FOURTH FIVE-YEAR REVIEW REPORT
COLESVILLE MUNICIPAL LANDFILL SUPERFUND SITE
BROOME COUNTY, TOWN OF COLESVILLE, NEW YORK

Prepared by

U.S. Environmental Protection Agency
Region 2
New York, New York

May 2015

Approved by:

Walter E. Mugdan, Director
Emergency and Remedial Response Division

May 26, 2015
Date

334298

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EXECUTIVE SUMMARY

This is the fourth five-year review (FYR) for the Colesville Municipal Landfill Superfund site, located in the Town of Colesville, Broome County, New York. The purpose of this FYR is to review information to determine if the remedy is and will continue to be protective of human health and the environment. The triggering action for this statutory FYR is the completion date of the previous FYR (April 5, 2010).

The remedy protects human health and the environment in the short term because unacceptable exposure to contaminated media has been interrupted by the implemented remedial actions and institutional controls are in place. In order for the remedy to be protective in the long-term, natural attenuation parameters need to be evaluated to determine if natural attenuation is occurring, the continuing contaminant contributions from the springs into the stream need to be evaluated, North Stream sediment sampling/scraping needs to continue and technologies need to be evaluated to address increasing groundwater contaminant concentrations in the vicinity of landfill perimeter well PW-7.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site Name: Colesville Municipal Superfund Site		
EPA ID: NYD980768691		
Region: 2	**State:** NY	**City/County:** Town of Colesville/Broome County

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

REVIEW STATUS
Lead agency: State **If "Other Federal Agency" was selected above, enter Agency name:** N/A
Author name (Federal or State Project Manager): **George Jacob**
Author affiliation: EPA
Review period: 04/05/2010 – 04/05/2015
Date of site inspection: 10/30/2014
Type of review: Statutory
Review number: 4
Triggering action date: 04/05/2010
Due date *(five years after triggering action date)*: 04/05/2015

ISSUES/RECOMMENDATIONS
OU(s) without Issues/Recommendations Identified in the Five-Year Review:
N/A

Issues and Recommendations Identified in the Five-Year Review:				
OU(s): 01	**Issue Category: Remedy Performance**			
	Issue: A pilot study is underway to evaluate the effects of terminating the operation of the groundwater extraction and treatment and molasses injections.			
	Recommendation: Complete the pilot study and submit a report containing recommendations to the Agencies.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	5/31/2016
OU(s): 01	**Issue Category: Remedy Performance**			
	Issue: Natural attenuation parameters are not being evaluated in the downgradient monitoring wells.			
	Recommendation: Conduct a full evaluation of the extent of natural attenuation parameters in the downgradient monitoring wells.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	5/31/2016
OU(s): 01	**Issue Category: Remedy Performance**			
	Issue: Monitoring results indicate contaminant contributions from the springs into the stream.			
	Recommendation: Include seep, surface water, sediment sampling and sediment scraping in the site management plan.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	05/31/2016
OU(s): 01	**Issue Category: Remedy Performance**			
	Issue: Groundwater contaminant concentrations are increasing in landfill perimeter well PW-7, which is upgradient of the seep impacting the North Stream.			
	Recommendation: Evaluate technologies to contain or remediate groundwater contamination in the vicinity of this well.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	5/31/2016
OU(s): 01	**Issue Category: Remedy Performance**			

	Issue: A recently-implemented institutional control requiring vapor intrusion sampling if, in the future, buildings are constructed on-site in an area where elevated VOC groundwater contamination is present or if nearby vacate houses are reoccupied is not part of the selected remedy for the site.			
	Recommendation: An institutional control requiring vapor intrusion sampling if, in the future, buildings are constructed on-site where elevated VOC groundwater contamination is present or if nearby vacate houses are reoccupied needs to be incorporated into the remedy via an Explanation of Significant Differences.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	
No	No	EPA	EPA	5/31/2016

OU 01 PROTECTIVENESS STATEMENT

Operable Unit:	*Protectiveness Determination:*	*Addendum Due Date (if applicable):*
01	Short-term Protective	

Protectiveness Statement:

The OU1 remedy protects human health and the environment in the short-term because unacceptable exposure to contaminated media has been interrupted by the implemented the remedial actions and has been completed and has addressed all human health and ecological risks and all institutional controls are in place, preventing unacceptable use of soil and groundwater. In order for the remedy to be protective in the long-term, natural attenuation parameters need to be evaluated to determine if natural attenuation is occurring, the continuing contaminant contributions from the springs into the stream need to be evaluated, North Stream sediment sampling/scraping needs to continue and technologies need to be evaluated to address increasing groundwater contaminant concentrations in the vicinity of landfill perimeter well PW-7.

SITEWIDE PROTECTIVENESS STATEMENT

Protectiveness Determination:	*Addendum Due Date (if applicable):*
Short-term Protective	

Protectiveness Statement:

The sitewide remedy protects human health and the environment in the short-term because unacceptable exposure to contaminated media has been interrupted by the implemented the remedial actions and has been completed and has addressed all human health and ecological risks and all institutional controls are in place, preventing unacceptable use of soil and groundwater. In order for the remedy to be protective in the long-term, natural attenuation parameters need to be evaluated to determine if natural attenuation is occurring, the continuing contaminant contributions from the springs into the stream need to be evaluated, North Stream sediment sampling/scraping needs to continue and technologies need to be evaluated to address increasing groundwater contaminant concentrations in the vicinity of landfill perimeter well PW-7.

INTRODUCTION

This is the fourth five-year review (FYR) for the Colesville Municipal landfill Superfund site, located in the Town of Colesville, Broome County, New York. This FYR was conducted by United States Environmental Protection Agency (EPA) Remedial Project Manager (RPM) George Jacob. The review was conducted pursuant to Section 121 (c) of the Comprehensive Environmental Response, Compensation, and Liability Act, as amended, 42 U.S.C. §9601 *et seq.* and 40 CFR 300.430(F)(4)(ii) and in accordance with the *Comprehensive Five-Year Review Guidance*, OSWER Directive 9355.7-03B-P (June 2001). The purpose of a FYR is to ensure that implemented remedies continue to protect public health and the environment and function as intended by the site decision documents. This report will become part of the site file.

A FYR is required at this site due to the fact that hazardous substances, pollutants or contaminants remain at the site above levels that allow for unlimited use and unrestricted exposure. The triggering action for this statutory review is the completion date of the previous FYR, which was April 5, 2010. The site is being addressed as a single operable unit (OU), which is the subject of this FYR.

SITE CHRONOLOGY

See Table 1 for the chronology of the site events.

BACKGROUND

Site Location

The Colesville Landfill site is located in the Town of Colesville, Broome County, New York. The property on which the landfill is situated is bounded by East Windsor Road to the south and by unnamed tributaries of the Susquehanna River to the west-northwest (North Stream) and to the east (South Stream) (see Figure 1). Both tributaries discharge to the Susquehanna River, which is located to the south of the landfill.

Physical Characteristics

The Colesville Landfill Superfund site is characterized as rural and includes large tracts of undeveloped woodlands, as well as agricultural tracts and scattered residential parcels. Of the 113 acres on which the site is situated, the landfill occupies approximately 35 acres. The property's topography ranges from approximately 1,400 feet above mean sea level in the east to about 970 feet above mean sea level in the west.

Surface water drainage at the site is via two tributaries of the Susquehanna River—the North Stream and the South Stream. The North Stream, located to the north and west of the landfill, flows southwesterly to the Susquehanna River. To the east and south of the landfill is the South Stream, which flows to the south-southwest into a low-lying wet area. Both tributaries join the Susquehanna River approximately 0.5 miles north of Doraville.

The Susquehanna River is classified as Class B surface water in the vicinity of the site. Class B waters are suitable for both primary[1] and secondary[2] contact recreation, as well as for fish propagation. The North Stream and South Stream are Class C and D waters, respectively. These waters are suitable for secondary contact recreation and fish propagation only.

Vegetation patterns at the site are a mixture of herbaceous field, weed, and grass species. Both open-field and forested habitats characterize the surrounding area. These habitats support a large variety of avian and mammalian species. No New York State Department of Environmental Conservation (NYSDEC) Significant Habitat Areas are found on-site, although the site is located within the range of several migratory endangered or threatened species. The predominant aquatic species found in the Susquehanna River include small mouth bass, rock bass, and white suckers.

Site Geology/Hydrogeology

Glacial outwash deposits at the site consist of a heterogeneous mixture of gravel, sand, clay and silt. The average hydraulic conductivity of these materials is approximately 0.3 feet per day. Water moving within the glacial outwash aquifer beneath the landfill is part of a shallow groundwater subsystem that discharges into nearby surface-water bodies. In this type of hydrogeologic setting, essentially all of the areal recharge to the glacial outwash aquifer moves horizontally because of the dense glaciolacustrine clay confining unit that underlies the glacial outwash aquifer. The direction of groundwater flow at the Colesville Landfill site is toward the west, southwest, and south discharging to the North Stream and Susquehanna River. Although groundwater is present in the till and glaciolacustrine clay, the low permeabilities of these units limit their potential for groundwater flow. A very small portion of the base flow to the Susquehanna River is derived from groundwater flow moving upward from the bedrock aquifer, through the glaciolacustrine clay into the overlying glacial outwash aquifer, where it ultimately seeps into the Susquehanna River.

Land and Resource Use

The area surrounding the site includes large tracts of undeveloped woodlands, as well as agricultural tracts and scattered residential parcels.

Many of the residents of the Town of Colesville use private water supply wells. These wells utilize groundwater from both shallow and deep aquifers. Other homes utilize groundwater obtained from springs.

The nearest residential parcels to the landfill are located to the south and southeast along East Windsor Road. Measures have been taken at six properties that are impacted by site contamination to prevent human exposure to site contaminants. The measures included purchase by Broome County, implementation of environmental easements and installation of double-cased wells. Table

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1 Primary Contact Recreation—recreational activities where the human body may come in direct contact with water to the point of complete body submergence (*i.e.*, swimming, diving, water sports, and surfing).

2 Secondary Contact Recreation—recreational activities where contact with water is minimum and where ingestion of water is not probable (*i.e.*, fishing and boating).

2 provides the status of the six properties; Figure 2 shows the locations of the properties.

History of Contamination

Waste disposal operations at the landfill commenced in 1969. The landfill was owned and operated by the Town of Colesville between 1969 and 1971. Broome County purchased the landfill in 1971, and operated it until 1984 when it closed.

The landfill was primarily used for the disposal of municipal solid waste, although drummed industrial wastes from various sources were also disposed of between 1973 and 1975. Operational records indicate that these drummed wastes consisted of aqueous dye waste and organic solvent waste. Known waste constituents included benzene, cyclohexane, acetone, isopropyl alcohol, methanol, ethanol, n-hexane, toluene, xylene, dimethyl ether, zinc, aluminum, iron, tin sulfate, and chloride. In practice, drummed wastes were randomly co-disposed with the municipal solid wastes and disposed of in segregated areas. The drums were either buried intact, or were punctured and crushed prior to burial.

The landfill contains approximately 468,000 cubic yards of co-disposed waste.

Initial Response

The site was proposed for inclusion on the Superfund National Priorities List (NPL) in October 1984; it was listed on the NPL in June 1986. NYSDEC was designated the lead agency for this site.

