LONGEVITY OF MINE DISCHARGES FROM ABOVE-DRAINAGE UNDERGROUND MINES

L.M. McDonald, J. Skousen, and J. Demchak
Division of Plant and Soil Sciences
West Virginia University
PO Box 6108, Morgantown, WV 26506
(304) 293-6256
jskousen@wvu.edu

Abstract

The duration of acid mine drainage flowing out of underground mines is important in the design of watershed restoration and abandoned mine land reclamation projects. People conducting land reclamation projects usually employ remediation strategies once (reshaping land, revegetating soils, and installing water treatment) with the hope that these methods will adequately improve water quality for a long time, with little planning for future changes. An understanding of changing acid water conditions from underground mines over time will help in designing efficient and cost-effective treatment methods. Past studies have reported that acid water flows from underground mines for hundreds of years with little change. Water quality from below drainage underground mines appears to improve exponentially such that poor drainage quality may last only 20 to 40 years. Several factors are important in making a prediction of drainage quality over time, such as inundation or flooding history, coal seam characteristics (primarily sulfur content), residence time of water in the mine, time since mine closure, mining method and amount of coal remaining, collapse of roof and other disturbances within the mine, and subsequent nearby surface mining. More than 150 above-drainage (those not flooded after abandonment) underground mine discharges were located and sampled during 1968 in northern West Virginia, and we revisited 44 of those sites in 2000 and measured water flow, pH, acidity, alkalinity, Fe, Al, and sulfate. Discharge data from 1980 were available for 20 of these sites. All discharges were from mines in the Pittsburgh and Upper Freeport coal seams, and both seams have been extensively mined in this area during the past 70 years. There were significant water quality differences between year and coal seam. Average acidity declined 79% between 1968 and 2000 in Pittsburgh mines (from 3,342 to 702 mg/L), and 56% in Upper Freeport mines (from 1,189 to 519 mg/L). Iron decreased an average of about 80% across all sites (from an average of 345 to 69 mg/L), while sulfate decreased between 50 to 75%. Despite these overall improvements, not every site improved. Water quality for all Pittsburgh sites was better in 2000 than in 1968. However, one-third of the Upper Freeport sites showed no improvement, and some of these were considerably worse in 2000. For those discharges where 1980 data was available, all Pittsburgh sites (n=5) improved, most of these exponentially. However, of the Upper Freeport sites (n=15), five were worse in 2000 than in 1968, and of those that improved, most (8/10) improved linearly, not exponentially. There is no evidence to conclude that the improvement in water quality with time from above-drainage underground mines improves exponentially, as it does for below-drainage underground mines; trends with time are strongly dependent on coal seam. Nor can it be concluded that all above-drainage discharge water quality is improving with time. Although the overall water quality trends with time indicate that water quality on a regional or watershed basis is improving, predictions about a specific site cannot be made. More research is needed to characterize the properties of above-drainage deep mines likely to affect discharge water quality before such predictions are possible.