THIRD FIVE-YEAR REVIEW REPORT FOR HALBY CHEMICAL CO. SUPERFUND SITE NEW CASTLE COUNTY, DELAWARE

SEPTEMBER 2017

Prepared by

U.S. Environmental Protection Agency
Region 3
Philadelphia, Pennsylvania

SEP 26 2017

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Date

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LIST OF ABBREVIATIONS & ACRONYMS

ARAR	Applicable or Relevant and Appropriate Requirement
BCC	Brandywine Chemical Company
BRA	Baseline Risk Assessment
CIC	Community Involvement Coordinator
COC	Contaminant of Concern
DNREC	Delaware Department of Natural Resources and Environmental Control
EPA	United States Environmental Protection Agency
ERA	Ecological Risk Assessment
FYR	Five-Year Review
GMZ	Groundwater Management Zone
HQ	Hazard Quotient
IC	Institutional Control
MCL	Maximum Contaminant Level
mg/kg	Milligrams per Kilogram
µg/L	Micrograms per Liter
NPL	National Priorities List
O&M	Operation and Maintenance
OU	Operable Unit
PRP	Potentially Responsible Party
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RPM	Remedial Project Manager
RSL	Regional Screening Level
UU/UE	Unlimited Use/Unrestricted Exposure

I. INTRODUCTION

The purpose of a five-year review (FYR) is to evaluate the implementation and performance of a remedy to determine if the remedy is and will continue to be protective of human health and the environment. The methods, findings and conclusions of reviews are documented in FYR Reports such as this one. In addition, FYR Reports identify issues found during the review, if any, and document recommendations to address them.

The U.S. Environmental Protection Agency (EPA) is preparing this FYR pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act Section 121, consistent with the National Contingency Plan (40 Code of Federal Regulations Section 300.430(f)(4)(ii)), and considering EPA policy.

This is the third FYR for the Halby Chemical Co. Superfund site (the Site). The triggering action for this statutory review is the completion date of the previous FYR. The FYR has been prepared because hazardous substances, pollutants or contaminants remain at the Site above levels that allow for unlimited use and unrestricted exposure (UU/UE).

The Site consists of one active operable unit (OU). EPA originally divided the Site into two OUs to address the cleanup. OU1 was soils inside the process area and OU2 was air, groundwater and sediments. The OU2 cleanup now includes the soils originally defined as OU1 because they are similar in character to soils characterized in OU2. This FYR addresses OU2, which now includes soil contamination, sediments, air releases, surface water and groundwater.

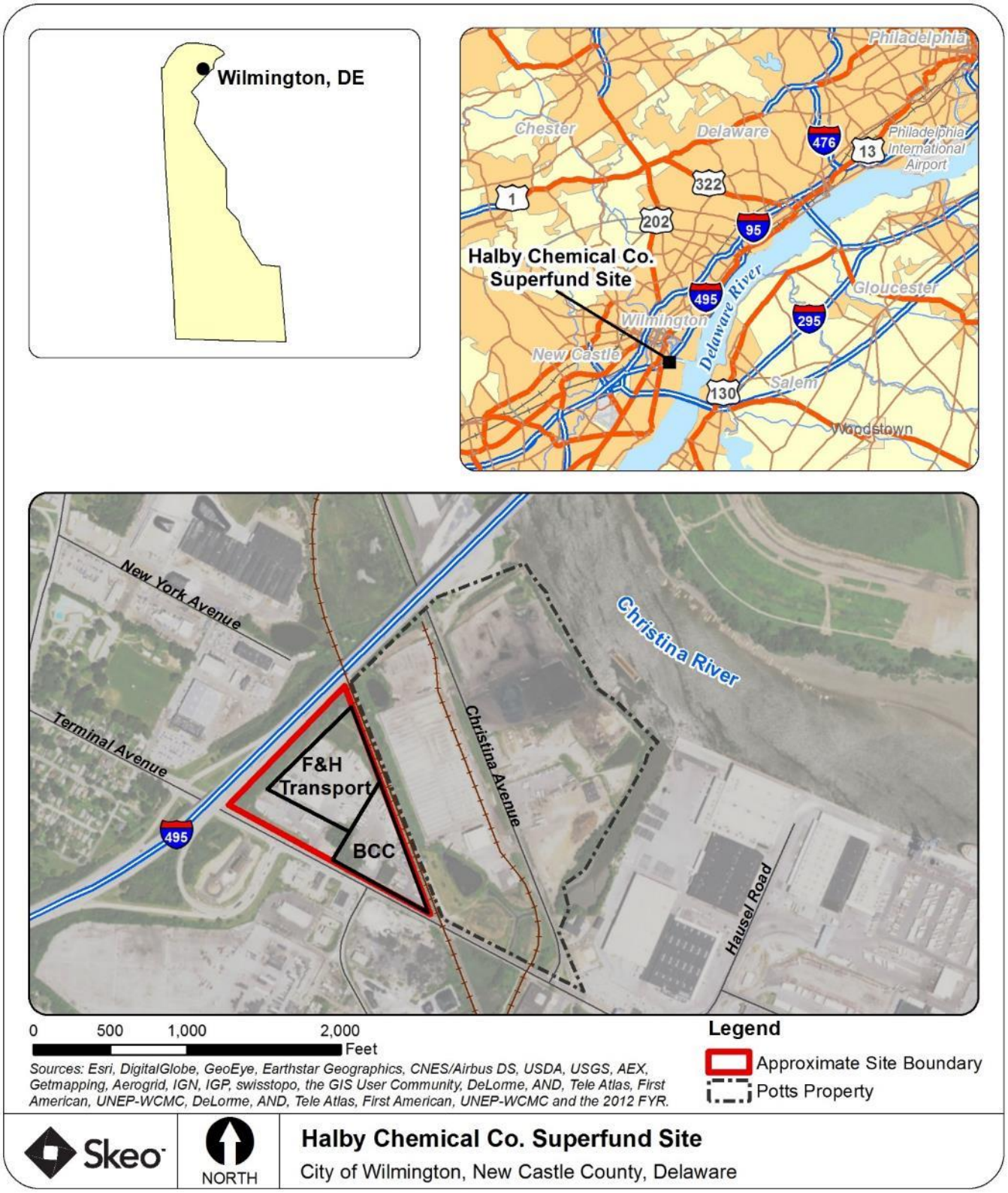
The FYR was led by EPA remedial project manager (RPM) Stepan Nevshehirlian. Participants included Vance Evans, Mark Leipert, Kimberly Plank, and Jeff Tuttle of EPA; John Cargill and Stephanie Gordon of the Delaware Department of Natural Resources and Environmental Control (DNREC), and Hagai Nassau and Brice Robertson of EPA contractor Skeo. The review began on 12/9/2016. Appendix A includes a list of documents reviewed for this FYR. Appendix B includes a site chronology.

Site Background

The 9-acre Site is located in a highly-industrialized area near the Port of Wilmington, New Castle County, Delaware (Figure 1). From 1940 until 1995, the Site operated as a chemical manufacturing and storage plant. Part of the site is in the City of Wilmington, and the rest is in an unincorporated area of New Castle County. Site operations discharged production wastewater and cooling water into an unlined on-site lagoon (where the Halby stormwater pond is now located) that drained into the tidal marsh on the adjacent Potts Property and finally into the Christina River (Figure 2). The Site is comprised of several parcels of land, which are owned and operated by several private parties, including Brandywine Chemical Company (BCC); F&H Transport (a trucking company); and 524 Terminal Avenue LLC. The Site is bordered by railroad tracks (formerly Conrail, now Norfolk-Southern), Interstate 495 (I-495), and Terminal Avenue. Surrounding land use is industrial to the north. An asphalt plant is located to the south and the Potts Property, which is a DNREC Hazardous Site Cleanup Act site with similar contaminants, is located to the east. The Eden Park residential community is located about 1/4 mile west of the Site.

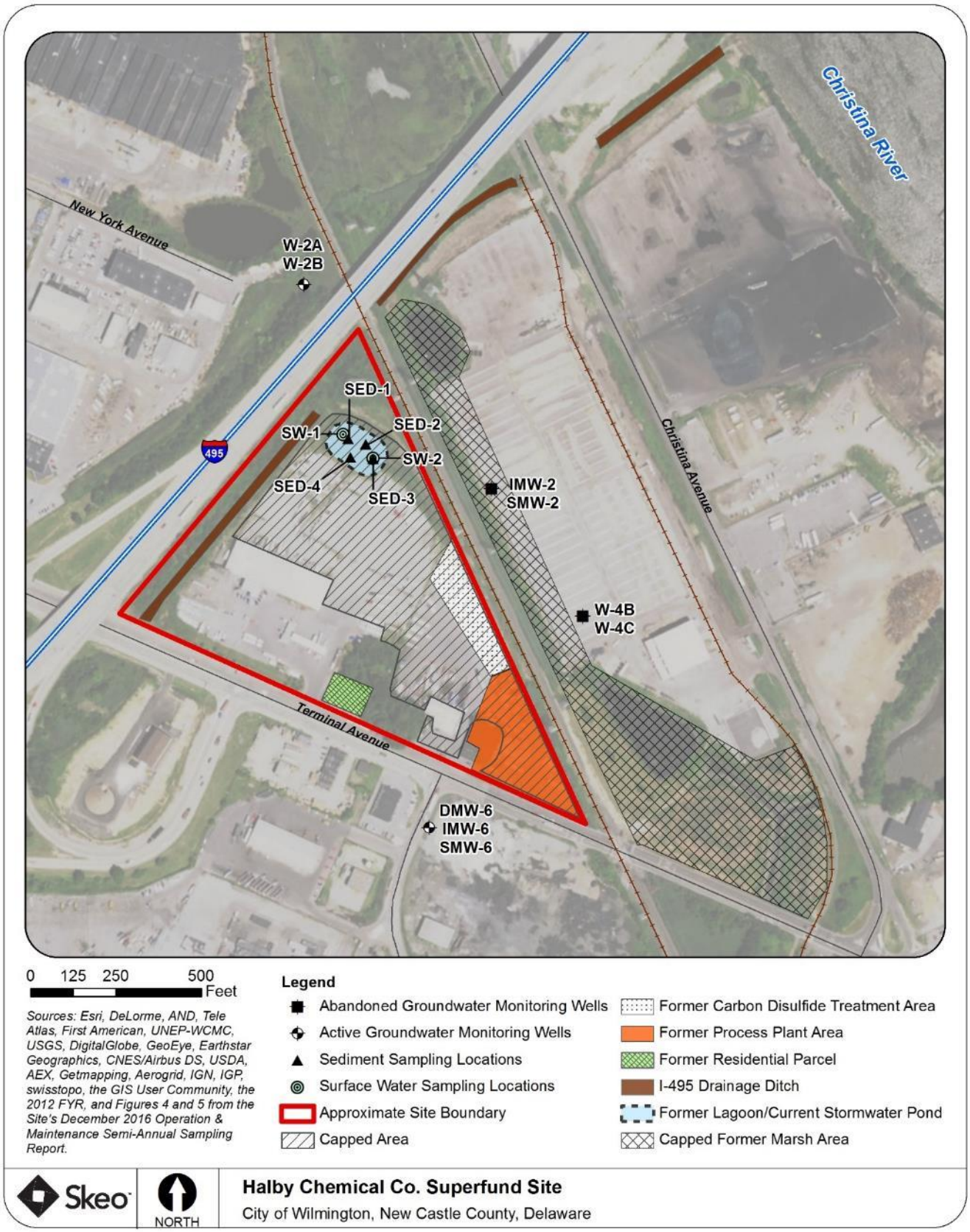
The Site is generally flat and slopes gently northeastward. There are three water-bearing formations, or aquifers, beneath the Site. The surficial aquifer is the Columbia formation followed by the sands of the Upper Potomac Aquifer. The groundwater in both the Columbia and Upper Potomac flows to the northeast, under the adjacent Potts Property site and toward the Christina River. The third and deepest aquifer is the Lower Potomac, which is confined by a clay layer that separates it from the Upper Potomac Aquifer. This clay layer likely prevented site-related contaminants found in the shallower aquifers from migrating to the Lower Potomac Aquifer. Groundwater in the Lower Potomac Aquifer flows to the south. The State of Delaware instituted a groundwater management zone (GMZ) in 1998 to restrict groundwater use and prohibit the installation of drinking water wells in the area.

Figure 1: Site Vicinity Map



Disclaimer: This map and any boundary lines within the map are approximate and subject to change. The map is not a survey. The map is for informational purposes only regarding EPA's response actions at the Site.

Figure 2: Detailed Site Map



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FIVE-YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION		
Site Name: Halby Chemical Co.		
EPA ID: DED980830954		
Region: 3	**State:** Delaware	**City/County:** Wilmington / New Castle
SITE STATUS		
NPL Status: Final		
Multiple OUs? No	**Has the site achieved construction completion?** Yes	
REVIEW STATUS		
Lead agency: EPA		
Author name: Stepan Nevshehirlian, with additional support provided by Skeo		
Author affiliation: EPA Region 3		
Review period: 12/9/2016 - 9/27/2017		
Date of site inspection: 3/21/2017		
Type of review: Statutory		
Review number: 3		
Triggering action date: 9/27/2012		
Due date *(five years after triggering action date)*: 9/27/2017		

II. RESPONSE ACTION SUMMARY

Basis for Taking Action

At some time between May 1977 and June 1983, the northwest bank of the on-Site lagoon was breached and the lagoon began draining through the drainage ditch along I-495. In 1984, EPA conducted an inspection of the Site and found evidence of contamination in the lagoon, marsh sediments, surface water, soils and groundwater. EPA placed the Site on the National Priorities List (NPL) on June 10, 1986 and began the remedial investigation/feasibility study (RI/FS).

In 1991, EPA divided the Site into two OUs. OU1 consisted of the soils within the former process area. OU2 consisted of groundwater, air releases, sediments and surface water in the adjacent outfall and areas east of the plant process area, including the lagoon, tidal marsh and the drainage ditch along I-495. EPA completed the OU1 RI/FS in June 1991 and issued the OU1 Record of Decision (ROD) in July 1991. Under an April 9, 1992 Consent Decree, one of the potentially responsible parties (PRPs), Witco, agreed to perform the OU1 remedial design/remedial action. At the time, Brandywine Chemical Company (BCC) was operating a chemical distribution business on the former process plant parcel. While Witco was performing remedial design activities,

BCC announced its decision to cease its chemical operations at the facility. Witco's remedial design was suspended to consider appropriate remedy modifications. As a result, EPA decided to address all threats posed by the release of hazardous substances at the Site under the OU2 ROD. Thus, the OU2 ROD would supersede the 1991 ROD for OU1.