In 1983, samples collected by the Broome County Health Department from residential wells in the vicinity of the site indicated that the Colesville Landfill was contaminating the groundwater beneath and in the immediate vicinity of the site. The sample results prompted the Broome County Department of Public Works to install carbon filters on the affected residences, to conduct a quarterly residential well monitoring program, and to perform two investigative studies of the Colesville Landfill. These studies were performed by Wehran-New York, Inc., (Wehran) in 1983 and 1984.

Wehran's 1983 study indicated that the groundwater quality in the vicinity of the Colesville Landfill demonstrated a strong indication of contamination by landfill leachate. Volatile organic levels, measured as total volatile organics, ranged from 48 to 2,800 micrograms per liter (µg/l) within and around the landfill. Concentrations of total volatile organics compounds (VOCs) in residential wells ranged from 32 µg/l to 415 µg/l.

Wehran's 1984 investigation confirmed the findings of the 1983 study with respect to the immediate landfill vicinity. Total volatile pollutant concentrations ranged from "not detected" in upgradient monitoring wells to 7,795 µg/l immediately downgradient. Contamination was confined, primarily, to the upper portions of the glacial outwash aquifer that underlies the site.

Basis for Taking Action

In 1988, Wehran completed a remedial investigation (RI) at the site on behalf of the Broome County Department of Public Works and GAF Corporation, the Potentially Responsible Parties

(PRPs), pursuant to an Order on Consent (Index No. T010687) issued by NYSDEC.

The RI found that the landfill was releasing low levels of VOCs into the groundwater. In general, the following five VOCS were the major contaminants in the contaminant plume: 1,1-dichloroethane, 1,1,1-trichloroethane, trichloroethene, trans-1,2-dichloroethene and benzene. The risk assessment concluded that exposure to the chemicals identified at the site could result from the consumption of contaminated well water or the inhalation of VOCs present in the water. Ecological risks were not evaluated in the RI.

In 1990, Wehran completed a confirmatory sampling program which confirmed the findings of the 1988 RI.

In December 1990, Wehran completed a feasibility study (FS) report, which presented an analysis of the potential alternatives for the remediation of contamination observed at the site.

REMEDIAL ACTIONS

Remedy Selection

Based upon the results of the RI/FS, in 1991, EPA signed a Record of Decision (ROD) for the site. The major components of the selected remedy include the following:

- Installation of a multimedia cap on the landfill;
- Installation of a leachate collection system;
- Installation of groundwater extraction wells to contain the groundwater contamination;
- Collection of contaminated groundwater from beneath and downgradient of the landfill;
- Treatment of the extracted groundwater, using metals treatment and air stripping;
- Discharge of the treated water to surface water;
- Imposition of property deed restrictions, if necessary, to prevent the installation of drinking water wells at the site and to restrict activities which could affect the integrity of the cap; and
- Provision of new wells for affected residents located in the vicinity of the site.

Remedy Implementation

Pursuant to the above-referenced Order on Consent with NYSDEC, Wehran, on behalf of the PRPs, began the engineering design for the selected remedy in the spring of 1991. During the initial stages of the design, the PRPs' consultant performed extensive field work to collect additional data for the groundwater portion of the remedial design. By June 1993, it was apparent that there were technical issues related to the groundwater extraction and treatment system that would not be easily or promptly resolved. It was, therefore, decided that the landfill cap design and the alternate water supply (double-cased deep wells) design should be completed separately from the groundwater extraction and treatment system design to allow the capping of the landfill and alternate water supply components of the remedy to proceed.

Landfill Cap

In 1994, Wehran, on behalf of the PRPs, completed the engineering design for the capping of the landfill and wetland restoration (creation of a new wetland to replace the three small wetland areas on the landfill's surface); the capping of the landfill and wetland restoration, performed by Tug Hill Construction, Inc., was completed in October 1995.

Alternate Water Supply

An alternate water supply well design (deep wells), which was prepared by Wehran, was approved by NYSDEC in 1995. The implementation of the design was delayed, however, while Broome County attempted to purchase the five affected properties and to place deed restrictions preventing the installation and use of groundwater wells on the properties so that there would be no drinking water receptors. The status of measures to prevent exposure to contaminants in the groundwater at these properties and another property by the river that is not considered one of the affected properties is provided in Table 2; the locations of the properties are shown on Figure 2. All but two of the properties have environmental easements; the two remaining properties have double-cased wells.

Groundwater Remedy

Based upon design-related aquifer tests conducted at the site, it was determined that extracting contaminated groundwater at the landfill, as called for in the ROD, would not likely be an effective means of remediating the groundwater at the source in a reasonable time frame. Specifically, the aquifer tests determined that the aquifer near the landfill has a low permeability, which would severely limit the area of influence of the extraction wells and would allow the groundwater to be pumped at only a very low rate (0.25 to 0.5 gallon per minute). Such conditions would necessitate the installation of an inordinate number of extraction wells. This conclusion led to an evaluation of alternative groundwater technologies and the performance of a pilot-scale study to evaluate the effectiveness of one of the more promising technologies, enhanced reductive dechlorination. This process involves injecting the contaminated groundwater with an easily degradable carbohydrate solution (*.e.g.*, molasses), which provides excess organic carbon that promotes microbial activity in the aquifer, enhancing the breakdown of chlorinated VOCs. Based upon the results of the pilot study, which showed a significant decline in VOC concentrations, it was concluded that this technology, in combination with the installation of downgradient extraction wells (as called for in the ROD), offered the most technically feasible approach to restoring groundwater quality in a reasonable time frame.[3]

In January 2001, while the groundwater remedy was under construction, GAF Corporation declared bankruptcy. Subsequently, NYSDEC and Broome County negotiated a new State Order under which the remaining work was completed.

The groundwater management system, constructed by Clean Earth Technologies, Inc., a subcontractor to the PRP's consultant Arcadis, became operational in September 2002. It consists

[3] The change to the remedy was documented in a September 2000 Explanation of Significant Differences (ESD).

of 17 automated reagent injection wells, three groundwater recovery wells, and an on-site groundwater treatment system. Molasses injections were performed every three months.

Additional Remedial Measures

In April 2000, during an inspection of the site performed as part of the five-year review process, EPA inspected a low-lying wet area and a spring on south side of the landfill in the vicinity of spring location SP-5 that were contaminated with site-related pollutants that exceeded NYSDEC's Ambient Water Quality Values. The source of the low-lying wet area was groundwater discharging upward through a vertical, three-foot diameter concrete structure that extends approximately 2.5 feet below the ground surface. The concrete structure appears to have been placed there to enhance the spring as a source of water. Until the contamination was detected, the opening of this structure was partially buried and obscured by dense vegetation. Since contaminated water from the spring and the low-lying wet area could potentially discharge to nearby streams, remedial measures to address these areas were undertaken in September 2003 and July 2004, respectively. The remedy for the low-lying wet area consisted of a sand filter and a granular activated carbon unit that were placed in the concrete structure (a cover was placed over the top of the structure). The water then flows through a horizontal 4-inch diameter drainage pipe running through the side of the concrete structure. A riprap-lined outlet structure to prevent erosion was installed at the discharge point of the drainage pipe.

The remedy for the contaminated spring along the North Stream consisted of the installation of a subsurface stone infiltration bed in the area of the spring to prevent the contaminated spring water from exfiltrating above the land surface. Larger boulders were placed between the stream and the infiltration bed to protect the integrity of the infiltration bed during high water conditions. These actions, which were performed by ARCADIS, were documented in a July 2004 Explanation of Significant Differences (ESD).

System Operations/Operation, Maintenance and Monitoring

To maintain the integrity and effectiveness of the cap, routine operation and maintenance (O&M) activities are necessary. The inspection/maintenance plan for the cap calls for regular inspection and evaluation of the cap, mowing the vegetation during the growing season, and fence maintenance. Repairs are to be made to the cap, as necessary, to control the effects of settling, subsidence, erosion or other events, and to prevent run-on from eroding or otherwise damaging the final cover. The inspection/maintenance plan has been modified to incorporate long-term groundwater monitoring, the molasses injections, the O&M of the groundwater extraction and treatment facility, and the maintenance of the passive treatment system placed in the concrete structure (granular activated carbon replacement) based upon post-treatment sampling results.
The site is inspected on a quarterly basis as follows:

- the site is inspected for debris, litter, waste and vandalism;
- the landfill cap is inspected for vegetation loss due to erosion or poor grass growth. annual ground inspections note stressed or undesirable species of vegetation on the landfill surface and side slopes;
- the landfill property is visually inspected for leachate outbreaks (precipitates on the ground surface, intermittent seeps, or soft spots);

- the landfill cap is inspected for cracks, settlement, erosion and deposition, ponding, and animal borrows;
- the gas venting pipes are inspected for damage;
- the site access gate and fence are inspected for operational locks and vandalism;
- the culverts, drainage ditches, and settlement gauges are inspected for sediment buildup or erosion; and
- the groundwater monitoring wells are inspected for operational locks, damage, and vandalism.

Molasses was injected via 17 automated reagent injection wells every three months until October 2012. The groundwater extraction and treatment and the injections of molasses were stopped at that time to allow the performance of a natural attenuation study.

The monitoring program at the site is being conducted as called for in the Long-Term Monitoring Plan (Arcadis Geraghty & Miller, 2002) and the sampling plans were revised in 2003, 2005 and 2011. Currently, there are 25 groundwater monitoring wells at the site. Eight monitoring wells are sampled quarterly, nine monitoring wells are sampled semiannually and all of the monitoring wells are sampled annually. Spring water sampling is on a quarterly schedule and sediment and surface water sampling are on a semi-annual sampling schedule. A new sampling plan is proposed in the Site Management Plan (SMP)[4] draft which currently under Agency review. An annual O&M report that is submitted by the PRP includes a summary of the results of the sampling and findings of the inspections, along with a certification that remedy-related O&M is being performed.

Sampling was conducted between December 2012 and March 2014 to assess potential risks to ecological receptors utilizing habitat in the North Stream. This sampling included multiple surface water and sediment samples collected from the stream, as well as surface water samples collected from the springs. The data show the concentrations of contaminants in the stream surface water samples to be below ecological screening levels. There were, however, some exceedances of ecological screening levels found in the surface water samples collected from the springs. These exceedances do not, however, contribute significant risks to ecological receptors, as these areas support a limited habitat. Sediment samples collected in the North Stream showed some metal concentrations that exceeded ecological screening values. A vertical delineation of the sediment indicated that the more elevated contaminant concentrations were between three inches and the surface. A scraping of this layer was conducted, thereby removing the iron staining and the elevated metals contamination. As a result of the noted findings of the sampling in combination with the scraping of the sediment, it was concluded that the remedy is protective of ecological receptors.

[4] The SMP provides for the proper management of all post-construction remedy components. Specifically, the SMP describes procedures to confirm that the requisite engineering and institutional controls are in place and that nothing has occurred that will impair the ability of said controls to protect public health or the environment. The SMP also includes an inventory of use restrictions; the necessary provisions related to the implementation of the requirements of a Declaration of Covenants and Restrictions and Environmental Easement, a provision for the performance of the operation, maintenance and monitoring required by the remedy; and a provision that the County submit periodic certifications that the institutional and engineering controls are in place.

