SIXTH FIVE-YEAR REVIEW REPORT FOR
AVTEX FIBERS, INC. SUPERFUND SITE
WARREN COUNTY, VIRGINIA

MARCH 2023

Prepared by

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

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Date

Table of Contents

LIST OF ABBREVIATIONS & ACRONYMS

ARAR	Applicable or Relevant and Appropriate Requirement
bgs	Below Ground Surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	Contaminant of Concern
CZA	Capture Zone Analysis
EDA	Economic Development Authority
EPA	United States Environmental Protection Agency
ESD	Explanation of Significant Differences
FAB	Fly Ash Basin
FMC	FMC Corporation
FYR	Five-Year Review
GLTP	Groundwater and Leachate Treatment Plant
GV	Gas Vent
GWMP	Groundwater Management Plan
HQ	Hazard Quotient
IC	Institutional Control
ICIAP	Institutional Control Implementation and Assurance Plan
LEL	Lower Explosive Limit
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
µg/L	Micrograms Per Liter
mg/kg	Milligrams Per Kilogram
mg/L	Milligrams Per Liter
MSL	Mean Sea Level
NCP	National Contingency Plan
NLF	New Landfill
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NTCRA	Non-Time-Critical Removal Action
O&M	Operation and Maintenance
OU	Operable Unit
PAH	Polycyclic Aromatic Hydrocarbon
PB	Polishing Basin
PCB	Polychlorinated Biphenyl
PPM	Parts Per Million
PPA	Prospective Purchaser Agreement
PRP	Potentially Responsible Party
RAO	Remedial Action Objective
RI/FS	Remedial Investigation and Feasibility Study
RSL	Regional Screening Level
ROD	Record of Decision
SB	Sulfate Basin
SPLP	Synthetic Precipitation Leaching Procedure
RPM	Remedial Project Manager
SLERA	Screening-Level Ecological Risk Assessment
SVOC	Semi-Volatile Organic Compound
TCRA	Time-Critical Removal Action
TSCA	Toxic Substances and Control Act
TSDF	Toxic Substance Disposal Facility
UECA	Uniform Environmental Covenant Act

UU/UE	Unlimited Use and Unrestricted Exposure
VISL	Vapor Intrusion Screening Level
VA DEQ	Virginia Department of Environmental Quality
VB	Viscose Basin
VOC	Volatile Organic Compound
VSWMR	Virginia Solid Waste Management Regulations
WWTP	Wastewater Treatment Plant

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 (CERCLA) Section 121, consistent with the National Contingency Plan (NCP) (40 Code of Federal Regulations (CFR) Section 300.430(f)(4)(ii)) and considering EPA policy.

This is the Sixth FYR for the Avtex Fibers, Inc. 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 10 operable units (OUs) (Table 1). EPA selected remedies in decision documents for OUs 1, 2, 3, 4, 5, 7, 8 and 10. With the exception of OU1, those OUs will be addressed in this FYR.[1] EPA established OU6 and OU9 for administrative purposes.

Table 1: Site OUs

OU1	Groundwater contamination caused by leachate leaking from Viscose Basins (VBs) 9, 10 and 11; EPA later suspended OU1 remediation and addressed the cleanup under OU7
OU2	Polychlorinated biphenyl (PCB)-impacted soil above 10 milligrams per kilogram (mg/kg)
OU3	Unstable acid reclaim buildings
OU4	Site security
OU5	Drums of hazardous substances
OU6	Investigation of on-site buildings
OU7	Groundwater, surface water and VBs 9, 10 and 11
OU8	Site areas previously known as Areas B and C
OU9	Ecological risk investigation and risk assessment
OU10	VBs 1 through 8, and the New Landfill (NLF), Plant Area Soils and the wastewater treatment plant (WWTP)

EPA Remedial Project Manager (RPM) Alan Geyer led the FYR. Participants included EPA Co-RPM Lisa Denmark, Virginia Department of Environmental Quality (VA DEQ) Project Manager Cortney Marquette and staff members from the potentially responsible party's (PRP) contractor, Parsons. FMC Corporation (FMC), the PRP, was notified of the initiation of the FYR. The review began on 5/18/2022.

Site Background

The 440-acre Site is located in Front Royal, Warren County, Virginia (Figure D-1). Between 1940 and 1989, different companies, including Avtex Fibers-Front Royal, Inc. (Avtex), manufactured rayon, polyester and polypropylene fibers for commercial, defense and space industries. Plant operations generated three major waste types:

- Metal-bearing sludge generated when waste acid from the production process was treated with lime in the wastewater treatment plant (WWTP). Operators disposed of this sludge in six sulfate basins (SBs).
- Fly ash generated from the combustion of coal in the on-site power plant. Operators disposed of fly ash in four impoundments and one stockpile.

[1] Following Avtex's bankruptcy in 1990, EPA suspended OU1 remediation and later addressed cleanup of groundwater contaminated by VBs 9-11 under OU7.

- Waste viscose that was primarily an off-specification product from the production process. Operators disposed of waste viscose in 11 on-site viscose basins (VBs).

Plant operators disposed of other solid wastes in an on-site solid waste landfill permitted by the Commonwealth of Virginia. Facility operations and waste disposal practices contaminated soil, sediment, surface water and groundwater with hazardous constituents, including polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), metals and carbon disulfide. In 1963, American Viscose sold the plant and property to FMC. In 1976, FMC sold the plant and property to Avtex Fibers-Front Royal, Inc. (Avtex). Following Avtex's bankruptcy in 1990, responsibility for cleanup was referred back to FMC. FMC is the Site's sole PRP.

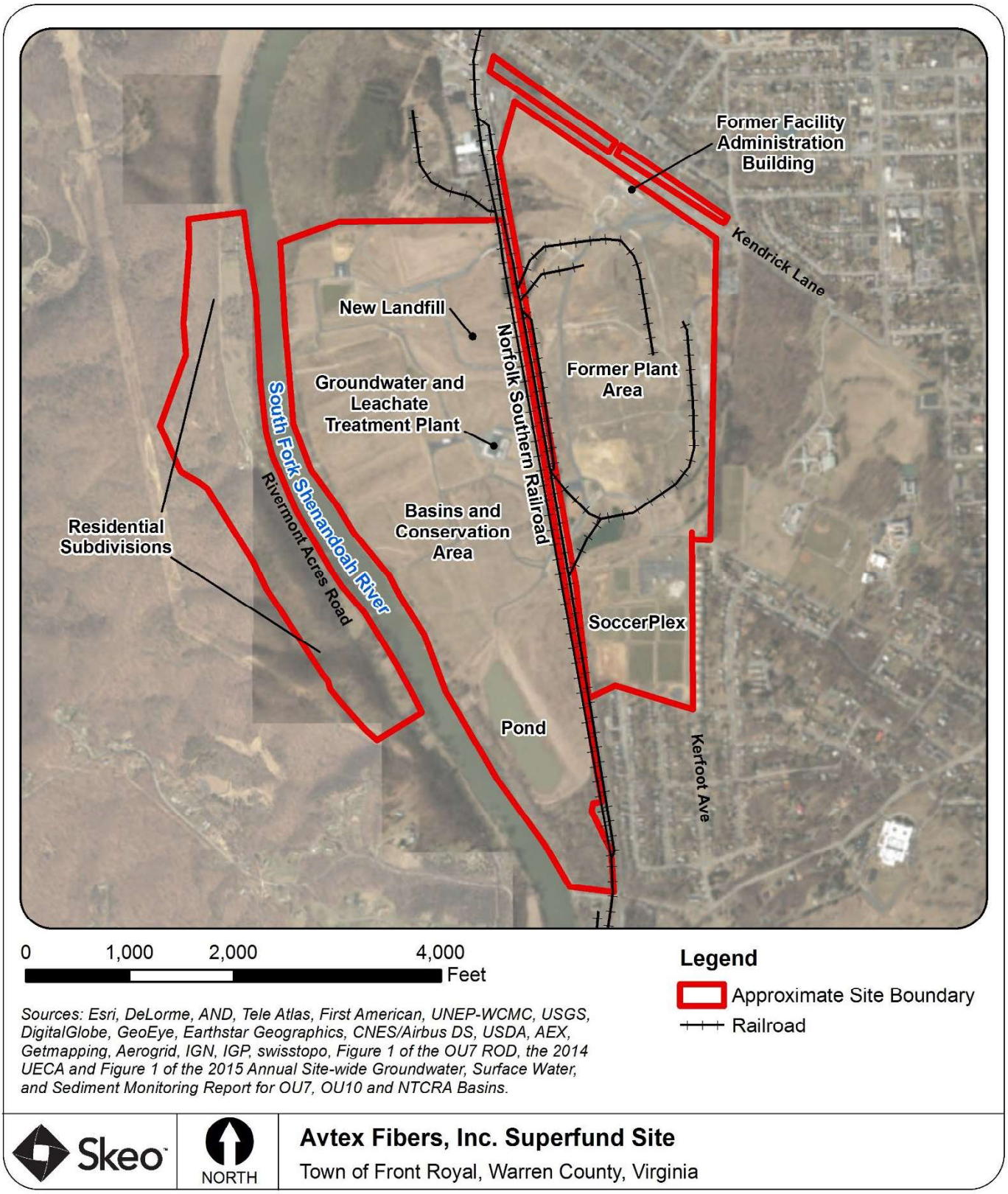
The Norfolk Southern Railroad bisects the Site from north to south and divides it into two areas. The former plant production area (plant area) occupies about 200 acres east of the railroad tracks; the Former Waste Disposal Areas occupy about 240 acres west of the railroad tracks (Figure 1). Current features of the plant area include offices within the former facility administration building, open fields and parking lots. A recreation area referred to as the Skyline SoccerPlex (SoccerPlex) occupies the far southeast part of the Site. The area west of the railroad tracks has been designated as a conservation area. It includes 23 capped or covered basins and fill areas, paved and gravel roads, a pond, remedial features and equipment, and a groundwater and leachate treatment plant (GLTP) (Figures 1 and 2). FMC's cleanup efforts on the Site's multiple capped or covered areas have resulted in the return of native vegetation and wildlife to the area. A groundwater plume from the conservation area/former waste disposal areas extends southwest under the South Fork Shenandoah River and beneath properties on the west bank of the river. Properties overlying the contaminated groundwater west of the river are considered part of the Site (Figures 1 and 3). Avtex acquired and demolished structures on most of the properties where the contamination was discovered.

Redevelopment of the Site has been a top priority since the beginning of cleanup efforts. The Town of Front Royal and the Front Royal Economic Development Authority (EDA) worked together to develop a redevelopment plan for the Site, which has facilitated the beneficial reuse of parts of the Site. In partnership with the EDA, the U.S. Soccer Foundation, FMC and Warren County; the SoccerPlex was built on a portion of the Site in 2006. It includes a skate park, soccer fields, walking trails, a covered pavilion, restrooms and associated parking areas. The Town of Front Royal owns 5 acres of the plant area north of Kendrick Lane, which is being developed as a new police station. In December of 2017, the Town of Front Royal broke ground on the police station project which was completed in late 2018. In 2014, EPA and EDA, along with other site property owners, FMC, a nonprofit organization named The Clean Water Project, Inc. (Clean Water Project), and VA DEQ, worked together to create environmental covenants that address area-specific activity and use restrictions at the Site, as well as the adjacent property to the north/northwest. The new covenants' varied restrictions and permissions for use across the Site, including light industrial/commercial uses on the plant side and support future redevelopment efforts and reuse of site properties.

Groundwater was the primary source of potable water for areas west of the South Fork Shenandoah River. FMC provides water to three private property owners on the west side of the river by filling cisterns. The Town of Front Royal provides potable water to areas east of the river via a public water supply system. There are two hydrogeologic units at the Site – the overburden unit and the shale bedrock unit. Groundwater is present in both units, although only the bedrock unit is used regionally for water supply. Lateral groundwater flow through the overburden materials is generally west toward the river, where it discharges. Groundwater within the bedrock zone flows toward the southwest. At depth, groundwater passes under the river. The primary surface water feature at the Site is the South Fork Shenandoah River. Surface water from the Site generally drains west toward the river. The South Fork Shenandoah River flows northeast to its confluence with the North Fork. Next to the Site, the river is used for recreational fishing and boating.

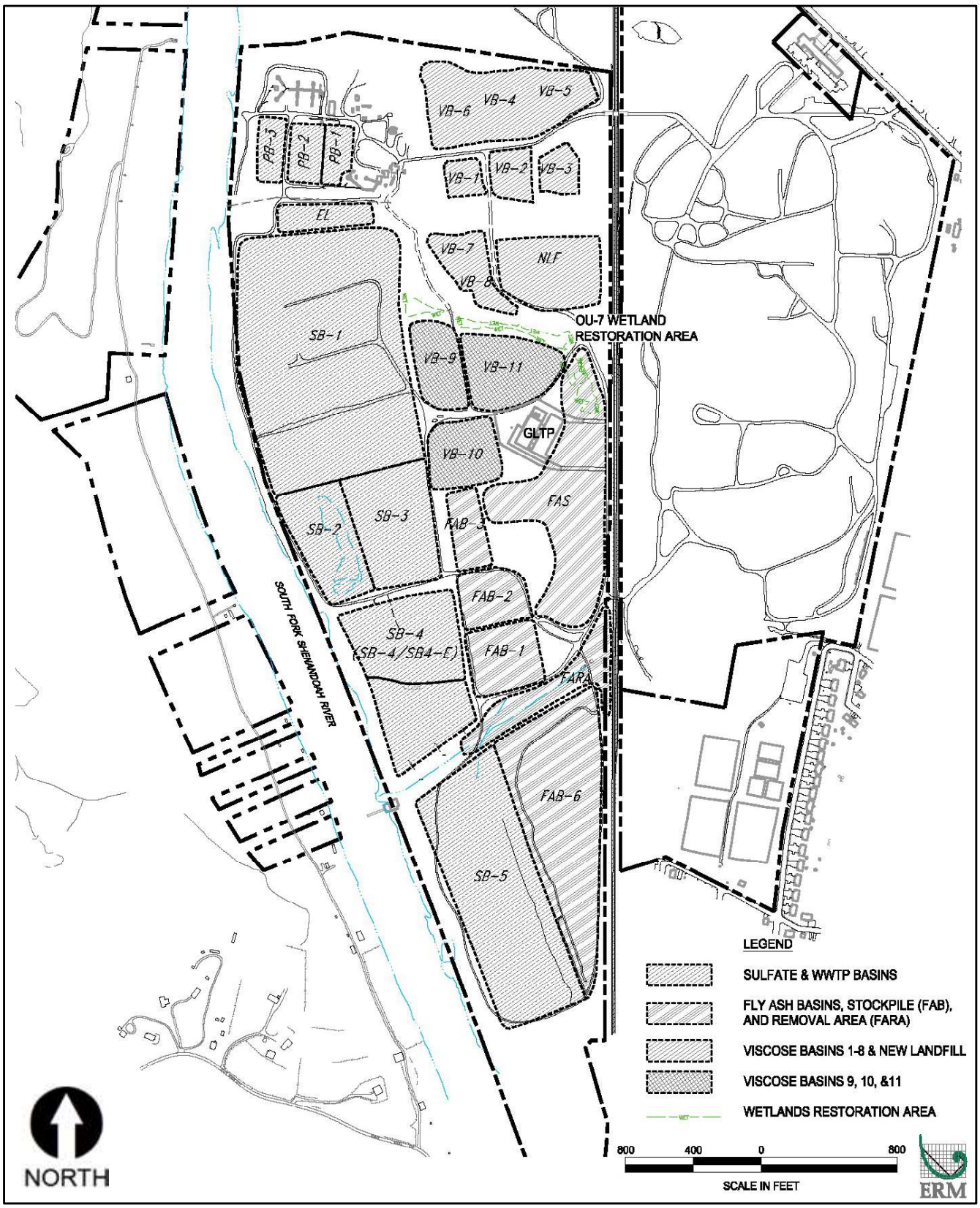
For reference, Appendix A includes a list of documents reviewed during this FYR. Appendix B includes a timeline of site events.

Figure 1. Site 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. Groundwater and Leachate Treatment Plant (GLTP)

Figure 2. Site Waste Disposal Basins



Note: Figure above is Figure 1 from the Site's May 2015 Site-Wide Post-Closure Care Operation and Maintenance (O&M) Plan.

FIVE-YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION		
Site Name: Avtex Fibers, Inc.		
EPA ID: VAD070358684		
Region: 3	**State:** Virginia	**City/County:** Front Royal / Warren
SITE STATUS		
NPL Status: Final		
Multiple OUs? Yes	**Has the Site achieved construction completion?** Yes	
REVIEW STATUS		
Lead agency: EPA		
Author name: Alan Geyer		
Author affiliation: EPA Region 3		
Review period: 5/18/2022 – 3/23/2023		
Date of site inspection: 10/12/2022		
Type of review: Statutory		
Review number: 6		
Triggering action date: 3/23/2018		
Due date *(five years after triggering action date)*: 3/23/2023		

II. RESPONSE ACTION SUMMARY

Basis for Taking Action

EPA added the Site to the Superfund program's National Priorities List (NPL) in 1986. In 1993, EPA and FMC entered into a Consent Order requiring FMC to thoroughly investigate the Site. In 1994, EPA and FMC completed a site wide Remedial Investigation (RI). The RI assessed buildings, sewers, waste disposal areas, on-site soil and groundwater.

EPA divided the Site into 10 OUs to manage the cleanup. EPA established OU6 and OU9 as administrative OUs to require building investigations and to require an ecological risk investigation and risk assessment. EPA addressed OU6 through a time-critical removal action (TCRA), which is discussed in the Response Actions section of this FYR. EPA addressed OU9 through the performance of the Site's 1999 Final Ecological Risk Assessment. It concluded that metals and PCBs posed an unacceptable risk to ecological receptors site wide. The remedies selected by the Site's decision documents addressed those ecological risks.[2] The following sections describe the basis for taking action for each non-administrative OU.

[2] There is no ROD for OU9. Ecological risks for the Plant Area Soils are discussed in greater detail in the Technical Assessment section.

OU1 and OU7 (groundwater and surface water contamination caused by leachate from VBs 9, 10 and 11):
The risk assessment, performed as part of the OU7 RI, identified unacceptable risks associated with the following exposure pathways: inhalation of hydrogen sulfide and carbon disulfide from VB 9 for future residents and commercial worker exposure scenarios, and dermal contact with and ingestion of groundwater for future residents. The OU7 risk assessment identified carbon disulfide, arsenic and mercury as the primary risk drivers for groundwater. The RI did not identify any risks to human health associated with surface water in the South Fork Shenandoah River; however, samples collected during the low river stage identified potential risks to ecological receptors.

OU2 (PCB-impacted soil):
In 1989 EPA completed the RI and identified unacceptable human health risks associated with contact with PCB-contaminated soil and an immediate threat to the ecological receptors through the discharge of PCB-contaminated wastewater from the plant's sewer system to the river.

OUs 3, 4 and 5 (unstable buildings, site security and drummed waste):
The 1990 Record of Decision (ROD), which also included OU2, determined that the acid reclaim building, drummed waste and the lack of site security posed potential physical safety and chemical hazards to on-site visitors and workers. The acid reclaim building also presented an obstacle to future site work.

OU8 (Areas B and C):
The 2000 ROD defined OU8 as soil associated with a 24-acre open field on-site, referred to as Area B, and a 10-acre paved parking area, referred to as Area C. In 1995, FMC investigated soil at site Areas A, B and C.[3] Area investigations identified shallow soil (0-2 feet) in Areas B and C as the only media of concern, but concluded that the soil does not pose a risk to human health based on an industrial/commercial land use scenario.[4] Risks associated with Area B and C shallow soil under other land use scenarios, such as residential use, have not been evaluated. The site's 1999 ecological risk assessment did not identify any unacceptable risks to ecological receptors in Areas B and C. The Site's 2012 Explanation of Significant Differences (ESD) renamed site Areas B and C as Areas 2B and 2A, respectively.

OU10 (VBs 1 through 8, the New Landfill (NLF), Plant Area Soils, and Area A):
VBs 1 through 8
The risk assessment performed as part of the 1994 Sitewide RI found that several compounds in soil/waste samples collected from the top 2 feet of VBs 1 through 8 exceeded EPA's Region 3 risk-based screening concentrations, based on individual soil exposure for future recreational, current site worker and trespasser use scenarios. The constituents that exceeded the risk-based screening concentrations included arsenic, lead, benzo(a)pyrene and dibenzo(a,h)anthracene. Several leachate constituents – lead, mercury and nickel – from the VBs exceeded Virginia Surface Water Quality Standards for human health.

The NLF
At the time of the 1994 Sitewide RI, wastes in the NLF were exposed and posed a direct contact risk to future recreational users and future construction workers. Arsenic concentrations in surface materials and adjacent soil exceeded the EPA Region 3 risk-based screening concentrations. The Site's 1999 Final Ecological Risk Assessment concluded that metals and PCBs pose a potential risk to ecological receptors at the NLF. The risk assessment also determined that arsenic concentrations in leachate from the NLF would pose a threat to groundwater quality if containment and collection of leachate were discontinued.

[3] FMC addressed soil contamination at Area A as part of OU10 Plant Area Soils (discussed in the following FYR section).
[4] The site's OU8 ROD concluded that plant operations were not conducted in site Areas B and C. It also concluded that contamination discovered in those areas must have migrated or been transported from the manufacturing areas.

Plant Area Soils, Area A
The risk assessment performed as part of the 1994 Sitewide RI concluded that lead concentrations in Plant Area Soils presented an unacceptable risk to future workers. The Site's 1999 Final Ecological Risk Assessment concluded that metals and PCBs in Plant Area Soils pose a potential risk to ecological receptors at the NLF.

Response Actions

In the 1988 OU1 ROD, EPA selected a remedy to address the groundwater contamination. The remedy called for the extraction and treatment of groundwater beneath and downgradient of VBs 9, 10 and 11. EPA subsequently suspended the OU1 remedy, pending the completion of a sitewide investigation (the 1994 Sitewide RI).

In 1989, Avtex, who had been struggling to remain solvent for many years, declared bankruptcy and ceased operations. EPA subsequently initiated emergency removal actions to prevent releases from reactive and dangerous materials left in tanks, piping and buildings.

In 1999, EPA entered into a Consent Decree with FMC in which FMC agreed to conduct all future response actions at the Site, including, but not limited to, a TCRA, two non-time-critical removal actions (NTCRAs), and the implementation of remedies to be selected by an OU7 ROD and an OU10 ROD. The sections below summarize those actions.

TCRA – Buildings (1994-2011)
EPA conducted building investigations (OU6) and evaluations in 1994 and 1996. The investigations identified large amounts of remaining chemicals, leaking pipes and vessels, and poor structural integrity of the Site buildings. In response to those findings, EPA completed the TCRA to demolish manufacturing buildings on-site. In September 1998, as part of a global settlement with EPA, FMC assumed responsibility for management of the demolition debris and waste materials, as well as management of wastewater and stormwater at the Site. Debris and materials were either treated on-site for reuse or taken off-site for disposal or recycling. FMC with EPA oversight, completed most of the demolition work in 2006, with some components incorporated into the NTCRAs and OU10 remedial action. EPA determined that the work was completed in September 2011.

NTCRA – Basins (2000-2014)
On January 31, 2000, EPA signed a Removal Action Memorandum for the closure of the basins. The goal of this removal action was to mitigate current and potential future risk to ecological receptors from direct contact with uncovered waste in the basins and to mitigate the release of contaminants that could potentially impact ecological receptors in the South Fork Shenandoah River. The cleanup plan called for consolidation of wastes on Site and provided for closure of the basins containing wastes using engineered protective caps or soil covers. Depending on the basin and its contents, the basin closures involved either covering with 2 feet of clean soil or construction of low-permeability caps. The basin cover systems prevent direct human and ecological exposure to wastes consolidated within the basins, and geomembrane caps installed over some of the basins also prevent infiltration of water through wastes, reducing leachate generation and groundwater impacts. Table 2 below summarizes the cover systems for each of the NTCRA areas. The work also included installation of passive gas vents within the SB cover systems, vegetation of the basin covers with warm-season grasses and installation of stormwater drainage controls. FMC, with EPA oversight, began implementing the basin closure project in May 2001 and completed it in 2014. EPA approved FMC's Remedial Action Report and certification of completion for the Basins NTCRA in September 2015.

Table 2: Summary of NTCRA Basin Cover Systems

Basin/Area	Cover System
SB-1 cells 1 through 3 and cell 4 east, SB-3, SB-4 and the emergency lagoon	Combination of a geomembrane cap and a 2-foot clean soil cover
SB-1 cell 4 west, Fly Ash Basins (FABs) 1 through 3, FAB 6, fly ash removal area, and polishing basins (PBs) 1 through 3	2-foot soil cover system

SB-2 and Fly Ash Stockpile	Combination of 2-foot soil cover and clean closed*
SB-5	Clean closed*
Note: Figure 2 shows the locations of the basins listed above. *Clean closed = cover not required-water covering the basins was treated and sludge was excavated and placed in SB1,3,4	

NTCRA – Buildings and Sewers (2002-2013)

Between January 2002 and December 2013, FMC performed a NTCRA to address site sewers and buildings that were not addressed under the previous Buildings TCRA. Cleanup involved decontamination of buildings, foundations, and aboveground and subgrade structures, as well as the removal of over 56,000 linear feet of sewers and 222 manholes. EPA approved FMC's Remedial Action Report and certification of completion for the Buildings NTCRA in December 2015.

Decision Documents

EPA selected long-term remedies in individual RODs for OU1, OU2, OU7, OU8 and OU10 and two ESDs. The OU2 ROD also established remedies for OUs 3, 4 and 5. OU6 and OU9 are administrative OUs and do not have RODs. Table 3 lists the remedies selected by each decision document and the associated remedial action objectives (RAOs).

Table 3: Decision Documents, Selected Remedies and RAOs

Decision Document and Year	Associated Site Area(s)/Impacted Media	Selected Remedy	RAOs
OU1 ROD (1988)	Groundwater contamination caused by leachate from VBs 9, 10 and 11	Extraction and treatment of contaminated groundwater, monitoring of on-site and off-site groundwater, surface water and basin fluids; and groundwater use restrictions. Following Avtex's bankruptcy in 1990, EPA suspended OU1 remediation and later addressed the cleanup under OU7.	Not applicable. See OU7 ROD.
OU2, OU3, OU4 and OU5 ROD (1990)	PCB-impacted soil, the acid reclaim building, site security and drums	OU2 – PCB-impacted soils: Excavation and off-site disposal of 5,000 cubic yards of PCB-contaminated soil and restoration of excavated areas. OU3 – Acid reclaim building: Dismantling and demolition of the unstable acid reclaim building and associated equipment for off-site disposal/recycle. OU4 – Continued site security, control, maintenance, and health and safety measures. OU5 – Identification and off-site disposal of 2,879 drums.	Mitigate potential risks to public health and the environment associated with wastes contained in drums, PCB-contaminated soil, the acid reclaim building and the lack of site security. Remove obstructions to future site investigations and remediation efforts.
OU8 ROD (2000)	Areas B and C[5]	Institutional controls to permanently restrict land uses to commercial/industrial.	Ensure that the reasonably anticipated future land use remains commercial/industrial in perpetuity.
OU10 ROD (2004)	VBs 1 through 8, the NLF, Plant Area Soils and the WWTP	VBs 1-8: Improvement of existing soil covers, leachate collection and treatment, and groundwater monitoring.	VBs 1-8 and the NLF: Prevent direct human and ecological receptor contact with VBs 1-8 and

[5] The Site's 2012 ESD renamed site Areas B and C as Areas 2B and 2A, respectively.

Decision Document and Year	Associated Site Area(s)/Impacted Media	Selected Remedy	RAOs
		The NLF: Construction of a soil cap, leachate collection and treatment, and groundwater monitoring. Plant Area Soils: Excavation of soil with contaminant concentrations above defined criteria, stabilization of soil deemed to be characteristically hazardous due to metals, off-site disposal of all treated and untreated soil with contaminant concentrations above specified groundwater protection standards and all soil containing 50 milligrams per kilogram (mg/kg) or greater of total PCBs, and either on-site or off-site disposal of remaining excavated soil.* The WWTP: Decontamination and demolition.	NLF soil and waste and prevent the migration of contaminants. Mitigate current and future potential risks to human health and ecological receptors associated with leachate from VBs 1-8 and uncovered leachate-contaminated soil. Control production and uncontrolled releases of gases from VBs 1-8 and the NLF. Plant Area Soils: Mitigate direct contact risks to humans and ecological receptors posed by contaminants in Plant Area Soils. Mitigate future human health and ecological risks associated with the potential migration of contaminants to surface water. Mitigate current and potential future risks associated with the migration of contaminants to groundwater. WWTP: Remove the WWTP when it is no longer needed.
OU10 ESD (2006)	Plant Area soils	Expansion of the area being addressed as Plant Area Soils to include additional areas of concern, including soil in the Vicinity of the SoccerPlex, the Burnt Debris/Ash Area and the Coal Seam Area.	Prevent direct contact with soil containing contaminants above health-based levels.
OU7 ROD (2007)	Groundwater contamination caused by leachate from VBs 9, 10 and 11	Construction and operation of a groundwater extraction and treatment plant and a WWTP; capping and construction of a leachate extraction system for VBs 9-11; characterization, removal and disposal of contaminated sediment associated with seeps next to VBs 1, 10 and 11 and OU7 soil located outside of VBs 9, 10 and 11; institutional controls; provision of water to affected property owners on the west side of the South Fork Shenandoah River; annual monitoring of surface water, sediment and biota in the South Fork Shenandoah River; and post-closure monitoring and maintenance.	Prevent human exposure to contaminated groundwater that would result in unacceptable levels of risk. Prevent human and ecological receptor exposure through direct contact with waste in VBs 9-11. Mitigate risks from principal threat waste in VBs 9-11 through leachate treatment. Restore groundwater to its beneficial uses by reducing contaminant concentrations.

Decision Document and Year	Associated Site Area(s)/Impacted Media	Selected Remedy	RAOs
			Mitigate further releases to groundwater of hazardous substances from residual contamination in VBs 9, 10 and 11. Control and mitigate contaminated groundwater plume discharge to the river. Control the production and release of hazardous and/or noxious gases from VBs 9, 10 and 11 that can present an unacceptable risk or public nuisance.
OU7, OU8 and OU10 ESD (2012)	Areas B and C, VBs 1-8, the WWTP, the NLF, Plant Area Soils, and areas of contaminated groundwater	Modification of the Conservation Easement by replacing the existing easement with multiple Environmental Covenants to address multiple owners and property uses, and modification of Ecological Backfill Values with site-specific cleanup values.	The ESD did not establish new RAOs; it states that the modified remedy is consistent with the RAOs established by the OU7, OU8 and OU10 RODs.
* The remedy selected in the OU10 ROD does not require institutional controls. However, the OU10 ROD states that the Conservation Easement, implemented under OU8, as an institutional control will provide additional long-term protection.			

Clean Up Goals

EPA established cleanup goals for each affected media and corresponding area(s) in the decision documents listed above. Those cleanup goals are presented below, by OU. A compendium of the cleanup goals is included as Appendix C

OU2 Soil

The OU2 ROD established a soil cleanup goal for PCBs of 10 milligrams per kilogram (mg/kg). Table C-1 in Appendix C lists the OU2 Soil Remedial Goal for Total PCBs.

OU7

Groundwater

The OU7 ROD states that the remediation of groundwater at the Site will continue until the respective maximum contaminant levels (MCLs) for carcinogens and Maximum Contaminant Level Goals (MCLGs) for non-carcinogens for the COCs are attained and the excess cancer risk associated with potential residential use of the groundwater is reduced to one in 10,000 ($1x10^{-4}$) and the hazard index is reduced to 1 for each specific organ. For COCs without MCLs or MCLGs, Risk Based Cleanup Goals were established from EPA Region 3 risk-based tap water standards presented at cancer/hazard target benchmarks of 1x10-4 for carcinogens and 1 for noncarcinogens. Table C-2 in Appendix C lists the groundwater cleanup goals established by the OU7 ROD.

Soil

The OU7 ROD required characterization of OU7 soil located outside the basins that would not be covered by the VB 9, 10, and 11 cover systems. All soils and sediments classified as hazardous waste were to be disposed of at an off-site Resource Conservation and Recovery Act Subtitle C landfill. All non-hazardous soil and sediment that met groundwater protection standards but exceeded the regional screening levels (RSLs) for industrial soil at a total excess cancer risk of $1x10^{-5}$, a total non-cancer risk for target organ-specific HQ of 1, and/or EPA's Region 3 Ecologically Protective Backfill Values, as listed in Table 11 of the OU7 ROD, were to be excavated and placed in the basins under the cap.

Following the OU7 ROD, EPA determined that the original Ecologically Protective Backfill Values for aluminum, iron, manganese, mercury and zinc were lower than naturally occurring regional background levels. Therefore, EPA concluded that remediation of soil below background levels to meet the original standards in Table 11 of the OU7 ROD, for those five metals would be extremely difficult to achieve. Table 4 lists the modified, site-specific OU7 soil cleanup goals established by the 2012 Second ESD (2012 ESD) for those five metals. Table C-3 in Appendix C list the soil cleanup goals established by the OU7 ROD and modified by the 2012 ESD.

Table 4: Modified Ecologically Protective Cleanup Values for Five OU7 Soil COCs

COC	Modified 2012 ESD Ecologically Protective Backfill Cleanup Values (mg/kg)
aluminum	20,200
iron	31,700
manganese	441
mercury	0.14
zinc	233
pH*	5.5 standard units
* The 2012 ESD also added an additional OU7 soil performance standard to address the acidic nature of site soil. The ESD requires that the upper 6 inches of cover soil in remediated areas be amended as needed to achieve a pH of no less than 5.5 prior to seeding/replanting.	

Surface Water, Sediment and Biota

The OU7 ROD did not establish cleanup goals for surface water, sediment or biota. It states that annual sampling of surface water, sediment and biota in the South Fork Shenandoah River will be conducted to determine if there are decreasing trends in the concentration of contaminants. The Site's February 2015 Revised Surface Water and Sediment Monitoring Plan for OU7 established screening criteria for surface water and sediment. Screening criteria for naphthalene is based on EPA Region 3 Biological Technical Assistance Group Aquatic Freshwater Screening Levels. The Plan established the EPA Region 3 Freshwater Sediment Screening Benchmarks as the sediment screening criteria.

Air

The OU7 ROD established an air sampling and monitoring program to be implemented during the remedial action to ensure that air emissions from the VB 9, 10 and 11 vents do not: 1) result in air concentrations that pose an unacceptable risk by exceeding the $1x10^{-5}$ risk level for carcinogens or a hazard quotient (HQ) of 1 for non-carcinogens; 2) pose an ignition or explosion hazard; and 3) pose nuisance odor issues with off-site residences or area users.

<u>OU10 Soil</u>

The OU10 ROD established soil cleanup goals based on both direct contact and protection of groundwater. Soil from 0-10 feet below final grade shall meet the direct contact human health standards and the groundwater protection standards. The OU10 ROD established a direct contact soil cleanup goal for PCBs of 25 mg/kg. Soil deeper than 10 feet shall meet the groundwater protection standards only.

The soil cleanup standards for groundwater protection are based on non-zero maximum contaminant level goals (MCLGs). In the absence of a non-zero MCLG, the MCL is used as the groundwater protection standard, when available. See Appendix I for information regarding how to screen soil samples against the soil cleanup goals for protection of groundwater. Table C-4 in Appendix C lists the soil cleanup standards for the Plant Area Soils established by the OU10 ROD.

Following establishment of the OU10 Plant Area Soils boundaries by the OU10 ROD, FMC discovered contaminated soil at three areas outside the initially established OU10 boundary. The newly identified areas were within the parcel now occupied by the SoccerPlex (Figure 1). In 2004, FMC completed the Remedial Investigation of the Proposed Skyline SoccerPlex to supplement the 1994 Sitewide RI. The 2004 RI identified a 3-acre part of the proposed SoccerPlex property that may have been contaminated by site activities. The 2004 RI referred to the area as the "Soils in the Vicinity of the SoccerPlex." Subsequent grading activities identified two more areas of potential concern on the proposed SoccerPlex property, which became known as the "Burnt Debris/Ash Area" and the "Coal Seam Area." Sampling identified elevated concentrations of lead, arsenic and other metals in the surface soil in the Vicinity of the SoccerPlex and Burnt Debris/Ash Areas, and a material with a coal-like appearance at the Coal Seam Area. The Site's 2006 OU10 ESD established soil cleanup goals for the three areas and defined the entire area as the Expanded Plant Area Soils. To facilitate future recreational use of the Expanded Plant Area Soils area, EPA selected risk-based soil cleanup goals based on future residential use. The ESD established a total PCB soil cleanup goal for the Expanded Plant Area Soils of 1 mg/kg.

Table C-5 in Appendix C lists the residential soil cleanup standards for the Expanded Plant Area Soils established by the 2006 OU10 ESD. Figure I-1 in Appendix I shows the location of the Expanded Plant Area Soils.

Status of Implementation

Prior to the 1999 Consent Decree, EPA completed parts of the selected remedies for OU2, OU3, OU4, and OU5, as established by the 1990 ROD, as removal actions and remedial actions to address immediate threats to human health and the environment. Following the 1999 Consent Decree, FMC conducted the remedial actions established by subsequent RODs and ESDs. Remedy implementation for each non-administrative OU is described below.

OU1

Following Avtex's bankruptcy in 1990, EPA suspended OU1 remediation and later addressed cleanup of groundwater contaminated by VBs 9-11 under OU7.

OUs 2, 3, 4 and 5

The 1990 ROD selected remedies to address OUs 2 through 5. EPA and FMC completed the required remedial actions for those OUs as described below.

OU2:

Between March 1991 and January 1992, EPA excavated and disposed of 5,000 cubic yards of PCB-contaminated soil off site.

OU3:

Between March 1991 and September 1993, EPA dismantled and demolished the unstable acid reclaim facility. Debris and materials were either treated on-site for reuse or taken off-site for disposal or recycling.

OU4:

EPA started providing site security in July 1991; FMC took over site security in October 1999.

OU5:

In September 1994, EPA identified and disposed of 2,879 drums off site.

OU7

FMC completed the final OU7 remedial design in October 2011 and performed the OU7 remedial action between 2011 and 2015. Pre-design activities in 2010 included characterization, excavation and disposal of contaminated sediment associated with seeps next to VBs 1, 10 and 11 and OU7 soil located outside of VBs 9, 10 and 11; installation of a bridging layer on VBs 9, 10 and 11 with leachate extraction; additional fill to support the cap on top of the bridging layer and bench-scale testing for the GLTP. In 2012, FMC constructed a geomembrane cap

over VBs 9, 10 and 11; installed a passive landfill gas venting system (passive gas vents (GVs) GV-1 through GV-11) to reduce the accumulation of gas beneath the cap; covered the cap with soil; and seeded the area. Remedy construction also included the installation of stormwater management controls for VBs 9-11 and vegetation of the caps with cool- and warm-season grasses and wetland species. A wetland restoration area was also completed as part of the OU7 remediation. The sitewide O&M Plan requires annual monitoring of the wetland restoration area for five full growing seasons after its construction and planting (from 2014 through 2018). The minimum five-year monitoring period was completed in 2018. However, due to issues with invasive species, annual monitoring is being continued until the area becomes more self-sustaining.

The OU7 leachate extraction system removes leachate from VBs 9, 10 and 11 and conveys it to the GLTP. Construction included the installation of 30 leachate extraction wells (10 per VB) and associated conveyance lines, and construction of the VB Building to house the extraction system pumps and controls, compressors and other associated components. The VB Building is ventilated and is continuously monitored for gases of concern. FMC constructed the Site's leachate extraction system between 2013 and 2014. The leachate extraction system includes the VB 9-11 leachate extraction wells, four lift stations and associated conveyance systems. The lift stations pump leachate from different areas on the basin/western half of the Site to the GLTP via underground conveyance pipes.

Between 2011 and 2013, FMC installed three bedrock groundwater extraction wells, two on the east side of the river and one on the west side. A lateral bedrock conveyance line, drilled beneath the river, conveys groundwater from the 400-foot-deep well on the west side of the river to the GLTP. FMC constructed the GLTP between 2012 and 2014. The GLTP design includes an enclosed leachate tank with an air scrubber to control odors. The system blends the leachate with contaminated groundwater in an enclosed 192,000-gallon equalization tank. The treatment train includes bag filters to remove solids, equalization, metal precipitation, biological treatment, multi-media filtering, and granulated activated carbon filtering. The system processes solids/sludge through a filter press. The solids are disposed of off-site and the system's effluent discharges to the South Fork Shenandoah River under a NPDES permit. The GLTP began full operation in mid-2015. Remedy construction included the installation of tall chain-link fence around the GLTP and VBs 9-11 to restrict unauthorized access to those areas. Institutional controls are in place for OU7 and are discussed in the Institutional Control Review section. EPA approved FMC's Remedial Action Report for the Viscose Basins 9-11 Cap System and Groundwater & Leachate Extraction Components of OU7 in September 2015. As required by the OU7 ROD, FMC provides water to the three residences on the west side of the river. FMC fills cisterns at those properties with clean water that can be used for both potable and non-potable purposes, such as irrigation. The OU7 ROD states that none of the privately owned parcels west of the river have drinking water wells. EPA confirmed this by contacting the Virginia Department of Health in Warren County, during the preparation of this report, and requesting a subject parcel search. The Virginia Department of Health responded that the subject parcels do not have an active well or permit for a well currently requested.

<u>OU8</u>
The selected remedy for OU8 includes institutional controls for Areas B and C. The implementation of the OU8 remedy is discussed in the Institutional Control Review section below.

<u>OU10</u>
FMC, in accordance with the 1999 Consent Decree, performed the OU10 remedial action, as established by the OU10 ROD and subsequent 2006 ESD, between 2004 and 2014. The following sections describe the different components of the OU10 remedy.

VBs 1-8 and the NLF
The remedy for VBs 1-8 included capping of the basins with a geosynthetic cap and 2 feet of soil, and the installation of 25 passive gas vents. FMC capped the basins in 2008 and 2009 and completed seeding of the final covers in 2010. The Site's leachate extraction system conveys leachate generated by VBs 1-8 to the GLTP for treatment. The remedy also included installation of stormwater drainage controls.

Due to historically high levels of hydrogen sulfide and other gases, FMC installed carbon filtration units at vents OU10 GV-4 and OU10 GV-5 in the spring of 2014. The units treat vapors from the vents and prevent exposure to hazardous vapors.

The NLF is a 2.75-acre landfill that stands about 40 feet tall from base to peak. The landfill closure complies with the Virginia Solid Waste Management Regulations for closure of a non-hazardous industrial waste landfill (9 Virginia Administrative Code Section 20-80-207E). The landfill cap includes a geosynthetic liner with a 2-foot soil cover and four passive gas vents. The monitoring well network for VBs 1-8 and the NLF includes 19 monitoring wells. FMC completed landfill closure in July 2012.

Plant Area Soils
FMC performed the Plant Area Soils remedial action between 2004 and 2012. Cleanup of soil characterized as hazardous waste due to lead contamination involved stabilization and placement beneath the cap of the NLF. FMC placed PCB-contaminated soil (concentrations between 25 mg/kg and 50 mg/kg) and soil above direct human contact health standards in basins and landfill closures below the impermeable layer. Soil exceeding the groundwater protection standards and soil with PCB concentrations above 50 mg/kg was disposed of off-site in an appropriately permitted Transportation, Storage, and Disposal Facility (TSDF).

FMC conducted a cleanup evaluation of the OU10 Plant Area Soils and NTCRA – Buildings soils in 2012. The evaluation concluded that the remedial actions performed at those areas met the established cleanup goals. The Remedial Action Report was approved by EPA in May of 2015.

There is a complete ecological exposure pathway associated with OU10 Plant Area Soils due to the lack of redevelopment at the former Plant Area part of the Site. To prevent further re-establishment of potential habitat in the future, FMC proposed to remove the old field / wooded habitat and replace with a vegetative cover that can be easily maintained (i.e., turf grass). Due to topography, drainage requirements, and other concerns, some areas may not be easily accessible for mowing and may require an alternative cover (e.g., mulch or gravel). The PRPs are currently carrying out this work under the approved 'Former Manufacturing Area Habitat Removal Work Plan.' The anticipated completion date is Spring 2023.

Expanded Plant Area Soils
In accordance with the Site's 2006 OU10 ESD, FMC excavated Expanded Plant Area Soils with COC concentrations above residential soil cleanup goals and disposed of them off-site, in an appropriately permitted TSDF or on-site in areas to be capped, depending on the level of contamination. Before collecting soil samples from the Vicinity of the SoccerPlex area, FMC excavated about 2,000 cubic yards of soil from the area with visual evidence of fly ash or coal fines, characterized it, and put it in the NLF. Subsequent samples demonstrated that soils in the area do not pose an unacceptable risk to human health or the environment, and that additional remediation was not required. EPA concurred with this finding and approved the remedial work in a June 7, 2012 letter to FMC.

