

Application of Multiple Remedial Techniques and Approaches (In Situ/Ex Situ) at the Ewan Property Superfund Site

David J. Russell, P.E., BCEE, LSRP (david.russell@aecom.com) and Patricia Jannett
(AECOM, Princeton, NJ)
Christopher P. Wong, P.G. (AECOM, Conshohocken, PA)

ABSTRACT: The Ewan Property Superfund Site is located in Shamong Township, Burlington County, New Jersey in the Pinelands National Reserve (Pinelands). The Pinelands area of New Jersey is considered to be an environmentally sensitive area with conservative groundwater cleanup standards of pristine or background. Site remediation was addressed in two operable units, referred to as Operable Unit 1 (OU-1) and Operable Unit 2 (OU-2). OU-1 addressed the source material and heavily contaminated soils and OU-2 addressed lesser contaminated soils and contaminated groundwater. A groundwater recovery, treatment and reinfiltration system was designed and operated for several years. However, the rate of contaminant mass recovery reduced quickly and remedy evaluations to remediate residual sources not addressed were conducted to move the site more quickly toward closure. This Case Study provides a summary of how multiple remedial technologies (in-situ and ex-situ) were implemented to bring a Superfund Site toward closure in an expeditious manner within the OU-2 Record of Decision (ROD).

Several in situ technologies were pilot tested to address areas of residual contamination that were not being effectively addressed by the groundwater recovery and treatment system. High vacuum dual phase extraction was implemented in two areas of residual contamination to improve mass recovery in these areas. A source removal program was also implemented at a third area of residual contamination. This was all conducted while the groundwater recovery and treatment system continued to operate, providing hydraulic control of the plume. The integration of these remedial technologies effectively expedited the remedial action. Once the residual sources were effectively addressed, a comprehensive natural attenuation evaluation was conducted for impacted groundwater to demonstrate that the remaining residual dissolved groundwater impacts would naturally attenuate in a reasonable period to the required Pinelands groundwater quality standards. Based upon the findings of this evaluation, USEPA approved termination of active remediation with monitored natural attenuation for residual groundwater impacts.

The site is currently in the process of site restoration to return the site to indigenous Pinelands conditions. This Superfund Case Study presents effective use of the flexibility of the remedial process integrating various remedial technologies within the ROD to reach remedial objectives more expeditiously. The remedy implemented at this Superfund Site provides an example of how maintaining “status quo” under a ROD may not be the most effective means to remediate the site. The remedy should continue to be evaluated to identify supplemental means to reach the remedial objectives in an expeditious manner. This Superfund Case Study also demonstrates how the PRP Group, Contractor and Regulator can cooperate in formulating the most effective way of remediating the site.

INTRODUCTION

The Ewan Property Superfund Site has been addressed in two remedial phases. Operable Unit 1 (OU-1) addressed buried drums, disposal trenches, and heavily contaminated soils. The Operable Unit 2 (OU-2) remedy addressed the remaining moderately and residually contaminated soils and contaminated groundwater. The OU-2 ROD was issued on September 29, 1989. Extraction, treatment and on-Site reinfiltration of treated groundwater was selected as the remedial action for both contaminated groundwater and lesser contaminated soils. This remedial technology was supplemented by multiple remedial technologies to meet the Response Action Objectives in a timely manner.

Site Description. The Ewan Property Superfund Site is in the Atlantic Coastal Plain physiographic province. The Cohansey Sand immediately underlies the Site and is composed of unconsolidated sands, silts and fine gravel; it averages 85 feet thick. A discontinuous clay layer partially separates the Cohansey Sand from the underlying Kirkwood Aquifer, but the two aquifers are considered to be hydraulically linked at the Site. The deeper Kirkwood Aquifer is at a depth of approximately 85 feet. The Site borders the Pinelands Agricultural Production Area and is within the Pinelands Preservation Area, located within the central Pine Barrens area of the New Jersey Pinelands. This area is considered ecologically sensitive and development is guided by the Pinelands Comprehensive Management Plan administered by the New Jersey Pinelands Commission in cooperation with units of local, state and federal governments. The Cohansey and Kirkwood Aquifers are the primary potable drinking water supplies for local residents. An unnamed tributary to Springer's Brook is located adjacent to the northern and western boundaries of the property.