In May 1997, EPA completed the RI/FS for OU2. The OU2 RI/FS, including the baseline risk assessment (BRA) and the ecological risk assessment (ERA), was based on field data collected during the OU1 investigation and additional data collected between 1993 and 1995. Table 1 contains a list of contaminants of potential concern by media. The BRA identified unacceptable cancer risk and noncancer hazards associated with site workers, construction workers, and youth trespassers exposed to on-site soil; child and adult residents exposed to soil on a former residential parcel at the site; site workers and youth trespassers exposed to lagoon and tidal marsh sediment; site workers exposed to lagoon surface water; and hypothetical exposure of off-site residents to on-site and downgradient groundwater. The ERA concluded that concentrations of contaminants in lagoon and tidal marsh surface water and sediment had the potential to have significant adverse effects on the aquatic ecosystem. The ERA also concluded that the on-site soils could be potentially harmful to ecological receptors.

Table 1: Contaminants of Potential Concern by Media[a]

Contaminant of Potential Concern	Media			
	Soil	Groundwater	Sediment	Surface Water
Ammonia		X		X
Arsenic	X	X	X	X
Carbon disulfide	X	X		X
Cyanide		X		X
Manganese		X		

Notes:
a. Based on information presented in the OU2 ROD and 2011 O&M plan.

Response Actions

Between February and July 1995, EPA completed emergency removal actions to mitigate the immediate threat posed by improperly stored chemicals in the former process plant area. These actions included dismantling and disposing of buildings and aboveground storage tanks (leaving only a warehouse) and off-site disposal of chemicals found in drums, tanks, pressurized cylinders and small containers. During emergency removal actions, EPA identified an area of carbon disulfide contamination extending from the point where wastewater had been discharged from the chemical production facility to the lagoon. On July 20, 1995, EPA issued a Unilateral Administrative Order for Removal Action to the PRP Witco to perform additional emergency removal actions. Witco completed the emergency removal actions in 1998, including installing a security fence around the carbon disulfide contamination, constructing a berm to prevent the migration of contaminants from the on-site lagoon to the Christina River, and treating contaminated soils with sodium percarbonate followed by solidifying soils within the carbon disulfide treatment zone with cement to a depth of 4-6 feet.

In March 1998, EPA issued the OU2 ROD, which superseded the 1991 OU1 ROD and addressed sitewide contamination. The remedial action objectives listed in the 1998 ROD include the following:

Soil

- Eliminate the risk due to direct contact with contaminants at the Site.
- Reduce mobility of contaminants in soil above the water table to the groundwater.

Sediment/Surface Water

- Prevent human and ecological receptors from coming into direct contact with contaminated sediment.
- Create or restore wetland habitat to restore wetland destroyed on site.

Groundwater

- Prevent exposure to groundwater.

The major components of the OU2 remedy are summarized in Table 2.

Table 2: Summary of OU2 Remedial Components by Media

Media	Remedy Components
Soil	Cover the areas of the Site with a paved cap where soil exceeds the performance standards for arsenic.
	Excavate soil on the adjacent residential property that exceeds the arsenic performance standard and combine with the contaminated soil under the site cap.
	Backfill the residential property with clean soil, cover with six inches of topsoil and re-establish vegetation.
	Monitor gas in the carbon disulfide treatment zone area; install a gas collection system, if necessary.
	Install a system to control both surface water and soil erosion.
	Conduct long-term monitoring to ensure the integrity of the cap.
	Implement deed restrictions.
Lagoon and Marsh	Drain the lagoon and marsh, excavate the I-495 drainage ditch sediments, and place the sediments in the lagoon/marsh area.
	Backfill and level the lagoon and marsh with clean soil.
	Cap the lagoon area with a paved surface.
	Cover the marsh area with topsoil and establish vegetation.
	Utilize a mobile water treatment plant to treat water taken from the lagoon and marsh, if necessary.
	Create a new wetland area at an off-site location, equivalent in function and value to the approximately 7 acres of the on-site lagoon and marsh areas to be eliminated.
	Conduct long-term monitoring and maintenance activities.
	Implement deed restrictions.
Groundwater	Implement deed restrictions consistent with Delaware's DNREC GMZ to provide additional continued assurance that public or domestic water supply wells are not permitted to draw water from aquifers affected by the Site.
	Conduct groundwater monitoring to track site-related contamination.

The ROD specified cleanup goals for soil and sediment (Table 3) but did not specify cleanup goals for groundwater or surface water.

Table 3: Cleanup Goals for Soil and Sediment

Contaminant of Concern (COC)	1998 ROD Cleanup Goal	Basis
Arsenic	38 mg/kg	Applied to the soil in the industrial areas of the Site and the sediment.
	14 mg/kg	Applied to a parcel on the Site that was formerly used for residential use. This cleanup goal was representative of background concentrations.
Notes: mg/kg = milligram per kilogram *Source:* 1998 OU2 ROD		

Status of Implementation

The PRP began the remedial action in September 2000 and completed it in September 2005. It included soil, lagoon, and marsh cleanup activities.

Capping

The PRP covered all areas of the Site behind the former F&H Transport building, including the former lagoon, with an aggregate cap. The PRP paved the area behind and surrounding the former BCC buildings with asphalt. The carbon disulfide area was covered with an aggregate cap. In addition, a passive gas venting system was installed in this treated area, to prevent the accumulation of any carbon disulfide off-gas. These areas encompassed all soils exceeding 38 milligrams per kilogram (mg/kg) arsenic. At the former residential area, the PRP excavated, backfilled and paved where soil exceeded 14 mg/kg arsenic. The excavated soil was incorporated under capped areas of the Site.

Lagoon and Marsh Sediments

The PRP drained the lagoon and marsh and excavated the I-495 drainage ditch sediments. Sediments were incorporated under capped areas of the Site. The PRP backfilled the lagoon with clean soil, and leveled it. The lagoon area was covered with an aggregate cap, which was better suited to the business operating on site than was asphalt. A small stormwater pond was placed over part of the lagoon area.

Excavated drainage ditch sediments were also placed in the marsh area adjacent to the railroad tracks. The excavated sediments placed in the marsh area were formed into a berm, covered with geotextile fabric and six inches of topsoil, and vegetated. The larger area of the marsh was backfilled with clean soil to the surrounding grade and seeded. The channels that convey stormwater through the marsh were excavated to accommodate a rip-rap over stone and geotextile profile. With approval from EPA and DNREC, the owner of the Potts Property subsequently excavated the berm, placed the material about 200 feet to the east, and capped it with a concrete pad. This was completed in 2009 to raise the area's elevation prior to constructing a composting operation.

A large settling tank was utilized while water from the lagoon was being pumped to the sanitary sewer. Following the approval to discharge this water directly to the river, a large filtration unit was utilized to prevent the release of any sediment from the Site.

Wetland

The PRP identified, acquired and transferred a suitable wetland to the State of Delaware, comprising approximately 247 acres. The PRP implemented a plan to enhance and monitor the wetland. In addition, the PRP constructed a system to control stormwater and erosion at the Site.

Arsenic Identified in Sediment

In 2011, Halby stormwater management operation and maintenance (O&M) sampling identified elevated levels of arsenic in the Halby stormwater pond sediment. Additional sampling also identified even higher arsenic concentrations in the nearby I-495 ditch. To eliminate the potential transfer of sediment between the ditch and the stormwater pond during elevated tides, the PRP re-constructed a berm between the stormwater pond and the I-495 ditch as an interim protective measure in October 2012, under EPA and DNREC oversight. In 2014, the PRP completed an arsenic source investigation, which could not identify an on-Site surficial source for the arsenic measured in the Halby stormwater pond. The investigation did identify significantly higher elevated concentrations of arsenic along the I-495 ditch. The highest concentrations were found along the bank of the ditch approximately 1,000 ft northeast of the Halby site, adjacent to the Potts Property. Groundwater seeps at this location were identified as a primary source of arsenic impacts to the I-495 ditch. The 2014 investigation hypothesized that arsenic in soil is mobilized to groundwater under reducing conditions and transported under local groundwater gradients where it discharges via seeps to the I-495 ditch adjacent to the Potts Property. When the groundwater encounters oxygenated conditions, the arsenic ultimately accumulates in ditch sediments. The 2014 report also stated that reducing conditions in the surficial aquifer are a critical factor controlling the dissolution of arsenic and iron from the subsurface and creating the arsenic-enriched groundwater.

Additional groundwater seeps and other potential sources of arsenic exist along the I-495 ditch due to the industrial nature of the surrounding area. Due to fluctuating tidal conditions in the I-495 ditch, sediment with elevated arsenic concentrations appears to have been transported to the Halby stormwater pond and is the likeliest cause of the elevated arsenic observed during O&M sampling in the stormwater pond.

A study completed by the University of Delaware in March 2016 on behalf of DNREC concluded, among other things, that tidal fluctuations make the aquifer in the immediate area susceptible to shifting hydrologic and reduction-oxidation regimes, which can affect the mobility of arsenic in groundwater. The study also suggests the arsenic at the Halby site is more mobile than the arsenic at the Potts Property. EPA and DNREC agree that additional investigation at the Potts Property under DNREC authorities and oversight and continued enhanced monitoring at the Halby site will be pursued to find a solution to the elevated arsenic concentrations in the I-495 drainage ditch. However, it does not appear these elevated arsenic concentrations are a result of a failure of the Halby Site remedy components.

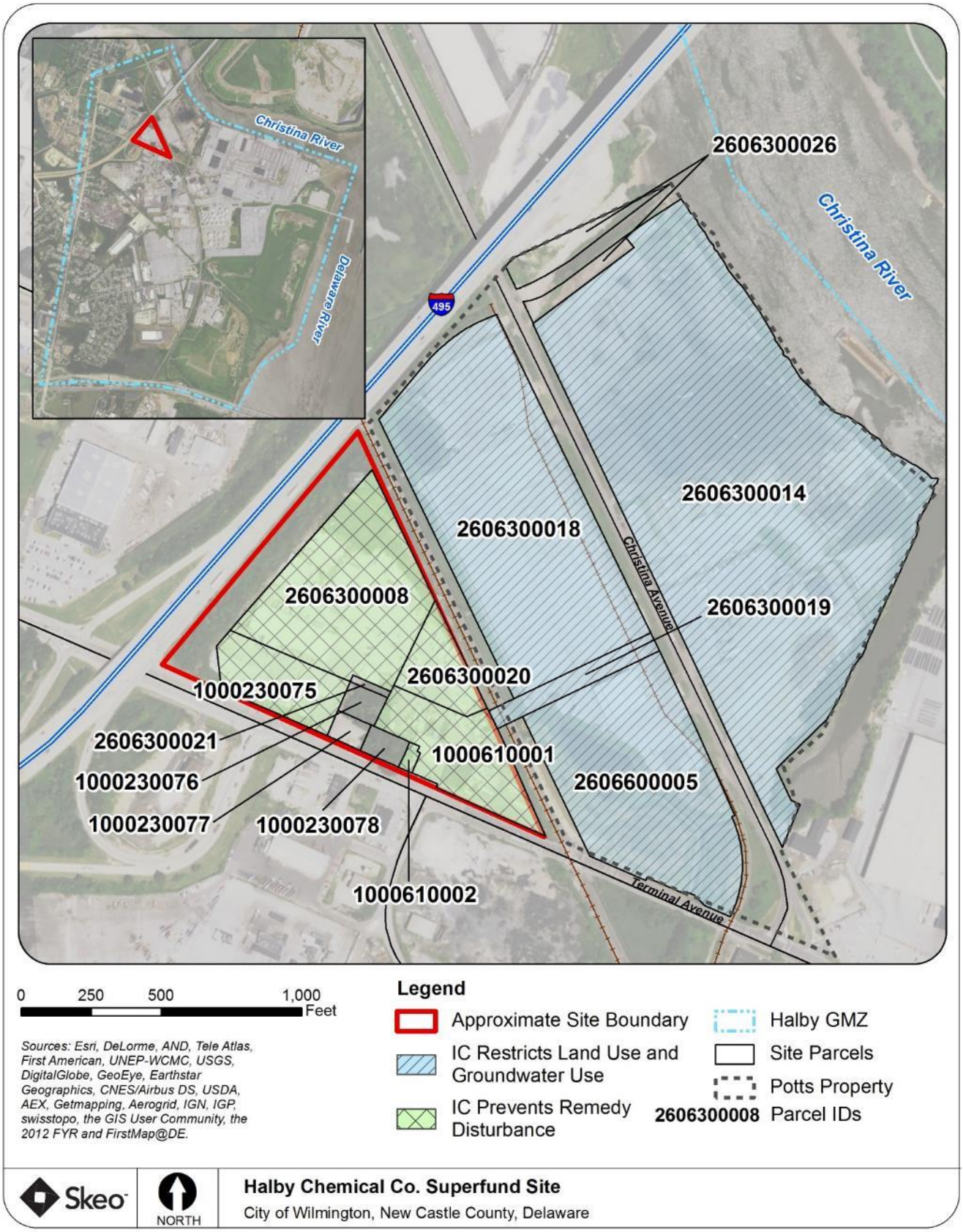
Institutional Control Review

As stipulated in the 1998 OU2 ROD, restrictions have been added to the F&H, BCC and Potts Properties to protect the remedy and restrict use of groundwater below the site (Table 4 and Figure 3). The 1998 OU2 ROD required that institutional controls be implemented to ensure that remedial components are not compromised by future use of the properties and any future subsurface work is completed in a manner protective of workers and the environment. The restrictions for future use of the property prevent exposure to contaminated soil and sediment. Land use restrictions were implemented in 1996 and 2004 for the F&H and BCC parcels, respectively, stipulating that no activities shall disturb the site remedy. Zoning restricts the Site parcels to commercial, industrial, or manufacturing use. Restrictions on the Potts property also limit future land uses to commercial, manufacturing or industrial use. The State of Delaware instituted a GMZ in 1998 to restrict groundwater use and prohibit the installation of drinking water wells in the area (Figure 3).

Table 4: Summary of Institutional Controls (ICs) on the Site and Adjacent Potts Property

Media, engineered controls, and areas that do not support UU/UE based on current conditions	ICs Needed	ICs Called for in the Decision Documents	Impacted Parcel(s)	IC Objective	Title of IC Instrument Implemented and Date (or planned)
Groundwater	Yes	Yes	2606300008 1000230075 2606300020 1000610001 1000610002 1000230078 1000230077 1000230076 2606300021 2606300018 2606300019 2606600005 2606300014	Restrict installation of groundwater wells	GMZ DE-0067
			2606300014 2606300018 2606300019 2606600005	No groundwater wells or withdrawal without prior approval	Environmental Covenant recorded on May 30, 2007
Soil	Yes	Yes	*F&H* 2606300008 1000230075	Prevent disturbance of remedy	Declaration of Restrictions recorded on January 13, 2004
			BCC 2606300020 1000610001 1000610002		Declaration of Restrictions recorded on May 22, 1996
Capped Former Marsh Area	Yes	Yes	*Potts* 2606300014 2606300018 2606300019 2606600005	Restricted solely to non-residential uses; No interference with remedy	Environmental Covenant recorded on May 30, 2007

Figure 3: Institutional Control Map for the Site and Adjacent Potts Property



Disclaimer: This map and any boundary lines within the map are approximate and subject to change. The map is not a survey. The map is for informational purposes only regarding EPA's response actions at the Site.