Consistent with NYSDEC requirements associated with effecting a Declaration of Covenants and Restrictions and Environmental Easement, the County prepared a draft SMP in March 2014. A revised SMP was submitted in September 2014; the document is currently under review by the Agencies.

The groundwater extraction and treatment system O&M, injections of molasses, inspections, landfill maintenance, sampling, monitoring, data evaluation and reporting costs are approximately $127,000 on an annual basis; these costs are broken down in Table 3.

Potential site impacts from climate change have been assessed. The performance of the remedy is currently not at risk due to the expected effects of climate change in the region and near the site.

PROGRESS SINCE LAST FIVE-YEAR REVIEW

The third FYR was completed on April 5, 2010. The FYR concluded:

"Based on the current and reasonably anticipated site and groundwater uses, the Environmental Protection Agency has determined that the sitewide remedy protects human health in the short-term. There are no current risks present at the site in either groundwater or soils and none are expected, as long as the site use does not change and the engineered and access controls are properly operated, monitored, and maintained. In order to ensure the continued protectiveness of the remedy relative to human health, institutional controls need to be implemented. A protectiveness determination relative to ecological receptors cannot be made until additional information is obtained and corrective measures are undertaken, if necessary. It is expected that a report addendum containing a protectiveness statement relative to ecological receptors will be issued within eighteen months of the date of this report."

In order to determine protectiveness to ecological receptors utilizing habitat in the vicinity of the North Stream, the PRP's contractor, Arcadis, conducted sampling between December 2012 and September 2014. Media sampled included surface water, spring water, and sediment sampling. A total of 16 samples were collected during four rounds of sampling (March and September 2013 and 2014) from locations adjacent to and downstream of the springs along the North Stream and at the downstream location (F-6). Sporadic trace concentrations of VOCs have been detected in surface water, but the concentrations were consistently well below the Water Quality Standards and Guidance Values (WQSGV). With the exception of minor exceedances of aluminum, all detected concentrations of metals in surface water samples of the North Stream were below WQS, and metals in surface water do not pose an unacceptable risk for adverse health effects to aquatic organisms. In addition, sediment samples were collected within the North Stream in the vicinity of sampling location SP-3 on five occasions from March 2013 to September 2014 and analyzed for target analyte list (TAL) metals. The results were also evaluated relative to Freshwater Sediment Guidance Values of the NYSDEC Screening and Assessment of Contaminated Sediment document (NYSDEC 2014), which characterizes freshwater sediment as either Class A (low risk to aquatic life), Class B (slightly to moderately contaminated and additional testing is required to evaluate the potential risks to aquatic life), and Class C (sediments are considered to be highly contaminated and likely to pose a risk to aquatic life). Sediment samples exhibited sporadic exceedances that were primarily associated with the Class B criteria, with no exceedances of Class

C criteria in September 2014. A vertical delineation of the sediment indicated that the more elevated contaminant concentrations (primarily iron and manganese) were in the upper three inches of sediment. A scraping of this layer is conducted by Broome County, thereby removing the iron staining and the elevated metals concentrations.

Based on this assessment, a FYR addendum was completed on September 29, 2014. Based on the North Stream assessment, the FYR addendum concluded:

"The implemented OU1 remedy is functioning as intended by the decision documents and is protecting human health and the environment in the short-term. In order for the site to be protective in the long-term, an institutional control is needed to prohibit the installation of groundwater wells on private property located immediately downgradient of the landfill property.

"The implemented sitewide remedy is functioning as intended by the decision documents and is protecting human health and the environment in the short-term. In order for the site to be protective in the long-term, an institutional control is needed to prohibit the installation of groundwater wells on private property located immediately downgradient of the landfill property."

In addition, the FYR addendum recommended that sediment and surface water sampling should continue to monitor contaminant concentrations in the North Stream. Sediment sampling in the future should involve a decanting process that will assist in the reduction of the moisture content (elevated moisture content in sediment may artificially increase the contaminant concentrations in laboratory analysis).[5] Additionally, the iron staining in the North Stream should be carefully monitored. Scraping of the sediment should continue as needed. These items will be incorporated into the SMP. No sampling or scraping of the sediments have been conducted at the site since May 2014.

In addition to the ecological risk evaluation activities, in October 2012 molasses injections were halted to conduct a new pilot test, In-Situ Reactive Zone Discontinuation Pilot Test (including discontinuation of the groundwater extraction and treatment system). The specific objectives of the new pilot test are to:

- Demonstrate or measure the potential benefit to groundwater quality by continuing injections and groundwater extraction and treatment;
- Document the response to groundwater geochemistry including the evaluation of alternate electron acceptors such as dissolved iron and manganese;
- Evaluate if nearby springs (e.g., SP-3) have a positive response to the discontinuation of injections, including a reduction in visible iron staining and reduction in overall spring water volume;
- Evaluate VOC and metals concentration trends in spring water relative to New York State Department of Environmental Conservation (NYSDEC) Division of Technical and Operational Guidance Series 1.1.1 and WQSGV; and

[5] When the moisture content of a sediment sample is very high, metals are likely present in not only the sediment, but the sediment pore water. When the sample results are normalized to a dry weight basis, the net result are artificially high concentrations of metals in the sediment. Decanting the excess water from the sample will reduce the moisture content, thereby resulting in more accurate measurement of the metals concentrations in the sediment.

- Evaluate VOC and metals concentration trends in sediment relative to NYSDEC Technical Guidance for Screening Contaminated Sediments.

In addition to the above, results of the discontinuation pilot test are also being used to evaluate if natural attenuation mechanisms, without the injection of additional organic carbon, are sufficient for the complete reductive dechlorination of residual VOCs at the site. Currently, the injections and groundwater extraction wells have not been restarted and the pilot study is ongoing. Upon completion, recommendations for modifications to the groundwater remedy will be made and the EPA and the State will review the recommendations and determine whether changes to the remedy are appropriate.

FIVE-YEAR REVIEW PROCESS

Administrative Components

The FYR team consisted of George Jacob (RPM), Katherine Mishkin (hydrogeologist), Urszula Kinahan (human health risk assessor), Michael Clemetson (ecological risk assessor, Biological Technical Assistance Group) and Michael Basile (the EPA Community Involvement Coordinator [CIC]).

Community Involvement

The CIC, Michael Basile, posted a notice about the FYR on the EPA's Colesville Landfill Superfund site webpage on January 20, 2015. The notice was provided to the Town Clerk on January 20, 2015 and was subsequently posted in the municipal office.

The notice indicated that EPA would be conducting a FYR of the remedy at the Colesville Landfill Superfund site to ensure that the remedy remains protective of public health and is functioning as designed. The notice included the RPM's address and telephone number for questions related to the FYR process

The RPM did not receive any questions regarding the FYR.

This completed FYR will be made available at the Colesville Landfill Superfund site information repositories, which are at the Town of Colesville Town Hall, Harpursville, New York, and the EPA Region 2 Superfund Records Center, 290 Broadway, 18th Floor, New York, New York. The FYR report will also be posted on the EPA's webpage.

Document Review

The documents, data and information which were reviewed in completing this FYR are summarized in Table 4.

Data Review

Groundwater

Water-levels are collected from 25 monitoring wells and the data indicate that the groundwater flow is directed toward the west, southwest, and south toward the discharge boundaries of the North Stream and the Susquehanna River. Groundwater samples are collected on a quarterly basis from 8 monitoring wells, semi-annually from 9 and annually from all 25 monitoring wells. The groundwater is sampled for VOCs, dissolved gases (ethene, ethane and methane), alternate electron acceptors, and total organic carbon (TOC). Groundwater samples are also collected from select injection wells to analyze for TOC.

Groundwater samples are collected from monitoring wells using passive diffusion bags or as grab samples using bailers or a whale pump. Since this site covers a large area and there is a radial component to groundwater flow, groundwater conditions are assessed according to locations of monitoring wells. Mid-plume monitoring wells are situated closest to the former injection activities, former recovery wells are situated downgradient of the mid-plume monitoring wells, plume boundary wells are located downgradient and south of the former recovery wells, off-site monitoring wells are serving as sentinel wells are situated downgradient of the southern boundary of the landfill, and perimeter wells are situated along the outer edges of the landfill. See Figure 1.

Mid-Plume Monitoring Wells

Groundwater monitoring data exceeded the NYSDEC WQSGV for a number of site-related VOCs. The reoccurring highest levels of VOCs include trichloroethylene (TCE), cis-1,2-dichloroethene (cis-1,2-DCE), 1,1-dichloroethane (1,1-DCA), and chloroethane which all have a NYSDEC WQSGV of 5 ug/L. Historically, the highest levels of VOCs have been detected in the mid-plume monitoring wells and for this reason, this area was designated for molasses injections. These wells include GMMW-2, GMMW-5, GMMW-6, PW-3, PW-4, PW-5, W-5, and TW-1.

Overall, the original parent compounds (PCE, 1,1,1-TCA) are at low-level concentrations and mostly below their respective NYSDEC WQSGV of 5 ug/L. Over the last five years of monitoring, PCE and 1,1,1-TCA were found at maximum concentrations of 2.5 J ug/L (PW-3) and 9.9 ug/L (PW-4), respectively. Daughter products of both parent compounds have been more persistent over the last five years of monitoring. As shown in Figures 2 through 15, PCE degradation compounds (*i.e.,* TCE, 1,2-dichloroethylene [DCE]) and 1,1,1-TCA degradation compounds (*i.e.,* 1,1-DCA, chloroethane) are present in all of the monitoring wells. These figures show variable concentrations of degradation products in most monitoring wells with no apparent trend in some of the wells. The maximum concentrations of PCE degradation compounds were found in monitoring well GMMW-2 (cis-1,2-DCE at 67 ug/L in December 2009; the NYSDEC WQSGV is 5 ug/L). The maximum concentrations of 1,1,1-TCA degradation compounds were found in monitoring well GMMW-6 (chloroethane – 290 ug/L in June 2014). Additionally, ethene and ethane are present in all of the monitoring wells, indicating that complete reductive dechlorination is occurring in this portion of the site. Although ethene and ethane are present, samples over the last five years show declining TOC concentrations in injection wells and monitoring wells situated in this reduction zone. In some cases, TOC levels are below the 20 milligrams per liter, a level that is recommended to support enhanced reductive dechlorination on a long-term basis. It is

recommended that additional natural attenuation parameters continue to be collected and analyzed as part of the ongoing discontinuation pilot study to determine if natural attenuation parameters are sufficient or additional substrates are necessary to continue VOC degradation.

