FIVE-YEAR REVIEW REPORT FOR A.O. POLYMER SUPERFUND SITE SUSSEX COUNTY, NEW JERSEY

Prepared by

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Region II
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Approved by:

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Date

232341

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EXECUTIVE SUMMARY

This is the third five-year review for the A.O. Polymer Superfund Site. This Site is located in Sparta Township, Sussex County, New Jersey. Currently, the implemented actions at the Site protect human health and the environment. All remedial action construction has been completed. Institutional controls are in place. There are no exposure pathways that could result in unacceptable risks and none are expected.

FIVE-YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION		
Site Name: A.O. Polymer		
EPA ID: NJD030253355		
Region: 2	**State:** NJ	**City/County:** Sparta/Sussex

SITE STATUS	
NPL Status: Final	
Multiple OUs? No	**Has the site achieved construction completion?** Yes

REVIEW STATUS
Lead agency: EPA Click here to enter text.
Author name (Federal or State Project Manager): Rich Puvogel
Author affiliation: United States Environmental Protection Agency
Review period: 5/08/2008 – 5/08/2013
Date of site inspection: 2/19/2013
Type of review: Policy
Review number: 3
Triggering action date: 5/8/2008
Due date *(five years after triggering action date)*: 5/8/2013

Protectiveness Statements		
Operable Unit: OU1	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):* Not Applicable
Protectiveness Statement: The OU1 remedy protects human health and the environment.		
Operable Unit: OU2	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):* Not Applicable
Protectiveness Statement: The OU2 remedy protects human health and the environment because the pump and treat system is effectively containing the plume and no residents are exposed to contaminated groundwater.		

Sitewide Protectiveness Statement	
Protectiveness Determination: Protective	*Addendum Due Date (if applicable):* Click here to enter date.
Protectiveness Statement: The OU1 and OU2 remedies protect human health and the environment because the pump and treat system is effectively containing the plume and no residents are exposed to contaminated groundwater.	

I. Introduction

This is the third five-year review for the A.O. Polymer Superfund Site (Site), located in Sparta Township, Sussex County, New Jersey. This review was conducted by U.S. Environmental Protection Agency (EPA) remedial project manager (RPM), Rich Puvogel. This review was conducted in accordance with the Comprehensive Five-Year Review Guidance, OSWER Directive 9355.7-03B-P (June 2001). The purpose of five-year reviews is to assure that implemented remedies protect public health and the environment and that they function as intended by the decision documents. This report will become part of the Site file.

The evaluation described herein assesses the protectiveness of the selected remedies for the A.O. Polymer Site. For the purpose of remediation, the Site has been divided into two portions, the Disposal Area and the Facility Area. EPA and the State of New Jersey Department of Environmental Protection (NJDEP) addressed surficial contamination on the Facility Area via their removal programs. The Facility Area was deleted from the National Priorities List (NPL) on August 26, 2000, and is not subject to this five year review. The remedial response actions address all known soil and groundwater contamination at the Disposal Area of the Site.

The June 28, 1991, Record of Decision (ROD) called for two distinct technologies to address the Site's contamination. One addresses subsurface soil contamination above the groundwater table in the former waste lagoon area (Disposal Area – Operable Unit 1 (OU1)), and the other addresses the groundwater contamination (OU2). This five-year review evaluates both the OU1 and OU2 remedies.

II. Site Chronology

Table 1 (attached) summarizes the site-related events from discovery to the present.

III. Background

Site Location

The Site is an inactive facility located at 44 Station Road in the Township of Sparta, Sussex County, New Jersey. The Site occupies 4.18 acres near the Sparta Rail Road Station along the New York, Susquehanna and Western (NYS&W) Railway. The Site is bounded to the north and east by Station Park, a municipal recreation area, to the southeast by Station Road and to the south and west by the NYS&W Railway. The Site is located on two lots delineated by a Sussex County tax map as Block 19, Lot 45-B (3.22 acres) and Lot 45-C (0.96 acres).

Physical Characteristics

As previously mentioned, EPA divided the Site into two separate portions, the Facility Area and

the Disposal Area. Structures at the 3.76-acre Facility Area portion included office and laboratory facilities, a main reactor building, assorted storage buildings and a non-contact cooling water pond. The office, reactor building and laboratory were used by A.O. Polymer in its manufacturing processes. The cooling water pond, was located in the southeast quadrant, had no surface outlet and was lined with concrete. The pond was used for the recirculation of non-contact cooling water and was periodically replenished with water from an on-site production well. The 0.42-acre Disposal Area contained disposal pits.

In accordance with 40 CFR 300.425(e) and the Notice of Policy Change: Partial Deletion of Sites Listed on the National Priorities List 60 Federal Register 55466 (Nov. 1, 1995), EPA deleted the Facility Area portion of the Site from the NPL on August 26, 2000, and this area is available for unrestricted use. Hence, only the Disposal Area portion of the Site and groundwater plume remain on the NPL and are subject to evaluation in this five-year review.

Site Geology/Hydrogeology

The water table beneath the A.O. Polymer property is approximately 20 feet below grade. Depth to the water table decreases to the north and east of the property, until it is only 2.6 feet below the surface in Station Park next to the Wallkill River. Remedial Investigation (RI) data indicate that both the water table and bedrock aquifers are hydraulically interconnected, groundwater contamination from the Site has moved downward through the glacial overburden and migrated from the Site through a shallow portion of the bedrock. Groundwater flow in this shallow portion of the bedrock aquifer is moving from the bedrock to the overburden.

The 1990 RI data defined the extent of the groundwater contaminant plume (see Figure 1). The plume originates from the Disposal Area and extends to the Wallkill River in an east/northeasterly direction. The plume is confined to relatively shallow portions of the groundwater flow system and is discharged to the river along with the normal groundwater flow. The downgradient extent of the plume from the Disposal Area is limited by the Wallkill River. Transport past the river is not indicated by the RI or subsequent data and appears to be unlikely given present hydrologic conditions.

Land and Resource Use

Since the previous five-year review, the Facility Area has been redeveloped into an office park, storage and recreation facility. The 0.42 acre Disposal Area remains on the NPL. The groundwater plume extends downgradient beneath Station Park.

