

**INTERIM REMEDIAL ACTION REPORT  
FOR  
HAVERTOWN PCP SITE  
Operable Unit 3 (OU-3)**

**HAVERTOWN, PENNSYLVANIA**

*Prepared for:*  
**U.S. Environmental Protection Agency, Region III  
Philadelphia, PA**

**Submitted by:  
Tetra Tech, NUS, Inc.  
240 Continental Drive, Suite 200  
Newark, Delaware**

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**SUBMITTED BY:**

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**Harish Mital, PE  
Project Manager  
Tetra Tech NUS, Inc.  
Newark, Delaware**

**APPROVED BY:**

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**Neil Teamerson  
Program Manager  
Tetra Tech NUS, Inc.  
King of Prussia, Pennsylvania**

**ACCEPTED BY:**

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**James Webb  
Associate Director  
Office of Superfund Site Remediation  
U.S. Environmental Protection Agency  
Region 3  
Philadelphia, PA**

## TABLE OF CONTENTS

<b><u>SECTION</u></b>	<b><u>PAGE</u></b>
1.0 INTRODUCTION .....	1
2.0 Operable Unit 3 (OU-3) Background .....	4
3.0 Construction Activities .....	8
4.0 OU-3 Chronology of Events .....	10
5.0 Performance Standards and Construction Quality Control .....	12
6.0 Final Inspection and Certifications .....	13
7.0 Operation and Maintenance Activities .....	13
8.0 Summary of Project Costs .....	15
9.0 Observations and Lesson Learned .....	15
10.0 Operable Unit Contact Information .....	15

## ATTACHMENTS

Attachment A	Detailed Construction Activities and Erosion & Sediment Control Permit
Attachment B	ROS Area Excavation - Field Screening Sampling Data
Attachment C	ROS Area Excavation – Confirmatory Sampling Data
Attachment D	ROS Area Soil- Characterization and Off-Site Disposal Data
Attachment E	On-Site Soil Proctor and Compaction Test Results and Backfill/Topsoil Data
Attachment F	McCandless Lot - Soil Sampling Data
Attachment G	Recovery Wells (RW-7 thru RW-10) and Monitoring Wells (CW-32 thru CW-34) Boring Logs
Attachment H	Pump Test Reports
Attachment I	Groundwater Sampling Data
Attachment J	Site Progress Meeting Minutes
Attachment K	Copy of Field Reports
Attachment L	Site Photographs

## LIST OF FIGURES

Figure 1	Site Location Map
Figure 2	Overall Site Plan- OU3 Construction Plan
Figure 3	Site Easement Plan
Figure 4	ROS Area - Excavation Cells layout
Figure 5	ROS Area wells – Enlarged Plan
Figure 6	McCandless Lot- Soil Sampling Locations

## 1.0 INTRODUCTION

The United States Environmental Protection Agency (EPA), in accordance with provisions of the Remedial Action Contract (RAC) Number EP-S3-07-04 and as Work Assignment 036-RARA-0354, authorized Tetra Tech to perform Technical Assistance during the implementation of Remedial Action (RA) phase for Operable Unit 3 (OU3). OU3 consists of contamination from the site contaminants of concern (COCs) in deep groundwater in the immediate vicinity of the former National Wood Preserver (NWP) operation and adjacent properties (Source area) and soil and groundwater contamination identified in the Recreation and Open Space (ROS) area, located in Haverford Township, Pennsylvania.

During the OU-3 feasibility study phase, OU-3 was subdivided into two operable sub-units—OU-3A and OU-3B (Tetra Tech, 2007). OU-3A addressed contamination related to deep groundwater in the Source area, whereas OU3B addressed contamination in the ROS area. For the purposes of this report, the two areas will be hereafter referred to simply as OU-3.

This Interim Remedial Action (RA) Report presents the implementation of the OU-3 Basis of Design (BOD) Report (Tetra Tech, 2009), for the remedies identified in the Record of Decision (ROD). This report presents the details of the additional groundwater recovery system in the Source area, remediation of ROS area, in-situ flushing in the Source area, ecological monitoring, and groundwater monitoring and system operations and maintenance as they relate to the Source and ROS areas.

### 1.1 Site History

The Havertown PCP Superfund site is located in Havertown, Haverford Township, Delaware County, in southeastern Pennsylvania (Figure 1). The site is located approximately 10 miles west of Philadelphia and is surrounded by commercial establishments, industries, parks, schools, and residential homes.

The Havertown PCP site covers approximately 12 to 15 acres, but has no distinct boundaries. It is roughly delineated by Lawrence Road and Rittenhouse Circle to the south, the former Penn Central Railroad (PCRR) tracks to the north, fencing on the Continental Motors property to the west, and Naylor's Run to the east.

The site was formerly used as a wood-treatment facility operated by National Wood Preservers (NWP) on property owned by Clifford Rogers. Because of the facility's methods of waste disposal, the property's soil and groundwater in the area are contaminated. The contaminated groundwater in the shallow zone migrates to the east underneath Eagle Road.

The Havertown PCP Site was first developed as a railroad storage yard and later became a lumberyard. In 1947 the wood-preserving facility was constructed and operated by Mr. Samuel T. Jacoby. In 1963 the existing facility was purchased by the Harris Goldstein family.

In 1962 the Pennsylvania State Department of Health became aware of contaminants in Naylor's Run, and linked the source of contamination to National Wood Preservers' waste disposal practices.

