad influence of mining activities, including the geo-mechanical transformation, soil degradation, water and atmosphere pollution.

Assessment of the impact of mining on the environment should include information on the impact on human, flora and fauna, air, water and soil in the landscape, material assets and cultural heritage (Kowalska, Sobczyk, 2010, 2014; Sobczyk, Kowalska, Sobczyk, 2014).

After the completion of the exploitation at the mine is obliged to restore degraded land. The main environmental problems of coal mining are deformations with the secondary effects (mining damage and the impact of the rock mass to buildings, roads, infrastructure, agricultural and forest lands), the discharge of saline waters from the drainage of mining plants, mining waste, lands requiring reclamation and management, emissions of methane, emissions of dust and gases. Coal mining discharges to surface waters millions of tons of salt along with unused mines water.

At the same time the coal mines generate millions of tons of mining waste. Waste economically used on the surface is used for leveling areas (reclamation and removal of mining damage), production of construction materials, engineering and hydraulic engineering works. Coal mines lead reclamation and revitalization on the surface covering more than 80 hectares of land degraded by industrial activity.

### **The study public opinion on the post-mining reclamation**

The use of the environment by mining is subject to adjustment to the legislation and carrying out mining activities in line with environmental requirements. The public discussion gives the opportunity to speak to people affected by industrial nuisance, both the government and the local community. In an efficient manner conducive to optimal decisions take into account the interests of all stakeholders. It can also be an excellent example of a process of environmental education.

The public opinions about the harmful impact of mining on the environment have been the subject of many studies, including scientists from the Polish Academy of Sciences in Krakow, AGH University of Science and Technology and the Central Mining Institute in Katowice.

### **Conclusions**

Mining areas often are adjacent to protected areas, natural and valuable, arable land, or simply from the housing estates. By this fact are areas of conflicts (Sobczyk, Kowalska 2015).

The environment is subject to unfavorable changes in the mining districts. Therefore, you must create a protective zone around the mining facilities in order to prevent the negative consequences of their impact on the environment,

and consequently, on the health and lives of people. Most of the respondents underlines the paramount importance of the human factor as the object of most sentient effects of mining activity. Determination of the degree of nuisance industrial facilities is an indispensable step to identify the real environmental risk. Understanding the views of the public on the environmental nuisance mining sector will develop a proper environmental policy in the region.

## **Literature**

- Dziewański, J. (1993). *Encyclopedic Sozological (Environmental Protection) Dictionary*. Kraków: CPPGSMiE PAN.
- Kowalska, A., Sobczyk W. (2014). Negative and Positive Effects of the Exploitation of Gravel-Sand. *IM Journal of the Polish Mineral Engineering Society*, 1(33), 105–110.
- Kulczycka, J., Pietrzyk-Sokulska, E., Uberman, R. (2015). The Impact of Mining on the Environment in Poland – Myths and Reality. *Mineral Resources Management*, 31(1), 45–64.
- Sobczyk, W., Kowalska, A. (2015). *Mining Activities and the Environment. Case Study*. Kraków: Scientific Publishers AGH.
- Sobczyk, W., Kowalska, A., Sobczyk, E.J. (2014). The Use of the Multi-criteria AHP Method and the Leopold Matrix to Assess the Impact of Exploitation of Gravel and Sand Deposits on the Natural Environment of the Jasiołka Valley. *Mineral Resources Management*, 2, 157–172.