History of Contamination

Complaints of odors emanating from well water and air near the Site were first registered by citizens living or working near the Site in 1973. Complaints of odors and foul smelling well water intensified in 1978, touching off formal investigations by the Sparta Health Department and the NJDEP.

In 1978, NJDEP began investigating reports of drum stockpiling at the Site. These investigations identified on-site waste disposal and storage practices as the source of groundwater contamination in residential wells. Waste handling practices included disposal of liquid chemical waste into unlined disposal pits, improper storage of over 800 deteriorating drums, and burial of crushed and open drums containing waste materials including volatile and semi-volatile organic compounds.

In December 1978, NJDEP inspectors and Sparta Health Department officials collected samples from potable wells surrounding the Site. Analysis of these samples revealed the existence of VOCs in three domestic wells located on Station Road. In June 1979, the owners of the three affected wells filed damage claims with the New Jersey Hazardous Spill Fund, and in January 1980, these homes were connected to a municipal water supply.

In 1980 and 1981, surficial cleanup at the Site was initiated by NJDEP, including the removal of surface drums and the excavation and removal of contaminated soil located in the unlined waste pit area (i.e., the Disposal Area). The Disposal Area of the Site was reportedly excavated to a depth of approximately 10 feet and backfilled with clean soil. This cleanup resulted in the removal of 1,150 drums; 1,700 cubic yards of contaminated soil; and 120 cubic yards of crushed drums and debris.

Concern regarding the extent of groundwater contamination resulted in additional investigations by NJDEP. In January 1982, NJDEP's Division of Water Resources installed 11 monitoring wells on and adjacent to the Site to determine the extent of groundwater contamination. Sampling confirmed that contamination had reached the Allentown formation, which is a source of potable water in the area. Sampling also indicated that groundwater contamination had migrated to Station Park, 300 yards northeast of the Site.

On September 1, 1983, the Site was placed on the NPL.

In 1984, a remedial investigation and feasibility study (RI/FS) was initiated by NJDEP. During the RI, the Disposal Area was sampled. Soil samples taken from this area of the Site and compared with other soil samples taken from other portions of the Site indicated that the soil beneath the Disposal Area contained residual VOC contamination. The contaminants in the disposal pit soils desorbed upon contact with infiltrated groundwater providing a relatively constant release of contamination to groundwater. The source of soil contamination within the Disposal Area footprint is located approximately 10 feet below the ground surface down to the water table at a depth of 25 feet. This contaminated soil area is located within a 0.42 acre area of the A.O. Polymer property and is bounded to the northwest and southwest by a gun club access road and to the northeast and southeast by a steep embankment that adjoins the park property. At the time of the RI, the volume of contaminated soil beneath disposal pits was estimated to be 7,500 cubic yards.

After initial indications of groundwater contamination were confirmed, NJDEP expanded the RI monitoring well network to a total of 29 monitoring wells. Of the 29 monitoring wells, 15 were screened in the overburden and 14 were screened in the bedrock.

Groundwater contamination in the water table aquifer consists primarily of VOCs including trichloroethene (TCE), cis-1,2-dichloroethene (cis-1,2-DCE), 1,1-dichloroethane (1,1-DCA) and 1,1,1-trichloroethane (1,1,1-TCA). The compounds were detected at levels above the Federal Maximum Contaminant Levels (MCLs) and New Jersey Groundwater Quality Standards (NJGWQS).

Of the 14 bedrock monitoring wells sampled, 13 had no elevated levels of contaminants. Only one bedrock monitoring well indicated the presence of contaminants but at significantly lower concentrations than found in the overburden. This bedrock well is located in the top ten feet of a bedrock subsurface wall oriented southeast with a vertical relief of over 100 feet. Groundwater flow in this area is moving from the bedrock to the overburden. Samples from bedrock monitoring wells upgradient, downgradient and sidegradient from this position detected no contaminants.

As residual subsurface soil contaminants enter the groundwater they eventually discharge to the wetland area and the Wallkill River. At the time of the RI the groundwater contaminant plume was discharging to the wetland area located on the west side of the river as well as the river itself, as evidenced by detections of 1,1-dichloroethene (1,1-DCE) and total 1,2-dichloroethene (1,2-DCE) in surface water samples from the wetland and river. Eight surface water samples were taken during the RI from four points in the river and wetland. Samples taken upstream from the contaminant discharge plume were consistent with background levels. It is believed that VOCs entering the Wallkill River from the contaminated groundwater are quickly attenuated by dilution, volatilization and degradation as reflected by the low levels that were detected in the downstream samples.

Initial Response

In 1993, manufacturing operations ceased at the site. The site was abandoned by its owner in 1994 leaving behind unsecured hazardous waste. In April 1994, EPA initiated a removal action to address immediate environmental hazards posed by the abandoned facility. During EPA's removal activities, 121 cubic yards of soil, 91 cubic yards of asbestos-containing materials, 34,000 pounds of hazardous waste, 37,600 pounds of non-hazardous waste and 3,491 gallons of bulked hazardous liquids were removed from the Site.

After removal activities were completed, EPA collected confirmatory soil samples to determine if any remaining areas of the Site were in need of remediation. An analysis of earlier RI/FS soil samples and the post-removal action soil samples taken on the Facility Area indicated that soil on the Facility Area did not exceed New Jersey Residential Direct Contact Soil Cleanup Criteria.

Basis for Taking Action

In 1984, a (RI/FS) was initiated by NJDEP. The RI focused on soils in the Disposal Area, groundwater and surface water. The risk assessment concluded that the risk from all evaluated exposure pathways at the Site was 4.7×10^{-4}. The risks for carcinogens at the Site were at the

high end of the acceptable risk range due to the presence of sensitive receptors (children). Non-carcinogenic risks were above a hazard index of 1.0 for future ingestion of groundwater. The main contaminants of concern were VOCs including TCE, cis-1,2-DCE, 1,1-DCA, 1,1,1-TCA.

An ecological risk assessment concluded that chemicals of concern that discharge from groundwater into the Wallkill River wetland are not expected to bioaccumulate; therefore, significant exposures to terrestrial wildlife from surface water are unlikely.