The Burnt Debris Area contained inert construction debris, black ash, viscose material, rayon fiber and other burnt debris. A composite sample of the material indicated it was characteristically hazardous for lead and had elevated concentrations of other metals. Cleanup included excavation of 1,513 tons of lead-contaminated soil and debris and off-site disposal. Post-excavation soil samples confirmed that the underlying and adjacent soil met the cleanup standards, and no further remediation was necessary. EPA concurred with these findings and approved the remedial work in an August 7, 2006 letter to FMC.

Sampling of the Coal Seam Area determined that the coal seam material and layer of rubble do not pose an unacceptable risk to human health or the environment; therefore, remediation was not required. EPA concurred with this finding in a March 19, 2007 letter to FMC. In 2015, EPA approved FMC's Remedial Action Report for the Plant Area Soils Component of Operable Unit 10.

WWTP
In accordance with the Site's 2012 EPA-approved work plan, FMC demolished the WWTP in 2013. Inert debris from the WWTP was disposed of either on-site in subgrade structures or off-site in an appropriately permitted landfills or scrap metal recyclers. The demolition removed aboveground structures except for a tin storage building that FMC retained for storage of operation and maintenance (O&M) equipment.

In June 2014, FMC documented the completion of OU10 remedy construction in a Remedial Action Report. In September 2015, EPA approved FMC's Remedial Action Report for OU10.

Institutional Control Review

In November 1999, the EDA purchased the site property from the Avtex Bankruptcy Trustee pursuant to a Real Estate Sale Contract, which included a contingency of execution of a Prospective Purchaser Agreement (PPA). The PPA was executed and became effective March 2000. The purchase included the 428-acre former Avtex industrial site and about 69 acres of land on the west bank of the South Fork Shenandoah River. Since that time, small parts of the Site have been acquired by different parties, including the town of Front Royal and Warren County. Several privately-owned parcels on the west bank of the South Fork Shenandoah River that overlie the groundwater plume, or that are located near the plume, were not purchased by EDA in the 1999 Real Estate Sale Contract, and have remained privately owned.

The OU7 ROD required Institutional Controls to maintain and protect the integrity of the remedy and to prevent installation of drinking water supply wells where groundwater contamination exceeds cleanup goals. The OU7 ROD also requires the development of an Institutional Control Implementation and Assurance Plan (ICIAP). In 2019, FMC prepared the ICIAP, which identifies its purpose as: to identify existing and proposed Institutional Controls, document the activities necessary to implement, monitor, and enforce the Institutional Controls, identify the parties responsible for implementing, monitoring, and enforcing the Institutional Controls, and specify a schedule for implementation and reporting of the Institutional Controls including, at a minimum, a requirement for annual review of the status, effectiveness, and appropriateness of the Institutional Controls.

The OU8 ROD required institutional controls to permanently restrict land use of Areas B and C (Former Plant Side: Areas 2, 2A and 2B) to commercial or industrial uses. In December 1999, several parties entered into a Conservation and Environmental Protection Easement and Declaration of Restrictive Covenants (Conservation Easement) for Areas B and C, to meet the OU8 institutional control requirement. The town of Front Royal has also zoned Areas B and C for industrial land use.

The Site's 2012 ESD for OU7, OU8, and OU10 selected multiple environmental covenants as part of the remedy to replace the existing conservation easement to address multiple owners and property uses (Table 6). Except for a few properties on the west side of the river (discussed below), the multiple covenants addressed the entire Site (Figure 3). In 2014, FMC, site property owners and the Clean Water Project entered into four different Virginia Uniform Environmental Covenant Act (UECA) Environmental Covenants. Additionally, in 2014, Honeywell International Inc. also entered into a Virginia UECA Environmental Covenant for the property north of the site known as Area 5 (Figure 3), upon which previous restrictive covenants were placed in 1999 in order to ensure access and implementation of the response actions at the Avtex Site. Response work at the Honeywell site was completed by General Chemical Corporation under a 1998 Administrative Order with oversite by the EPA Removal Program but was not part of the Avtex Superfund Site. However, due to the Honeywell property's proximity, and the covenant's origin and similar activity and use restrictions, the Honeywell property covenants are associated with the four other Avtex Site UECA environmental covenants, so they are also included here. All five covenants run with the land, and many restrict land use (e.g., to open space or light commercial/industrial use), place restrictions on soil excavation, and prohibit activities that could adversely affect the integrity of the remedy. All five covenants prohibit the extraction and use of groundwater and the installation of groundwater wells, restrict specific land uses or activities (e.g., for schools, residences), and grant EPA and VA DEQ access to the Site property to carry out remedy-related activities. The five covenants were recorded with the Warren County Clerk's Office on September 17, 2014.

One of the five covenants applies to the basin side of the Site and part of the Site on the west bank of the river, referred to as West Bank Acres (Instrument 140004560). The West Bank Acres area subject to the covenant includes only the property parcels owned by the EDA; it does not include privately owned parcels on the west bank of the river that overlie the groundwater plume, or that are located near the plume (Figure 3). FMC provides potable water to three private property owners on the west side of the river. At the time of the OU7 ROD, none of the private properties west of the river had drinking water wells. However, there are no groundwater use restrictions in place for privately-owned parcels located above the groundwater plume west of the river to prohibit the installation of new water supply wells. Installation of new private wells at those privately-owned parcels could potentially affect the direction of plume migration, and potentially result in unacceptable exposures if the water was used for potable purposes.

While not required by the ROD, a May 1989 Virginia Department of Health fish advisory remains in effect. It advises against consuming fish from the lower portions of the South Fork of the Shenandoah River, and the main stem of the Shenandoah River from Front Royal downstream to the West Virginia state line.

Table 5 shows the implemented institutional controls for the different site media, as well as the tax map identification numbers for the privately-owned parcels west of the river for which institutional controls are not in place. Table 6 summarizes the environmental covenants in place. Figure 3 illustrates the status of institutional controls at the Site.

Table 5: Summary of Institutional Controls (ICs)

Media, Engineered Controls and Areas that Do Not Support UU/UE Based on Current Conditions	Impacted Area(s)	IC Objective	Title of IC Instrument Implemented and Date
Groundwater	Areas 1, 2, 2A, 2B, 3, 4 and 5, as shown in Figure 3	Prevent the installation of drinking water supply wells in the area where groundwater contamination concentration exceeds cleanup goals and prohibit the extraction and use of groundwater.	UECA Environmental Covenants for the Site's five areas, recorded 9/17/2014
	Privately owned properties west of the river that overlie the groundwater plume. Tax map identification numbers: 19F 1 59, 19F 1 57, 19F 1 56, 19F 1 54, and 19 90B. May also include additional privately-owned parcels along the river where installation and pumping of new water wells could affect plume migration.		ICs not in place
Soil	All site areas depicted in Figure 3, east of the river	Restrict land use to either commercial/industrial, recreational, conservancy or open space depending on site area; prohibit activities that could adversely impact the integrity of the remedy (which includes excavation at certain site areas); restrict	UECA Environmental Covenants for the Site's five areas, recorded 9/17/2014

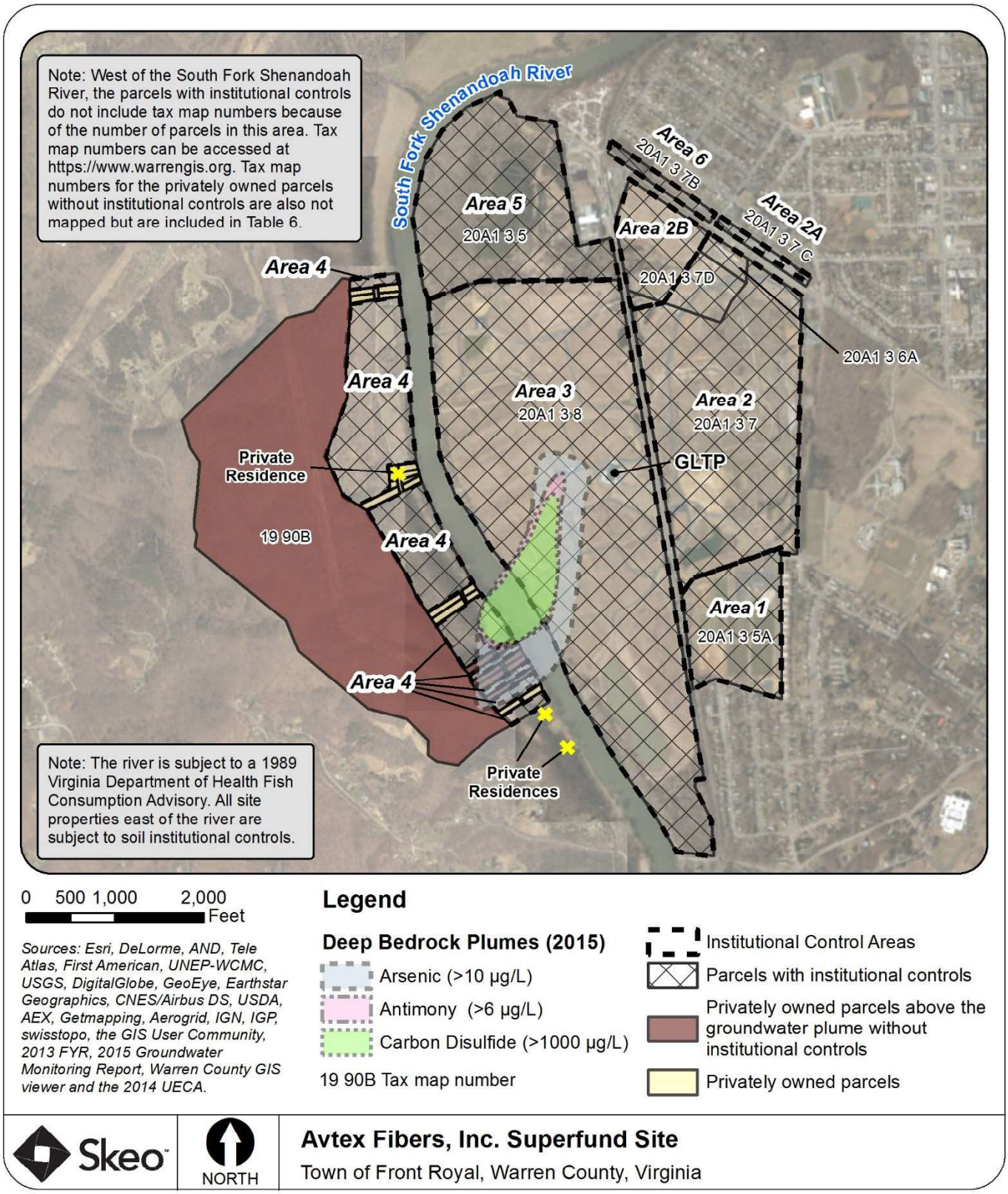
Media, Engineered Controls and Areas that Do Not Support UU/UE Based on Current Conditions	Impacted Area(s)	IC Objective	Title of IC Instrument Implemented and Date
		other certain land uses depending onsite area (see Table 6).	

Table 6: Summary of UECA Environmental Covenants

Environmental Covenant Instrument Number	Grantor	Grantee	Site Area Subject to the IC (see Figure 3)	Tax Map ID Numbers	Restrictions
140004561	Industrial Development Authority of the Town of Front Royal and the County of Warren, VA	FMC Corporation and The Clean Water Project, Inc.	Former Plant Side: Area 2 and Areas 2A and 2B	20A1 3 7, 20A1 3 7C, 20A1 3 7A, and 20A1-3-6A	Restricts land use to light commercial and industrial use; prohibits various specific activities and uses, including but not limited to, child care centers and residential dwellings; prohibits excavation of any soil from Borrow Area A and prohibits excavation of soil 10 feet below the elevations depicted in Exhibit C of the IC; prohibits groundwater extraction and use, except as may be required by EPA or VA DEQ for remedial purposes; prohibits the installation of groundwater wells unless approved in writing by EPA; prohibits activities that could impact the integrity of the remedy; grants EPA and VA DEQ rights of access to the property for remedial purposes
140004562	Warren County	FMC Corporation and The Clean Water Project, Inc.	Former Plant Side – SoccerPlex: Area 1	20A1 3 5A	Restricts land use to recreational or public park use and associated parking lots only; prohibits residential dwellings of any kind; prohibits construction of any permanent or temporary building or structures on the property (with the exception of infrastructure needed for protection of human health or the environment or constructed by EPA or FMC to implement response action, or as customary and appropriate as a public park and recreation space); prohibits groundwater extraction and use, except as may be required by EPA or VA DEQ for remedial purposes; prohibits the installation of groundwater wells unless approved in writing by EPA; prohibits activities that could impact the integrity of the remedy; grants EPA and VA DEQ rights of access to the property for remedial purposes.
140004563	Town of Front Royal	FMC Corporation and The Clean Water Project, Inc.	Former Plant Side – Area 6	20A1 3 7B	Restricts land use to light commercial and industrial use; prohibits various specific activities and uses, including but not limited to, child care centers and residential dwellings; prohibits groundwater extraction and use, except as may be required by EPA or VA DEQ for remedial purposes; prohibits the installation of groundwater wells unless approved in writing by EPA; prohibits activities that could impact the integrity of the remedy; grants EPA and VA DEQ rights of access to the property for remedial purposes.
140004560	Industrial Development Authority of the Town of Front Royal and the County of Warren, VA	FMC Corporation and The Clean Water Project, Inc.	Basin Side: Area 3 (Conservancy and Open Space) and Area 4 (West Bank Acres)	20A1 3 8 and several EDA-owned parcels west of the river	Prohibits residential dwellings of any kind; prohibits construction of any permanent or temporary building or structures on the property (with the exception of buildings that are customary and appropriate for park and recreational usage or those necessary for protection of human health or the environment, or constructed by EPA or FMC to implement response action); prohibits groundwater extraction and use, except as may be required by EPA or VA DEQ for remedial purposes; prohibits the installation of groundwater wells unless approved in writing by EPA; prohibits activities that could impact the integrity of the remedy; grants

Environmental Covenant Instrument Number	Grantor	Grantee	Site Area Subject to the IC (see Figure 3)	Tax Map ID Numbers	Restrictions
					EPA and VA DEQ rights of access to the property for remedial purposes; restricts the Conservation and Open Space Area of the property (Area 3) to conservancy and open space but may permit particular activities as specified in the Environmental Covenant; restricts the West Bank Acres area of the property (Area 4) to public park and recreational uses.
140004559	Honeywell International Inc.	The Clean Water Project, Inc.	Basin Side – Honeywell: Area 5	20A1 3 5 and 20A1-3-6	Prohibits groundwater extraction and use, except as may be required by EPA or VA DEQ for remedial purposes; prohibits the installation of groundwater wells unless approved in writing by EPA; prohibits residential dwellings of any kind; restricts the part of the property located within the 100-year floodplain to conservancy, open space and park usage only; prohibits construction of any permanent or temporary building or structures within the flood zone (with the exception of buildings that are customary and appropriate for park usage).
Note: The restriction descriptions above do not include all restrictions outlined in each Environmental Covenant; they describe the restrictions that are most relevant to the protection of the selected remedy and that serve to prevent unacceptable exposure to site-related contamination.					

Figure 3: Institutional Control 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.

Systems Operations/Operation & Maintenance (O&M)

In accordance with the Site's 2015 Sitewide Operations and Maintenance Plan, PRP contractor Parsons prepares and submits annual sitewide O&M reports to EPA. The Sitewide O&M Plan includes three parts. Part one addresses the landfill and basin cover systems. Part two addresses the groundwater and leachate extraction systems. Part three addresses the GLTP.

The sections below summarize the Site's O&M activities and any noteworthy O&M-related events since the previous FYR. The Site transitioned into the O&M phase on December 30, 2015.

Landfill/Basins Cover System

Part 1 of the Sitewide O&M Plan requires the following O&M activities:

- Post-closure inspection of the final cover.
- Monitoring and maintenance of passive gas vents and gas vent filter systems.
- Routine maintenance and repairs to maintain the effectiveness and integrity of the final cover system.
- Procedures to be followed in the event of catastrophic events.
- Documentation and reporting.

Since the previous FYR, only one significant O&M issue was reported regarding settlement, indicated by the topographical surveys. Typical minor O&M observations include bare spots, small trees, minor erosion and small areas of standing water. Parsons addresses these types of minor issues upon discovery.

Topographical Surveys

In lieu of using settlement markers, the O&M Plan requires an annual land surface topographic survey of the cover systems. Yearly survey results indicated settled areas of the cover system above established allowable limits in Viscose Basins 4, 6, 9, 10, and Fly Ash Basin 3. These areas required elevation adjustment to correct differential settlement. In 2020, approximately 3,200 cubic yards of soil were placed across the Site in the low areas.

Wetlands

The OU7 remedy included an area of wetland restoration. The sitewide O&M Plan requires annual monitoring of the wetland restoration area for five full growing seasons after its construction and planting (from 2014 through 2018). The minimum five-year monitoring period was completed in 2018. However, due to issues with invasive species, annual monitoring is being continued until the area becomes more self-sustaining. The reports conclude that a combination of mowing, spot treating with herbicide and continued monitoring are expected to help control these species. Overall, the surveys indicate that the wetland restoration area is becoming established with more desirable, native wetland vegetation.

Gas Vents

In accordance with the sitewide O&M Plan, the PRP's contractor(s) performs quarterly monitoring and inspections of the passive gas vents associated with OU7, OU10 and the NTCRA Basins. The 2021 sitewide O&M Report noted that several passive vents are slightly tilted, ranging from five to 20 degrees from vertical. However, the report concluded that the tilting of the vents does not impact their operation. The PRP contractor will continue to monitor the vents and will repair them if further tilting inhibits their ability to function. Other deficiencies noted during the inspections included broken sample ports and, in one instance, a broken vent fan. These issues were addressed quickly, and all vents continue to function as design. The PRP contractor will continue to monitor the inline carbon filtration units to determine when breakthrough occurs on the primary unit. Once break though occurs, the secondary unit transitions to the primary unit and a new secondary unit must be installed. The spent unit is transported for recharge and disposal at an approved treatment facility.

Groundwater and Leachate Extraction System

The groundwater and leachate extraction system includes three primary components: the VB 9-11 leachate extraction system, the OU10 and NLF leachate conveyance system (lift stations), and the OU7 groundwater

extraction system. The Site's supervisory control and data acquisition system tracks and monitors system operations. In 2022, EPA approved FMC's request to remove TW-03 from routine groundwater extraction. TW-03 is no longer needed to run continuously to maintain effective capture. If recovery wells TW-01 or TW-02 are out of service for an extended period, TW-03 would return to service to maintain capture. An equipment maintenance program is used to record routine and non-routine maintenance activities and repairs. Parsons prepares and submits quarterly reports that summarize operation of the groundwater and leachate extraction system. Per the sitewide O&M Plan, Parsons samples the extracted VB leachate and groundwater to monitor and track any changes in the leachate characteristics. In general, concentrations of leachate constituents have either decreased or remained relatively stable since system startup. Table G-7 in Appendix G presents the Leachate Sample Results Summary for 2020.

Groundwater and Leachate Treatment Plant

The GLTP treats a range of constituents, including, but not limited to, organic content, metals, chlorobenzene, chloroform, 2,4-dimethylphenol, carbon disulfide, ethylbenzene, methylene chloride, phenol, toluene and trichloroethene. The design flow rate for the plant is 125 gallons per minute. The GLTP discharges effluent at Outfall 004 directly to the South Fork Shenandoah River in accordance with the plant's NPDES permit. Parsons reports discharge monitoring results to VA DEQ each month in Discharge Monitoring Reports. There were no permit exceedances during the 2018-2021 reporting periods. In 2021, the GLTP discharged 22.2 million gallons of treated water to the river or an average of 60,000 gallons per day. In 2021, EPA approved FMC's request to remove the two parallel metal precipitation system (MPS-001 and MPS-002) from service and install a bypass pipe. The amount of precipitate that was being produced was not sufficient to necessitate the continued operation of the system. The bypass will be considered permanent, but isolation valves were installed to maintain the ability to direct water to the MPS if a change in site conditions necessitates the future use of the MPS.

III. PROGRESS SINCE THE PREVIOUS REVIEW

This section includes the protectiveness determinations and statements from the previous FYR as well as the recommendations from the previous FYR and the current status of those recommendations.

Table 7: Protectiveness Determinations/Statements from the 2018 FYR

OU #	Protectiveness Determination	Protectiveness Statement
2	Protective	The OU2 remedy is protective of human health and the environment because there are no complete exposure pathways between contaminated soil and receptors.
3	Protective	The OU3 remedy is protective of human health and the environment because the risks previously associated with the unstable acid reclaim building have been addressed via demolition of the building.
4	Protective	The OU4 remedy is protective of human health and the environment because the risks previously associated with the lack of site security have been addressed.
5	Protective	The OU5 remedy is protective of human health and the environment because removal of drummed wastes from the Site eliminated the potential for direct human contact and also mitigated the potential for fire, explosion and releases associated with the wastes.

OU #	Protectiveness Determination	Protectiveness Statement
7	Short-term Protective	The remedy at OU7 currently protects human health and the environment in the short term because there are no complete exposure pathways between contaminated groundwater and receptors. Prior impacted residential wells users located across the river are supplied with potable water, institutional controls are in place at the Site and at most downgradient residential properties to prevent installation of new groundwater wells, and the caps over VBs 9, 10 and 11 prevent direct exposure to contaminated soil within the basins. For the remedy to be protective over the long term, the following actions are needed: 1) Implement institutional controls to prevent human exposure to contaminated groundwater and to prevent the installation of water wells at the privately-owned properties west of the river where pumping of water wells could potentially affect plume migration. 2) Finalize and implement the ICIAP, as required by the OU7 ROD.
8	Protective	The OU8 remedy is protective of human health and the environment because there are no complete exposure pathways between contaminated soil and receptors. The UECA Environmental Covenant, Instrument 140004561, restricts land use at the areas previously referred to as Areas B and C to commercial/industrial use only.
10	Short-term Protective	The remedy at OU10 currently protects human health and the environment in the short term because there are no known complete exposure pathways between contaminated soil and receptors. The cover systems over VBs 1-8 and the NLF prevent direct human and ecological receptor contact with VBs 1-8 and NLF soil and waste and prevent the migration of contaminants from those areas. Excavation of soil contaminated at levels above industrial/commercial cleanup goals at the former Plant Area and the Expanded Plant Area and institutional controls mitigate the risk of direct contact with impacted soil and groundwater at OU10. Ecological habitat is reestablishing due to the delayed redevelopment of the Site. For the remedy to be protective over the long term, the following actions are needed: 1) Evaluate the current habitat and if needed develop and implement a plan to identify and mitigate unacceptable ecological risks at the former Plant Area, regardless of anticipated possible future land use.

Table 8: Status of Recommendations from the 2018 FYR

OU #	2018 FYR Identified Issue	2018 FYR Recommendation	Current Status	Current Implementation Status Description	Completion Date
OU7	The OU7 ROD requires the development of an ICIAP. While FMC is currently developing the ICIAP, it has not yet been completed. Additionally, Site-related groundwater contamination is present beneath the properties west of the South Fork Shenandoah River. However, there are no groundwater use restrictions in place for privately-owned site properties in that area that overlie the groundwater plume.	Finalize and implement the ICIAP, as required by the OU7 ROD. Furthermore, implement institutional controls to prevent the installation of water wells at the privately-owned properties west of the river where pumping of water wells could potentially affect plume migration and potentially result in unacceptable human exposure to contaminated groundwater.	Ongoing	The ICIAP was developed in 2019. Implementation of institution controls is ongoing. Institutional controls have been fully implemented on the majority of the Site, however, the institutional controls described in the ICIAP for the privately-owned properties west of the rive are still being pursued by FMC.	--

OU #	2018 FYR Identified Issue	2018 FYR Recommendation	Current Status	Current Implementation Status Description	Completion Date
OU10	Due to the delay of the planned site redevelopment, ecological habitat is reestablishing in the Plant Area. The SLERA had found several chemicals of potential ecological concern present in soil and sediment at concentrations that exceed ecological risk thresholds. If the reestablishing habitat allows foraging, cover or nesting opportunities, the potential for unacceptable ecological risks exists for exposure to soil and sediment in the former plant area.	Evaluate the current habitat and if needed develop and implement a plan to identify and mitigate unacceptable ecological risks at the former plant area, regardless of anticipated possible future land use.	Ongoing	In response to this issue, FMC developed a Habitat Removal Work Plan (2022) to address the Former Manufacturing Area habitat. In order to prevent re-establishment of potential habitat in the future, FMC proposed to remove the old field/ wooded habitat and replace with a vegetative cover that can be easily maintained (i.e. turf grass) to reduce unacceptable ecological risks at the former plant area. In support of this work, below is a list of completed tasks as well as anticipated schedules: • Topographic Survey Complete: April 2022 • Design Documents Complete: Third Quarter 2022 • Construction Complete: Expected Second Quarter 2023 • O&M Plan Complete: Expected Second Quarter 2023	--

IV. FIVE-YEAR REVIEW PROCESS

Community Notification, Involvement & Site Interviews

A public notice was made available by newspaper posting in the *Warren Sentinel* on December 9, 2022. It stated that the FYR was underway and invited the public to submit any comments to EPA. A copy of the press notice is included in Appendix K. The results of the review and the report will be made available at the Site's information repository, Samuels Public Library, located at 330 East Criser Road in Front Royal, Virginia, and online at: https://www.epa.gov/superfund/search-superfund-five-year-reviews.

EPA interviewed VADEQ RPM Cortney Marquette on October 18, 2022. Ms. Marquette has been a member of this site team since January 2020 and expressed that the overall operation at the site is going well. The pump and treat system continues to work well, the PRPs are proactive, punctual, communicate well, and there are no other issues of concern at the site. The RPM is hopeful that the site could someday be deleted from the EPA National Priorities List. The RPM receives a quarterly report of the site and is aware and informed of all cleanup activities and timeline for activities at the site. Though there are not any reports of vandalism at the site, the team learned of potential trespassing at the site during the October 2022 site visit. Ms. Marquette shared that everything at the site was running smoothly and that there is interest in the site for potential reuse. Though that reuse would be limited use, it could still be turned in to a resource that could be used by the surrounding community.

EPA interviewed Joe Petty, the Director for the Warren County EDA on October 21, 2022. The Director's overall impression of the site is that the cleanup efforts are going very well. The Director framed the current status of the site as a success because of the significant improvements over the many years of cleanup efforts, and because it has restored the site back to a beautiful landscape with positive impacts to the nearby river. The Director has not heard much feedback from the surrounding community, but he believes this is because the site is relatively quiet and not much active work is going on currently. The Director has not heard of any instances of vandalism or trespassing at the site. One of goals of the Director is to install a bike and pedestrian path on the Superfund site property to connect neighboring communities and provide a beneficial use of the site to community members[6]. The Director expressed an interest in sharing the success story of the site cleanup with community members to show the positive effects that the cleanup has had on human health and the environment over the many decades of cleanup activities.

EPA interviewed three team members of Parsons. The following is a summary of all three responses received. Parsons shared with the CIC that the operation, monitoring, and maintenance of the site continues to run smoothly. This is in part because the project is managed well, the staff are knowledgeable, and the public has a positive perception of the site work. Parsons' collective assessment of the current performance of the remedy at the site is that the remedy is effective. The results of various monitoring programs, including annual groundwater monitoring, surface water and sediment sampling, and GLTP system sampling show that the concentrations of contaminants in the recently collected data are generally stable or decreasing. The representatives from Parsons indicated that there have not been any complaints or inquiries from nearby residents regarding the site. The representatives also shared that they are not aware of any changes to state laws that might affect the protectiveness of the site's remedy, but also included that the project team regularly monitors state regulations that would affect site activities for potential changes.

All three Parsons representatives reflected that the site has frequent trespassers entering from wooded areas, river, and parks adjacent to the property. There has also been evidence of hunting on the site property multiple times, and local police and EDA have been notified of those incidences. The cable to the north entrance to the site has been cut at least once, and local law enforcement was notified. Two poachers who were hunting deer were arrested onsite as recently as 11/14/22. That case is being handled by respective agencies.

[6] EPA would work to ensure that any site reuse remains compatible with site conditions and protective of human health and the environment.

In conclusion, the Parsons representatives are comfortable with the status of the institutional controls at the site, and any outstanding items are in the process for review and finalization. One Parsons interview respondent reflected that they would like to see more engagement and pro-active controls from the local EDA in response to the increase in trespassing and hunting-related unauthorized site access.

EPA interviewed [redacted] a former resident of the Front Royal community. Mr. [redacted] continues to have concerns and interest in the site and wanted to offer his responses to the FYR interview on behalf of the students who attended Randolph Macon during the Avtex operation and cleanup. He has been aware of the operation of the Ground Leachate Treatment Plant (GLTP) since 2015 and the quarterly/annual reports provided by Parsons for the Site. He also expressed concerns that the human health risk to the students and staff at the Randolph Macon Academy boarding school was not considered at any time. The boarding school shared a property line with Avtex, and he believes action was warranted because children were living next door to the site. He also noted that in the 2008 Baseline Human Health Assessment, the highest risks for cancer were calculated for a future child resident at 4.3E-03 and non-cancer risk of 5.2E+01. These are the highest cancer and non-cancer risk calculations in the report.

Mr. [redacted] acknowledged that EPA did a good job addressing contamination aboveground but has doubt regarding the contamination problem underground. He believes that it took too long for EPA to address the underground contamination and has concerns that this may have led to impacting the community. Though it took a long time for EPA to address the underground aspect of the cleanup, he shared that he was still glad to know that something is being done about it.

Regarding the GLTP, he shared that it is difficult to find any information in publicly available EPA reports about what the GLTP is doing and how it is performing. He requested that EPA make all of the GLTP data available to the public. Mr. [redacted] stated, there needs to be transparency and accountability on the effectiveness of the underground cleanup efforts, both past and ongoing. Interview forms with additional information are included in Appendix J.

Data Review

All available data was evaluated over the last five years. This data review presents groundwater, surface water, sediment and aquatic biota data collected as part of long-term monitoring requirements for OU7, OU10 and the NTCRA basins and presented in the 2020 Annual Site-Wide Groundwater, Surface Water, and Sediment Monitoring Report for OU-7, OU-10, and NTCRA Basins Report (2020 Annual Report). Appendix G presents data tables and figures that support the data review. A summary of the data review is presented below.

OU7

Groundwater

The purpose of the OU7 groundwater monitoring program is to monitor groundwater elevations and quality to evaluate remedy performance and to support plume capture zone analyses, and to monitor groundwater quality for the closed VB 9-11 units in accordance with the Virginia Solid Waste Management Regulations (VSWMRs). Figure G-1 in Appendix G shows the locations of the wells in the OU7 monitoring program in each of four flow zones: overburden, shallow bedrock, intermediate bedrock and deep bedrock. Figure G-1 also shows pumping wells TW-01, TW-02 and TW-03, which began consistent operation in March, June and August 2015, respectively. This FYR evaluates the groundwater data collected from 2020 in detail and presents limited historical data to provide context for the evaluation. Table G-1 in Appendix G presents a summary of the 2020 sampling results.

2020 Capture Zone Analysis

PRP contractors collect water level data on a quarterly basis to support capture zone analyses. In support of the 2020 Capture Zone Analysis (CZA), the OU7 monitoring wells were gauged four times during 2019 and once

during 2020. On May 1, 2020, EPA approved the reduction of water level monitoring from quarterly to annually. Under non-pumping conditions, groundwater under the Site (on the east side of the river) generally flows to the west toward the river. However, groundwater within the bedrock aquifer flows southwest parallel to a geologic strike. In the subdivisions on the west side of the Shenandoah River, groundwater typically flows to the east and southeast, toward the river. Below are the results of capture zone analysis presented in the 2020 Annual Report.

Shallow Bedrock

Pumping in the shallow bedrock is influenced more strongly by surface water flow in the river. The stagnation point does not extend to the opposite side of the river, as much as it extends "along" the river. The stagnation point appears to extend 1,600 feet in the downstream direction of TW-01. The stagnation point extends across the river in the vicinity of TW-03. The maximum capture zone width is over 2,000 feet at TW-02 (i.e., 1,000 feet cross gradient to either side of TW-02). The capture zone width extends beyond the monitoring well field at TW-02. As discussed above, the capture zone is elongated along the river, which causes a variable width (as well as direction) in the capture zone associated with pumping at TW-01. At TW-01, the width of the capture zone is at least 500 feet, but there is a much wider capture zone width on the east side of the river due to the combined influence from TW-02.

Intermediate Bedrock

In the intermediate bedrock, the stagnation point appears to extend to the opposite side of the river, at least 500 feet downgradient from TW-01 (most likely beyond the extent of the monitoring well field). The maximum capture zone width is at least 600 feet at TW-02 and 1,000 feet at TW-01. The capture zone width extends beyond the monitoring well field at both locations.

Deep Bedrock

In the deep bedrock, the stagnation point extends to the opposite side of the river, more than 1,400 feet downgradient of TW-01, near the vicinity of pumping well TW-03 and beyond the extent of the monitoring well field. The maximum capture zone width could not be measured at TW-02 because it was not in operation during the monitoring event. The maximum capture zone width was at least 700 feet at TW-01. The capture zone width extends beyond the monitoring well field. In conclusion, the capture zone analysis indicates that the current system is maintaining effective capture as designed

Bedrock Interval	Stagnation Point	Maximum Capture Zone Width
Shallow	Between 118 feet and 260 feet	Between 744 feet and 1,636 feet
Intermediate	Between 183 feet and 264 feet	Between 1,150 feet and 1,656 feet
Deep	Between 154 feet and 413 feet	Between 968 feet and 2,594 feet

Groundwater Quality

During the 2020 sampling event, carbon disulfide was the only volatile organic compound (VOC) detected above its OU7 remedial goal of 1,000 micrograms per liter (µg/L). Carbon disulfide was detected in 25 of the sampled wells and appeared in each of the four flow zones (overburden, shallow bedrock, intermediate bedrock, and deep bedrock). The detected concentrations exceeded the OU-7 cleanup standard of 1,000 µg/L in three wells (MW-09, 215, and 305). With a few exceptions (e.g., wells 305 and MW-09), a significant decrease in the concentrations and extent of carbon disulfide in groundwater has been observed since pumping began. In 2014, 11 of the wells (138, 206, 215, 216, 305, 316, 336, 603-Z1, MW-03R, MW-09, and PW-02) had concentrations exceeding the cleanup criteria compared with only three in 2019 and 2020. The concentrations measured at well 305 has remained relatively stable since 2013. (Table G-1 of Appendix G).

Shallow bedrock - carbon disulfide was not detected in the shallow bedrock groundwater at concentrations above the OU-7 groundwater cleanup standard. The last time carbon disulfide was detected in this zone above the standard was in 2014.

Intermediate bedrock - concentrations show the carbon disulfide plume has shrunk considerably since

pumping began and carbon disulfide concentrations above the cleanup standard are now limited to the area around well 215 west of the Shenandoah River.

Deep bedrock - concentrations show the carbon disulfide plume in the deep bedrock groundwater has decreased significantly since pumping began and since 2016 the area in exceedance of the standard is now limited to the area around wells 305 and TW-01.

During the 2020 sampling event, overburden well 128 was the only well to report a semi-volatile organic compound (SVOC) detection above the OU7 remedial goals (bis(2-ethylhexyl)phthalate). SVOCs were not detected above the OU7 remedial goals in the shallow, intermediate or deep groundwater, which is consistent with historical results.

During the 2020 sampling event, concentrations of six metals (antimony, arsenic, cobalt, iron, manganese and nickel exceeded their respective OU7 remedial goals in at least one monitoring well. All other metals and cyanide were either not detected or were detected below remedial goals.

Arsenic and antimony are the two most widespread inorganic constituents in groundwater at OU7 and serve as reasonable indicator constituents for delineating the extent of all inorganic constituents.

Overburden - concentrations show the antimony plume in overburden groundwater is limited to the area around MW-09, which is under and immediately downgradient of VBs 9, 10, and 11. Consistent with results from 2018 and 2019, the arsenic plume is slightly more widespread, extending upgradient to well WP-10, and downgradient to well MW-10. The concentrations of both constituents are consistent with those detected in past events and the plume extents have reduced slightly since 2015.

The extent of antimony and arsenic in shallow bedrock groundwater has remained relatively unchanged since 2016. The antimony plume is limited to the area under and immediately downgradient of VB 9, 10, and 11. Antimony was not detected in any of the shallow bedrock wells west of the Shenandoah River. The leading edge of the arsenic plume remains near PZ-06 and well 105 on the east side of the river.

In the intermediate bedrock zone, detected concentrations of arsenic, antimony, and other metals at well GM-02B result from the preferential flow of the plume along the bedrock strike. Consistent with results from 2018 and 2019, the antimony plume has narrowed and shortened considerably since 2015 and has split into two separate plumes: one on the east side of the river around well 238; and one on the west side around well GM-02B. The arsenic plume remains relatively unchanged since 2017 and the plume turns south from GM-02B toward well 206 once west of the river. The arsenic plume appears to extend just south of well location 206.

Similar to the intermediate bedrock, the arsenic plume in the deep bedrock flows to the southwest parallel to the bedrock strike before moving southward once west of the river. The leading edge of the arsenic plume, as defined by the OU-7 cleanup standards, has been confirmed to the southernmost extent by well nest 501. The antimony and arsenic plumes have narrowed and decreased in length since pumping began. The antimony plume is now limited to the area around well 305. The data suggests that concentrations of inorganic constituents in bedrock groundwater are consistent with or less than prior monitoring events and indicate that the groundwater plumes in the overburden, shallow, intermediate and deep bedrock flow zones are stable or decreasing in concentration.

Virginia Solid Waste Management Regulation (VSWMR) Compliance Monitoring

Eleven of the 52 sampled wells in the OU7 groundwater monitoring network also serve as VSWMR compliance wells (Figure G-2 in Appendix G). A review of the control charts for the 2020 sampling event, which are included in the 2020 Annual Report, found that most constituents remain below their baseline concentrations, with the exception of a few constituents at WP-10, 116R, and 138. These constituents were not significantly above their baseline concentrations. Data will continue to be reviewed to establish whether there is a statistically significant pattern indicating increases in the groundwater concentrations.

Surface Water
The objective for the OU7 river monitoring is to collect surface water quality data to determine whether there are decreasing trends in the constituent concentrations found in surface water in the area where the groundwater contamination plume from VB 9-11 is entering the South Fork Shenandoah River. Surface water samples were collected annually, beginning in 2012. Figure G-3 in Appendix G presents the surface water and co-located sediment sampling locations.

During the 2020 sampling event, VOCs, SVOCs and cyanide were not detected in surface water samples. Table G-2 in Appendix G presents the 2020 surface water sampling results. Refer to the 2020 Annual Report for historical analytical results for OU7 surface water.

During the 2020 sampling event, concentrations of metals in river surface water samples were reported as non-detect or at concentrations below the VA DEQ Surface Water Criteria for Public Water Supply (2012) at all sampling locations. This is consistent with historical results.

Sediment
The objective for the OU7 river sediment monitoring is to determine whether there are decreasing trends in the constituent concentrations found in sediment in the area where the groundwater contamination plume from VB 9-11 is entering the South Fork Shenandoah River. Sediment samples were collected annually, beginning in 2012. Figure G-3 in Appendix G presents the 2020 sediment and co-located surface water sampling locations.

Only one VOC (acetone) was detected in any of the locations. The concentration was only slightly above the detection limit. Historically low levels of acetone have been detected at several locations. There is no sediment criterion for acetone.
Carbon disulfide was not detected at any of the locations in 2020. Historically, carbon disulfide has been detected at several locations exceeding the screening criterion. Overall, groundwater extraction has reduced the carbon disulfide levels in sediment. Consistent with results from the last several years, chlorobenzene was not detected in any of the sediment samples. A decreasing trend is evident for carbon disulfide. Table G-3 in Appendix G presents a summary of 2020 sediment sampling results. Refer to the 2020 Annual Report for historical analytical results for OU7 sediment.

During the 2020 sampling event, one SVOC (bis[2-ethylhexyl]phthalate) was detected at SED-07 at a concentration (200 µg/kg) slightly above the screening criterion (108 µg/kg). Naphthalene was also detected at upgradient location SED-08 but was below the screening criterion.

Metals are also routinely detected at all the sediment sampling locations. However, all metals reported as below detection or at concentrations below the freshwater sediment screening benchmarks during the 2020 sampling event with the exception of iron, manganese, and zinc. Aluminum, iron, lead, mercury, and zinc were generally higher than past results. The remaining metals detected in sediments in 2020 are relatively consistent with results reported from 2013 through 2019.

Total cyanide was not detected in any of the samples in 2020 which is consistent with historic results.

Aquatic Biota
Triennial aquatic biota sampling is conducted to determine whether there are decreasing trends in the concentration of PCBs found in the aquatic biota (i.e., fish and macroinvertebrates) that live next to the Site. During the 2018 sampling event, samples were collected at six aquatic biota sampling locations (BMI-1 through BMI-6). Figure G-4 in Appendix G presents the aquatic biota sampling locations. Refer to the 2018 Annual Report for current and historical analytical results for OU7 aquatic biota.

In fish samples, PCBs were detected in multiple samples of smallmouth bass, redbreast sunfish, northern hogsucker, fallfish and comely shiner at concentrations that exceed the VA DEQ Fish Screening Value for PCBs

of 0.020 mg/kg. While significant decreases in PCB concentrations were observed in the smallmouth bass and redbreast sunfish samples between 2012 and 2015, the concentrations measured in 2018 rebounded somewhat and were similar to those measured in 2012. Comparing the comely shiner to the previous bluntnose minnow results indicates similar concentrations between 2012, 2015, and 2018. Spatially, upstream location BMI-6 had the fewest exceedances of the screening criterion while downstream locations BMI-1 and BMI-2 had the most exceedances.

PCBs were not detected in any of the benthic macroinvertebrate (fingernail clams) tissue samples collected during the 2018 sampling event.

PCBs were not detected in any of the six sediments samples collected at the aquatic biota sampling stations during the 2018 sampling event.

OU10

Groundwater

The OU10 ROD established soil cleanup goals based on both direct contact and protection of groundwater. The purpose of the groundwater monitoring program for the closed OU10 units (VBs 1-8 and the NLF) is to determine whether groundwater quality becomes further degraded and, if so, whether an unacceptable risk is posed by the change in water quality conditions. Table G-4 in Appendix G presents the 2020 analytical results. Refer to the 2020 Annual Report for historical results.

VBs 1-8

Overburden

Two VOCs (acetone and carbon disulfide at GPW-14) and one SVOC (naphthalene at MW-12) were detected in the overburden groundwater downgradient of VB 1-8 in 2020. Of these compounds, only naphthalene at MW-12 exceeded the RSL; however, the concentration was within the baseline range for this location. VOCs and SVOCs have only been detected sporadically at relatively low concentrations and with a few exceptions have generally not been observed in the upgradient wells. Low-level historical detections of acetone, 2-butanone, 2-hexanone, and xylenes have been observed in well GPW-02 and acetone in well GPW-03R. Therefore, VB 1-8 may be contributing trace to low levels of VOCs and SVOCs to groundwater in the overburden aquifer, but it is not a significant source of these compounds in overburden groundwater.

Arsenic (GPW-14 and MW-12) and thallium (GPW-14) were the only metals detected downgradient of VB 1-8 at concentrations exceeding their RSLs. The concentrations detected at these locations were within their respective baselines. Copper and zinc were also detected at these locations at concentrations exceeding their baselines but not above the RSLs. The concentration of arsenic appears to be decreasing and the copper and zinc concentrations appear to be increasing slightly (especially compared to upgradient concentrations). Therefore, this unit may be contributing arsenic and low levels of coper and zinc to the overburden groundwater. The detected concentrations could reflect naturally occurring levels of these metals

Shallow Bedrock

One VOC (trichloroethylene) was detected at well 119 at a concentration exceeding the RSL; however, the concentration is within the baseline range for this location. One SVOC (bis[2-ethylhexyl]phthalate) was also detected at this location at a concentration slightly above the RSL and baseline. All other detected VOCs and SVOCs were below their RSLs and baselines. Carbon disulfide, and several other VOCs and SVOCs have been detected in the shallow bedrock groundwater in previous sampling events, but these constituents were not detected in 2020 in this interval. Therefore, VB 1-8 may be contributing trace levels of VOCs and SVOCs to groundwater in the shallow bedrock aquifer, but it is not a significant source.

One metal (beryllium) was detected in groundwater at well 132 at a concentration below the RSL and baseline. Metals were not detected in other downgradient wells. Control charts, a plot of concentration versus time, indicate that metals concentrations are either decreasing or mirror upgradient concentration fluctuations. Therefore, VB 1-

8 does not appear to be contributing metals to groundwater in the shallow bedrock. The detected concentrations could reflect naturally occurring levels of these metals.

