Enhanced Bioremediation using Controlled-Release Oxygen Facilitates Site Closure at DoD Site

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SITE BACKGROUND

Hill Air Force Base houses the former Defense Distribution Depot located in Ogden, Utah. The Depot was closed in September 1997 and building #321 was formerly used as a gasoline re-fueling station. Originally, the site contained four aboveground storage tanks, one underground storage tank (UST), one aboveground propane tank, one fuel dispenser island, and two attendant buildings. Based on previous environmental site investigation work, soil and groundwater were determined to have been impacted with petroleum-based fuel hydrocarbons, resulting from the former operation of the fueling system at the site. Total petroleum hydrocarbons as gasoline (TPHg) had reached more than 1,000 micrograms per liter (ug/L) on-site while benzene, toluene, ethylbenzene, and xylene (BTEX) concentrations were more than 100 ug/L.

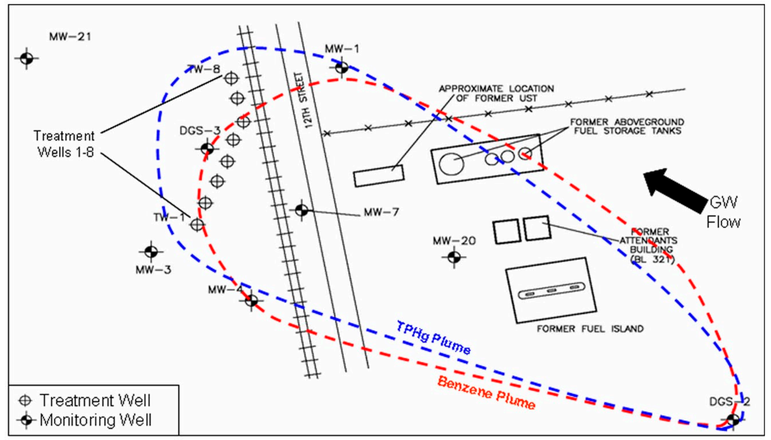


Figure 1. Isoconcentrations of Benzene Plume and TPHg Plume

The State of Utah Department of Environmental Quality (UDEQ), Division of Environmental Response and Remediation (DERR) required that corrective action be conducted to reduce contaminant concentrations to less than the Risk-Based Corrective Action (RBCA) Tier 1 levels. The corrective actions at the site included the removal of all aboveground structures and underground petroleum pipelines, the excavation and removal of approximately 1,120 yd^3 of contaminated soil, the installation of groundwater monitoring wells at various locations across the site, the installation of a row of groundwater treatment wells near the leading edge of the known groundwater plume, and the injection of Oxygen Release Compound (ORC®) to enhance biodegradation of residual hydrocarbons.

TREATMENT APPROACH

Figure 2. ORC and ORC Advanced Filter Socks - 2", 4", and 6"

The former UST area (source) was excavated down to the top of the water table (~10 feet bgs). The top 2 feet of clean backfill (8-10 feet bgs) material was blended with granular ORC and placed in the excavation for treatment of the vadose zone.

To reduce petroleum hydrocarbons within the sand and clay subsurface, an ORC Filter Sock program was implemented. In Treatment Wells 1-8 (Figure 1), ORC Filter Socks (Figure 2) were installed from approximately 10 feet below ground surface (bgs) to 20 feet bgs using rope (Figure 3). A sampling program was structured to observe concentration reduction.

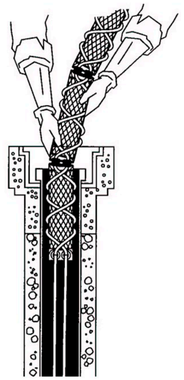
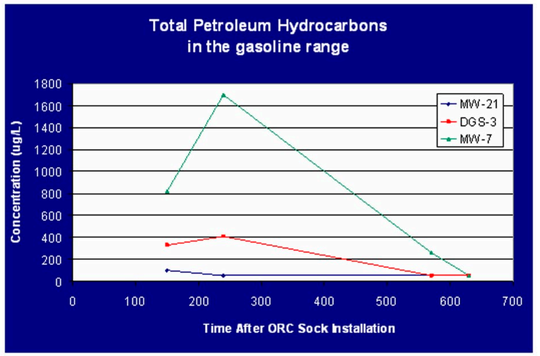
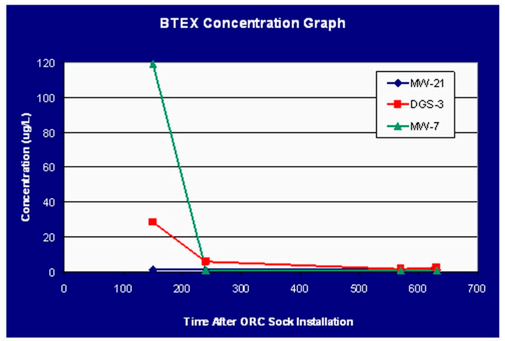


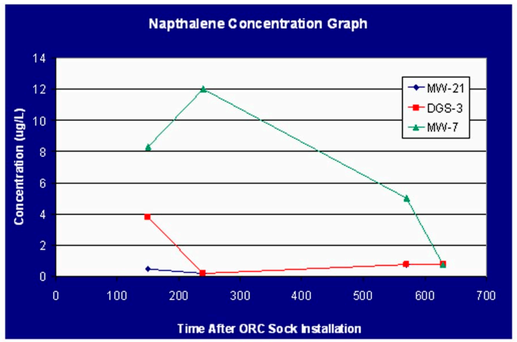
Figure 3. ORC Sock Installation

RESULTS

- **A high in TPHg, BTEX, and naphthalene was observed in well MW-7 followed by a significant reduction.**
- **In MW-7, TPHg concentrations declined from 1,700 to 53 ug/L within 8 months, a 97% reduction.**
- **A BTEX reduction to below 2 ug/L was observed in MW-7, DGS-3, and MW-21.**
- **Naphthalene concentrations declined to below 1 ug/L in all wells.**







Successful Reduction using ORC

Four groundwater monitoring events were performed to evaluate the quality of groundwater beneath the site with respect to petroleum hydrocarbon contamination and to assess the effectiveness of the ORC Filter Socks. The results of the sampling revealed that TPHg, BTEX, and naphthalene were non-detect or measured at concentrations below the screening levels established by the State of Utah DERR.

No Further Action

Since the conditions of the DERR corrective action plan were met, in November of 2000, Insight, EE&C, Inc. requested that no further action status be granted and that the site be closed.