Systems Operations/Operation & Maintenance

The 2010 O&M plan, revised in February 2011, describes three general types of tasks, as follows: (1) inspection of remedial caps and covers; (2) sampling of sediment, surface water and groundwater; and (3) reporting of the findings of the inspections and sampling. Caps and covers are inspected annually. The O&M plan includes requirements for monitoring of groundwater, surface water and sediment quality in accordance with the 1998 ROD. Sampling locations are shown on Figure 2 (page 5). In addition, monitoring of two passive gas vents for volatile organic compounds is conducted in the former carbon disulfide treatment area.

III. PROGRESS SINCE THE PREVIOUS REVIEW

This section includes the protectiveness determinations and statements from the previous FYR (Table 5) as well as the recommendations from the previous FYR and the status of those recommendations (Table 6).

Table 5: Protectiveness Determinations/Statements from the 2012 FYR

OU #	Protectiveness Determination	Protectiveness Statement
Sitewide	Short-term Protective	The remedy is currently protective in the short term because there are no complete exposure routes that pose unacceptable risk to human and/or ecological receptors. However, in order for the remedy to be protective in the long term, the source of elevated arsenic concentrations in the pond sediments needs to be identified and addressed and an evaluation of the need for additional institutional controls to prevent future residential land use needs to be performed.

Table 6: Status of Sitewide Recommendations from the 2012 FYR

Issue	Recommendation	Current Status	Current Implementation Status Description	Completion Date (if applicable)
Arsenic concentrations in the on-site stormwater pond exceed the cleanup level.	Determine the source of the elevated arsenic concentrations and address accordingly.	Completed	The PRP completed an investigation to determine the source of arsenic in the Halby stormwater pond in 2014. The source of arsenic appears to be sediment from the I-495 drainage ditch. The PRP raised the level of the stormwater pond berm and installed other measures to prevent I-495 drainage ditch sediments from discharging into the Halby stormwater pond. Monitoring of the stormwater pond sediments shows a general decreasing trend since the highest arsenic concentrations were observed in 2013 - 2015.	2014

Issue	Recommendation	Current Status	Current Implementation Status Description	Completion Date (if applicable)
Deed restrictions for the F&H Transport and Brandywine Chemical Company (BCC) portions of the Site do not restrict future residential land use.	Evaluate the need to implement additional restrictions on future land use.	Completed	Given the highly industrialized nature of the site and adjoining properties, future residential use is unlikely. Zoning restricts the Site parcels to commercial, industrial, or manufacturing use. Additional restrictions are not required.	8-8-2017 (Memo to file)
Damaged fencing along the BCC and F&H Transport properties.	Repair damaged fencing.	Considered But Not Implemented	Fencing is not required as part of the remedy and is not needed for protectiveness. Issue re-evaluated and eliminated.	8-8-2017 (Memo to file)
High vegetation in some capped areas prevents proper inspection for erosion.	Cut down and/or remove vegetation to facilitate future inspections of capped areas.	Considered But Not Implemented	Vegetation acts to protect against erosion during heavy rain events in the growing season. It is recommended that cap inspections occur in late Winter or very early Spring, when vegetation is not as high.	8-8-2017 (Memo to file)
Materials are being stockpiled within the capped former lagoon area on the Potts property.	Identify stockpiled materials and determine if they are anticipated to affect the capped areas.	Completed	The materials present during the 2012 5-year review were part of a composting operation. That operation has ceased and the compost stockpiles are no longer present. Operations observed on the Potts Property during the site inspection are not anticipated to affect the capped areas.	3/21/2017

IV. FIVE-YEAR REVIEW PROCESS

Community Notification, Involvement & Site Interviews

A public notice was published in the *Delaware News Journal* on 8/4/2017, stating that there was a FYR and inviting the public to submit any comments to EPA (Appendix C). The results of the review and the report will be made available at the Site's information repository, located at Wilmington Public Library, 10 East 10th Street, Wilmington, Delaware, 19801.

During the FYR process, interviews were conducted to document any perceived problems or successes with the remedy that has been implemented to date. Overall, the interviewees believe that the remedy is effective and is protective of human health and the environment. The remedy is generally performing as intended and there have been no complaints over the past five years. The results of these interviews are summarized below. Interview forms are included in Appendix D.

John Cargill of DNREC commented that off-site migration of arsenic in groundwater is a potential concern, as highly elevated concentrations of arsenic have been identified in the I-495 drainage ditch, hydraulically downgradient of the Site. Mr. Cargill also commented that the results of a University of Delaware study on

arsenic in the I-495 drainage ditch indicate there is potential for the arsenic in the ditch to have originated from the Halby site versus the Potts Property. However, a definitive signature could not be determined. As a result, EPA and DNREC have agreed to address these arsenic concentrations through DNRECs voluntary cleanup program. Mr. Cargill also commented that the groundwater monitoring portion of O&M activities needs to be reworked because monitoring data have not provided useful information and several monitoring wells have been destroyed. EPA will re-evaluate the remaining monitoring well network configuration and recommend modifications to the groundwater sampling program during the next FYR period.

Clayton Greer of Ten Bears Environmental, the O&M contractor, commented that increasing arsenic levels found in sediments in the Halby stormwater pond were the result of turbid water overtopping the spillway on a regular basis from the I-495 drainage ditch into the Halby stormwater pond. As a result, changes were made to the stormwater pond to limit off-site impacts. Since these changes, COC levels have decreased in pond sediments. Mr. Greer commented that monitoring of groundwater, gas vents, sediments and surface water no longer serves a useful purpose and recommended discontinuing this sampling.

Gerald Pepper of the Pyrites Company (the PRP for the Halby Site and one of the responsible parties for the Potts Property) commented that EPA should evaluate the impacts of the adjacent site (the Potts Property) on the Halby Site and take corrective action if necessary.

One of the current site owners has a good impression of the remedial activities at the Site and thinks the remedy is currently performing well.

Vance Evans interviewed residents on March 27, 2017 at a community meeting of the Eden/Hamilton Park Civic Association. Residents indicated they were unsure what was going on at the site and had some concerns. They would like to be kept better updated on site activities. EPA agreed to meet with the community after the FYR is completed and share the findings of the review.

Data Review

This section summarizes surface water, sediment and groundwater sampling data collected during this FYR period to evaluate remedy performance. Surface water and sediment samples are collected from the Halby stormwater pond to assess the quality of on-Site surface runoff. Figure 2 shows sampling locations. The PRP also samples the passive gas vents for volatile organic compounds; the results were all below detection limits. Appendix E includes a detailed review of applicable or relevant and appropriate requirements (ARARs). Appendix F includes a toxicity review.

Surface Water

Surface water samples are collected annually at two locations in the Halby stormwater pond. Table 7 shows O&M plan standards, method detection limits and detections during this FYR period. Historical surface water sampling data are included in Appendix G, Table G-1.

Table 7: Summary of Surface Water Sampling

COC	2011 O&M Plan[a] (µg/L)		Method Detection Limit (µg/L)	Detections 2012-2016 (µg/L)
	Acute F/M	Chronic F/M		
Ammonia	NA	NA	200	270 J (May 2011) 300 J (November 2012)
Arsenic	340/69	150/36	5.1 to 9.8[b]	None
Carbon disulfide	NA	NA	1,000	None
Cyanide	22/1	5.2/NA	5	9.5 J (November 2015)

Notes:

a. Delaware Surface Water Quality Standards for the Protection of Aquatic Life listed in the 2011 O&M plan.
b. Method detection limit varied based on sample date.

µg/L – microgram per liter
NA – criteria not available
F – freshwater criteria
M – marine criteria
J – estimated

Sediment

Historical sediment sampling data are included in Table 8 and Appendix G, Table G-2. Semi-annual samples collected at each of the four current sampling locations in the stormwater pond have sporadically exceeded the arsenic cleanup goal of 38 mg/kg during the past five years.

In 2012, as a result of these exceedances, PRP contractors began investigating the I-495 drainage ditch. The purpose of the investigation was to characterize the nature and extent and possible sources of increased arsenic concentrations initially identified during O&M sediment samples from the Halby stormwater pond in 2011. Sediment sampling revealed numerous locations of elevated concentrations of arsenic at various locations of the I-495 drainage ditch that were significantly higher than those observed in the Halby stormwater pond. The investigations identified a localized seepage face (groundwater discharge area) on the south bank of the I-495 drainage ditch with the highest elevated arsenic sediment concentrations. This seepage face is located approximately 1,000 feet northeast of the Site, adjacent to the Potts Property site. It is believed that sediment with elevated arsenic concentrations from the I-495 drainage ditch was transported to the Halby stormwater pond during high tide conditions. Corrective measures were implemented in 2012 to prevent this transport from occurring. Options for addressing arsenic contamination in the I-495 drainage ditch adjacent to the Potts property will be evaluated through DNRECs voluntary cleanup program.

Table 8: Sediment Sampling Results from 2012-2016

Date	Total Arsenic Concentrations (mg/kg)				
	SED-1 (SED-1 Duplicate)	**SED-2**	**SED-3**	**SED-4**	**SED-5***
May 2012	15.3 J (< 5.0)	<11.9	12.3	26.2	NS
November 2012	**66.4 (67.1)**	**50.5**	**38.4**	**68**	**48.1**
May 2013	**54.2** (26.9)	**52.7**	**53.9**	**94.7**	NS
October 2014	14.7 (26.0)	37.8	17.3	**105**	NS
June 2015	**128 (106)**	**133**	37.2	**185**	NS
November 2015	**41.5 (38.2)**	**59.8**	19.6	**53.7**	NS
May 2016	**43.5 (45.8)**	**58.2**	20.5	**69.9**	NS
December 2016	**57.0** (20.7)	**45.0**	<3.72	<4.55	NS

Notes:
*SED-5 is not a designated O&M sample station in the Halby Site O&M Plan
NS – not sampled
J – estimated; detected above Method Detection Limit but below lab Limit of Quantitation
Bold – Sample exceeds arsenic cleanup goal of 38 mg/kg
Source: O&M Semi-Annual Sampling Report December 2016 Event. January 2017.

Groundwater

The O&M plan outlines groundwater monitoring for the Columbia Aquifer using four wells: SMW-6 (upgradient) and SMW-2, W-4C and W-2A (downgradient); the Upper Potomac Aquifer using four wells IMW-6 (upgradient) and IMW-2, W-4B and W-2B (downgradient); and the Lower Potomac Aquifer at DMW-6 (side or downgradient). Samples are analyzed for arsenic (total and dissolved), manganese (total and dissolved), total cyanide, carbon disulfide and ammonia nitrogen. Historical groundwater sampling data are included in Appendix G, Table G-3.

During this FYR period all O&M network monitoring wells were sampled at least once. However, during the December 2016 groundwater monitoring event, only two wells of the original nine-well O&M network were sampled. Four of the original O&M wells were abandoned in February 2013 due to well damage (SMW-2, IMW-2, W-4B and W-4C). Additionally, access could not be obtained to the adjacent property to sample wells SMW-6, IMW-6 and DMW-6. Table 9 shows arsenic concentrations in the monitoring wells over the past five years. Given that the groundwater monitoring network no longer exists in the form that was described in the O&M plan and the fact that elevated concentrations of arsenic have been observed in downgradient portions of the I-495 drainage ditch, EPA will re-evaluate the remaining monitoring well network configuration and recommend modifications to the groundwater sampling program if appropriate. An existing groundwater monitoring point doesn't exist immediately downgradient of the Halby stormwater pond. Such a location would better inform the understanding of whether arsenic from the Halby site is contributing to groundwater contamination, which is also contributing to arsenic in the I495 drainage seeps adjacent to the Potts property.

Table 9: Groundwater Monitoring Results from 2012-2016

Aquifer	Well	Chemical (µg/L)	Sampling Results (µg/L)							
			5/12	11/12	9/13	10/14	6/15	11/15	5/16	12/16
Shallow Monitor Well – Columbia Aquifer	SMW-6	Total Arsenic	7.7J	ND	14.8J	ND	ND	ND	ND	NS
		Arsenic Dissolved	ND	ND	ND	ND	ND	ND	ND	NS
	W-4C	Total Arsenic	44J	ND	NS-A	NS-A	NS-A	NS-A	NS-A	NS-A
		Arsenic Dissolved	ND	ND	NS-A	NS-A	NS-A	NS-A	NS-A	NS-A
	SMW-2	Total Arsenic	33.6J	NS	NS-A	NS-A	NS-A	NS-A	NS-A	NS-A
		Arsenic Dissolved	30.9J	NS	NS-A	NS-A	NS-A	NS-A	NS-A	NS-A
	W-2A	Total Arsenic	ND	ND	166J	ND	ND	10	51.5J	7.8
		Arsenic Dissolved	ND	ND	ND	ND	ND	10	9.9	7.2
Intermediate Monitor Well – Upper Potomac Aquifer	IMW-6	Total Arsenic	5.7J	ND	28.4	ND	ND	9.5J	ND	NS
		Arsenic Dissolved	ND	ND	ND	ND	ND	10.7J	ND	NS
	IMW-2	Total Arsenic	32.2J	ND	NS-A	NS-A	NS-A	NS-A	NS-A	NS-A
		Arsenic Dissolved	45.4J	ND	NS-A	NS-A	NS-A	NS-A	NS-A	NS-A
	W-4B	Total Arsenic	ND	ND	NS-A	NS-A	NS-A	NS-A	NS-A	NS-A
		Arsenic Dissolved	ND	ND	NS-A	NS-A	NS-A	NS-A	NS-A	NS-A
	W-2B	Total Arsenic	ND	ND	18.2J	ND	ND	18.7J	ND	<9.7
		Arsenic Dissolved	ND	ND	ND	ND	ND	14.5J	ND	<9.7
Deep Monitor Well – Lower Potomac Aquifer	DMW-6	Total Arsenic	ND	ND	ND	10.7J	ND	ND	ND	NS
		Arsenic Dissolved	ND	ND	ND	ND	ND	ND	ND	NS

Notes:
ND – not detected
NS – not sampled
NS-A – not sampled; well abandoned 2/8/2013
J – estimated
Current arsenic MCL = 10 µg/l
Source: O&M Semi-Annual Sampling Report December 2016 Event. January 2017.

