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Mine Water Management Objectives GENERAL REPORT

By PETER NETCHAEF

I have the pleasure to present 6 excellent papers in this section all of major relevance to the mining environment of today where competing social, legal and monetary interests and their often complex interaction require serious consideration. This is particularly true today where huge fluctuations in commodity prices makes mining a perilous undertaking while the world increasingly are becoming aware of the serious threat that mans activities has on his environment.

The 6 papers deal with such complex issues as safety in an underground environment; How to protect sensitive wetlands well into the next century; The enormeous waterproblems in China and conflicting dewatering/water supply needs; Disposal of contaminated water in sensitive areas and the dynamic interaction between mining companies and legislation.

WATER INRUSH PROTECTION CRITERIA AND DEWATERING SCHEME AT SAKOG BROWN COAL MINE, TRIMMELKAM, AUSTRIA.

It is often asked at Conferences and Congresses:" Are case studies really of use to others than the authors?". The following paper answers this question.

Miran Veselic and Erich Enichlmayr have in their paper described the successful methods applied to combat water related stability and inflow problems at the SAKOG coal mine in Austria.

There are 4 coal seams at SAKOG, 3 of which are exploited. The main aquifers separating these coal seams are highly permeable (in the order of 10-5 to 10-6m/s) and are in part subject to piping.
The mine which is nearing the end of its economic life has a long history of water related cave ins and inflows.

The problems facing the authors were to provide mine designers with the tools necessary to define the optimum combination of length of longwall and prelimenary dewatering/depressurization requirements considering that:

1 Safety criteria for hanging and bottom wall had to be defined separately.
2 Hanging and bottom walls were subject to piping.
3 Scatter in the distribution of the registered rock properties did not allow for safe and realistic application of mathematical modeling.

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4 The in-situ stress condition of the hanging and bottom wall was plastic apart from the coal measures.
5 No in-situ measurements of the caving in process were available or possible at the time.

Given these constaints and requirements, the authors have successfully applied the methods and experiences of the Velenje mine in Yugoslavia to formulate a dewatering/depressurisation policy for safe operation of the SAKOG mine through a combination of surface dewatering and in-mine dewatering from advance gates and main ways.

Subsequent experiences have confirmed the recommendations of the authors. In all subsequent cases of inflow it has been found that the safety criteria had not been achieved.

WATER MANAGEMENT TO PROTECT WETLAND TO THE NORTH OF THE RHENISH LIGNITE DISTRICT.

The Germans have always been recognised for their methodical approach and foresight in a rapidly changing environment and the paper by H. Trumpff illustrates that Rheinbraun is already considering the possible environmental effects far into the 2100 century.

It is well known that Rheinbraun operates one of the largest lignite mining operations in the world, an operation of major significance to the energy needs of the Federal Republic of Germany. However, the opencast mining method used requires the topwall stata to be fully dewatered and footwall aquifers to be sufficiently depressurised to maintain stability. Because of this requirement and the scale of the operation nearby areas along steams and rivers are suffering severe loss of vegetation due to lack of available water.

To limit the ecological effects of the mine dewatering scheme, Rheinbraun investigated 3 principal countermeasure techniques:

1 Shutting down public and industrial water producing wells near the perimeter of the cone of depression.

2 Artificial recharge of the stressed aquifers through infiltration near the threatned wetlands.

3 The construction of a slurry wall near the mine to limit the effect of mine dewatering.

Because the mine is a major supplier of water to users in the area the need for local suppliers is diminshing. By shutting down local water works the combined effect of mining and waterworks can be reduced. While this method is effective around the perimeter of the

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depression cone where the dewatering effect of the mine is minimal, it would be insufficient where the drawdown amounts to several meters. In such areas numerical simulation and field test have shown recharge to be an effective way of protecting valuable wetland from drying up. However, while the techniques and methods of recharge are well known testing is currently underway to gain experience in operating recharge works on such a large scale.

Investigations into the construction of a slurry wall showed this solution to be non-viable.

Comprehensive modeling has shown that the combination of the above 2 methods should, by and large, protect the majority of wetlands around the mine.

