

Treating Extreme Acid Mine Drainage with Passive Techniques¹

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Abstract: Coal refuse placement in Young Township, Indiana County, Pennsylvania, USA resulted in the most severely degraded coal-related acidic discharge intentionally being addressed with passive treatment techniques known to the authors. Average[maximum] discharge characteristics include: 63[108] L/min (16.6[28.5] gpm), 2.9 pH, 4,477[5,363] mg/L acidity as CaCO₃, 951[1,438] mg/L dissolved iron, 439[627] mg/L dissolved aluminum, 16[27] mg/L dissolved manganese, and 4,635[7,079] mg/L sulfate. The current passive system includes a 1,460 m² terraced iron formation (TIF#1), 649 tonne limestone-only automatic flushing limestone pond (AFVFP), 890 m² settling pond (SP), and a second 520 m² TIF (TIF#2). Dissolved iron removal rates in TIF#1 range from 6 to 30 g d⁻¹ m⁻² with an average of 14 g d⁻¹ m⁻². The AFVFP-SP complex removes an average of 211 grams of acidity per day per tonne of limestone (g d⁻¹ t⁻¹) with removal rates ranging from 79 to 351 g d⁻¹ t⁻¹. The Neal Run treatment system does not treat the entire pollutant load and is influenced by other alkaline inputs but does affect the following concentration reductions on average: 3,105 mg/L acidity (69%), 789 mg/L dissolved iron (83%), 9 mg/L dissolved manganese (55%), and 273 mg/L dissolved aluminum (62%). Notably, the passive treatment system removes an average of 234 kg d⁻¹ of acidity, 66 kg d⁻¹ dissolved iron, and 19 kg d⁻¹ dissolved aluminum. If a lime-based system were deployed, the expected chemical consumption would be approximately equal to four truckloads (~88 tonnes) of hydrated lime per year. The total capital cost related to the installation of the current passive system is about \$200,000. The limestone in the AFVFP is washed about once every other year and the system requires essentially no other maintenance effort, resulting in a cost savings of about \$25,000 annually.

Additional Key Words: Passive treatment, Terraced Iron Formation (TIF), Automatic Flushing Vertical Flow Pond (AFVFP), Acid Mine Drainage (AMD), mine drainage operation and maintenance, passive treatment cost.

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1. Oral paper presented at the National Meeting of the American Society of Reclamation Sciences, Duluth, MN. June 12-16, 2022. Published by ASRS; 1305 Weathervane Dr., Champaign, IL61821.
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 3. Work reported here was conducted near 40° 34' 1.2" N; 79° 17' 41.6" W.