STUDIES OF ACIDIC MINE SPOIL AND WATER QUALITY IN AN ABANDONED MINE IN WESTERN NORTH DAKOTA[1]

by

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Abstract. Prereclamation studies at an abandoned uranium mine in western North Dakota were conducted to characterize the radiation hazard and potential to generate acid leachate in spoil materials. The reclamation research was performed for the North Dakota Public Service Commission at the Fritz Mine south of Belfield, ND, under the Western Region National Mine Land Reclamation Center (NMLRC) program, with the initial results indicating a significant potential to generate acidic leachate in the pH range of 2 to 4. This is an unusual problem for North Dakota where normally alkaline conditions and sodic spoils dominate reclamation concerns.

Vertical profiles of pH and electrical conductivity (EC) generated from 3200 paste tests of spoil samples from throughout the mine suggested a significant potential to generate acid leachate with high dissolved solids. However, leachate collected from nests of pressure-vacuum porous cup lysimeters, installed throughout the site to verify the distribution and magnitude of the potential problem, showed a more neutral, fresher water being generated by natural weathering processes, with the hint that the difference between the lab and the field results might be based in the paste test procedure. In the field, the natural buffering capacity of sodic clays in the spoils apparently neutralizes acidic porewaters, except in saturated sediment surrounding several pit ponds. In the lab paste, the amount of water added is comparatively high, the mixing more thorough, and production of sulfuric acid relatively active, presumably due to increased mineral/water interactions.

Preliminary work to identify the type and quantity of soluble, reactive mineral phases in the spoils, by x-ray diffraction, showed pyrite and other iron- and sulfur-bearing minerals were present, with natrojarosite the most abundant to the eye, and pyrite the most elusive for quantitative XRD work due to the relatively small weight percent.

The long-term goal of this research focuses on identifying and understanding the physical and chemical processes involved in weathering, and the extent to which these factors control the chemistry of water in the unsaturated and saturated zones in the mine environment, and thus the potential impact on revegetation efforts, slope stability, and groundwater quality. Although the Fritz Mine has now been partially reclaimed under a selective placement scheme, postreclamation studies will continue to examine the relationships between water availability and movement through the subsurface, mineral/water interactions, and the evolution of subsurface waters. This type of process-oriented data and understanding is needed in designs where total reclamation of the landscape is the goal.

This manuscript was unavailable for inclusion in the published proceedings. A copy of the paper is available by contacting the author at the Energy and Environmental Research Center, University of North Dakota, Box 8213, University Station, Grand Forks, North Dakota 58202. Phone: (701) 777-5000.

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