Approaching Closure at a Fuel Oil Recovery Site Along a Pier Using a Vertical Impermeable Barrier and Interceptor Trench

Robert E. Strahle, P.E[1], Robert W. Magee, P.G.[2], Katherine M. Lista, P.E.[3]

This presentation is a case study on the success of a petroleum recovery project at a Navy facility in Norfolk, Virginia where over 16,700 gallons of free product were recovered and approval was obtained from the Virginia Department of Environmental Quality (VADEQ) to cease active product recovery operations. Based on known site history, the product originated from several sources, had properties similar to a No. 2 fuel oil, and had migrated along several piers and into a nearby sensitive body of water. The project strategy was to intercept the product plume with a vertical impermeable barrier to stop the product from migrating into the nearby harbor and to remove the source by capturing the product with an interceptor trench. This combination provided a unique application of innovative and tested technologies that shortened the duration of the cleanup and provided a responsive and effective solution for stopping the product from migrating into the harbor. Underground steam vaults were used to reduce the trenching and piping costs, which are normally expensive in a pier area full of utility unknowns. After system startup and initial operation, the groundwater treatment system portion of the project was modified to include the addition of a microbiological control agent to prevent biological growth and fouling of process equipment.

The Piers 11-19 area at the Naval Amphibious Base in Little Creek, Virginia is a heavily used facility for servicing ships. In the late 1970's, during the construction of a new wastewater pipeline, fuel-impacted soils and groundwater were observed in the vicinity of the piers. Subsequent investigations in the 1980's and early 1990's revealed that the source of the fuel impacted soils was most likely the result of dust control practices and a leaky underground fuel oil supply pipeline in the 1950's and 1960's. During the initial investigations, it was determined that removal of the unsaturated soil was not feasible due to the "low variable concentrations over a large area" and that "most of the area lies beneath a heavily used parking lot" (R.E. Wright, 1982). Site Characterizations between 1990 and 1993 identified two separate petroleum hydrocarbon product plumes along the pier front. The Southern Plume was located near Piers 12-14 and the northern plume was located near Piers 16 through 18. Within these plumes, free product thickness ranged from 0.03 feet to 8 feet.

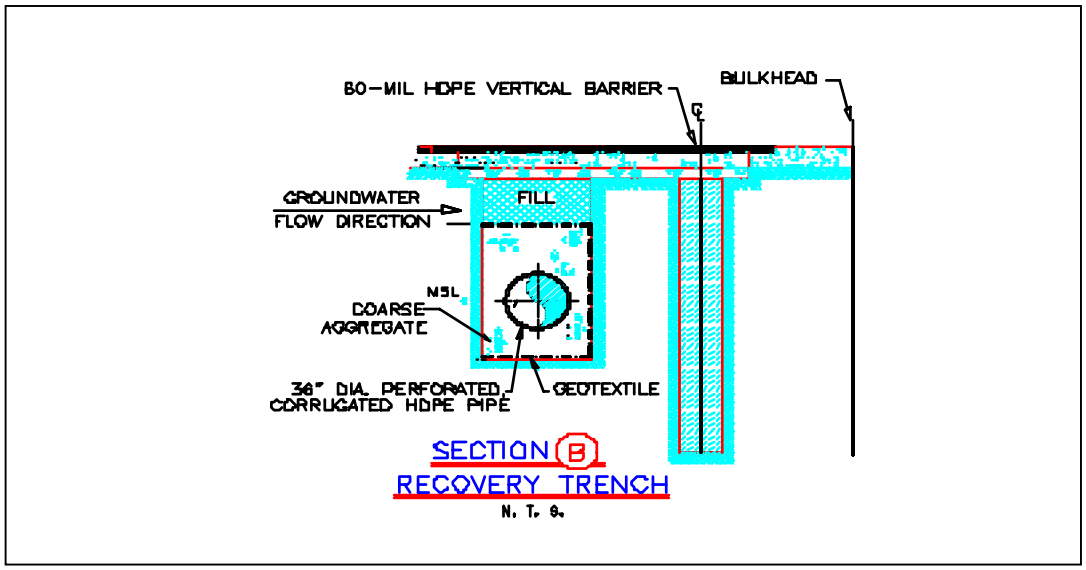
---

[1] Project Manager, OHM Remediation Services/The IT Group, 200 Horizon Center Boulevard, Trenton, NJ 08691, Ph: (609) 588-6343, Fax: (609) 588-6403, rstrahle@theitgroup.com