IV. Remedial Actions

Remedy Selection

Based on the results of the RI/FS, EPA issued a ROD on June 28, 1991. The ROD did not have RAOs. However, the ROD stated that the selected remedy would not result in hazardous substances remaining on site above health-based levels. Therefore, the soil and groundwater remedies have goals that support unlimited use and unrestricted exposure.

The selected remedy called for a soil vapor extraction (SVE) system to remove VOC contamination from soil in the Disposal Area and a groundwater extraction and treatment system to address the contaminated groundwater through a system of extraction wells and treatment utilizing powdered activated carbon filtration system. The soil cleanup levels in the ROD are based on State soil action levels including total VOCs at one milligram/kilogram (1 mg/kg) and total semivolatile organics at 10 mg/kg. Groundwater cleanup levels in the ROD are the more restrictive of Federal MCLs or NJGWQS.

Remedy Implementation

After the 1991 ROD was signed, EPA became the lead agency in charge of response activities at the Site. EPA identified potentially responsible parties (PRPs) and issued a unilateral administrative order to one PRP to conduct the remedial design and remedial action (RD/RA). Design of the SVE system started on April 2, 1992, and was completed on May 11, 1994. By October 1994, construction of the SVE system was completed and the system was operational and functional in January of 1995.

The groundwater treatment component of the selected remedy called for pumping the contaminated groundwater from the aquifer, treating it with a powdered activated carbon treatment system and then returning the treated groundwater to the aquifer.

Results from pump tests and groundwater modeling during design indicated that the remedy objectives would be met by installing two extraction wells, RW-1, with an expected extraction rate of approximate 40 gallons per minute (40 gpm), and RW-2 with an expected extraction rate of approximately 30 gpm.

Treatability studies conducted on the PACT system showed that this treatment system could not

meet the discharge limitations; therefore, an Explanation of Significant Differences (ESD), issued on September 17, 1996, called for modifying the ROD to allow the use of an air stripper to remove contaminants from groundwater and allow surface water discharge to be implemented instead of using groundwater reinjection. In addition, the ESD called for only the most contaminated part of the plume to be treated via the extraction and treatment system, thereby allowing the remaining low-level contaminant concentrations outside the capture zone (Figure 3) to naturally attenuate. Construction of the groundwater pump and treatment system was completed on March 1998.

Operation and Maintenance

The SVE unit operates on a continuous basis. Monitoring of the intake air from the extraction wells is reported on a monthly basis. Levels of contaminants in the SVE wells have dropped by orders of magnitude since the startup of the system.

A Groundwater Monitoring Plan was finalized in 1999. The Groundwater Monitoring Plan evaluates the effectiveness and protectiveness of the groundwater treatment remedy. In summary, the Groundwater Monitoring Plan calls for the monitoring of a total of 12 wells, four of which are compliance wells (CWs): AOP-9, AOP-110, MW-5 and AOP-108, three recovery wells (RWs): RW-1 and RW-2 and RW-3 and five monitoring wells: MW-3S, MW-6, AOP-6, AOP-117 and MW-4. Groundwater samples are collected on a quarterly basis for TCE and semi-annually for all other contaminants of concern (COCs).

RW-1 achieved its expected extraction rate; however, the maximum extraction rate at RW-2 was only 10 gpm. As a result, a third recovery well, RW-3, was installed in 2002 in an attempt to increase extraction of groundwater contaminants and therefore increase efficiency of the capture zone. RW-3 was installed approximately 50 feet downgradient of RW-2 and produced a maximum flow rate of 17 gpm. Since beginning operation, RW-3 has averaged maximum flow rate of 8.3 gpm. In 2013, due to high concentrations of contaminants in MW-3S, it was converted into a fourth extraction well.

Three CWs are screened in the overburden and one is screened in the shallow bedrock. Using a model, it was estimated that with efficient capture of groundwater contaminant near its source, the cleanup goals would be achieved in the CWs in 9 to 13 years. TCE concentrations in the CWs exceeded cleanup goals at the end of the 13 year period indicating that the groundwater remedy is taking longer than predicted by the model. In response, the PRP modified the pumping scheme by recently converting a monitoring well into a recovery well.

As of February 2013, there are four extraction wells in the overburden. In addition to the extraction wells, nine monitoring wells are sampled to monitor the concentration of contaminants in groundwater; eight of the monitoring wells are in the overburden and one is in the bedrock.

To improve treatment efficiencies of the two systems, the PRP diverted condensate captured by the SVE system to the groundwater treatment system beginning in September 2001. In total, 8,525 gallons (79,660 lbs) of product have been removed from the soil and groundwater. At least 5,205 gallons of this product have been removed from the soil by the SVE system and 3,320

gallons of product have been removed by the groundwater pump and treatment system.

Steady operation and maintenance (O&M) performance has resulted in an average throughput of 1.5 million gallons of water per month through the water treatment system while adhering to all sampling protocols and contaminant removal efficiencies, as well as the prescribed preventive maintenance requirements of the individual unit operations. The total annual cost, which varies year to year for both the SVE and groundwater treatment system including quarterly groundwater sampling, has been approximately $700,000 per year.

V. Progress Since Last Review

In the last five-year review (the second five-year review conducted for the Site) for the A.O. Polymer Superfund Site it was determined that the implemented remedial actions were functioning as intended and were protective of human health and the environment.

The second five-year review did not identify any issue or make any recommendation for the protection of public health and/or the environment, which was not included or anticipated by the Site decision documents, however, the second five-year review noted that contaminant levels in some monitoring wells may not attain cleanup goals within the estimated time frame.

As mentioned previously, an additional extraction well was added to the extraction well network since the last five year review. Contaminant levels in the groundwater will continue to be monitored to determine what effect this additional well has on mass removal. The PRP and EPA are currently discussing alternative remedial options in the source area to accelerate the rate of source removal.

VI. Five-Year Review Process

Administrative Components

The five-year review team consisted of Rich Puvogel (EPA-RPM), Katherine Ryan-Mishkin (EPA-hydrogeologist), Chloe Metz and Julie McPherson (EPA-risk assessors).

Document Review

The documents, data and information reviewed to complete this five-year review are summarized in Table 2.

