



# ANALYSIS OF ENVIRONMENTAL RISKS AND BURDENS IN THE SLOVAK REPUBLIC

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## ABSTRACT

*The topic of environmental burdens is currently very actual and discussed at different levels (from the EU level to individual Member States). Thorough identification and classification of sites recorded in the database can be a major benefit for subsequent rehabilitation of these areas. An important aspect is also to inform the public through online applications. The public becomes the active element in the detection of other unidentified potential sources of environmental pollution. The paper describes the situation with regard to identification and mapping environmental burdens. This issue is intensively engaged in the Slovak government and especially the Ministry of the Environment of the Slovak Republic.*

**Keywords:** *Environmental burden, environmental risk mining operations, landfills, geodatabase*

## 1. INTRODUCTION

Currently, in Slovakia and in other Member States of the European Union a significant amount of contaminated areas, the intensity of industrial activity does not exclude the emergence of new sites. These sites may pose to the population potential source of increased health and safety risks. Failure to act in such cases may result in the future spread of the contamination and greater loss of biodiversity. The prevention and remedying of environmental damage to the extent possible contribute to implementing the objectives and principles of the environmental policy of the European Community, therefore when deciding how to remedy damage should take into account both the local natural and economic factors

Slovakia belongs to the advanced industrialized countries. Thanks to the rich mineral deposits had conditions for the development of mining, metallurgy and other related disciplines. In the last twenty years there has been attenuation of mining activities and of course the mining remained a number of sites that have become or will become at some future possible source of environmental burden. It is essential these localities mapped and recorded. A suitable tool for building of database and data presentation is geographic information systems. Nowadays it is mainly geodatabase, which

provides the environment and tools for managing spatial data and larger scale. [8]

The part of creation the geodatabase is a data presentation and subsequent lay and professional public. With the development of information technologies and the associated development and practices, data formats is at present one of the most common methods of presentation and online presentation through the web map server. Sometimes for better visualization and clearness it is preferable to use 3D display either using VRML (Virtual Reality Modelling Language) or newer formats such as X3D, Collada. [6]

## 2. RISK ANALYSIS OF CONTAMINATED SITES

Basic concepts of environmental burdens are described in the Act. 384/2009 Coll. [2]

Environmental burden is pollution of the locality caused by human activity, which constitutes a serious risk to human health or the rock environment, groundwater and soil, with the exception of environmental damage.

It is a wide range of areas contaminated by industrial, military, mining, transport and

agricultural activity as well as to inappropriate waste handling.

Possible environmental burden is the state territory where reasonably expected to present environmental burden.

Analysis of the risk of pollution zone is a process that seamlessly follows the exploration environment in which to verify serious pollution of human activity and environmental burden.

Concerning the analysis of the risk of polluting the territory publish the Ministry of Environment of the Slovak Republic Guideline no. 1/2012-7 of 27 January 2012 to carry out risk assessments of contaminated sites. [1]

The subject of risk assessment are polluted rock environment, contaminated soil and soil air and pollution groundwater that may pose a serious threat to human health and the individual components of the environment

Risk analysis is based on the precautionary principle. This means that the assessment of the risks arising from the present pollution on human health and the environment from possible exposure scenarios selects and evaluates the least favorable. It is a crucial basis for decisions of the organs of state administration in the process of reducing the adverse effects of contaminated sites on the environment and human health.

The objective of risk analysis is to characterize existing and potential risks arising from the existence of contaminated land on human health and the environment, and an assessment of its severity (assessment of exposure scenarios) propose targets remediation of contaminated sites.

To assess the relationship of contaminated sites on the environment sometimes is necessary to complement data on the investigational area. (Figure 1)



Figure 1 Additional information about the studied area

Risk identification includes hazard identification, characterization of all pollutants and other risk factors and the development of the current model of situational sites.

### 3. ENVIRONMENTAL RISK ASSESSMENT

Environmental risk assessment is to identify vulnerable receptors, including the description of the potential environmental risks to vulnerable receptors resulting from the presence of pollution mechanisms and the possible negative effects of pollution on vulnerable receptors.