The majority of the activities resulting in pollution to the water bearing strata (aquifer) beneath the site occurred during the years of 1947 to 1963. Approximately one million gallons of spent wood preservatives are believed to have been dumped into a 26-foot deep well on property adjacent to the NWP property that was leased from Clifford Rogers to Shell Oil Company. This disposal practice appears to be the major source of contamination.

In 1972 the Pennsylvania Department of Environmental Resources (PADER), now known as Pennsylvania Department of Environmental Protection (PADEP), identified contaminated groundwater discharging from a storm sewer into Naylor's Run. PADEP ordered NWP, Philadelphia Chewing Gum Company (owners of the property downgradient from NWP), Shell Oil Company (lessee adjacent to Clifford Rogers property), and Mr. Clifford Rogers (owner of property leased to NWP) to clean up Naylor's Run, since they occupied land where contaminated groundwater exists. The above parties appealed to the State Environmental Hearing Board, and later to the Commonwealth Court of Pennsylvania. The court sustained Philadelphia Chewing Gum and Shell Oil Company's appeals and ordered the cleanup to be executed by NWP and Mr. Rogers. Implementation and maintenance of the cleanup actions by NWP and Mr. Rogers were inadequate, however, and failed to address all of the environmental concerns both on and off the site.

In response to a request from PADEP in 1976, the EPA initiated cleanup activities under Section 311 of the Clean Water Act. Cleanup activities occurred in two phases. The first phase established containment operations at Naylor's Run. Filter fences were installed to remove pentachlorophenol (PCP) contaminated oil from the surface water. These fences were located just downstream from the outfall of the 24-inch storm sewer pipe and a 12-inch sanitary sewer was sealed; however, contaminated groundwater still discharged into Naylor's Run from the 24-inch storm sewer pipe.

In 1982 EPA ended containment operations in Naylor's Run, when NWP agreed to maintain in-stream treatment measures pursuant to a consent agreement with EPA. However, subsequent inspections revealed NWP was not properly maintaining the filter fences.

The Havertown PCP Site was listed on the National Priorities List by the EPA in December 1982. Subsequently, PADEP signed an agreement with EPA to conduct a Remedial Investigation/Feasibility Study (RI/FS) at the site.

Because of continuing releases of PCP-contaminated oil into Naylor's Run, in 1988 EPA's Emergency Response Team installed a catch basin in Naylor's Run to trap the discharge from the storm pipe.

According to the RI performed by PADEP in 1988, at least six wood-treatment chemical solutions had been used at the NWP facility since its construction. The primary COCs at the site are the result of wood-treatment operations at NWP; these COCs are PCP, chlorinated dioxins and dibenzofurans (typical low-level contaminants in the manufacture of PCP), fuel oil and mineral spirits components, heavy metals, certain volatile organic compounds (VOCs), and phenols. These materials are primary constituents or impurities of the various wood-treatment solutions used at NWP since operations began in 1947.

The cleanup of the site was initially divided into two operable units—OU-1 and OU-2 (OU-3 was added later). OU-1 focused on addressing on-site soils, staged waste materials, and the storm sewer effluent at the catch basin in Naylor's Run. OU-2 focused on the existing shallow groundwater aquifer. OU-3 addresses groundwater throughout the site and soil contamination in the ROS area.

## **1.2 Operable Unit 1 (OU-1) Remedy Implementation**

EPA issued the first ROD for the site in September 1989 (hereinafter, 1989 ROD) for an interim remedial action. This ROD identified remedies for the three areas of contamination to address on-site soil, surface water, and disposal of the contaminated drums on-site. The No-Action alternative for on-site soils was originally chosen, as it achieved the remedial action objectives. The potential threat to the public's health associated with contaminated dust and infiltration of contaminants into the environment was believed to pose no significant risk to human health.

The recommended alternative for cleaning up the contaminated waste staged on site was to landfill the soil and oily debris, as well as off-site treatment of aqueous waste. Off-site treatment of the liquid waste was recommended because it could be more readily implemented and would not require discharging effluent to Naylor's Run. EPA successfully removed and disposed of approximately 245 55-gallon drums of waste during the first phase of the cleanup. Also during the first phase, a tanker was emptied of 4,721 gallons of liquid waste and 100 gallons of sludge which were properly disposed. The second phase included removal and disposal of 30 55-gallon drums.

The installation of an oil/water separator (OWS) at the point where contamination discharged into Naylor's Run was chosen as the best alternative to address the contamination of surface water. During installation of the OWS, 11,850 pounds of solid waste and 395 gallons of liquid waste were generated and properly disposed of. After installation in 1991, the OWS was maintained and sampled on a regular basis to ensure that it continued to be effective in reducing the discharge of oil from the storm drain. The unit was removed in 2002, after the OU2 remedy was constructed and placed into operation.

A five-year monitoring program for the soils was implemented, and results were reviewed annually. EPA identified that the contamination was more extensive than originally determined. The soil contamination consisted of arsenic, PCP, polynuclear aromatic hydrocarbons (PAHs), and dioxin. The sampling program was designed to determine if the soils, in their exposed conditions, presented a direct contact threat to people working on or crossing the site.

The NWP soil contamination was addressed in 1996-1997 by a non-time critical removal action (NTCRA), which provided for a synthetic geomembrane cap to be installed on three acres of the site. The installation of the cap removed the potential for exposure to soils contaminated with arsenic and dioxin by providing a synthetic geomembrane barrier and a minimum of 18 inches of soil cover over the areas of contamination. In the fall of 1997, EPA covered the capped area with an additional 4 to 10 feet of fill and planted the fill with a mixture of seed mulch and fertilizer. The area currently is covered with grasses and can be used for construction of a light industrial type building with certain restrictions.

