Special Problems of Management GENERAL REPORT

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The papers to be presented in this Session show an interesting range of subject matter. Three discuss specific problems associated with existing mines, one deals with hydrogeological risk evaluation and one uses the impact of mine drainage on an aquifer to analyse a large-scale hydraulic parameter.

Paper 1. Environment studies to determine the impacts of re-opening Banska Stiavnica-Hodrusa ore district in Czechoslovakia - Dusan Cababla - Marian Skaviniak.

Future developments in established mining areas may have significant hydrogeological implications, especially where the existing mines are to be deepened. In turn this may have an impact in the area of the disposal of ever larger quantities of mine water, particularly, as is often the case, where the quality of this water is poor.

This paper provides a good example of this aspect of mining for an area of Czechoslovakia where mining has been undertaken for millenia. The Stiavnica Mines have been dewatered for hundreds of years by water hoisting engines and by drainage galleries.

It is easy to overlook the remarkable achievements of the past in mine water control. This problem has been confronted by the mining industry for a long time, using whatever technology has been available.

Deeper mining developments in the Stiavnika Mines will not only intersect ever-increasing amounts of water, but also will be expected to encounter thermal waters up to 50°C.

Geological survey work will involve driving more than 150km of tunnel, which, together with existing workings, will further affect the pattern of groundwater movement

in the area. Part of the workings are to include a New Drainage Tunnel with a capacity of 1800 litres/second.

An important aspect is the chemistry of the water, which has a calcium sulphate chemistry and high levels of dissolved iron. This points to the need to recognize the impact on concrete and metallic structures and on the receiving surface waters. The latter may lead to a decision to treat the waters before discharging them to the environment.

The paper provides a useful and interesting account of the planned expansion of an existing mining region, with careful consideration of water-related aspects. It is to be hoped that those involved are successful in their endeavours both to drain the new mine workings and to minimize environmental impact.

Paper 2. Evaluation of the hydrogeological risk involved in the siting of mining operations - P.E. Brown, S. Bamberg and M.B. Arndt.

As the paper states, risk evaluation is becoming more important in the siting of mining operations, and hydrogeology is one of the factors to be considered in any thorough risk evaluation procedure.

The authors have provided a thorough description of the uses to which risk analyses can be put, pointing out that the procedure is appropriate before and during a mining operation, and also to assist with aspects such as regulatory compliance and insurance.

The systematic and stepwise process of carrying out a risk analysis, with four major categories of activity, are described in the paper. They are:

1. Data Base,
2. Hazard Identification,
3. Risk Analysis, and
4. Risk Evaluation or Management.

Importantly the process results in adequate recognition and quantification of the probability and probable costs of failures in a mining system. Properly carried out, the benefits of such analyses can be seen to be great.

The other papers discussed in this session all provide good examples of this. With the wisdom of hindsight, the problems of interrupted drainage in India, of the transmittal of pollutants to a mine in Poland, and of many other mining operations across the world could in theory have been avoided. The application of the techniques of stepwise risk assessment, as outlined in the paper, would certainly have identified

hydrogeological problems such as those of which all delegates would have some experience.

Paper 3. Problems of mine water drainage due to damage to hydrological amenities in a coalfield - a case of a coal bearing area in India - R. Ghosh and D.K. Sinha.

This paper describes some of the dramatic effects on the natural environment which can be caused by the haphazard development of mining an waste disposal operations.

Using topographic maps and aerial photographs the authors have made estimates of the damage already done. In addition the authors have made numbers of practicable suggestions aimed at ameliorating many of the problems and undertaking future mining and water disposal operations in ways which will minimise the long-term degradation.

The authors document many examples of the types of problem which may result from mining which is carried out without due regard for the consequences. The degree to which these effects have developed in India, in the Jharia Coalfield, seem remarkable. However there would be few, if any, countries in which these problems have not developed to some degree in the past. The effects of acid mine drainage upon surface water systems in some parts of Australia and New Zealand have been severe, for example.

It is important, in situations such as these, to provide constructive suggestions for the future. These should not only aim to progressively rehabilitate damaged areas, where this is practicable, but also draw upon the experience gained from the past to improve planning and operating in the future. In this way future generations should not need to address the problems caused by the techniques of the past.

This aspect is addressed in the paper. The authors provide many suggestions, for example concerning the filling of old goafs and quarries (necessary both for safety and environmental purposes) leading to the partial restoration of the natural drainage system.

They also point to the possibility of using mine water to augment local water resources, which are needed for local settlements, and of planning future mining in such a way as to avoid further damage to surface water bodies.

Overall the paper provides excellent examples, both of the hydrological dangers of inadequate documentation of mine workings and also of the need to take considerable care of the surface environment when operating in mines.

Paper 4. A Zinc-lead ore mine water contamination by a paper factory fluid waste - Z. Wilk, A.F. Adamczyk, J. Motyka and S. Witczak.

This paper uses the fortuitous combination of a major cone of depression associated with the pumping of 300 ML/day from a mine in Poland and the discharge of paper factory effluent into the same aquifer to calculate parameters such as real flow velocity and longitudinal dispersivity.

It provides a good example of the benefits that can be obtained from careful and thoughtful analysis of data from field situations which have been monitored, whether deliberately or with other purposes. The difficulty of planning (and funding) a planned, long term test aimed at determining the parameters calculated here would be enormous.

It also provides a good lesson about the potential for pollutants to be transmitted considerable distances from their source within an aquifer, to be discharged at a later date with the need for disposal at that locality. In this case, ironically, the mine is the recipient rather than the source of the pollution.

Paper 5. Surface impacts of dewatering old colliery workings - B.C. Ham

The final paper in this session describes an assessment of possible surface subsidence in the West Moreton coalfield in Queensland, Australia. This paper documents a potential consequence of renewed, or rather expanded activity in an old mining field.

The author describes the site conditions, and proceeds with an analysis of the likely impact of dewatering the old mine workings. As the old workings underlie a highway and an industrial site there are practical reasons for assessing the effects of dewatering.

In one case, along a main road, minor subsidence has been correlated with failures in underlying mine workings, and more widespread subsidence is being investigated further at present.

The author concludes from his analysis that the stress in old pillars will increase significantly as a result of the dewatering, but that their strength is nonetheless likely to be adequate to maintain surface stability.

This conclusion is based upon the important assumptions that the old mine plans are reliable and that interseam strata do not fail as a result of pillar stress

interactions. The former is an excellent example of the benefits to be gained in the long term from keeping good records of mining activity.