GEOCHEMICAL RELATIONSHIPS BETWEEN SURFACE MINE SPOILS, SPOIL GROUNDWATERS, AND ADJACENT MINE LAKES[1]

by

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Abstract. Surveys of pre-1975 mine lakes have shown that 90-95% of the lakes are neutral to alkaline (i.e., pH > 6.0). Some lakes, however, may be quite acidic and contain relatively high concentrations of sulfate, iron, aluminum, and other trace metals. Presumably, there are some types of geolog-ical, geochemical, and hydrological data that would be collected prior to mining that might allow us to predict potential water quality problems in advance. Twenty-one mine lakes in the eastern and central U.S. were visited, spoil samples were collected from drillholes around each lake, and water samples were collected from the lakes as well as the drillholes. Many other mining, reclamation, and hydrologic data have been collected. The lake pH values ranged from 2.5 to 8.3. Alkalinity is essentially 0 below a pH of 6.0. Acidity increases greatly with decreasing pH, as does sulfate, iron, manganese, and aluminum. The same general relationships were found true for groundwater in spoil materials. However, groundwaters generally had much higher concentrations than did lake waters at equivalent pH values. The pH (1:1 paste) of the spoil materials ranged from 3.3 to 8.5. The neutralization potentials of individual samples were generally higher when the paste pH values were high. Conversely, the total sulfur values were higher when the paste pH values were low. Correlation analysis between the spoil chemical variables and lake water variables (averaged for each lake) showed several significant relationships. Acidity correlated with many other lake water variables. Our study found a moderately good relationship between net neutralization potential and lake water acidity.

Additional Key Words: water quality, trace metals.

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