EARTH SYSTEMS
Environment · Water · Sustainability

Preventing Pollution from Underground Mines

Earth Systems has been a global industry leader in acid and metalliferous drainage/acid rock drainage (AMD/ARD) management for more than 20 years. We have developed an innovative technology for rapidly lowering or preventing pollution from underground mines. This method, based on mine void atmosphere control, provides a clear, cost effective alternative to "water treatment in perpetuity" or accepting ongoing water pollution.

There are more than 400,000 abandoned underground mines worldwide. Many of these discharge acid and metal and salinity contaminated drainage. The pollution is a result of the exposure of sulfidic minerals (such as pyrite) within the mine to atmospheric oxygen. If not managed, pollution often continues for centuries. Solutions for the management of these legacy mines include hydraulic seals which flood the workings and prevent oxygen access to the reactive sulfides, or treatment of the discharge water via costly and ongoing chemical addition. Hydraulic bulkheads are difficult to engineer, can be expensive to install and have some history of catastrophic failure. When water treatment is chosen, it is often considered necessary in perpetuity. For most sites, particularly remote ones, pollution control has simply not been economically viable – until now.

Earth Systems has developed and successfully implemented an innovative, low cost and low risk alternative to existing management options. The rate of pollution generation (ie. sulfide oxidation) from underground mine voids is directly proportional to their internal oxygen concentration. By installing effective air entry and drainage controls, unavoidable sulfide oxidation within mine voids helps to lower internal oxygen concentrations and thereby pollution generation. When internal sulfide oxidation rates exceed oxygen re-supply rates, improvements in discharge water quality can be achieved. For example, every cubic meter of oxygen consumed internally is replaced by a cubic meter of air, which only contains 21 vol.% oxygen, ensuring that nitrogen gas enrichment within voids is inevitable.

Applications of the technology can be divided into two general stages. Stage 1 involves air entry and drainage control civil works and monitoring, and Stage 2, if required, involves active injection of an inert gas to compensate for barometric pumping. Stage 1 can significantly lower pollution generation and Stage 2 works should completely prevent it.

Phased Implementation

Inert atmosphere installations in underground mines are designed and implemented in a multi-phase process. Not all phases are necessary to achieve substantial pollution reduction. Solutions are site specific but can involve the following phases:

Phase 1: Feasibility Study
- Water quality assessment
- Site investigation and risk assessment
- Investigations to locate underground workings
- Investigations to locate key air entry points
- Surveys to identify interconnection
- Predictive modelling of inert atmosphere performance
- Cost-benefit analysis

Phase 2: Mine air entry and drainage control design and implementation and installation of monitoring systems

Phase 3: Air entry control performance assessment and additional air entry control works if required

Phase 4: Extended water and gas monitoring and assessment of the need for an inert gas injection system

Phase 5: Design, supply, installation and commissioning of inert gas injection system

CASE STUDY

Two full scale case studies are underway in New South Wales, Australia. Success in pollution reduction (ie. decrease in acidity loads) to date has been unprecedented. Please contact Earth Systems Melbourne Office for more information on the technology and case study outcomes, or email Dr Jeff Taylor at jeff.taylor@earthsystems.com.au to arrange a presentation.






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