The objective of the environmental risk assessment is to characterize the action of the negative effects of pollution on identified receptors. [1]

The subject of environmental risk assessment is the evaluation of dose - effect on the environment, assessment of the timeliness of environmental risks, calculating risk of the spread of pollution, a summary of environmental risk

In the event that the site is updated environmental risk assessment established risk of spread of contamination, it is necessary to develop the calculation of the risk of the spread of contamination.

Health risk assessment is to determine the degree of risk to the health of individuals and populations in the studied area with respect to current and future land use.

If the contamination zone is a health or environmental hazard, or health and also environmental risk should be carried out remediation of contaminated sites.

### 4. ENVIRONMENTAL INVESTIGATION OF STUDY AREA

Until now environmental exploration of the area has a long tradition, the sponsor of exploration activities, the Ministry of Environment and its affiliated organizations, mainly Slovak Environment Agency and State Geological Institute of Dionýz Štúr.

Concentration and processing of archival documents was one of the main objectives of the exploration activities. This activity is focused primarily on existing registers, respectively databases that contain, or could contain information about the location of environmental

liabilities and possibly their nature. These are mainly the following registers and databases:

- Register of landfills,
- Register of old environmental burdens,
- Register of old mining works,
- Environmental database of mining districts and localities with negative impacts on the environment.

#### 4.1 Register of landfills

Register of landfills started to be built in 1992 in the framework of the Slovak Geological Institute. Leads all registered landfills in the Slovak Republic. It is updated continuously based on the reports of district environment offices). It is part of a web mapping application register environmental burdens - environmental burden information system operated by the SEA. The register contains the location of the landfill, basic technical support dumps, landfills basic relationship to the environment, estimating the amount of deposited waste and a proposal for its further use. The application is available online through the map server. [3]

Due to the need of limiting the increase of waste production today's society it is currently a big trend ascertaining the amount of accumulated inert waste in landfills. For making the most accurate determination of volume is currently possible to use the most modern geodetic measurement techniques. The need for additional storage of inert waste is needed landscaping design project as ongoing process dump reclamation. [10]

#### 4.2 Information system of old environmental burdens

Information system of old environmental burdens provides data collection and provision of information on environmental burdens and is part of the public administration information system. [5] Information system established, operated and data from it, except those on the likely environmental burdens makes the Ministry of Environment.

This information system consists of:

- Register of environmental burdens
  - Part A containing the records of likely environmental burdens,
  - Part B containing a records of environmental burdens,
  - Part C of records containing rehabilitated and reclaimed areas.

- Register of professionally qualified persons
- Register of geological authorization
- State program of environmental remediation of contaminated sites
- Register of documents of environmental burdens

#### 4.3 Register of old mining works

Register of old mining works on behalf of the Ministry of Environment manages State Geological Institute of Dionýz Štúr Bratislava - Department of Geofond. Currently it is containing 17,260 records, the following arrangement:

- heaps: 6,418 records
- ponds: 10 records
- shafts: 496 records
- tunnels: 4913 records
- dumps and dumping moves: 4,566 records
- other: 857 records

The database contains the following information: location, type, characteristics, notes of object relations to the environment, annotation data. Locations of Register of old mining works as meet the definition of environmental burdens annotators were excluded or included in the register of environmental burdens. Data are presented to the public via the web application (Figure 2) [7]



Figure 2 Application old mining works and mining works [7]

#### 4.4 Environmental database mining districts and localities with negative impacts on the environment

Environmental database mining districts was created within the project SEA "The identification and monitoring of environmental damage, arising from mining, solutions from GEOCOMPLEX Bratislava. Database contains about 500 sites. The information in this database is up to date, and is not undergone relatively risk assessment of each site selected through the evaluation criteria (similar to



the classification), under which they were divided into three categories

- mine sites that pose a direct threat to public health and significant damage to ecosystems, or where there is a demonstrable risk of damage to property and threats. These are designed to remediate.
- intensity and impact of mining activities are to some extent eliminated, but the existing evidence indicates negative impacts on the environment.
- muted or insignificant effect on the environment, are not required specific actions sufficient general observation network, or monitoring is not required at all.

The scope of the project, launched in 1997, was carried out basic inventory of endangered sites and have been committed with the use of auxiliary criteria the locations at which the solution (redevelopment) the negative impact of mining activities on the environment necessary.

