THE LATEST TECHNOLOGIES TO CONTROL AND TREAT ACID MINE DRAINAGE

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Acid mine drainage (AMD) control technologies are measures that can be applied where AMD formation has already taken place or is anticipated. At-source control methods treat the acid-producing rock directly and stop or retard the production of acid, whereas treatment methods add chemicals directly to acidified water or direct the acid water through passive systems for treatment. Due to long term water treatment, its costs and liabilities, cost-effective methods which prevent the formation of AMD at its source are preferable. Some control methods are most suitable for abandoned mines and others are only practical on active operations. Others methods can be used in either setting.

Some of the techniques have been very successful, while others have been only partially successful. This may be due to several site-specific factors including: mining technique, rock type and chemistry, ground water flow rates, etc. While a technique that controls 80% of a site's acid production and reduces long term operation and maintenance costs may not relieve a mine operator of liability, the method may be suitable for active sites which meet certain criteria, abandoned mine reclamation programs, or watershed restoration projects. Removing a significant portion of the acid or metal load in a watershed by partially-effective control strategies may improve the health of a stream to a point of re-introducing some fish species or re-establishing some designated uses of the stream. Alternatively, the method may be combined with another partial control scheme to achieve effluent limits.

Alkaline recharge structures have received attention recently because several new alkaline materials (steel slag, kiln dust, AMD sludges) have been found that can generate high alkalinities. The highly alkaline water is then introduced into a backfill when it contacts AMD for neutralization. Recent studies have also documented the positive benefits of remining abandoned mine lands. Where AMD occurs, remining reduces acid loads to streams by 1) decreasing infiltration rates, 2) covering acid-producing materials, and 3 removing the remaining coal which is the source of most of the pyrite. Remining has been combined with alkaline addition and special handling to change water quality from acid to alkaline at many sites.

Chemical treatment of AMD to remove metals and acidity is often expensive and a long term prospect. However, limestone sand application has shown great

success for restoring streams at low cost. Replenishing the limestone sand is needed every 3 to 4 months, so a system to generate money to prolong application is needed.

Passive treatment systems have been developed that do not require continuous chemical inputs and that take advantage of naturally occurring chemical and biological processes to cleanse contaminated mine waters. The primary passive technologies include constructed wetlands, anoxic limestone drains (ALD), vertical flow systems such as successive alkalinity producing systems (SAPS), and open limestone channels (OLC). At their present stage of development, passive systems can be implemented as a single permanent solution for many types of AMD at a much lower cost than active treatment. Selection and design of an appropriate passive system is based on water chemistry, flow rate, and local topography and site characteristics, and refinements in design are ongoing. In cases where theassive systems have not met treatment expectations, evaluations are being conducted to determine reasons for poor results.