TABLE OF CONTENTS:

2 The latest in mining waste management research and practice from Poland
3 Industry viewpoints: interview with Johannes Drielsma, deputy director of Euromines
4 Management of the Żelazny Most tailings dam by Izabela Kotarska
Copper ore processing waste recovery and re-use

The main waste streams of copper ore mining in Poland are flotation tailings. The most promising means of recovering these wastes is to use them as a component of mixture (paste fill product) for empty cavity backfilling in copper ore mines. The technology for such recovery is being set up at a pilot plant in the Rudna copper ore mine. The quantity of waste which could be recovered in the described process was determined on the basis of the density of filling material (paste) and volume of cavities to be backfilled and has been assessed at about 7 mln Mg/year in the coming years, or approx. 25% of the amount generated every year. After adjustment, it can also be used as hydraulic binding material.

Another technology for recovering flotation tailings was recently developed by KGHM ECOREN S.A. in cooperation with the Institute of Glass, Ceramics, Refractory and Construction Materials from Warsaw and involves using the tailings (after calcination) for production of material with parameters of natural hydraulic lime. Such material could be also used as filling material for other construction materials, e.g. pavement cubes, lime sand brick etc. but to meet appropriate standards for such materials, addition of proper supplements is required. Another potential application are environment protection technologies like exhaust gas desulphurization or sanitation of sewage sludge. For more information, please see patent no. PL390084 or contact KGHM ECOREN SA - http://en.ecoren.pl/.

Coal waste recovery and re-use

Mining wastes and coarse-grained processing wastes are utilized in increasing amounts. Recently Haldex, a recovering company based in Upper Silesia has begun to produce various road aggregates of low and medium quality on the basis of coarse-grained processing wastes from different mines. Moreover, the company also started to process mining wastes in two crushing and sieving units to obtain medium quality aggregates.

Of late, coal processing wastes, e.g. coal mud have also begun be utilized for the production of granulated mud (by mixing and granulating), which is useful as low calorific material for power plants. Granulation technology allows reducing moisture and increasing calorific value. Haldex Co. has carried out such production in Makoszowy, Piekary and Brzeszcze plants (calorific values 10-18 MJ/kg). Another company, PKW (Southern Coal Company) also started to produce such a mud granulate in its two coal mines: Sobieski (9.3 MJ/kg) and Janina (5.5 MJ/kg). For more information on these developments in waste recovery practice, please contact Krzysztof Galos, PhD Eng. kgalos@min-pan.krakow.pl.

Stability of mining waste disposal sites

The increasing computing efficiency during past few years has considerably improved slope stability analyses of waste disposal sites. Implementations of numerical methods to solve issues connected with geotechnical aspects of mining waste storing are becoming more popular these days. The latest development in this area is the Modified Shear Strength Reduction Technique (MSSR) which allows for estimating the stability of all sizes of analysed objects and also gives the possibility to observe the propagation of the damage development. This method is applicable only in FLAC and FLAC 3D codes.


Current software availability allows one to design 3D models of the facilities. This is important especially for landfill slope stability analysis. 3D modelling presents the real geometry of the object, which is necessary when calculations are conducted for complex geology (such as in the case of mining waste storage facilities). In this kind of analysis, 2D model application is sometimes not enough to obtain reliable results. For more information on practical application of 3D modelling in slope stability analysis, please contact prof. Marek Cała, cala@agh.edu.pl.
Industry viewpoints: interview with Johannes Drielsma, deputy director of Euromines

**What steps need to be taken so that certain types of mining waste (especially waste rock) cease to be considered ‘waste’ and instead are defined as ‘by-product’?**

Waste rock must meet the definition of "waste" contained in the Waste Framework Directive to be regulated as waste. If, for example, the waste rock is used for structural purposes within the mine (e.g. backfilling), it should not be regulated as waste, but if leftover stone is stored for an indefinite length of time to await possible use, it must be regulated as waste irrespective of the place of storage, its composition, or risk to human health or the environment. There is also an existing EU definition of "by-product", which requires that further use of the material is certain and that it can be used directly without any further processing other than normal industrial practice. It may be necessary to provide some specific derogation to these criteria for the case of mining waste, for example in the Mine Waste Directive, in order to encourage their re-processing as a useful resource. Minerals, ores, ore concentrates, raw and processed natural gas, crude oil and coal extracted from mine waste would remain exempt from REACH Registration as long as they were not "chemically modified".