An Interim RA Report was finalized in two parts for OU-1. Part I, dated June 1991, included the cleanup of the NWP facility; Part II, dated February 1992, included the oil/water separator installation.

### **1.3 Operable Unit 2 (OU2) Remedy Implementation**

In the second ROD for the Site (EPA, 1991), EPA selected an interim remedy for the contaminated shallow groundwater, known as OU2. It provided for the installation of free-product recovery wells on the NWP property; rehabilitation of the existing storm sewer line; installation of a groundwater collection drain adjacent to the existing storm sewer line under the backyards of residential properties; and construction of a groundwater treatment plant adjacent to the NWP property.

The OU2 work was delayed while EPA focused on a Removal Action in 1993 to remove tanks and drums contaminated with hazardous waste from the facility and secured the wood treatment property buildings. This removal action was followed by the NTCRA, which capped the NWP property soil.

Phased construction of the OU2 remedy was started in 1997, with the treatment building construction and installation of both the extraction wells and groundwater collection trench. From 2000 to 2001 a treatability study was conducted along with plant design, storm drain repairs and construction of transport lines. The plant went operational in June 2001, with the discharge sent to the temporary pre-treatment facility used during the design/construction of the permanent facility. The treatment plant was fully on-line

in August 2001 with the discharge sent to Naylor's Run and sampling in accordance with the substantive requirements of an EPA National Pollutant Discharge Elimination System (NPDES) permit.

The groundwater extraction and treatment system consisted of four shallow groundwater recovery wells (RW-1, RW-2, RW-3, and RW-4), one collection trench (CTR) with a shallow groundwater pumping system, and an on-site treatment system. The treatment system consists of two major parts: (1) a pre-treatment system (for separating the oil-water emulsion, removing metals, and removing suspended solids); and (2) an organics removal/treatment system consisting of ultraviolet oxidation (UV/OX) system.

In April 2006 EPA added two additional recovery wells (RW-5 and RW-6) to the existing groundwater extraction and treatment facility by converting two monitoring wells. The new recovery wells capture water from the deeper aquifer, which has resulted in an increase in the mass of contamination sent to the treatment facility for processing. The four shallow recovery wells (RW-1 through RW-4) were shut down once wells RW-5 and RW-6 were placed online (February 2006) because of their ineffectiveness (very low flow and high maintenance).

The OU-2 Interim RA Report was finalized on June 4, 2003.

## **2.0 Operable Unit 3 (OU-3) Background**

### **Remedy**

The third ROD for the site (EPA, April 2008) was the final remedy for groundwater and contaminated soils at the ROS area.

Based on the information relating to the types of contaminants, environmental media of concern, and potential exposure pathways, Remedial Action Objectives (RAOs) were developed to aid in the development and screening of remedial alternatives. EPA established the following OU-3 RAOs to mitigate and/or prevent existing and future potential threats to human health and the environment:

#### Groundwater

- Mitigate contamination to Applicable, Relevant or Appropriate Requirements (ARARs) and/or risk-based cleanup levels to protect human health and the environment.
- Discharge treated groundwater to the surface water (Naylor's Run) in concentrations that meet NPDES regulations (through the existing OU2 treatment plant).
- Prevent exposure to contaminated groundwater in the future.
- Prevent discharge of groundwater to surface water at concentrations of contaminants that would result in exceedances of water quality criteria.
- Contain the contamination plume in the source area and the ROS area to prevent further off-site migration and to ensure that downgradient groundwater is not impacted.
- Restore groundwater quality at the site.

Soil – ROS Area

- Eliminate current exposure of human and ecological receptors to contaminated soils.
- Prevent further migration of contaminants in soil to groundwater.
- Prevent transport of contaminants in surface soils via surface water runoff.
- Prevent potential future exposure to contaminants through ingestion and dermal contact by human and ecological receptors.

The OU-3 remedy selected to meet these RAOs consisted of the following elements:

- Installation of an additional groundwater recovery well and associated piping in the Source area of the site.
- Operate and maintain the existing groundwater treatment facility. Upgrade or retrofit the existing groundwater treatment facility to increase the capacity of the facility to process 60 to 70 gallons per minute of contaminated water.
- Treat collected groundwater as necessary to meet discharge requirements.
- In-situ flushing in the Source area of the Site, with treated water from the groundwater treatment facility.
- Excavation of an area approximately 50 ft. by 50 ft. around wells SW-8 and SW-9 in the ROS area, and a narrow zone along the abandoned sewer line about 200 ft. long and 20 ft. wide. The portion of the abandoned sewer line that has not been sealed will be removed. All excavated material will be properly disposed of off-site.
- Backfilling of the excavated area with clean fill, restoration of sidewalks, curbs, utilities, etc. and planting of appropriate vegetation.
- Installation of three groundwater recovery wells and associated piping in the ROS area to extract groundwater and transport it to the site's groundwater treatment facility for remediation.
- Demonstrate recovery of benthic macroinvertebrate and fish communities, to examine the efficacy of the ROS area excavation and groundwater treatment to reduce or eliminate the contaminant releases that are the major source of risk to aquatic organisms in Naylor's Run.
- Perform groundwater monitoring.
- Institutional controls to protect the integrity of the remedy and to prevent the installation of groundwater wells, through groundwater use restrictions and notices for the site and surrounding area, as appropriate.