The NLF
The two wells that are representative of upgradient overburden groundwater quality at the New Landfill have been sampled, but all downgradient overburden monitoring wells have been dry during each of the monitoring events. Based on these dry conditions, it appears that minimal overburden groundwater is present beneath and downgradient of the NLF.

Carbon disulfide (well 133) and vinyl chloride (MW-07) were the only VOCs detected in the shallow bedrock monitoring wells downgradient of the NLF during the 2020 sampling event. The carbon disulfide concentration was below the RSL and the baseline range. Vinyl chloride exceeded the RSL and the baseline range. The concentration has been consistently above the baseline since 2015 and while the concentrations have increased since monitoring began in 2008, the concentrations have been relatively consistent since 2013.

No SVOCs were detected in the shallow bedrock monitoring wells downgradient of the New Landfill during the 2019 sampling event. Therefore, it is concluded that the NLF is not contributing significant VOCs or SVOCs to groundwater in the shallow bedrock zone.

Arsenic, chromium, copper, nickel, and zinc were detected in the downgradient shallow bedrock groundwater in 2020. Arsenic exceeded the RSL at well 133. Zinc exceeded its baselines at wells MW-07 and MW-08 but was below the RSL. The other metals were below their RSL and baselines. The concentration of zinc at upgradient well 128 has also increased during the monitoring period. Therefore, with the exception of arsenic, the NLF does not appear to be contributing metals to groundwater in the shallow bedrock. The detected concentrations could reflect naturally occurring levels of these metals.

NTCRA Basins

The purpose of the groundwater monitoring program for the NTCRA-Basin units (that is, the Fly Ash Basins (FABs) and the Sulfate Basins (SBs)) is to determine whether groundwater quality becomes further degraded from the viscose and other waste within the units and, if so, whether there is an unacceptable risk posed by the change in water quality conditions. Figures G-6 in Appendix G show the NTCRA-Basin monitoring well locations. Sumps for each cover system are also monitored. Table G-5 in Appendix G presents the 2020 analytical results. Refer to the 2020 Annual Report for historical results.

Fly Ash Management Unit
Monitoring of metals in the overburden wells indicates that the unit may be contributing to arsenic concentrations in the overburden groundwater near well 014R. Concentrations of arsenic at this location have increased since monitoring began but have been relatively consistent since 2014. Concentrations of calcium, magnesium, sodium, chloride, and sulfate are similar to those detected since 2015. Nickel shows an apparent increasing trend at well 114 in the shallow bedrock groundwater, but the concentrations remain well below the RSL and the 2020 result was significantly lower than 2019. Monitoring of the remaining metals in the shallow bedrock wells both upgradient and downgradient of the FAB units did not indicate any increasing trends in metal concentrations.

Sulfate Basin Management Unit
Results of metals monitoring in the overburden wells both upgradient and downgradient of the SB units did not indicate any increasing trends in metal concentrations and major ion concentrations are also relatively stable. Results of metals monitoring in the shallow bedrock wells both upgradient and downgradient of the SB units did not indicate any increasing trends in metal concentrations.

Fly Ash Basin Cover System Drain Sumps
The water quality data collected from the sumps indicate that arsenic, copper, nickel, zinc, and sulfate were

present during the 2020 sampling event at concentrations exceeding Virginia's surface water quality standards (9 VAC 25-260-140). The concentrations of nickel and sulfate have remained relatively stable historically. The concentrations of the remaining constituents have decreased or remained stable over time.

Sulfate Bain Cover System Drain Sumps
The water quality data indicate that arsenic, copper, and sulfate were present at concentrations exceeding Virginia's surface water quality standard (9 VAC 25-260-140). The concentrations of COPCs in these sumps has decreased or remained stable over the monitoring period, although many of the locations exhibited an increase since 2017. The sulfate concentrations in the SB sumps have generally decreased since monitoring began in 2012, when sulfate concentrations exceeded the screening criterion in six sumps.

Based on these results, the NTCRA basins do not appear to be contributing significant concentrations of metals to the shallow bedrock.

OU7, OU10 and NTCRA Basin Gas Vents

In accordance with the Sitewide O&M Plan, the PRP performs quarterly monitoring of the passive gas vents associated with OU7, OU10 and the NTCRA Basins. Vents are monitored for methane, lower explosive limit (LEL) of methane, VOCs, hydrogen sulfide, carbon monoxide and oxygen. Vents GV-4 and GV-5 at OU10 have vent filter systems (carbon canisters) to treat the vapors from these vents. The PRP monitors the systems for the same parameters as the passive vents, but on a more frequent schedule (twice weekly from May 1 to October 31 and monthly from November 1 to April 31). The VOC and hydrogen sulfide monitoring results are compared to baseline results, and for methane, to an arbitrary 25 percent of the LEL to determine if monitoring should continue at the specified frequency. Two-year baseline monitoring was completed in 2015.

Throughout the two-year baseline monitoring period (2014 through 2015) and the subsequent two years of monitoring (2016 through 2017), there were only sporadic detections of hydrogen sulfide in the breathing zone and none of the detections exceeded 1 part per million (ppm). In many cases, hydrogen sulfide was not detected in the associated vent and the detections were rarely associated with any odors. Methane and LEL were only detected in the breathing zone at one location in 2016 (OU-10 GV-07) and two locations in 2017 (OU-7 GV-04 and OU-10 GV-11). The concentrations were relatively low at 0.1 percent and 2 percent for methane and LEL, respectively. There were no detections of organic vapors in the breathing zone in 2016 or 2017.

In a letter dated February 28, 2018 (USEPA 2018), the EPA approved a reduction in the gas vent monitoring. Except for OU10-GV-4 and OU10-GV-5 (the two vents with carbon filtration systems), breathing zone readings were discontinued at all locations. While all gas vents are monitored once per year, quarterly monitoring was reduced to just the OU-7 and OU-10 vents along with the SB vents.

In 2021, the four quarterly gas monitoring events were performed in March, June, September, and November. Quarterly monitoring results were compared to the baseline for hydrogen sulfide, methane, LEL, and organic vapors, respectively. Similar to the 2018 findings, several vents were noted to be leaning approximately 5 to 20 degrees from vertical; however, the minor damage is not affecting the function of the vents. Other deficiencies noted during the inspections included broken sample ports and, in one instance, a broken vent fan. These issues were addressed quickly, and all vents continue to function as designed.

With the exception of the two vents with carbon filtration (OU10-GV-04 and OU10-GV-05) and several of the OU-7 vents, detections of hydrogen sulfide have been sporadic. Hydrogen sulfide was not detected above 1 ppm at any of the SB vents and was not detected at all in SB-1. Consistent with past events, the highest hydrogen sulfide readings at the SBs and OU-7 were generally observed in June while the highest readings at OU-10 were observed in September.

Methane is the most widely detected constituent across the Site. Similar to previous years, the highest concentrations were observed at OU-7 and OU-10, where a significant number of the methane results exceeded the calculated baseline values. During 2020 and 2021, 28 of the 33 vents at these two units had methane concentrations exceeding their baseline values in at least one event. Only 22 out of 68 SB vents had at least one result exceeding their baseline value and the concentrations were significantly lower at these units.

Similar to methane, the highest LEL readings were observed at OU-7 and OU-10, while LEL was only sporadically detected at the SBs. An arbitrary screening criterion of 25 percent of the LEL was established. Similar to previous events, the LEL criterion was exceeded at least once in most of the OU-7 and OU-10 vents. Several vents in these two units exceeded the criterion in each of the four quarterly sampling rounds. Eight of the 68 SB vents had exceedances of the LEL screening criteria in at least one monitoring event.

Organic vapor readings are now collected at only two vents (OU10-GV-04 and OU10-GV-05). The baseline value was exceeded in the effluent (after the carbon filters) at both locations at least once. The influent VOC concentrations were also elevated during these events and the effluent values were generally lower, indicating the carbon filters were removing the VOCs.

Site Inspection

The site inspection took place on 10/12/2022. In attendance were Alan Geyer and Lisa Denmark (EPA Region 3 RPMs), Cortney Marquette (VA DEQ), and Anne Burnham, Nick Loizos and Adam Pugh (PRP contractor Parsons). The purpose of the inspection was to assess the protectiveness of the remedy. The site inspection checklist is included in Appendix E. Site inspection photographs are included in Appendix F.

The Site inspection began with a safety briefing and a tour of the GLTP. Site inspection participants observed the treatment system components, the on-site laboratory, equipment storage room, mechanical room, document storage room, office/control room and the outdoor tank deck area. All treatment system equipment and components were in good condition, operational and clearly labeled. Secondary containment was observed around all tanks and containers. The tank deck is continuously monitored for hydrogen sulfide. Following the GLTP tour, site inspection participants observed VB 9, VB 10, VB 11 and the building that houses the leachate extraction equipment. The cap covering the rest of VBs 9-11 appeared to be well-vegetated and in good condition; no burrowing or evidence of erosion were observed.

Site inspection participants observed the former WWTP basins (PB 1, PB 2 and PB 3) and Outfall 004, where the GLTP effluent discharges to the river. The discharge structure was in good condition and operational. “No trespassing” signs were observed at the outfall. The cap covering VB 4, VB 5 and VB 6 appeared to be in good condition. Vegetation is well-established and no evidence of burrowing or erosion was observed. The carbon filtration systems installed at gas vents OU10 GV-4 and OU10 GV-5 were in good condition, operational, secured within tall, locked fence enclosures and clearly labeled.

The PRP contractor uses solar power to power the receiver that receives data transmitted from the extraction well west of the river. The solar panel and receiver appeared to be in good condition and were operational. Site inspection participants then toured the SoccerPlex and former plant side of the Site. Except for the former Avtex administrative building, which now houses the EDA and several small businesses, the plant side of the Site is vacant. Features on the plant side of the Site include gravel roads, scattered concrete and steel rebar, trees and grass. There are no remedial features on the plant side of the Site.

Access to the GLTP and VBs 9-11 is restricted by a tall fence with locking gates. The main site entrance along Kendrick Lane is fenced and secured with a locked gate outside of normal business hours. All stormwater management features inspected were in good condition.

Following the focused walking inspection, participants drove to the western side of the river and toured the part of the Site along the western bank of the river, along Rivermont Acres Road. The part of the Site west of the river includes several vacant properties owned by the EDA, three permanent residences, a few private properties used

temporarily for camper storage, deep groundwater extraction well TW-03, and several monitoring wells. Extraction well TW-03 is secured within a tall, locked fence and appeared to be in good condition. All monitoring wells observed on the west side of the river were secured with locks and clearly labeled. FMC provides residents along Rivermont Acres Road with clean water by filling cisterns with water delivered by truck.

V. TECHNICAL ASSESSMENT

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

Question A Summary:
Yes, the review of relevant documents, applicable or relevant and appropriate requirements (ARARs), risk assumptions, and the Site inspection indicate that the OU2, OU3, OU4, OU5, OU7, OU8 and OU10 remedies are functioning as intended by site decision documents with one potential exception. There is a complete ecological exposure pathway associated with OU10 Plant Area Soils due to the lack of redevelopment at the former Plant Area part of the Site. FMC proposed to remove the old field / wooded habitat and replace with a vegetative cover that can be easily maintained (i.e., turf grass) to prevent re-establishment of potential habitat in the future. Due to topography, drainage requirements, and other concerns, some areas may not be easily accessible for mowing and may require an alternative cover (e.g., mulch or gravel). The PRPs are currently carrying out this work under the approved 'Former Manufacturing Area Habitat Removal Work Plan.' The anticipated completion date is Spring 2023.

Following Avtex's bankruptcy in 1990, EPA suspended OU1 remediation and later addressed the cleanup under OU7. EPA addressed OU6 (buildings investigation) during the TCRA that addressed site buildings. There is no ROD or selected remedy for OU9. EPA created OU9 as an administrative OU to require the performance of an Ecological Risk Assessment. The Site's 1999 Final Ecological Risk Assessment met the OU9 requirement. Except for the Plant Area Soils (discussed below), the remedies selected by the Site's decision documents addressed the ecological risks identified by the 1999 Final Ecological Risk Assessment.

Implementation of the OU2 remedy by EPA, and later FMC, mitigated potential risks to public health and the environment associated with PCB-contaminated soil, wastes contained in drums, the acid reclaim building and the lack of site security. Demolition of the acid reclaim building and drums also removed obstructions to future site investigations and remediation efforts.

The OU7 remedy addresses groundwater and surface water contamination caused by leachate from VBs 9, 10 and 11. Capping of VBs 9, 10 and 11 prevents human and ecological exposure to basin wastes through direct contact and reduces the amount of leachate generated by the basins. The OU7 ROD included performance standards for land and groundwater use restrictions to maintain and protect the integrity of the remedy and to prevent the installation of drinking water supply wells in the area where groundwater contamination concentrations exceed cleanup goals. Except for some privately owned properties west of the river, the Site's five UECA Environmental Covenants fulfill the institutional control components of the selected remedies, as subsequently modified, for OU7, OU8 and OU10. The covenants run with the land and restrict certain land uses depending on-site area, place restrictions on soil excavation, and prohibit the extraction and use of groundwater and the installation of groundwater wells. The covenants also prohibit activities that could adversely impact the integrity of the remedy. FMC continues to provide water to three residences west of the river, preventing potential exposure to contaminated groundwater via ingestion. The OU7 ROD stated that none of the privately-owned parcels west of the river (in the residential subdivision) have drinking water wells. However, there are no groundwater use restrictions in place for the privately-owned parcels west of the river that overlie the groundwater plume to prohibit the installation of new water supply wells. Installation of new private wells at those privately-owned parcels could potentially affect the direction of plume migration, and potentially result in unacceptable exposures if the water is used for potable purposes. FMC prepared the ICIAP, which was required by the OU7 ROD, in 2019. Implementation of the ICIAP is ongoing as discussed in Table 8: Status of Recommendations from the 2018 FYR.

Implementation of the OU8 remedy required institutional controls to limit land use for Areas B and C to commercial/industrial use in perpetuity. The 2014 UECA Environmental Covenants fulfill the OU8 ROD's selected remedy, as subsequently modified by the 2012 and 2014 ESDs, to implement institutional controls for Areas B and C.

The remedy for the OU10 ROD addressed VBs 1-8, the WWTP, the NLF and Plant Area Soils. The cover systems constructed over the OU10 basins and the NLF prevent direct contact of both human and ecological receptors with impacted soil and wastes, prevent uncontrolled releases of gases from the VBs and NLF, and protect groundwater quality. Excavation of soil with COC concentrations above cleanup goals at the Plant Area Soils and Expanded Plant Area Soils areas mitigated direct contact risks for human receptors in those areas. There is the potential for unacceptable ecological risk given the habitat present and the data presented in the 2014 SLERA. That topic is discussed below in the Question B summary.

The TCRAs and NTCRAs completed by EPA and FMC addressed risks to human health and the environment associated with site buildings, sewers and basins not addressed by other site remedial actions. The basin cover systems prevent direct human and ecological exposure to wastes consolidated within the basins, and geomembrane caps installed over some of the basins also prevent infiltration of water through wastes, reducing leachate generation and groundwater impacts. The removal of contaminated site buildings and sewers also mitigated risks to ecological receptors in the river due to the discharge of PCB-impacted wastewater through the plant's former sewer system.

Based on a review of O&M reports and site inspection observations, the cover systems are well-maintained, as are the associated remedial components, such as the gas vents and stormwater management features. The GLTP and associated infrastructure, such as wells and groundwater and leachate extraction components, are also well-maintained. When routine O&M inspections identify issues, FMC promptly corrects them and documents the process in O&M reports.

EPA agreed to discontinue the organic vapor monitoring and of breathing zone reading monitoring at all basin areas except OU10 GV-4 and OU10 GV-5. Due to historically high levels of hydrogen sulfide and other gases, FMC installed carbon filtration units at OU10 GV-4 and OU10 GV-5 in 2014. The units treat vapors from the vents and prevent exposure to hazardous vapors. Hydrogen sulfide levels at the monitoring points after the filters are typically much lower. The PRP changes the filter media for the system when elevated levels are observed; however, more frequent changes or other optimization efforts may be necessary.

FMC regularly monitors groundwater, surface water, sediment and aquatic biotic in accordance with EPA-approved monitoring plans. Sampling results from 2020 indicate that COCs, including key contaminants carbon disulfide, arsenic and antimony, continue to exceed OU7 groundwater remedial goals in overburden and shallow, intermediate and deep bedrock. Groundwater contamination extends from the former VBs south and southwest to the west side of the South Fork Shenandoah River. The OU7 groundwater extraction and treatment system became operational in 2015. Pumping of the three recovery wells is expected to reduce contamination concentrations over time in all groundwater zones downgradient of wells. However, ongoing monitoring is necessary to evaluate the effectiveness of the groundwater extraction and treatment at reducing COCs to remedial goals. The purpose of the groundwater monitoring program for the closed OU10 units (VBs 1-8 and the NLF) is to determine whether groundwater quality becomes further degraded and, if so, whether an unacceptable risk is posed by the change in water quality conditions. Additional OU10 groundwater sampling will determine if constituent concentrations are exhibiting trends that may pose unacceptable risk in the future.

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

Question B Summary:

Yes, the cleanup levels and RAOs used at the time of remedy selection are still valid, with one potential exception, OU10 Plant Area Soils, which is discussed below. Although changes to toxicity data have occurred since remedy selection at some OUs, the changes do not call into question the protectiveness of the remedy. Some changes to exposure assumptions have occurred since the time of remedy selection (e.g., the potential for ecological risk at OU10). The effects of these changes are addressed below.

Appendix H of this FYR evaluates the chemical-specific ARARs identified in Site decision documents to determine if changes in chemical-specific standards affect the protectiveness of the Site's remedy. OU2, OU7 and OU10 were the only OUs where chemical-specific ARARs were identified in decision documents. The evaluation in Appendix H demonstrates that there are no changes to chemical-specific ARARs that affect the protectiveness of the remedies at OU2, OU7 and OU10.

Appendix I of this FYR evaluates the current validity of human health risk-based cleanup standards selected for OU2, OU7 and OU10 using the 2022 EPA RSLs; the RSLs incorporate current toxicity values and standard default exposure factors.

The evaluation demonstrates that the OU2 total PCBs cleanup goal of 10 mg/kg remains valid for commercial/industrial use.

The OU7 ROD selected MCLs and non-zero MCLGs as remedial goals for groundwater. In the absence of MCLs and non-zero MCLGs, risk-based concentrations were selected as the remedial goals. Groundwater which meets the MCLs/MCLGs for individual contaminants may not meet the risk-based standards (1.0E-04 and HI less than or equal to 1) cumulatively if multiple contaminants are present; therefore, the determination of meeting the "protection of human health and the environment" RAO will be performance-based. When cleanup standards have been attained, EPA will evaluate post-ROD data, from the periodic groundwater monitoring and develop a trend analysis and risk assessment. The risk assessment will be based on an assessment of the cumulative risk across all applicable exposure routes for all COCs remaining in groundwater following achievement of the cleanup goals. Based on the evaluation in Appendix I, the risk-based remedial goals for carcinogenic COCs remain valid. Remedial goals for 12 COCs result in HQs that exceed EPA's benchmark of 1 for noncarcinogens. Although the remedial goals exceed the noncarcinogenic benchmark, the OU7 ROD states that remediation of groundwater at the Site will continue until the respective MCLs for the COCs are attained and the excessive cancer risk associated with potential residential use of the groundwater is reduced to one in 10,000 (1×10^{-4}) and the hazard index is reduced to 1 for each specific organ.

The OU7 ROD also identified soil remedial goals for soil located outside the VBs 9, 10 and 11 cover systems. Based on the evaluation in Appendix I, soil remedial goals based on direct contact for carcinogenic COCs remain valid. Soil remedial goals for carbon disulfide and mercury result in HQs that slightly exceed EPA's benchmark of 1 for noncarcinogens. This finding does not affect the protectiveness of the remedy because all soils with concentrations above the standards listed in Table 2 of the 2015 Remedial Action Report were excavated and the areas were either covered with the VB 9-11 cap system or were covered with 2 feet of soil to mitigate the human and ecological pathway. There are no complete exposure pathways for human or ecological receptors for OU7 soil.

The OU10 ROD established soil cleanup goals for PCBs and additional COCs, based on commercial/industrial land use and protection of groundwater. A 2012 risk analysis of all the Plant Area Soils remaining on-site after the completion of the remedial action demonstrated that the soils from zero to 10 feet below ground surface (bgs) are protective of human health for an industrial/commercial scenario and both the surface and the deeper soils are protective of groundwater.

In response to a previous FYR issue, FMC completed a screening-level ecological risk assessment (SLERA) for the former Plant Area Soils part of OU10 in December 2014. The area evaluated included the location of the former manufacturing plant and the surrounding area east of the railroad tracks (about 125 acres). FMC used existing soil

data to perform the evaluation; no new sampling was conducted. The SLERA found several chemicals of potential ecological concern present in soil and sediment in the area evaluated at concentrations that exceed ecological risk thresholds, including bioaccumulative contaminants such as mercury and PCBs. As future land use at the Plant Area Soils part of the Site is expected to be developed for commercial/industrial uses, FMC concluded that such development will eliminate ecological habitat.

EPA reviewed the SLERA and issued a response in August 2015. EPA commented that several aspects of the assessment may need to be further addressed. EPA concluded that while future use of the area is intended to be industrial/commercial, the potential for ecological risk exists if left undeveloped. The ecological risk assessment of the Plant Area Soils part of the Site had previously been delayed due to the promise of redevelopment. However, the area remains vacant and it is unclear when development will occur. In the absence of redevelopment ecological habitat has reestablished on the Former Plant Side; however the quality of this habitat has not been evaluated. EPA also noted that, even with development, it is unknown if such development would effectively mitigate the potential for unacceptable risks to ecological receptors. In order to resolve this issue and prevent re-establishment of potential habitat in the future, FMC proposed to remove the old field / wooded habitat and replace with a vegetative cover that can be easily maintained (i.e., turf grass). Due to topography, drainage requirements, and other concerns, some areas may not be easily accessible for mowing and may require an alternative cover (e.g., mulch or gravel). The PRPs are currently carrying out this work under the approved 'Former Manufacturing Area Habitat Removal Work Plan.' The anticipated completion date is Spring 2023.

The OU10 ESD set soil cleanup goals based on a very conservative residential land use for the Expanded Plant Area Soils. The previous FYR included review of post-excavation soil results for the Expanded Soils Area included in FMC's Remedial Action Report for the Plant Area Soils Component of Operable Unit 10. Soils remaining on-site after the completion of the remedial action demonstrated that the soils are protective of human health for a residential scenario. The evaluation of the soil cleanup goals in Appendix I demonstrates that the direct contact cleanup goals remain valid for most COCs.

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
OUs for which Protectiveness was not evaluated:
OU1, OU6 and OU9
OUs without Issues/Recommendations Identified in the FYR:
OU2, OU3, OU4, OU5 and OU8

Issues and Recommendations Identified in the FYR:

OU(s): OU7	**Issue Category: Institutional Controls**
	Issue: Site-related groundwater contamination is present beneath the properties west of the South Fork Shenandoah River. However, there are no groundwater use restrictions in place for privately-owned site properties in that area that overlie the groundwater plume.

	Recommendation: Implement institutional controls to prevent the installation of water wells at the privately-owned properties west of the river where pumping of water wells could potentially affect plume migration and potentially result in unacceptable human exposure to contaminated groundwater.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	3/23/2024

OU(s): OU10	**Issue Category: Changed Site Conditions**			
	Issue: Due to the delay of the planned site redevelopment, ecological habitat is reestablishing in the Plant Area. The SLERA had found several chemicals of potential ecological concern present in soil and sediment at concentrations that exceed ecological risk thresholds. If the reestablishing habitat allows foraging, cover or nesting opportunities, the potential for unacceptable ecological risk exists for exposure to soil and sediment in the former plant area.			
	Recommendation: Continue habitat / vegetation removal to replace reestablishing habitat with a vegetative cover that can be easily maintained and ensure the potential for ecological exposure is reduced. In October 2022, the PRP began habitat removal and has an anticipated completion date of Spring 2023. Following the completion of the cover installation, an O&M plan will be developed and implemented to document the steps required to maintain the cover including routine mowing, inspections, and reporting requirements. The results of the inspections will be included in the annual Site-Wide O&M report.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	3/23/2024

OTHER FINDINGS

In addition, the following recommendations were identified during the FYR. While they may reduce costs and improve management of O&M, they do not affect current and/or future protectiveness:

- *Review all detection limits currently used to analyze groundwater COC concentrations to ensure that all detection limits are as low as, or lower than, COC cleanup goals.*
- *Continue to closely monitor settlement of the NLF cap to ensure that settlement is taking place uniformly and within acceptable tolerances.*
- *Review the Site's security and make improvements where necessary to prevent and/or deter trespassers.*

VII. PROTECTIVENESS STATEMENT

Protectiveness Statement	
Operable Unit: OU2	*Protectiveness Determination:* Protective
Protectiveness Statement: The OU2 remedy is protective of human health and the environment because there are no complete exposure pathways between contaminated soil and receptors because PCB-impacted soil was excavated and disposed off-site.	

Protectiveness Statement	
Operable Unit: OU3	*Protectiveness Determination:* Protective
Protectiveness Statement: The OU3 remedy is protective of human health and the environment because the risks previously associated with the unstable acid reclaim building have been addressed via demolition of the building.	

Protectiveness Statement	
Operable Unit: OU4	*Protectiveness Determination:* Protective
Protectiveness Statement: The OU4 remedy is protective of human health and the environment because the risks previously associated with the lack of site security have been addressed.	

Protectiveness Statement	
Operable Unit: OU5	*Protectiveness Determination:* Protective
Protectiveness Statement: The OU5 remedy is protective of human health and the environment because removal of drummed wastes from the Site eliminated the potential for direct human contact and also mitigated the potential for fire, explosion and releases associated with the wastes.	

Protectiveness Statement	
Operable Unit: OU7	*Protectiveness Determination:* Short-term Protective
Protectiveness Statement: The remedy at OU7 currently protects human health and the environment in the short term because there are no complete exposure pathways between contaminated groundwater and receptors. Prior impacted residential wells users located across the river are supplied with potable water, institutional controls are in place at the Site and at most downgradient residential properties to prevent installation of new groundwater wells, and the caps over VBs 9, 10 and 11 prevent direct exposure to contaminated soil within the basins. For the remedy to be protective over the long term, institutional controls should be implemented to prevent human exposure to contaminated groundwater by preventing the installation of water wells at the privately-owned properties west of the river, where pumping of water wells could potentially affect plume migration.	

Protectiveness Statement	
Operable Unit: OU8	*Protectiveness Determination:* Protective
Protectiveness Statement: The OU8 remedy is protective of human health and the environment because there are no complete exposure pathways between contaminated soil and receptors. The UECA Environmental Covenant, Instrument 140004561, restricts land use at the areas previously referred to as Areas B and C to commercial/industrial use only.	

Protectiveness Statement

Operable Unit: OU10	*Protectiveness Determination:* Short-term Protective
Protectiveness Statement: The remedy at OU10 currently protects human health in the short term because there are no known complete exposure pathways between contaminated soil and receptors. However, a complete ecological exposure pathway associated with Plant Area Soils was identified due to the lack of significant redevelopment at the Former Plant Area of the Site. The cover systems over VBs 1-8 and the NLF prevent direct human and ecological receptor contact with VBs 1-8 and NLF soil and waste and prevent the migration of contaminants from those areas. Excavation of soil contaminated at levels above industrial/commercial cleanup goals at the former Plant Area and the Expanded Plant Area and institutional controls mitigate the risk of direct contact with impacted soil and groundwater at OU10. Ecological habitat is reestablishing due to the delayed redevelopment of the Site. For the remedy to be protective over the long term, habitat/vegetation removal at the Plant Area should be completed and an O&M plan to reduce the potential for ecological exposure should be implemented.	

Sitewide Protectiveness Statement
Protectiveness Determination: Short-term Protective
Protectiveness Statement: Because the remedial actions for all OUs are currently protective, the Site's remedy is currently protective of human health and the environment. Aside from the OU10 Plant Area, there are no known complete exposure pathways between contaminated media and receptors. For the Site remedy to be protective over the long term, the actions listed above for each OU should be implemented.

VIII. NEXT REVIEW

The next FYR Report for the Avtex Fibers, Inc. Superfund site is required five years from the completion date of this review.

APPENDIX A – REFERENCE LIST

2018 Annual Site-Wide Ground Water, Surface Water, and Sediment Monitoring Report for OU-7, OU10, and NTCRA Basins. Avtex Superfund Site, Front Royal, Virginia. Prepared by Parsons for FMC Corporation. September 14, 2020.

2019 Annual Site-Wide Ground Water, Surface Water, and Sediment Monitoring Report for OU-7, OU10, and NTCRA Basins. Avtex Superfund Site, Front Royal, Virginia. Prepared by Parsons for FMC Corporation. January 29, 2021.

2020 Annual Site-Wide Ground Water, Surface Water, and Sediment Monitoring Report for OU-7, OU10, and NTCRA Basins. Avtex Superfund Site, Front Royal, Virginia. Prepared by Parsons for FMC Corporation. September 7, 2021.

Basin Repairs Work Plan. Avtex Superfund Site, Front Royal, Virginia. Prepared by Parsons for FMC Corporation. July 2019.

Explanation of Significant Differences, Operable Unit 10, Avtex Superfund Site. U.S. Environmental Protection Agency, Region 3. January 10, 2006.

Fifth Five-Year Review Report, Avtex Fibers Superfund Site, Front Royal, Warren County, Virginia. U.S. Environmental Protection Agency, Region 3. March 23, 2018.

Final Ecological Risk Assessment, Volume I, Avtex Fibers Site, Front Royal, Virginia. U.S. Environmental Protection Agency, Region 3. February 1999.

Former Manufacturing Area Habitat Removal Work Plan. Basin Repairs Work Plan. Avtex Superfund Site, Front Royal, Virginia. Prepared by Parsons for FMC Corporation. August 2022.

Monitoring Well Repair and Abandonment Report, Avtex Fibers Superfund Site, Front Royal, Virginia. Prepared by Environmental Resources Management for FMC Corporation. May 30, 2014.

Operations, Maintenance and Monitoring Manual, Groundwater and Leachate Extraction System, Operable Unit 7, Avtex Fibers Superfund Site. Prepared by Arcadis for FMC Corporation. May 2015.

Operation & Maintenance Manual, Groundwater and Leachate Treatment Plant, Avtex Site, Front Royal, Virginia. Prepared by Parsons for FMC Corporation. May 2015.

Record of Decision, Operable Unit 1, Avtex Fibers Superfund Site, Front Royal, Warren County, Virginia. U.S. Environmental Protection Agency, Region 3. September 30, 1988.

Record of Decision, Operable Unit 2, Avtex Fibers Superfund Site, Front Royal, Warren County, Virginia. U.S. Environmental Protection Agency, Region 3. September 28, 1990.

Record of Decision, Operable Unit 8 (Areas B and C), Avtex Fibers Superfund Site, Front Royal, Warren County, Virginia. U.S. Environmental Protection Agency, Region 3. September 29, 2000.

Record of Decision, Operable Unit 10, Avtex Fibers Superfund Site, Front Royal, Warren County, Virginia. U.S. Environmental Protection Agency, Region 3. March 10, 2004.

Record of Decision, Operable Unit 7, Avtex Fibers Superfund Site, Front Royal, Warren County, Virginia. U.S. Environmental Protection Agency, Region 3. January 13, 2010.

Remedial Action Report for the Plant Area Soils Component of Operable Unit 10 for the Avtex Fibers Superfund Site, Front Royal, Virginia. Prepared by Environmental Resources Management for FMC Corporation. May 2015.

Remedial Action Report for the Viscose Basins 9-11 Cap System and Groundwater & Leachate Extraction Components of Operable Unit 7, Avtex Fibers Superfund Site, Front Royal, Virginia. Prepared by Environmental Resources Management for FMC Corporation. July 2015.

Remedial Investigation Report for the Proposed SoccerPlex Parcel, Avtex Fibers Superfund Site, Front Royal, Virginia. Prepared by Environmental Resources Management for FMC Corporation. February 2004.

Review Comments on the Screening Level Ecological Risk Assessment for Plant Area Soils, Avtex Fibers Superfund Site, Front Royal, Virginia. Comments submitted by the U.S. Environmental Protection Agency, Region 3 to FMC Corporation. August 18, 2015.

Screening Level Ecological Risk Assessment for Plant Area Soils, Avtex Fibers Superfund Site, Front Royal, Virginia. Prepared by Environmental Resources Management for FMC Corporation. December 30, 2014.

Second Explanation of Significant Differences, Operable Units 7, 8 and 10, Avtex Superfund Site, Front Royal, Virginia. U.S. Environmental Protection Agency, Region 3. January 25, 2012.

Site-Wide Post-Closure Care Operations and Maintenance (O&M) Plan, Avtex Fibers Superfund Site, Front Royal, Virginia. FMC Corporation. May 2015.

2018 Site-Wide Operations and Maintenance (O&M) Report, Avtex Fibers Superfund Site, Front Royal, Virginia. Prepared by Parsons for FMC Corporation. March 2019.

2019 Site-Wide Operations and Maintenance (O&M) Report, Avtex Fibers Superfund Site, Front Royal, Virginia. Prepared by Parsons for FMC Corporation. March 2020.

2020 Site-Wide Operations and Maintenance (O&M) Report, Avtex Fibers Superfund Site, Front Royal, Virginia. Prepared by Parsons for FMC Corporation. March 2021.

2021 Site-Wide Operations and Maintenance (O&M) Report, Avtex Fibers Superfund Site, Front Royal, Virginia. Prepared by Parsons for FMC Corporation. March 2022.

Spring 2016 OU-7 Post-Closure Stormwater Sampling Report for the Avtex Fibers Superfund Site, Front Royal, Virginia. Prepared by Parsons for FMC Corporation. February 14, 2017.

Superfund Preliminary Close-Out Report, Avtex Fibers Superfund Site, Front Royal, Warren County, Virginia. U.S. Environmental Protection Agency, Region 3. August 29, 2014.

Termination of Conservation and Environmental Protection Easement and Declaration of Restrictive Covenants. September 17, 2014.

UECA Environmental Covenants for the Avtex Fibers Superfund Site, Front Royal, Virginia. September 17, 2014.

APPENDIX B – SITE CHRONOLOGY

Table B-1: Site Chronology

Event	Date
American Viscose opened a rayon manufacturing plant at the Site	1940
American Viscose sold the plant and property to FMC	1963
FMC sold the plant and property to Avtex	1976
The Commonwealth of Virginia detected carbon disulfide in domestic water supply wells in the subdivisions across the South Fork Shenandoah River from the Site.	1982
Avtex purchased 23 residential properties west of the river and started providing water to impacted residences in that area	1983-1984
EPA proposed the Site for listing on the NPL	October 15, 1984
An electric transformer exploded on-site, resulting in a release of PCBs	1985
EPA added the Site to the NPL	June 10, 1986
EPA entered a Consent Decree with Avtex to perform an RI/FS to investigate the impacts of the VBs on groundwater	August 11, 1986
Avtex initiated the Site's initial RI/FS	August 13, 1986
EPA amended the Consent Decree to include FMC as a PRP	January 6, 1988
Avtex completed the Site's initial RI/FS	August 27, 1988
EPA issued the OU1 ROD to address groundwater impacts associated with the VBs	September 30, 1988
Sampling conducted by the Virginia State Water Control Board identified PCBs in site soil and in fish tissue samples collected from the Shenandoah River.	1989
Virginia Department of Health issued an advisory against fish consumption in parts of the Shenandoah River, including the South Fork Shenandoah River adjacent to the Site	May 12, 1989
EPA issued a Unilateral Administrative Order to Avtex and FMC to implement the OU1 remedy	June 30, 1989
Virginia Department of Waste Management requested that EPA conduct a removal assessment at the Site	September 20, 1989
EPA issued a Unilateral Administrative Order to Avtex to perform a removal action to address drummed and other site-related waste and site security	October 31, 1989
Virginia Water Control Board revoked Avtex's NPDES permit and Avtex ceased operations on-site	November 10, 1989
EPA initiated the Site's first removal action, which included establishing site security, design and operation of a wastewater treatment system, and management and treatment or disposal of several types of on-site wastes	November 11, 1989
Avtex Fibers, Inc. and Avtex Fibers – Front Royal filed for Chapter XI bankruptcy	February 6, 1990
EPA signed the OU2 ROD. Following signature of the OU2 ROD, EPA redefined site OUs to facilitate project management, site characterization and remedial action. The OU2 ROD established OU2 to address PCB-impacted soil, OU3 to address demolition of the acid reclaim building, OU4 to address site security and OU5 to address drum removal.	September 28, 1990
EPA initiated OU2 (site stabilization and PCB-impacted soil) and OU3 (demolition of the acid reclaim building) remedial action	March 4, 1991
EPA initiated OU4 remedial action (site security)	July 22, 1991
EPA issued a Unilateral Administrative Order to FMC to provide water to residents of the subdivision, west of the river	October 22, 1991
EPA completed OU2 remedial action (cleanup of PCB-impacted soil)	January 22, 1992

Event	Date
EPA and FMC signed a Consent Order that required FMC to complete parts of a sitewide RI (EPA would complete the rest of the RI) Both parties initiated the sitewide RI	March 30, 1993
FMC completed OU5 remedial action (drums)	August 5, 1993
EPA completed the OU3 remedial action	September 23, 1993
FMC and EPA completed the sitewide RI	August 1, 1994
EPA completed OU5 remedial action	September 30, 1994
EPA initiated FS for OU8	June 19, 1995
EPA initiated a TCRA to address site buildings	September 20, 1996
EPA completed the Site's first FYR	November 18, 1996
EPA initiated FS for OU10	June 26, 1997
EPA completed the TCRA to address site buildings	September 1998
EPA completed the Site's Final Ecological Risk Assessment	February 1999
FMC entered into a Consent Decree with EPA to perform additional time-critical removal activities to address site buildings, a NTCRA to address site basins and a NTCRA to address buildings and sewers. The Consent Decree also required that FMC implement the OU7 and OU10 remedies following remedy selection.	July 9, 1999
FMC took over responsibility for site security, control, maintenance and halt and safety measures at the Site, in accordance with the Consent Decree.	October 21, 1999
Avtex Bankruptcy Plan of Reorganization became effective. The Industrial Development Authority of the Town of Front Royal and Warren County, doing business as the Economic Development Authority (EDA) took title to the Site property	November 1999
Stakeholders filed the Conservation Easement to enforce land use restrictions at the Site	December 7, 1999
FMC initiated the OU7 FS	2000
FMC initiated the NTCRA – Buildings and Sewers work	January 2000
EPA signed a removal action memorandum, selecting a NTCRA to address the Site basins (NTRA – Basins)	January 31, 2000
EPA provided the EDA, Town of Front Royal and Warren County with a prospective purchaser agreement and EDA purchased the Site property from the Avtex Bankruptcy Trustee	March 20, 2000
FMC completed the OU8 FS	June 2000
EPA signed the OU8 ROD (institutional controls to restrict land use at Areas B and C to commercial/industrial use)	September 29, 2000
FMC began work to close the on-site basins (NTCRA – Basins)	May 17, 2001
EPA signed a removal action memorandum, selecting NTCRA to address remaining site buildings and sewers (NTCRA – Buildings)	December 2001
FMC completed OU4 remedial action	September 19, 2002
EPA completed the second FYR	March 28, 2003
FMC completed the OU10 FS	July 25, 2003
EPA signed the OU10 ROD (VBs 1-8, the WWTP, the NLF and Plant Area Soils)	March 10, 2004
FMC began OU10 remedial design	May 24, 2004
EPA modified the OU10 remedy in an ESD to expand the Plant Area Soils to include additional areas of concern	January 10, 2006
The Site's first redevelopment project, the Skyline SoccerPlex, opened on-site	September 9, 2006
FMC completed OU10 remedial design and began OU10 remedial action	January 22, 2008
EPA completed the third FYR	March 26, 2008
FMC completed the OU7 FS	July 30, 2009
EPA signed the OU7 ROD (VBs 9-11, groundwater and surface water)	January 13, 2010
FMC started OU7 remedial design	March 15, 2010

Event	Date
FMC completed OU7 remedial design and began OU7 remedial action	October 7, 2011
EPA modified the OU7, OU8 and OU10 remedies with an ESD. The modified remedy replaced the existing Conservation Easement with multiple Environmental Covenants to address multiple property owners and land uses	January 25, 2012
FMC started construction of the OU7 GLTP	July 23, 2012
EPA completed the fourth FYR	March 26, 2013
EPA, VA DEQ and FMC conducted a pre-final construction completion inspection	July 1, 2014
FMC completed remedy construction and EPA issued the Site's Preliminary Close Out Report	August 29, 2014
Site property owners and stakeholders filed five individual UECA Environmental Covenants and a Termination of Conservation and Environmental Protection Easement and Declaration of Restrictive Covenants with the Warren County Clerk's Office	September 17, 2014
FMC completed the Screening Level Ecological Risk Assessment for Plant Area Soils	December 30, 2014
FMC completed the volumes of the Sitewide Post-Closure Care Operations and Maintenance Plans	May 8, 2015
FMC completed the "Remedial Action Report for the Plant Area Soils Component of Operable Unit 10 for the Avtex Fibers Superfund Site"	May 14, 2015
EPA provided FMC with review comments of the 2014 Screening Level Ecological Risk Assessment for Plant Area Soils	August 18, 2015
FMC completed OU10 remedial action; EPA approved FMC's Remedial Action Report for Viscose Basins 1-8, and New Landfill Component of Operable Unit 10; site entered O&M phase	September 1, 2015
FMC completed OU7 remedial action and NTCRA - Basins; EPA approved FMC's Construction Completion Report for the Viscose Basins 9-11 Cap System and Groundwater & Leachate Extraction Components of OU7, Construction Completion Report Remedial Action Groundwater and Leachate Treatment Plant (GLTP) Component of OU7 and FMC's removal action report and certification of completion for the NTCRA – Basins	September 29, 2015
FMC completed GLTP commissioning activities	December 2015
EPA approved FMC's removal action report and certification of completion for the NTCRA – Buildings	December 30, 2015
EPA Completed the fifth 5YR	March 23, 2018
FMC completed the Basin Repair Work Plan and carried out the repair activities	July 2019
FMC finalized the Institutional Control Implementation and Assurance Plan	July 2019
EPA approved FMC's request to remove the (2) GLTP MPS units and install a bypass pipe	June 23, 2021
FMC completed an updated Sitewide QAPP	February 8, 2022
EPA, FMC, Parsons, VADEQ attend 6th 5YR site visit / inspection	October 12, 2022
EPA approved FMC's request to remove recovery well TW-03 from routine groundwater extraction	October 13, 2022
FMC / Parsons began habitat removal work to mitigate unacceptable ecological risk at the Former Manufacturing Area	November 2022

APPENDIX C – CLEANUP GOALS FOR OU2, OU7 AND OU10 MEDIA

Table C-1: OU2 Soil Remedial Goal – Total PCBs

COC	Soil Remedial Goal[a] (mg/kg)
PCBs, total	10

Notes:
[a] Soil cleanup goal established by the OU2 ROD.
mg/kg = milligrams per kilogram

Table C-2: OU7 Groundwater Cleanup Goals

COC	ROD Cleanup Goal [a]	
	MCL/non-zero MCLG (µg/L)	Risk-Based Cleanup Goal[b] (µg/L)
Volatile Organics		
acetone		22,000
carbon disulfide		1,000
Semi-volatile Organics		
2-methylphenol (o-cresol)		1,800
4-methylphenol (p-cresol)		180
bis(2-ethylhexyl) phthalate	6	
naphthalene		14
pentachlorophenol	1	
phenol		11,000
Metals		
aluminum		37,000
antimony	6	
arsenic	10	
cadmium	5	
chromium	100	
cobalt		11
cyanide, free	200	
iron		26,000
lead	15	
manganese		880
mercury	2	
nickel		730
vanadium		260
zinc		11,000

Notes:

a. Groundwater cleanup goals are from Table 7 of the OU7 ROD. The OU7 ROD states that the remediation of groundwater at the Site will continue until the respective maximum contaminant levels (MCLs) for the contaminants of concern (COCs) are attained and the excessive cancer risk associated with potential residential use of the groundwater is reduced to one in 10,000 (1×10^{-4}) and the hazard index is reduced to 1 for each specific organ.

b. EPA Region 3 risk-based tap water standards presented at cancer/hazard target benchmarks of 1×10^{-4} for carcinogens and 1 for noncarcinogens.