REMEDIAL ACTIONS

The Ewan Property Superfund Site has been addressed in two remedial phases: Operable Unit 1 (OU-1) and Operable Unit 2 (OU-2) supplemented by additional remedial technologies.

Operable Unit 1. An estimated 3,820 drums and 14,000 cubic yards of contaminated soil were excavated to a depth of approximately 10 feet for off-site disposal from 35 disposal trenches in the seasonally unsaturated zone. During excavation, many of the drums were found to be damaged or disintegrated. Trench excavations were backfilled with a combination of soil from an off-site borrow pit and Site soil of acceptable quality generated during excavation. At the conclusion of OU-1 remedial construction, confirmatory sidewall



FIGURE 1. Site plan showing soil excavation areas and sample locations exceeding applicable soil criteria.

samples were collected within the excavation trenches to assure that the soil remedial objectives had been attained. An earthen berm was constructed around the perimeter of the excavation area to prevent stormwater run-on and run-off.

Concurrent with the OU-1 Remedial Construction activities, wetlands mitigation was conducted to create and restore three acres of wetlands that were impacted by the remedial action and the construction of the Site access road. The created and restored wetlands were developed in conjunction with the NJDEP and the Pinelands Commission, to be consistent in vegetative characteristics with local wetlands. The wetland-monitoring program was conducted to verify the overall health and condition of the on-Site wetlands, and to ensure that the wetlands that had been created as part of the mitigation activities remain viable and healthy.

Operable Unit 2. Extraction, treatment, and on-Site reinfiltration of treated groundwater was chosen as the remedial action for both contaminated groundwater and lesser contaminated soils. Treated effluent was reinfiltrated into the underlying aquifer within the plume boundaries until the groundwater Remedial Objectives were met. Residual contaminated soils would be remediated via flushing. After remediation was complete, the disposal areas would be restored to their indigenous condition.

The remedial system was designed to handle a flow of more than 200,000 gallons per day. Six reinfiltration basins were constructed, covering approximately 200,000 square feet. In September 1999, the remedial system entered the long-term operation and maintenance phase. The groundwater extraction, treatment, and reinfiltration system was designed to achieve the following objectives: establish hydraulic control of the contaminant plume via a closed loop system; aquifer restoration to meet maximum contaminant levels (MCLs), and the New Jersey Class 1-PL standards, by the extraction of aqueous-phase contaminants for ex-situ treatment; and reinfiltration of the treated effluent within the plume boundaries.



FIGURE 2. On-Site treatment system building as seen from reinfiltration basins.

Saturated zone flow modeling was conducted using aquifer hydraulic characteristics generated during the OU-1 and OU-2 remedial design investigations. Based on the model results, an extraction system was designed that consisted of seven extraction wells and a total extraction rate of 200 gallons per minute (gpm).

Dual Phase Extraction. As a result of the on-going monitoring programs and investigations described above, two residual hot spot soil areas (TC-32 and TC-33) were previously identified on site. These two areas were addressed through supplemental actions. During 2003 and 2004, the PRPs conducted a dual phase extraction (DPE) pilot

study. The study involved piloting contaminant recovery in soil vapor and aqueous phases from TC-32 and TC-33 areas. The results of the pilot study revealed that the DPE technology would address residual contaminant areas more efficiently and in a shorter amount of time than the current full-scale ground water remediation system. In mid-2004, the full-scale DPE operation was initiated. Termination of continuous operation of the groundwater recovery, treatment and reinfiltration system, with continued operation of the DPE system to address residual contamination, was implemented on June 2006. The DPE system continued to operate until 2011. Because of significantly lower flow rates generated by DPE, the extracted water underwent batch treatment in the full-scale treatment plant, twice a week, followed by recharge of the effluent through the existing reinfiltration network.



FIGURE 3. DPE system during pilot study.

The OU-2 groundwater treatment methods, composed of both the full-scale pump and treatment, and the DPE systems, operated effectively. They contained the plume, and significantly reduced levels of groundwater contamination in most areas. Approximately 304 pounds of contaminants were recovered through treatment of the groundwater via the full-scale treatment system, and an additional 190 pounds were removed through the DPE system for a total of 494 pounds. Approximately 468,930,499 gallons of contaminated groundwater were extracted and treated.