Remediation of the groundwater at the site would continue until the Maximum Contaminant Levels (MCLs) or Site-Specific Risk-Based Criteria are attained. Since groundwater that meets the MCLs or Site-Specific Risk-Based levels for individual contaminants may not meet the cumulative risk standards specified by EPA if multiple contaminants are present, EPA's determination regarding the attainment of treatment objectives is based on an assessment of the cumulative risk following the achievement of the preliminary standards. (Note: For the site COCs, Maximum Contaminant Level Goals (MCLGs) are

either the same as MCLs, have not been developed, or are zero. Non-zero MCLGs are not applicable for Site COCs.)

Consistent with 40 C.F.R. § 300.430(e)(2)(i) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), risk-based chemical-specific Remedial Goal Objectives (RGO) were developed for groundwater that are protective of human health and the environment, and are to be considered along with the MCLs, and the other ARARs for COCs identified for the site. Determination of meeting the “protection of human health and the environment” RGO will be performance-based, as part of the Superfund 5-year review cycle. When preliminary cleanup standards have been attained, EPA will evaluate post-ROD data from the periodic groundwater monitoring, develop a trend analysis and risk assessment to demonstrate the performance of the treatment system, and document compliance with 40 CFR. § 300.430(e)(2)(i) of the NCP.

The following table (from OU3 ROD) presents the MCLs and the Site-Specific Risk-Based RGO value, where no MCL is available.

<b>Table 1 Remedial Goal Objectives for Groundwater</b>		
<b>COC</b>	<b>MCL µg/L</b>	<b>Site-Specific Risk-Based Value</b>
Benzo(a)pyrene	0.2	NA
Dieldrin	Not Applicable (NA)	3.8E-02
Bis (2-ethylhexyl)phthalate	6	NA
Diebenzofuran	NA	4.0E+00
2- Methylnaphthalene	NA	2.0E+00
Naphthalene <sup>1</sup>	NA	3.0E+00
Pentachlorophenol	1	NA
Phenanthrene	NA	4.1E+01
Total 2,3,7,8-TCDD	3.0E-05	NA
1,2,4-Trimethylbenzene	NA	1.6E+01
1,3,5-Trimethylbenzene	NA	1.6E+01
4,6-Dinitro-2-methylphenol	NA	1.7E+00
Aluminum <sup>2</sup>	50-200	NA
Arsenic	10	NA
Chromium	100	NA
Barium	2000	NA
Manganese <sup>2</sup>	50	NA
Iron <sup>2</sup>	300	NA
Vanadium	NA	3.1E+00

<sup>1</sup>The site-specific risk-based value presented is for the risk for construction workers, which is the most stringent. The site-specific risk-based value for an adult resident is 1.2E+01 µg/l.

<sup>2</sup>Based on National Secondary Drinking Water Regulations.

The development of RGOs for soil was done by an iterative process. The first step in the process was for EPA to develop the Site-Specific Risk-Based cleanup levels for individual contaminants based on the direct contact pathway. These values were calculated to meet the cumulative risk standards specified by

EPA if multiple contaminants were present. The RGOs were established for direct contact with surface and subsurface soils.

The next step in the process was to review EPA's Site-Specific Risk-Based cleanup levels with ARARs and other helpful guidance for chemical-specific soil contamination. The first guidance reviewed was EPA's Office of Solid Waste and Emergency Response (OSWER) Directive 9200.4-26, titled "The Approach for Addressing Dioxin in Soil at CERCLA and Resource Conservation and Recovery Act (RCRA) Sites," which was issued in April 1998. The purpose of the directive is to recommend preliminary remediation goals for dioxin in site soils. The Directive sets the preliminary remediation goals for dioxin for residential surface soil at 1 part per billion (ppb) (1.0E-03 mg/kg). This level was set based on available information, and using standard default assumptions for reasonable maximum exposure scenarios, which were also used to establish the Site-Specific Risk-Based value for dioxin. The upper-bound excess cancer risk range from residential exposure at this dioxin level (1 ppb) is at the high end of EPA's acceptable range (2.5E-04). EPA has set this default cleanup level for dioxin because it is currently completing a comprehensive reassessment of the toxicity of dioxin.

The final step to establish RGOs for soil at the site was to compare EPA's Site-Specific Risk-Based values to Pennsylvania's Land Recycling and Environmental Remediation Standards Act (Act 2), which promulgates Statewide Health Standards for soils. Act 2 establishes direct contact cleanup values, as well as soil to groundwater values, and a process to determine which apply at a site. Based on the facts and circumstances of this site, the Pennsylvania Statewide Health Standards for dioxin, PCP and dieldrin in soils provide more stringent requirements than the EPA's Site-Specific Risk-Based cleanup standards for this site. Therefore, EPA incorporated these more stringent requirements as the cleanup standards for this site.

Although Pennsylvania's dioxin cleanup value is more stringent than the EPA Policy value, using Pennsylvania's dioxin cleanup value does not affect the cost or description of the selected remedy. The resulting RGOs for soil are listed below.

