Environmental Risk Management of diffuse pollution of mining origin

Katalin Gruiz, Emese Vaszita, Viktória Feigl and Zoltán Siki

Budapest University of Technology and Economics, Budapest, Hungary
1111 Budapest, St. Gellért sq.4
Email: gruiz@mail.bme.hu ; emvaszita@mail.bme.hu ; vfeigl@mailbme.hu, siki@agt.bme.hu

Abstract

Coping with diffuse pollution problems and sustainable watershed management plays increasingly important role in water quality control worldwide. Internationally it has become recognised that diffuse source pollution from mining activities severely affects the water quality especially with regards to acidification and metal loading.

This paper presents an Environmental Risk Management approach employed to the Toka catchment in Gyöngyösoroszi, an abandoned Pb and Zn sulphide ore mining area in Hungary. The approach can be applied for many similar cases in Europe and all over the world. The Hungarian mine had been abandoned for 25 years, mine closure and remediation activities started in 2005. The main risk is related to the toxic metal content (As, Cd, Pb and Zn) of the point and diffuse pollution sources in the studied area. The toxic metals are transported on all possible pathways: 1–3 pH leachate from the pyrite containing waste is transported by the rainwater runoff and seepage, as well as through erosion by water and wind.

The catchment scale risk management includes: 1. Establishment of a GIS-based transport model; 2. Three tiered, iterative risk assessment methodology; 3. Calculation of the targeted emission from the diffuse sources to fulfil environmental criteria for the surface water system and its ecosystem, 4. Risk reduction by a realistic, non-expensive, but efficient remediation methodology suitable to diffuse sources.

The site-specific processes were modelled in soil microcosm experiments. Leaching of metals from pollution sources and the characteristic parameters of the process were given based on a leaching test. The rate of acidification, metal mobilisation and the metal concentration of the emitted leachate have been determined and used in the transport models.

The risk reduction concept aims at reducing the runoff water quantity and contamination by chemical & phytostabilisation of the diffuse pollution sources. Immobilisation/stabilisation of contaminants in soil and waste was modelled in microcosms. Field demonstration was completed during 2007.

The aim of risk reduction planning is to reduce the metal concentration in the Toka-water to the targeted Quality Criteria. The combined chemical and phytostabilisation field experiments showed that chemical stabilisation itself is able to reduce Cd, Zn and water soluble Pb emission with 99,5%, 99,7% and 88%, respectively, such as to comply with the targeted quality criteria for sensitive water usage. The chemical and phytostabilisation together are able to mitigate As emission by reducing solid erosion.

The work was supported by the "DIFPOLMINE" EU Life demonstration project, "BANYAREM" (GVOP-3.1.1-2004-05-0261) and "Anyos Jedlik" (NKFP-3-020/2005) Hungarian Research Programmes