

DEMONSTRATION OF MODULAR SULFATE REDUCING BIOREACTORS IN THE UPPER CLEAR CREEK WATERSHED¹

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Abstract: Advances in understanding critical components of sulfate reducing systems in recent years has allowed for the development of a better sulfate reducing bioreactor (SRB) system that considers the issues of sustainability of sulfate reducing activity, flow distribution, maintenance and placement at remote sites. Remote sites with low flow mine seeps or drainages number in the thousands in Colorado alone. SRB systems are ideal for remote sites with low flow and heavy metals such as zinc, copper, cadmium and lead at near neutral pH. SRB based systems for high acidity and metals are prohibitively large for most remote sites. In these situations, a much smaller required area can be achieved by using a two stage approach where an alkalinity generating system is used first to reduce acidity and the SRB based system is applied second for heavy metal removal.

The Upper Clear Creek Watershed in Clear Creek County Colorado has been selected for demonstration of a modular SRB design developed by MSE, Inc. A modular bioreactor system will facilitate installation and maintenance at remote sites. The bioreactor system is modular in the sense of the reaction vessel (maximum diameter of 8 ft) and includes replaceable cartridges of organic substrate (5-gallon volume in a mesh bag). Four reactors will be constructed with a mix of substrates consisting of corn stover and walnut shells to evaluate SRB systems. The design includes an impermeable cover on the bioreactor to minimize oxygen intrusion and facilitate insulation from cold temperatures. Two vertical sampling ports per reactor will be installed for quarterly sampling of the various substrates. In addition to liquid phase analyses for metals and pH, solid phase samples will be collected. Analyses will include evaluation of microbial activity and organic matter consumption. Bioreactor design, including port design will be presented.

Additional Key Words: mine drainage, organic substrates, Upper Clear Creek Watershed

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