

Title: High Energy Electron Injection
MTBE Wellhead Treatment, NCBC-48-00

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Date/Duration:
Initiated - 8/00
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Abstract:

The EPA National Risk Management Research Laboratory will evaluate five remediation technologies for reducing the concentration of MTBE in contaminated groundwater. Each technology will be evaluated under one or more of the following conditions: (1) in situ and ex situ source area (both BTEX and MTBE present), (2) in situ MTBE devolved phase portion of a plume, and (3) ex situ wellhead protection.

The proposed technology, high energy electron injection (E-beam), is a highly efficient, unique advanced oxidation process. The technology uses electrical energy, without high power consumption, to create a stream of high energy electrons, which are scanned to penetrate the water stream to be treated. When the electrons penetrate water, treatment chemistry in the form of highly reactive oxidizing and reducing species are formed.

The chemistry of principal importance with respect to the electron beam process is that of the three reactive species: the reducing species, the hydrogen ions, and the oxidizing radical (-OH).

MTBE reacts primarily with the -OH. Therefore, if one were interested only in the disappearance of MTBE, oxidizing chemistry would be the most advantageous. However, if the elimination of reaction by-products is also of concern, for example tert-butyl formate (TBF) and acetone.

According to the vendor's proposal, the E-beam process is continuous, self-contained, and destroys contaminants in the aqueous stream being treated. Process reactions are complete in a fraction of a second, and no residual wastes are generated for subsequent disposal.

Water requiring treatment is first passed through a coarse particle filter, and pumped at low pressure to a feed delivery system, where high-energy electrons are injected. As the water passes through the treatment zone, it receives multiple doses of electrons where each electron induces a chemical reaction, which occurs in milliseconds.

Primary Objective 1: Will the technologies reduce the concentration of MTBE to below 5 ppb?

Primary Objective 2: Will the technologies produce an effluent that meets or exceeds all relevant State of California MCLs for applicable contaminants?

Primary Objective 3: When subjected to uniform formation conditions (UFC), does the effluent meet TTHM and HAA5 requirements of the Stage 2 DBPR?

Primary Objective 4: Will the removal efficiency (percent removal) change over time for these technologies?

From late 1984 to early 1985, approximately 10,800 gallons of gasoline leaked from two storage tanks and piping under the Naval Exchange (NEX) gas station at the Naval Base Ventura County Port Hueneme Site (NBVC). Since 1985, the Navy has taken actions to prevent any further damage to the environment from the leaks. The MTBE remediation technologies demonstrated at NBVC Port Hueneme Site are part of the overall strategy in the NEX Plume Management plan for containment and control of the plume to prevent any further damage to the environment.

Results/Conclusions: Ongoing project

Publications: None