Site Inspection

The site inspection took place on 3/21/2017. In attendance were Stepan Nevshehirlian, Vance Evans, Jeff Tuttle, Mark Leipert, and Kimberly Plank of EPA; John Cargill and Stephanie Gordon of DNREC; Clay Greer of Ten Bears Environmental; and Hagai Nassau and Brice Robertson of Skeo. The purpose of the inspection was to assess the protectiveness of the remedy. See Appendix H for a detailed site inspection checklist and Appendix I for site inspection photos.

The site inspection participants began by meeting in the conference room of Port Contractors, Inc., who conduct operations on the adjacent Potts Property site, and discussing site safety and the layout of the Site. The FYR site inspection was conducted at low tide to provide the best observation of the I-495 ditch, which is tidal. Participants then met at the eastern section of the I-495 drainage ditch, located on the adjacent Potts Property and inspected it. No issues were noted. Participants observed portions of the Potts Property where operations for a material stockpiling and recycling company are based. At the time of the FYR site inspection, the Potts Property was used for storing large stockpiles of petroleum coke and road salt. No issues were identified with the concrete cap constructed on top of and adjacent to the former marsh area on the Potts Property. Participants then observed the section of the I-495 ditch southwest of Christina Avenue on the Potts Property and noted no issues. Next, participants met at the Halby Site, where they inspected the capped area on the F&H Transport property. Participants noted minor ponding on parts of this capped area. Current owners indicated that fill material is used to address this ponding periodically as part of current site operations. Participants then observed the stormwater pond and its discharge pipes to the I-495 drainage ditch. The water level was about 3 feet and the stormwater pond was surrounded by tall stands of marsh grasses and small trees. Participants then walked to the former carbon disulfide treatment area. Finally, participants viewed the marsh area just north of the railroad tracks (northeast of the former BCC process plant area) and noted no issues.

During the site visit, Skeo staff visited the local information repository for the Site, located at the Wilmington Public Library, 10 East 10th Street, Wilmington, Delaware 19801. The repository did not contain any site-related documents. EPA updated the repository with information on how to access the administrative record documents on-line in August 2017.

V. TECHNICAL ASSESSMENT

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

The soil remedy is functioning as intended by the decision documents. The remedy eliminated the direct contact risk to soil contaminants by excavating soils from the former residential area and paving and covering the Site where arsenic exceeded industrial standards. The soil remedy also reduced the mobility of contaminants in soil above the water table to the groundwater by installing a cap over impacted soil. Institutional controls are in place to prevent disturbance of the remedy on the F&H and BCC properties.

The sediment remedy prevents human and ecological receptors from coming into direct contact with contaminated sediment. The PRP excavated and consolidated sediments and covered them with a geotextile fabric and clean soil. Stormwater drainage features were replaced with rip-rap and geotextile. However, arsenic concentrations slightly above the cleanup goals have been observed in stormwater pond sediments. There doesn't appear to be a significant amount sedimentation occurring in the stormwater pond and it is theorized that these arsenic concentrations may be a remnant of prior sediment transport from the I-495 drainage ditch to the Halby stormwater pond that occurred prior to 2012. Corrective measures were taken in 2012 to prevent the transport of sediment from the I-495 drainage ditch to the Halby stormwater pond. There are elevated arsenic concentrations in the I-495 ditch sediment, adjacent to the Potts Property, due to apparent discharge of arsenic from groundwater seeps. These seeps do not appear to be the result of a failure of the Halby Site remedy components.

The groundwater remedy appears to be functioning as intended. Exposure to groundwater is prevented due to the availability of a public water supply. A DNREC GMZ restricts groundwater use in the area and prohibits installation of drinking water wells. The remaining site groundwater monitoring wells, when sampled, indicate the remedy is functioning as intended as no trend of increasing groundwater concentrations has been observed since the remedy was installed. However, the groundwater monitoring network no longer exists in the form that was described in the O&M plan and may not be effectively monitoring groundwater, especially downgradient of the Halby stormwater pond. Given the high concentrations of arsenic identified in the I-495 drainage ditch adjacent to the Potts Property, the groundwater monitoring network should be reviewed and updated to further verify the remedy continues to function as intended and confirm that groundwater from the Halby Site is not the source of the high arsenic concentrations in the I-495 drainage ditch.

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

Yes. Although there may have been some changes in EPA's regional screening levels (RSLs) and contaminant toxicity values for soil since the remedy was selected, the soil cleanup goals remain valid based on a screening level risk evaluation using the current RSLs (Appendix F). No significant changes have occurred in risk assessment guidance since the previous FYR and no changes in exposure pathways have occurred. The remedy is progressing to meet the remedial action objectives for soil, sediment and surface water. However, arsenic concentrations slightly above the cleanup levels continue to be observed in the Halby stormwater pond. These concentrations appear to be the result of sediment transport from the I-495 drainage ditch to the stormwater pond (prior to 2012).

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

No other information has come to light that could call into question the protectiveness of the remedy.

VI. ISSUES/RECOMMENDATIONS

Issues/Recommendations
OU(s) without Issues/Recommendations Identified in the FYR:
None.

Issues and Recommendations Identified in the FYR:

OU(s): OU2	Issue Category: Remedy Performance			
	Issue: Arsenic concentrations slightly above the ROD cleanup level of 38 mg/kg have been observed in the Halby stormwater pond sediments.			
	Recommendation: Continue to monitor sediments in the pond to determine if concentrations continue to show a decreasing trend.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA/State	9/27/2018

OU(s): OU2	Issue Category: Monitoring			
	Issue: The current groundwater monitoring well network is not the same as the network identified in the O&M plan and lacks a monitoring location downgradient of the stormwater pond.			
	Recommendation: Review the current groundwater monitoring program and update it as appropriate based on current site conditions including, at a minimum, a monitoring location(s) downgradient of the stormwater pond.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA/State	9/27/2018

OTHER FINDINGS

- None

VII. PROTECTIVENESS STATEMENT

Sitewide Protectiveness Statement
Protectiveness Determination: Short-term Protective
Protectiveness Statement: The remedy at the Site currently protects human health and the environment in the short term because there are no completed exposure pathways. However, for the remedy to be protective in the long term, the following actions need to be taken: continue to monitor stormwater pond sediments to confirm a decreasing trend and review the current groundwater monitoring program and update it as appropriate based on current site conditions including, at a minimum, a monitoring location(s) downgradient of the stormwater pond.

VIII. NEXT REVIEW

The next FYR Report for the Halby Chemical Co. Superfund site is required five years from the completion date of this review.

APPENDIX A – REFERENCE LIST

First Five-Year Review Report for Halby Chemical Superfund Site. Wilmington, New Castle County, Delaware. Prepared by U.S. Environmental Protection Agency. September 2007.

Operation & Maintenance Semi-Annual Sampling Report December 2016 Event. Halby Chemical Superfund Site. Terminal Avenue. Wilmington, Delaware. Prepared for: United States Environmental Protection Agency Region 3 Hazardous Site Cleanup Division and State of Delaware Department of Natural Resources and Environmental Control. Prepared by: Ten Bears Environmental Associates Company on behalf of The Pyrites Company, Inc. January 2017.

Operations & Maintenance Plan. Halby Chemical Superfund Site, Wilmington, Delaware. Prepared by Ten Bears Environmental, LLC. August 2010, revised February 2011.

Preliminary Close Out Report. Halby Chemical Superfund Site. Wilmington, New Castle County, Delaware. United States Environmental Protection Agency. April 22, 2002.

Record of Decision. Halby Chemical Co. OU 01. United States Environmental Protection Agency. June 28, 1991.

Record of Decision. Halby Chemical Co. OU 02. United States Environmental Protection Agency. March 31, 1998.

Report of Findings. Arsenic Source Investigation. I-495 Drainage Ditch. Halby Chemical Superfund Site. Prepared by U.S. EPA Region III Hazardous Site Cleanup Division and State of Delaware Department of Natural Resources and Environmental Control. Prepared by Ten Bears Environmental Associates Co. on behalf of The Pyrites Company, Inc. January 2014.

Report: Arsenic Mobility and Speciation as Determined by X-ray Absorption Spectroscopy and Bulk Methods for the I-495 Ditch Site. Prepared by the Delaware Environmental Institute, University of Delaware, Newark, DE and Delaware Department of Natural Resources and Environmental Control, Division of Waste and Hazardous Substances, Site Investigation and Restoration Section, New Castle, DE. March 2016.

Second Five-Year Review Report for Halby Chemical Co. Superfund Site, New Castle, Delaware. U.S. Environmental Protection Agency. Prepared by United States Environmental Protection Agency, Region 3, Philadelphia, Pennsylvania. September 27, 2012.

APPENDIX B – SITE CHRONOLOGY

Table B-1: Site Chronology

Event	Date
Halby Chemical plant constructed at southeastern portion of property	Late 1940s
Production wastewater and cooling water discharged to unlined on-site lagoon; lagoon drained to adjacent tidal marsh; tidal marsh drained to Christina River via Lobdell Canal	1948-1964
Halby processed specialty chemicals at manufacturing plant, primarily sulfur compounds	1948-1980
Production wastes reportedly discharged into sewer lines; cooling water and storm drains continued to drain into lagoon	1964-1972
Production wastewater combined with cooling water and stormwater; treated and again discharged to lagoon	1972
Halby Chemical closed, property sold to BCC; BCC produced a few batches of specialty chemicals through 1980	1977
Lagoon reduced from 6 acres to 2 acres by addition of fill material	1979-1982
BCC limited business to on-site short-term chemical storage only	1981
State of Delaware DNREC started preliminary assessment	December 1, 1983
State (DNREC) completed preliminary assessment	February 1, 1984
EPA initiated and completed a site inspection	March 29, 1985
EPA proposed the Site to the NPL	September 18, 1985
EPA started site inspection	October 30, 1985
EPA completed site inspection	January 10, 1986
EPA listed the Site on the NPL	June 10, 1986
EPA started a RI/FS for OU1	March 6, 1987
EPA completed RI/FS for OU1 and issued the OU1 ROD	June 28, 1991
EPA started RI/FS for OU2	December 20, 1991
PRP (Witco) started remedial design for OU1	March 16, 1992
PRP Witco agreed to perform remedial design and remedial action under a Consent Decree BCC announced decision to cease chemical operations at the Site; Witco remedial design suspended to consider appropriate remedy modifications	April 9, 1992
PRP completed the remedial design for OU1	August 2, 1993
BCC stopped handling chemicals	1995
EPA started removal action at the Site to mitigate immediate threats by improperly stored chemicals	February 3, 1995
EPA issued Action Memorandum citing imminent and substantial endangerment due to carbon disulfide at the Site	July 6, 1995
EPA completed removal action for chemicals improperly stored on site and issued a Unilateral Administrative Order (Removal Order) to Witco for additional removal actions at the Site	July 20, 1995
EPA completed an RI/FS for OU2	May 1, 1997
PRP completed carbon disulfide soil treatment at the Site	January 6, 1998
DNREC established a GMZ encompassing the Site and forbidding installation of drinking water wells	February 5, 1998
EPA issued ROD for OU2 (supersedes ROD for OU1)	March 31, 1998
PRP completed removal action	September 30, 1998
PRP started remedial design for OU2	June 3, 1999
PRP entered into Consent Decree with EPA to implement the selected remedy in the ROD	May 29, 2000
EPA approved PRP remedial design for OU2	August 15, 2000
PRP started remedial action for OU2	April 15, 2001
Pre-final inspection and construction completion for remedial action on OU2	February 26, 2002

Event	Date
EPA issued a Preliminary Close Out Report for OU2	April 22, 2002
PRP completed remedial action for OU2	September 30, 2005
EPA completed the first FYR	September 28, 2007
EPA requested PRP design and implement measures to prevent arsenic contamination into Halby pond following remediation	March 11, 2011
PRP proposed 'redesign' of Halby stormwater pond to EPA and DNREC, including a 25-year-storm event berm to prevent apparently contaminated backwash from ditch from entering Halby pond	October 11, 2011
DNREC and EPA sample previously remediated portions of the ditch for arsenic, iron and other metals to identify possible 'interference effect' regarding previously measured arsenic levels. EPA laboratory found no evidence of iron/arsenic interference, but did find high levels of arsenic in ditch sediments and nearby soils.	June 18, 2012
PRP agreed to execute protective redesign proposed in 2011 under EPA and DNREC oversight as an interim measure. PRP also agreed to design investigation to characterize and determine source of arsenic in the ditch and surrounding areas.	July 18, 2012
EPA completed the second FYR	September 27, 2012
PRP completed Report of Findings on Arsenic Source Investigation of I-495 Drainage Ditch	January 2014
University of Delaware and DNREC completed arsenic mobility and speciation study for the I-495 drainage ditch.	March 2016

APPENDIX C – PRESS NOTICE

EPA REVIEWS CLEANUP

Halby Chemical Superfund Site

The U.S. Environmental Agency is reviewingthe cleanup that was conducted at the Halby Chemical Company Superfund Site located in New Castle. EPA inspects sites regularly to ensure that cleanups conducted remain protective of public health and the environment. EPA's previous review of the site in 2012 determined that the remedy is protective in the short-term, and that further investigation is needed to determine protectiveness in the long-term. Findings from the current review being conducted will be available September 2017.

To access the review, or to provide site-related information:
Contact: Vance Evans, *Community Involvement Coordinator*
Phone: 215-814-5526
Email: evans.vance@epa.gov

To access detailed site information, including Review Report:
https://www.epa.gov/superfund/halby

Protecting human health and the environment

APPENDIX D – INTERVIEW FORMS

Halby Chemical Co. Superfund Site Five-Year Review Interview Form

Site Name: Halby Chemical Co. **EPA ID No.:** DED980830954
Interviewer Name: Vance Evans **Affiliation:** EPA
Subject Name: John Cargill **Affiliation:** DNREC
Subject Contact Information: John.cargill@state.de.us
Time: N.A. **Date:** 03/29/2017
Interview Location: NA

Interview Format (circle one): In Person Phone Mail Other: E-mail
Interview Category: State Agency

1. What is your overall impression of the project, including cleanup, maintenance and reuse activities (as appropriate)?

   DNREC's overall impression of the project is good. Maintenance issues at the site are generally completed promptly and adequately by property owners and the remaining responsible party.

2. What is your assessment of the current performance of the remedy in place at the Site?

   The on-site remedy appears to be working very well at limiting direct contact to contaminated soils. Off-site migration of arsenic in groundwater is a potential concern, as very elevated concentrations of arsenic have been identified in the I-495 drainage ditch, hydraulically downgradient of the Halby Chemical Site.

3. Are you aware of any complaints or inquiries regarding site-related environmental issues or remedial activities from residents in the past five years?

