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TECHNOLOGY EVALUATION

Demonstration Bulletin

Metal-Enhanced Abiotic Degradation Technology

EnviroMetal Technologies, Inc.

Technology Description: EnviroMetal Technologies, Inc. (ETI), of Guelph, ON, Canada, has developed the metal-enhanced abiotic degradation technology to treat halogenated volatile organic compounds (VOC) in water. A reactive, zero-valent, granular iron medium causes reductive dehalogenation of VOCs yielding simple hydrocarbons and halogen salts as byproducts. The ETI technology can be installed and operated aboveground in a reactor, or in situ, as a continuous wall or a "funnel and gate" system.

The SITE Program evaluated an aboveground reactor for remediation of groundwater from the SGL Printed Circuits site in Wayne, NJ over 3 mo during 1994 and 1995. Based on ETI's laboratory studies, the technology was designed to lower chlorinated VOC concentrations below regulatory limits after one pass through the reactive iron medium.

The aboveground reactor design may be used to simulate the treatment process at pilot scale, allowing for measurement, control, modification, and optimization of design and operating parameters, or may be operated as a stand-alone treatment unit. Figure 1 presents a schematic of the aboveground reactor as demonstrated. Contaminated groundwater enters the reactor through an air eliminator, 5-μm water filter (to remove suspended solids which may inhibit flow through the reactive iron medium), and flow meter. Water flows by gravity through the reactive iron medium and into the collector line at the bottom of the reactor, and then exits through the effluent line. The effluent line is plumbed such that about 2 ft of influent water remains ponded above the surface of the reactive iron medium. A passive gas vent in the top of the reactor prevents accumulation of excess pressure. A manhole with a sightglass allows observation of the reactive iron surface and access to the tank interior. The demonstration system included the reactive iron medium, well sand, a fiberglass reactor tank for the aboveground installation, and appropriate ancillary groundwater pumps and piping, where necessary.

Waste Applicability: ETI claims that its system for treating halogenated VOCs in water is an improvement over conventional

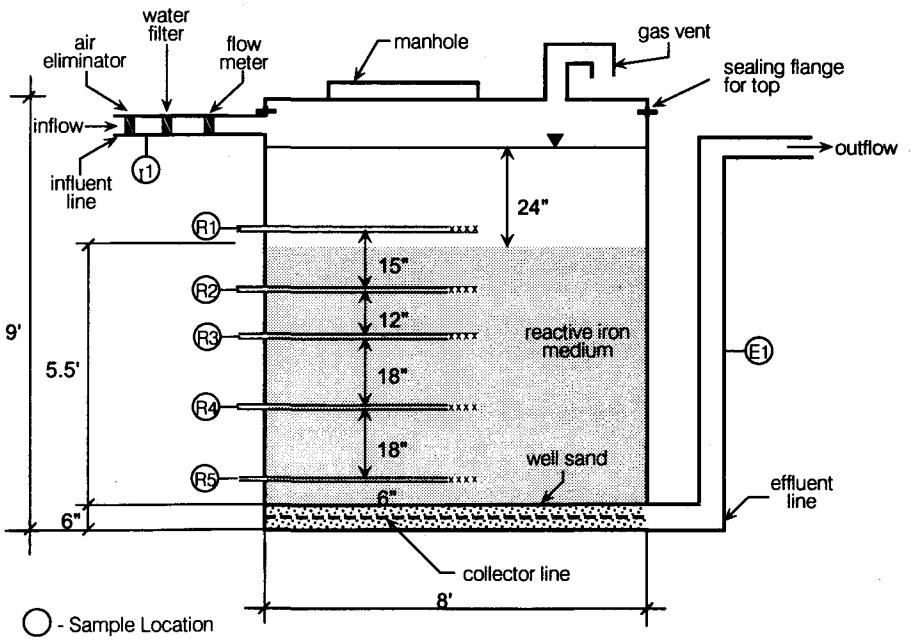

Figure 1. The metal-enhanced abiotic degradation technology as demonstrated.

methods for removing or destroying these contaminants. ETI also claims that its technology is applicable to a wide range of halogenated VOCs in water; the SITE Program examined only chlorinated solvents, primarily trichloroethene (TCE) and tetrachloroethene (PCE). ETI further claims that the technology is a highly efficient dechlorination process requiring minimal maintenance and that contaminants are completely dechlorinated.

Demonstration Results: The primary objectives of the demonstration were 1) to determine whether or not effluent met New Jersey Department of Environmental Protection (NJDEP) and federal maximum contaminant level (MCL) requirements for all chlorinated VOCs detected, and 2) to determine the conversion efficiency of PCE and other chlorinated VOCs. As with all SITE Program demonstrations, data were gathered to evaluate the operating and design parameters, and the costs of using the technology.

Water samples were collected at influent (I1) and effluent (E1) locations weekly over 3 mo and analyzed for VOCs. Water samples were also collected at 5 points within the reactor (R1 - R5) at monthly intervals. Monthly samples were analyzed for VOCs, metals, chloride, sulfate, and inorganic carbon. Field measurements on all samples included pH, oxidation-reduction potential or Eh, temperature, specific conductance, and dissolved oxygen.

Preliminary results indicate that a flowrate of approximately 0.5 gal/min was maintained throughout most of the demonstration period. About 60,833 gal were treated during 13 weeks of sampling.

Table 1 displays preliminary influent and effluent contaminant concentrations in comparison to regulatory limits. Vinyl chloride and cis-1,2-dichloroethene (cDCE) exceeded NJDEP regulatory limits during Week 13. This may be due to higher than expected levels of PCE in the influent, or channeling through the reactor. Conversion efficiency of PCE during the demonstration period exceeded 99.9%. Flow conditions and reaction rates in the iron bed may decrease over time due to precipitation. Complete demonstration results including evaluation of precipitation in the bed and costs of the technology will be published in a Technology Capsule and an Innovative Technology Evaluation Report which will be available late in 1995. The SITE Program will also evaluate a field-scale "funnel and gate" design in 1995. These results will be available in 1996.

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Table 1. *Preliminary Influent and Effluent Concentrations and Regulatory Limits*

	Influent (µg/L)		*Effluent [a] (µg/L)*		*Regulatory Limits (µg/L)*		
Contaminant	*Range*	*Mean*	*Range*	*Mean*	*Limit*	*MCL [b]*	*NJDEP [c]*
PCE	*4,100-13,000*	*7,962*	*ND*	*ND*	*0.9*	*5*	*1*
TCE	*54-590*	*159*	*ND*	*ND*	*0.9*	*5*	*1*
cDCE	*0-1,200 [d]*	*550 [e]*	*1.3-37*	*9.2*	*0.9*	*70*	*10*
Vinyl Chloride	*0*	*0*	*1.2-8.4 [f]*	*4.1*	*0.9*	*2*	*5*

Notes:
µg/L micrograms per liter
ND Not detected
a No contaminants detected until Week 9
b Federal maximum contaminant levels
c New Jersey Department of Environmental Protection site-specific discharge permit standards
d Not detected until Week 6
e Mean of non-zero values only
f Not detected until Week 11

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