Data Review

It is assumed that until the SVE system's VOC off-gas concentrations reach insignificant levels, the system will continue to remove contamination from the soil and, therefore, will continue to operate. The most recent contaminant concentrations collected from the SVE system are

presented in Table 4.

Comparison of groundwater data prior to the start-up of the groundwater remediation system to most recent groundwater data, indicates contaminant levels have reduced significantly, often by at least an order of magnitude. Since the second five-year review, some contaminant data indicate a gradual decline in concentrations, but data variability within this five-year period is also evident.

The monitoring program has been reduced in terms of the number of monitoring wells since the early stages of groundwater monitoring to eliminate wells that demonstrated consistent detections below applicable standards. The wells presently in the sampling program include: AOP-6, AOP-9, AOP-108, AOP-110, AOP-117, MW-4, MW-5, MW-6, as well as the recovery wells RW-1, RW-2, RW-3 and MW-3S.

Groundwater COCs that are relied on as indicator compounds to track groundwater cleanup progress include: TCE, cis-1,2-DCE, 1,1-DCA and 1,1,1-TCA. Of these indicator compounds, TCE and cis-1,2-DCE are found at the highest concentrations. Table 3 provides applicable groundwater standards, maximum concentrations of contaminants in groundwater prior to start of the pump and treatment system, and compares maximum groundwater concentrations at the start of this five-year review to maximum concentrations at the end of the five-year review period.

During this five-year review period, the highest VOC concentrations have been detected in the overburden wells that were installed during the design of the groundwater remedy, specifically MW-3S, MW-5 and MW-6. Concentrations of contaminants in MW-5 and MW-6 are an order of magnitude below MW-3S. Large seasonal fluctuations of contaminant levels were observed in MW-3S. During this five-year review period, TCE concentrations in MW-3S ranged from 8.4 micrograms/liter (8.4 ug/L) to 15,000 ug/L and cis-1,2-DCE ranged from 21 ug/L to 4,400 ug/L. Concentrations of contaminants in MW-3S have been among the highest levels when water levels in the monitoring well have been relatively low. To address the high mass at this location, MW-3S was converted into a recovery well in February 2013. It has been estimated that the conversion of MW-3S into a recovery well may increase mass removal by 60 percent.

MW-5 is located within the capture zone of the pumping system, approximately 10 feet from recovery well RW-3. While TCE concentrations increased in MW-5 from 180 ug/L at the beginning of the five-year review period to 230 ug/L at the end of the five year review period, in contrast, cis-1,2-DCE exhibited a decreasing trend from 720 ug/L to 190 ug/L. A slight decreasing concentration trend was noted for 1,1,1-TCA 120 ug/L to 110 ug/L. MW-6, located downgradient to MW-5, is also within the capture zone of the pumping system. Concentrations of TCE in MW-6, are lower than TCE concentrations in MW-5 and have remained relatively steady during this five-year review period.

Prior to start of the groundwater remedy, the concentration of TCE in AOP-6, an overburden well, was 35,000 ug/L. Concentrations of VOCs in AOP-6 have declined steadily since the start of the pumping system. Most recent concentrations of TCE in AOP-6, located within the capture zone, remain above the groundwater criterion at 3.4 ug/L. In contrast, the concentration of TCE in MW-3S, located 60 feet upgradient of AOP-6, has been variable during this review period (8.4

– 15,000 ug/L). MW-3S is screened at an elevation just above AOP-6. A local geologic constraint may exist that inhibits the high contaminant levels observed in MW-3S from impacting AOP-6, 60 feet away.

MW-4, AOP-108 and AOP-110 overburden wells are situated within the plume boundary. Individual VOC concentrations have ranged between the NJGWQS and 100 ug/L at these monitoring wells in the last five years.

AOP-117, is an overburden monitoring well located downgradient of the source area. While TCE and cis-1,2-DCE remain above NJGWQS at this well, a steady decline in their concentrations was observed within this five-year review period: TCE from 60 ug/L to 25 ug/L, and cis-1,2-DCE from 290 ug/L to 47 ug/L. Overburden wells located further downgradient to AOP-117, specifically MW-1S, and AOP-111, have historically been non-detect for contaminants.

All four recovery wells are screened in the overburden and sampling at these wells has focused primarily on the key COCs. MW-3S was recently converted to an extraction well in response to data trends found in that well. Data trends for the other three extracton wells over the last five years have indicated decreasing concentration trends, with a few exceptions. RW-1 has consistently shown some of the highest concentrations, especially for TCE at 700 ug/L at the start of the five-year review period, which decreased to 300 ug/L at the end of the five-year review period; and 1,1,1-TCA at 630 ug/L at the start of the five year review period, which decreased to 320 ug/L at the end of the five year review period. In addition to the decreasing trends of TCE and 1,1,1-TCA in RW-1, cis-1,2-DCE has shown an overall decreasing trend over the last five years, while 1,1-DCA has been consistently below the NJGWQS, with a few exceptions just above the standard earlier in the five-year review period. In contrast to the large decreasing trend in RW-1, RW-2 demonstrated an increasing trend, TCE (43ug/L to 59 ug/L) and 1,1,1-TCA (16ug/L to 28 ug/L). The contaminants cis-1,2-DCE and 1,1-DCA have exhibited decreasing trends in RW-2. In RW-3, all constituents have shown decreasing trends.

Contaminant concentrations in shallow bedrock well AOP-9 have also declined during the last five years for TCE (32ug/L to 25 ug/L) and cis 1,2-DCE (390 ug/L to 240 ug/L). Due to the presence of contaminants in the shallow fractured bedrock, EPA has directed the PRP to include bedrock well AOP-118, located downgradient to AOP-9, in the next round of groundwater sampling.

The PRP is considering additional investigations in the source area to evaluate if targeted remediation in these areas may decrease the timeframe to restore the groundwater.

Site Inspection

The PRP routinely evaluates the effectiveness of the groundwater treatment system by sampling the groundwater passing through the treatment units. The plant operators are present on Site to make sure the system is properly functioning and all required testing and sampling is being done on schedule. Similarly, the PRP consultant is on the Site as needed to monitor and inspect the system and conduct field sampling. A Site inspection for this five-year review was conducted on

February 19, 2013. The EPA RPM, hydrogeologist and PRP consultant were present for the five-year review Site inspection.

