

MASTERS THESIS ABSTRACT

ENGINEERING FEASIBILITY AND ECONOMIC COMPARISON OF REPLACING GRANULAR ACTIVATED CARBON ADSORPTION WITH HIGH ENERGY ELECTRON BEAM OXIDATION FOR THE TREATMENT OF DISSOLVED TRICHLOROETHYLENE IN GROUND WATER

The research described in this study evaluates the engineering feasibility and compares the economies of replacing granular activated carbon adsorption with high energy electron beam oxidation to treat dissolved trichloroethylene (TCE) from ground water cleanup activities. A matrix ranking the optimum treatment designs and costs to treat 1000 gallons of TCE contaminated ground water is developed to assist environmental project managers with the selection of appropriate remedial strategies.

Sixty-six separate designs are developed from four groups of treatment technologies including liquid phase granular activated carbon (GAC) adsorption, air stripping with vapor phase granular activated carbon (VPC) adsorption; liquid phase electron beam (E-beam) oxidation, and air stripping with vapor phase E-beam oxidation. Engineering feasibility is determined by mathematically modeling each design using fifty-three combinations of process input variables representing volumetric flow rates of 5, 30, 60, 300 and 600 gpm; dissolved TCE concentrations of 0.01, 0.1, 1, 10, and 100 mg/l; and total recoverable TCE masses of 10, 100, 1000, and 10,000 lb. An economic comparison of alternatives is prepared using net present value theory and basic statistical parameters including arithmetic mean, median, sample standard deviation and cost per 1000 gallons.

The study showed that designs using GAC adsorption or air stripping with VPC were preferred in 43 of 53 applications. Designs using liquid phase E-beam oxidation or air stripping with vapor phase E-beam oxidation were favorable in only 10 of 53 applications. Additional research and development into higher powered, more energy efficient electron accelerators is required before conventional GAC and VPC adsorption technology can be displaced as preferred methods of treating TCE contaminated ground water.