<b>Table 2 Remedial Goal Objectives for ROS Area Soils</b>		
<b>COC</b>	<b>Remedial Goal Objective (mg/kg)</b>	<b>Basis for Remedial Goal Objective</b>
Benzo(a)pyrene	1.3	Site-Specific Risk-Based Value
Dieldrin	1.1E-02 <sup>1</sup>	Statewide Health Standards Soil to Groundwater
PCP	0.5 <sup>1</sup>	Statewide Health Standards Soil to Groundwater
Total 2,3,7,8-TCDD TEQ	1.2E-04	Statewide Health Standards Direct Contact
Aluminum	6.2E+03	Site-Specific Risk-Based Value
Iron	1.5E+04	Site-Specific Risk-Based Value
Manganese <sup>2</sup>	1.6E+02	Site-Specific Risk-Based Value

<sup>1</sup>Soil to groundwater value based on 1/10 the generic value for saturated soils.

<sup>2</sup>The site-specific risk-based value presented is for the risk for construction workers, which is the most stringent. The site-specific risk-based value for child and adult resident are 5.7E+02 mg/kg and 5.5E+03 mg/kg, respectively.

### 3.0 Construction Activities

In November 2008 EPA began work to increase the capacity and optimize the existing groundwater treatment facility and to meet the 2008 ROD requirements. EPA redesigned the pretreatment portion of the facility to increase the amount of water being treated. This portion of the RA was completed in February 2009 as part of the OU-2 Long-Term Remedial Action (LTRA). The facility now treats 70 gallons per minute of contaminated groundwater.

In July 2009 the OU-3 BOD Report was issued, which included detailed technical specifications and drawings. This document was approved by EPA and PADEP and became the basis for construction of the OU-3 remedy. Later, EPA tasked Kemron Environmental Services (Kemron) to carry out the construction phase while Tetra Tech provided technical assistance. Figure 2 shows the overall site plan for OU-3 construction activities.

A summary of OU-3 construction activities is provided below. A detailed description is included under Attachment A.

Prior to the start of construction, property easement was obtained. Tetra Tech provided detailed maps of all affected properties and related deed descriptions, and the U.S. Army Corps of Engineers (USACE) obtained these easements. Many properties had several types of easements negotiated, but in total, 9 temporary easements, 7 perpetual pipeline easements, and 1 perpetual maintenance easement were negotiated (Figure 3). On November 17, 2009, construction began for the OU-3 remedy using American Recovery and Reinvestment Act (ARRA) funding. Prior to the start of the contaminated soil excavation, site preparation occurred, and a temporary bridge over the tributary of Naylor's Run was constructed to access the area.

Site preparation consisted of surveying all construction locations, posting project and safety signs, flagging, setting up the contractor's office (trailer with power and telephone connections), and restricting access as required. Also, site clearing was performed to allow ample access to the entire work area. Site clearing consisted of the removal and disposal of all shrubs, roots, and any other materials that could interfere with any work within the areas defined on the Contract Drawings and as approved by the EPA Project Manager.

Excavation of contaminated soils and the abandoned sanitary sewer line in the ROS area began on January 26, 2010, and was completed on March 18, 2010. Approximately 3,000 cubic yards of soils were excavated along with the portion of the abandoned sewer line that was not filled with grout in May 2004, during the RI. The excavation was conducted in a residential area originating between two homes then continuing through the backyards and into the ROS area. The ROS area is bordered by two creeks, and excavation continued to the creek banks. Frequent dewatering of contaminated groundwater was required during excavation work. Figure 4 shows the extent of soil excavation at the ROS area.

Upon completion of excavation work in the ROS area, excavated areas were backfilled with clean fill and then with at least 6 inches of topsoil at the surface. Compaction was completed for both the ROS area and also in trenching areas where macadam was reinstalled. A vegetative cover was then planted over backfilled areas to allow for a stabilized ground surface. Areas were graded to manage storm water runoff and erosion. Also, any plantings that were removed during excavations were replaced with acceptable replacement plantings. The recovery wells and electrical panel were fenced, and an "open paver" maintenance path was installed.

During the ROS area excavation work, a second pipe was found directly below the abandoned sanitary sewer line. This pipe was removed along with the portion of the original pipe that was not filled with grout in 2004. (The original pipe investigation and action are documented in the OU-3 RI report.) An additional investigation was conducted to determine if the second pipe followed the abandoned sanitary sewer all the way to the groundwater collection trench. The second pipe was found at the groundwater collection trench and was plugged to ensure contaminated groundwater could not flow through the pipe.

The construction of three monitoring wells (CW-32 thru CW-34) and three new recovery wells (RW-8 through RW-10) in the ROS area began during the week of March 29, 2010. These monitoring wells, shown on Figure 5, were installed to help further monitor shallow groundwater conditions in the ROS area. The wells were developed, and a pump test was completed during the week of April 19, 2010. All well-related activities were performed by A.C. Schultes, a Pennsylvania licensed driller.

To provide ample room and protection to each of the three new recovery wells, pre-cast concrete flush-mount vaults were installed at each location to allow connections to the force main for plant treatment. All piping and appurtenances in these well vaults were installed to provide easy access and sufficient working room.

Force main construction began in April 2010 and continued through June 2010. Approximately 2,700 linear feet of trenching/piping was constructed to transfer extracted groundwater from wells RW-8, RW-9 and RW-10 to the existing groundwater treatment plant.

Transportation and disposal of excavated soils began on May 24, 2010, and were completed on June 22, 2010. The soils were transported to Horizon Environmental, Inc. in Quebec, Canada, a permitted hazardous waste landfill (per Canadian Government). The soil was manifested through Enpro Services of Vermont, Inc. acting as an intermediary arranging for export. A total of approximately 4,421 tons of contaminated soil was shipped off-site for disposal.