Interviews / Meetings

There is daily contact between the plant operator and the PRP's contractor. There is monthly contact between the EPA and the PRP's contractor. There have been numerous meetings, phone calls and correspondence with the PRP. An interview with the Sparta Township Engineer, Eric Powell, was conducted on January 23, 2013. Mr. Powell indicated that Township of Sparta had no concerns about the remedy.

Institutional Controls Verification

On April 30, 1998, the NJDEP approved a Classification Exception Area (CEA) and a Well Restriction Area (WRA), for a portion of the Site. The CEA was established in accordance with N.J.A.C. 7:9-6.6, because groundwater quality standards are not being met at this Site due to pollution caused by human activity. The Well Restriction Area was established to preclude withdrawal of the contaminated groundwater associated with this Site, except for the purposes of monitoring and/or additional treatment. It was originally anticipated, based upon groundwater modeling, that remediation to the groundwater quality standards outside the capture zone would be achieved in 9 to 13 years. A CEA/WRA established for this duration, expired. On March 26, 2013, NJDEP established a revised CEA/WRA for groundwater contamination. The CEA/WRA will continue for an indeterminate period of time until post-remediation monitoring indicates that COCs are below standards.

VII. Technical Assessment

Question A: Is the remedy functioning as intended by the decision documents?

The SVE system is currently operational and continues to remove contamination from the subsurface soils. It has been observed that the contaminant mass in the extracted air of the SVE system increases as the water table drops. As the water table rises, it has been observed that the contaminant mass in the extracted air of the SVE system decreases. Based on these observations, it is believed that the mass of VOC contamination has been removed from the soil source area and the fluctuating water table containing groundwater contaminants is depositing contaminants in soils where the water table rises and falls.

The pump and treatment system removes contamination from the groundwater via four recovery wells and effectively treats groundwater below applicable standards prior to discharge into the Wallkill River. The pump and treatment system is functioning as intended since it continues to reduce the contaminant mass in groundwater. MW-3S was converted into a recovery well in February 2013 to optimize extraction of contaminant mass from the groundwater. Groundwater will be monitored to determine the effect this addition to the recovery well network will have on

mass removal. Although the pump and treat is effectively capturing contaminant mass, concentrations of contaminants in monitoring wells within the capture zone remain elevated. EPA and the PRP have engaged in discussions that consider the use of additional source delineation and evaluation of technologies to accelerate remediation.

Impacted residents downgradient from the Site (along Station Road) have been previously connected to the municipal water supply. Groundwater use is not expected to change in this area within the next five years.

Question B: Are the exposure assumptions, toxicity data, cleanup levels and Remedial Action Objectives (RAOs) used at the time of the remedy still valid?

- **Are the exposure assumptions and toxicity data used at the time of the remedy selection still valid?**

a) Groundwater

Currently, the aquifer underlying the site is identified as a potable aquifer. Residents in the area receive their drinking water from a municipal supply. This aquifer use is still valid.

b) Soils

The exposure assumptions and toxicity values that were used to estimate the potential cancer risks and non-cancer hazards in the risk assessment supporting the ROD for human health followed the Risk Assessment Guidance for Superfund used by EPA. The process that was used in the human health risk assessment is still valid.

c) Vapor Intrusion

The Facility Area of the site has been purchased and has been redeveloped. A building has been erected in the footprint of the former A.O. Polymer laboratory, which is upgradient to the groundwater plume. In addition to office and storage space, the new building is used as a recreation center for children. As a precaution, the building has been equipped with a soil vapor mitigation system. No inhabited buildings are overlying the plume and, therefore, vapor intrusion is not an issue.

- **Are the Cleanup Values Selected in the ROD Still Valid?**

a) Groundwater

Multiple COCs continue to exceed their respective NJGWQS. Although contaminant-specific NJGWQS may have changed since the time the 1991 ROD was written, the goal of the groundwater remedy remains to achieve these standards and is, therefore, still protective.

b) Soil

The soil remedy selected for the Site was SVE. The soil cleanup goals in the ROD are 1 mg/kg for total VOCs and 10 mg/kg for total SVOCs. The values of the soil cleanup goals were selected as an optimum value to maintain groundwater quality for soils in contact with groundwater. The SVE system continues to remove contamination from the source area. Prior to shut down of the SVE system, soil sampling will determine if levels of COCs in the soil meet the groundwater protection objective.

- **Are the remedial action objectives (RAOs) still valid?**

The 1991 ROD did not identify specific RAOs. However, the ROD stated that the selected remedy would not result in hazardous substances remaining on site above health-based levels. Therefore, the soil and groundwater remedies have goals that support unlimited use and unrestricted exposure, with the expectation of restoring the aquifer to NJGWQS.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

1,4-Dioxane has been used as a stabilizer for 1,1,1-TCA and TCE. Due to the presence of 1,1,1-TCA and TCE in the groundwater, groundwater from the source area was recently analyzed for 1,4-dioxane. 1,4-Dioxane was not detected in the groundwater.

Large seasonal fluctuations of contaminant levels were observed in MW-3S. The highest concentrations of contaminants in the well were detected when the water level was low and samples were collected near the bottom of the well. This may be an indication of product accumulating at the bottom of the well. This has been addressed by converting this monitoring well to a recovery well.

Considering the connection of overburden flow to shallow bedrock, the contaminant levels in bedrock well AOP-9 will continue to be monitored. To ensure conditions in the bedrock have not changed since the remaining bedrock wells were removed from the sampling plan, bedrock well MW-118, located downgradient to AOP-9, will be included in the next round of groundwater sampling.

Remedy Assessment Summary

Based upon this five-year review, it has been found that:

- Contaminated soils in the Disposal Area are being remediated by an SVE system, which is operating properly.

- There are no drinking water wells within the contaminant plume and none are expected because of existing state restrictions. No downgradient wells are threatened by the contaminant plume.

- Groundwater monitoring wells and recovery wells are functional. Operational adjustments of the pumping system have been implemented, and plans for additional adjustments are being considered by EPA and the PRP. The groundwater and SVE treatment systems are operating properly.