Recovery Wells

The recovery wells are no longer pumping as part of the Discontinuation Pilot Study, but currently serving as monitoring wells. The recovery wells with data from the last five years include: GMPW-3, GMPW-4, and GMPW-5, which are all further downgradient than the wells discussed above. Of these three wells, the one showing the highest levels of site-related contaminants and exceeding the NYSDEC WQSGV is GMPW-4, with cis-1,2-DCE reaching 56 ug/L and 1,1-DCA reaching 59 ug/L in April 2011. Groundwater sampled between June 2010 to present at GMPW-4 showed exceedances of groundwater criteria for 1,1,1-TCA, 1,1,-DCA, chloroethane, TCE, cis-1,2-DCE, and vinyl chloride. Concentrations of 1,1,1-TCA range from below the groundwater criteria (5 ug/L) to 8.2 ug/L, 1,1,-DCA ranges from 9 ug/L to 59 ug/L, chloroethane ranges from below groundwater criteria (5 ug/L) to 35 ug/L,TCE ranges from 5.7 ug/L to 36 ug/L, cis-1,2-DCE ranges from just below groundwater criteria (5 ug/L) to 56 ug/L, and vinyl chloride ranges from below groundwater criteria (1 ug/L) to 8.0 ug/L. Moderately decreasing trends to no clear trends are evident in data collected from GMPW-4.Groundwater sampled in GMPW-3 in 2013 and 2014 indicated site-related exceedances of the NYSDEC WQSGV for 1,1-DCA with a range of 9.8 to 11 ug/L, cis-1,2-DCE with a range of 8.4 to 10 ug/L, and TCE with a range of 18 to 20 ug/L. GMPW5 was only sampled once during the FYR (2012) and results indicate exceedances of the NYSDEC WQSGV in 1,1-DCA (30 ug/L), chloroethane (12 ug/L), cis-1,2-DCE (15 ug/L), TCE (20 ug/L), and vinyl chloride (3.2 ug/L).

Plume Boundary Wells

The area further downgradient of the recovery wells is monitored by the plume boundary wells. The monitoring wells identified as plume boundary wells include: W-16S, W-17S, and W-18. While W-16S and W-17S are sidegradient of contamination and have shown only low levels of site-related contaminants, W-18 has recently shown PCE-related daughter (TCE, cis-1,2-DCE, vinyl chloride) at concentrations exceeding their respective NYSDEC groundwater criteria and no clear data trend is evident (Figure 12). In order to delineate the extent of VOCs downgradient of W-18, 4 temporary groundwater points were installed using geoprobes in June 2011. The temporary wells were located east of the North Stream and north of the Susquehanna River. Although VOCs were detected in the most upgradient temporary samples, they were below their respective NYSDEC WQSGV in the two most downgradient samples. Since this was a one-time sampling event, concentration trends downgradient of W-18 remain unknown. Since W-18 continues to remain above cleanup levels, natural attenuation parameters will be evaluated at this well to determine if attenuation is sufficient to prevent further plume migration.

Off-Site Wells

W-14S and W-20S are situated downgradient of the south side of the landfill (downgradient of W-18) and have been serving as sentinel wells. These wells have shown no exceedances of site-related contaminants.

Landfill Perimeter Wells

Landfill perimeter wells are located along the outer edges of the landfill. W-6, W-7, and W-13 are along the south side of the landfill and sidegradient of where the groundwater contaminant plumes have been identified in the mid-plume area. These wells have not shown any exceedances of site-related contaminants. PW-7 is situated along the northwest boundary of the landfill, upgradient of where injection activities have occurred. During the review period, this well has shown increasing concentrations of site-related contaminants (Figure 11). The highest levels observed were of 1,1-DCA with concentrations ranging from 42 to 310 ug/L over the last five years and show an increasing concentration trend. In fact, concentrations of TCE, cis-1,2-DCE, vinyl chloride, and chloroethane similarly seem to be increasing in concentration at this location. The next nearest downgradient measuring points from PW-7 are the downgradient seep samples.

Seep, Sediment, Surface Water

Seep and North Stream sediment and surface water samples were collected and evaluated in accordance with recommendations in the 2010 FYR. Seep and North Stream surface water sampling events showed some exceedances of WQS for aluminum, iron, and manganese. In addition, sediment samples immediately downgradient of the seeps showed some exceedances of arsenic, copper, iron, manganese, and nickel. However, these contaminant exceedances were limited to the top 3 inches of sediment. Consequently, these sediments have been removed. Surface water, seep, and sediment monitoring will continue to ensure the North Stream is protective to ecological receptors. Since the seeps continue to be a source of contamination to the North Stream and the upgradient well P-7 continues to show exceedances, the responsible parties are in the process of evaluating technologies to address contamination in the vicinity of P-7 and reduce seep contributions to the North Stream.

Site Inspection

A site inspection related to this FYR was conducted on October 30, 2014. Those in attendance included George Jacob, Urszula Kinahan, Katherine Mishkin and Michael Clemetson from the EPA; Payson Long, the NYSDEC project manager; Dan Schofield, Richard Hand and Laurie Haskell from the Broom County and Steven Feldman from Arcadis.

During the site visit in October 2014, the areas around SP-2, SP-3, and SP-4 were observed to be highly impacted by iron hydroxide staining. During the inspection, standing water was observed in a small, low-lying area of the cap.

Interviews

No interviews were conducted for this review.

Institutional Controls Verification

A Declaration of Covenants and Restrictions and Environmental Easement was recorded by the Broome County Clerk on March 19, 2014. The easement restricts future development or use of the landfill property that could compromise the integrity of the remedy or cause the contaminants

to migrate without the express written approval of NYSDEC and EPA and prohibits the installation of drinking water wells on the landfill property and the use of the underlying groundwater for potable or process water. A Declaration of Covenants and Restrictions and Environmental Easement for a property located immediately downgradient of the landfill property was recorded by the Broome County Clerk's office on February 13, 2015. The easement allows only the installation double-cased bedrock wells. The installation of any other potable supply wells are prohibited.

TECHNICAL ASSESSMENT

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

The ROD, as modified by the ESDs calls for, among other things, the installation of a cap, molasses injections at the landfill and downgradient contaminated groundwater collection and treatment. The purpose of the response action is to reduce the risk to human health and the environment due to contaminants leaching from the landfill mound. The capping of the landfill was implemented to minimize the infiltration of rainfall and snowmelt into the landfill, thereby reducing the potential for contaminants leaching from the landfill and negatively impacting groundwater quality. Capping was also intended to prevent direct contact exposure to contaminated soils. The groundwater remediation system consists of a molasses reagent injection system to enhance naturally-occurring biologically mediated degradation of contaminants and a groundwater extraction component to capture contaminated groundwater near the site boundary and to provide feed water for reagent injections. The objective of the groundwater remediation system is to ensure that groundwater outside the landfill boundary meets Applicable or Relevant and Appropriate Requirements (ARARs) for groundwater.

In October 2012, the extraction wells were also shut down and molasses injections were discontinued to conduct an In-Situ Reactive Zone Discontinuation Pilot Test. The test is ongoing and will be used to determine if reducing conditions could remain in the aquifer without continuing molasses injections or if additional reducing substrates need to be used to meet groundwater ARARs.

The monitoring well network indicates that the plume has not migrated past the sentinel well. Downgradient wells continue to remain above ARARs for site contaminants and their daughter products. Additional attenuation studies will be conducted in downgradient wells to determine if attenuation will prevent further plume migration.

In addition, as evidenced by FYR addendum sampling activities, the seeps in the vicinity of the North Stream continue to impact sediment. Although these levels do not adversely impact ecological receptors, it is recommended that additional sampling/sediment scraping occur in this area and the responsible parties evaluate technologies to reduce contamination upgradient of the seeps.

The ROD called for the imposition of property deed restrictions, if necessary, to prevent the installation of drinking water wells at the Site and to restrict activities which could affect the integrity of the cap. A Declaration of Covenants and Restrictions and Environmental Easement

restricts future development or use of the landfill property that could compromise the integrity of the remedy or cause the contaminants to migrate and prohibits the installation of drinking water wells on the landfill property and the use of the underlying groundwater for potable or process water; any future development or change in use of the landfill requires the express written approval of NYSDEC and the EPA. A Declaration of Covenants and Restrictions and Environmental Easement for a property located immediately downgradient of the landfill property (Property 3 in Table 2) allows only the installation double-cased bedrock wells.

Question B: Are the exposure assumptions, toxicity data, cleanup levels and remedial action objectives used at the time of the remedy still valid?

The exposure assumptions and toxicity data used to estimate potential risks and hazards to human health followed general risk assessment practices at the time the risk assessment was conducted. Although the risk assessment process has since been updated, and specific parameters and toxicity values may have changed, the risk assessment process that was used is consistent with current practice and the need to implement the remedial action remains valid.

Possible human exposure pathways and media evaluated in the Baseline Human Health Risk Assessment (HHRA) included consumption of contaminated site groundwater and direct contact with contaminated stream sediments in the vicinity of the landfill. The results of the HHRA indicated that the carcinogenic risk (2.85×10^{-4}) and noncancer hazard (3.85) associated with exposure to potable well water at the site exceeded EPA's acceptable risk range and target threshold values of 10^{-6} to 10^{-4} and 1, respectively. Although the calculated risk of 7.41×10^{-6} associated with direct contact with leachate seep soils/sediments did not exceed EPA's risk range, the RI concluded that remediation of these seeps were warranted in order to minimize any future environmental impacts.

As for potential groundwater exposures, as described in Table 2 and shown in Figure 2, the nearest residences in the vicinity of the site have either been demolished, vacated or are currently using a double-cased bedrock well. Analytical results collected from the two residential bedrock wells in the vicinity of the site do not show any detectable concentrations of organic compounds. Ongoing site-wide groundwater monitoring continues to ensure contamination emanating from the landfill is not impacting nearby potable wells. Furthermore, environmental easements preventing the installation and use of groundwater wells on nearby residential properties are in place.

The following RAOs were identified in the decision documents and remain valid for the site: control the release of VOCs from the site to the glacial outwash aquifer that underlies the project area; properly close the landfill and eliminate leachate seeps and any associated leachate discharges to the North and South streams; eliminate the potential for direct human or animal contact with any active leachate seeps; continue the existing quarterly residential well monitoring program along with the temporary water supply and carbon filtration program for the affected residences until a new water supply is constructed and restore the groundwater underlying the site to levels consistent with state and federal MCLs.

The groundwater cleanup goals selected at the time of the ROD were the more stringent of state and federal MCLs. Although some of the NYSDEC groundwater standards have changed since the time of the decision documents, most notably those for 1,2-DCA and 1,1-DCE, the ROD-

established cleanup levels remain protective of human health.

Although the ecological risk assessment screening and toxicity values used to support the ROD may not necessarily reflect the current values, the landfill cap has eliminated any potential risk from surface soil contaminants to terrestrial receptors. Potential adverse effect to aquatic organisms associated with the North Stream is limited due to acceptable surface water quality, and lack of aquatic habitat offered at the springs. Furthermore, as a result of the noted findings of the sediment sampling in combination with the scraping of sediment, it is concluded that the remedy is overall protective of ecological receptors.