µg/L = micrograms per liter
MCLG = maximum contaminant level goal

Table C-3: OU7 Soil Cleanup Goals

COC	Human Health (HH) Direct Contact Standard[a,b] (1×10^{-6} Risk and HQ=0.1) (mg/kg)	HH Direct Contact Standard[a,b] (1×10^{-5} Risk and HQ=1) (mg/kg)	Ecologically Protective Soil Values[a,,e] (mg/kg)	Groundwater Protection Standards[a,d] (mg/L)
Volatile Organic Compounds (VOCs)				
carbon disulfide	378	3,780	NV	1
ethylbenzene	NV	NV	0.05	NV
styrene	NV	NV	0.1	NV
toluene	NV	NV	0.05	NV
xylenes (total)	NV	NV	0.05	NV
Semi-volatile Organic Compounds (SVOCs)				
acenaphthene	NV	NV	20	NV
anthracene	NV	NV	0.1	NV
benzo(a)anthracene	7.8	78	NV	0.000029
benzo(a)pyrene	0.78	7.8	0.1	0.0002
benzo(b)fluoranthene	7.8	78	NV	0.000029
benzo(k)fluoranthene	78.4	784	NV	0.00029
dibenz(a,h)anthracene	0.78	7.8	NV	0.0000029
fluoranthene	NV	NV	0.1	NV
fluorene	NV	NV	30	NV
indeno(1,2,3-cd)pyrene	7.8	78.4	NV	0.000029
naphthalene	18	180	0.1	0.00014
phenanthrene	NV	NV	0.1	NV
pyrene	NV	NV	0.1	NV
PAHs, high molecular weight	NV	NV	11	NV
PAHs, low molecular weight	NV	NV	29	NV
PAHs, total	NV	NV	1.0	NV
Polychlorinated Biphenyls (PCBs)				
PCBs, total	NV	NV	0.371	NV
Metals				
aluminum	NV	NV	20,200[c]	NV
antimony	81.8	818	2.7	0.006
arsenic	3.8	38	18	0.01
barium	NV	NV	330	NV
cadmium	NV	NV	3.6	NV
chromium (as Cr^{+3})	NV	NV	260	NV
cobalt	60	603	13	0.011
copper	8,180	81,800	70	1.3
iron	143,000	1,430,000	31,700[c]	26
Lead[b]	800	800	110	0.015
manganese	NV	NV	441[c]	NV
Mercury (as methyl)	61	613	0.14[c]	0.002
nickel	NV	NV	38	NV
selenium	1,020	10,200	0.52	0.05
silver	NV	NV	42	NV
vanadium	1,030	10,300	78	0.18

COC	Human Health (HH) Direct Contact Standard[a,b] (1×10^{-6} Risk and HQ=0.1) (mg/kg)	HH Direct Contact Standard[a,b] (1×10^{-5} Risk and HQ=1) (mg/kg)	Ecologically Protective Soil Values[a,,e] (mg/kg)	Groundwater Protection Standards[a,d] (mg/L)
zinc	61,300	613,000	233	11
pH	NV	NV	5.5 standard units[e]	NV

Notes:

a. Standards listed in Table 2 of the Site's 2015 OU7 Remedial Action Report for the Viscose Basins 9-11 Cap System and Groundwater & Leachate Extraction Components of Operable Unit 7.

b. Per the OU7 ROD, the direct contact standards are based on a total excess cancer risk of 1×10^{-5} and target organ-specific HQ of 1. Direct contact standards are calculated according to procedures detailed in the EPA Risk Assessment Users Guide (May 2010) for potential indoor worker exposure to industrial soil (soil ingestion = 50 mg/day). According to the Users Guide, the indoor worker scenario includes ingestion of soil and inhalation of volatiles/particulate released from soil. The default lead direct contact exposure standard is 800 mg/kg based on typical commercial/industrial exposure. Chromium direct contact exposure standard based on Cr^{+3}.

c. EPA Region 3 Ecologically Protective Backfill Values as listed in Table 11 of the 2010 OU7 ROD, as modified by EPA in the letter to FMC dated March 10, 2010.

d. The soil cleanup standards for groundwater protection are based on the non-zero MCLGs. In the absence of a non-zero MCLG, the MCL is used as the groundwater protection standard, when available. If neither a non-zero MCLG or MCL have been established for a compound, the groundwater protection standard is based on the EPA Region 3 risk-based concentrations (RBCs) for tap water. To determine compliance with the groundwater protection soil standards, soil samples would be collected and analyzed by the Synthetic Precipitation Leaching Procedure (SPLP) to determine the concentration of a contaminant that could be leached from the soil into pore water. The SPLP concentration would be divided by a dilution attenuation factor of 10. Remediation would be required when the SPLP concentration divided by 10 exceeds the groundwater protection soil standard.

e. The 2012 ESD also added an additional OU7 soil performance standard to address the acidic nature of site soil. The ESD requires that the upper 6 inches of cover soil in remediated areas be amended as needed to achieve a pH of no less than 5.5 prior to seeding/replanting.

HQ = Hazard quotient
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
NV = no value available

Table C-4: OU10 Soil Cleanup Goals for Direct Contact and Groundwater Protection

COC	HH Direct Contact Standard[a,b] (1×10^{-6} Risk and HQ=0.1) (mg/kg)	HH Direct Contact Standard[a,b] (1×10^{-5} Risk and HQ=1) (mg/kg)	Groundwater Protection Standards[a,c] (mg/L)
Volatile Organic Compounds (VOCs)			
1,1,2,2-tetrachloroethane	29	290	0.000053
1,1,1-trichloroethane	57,000	570,000	0.2
1,1,2-trichloroethane	100	1,000	0.003
1,1-dichloroethane	20,000	200,000	0.8
1,1-dichloroethene	10,000	100,000	0.007
1,2-dibromo-3-chloropropane	4.1	41	0.0002
1,2-dibromoethane	0.068	0.68	0.00000075
1,2-dichloroethane	63	630	0.005
1,2-dichlorobenzene	18,000	180,000	0.6
1,2,4-trichlorobenzene	2,000	20,000	0.07
1,3-dichlorobenzene	6,100	61,000	0.18
1,4-dichlorobenzene	240	2,400	0.075
1,2-dichloropropane	84	840	0.005
2-butanone (MEK)	120,000	1,200,000	1.9
2-hexanone	8,200	82,000	1.5
4-methyl-2-pentanone (MIBK)	16,000	160,000	2
acetone	20,000	200,000	0.61
benzene	100	1,000	0.005
bromochloromethane	NV	NV	NV
bromodichloromethane	92	920	0.08
bromoform	720	7,200	0.08
bromomethane	280	2,800	0.0085
carbon disulfide	20,000	200,000	1
carbon tetrachloride	44	440	0.005
chlorobenzene	4,100	41,000	0.1
chloroethane	2,000	20,000	0.0036
chloroform	2,000	20,000	0.08
chloromethane	NV[d]	NV[d]	0.19
cis-1,2-dichloroethene	2,000	20,000	0.07
cis-1,3-dichloropropene[e]	57	570	0.00044
dibromochloromethane	68	680	0.06
ethylbenzene	20,000	200,000	0.7
methylene chloride	760	7,600	0.005
styrene	41,000	410,000	0.1
tetrachloroethene	280	2,800	0.005
toluene	41,000	410,000	1
trans-1,2-dichloroethene	4,100	41,000	0.1
trans-1,3-dichloropropene[e]	57	570	0.0004
trichloroethene	14	140	0.005
vinyl chloride	7.9	79	0.002
xylenes (total)	41,000	410,000	10
Semi-volatile Organic Compounds (SVOCs)			

COC	HH Direct Contact Standard[a,b] (1×10^{-6} Risk and HQ=0.1) (mg/kg)	HH Direct Contact Standard[a,b] (1×10^{-5} Risk and HQ=1) (mg/kg)	Groundwater Protection Standards[a,c] (mg/L)
1,2-diphenylhydrazine	7.2	72	0.000084
2,2'-oxybis(1-chloropropane)	NV	NV	NV
2,4,5-trichlorophenol	20,000	200,000	3.7
2,4,6-trichlorophenol	520	5,200	0.0061
2,4-dichlorophenol	610	6,100	0.11
2,4-dimethylphenol	4,100	41,000	0.73
2,4-dinitrophenol	410	4,100	0.073
2,4-dinitrotoluene	410	4,100	0.073
2,6-dinitrotoluene	200	2,000	0.037
2-chloronaphthalene	16,000	160,000	0.49
2-chlorophenol	1,000	10,000	0.03
2-methylnaphthalene	4,100	41,000	0.12
2,4-dichloroaniline	NV	NV	NV
2-nitrophenol	NV	NV	NV
3,3'-dichlorobenzidine	13	130	0.00015
3-nitroaniline[f]	61/286	613/2,860	0.0033
4,6-dinitro-2-methylphenol	20	200	0.0037
4-bromophenyl phenyl ether	NV	NV	
4-chloroaniline	820	8,200	0.15
4-chlorophenyl phenyl ether	NV	NV	
4-nitroaniline	290	2,900	0.0033
4-nitrophenol	1,600	16,000	0.29
acenaphthene	12,000	120,000	0.37
acenaphthylene	NV	NV	
anthracene	61,000	610,000	1.8
benzidine	0.025	0.25	0.00000029
benzo(a)anthracene	7.8	78	0.000092
benzo(a)pyrene	0.78	7.8	0.0002
benzo(b)fluoranthene	7.8	78	0.000092
benzo(g,h,i)perylene	NV	NV	NV
benzo(k)fluoranthene	78	780	0.00092
bis(2-chloroethoxy)methane	NV	NV	NV
bis(2-chloroethyl)ether	5.2	52	0.0000096
bis(2-chloroisopropyl ether)	82	820	0.00026
bis(2-ethylhexyl)phthalate	410	4,100	0.006
butylbenzyl phthalate	41,000	410,000	7.3
carbazole	290	2,900	0.0033
p-chloro-m-cresol	NV	NV	NV
chrysene	780	7,800	0.0092
di-n-butylphthalate	20,000	200,000	3.7
di-n-octyl phthalate	4,100	41,000	0.73
dibenzo(a,h)anthracene	0.78	7.8	0.0000092
dibenzofuran	400	4,000	0.012
diethylphthalate	160,000	1,600,000	29

COC	HH Direct Contact Standard[a,b] (1×10^{-6} Risk and HQ=0.1) (mg/kg)	HH Direct Contact Standard[a,b] (1×10^{-5} Risk and HQ=1) (mg/kg)	Groundwater Protection Standards[a,c] (mg/L)
dimethyl phthalate	2,000,000	20,000,000	370
fluoranthene	8,200	82,000	1.5
fluorene	8,200	82,000	0.24
hexachlorobenzene	3.6	36	0.001
hexachlorobutadiene[f]	40.9/73.4	409/734	0.00086
hexachlorocyclopentadiene	1,200	12,000	0.05
hexachloroethane[f]	204/409	2,044/4,088	0.0048
indeno(1,2,3-cd)pyrene	7.8	78	0.000092
isophorone	6,000	60,000	0.07
n-nitrosodiphenylamine	1,200	12,000	0.014
n-nitrosodipropylamine	0.82	8	0.0000096
naphthalene	4,100	41,000	0.0065
nitrobenzene	100	1,000	0.0035
p-chloro-m-cresol	NV	NV	NV
p-(dimethylamino)azobenzene	NV	NV	NV
pentachlorobenzene	160	1,600	0.029
pentachlorophenol	48	480	0.001
phenanthrene	NV	NV	NV
o-cresol/2-methylphenol	10,000	100,000	1.8
p-cresol/4-methylphenol	1,000	10,000	0.18
phenol	61,000	610,000	11
pyrene	6,100	61,000	0.18
Metals			
aluminum	200,00	2,000,000	37
antimony	82	820	0.006
arsenic	3.8	38	0.01
barium	14,000	140,000	2
beryllium	410	4,100	0.004
cadmium	200	2,000	0.005
calcium	NV	NV	NV
chromium	610	6,100	0.1
cobalt	4,100	41,000	0.73
copper	8,200	82,000	1.3
iron	61,000	610,000	11
lead	1,000[g]	1,000[g]	0.015
magnesium	NV	NV	NV
manganese	4,100	41,000	0.73
mercury[h]	20	200	0.002
nickel	4,100	41,000	0.73
potassium	NV	NV	NV
selenium	1,000	10,000	0.05
silver	1,000	10,000	0.18
sodium	NV	NV	NV
thallium	14.4	144	0.0005

COC	HH Direct Contact Standard[a,b] (1×10^{-6} Risk and HQ=0.1) (mg/kg)	HH Direct Contact Standard[a,b] (1×10^{-5} Risk and HQ=1) (mg/kg)	Groundwater Protection Standards[a,c] (mg/L)
vanadium	1,400	14,000	0.26
zinc	61,000	610,000	11
cyanide, free	4,100	41,000	0.2
Polychlorinated Biphenyls (PCBs)			
Arochlor 1016	14.3/81.8[f,i]	NA[i]	0.0005
Arochlor 1221	2.9[i]	NA[i]	0.0005
Arochlor 1232	2.9[i]	NA[i]	0.0005
Arochlor 1242	2.9[i]	NA[i]	0.0005
Arochlor 1248	2.9[i]	NA[i]	0.0005
Arochlor 1254	2.9[i]	NA[i]	0.0005
Arochlor 1260	2.9[i]	NA[i]	0.0005
Total PCBs	NA	25[j]	0.0005

Notes:

a. Standards as presented in Table 1 of the Site's 2004 OU10 ROD. The OU10 ROD established soil cleanup standards for direct contact (soils 0 to 10 feet) and groundwater protection (entire depth of soil to the water table).

b. The direct contact cleanup goals based on 1×10^{-5} risk level for carcinogens and a HQ of 1 for non-carcinogens are applicable if it can be demonstrated that there are no more than 10 carcinogens present in excess of the 1×10^{-6} risk level, and that none of the noncarcinogens exceeding an HQ of 0.1 have the same target organ. If more than 10 carcinogens are present in excess of the 1×10^{-6} risk level, the direct contact cleanup goals will be the levels identified for a 1×10^{-6} excess cancer risk. The cumulative risks for noncarcinogens that have the same target organ must not exceed a HQ of 1; therefore, the direct contact cleanup goals for noncarcinogens having the same target organ will be the levels identified for a HQ of 0.1. The direct contact standards are calculated according to procedures utilized in the EPA Region 3 Risk-based Concentration Table (April 25, 2003 version with June 17, 2003 update) for industrial soil, except an indoor worker exposure scenario (soil ingestion = 50 mg/day) was used instead of the outdoor worker exposure (soil ingestion = 100 mg/day). The default lead direct contact exposure standard is 1,000 mg/kg based on typical commercial/industrial exposure. Chromium direct contact exposure based on Cr^{+6}.

c. The soil cleanup standards for groundwater protection are based on the non-zero MCLGs. In the absence of a non-zero MCLG, the MCL is used as the groundwater protection standard, when available. If neither a non-zero MCLG or MCL have been established for a compound, the groundwater protection standard is based on the EPA Region 3 risk-based concentrations (RBCs) for tap water. To determine compliance with the groundwater protection soil standards, soil samples would be collected and analyzed by the Synthetic Precipitation Leaching Procedure (SPLP) to determine the concentration of a contaminant that could be leached from the soil into pore water. The SPLP concentration would be divided by a dilution attenuation factor of 10. Remediation would be required when the SPLP concentration divided by 10 exceeds the groundwater protection soil standard.

d. EPA Region 3 removed the direct contact standard for chloromethane in the April 2003 update of the RBCs.

e. 1,3-Dichloropropene standard used.

f. 3-Nitroaniline, hexachloroethane, hexachlorobutadiene and Arochlor 1016 are listed as carcinogens; however, the noncarcinogenic standards at an HQ=0.1 and

COC	HH Direct Contact Standard[a,b] (1×10^{-6} Risk and HQ=0.1) (mg/kg)	HH Direct Contact Standard[a,b] (1×10^{-5} Risk and HQ=1) (mg/kg)	Groundwater Protection Standards[a,c] (mg/L)

an HQ=1.0 are less than the carcinogenic standards at 1×10^{-6} and 1×10^{-5}, respectively. Both carcinogenic and noncarcinogenic standards are shown.

g. The soil cleanup level for lead of 1,000 mg/kg is the only value used and is irrespective of the HQ.

h. Methylmercury direct contact standard used as default standard for mercury.

i. The 1×10^{-6} Arochlor-specific direct contact cleanup standards for PCBs will only be used to determine if there are more than 10 carcinogens present that exceed the 1×10^{-6} risk level direct contact cleanup standards. If more than 10 carcinogens exceed 1×10^{-6} risk level standards, then the non-PCB carcinogens will be compared to their respective 1×10^{-6} risk level direct contact cleanup standards and the total PCB concentration will be compared to the 25 mg/kg direct contact cleanup standard. If 10 or fewer carcinogens are present that exceed the 1×10^{-6} risk level direct contact cleanup standards, the non-PCB carcinogens will be compared to their respective 1×10^{-5} risk level direct contact standards and the total PCB concentration will be compared to the 25 mg/kg direct contact cleanup standard. A soil direct contact cleanup standard for the 1×10^{-5} cancer risk level in not applicable (NA) for PCBs for use at OU10.

j. The OU10 direct contact soil cleanup standard for total PCBs is 25 mg/kg. This cleanup standard is risk-based and consistent with the substantive standards of 40 CFR, § 761.61(c). While none of the cleanup levels found in 40 CFR § 761.61 are applicable to CERCLA cleanups, EPA determined that the risk-based cleanup approach found in 40 CFR, § 761.61(c) is relevant and appropriate to this cleanup, and that the 25 mg/kg total PCB cleanup level will not pose an unreasonable risk of injury to health or the environment. EPA also notes that this level is consistent with EPA's "Guidance on Remedial Actions for Superfund Sites with PCB Contamination," EPA 540 G-90-007, August 1990, page 27, Table 3-1.

HQ = Hazard quotient
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
NV = no value available

Table C-5: OU10 Expanded Plant Area Soils - Soil Cleanup Standards for Direct Contact and Groundwater Protection

COC	HH Direct Contact Standard[a,b] (1×10^{-6} Risk and HQ=0.1) (mg/kg)	HH Direct Contact Standard[a,b] (1×10^{-5} Risk and HQ=1) (mg/kg)	Groundwater Protection Standards[a,c] (mg/L)
Volatile Organic Compounds (VOCs)			
1,1,2,2-tetrachloroethane	3.2	32	0.000053
1,1,1-trichloroethane	2,200	22,000	0.2
1,1,2-trichloroethane	1.1	11	0.003
1,1-dichloroethane	1,600	16,000	0.8
1,1-dichloroethene	390	3,900	0.007
1,2-dibromo-3-chloropropane	0.46	4.6	0.0002
1,2-dibromoethane	0.32	3.2	0.00000075
1,2-dichloroethane	7	70	0.005
1,2-dichlorobenzene	700	7,000	0.6
1,2,4-trichlorobenzene	78	780	0.07
1,3-dichlorobenzene	23	230	0.18
1,4-dichlorobenzene	27	270	0.075
1,2-dichloropropane	9.4	94	0.005
2-butanone (MEK)	4,700	47,000	1.9
2-hexanone	313	3,130	1.5
4-methyl-2-pentanone (MIBK)	NV	NV	NV
acetone	7,000	70,000	0.61
benzene	12	120	0.005
bromochloromethane	NV	NV	NV
bromodichloromethane	10	100	0.08
bromoform	81	810	0.08
bromomethane	11	110	0.0085
carbon disulfide	780	7,800	1
carbon tetrachloride	4.9	49	0.005
chlorobenzene	160	1,600	0.1
chloroethane	220	2,200	0.0036
chloroform	78	780	0.08
chloromethane	NV[d]	NV[d]	0.19
cis-1,2-dichloroethene	78.2	782	0.07
cis-1,3-dichloropropene[e]	6.4	64	0.00044
dibromochloromethane	7.6	76	0.06
ethylbenzene	780	7,800	0.7
methylene chloride	85	850	0.005
styrene	1,600	16,000	0.1
tetrachloroethene	1.2	12	0.005
toluene	630	6,300	1
trans-1,2-dichloroethene	160	1,600	0.1
trans-1,3-dichloropropene[e]	6.4	64	0.0004
trichloroethene	1.6	16	0.005
vinyl chloride	0.09	0.9	0.002
xylenes (total)	1,600	16,000	10

COC	HH Direct Contact Standard[a,b] (1×10^{-6} Risk and HQ=0.1) (mg/kg)	HH Direct Contact Standard[a,b] (1×10^{-5} Risk and HQ=1) (mg/kg)	Groundwater Protection Standards[a,c] (mg/L)
Semi-volatile Organic Compounds (SVOCs)			
1,2-diphenylhydrazine	0.8	8.0	0.000084
2,2'oxybis(1-chloropropane)	NV	NV	NV
2,4,5-trichlorophenol	780	7,800	3.7
2,4,6-trichlorophenol	58	580	0.0061
2,4-dichlorophenol	23	230	0.11
2,4-dimethylphenol	160	1,600	0.73
2,4-dinitrophenol	16	160	0.073
2,4-dinitrotoluene	16	160	0.073
2,6-dinitrotoluene	7.8	78	0.037
2-chloronaphthalene	630	6,300	0.49
2-chlorophenol	39	390	0.03
2-methylnaphthalene	31	310	0.12
2-nitroaniline	NV	NV	NV
2-nitrophenol	NV	NV	NV
3,3'-dichlorobenzidine	1.4	14	0.00015
3-nitroaniline	2.3	23	0.0033
4,6-dinitro-2-methylphenol	0.78	7.8	0.0037
4-bromophenyl phenyl ether	NV	NV	NV
4-chloroaniline	31	310	0.15
4-chlorophenyl phenyl ether	NV	NV	NV
4-nitroaniline[f]	23.5/32	235/320	0.0033
4-nitrophenol	62.6	626	0.29
acenaphthene	470	4,700	0.37
acenaphthylene	NV	NV	NV
anthracene	2,300	23,000	1.8
benzidine	0.0028	0.028	0.00000029
benzo(a)anthracene	0.87	8.7	0.000092
benzo(a)pyrene	0.087	0.97	0.0002
benzo(b)fluoranthene	0.87	8.7	0.000092
benzo(g,h,i)perylene	NV	NV	NV
benzo(k)fluoranthene	8.7	87	0.00092
bis(2-chloroethoxy)methane	NV	NV	NV
bis(2-chloroethyl)ether	0.58	5.8	0.0000096
bis(2-chloroisopropyl ether)	9.1	91	0.00026
bis(2-ethylhexyl)phthalate	46	460	0.006
butylbenzyl phthalate	340	3,400	7.3
carbazole	32	320	0.0033
p-chloro-m-cresol	NV	NV	NV
chrysene	87	870	0.0092
di-n-butylphthalate	780	7,800	3.7
di-n-octylphthalate	313	3,130	0.73
dibenz(a,h)anthracene	0.087	0.87	0.0000092
dibenzofuran	15.6	156	0.012

COC	HH Direct Contact Standard[a,b] (1×10^{-6} Risk and HQ=0.1) (mg/kg)	HH Direct Contact Standard[a,b] (1×10^{-5} Risk and HQ=1) (mg/kg)	Groundwater Protection Standards[a,c] (mg/L)
diethyl phthalate	6,300	63,000	29
dimethyl phthalate	78,200	782,000	370
fluoranthene	310	3,100	1.5
fluorene	310	3,100	0.24
hexachlorobenzene	0.4	4.0	0.001
hexachlorobutadiene[f]	1.56/8.2	15.6/82	0.00086
hexachlorocyclopentadiene	47	470	0.05
hexachloroethane[f]	7.8/46	78/460	0.0048
indeno(1,2,3-cd)pyrene	0.87	8.7	0.000092
isophorone	670	6,700	0.07
n-nitrosodiphenylamine	130	1,300	0.014
n-nitrosodipropylamine	0.091	0.91	0.0000096
naphthalene	160	1,600	0.0065
nitrobenzene	3.9	39	0.0035
p-chloro-m-cresol	NV	NV	NV
p-(dimethylamino)azobenzene	NV	NV	NV
pentachlorobenzene	6.3	63	0.029
pentachlorophenol	2.5	25	0.001
phenanthrene	NV	NV	NV
o-cresol/2-methylphenol	390	3,900	1.8
p-cresol/4-methylphenol	39	390	0.18
phenol	2,300	23,000	11
pyrene	230	2,300	0.18
Metals			
aluminum	7,820	78,200	37
antimony	3.1	31	0.006
arsenic	15.9[g]	15.9[g]	0.01
barium	1,600	16,000	2
beryllium	16	160	0.004
cadmium	7.8	78	0.005
calcium	NV	NV	NV
chromium	233[g]	233[g]	0.1
cobalt	156	1,560	0.73
copper	310	3,100	1.3
iron	2,300	23,000	11
lead	400[h]	400[h]	0.015
magnesium	NV	NV	NV
manganese	2,272[g]	2,272[g]	0.73
mercury[i]	0.78	7.8	0.002
nickel	160	1,600	0.73
potassium	NV	NV	NV
selenium	39	290	0.05
silver	39	390	0.18
sodium	NV	NV	NV

COC	HH Direct Contact Standard[a,b] (1×10^{-6} Risk and HQ=0.1) (mg/kg)	HH Direct Contact Standard[a,b] (1×10^{-5} Risk and HQ=1) (mg/kg)	Groundwater Protection Standards[a,c] (mg/L)
thallium	0.55	5.5	0.0005
vanadium	184[g]	184[g]	0.26
zinc	2,300	23,000	11
cyanide, free	1,600	16,000	0.2
Polychlorinated Biphenyls (PCBs)			
Arochlor 1016	5.5/9.12[j]	NA[j]	0.0005
Arochlor 1221	0.32[j]	NA[j]	0.0005
Arochlor 1232	0.32[j]	NA[j]	0.0005
Arochlor 1242	0.32[j]	NA[j]	0.0005
Arochlor 1248	0.32[j]	NA[j]	0.0005
Arochlor 1254	0.32[j]	NA[j]	0.0005
Arochlor 1260	0.32[j]	NA[j]	0.0005
PCBs, total	NA	1[k]	0.0005

Notes:

a. Standards as presented in Table 1A of the Site's 2006 OU10 ESD. To facilitate future recreational use of the Expanded Plant Area Soils area, EPA selected risk-based soil cleanup goals based on future residential use.

b. The direct contact cleanup goals based on 1×10^{-5} risk level for carcinogens and a HQ of 1 for non-carcinogens are applicable if it can be demonstrated that there are no more than 10 carcinogens present in excess of the 1×10^{-6} risk level, and that none of the noncarcinogens exceeding an HQ of 0.1 have the same target organ. If more than 10 carcinogens are present in excess of the 1×10^{-6} risk level, the direct contact cleanup goals will be the levels identified for a 1×10^{-6} excess cancer risk. The cumulative risks for noncarcinogens that have the same target organ must not exceed a HQ of 1; therefore, the direct contact cleanup goals for noncarcinogens having the same target organ will be the levels identified for a HQ of 0.1. The direct contact standards are calculated according to procedures utilized in the EPA Region 3 Risk-based Concentration Table (October 25, 2005 version) for residential soil. The default lead direct contact exposure standard is 400 mg/kg based on typical residential exposure. Chromium direct contact exposure based on Cr^{+6}.

c. The soil cleanup standards for groundwater protection are based on the non-zero MCLGs. In the absence of a non-zero MCLG, the MCL is used as the groundwater protection standard, when available. If neither a non-zero MCLG or MCL have been established for a compound, the groundwater protection standard is based on the EPA Region 3 risk-based concentrations (RBCs) for tap water. To determine compliance with the groundwater protection soil standards, soil samples would be collected and analyzed by the Synthetic Precipitation Leaching Procedure (SPLP) to determine the concentration of a contaminant that could be leached from the soil into pore water. The SPLP concentration would be divided by a dilution attenuation factor of 10. Remediation would be required when the SPLP concentration divided by 10 exceeds the groundwater protection soil standard.

d. EPA Region 3 removed the direct contact standard for chloromethane in the April 2003 update of the RBCs.

e. 1,3-Dichloropropene standard used.

f. 4-Nitroaniline, hexachloroethane and hexachlorobutadiene are listed as carcinogens; however, the noncarcinogenic standards at an HQ=0.1 and an

COC	HH Direct Contact Standard[a,b] (1×10^{-6} Risk and HQ=0.1) (mg/kg)	HH Direct Contact Standard[a,b] (1×10^{-5} Risk and HQ=1) (mg/kg)	Groundwater Protection Standards[a,c] (mg/L)

HQ=1.0 are less than the carcinogenic standards at 1×10^{-6} and 1×10^{-5}, respectively. Both carcinogenic and noncarcinogenic standards are shown.

g. Upper Tolerance Limit calculated from the Virginia data in Boerngen and Shacklette (1981).

h. The soil cleanup level for lead of 400 mg/kg is the only value used and is irrespective of the HQ.

i. Methylmercury direct contact standard used as default standard for mercury.

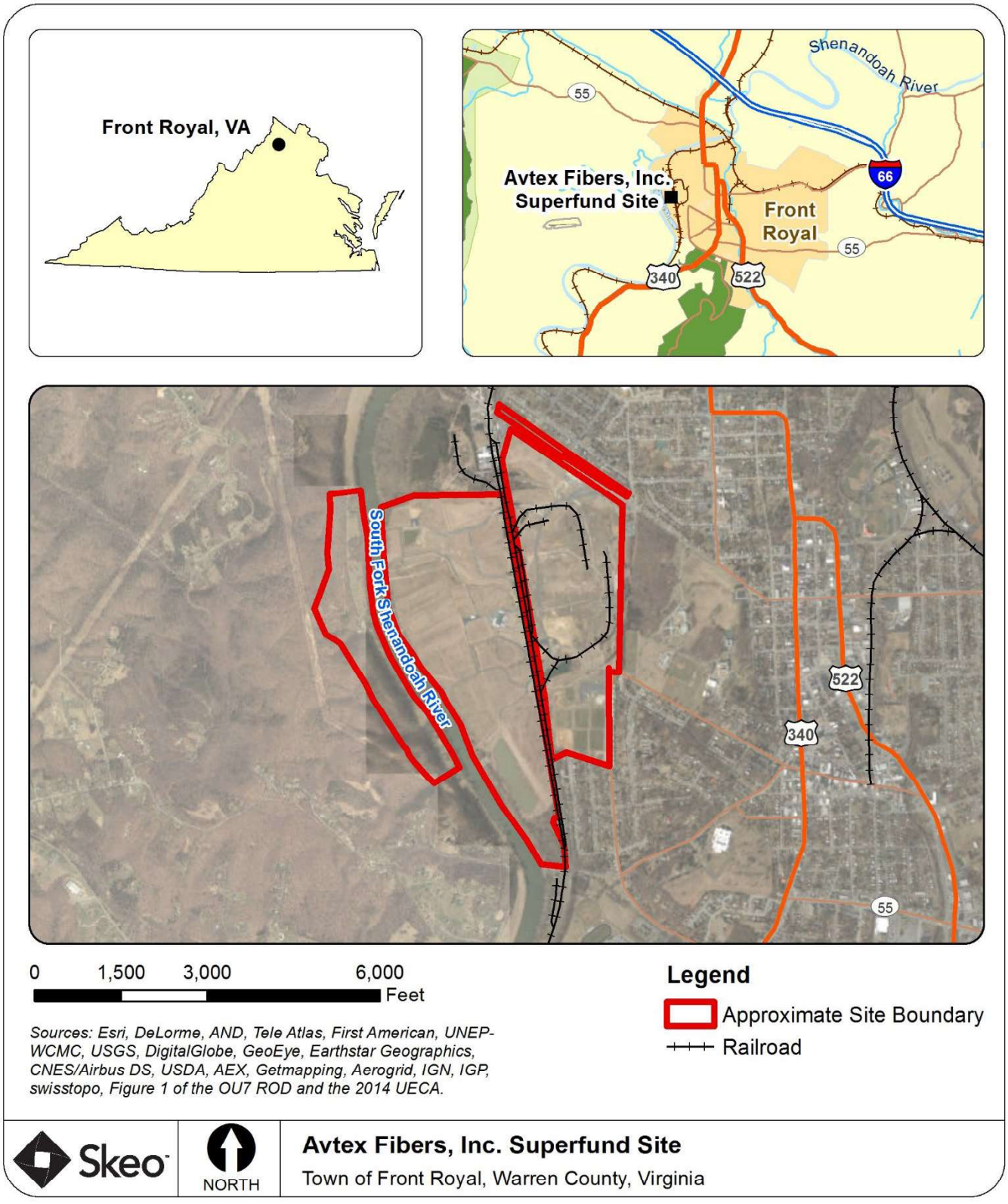
j. The 1×10^{-6} Arochlor-specific direct contact cleanup standards for PCBs will only be used to determine if there are more than 10 carcinogens present that exceed the 1×10^{-6} risk level direct contact cleanup standards. If more than 10 carcinogens exceed 1×10^{-6} risk level direct contact cleanup standards, then the non-PCB carcinogens will be compared to their respective 1×10^{-6} risk level direct contact cleanup standards and the total PCB concentration will be compared to the 1 mg/kg direct contact cleanup standard. If 10 or fewer carcinogens are present that exceed the 1×10^{-6} risk level direct contact cleanup standards, the non-PCB carcinogens will be compared to their respective 1×10^{-5} risk level direct contact standards and the total PCB concentration will be compared to the 1 mg/kg direct contact cleanup standard. A soil direct contact cleanup standard for the 1×10^{-5} cancer risk level is not applicable (NA) for PCBs for use at OU10.

k. The OU-10 direct contact soil cleanup standard for total PCBs is 1 mg/kg. This cleanup standard is risk-based and consistent with the substantive standards of 40 CFR, § 761.61(c). While none of the cleanup levels found in 40 CFR § 761.61 are applicable to CERCLA cleanups, EPA determined that the risk-based cleanup approach found in 40 CFR, § 761.61(c) is relevant and appropriate to this cleanup, and that the 1 mg/kg total PCB cleanup level will not pose an unreasonable risk of injury to health or the environment. EPA also notes that this level is consistent with EPA's "Guidance on Remedial Actions for Superfund Sites with PCB Contamination," EPA 540 G-90-007, August 1990, page 27, Table 3-1.

HQ = Hazard quotient
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
NV = no value available

APPENDIX D – SITE MAP

Figure D-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.

APPENDIX E – SITE INSPECTION CHECKLIST

FIVE-YEAR REVIEW SITE INSPECTION CHECKLIST

I. SITE INFORMATION

Site Name: Avtex Fibers, Inc.	**Date of Inspection: 10/12/2022**
Location and Region: Front Royal, Virginia 3	**EPA ID: VAD070358684**
Agency, Office or Company Leading the Five-Year Review: EPA Region 3	**Weather/Temperature: Sunny and 70 degrees**

Remedy Includes: (Check all that apply)

- ☒ Landfill cover/containment
- ☒ Access controls
- ☒ Institutional controls
- ☒ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☒ Other: Leachate extraction and treatment
- ☐ 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** — Adam Pugh (Name) | Superintendent (Title) | 11/29/2022 (Date)
   Interviewed ☐ at site ☐ at office ☒ by phone : _____
   Problems, suggestions ☐ Report attached:

2. **O&M Staff** — Anne Burnham & Nick Loizos (Name) | Senior Scientists (Title) | 11/29/2022 (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 VADEQ
   Contact Cortney Marquette (Name) | RPM (Title) | 10/18/22 (Date) | _____ (Phone No.)
   Problems/suggestions ☐ Report attached: _____

4. **Other Interviews** (EDA) ☒ Report attached:

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: The Site has three O&M manuals, one sitewide plan, one plan for the GLTP and one plan for the VB leachate extraction system. All O&M plans, as-built drawings and maintenance logs are maintained electronically. Hard copies are also maintained on-site in the GLTP office/control room.

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: The site-specific health and safety plan and emergency response plan are maintained electronically. Hard copies are also maintained on-site in the GLTP office/control room.

3. **O&M and OSHA Training Records** ☒ Readily available ☒ Up to date ☐ N/A

Remarks: All training records are maintained electronically. Hard copies of training records are also maintained on-site in the GLTP office/control room.

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: The NLF operates under a state-issued landfill permit.	☒ Readily available	☒ Up to date	☐ N/A

Remarks: The GLTP discharges effluent to the South Fork Shenandoah River in accordance with a NPDES permit.

5. **Gas Generation Records** ☐ Readily available ☐ Up to date ☒ N/A

Remarks: _____

6. **Settlement Monument Records** ☐ Readily available ☐ Up to date ☐ N/A

Remarks: The O&M Plan requires an annual land surface topographic survey of the cover systems for at least two years following construction completion. The annual topographic survey is to be compared to the baseline topographic survey (i.e., the "as built" survey conducted at construction completion) to assess whether settlement has occurred on any of the units. Prior topographic data will be compared to subsequent topographic data to identify areas of settlement. This comparison is used in lieu of settlement monuments. The most recent survey did not identify any areas of significant settlement.

7. **Groundwater Monitoring Records** ☒ Readily available ☒ Up to date ☐ N/A

Remarks: FMC submits annual groundwater monitoring reports.

8. **Leachate Extraction Records** ☒ Readily available ☒ Up to date ☐ N/A

Remarks: FMC documents leachate and groundwater extraction in quarterly and annual O&M reports.

9. **Discharge Compliance Records**

☐ Air	☐ Readily available	☐ Up to date	☒ N/A
☒ Water (effluent)	☒ Readily available	☒ Up to date	☐ N/A

Remarks: FMC documents effluent discharge compliance records in quarterly and annual O&M reports.

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

Remarks: All visitors to the GLTP are required to sign in upon entry into the facility.

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

☒ FMC has contracted Parsons to manage site-related O&M activities.

2. **O&M Cost Records**

☒ Readily available ☒ Up to date

☐ Funding mechanism/agreement in place ☐ Unavailable

Original O&M cost estimate: The OU7 ROD estimated annual OU7 O&M costs of $1,230,000. O&M activities associated with OU7 remedial components began at the end of 2015. The costs below do not include utilities.

Total annual cost by year for review period.

Year: 2018 Total cost: $2,030,627

Year: 2019 Total cost: $1,930,627

Year: 2020 Total cost: $1,847,627

Year: 2021 Total cost: $1,692,627

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

Describe costs and reasons: The actual annual O&M costs are significantly higher than the original annual cost estimate presented in the ROD. However, it should be noted that the costs presented above also include utilities. The annual costs seem relatively consistent from year-to-year and are more accurate than the original estimate. In the future, significant changes in annual O&M costs will be investigated to determine if the fluctuations in cost are related to potential O&M issues.

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

A. Fencing

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

Remarks: All fencing appeared to be in good condition.

B. Other Access Restrictions

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

Remarks: "No trespassing" signs are posted along the Site perimeter, at outfalls along the river and on the GLTP fence. Gates remain locked outside of normal business hours.

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: FMC and the EDA (for EDA-owned properties)

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

Please see response below.

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

Remarks: The OU7 ROD requires institutional controls that prevent the installation of drinking water supply wells in the area where the groundwater contamination exceeds cleanup goals. Groundwater use restrictions are not in place for the privately owned properties located above the plume, west of the river. The OU7 ROD also requires the creation of an ICIAP which was developed in 2019.

D. General

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

Remarks: No trespassing or vandalism has taken place within the GLTP fence. Trespassers sometimes gain access to the Site from the boat landing, the river or the railroad tracks that bisect the Site. Since the previous FYR, people would trespass in the former pump house structure along the eastern bank of the river, within the Site. In response, the PRP contractor secured the doors and windows with boards and cut down the trees near the building used to gain access to the inside of the building. The trespassers do not tamper with any of the remedial components. FMC has posted "no trespassing" signs throughout the Site and works with local law enforcement authorities to address trespassing when it occurs.

2. **Land Use Changes On Site** ☐ N/A

Remarks: Since the previous FYR, on the former plant side of the Site, IT Federal build a large data management center at the Site as part of the larger Royal Phoenix development. The Town of Front Royal constructed a new police department on the far eastern part of the Site (east of Kendrick Lane) in 2018.

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: All site roads are in good condition.

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

Arial extent: _____ Depth: _____

Remarks: Several of the "crook-neck" passive gas vents are at lower elevations, indicating minor cap settlement across several of the capped site areas. However, the gas vents remain completely functional and the minor settlement is not considered an issue at this time. The gas vents will be raised with extension caps to meet spec height.

2. **Cracks** ☐ Location shown on site map ☒ Cracking not evident

Lengths: _____ Widths: _____ Depths: _____

Remarks: _____

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

Arial extent: _____ Depth: _____

Remarks: No significant erosion was observed on the NLF or on the covers of any of the Site basins.

4. **Holes** ☐ Location shown on site map ☒ Holes not evident
Arial extent: _____ Depth: _____
Remarks: _____

5. **Vegetative Cover** ☒ Grass ☒ Cover properly established
☒ No signs of stress ☐ Trees/shrubs (indicate size and locations on a diagram)
Remarks: In general, the vegetative grass cover over the Site is well-established and appears healthy.

6. **Alternative Cover** (e.g., armored rock, concrete) ☒ N/A
Remarks: _____

7. **Bulges** ☐ Location shown on site map ☒ Bulges not evident
Arial extent: _____ Height: _____
Remarks: _____

8. **Wet Areas/Water Damage** ☒ Wet areas/water damage not evident

☐ Wet areas ☐ Location shown on site map Arial extent: _____
☐ Ponding ☐ Location shown on site map Arial extent: _____
☐ Seeps ☐ Location shown on site map Arial extent: _____
☐ Soft subgrade ☐ Location shown on site map Arial extent: _____
Remarks: _____

9. **Slope Instability** ☐ Slides ☐ Location shown on site map
☒ No evidence of slope instability
Arial 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
Arial extent: _____ Depth: _____

Remarks: _____

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

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

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

5. **Obstructions** Type: _____ ☒ No obstructions
☐ Location shown on site map Arial 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 Arial 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: Due to minor cap settlement, the gas vents are below spec height. Extension pipe has been ordered to raise the vents and will be in installed Spring 2023.

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: Monitoring wells are located outside of the basin covers.

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: Not applicable.

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

☐ Good condition ☐ Needs maintenance ☐ N/A

Remarks: Not applicable.

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

1. **Pumps, Wellhead Plumbing and Electrical**
   ☒ Good condition ☒ All required wells properly operating ☐ Needs maintenance ☐ N/A
   Remarks: _____

2. **Extraction System Pipelines, Valves, Valve Boxes and Other Appurtenances**
   ☒ Good condition ☐ Needs maintenance
   Remarks: _____

3. **Spare Parts and Equipment**
   ☒ Readily available ☒ Good condition ☐ Requires upgrade ☐ Needs to be provided
   Remarks: _____

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

1. **Collection Structures, Pumps and Electrical**
   ☐ Good condition ☐ Needs maintenance

Remarks: _____

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes and Other Appurtenances**

☐ Good condition ☐ Needs maintenance

Remarks: _____

3. **Spare Parts and Equipment**

☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided

Remarks: _____

C. Treatment System ☒ Applicable ☐ N/A

1. **Treatment Train** (check components that apply)

☒ Metals removal ☐ Oil/water separation ☒ Bioremediation

☐ Air stripping ☒ Carbon adsorbers

☒ Filters: Multi-media filtration, granulated activated carbon (GAC) adsorption and post-GAC bag filtration

☐ Additive (e.g., chelation agent, flocculent): _____

☒ Others: Solids thickening and dewatering

☒ Good condition ☐ Needs maintenance

☒ Sampling ports properly marked and functional

☒ Sampling/maintenance log displayed and up to date

☒ Equipment properly identified

☐ Quantity of groundwater treated annually: _____

☐ Quantity of surface water treated annually: _____

Remarks: The GLTP was constructed in 2014 and started full-scale operation in mid-2015. The system is relatively new and in good condition. EPA approved bypassing MPS units in 2022 as they were not precipitating any material.

2. **Electrical Enclosures and Panels** (properly rated and functional)

☐ N/A ☒ Good condition ☐ Needs maintenance

Remarks: _____

3. **Tanks, Vaults, Storage Vessels**

☐ N/A ☒ Good condition ☒ Proper secondary containment ☐ Needs maintenance

Remarks: _____

4. **Discharge Structure and Appurtenances**

☒ N/A ☐ Good condition ☐ Needs maintenance

Remarks: _____

5. **Treatment Building(s)**

☐ N/A ☒ Good condition (esp. roof and doorways) ☐ Needs repair

☒ Chemicals and equipment properly stored

Remarks: _____

6. **Monitoring Wells** (pump and treatment remedy)

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

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

Remarks:

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: _____

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 site inspection indicates that the OU2, OU7, OU8 and OU10 remedies are functioning as intended by site decision documents. Implementation of the OU2 remedy mitigated potential risks to public health and the environment associated PCB-contaminated soil, with wastes contained in drums, the acid reclaim building and the lack of site security. The long-term remedy for OU7 includes installation of low-permeability caps over VB-9, VB-10 and VB-11; construction and operation of a groundwater and leachate extraction and treatment system; characterization and remediation of soil and sediment outside of the VB 9-11 cap system, including sediment associated with seeps adjacent to VB 9-11, and OU-7 soils outside of the VB 9-11 cap system; institutional controls; and long-term monitoring and maintenance. FMC provides water to three affected residences along the west bank of the river. The Town of Front Royal provides potable water to areas east of the river via a public water supply system. Institutional controls are in place at the Site and at most downgradient residential properties to prevent installation of new groundwater wells, and the caps over VBs 9, 10 and 11 prevent direct exposure to contaminated soil within the basins. However, groundwater use restrictions are not in place for the privately owned properties west of the river. UECA Environmental Covenant, Instrument 140004561 restricts land use at the areas previously referred to as Areas B and C (OU8) to commercial/industrial use only. Regarding OU10, the cover systems over VBs 1-8 and the NLF prevent direct human and ecological receptor contact with VBs 1-8 and NLF soil and waste and prevent the migration of contaminants from those areas. Excavation of soil contaminated at levels above cleanup goals at the plant area and expanded plant area, and institutional controls mitigate the risk of direct contact with impacted soil and groundwater at OU10. However, following a review of the 2014 Plant Area Soils SLERA, EPA concluded that the unacceptable ecological risk exists. The unacceptable eco risk is currently being addressed through a Habitat Removal Work Plan.

