INNOVATIVE POINT-OF-ENTRY (POE) TREATMENT FOR PETROLEUM CONTAMINATED WATER SUPPLY WELLS

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Problem and Research Objectives:

An ongoing study by New Hampshire Department of Environmental Services (NHDES) has been looking at aeration and/or aeration plus granular activated carbon (GAC) as short term POE technologies to be used at contaminated sites. These technologies are considered the standard POE options for underground petroleum storage tank (UST) remediation. However, several problems exist with conventional POE technologies: (1) the combination of aeration plus GAC cannot cost-effectively meet the NHDES standard of 100 mg/L for methyl-t-butyl ether (MTBE); (2) MTBE is poorly removed by aeration and will rapidly exhaust the adsorption capacity of the GAC; (3) the fate of lead in petroleum contaminated ground waters and conventional POE units has not been examined; and (4) non-volatile dissolved organic carbon (NVDOC), which is abundant in petroleum contaminated ground waters, can interfere with conventional POE processes. While the impact of competitive adsorption has been examined for GAC in many surface waters, the impact of NVDOC from petroleum contamination on aeration and GAC has not received extensive study. For these reasons, the research project had three objectives:

- Determine performance and cost effectiveness of removing MTBE with synthetic resins and/or preoxidation rather than GAC.
- Determine the prevalence of lead in petroleum contaminated ground water and its fate in POE treatment systems.
- Determine the effect of petroleum related NVDOC on performance of aeration and sorption POE systems.

Principal Findings and Significance:

Principal findings of the research are as follows:

UV/peroxide oxidation was extremely effective at removing MTBE from petroleum contaminated ground waters. Studies in simulated ground waters showed that greater than 90% removal of MTBE could be obtained in twenty minutes using a 15:1 (peroxide: MTBE) molar ratio (5.8 mg/L peroxide per 1000 mL MTBE). Initial MTBE concentrations up to 10,000 mg/L could easily be treated to meet the NHDES guidelines of 100 mg/L.

Ambersorb Tm (563, 572, 575) resins (Rohm & Haas, Philadelphia, PA) produced by pyrolysis of highly sulfonated styrene-divinylbenzene macroeticular ion exchange resins are a promising alternative to GAC for MTBE adsorption. In simulated ground waters Ambersorb resins had faster adsorption kinetics and about the same capacity as GAC. However, in actual contaminated ground waters AmbersorbTm resins maintained a high capacity for MTBE whereas GAC showed significantly lower capacities.

Sampling of petroleum contaminated water supplies during two seasons found no detectable (less than 0.01 mg/L) lead concentrations in the contaminated ground waters. These data are consistent with transport and fate models which suggest lead compounds will be attenuated (sorbed) by the soil.

Non-volatile dissolved organic carbon (NVDOC) did not significantly reduce the efficiency of aeration systems for removing BTEX 1, 2 DCA and MTBE compounds. Further, NVDOC did not affect GAC adsorption of BTEX or 1, 2 DCA compounds. Removal of MTBE by GAC adsorption was affected by BTEX compounds and studies are ongoing to determine if NVDOC affects MTBE adsorption on GAC.