An Evaluation of Physicochemical Treatment Technologies for Water Contaminated with MTBE

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Abstract

Treatment of Methyl Tert-Butyl Ether (MTBE) from contaminated surface and groundwater supplies presents specific challenges due to the physicochemical properties of MTBE which depend strongly on its hydrophilic nature, and translate into a high solubility in water, very low Henry's constant and very low affinity for common adsorbents. Here we evaluate four treatment technologies, air stripping and granular activated carbon (GAC), hydrophobic hollow fiber membranes and advanced oxidation (AOP) using ozone or ozone/hydrogen peroxide. Experimental work was carried out to generate parameter values necessary for the designs. Ten different flow rates/concentration combinations were evaluated in our designs, to cover the range from high flow rate/low concentration typical of surface waters and groundwater drinking water supplies, to low flow rate/high concentration typical of groundwater remediation sites. For all cases, the processes were designed to produce effluent water of 5 µg/L or less. Capital costs and operating and maintenance costs were determined at the feasibility level, using standard engineering estimating practices.

Air stripping is the lowest cost technology for high flow rates (100 to 1000 gpm), if no air treatment is required. Hollow fiber membranes are the lowest cost technology for flow rates of 10 to 100 gpm if no air treatment is required, which is typical at these low flow rates. AOP is in all cases more expensive than the alternative technologies, and there are sufficient uncertainties at this point with respect to by-products of AOP to warrant further study of this technology. The cost of treating MTBE-contaminated water is 40 to 80% higher than treating water contaminated only with other hydrocarbons such as benzene, for conventional technologies such as air stripping and GAC.