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.

No significant O&M issues have been identified that could potentially impact the current protectiveness of the remedy.

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. None.
D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. FMC is requesting permission from EPA to curtail pumping of extraction well TW-03 in order to optimize the remedy and reduce costs.

APPENDIX F – SITE INSPECTION PHOTOS

Sign posted at the gated entrance to the Site and GLTP

View of the GLTP, looking east

Carbon filtration units inside the GLTP

Filter press room inside the GLTP

Metals precipitation tanks on the tank deck at the GLTP

Hydrogen sulfide gas monitor on the tank deck at the GLTP

View of VB 9, looking northwest. The PRP is aware of the two bare low spots (shown on the left side of the photo) and plans to address the areas in the fall of 2017

View of VB 10, looking southwest

Exterior of the VB extraction equipment building

Interior of the VB extraction equipment building

View of former WWTP polishing basin (PB 3)

Outfall 004 and the South Fork Shenandoah River

Signage posted facing the river at Outfall 004

Carbon filtration unit installed on VB 5 at OU10 GV-04

View of clean-closed sulfate basin, SB 2

Stormwater discharge outlet at SB 2

Stormwater discharge culvert from SB 2

Deep groundwater extraction well TW-01

Pond on the southern end of the Site


Solar-powered receiver receives monitoring well data from across the river

Restored wetland area

Several passive gas vents

View of the NLF, looking south

VB 6 stormwater discharge chute

Previously unidentified bare spot observed on SB 3 near GV-8. The PRP is aware of the maintenance issue and plans to address the issue in the fall of 2017

The Norfolk Southern rail line that runs north-south through the center of the Site

View of the former plant area side of the Site, looking west

Site property on the west side of the river

Locked monitoring well on the west side of the river

Deep groundwater extraction well TW-03, located within a locked enclosure on the west side of the river

Kendrick Lane entrance to the former administration building complex on-site

The former American Viscose Corporation administrative building now houses several small businesses

Sign at the entrance to the on-site Skyline SoccerPlex

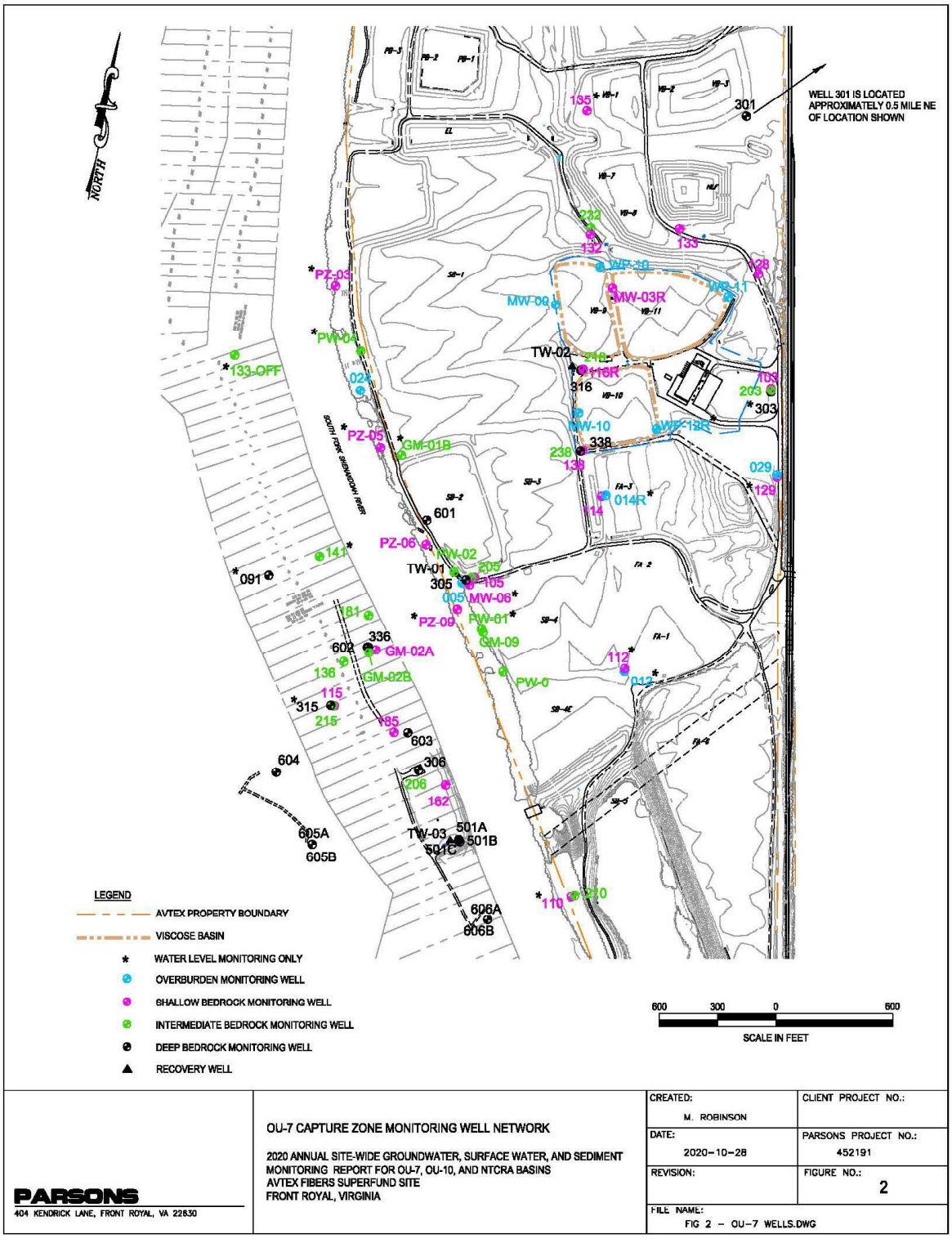

Playground at the Skyline SoccerPlex

Soccer fields at the Skyline SoccerPlex

Skate park at the Skyline SoccerPlex

APPENDIX G – FIGURES AND TABLES

Figure G-1: OU7 Monitoring Well Network



Note: All figures in this appendix are from the Site's 2020 Annual Site-Wide Groundwater, Surface Water and Sediment Monitoring Report for OU-7, OU-10 and NTCRA Basins.

Figure G-2: OU7 VSMWR Monitoring Network

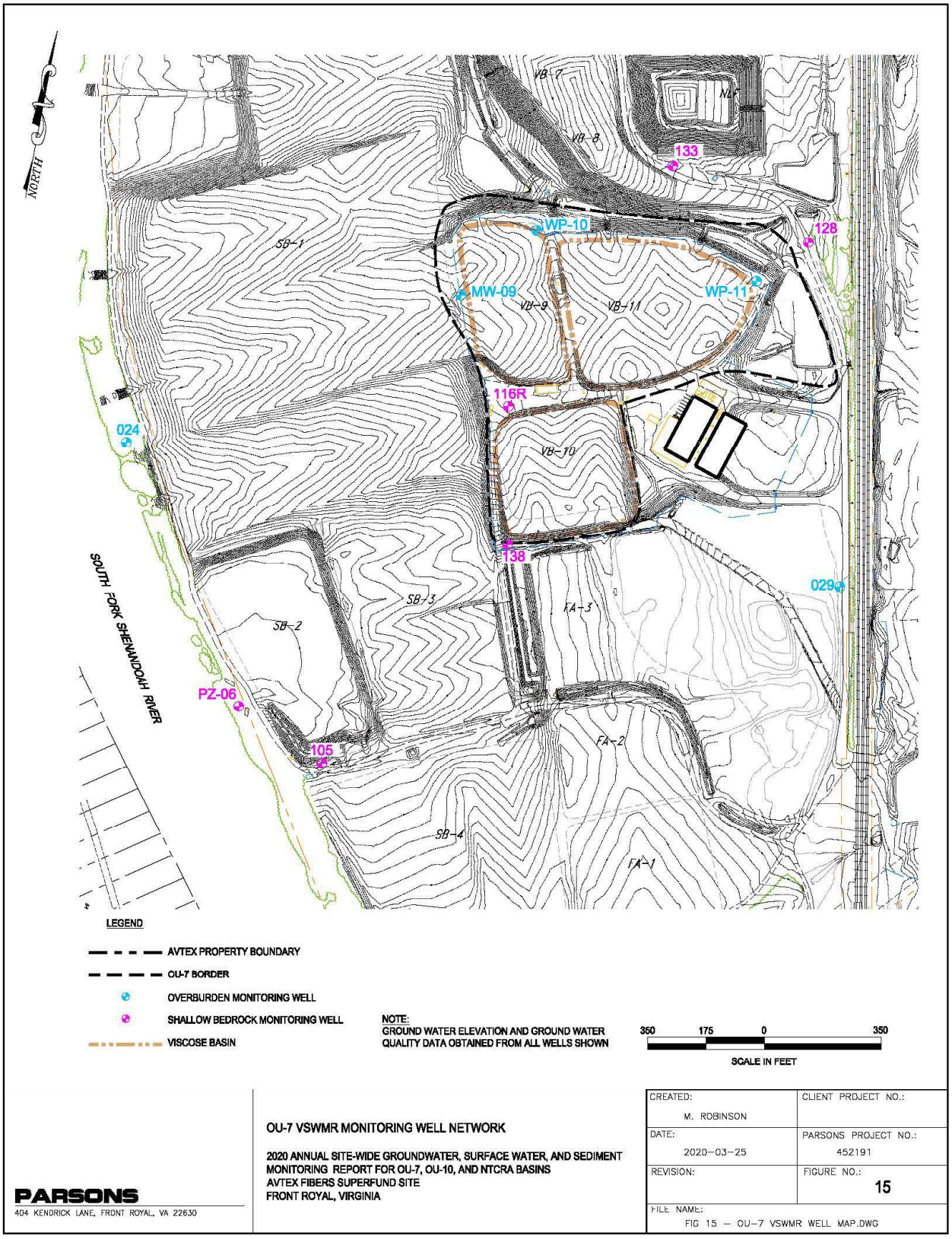


Figure G-3: OU7 River Water and Sediment Sampling Locations

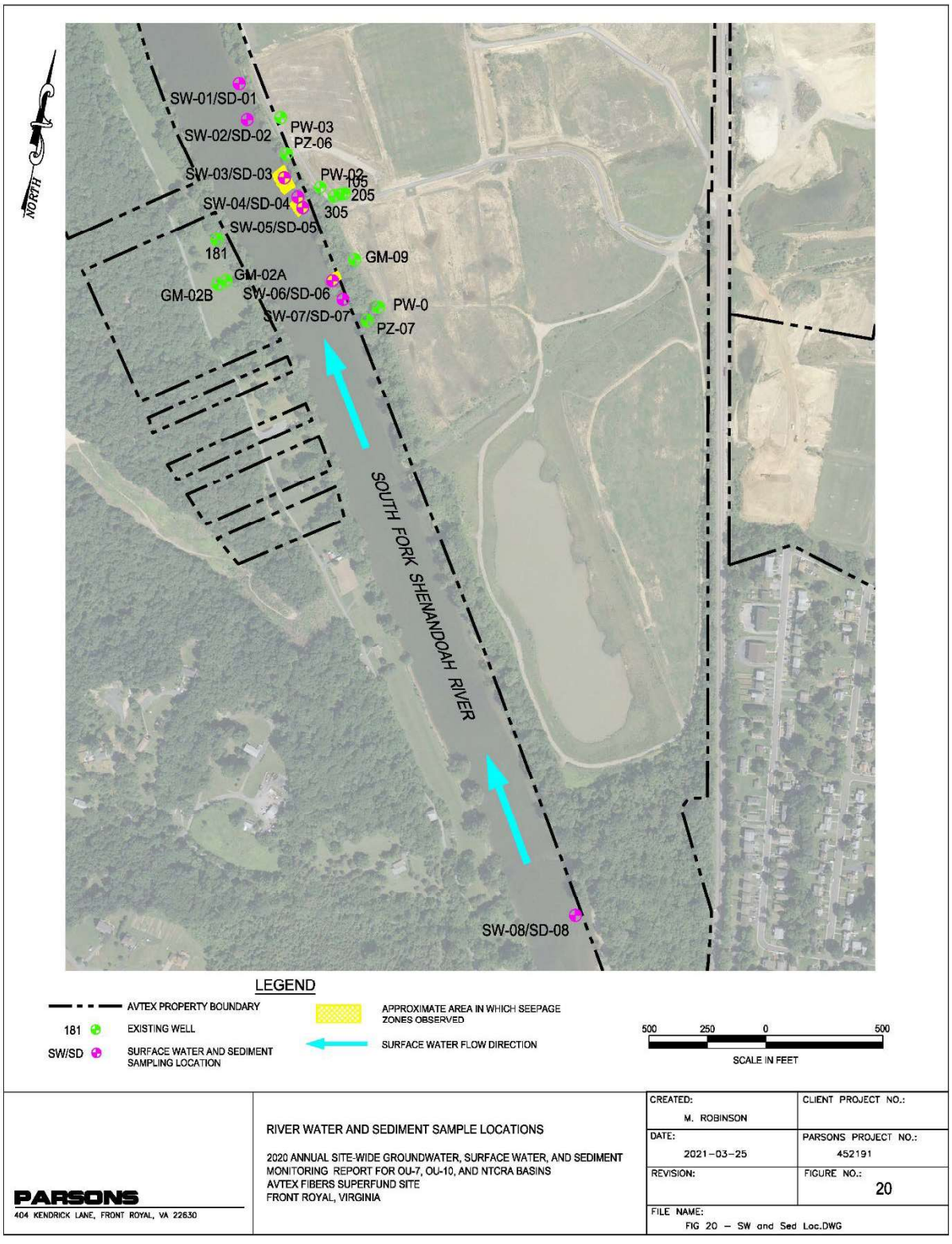


Figure G-4: OU7 Aquatic Biota Sampling Locations

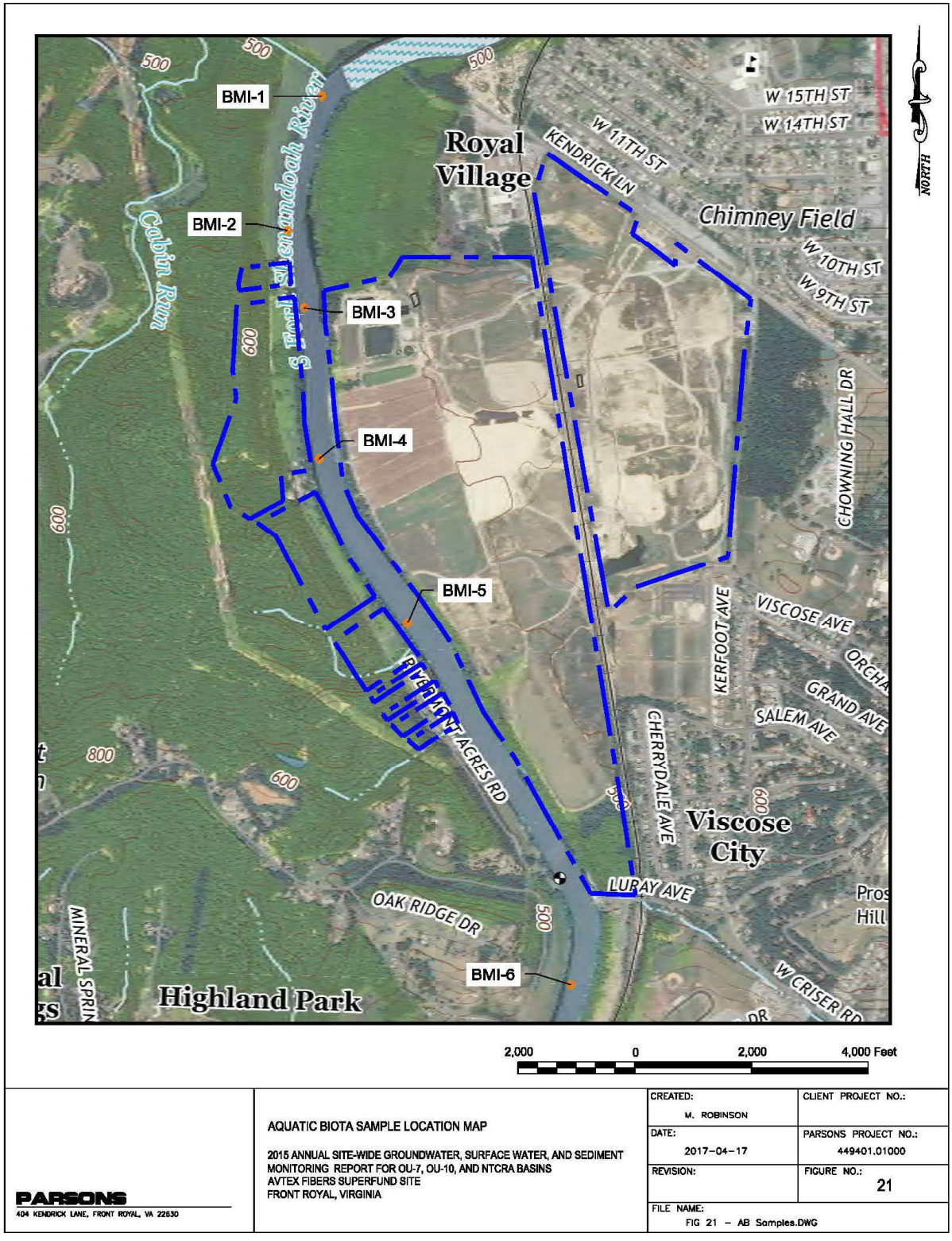


Figure G-5: OU10 Overburden Groundwater Contour Map

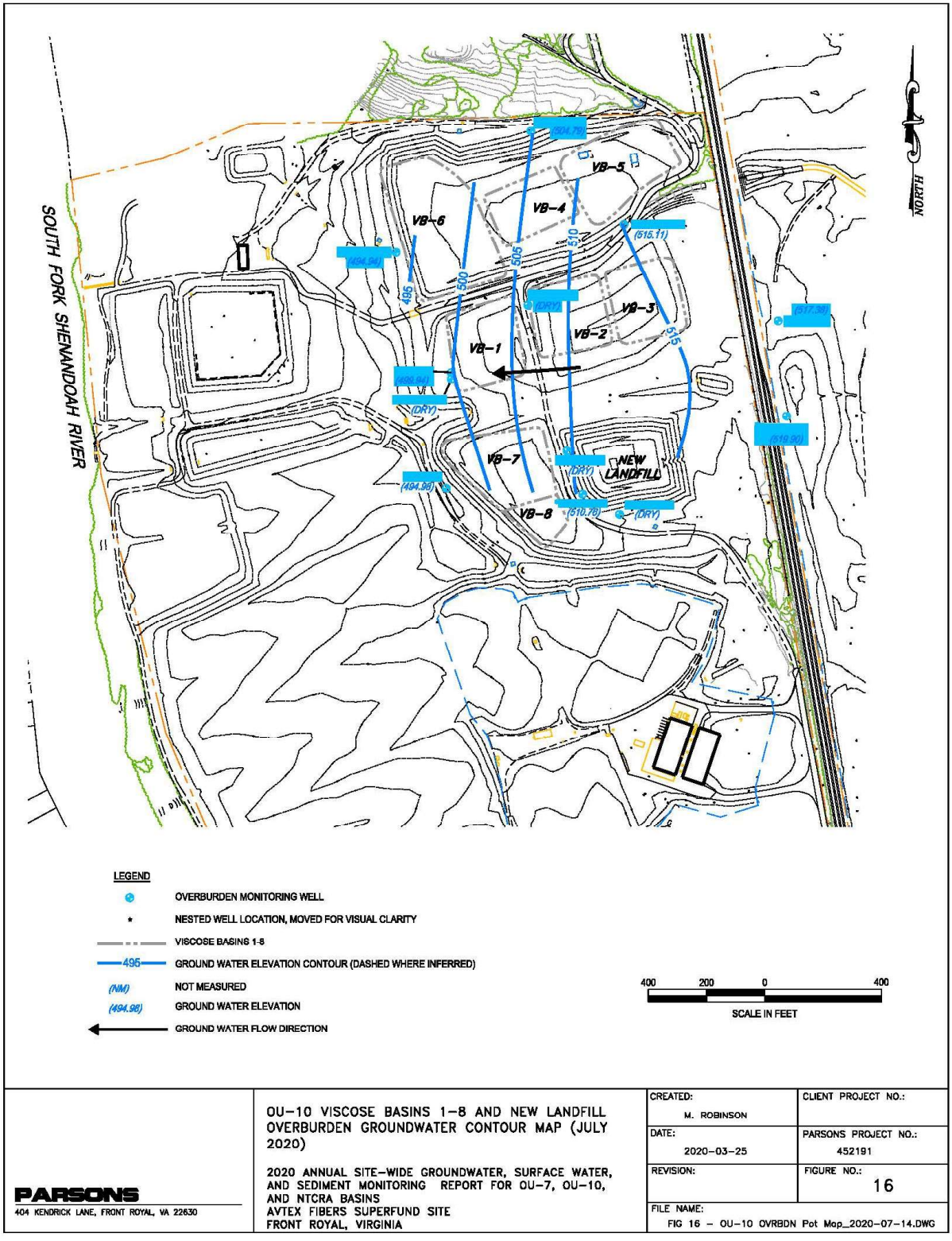
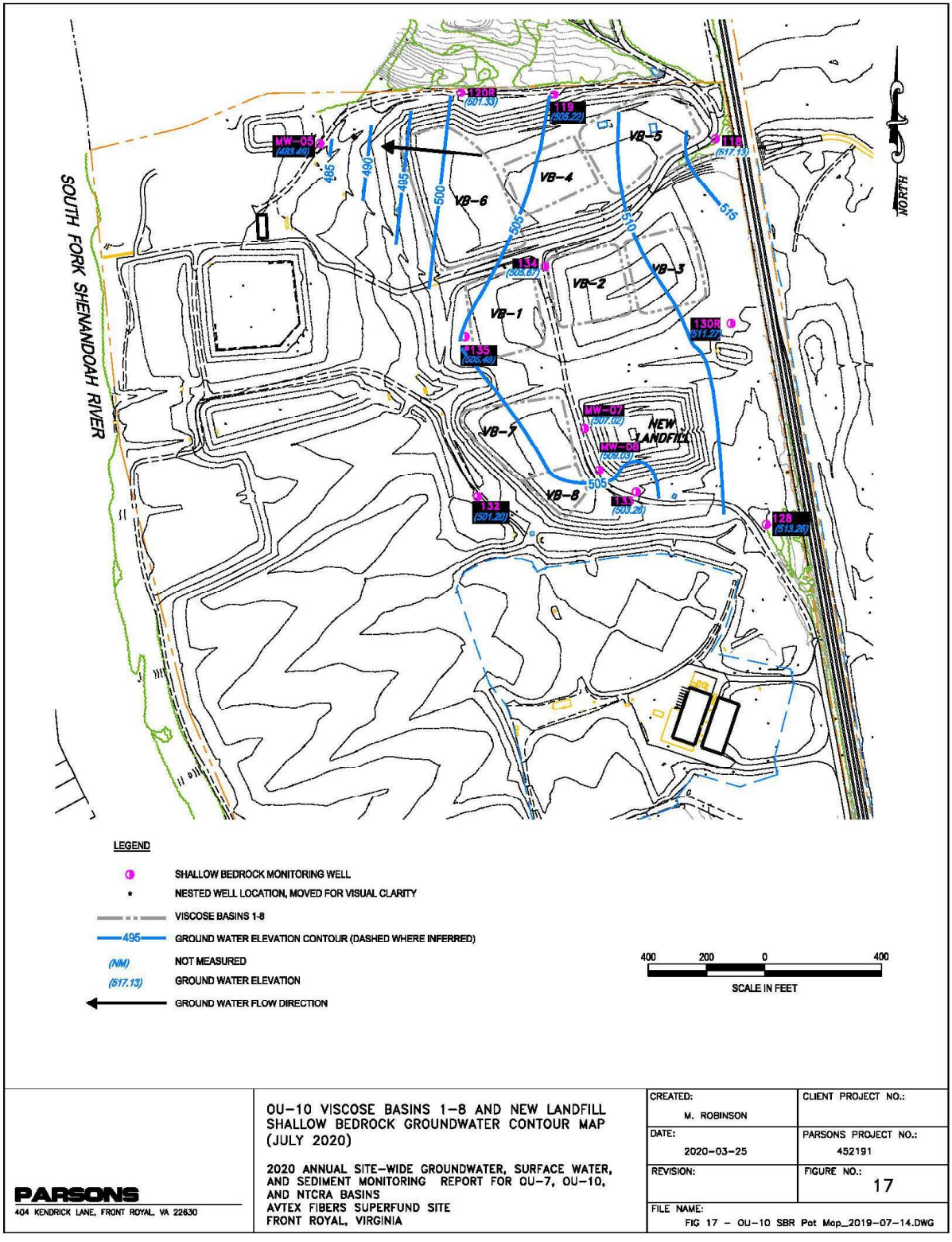


Figure G-6: OU10 Shallow Bedrock Groundwater Contour Map



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OU-10 VISCOSE BASINS 1-8 AND NEW LANDFILL SHALLOW BEDROCK GROUNDWATER CONTOUR MAP (JULY 2020)

2020 ANNUAL SITE-WIDE GROUNDWATER, SURFACE WATER, AND SEDIMENT MONITORING REPORT FOR OU-7, OU-10, AND NTCRA BASINS
AVTEX FIBERS SUPERFUND SITE
FRONT ROYAL, VIRGINIA

CREATED: M. ROBINSON	CLIENT PROJECT NO.:
DATE: 2020-03-25	PARSONS PROJECT NO.: 452191
REVISION:	FIGURE NO.: 17
FILE NAME: FIG 17 - OU-10 SBR Pot Map_2019-07-14.DWG	

Figure G-7: NTCRA Basins Overburden Groundwater Contour Map

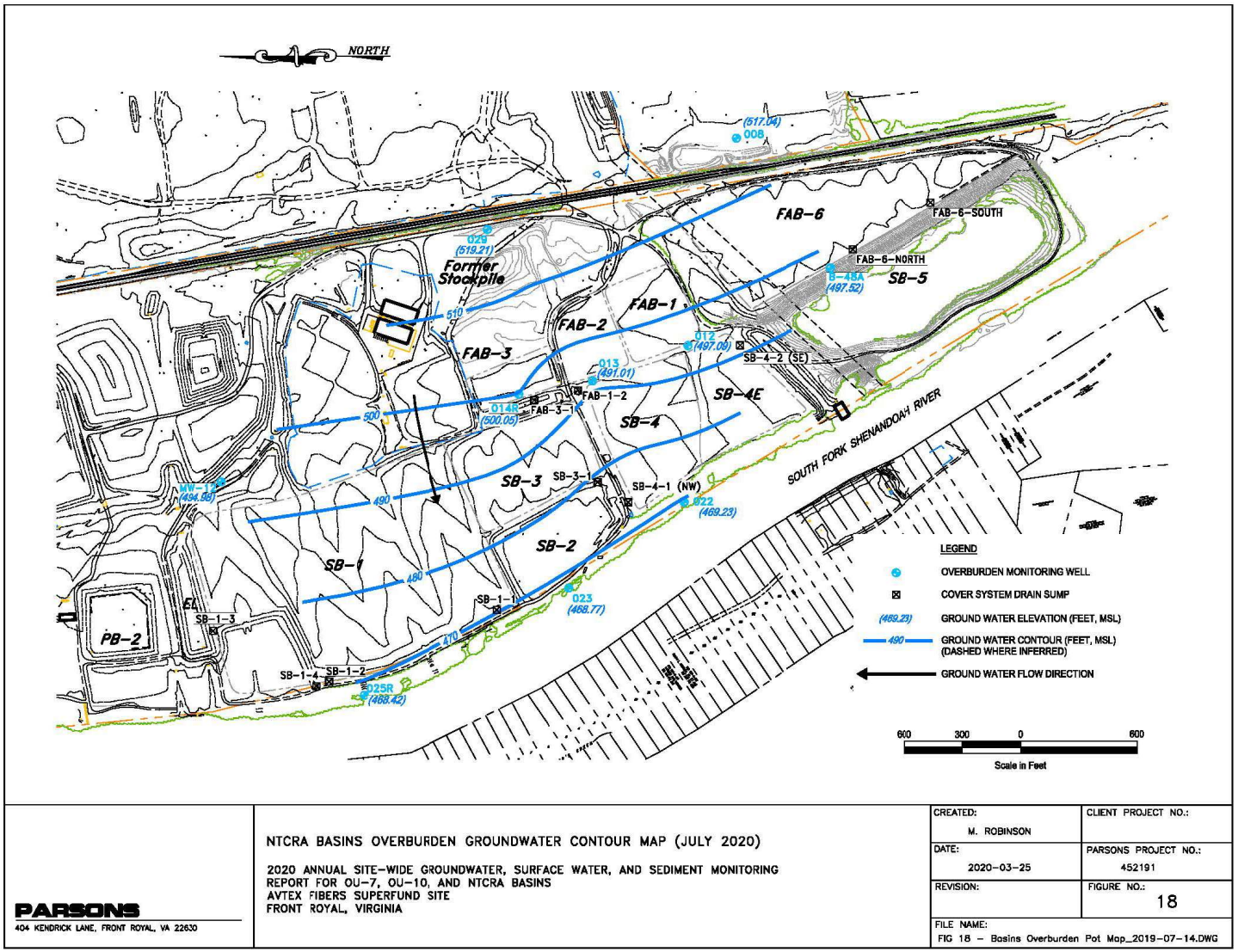
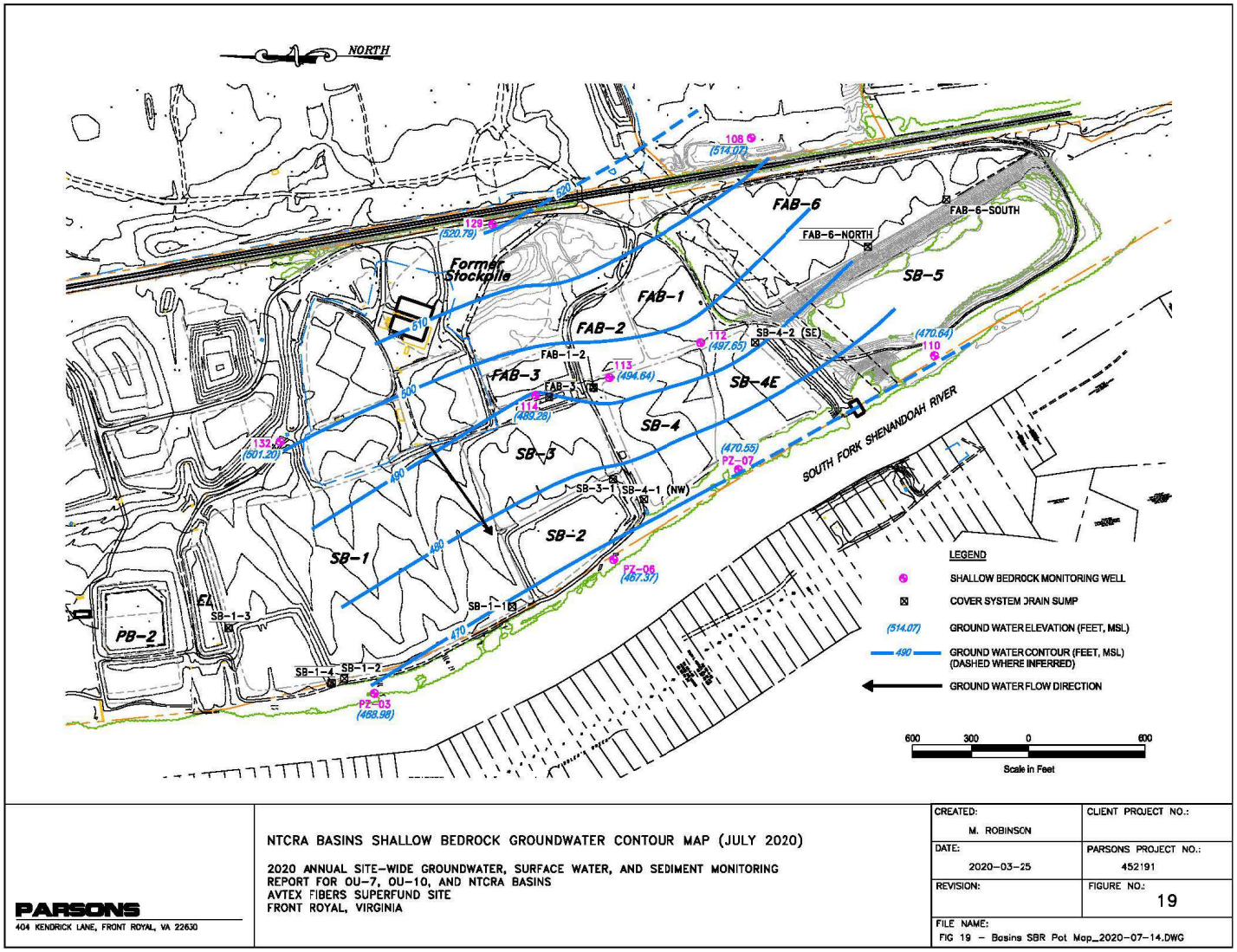


Figure G-8: NTCRA Basins Shallow Bedrock Groundwater Contour Map



PARSONS
404 KENDRICK LANE, FRONT ROYAL, VA 22630

NTCRA BASINS SHALLOW BEDROCK GROUNDWATER CONTOUR MAP (JULY 2020)

2020 ANNUAL SITE-WIDE GROUNDWATER, SURFACE WATER, AND SEDIMENT MONITORING REPORT FOR OU-7, OU-10, AND NTCRA BASINS
AVTEX FIBERS SUPERFUND SITE
FRONT ROYAL, VIRGINIA

CREATED: M. ROBINSON	CLIENT PROJECT NO.:
DATE: 2020-03-25	PARSONS PROJECT NO.: 452191
REVISION:	FIGURE NO.: 19
FILE NAME: FIG 19 – Basins SBR Pot Map_2020-07-14.DWG	

Table G-1: OU7 Groundwater Analytical Results – 2020

Source: 2020 Annual Report

TABLE 9

OU-7 Monitoring Network Sampling Results
2020 Annual Site-Wide Groundwater, Surface Water, and Sediment Monitoring Report for OU-7, OU-10 and NTCRA Basins
Avtex Fibers Superfund Site
Front Royal, Virginia

FMC-Front Royal Avtex Fibers 2020 Sampling Event Validated OU-7 Groundwater Data		Location ID: Sample Name: Well Type: Sample Date:	Groundwater Cleanup Standards[1]		024 2020AN-024 OMW 07/18/2020	029 2020AN-029 OMW 07/17/2020	029 (DUP) 2020AN-029D OMW 07/17/2020	103 2020AN-103 S EMW 07/31/2020	105 2020AN-105 S BMW 07/28/2020	114 2020AN-114 S BMW 07/29/2020	115 2020AN-115 S BMW 09/23/2020	116R 2020AN-116R S BMW 07/16/2020	116R (DUP) 2020AN-116R-D S BMW 07/16/2020	128 2020AN-128 S BMW 07/31/2020	132 2020AN-132 S BMW 07/27/2020
CAS NO.	COMPOUND	UNITS:													
	VOLATILES														
67-64-1	Acetone	ug/L	22000	RBC	5.4 U	5.4 UJ	5.4 U	5.4 U	5.4 U	**6.3 J**	5.4 U	54 U	54 U	5.4 U	5.4 U
75-15-0	Carbon disulfide	ug/L	1000	RBC	0.28 UJ	0.28 UJ	0.28 UJ	0.28 U	0.28 UJ	0.28 U	0.28 U	**16 J-**	**8.7 J-**	0.28 U	0.28 U
	SEMIVOLATILES														
117-81-7	bis(2-Ethylhexyl)phthalate (DEHP)	ug/L	6	MCL	2.3 U	2.2 U	2.1 U	2.3 U	2.1 U	2.4 U	0.2 U	12 U	23 U	**18**	2.1 U
95-48-7	2-Methylphenol	ug/L	1800	RBC	0.22 U	0.21 U	0.2 U	0.22 U	0.2 U	0.23 U	0.18 U	1.1 U	2.2 U	0.21 U	0.2 U
	3&4-Methylphenol	ug/L	180	RBC	0.2 U	0.19 U	0.18 U	0.2 U	0.18 U	0.21 U	2.1 U	0.99 U	2 U	0.19 U	0.18 U
91-20-3	Naphthalene	ug/L	14	RBC	0.11 U	0.11 U	0.1 U	0.11 U	0.1 U	0.12 U	0.1 U	0.57 U	1.1 U	0.11 U	0.1 U
87-86-5	Pentachlorophenol	ug/L	1	MCL	3.2 U	3.1 U	3 U	3.2 U	3 U	3.4 U	3 U	16 U	32 U	3.1 U	3 U
108-95-2	Phenol	ug/L	11000	RBC	0.13 U	0.13 U	0.12 U	0.13 U	0.12 U	0.14 U	0.12 U	0.67 U	1.3 U	0.13 U	0.12 U
	METALS - DISSOLVED														
7429-90-5	Aluminum	ug/L	37000	RBC	34 U	34 U	34 U	34 U	34 U	34 U	34 U	**37 J**	34 U	34 U	34 U
7440-36-0	Antimony	ug/L	6	MCLG	0.57 U	0.57 U	0.57 U	0.57 U	0.57 U	0.57 U	0.57 U	**150**	**110**	0.57 U	0.57 U
7440-38-2	Arsenic	ug/L	10	MCL	0.75 U	0.75 U	0.75 U	0.75 U	**1.2 J**	0.75 U	0.75 U	**1300**	**1200**	0.75 U	0.75 U
7440-43-9	Cadmium	ug/L	5	MCLG	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	**0.71 J**	**0.43 J**	0.2 U	0.2 U
7440-47-3	Chromium	ug/L	100	MCLG	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	**57**	**53**	0.98 U	0.98 U
7440-48-4	Cobalt	ug/L	11	RBC	**0.57 J**	**0.28 J**	**0.3 J**	**16**	**0.28 J**	**1.3**	0.19 U	**980**	**930**	**0.44 J**	**0.57 J**
7439-89-6	Iron	ug/L	26000	RBC	47 U	47 U	47 U	**5800**	**1600**	**30000**	47 U	**83 J**	**81 J**	**7600**	**8200**
7439-92-1	Lead	ug/L	15	AL	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U
7439-96-5	Manganese	ug/L	880	RBC	**120**	**6**	**7.8**	**6300**	**370**	**4400**	2.1 U	**2.1 J**	**2.5 J**	**1100**	**2400**
7439-97-6	Mercury[2]	ug/L	2	MCLG	0.13 UJ	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U	0.13 UJ	0.13 U	0.13 U	0.13 U
7440-02-0	Nickel	ug/L	730	RBC	**3.1**	**2**	**2**	**3.7**	**3.5**	**33**	1.5 U	**3600**	**3500**	1.5 U	1.5 U
7440-62-2	Vanadium	ug/L	260	RBC	**1.3 J**	0.82 U	0.82 U	0.82 U	0.82 U	0.82 U	0.82 U	**72**	**69**	0.82 U	0.82 U
7440-66-6	Zinc	ug/L	11000	RBC	15 U	**88**	77	**240**	15 U	15 U	15 U	**450**	**370**	**34**	15 U
	OTHER														
FREE CN	Cyanide (free)	ug/L	200	MCLG	R	R	R	0.79 U	R	0.79 UJ	0.79 U	0.79 UJ	1.6 UJ	0.79 U	R
	FIELD PARAMETERS														
	Temperature	°C	---	---	23.28	19.52	19.52	22.03	22.05	27.94	16.29	19.7	19.7	20.05	23.01
	Conductivity	mS/cm	---	---	2.33	0.98	0.98	2.60	1.72	1.87	0.43	24.26	24.26	1.35	2.02
	pH	s.u.	---	---	7.13	6.16	6.16	7.06	7.43	6.68	8.16	9.51	9.51	6.99	6.52
	ORP	mV	---	---	-92.4	103.5	103.5	-83.3	-156.3	-155.8	-1.6	-500	-500	-150.8	-70.1
	Turbidity	NTU	---	---	110	22.8	22.8	59.8	6.96	18.1	3.74	1.87	1.87	28.7	3.06
	Dissolved Oxygen	mg/L	---	---	2.72	2.93	2.93	2.46	1.27	0.14	11.16	0.21	0.21	1.79	3.8

[1] - Groundwater cleanup standards as presented in Table 7 of the ROD.
[2] - Reported standard is for Mercury as Methyl.
Bold text indicates detected value.
MCL = Maximum Contaminant Level MCLG = MCL Goal
RBC = Risk Based Concentration AL = Action Level
U = Not Detected J = Estimated value J- = Estimated value biased low
NR = Not Reported UJ = Not detected; reporting limit is estimated R = Rejected
mg/L = miligrams per liter mV = millivolts
ug/L = micrograms per liter uS/cm = microsiemens per centimeter
s.u = std. units NTU = nephelometric turbidity unit
DUP = Duplicate Sample
= Detected value exceeds groundwater cleanup standard.