VIII. Recommendations and Follow-Up Actions

This Site has ongoing remedial activities including operating remedies, maintenance and monitoring activities. As expected by the decision documents, these activities are subject to routine modification and adjustment. This report documented recent modifications and adjustments that will require monitoring to determine effectiveness. As a follow up action, EPA and the PRP will continue discussions regarding improvement of the efficiency of the groundwater pumping system.

IX. Protectiveness Statement

The OU1 remedy protects human health and the environment.

The OU2 remedy protects human health and the environment because the pump and treat system is effectively containing the plume and no residents are exposed to contaminated groundwater.

The OU1 and OU2 remedies protect human health and the environment because the pump and treat system is effectively containing the plume and no residents are exposure to contaminated groundwater.

XI. Next Review

The fourth five-year review for the AOP Site should be completed by May 8, 2018.

Table 1

Chronology of Events

Event	Date
Operator of the Site expands business from the manufacture of resins to include solvent reclamation.	1964
Citizens living and working near the Site register first complaints of odors emanating from the Site and well water.	1973
Complaints of odors and foul smelling well water intensify, touching off formal investigations by the Sparta Health Department and NJDEP.	1978
Owners of affected wells in the vicinity of the Site file claims to the New Jersey Hazardous Spill Fund and are subsequently connected to the municipal water supply.	1979
Cleanup at the Site was initiated by NJDEP, including removal of 1,150 drums and excavation and removal of 1,700 cubic yards of contaminated soil in the Disposal Area.	1980
NJDEP installed monitoring wells in and around the Site.	1982
Site was placed on the National Priorities List.	1983
The Remedial Investigation and Feasibility Study initiated by NJDEP.	1984
Record of Decision for soil and groundwater remedy issued.	1991
Production activities at the facility cease and the Site operator abandons unsecured hazardous material on the Facility Area of the Site.	1994
Construction of the soil remediation system (soil vapor extraction) is completed and was operational and functional.	1995
ESD was issued, modifying the ROD to allow the use of an air stripper in the groundwater treatment process, and discharge to surface water.	1996
Construction of the groundwater treatment system was completed.	1998
EPA removal activities at the Facility Area of the Site were completed resulting in the removal 34,000 pounds of hazardous waste.	1998
Facility Area of the Site was deleted from the NPL.	2002
First Five-year Review Completed.	2003
Second Five-year Review Completed.	2008

Table 2
Documents, Data and Information Reviewed in Completing the Five-year Review

Remedial Investigation Report	4/1991
A.O. Polymer Record of Decision	6/1991
Pre-Design Report	12/1995
NJDEP CEA Approval Letter	4/1998
Remedial Action Report Ground Water Treatment System	9/1998
Groundwater Monitoring Plan	1/1999
A.O. Polymer Five-year Review Report	9/2003
Grab Groundwater Sampling Letter Report	1/2005
Additional Grab Groundwater Sampling Letter Report	2/2006
Groundwater Monitoring Progress Report	5/2013
Monthly Progress Report	3/2013

Table 3: Comparison of Groundwater Standards for Chemicals of Concern:
Pre Treatment and Post Treatment Concentrations

Parameter	Federal MCL (ug/l)	NJ GWQS (ug/l)	Maximum Conc. Before Pump and Treatment (1994) (ug/l)	Maximum Concentration at Start of Third Five-year Review Sampling Period (2008) (ug/l)	Maximum Concentration at End of Third Five-Year Review Sampling Period (2012-2013) (ug/l)
Trichloroethene	5	1	46,000	700 (RW-1)	340 (MW-6)
cis-1,2-Dichloroethene	70	70	25,000	390 (AOP-9)	240 (AOP-9)
1,1-Dichloroethane	--	50	1,000	43 (AOP-9)	23 (AOP-9)
1,1-Dichloroethene	7	1	170	15 (AOP-9)	26 (MW-5)
trans-1,2-Dichloroethene	100	100	13	0.5 (AOP-9)	2.2 (MW-6)
Ethylbenzene	700	700	640	2.4 (MW-5)	2.4 (MW-6)
Toluene	1000	600	9700	1.7 (MW-6)	2.0 (MW-6)
1,1,1-Trichloroethane	200	30	41,000	530 (RW-1)	320 (RW-1)
1,1,2-Trichloroethane	5	3	65	0.3 (MW-6)	0.4 (MW-5)
Xylenes	10,000	1,000	2,800	3 (MW-6)	3.2 ((MW-6)

Gray shaded boxes indicate cleanup goal achieved.

A.O. Polymer Site
SVE Monthly Monitoring Results

Concentrations are ppm as methane

	Mar-12	Apr-12	May-12	Jun-12	Jul-12	Aug-12	Sep-12	Oct-12	Nov-12	Dec-12	Jan-13	Feb-13
SV-1	0	0	0	0	0	1	0	1	1	1	0	0
SV-2	1	1	1	1	1	2	2	2	3	3	1	2
SV-3	4	7	9	7	15	23	36	23	16	15	2	2
SV-4	1	1	1	2	3	3	10	11	18	14	2	2
SV-5	1	1	3	3	4	2	3	3	3	3	2	1
SV-6	1	1	2	2	5	3	6	17	7	4	1	2
SV-7	3	3	7	9	16	31	77	98	44	37	3	3
SV-8	4	4	6	7	18	41	60	38	66	70	15	6
SV-9	1	2	4	6	15	14	77	122	50	6	1	2
SV-10	7	7	12	9	18	48	89	92	48	19	7	6
SV-11	1	1	1	1	16	21	21	21	15	10	1	1
SV-12	1	1	2	2	4	4	2	1	1	1	0	0