Soil Removal. In 2004, a soil sampling program was conducted to identify if any other soil hot spots remained within the recharge basin area, and to determine the overall effectiveness of the soil flushing part of the original remedy.

In June 2004, soil excavation was conducted in the vicinity of monitoring well TC-30, where periodically Light Non-Aqueous Phase Liquid (LNAPL) was observed. Approximately 1,100 cubic yards of contaminated soil



FIGURE 4. 2012 soil excavation in the vicinity of well TC-32.

was removed from this area of residual contamination that had been identified through the

soil sampling program. Subsequent groundwater monitoring confirmed the effective source removal in this area.

In November 2012, the TC-32/VE-2 removal action was completed. This removal action consisted of the excavation of soil previously delineated in the TC-32/VE-2 area, collection of excavation base and sidewall confirmatory soil samples, and collection of soil samples from the excavated clean soils. Approximately 600 tons of soil were excavated from the TC-32/VE-2 area, and transported off-site for disposal. During the remedial action, approximately 15,000 gallons of groundwater accumulated in the excavation and was pumped to the treatment plant for treatment and subsequent discharge. Groundwater monitoring in the vicinity of TC-32/VE-2 confirmed that the soil removal action effectively remediated the residual concentrations in this area.

GROUNDWATER QUALITY

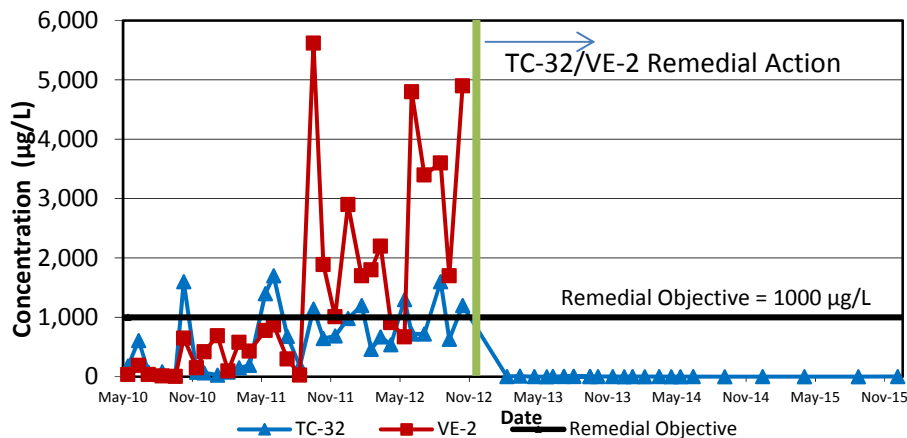
The Record of Decision (ROD) for Operable Unit 2 (OU-2) of the Ewan Property Superfund Site identified Remedial Objectives for Site groundwater quality to demonstrate compliance. Site groundwater monitoring data has demonstrated that groundwater in all Site monitoring wells is approaching the Remedial Objectives. Only two wells located in two different areas of the Site are not consistently meeting the Remedial Objectives, concentrations in these two wells fluctuate above and below the Remedial Objectives. The exceedances are, inconsistent, negligible and are expected to attenuate over time. A Classification Exception Area (CEA) boundary was applied to the Site and CEA Compliance Criteria developed based upon the applicable aquifer (Pinelands National Reserve Groundwater Quality Criteria (NJAC 7.9C-1.7b). This CEA boundary is provided with Site groundwater quality compared to the site-specific Pinelands Preservation Area Criteria (Class I-PL).

Groundwater quality data from groundwater monitoring wells within the reinfiltration basins support the conclusion that VOC and SVOC concentrations have decreased over time and are currently at levels at or below the Remedial Objectives with the exception of sporadic detections.

Based upon groundwater quality conditions, the maintenance of the groundwater recovery and treatment system as an active remedial action was no longer required. Decommissioning of the groundwater treatment plant was initiated in November 2014.

Plant decommissioning was completed in May 2015. Groundwater recovery and treatment system demolition activities were completed in October 2015. No further discharge will occur as the decommissioning of the recovery and treatment system is complete. Site restoration activities were initiated in November 2015 and were completed in the spring of 2016.

