

LONGEVITY OF ACID DISCHARGES FROM UNDERGROUND MINES LYING ABOVE THE REGIONAL WATER TABLE¹

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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. Past studies have reported that acid water flows from underground mines for hundreds of years with little change, while others state that poor drainage quality may last only 20 to 40 years. More than 150 above-drainage (those not flooded after abandonment) underground mine discharges from Pittsburgh and Upper Freeport coal seams were located and sampled during 1968 in northern West Virginia, and we revisited 44 of those sites in 1999-2000 and measured water flow, pH, acidity, Fe, sulfate, and conductivity. We found no significant difference in flows between 1968 and 1999-2000. Therefore, we felt the water quality data could be compared and the data represented real changes in pollutant concentrations. There were significant water quality differences between year and coal seam, but no effect of disturbance. While pH was not significantly improved, average total acidity declined 79% between 1968 and 1999-2000 in Pittsburgh mines (from 66.8 to 14 mmol H⁺ L⁻¹), and 56% in Upper Freeport mines (from 23.8 to 10.4 mmol H⁺ L⁻¹). Iron decreased an average of about 80% across all sites (from an average of 400 to 72 mg/L), while sulfate decreased between 50 to 75%. Pittsburgh seam discharge water was much worse in 1968 than Upper Freeport seam water. Twenty of our 44 sites had water quality information in 1980, which served as a midpoint to assess the slope of the decline in acidity and metal concentrations. Five of 20 sites (25%) showed an apparent exponential rate of decline in acidity and iron, while 10 of 20 sites (50%) showed a more linear decline. Drainage from five Upper Freeport sites increased in acidity and iron. While it is clear that surface mines and below-drainage underground mines improve in discharge quality relatively rapidly (20-40 years), above-drainage underground mines are not as easily predicted. In total, the drainage from 34 out of 44 (77%) above-drainage underground mines showed significant improvement in acidity over time, some exponentially and some linearly. Ten discharges showed no improvement and three of these got much worse.

Additional Key Words: Above-Drainage Underground Mines, Acid Mine Drainage, Metals, Sulfate, Water Quality.

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