TABLE 9

OU-7 Monitoring Network Sampling Results
2020 Annual Site-Wide Groundwater, Surface Water, and Sediment Monitoring Report for OU-7, OU-10, and NTCRA Basins
Avtex Fibers Superfund Site
Front Royal, Virginia

FMC-Front Royal Avtex Fibers 2020 Sampling Event Validated OU-7 Groundwater Data		Location ID: Sample Name: Well Type: Sample Date:	Groundwater Cleanup Standards[1]		132 (DUP) 2020AN-132D S BMW 07/27/2020	133 2020AN-133 S BMW 07/29/2020	136 2020AN-136 I BMW 07/18/2020	138 2020AN-138 S BMW 07/30/2020	162 2020AN-162 S BMW 07/16/2020	181 2020AN-181 I BMW 07/16/2020	185 2020AN-185 S BMW 07/20/2020	203 2020AN-203 I BMW 07/31/2020	205 2020AN-205 I BMW 07/29/2020	206 2020AN-206 I BMW 07/16/2020	210 2020AN-210 I BMW 07/30/2020
CAS NO.	COMPOUND	UNITS:													
	VOLATILES														
67-64-1	Acetone	ug/L	22000	RBC	5.4 U	5.4 U	5.4 U	27 U	5.4 U	5.4 U	5.4 U	5.4 U	11 U	110 U	5.4 U
75-15-0	Carbon disulfide	ug/L	1000	RBC	0.28 U	**0.67 J**	0.28 U	**81**	0.28 U	0.28 U	0.28 UJ	**1.7**	**36**	**190**	0.28 U
	SEMIVOLATILES														
117-81-7	bis(2-Ethylhexyl)phthalate (DEHP)	ug/L	6	MCL	2.2 U	2.4 U	2.3 U	2.2 U	2.2 U	2.3 U	2.1 U	2.2 U	2.3 U	2.3 U	2.2 U
95-48-7	2-Methylphenol	ug/L	1800	RBC	0.21 U	0.23 U	0.22 U	0.21 U	0.21 U	0.22 U	0.2 U	0.21 U	0.22 U	0.22 U	0.21 U
	3&4-Methylphenol	ug/L	180	RBC	0.19 U	0.21 U	0.2 U	0.19 U	0.19 U	0.2 U	0.18 U	0.19 U	0.2 U	0.2 U	0.19 U
91-20-3	Naphthalene	ug/L	14	RBC	0.11 U	0.12 U	0.11 U	0.11 U	0.11 U	0.11 U	0.1 U	0.11 U	0.11 U	0.11 U	0.11 U
87-86-5	Pentachlorophenol	ug/L	1	MCL	3.1 U	3.4 U	3.2 U	3.1 U	3.1 U	3.2 U	3 U	3.1 U	3.2 U	3.2 U	3.1 U
108-95-2	Phenol	ug/L	11000	RBC	0.13 U	0.14 U	0.13 U	0.13 U	0.13 U	0.13 U	0.12 U	**4**	0.13 U	0.13 U	0.13 U
	METALS - DISSOLVED														
7429-90-5	Aluminum	ug/L	37000	RBC	34 U	34 U	34 U	34 U	34 U	34 U	34 U	34 U	34 U	34 U	34 U
7440-36-0	Antimony	ug/L	6	MCLG	0.57 U	0.57 U	0.57 U	**1.1 J**	0.57 U	0.57 U	0.57 U	0.57 U	0.57 U	**1.3 J**	0.57 U
7440-38-2	Arsenic	ug/L	10	MCL	0.75 U	**23**	0.75 U	**21**	0.75 U	0.75 U	0.75 U	0.75 U	**4.7 J**	**13**	0.75 U
7440-43-9	Cadmium	ug/L	5	MCLG	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
7440-47-3	Chromium	ug/L	100	MCLG	0.98 U	**1.2 J**	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	**2.1**	0.98 U
7440-48-4	Cobalt	ug/L	11	RBC	**0.45 J**	**10**	0.19 U	**10**	**0.35 J**	0.19 U	0.19 U	0.19 U	**0.36 J**	**1.3**	0.19 U
7439-89-6	Iron	ug/L	26000	RBC	**7900**	**6200**	**430**	**71 J**	**510**	**1800**	47 U	47 U	47 U	47 U	**440**
7439-92-1	Lead	ug/L	15	AL	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U
7439-96-5	Manganese	ug/L	880	RBC	**2300**	**560**	**110**	**570**	**190**	**520**	**12**	**3.8 J**	**8.6**	**4 J**	**120**
7439-97-6	Mercury[2]	ug/L	2	MCLG	0.13 U	0.13 U	0.13 UJ	0.13 U	0.13 UJ	0.13 UJ	0.13 UJ	0.13 U	0.13 U	0.13 UJ	0.13 U
7440-02-0	Nickel	ug/L	730	RBC	1.5 U	**12**	1.5 U	**30**	**1.6 J**	1.5 U	1.5 U	1.5 U	**11**	**3.8**	**5.5**
7440-62-2	Vanadium	ug/L	260	RBC	0.82 U	0.82 U	0.82 U	**1.4 J**	0.82 U	0.82 U	0.82 U	0.82 U	0.82 U	**1.3 J**	0.82 U
7440-66-6	Zinc	ug/L	11000	RBC	15 U	**16 J**	15 U	15 U	15 U	15 U	15 U	15 U	15 U	15 U	15 U
	OTHER														
FREE CN	Cyanide (free)	ug/L	200	MCLG	R	R	R	0.79 UJ	R	R	0.79 U	**690**	**78 J-**	R	0.79 UJ
	FIELD PARAMETERS														
	Temperature	°C	---	---	23.01	20.96	19.85	18.03	15.82	16.22	15	22.92	23.58	18.82	24.58
	Conductivity	mS/cm	---	---	2.02	4.83	0.45	2.03	581.00	615.00	0.35	0.33	2.69	1.93	1.97
	pH	s.u.	---	---	6.52	7.1	7.6	7.1	7.49	7.7	6.65	9.64	9.84	7.73	6.98
	ORP	mV	---	---	-70.1	-189	-129.1	-364.7	-220.2	-296.00	-185	-184.2	-349.1	-395.2	-138.9
	Turbidity	NTU	---	---	3.06	1.91	0.54	0.56	2.91	0.64	6.2	0.03	37.7	0.29	15.9
	Dissolved Oxygen	mg/L	---	---	3.8	2.81	0.9	1.03	0.8	0.88	1.96	1.53	0.06	0.95	0.39

[1] - Groundwater cleanup standards as presented in Table 7 of the ROD.
[2] - Reported standard is for Mercury as Methyl.
Bold text indicates detected value.
MCL = Maximum Contaminant Level MCLG = MCL Goal
RBC = Risk Based Concentration AL = Action Level
U = Not Detected J = Estimated value J- = Estimated value biased low
NR = Not Reported UJ = Not detected, reporting limit is estimated R = Rejected
mg/L = miligrams per liter mV = millivolts
ug/L = micrograms per liter uS/cm = microsiemens per centimeter
s.u = std. units NTU = nephelometric turbidity unit
DUP = Duplicate Sample
= Detected value exceeds groundwater cleanup standard.

TABLE 9

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2020 Annual Site-Wide Groundwater, Surface Water, and Sediment Monitoring Report for OU-7, OU-10, and NTCRA Basins
Avtex Fibers Superfund Site
Front Royal, Virginia

FMC-Front Royal Avtex Fibers 2020 Sampling Event Validated OU-7 Groundwater Data		Location ID: Sample Name: Well Type: Sample Date:	Groundwater Cleanup Standards[1]		215 2020AN-215NP I BMW 07/15/2020	215 2020AN-215LF I BMW 12/08/2020	216 2020AN-216 I BMW 07/30/2020	232 2020AN-232 I BMW 07/28/2020	238 2020AN-238 I BMW 07/29/2020	238 (DUP) 2020AN-238D I BMW 07/29/2020	301 2020AN-301 D EMW 07/18/2020	305 2020AN-305 D BMW 07/21/2020	306 2020AN-306NP D BMW 07/15/2020	306 2020AN-306LF D BMW 12/08/2020
CAS NO.	COMPOUND	UNITS:												
	VOLATILES													
67-64-1	Acetone	ug/L	22000	RBC	540 U	1100 U	54 U	5.4 U	36 U	36 U	5.4 U	5400 U	5.4 U	5.4 U
75-15-0	Carbon disulfide	ug/L	1000	RBC	**2500**	**2600**	**10**	0.28 UJ	**81**	**78**	0.28 U	**22000**	**7.3**	**13**
	SEMIVOLATILES													
117-81-7	bis(2-Ethylhexyl)phthalate (DEHP)	ug/L	6	MCL	14 U	21 U	2.2 U	2.2 U	2.2 U	12 U	2.2 U	14 U	2.2 U	0.19 U
95-48-7	2-Methylphenol	ug/L	1800	RBC	1.3 U	**13 J**	0.21 U	0.21 U	0.21 U	1.1 U	0.21 U	1.3 U	0.21 U	0.18 U
	3&4-Methylphenol	ug/L	180	RBC	**14**	22 U	0.19 U	0.19 U	0.19 U	0.99 U	0.19 U	1.2 U	0.19 U	2.1 U
91-20-3	Naphthalene	ug/L	14	RBC	0.67 U	1.1 U	0.11 U	0.11 U	0.11 U	0.57 U	0.11 U	0.7 U	**0.47**	0.1 U
87-86-5	Pentachlorophenol	ug/L	1	MCL	19 U	31 U	3.1 U	3.1 U	3.1 U	16 U	3.1 U	20 U	3.1 U	2.9 U
108-95-2	Phenol	ug/L	11000	RBC	**200**	**210**	0.13 U	0.13 U	0.13 U	0.67 U	0.13 U	**240**	0.13 U	0.12 U
	METALS - DISSOLVED													
7429-90-5	Aluminum	ug/L	37000	RBC	34 U	**150**	34 U	34 U	34 U	34 U	34 U	34 U	34 U	34 U
7440-36-0	Antimony	ug/L	6	MCLG	0.57 U	0.57 U	**0.82 J**	0.57 U	**6.4**	**3.4**	0.57 U	**390**	0.57 U	**0.59 J**
7440-38-2	Arsenic	ug/L	10	MCL	**0.99 J**	0.75 U	**23**	**5.3**	**63**	**54**	0.75 U	**2200**	**14**	**16**
7440-43-9	Cadmium	ug/L	5	MCLG	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
7440-47-3	Chromium	ug/L	100	MCLG	0.98 U	0.98 U	**3**	**1.2 J**	**4.7**	**5.1**	0.98 U	**6**	0.98 U	0.98 U
7440-48-4	Cobalt	ug/L	11	RBC	**0.2 J**	**0.31 J**	**49**	**2.7**	**2.8**	**2.9**	0.19 U	**88**	**0.69 J**	**0.75 J**
7439-89-6	Iron	ug/L	26000	RBC	47 U	47 U	**47 J**	**3100**	47 U	47 U	47 U	**1900**	47 U	47 U
7439-92-1	Lead	ug/L	15	AL	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U
7439-96-5	Manganese	ug/L	880	RBC	2.1 U	2.1 U	**24**	**210**	**8.5**	**7.5**	**5.8**	**51**	2.1 U	**14**
7439-97-6	Mercury[2]	ug/L	2	MCLG	0.13 UJ	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U	0.13 UJ	1.3 UJ	0.13 UJ	0.13 U
7440-02-0	Nickel	ug/L	730	RBC	**4.8**	**5**	**160**	**4.5**	**3.1**	**2.8**	1.5 U	**87**	**6**	**6.9**
7440-62-2	Vanadium	ug/L	260	RBC	0.82 U	0.82 U	0.82 U	0.82 U	**3.3 J**	**3.5 J**	0.82 U	**1.7 J**	0.82 U	**0.94 J**
7440-66-6	Zinc	ug/L	11000	RBC	15 U	15 U	15 U	15 U	15 U	15 U	15 U	**32**	15 U	15 U
	OTHER													
FREE CN	Cyanide (free)	ug/L	200	MCLG	R	**19 J-**	**51 J-**	**1.9 J-**	0.79 UJ	0.79 UJ	**8.6 J-**	**2.8**	R	**3.8 J-**
	FIELD PARAMETERS													
	Temperature	°C	---	---	16.53	5.4	22.91	19.6	19.29	19.29	16.77	20.39	17.24	12.66
	Conductivity	mS/cm	---	---	0.70	1.99	5.47	3.97	1.85	1.85	0.3	11.71	1	1.31
	pH	s.u.	---	---	6.97	12.3	10.26	6.82	7.20	7.20	9.13	9.39	7.41	9.48
	ORP	mV	---	---	-361.2	-140	-224.10	-146.1	-395.4	-395.4	-228.9	-454.5	-264.9	-171.6
	Turbidity	NTU	---	---	113	5.41	4.39	0.41	0.66	0.66	0.24	23.2	5.12	2.13
	Dissolved Oxygen	mg/L	---	---	0.84	2.2	0.25	0.07	0.70	0.70	0.26	0.12	1.16	2.28

[1] - Groundwater cleanup standards as presented in Table 7 of the ROD.
[2] - Reported standard is for Mercury as Methyl.
Bold text indicates detected value.
MCL = Maximum Contaminant Level MCLG = MCL Goal
RBC = Risk Based Concentration AL = Action Level
U = Not Detected J = Estimated value J- = Estimated value biased low
NR = Not Reported UJ = Not detected; reporting limit is estimated R = Rejected
mg/L = miligrams per liter mV = millivolts
ug/L = micrograms per liter uS/cm = microsiemens per centimeter
s.u = std. units NTU = nephelometric turbidity unit
DUP = Duplicate Sample
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Avtex Fibers Superfund Site
Front Royal, Virginia

FMC-Front Royal Avtex Fibers 2020 Sampling Event Validated OU-7 Groundwater Data		Location ID: Sample Name: Well Type: Sample Date:	Groundwater Cleanup Standards[1]		316 2020AN-316 D BMW 07/30/2020	336 2020AN-336 D BMW 07/17/2020	338 2020AN-338 D BMW 07/29/2020	501A 2020AN-501A D BMW 07/18/2020	501B 2020AN-501B D BMW 07/18/2020	501C 2020AN-501C D BMW 07/18/2020	601 2020AN-601 D BMW 07/31/2020	602 2020AN-602 D BMW 07/28/2020	603-Z1 2020AN-603-Z1 D BMW 07/21/2020	603-Z2 2020AN-603-Z2 D BMW 07/21/2020	603-Z3 2020AN-603-Z3 D BMW 07/21/2020
CAS NO.	COMPOUND	UNITS:													
	VOLATILES														
67-64-1	Acetone	ug/L	22000	RBC	54 U	77 U	5.4 U	5.4 U	5.4 U	5.4 U	5.4 U	5.4 U	5.4 U	5.4 U	5.4 U
75-15-0	Carbon disulfide	ug/L	1000	RBC	**84**	**200**	**2.6**	0.28 U	0.28 U	0.28 U	0.28 U	0.28 UJ	**0.33 J**	**0.32 J**	0.28 U
	SEMIVOLATILES														
117-81-7	bis(2-Ethylhexyl)phthalate (DEHP)	ug/L	6	MCL	2.1 U	2.2 U	2.2 U	2.2 U	2.1 U	2.1 U	2.3 U	2.1 U	2.1 U	2.1 U	2.1 U
95-48-7	2-Methylphenol	ug/L	1800	RBC	0.2 U	0.21 U	0.21 U	R	0.2 U	0.2 U	0.22 U	0.2 U	0.2 U	0.2 U	0.2 U
	3&4-Methylphenol	ug/L	180	RBC	0.18 U	0.19 U	0.19 U	R	0.18 U	0.18 U	0.2 U	0.18 U	0.18 U	0.18 U	0.18 U
91-20-3	Naphthalene	ug/L	14	RBC	0.1 U	0.11 U	0.11 U	0.11 U	0.1 U	0.1 U	0.11 U	0.1 U	0.1 U	0.1 U	0.1 U
87-86-5	Pentachlorophenol	ug/L	1	MCL	3 U	3.1 U	3.1 U	R	3 U	3 U	3.2 U	3 U	3 U	3 U	3 U
108-95-2	Phenol	ug/L	11000	RBC	0.12 U	0.13 U	0.13 U	R	0.12 U	0.12 U	0.13 U	0.12 U	0.12 U	0.12 U	0.12 U
	METALS - DISSOLVED														
7429-90-5	Aluminum	ug/L	37000	RBC	34 U	34 U	34 U	34 U	34 U	34 U	**110**	**45 J**	34 U	34 U	34 U
7440-36-0	Antimony	ug/L	6	MCLG	**1.5 J**	0.57 U	**0.59 J**	0.57 U	0.57 U	0.57 U	0.57 U	0.57 U	**0.7 J**	0.57 U	0.57 U
7440-38-2	Arsenic	ug/L	10	MCL	**22**	**3.9 J**	**12**	0.75 U	**1.4 J**	**0.87 J**	0.75 U	**0.76 J**	0.75 U	**1.4 J**	0.75 U
7440-43-9	Cadmium	ug/L	5	MCLG	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
7440-47-3	Chromium	ug/L	100	MCLG	0.98 U	0.98 U	0.98 U	0.98 U	**1.1 J**	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U
7440-48-4	Cobalt	ug/L	11	RBC	**6**	**0.25 J**	**2.7**	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
7439-89-6	Iron	ug/L	26000	RBC	47 U	47 U	47 U	47 U	47 U	47 U	47 U	47 U	47 U	47 U	47 U
7439-92-1	Lead	ug/L	15	AL	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U
7439-96-5	Manganese	ug/L	880	RBC	**7.1**	**440**	**8.6**	**6.7**	**2.4 J**	**3.5 J**	2.1 U	2.1 U	**41**	**53**	**30**
7439-97-6	Mercury[2]	ug/L	2	MCLG	0.13 U	0.13 UJ	0.13 U	0.13 UJ	0.13 UJ	0.13 UJ	0.13 U	0.13 U	0.13 UJ	0.13 UJ	0.13 UJ
7440-02-0	Nickel	ug/L	730	RBC	**18**	1.5 U	**7.6**	**4.9**	**3**	**2.1**	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U
7440-62-2	Vanadium	ug/L	260	RBC	0.82 U	0.82 U	**1.1 J**	0.82 U	0.82 U	0.82 U	0.82 U	0.82 U	0.82 U	0.82 U	0.82 U
7440-66-6	Zinc	ug/L	11000	RBC	15 U	15 U	15 U	15 U	15 U	15 U	15 U	15 U	15 U	15 U	15 U
	OTHER														
FREE CN	Cyanide (free)	ug/L	200	MCLG	0.79 UJ	R	0.79 UJ	R	R	R	**1600**	**7.5 J-**	0.79 U	0.79 U	0.79 U
	FIELD PARAMETERS														
	Temperature	°C	---	---	21.78	17.28	21.89	18.22	17.24	17.33	19.02	15.91	16.79	14.86	16.21
	Conductivity	mS/cm	---	---	2.02	4.72	0.58	1.61	0.74	0.64	0.59	0.41	0.59	0.6	0.58
	pH	s.u.	---	---	10.24	6.83	8.00	7.63	9.09	9.4	10.31	9.66	7.61	7.63	7.68
	ORP	mV	---	---	-278.4	-299.8	-421.6	-345.3	-353.4	-365.3	-350.7	-252.4	-252.9	-266.4	-274.6
	Turbidity	NTU	---	---	50.4	0.76	0.41	0.09	0.07	0.22	0.18	0.66	4.55	0.11	0.08
	Dissolved Oxygen	mg/L	---	---	1.89	0.7	0.34	1.21	1.00	0.99	0.52	0.29	1.18	1.29	1.39

[1] - Groundwater cleanup standards as presented in Table 7 of the ROD.
[2] - Reported standard is for Mercury as Methyl.
Bold text indicates detected value.
MCL = Maximum Contaminant Level MCLG = MCL Goal
RBC = Risk Based Concentration AL = Action Level
U = Not Detected J = Estimated value J- = Estimated value biased low
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CAS NO.	COMPOUND	UNITS:												
	VOLATILES													
67-64-1	Acetone	ug/L	22000	RBC	5.4 U	5.4 U	5.4 U	5.4 U	5.4 U	5.4 U	5.4 U	5.4 U	5.4 U	5.4 U
75-15-0	Carbon disulfide	ug/L	1000	RBC	**0.28 J**	0.28 UJ	0.28 UJ	0.28 UJ	0.28 UJ	**2.5**	0.28 U	0.28 U	0.28 U	**1.2**
	SEMIVOLATILES													
117-81-7	bis(2-Ethylhexyl)phthalate (DEHP)	ug/L	6	MCL	2.1 U	2.1 U	2.1 U	2.2 U	2.2 U	2.1 U	2.3 U	2.2 U	2.1 U	2.2 U
95-48-7	2-Methylphenol	ug/L	1800	RBC	0.2 U	0.2 U	0.2 U	0.21 U	0.21 U	0.2 U	0.22 U	0.21 U	0.2 U	0.21 U
	3&4-Methylphenol	ug/L	180	RBC	0.18 U	0.18 U	0.18 U	0.19 U	0.19 U	0.18 U	0.2 U	0.19 U	0.18 U	0.19 U
91-20-3	Naphthalene	ug/L	14	RBC	0.1 U	0.1 U	0.1 U	0.11 U	0.11 U	0.1 U	0.11 U	0.11 U	0.1 U	0.11 U
87-86-5	Pentachlorophenol	ug/L	1	MCL	3 U	3 U	3 U	3.1 U	3.1 U	3 U	3.2 U	3.1 U	3 U	3.1 U
108-95-2	Phenol	ug/L	11000	RBC	0.12 U	0.12 U	0.12 U	0.13 U	0.13 U	0.12 U	0.13 U	0.13 U	0.12 U	0.13 U
	METALS - DISSOLVED													
7429-90-5	Aluminum	ug/L	37000	RBC	34 U	34 U	34 U	34 U	34 U	34 U	34 U	34 U	34 U	34 U
7440-36-0	Antimony	ug/L	6	MCLG	0.57 U	0.57 U	0.57 U	0.57 U	0.57 U	**0.61 J**	0.57 U	0.57 U	0.57 U	0.57 U
7440-38-2	Arsenic	ug/L	10	MCL	0.75 U	0.75 U	0.75 U	0.75 U	0.75 U	**7.8**	**2.2 J**	0.75 U	0.75 U	**0.78 J**
7440-43-9	Cadmium	ug/L	5	MCLG	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
7440-47-3	Chromium	ug/L	100	MCLG	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	**1.2 J**	0.98 U	0.98 U	0.98 U	0.98 U
7440-48-4	Cobalt	ug/L	11	RBC	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	**0.52 J**	0.19 U	0.19 U	0.19 U
7439-89-6	Iron	ug/L	26000	RBC	47 U	**330**	**200**	47 U	47 U	47 U	47 U	47 U	47 U	47 U
7439-92-1	Lead	ug/L	15	AL	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U
7439-96-5	Manganese	ug/L	880	RBC	**33**	**200**	**170**	**150**	**17**	2.1 U	**7.3**	**5.3**	**9.2**	**88**
7439-97-6	Mercury[2]	ug/L	2	MCLG	0.13 UJ	0.13 UJ	0.13 UJ	0.13 UJ	0.13 UJ	0.13 UJ	0.13 UJ	0.13 UJ	0.13 UJ	0.13 UJ
7440-02-0	Nickel	ug/L	730	RBC	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	**1.8 J**	**33**	**1.6 J**	1.5 U	1.5 U
7440-62-2	Vanadium	ug/L	260	RBC	0.82 U	0.82 U	0.82 U	0.82 U	0.82 U	**0.92 J**	**0.86 J**	0.82 U	0.82 U	0.82 U
7440-66-6	Zinc	ug/L	11000	RBC	15 U	15 U	15 U	15 U	15 U	15 U	15 U	15 U	15 U	15 U
	OTHER													
FREE CN	Cyanide (free)	ug/L	200	MCLG	0.79 U	0.79 U	0.79 U	**14**	**72**	R	R	0.79 U	**28**	**73 J-**
	FIELD PARAMETERS													
	Temperature	°C	---	---	16.62	18.26	17.44	16.99	16.15	20.74	22.45	19.44	16.89	16.40
	Conductivity	mS/cm	---	---	0.58	0.57	0.57	0.56	0.58	0.57	2.17	0.78	0.88	0.56
	pH	s.u.	---	---	7.67	7.89	7.38	7.4	7.93	10.08	8.06	8.94	9.14	7.75
	ORP	mV	---	---	-284.7	-119.4	-90.7	-133.7	0.17	-271.1	-36.9	-235.3	-377.6	-291.00
	Turbidity	NTU	---	---	0.01	2.93	1.16	0.8	1.27	0.38	1.41	0.11	0.32	0.40
	Dissolved Oxygen	mg/L	---	---	1.19	1.06	1.87	1.01	1.59	0.84	4.81	0.94	2.54	0.47

[1] - Groundwater cleanup standards as presented in Table 7 of the ROD.
[2] - Reported standard is for Mercury as Methyl.
Bold text indicates detected value.
MCL = Maximum Contaminant Level MCLG = MCL Goal
RBC = Risk Based Concentration AL = Action Level
U = Not Detected J = Estimated value J- = Estimated value biased low
NR = Not Reported UJ = Not detected, reporting limit is estimated R = Rejected
mg/L = milligrams per liter mV = millivolts
ug/L = micrograms per liter uS/cm = microsiemens per centimeter
s.u = std. units NTU = nephelometric turbidity unit
DUP = Duplicate Sample
= Detected value exceeds groundwater cleanup standard.

TABLE 9

OU-7 Monitoring Network Sampling Results
2020 Annual Site-Wide Groundwater, Surface Water, and Sediment Monitoring Report for OU-7, OU-10, and NTCRA Basins
Avtex Fibers Superfund Site
Front Royal, Virginia

FMC-Front Royal Avtex Fibers 2020 Sampling Event Validated OU-7 Groundwater Data		Location ID: Sample Name: Well Type: Sample Date:	Groundwater Cleanup Standards[1]		GM-02B 2020AN-GM-02B I BMW 07/17/2020	GM-09R 2020AN-GM-09R I BMW 08/01/2020	MW-03R 2020AN-MW-03R S BMW 07/31/2020	MW-09 2020AN-MW-09 OMW 08/01/2020	MW-09 (DUP) 2020AN-MW-09D OMW 08/01/2020	MW-10 2020AN-MW-10 OMW 07/30/2020	PW-0 2020AN-PW-0 I BMW 08/01/2020	PW-02 2020AN-PW-02 I BMW 07/31/2020	PZ-06 2020AN-PZ-06 S BMW 07/31/2020
CAS NO.	COMPOUND	UNITS:											
	VOLATILES												
67-64-1	Acetone	ug/L	22000	RBC	27 U	5.4 U	27 U	140 U	270 U	**47**	5.4 U	5.4 U	5.4 U
75-15-0	Carbon disulfide	ug/L	1000	RBC	**48**	0.28 U	**64**	**310 J**	**1600 J-**	**5.2**	0.28 U	**1.4**	0.28 U
	SEMIVOLATILES												
117-81-7	bis(2-Ethylhexyl)phthalate (DEHP)	ug/L	6	MCL	2.1 U	2.3 U	2.3 U	22 U	46 U	2.2 U	2.4 U	2.2 U	2.6 U
95-48-7	2-Methylphenol	ug/L	1800	RBC	0.19 U	0.22 U	0.22 U	**46**	**55**	0.21 U	0.23 U	0.21 U	0.25 U
	3&4-Methylphenol	ug/L	180	RBC	0.18 U	0.2 U	0.2 U	**10 J**	4 UJ	0.19 U	0.21 U	0.19 U	0.23 U
91-20-3	Naphthalene	ug/L	14	RBC	0.1 U	0.11 U	0.11 U	1.1 U	2.3 U	**0.38**	0.12 U	0.11 U	0.13 U
87-86-5	Pentachlorophenol	ug/L	1	MCL	2.9 U	3.2 U	3.2 U	31 U	65 U	3.1 U	3.4 U	3.1 U	3.7 U
108-95-2	Phenol	ug/L	11000	RBC	0.12 U	0.13 U	0.13 U	**370**	**480**	0.13 U	0.14 U	0.13 U	0.15 U
	METALS - DISSOLVED												
7429-90-5	Aluminum	ug/L	37000	RBC	**37 J**	34 U	34 U	**100**	**110**	34 U	34 U	**130**	34 U
7440-36-0	Antimony	ug/L	6	MCLG	**27**	0.57 U	**5.4**	**22**	**20**	0.57 U	0.57 U	0.57 U	0.57 U
7440-38-2	Arsenic	ug/L	10	MCL	**140**	0.75 U	**160**	**940**	**920**	**51**	0.75 U	**1.5 J**	**1.8 J**
7440-43-9	Cadmium	ug/L	5	MCLG	0.2 U	0.2 U	**0.58 J**	**0.82 J**	**0.73 J**	0.2 U	0.2 U	0.2 U	0.2 U
7440-47-3	Chromium	ug/L	100	MCLG	0.98 U	0.98 U	**9.3**	**38**	**45**	**1.2 J**	0.98 U	0.98 U	**1.5 J**
7440-48-4	Cobalt	ug/L	11	RBC	**3.7**	**0.72 J**	**130**	**250**	**250**	**18**	0.19 U	**0.35 J**	0.19 U
7439-89-6	Iron	ug/L	26000	RBC	**56 J**	**8200**	47 U	**88 J**	**150 J**	**23000**	**6100**	47 U	47 U
7439-92-1	Lead	ug/L	15	AL	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U
7439-96-5	Manganese	ug/L	880	RBC	**29**	**3300**	**4.5 J**	**59**	**57**	**1700**	**1800**	**140**	**22**
7439-97-6	Mercury[2]	ug/L	2	MCLG	0.13 UJ	0.13 U	0.13 UJ	0.13 UJ	0.13 UJ	0.13 U	0.13 U	0.13 U	0.13 U
7440-02-0	Nickel	ug/L	730	RBC	**14**	**14**	**380**	**570**	**550**	**26**	**19**	**1.9 J**	1.5 U
7440-62-2	Vanadium	ug/L	260	RBC	**0.95 J**	0.82 U	**14**	**160**	**150**	**2.6 J**	0.82 U	**0.88 J**	0.82 U
7440-66-6	Zinc	ug/L	11000	RBC	15 U	15 U	15 U	**660**	**660**	15 U	15 U	15 U	15 U
	OTHER												
FREE CN	Cyanide (free)	ug/L	200	MCLG	R	0.79 U	R	**6.2 J-**	**3.7 J-**	0.79 UJ	R	**4600**	R
	FIELD PARAMETERS												
	Temperature	°C	---	---	17.87	21.46	19.61	19.09	19.09	23.99	20.84	17.94	22.14
	Conductivity	mS/cm	---	---	6.33	3.58	8.73	20.75	20.75	8.71	1.82	0.86	0.64
	pH	s.u.	---	---	8.28	6.91	9.75	9.00	9.00	6.70	6.76	8.55	7.60
	ORP	mV	---	---	-412.9	-150.5	-413.2	-442.6	-442.6	-190.7	-131.5	-303.90	80.8
	Turbidity	NTU	---	---	1.76	0.52	22.9	9.49	9.49	21.6	1.62	59.70	3.11
	Dissolved Oxygen	mg/L	---	---	0.33	0.28	0.29	1.68	1.68	0.5	0.28	1.40	0.93

[1] - Groundwater cleanup standards as presented in Table 7 of the ROD.
[2] - Reported standard is for Mercury as Methyl.
Bold text indicates detected value.
MCL = Maximum Contaminant Level MCLG = MCL Goal
RBC = Risk Based Concentration AL = Action Level
U = Not Detected J = Estimated value J- = Estimated value biased low
NR = Not Reported UJ = Not detected; reporting limit is estimated R = Rejected
mg/L = miligrams per liter mV = millivolts
ug/L = micrograms per liter uS/cm = microsiemens per centimeter
s.u. = std. units NTU = nephelometric turbidity unit
DUP = Duplicate Sample
= Detected value exceeds groundwater cleanup standard.

TABLE 9

OU-7 Monitoring Network Sampling Results
2020 Annual Site-Wide Groundwater, Surface Water, and Sediment Monitoring Report for OU-7, OU-10, and NTCRA Basins
Avtex Fibers Superfund Site
Front Royal, Virginia

FMC-Front Royal Avtex Fibers 2020 Sampling Event Validated OU-7 Groundwater Data		Location ID: Sample Name: Well Type: Sample Date:	Groundwater Cleanup Standards[1]		TW-01 2020AN-TW-01 D BMW 08/03/2020	TW-02 2020AN-TW-02 D BMW 12/09/2020	TW-03 2020AN-TW-03 D BMW 12/10/2020	WP-10 2020AN-WP-10 OMW 07/30/2020	WP-11 2020AN-WP-11 OMW 08/01/2020
CAS NO.	COMPOUND	UNITS:							
	VOLATILES								
67-64-1	Acetone	ug/L	22000	RBC	27 U	110 U	5.4 U	27 U	5.4 U
75-15-0	Carbon disulfide	ug/L	1000	RBC	**100**	**420 J**	0.28 UJ	**5.5**	0.28 U
	SEMIVOLATILES								
117-81-7	bis(2-Ethylhexyl)phthalate (DEHP)	ug/L	6	MCL	2.1 U	1 U	0.2 U	**2.9 J**	2.2 U
95-48-7	2-Methylphenol	ug/L	1800	RBC	0.19 U	0.96 U	0.18 U	0.22 U	0.21 U
	3&4-Methylphenol	ug/L	180	RBC	0.18 U	11 U	2.1 U	0.2 U	0.19 U
91-20-3	Naphthalene	ug/L	14	RBC	0.1 U	0.55 U	0.1 U	7	0.11 U
87-86-5	Pentachlorophenol	ug/L	1	MCL	2.9 U	16 U	3 U	3.2 U	3.1 U
108-95-2	Phenol	ug/L	11000	RBC	0.12 U	0.64 U	0.12 U	0.13 U	0.13 U
	METALS - DISSOLVED								
7429-90-5	Aluminum	ug/L	37000	RBC	34 U	34 U	34 U	**55**	34 U
7440-36-0	Antimony	ug/L	6	MCLG	**1.2 J**	**4.4**	0.57 U	0.57 U	0.57 U
7440-38-2	Arsenic	ug/L	10	MCL	**13**	**39**	0.75 U	**260**	0.75 U
7440-43-9	Cadmium	ug/L	5	MCLG	0.2 U	0.2 U	0.2 U	**0.72 J**	0.2 U
7440-47-3	Chromium	ug/L	100	MCLG	0.98 U	**4.4**	0.98 U	**21**	0.98 U
7440-48-4	Cobalt	ug/L	11	RBC	**5.1**	**25**	0.19 U	**220**	**0.74 J**
7439-89-6	Iron	ug/L	26000	RBC	47 U	**180**	47 U	**520**	**5500**
7439-92-1	Lead	ug/L	15	AL	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U
7439-96-5	Manganese	ug/L	880	RBC	**130**	**150**	**49**	**69**	**480**
7439-97-6	Mercury[2]	ug/L	2	MCLG	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U
7440-02-0	Nickel	ug/L	730	RBC	**17**	**86**	**1.9 J**	**580**	1.5 U
7440-62-2	Vanadium	ug/L	260	RBC	0.82 U	**1.8 J**	0.82 U	**74**	0.82 U
7440-66-6	Zinc	ug/L	11000	RBC	15 U	**40**	15 U	**22**	**53**
	OTHER								
FREE CN	Cyanide (free)	ug/L	200	MCLG	R	**110 J-**	2 UJ	0.79 UJ	R
	FIELD PARAMETERS								
	Temperature	°C	---	---	19.21	13.16	9.18	28.22	22.05
	Conductivity	mS/cm	---	---	1.51	1.92	0.72	11.45	2.15
	pH	s.u.	---	---	7.97	8.45	8.15	9.78	7.19
	ORP	mV	---	---	-321.1	-274.1	-345.3	-275.4	-80.40
	Turbidity	NTU	---	---	NM	211	6.24	19.20	15.10
	Dissolved Oxygen	mg/L	---	---	1.24	6.85	6.07	0.19	3.01

[1] - Groundwater cleanup standards as presented in Table 7 of the ROD.
[2] - Reported standard is for Mercury as Methyl.
Bold text indicates detected value.
MCL = Maximum Contaminant Level MCLG = MCL Goal
RBC = Risk Based Concentration AL = Action Level
U = Not Detected J = Estimated value J- = Estimated value biased low
NR = Not Reported UJ = Not detected, reporting limit is estimated R = Rejected
mg/L = miligrams per liter mV = millivolts
ug/L = micrograms per liter uS/cm = microsiemens per centimeter
s.u = std. units NTU = nephelometric turbidity unit
DUP = Duplicate Sample
= Detected value exceeds groundwater cleanup standard.

Table G-2: OU7 Surface Water Analytical Results – 2020

Source: 2020 Annual Report

TABLE 21

OU-7 River Water Sample Results
2020 Annual Site-Wide Groundwater, Surface Water, and Sediment Monitoring Report for OU-7, OU-10, and ITCRA Basins
Avtex Fibers Superfund Site
Front Royal, Virginia

FMC-Front Royal Avtex Fibers 2020 Sampling Event Validated OU-7 Surface Water Data	Location ID: Sample Name: Sample Date:	Virginia Chronic Water Quality Criteria[1] Freshwater-Chronic	Virginia Chronic Water Quality Criteria[1] Human Health Drinking Water	Virginia Chronic Water Quality Criteria[1] Human Health All Other SW	EPA Region III BTAG Freshwater Benchmarks[2]	SW-01 2020AN-SW-01 07/15/2020	SW-02 2020AN-SW-02 07/15/2020	SW-03 2020AN-SW-03 07/15/2020	SW-03 (DUP) 2020AN-SW-03D 07/15/2020
COMPOUND	UNITS:								
VOLATILES									
Acetone	ug/L	NV	NV	NV	1500	5.4 U	5.4 U	5.4 U	5.4 UJ
Carbon disulfide	ug/L	NV	NV	NV	0.92	0.28 U	0.28 U	0.28 U	0.28 UJ
Chlorobenzene	ug/L	NV	100	800	1.3	0.32 U	0.32 U	0.32 U	0.32 UJ
SEMIVOLATILES									
bis(2-Ethylhexyl)phthalate (DEHP)	ug/L	NV	3.2	3.7	16	2.2 U	2.2 U	2.2 U	2.2 UJ
2-Methylphenol	ug/L	NV	NV	NV	13	0.21 U	0.21 U	0.21 U	0.21 UJ
3&4-Metxylphenol	ug/L	NV	NV	NV	543	0.19 U	0.19 U	0.19 U	0.19 UJ
Naphthalene	ug/L	NV	NV	NV	1.1	0.11 U	0.11 U	0.11 U	0.11 UJ
Pentachlorophenol	ug/L	6.7	0.3	0.4	0.5	3.1 U	3.1 U	3.1 U	3.1 UJ
Phenol	ug/L	NV	4,600	300,000	4	0.13 U	0.13 U	0.13 U	0.13 UJ
METALS - TOTAL									
Aluminum	ug/L	NV	NV	NV	87	47 U	47 U	47 U	47 UJ
Antimony	ug/L	NV	5.6	640	30	0.57 U	0.57 U	0.57 U	0.57 UJ
Arsenic	ug/L	150	10	NV	5	0.75 U	0.75 U	0.75 U	0.75 UJ
Cadmium	ug/L	0.72	5	NV	0.25	0.2 U	0.2 U	0.2 U	0.2 UJ
Chromium	ug/L	11	NV	NV	85	**1.2 J**	0.63 U	0.63 U	0.63 UJ
Cobalt	ug/L	NV	NV	NV	23	**0.28 J**	**0.3 J**	**0.27 J**	**0.26 J**
Iron	ug/L	NV	300*	NV	300	**47 J**	**100 J**	**47 J**	**36 J**
Lead	ug/L	2.1	15	NV	2.5	**1.1**	0.45 U	0.45 U	0.45 UJ
Manganese	ug/L	NV	NV	NV	120	**5 J**	**8.2 J**	**4.6 J**	**4.4 J**
Mercury	ug/L	0.77	NV	NV	0.026	0.13 U	0.13 U	0.13 U	0.13 UJ
Nickel	ug/L	20	610	4,600	52	2.2 U	2.2 U	2.2 U	2.2 UJ
Vanadium	ug/L	NV	NV	NV	20	5.6 U	5.6 U	5.6 U	5.6 UJ
Zinc	ug/L	120	7,400	26,000	120	9.7 U	9.7 U	9.7 U	9.7 UJ
METALS - DISSOLVED									
Aluminum	ug/L	NV	NV	NV	87	47 U	47 U	47 U	47 UJ
Antimony	ug/L	NV	5.6	640	30	0.57 U	0.57 U	0.57 U	0.57 UJ
Arsenic	ug/L	150	10	NV	5	0.75 U	0.75 U	0.75 U	0.75 UJ
Cadmium	ug/L	0.72	5	NV	0.25	0.2 U	0.2 U	0.2 U	0.2 UJ
Chromium	ug/L	11	NV	NV	85	0.63 U	0.63 U	0.63 U	0.63 UJ
Cobalt	ug/L	NV	NV	NV	23	**0.25 J**	**0.23 J**	**0.28 J**	**0.33 J**
Iron	ug/L	NV	300*	NV	300	26 U	26 U	26 U	26 UJ
Lead	ug/L	2.1	15	NV	2.5	0.45 U	0.45 U	0.45 U	0.45 UJ
Manganese	ug/L	NV	NV	NV	120	**2.1 J**	**2.5 J**	**2.6 J**	**2.9 J**
Mercury	ug/L	0.77	NV	NV	0.026	0.13 U	0.13 U	0.13 U	0.13 UJ
Nickel	ug/L	20	610	4,600	52	2.2 U	2.2 U	2.2 U	2.2 UJ
Vanadium	ug/L	NV	NV	NV	20	5.6 U	5.6 U	5.6 U	5.6 UJ
Zinc	ug/L	120	7,400	26,000	120	9.7 U	9.7 U	9.7 U	9.7 UJ
OTHER									
Cyanide (total)	ug/L	5.2	4	400	5	6 U	6 U	6 U	6 UJ
Cyanide (free)	ug/L	5.2	4	400	5	R	R	R	R
FIELD PARAMETERS									
Temperature	°C	20	NV	NV	NV	26.09	27.33	29.73	29.73
Conductivity	uS/cm	NV	NV	NV	NV	292	282	273	273
pH	s.u.	6.6-9.0	NV	NV	6.5-9	8.57	8.85	9.11	9.11
ORP	mV	NV	NV	NV	NV	28.5	-0.9	-4.3	-4.3
Turbidity	NTU	NV	NV	NV	NV	NM	NM	NM	NM
Dissolved Oxygen	mg/L	6.0 (min); 7.0 (avg)	NV	NV	NV	8.16	8.56	9.09	9.09

[1]Screening criteria, where available, are based on the Virginia Chronic Water Quality Criteria (9 VAC 25-260-140) (effective 10/18/19).

[2]Screening criteria is the Region III BTAG Aquatic Freshwater Screening Benchmarks (July 2006).

[3]Screening criteria based on hardness of 100 mg/L as $CaCO_3$.

[4]Screening criteria for Chromium 6 based on hardness of 100 mg/L as $CaCO_3$.

* applies to drinking water characteristics (taste, odor, etc.)

NV - No Value Available
NTU = nephelometric turbidity unit
uS/cm = microsiemens per centimeter

J = Estimated value
U - Not detected, value indicates reporting limit.
NM - Not Measured

= Detected value exceeds Screening Criteria.
ug/L = micrograms per liter
mg/L = miligrams per liter

s.u = std. units
mV = millivolts
DUP = Duplicate Sam

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TABLE 21

OU-7 River Water Sample Results
2020 Annual Site-Wide Groundwater, Surface Water, and Sediment Monitoring Report for OU-7, OU-10, and NTCRA Basins
Avtex Fibers Superfund Site
Front Royal, Virginia

FMC-Front Royal Avtex Fibers 2020 Sampling Event Validated OU-7 Surface Water Data	Location ID: Sample Name: Sample Date:	Virginia Chronic Water Quality Criteria[1] Freshwater-Chronic	Virginia Chronic Water Quality Criteria[1] Human Health Drinking Water	Virginia Chronic Water Quality Criteria[1] Human Health All Other SW	EPA Region III BTAG Freshwater Benchmarks[2]	SW-04 2020AN-SW-04 07/15/2020	SW-05 2020AN-SW-05 07/15/2020	SW-06 2020AN-SW-06 07/15/2020	SW-07 2020AN-SW-07 07/15/2020	SW-08 2020AN-SW-08 07/16/2020
COMPOUND	UNITS:									
VOLATILES										
Acetone	ug/L	NV	NV	NV	1500	5.4 U	5.4 U	5.4 U	**6.7 J**	5.4 U
Carbon disulfide	ug/L	NV	NV	NV	0.92	0.28 U	0.28 U	0.28 U	0.28 U	0.28 U
Chlorobenzene	ug/L	NV	100	800	1.3	0.32 U	0.32 U	0.32 U	0.32 U	0.32 U
SEMIVOLATILES										
bis(2-Ethylhexyl)phthalate (DEHP)	ug/L	NV	3.2	3.7	16	2.1 U	2.1 U	2.2 U	2.2 U	2.1 U
2-Methylphenol	ug/L	NV	NV	NV	13	0.2 U	0.2 U	0.21 U	0.21 U	0.2 U
3&4-Methylphenol	ug/L	NV	NV	NV	543	0.18 U	0.18 U	0.19 U	0.19 U	0.18 U
Naphthalene	ug/L	NV	NV	NV	1.1	0.1 U	0.1 U	0.11 U	0.11 U	0.1 U
Pentachlorophenol	ug/L	6.7	0.3	0.4	0.5	3 U	3 U	3.1 U	3.1 U	3 U
Phenol	ug/L	NV	4,000	300,000	4	0.12 U	0.12 U	0.13 U	0.13 U	0.12 U
METALS - TOTAL										
Aluminum	ug/L	NV	NV	NV	87	47 U	47 U	47 U	47 U	47 U
Antimony	ug/L	NV	5.6	640	30	0.57 U	0.57 U	0.57 U	0.57 U	0.57 U
Arsenic	ug/L	150	10	NV	5	0.75 U	0.75 U	0.75 U	0.75 U	0.75 U
Cadmium	ug/L	0.72	5	NV	0.25	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Chromium	ug/L	11	NV	NV	85	0.63 U	0.63 U	0.63 U	0.63 U	0.63 U
Cobalt	ug/L	NV	NV	NV	23	**0.29 J**	**0.26 J**	**0.26 J**	**0.26 J**	**0.28 J**
Iron	ug/L	NV	300*	NV	300	**66 J**	**120 J**	**50 J**	**53 J**	**56 J**
Lead	ug/L	11	15	NV	2.5	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U
Manganese	ug/L	NV	NV	NV	120	**6.2 J**	**5.2 J**	**4.9 J**	**5.8 J**	**6.2 J**
Mercury	ug/L	0.77	NV	NV	0.026	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U
Nickel	ug/L	20	610	4,600	52	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U
Vanadium	ug/L	NV	NV	NV	20	5.6 U	5.6 U	5.6 U	5.6 U	5.6 U
Zinc	ug/L	120	7,400	26,000	120	9.7 U	9.7 U	9.7 U	9.7 U	9.7 U
METALS - DISSOLVED										
Aluminum	ug/L	NV	NV	NV	87	47 U	47 U	47 U	47 U	47 U
Antimony	ug/L	NV	5.6	640	30	0.57 U	0.57 U	0.57 U	0.57 U	0.57 U
Arsenic	ug/L	150	10	NV	5	0.75 U	0.75 U	0.75 U	0.75 U	0.75 U
Cadmium	ug/L	0.72	5	NV	0.25	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Chromium	ug/L	11	NV	NV	85	0.63 U	0.63 U	0.63 U	0.63 U	0.63 U
Cobalt	ug/L	NV	NV	NV	23	**0.23 J**	**0.24 J**	**0.25 J**	**0.26 J**	**0.25 J**
Iron	ug/L	NV	300*	NV	300	26 U	26 U	26 U	26 U	26 U
Lead	ug/L	11	15	NV	2.5	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U
Manganese	ug/L	NV	NV	NV	120	**2.3 J**	**2.5 J**	**2.5 J**	**2.8 J**	**3 J**
Mercury	ug/L	0.77	NV	NV	0.026	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U
Nickel	ug/L	20	610	4,600	52	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U
Vanadium	ug/L	NV	NV	NV	20	5.6 U	5.6 U	5.6 U	5.6 U	5.6 U
Zinc	ug/L	120	7,400	26,000	120	9.7 U	9.7 U	9.7 U	**32 J**	9.7 U
OTHER										
Cyanide (total)	ug/L	5.2	4	400	5	6 U	6 U	6 U	6 U	6 U
Cyanide (free)	ug/L	5.2	4	400	5	R	R	R	R	R
FIELD PARAMETERS										
Temperature	°C	20	NV	NV	NV	30.22	29.86	31.13	30.67	27.05
Conductivity	uS/cm	NV	NV	NV	NV	265	261	259	258	349
pH	s.u.	6.0-9.0	NV	NV	6.5-9	9.43	9.40	9.53	9.48	8.49
ORP	mV	NV	NV	NV	NV	-9.4	-23.5	-47.0	-55.0	-104.9
Turbidity	NTU	NV	NV	NV	NV	NM	NM	NM	NM	NM
Dissolved Oxygen	mg/L	6.0 (min); 7.0 (avg)	NV	NV	NV	9.24	8.93	9.88	8.88	6.01

[1]Screening criteria, where available, are based on the Virginia Chronic Water Quality Criteria (9 VAC 25-260-140) (effective 10/18/15

[2]Screening criteria is the Region III BTAG Aquatic Freshwater Screening Benchmarks (July 2006).

