

Environmental Bio-Systems, Inc.

TECH MEMO #102: IN-SITU OXIDATION OF PCE & TCE

By Jim Jacobs, CHG, 415-381-5195

THE VOC PROBLEM: Volatile Organic Compounds (VOCs), including tetrachlorethylene (PCE), trichloroethylene (TCE) and dichloroethylene (DCE) and other chemicals are commonly found in former industrial areas. These chemicals were found at the Subject Property.

PAST REMEDIATION OPTIONS: Conventional soil remediation of VOC impacted soil relied on soil excavation, which is expensive and disruptive. In highly permeable soil, soil vapor extraction is popular, but can take a long time to complete and generally requires costly regular operations and maintenance. For groundwater, pump and treat remediation relies on pumps to remove groundwater from the aquifer through a series of extraction wells or trenches. The extracted water was then treated above ground or disposed of off-site. Unfortunately, pump and treat methods have not been shown to be highly effective for treating VOC-impacted groundwater. Although the construction of passive permeable treatment walls containing zero valent iron filings can create the hydroxyl radical that can oxidize VOCs, the passive barriers are expensive and do not treat source areas.



Installation of treatment liquids using the high-pressure Remediation Injection Process (RIP[®])

NEW REMEDIATION APPROACH: Hydrogen peroxide or potassium permanganate can chemically oxidize VOCs forming carbon dioxide and water. ENVIRONMENTAL BIO-SYSTEMS uses both a direct push method as well as a specialized lance system for the delivery of treatment chemicals.

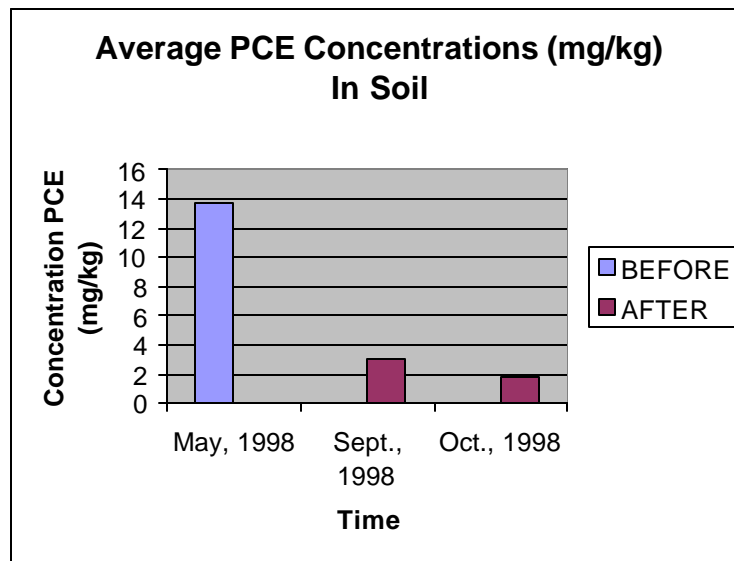
RESEARCH AND CASE STUDY: TUMWATER, WASHINGTON INDUSTRIAL FACILITY: ENVIRONMENTAL BIO-SYSTEMS provided the delivery system for a chemical oxidation. Prior to the treatment, average concentrations of soil were 13.7 mg/kg. Approximately 1,000 cubic yards of soil required remediation. The depth of contamination was 0 to 15 feet. ENVIRONMENTAL BIO-SYSTEMS treated the soil with 18% hydrogen peroxide. The natural iron content in the soil was sufficient for Fenton's Reagent and creating the hydroxyl radical. Adjustment of pH was not needed. ENVIRONMENTAL BIO-SYSTEMS injected 32 ports with approximately 52 gallons of 18% hydrogen peroxide per port. All TCE, DCE and toluene were oxidized during the first treatment event. Some PCE hot spots still

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existed and one month later, a second treatment event was conducted with twenty-one more injection ports, each having approximately 58 gallons per port. An average injection pressure of 2,000 psi was maintained. Soil confirmation samples were collected after each treatment event. Conventional excavation with shoring and off-site disposal costs was estimated at \$500,000. The client spent only a fraction of that amount using the ENVIRONMENTAL BIO-SYSTEMS RIP[®] system. Site closure was granted a few months after the second treatment event. Client reference: MFG, Inc.



COMPANY BACKGROUND: Since 1990, ENVIRONMENTAL BIO-SYSTEMS has been a leader in in-situ remediation. The company has developed proprietary injection remediation technologies, allowing for successful remediations of metals, hydrocarbons, and chlorinated solvents.

RECOMMENDED PLAN: ENVIRONMENTAL BIO-SYSTEMS recommends a review of the existing physical and chemical data, including pH, permeability, lithology, and water depth, concentrations of VOCs, alkalinity, and other data and a simple bench test (5 to 10 working days). The in-situ remediation can occur within 10 to 15 working days after the bench test results are available.

REFERENCES:

Jacobs, J., 2001, In-Situ Liquid Delivery Systems for Chemical Oxidation, Bioremediation and Metals Stabilization, Association for Environmental Health and Sciences, 11th Annual West Coast Conf. on Contaminated Soils, Sediments and Water, March 21, 2001, San Diego, California, Abstracts.

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Jacobs, J., 2001, Passive In-Situ Remediation Technologies, Standard Encyclopedia of Environmental Science and Technology, McGraw Hill, New York, NY, p. 14.12 – 14.25.