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

by

Jeffrey P. Schubert

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 geological, 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, recla-
mation, 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 relation-
ships 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.

1 Paper presented at the
conference Reclamation, A
Global Perspective, held in
Calgary, Alberta, Canada,

2 Jeffery P. Schubert is a
hydrologist with the Argonne
National Laboratory in
Argonne, Illinois.