**FIGURE 5. Toluene Concentrations over Time
TC-32/TC-32R and VE-2.**



Analysis for 1,4-dioxane during the April 2016 sampling event was conducted due to the revised NJDEP Groundwater Quality Interim Specific Criterion of 0.4 µg/L. 1,4-Dioxane was not detected in any of the 19 wells sampled during the 2016 tri-annual groundwater monitoring event. 1,4-Dioxane was also not detected in any of the 53 wells sampled during the August 2016 annual groundwater monitoring event, confirming that 1,4-dioxane is not a constituent of concern for the Site.

As part of the remedial action, an off-site residential well sampling program is conducted at nine downgradient residential wells and a private pond, to ensure that no Site-related contamination is impacting local potable wells or surface waters. The nearest downgradient wells are located approximately ¾ miles southwest of the Site. Off-site wells are sampled on a five-year basis. The off-site well sampling conducted in 2016 confirmed that there were no impacts to off-site wells.

CONCLUSIONS

Implementation of the remedy at the Ewan Property Superfund Site presents effective use of the flexibility of the remedial process, integrating various remedial technologies within the ROD to reach remedial objectives more expeditiously. The remedial activities conducted provide an example of how maintaining “status quo” under a ROD may not be the most effective means to remediate the site. The remedy should continue to be evaluated to identify supplemental means to reach the remedial objectives in an expeditious manner. This case study also demonstrates how the PRP Group, Contractor and Regulator can cooperate in formulating the most effective way of remediating the site.

REFERENCES

- Final Report for Remedial Construction, Operable Unit One, Ewan Property Site, Shamong Township, New Jersey*, prepared by McLaren Hart Corporation, Submitted to the U.S.E.P.A. Region 2, for the Ewan Site PRP Group, October 1995.
- IC-7 Corrective Action Plan Supplemental Investigation Report, Volumes I and II, December 2002, Revised July 2004, Operable Unit Two, Ewan Property Site, Shamong Township, New Jersey*, prepared by Earth Tech, Inc.; submitted to the U.S.E.P.A. Region 2, for the Ewan Site PRP Group.
- In-Situ Remediation Pilot Study Report, October 2003, for the Ewan Site PRP Group, Operable Unit Two, Ewan Property Site, Shamong Township, New Jersey*, prepared by Earth Tech, Inc.; submitted to the U.S.E.P.A. Region 2.
- Wetland Creation Area Monitoring Program 2004 Annual Report for the Ewan Site, Operable Unit Two, Ewan Property Site, Shamong Township, New Jersey, April 2005*, prepared by Earth Tech, Inc.; submitted to the U.S.E.P.A. Region 2, for the Ewan Site PRP Group.
- Focused Subsurface Soil/Groundwater Seasonally Saturated Zone Sampling Report, September 2005*, prepared by Earth Tech Inc.; submitted to the U.S.E.P.A. Region 2, for the Ewan Site PRP Group.
- Off-Site Well Sampling Report, November 2006*, prepared by Earth Tech, Inc.; submitted to the U.S.E.P.A. Region 2, for the Ewan Site PRP Group.
- Comprehensive Evaluation of Dual Phase Extraction as the Sole Remedy, March 2007*, prepared by Earth Tech Inc.; submitted to the U.S.E.P.A. Region 2, for the Ewan Site PRP Group.
- Letter Evaluating Monitored Natural Attenuation and Proposing a Revised CEA for the Ewan Superfund Site, October 2009*, prepared by AECOM; submitted to the U.S.E.P.A. Region 2, for the Ewan Site PRP Group.

DPE System Operation Using a Phased Pumping Approach Pilot Test Report, June 2011, prepared by AECOM; submitted to the U.S.E.P.A. Region 2, for the Ewan Site PRP Group.

TC-32 & VE-2 Soil Remedial Program Report, February 2013, prepared by AECOM; submitted to the U.S.E.P.A. Region 2, for the Ewan Site PRP Group.

Off-Site Well Sampling Report, June 2016, prepared by AECOM; submitted to the U.S.E.P.A. Region 2, for the Ewan Site PRP Group.

Groundwater Recovery and Treatment System Demolition Report, January 2016 prepared by AECOM; submitted to the U.S.E.P.A. Region 2, for the Ewan Site PRP Group.

Ewan Property Site Restoration Report, August 2016, prepared by AECOM; submitted to the U.S.E.P.A. Region 2, for the Ewan Site PRP Group.