The protective measures has been agreed upon between the Government and Rheinbraun. Under this agreement Rheinbraun will collect 55 mill cubic metre of water per year de-ironize it and distribute to several recharge sites in the area. The necessary facilities will be installed during 1989 and 1991. When the proposed Garzweiler II mine, which is scheduled to operate between the years 2005 to 2045, shuts down, water from the Rhine will be used to fill the hole. The resulting lake will also contribute to the recharge of the region and modelling shows a new groundwater equilibrium established around year 2085.

THE BASIC HYDROGEOLOGICAL CHARACTERISTICS OF SOLID MINERAL DEPOSITS IN CHINA.

It is only recently that the west has gained ready access to some of the mining experiences of the far east and particularly China, which are now emerging as one of the major resource countries of the coming decades.

The paper by Liu Qiren is therefore particularly interesting, since it gives a very comprehensive review of the hydrogeological conditions prevalent in the various provinces and areas of China.

The hydrogeological conditions found in China are diverse and often of awsome magnitude. Depending on whether the hydrogeological environment can be described as:

1 Mineral deposits with fissure water;

2 Mineral deposits with pore water;

3 Mineral deposits with karst water;

the size of inflows can be enormeous and several occurrences of water inrush, inundation ands karst collapse have frequently resulted in

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heavy financial losses. In some cases water pressure is so high that floating sand occurs rather than just water ingress.
These problems may be exacerbated through poor understanding of the predominant hydrological environment and its dynamics resulting in unnecessary or inapropriate solutions.

Of particular concern in China is the often serious effect that conventional dewatering can have on local rural communities which entire existance relies on ready access to groundwater or small local streams for water supply.

While all the people at this Congress are familiar with the interaction of water and mining and the problems that often result, it is sometimes usefull to be reminded of the incredible force and volume of water that can occur underground particularly in karst areas were the describtion groundwater is better replaced by underground river. Similarly the western contries with their well developed infrastructure sometimes forget the tremendous difficulties of commencing and operating mines in often very remote locations where water pressure and inflow to mining operations have to be solved with due regard to the continued existance of ageold small communities.

MINE DEWATERING AND WATER DISPOSAL, BENDIGO GOLDFIELD.

It would seem that all the world currently is concentration on the mining of gold as the only safe island in a sea of changing commodity prices. This trend has caused the reinspection of many old mineworkings and the paper by C. Forbes and J. Showers illustrate some of the innovative solutions that can be applied when faced with the task of dewatering old mineworkings and disposing of contaminated water in an environmentally acceptable way.

When Western Mining Company wanted to obtain bulk samples for assaying from the New Chum lines of lodes at Bendigo, it became necessary to dewater the abandoned Williams United Shaft workings (which access the lodes) to a depth of 100 meters below collar level.

Instead of using complex matematical models, approximate analytical techniques were used to estimate the amount of water stored in the old workings, the amount of inflow from the surrounding strata and hence the amount of dewatering required so that access could be gained to the old workings.

Subsequent dewatering showed that the actual achieved drawdown was within 4% of the predicted drawdown for a total extraction of 534Ml.

The extracted water contained arsenic and was moderately saline and would therefore have to be contained or treated prior to release. Any disposal option also had to be flexible enough to accommodate

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expansion should assaying show mining to be viable.

Three options were considered:

1 Treatment for removal of arsenic and disposal into the local creek system.

2 Desalination to acceptable levels prior to release.

3 Discharge into closed circuit evaporation ponds.

Detailed consideration and study deemed option 3 to be the only viable solution, but because of the low nett evaporation water balance calculations indicated that evaporation ponds needed to cover at least 50 Ha combined with buffer storage area of 700 Ml. Such areas were not available within the lease and areas 4 km north of the mine site were secured for this purpose. To get the water from the mineworkings to the evaporation ponds with minimal environmental effect, innovative use has been made of pipelines, underground workings and a local creek.

BALANCING COMPETING WATER RESOURCE DEMANDS AND MINING IN A COASTAL ENVIRONMENT.

Watermanagement and persuant legislation is of course an ongoing process which will change direction as more and more are learned about the environment and the processes that govern it. While some people may mistrust the environmental motivation of mining companies, it is often forgotten that mining companies by and large are responsible corporate citizens who also want to be around tomorrow. Because poor watermanagement interfere with production there is also a direct monetary benefit for companies to adhere and indeed improve on existing procedures.

The paper by Merike Johnson clearly illustrates the benefit of this dynamic process and the great role that monitoring plays as an absolutely necessary foundation for our understanding.