As most at risk have been identified following locations respectively mining district [4]:

- Jelšava - Lubeník (extraction and processing of magnesite) - high alkalization of soils and stream sediments.
- Handlova (the deep coal mining method) - vertical and horizontal changes in plasticity surface subsidence, landslides, changes in hydrogeological conditions,
- Banská Štiavnica - (extraction of ore) - local acidification of water and soil, contamination of soils and sediments with heavy metals from heap, heavy metal migration, subsidence of the ground, the destruction caused by mining subsidence 215 mining projects,
- Cígel' (the deep coal mining method) - slope deformation - falls, landslides, hydrogeological change regimes,
- Rudňany - Poráč - Zlatník (mining of barite, siderite, polymetallic, sulphide ores) - significant signs of contamination of waters, soils, river sediments and vegetation with heavy metals, local manifestations of acidification. Secondary attainment areas by air pollutants, toxicity and bioaccessibility of metals

- Hodruša - Hámre (ore mining) - subsidence of the ground, the destruction of the buildings,
- Lubeník (underground mining of magnesite) - subsidence of the ground, the destruction of buildings,
- Slovinky (Fe-ore mining) - deformation field declines,
- Kremnica (underground mining of gold) - slope deformation, subsidence of the ground, the destruction of the buildings,
- Smolník (mining pyrite ores) - discharge of mine water (sulfuric acid content, low pH, high content of heavy metals and hazardous elements) into surface waters, acidification and contamination of soils, sediments, surface water and groundwater, subsidence, building collapse,
- Nižná Slaná (mining and ore treatment plant siderite) - a local water and soil acidification, contamination of soils, surface water and groundwater with heavy metals in the vicinity of the heap material mobilization of heavy metals mining water,
- Rožňava (mining of siderite ores) - contamination of soils, surface water and groundwater in the vicinity heaps (siderite and sulphide ores), local acidification of water and soil, signs of subsidence,
- Nováky (underground mining of fossil fuels) - deformation speeches, building collapses,
- Hnúšťa - Mútnik (underground mining of talc) - subsidence, cave-ins, pitfalls,
- Dolina Mine (underground mining of fossil fuels) - deformation features in the terrain surface,
- Novoveská Huta (mining of gypsum, anhydrite, uranium and copper ores) - Mobilisation of heavy metals into the environment, soil contamination of the heap material (increased radioactivity, radon risk), increased content of sulphate, subsidence,
- Košice - Bankov - reducing erosion base area by pumping mine water as a result of subsurface mining of magnesite, changes relief - drop, cave-ins,

Areas where mining takes place, it is essential to track and monitor mainly due to a possible downturn, slump, falling and deformation. [9]



#### 4.5 Maps of geological factors of environment

Other important documents are maps of geological environmental factors. The issue of geological factors of environment since 1991 to tackle the wider environmental research program on geological factors of the environment in which he was treated well "Geochemical Atlas of Slovak Republic", and consequently it sets of maps of geological factors of the environment for the selected regions of Slovakia at scale 1: 50000

Maps of geological factors on a scale of 1: 50,000 give information on the geological structure of the area, lithological composition of the ground, hydrogeological conditions, the distribution of chemical elements and pollution of the individual components of the environment in rocks, river sediments, surface and ground waters, soils, as well as knowledge on geological hazards such as radon occurrence, natural radioactivity, geodynamic phenomena and the like. The data source for the systematic identification of environmental burdens may be geochemical map of stream sediments, pedogeochemical maps and natural water quality, as well as maps of major geological factors (within a subset of engineering maps). Map sets are compiled from 1992 continuously, currently covering the Slovak Republic following maps about 70% of the territory.

#### 5. CONCLUSION

Liability for environmental damage is one of the priorities of the European Union, with particular emphasis in the programming period 2010-2015 puts just the remediation of environmental damage and preventive measures to avoid new environmental burdens. Based on the estimate of the Ministry of the Environment in Slovakia are 30,000 potential pollution sources. Many of these sites is a serious hazard to human health and the environment. It is a locality which must be removed or rendered harmless.

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