A Feasibility Study for the Automated Monitoring and Control of Mine Water Discharges

Christopher Vass* and Aaron Noble[1]

Abstract: The chemical treatment of mine-influenced waters is a longstanding environmental challenge for many coal operators, particularly in Central Appalachia. Mining conditions in this region present several unique obstacles to meeting NPDES effluent limits. Outlets are often located in remote areas with challenging terrain where conditions do not facilitate the implementation of large-scale commercial treatment systems. Maintenance and monitoring of these systems is often laborious, expensive, and time consuming, as environmental technicians are often used to visit outlets on a periodic basis. When combined with the lower effluent limits imposed by increased regulatory scrutiny, this treatment method can lead to the discharge of non- compliant water and high regulatory costs. As an alternative solution, ongoing research at West Virginia University is addressing the design and development of automated protocols for the treatment and monitoring of mine water discharges. In particular, the current presentation describes a pH control strategy based on machine learning algorithms. During this research project, a bench-scale pond treatment system was constructed, and a machine learning controller was implemented to administer alkaline material to adjust the outlet pH to a desired set point. Results from these tests showed that, when optimized, the machine learning approach provides a robust control strategy that can overcome multiple simultaneous disturbances while maintaining the outflow pH within a strict tolerance. Following the successful laboratory test campaign, this system was implemented at an active AMD treatment site, to further prove the advantages of this technology in a realistic setting. Preliminary results from this test campaign will be discussed.

Additional Key Words: Acid Mine Drainage, Adaptive Neuro fuzzy Inference Systems

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[1] Christopher Vass, PhD Student, Mining Engineering, West Virginia University, Morgantown, WV 26508; Aaron Noble, Assistant Professor, Mining Engineering, West Virginia University, Morgantown, WV, 26508.