Although soil vapor intrusion into indoor air was not evaluated during the 1988 risk assessment, this evaluation was conducted in 2008 based on recommendations from past five-year reviews. Because no homes in the immediate vicinity of the landfill were appropriate for subslab soil gas sampling (the only home directly downgradient of the landfill is unoccupied, dilapidated and the safety of the basement is questionable), ARCADIS collected six soil gas samples from the interval immediately above the water table on the south side of East Windsor Road in October 2008. Based on the sampling results, the 2010 five-year review concluded that if structures are built downgradient of the landfill, vapor intrusion could be a concern primarily based on the TCE concentration of 550 micrograms per cubic meter detected in one location out of the six locations sampled. (This analysis was conservative because elevated levels of TCE were detected in only one out of six locations). This determination was valid for the 2010 five-review period and remains valid for the current review period. Because no buildings are currently occupied in the immediate area of this sample location, this pathway remains incomplete. If buildings are constructed in this area in the future, or if the nearby homes are reoccupied, additional vapor intrusion sampling would be necessary to determine whether this pathway is of concern. Accordingly, letters were sent to the Broome County's Department of Public Works and the Town of Coleville's Office of Code Enforcement on May 7, 2015 indicating that the EPA and NYSDEC should be contacted prior to the approval of any building permits or Certificates of Occupancy for the noted areas; periodic reminders to these agencies will be issued. The initial notifications and the subsequent reminders constitute an institutional control, which will be added to the implemented remedy via an ESD.

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

No.

Technical Assessment Summary

Based upon the results of the five-year review, it has been concluded that:

- although a small, low-lying area of the cap where standing water was observed needs to be filled and regraded, overall, there has been very little apparent settling of the cap;
- the cap and vegetative cover are intact and in good condition;
- the fence around the cap within the site is intact and in good repair;
- the monitoring wells are functional;
- there is no evidence of trespassing or vandalism;
- the groundwater remedy is functioning as intended and is significantly reducing the mass flux of contaminants migrating from the landfill perimeter;

- the remedy has prevented residents from drinking contaminated groundwater; and
- additional measures may be needed to protect public health and the environment in the long term.

During the five-year review site inspection, significant iron staining was observed at various locations.

Because the areas where the seeps are located are remote, trespassers would need to go out of their way to get there, and the area is not attractive as a recreational location, human exposure is unlikely. Water from the seepage areas should, however, be sampled to ensure that there are no unacceptable ecological impacts.

A determination needs to be made as to whether or not the groundwater plume discharges to surface water and whether such discharge poses an ecological risk in the long term.

ISSUES, RECOMMENDATIONS AND FOLLOW-UP ACTIONS

Table 6 summarizes recommendations and follow-up action stemming from this FYR.

PROTECTIVENESS STATEMENTS

OU1

The OU1 remedy protects human health and the environment in the short-term because unacceptable exposure to contaminated media has been interrupted by the implemented the remedial actions and has been completed and has addressed all human health and ecological risks and all institutional controls are in place, preventing unacceptable use of soil and groundwater. In order for the remedy to be protective in the long-term, natural attenuation parameters need to be evaluated to determine if natural attenuation is occurring, the continuing contaminant contributions from the springs into the stream need to be evaluated, North Stream sediment sampling/scraping needs to continue and technologies need to be evaluated to address increasing groundwater contaminant concentrations in the vicinity of landfill perimeter well PW-7.

Sitewide

The sitewide remedy protects human health and the environment in the short-term because unacceptable exposure to contaminated media has been interrupted by the implemented the remedial actions and has been completed and has addressed all human health and ecological risks and all institutional controls are in place, preventing unacceptable use of soil and groundwater. In order for the remedy to be protective in the long-term, natural attenuation parameters need to be evaluated to determine if natural attenuation is occurring, the continuing contaminant contributions from the springs into the stream need to be evaluated, North Stream sediment sampling/scraping needs to continue and technologies need to be evaluated to address increasing groundwater contaminant concentrations in the vicinity of landfill perimeter well PW-7.

NEXT REVIEW

The next FYR report for the Colesville Municipal Landfill Superfund site is required five years from the completion date of this review.

Table 1: Chronology of Site Events	
Event	**Date**
Landfill Operations	1969- 1984
Samples collected by Broome County Health Department from residential wells in the vicinity of site indicate that landfill contaminating groundwater	1983
Site is placed on NPL	1986
ROD signed	1991
Landfill Cap Remedial Design	1991-1994
Landfill Cap Remedial Action	1995
Alternate Water Supply Well Remedial Design approved by NYSDEC	1995
Explanation of Significant Differences by EPA	2000
Groundwater Remedial Design	2000-2004
First Five-Year Review conducted	2000
Alternate Water Supply Well Remedial Action	2002
Groundwater Remedial Action	2002-2004
Explanation of Significant Differences by EPA	2004
Preliminary Site Close-Out Report	2004
Second Five-Year Review conducted	2005
Subsurface stone infiltration bed damaged during flood event	2006
Infiltration bed repaired and extended and stone retaining wall	2006
Soil Vapor evaluation performed	2008
Third Five-Year Review conducted	2010
Plume delineation report submitted	2012
Institutional Controls implemented at the Landfill	2014
Third Five-Year Review Report Addendum completed	2014
Institutional Controls implemented at the affected private parcel	2015

Table 2: Residential Property Distribution

Property	Property Distance from Landfill (ft.)	Occupancy Status	Environmental Easement?	Double-Cased Well?
Property 1	400	Demolished	Yes	N/A
Property 2	1,140	Vacant	Yes	No
Property 3	560	Vacant	Yes	No
Property 4	900	Occupied	No	Yes
Property 5	1,240	Vacant	No	Yes
Property 6	2,000	Demolished	Yes	N/A

Table 3: Annual Operations, Maintenance and Monitoring Costs	
Activity	**Cost per Year**
Groundwater Remediation OM&M, Injection of Molasses	$18,000
Groundwater Monitoring, Sampling and Analysis	$49,000
Data Management and Reporting	$35,000
Site Inspection/Maintenance	$25,000
Total estimated cost	***$127,000***

Table 4: Documents, Data, and Information Reviewed in Completing Five-Year Review	
Remedial Investigation/Feasibility Study, Wehran Engineering	1990
Record of Decision, EPA	1991
Operation and Maintenance Monitoring Manual, Arcadis	1994
Groundwater Remediation System Engineering Report, Arcadis	2000
First Five-Year Review Report, EPA	2000
Explanation of Significant Differences, EPA	2000
LTM (Long Term Monitoring) Plan, Arcadis	2002
Spring Remedy, Arcadis	2003
Explanation of Significant Differences, EPA	2004
Preliminary Close-Out Report, EPA	2004
Interim Remedial Action Report, Arcadis	2004
Annual Monitoring Reports, Arcadis	2009-2014
Second Five-Year Review Report, EPA	2005
Third Five-Year Review Report, EPA	2010
Plume Delineation Report, Arcadis	2012
DCR&EE, EPA, NYSDEC	2014
Sediment Report, Arcadis	2014
Third Five-Year Review Report Addendum, EPA	2014
EPA guidance for conducting five-year reviews and other guidance and regulations to determine if any new Applicable or Relevant and Appropriate Requirements relating to the protectiveness of the remedy have been developed since EPA issued the ROD.	

Table 5: Other Comments on Operation, Maintenance, Monitoring, and Institutional Controls

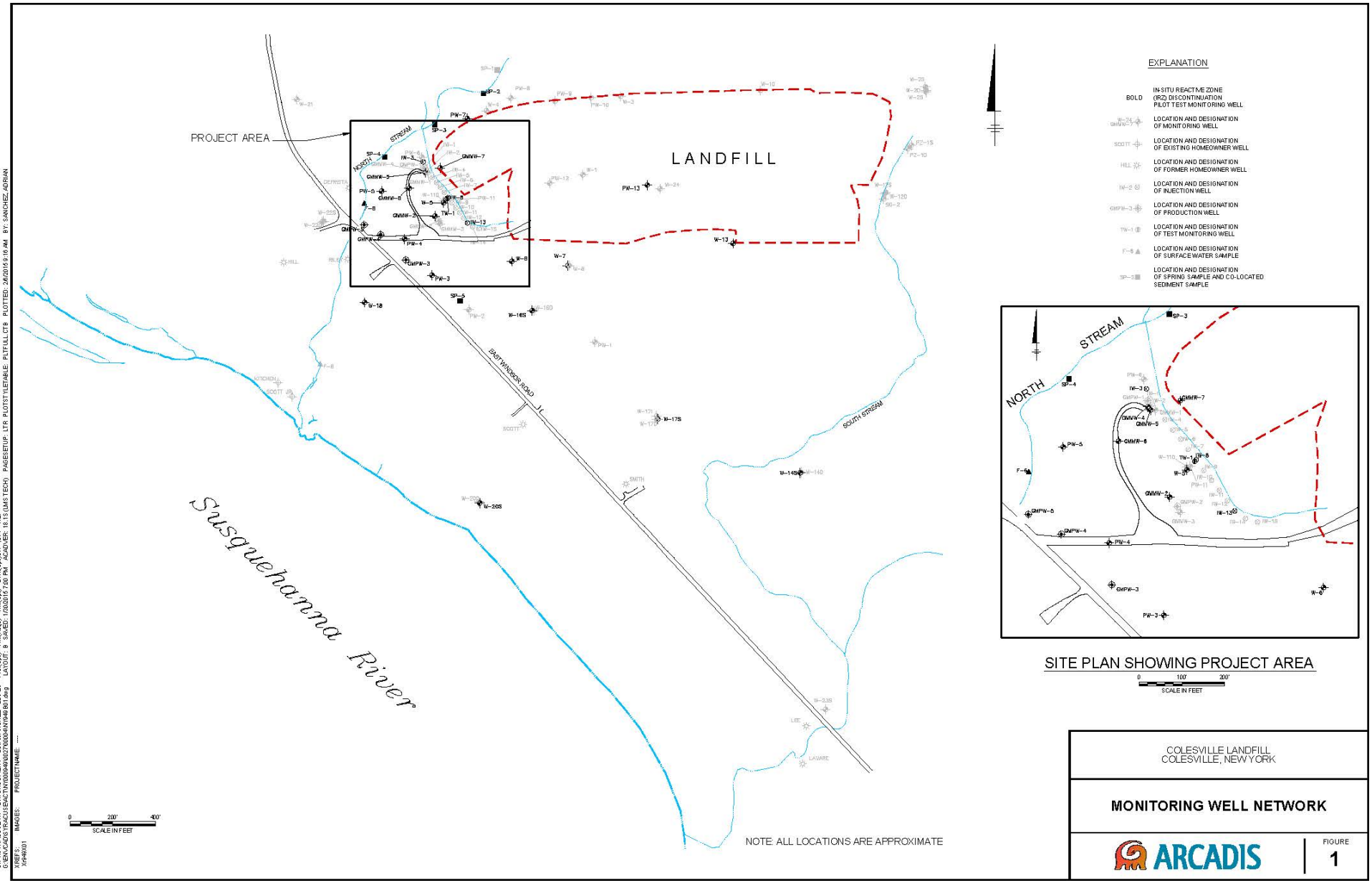
Comment	Suggestion
During the inspection, standing water was observed in a small, low-lying area of the cap.	The low-lying area of the cap needs to be regraded.
The Quality Assurance Project Plan (QAPP) for the site was prepared in 2002. EPA requires QAPP be updated every 5 years	Update the QAPP in Compliance with the Uniform Federal Guidance for QAPPs (UFP-QAPP.) This can be found at http://www2.epa.gov/fedfac/assuring-quality-federal-cleanups