**Can a case be made for issuing guidelines on interpreting and implementing the 2006/21/EC Directive?**

Some EU guidance already exists, to wit, the European Commission Reference Document on Best Available Techniques for Management of Tailings and Waste-Rock in Mining Activities, from January 2009. The European Commission has just completed a study that recommends updating this “BAT Document” and the work is expected to begin during 2013. Given that the EU Mine Waste Directive (2006/21/EC) requires operators to consider ways to “encourage the recovery of extractive waste by means of recycling, reusing or reclaiming such waste”, guidance on how to manage mine wastes as resources could theoretically be considered for inclusion in the new BAT Document, if Member State experts agree.

**Why has re-mining and re-processing not been the object of greater interest on the part of EU institutions and trade associations?**

Generally, it is assumed that market forces are sufficient to encourage investment in re-processing of tailings, but no doubt there has also been a certain level of ignorance about the existence of mine waste deposits in the EU – let alone any valuable resources still sitting within them. The inventories that are now held by Member States could be complimented with mineralogical information about what is contained in each of the mine waste sites. From the industry side, cost and liability risks are probably still the dominant reasons for a lack of investment in this area, since relatively low grades make the investment less attractive. National and regional regulations could provide support with regard to historic, cultural heritage and archaeological findings; liability issues linked to old mine workings; overcoming the sometimes long distances to market; protecting the investment (risk-sharing); and allowing for efficient and timely permitting. New investors need to know that they will not be left liable for contamination that has arisen from the past activities of others.

**What would you single out as the most important to-do item on Euromines’ agenda for 2013?**

Euromines top priority in 2013 is to support the launch of the European Innovation Partnership on Raw Materials. Euromines member companies are represented on the High Level Steering Group, which will this year prepare a Strategic Innovation Plan for the period 2014-20. The Plan will then be used to guide the combined strength of public and private efforts at regional, national and EU level in innovation and R&D to increase the EU’s share of raw-materials coming from sustainable sources – hopefully including ongoing projects to clean up and secure historic mine waste deposits. One of the objectives will be related to the creation of an EU raw materials knowledge base, one that will take into account not only primary but also secondary reserves.

Interview conducted by Piotr Szmigielski
The Żelazny Most Tailings Management Facility (TMF), covering an area of over 1500 ha and collecting over 800 mln Mg of flotation tailings from the copper ore enrichment process, is the biggest storage facility of its kind in Europe. Despite the high level of protection measures in place, the sheer size of the facility makes it necessary to address a variety of environmental issues. Below are listed the crucial processes along with approaches used to mitigate their environmental impact:

- **Changes of ground water quality and level, caused by infiltration of salty water from the pond**

  Drainage systems have been introduced in the dam and its immediate vicinity, as well as ditches running along the dam, which altogether intercept approx. 80% of infiltrating water. In order to regulate the balance of water in the ground, a variety of works have been carried out to reclaim land around the base of the dam. The overriding goal of these actions is to ensure that the surface water in the vicinity of Żelazny Most meets current standards of purity.

- **Dusting from the beaches and resulting local contamination of air surrounding the TMF**

  A source of pollution by the Żelazny Most TMF is dust blown off the dried beach of the facility. Starting in 1984, several solutions have been implemented to counteract these conditions. A curtain of water was introduced, comprised of a system of pipes with sprayers, together with helicopters and special vehicles which spray the beach with an asphalt emulsion. Another protection measure has been to ensure sufficient vegetation growth along the outside of the dam.

  ![Fig. 1 Protection of the dam against dusting - outer side of the dam covered with plants, inner side - covered with asphalt emulsion](image)

- **Surface water quality changes caused by discharging excess of salty waters from the TMF to Odra river**

  A system of purification plants effectively protects against pollution by solids and heavy metals, while pipes located at the bottom of the river provide for the equal distribution of water.

  Constant observation and monitoring is maintained of pollution of the air, soil and plants, underground and surface water, and of the health of livestock, representing the basis of programs aimed at improving the condition of the natural environment.

  The security of the facility is under constant supervision, based on a system of geotechnical monitoring. Actions aimed at increasing the economic utilisation of flotation tailings are helping to reduce the rate of expansion of the storage pond.

  The operations and pro-environmental actions taken in relation to this facility are performed in accordance with BAT (Best Available Techniques).