   None that DNREC is aware of.

4. Has your office conducted any site-related activities or communications in the past five years? If so, please describe the purpose and results of these activities.

   DNREC initiated the University of Delaware Study related to arsenic in the I-495 drainage ditch in 2014 (completed in 2016). The purpose of the study was to determine if the arsenic in the ditch could be sourced to the Halby site vs the adjacent Potts Property Site, where arsenic is a primary contaminant of concern. The methods used for speciation of arsenic were synchrotron based. Results of the study have been provided to USEPA and the responsible parties. Results related to the valence state of arsenic, including fate and transport considerations, indicate that there is potential for the arsenic in the ditch to have originated from the Halby site. However, a definitive signature could not be determined.

5. Are you aware of any changes to state laws that might affect the protectiveness of the Site's remedy?

   No.

6. Are you comfortable with the status of the institutional controls at the Site? If not, what are the associated outstanding issues?

   DNREC is comfortable with the established institutional controls at the Site.

7. Are you aware of any changes in projected land use(s) at the Site?

No.

8. Do you have any comments, suggestions or recommendations regarding the management or operation of the Site's remedy?

   The groundwater monitoring portion of O&M activities has been in question since the last 5 year review, and needs to be reworked. Currently, the groundwater monitoring data isn't providing useful information. Many of the monitoring wells in the network have been destroyed or damaged. DNREC is more concerned at this time with the potential ecological impacts of site related arsenic in the adjacent ditch and Christina River.

9. Is it OK if EPA includes your name in the FYR report, which will be published online?

   Yes.

Halby Chemical Co. Superfund Site Five-Year Review Interview Form

Site Name: Halby Chemical Co. **EPA ID No.:** DED980830954
Interviewer Name: Vance Evans **Affiliation:** EPA
Subject Name: R. Clayton Greer **Affiliation:** Ten Bears Environmental Associates Co.
Subject Contact Information: clay@tenbears.us
Time: N.A. **Date:** 03/28/2017
Interview Location: N.A.
Interview Format (circle one): In Person Phone Mail Other: E-mail

Interview Category: O&M Contractor

1. What is your overall impression of the project, including cleanup, maintenance and reuse activities (as appropriate)?

   My overall impression is that the Halby Superfund Site remedy was appropriate and well-suited to the ongoing light-industrial use of the site. Ongoing review and maintenance have been successful at limiting site users' contact with contaminants of concern.

2. What is your assessment of the current performance of the remedy in place at the Site?

   The results of 12 years of O&M monitoring indicate the Halby remedy remains protective.

3. What are the findings from the monitoring data? What are the key trends in contaminant levels that are being documented over time at the Site?

   Overall, the results document the performance of the remedy. No measurable emissions have been detected from the CS2 gas vents. Halby stormwater management (SWM) basin surface water samples exhibited no COCs. Groundwater and sediment sample results indicate decreasing trends, with no receptors to existing contamination (limited access to SWM pond, groundwater ingestion controlled by municipal code preventing use of drinking water wells in City water service area and redundant Groundwater Management Zone (GMZ).

4. Is there a continuous on-site O&M presence? If so, please describe staff responsibilities and activities. Alternatively, please describe staff responsibilities and the frequency of site inspections and activities if there is not a continuous on-site O&M presence.

   Indirectly, yes. Property owners have near-continuous presence and active interest in maintaining site cover, as it is currently in use. Ten Bears Environmental conducts annual cap inspections, along with semi-annual monitoring of groundwater, sediment, and surface water.

5. Have there been any significant changes in site O&M requirements, maintenance schedules or sampling routines since start-up or in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe changes and impacts.

   Two clusters of downgradient wells formerly used for O&M groundwater monitoring were damaged by tenant operations on the adjoining Potts HSCA Site and subsequently abandoned. Groundwater COC levels in those and other O&M wells were low and diminishing at the time. As such, these wells have not been replaced pending a decision to terminate the monitoring program. In preparation for the prior EPA 5-year review, EPA requested the relocation of the sediment & surface water samples from the banks of the nearby I-495 Ditch and Chistina River to the Halby SWM Basin, in order to more directly measure potential impacts from Halby Site. Increasing arsenic levels found in pond sediments were concluded to be the result of turbid ditch water overtopping the spillway on a regular basis. This resulted in changes to the SWM Basin design to

limit impacts from off-site. Since this change, COC levels have decreased. These changes do not impact the protectiveness of the remedy and serve to document its effectiveness.

6. Have there been unexpected O&M difficulties or costs at the Site since start-up or in the last five years? If so, please provide details.

   High arsenic in SWM Basin sediments led to discovery of post-remedy deposits of high arsenic sediments in I-495 Ditch associated with groundwater seep at adjoining Potts Site. Substantial investigation, with associated cost, was needed to evaluate the source and extent of the arsenic-laden sediments.

7. Have there been opportunities to optimize O&M activities or sampling efforts? Please describe changes and any resulting or desired cost savings or improved efficiencies.

   In our opinion, ongoing monitoring of groundwater, gas vents, sediment and surface water at Halby no longer serve a useful purpose. We recommend discontinuing this testing, but continuing annual O&M cover inspections.

8. Do you have any comments, suggestions or recommendations regarding O&M activities and schedules at the Site?

   In our opinion, ongoing monitoring of groundwater, gas vents, sediment and surface water at Halby no longer serve a useful purpose. We recommend discontinuing this testing, but continuing annual O&M cover inspections.

9. Is it OK if EPA includes your name in the FYR report, which will be published online?

   Yes.

Halby Chemical Co. Superfund Site Five-Year Review Interview Form

Site Name: Halby Chemical Co. **EPA ID No.:** DED980830954
Interviewer Name: Vance Evans **Affiliation:** EPA
Subject Name: Gerald Pepper **Affiliation:** The Pyrites Company
Subject Contact Information: 661-435-5210
Time: N.A. **Date:** 03/29/2017
Interview Location: N.A.

Interview Format (circle one): In Person Phone Mail Other: E-mail

Interview Category: Potentially Responsible Parties (PRPs)

1. What is your overall impression of the remedial activities at the Site?

   The initial remediation was completed per design. Many years of monitoring have indicated that the remediation has performed as intended. Additional work was performed on the Halby Basin to minimize backflow from the I495 ditch into the Basin. That has also performed as intended.

2. What have been the effects of this Site on the surrounding community, if any?

   There have been no effects from the Site on surrounding communities.

3. What is your assessment of the current performance of the remedy in place at the Site?

   As noted in #1 above, remediation has performed as intended. However, it is believed that the remedy may have been impaired by the current Owner/Operators of the property under the Potts HSCA DNREC Site (essentially all property from rail tracks to the river).

4. Are you aware of any complaints or inquiries regarding environmental issues or the remedial action from residents since implementation of the cleanup?

   There have been no known complaints from residents.

5. Do you feel well-informed regarding the Site's activities and remedial progress? If not, how might EPA convey site-related information in the future?

   As the responsible manager for implementation of the portion of the remedy undertaken by Pyrites, I am aware of progress of the remedy and the unsung O&M.

6. Do you have any comments, suggestions or recommendations regarding the management or operation of the Site's remedy?

   As the remedy itself has proven to be completed in meeting its intended purpose, current site conditions should be evaluated as to the cause and effect. It is believed that impacts to the EPA Halby Site remedy have been caused by adjacent site Owner/Operators. EPA should evaluate this and have DNREC take action as necessary to correct these impacts.

7. Is it OK if EPA includes your name in the FYR report, which will be published online?

   Yes.

Halby Chemical Co. Superfund Site — Five-Year Review Interview Form

Site Name: Halby Chemical Co. **EPA ID No.:** DED980830954
Interviewer Name: Vance Evans **Affiliation:** EPA
Subject Name: Property Owner **Affiliation:** Current Site Owner
Subject Contact Information: N.A.
Time: N.A. **Date:** 03/31/2017
Interview Location: N.A.

Interview Format (circle one): In Person Phone Mail Other: E-mail

Interview Category: Current Site Owner

1. What is your overall impression of the remedial activities at the Site?

   Good.

2. What have been the effects of this Site on the surrounding community, if any?

   None.

3. What is your assessment of the current performance of the remedy in place at the Site?

   Good.

4. Are you aware of any complaints or inquiries regarding environmental issues or the remedial action from residents since implementation of the cleanup?

   No.

5. Do you feel well-informed regarding the Site's activities and remedial progress? If not, how might EPA convey site-related information in the future?

   Yes.

6. Do you have any comments, suggestions or recommendations regarding the management or operation of the Site's remedy?

   None.

7. Is it OK if EPA includes your name in the FYR report, which will be published online?

   No.

Halby Superfund Site
Community Interview Questions - 2017

Epa has two sets of superfund activities it is currently conducting for the Site.

1. **We are updating the Community Involvement Plan (CIP). This activity includes interviews to gather data on what information the affected community is interested in getting and how they would best like to get it.**

2. **We are, also, performing a review of the completed cleanup action at the site, known as a Five-Year Review. As part of the review we often interview those directly next to the site to get their input.**

Name:_____Eden Park Civic Association_____

Address:_____

Telephone Number:_____

Email:_____

Date and Time of Interview:_____

Community Involvement Plan Update Questions

1. How long have you lived in this community?

Over 27- 40 years

2. In general, what local issues receive the most attention (not necessarily site-related)?

Halby is #, also, dust from the Diamond Materials site and traffic, which contains cancer-causing chemicals

3. Who do you consider to be the leaders in the community?

Elder McDuffy, Eden/Hamilton Park Civic Association.

4. How sensitive is the community to environmental issues on a scale of 1 to 10, with 10 being extremely sensitive?
   10

5. What is the most important environmental issue facing this community?

Halby, and Diamond Materials (putting out a chemical that causes cancer. DNREC's State Air Quality Control Division is involved with testing this area.

6. What organizations or individuals do you consider most credible or trustworthy when it comes to environmental information?

State Rep. James Johnson, Representative 16th District.
105 Skelton Dr, New Castle DE 19720
Dover Office: (302) 744-4351, Wilmington Office: (302) 577-8476
Email: JJ.Johnson@state.de.us

7. Do you think there is environmental interest or concern about the Halby Superfund Site?

Yes

8. Do you know of any local environmental or community groups that may be interested in the site?

A Group is forming; they will let us know more; the Fire Department (there is a memorial at Holloway Terrace Fire Hall for a firefighter that died in one of the many fires at Halby

9. Have you or anyone you know had any problems that you think might be attributable to the site?

We did testing and found many of the same problems that EPA found. We sued and won for all but two homes in the neighborhood, for arsenic.

10. From what sources have you received information about the site?

The litigation, internet, our scientists, DNREC

11. Do you feel that EPA has provided adequate information to you?

Not quite, we have meeting notes from 2007, they didn't supply information that was helpful.

12. What would be the best way to keep the community informed about the site?

Find out where the arsenic is, and is going, and carbon disulfide; fact sheets, meetings, TV, and any other relevant means are good for getting information.

13. What newspapers cover local issues?

The News Journal

14. What television stations cover local news? Are there any local government channels?

Channel 28, public access channel that covers the county

15. What radio stations broadcast local news?

WDEL AM and FM, WJBR, FM

16. a. Do you use the Internet as an information source? Yes___ No___

Yes

b. Do you think that the community members utilize the Internet for information? Yes___ No___

Some

c. Can we send you information via e-mail? Yes_x__ No___
(If yes, please provide your e-mail address)

mcduffybe@yahoo.com

17. An information repository has been established at the Library. Do you think that this is the best and most convenient place to store information?
Yes___ No___
(If no, please provide alternate information)

18. Where do you think the best place to hold a public meeting would be?

Carter Temple Church of God,
4066 New Castle Ave.
New Castle, DE 19720
302-777-4175
(best during the Civic League meetings on the last Monday of each month)

19. Do you know of any residents near the Site that have special needs (homebound, deaf, blind, speaks a language other than English)?

There are homebound residents

20. Do you know of anyone else we should contact to be a part of this survey?

Yes, the rest of the group

21. Do you have anything you would like to add about the Site that you think EPA should know?

There were a lot of people with illnesses related to carbon disulfide, and many died. Would like to get photos of the originally operating site.

Five-Year Review Questions

1. What is your overall impression of the project and the effectiveness of the cleanup?

We would not have sued if the cleanup was adequate. The community was not adequately involved, most of those that attended the meetings were not from the community. People knew and understood more after DNREC came out. They did it differently, they had meetings at the church, did one-on-one meetings with residents and sent flyers out saying "do not step on the dirt, talked about anthrax, etc.

2. Were you involved with or had an opinion concerning how the cleanup was decided and implemented?

No, we did not even know about the cleanup.

3. What effects have the current site operations had on the surrounding community?

We don't know, come and do testing. You know it is active and still moving (carbon disulfide). We know it moves and saws signs of it, like sink holes. They are on private properties, some residents have moved or died. We can show you some of these areas and would like to see where EPA is sampling, to see if there is any possible correlation to movement towards the neighborhood.

4. Are you aware of any community concerns regarding the site or its operation and administration? If so, please give details.

There was concern that the current owners should not have put a gasoline pumping station in the area. We don't know what is going on at the site, as we do not see anyone doing work. We would like the project manager to provide an email update and presentation to the public, as well as a walkthrough with representatives from the Civic Association.

5. Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from local authorities? If so, please give details.

N/A

Current sampling results are showing that the remedy now in place is working. Do you have an opinion as to anything that we should currently be doing?

6. Do you feel well informed about EPA's activities and progress?

No, we don't see people. Can't say that we have seen anything you have done. EPA did sampling in the community they tested within a circled area from the site. We gave copies of the report results to DNREC from some of the properties tested.

7. Do you have any comments, suggestions, or recommendations regarding EPA's management or operation of the site?

We need to have a meeting with EPA to update us, and to come down and show us where 3where you have tested arsenic and where it is moving. Our scientists have done testing and have backed up EPA, but not with respect to how it may have moved into Eden Park.

8. How do you want to be informed about upcoming work at the site?

Internet

9. What extent of community involvement do you wish to have during the future work at the site?

When you email us with an update of where you are, that will determine what input we would want with EPA. A lot of the same comments were shared the last time EPA came during the last Five-Year Review, and we are still waiting for EPA to get back to us. Correspondence can be sent through Elder McDuffy, who will share it with the Civic Association and community, at: mcduffybe@yahoo.com

The attending state rep. would also like an update on the site as well:

State Rep. James Johnson, Representative 16th District.
105 Skelton Dr, New Castle DE 19720
Dover Office: (302) 744-4351, Wilmington Office: (302) 577-8476
Email: JJ.Johnson@state.de.us

APPENDIX E – DETAILED ARARs REVIEW

Remedial actions are required to comply with the chemical-specific ARARs identified in the ROD. In performing the FYR for compliance with ARARs, only those ARARs that address the protectiveness of the remedy are reviewed.