Table 6: Recommendations and Follow-Up Actions

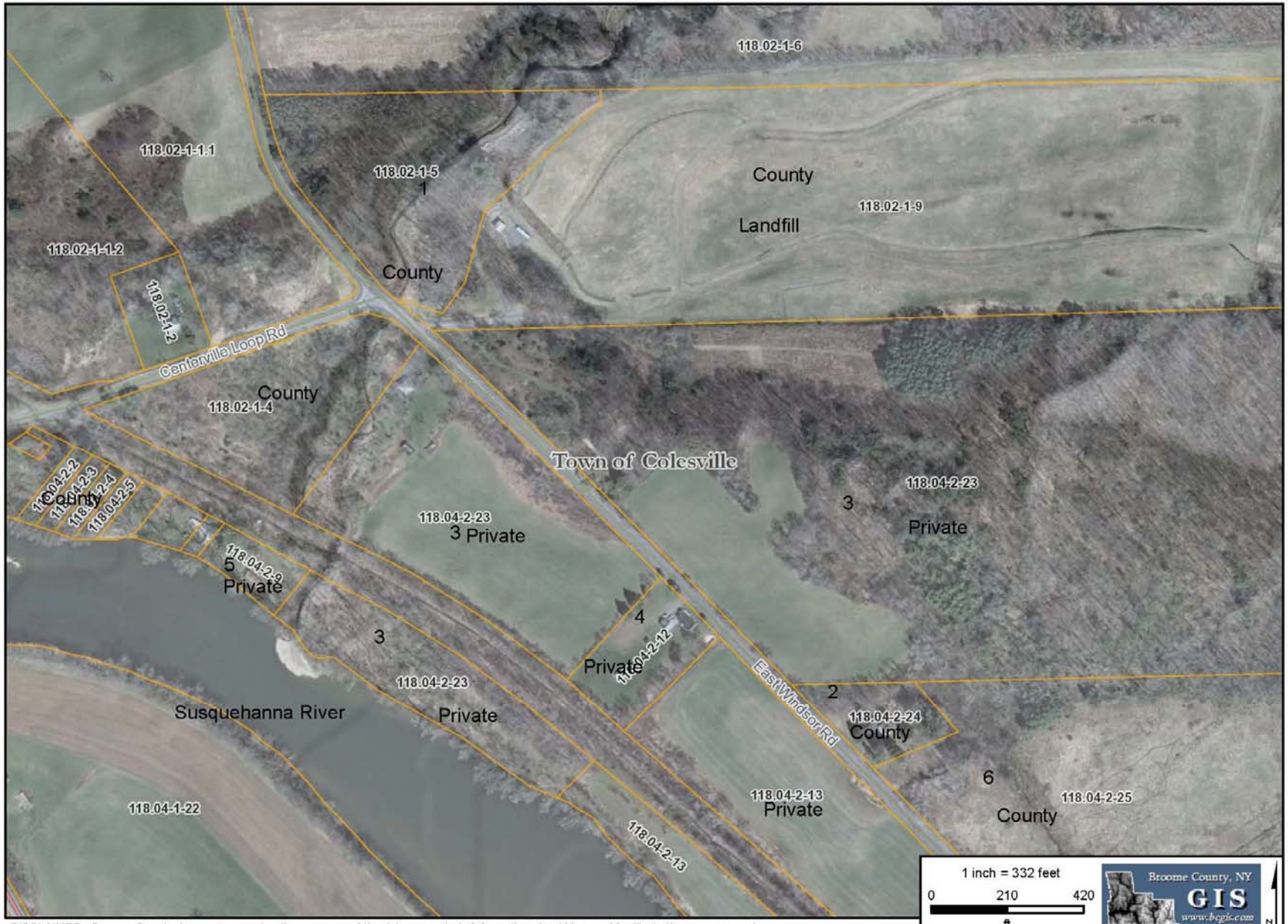
Issues and Recommendations Identified in the Five-Year Review:				
OU(s): 01	**Issue Category: Remedy Performance**			
	Issue: A pilot study is underway to evaluate the effects of terminating the operation of the groundwater extraction and treatment and molasses injections.			
	Recommendation: Complete the pilot study and submit a report containing recommendations to the Agencies.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	5/31/2016
OU(s): 01	**Issue Category: Remedy Performance**			
	Issue: Natural attenuation parameters are not being evaluated in the downgradient monitoring wells.			
	Recommendation: Conduct a full evaluation of the extent of natural attenuation parameters in the downgradient monitoring wells.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	5/31/2016
OU(s): 01	**Issue Category: Remedy Performance**			
	Issue: Monitoring results indicate contaminant contributions from the springs into the stream.			
	Recommendation: Include seep, surface water, sediment sampling and sediment scraping in the operation and maintenance plan.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	05/31/2016
OU(s): 01	**Issue Category: Remedy Performance**			
	Issue: Groundwater contaminant concentrations are increasing in landfill perimeter well PW-7, which is upgradient of the seep impacting the North Stream.			
	Recommendation: Evaluate technologies to contain or remediate groundwater contamination in the vicinity of this well.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	5/31/2016
OU(s): 01	**Issue Category: Remedy Performance**			

	Issue: A recently-implemented institutional control requiring vapor intrusion sampling if, in the future, buildings are constructed on-site area where elevated VOC groundwater contamination is present or if nearby vacate houses are reoccupied is not part of the selected remedy for the site.			
	Recommendation: An institutional control requiring vapor intrusion sampling if, in the future, buildings are constructed on-site where elevated VOC groundwater contamination is present or if nearby vacate houses are reoccupied needs to be incorporated into the remedy via an Explanation of Significant Differences.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	
No	No	EPA	EPA	5/31/2016

Figure 1: Site Location Map showing monitoring well locations



Broome County Parcel Mapper



DISCLAIMER: Broome County does not guarantee the accuracy of the data presented. Information should be used for illustrative purposes only.

Figure 2

Figure 3: PCE degradation products in GMMW-6.

