Low Maintenance Passive Treatment Systems for Mining Site Contaminants

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Acid rock drainage (ARD) is a major source of contamination at metal and coal-mining operations worldwide. When ARD reaches a receiving stream, it is often toxic to aquatic life and can threaten domestic drinking water supplies. Generation of ARD is initiated with the oxidation of pyrite in the presence of water and the consequent release of Fe^{2+}, SO_4^{2-}, and acidity; trace metals such as As, Cu, Ni, Zn, Co, and Cr, associated with the pyrite may also be released to the environment at levels above regulatory guidelines. In North America, mining companies commonly treat ARD contamination using chemical methods. Although effective, it is not unusual for expensive chemical water treatment costs to continue for years following successful site reclamation of mining sites increasing life-cycle costs.

One alternative to chemical treatment is passive treatment, which refers to any zero to low maintenance ARD treatment method that does not require continual energy consuming chemical or mechanical addition and monitoring. During the past two decades, the possibility that ARD might be treated passively has developed from an experimental concept to full-scale field implementation at hundreds of sites around the world. Types of passive treatment systems include aerobic and compost (high organic carbon) wetlands modeled after natural peat wetlands to more engineered units such as anoxic limestone drains (ALD) and reducing and alkalinity producing systems (RAPS). Selection of an appropriate passive system is based on balancing ARD water chemistry, flow rate, local topography, and various other site characteristics with the most suitable and effective passive technology.

The focus of this talk will be the historical development of passive treatment systems from natural peat bogs, to empirically-based constructed wetlands, to the more influent-chemistry-based engineered systems that are successfully employed today. Discussions will include how to design a passive treatment system using the different passive treatment operational units and given example influent chemistries. Recommended loading rates and influent chemistry limitations for the different passive treatment operational units will also be discussed.

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Dr. Thomas specializes in the evaluation and passive treatment of waters from abandoned mine lands, mine tailings, and active mine dewatering operations. He holds a Ph.D. in geology and did his dissertation research on vertical flow constructed treatment wetlands for acid rock drainage. Since coming to CH2M HILL he has both led design and overseen construction of several passive treatment systems for mine impacted water. Most notably he was the quality control manager overseeing construction of a passive treatment system built for the University of Oklahoma in the Tar Creek Watershed, Miami, Oklahoma. He is currently taking a technical lead in the design of passive treatment systems for mine impacted waters in Italy, Canada, Australia, and the United States. He is a member, technical reviewer, and chairman of the Water Management Technical Division of the American Society of Mine Restoration.