[3]Screening criteria based on hardness of 100 mg/L as $CaCO_3$.

[4]Screening criteria for Chromium 6 based on hardness of 100 mg/L as $CaCO_3$.

* applies to drinking water characteristics (taste, odor, etc.)

NV - No Value Available
NTU = nephelometric turbidity unit
uS/cm = microsiemens per centimeter

J = Estimated value
U - Not detected, value indicates reporting limit.
NM - Not Measured

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Table G-3: OU7 Sediment Analytical Results – 2020

Source: 2020 Annual Report

TABLE 20

OU-7 River Sediment Sample Results
2020 Annual Site-Wide Groundwater, Surface Water, and Sediment Monitoring Report for OU-7, OU-10, and NTCRA Basins
Avtex Fibers Superfund Site
Front Royal, Virginia

FMC Front Royal Avtex Fiber 2020 Sampling Event Validated OU-7 Sediment Data	Location ID: Sample Name: Sample Date:	Screening Criteria[1]	SED-01 2020AN-SED-01 07/15/2020	SED-02 2020AN-SED-02 07/15/2020	SED-03 2020AN-SED-03 07/15/2020	SED-03 (DUP) 2020AN-SED-03D 07/15/2020	SED-04 2020AN-SED-04 07/15/2020	SED-05 2020AN-SED-05 07/15/2020	SED-06 2020AN-SED-06 07/15/2020	SED-07 2020AN-SED-07 07/15/2020	SED-08 2020AN-SED-08 07/16/2020
COMPOUND	UNITS:										
VOLATILES											
Acetone	ug/kg	NV	24 U	26 U	29 U	38	26 U	29 U	28 U	53 U	47 U
Carbon disulfide	ug/kg	0.851	1.5 U	1.7 U	2.1 U	4.5 U	2 U	1.9 U	1.9 U	2.9 U	2.6 U
Chlorobenzene	ug/kg	8.42	1 U	1.1 U	1.3 U	1.3 U	1.1 U	1.3 U	1.2 U	2.3 U	2 U
SEMIVOLATILES											
bis(2-Ethylhexyl)phthalate (DEHP)	ug/kg	182	65 U	67 U	76 U	81 U	72 U	77 U	78 U	200	130 U
2-Methylphenol	ug/kg	NV	39 U	40 U	46 U	49 U	44 U	47 U	47 U	83 U	79 U
3&4-Methylphenol	ug/kg	670	37 U	38 U	43 U	46 U	41 U	44 U	44 U	78 U	74 U
Naphthalene	ug/kg	176	3.1 U	3.1 U	3.6 U	3.8 U	3.4 U	3.6 U	3.7 U	6.4 U	13 J
Pentachlorophenol	ug/kg	504	74 U	76 U	86 U	92 U	82 U	88 U	88 U	160 U	150 U
Phenol	ug/kg	420	10 U	10 U	12 U	13 U	11 U	12 U	12 U	21 U	20 U
METALS											
Aluminum	mg/kg	NV	5700	5000	7400	8700	6900	3700	6700	7800	8400
Antimony	mg/kg	2	0.25 J	0.13 UJ	0.16 UJ	0.15 J	0.16 J	0.17 UJ	0.14 UJ	0.28 UJ	0.26 UJ
Arsenic	mg/kg	9.8	9	5.8	2.9	3.7	4	1.6	3.7	2.1 J	2.9
Cadmium	mg/kg	0.99	0.073 J	0.061 J	0.082 J	0.11 J	0.18 J	0.058 U	0.093 J	0.11 J	0.13 J
Chromium	mg/kg	43.4	28	14	12	14	18	11	12	17	20
Cobalt	mg/kg	50	9.4	7.7	8.1	10	14	5.5	8.6	9.6	11
Iron	mg/kg	20000	59000	22000	14000	17000	15000	12000	17000	19000	24000
Lead	mg/kg	35.8	18	8	11	13	14	7	12	12	15
Manganese	mg/kg	460	780 J	420 J	470 J	450 J	2000 J	210 J	390 J	400 J	490 J
Mercury	mg/kg	0.18	0.077 J	0.051 J	0.072 J	0.2	0.62	0.16	0.26	0.33	0.43
Nickel	mg/kg	22.7	14 J	14	10	12	12	6	10	12	17
Vanadium	mg/kg	NV	49	17	24	24	19	14	19	24	29
Zinc	mg/kg	121	31	31	34	46	140	47	42	51	89
OTHER											
Cyanide (total)	mg/kg	NV	0.22 U	0.25 U	0.25 U	0.28 U	0.26 U	0.29 U	0.3 U	0.54 U	0.48 U
Cyanide (free)	mg/kg	0.1	0.43 J	0.4 U	0.45 U	0.5 U	0.92 J	0.51 J	0.47 U	0.81 U	0.78 U
Moisture, Percent	%	NV	21.1	23.1	32.4	38.0	30.0	33.5	34.7	62.1	60.6
Total organic carbon (TOC)	mg/kg	NV	800 J	1100	4300 J	9900 J	9600	3000	13000	17000	34000
Percent Solids	%	NV	78.9	76.9	67.6	62.0	70.0	66.5	65.3	37.9	39.4

U - Not detected at the associated reporting limit
UJ - Not detected, estimated reporting limit
mg/Kg = milligrams per kilogram
J - Estimated Concentration
NV - No value available
ug/Kg = micrograms per kilogram
[1]Screening criteria based on EPA Region III Freshwater Sediment Screening Benchmarks (EPA, 2006).
– Detected value exceeds screening criteria
DUP = Duplicate

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Page 1 of 2

TABLE 20

OU-7 River Sediment Sample Results
2020 Annual Site-Wide Groundwater, Surface Water, and Sediment Monitoring Report for OU-7, OU-10, and NTCRA Basins
Avtex Fibers Superfund Site
Front Royal, Virginia

FMC-Front Royal Avtex Fiber 2020 Sampling Event Validated OU-7 Sediment Data	Location ID: Sample Name: Sample Date:	Screening Criteria[1]	SED-01 2020AN-SED-01 07/15/2020	SED-02 2020AN-SED-02 07/15/2020	SED-03 2020AN-SED-03 07/15/2020	SED-03 (DUP) 2020AN-SED-03D 07/15/2020	SED-04 2020AN-SED-04 07/15/2020	SED-05 2020AN-SED-05 07/15/2020	SED-06 2020AN-SED-06 07/15/2020	SED-07 2020AN-SED-07 07/15/2020	SED-08 2020AN-SED-08 07/16/2020
COMPOUND	UNITS:										
GRAIN SIZE											
Clay - Material passing a 0.075-mm (No. 200) that exhibits plasticity, and strength when dry (PI ≥ 4)	%	NV	1.3	1.4	11.7	3.1	14.8	4.5	11.3	12	15.8
Silt - Material passing a 0.075-mm (No. 200) that is non-plastic, and has little strength when dry (PI < 4).	%	NV	1.7	4.6	16.7	7.4	29	5.8	21.5	26.6	33.2
Fine sand - Material passing a 0.475-mm (No. 40) sieve and retained on a 0.075-mm (No. 200) sieve.	%	NV	22.6	21.6	61.7	43.9	48.1	61.8	61	47.5	31.8
Medium sand - Material passing a 2.00-mm sieve (No. 10) and retained on a 0.475-mm (No. 40) sieve.	%	NV	36.1	42.7	7.8	13.3	7.4	10.9	4	13.5	7.3
Coarse sand - Material passing a 4.75-mm sieve (No. 4) and retained on a 2.00-mm (No. 10) sieve.	%	NV	5.8	7.8	0.4	2.8	0.4	1.6	0.8	0.2	4.4
Sand - Material passing a 4.75-mm sieve (No. 4) and retained on a 0.075-mm (No. 200) sieve.	%	NV	64.5	72.1	69.9	60	55.9	74.3	65.8	61.2	43.5
Gravel - Material passing a 75-mm (3-inch) sieve and retained on a 4.75-mm (No. 4) sieve.	%	NV	32.5	21.9	1.7	29.5	0.3	15.4	1.4	0.2	7.5
Hydrometer 1 for particle size distribution	% passed	NV	1.4	4.3	7.6	4.3	16.7	3	12.4	15.8	26.8
Hydrometer 2 for particle size distribution	% passed	NV	0.3	0.3	1.2	0.9	4.1	0.6	2.8	4.9	2.6
Hydrometer 3 for particle size distribution	% passed	NV	0	0	2.5	0.9	3	1.1	2.8	2	1.3
Hydrometer 4 for particle size distribution	% passed	NV	0	0	3	0.4	2.9	1.1	1.4	1.9	2.5
Hydrometer 5 for particle size distribution	% passed	NV	0	0	2.4	0.9	2.3	0	2.1	2	0
Hydrometer 6 for particle size distribution	% passed	NV	0.3	0.3	3.7	0.9	4.2	1.1	4.2	4	7.8
Hydrometer 7 for particle size distribution	% passed	NV	0.3	0.3	3	0.4	4.1	1.1	2.8	1	2.6
Sieve, #200	% passed	NV	0.7	0.4	14.9	5.1	14.2	10.7	24.1	7.4	21.6
Sieve, #100	% passed	NV	0.9	0.3	7.9	3.7	5.8	6.7	9.4	3.6	4
Sieve, #80	% passed	NV	4.4	1.6	13.6	8.8	9.2	13	12.6	6.5	3.3
Sieve, #60	% passed	NV	16.6	19.3	25.3	26.3	18.9	31.4	14.9	30	2.9
Sieve, #40	% passed	NV	26.5	35	7	10.5	5.7	9.3	2.8	12	3.4
Sieve, #20	% passed	NV	9.6	7.7	0.8	2.8	1.7	1.6	1.2	1.5	3.9
Sieve, #10	% passed	NV	5.8	7.8	0.4	2.8	0.4	1.6	0.8	0.2	4.4
Sieve, #4	% passed	NV	6.7	11.3	1.7	8.8	0.3	2.9	0.4	0.2	7.5
Sieve, 0.375 inch	% passed	NV	11.5	10.6	0	20.7	0	12.5	1	0	0
Sieve, 0.75 inch	% passed	NV	14.3	0	0	0	0	0	0	0	0
Sieve, 1 inch	% passed	NV	0	0	0	0	0	0	0	0	0
Sieve, 1.5 inch	% passed	NV	0	0	0	0	0	0	0	0	0
Sieve, 2 inch	% passed	NV	0	0	0	0	0	0	0	0	0
Sieve, 3 inch	% passed	NV	0	0	0	0	0	0	0	0	0

U - Not detected at the associated reporting limit
UJ - Not detected, estimated reporting limit
J - Estimated Concentration
NV - No value available.
mg/Kg = miligrams per kilogram
ug/Kg = micrograms per kilogram
[1]Screening criteria based on EPA Region III Freshwater Sediment Screening Benchmarks (EPA, 2006).
– Detected value exceeds screening criteria.
DUP = Duplicate

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Table G-4: OU10 Groundwater Results – 2020

Source: 2020 Annual Report

TABLE 12

OU-10 Viscose Basin 1-8 Groundwater Monitoring Network Sampling Results
2020 Annual Site-Wide Groundwater, Surface Water, and Sediment Monitoring Report for OU-7, OU-10, and NTCRA Basins
Avtex Fibers Superfund Site
Front Royal, Virginia

FMC-Front Royal Avtex Fibers 2020 Sampling Event OU-10 VB 1-8 Groundwater Wells		Purpose:			Upgradient Overburden Monitoring Wells		Upgradient Shallow Bedrock Monitoring Wells			
		Location ID Sample ID: Sampled:	Regional Screening Level[1] HQ=0.1	Regional Screening Level[1] HQ=1.0	GPW-02 2020AN-GPW-02 07/18/2020	GPW-03R 2020AN-GPW-03R 07/17/2020	MW-07 2020AN-MW-07 07/28/2020	MW-08 2020AN-MW-08 07/28/2020	118 2020AN-118 07/28/2020	128 2020AN-128 07/31/2020
CAS NO.	COMPOUND	UNITS:								
	VOLATILES									
67-64-1	Acetone	ug/L	1400	14000	**9.7 J**	5.4 U	5.4 U	5.4 U	5.4 U	5.4 U
71-43-2	Benzene	ug/L	0.46	0.46	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U
75-27-4	Bromodichloromethane	ug/L	0.13	0.13	0.35 U	0.35 U	0.35 U	0.35 U	0.35 U	0.35 U
75-25-2	Bromoform	ug/L	3.3	3.3	0.76 U	0.76 U	0.76 U	0.76 U	0.76 U	0.76 U
74-83-9	Bromomethane (Methyl bromide)	ug/L	0.75	7.5	0.42 U	0.42 U	0.42 U	0.42 U	0.42 U	0.42 U
78-93-3	2-Butanone (Methyl ethyl ketone) (MEK)	ug/L	560	5600	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U
75-15-0	Carbon disulfide	ug/L	81	810	0.28 U	**0.32 J**	0.28 UJ	0.28 UJ	0.28 UJ	0.28 U
56-23-5	Carbon tetrachloride	ug/L	0.46	0.46	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U
108-90-7	Chlorobenzene	ug/L	7.8	78	0.32 U	0.32 U	0.32 U	0.32 U	0.32 U	0.32 U
75-00-3	Chloroethane	ug/L	2100	21000	0.83 U	0.83 U	0.83 U	0.83 U	0.83 U	0.83 U
67-66-3	Chloroform (Trichloromethane)	ug/L	0.22	0.22	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
74-87-3	Chloromethane (Methyl chloride)	ug/L	19	190	0.64 U	0.64 U	0.64 U	0.64 U	0.64 U	0.64 U
124-48-1	Dibromochloromethane	ug/L	0.87	0.87	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U
95-50-1	1,2-Dichlorobenzene	ug/L	30	300	0.43 U	0.43 U	0.43 U	0.43 U	0.43 U	0.43 U
541-73-1	1,3-Dichlorobenzene	ug/L	NV	NV	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
106-46-7	1,4-Dichlorobenzene	ug/L	0.48	0.48	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U
75-34-3	1,1-Dichloroethane	ug/L	2.8	2.8	0.41 U	0.41 U	0.41 U	0.41 U	0.41 U	0.41 U
107-06-2	1,2-Dichloroethane	ug/L	0.17	0.17	0.43 U	0.43 U	0.43 U	0.43 U	0.43 U	0.43 U
75-35-4	1,1-Dichloroethene	ug/L	28	280	0.46 U	0.46 U	0.46 U	0.46 U	0.46 U	0.46 U
156-59-2	cis-1,2-Dichloroethene	ug/L	3.6	36	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U
156-60-5	trans-1,2-Dichloroethene	ug/L	6.8	68	0.43 U	0.43 U	0.43 U	0.43 U	0.43 U	0.43 U
78-87-5	1,2-Dichloropropane	ug/L	0.82	0.85	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U
10061-01-5	cis-1,3-Dichloropropene	ug/L	0.47	0.47	0.61 U	0.61 U	0.61 U	0.61 U	0.61 U	0.61 U
10061-02-6	trans-1,3-Dichloropropene	ug/L	0.47	0.47	0.67 U	0.67 U	0.67 U	0.67 U	0.67 U	0.67 U
100-41-4	Ethylbenzene	ug/L	1.5	1.5	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U
591-78-6	2-Hexanone	ug/L	3.8	38	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U
108-10-1	4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	ug/L	630	6300	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U
75-09-2	Methylene chloride	ug/L	11	11	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U
100-42-5	Styrene	ug/L	120	1200	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
79-34-5	1,1,2,2-Tetrachloroethane	ug/L	0.076	0.076	0.56 U	0.56 U	0.56 U	0.56 U	0.56 U	0.56 U
127-18-4	Tetrachloroethene	ug/L	4.1	11	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
108-88-3	Toluene	ug/L	110	1100	0.35 U	0.35 U	0.35 U	0.35 U	0.35 U	0.35 U
120-82-1	1,2,4-Trichlorobenzene	ug/L	0.4	1.2	0.81 U	0.81 U	0.81 U	0.81 U	0.81 U	0.81 U
71-55-6	1,1,1-Trichloroethane	ug/L	800	8000	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U
79-00-5	1,1,2-Trichloroethane	ug/L	0.041	0.28	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U
79-01-6	Trichloroethene	ug/L	0.28	0.49	0.36 U	0.36 U	0.36 U	0.36 U	0.36 U	0.36 U
75-01-4	Vinyl chloride	ug/L	0.019	0.019	0.5 U	0.5 U	**1.6**	0.5 U	0.5 U	0.5 U
1330-20-7	Xylenes (total)	ug/L	19	190	0.42 U	0.42 U	0.42 U	0.42 U	0.42 U	0.42 U
	SEMIVOLATILES									
83-32-9	Acenaphthene	ug/L	53	530	0.16 U	0.17 U	0.17 U	0.19 U	0.17 U	0.17 U
208-96-8	Acenaphthylene	ug/L	NV	NV	0.12 U	0.12 U	0.12 U	0.14 U	0.13 U	0.13 U
120-12-7	Anthracene	ug/L	180	1800	0.13 U	0.13 U	0.13 U	0.15 U	0.14 U	0.14 U

[1] - EPA Regional Screening Levels (RSLs) for tapwater (November 2020).
[2] - Reported standard is for elemental mercury.
U - Not detected, value indicates reporting limit
NR - Not Reported
= Detected value exceeds RSL (HQ=0.1).
= Detected value exceeds RSL (HQ=1.0).

Bold text indicates detected value.
NTU = nephelometric turbidity unit
NV - No Value Available
uS/cm = microsiemens per centimeter
ug/L = micrograms per liter
DUP = Duplicate Sample

J – Estimated value
s.u = std. units
mg/L = miligrams per liter
mV = millivolts
UJ – Not detected at est. detection limit

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TABLE 12

OU-10 Viscose Basin 1-8 Groundwater Monitoring Network Sampling Results
2020 Annual Site-Wide Groundwater, Surface Water, and Sediment Monitoring Report for OU-7, OU-10, and NTCRA Basins
Avtex Fibers Superfund Site
Front Royal, Virginia

FMC-Front Royal Avtex Fibers 2020 Sampling Event OU-10 VE 1-8 Groundwater Wells		Purpose:			Upgradient Overburden Monitoring Wells		Upgradient Shallow Bedrock Monitoring Wells			
		Location ID Sample ID Sampled:	Regional Screening Level[1] HQ=0.1	Regional Screening Level[1] HQ=1.0	GPW-02 2020AN-GPW-02 07/18/2020	GPW-03R 2020AN-GPW-03R 07/17/2020	MW-07 2020AN-MW-07 07/28/2020	MW-08 2020AN-MW-08 07/28/2020	118 2020AN-118 07/28/2020	128 2020AN-128 07/31/2020
CAS NO.	COMPOUND	UNITS:								
	SEMIVOLATILES (CONTINUED)									
56-55-3	Benzo(a)anthracene	ug/L	0.03	0.03	0.16 U	0.16 U	0.16 U	0.19 U	0.17 U	0.17 U
50-32-8	Benzo(a)pyrene	ug/L	0.025	0.025	0.16 U	0.17 U	0.17 U	0.19 U	0.17 U	0.17 U
205-99-2	Benzo(b)fluoranthene	ug/L	0.25	0.25	0.14 U	0.15 U	0.15 U	0.17 U	0.15 U	0.15 U
191-24-2	Benzo(g,h,i)perylene	ug/L	NV	NV	0.16 U	0.17 U	0.17 U	0.19 U	0.18 U	0.18 U
207-08-9	Benzo(k)fluoranthene	ug/L	2.5	2.5	0.13 U	0.13 U	0.13 U	0.15 U	0.14 U	0.14 U
101-55-3	4-Bromophenyl phenyl ether	ug/L	NV	NV	0.46 U	0.48 U	0.48 U	0.54 U	0.5 U	0.5 U
85-68-7	Butyl benzylphthalate (BBP)	ug/L	16	16	0.62 U	0.64 U	0.64 U	0.72 U	0.67 U	0.67 U
86-74-8	Carbazole	ug/L	NV	NV	0.45 U	0.47 U	0.47 U	0.53 U	0.49 U	0.49 U
59-50-7	4-Chloro-3-methylphenol	ug/L	140	1400	0.27 U	0.28 U	0.28 U	0.32 U	0.3 U	0.3 U
106-47-8	4-Chloroaniline	ug/L	0.37	0.37	0.29 U	0.3 U	0.3 U	0.34 U	0.32 U	0.32 U
111-91-1	bis(2-Chloroethoxy)methane	ug/L	5.9	59	0.42 U	0.44 U	0.44 U	0.49 U	0.46 U	0.46 U
111-44-4	bis(2-Chloroethyl)ether	ug/L	0.014	0.014	0.37 U	0.39 U	0.39 U	0.44 U	0.4 U	0.4 U
91-58-7	2-Chloronaphthalene	ug/L	75	750	0.45 U	0.46 U	0.46 U	0.53 U	0.48 U	0.48 U
95-57-8	2-Chlorophenol	ug/L	9.1	91	0.25 U	0.26 U	0.26 U	0.3 U	0.27 U	0.27 U
7005-72-3	4-Chlorophenyl phenyl ether	ug/L	NV	NV	0.51 U	0.53 U	0.53 U	0.6 U	0.55 U	0.55 U
218-01-9	Chrysene	ug/L	25	25	0.17 U	0.18 U	0.18 U	0.2 U	0.19 U	0.19 U
53-70-3	Dibenz(a,h)anthracene	ug/L	0.025	0.025	0.14 U	0.15 U	0.15 U	0.16 U	0.15 U	0.15 U
132-64-9	Dibenzofuran	ug/L	0.79	7.9	0.52 U	0.54 U	0.54 U	0.61 U	0.56 U	0.56 U
91-94-1	3,3'-Dichlorobenzidine	ug/L	0.13	0.13	1.1 U	1.1 U	1.1 U	1.3 U	1.2 U	1.2 U
120-83-2	2,4-Dichlorophenol	ug/L	4.6	46	0.24 U	0.25 U	0.25 U	0.28 U	0.26 U	0.26 U
84-66-2	Diethyl phthalate	ug/L	1500	15000	3.5 U	3.7 U	3.7 U	4.1 U	3.8 U	3.8 U
105-67-9	2,4-Dimethylphenol	ug/L	36	360	0.48 U	0.5 U	0.5 U	0.56 U	0.52 U	0.52 U
131-11-3	Dimethyl phthalate	ug/L	NV	NV	0.48 U	0.5 U	0.5 U	0.56 U	0.52 U	0.52 U
84-74-2	Di-n-butylphthalate (DBP)	ug/L	90	900	1.7 U	1.7 U	1.7 U	2 U	1.8 U	1.8 U
534-52-1	4,6-Dinitro-2-methylphenol	ug/L	0.15	1.5	2.6 U	2.7 U	2.7 U	3.1 U	2.8 U	2.8 U
51-28-5	2,4-Dinitrophenol	ug/L	3.9	39	5.7 U	6 U	6 U	6.8 U	6.2 U	6.2 U
121-14-2	2,4-Dinitrotoluene	ug/L	0.24	0.24	1.9 U	2 U	2 U	2.3 U	2.1 U	2.1 U
606-20-2	2,6-Dinitrotoluene	ug/L	0.049	0.049	2 U	2 U	2 U	2.3 U	2.1 U	2.1 U
117-84-0	Di-n-octyl phthalate (DnOP)	ug/L	20	200	0.76 U	0.79 U	0.79 U	0.89 U	0.82 U	0.82 U
117-81-7	bis(2-Ethylhexyl)phthalate (DEHP)	ug/L	5.6	5.6	2.1 U	2.1 U	2.1 U	2.4 U	2.2 U	18
206-44-0	Fluoranthene	ug/L	80	800	0.15 U	0.15 U	0.15 U	0.17 U	0.16 U	0.16 U
86-73-7	Fluorene	ug/L	29	290	0.16 U	0.16 U	0.16 U	0.18 U	0.17 U	0.17 U
118-74-1	Hexachlorobenzene	ug/L	0.0098	0.0098	0.15 U	0.15 U	0.15 U	0.18 U	0.16 U	0.16 U
87-68-3	Hexachlorobutadiene	ug/L	0.14	0.14	0.5 U	0.52 U	0.52 U	0.59 U	0.54 U	0.54 U
77-47-4	Hexachlorocyclopentadiene	ug/L	0.041	0.41	1.6 U	1.7 U	1.7 U	1.9 U	1.8 U	1.8 U
67-72-1	Hexachloroethane	ug/L	0.33	0.33	0.37 U	0.38 U	0.38 U	0.43 U	0.4 U	0.4 U
193-39-5	Indeno(1,2,3-cd)pyrene	ug/L	0.25	0.25	0.13 U	0.13 U	0.13 U	0.15 U	0.14 U	0.14 U
78-59-1	Isophorone	ug/L	78	78	0.3 U	0.31 U	0.31 U	0.35 U	0.32 U	0.32 U
91-57-6	2-Methylnaphthalene	ug/L	3.6	36	0.1 U	0.11 U	0.11 U	0.12 U	0.11 U	0.11 U

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[2] - Reported standard is for elemental mercury.
U - Not detected, value indicates reporting limit
NR - Not Reported
= Detected value exceeds RSL (HQ=0.1).
= Detected value exceeds RSL (HQ=1.0).

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J – Estimated value
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2020 Annual Site-Wide Groundwater, Surface Water, and Sediment Monitoring Report for OU-7, OU-10, and NTCRA Basins
Avtex Fibers Superfund Site
Front Royal, Virginia

FMC-Front Royal Avtex Fibers 2020 Sampling Event OU-10 VE 1-8 Groundwater Wells		Purpose:			Upgradient Overburden Monitoring Wells		Upgradient Shallow Bedrock Monitoring Wells			
		Location ID Sample ID Sampled:	Regional Screening Level[1]	Regional Screening Level[1]	GPW-02 2020AN-GPW-02 07/18/2020	GPW-03R 2020AN-GPW-03R 07/17/2020	MW-07 2020AN-MW-07 07/28/2020	MW-08 2020AN-MW-08 07/28/2020	118 2020AN-118 07/28/2020	128 2020AN-128 07/31/2020
CAS NO.	COMPOUND	UNITS:	HQ=0.1	HQ=1.0						
	SEMIVOLATILES (CONTINUED)									
95-48-7	2-Methylphenol	ug/L	93	930	0.19 U	0.2 U	0.2 U	0.23 U	0.21 U	0.21 U
	3&4-Methylphenol	ug/L	93	930	0.18 U	0.18 U	0.18 U	0.21 U	0.19 U	0.19 U
91-20-3	Naphthalene	ug/L	0.12	0.12	0.1 U	0.1 U	0.1 U	0.12 U	0.11 U	0.11 U
88-74-4	2-Nitroaniline	ug/L	19	190	0.47 U	0.49 U	0.49 U	0.55 U	0.51 U	0.51 U
99-09-2	3-Nitroaniline	ug/L	NV	NV	0.52 U	0.54 U	0.54 U	0.62 U	0.57 U	0.57 U
100-01-6	4-Nitroaniline	ug/L	3.8	3.8	0.85 U	0.88 U	0.88 U	1 U	0.92 U	0.92 U
98-95-3	Nitrobenzene	ug/L	0.14	0.14	0.48 U	0.49 U	0.49 U	0.56 U	0.51 U	0.51 U
88-75-5	2-Nitrophenol	ug/L	NV	NV	0.52 U	0.54 U	0.54 U	0.61 U	0.56 U	0.56 U
100-02-7	4-Nitrophenol	ug/L	NV	NV	2 U	2.1 U	2.1 U	2.4 U	2.2 U	2.2 U
621-64-7	N-Nitrosodi-n-propylamine	ug/L	0.011	0.011	0.23 U	0.24 U	0.24 U	0.28 U	0.25 U	0.25 U
86-30-6	N-Nitrosodiphenylamine	ug/L	12	12	0.41 U	0.42 U	0.42 U	0.48 U	0.44 U	0.44 U
108-60-1	2,2'-Oxybis(1-chloropropane) (bis(2-Chloroisopropyl) ethe	ug/L	71	710	0.51 U	0.53 U	0.53 U	0.6 U	0.55 U	0.55 U
87-86-5	Pentachlorophenol	ug/L	0.041	0.041	2.9 U	3 U	3 U	3.4 U	3.1 U	3.1 U
85-01-8	Phenanthrene	ug/L	NV	NV	0.15 U	0.16 U	0.16 U	0.18 U	0.17 U	0.17 U
108-95-2	Phenol	ug/L	580	5800	0.12 U	0.12 U	0.12 U	0.14 U	0.13 U	0.13 U
129-00-0	Pyrene	ug/L	12	120	0.16 U	0.17 U	0.17 U	0.19 U	0.18 U	0.18 U
95-95-4	2,4,5-Trichlorophenol	ug/L	120	1200	1.8 U	1.9 U	1.9 U	2.2 U	2 U	2 U
88-06-2	2,4,6-Trichlorophenol	ug/L	1.2	4.1	1.7 U	1.7 U	1.7 U	2 U	1.8 U	1.8 U
	METALS - DISSOLVED									
7440-36-0	Antimony	ug/L	0.78	7.8	0.57 U	0.57 U	0.57 U	0.57 U	0.57 U	0.57 U
7440-38-2	Arsenic	ug/L	0.052	0.052	0.75 U	0.75 U	0.75 U	0.75 U	0.75 U	0.75 U
7440-41-7	Beryllium	ug/L	2.5	25	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U	**0.31 J**
7440-43-9	Cadmium	ug/L	0.92	9.2	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
7440-47-3	Chromium	ug/L	2200	22000	**3.9**	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U
7440-50-8	Copper	ug/L	80	800	**13**	**11**	1.7 U	**4**	1.7 U	**2.5**
7439-92-1	Lead	ug/L	15	15	**4.5**	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U
7439-97-6	Mercury[2]	ug/L	0.063	0.63	0.13 UJ	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U
7440-02-0	Nickel	ug/L	39	390	**16**	**7.9**	1.5 U	1.5 U	1.5 U	1.5 U
7782-49-2	Selenium	ug/L	10	100	0.89 U	0.89 U	0.89 U	0.89 U	0.89 U	0.89 U
7440-28-0	Thallium	ug/L	0.02	0.20	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	**0.3 J**
7440-62-2	Vanadium	ug/L	8.6	86	0.82 U	0.82 U	0.82 U	0.82 U	0.82 U	0.82 U
7440-66-6	Zinc	ug/L	600	6000	**87**	**93**	**38**	**35**	**16 J**	**34**
	FIELD PARAMETERS									
	Temperature	°C	---	---	21.36	18.58	23.19	20.11	16.82	20.05
	Conductivity	uS/cm	---	---	0.33	0.64	1.39	1.04	0.84	1.35
	pH	s.u.	---	---	6.22	5.79	6.51	6.67	6.85	6.99
	ORP	mV	---	---	96.2	186.9	-67.4	-56.00	-94.50	-150.80
	Turbidity	NTU	---	---	94.4	2.39	1.15	48.50	48.80	28.70
	Dissolved Oxygen	mg/L	---	---	3.91	4.3	0.23	0.49	0.33	1.79

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Avtex Fibers Superfund Site
Front Royal, Virginia

FMC-Front Royal Avtex Fibers 2020 Sampling Event OU-10 VB 1-8 Groundwater Wells		Purpose:			Upgradient Shallow Bedrock Monitoring Wells (Continued)		Downgradient Overburden Monitoring Wells				
		Location ID Sample ID: Sampled:	Regional Screening Level[1]	Regional Screening Level[1]	130R 2020AN-130R 08/01/2020	133 2020AN-133 07/29/2020	GPW-14 2020AN-GPW-14 07/19/2020	GPW-14 (DUP) 2020AN-GPW-14D 07/19/2020	GPW-15R 2020AN-GPW-15R 07/19/2020	MW-11 2020AN-MW-11 07/31/2020	MW-12 2020AN-MW-12 07/29/2020
CAS NO.	COMPOUND	UNITS:	HQ=0.1	HQ=1.0							
	VOLATILES										
67-64-1	Acetone	ug/L	1400	14000	5.4 U	5.4 U	**5.7 J**	**17**	5.4 U	5.4 U	11 U
71-43-2	Benzene	ug/L	0.46	0.46	0.38 U	R	R	R	0.38 U	0.38 U	R
75-27-4	Bromodichloromethane	ug/L	0.13	0.13	0.35 U	0.35 U	0.35 U	0.35 U	0.35 U	0.35 U	0.7 U
75-25-2	Bromoform	ug/L	3.3	3.3	0.76 U	0.76 U	0.76 U	0.76 U	0.76 U	0.76 U	1.5 U
74-83-9	Bromomethane (Methyl bromide)	ug/L	0.75	7.5	0.42 U	0.42 U	0.42 U	0.42 U	0.42 U	0.42 U	0.84 U
78-93-3	2-Butanone (Methyl ethyl ketone) (MEK)	ug/L	560	5600	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U	4.8 U
75-15-0	Carbon disulfide	ug/L	81	810	0.28 U	**0.67 J**	0.28 U	**0.37 J**	0.28 U	0.28 U	0.56 U
56-23-5	Carbon tetrachloride	ug/L	0.46	0.46	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.52 U
108-90-7	Chlorobenzene	ug/L	7.8	78	0.32 U	R	R	R	0.32 U	0.32 U	R
75-00-3	Chloroethane	ug/L	2100	21000	0.83 U	0.83 U	0.83 U	0.83 U	0.83 U	0.83 U	1.7 U
67-66-3	Chloroform (Trichloromethane)	ug/L	0.22	0.22	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.81 U
74-87-3	Chloromethane (Methyl chloride)	ug/L	19	190	0.64 U	0.64 U	0.64 U	0.64 U	0.64 U	0.64 U	1.3 U
124-48-1	Dibromochloromethane	ug/L	0.87	0.87	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.78 U
95-50-1	1,2-Dichlorobenzene	ug/L	30	300	0.43 U	R	R	R	0.43 U	0.43 U	R
541-73-1	1,3-Dichlorobenzene	ug/L	NV	NV	0.4 U	R	R	R	0.4 U	0.4 U	R
106-46-7	1,4-Dichlorobenzene	ug/L	0.48	0.48	0.37 U	R	R	R	0.37 U	0.37 U	R
75-34-3	1,1-Dichloroethane	ug/L	2.8	2.8	0.41 U	0.41 U	0.41 U	0.41 U	0.41 U	0.41 U	0.81 U
107-06-2	1,2-Dichloroethane	ug/L	0.17	0.17	0.43 U	0.43 U	0.43 U	0.43 U	0.43 U	0.43 U	0.85 U
75-35-4	1,1-Dichloroethene	ug/L	28	280	0.46 U	0.46 U	0.46 U	0.46 U	0.46 U	0.46 U	0.92 U
156-59-2	cis-1,2-Dichloroethene	ug/L	3.6	36	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.76 U
156-60-5	trans-1,2-Dichloroethene	ug/L	6.8	68	0.43 U	0.43 U	0.43 U	0.43 U	0.43 U	0.43 U	0.87 U
78-87-5	1,2-Dichloropropane	ug/L	0.82	0.85	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.74 U
10061-01-5	cis-1,3-Dichloropropene	ug/L	0.47	0.47	0.61 U	0.61 U	0.61 U	0.61 U	0.61 U	0.61 U	1.2 U
10061-02-6	trans-1,3-Dichloropropene	ug/L	0.47	0.47	0.67 U	0.67 U	0.67 U	0.67 U	0.67 U	0.67 U	1.3 U
100-41-4	Ethylbenzene	ug/L	1.5	1.5	0.39 U	R	R	R	0.39 U	0.39 U	R
591-78-6	2-Hexanone	ug/L	38	38	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	4.2 U
108-10-1	4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	ug/L	630	6300	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	4.2 U
75-09-2	Methylene chloride	ug/L	11	11	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	2.6 U
100-42-5	Styrene	ug/L	120	1200	0.4 U	R	R	R	0.4 U	0.4 U	R
79-34-5	1,1,2,2-Tetrachloroethane	ug/L	0.076	0.076	0.56 U	0.56 U	0.56 U	0.56 U	0.56 U	0.56 U	1.1 U
127-18-4	Tetrachloroethene	ug/L	4.1	11	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.65 U
108-88-3	Toluene	ug/L	110	1100	0.35 U	R	R	R	0.35 U	0.35 U	R
120-82-1	1,2,4-Trichlorobenzene	ug/L	0.4	1.2	0.81 U	R	R	R	0.81 U	0.81 U	R
71-55-6	1,1,1-Trichloroethane	ug/L	800	8000	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.48 U
79-00-5	1,1,2-Trichloroethane	ug/L	0.041	0.28	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.78 U
79-01-6	Trichloroethene	ug/L	0.28	0.49	0.36 U	0.36 U	0.36 U	0.36 U	0.36 U	0.36 U	0.72 U
75-01-4	Vinyl chloride	ug/L	0.019	0.019	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.99 U
1330-20-7	Xylenes (total)	ug/L	19	190	0.42 U	R	R	R	0.42 U	0.42 U	R
	SEMIVOLATILES										
83-32-9	Acenaphthene	ug/L	53	530	0.19 U	0.19 U	0.17 U	0.17 U	0.17 U	0.18 U	0.17 U
208-96-8	Acenaphthylene	ug/L	NV	NV	0.14 U	0.14 U	0.13 U	0.12 U	0.12 U	0.13 U	0.13 U
120-12-7	Anthracene	ug/L	180	1800	0.15 U	0.15 U	0.14 U	0.13 U	0.13 U	0.14 U	0.14 U

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PARSONS

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FMC-Front Royal Avtex Fibers 2020 Sampling Event OU-10 VB 1-8 Groundwater Well		Purpose:			Upgradient Shallow Bedrock Monitoring Wells (Continued)		Downgradient Overburden Monitoring Wells				
		Location ID Sample ID: Sampled:	Regional Screening Level[1] HQ=0.1	Regional Screening Level[1] HQ=1.0	130R 2020AN-130R 08/01/2020	133 2020AN-133 07/29/2020	GPW-14 2020AN-GPW-14 07/19/2020	GPW-14 (DUP) 2020AN-GPW-14D 07/19/2020	GPW-15R 2020AN-GPW-15R 07/19/2020	MW-11 2020AN-MW-11 07/31/2020	MW-12 2020AN-MW-12 07/29/2020
CAS NO.	COMPOUND	UNITS:									
	SEMIVOLATILES (CONTINUED)										
56-55-3	Benzo(a)anthracene	ug/L	0.03	0.03	0.19 U	0.19 U	0.17 U	0.16 U	0.16 U	0.18 U	0.17 U
50-32-8	Benzo(a)pyrene	ug/L	0.025	0.025	0.19 U	0.19 U	0.17 U	0.17 U	0.17 U	0.18 U	0.17 U
205-99-2	Benzo(b)fluoranthene	ug/L	0.25	0.25	0.17 U	0.17 U	0.15 U	0.15 U	0.15 U	0.16 U	0.15 U
191-24-2	Benzo(g,h,i)perylene	ug/L	NV	NV	0.19 U	0.19 U	0.18 U	0.17 U	0.17 U	0.19 U	0.18 U
207-08-9	Benzo(k)fluoranthene	ug/L	2.5	2.5	0.15 U	0.15 U	0.14 U	0.13 U	0.13 U	0.15 U	0.14 U
101-55-3	4-Bromophenyl phenyl ether	ug/L	NV	NV	0.54 U	0.54 U	0.5 U	0.48 U	0.48 U	0.52 U	0.5 U
85-68-7	Butyl benzylphthalate (BBP)	ug/L	16	16	0.72 U	0.72 U	0.67 U	0.64 U	0.64 U	0.69 U	0.67 U
86-74-8	Carbazole	ug/L	NV	NV	0.53 U	0.53 U	0.49 U	0.47 U	0.47 U	0.51 U	0.49 U
59-50-7	4-Chloro-3-methylphenol	ug/L	140	1400	0.32 U	0.32 U	0.3 U	0.28 U	0.28 U	0.31 U	0.3 U
106-47-8	4-Chloroaniline	ug/L	0.37	0.37	0.34 U	0.34 U	0.32 U	0.3 U	0.3 U	0.33 U	0.32 U
111-91-1	bis(2-Chloroethoxy)methane	ug/L	5.9	59	0.49 U	0.49 U	0.46 U	0.44 U	0.44 U	0.47 U	0.46 U
111-44-4	bis(2-Chloroethyl)ether	ug/L	0.014	0.014	0.44 U	0.44 U	0.4 U	0.39 U	0.39 U	0.42 U	0.4 U
91-58-7	2-Chloronaphthalene	ug/L	75	750	0.53 U	0.53 U	0.48 U	0.46 U	0.46 U	0.5 U	0.48 U
95-57-8	2-Chlorophenol	ug/L	9.1	91	0.3 U	0.3 U	0.27 U	0.26 U	0.26 U	0.28 U	0.27 U
7005-72-3	4-Chlorophenyl phenyl ether	ug/L	NV	NV	0.6 U	0.6 U	0.55 U	0.53 U	0.53 U	0.57 U	0.55 U
218-01-9	Chrysene	ug/L	25	25	0.2 U	0.2 U	0.19 U	0.18 U	0.18 U	0.19 U	0.19 U
53-70-3	Dibenz(a,h)anthracene	ug/L	0.025	0.025	0.16 U	0.16 U	0.15 U	0.15 U	0.15 U	0.16 U	0.15 U
132-64-9	Dibenzofuran	ug/L	0.79	7.9	0.61 U	0.61 U	0.56 U	0.54 U	0.54 U	0.58 U	0.56 U
91-94-1	3,3'-Dichlorobenzidine	ug/L	0.13	0.13	1.3 U	1.3 U	R	1.1 U	1.1 U	1.2 U	1.2 U
120-83-2	2,4-Dichlorophenol	ug/L	4.6	46	0.28 U	0.28 U	0.26 U	0.25 U	0.25 U	0.27 U	0.26 U
84-66-2	Diethyl phthalate	ug/L	1500	15000	4.1 U	4.1 U	3.8 U	3.7 U	3.7 U	4 U	3.8 U
105-67-9	2,4-Dimethylphenol	ug/L	36	360	0.56 U	0.56 U	0.52 U	0.5 U	0.5 U	0.54 U	0.52 U
131-11-3	Dimethyl phthalate	ug/L	NV	NV	0.56 U	0.56 U	0.52 U	0.5 U	0.5 U	0.54 U	0.52 U
84-74-2	Di-n-butylphthalate (DBP)	ug/L	90	900	2 U	2 U	1.8 U	1.7 U	1.7 U	1.9 U	1.8 U
534-52-1	4,6-Dinitro-2-methylphenol	ug/L	0.15	1.5	3.1 U	3.1 U	2.8 U	2.7 U	2.7 U	2.9 U	2.8 U
51-28-5	2,4-Dinitrophenol	ug/L	3.9	39	6.8 U	6.8 U	6.2 U	6 U	6 U	6.5 U	6.2 U
121-14-2	2,4-Dinitrotoluene	ug/L	0.24	0.24	2.3 U	2.3 U	2.1 U	2 U	2 U	2.2 U	2.1 U
606-20-2	2,6-Dinitrotoluene	ug/L	0.049	0.049	2.3 U	2.3 U	2.1 U	2 U	2 U	2.2 U	2.1 U
117-84-0	Di-n-octyl phthalate (DnOP)	ug/L	20	200	0.89 U	0.89 U	0.82 U	0.79 U	0.79 U	0.86 U	0.82 U
117-81-7	bis(2-Ethylhexyl)phthalate (DEHP)	ug/L	5.6	5.6	2.4 U	2.4 U	2.2 U	2.1 U	2.1 U	2.3 U	2.2 U
206-44-0	Fluoranthene	ug/L	80	800	0.17 U	0.17 U	0.16 U	0.15 U	0.15 U	0.17 U	0.16 U
86-73-7	Fluorene	ug/L	29	290	0.18 U	0.18 U	0.17 U	0.16 U	0.16 U	0.18 U	0.17 U
118-74-1	Hexachlorobenzene	ug/L	0.0098	0.0098	0.18 U	0.18 U	0.16 U	0.15 U	0.15 U	0.17 U	0.16 U
87-68-3	Hexachlorobutadiene	ug/L	0.14	0.14	0.59 U	0.59 U	0.54 U	0.52 U	0.52 U	0.57 U	0.54 U
77-47-4	Hexachlorocyclopentadiene	ug/L	0.041	0.41	1.9 U	1.9 U	1.8 U	1.7 U	1.7 U	1.8 U	1.8 U
67-72-1	Hexachloroethane	ug/L	0.33	0.33	0.43 U	0.43 U	0.4 U	0.38 U	0.38 U	0.41 U	0.4 U
193-39-5	Indeno(1,2,3-cd)pyrene	ug/L	0.25	0.25	0.15 U	0.15 U	0.14 U	0.13 U	0.13 U	0.14 U	0.14 U
78-59-1	Isophorone	ug/L	78	78	0.35 U	0.35 U	0.32 U	0.31 U	0.31 U	0.34 U	0.32 U
91-57-6	2-Methylnaphthalene	ug/L	3.6	36	0.12 U	0.12 U	0.11 U	0.11 U	0.11 U	0.12 U	0.11 U