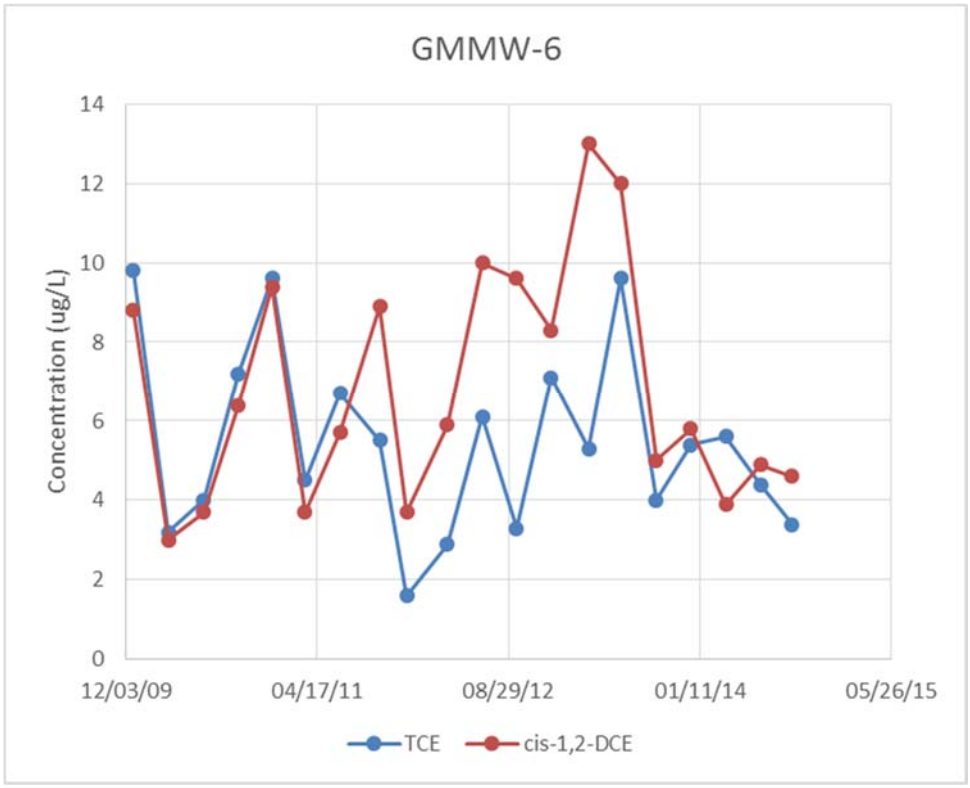


Figure 4: 1,1,1-TCA degradation products in GMMW-6

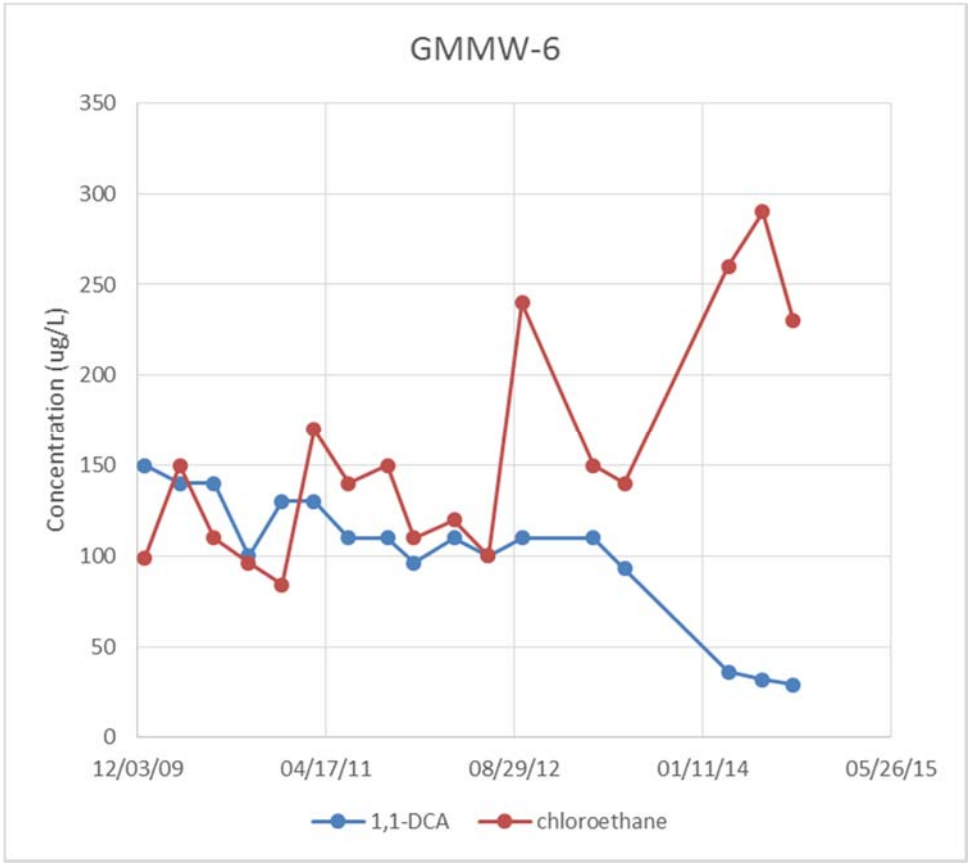


Figure 5: PCE-degradation products in GMMW-5

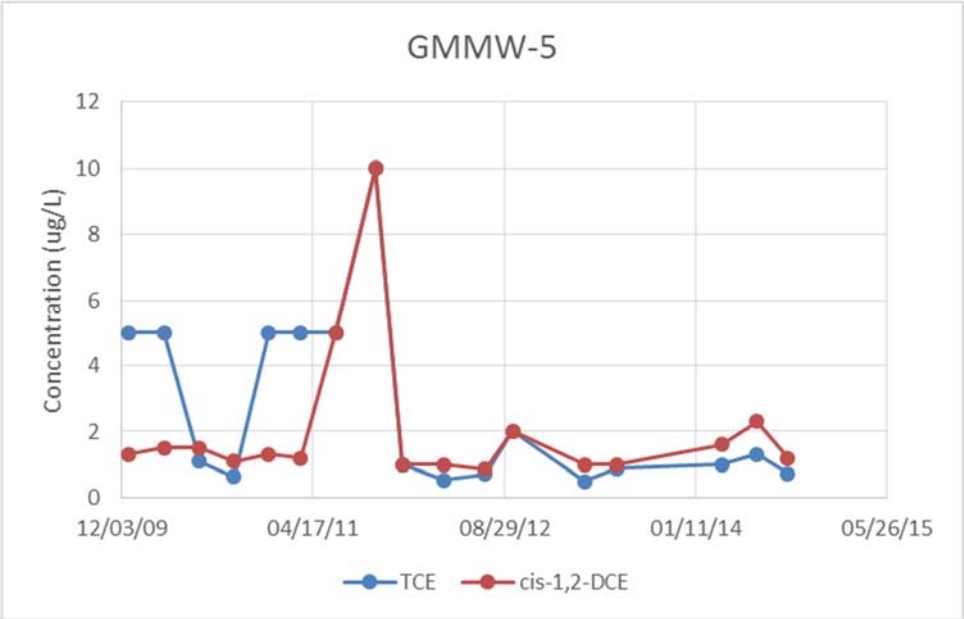


Figure 6: 1,1,1-TCA-degradation products in GMMW-2

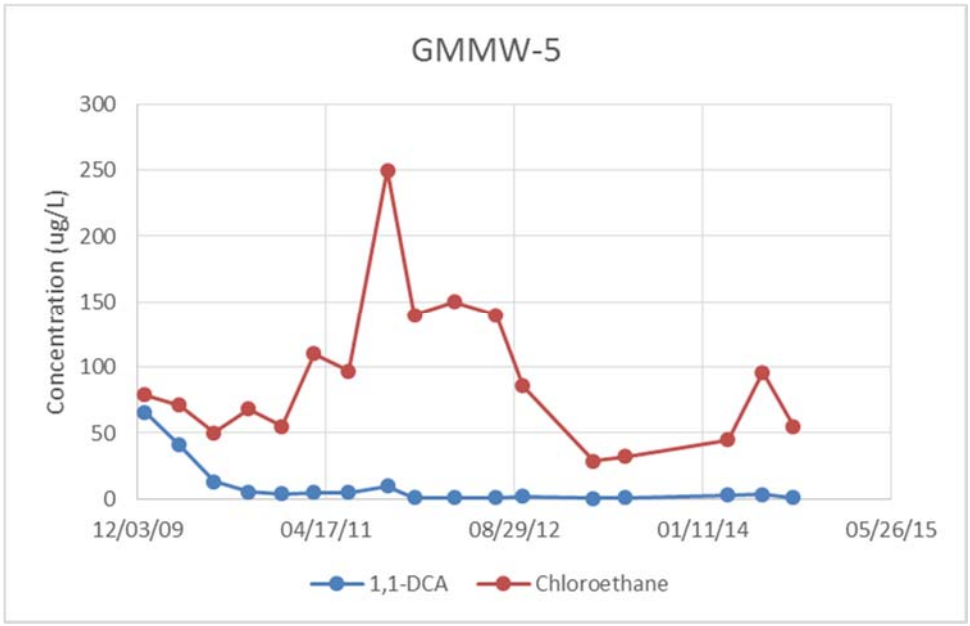


Figure 7: 1,1,1-TCA related degradation products in GMMW-2

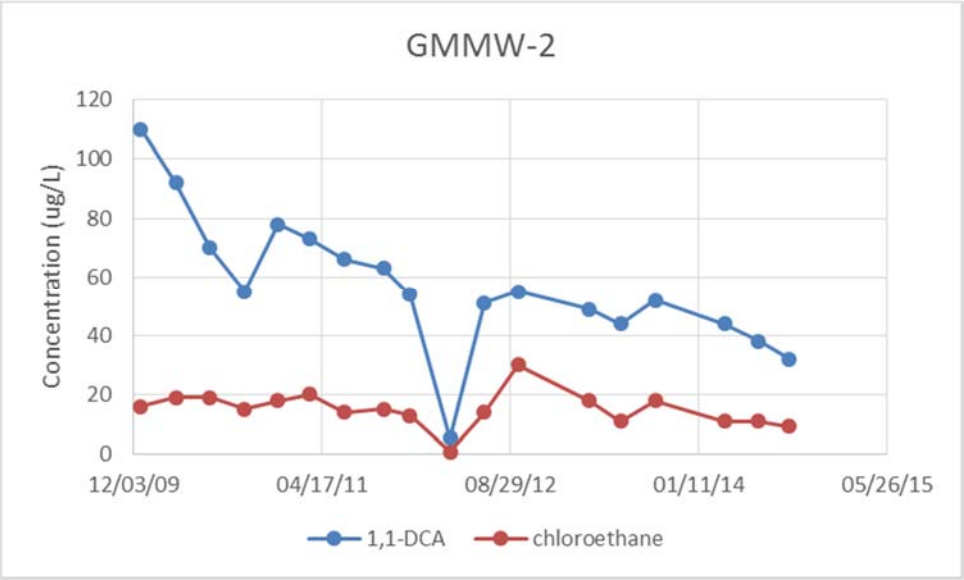


Figure 8: PCE-related degradation products in W-5

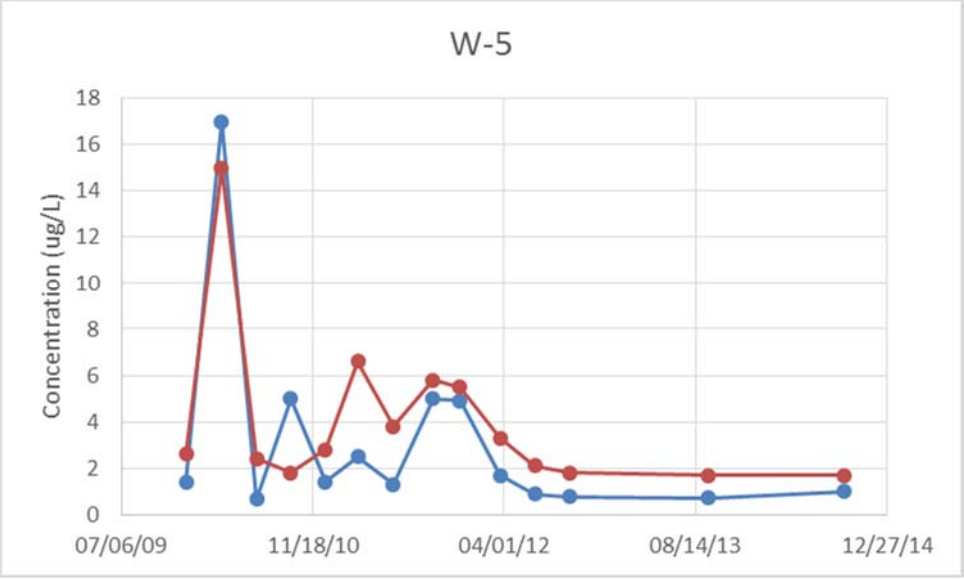


Figure 9: 1,1,1-TCA-degradation products in W-5

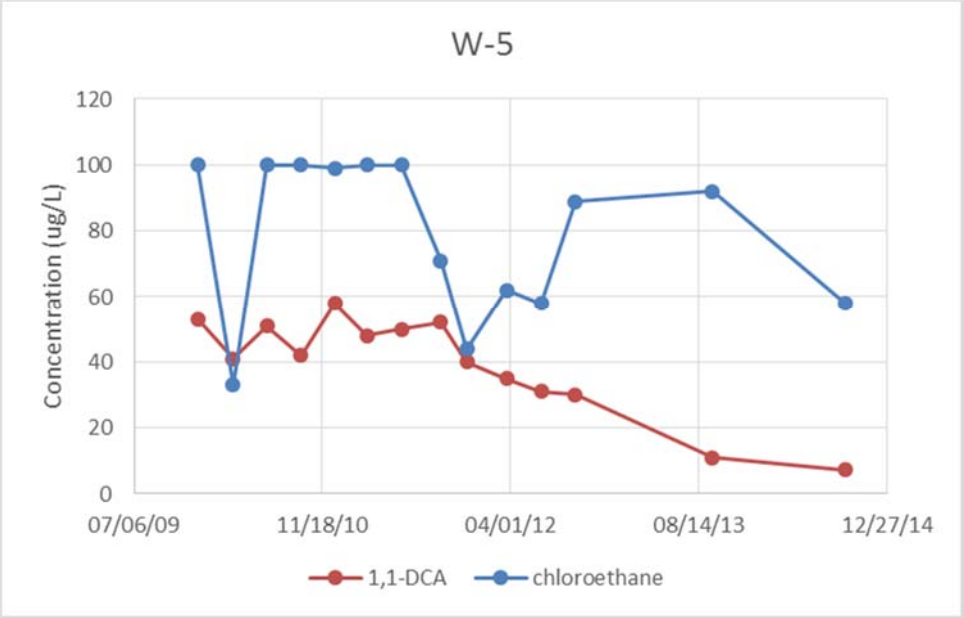


Figure 10: PCE-related degradation products in TW-1