Soil/Sediment ARARs
There are currently no chemical-specific ARARs establishing acceptable concentrations for contaminants in soil or sediment.

Groundwater ARARs/Comparison Values
The decision documents did not specify chemical-specific ARARs for groundwater. However, groundwater monitoring data are regularly compared to the Safe Drinking Water Act MCLs. Table E-1 below shows that the most current MCLs are being used in the O&M reports for this FYR.

Table E-1: Evaluation of Groundwater COC MCLs

COC	2012 – 2016 O&M Reports MCL[a] (µg/L)	Current MCL (µg/L)[b]	MCL Change
Ammonia	NA	NA	None
Arsenic	10	10	None
Carbon disulfide	NA	NA	None
Cyanide	200	200	None
Manganese	50[c]	50[d]	None

Notes:
a. The 1998 ROD did not establish cleanup goals for water. Therefore, the O&M reports were reviewed to identify if the most current MCLs are being used.
b. Based on the Safe Drinking Water Act primary MCL. Current Safe Drinking Water Act standards can be found at: https://www.epa.gov/ground-water-and-drinking-water/table-regulated-drinking-water-contaminants (accessed 3/28/2017).
c. Secondary MCL.
d. Secondary Drinking Water Standards: Guidance for Nuisance Chemicals can be found on: https://www.epa.gov/dwstandardsregulations/secondary-drinking-water-standards-guidance-nuisance-chemicals

NA – Cleanup goal is based on To-Be-Considered criteria.

Surface Water ARARs
The 1998 ROD identified the Delaware Surface Water Quality Standards and the Clean Water Act as ARARs for surface water. The 2011 O&M plan lists Delaware Surface Water Quality for the Protection of Aquatic Life to be used in evaluating the monitoring data. Table E-2 shows that the surface water ARARs have not changed.

Table E-2: Evaluation of Surface Water Criteria

COC	2011 O&M Plan[a] (µg/L)		Current Criteria		Criteria Change
	Acute F/M	Chronic F/M	Acute	Chronic	
Ammonia	NE/NA	NE/NA	NA	NA	None
Arsenic	340/69	150/36	340/69	150/36	None
Carbon disulfide	NA	NA	NA	NA	None
Cyanide	22/1	5.2/NA	22/1	5.2/NA	None

Notes:

c. Delaware Surface Water Quality for the Protection of Aquatic Life listed in the 2011 O&M plan.

d. Delaware Surface Water Quality for the Protection of Aquatic Life http://regulations.delaware.gov/AdminCode/title7/7000/7400/7401.shtml (accessed 3/28/2017).

NE – O&M plan did not establish a criterion for freshwater, which is pH and temperature dependent
NA – criteria not available
F – freshwater criteria
M – marine criteria

APPENDIX F – TOXICITY REVIEW

To help determine if the cleanup goals for soil remain valid, this FYR compared the cleanup goals against EPA's current regional screening levels (RSLs) for soil. RSLs incorporate current toxicity values and standard default exposure factors.

The evaluation of the arsenic cleanup levels based on industrial and residential exposure (Table F-1) demonstrates that the arsenic cleanup levels remain valid as the concentrations are within or below EPA's risk management range of 1×10^{-6} to 1×10^{-4} and below the noncancer hazard quotient (HQ) of 1.0.

Table F-1: Health Evaluation of Arsenic Soil Cleanup Levels

COC	1998 ROD Cleanup Levels (mg/kg)	RSL[a] (mg/kg)		Cancer Risk[b]	Noncancer HQ[c]
		1×10^{-6} Risk	HQ=1.0		
Industrial					
Arsenic	38	3.0	480	1.3×10^{-5}	0.08
Residential					
Arsenic	14	0.68	35	2.1×10^{-5}	0.4

Notes:

a. Current EPA RSLs, dated May 2016, are available at https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-may-2016 (accessed 3/30/2017).

b. The cancer risks were calculated using the following equation, based on the fact that RSLs are derived based on 1×10^{-6} risk:
Cancer risk = (cleanup level ÷ cancer-based RSL) × 10^{-6}

c. The noncancer HQ was calculated using the following equation:
HQ = cleanup level ÷ noncancer-based RSL

APPENDIX G – DATA TABLES

Table G-1: Surface Water Sampling Results[1]

TABLE 2
SURFACE WATER SAMPLE RESULTS (2010-2016)
HALBY STORMWATER BASIN O/M MONITORING
HALBY CHEMICAL SUPERFUND SITE
WILMINGTON, DELAWARE

Analysis Name	Units	Method	SW-1	SW-2	MDL	Trip Blank	Storage Blank
November 2010							
Carbon Disulfide	ug/l	SW-846 8260B	N.D.	N.D.	1	ND	ND
Arsenic	mg/l	SW-846 6010B	N.D.	N.D.	0.0098	n.a.	
Total Cyanide (water)	mg/l	SW-846 9012A	N.D.	N.D.	0.0050		
Ammonia Nitrogen	mg/l	SM20 4500NH3 B/C mod	N.D.	N.D.	0.20		
May 2011							
Carbon Disulfide	ug/l	SW-846 8260B	N.D.	N.D.	1	ND	ND
Arsenic	mg/l	SW-846 6010B	N.D.	N.D.	0.0098	n.a.	
Total Cyanide (water)	mg/l	SW-846 9012A	N.D.	N.D.	0.0050		
Ammonia Nitrogen	mg/l	SM20 4500NH3 B/C mod	N.D.	0.27 J	0.20		
May 2012							
Carbon Disulfide	ug/l	SW-846 8260B	N.D.	N.D.	1	ND	ND
Arsenic	mg/l	SW-846 6010B	N.D.	N.D.	0.0051	n.a.	
Total Cyanide (water)	mg/l	SW-846 9012A	N.D.	N.D.	0.0050		
Ammonia Nitrogen	mg/l	SM20 4500NH3 B/C mod	N.D.	N.D.	0.20		
November 2012							
Carbon Disulfide	ug/l	SW-846 8260B	N.D.	N.D.	1	ND	ND
Arsenic	mg/l	SW-846 6010B	N.D.	N.D.	0.0051	n.a.	
Total Cyanide (water)	mg/l	SW-846 9012A	N.D.	N.D.	0.0050		
Ammonia Nitrogen	mg/l	SM20 4500NH3 B/C mod	N.D.	0.30 J	0.20		
May 2013							
Carbon Disulfide	ug/l	SW-846 8260B	N.D.	N.D.	1	ND	ND
Arsenic	mg/l	SW-846 6010B	N.D.	N.D.	0.0068	n.a.	
Total Cyanide (water)	mg/l	SW-846 9012A	N.D.	N.D.	0.0050		
Ammonia Nitrogen	mg/l	SM20 4500NH3 B/C mod	N.D.	N.D.	0.20		
October-November 2014							
Carbon Disulfide	ug/l	SW-846 8260B	N.D.	N.D.	1	ND	ND
Arsenic	mg/l	SW-846 6010B	N.D.	N.D.	0.0072	n.a.	
Total Cyanide (water)	mg/l	SW-846 9012A	N.D.	N.D.	0.0050		
Ammonia Nitrogen	mg/l	SM20 4500NH3 B/C mod	N.D.	N.D.	0.20		
June 2015							
Carbon Disulfide	ug/l	SW-846 8260B	N.D.	N.D.	1	ND	ND
Arsenic	mg/l	SW-846 6010B	N.D.	N.D.	0.0072	n.a.	
Total Cyanide (water)	mg/l	SW-846 9012A	N.D.	N.D.	0.0050		
Ammonia Nitrogen	mg/l	SM20 4500NH3 B/C mod	N.D.	N.D.	0.20		
November 2015							
Carbon Disulfide	ug/l	SW-846 8260B	N.D.	N.D.	1	ND	ND
Arsenic	mg/l	SW-846 6010B	N.D.	N.D.	0.0070	n.a.	
Total Cyanide (water)	mg/l	SW-846 9012A	N.D.	0.0095 J	0.0050		
Ammonia Nitrogen	mg/l	SM20 4500NH3 B/C mod	N.D.	N.D.	0.20		
May 2016							
Carbon Disulfide	ug/l	SW-846 8260B	N.D.	N.D.	1	ND	ND
Arsenic	mg/l	SW-846 6010B	N.D.	N.D.	0.0078	n.a.	
Total Cyanide (water)	mg/l	SW-846 9012A	N.D.	N.D.	0.0050		
Ammonia Nitrogen	mg/l	SM20 4500NH3 B/C mod	N.D.	N.D.	0.20		
December 2016							
Carbon Disulfide	ug/l	SW-846 8260B	N.D.	N.D.	1	ND	ND
Arsenic	mg/l	SW-846 6010B	N.D.	N.D.	0.0097	n.a.	
Total Cyanide (water)	mg/l	SW-846 9012A	N.D.	N.D.	0.0050		
Ammonia Nitrogen	mg/l	SM20 4500NH3 B/C mod	N.D.	N.D.	0.20		

Notes: See Table 1

[1] Table 2. O&M Semi-Annual Sampling Report December 2016 Event, January 2017. Sample locations are shown on Figure 2 (page 6) of the 5-Year Review Report.

Table G-2: Sediment Sampling Results[2]

TABLE 3
SEDIMENT ARSENIC CONCENTRATIONS (2010-2016)
HALBY STORMWATER BASIN MONITORING
HALBY CHEMICAL SUPERFUND SITE
WILMINGTON, DELAWARE

METALS	METHOD	UNITS	SAMPLING DATE	SED-1 (SED-1 DUP)	SED-2	SED-3	SED-4	SED-5*
Total Arsenic	SW-846 6010B	mg/kg	2010 - March	15 (15.4)	15.7	23.4	16.5	14.3
Total Arsenic	SW-846 6010B	mg/kg	2010 - November	48.7 (NS)	43.0	40.7	38.7	NS
Total Arsenic	SW-846 6010B	mg/kg	2011 - May	61.3 (54.9)	35.9	47.1	66.6	NS
Total Arsenic	SW-846 6010B	mg/kg	2012 - May	15.3 J (< 5.0)	<11.9	12.3	26.2	NS
Total Arsenic	SW-846 6010B	mg/kg	2012 - November	66.4 (67.1)	50.5	38.4	68	48.1
Total Arsenic	SW-846 6010B	mg/kg	2013 - May	54.2 (26.9)	52.7	53.9	94.7	NS
Total Arsenic	SW-846 6010B	mg/kg	2014 - October	14.7 (26.0)	37.8	17.3	105	NS
Total Arsenic	SW-846 6010B	mg/kg	2015 - June	128 (106)	133	37.2	185	NS
Total Arsenic	SW-846 6010B	mg/kg	2015 - November	41.5 (38.2)	59.8	19.6	53.7	NS
Total Arsenic	SW-846 6010B	mg/kg	2016 - May	43.5 (45.8)	58.2	20.5	69.9	NS
Total Arsenic	SW-846 6010B	mg/kg	2016 - December	57.0 (20.7)	45.0	<3.72	<4.55	NS

Table Notes

* SED-5 is not a designated O&M sample station in the Halby Site O&M Plan (TBE, 2011)

NS = Not Sampled (sample not collected)

ND = Not Detected above the lab limit of detection

J = Estimated; detected above Method Detection Limit but below lab Limit of Quantitation

highest reported arsenic concentration

second highest

third highest

lowest

[2] Table 3. O&M Semi-Annual Sampling Report December 2016 Event, January 2017. Sample locations are shown on Figure 2 (page 6) of the 5-Year Review Report.

Table G-3: Groundwater Data[3]