The Tea Gardens mining operation for heavy minerals are located 50 Km north of Newcastle just outside the boundaries of the Myall lakes National Park. The operation uses a conventional dredge to mine the mineral sands and the heavy minerals are separated without any use of chemicals, so "pollution" in terms of extraneous material is not an issue.

However, the sandbeds are also used for local water supply for the nearby towns of Tea Gardens and Hawkes Nest and there is a concern to any detrimental effect that mining may cause to this source. In particular there is a concern to possible increases in iron content of

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the water which relates to similar concerns at the Tomago sand beds in Newcastle.

As a result an extensive monitoring programme has been implemented at Tea Gardens to see if the mining operation would cause an increase in iron content, but the results so far would seem to indicate a total lack of connection between the mining and local concentrations of iron content. Indeed the results and studies so far would indicate that the monitoring programme initially suggested is inadequate to determine the true cause for the fluctuating iron levels in the local water bores. To fullfill the overall aim of advance warning of any increases in iron concentration the programme has been modified resulting in a considerable cost saving for the company while better adressing the environmental requirements particularly in regard to the local water supply.

TRIGGER RELEASE MECHANISM FOR RELEASE OF MINE WATER TO MAGELA CREEK.

The paper by C. McQuade and R. McGill is another good example of the dynamic process between legislation and watermanagement as more and more is learned about the environment. This paper is properly of particular interest since the Ranger Uranium Mine is one of the early mines that liturally evolved with the issues now so well known in the mining industry, particularly where hazardous materials are mined, used or produced on a mine site. These issues are especially clear at Ranger because of its location in one of Australias largest national parks now registred as a World Heritage area.

Ranger Uranium mine has several categories of minewater, which are all subject to various retention criterias.

When Ranger started operations, little was known about the environment in general and the hydrological characteristics of the Jabiru area in Northern Territory specifically. Having grown with the issues, water balance has always been a critical issue and over the years the possible release of some of this water has been the subject of intense political, emotional, social, environmental and scientific debate.

One of the ageold problems in hydrology is how to recognise an event before it is too late. In Rangers case this is a real problem since the release of water is based around the concept of dilution in the local Magela Creek. With release only accepted on a one in ten year basis it is paramount to recognise this event so that release can be effectuated. Failure to do this would result in the release being missed and with relatively few events during the wet season suitable for release under the dilution criteria this could lead to an uncontrolled water balance situation on site.

The paper gives an interesting approach to determine the "Trigger

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Point" for release and discusses the limitations of the existing engineering works on site for maximising releases during the few but large flood events of relatively short duration in Magela Creek.

SUMMARISING REMARKS.

To briefly summarise, I think that the paper by Veselic/Enichlmayr clearly illustrate the great merit in learning from other mines' experiences and applying these lessons in a similar environment where data may be scarce or absent.

The paper by Trumpff illustrates the use of innovative approaches to ensure long term environmental protection, but I wonder about the remobilazation of residual acidity when the drying aquifers are resaturated. It would also be interesting to hear of the cost associated with the scheme.

The paper by Liu Qiren is awsome in the description of problems facing mining in China. The magnitude of some of the problems are staggering and with the additional problem of competing needs for dewatering and water supply for the rural communities, I wonder if there are circumstances where mining cannot be justified.

Forbes and Showers illustrate that good solutions can be achieved without the use of complex computer models. However,in using evaporation ponds as a disposal measure, I wonder how confident the authors are that they can maintain the necessary negative water balance.

The paper by Johnson is interesting in that it shows the responsible and professional attitude to environmental control which I believe characterises the majority of mining today. It also shows that dynamic interaction between social, legal and engineering requirements can benefit all parties.

McQuade and Gill's paper also illustrates this interaction and how there is a need for the operator to have clear engineering guidelines for operational control . This is unfortunately often not a "fait accompli" in most environmental and legal guidelines. Failure to have such clear guidelines will ultimately result in unsuccessfull water management and no matter who is to blame the environment in which we all live will suffer.

Paper entitled WATER INRUSH PROTECTION CRETIRIA AND DEWATERING SCHEME AT SAKOG BROWN COAL MINE, TRIMMELKAM, AUSTRIA, is contained in TS 6B (Technology for Mine Water Management)

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