Waste or Resource? Resource potential from acid mine drainage

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Acid mine drainage could be a source of hydrogen, metals, and gypsum for energy and commercial products. For example, discharge from the Richmond Tunnel at Iron Mountain, California and the Reynolds adit at the Summitville mine, Colorado, each release between 30 and 200 metric tons per year of dissolved copper. Instead of treating this drainage water with lime or limestone to produce an uneconomic sludge, the copper and other metals could be recovered and recycled into resources for commercial products. The challenge is (1) to separate the valuable components from each other in a manner that is efficient and economically viable, (2) to stockpile components in an environmentally safe manner, and (3) to transport the separated components to an industry that can use them as source material for production. Every site must be assessed individually to ascertain what types of extraction, stockpiling, and transport are most appropriate. The challenge is (1) to separate the valuable components from each other in a manner that is efficient and economically viable, (2) to stockpile components in an environmentally safe manner, and (3) to transport the separated components to an industry that can use them as source material for production. Extraction techniques cover a wide variety including electrochemical, microbiological, evaporation, precipitation, solvent extraction, ion exchange, and reverse osmosis. New techniques combining electrochemistry and microbiology such as microbial electrolysis of water are opening up new avenues for potential application. Many of these techniques have been tried before with variable and usually limited success either from an economic or technical perspective. However, from the point of view of getting aqueous contaminants out of the environment and into recycled production, these technologies may be considered effective. Every wastewater needs to be carefully considered with respect to the components that need to be removed, their marketability, and the energy and storage requirements. For each wastewater there may be an optimal sequence of extraction techniques that benefits the industry and the environmental concerns. With considerable emphasis on sustainable practices today, these techniques need to be evaluated and re-evaluated, improved, and further developed both alone and in combination for inactive and active mine sites.