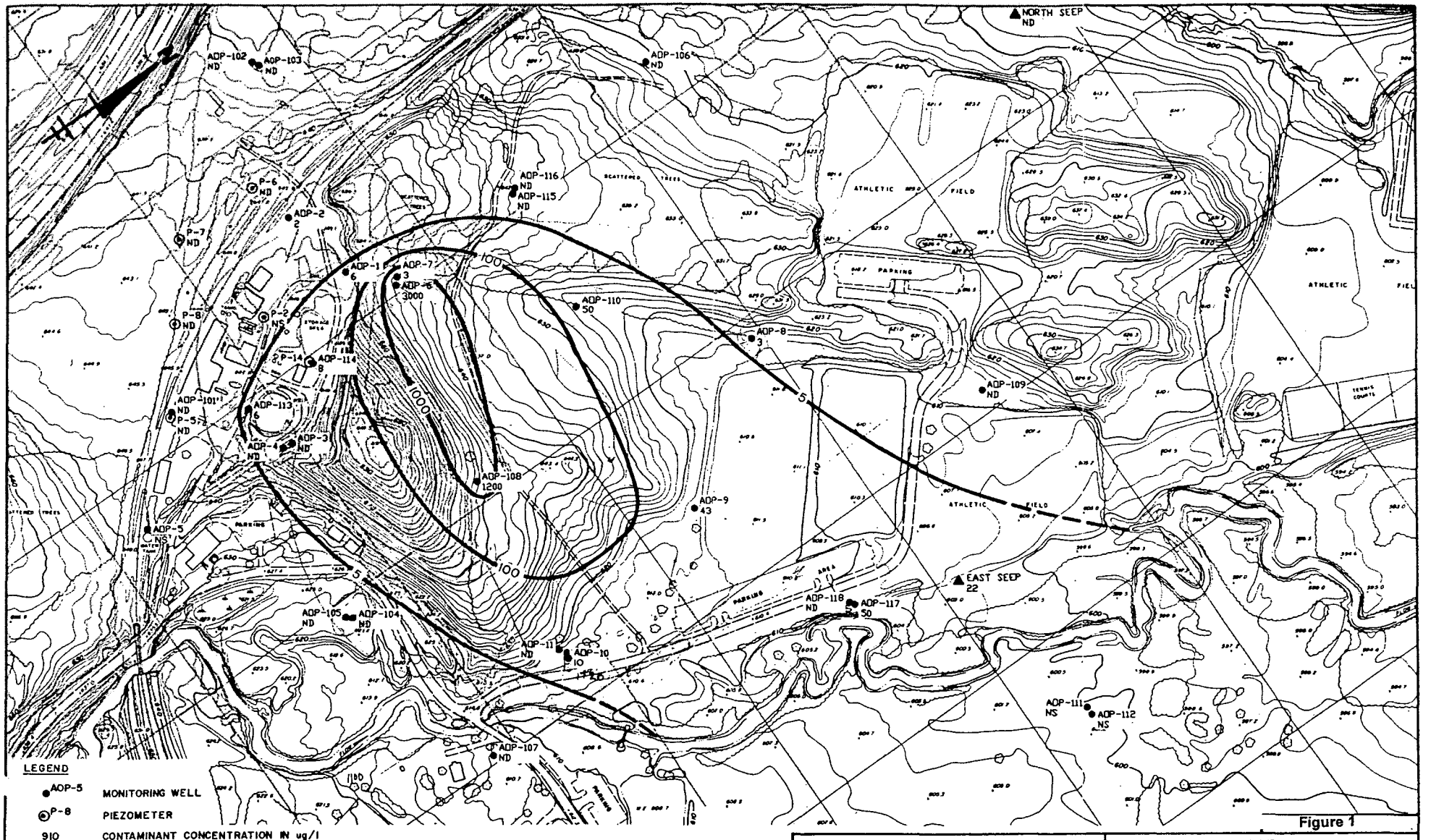
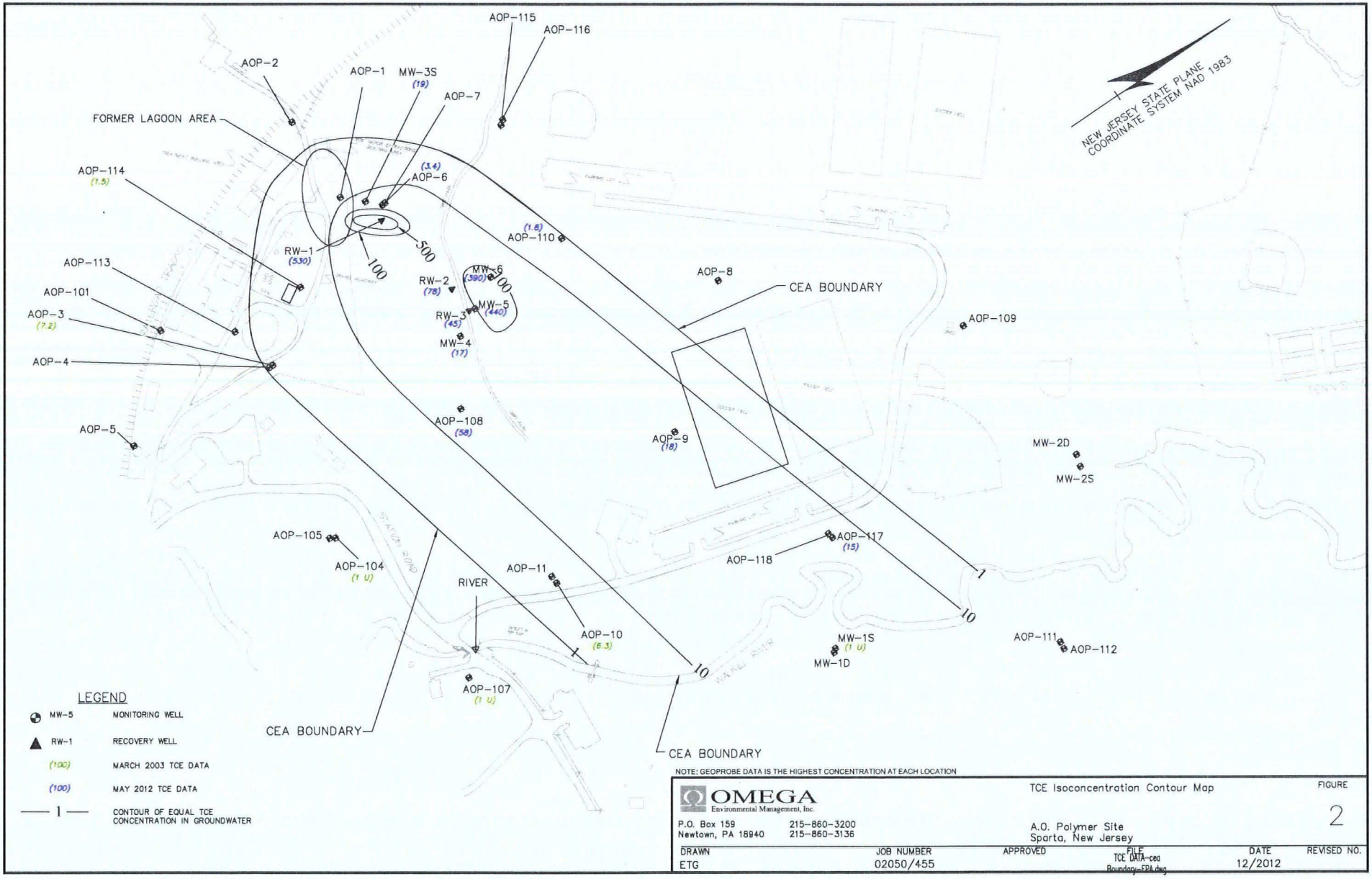


