

The Peerless Jenny King treatment system is a series of four sulfate reducing bioreactor cells installed to treat acid mine drainage in the Upper Tenmile Creek Superfund Site located in the Rimini Mining District, near Helena MT. The system consists of a wetland pretreatment followed by the four cells connected in a serpentine manner. The mining impacted water flows from the wetland through each cell before discharge. Sulfate reducing bioreactors mitigate acidity and metal contamination through the microbial production of sulfide. The produced biogenic sulfide precipitates metals, and the microbial process of reducing sulfate to sulfide produces alkalinity.

The health of the entire microbial community present in such systems is important for remediation to be effective. Classes of microbes generally present in such systems include fermenters, methanogens and sulfate reducers. The health can be measured in terms of active microbial populations and positive interactions between populations for the support of sulfate reduction. The goal of this research is to measure the activity of each class utilizing analyses that quantify the groups by their function, as opposed to the traditional molecular techniques of identifying bacteria. Gas chromatography, HPLC-DAD, and ICP-AES are used to identify and quantify the end products of metabolism. The microbial activity can then be characterized and changes can be monitored over time. Results from 2005 sampling of Cell 3 within the system indicate that the activity of sulfate reducing bacteria is much higher than the numbers present would indicate. These results combined with those from 2006 sampling indicate that methanogenesis is a minor process within this cell. The calculation of the stoichiometry of carbon utilization by SRB is much higher than what would be predicted from known stoichiometric ratios of carbon used per sulfate reduced.