

CHANGES IN SOIL MANGANESE CONCENTRATIONS: A CASE STUDY FROM AN ILLINOIS COAL STRIP MINE¹

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Abstract: The concentration of Mn in pond water attributed to acid mine drainage is a common problem for many mining operations. A retention pond at the restored Freeman United mine at Industry Illinois had continually tested above acceptable levels for Mn concentration even after repeated treatment with gypsum.

It was noted that the NRCS soil profile descriptions of the pre-mined soil series which originally comprised the watershed area of the retention pond had naturally occurring accumulations of Mn. Due to the occurrence of Mn in the undisturbed soil profiles, it is possible that the concentration of Mn in the water is the result of inherent concentrations of Mn from the original soil profiles and not that of acid rock drainage.

Six sample sites were selected from the reclaimed fields that drain into the pond and six corresponding sites, within the same watershed, were selected in undisturbed areas adjacent to the mine location. Six inch soil samples were taken to a depth of 72 inches at each location. Each sample was analyzed in the laboratory for pH and Mn concentration. The data was then plotted by depth and comparisons were made between the values found in the undisturbed sites and those found in the reclaimed sites. Statistical significance was determined within each sample depth and calculated at 95% confidence.

The average pH of the undisturbed samples in each six inch sample range as well as over the entire profile was lower than that of the reclaimed soils. The reclaimed soil profiles contain less total Mn than the profiles of the undisturbed soils from 0-12 inches, 30-72 inches, and through the entire 72 inch profile. When Mn concentrations at each depth were compared between reclaimed and undisturbed locations numerous incidences of statistically higher Mn were identified. Over two-thirds (69.23%) of the samples that contained statistically higher Mn concentrations were found in the undisturbed soil profiles.

The pH of the reclaimed soils was higher than that of the undisturbed soils indicating there was not an increase in acidity due to acid rock. Additionally, no layers of increased acidity (below pH of 4.5) were found through any of the reclaimed soil profiles. The Mn levels found in the undisturbed soils were higher than those found in the reclaimed soils and the undisturbed samples had far more incidences of significantly high Mn concentration than the reclaimed soils. The Mn levels found in the water of the retention pond, which received drainage from the reclaimed soils are most likely due to the naturally occurring Mn levels of the soil material in the region and not due to acid rock drainage.

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