One additional recovery well, designated as RW-7, was installed in the former Philadelphia Chewing Gum (PCG) source area as part of the remedy. This well was constructed by converting the existing monitoring well CW-31D and its associated piping to an extraction well.

Construction of the mix tank and injection wells for the in-situ flushing of the groundwater occurred in July 2010. In-situ flushing in the Source area was included as part of the OU3 ROD to enhance mobilization of the principal threat waste. Existing recovery wells RW-1, RW-2, and RW-4 were retro-fitted for injection and re-designated IW-1, IW-2, and IW-3, respectively. The electrical portion of the in-situ flushing system included the installation of level switches in the injection well vaults, flow elements, and heat tracing of piping system.

The ecological study called for as part of OU-3 ROD was initiated in May 2009 with a baseline sampling event. This study was implemented to demonstrate recovery of benthic macroinvertebrate and fish communities, and to examine the efficacy of the ROS area excavation and groundwater treatment to reduce or eliminate the contaminant releases that were the major source of risk to aquatic organisms in Naylor's Run. Sampling, analysis, and reporting were performed as outlined in the Ecological Study Work Plan for the site.

A pre-final inspection was conducted on July 7, 2010. The inspection was attended by representatives of EPA, PADEP, Tetra Tech, Kemron, U.S. Environmental, and Kelly Electric. A punch list of items requiring completion was developed as a result of the pre-final inspection. All tasks have been completed.

#### 4.0 OU-3 Chronology of Events

Date	Event
April 2008	OU3 ROD issued
November 2008	Construction started on groundwater treatment facility upgrade.
February 2009	Upgrade completed to groundwater treatment facility.
June 12, 2009	Sampling and Analysis Plan (SAP) completed and submitted to EPA for review.
July 2009	OU3 Basis of Design Report completed; Site Health and Safety Plan (HASP) finalized.
September 21, 2009	SAP revised and resubmitted to EPA for approval.
October 2, 2009	Tetra Tech submitted to EPA and Kemron revised contract drawings including erosion and sedimentation (E&S) details for entire construction site, realignment of forcemain across Eagle Rd. and PCG parking lot, and other minor corrections.
October 6, 2009	Tetra Tech submitted E&S permit application to Delaware County Conservation District
October 14, 2009	A site-wide HASP was prepared for Tetra Tech, Kemron, and EPA's activities and submitted to Kemron and EPA for approval. Tetra Tech attended a site meeting to conduct a walk-through with EPA and Kemron.
November 10, 2009	EPA approved revised SAP.
November 17, 2009	Kemron started to mobilize on-site. Tetra Tech began daily technical oversight full-time.
November 18, 2009	Project kick-off meeting.
November 23, 2009	Kemron began construction of lay-down area (128 Harvard Street) and approach ramp (Columbia Street).
December 2, 2009	Tetra Tech collected pre-construction surface soil samples at four background locations in the McCandless property lay-down area.
December 10, 2010	Kemron completed installation of temporary stream crossing of an unnamed tributary of Naylor's Run. This crossing was constructed utilizing two 48" diameter corrugated metal pipes, secured by ballast and #57 stone. Also, along each of the banks of this tributary, rip-rap was installed to help stabilize and protect from erosion.
December 11, 2009	Kemron completed construction of lay-down area (128 Harvard Street) and approach ramp (Columbia Street).
January 7, 2010	Kemron completed construction of a water collection sump pit at ROS area for groundwater control during construction. The sump pit utilizes a 2" HDPE discharge line to pump collected water to the Tetra Tech vault/sump located behind the PCG. Also, silt fencing was installed in the ROS area.
January 28, 2010	Real-time, on-site field screening of soil for PCP using Rapid Assay test kits started by Tetra Tech.

February 15, 2010	Two waste characterization composite soil samples were collected from the ROS soil waste pile for TAL/TCL VOA, SVOA, Pesticide, PCB (Aroclor), TCLP RCRA Metals, Dioxin, Ignitability, and Corrosivity. The samples were shipped as follows: VOA/SVOA/Pesticides/PCB (ARO) to Datachem Laboratories; TCLP Metals to A4 Scientific; and Dioxins to SGS Environmental.
March 2, 2010	Tetra Tech began conducting soil density testing on the backfilled cells.
March 1, 2010	Kemron authorized US Environmental for all mechanical, electrical, well construction and piping work. US Env. subcontracted work to Kelly Electric and AC Schultes.
March 25, 2010	Tetra Tech provided oversight during the excavation of an old existing manhole (MH-1) to determine the existence of a second 6" pipe below the existing 10" sanitary sewer (previously filled with concrete in 2004). The pipe was found, and water samples were taken and submitted to a local laboratory for SVOA analysis.
March 26, 2010	Tetra Tech surveyed the ROS area once all excavation was complete and sheet pile was in place. This information was used to redefine location of three extraction wells (RW-8 thru 10) and three monitoring wells (CW-32 thru 34). A revised site plan drawing was issued.
March 29, 2010	US Environmental mobilized to the site.
April 9, 2010	Tetra Tech finished real-time, on-site field screening of soil for PCP using Rapid Assay test kits.
April 21, 2010	Three recovery wells and three monitoring wells were constructed. An 8-hour and a 12-hour pump test were conducted at RW-9 on April 20 and 21, 2010.
May 4, 2010	Tetra Tech submitted a pump test report for the three recovery wells located in the ROS area. An 8-hour and a 12-hour pump test were conducted at Well RW-9 on April 20 and 21, 2010.
May 12, 2010	Tetra Tech performed the ecological sampling along Naylor's Run and its un-named tributary, and at an off-site location in French Creek State Park, PA.
June 2010	EPA and Tetra Tech started programming PLC to add ROS area wells and related control logic.
July 7, 2010	EPA and Tetra Tech conducted a pre-final inspection on July 7, 2010, and prepared a punch list for outstanding construction items.
July 23, 2010	Tetra Tech conducted startup/testing of newly constructed systems.
August 1, 2010	Tetra Tech ceased providing a full-time site representative to provide EPA with technical support during the RA.
August 11, 2010	Tetra Tech conducted startup/testing of OU3 pumping systems (RW-7 thru RW-10) and the injection system.
August 12, 2010	Tetra Tech performed the close-out background soil sampling at the McCandless property at the original four locations.