[2] Remedial Project Manager, Atlantic Division, Naval Facilities Engineering Command, Code EV21RM, 1510 Gilbert Street, Naval Base Norfolk, Norfolk, VA 23511-2699, Ph: (757) 322-4766, Fax: (757) 322-4804, MAGEERW@efdlant.navfac.navy.mil

[3] Sr. Project Manager, OHM Remediation Services/The IT Group, 2200 Cottontail Lane, Somerset, NJ 08873-1248, Ph: (732) 469-5599, Fax: (732) 469-7275, klista@theitgroup.com

A vertical impermeable barrier (60-mil HDPE) was installed to prevent product in the subsurface from migrating into the nearby harbor (Figure 1). The vertical impermeable barrier was installed using a horizontal single-pass-trenching machine adjacent to the existing bulkhead, downgradient of the recovery trenches.



The system was designed so that a total of 5 recovery trenches were located downgradient of the product plumes and upgradient of the vertical impermeable barrier. Three recovery trenches covered the northern product plume and two covered the southern product plume for a total length of 325 liner feet for all 5 trenches. The groundwater was locally depressed at the end of each recovery trench (at a manhole/sump) using a submersible groundwater depression pump. The depression of the groundwater in the vicinity enhanced product migration to the trench. The product collected in the trench until it reached a thickness sufficient enough to activate the product-only pump. Product was then pumped directly to the product recovery holding tank in the treatment building. The groundwater recovered during the depression pumping was also transferred to the treatment building where it was treated and discharged to Little Creek Harbor. Product was then disposed of offsite at the local Naval Public Works Center (PWC) oil recovery facility.

The first unit in the groundwater treatment system was an equalization tank, where water generated by the groundwater depression pumps at the trenches was directed. The collected groundwater was transferred by air operated double-diaphragm pumps through a bag filter to a coalescing oil/water separator (OWS) for removal of the remaining free-phase product. The water was then passed through a series of activated carbon units as a final polishing step to treat the dissolved-phase volatile organic compounds (benzene, toluene, ethylbenzene, and naphthalene) prior to discharging to the harbor.

As system operation entered the startup phase, severe fouling of the bag filters and OWS was encountered. A brown/black oily sludge was observed clogging the OWS media and a significant amount of effort was required to remove and clean the process equipment. Testing was conducted on the sludge fouling the equipment and a microbiological control agent (biocide) was employed to prevent biological growth and fouling of process equipment. The biocide was injected into the untreated water (equalization) tank at a concentration that would degrade to less than 0.5 parts per million before entering the harbor. As a result of the modification, system downtime and fouling of equipment components was reduced.

One major concern for the actual construction of the remediation system was the presence of various buried obstacles in the area between the proposed recovery trenches and the groundwater treatment building. The obstacles included underground utilities, former bulkheads, general buried debris and the steam vaults. In order to minimize the amount of open trenching in this area, special piping and brackets were used to allow installation of the product piping, groundwater piping, and electrical and control conduits within the existing steam vaults. The special piping and brackets were required due to the harsh environment of the underground steam vaults including high temperature and humidity. Although the work within the steam vaults required confined space entry, it was determined that the cost was offset with the possible difficulties with open trenching and the heavy use of the parking area.

In October 1998, approximately three years after system operation began, the Navy received approval from the VADEQ to shut down recovery operations in the southern trenches. Eight months later, in June 1999, approval was received to shut down recovery operations in the northern trenches. In February 2000, based on product thickness history since the shutdowns, the Navy requested and received approval from the VADEQ for a reduction in monitoring and sampling and is currently working on negotiating the dismantlement of the treatment system. The success of this project is an example of how traditional technologies can be adapted to specific site conditions and coupled with proper planning and open customer/client cooperation can achieve site closure.

References:

Extent of Subsurface Fuel Contamination – NABLC, RE Wright Associates. October 1982.
Corrective Action Plan – Little Creek Piers 11-19, Obrien & Gere. August 1993.
Final Workplan, OHM Remediation Services. September 23, 1994.
Startup Report, OHM Remediation Services August 9, 1996.
Contractor Closeout Report, OHM Remediation Services. June 27, 1997.