TABLE 7
O / M GROUNDWATER SAMPLING RESULTS 2005 - 2016
HALBY CHEMICAL SUPERFUND SITE
WILMINGTON, DELAWARE

Parameter	MDL (mg/L)	MCL or RSL (mg/L)	11/02/05	05/02/06	10/31/06	07/03/07	06/16/09	11/11/09	06/08/10	11/01/10	05/09/11	11/10/11	05/21/12	11/28/12	09/10/13	10/29/14	06/24/15	11/09/15	05/05/16	12/06/16
Shallow Monitor Well 6 (SMW-6) - Columbia Aquifer (in mg/L)																				
Carbon Disulfide	0.001	0.081*	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	N.D.	N.D.	ND	ND	NS
Arsenic total	0.0078	0.010	ND	0.0103 J	ND	ND	0.0089 J	ND	ND	ND	ND	ND	0.0077 J	ND	0.0148 J	N.D.	N.D.	ND	ND	NS
Arsenic diss	0.0078	0.010	ND	0.0136 J	ND		ND	ND	ND	ND	ND	ND	ND	ND	ND	N.D.	N.D.	ND	ND	NS
Manganese total	0.0012	0.05**	0.225	0.501	0.0032 J	1.04	1.67	1.75	1.78	1.99	1.76	1.80	1.70	1.69	1.25	1.04	0.907	0.808	0.603	NS
Manganese diss	0.0012	0.05**	0.217	0.474	0.688	1.21	1.46	1.72	1.66	2.13	1.79	1.83	1.77	1.87	1.23	1.05	0.940	0.826	0.625	NS
Ammonia Nitrogen	0.2	none	0.38 J	0.77	0.71	1.8	ND	1.0	ND	1.4	0.78	1.3	1.1	1.40	0.45 J	0.90	ND	ND	1.20	NS
Total Cyanide	0.005	0.200	ND	0.029	0.039	0.022	ND	0.011	ND	ND	ND	ND	ND	ND	ND	0.0064 J	ND	ND	ND	NS
Shallow Monitor Well W-4C (W-4C) - Columbia Aquifer (in mg/L)																				
Carbon Disulfide	0.001	0.081*	0.012	0.006	0.007	0.004 J	ND	ND	0.004 J	0.004 J	ND	0.021	0.012	0.018	NS-A	NS-A	NS-A	NS-A	NS-A	NS
Arsenic total	0.0078	0.010	ND	ND	ND	0.011 J	ND	ND	0.0154 J	ND	ND	ND	0.044 J	ND	NS-A	NS-A	NS-A	NS-A	NS-A	NS
Arsenic diss	0.0078	0.010	ND	0.0129 J	0.0116 J	0.0145 J	ND	ND	ND	ND	ND	ND	ND	ND	NS-A	NS-A	NS-A	NS-A	NS-A	NS
Manganese total	0.0012	0.05**	50.8	29.3	5.01	30.9	34.5	13.6	29.3	48.6	67	106	42.1	85.1	NS-A	NS-A	NS-A	NS-A	NS-A	NS
Manganese diss	0.0012	0.05**	58.6	30.7	45.3	29.5	30.1	12.9	28.3	42.9	67.5	99.6	33.6	81.1	NS-A	NS-A	NS-A	NS-A	NS-A	NS
Ammonia Nitrogen	0.2	none	22.1	32.4	5.2	33.4	37.7	36.3	38.9	30.3	24.5 J	20.8	28.3	27.8	NS-A	NS-A	NS-A	NS-A	NS-A	NS
Total Cyanide	0.005	0.200	3.1	0.12	0.0078 J	ND	0.011	0.036	ND	ND	0.0054 J	0.19	ND	0.15	NS-A	NS-A	NS-A	NS-A	NS-A	NS
Shallow Monitor Well 2 (SMW-2) - Columbia Aquifer (in mg/L)																				
Carbon Disulfide	0.001	0.081*	0.66	1.0	0.78	0.94	0.79	0.82	0.94	1.1	1	0.61	0.42	NS	NS-A	NS-A	NS-A	NS-A	NS-A	NS
Arsenic total	0.0078	0.010	ND	ND	ND	ND	ND	0.0099 J	0.0412 J	ND	ND	ND	0.0336 J	NS	NS-A	NS-A	NS-A	NS-A	NS-A	NS
Arsenic dis	0.0078	0.010	ND	0.0136 J	0.0155 J	0.0142	ND	ND	ND	ND	ND	ND	0.0309 J	NS	NS-A	NS-A	NS-A	NS-A	NS-A	NS
Manganese total	0.0012	0.05**	229	197	233	194	172	163	163	156	156	144	148	NS	NS-A	NS-A	NS-A	NS-A	NS-A	NS
Manganese dis	0.0012	0.05**	219	196	198	172	155	165	159	154	147	142	144	NS	NS-A	NS-A	NS-A	NS-A	NS-A	NS
Ammonia Nitrogen	0.2	none	33.2	40.1	39.5	41.7	35.5	36.6	33.2	33.5	26.9	31.3	24.8	NS	NS-A	NS-A	NS-A	NS-A	NS-A	NS
Total Cyanide	0.005	0.200	2.9	2.9	0.0056 J	ND	0.059	0.072	0.015	0.014	0.075	0.053	0.034	NS	NS-A	NS-A	NS-A	NS-A	NS-A	NS
Shallow Monitor Well W-2A (W-2A) - Columbia Aquifer (in mg/L)																				
Carbon Disulfide	0.001	0.081*	ND	ND	ND	0.003 J	0.002 J	ND	ND	ND	ND	ND	ND	ND	ND	N.D.	N.D.	ND	ND	ND
Arsenic total	0.0078	0.010	ND	0.0115 J	ND	ND	ND	ND	0.0267 J	ND	ND	ND	ND	ND	0.166 J	N.D.	N.D.	0.010	0.0515 J	0.0078
Arsenic diss	0.0078	0.010	0.0142 J	0.0991 J	0.0396	0.0276	ND	ND	ND	ND	0.0324	ND	ND	ND	ND	N.D.	N.D.	0.010	0.0099	0.0072
Manganese total	0.0012	0.05**	59.1	57.1	0.68	48.4	53.2	42.4	40.4	38.1	49.5	40.9	51.2	48	52.0	33.9	43.6	47.1	44.8	46.4
Manganese diss	0.0012	0.05**	55.8	59.3	60.6	42.5	47.4	41.7	37.7	33.6	50.6	38.3	49.3	49.8	53.2	32.8	47.7	45.9	48.1	39.7
Ammonia Nitrogen	0.2	none	152	151	121	124	110	101	92.9	92.9	131	102	131	128	152	393	250	152	136	125
Total Cyanide	0.005	0.200	0.069	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

TABLE NOTES: MDL = Lab Method Detection Limit; MCL = Maximum Contaminant Level; *RSL = EPA Regional Screening Level; **SMCL = Secondary MCL; NS = Not Sampled
ND = Not Detected at a concentration above the lab MDL; J = estimated concentration below lab MDL; NS-A = Not Sampled; well Abandoned 2/8/2013; Concentration Exceeds MCL or RSL

[3] Table 7. O&M Semi-Annual Sampling Report December 2016 Event, January 2017. Sample locations are shown on Figure 2 (page 6) of the 5-Year Review Report.

TABLE 7

O / M GROUNDWATER SAMPLING RESULTS 2005 - 2016

HALBY CHEMICAL SUPERFUND SITE

WILMINGTON, DELAWARE

Parameter	MDL (mg/L)	MCL or RSL (mg/L)	11/03/05	05/02/06	10/31/06	07/03/07	06/16/09	11/11/09	06/08/10	11/01/10	05/09/11	11/07/11	05/21/12	11/28/12	09/10/13	10/29/14	06/24/15	11/09/15	05/05/16	12/06/16
Intermediate Monitor Well 6 (IMW-6) - Upper Potomac Aquifer (in mg/L)																				
Carbon Disulfide	0.001	0.081*	ND	ND	ND	ND	ND	ND	0.003J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS
Arsenic total	0.0078	0.010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0057 J	ND	0.0284	ND	ND	0.0095 J	ND	NS
Arsenic diss	0.0078	0.010	ND	0.0095	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0107 J	ND	NS
Manganese total	0.0012	0.05**	0.58	0.578	0.27	0.637	0.845	0.906	1	1.04	0.369	1.36	0.911	1.12	1.8	2.38	0.189	2.77	0.005	NS
Manganese diss	0.0012	0.05**	0.578	0.555	0.658	0.618	0.819	0.904	0.961	1.08	0.36	1.36	0.908	1.16	1.85	2.27	0.668	2.93	0.0022 J	NS
Ammonia Nitrogen	0.2	none	0.26J	0.43 J	ND	ND	0.36J	0.35 J	ND	0.33 J	0.3 J	0.36 J	0.24 J	0.45 J	ND	0.51 J	ND	0.57 J	ND	NS
Total Cyanide	0.005	0.200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS
Intermediate Monitor Well 2 (IMW-2) - Upper Potomac Aquifer (in mg/L)																				
Carbon Disulfide	0.001	0.081*	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS-A	NS-A	NS-A	NS-A	NS-A	NS
Arsenic total	0.0078	0.010	NT	ND	ND	ND	ND	ND	0.0161 J	ND	ND	ND	0.0322 J	ND	NS-A	NS-A	NS-A	NS-A	NS-A	NS
Arsenic diss	0.0078	0.010	NT	0.0218	0.0129J	0.017 J	ND	ND	ND	ND	ND	ND	0.0454 J	ND	NS-A	NS-A	NS-A	NS-A	NS-A	NS
Manganese total	0.0012	0.05**	NT	76.3	90.7	87.6	94	87.9	89.3	87.1	84.3	86.4	88.6	84.2	NS-A	NS-A	NS-A	NS-A	NS-A	NS
Manganese diss	0.0012	0.05**	NT	74.4	83.6	82.2	82.9	82.2	82.2	82.1	86.4	87.1	87.3	78.7	NS-A	NS-A	NS-A	NS-A	NS-A	NS
Ammonia Nitrogen	0.2	none	NT	2.4	2.8	1.5	ND	3.0	6.6	2.9	3.5	5.4	3.3	4	NS-A	NS-A	NS-A	NS-A	NS-A	NS
Total Cyanide	0.005	0.200	NT	0.45	0.035	ND	ND	ND	ND	ND	ND	0.011	ND	ND	NS-A	NS-A	NS-A	NS-A	NS-A	NS
Intermediate Monitor Well W-4B - Upper Potomac Aquifer (in mg/L)																				
Carbon Disulfide	0.001	0.081*	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS-A	NS-A	NS-A	NS-A	NS-A	NS
Arsenic total	0.0078	0.010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS-A	NS-A	NS-A	NS-A	NS-A	NS
Arsenic dis	0.0078	0.010	ND	0.0117	ND	ND	ND	ND	ND	ND		ND	ND	ND	NS-A	NS-A	NS-A	NS-A	NS-A	NS
Manganese total	0.0012	0.05**	5.71	4.12	46.2	4.76	4.75	4.45	4.88	5.26	3.41	4.24	4.47	3.7	NS-A	NS-A	NS-A	NS-A	NS-A	NS
Manganese dis	0.0012	0.05**	5.59	4.33	4.85	4.69	4.51	4.11	4.52	5.52	3.85	4.33	4.42	3.85	NS-A	NS-A	NS-A	NS-A	NS-A	NS
Ammonia Nitrogen	0.2	none	0.21 J	ND	0.2J	ND	0.34	ND	ND	ND	0.45	0.3 J	ND	0.42 J	NS-A	NS-A	NS-A	NS-A	NS-A	NS
Total Cyanide	0.005	0.200	0.32	0.19	0.01	0.096	0.35	ND	ND	ND	0.011	0.012	ND	0.013	NS-A	NS-A	NS-A	NS-A	NS-A	NS
Intermediate Monitor Well W-2B - Upper Potomac Aquifer (in mg/L)																				
Carbon Disulfide	0.001	0.081*	ND	ND	ND	ND	0.002 J	0.002 J	ND	ND	ND	ND	0.001 J	ND	ND	ND	ND	ND	ND	ND
Arsenic total	0.0078	0.010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0182 J	ND	ND	0.0187 J	ND	<0.0097
Arsenic diss	0.0078	0.010	0.0131 J	ND	0.0105 J	ND	ND	ND	0.0075 J	ND	ND	ND	ND	ND	ND	ND	ND	0.0145 J	ND	<0.0097
Manganese total	0.0012	0.05**	76.4	61	77.8	74.8	58.3	65.4	67	69.5	67.2	62.5	66.3	67.2	62.7	61.0	58.7	58.5	60.0	58.0
Manganese diss	0.0012	0.05**	67.9	66.3	66.8	73	55.4	68.2	59.1	61.6	68	66.6	63.7	65.8	62.5	64.8	59.1	58.9	62.3	60.4
Ammonia Nitrogen	0.2	none	32.8	33.5	31.5	32.6	34.1	29.1	30	29.7	28.6	27.6	28.2	26.1	26.3	25.0	36.3	25.0	26.2	25.3
Total Cyanide	0.005	0.200	1.5	0.31	0.017	0.0069 J	0.31	0.0079J	ND	0.014	0.1	0.035	ND	0.009 J	ND	0.079	ND	0.045	ND	0.64

TABLE NOTES: MDL = Lab Method Dete NOTES: MDL = Lab Method Detection Limit MCL = Maximum Contaminant Level **SMCL = Secondary MCL

ND = Not Detected at a < *RSL = EPA Regional Tap Water Screening Level NS = Not Sampled NS-A = Not Sampled; well Abandoned 2/8/2013

TABLE 7
O /M GROUNDWATER SAMPLING RESULTS 2005 - 2016
HALBY CHEMICAL SUPERFUND SITE
WILMINGTON, DELAWARE

Parameter	MDL (mg/L)	MCL or RSL (mg/L)	Deep Monitor Well 6 (DMW-6) - Lower Potomac Aquifer (in mg/L)																	
			11/03/05	05/02/06	10/31/06	07/03/07	06/16/09	11/11/09	06/08/10	11/01/10	05/09/11	11/10/11	05/21/12	11/28/12	09/10/13	10/29/14	06/24/15	11/09/15	05/05/16	12/06/16
Carbon Disulfide	0.001	0.081*	ND	ND	ND	ND	ND	ND	0.005 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS
Arsenic total	0.0078	0.010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0107 J	ND	ND	ND	NS
Arsenic diss	0.0078	0.010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	N.D.	ND	ND	ND	NS
Manganese total	0.0012	0.05**	0.132	0.167	0.727	0.259	0.198	0.151	0.204	0.179	0.178	0.183	0.172	0.165	0.132	0.124	0.131	0.141	0.139	NS
Manganese diss	0.0012	0.05**	0.118	0.17	0.22	0.257	0.179	0.154	0.189	0.18	0.168	0.168	0.177	0.17	0.142	0.119	0.133	0.134	0.144	NS
Ammonia Nitrogen	0.2	none	0.42J	ND	ND	0.66	ND	0.24 J	0.68	0.35 J	ND	ND	ND	ND	0.67	0.48 J	ND	ND	ND	NS
Total Cyanide	0.005	0.200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.005 J	NS
Carbon Disulfide	0.001	0.081*																		
Arsenic total	0.0078	0.010																		
Arsenic diss	0.0078	0.010																		
Manganese total	0.0012	0.05**																		
Manganese diss	0.0012	0.05**																		
Ammonia Nitrogen	0.2	none																		
Total Cyanide	0.005	0.200																		
Carbon Disulfide	0.001	0.081*																		
Arsenic total	0.0078	0.010																		
Arsenic dis	0.0078	0.010																		
Manganese total	0.0012	0.05**																		
Manganese dis	0.0012	0.05**																		
Ammonia Nitrogen	0.2	none																		
Total Cyanide	0.005	0.200																		
Carbon Disulfide	0.001	0.081*																		
Arsenic total	0.0078	0.010																		
Arsenic diss	0.0078	0.010																		
Manganese total	0.0012	0.05**																		
Manganese diss	0.0012	0.05**																		
Ammonia Nitrogen	0.2	none																		
Total Cyanide	0.005	0.200																		

TABLE NOTES: MDL = Lab Method Dete NOTES: MDL = Lab Method Detection Limit MCL = Maximum Contaminant Level **SMCL = Secondary MCL NS = Not Sampled
ND = Not Detected at a c *RSL = EPA Regional Tap Water Screening Level NS-A = Not Sampled; well Abandoned 2/8/2013

APPENDIX H – SITE INSPECTION CHECKLIST

FIVE-YEAR REVIEW SITE INSPECTION CHECKLIST

I. SITE INFORMATION

Site Name: Halby Chemical Co.	**Date of Inspection:** 03/21/2017
Location and Region: Wilmington, Delaware 3	**EPA ID:** DED980830954
Agency, Office or Company Leading the Five-Year Review: EPA	**Weather/Temperature:** Sunny, 60 degrees fahrenheit

Remedy Includes: (Check all that apply)

- ☒ Landfill cover/containment
- ☐ Access controls
- ☒ Institutional controls
- ☐ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☒ Other: Soil stabilization and capping, long-term monitoring
- ☒ Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls

Attachments: ☒ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS (check all that apply)

1. **O&M Site Manager** R. Clayton Greer (Name) ____ (Title) 3/28/2017 (Date)
   Interviewed ☐ at site ☐ at office ☐ by phone Phone: ____
   Problems, suggestions ☐ Report attached: ____

2. **O&M Staff** ____ (Name) ____ (Title) ____ (Date)
   Interviewed ☐ at site ☐ at office ☐ by phone Phone: ____
   Problems/suggestions ☐ Report attached: ____

3. **Local Regulatory Authorities and Response Agencies** (i.e., state and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices). Fill in all that apply.