Figure 1

A. O. POLYMER SITE SPARTA, NEW JERSEY	TCE ISOCONCENTRATION CONTOUR MAP	
ICF TECHNOLOGY INCORPORATED PITTSBURGH, PA.	DATE: MAY 23, 1990	DR.: K. GARDNER
	SCALE: 1" = 200'	34090-003-12



NOTE: GEOPROBE DATA IS THE HIGHEST CONCENTRATION AT EACH LOCATION

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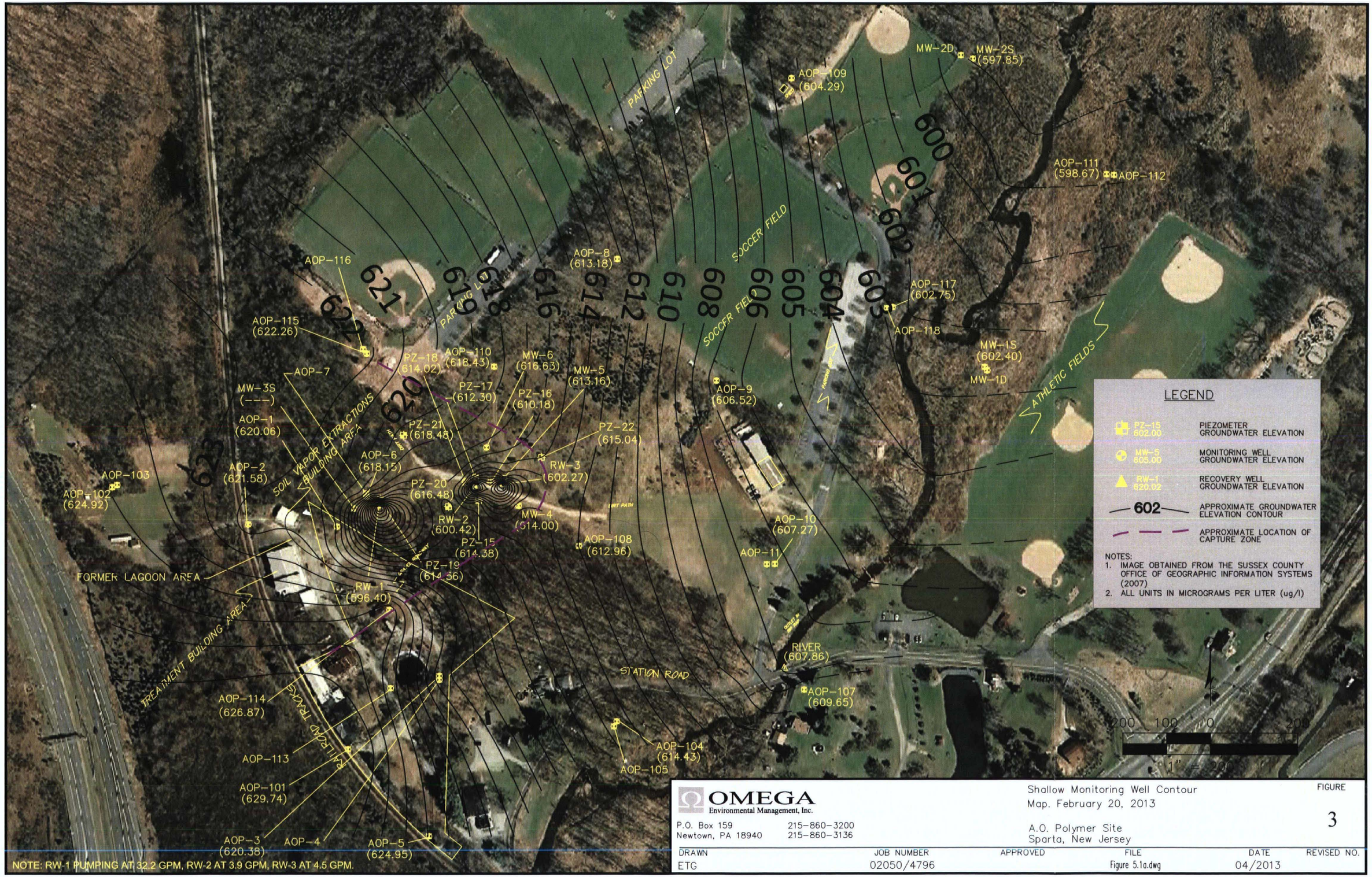
215-860-3136

TCE Isoconcentration Contour Map

A.O. Polymer Site
Sparta, New Jersey

FIGURE 2

DRAWN	JOB NUMBER	APPROVED	FILE	DATE	REVISED NO.
ETG	02050/455		TCE DATA-cea Boundary-EPA.dwg	12/2012	



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Newtown, PA 18940 215-860-3136

Shallow Monitoring Well Contour
Map. February 20, 2013

A.O. Polymer Site
Sparta, New Jersey

FIGURE
3

DRAWN	JOB NUMBER	APPROVED	FILE	DATE	REVISED NO.
ETG	02050/4796		Figure 5.1a.dwg	04/2013	