August 16, 2010	The ROS pumping system (RW-8 thru RW-10) was placed online. The OU3 ROS sump dewatering activities were ceased.
August 23, 2010	The injection system was placed online and began pumping effluent water to injection wells IW-1; IW-2; and IW-3.
September 10, 2010	Tetra Tech performed the closeout soil resampling at the McCandless property at the original four locations.
September 13, 2010	The fence contractor began installing new fencing behind two of the ROS residents, the ROS control panel fencing, and repair of the second PCG gate.
November 10 – 11, 2010	Kemron was on-site to place an additional 6 inches of top soil on lay down area at McCandless lot to bring back to original grade. The site was also re-seeded.
December 23, 2010	Kemron was on-site to repair the fence near the collection trench.

## 5.0 Performance Standards and Construction Quality Control

Cleanup construction quality assurance and quality control (QA/QC) for the other previously completed remedies implemented for the site are documented in the June 1991, February 1992, and the June 4, 2003 Interim RA Reports. The reports are located in the site file.

EPA and PADEP reviewed the OU-3 remediation contract and construction for compliance with QA/QC protocols. Construction activities at the site were determined to be consistent with the ROD and the RD. The construction contractor, Kemron Environmental Services (Kemron), adhered to the approved Construction Quality Assurance Plan (CQAP), which was part of the RD.

The CQAP incorporated all EPA and State requirements. All confirmatory inspections, independent testing, audits, and evaluations of materials and workmanship were performed in accordance with the construction drawings, technical specification and CQAP. Construction quality assurance was performed by the appropriate contractor with Tetra Tech ensuring that the tests were performed properly. During construction activities, an oversight engineer from Tetra Tech and EPA were on-site daily. A construction meeting was held approximately every week with EPA, Tetra Tech, Kemron, and PADEP to review construction progress and evaluate and review the results of QA/QC activities associated with OU-3. Site progress meeting minutes are included in Attachment J. During the construction phase, Tetra Tech provided technical oversight. A copy of field logbook is included as Attachment K. Selected construction photographs are included in Attachment L.

The Quality Assurance Project Plan (QAPP) incorporated all EPA and PADEP QA/QC procedures and protocols. EPA analytical methods were used for all confirmation and monitoring samples during RA activities. Sampling of soil and water followed the EPA protocol *Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods*. EPA and PADEP determined that analytical results were accurate to the degree necessary to assure satisfactory execution of the RA.

Prior to ROS area excavations, the entire area was barricaded with a temporary fence. A steel fence was also installed around the McCandless lot, and a gate was placed for security purposes. Site entrance was

controlled, and a daily sign-in and sign-out sheet was maintained by Kemron. During ROS area excavation, air monitoring was performed, and proper actions were taken as per site HASP.

Prior to beginning any construction activities, four surface soil samples were collected at the McCandless property on December 28, 2009. These samples were collected to obtain background concentration data. The samples were collected from 0'-1' below grade and analyzed for target analyte list (TAL) metals and dioxin. Upon completion of all site activities, these locations were re-sampled as part of closeout process. Sample locations are provided on Figure 6.

QA sampling was conducted for soils excavated from the ROS area. The sampling procedures were outlined in the Sampling and Analysis Plan (SAP). Analyses were conducted on-site to determine if PCP levels on the side walls of the excavation met the action levels. Whenever a field sample had a PCP concentration greater than 0.5 mg/kg, the excavation was extended 4 feet laterally and sampled again until the action level was met. In accordance with the SAP, confirmatory samples were sent to the lab for analysis of benzo(a)pyrene, PCP, aluminum, iron, manganese, and dioxin.

A few confirmatory samples were above the action level, and the excavation was extended until subsequent confirmatory samples were below the action level. One deep sample (CS12DL8-2010), shown on Figure 3, was identified by the lab samples as still above the action level. This area was not excavated further because the sample was below the groundwater level, and the sample location was approximately 8 feet below grade.

## **6.0 Final Inspection and Certifications**

Upon substantial completion, a pre-final inspection was conducted by EPA, Tetra Tech, Kemron, and their subcontractors and PADEP on July 7, 2010. A punch list of outstanding items to be completed was prepared. Subsequently, all systems have been tested for their intended use. All systems were placed in operation by August 23, 2010.