   Agency DNREC
   Contact John Cargill (Name) ____ (Title) 3/29/2017 (Date) ____ (Phone No.)
   Problems/suggestions ☐ Report attached: ____

   Agency ____
   Contact ____ Name ____ (Title) ____ (Date) ____ (Phone No.)
   Problems/suggestions ☐ Report attached: ____

   Agency ____
   Contact ____ (Name) ____ (Title) ____ (Date) ____ (Phone No.)
   Problems/suggestions ☐ Report attached: ____

   Agency ____
   Contact ____ (Name) ____ (Title) ____ (Date) ____ (Phone No.)
   Problems/suggestions ☐ Report attached: ____

   Agency ____
   Contact ____ ____ ____ ____

Name	Title	Date	Phone No.		
Problems/suggestions ☐ Report attached: _____					
4. **Other Interviews** (optional) ☐ Report attached: _____					
Gerald Pepper, The Pyrites Company (PRP)					
Current Site Owner					
III. ON-SITE DOCUMENTS AND RECORDS VERIFIED (check all that apply)					
1. **O&M Documents**					
☒ O&M manual	☒ Readily available	☐ Up to date	☐ N/A		
☒ As-built drawings	☒ Readily available	☐ Up to date	☐ N/A		
☒ Maintenance logs	☒ Readily available	☐ Up to date	☐ N/A		
Remarks: _____					
2. **Site-Specific Health and Safety Plan**		☐ Readily available	☐ Up to date	☒ N/A	
☐ Contingency plan/emergency response plan		☐ Readily available	☐ Up to date	☒ N/A	
Remarks: _____					
3. **O&M and OSHA Training Records**		☐ Readily available	☐ Up to date	☒ N/A	
Remarks: _____					
4. **Permits and Service Agreements**					
☐ Air discharge permit		☐ Readily available	☐ Up to date	☒ N/A	
☐ Effluent discharge		☐ Readily available	☐ Up to date	☒ N/A	
☐ Waste disposal, POTW		☐ Readily available	☐ Up to date	☒ N/A	
☐ Other permits: _____		☐ Readily available	☐ Up to date	☒ N/A	
Remarks: _____					
5. **Gas Generation Records**		☐ Readily available	☐ Up to date	☒ N/A	
Remarks: _____					
6. **Settlement Monument Records**		☐ Readily available	☐ Up to date	☒ N/A	
Remarks: _____					
7. **Groundwater Monitoring Records**		☒ Readily available	☐ Up to date	☐ N/A	
Remarks: _____					
8. **Leachate Extraction Records**		☐ Readily available	☐ Up to date	☒ N/A	
Remarks: _____					
9. **Discharge Compliance Records**					
☐ Air	☐ Readily available	☐ Up to date	☒ N/A		
☐ Water (effluent)	☐ Readily available	☐ Up to date	☒ N/A		
Remarks: _____					

10. **Daily Access/Security Logs** ☐ Readily available ☐ Up to date ☒ N/A

Remarks: _____

IV. O&M COSTS

1. **O&M Organization**

☐ State in-house ☐ Contractor for state

☐ PRP in-house ☒ Contractor for PRP

☐ Federal facility in-house ☐ Contractor for Federal facility

☐ _____

2. **O&M Cost Records**

☐ Readily available ☐ Up to date

☐ Funding mechanism/agreement in place ☒ Unavailable

Original O&M cost estimate: _____ ☐ Breakdown attached

Total annual cost by year for review period if available

From: _____ Date	To: _____ Date	_____ Total cost	☐ Breakdown attached
From: _____ Date	To: _____ Date	_____ Total cost	☐ Breakdown attached
From: _____ Date	To: _____ Date	_____ Total cost	☐ Breakdown attached
From: _____ Date	To: _____ Date	_____ Total cost	☐ Breakdown attached
From: _____ Date	To: _____ Date	_____ Total cost	☐ Breakdown attached

3. **Unanticipated or Unusually High O&M Costs during Review Period**

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. **Fencing Damaged** ☐ Location shown on site map ☐ Gates secured ☒ N/A

Remarks: Although fencing is not part of the remedy, there was an opening in the fencing along the railroad tracks and the north side of the truck storage facility.

B. Other Access Restrictions

1. **Signs and Other Security Measures** ☐ Location shown on site map ☒ N/A

Remarks: Although signs are not part of the remedy, signs stating - "Danger - Environmental Hazard - Unauthorized Personnel Keep Out," were on the truck storage's fencing.

C. Institutional Controls (ICs)

1. **Implementation and Enforcement**

Site conditions imply ICs not properly implemented ☐ Yes ☒ No ☐ N/A

Site conditions imply ICs not being fully enforced ☐ Yes ☒ No ☐ N/A

Type of monitoring (e.g., self-reporting, drive by): _____

Frequency: _____

Responsible party/agency: _____

Contact _____ _____ _____ _____

Name Title Date Phone no.

Reporting is up to date ☐ Yes ☐ No ☒ N/A

Reports are verified by the lead agency ☐ Yes ☐ No ☒ N/A

Specific requirements in deed or decision documents have been met ☒ Yes ☐ No ☐ N/A

Violations have been reported ☐ Yes ☒ No ☐ N/A

Other problems or suggestions: ☐ Report attached

2. **Adequacy** ☐ ICs are adequate ☒ ICs are inadequate ☐ N/A

Remarks: ICs for the F&H Transport and BCC properties do not restrict future residential use.

D. General

1. **Vandalism/Trespassing** ☐ Location shown on site map ☒ No vandalism evident

Remarks: _____

2. **Land Use Changes On Site** ☒ N/A

Remarks: _____

3. **Land Use Changes Off Site** ☒ N/A

Remarks: _____

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. **Roads Damaged** ☐ Location shown on site map ☒ Roads adequate ☒ N/A

Remarks: _____

B. Other Site Conditions

Remarks: _____

VII. LANDFILL COVERS ☒ Applicable ☐ N/A

A. Landfill Surface

1. **Settlement** (low spots) ☐ Location shown on site map ☒ Settlement not evident

Area extent: _____ Depth: _____

Remarks: _____

2.	**Cracks**	☐ Location shown on site map	☒ Cracking not evident
	Lengths: _____	Widths: _____	Depths: _____
	Remarks: _____		
3.	**Erosion**	☐ Location shown on site map	☒ Erosion not evident
	Area extent: _____		Depth: _____
	Remarks: _____		
4.	**Holes**	☐ Location shown on site map	☒ Holes not evident
	Area extent: _____		Depth: _____
	Remarks: _____		
5.	**Vegetative Cover**	☒ Grass	☒ Cover properly established
	☒ No signs of stress	☐ Trees/shrubs (indicate size and locations on a diagram)	
	Remarks: Vegetation is properly established at the capped marsh area.		
6.	**Alternative Cover** (e.g., armored rock, concrete)		☐ N/A
	Remarks: Aggregate and asphalt caps are in fair condition, with ponding in many depressions.		
7.	**Bulges**	☐ Location shown on site map	☒ Bulges not evident
	Area extent: _____		Height: _____
	Remarks: _____		
8.	**Wet Areas/Water Damage**	☒ Wet areas/water damage not evident	
	☐ Wet areas	☐ Location shown on site map	Area extent: _____
	☒ Ponding	☐ Location shown on site map	Area extent: _____
	☐ Seeps	☐ Location shown on site map	Area extent: _____
	☐ Soft subgrade	☐ Location shown on site map	Area extent: _____
	Remarks: See photos in Appendix I for evidence of ponding on aggregate caps.		
9.	**Slope Instability**	☐ Slides	☐ Location shown on site map
	☒ No evidence of slope instability		
	Area extent: _____		
	Remarks: _____		
B. Benches		☐ Applicable	☒ N/A
	(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)		
1.	**Flows Bypass Bench**	☐ Location shown on site map	☐ N/A or okay
	Remarks: _____		
2.	**Bench Breached**	☐ Location shown on site map	☐ N/A or okay
	Remarks: _____		
3.	**Bench Overtopped**	☐ Location shown on site map	☐ N/A or okay
	Remarks: _____		

C. Letdown Channels ☐ Applicable ☒ N/A

(Channel lined with erosion control mats, riprap, grout bags or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. **Settlement** (Low spots) ☐ Location shown on site map ☐ No evidence of settlement
   Area extent: _____ Depth: _____
   Remarks: _____

2. **Material Degradation** ☐ Location shown on site map ☐ No evidence of degradation
   Material type:_____ Area extent: _____
   Remarks: _____

3. **Erosion** ☐ Location shown on site map ☐ No evidence of erosion
   Area extent: _____ Depth: _____
   Remarks: _____

4. **Undercutting** ☐ Location shown on site map ☐ No evidence of undercutting
   Area extent: _____ Depth: _____
   Remarks: _____

5. **Obstructions** Type: _____ ☐ No obstructions
   ☐ Location shown on site map Area extent: _____
   Size: _____
   Remarks: _____

6. **Excessive Vegetative Growth** Type: _____
   ☐ No evidence of excessive growth
   ☐ Vegetation in channels does not obstruct flow
   ☐ Location shown on site map Area extent: _____
   Remarks: _____

D. Cover Penetrations ☒ Applicable ☐ N/A

1. **Gas Vents** ☐ Active ☒ Passive
   ☐ Properly secured/locked ☐ Functioning ☒ Routinely sampled ☐ Good condition
   ☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
   Remarks: _____

2. **Gas Monitoring Probes**
   ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
   ☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A
   Remarks: _____

3. **Monitoring Wells** (within surface area of landfill)

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition

☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A

Remarks: _____

4. **Extraction Wells Leachate**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition

☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A

Remarks: _____

5. **Settlement Monuments** ☐ Located ☐ Routinely surveyed ☒ N/A

Remarks: _____

E. Gas Collection and Treatment ☐ Applicable ☒ N/A

1. **Gas Treatment Facilities**

☐ Flaring ☐ Thermal destruction ☐ Collection for reuse

☐ Good condition ☐ Needs maintenance

Remarks: _____

2. **Gas Collection Wells, Manifolds and Piping**

☐ Good condition ☐ Needs maintenance

Remarks: _____

3. **Gas Monitoring Facilities** (e.g., gas monitoring of adjacent homes or buildings)

☐ Good condition ☐ Needs maintenance ☐ N/A

Remarks: _____

F. Cover Drainage Layer ☐ Applicable ☒ N/A

1. **Outlet Pipes Inspected** ☐ Functioning ☐ N/A

Remarks: _____

2. **Outlet Rock Inspected** ☐ Functioning ☐ N/A

Remarks: _____

G. Detention/Sedimentation Ponds ☒ Applicable ☐ N/A

1. **Siltation** Area extent: _____ Depth: _____ ☐ N/A

☒ Siltation not evident

Remarks: _____

2. **Erosion** Area extent: _____ Depth: _____

☒ Erosion not evident

Remarks: _____

3. **Outlet Works** ☒ Functioning ☐ N/A

Remarks: _____

4. **Dam** ☒ Functioning ☐ N/A

Remarks: _____

H. Retaining Walls ☐ Applicable ☒ N/A

1. **Deformations** ☐ Location shown on site map ☐ Deformation not evident

Horizontal displacement: _____ Vertical displacement: _____

Rotational displacement: _____

Remarks: _____

2. **Degradation** ☐ Location shown on site map ☐ Degradation not evident

Remarks: _____

I. Perimeter Ditches/Off-Site Discharge ☒ Applicable ☐ N/A

1. **Siltation** ☐ Location shown on site map ☒ Siltation not evident

Area extent: _____ Depth: _____

Remarks: _____

2. **Vegetative Growth** ☐ Location shown on site map ☐ N/A

☒ Vegetation does not impede flow

Area extent: _____ Type: _____

Remarks: _____

3. **Erosion** ☐ Location shown on site map ☒ Erosion not evident

Area extent: _____ Depth: _____

Remarks: _____

4. **Discharge Structure** ☒ Functioning ☐ N/A

Remarks: _____

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

1. **Settlement** ☐ Location shown on site map ☐ Settlement not evident

Area extent: _____ Depth: _____

Remarks: _____

2. **Performance Monitoring** Type of monitoring: _____

☐ Performance not monitored

Frequency: _____ ☐ Evidence of breaching

Head differential: _____

Remarks: _____

IX. GROUNDWATER/SURFACE WATER REMEDIES ☒ Applicable ☐ N/A

A. Groundwater Extraction Wells, Pumps and Pipelines ☐ Applicable ☒ N/A

B. Surface Water Collection Structures, Pumps and Pipelines ☐ Applicable ☒ N/A

C. Treatment System ☐ Applicable ☒ N/A

D. Monitoring Data

1. **Monitoring Data**

☒ Is routinely submitted on time ☒ Is of acceptable quality

2. **Monitoring Data Suggests:**

☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

E. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)

☐ Properly secured/locked ☐ Functioning ☒ Routinely sampled ☐ Good condition

☐ All required wells located ☒ Needs maintenance ☐ N/A

Remarks: Some monitoring wells have been damaged and can no longer be sampled.

X. OTHER REMEDIES

If there are remedies applied at the site and not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is designed to accomplish (e.g., to contain contaminant plume, minimize infiltration and gas emissions).

The remedy was designed to reduce or eliminate the potential for human or ecological exposure to unacceptable risks associated with contaminated soil, sediment in the on-site lagoon and adjacent tidal marsh, and groundwater. The design included excavation, consolidation and capping of contaminated materials, groundwater monitoring and institutional controls. Monitoring sampling identified elevated arsenic concentrations in sediments above the 38 mg/kg cleanup level in the I-495 drainage ditch. EPA is utilizing the results of current studies to identify potential options for addressing arsenic contamination at the Site.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

O&M activities are not implemented as prescribed in the O&M manual. The nine well groundwater monitoring network is no longer in place. O&M procedures need to be updated based on current site conditions. Caps have depressions with ponding.

C. Early Indicators of Potential Remedy Problems

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future.

EPA is considering options for handling recent sediment exceedances of cleanup levels.

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

No opportunities for optimization were noted during the site inspection.

APPENDIX I – SITE INSPECTION PHOTOS

I-495 ditch on Potts Property, near low tide

I-495 ditch on Potts Property

Asphalt cap at truck stop

Ponding on aggregate cap at truck stop

Ponding on aggregate cap at truck stop

Ponding on aggregate cap at truck stop

Halby stormwater pond

Halby stormwater pond

Outlet structure from Halby stormwater pond into I-495 ditch

Passive gas vent at carbon disulfide treatment area

Fence at truck stop


Damaged fence near former BCC property

Pond at northwestern end of capped former marsh area on Potts Property. Background: concrete pad constructed on top of excavated drainage ditch sediments.

Pond at southeastern end of capped former marsh area on Potts Property