9. Underground Mines

A sudden and large flow of water into an underground mine can have disastrous results and minor quantities will also cause inconvenience to personnel and machinery accessing the shaft.

The potential for this type of problem and hence the level of preventative works is dependant on the mine locality.

9.1 Surface Drainage Away from Head Works

The most cost-effective method to avoid water entering a shaft or decline is to locate the shaft away from any watercourses or flood plains.

If the general topography or the geological formation of the ore body makes this impossible, it will be necessary to undertake more pro-active flood protection civil works. For a discussion of flood mitigation and interception drainage techniques refer to Sections 8.1.1, 8.1.2 and 8.1.4. Due to the importance of a mine's access shaft, flood protection and mitigation works must be designed to give a very low risk of failure. Where flooding is possible the level of risk must be very carefully analysed. If flooding may be life threatening, it is advisable to cater for the probable maximum flood (PMF) (refer to Fact Sheet No.2).

9.2 Groundwater Inflow

Groundwater inflows may originate from lateral connections to local and regional groundwater resources at working faces, vertical seepage from roofs of underground pits and local seepage from water bearing strata or "pockets" of groundwater.

Unplanned interception of adjacent flooded workings, especially in coal mines, can have disastrous consequences on workers and machinery.

Blasting and drilling operations which tap into sources of water may result in a quick and widespread impact of the inflow in connected working areas.

9.2.1 MANAGING GROUNDWATER INFLOW

Managing groundwater inflow in underground mines can take many forms. Some techniques are:

- preventative, using flow restriction, containment and re-routing of flow (Section 8.2.2). Bore dewatering, in particular, provides an effective way of reducing the effects of groundwater inflow to the underground mine by removing a proportion of the groundwater resource;
- contingent, allowing for the inflow of groundwater. The confined nature of underground mines makes the design of adequate drainage into an adit or shaft used exclusively for collection of groundwater (ie. a sump) essential. Drainage to an adit which passively discharges to the environment may prove to be a long-term problem if acid drainage is present. Control and treatment of such drainage streams after mine closure is difficult and expensive;
- depressurisation at the interior surface of the underground working, which involves progressively tapping into water bearing strata to "bleed" water and hydrostatic pressure at several points; and
- pumping to the surface from sumps or pumping to abandoned shafts from temporary sumps may also be used to move volumes of water from areas in which they are not wanted.

In wet areas, the plugging of old shafts and surface exploration drill holes can reduce water inflows quite significantly

9.3 *Water Quality*

Water present within underground mines is normally derived from direct infiltration of rainfall and seepage of groundwater into the excavation. Water extracted from underground mine workings may be contaminated with:

- increased dissolved and particulate metals resulting from the abrasion and dissolution of metalliferous minerals (eg. acid drainage);
- nutrients from explosive residues;
- high concentrations of suspended sediments; and
- oils and greases from underground machinery

9.3.1 TREATMENT AND DISPOSAL OF UNDERGROUND MINE WATER

Water extracted from underground mine pits should be pumped to a central holding facility where suspended sediments can settle. If possible, the settling facilities should be underground, so that the sediment does not become a problem on the surface. Appropriate treatment technologies can then be implemented for the removal of any hydrocarbons, heavy metals or acid drainage.

If acid drainage is present within the underground workings, then treatment of this water will be required, as outlined in Sections 8.3.2 and 11.4.1. In addition to the water extracted for treatment, consideration should be given to water that may potentially escape through mine shafts, adits and bedrock cracks and fissures.

If at all possible, clean water flowing into a mine should be kept separate from dirty streams and removed as quickly as possible. This will prevent contamination of the water and reduce the quantity which then has to be treated.