A preliminary closeout report (PCOR) was drafted for the site. The PCOR was approved and signed on September 16, 2010, marking construction completion for the site. The PCOR indicated that an institutional control implementation and assessment plan (ICIAP) was to be drafted for the site as required by the ROD. The ICIAP is currently in review. The institutional controls (ICs) associated with this RA have been put into place. They include perpetual pipeline easements for 6 properties to protect the engineered remedy, and a township of Haverford Ordinance to restrict installation of wells in and around the groundwater plume of contamination. The ordinance (No. 2608-2010) was adopted on August 9, 2010.

## **7.0 Operation and Maintenance Activities**

### Groundwater Monitoring to Ensure Effectiveness of Remedy

A groundwater monitoring program was implemented as part of the OU-3 long-term remedial action (LTRA) to ensure the effectiveness of the groundwater remedy. As part of the LTRA, EPA collects and analyzes data from groundwater within and surrounding the contaminant plume using existing and new monitoring wells to determine whether the containment and groundwater treatment systems are operating effectively. EPA will follow the current groundwater monitoring plan, and any appropriate revisions.

The groundwater monitoring program includes sampling of up to three new monitoring wells, four new recovery wells, and three injection wells.

Groundwater samples are currently collected on a quarterly, semi-annual, and annual basis as follows:

- Quarterly sampling of eight locations to determine the recovery system water quality and extraction system's effectiveness.
- Quarterly sampling of new well locations to determine the recovery system water quality and extraction system's effectiveness.
- Semi-annual sampling of sixteen locations to monitor the edge of the shallow contaminant capture zone.
- Annual sampling of all monitoring wells to update the historical database. This includes all site-related monitoring wells.

Plant influent samples are analyzed for Target Compound List (TCL) VOCs, semi-volatile organic compounds (SVOCs), six metals, general minerals (annually), dioxins/furans, oil and grease, and total phenols.

Plant effluent samples are analyzed for TCL VOCs, and SVOCs, six metals, dioxins/furans, oil and grease, and total phenols.

Monitoring wells samples are analyzed for VOC, SVOCs, total metals, dissolved metals, and dioxin. During monitoring well sampling, other parameters were also collected (e.g., pH, temperature, dissolved oxygen, conductivity and oxidation/reduction potential).

All samples are sent to EPA laboratories (procured under Routine Analytical Services [RAS] program for VOCs, SVOCs, and metals analysis and Delivery of Analytical Services [DAS] program for total phenols, minerals [nitrite, nitrate, chloride, fluoride, and sulfate], dioxin, oil and grease, moisture content, TSS, reactivity, and corrosivity).

Additional details of groundwater sampling are provided in Attachment A.

#### Demonstrate Recovery of Benthic Macroinvertebrate and Fish Communities

An Ecological Sampling Work Plan (March 2009) implemented to demonstrate the recovery of benthic macroinvertebrate and fish communities, to examine the efficacy of the ROS area excavation and groundwater treatment to reduce or eliminate the contaminant releases that are the major source of risk to aquatic organisms in Naylor's Run. This ecological monitoring program will be used to evaluate incremental improvement in water and sediment quality and aquatic communities.

In 2009 and 2010, two rounds of sediment and fish samples were collected during the Naylor's Run ecological monitoring program. Additional details of this sampling are provided in Attachment A.

## 8.0 Summary of Project Costs

The original present net worth cost estimate to implement the actions described in the OU-3 ROD was \$8,895,000. The cost estimate included a capital cost of \$5,432,000 and an annual O&M cost of \$279,000.

In the OU-3 ROD, it was determined that the existing groundwater extraction and treatment facility would need to be upgraded to treat 70 gallons per minute. This work was completed as part of the OU-2 LTRA to optimize the treatment facility. The upgraded cost was \$752,000, which included a building expansion, procurement and installation of all pre-treatment equipment, engineering design and construction management.

Actual RA construction costs for the remainder of OU3 was approximately \$3,860,000. This included \$3,200,000 funded by ARRA for construction of the remedy, \$425,000 funded through a Special Account for Technical Assistance, and \$235,000 funded through RA funding and a Special Account to secure property access. The annual O&M costs are comparable to what were estimated in the ROD.

## 9.0 Observations and Lesson Learned

RaPID assay test kits used for field screening process for the ROS excavation worked quite effectively. Test kit results could be correlated to respective confirmatory sampling data most of the time. This saved a lot of excavation downtime.

Results from confirmatory sampling for the ROS excavation from the laboratory were not received in a timely manner. One excavation had to be further excavated after backfilling.

Installing well vaults next to the stream was difficult because of constant water infiltration.

Dewatering the excavation provided an excellent means of groundwater remediation. A large frac tank should have been used to allow for more settling of solids prior to discharge into the collection trench.

Not having detailed utility drawings for Eagle Road caused delays in laying the pipe across the road. Closing a main road during the day should have not been done.

## 10.0 Operable Unit Contact Information

Jill Lowe: EPA Remedial Project Manager  
1650 Arch Street  
3HS21  
Philadelphia, PA 19103  
215-814-3123

Tim Sheehan: PADEP Project Engineer  
Hazardous Sites Cleanup Program  
2 East Main Street  
Norristown, PA 19401  
484-250-5726

Gary Rogers: Kemron Environmental Services Project Manager  
1359-A Ellsworth Industrial Blvd.  
Atlanta, GA 30318  
404-636-0928

Harish Mital: Tetra Tech NUS, Inc. Project Manager  
240 Continental Drive  
Suite 200  
Newark, DE 19713  
302-738-7551