# RECOVERY OF METALS FROM WASTEWATER AND OIL

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Treatment of acid mine drainage is a major environmental issue for the mining industries. Old abandoned mines produce acid mine drainage that causes billions of dollars of damage to natural vegetation, lumber trees, rivers, natural habitats and aquatic life. The flow rate of acid water, generated from water introduced by spring thaws and rain, may vary from a few gallons per minute to several thousand gallons per minute. In the U.S., acid mine drainage and other toxins from abandoned mines have polluted 180,000 acres of reservoirs and lakes and 12,000 miles of streams and rivers, (Kleinman, 1989). It has been estimated that cleaning up these polluted waterways will cost U.S. taxpayers between $32 billion and $72 billion. The U.S. Bureau of Mines estimates that the U.S. mining industry spends over $1 million each day to treat acidic mine water.

Metals are an integral part of the world economy. The residual effects of metals and their use, particularly in aqueous streams, is a continuous problem for metal producers and users. As well as federal and state regulators. Innovating and alternative techniques that allow for the economic control or recovery of metals is one alternative that lends itself not only to human health and environmental protection, but also to resource conservation and reuse of valuable commodities.

In this paper, the theory and experimental data on the recovery of metals from the Berkeley Pit, Butte, Montana will be presented; Berkeley Pit is one of the largest sources of acid mine drainage in this country. The technical approach used in this study involves the manipulation of both pH and Oxidation-Reduction potential (ORP), rather than pH alone, which allows separation of individual metals, rather than a mixture of several metals. Experimental results obtained with Berkeley Pit's acid mine drainage shows that high purity of individual metals can be separated at high removal efficiencies. One of the metals precipitated is iron, which will be shown can be converted to Goethite, a valuable form of iron oxide.

Another source of metals, especially rare earth elements, is coal/coal ash. Since coal is no longer an economical energy source, due to lower cost oil and natural gas, at least in the U.S., coal can be liquefied through hydrothermal liquefaction to generate high quality oil. In this process, some of the rare earth elements partition either into the oil or into the water layer. Extraction of these rare earth elements from the oil and wastewater, will be included in this presentation.

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