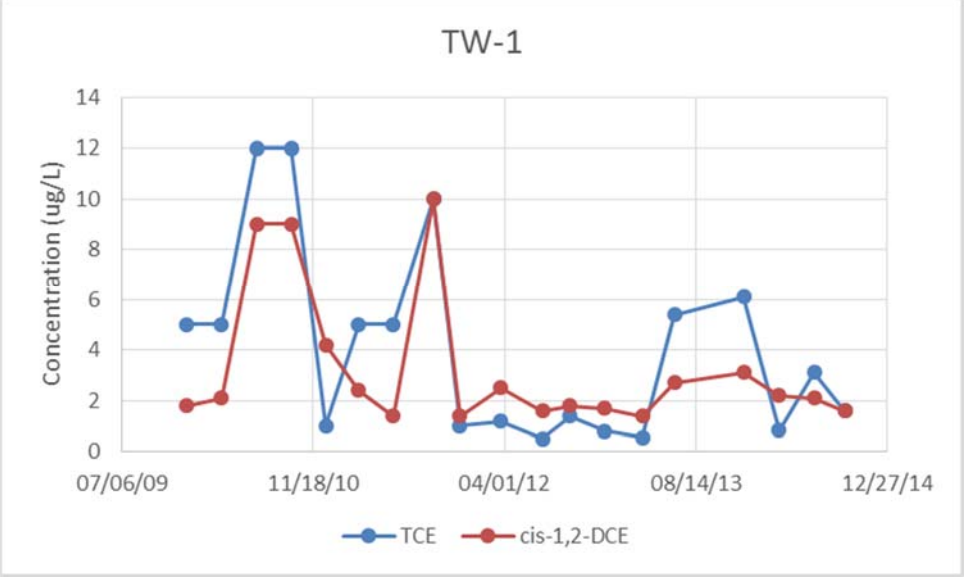


Figure 11: 1,1,1-TCA-degradation products in TW-1

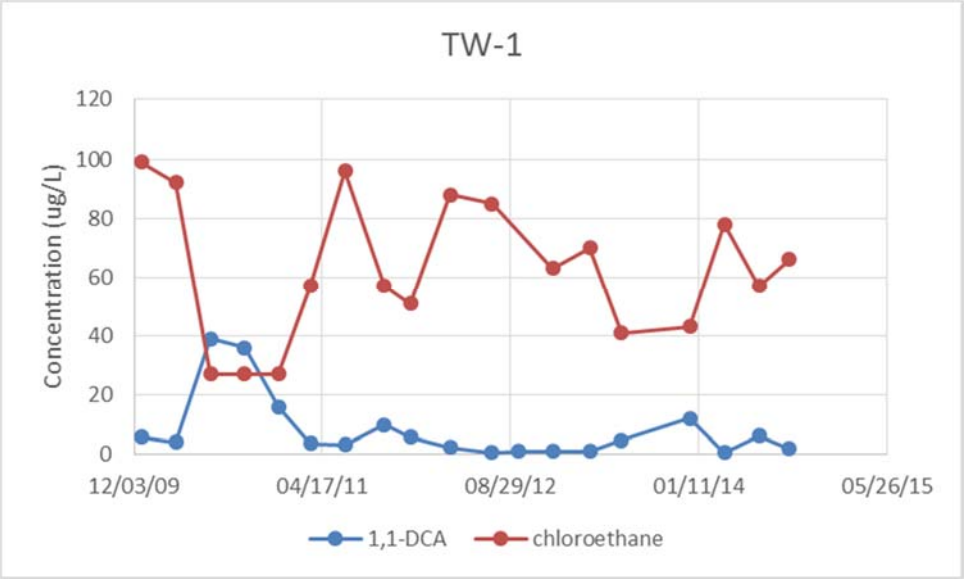


Figure 12: PCE and 1,1,1-TCA – degradation products in PW-7

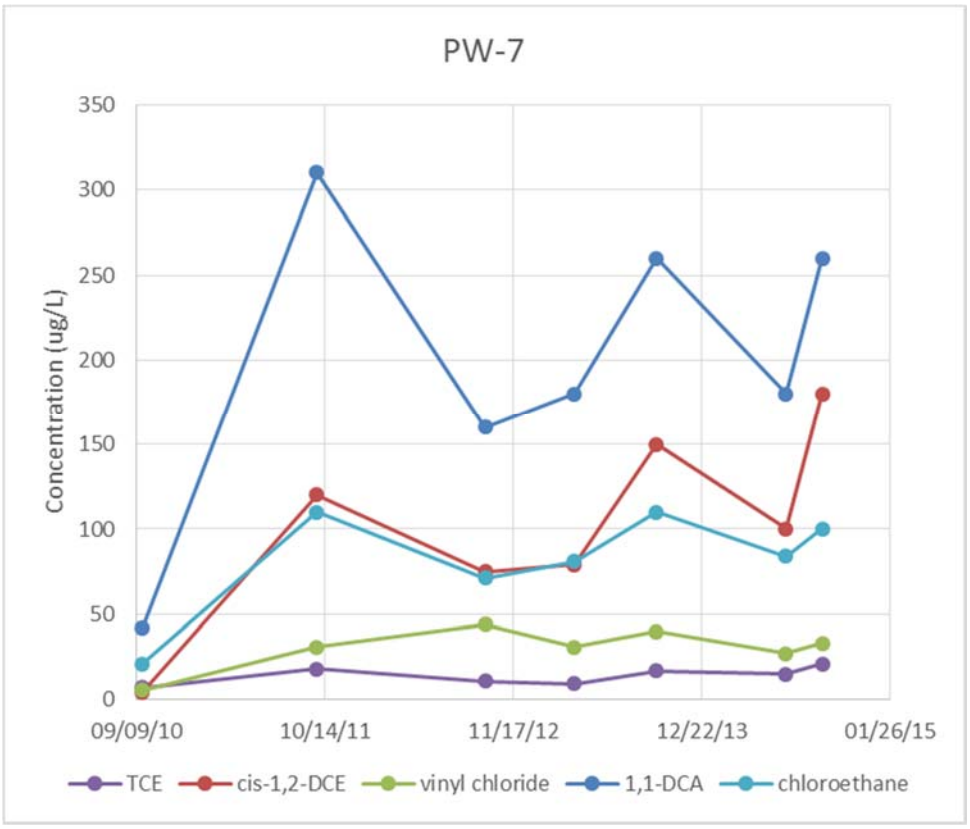


Figure 13: PCE – degradation products in W-18

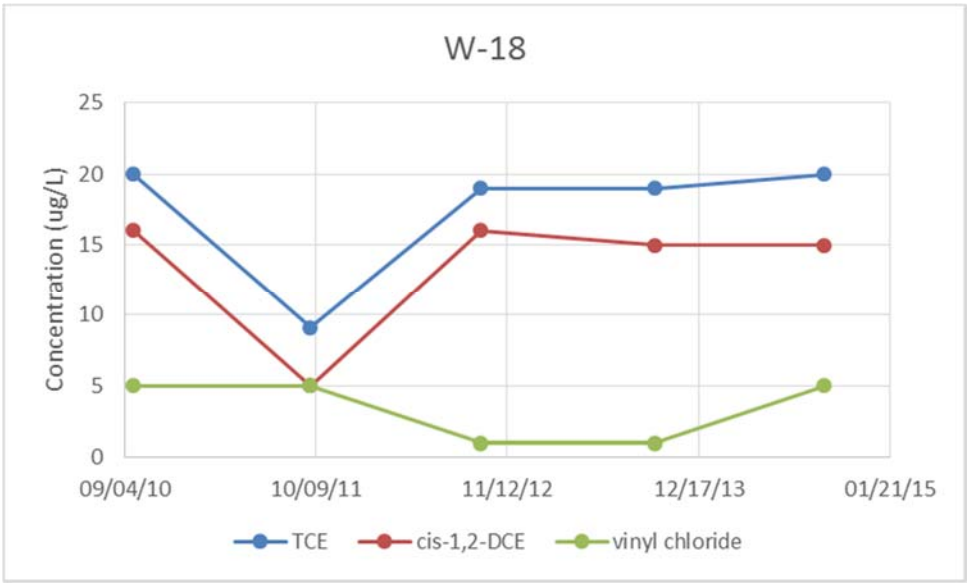


Figure 14: 1,1-DCA concentrations over the five-year review period in SP-3

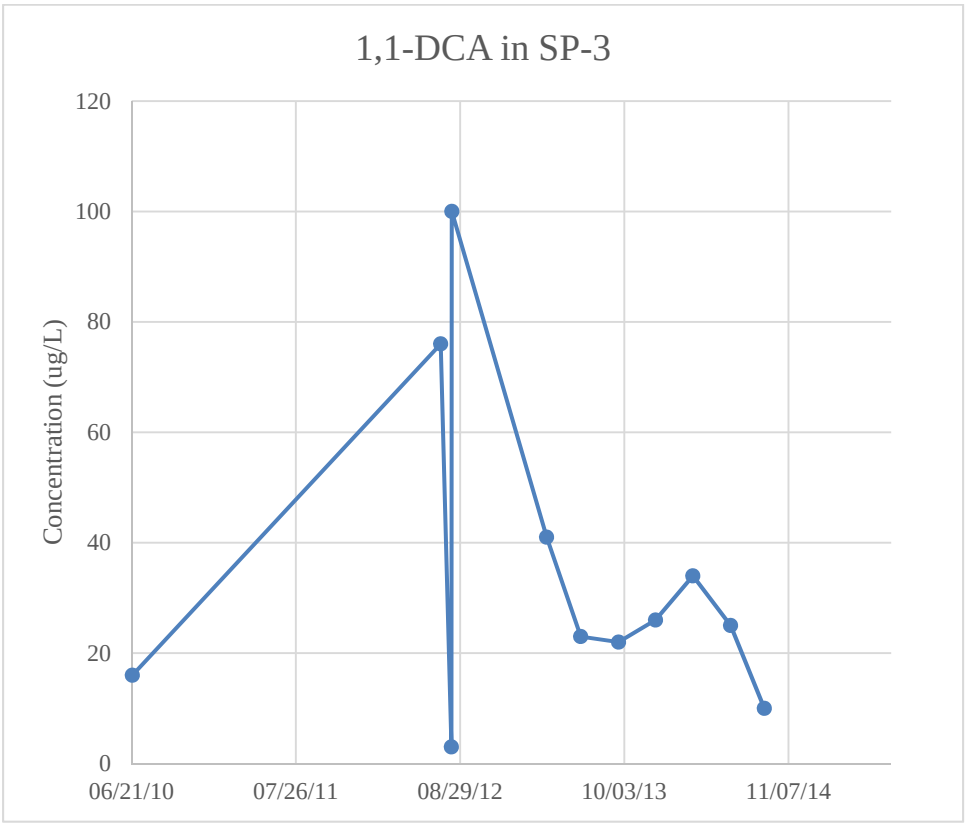


Figure 15: Cis-1,2-DCE concentrations over the five-year review period in SP-3

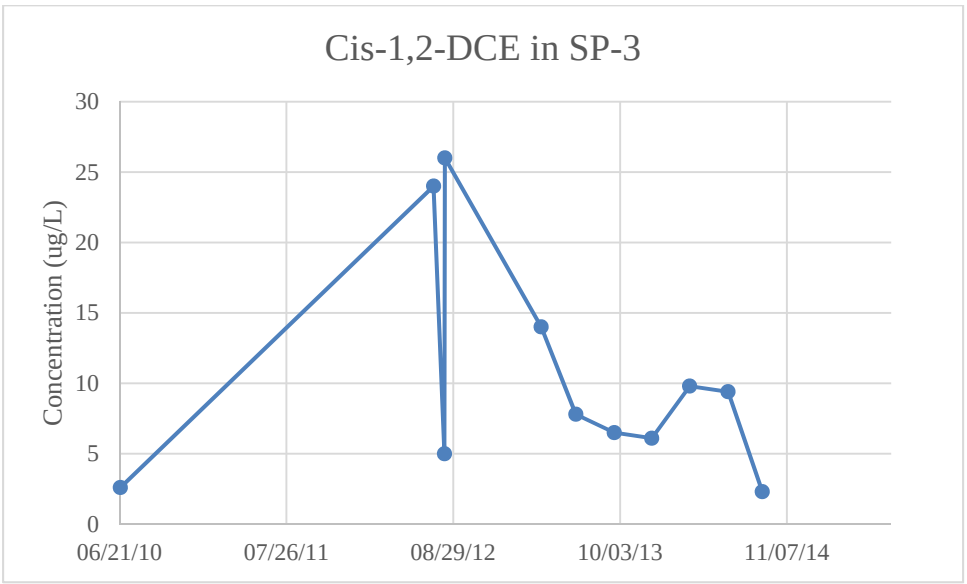


Figure 16: 1,1-DCA concentrations over the five-year review period in SP-4