

Prevention of Acid Mine Drainage

by

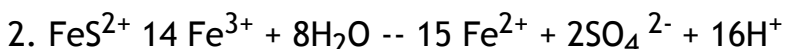
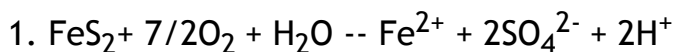
Robert Kleinmann

As you may have noticed, the AMDTAC's work has three primary thrusts: improving the prediction of acid mine drainage, developing a better understanding of the mechanism of acid formation, and developing or evaluating potential control methods. Although most of my work will be directed toward control of acid formation, I do want to mention that in conjunction with the prediction-oriented work of this committee, the Bureau of Mines will be conducting a field evaluation of the various overburden analysis methods. The study will include over 30 mine sites and will compare predicted acid potential to actual acid production, thereby identifying which parameters are significant and which are not. The work will be done over a two year period by a Bureau of Mines contractor (yet to be determined), in conjunction with the work of this committee.

Already-mined land can also present a problem of identifying acid-producing material. Before acid formation can be controlled in a backfilled area, we must have a technique to determine whether the acid is being produced near the discharge point or not. If an acid source area within the spoil can be located, then remedial treatment can be applied specifically to a small target area; otherwise, the entire site must be treated at much greater cost. We believe that surface geophysical techniques, such as resistivity or electromagnetic conductivity, can be used to track acid drainage below the surface. We will be conducting field tests at sites within West Virginia this summer; if you have an appropriate site, please let us know.

Once the source area is identified, the next problem is how to slow down the oxidation of pyrite. There are two avenues being investigated by the group: altering the water chemistry within the spoil material and killing the iron-oxidizing bacteria involved in the pyrite oxidation reaction system. Reviewing the chemistry of pyrite oxidation will make both approaches clearer.

Pyrite is primarily oxidized by air (reaction 1) or by ferric iron (reaction 2). Reaction 2 is much faster than reaction 1, but is only significant at low pH (pH below 2.5 approximately). Reaction 2 requires the activity of Thiobacillus ferrooxidans, an iron-oxidizing bacterium, for the production of ferric iron; eliminate the bacteria and acid production falls to the rate of reaction 1. Alternatively, reaction 2 can be stopped by removing the ferric iron from the reaction system; this is Dr. Stiller's approach.



Another approach is keeping the spoil water alkaline enough so that reaction 2 cannot occur--so that not even the pyrite microenvironment reaches a pH of 2.5--by keeping the pH at the

entire site at 5 or higher. Traditionally, limestone is used but the amount of alkalinity that limestone can contribute is quite limited. We are currently evaluating various alkaline agents as potential alternatives of additives to limestone, while Dr. Geidel is looking at making limestone use more effective by planning recharge areas. Another possible approach, once an acid source area is identified, is sealing, either by initiating a chemical reaction with the acid or iron in the system, or, if the identified area is small enough, by grouting.

The basis for the bactericidal approach was discussed at this meeting last year. Since that time, two full-scale field tests have been conducted, with other trials planned for this spring and summer.

The first field test was at an old 10 acre inactive refuse pile near Beckley, WV, where good water quality records were available for over twenty years. Three months after a sodium lauryl sulfate solution was sprayed on by hydroseeder, iron dropped from over 1,000 mg/l down to less than 2 mg/l and acidity was reduced to 60 pct, well below levels observed at the site in the past. Water quality has remained at this improved level since the end of December; an update will

A second field test be provided during the oral pr was at the active end of a ref WV. Acidity and sulfate fell from over 4,000 mg/l to again dropped from over 1,000 mg/l to less than 2 mg/l. low acid production have been recorded at the site so less than 1000 mg/l, iron to less than 2 mg/l. Over three months of far.

As part of the work of this committee, I will be conducting additional field tests in West Virginia. After I talked to this group last year, many of you expressed interest in having a field trial conducted at your sites. In some cases, there simply was not enough hydrologic control; at other sites, the areas were too big for my budget. That latter consideration is not as much a problem this year and I anticipate quite a few field trials this summer.

A lot of money can be saved if acid drainage is controlled at its source rather than treated. If AMDTAC's efforts are successful, two or three years down the road we should all know more about preventing the acidification of spoil or refuse as well as how to control existing acid problems.