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NV - No Value Available
uS/cm = microsiemens per centimeter
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Avtex Fibers Superfund Site
Front Royal, Virginia

FMC-Front Royal Avtex Fibers 2020 Sampling Event OU-10 VB 1-8 Groundwater Wells		Purpose:			Upgradient Shallow Bedrock Monitoring Wells (Continued)		Downgradient Overburden Monitoring Wells				
		Location ID Sample ID: Sampled:	Regional Screening Level[1]	Regional Screening Level[1]	130R 2020AN-130R 08/01/2020	133 2020AN-133 07/29/2020	GPW-14 2020AN-GPW-14 07/19/2020	GPW-14 (DUP) 2020AN-GPW-14D 07/19/2020	GPW-15R 2020AN-GPW-15R 07/19/2020	MW-11 2020AN-MW-11 07/31/2020	MW-12 2020AN-MW-12 07/29/2020
CAS NO.	COMPOUND	UNITS:	HQ=0.1	HQ=1.0							
	SEMIVOLATILES (CONTINUED)										
95-48-7	2-Methylphenol	ug/L	93	930	0.23 U	0.23 U	0.21 U	0.2 U	0.2 U	0.22 U	0.21 U
	3&4-Methylphenol	ug/L	93	930	0.21 U	0.21 U	0.19 U	0.18 U	0.18 U	0.2 U	0.19 U
91-20-3	Naphthalene	ug/L	0.12	0.12	0.12 U	0.12 U	0.11 U	0.1 U	0.1 U	0.11 U	**0.2**
88-74-4	2-Nitroaniline	ug/L	19	190	0.55 U	0.55 U	0.51 U	0.49 U	0.49 U	0.53 U	0.51 U
99-09-2	3-Nitroaniline	ug/L	NV	NV	0.62 U	0.62 U	0.57 UJ	0.54 U	0.54 U	0.59 U	0.57 U
100-01-6	4-Nitroaniline	ug/L	3.8	3.8	1 U	1 U	0.92 U	0.88 U	0.88 U	0.96 U	0.92 U
98-95-3	Nitrobenzene	ug/L	0.14	0.14	0.56 U	0.56 U	0.51 U	0.49 U	0.49 U	0.54 U	0.51 U
88-75-5	2-Nitrophenol	ug/L	NV	NV	0.61 U	0.61 U	0.56 U	0.54 U	0.54 U	0.59 U	0.56 U
100-02-7	4-Nitrophenol	ug/L	NV	NV	2.4 U	2.4 U	2.2 U	2.1 U	2.1 U	2.3 U	2.2 U
621-64-7	N-Nitrosodi-n-propylamine	ug/L	0.011	0.011	0.28 U	0.28 U	0.25 U	0.24 U	0.24 U	0.26 U	0.25 U
86-30-6	N-Nitrosodiphenylamine	ug/L	12	12	0.48 U	0.48 U	0.44 U	0.42 U	0.42 U	0.46 U	0.44 U
108-60-1	2,2'-Oxybis(1-chloropropane) (bis(2-Chloroisopropyl) ethe	ug/L	71	710	0.6 U	0.6 U	0.55 U	0.53 U	0.53 U	0.57 U	0.55 U
87-86-5	Pentachlorophenol	ug/L	0.041	0.041	3.4 U	3.4 U	3.1 U	3 U	3 U	3.2 U	3.1 U
85-01-8	Phenanthrene	ug/L	NV	NV	0.18 U	0.18 U	0.17 U	0.16 U	0.16 U	0.17 U	0.17 U
108-95-2	Phenol	ug/L	580	5800	0.14 U	0.14 U	0.13 U	0.12 U	0.12 U	0.13 U	0.13 U
129-00-0	Pyrene	ug/L	12	120	0.19 U	0.19 U	0.18 U	0.17 U	0.17 U	0.18 U	0.18 U
95-95-4	2,4,5-Trichlorophenol	ug/L	120	1200	2.2 U	2.2 U	2 U	1.9 U	1.9 U	2.1 U	2 U
88-06-2	2,4,6-Trichlorophenol	ug/L	1.2	4.1	2 U	2 U	1.8 U	1.7 U	1.7 U	1.9 U	1.8 U
	METALS - DISSOLVED										
7440-36-0	Antimony	ug/L	0.78	7.8	0.57 U	0.57 U	**1.7 J**	**1.5 J**	0.57 U	0.57 U	0.57 U
7440-38-2	Arsenic	ug/L	0.052	0.052	0.75 U	**23**	**3.5 J**	**9**	0.75 U	0.75 U	**32**
7440-41-7	Beryllium	ug/L	2.5	25	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U
7440-43-9	Cadmium	ug/L	0.92	9.2	0.2 U	0.2 U	**0.21 J**	**0.33 J**	0.2 U	**0.32 J**	0.2 U
7440-47-3	Chromium	ug/L	2200	22000	**5**	**1.2 J**	0.98 U	0.98 U	0.98 U	0.98 U	**1.2 J**
7440-50-8	Copper	ug/L	80	800	1.7 U	1.7 U	**27**	**24**	**3.8**	**1.7 J**	**230**
7439-92-1	Lead	ug/L	15	15	0.45 U	0.45 U	**0.98 J**	**0.7 J**	0.45 U	0.45 U	**0.63 J**
7439-97-6	Mercury[2]	ug/L	0.063	0.63	0.13 U	0.13 U	0.13 UJ	0.13 U	0.13 U	0.13 U	0.13 U
7440-02-0	Nickel	ug/L	39	390	1.5 U	**12**	**100**	**60**	**1.5 J**	**61**	**12**
7782-49-2	Selenium	ug/L	10	100	0.89 U	0.89 U	**2.8 J**	**3.2 J**	0.89 U	0.89 U	**1.4 J**
7440-28-0	Thallium	ug/L	0.02	0.20	0.2 U	0.2 U	**0.26 J**	0.2 U	0.2 U	0.2 U	0.2 U
7440-62-2	Vanadium	ug/L	8.6	86	0.82 U	0.82 U	7	**2.8 J**	0.82 U	0.82 U	**1.6 J**
7440-66-6	Zinc	ug/L	600	6000	15 U	**16 J**	**55 J**	**280 J**	**370**	15 U	**650**
	FIELD PARAMETERS										
	Temperature	°C	---	---	19.95	20.96	21.99	21.99	17.59	22.19	23.01
	Conductivity	uS/cm	---	---	0.52	4.83	20.57	20.57	0.66	6.27	11.08
	pH	s.u.	---	---	11.23	7.10	6.90	6.90	6.65	6.17	8.10
	ORP	mV	---	---	-46.3	-189	-25.40	-25.40	155.00	46.30	0.10
	Turbidity	NTU	---	---	2.64	1.91	831.00	831.00	50.60	15.80	1.11
	Dissolved Oxygen	mg/L	---	---	4.71	2.81	6.33	6.33	2.55	0.50	1.69

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PARSONS

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Avtex Fibers Superfund Site
Front Royal, Virginia

FMC-Front Royal Avtex Fibers 2020 Sampling Event OU-10 VB 1-8 Groundwater Wells		Purpose:			Downgradient Shallow Bedrock Monitoring Wells					
		Location ID Sample ID: Sampled:	Regional Screening Level[4]	Regional Screening Level[4]	MW-05 2020AN-MW-05 08/01/2020	119 2020AN-119 07/19/2020	120R 2020AN-120R 07/19/2020	132 2020AN-132 07/27/2020	132 (DUP) 2020AN-132D 07/27/2020	135 2020AN-135 07/31/2020
CAS NO.	COMPOUND	UNITS:	HQ=0.1	HQ=1.0						
	VOLATILES									
67-64-1	Acetone	ug/L	1400	14000	5.4 U	5.4 U	5.4 U	5.4 U	5.4 U	5.4 U
71-43-2	Benzene	ug/L	0.46	0.46	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U
75-27-4	Bromodichloromethane	ug/L	0.13	0.13	0.35 U	0.35 U	0.35 U	0.35 U	0.35 U	0.35 U
75-25-2	Bromoform	ug/L	3.3	3.3	0.76 U	0.76 U	0.76 U	0.76 U	0.76 U	0.76 U
74-83-9	Bromomethane (Methyl bromide)	ug/L	0.75	7.5	0.42 U	0.42 U	0.42 U	0.42 U	0.42 U	0.42 U
78-93-3	2-Butanone (Methyl ethyl ketone) (MEK)	ug/L	560	5600	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U
75-15-0	Carbon disulfide	ug/L	81	810	0.28 U	0.28 U	0.28 U	0.28 U	0.28 U	0.28 U
56-23-5	Carbon tetrachloride	ug/L	0.46	0.46	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U
108-90-7	Chlorobenzene	ug/L	7.8	78	0.32 U	0.32 U	0.32 U	0.32 U	0.32 U	0.32 U
75-00-3	Chloroethane	ug/L	2100	21000	0.83 U	0.83 U	0.83 U	0.83 U	0.83 U	0.83 U
67-66-3	Chloroform (Trichloromethane)	ug/L	0.22	0.22	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
74-87-3	Chloromethane (Methyl chloride)	ug/L	19	190	0.64 U	0.64 U	0.64 U	0.64 U	0.64 U	0.64 U
124-48-1	Dibromochloromethane	ug/L	0.87	0.87	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U
95-50-1	1,2-Dichlorobenzene	ug/L	30	300	0.43 U	0.43 U	0.43 U	0.43 U	0.43 U	0.43 U
541-73-1	1,3-Dichlorobenzene	ug/L	NV	NV	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
106-46-7	1,4-Dichlorobenzene	ug/L	0.48	0.48	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U
75-34-3	1,1-Dichloroethane	ug/L	2.8	2.8	0.41 U	0.41 U	0.41 U	0.41 U	0.41 U	0.41 U
107-06-2	1,2-Dichloroethane	ug/L	0.17	0.17	0.43 U	0.43 U	0.43 U	0.43 U	0.43 U	0.43 U
75-35-4	1,1-Dichloroethene	ug/L	28	280	0.46 U	0.46 U	0.46 U	0.46 U	0.46 U	0.46 U
156-59-2	cis-1,2-Dichloroethene	ug/L	3.6	36	0.38 U	**0.96 J**	**0.66 J**	0.38 U	0.38 U	0.38 U
156-60-5	trans-1,2-Dichloroethene	ug/L	6.8	68	0.43 U	0.43 U	0.43 U	0.43 U	0.43 U	0.43 U
78-87-5	1,2-Dichloropropane	ug/L	0.82	0.85	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U
10061-01-5	cis-1,3-Dichloropropene	ug/L	0.47	0.47	0.61 U	0.61 U	0.61 U	0.61 U	0.61 U	0.61 U
10061-02-6	trans-1,3-Dichloropropene	ug/L	0.47	0.47	0.67 U	0.67 U	0.67 U	0.67 U	0.67 U	0.67 U
100-41-4	Ethylbenzene	ug/L	1.5	1.5	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U
591-78-6	2-Hexanone	ug/L	3.8	38	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U
108-10-1	4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	ug/L	630	6300	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U
75-09-2	Methylene chloride	ug/L	11	11	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U
100-42-5	Styrene	ug/L	120	1200	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
79-34-5	1,1,2,2-Tetrachloroethane	ug/L	0.076	0.076	0.56 U	0.56 U	0.56 U	0.56 U	0.56 U	0.56 U
127-18-4	Tetrachloroethene	ug/L	4.1	11	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
108-88-3	Toluene	ug/L	110	1100	0.35 U	0.35 U	0.35 U	0.35 U	0.35 U	0.35 U
120-82-1	1,2,4-Trichlorobenzene	ug/L	0.4	1.2	0.81 U	0.81 U	0.81 U	0.81 U	0.81 U	0.81 U
71-55-6	1,1,1-Trichloroethane	ug/L	800	8000	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U
79-00-5	1,1,2-Trichloroethane	ug/L	0.041	0.28	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U
79-01-6	Trichloroethene	ug/L	0.28	0.49	0.36 U	**0.54 J**	**0.38 J**	0.36 U	0.36 U	0.36 U
75-01-4	Vinyl chloride	ug/L	0.019	0.019	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1330-20-7	Xylenes (total)	ug/L	19	190	0.42 U	0.42 U	0.42 U	0.42 U	0.42 U	0.42 U
	SEMIVOLATILES									
83-32-9	Acenaphthene	ug/L	53	530	0.18 U	0.17 U	0.17 U	0.17 U	0.17 U	0.19 U
208-96-8	Acenaphthylene	ug/L	NV	NV	0.13 U	0.13 U	0.12 U	0.12 U	0.13 U	0.14 U
120-12-7	Anthracene	ug/L	180	1800	0.14 U	0.14 U	0.13 U	0.13 U	0.14 U	0.15 U

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FMC-Front Royal Avtex Fibers 2020 Sampling Event OU-10 VB 1-8 Groundwater Wells		Purpose:			Downgradient Shallow Bedrock Monitoring Wells					
		Location ID Sample ID: Sampled:	Regional Screening Level[1] HQ=0.1	Regional Screening Level[1] HQ=1.0	MW-05 2020AN-MW-05 08/01/2020	119 2020AN-119 07/19/2020	120R 2020AN-120R 07/19/2020	132 2020AN-132 07/27/2020	132 (DUP) 2020AN-132D 07/27/2020	135 2020AN-135 07/31/2020
CAS NO.	COMPOUND	UNITS:								
	SEMIVOLATILES (CONTINUED)									
56-55-3	Benzo(a)anthracene	ug/L	0.03	0.03	0.18 U	0.17 U	0.16 U	0.16 U	0.17 U	0.19 U
50-32-8	Benzo(a)pyrene	ug/L	0.025	0.025	0.18 U	0.17 U	0.17 U	0.17 U	0.17 U	0.19 U
205-99-2	Benzo(b)fluoranthene	ug/L	0.25	0.25	0.16 U	0.15 U	0.15 U	0.15 U	0.15 U	0.17 U
191-24-2	Benzo(g,h,i)perylene	ug/L	NV	NV	0.19 U	0.18 U	0.17 U	0.17 U	0.18 U	0.19 U
207-08-9	Benzo(k)fluoranthene	ug/L	2.5	2.5	0.15 U	0.14 U	0.13 U	0.13 U	0.14 U	0.15 U
101-55-3	4-Bromophenyl phenyl ether	ug/L	NV	NV	0.52 U	0.5 U	0.48 U	0.48 U	0.5 U	0.54 U
85-68-7	Butyl benzylphthalate (BBP)	ug/L	16	16	0.69 U	0.67 U	0.64 U	0.64 U	0.67 U	0.72 U
86-74-8	Carbazole	ug/L	NV	NV	0.51 U	0.49 U	0.47 U	0.47 U	0.49 U	0.53 U
59-50-7	4-Chloro-3-methylphenol	ug/L	140	1400	0.31 U	0.3 U	0.28 U	0.28 U	0.3 U	0.32 U
106-47-8	4-Chloroaniline	ug/L	0.37	0.37	0.33 U	0.32 U	0.3 U	0.3 U	0.32 U	0.34 U
111-91-1	bis(2-Chloroethoxy)methane	ug/L	5.9	59	0.47 U	0.46 U	0.44 U	0.44 U	0.46 U	0.49 U
111-44-4	bis(2-Chloroethyl)ether	ug/L	0.014	0.014	0.42 U	0.4 U	0.39 U	0.39 U	0.4 U	0.44 U
91-58-7	2-Chloronaphthalene	ug/L	75	750	0.5 U	0.48 U	0.46 U	0.46 U	0.48 U	0.53 U
95-57-8	2-Chlorophenol	ug/L	9.1	91	0.28 U	0.27 U	0.26 U	0.26 U	0.27 U	0.3 U
7005-72-3	4-Chlorophenyl phenyl ether	ug/L	NV	NV	0.57 U	0.55 U	0.53 U	0.53 U	0.55 U	0.6 U
218-01-9	Chrysene	ug/L	25	25	0.19 U	0.19 U	0.18 U	0.18 U	0.19 U	0.2 U
53-70-3	Dibenz(a,h)anthracene	ug/L	0.025	0.025	0.16 U	0.15 U	0.15 U	0.15 U	0.15 U	0.16 U
132-64-9	Dibenzofuran	ug/L	0.79	7.9	0.58 U	0.56 U	0.54 U	0.54 U	0.56 U	0.61 U
91-94-1	3,3'-Dichlorobenzidine	ug/L	0.13	0.13	1.2 U	1.2 U	1.1 U	1.1 U	1.2 U	1.3 U
120-83-2	2,4-Dichlorophenol	ug/L	4.6	46	0.27 U	0.26 U	0.25 U	0.25 U	0.26 U	0.28 U
84-66-2	Diethyl phthalate	ug/L	1500	15000	4 U	3.8 U	3.7 U	3.7 U	3.8 U	4.1 U
105-67-9	2,4-Dimethylphenol	ug/L	36	360	0.54 U	0.52 U	0.5 U	0.5 U	0.52 U	0.56 U
131-11-3	Dimethyl phthalate	ug/L	NV	NV	0.54 U	0.52 U	0.5 U	0.5 U	0.52 U	0.56 U
84-74-2	Di-n-butylphthalate (DBP)	ug/L	90	900	1.9 U	1.8 U	1.7 U	1.7 U	1.8 U	2 U
534-52-1	4,6-Dinitro-2-methylphenol	ug/L	0.15	1.5	2.9 U	2.8 U	2.7 U	2.7 U	2.8 U	3.1 U
51-28-5	2,4-Dinitrophenol	ug/L	3.9	39	6.5 U	6.2 U	6 U	6 U	6.2 U	6.8 U
121-14-2	2,4-Dinitrotoluene	ug/L	0.24	0.24	2.2 U	2.1 U	2 U	2 U	2.1 U	2.3 U
606-20-2	2,6-Dinitrotoluene	ug/L	0.049	0.049	2.2 U	2.1 U	2 U	2 U	2.1 U	2.3 U
117-84-0	Di-n-octyl phthalate (DnOP)	ug/L	20	200	0.86 U	0.82 U	0.79 U	0.79 U	0.82 U	0.89 U
117-81-7	bis(2-Ethylhexyl)phthalate (DEHP)	ug/L	5.6	5.6	2.3 U	**6.2**	2.1 U	2.1 U	2.2 U	2.4 U
206-44-0	Fluoranthene	ug/L	80	800	0.17 U	0.16 U	0.15 U	0.15 U	0.16 U	0.17 U
86-73-7	Fluorene	ug/L	29	290	0.18 U	0.17 U	0.16 U	0.16 U	0.17 U	0.18 U
118-74-1	Hexachlorobenzene	ug/L	0.0098	0.0098	0.17 U	0.16 U	0.15 U	0.15 U	0.16 U	0.18 U
87-68-3	Hexachlorobutadiene	ug/L	0.14	0.14	0.57 U	0.54 U	0.52 U	0.52 U	0.54 U	0.59 U
77-47-4	Hexachlorocyclopentadiene	ug/L	0.041	0.41	1.8 U	1.8 U	1.7 U	1.7 U	1.8 U	1.9 U
67-72-1	Hexachloroethane	ug/L	0.33	0.33	0.41 U	0.4 U	0.38 U	0.38 U	0.4 U	0.43 U
193-39-5	Indeno(1,2,3-cd)pyrene	ug/L	0.25	0.25	0.14 U	0.14 U	0.13 U	0.13 U	0.14 U	0.15 U
78-59-1	Isophorone	ug/L	78	78	0.34 U	0.32 U	0.31 U	0.31 U	0.32 U	0.35 U
91-57-6	2-Methylnaphthalene	ug/L	3.6	36	0.12 U	0.11 U	0.11 U	0.11 U	0.11 U	0.12 U

[1] - EPA Regional Screening Levels (RSLs) for tapwater (November 2020).
[2] - Reported standard is for elemental mercury.
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NR - Not Reported
= Detected value exceeds RSL (HQ=0.1).
= Detected value exceeds RSL (HQ=1.0).

Bold text indicates detected value.
NTU = nephelometric turbidity unit
NV - No Value Available
uS/cm = microsiemens per centimeter
ug/L = micrograms per liter
DUP = Duplicate Sample

J – Estimated value
s.u = std. units
mg/L = miligrams per liter
mV = millivolts
UJ – Not detected at est. detection limit

TABLE 12

OU-10 Viscose Basin 1-8 Groundwater Monitoring Network Sampling Results
2020 Annual Site-Wide Groundwater, Surface Water, and Sediment Monitoring Report for OU-7, OU-10, and NTCRA Basins
Avtex Fibers Superfund Site
Front Royal, Virginia

FMC-Front Royal Avtex Fibers 2020 Sampling Event OU-10 VB 1-8 Groundwater Wells		Purpose:			Downgradient Shallow Bedrock Monitoring Wells					
		Location ID Sample ID: Sampled:	Regional Screening Level[1] HQ=0.1	Regional Screening Level[1] HQ=1.0	MW-05 2020AN-MW-05 08/01/2020	119 2020AN-119 07/19/2020	120R 2020AN-120R 07/19/2020	132 2020AN-132 07/27/2020	132 (DUP) 2020AN-132D 07/27/2020	135 2020AN-135 07/31/2020
CAS NO.	COMPOUND	UNITS:								
	SEMIVOLATILES (CONTINUED)									
95-48-7	2-Methylphenol	ug/L	93	930	0.22 U	0.21 U	0.2 U	0.2 U	0.21 U	0.23 U
	3&4-Methylphenol	ug/L	93	930	0.2 U	0.19 U	0.18 U	0.18 U	0.19 U	0.21 U
91-20-3	Naphthalene	ug/L	0.12	0.12	0.11 U	0.11 U	0.1 U	0.1 U	0.11 U	0.12 U
88-74-4	2-Nitroaniline	ug/L	19	190	0.53 U	0.51 U	0.49 U	0.49 U	0.51 U	0.55 U
99-09-2	3-Nitroaniline	ug/L	NV	NV	0.59 U	0.57 U	0.54 U	0.54 U	0.57 U	0.62 U
100-01-6	4-Nitroaniline	ug/L	3.8	3.8	0.96 U	0.92 U	0.88 U	0.88 U	0.92 U	1 U
98-95-3	Nitrobenzene	ug/L	0.14	0.14	0.54 U	0.51 U	0.49 U	0.49 U	0.51 U	0.56 U
88-75-5	2-Nitrophenol	ug/L	NV	NV	0.59 U	0.56 U	0.54 U	0.54 U	0.56 U	0.61 U
100-02-7	4-Nitrophenol	ug/L	NV	NV	2.3 U	2.2 U	2.1 U	2.1 U	2.2 U	2.4 U
621-64-7	N-Nitrosodi-n-propylamine	ug/L	0.011	0.011	0.26 U	0.25 U	0.24 U	0.24 U	0.25 U	0.28 U
86-30-6	N-Nitrosodiphenylamine	ug/L	12	12	0.46 U	0.44 U	0.42 U	0.42 U	0.44 U	0.48 U
108-60-1	2,2'-Oxybis(1-chloropropane) (bis(2-Chloroisopropyl) ethe	ug/L	71	710	0.57 U	0.55 U	0.53 U	0.53 U	0.55 U	0.6 U
87-86-5	Pentachlorophenol	ug/L	0.041	0.041	3.2 U	3.1 U	3 U	3 U	3.1 U	3.4 U
85-01-8	Phenanthrene	ug/L	NV	NV	0.17 U	0.17 U	0.16 U	0.16 U	0.17 U	0.18 U
108-95-2	Phenol	ug/L	580	5800	0.13 U	0.13 U	0.12 U	0.12 U	0.13 U	0.14 U
129-00-0	Pyrene	ug/L	12	120	0.18 U	0.18 U	0.17 U	0.17 U	0.18 U	0.19 U
95-95-4	2,4,5-Trichlorophenol	ug/L	120	1200	2.1 U	2 U	1.9 U	1.9 U	2 U	2.2 U
88-06-2	2,4,6-Trichlorophenol	ug/L	1.2	4.1	1.9 U	1.8 U	1.7 U	1.7 U	1.8 U	2 U
	METALS - DISSOLVED									
7440-36-0	Antimony	ug/L	0.78	7.8	0.57 U	0.57 U	0.57 U	0.57 U	0.57 U	0.57 U
7440-38-2	Arsenic	ug/L	0.052	0.052	0.75 U	0.75 U	0.75 U	0.75 U	0.75 U	0.75 U
7440-41-7	Beryllium	ug/L	2.5	25	0.31 U	0.31 U	0.31 U	**0.41 J**	**0.31 J**	0.31 U
7440-43-9	Cadmium	ug/L	0.92	9.2	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
7440-47-3	Chromium	ug/L	2200	22000	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U
7440-50-8	Copper	ug/L	80	800	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U
7439-92-1	Lead	ug/L	15	15	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U
7439-97-6	Mercury[2]	ug/L	0.063	0.63	0.13 U	0.13 UJ	0.13 UJ	0.13 U	0.13 U	0.13 U
7440-02-0	Nickel	ug/L	39	390	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U
7782-49-2	Selenium	ug/L	10	100	0.89 U	0.89 U	0.89 U	0.89 U	0.89 U	0.89 U
7440-28-0	Thallium	ug/L	0.02	0.20	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
7440-62-2	Vanadium	ug/L	8.6	86	0.82 U	0.82 U	0.82 U	0.82 U	0.82 U	0.82 U
7440-66-6	Zinc	ug/L	600	6000	15 U	15 U	15 U	15 U	15 U	15 U
	FIELD PARAMETERS									
	Temperature	°C	---	---	21.21	23.08	25.39	23.01	23.01	21.81
	Conductivity	uS/cm	---	---	0.30	0.37	0.41	2.02	2.02	0.63
	pH	s.u.	---	---	8.60	7.98	8.32	6.52	6.52	9.64
	ORP	mV	---	---	-45.50	-287.50	-129.60	-70.10	-70.10	-132.20
	Turbidity	NTU	---	---	4.69	181.00	16.90	3.06	3.06	31.20
	Dissolved Oxygen	mg/L	---	---	1.77	0.31	0.29	3.80	3.80	0.30

[1] - EPA Regional Screening Levels (RSLs) for tapwater (November 2020).
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PARSONS

TABLE 13

OU-10 New Landfill Groundwater Monitoring Network Sampling Results
2020 Annual Site-Wide Groundwater, Surface Water, and Sediment Monitoring Report for OU-7, OU-10, and NTCRA Basins
Avtex Fibers Superfund Site
Front Royal, Virginia

FMC-Front Royal Avtex Fibers 2020 Sampling Event OU-10 NLF Groundwater Wells		Purpose			Upgradient Overburden Monitoring Well	Upgradient Shallow Bedrock Monitoring Wells		Downgradient Shallow Bedrock Monitoring Wells		
		Location ID: Sample ID: Sampled:	Regional Screening Level[1]	Regional Screening Level[1]	GPW-03R 2020AN-GPW-03R 07/17/2020	128 2020AN-128 07/31/2020	130R 2020AN-130R 08/01/2020	MW-07 2020AN-MW-07 07/28/2020	MW-08 2020AN-MW-08 07/28/2020	133 2020AN-133 07/29/2020
CAS NO.	COMPOUND	UNITS:	HQ=0.1	HQ=1.0						
	VOLATILES									
67-64-1	Acetone	ug/L	1400	14000	5.4 U	5.4 U	5.4 U	5.4 U	5.4 U	5.4 U
71-43-2	Benzene	ug/L	0.46	0.46	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	R
75-27-4	Bromodichloromethane	ug/L	0.13	0.13	0.35 U	0.35 U	0.35 U	0.35 U	0.35 U	0.35 U
75-25-2	Bromoform	ug/L	3.3	3.3	0.76 U	0.76 U	0.76 U	0.76 U	0.76 U	0.76 U
74-83-9	Bromomethane (Methyl bromide)	ug/L	0.75	7.5	0.42 U	0.42 U	0.42 U	0.42 U	0.42 U	0.42 U
78-93-3	2-Butanone (Methyl ethyl ketone) (MEK)	ug/L	560	5600	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U
75-15-0	Carbon disulfide	ug/L	81	810	**0.32 J**	0.28 U	0.28 U	0.28 UJ	0.28 UJ	**0.67 J**
56-23-5	Carbon tetrachloride	ug/L	0.46	0.46	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U
108-90-7	Chlorobenzene	ug/L	7.8	78	0.32 U	0.32 U	0.32 U	0.32 U	0.32 U	R
75-00-3	Chloroethane	ug/L	2100	21000	0.83 U	0.83 U	0.83 U	0.83 U	0.83 U	0.83 U
67-66-3	Chloroform (Trichloromethane)	ug/L	0.22	0.22	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
74-87-3	Chloromethane (Methyl chloride)	ug/L	19	190	0.64 U	0.64 U	0.64 U	0.64 U	0.64 U	0.64 U
124-48-1	Dibromochloromethane	ug/L	0.87	0.87	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U
95-50-1	1,2-Dichlorobenzene	ug/L	30	300	0.43 U	0.43 U	0.43 U	0.43 U	0.43 U	R
541-73-1	1,3-Dichlorobenzene	ug/L	NV	NV	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	R
106-46-7	1,4-Dichlorobenzene	ug/L	0.48	0.48	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	R
75-34-3	1,1-Dichloroethane	ug/L	2.8	2.8	0.41 U	0.41 U	0.41 U	0.41 U	0.41 U	0.41 U
107-06-2	1,2-Dichloroethane	ug/L	0.17	0.17	0.43 U	0.43 U	0.43 U	0.43 U	0.43 U	0.43 U
75-35-4	1,1-Dichloroethene	ug/L	28	280	0.46 U	0.46 U	0.46 U	0.46 U	0.46 U	0.46 U
156-59-2	cis-1,2-Dichloroethene	ug/L	3.6	36	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U
156-60-5	trans-1,2-Dichloroethene	ug/L	6.8	68	0.43 U	0.43 U	0.43 U	0.43 U	0.43 U	0.43 U
78-87-5	1,2-Dichloropropane	ug/L	0.82	0.85	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U
10061-01-5	cis-1,3-Dichloropropene	ug/L	0.47	0.47	0.61 U	0.61 U	0.61 U	0.61 U	0.61 U	0.61 U
10061-02-6	trans-1,3-Dichloropropene	ug/L	0.47	0.47	0.67 U	0.67 U	0.67 U	0.67 U	0.67 U	0.67 U
100-41-4	Ethylbenzene	ug/L	1.5	1.5	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	R
591-78-6	2-Hexanone	ug/L	38	38	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U
108-10-1	4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	ug/L	630	6300	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U
75-09-2	Methylene chloride	ug/L	11	11	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U
100-42-5	Styrene	ug/L	120	1200	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	R
79-34-5	1,1,2,2-Tetrachloroethane	ug/L	0.076	0.076	0.56 U	0.56 U	0.56 U	0.56 U	0.56 U	0.56 U
127-18-4	Tetrachloroethene	ug/L	4.1	11	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
108-88-3	Toluene	ug/L	110	1100	0.35 U	0.35 U	0.35 U	0.35 U	0.35 U	R
120-82-1	1,2,4-Trichlorobenzene	ug/L	0.4	1.2	0.81 U	0.81 U	0.81 U	0.81 U	0.81 U	R
71-55-6	1,1,1-Trichloroethane	ug/L	800	8000	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U
79-00-5	1,1,2-Trichloroethane	ug/L	0.041	0.28	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U
79-01-6	Trichloroethene	ug/L	0.28	0.49	0.36 U	0.36 U	0.36 U	0.36 U	0.36 U	0.36 U

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FMC-Front Royal Avtex Fibers 2020 Sampling Event OU-10 NLF Groundwater Wells		Purpose			Upgradient Overburden Monitoring Well	Upgradient Shallow Bedrock Monitoring Wells		Downgradient Shallow Bedrock Monitoring Wells		
		Location ID Sample ID: Sampled:	Regional Screening Level[1]	Regional Screening Level[1]	GPW-03R 2020AN-GPW-03R 07/17/2020	128 2020AN-128 07/31/2020	130R 2020AN-130R 08/01/2020	MW-07 2020AN-MW-07 07/28/2020	MW-08 2020AN-MW-08 07/28/2020	133 2020AN-133 07/29/2020
CAS NO.	COMPOUND	UNITS:	HQ=0.1	HQ=1.0						
	VOLATILES (CONTINUED)									
75-01-4	Vinyl chloride	ug/L	0.019	0.019	0.5 U	0.5 U	0.5 U	**1.6**	0.5 U	0.5 U
1330-20-7	Xylenes (total)	ug/L	19	190	0.42 U	0.42 U	0.42 U	0.42 U	0.42 U	R
	SEMIVOLATILES									
83-32-9	Acenaphthene	ug/L	53	530	0.17 U	0.17 U	0.19 U	0.17 U	0.19 U	0.19 U
208-96-8	Acenaphthylene	ug/L	NV	NV	0.12 U	0.13 U	0.14 U	0.12 U	0.14 U	0.14 U
120-12-7	Anthracene	ug/L	180	1800	0.13 U	0.14 U	0.15 U	0.13 U	0.15 U	0.15 U
56-55-3	Benzo(a)anthracene	ug/L	0.03	0.03	0.16 U	0.17 U	0.19 U	0.16 U	0.19 U	0.19 U
50-32-8	Benzo(a)pyrene	ug/L	0.025	0.025	0.17 U	0.17 U	0.19 U	0.17 U	0.19 U	0.19 U
205-99-2	Benzo(b)fluoranthene	ug/L	0.25	0.25	0.15 U	0.15 U	0.17 U	0.15 U	0.17 U	0.17 U
191-24-2	Benzo(g,h,i)perylene	ug/L	NV	NV	0.17 U	0.18 U	0.19 U	0.17 U	0.19 U	0.19 U
207-08-9	Benzo(k)fluoranthene	ug/L	2.5	2.5	0.13 U	0.14 U	0.15 U	0.13 U	0.15 U	0.15 U
101-55-3	4-Bromophenyl phenyl ether	ug/L	NV	NV	0.48 U	0.5 U	0.54 U	0.48 U	0.54 U	0.54 U
85-68-7	Butyl benzylphthalate (BBP)	ug/L	16	16	0.64 U	0.67 U	0.72 U	0.64 U	0.72 U	0.72 U
86-74-8	Carbazole	ug/L	NV	NV	0.47 U	0.49 U	0.53 U	0.47 U	0.53 U	0.53 U
59-50-7	4-Chloro-3-methylphenol	ug/L	140	1400	0.28 U	0.3 U	0.32 U	0.28 U	0.32 U	0.32 U
106-47-8	4-Chloroaniline	ug/L	0.37	0.37	0.3 U	0.32 U	0.34 U	0.3 U	0.34 U	0.34 U
111-91-1	bis(2-Chloroethoxy)methane	ug/L	5.9	59	0.44 U	0.46 U	0.49 U	0.44 U	0.49 U	0.49 U
111-44-4	bis(2-Chloroethyl)ether	ug/L	0.014	0.014	0.39 U	0.4 U	0.44 U	0.39 U	0.44 U	0.44 U
91-58-7	2-Chloronaphthalene	ug/L	75	750	0.46 U	0.48 U	0.53 U	0.46 U	0.53 U	0.53 U
95-57-8	2-Chlorophenol	ug/L	9.1	91	0.26 U	0.27 U	0.3 U	0.26 U	0.3 U	0.3 U
7005-72-3	4-Chlorophenyl phenyl ether	ug/L	NV	NV	0.53 U	0.55 U	0.6 U	0.53 U	0.6 U	0.6 U
218-01-9	Chrysene	ug/L	25	25	0.18 U	0.19 U	0.2 U	0.18 U	0.2 U	0.2 U
53-70-3	Dibenz(a,h)anthracene	ug/L	0.025	0.025	0.15 U	0.15 U	0.16 U	0.15 U	0.16 U	0.16 U
132-64-9	Dibenzofuran	ug/L	0.79	7.9	0.54 U	0.56 U	0.61 U	0.54 U	0.61 U	0.61 U
91-94-1	3,3'-Dichlorobenzidine	ug/L	0.13	0.13	1.1 U	1.2 U	1.3 U	1.1 U	1.3 U	1.3 U
120-83-2	2,4-Dichlorophenol	ug/L	4.6	46	0.25 U	0.26 U	0.28 U	0.25 U	0.28 U	0.28 U
84-66-2	Diethyl phthalate	ug/L	1500	15000	3.7 U	3.8 U	4.1 U	3.7 U	4.1 U	4.1 U
105-67-9	2,4-Dimethylphenol	ug/L	36	360	0.5 U	0.52 U	0.56 U	0.5 U	0.56 U	0.56 U
131-11-3	Dimethyl phthalate	ug/L	NV	NV	0.5 U	0.52 U	0.56 U	0.5 U	0.56 U	0.56 U
84-74-2	Di-n-butylphthalate (DBP)	ug/L	90	900	1.7 U	1.8 U	2 U	1.7 U	2 U	2 U
534-52-1	4,6-Dinitro-2-methylphenol	ug/L	0.15	1.5	2.7 U	2.8 U	3.1 U	2.7 U	3.1 U	3.1 U
51-28-5	2,4-Dinitrophenol	ug/L	3.9	39	6 U	6.2 U	6.8 U	6 U	6.8 U	6.8 U
121-14-2	2,4-Dinitrotoluene	ug/L	0.24	0.24	2 U	2.1 U	2.3 U	2 U	2.3 U	2.3 U
606-20-2	2,6-Dinitrotoluene	ug/L	0.049	0.049	2 U	2.1 U	2.3 U	2 U	2.3 U	2.3 U
117-84-0	Di-n-octyl phthalate (DnOP)	ug/L	20	200	0.79 U	0.82 U	0.89 U	0.79 U	0.89 U	0.89 U
117-81-7	bis(2-Ethylhexyl)phthalate (DEHP)	ug/L	5.6	5.6	2.1 U	**18**	2.4 U	2.1 U	2.4 U	2.4 U

[1] - EPA Regional Screening Levels (RSLs) for tapwater (November 2020).
[2] - Reported standard is for elemental mercury.
U - Not detected, value indicates reporting limit.
NR - Not Reported
= Detected value exceeds RSL (HQ=0.1).
= Detected value exceeds RSL (HQ=1.0).

Bold text indicates detected value.
NTU = nephelometric turbidity unit
NV - No Value Available
nS/cm = microsiemens per centimeter
ug/L = micrograms per liter
DUP – Duplicate Sample

J = Estimated value
s.u = std. units
mg/L = miligrams per liter
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TABLE 13

OU-10 New Landfill Groundwater Monitoring Network Sampling Results
2020 Annual Site-Wide Groundwater, Surface Water, and Sediment Monitoring Report for OU-7, OU-10, and NTCRA Basins
Avtex Fibers Superfund Site
Front Royal, Virginia

FMC-Front Royal Avtex Fibers 2020 Sampling Event OU-10 NLF Groundwater Wells		Purpose			Upgradient Overburden Monitoring Well	Upgradient Shallow Bedrock Monitoring Wells		Downgradient Shallow Bedrock Monitoring Wells		
		Location ID Sample ID: Sampled:	Regional Screening Level[1]	Regional Screening Level[1]	GPW-03R 2020AN-GPW-03R 07/17/2020	128 2020AN-128 07/31/2020	130R 2020AN-130R 08/01/2020	MW-07 2020AN-MW-07 07/28/2020	MW-08 2020AN-MW-08 07/28/2020	133 2020AN-133 07/29/2020
CAS NO.	COMPOUND	UNITS:	HQ=0.1	HQ=1.0						
	SEMIVOLATILES (CONTINUED)									
206-44-0	Fluoranthene	ug/L	80	800	0.15 U	0.16 U	0.17 U	0.15 U	0.17 U	0.17 U
86-73-7	Fluorene	ug/L	29	290	0.16 U	0.17 U	0.18 U	0.16 U	0.18 U	0.18 U
118-74-1	Hexachlorobenzene	ug/L	0.0098	0.0098	0.15 U	0.16 U	0.18 U	0.15 U	0.18 U	0.18 U
87-68-3	Hexachlorobutadiene	ug/L	0.14	0.14	0.52 U	0.54 U	0.59 U	0.52 U	0.59 U	0.59 U
77-47-4	Hexachlorocyclopentadiene	ug/L	0.041	0.41	1.7 U	1.8 U	1.9 U	1.7 U	1.9 U	1.9 U
67-72-1	Hexachloroethane	ug/L	0.33	0.33	0.38 U	0.4 U	0.43 U	0.38 U	0.43 U	0.43 U
193-39-5	Indeno(1,2,3-cd)pyrene	ug/L	0.25	0.25	0.13 U	0.14 U	0.15 U	0.13 U	0.15 U	0.15 U
78-59-1	Isophorone	ug/L	78	78	0.31 U	0.32 U	0.35 U	0.31 U	0.35 U	0.35 U
91-57-6	2-Methylnaphthalene	ug/L	3.6	36	0.11 U	0.11 U	0.12 U	0.11 U	0.12 U	0.12 U
95-48-7	2-Methylphenol	ug/L	93	930	0.2 U	0.21 U	0.23 U	0.2 U	0.23 U	0.23 U
	3&4-Methylphenol	ug/L	93	930	0.18 U	0.19 U	0.21 U	0.18 U	0.21 U	0.21 U
91-20-3	Naphthalene	ug/L	0.12	0.12	0.1 U	0.11 U	0.12 U	0.1 U	0.12 U	0.12 U
88-74-4	2-Nitroaniline	ug/L	19	190	0.49 U	0.51 U	0.55 U	0.49 U	0.55 U	0.55 U
99-09-2	3-Nitroaniline	ug/L	NV	NV	0.54 U	0.57 U	0.62 U	0.54 U	0.62 U	0.62 U
100-01-6	4-Nitroaniline	ug/L	3.8	3.8	0.88 U	0.92 U	1 U	0.88 U	1 U	1 U
98-95-3	Nitrobenzene	ug/L	0.14	0.14	0.49 U	0.51 U	0.56 U	0.49 U	0.56 U	0.56 U
88-75-5	2-Nitrophenol	ug/L	NV	NV	0.54 U	0.56 U	0.61 U	0.54 U	0.61 U	0.61 U
100-02-7	4-Nitrophenol	ug/L	NV	NV	2.1 U	2.2 U	2.4 U	2.1 U	2.4 U	2.4 U
621-64-7	N-Nitrosodi-n-propylamine	ug/L	0.011	0.011	0.24 U	0.25 U	0.28 U	0.24 U	0.28 U	0.28 U
86-30-6	N-Nitrosodiphenylamine	ug/L	12	12	0.42 U	0.44 U	0.48 U	0.42 U	0.48 U	0.48 U
108-60-1	2,2'-Oxybis(1-chloropropane) (bis(2-Chloroisopropyl) ether)	ug/L	71	710	0.53 U	0.55 U	0.6 U	0.53 U	0.6 U	0.6 U
87-86-5	Pentachlorophenol	ug/L	0.041	0.041	3 U	3.1 U	3.4 U	3 U	3.4 U	3.4 U
85-01-8	Phenanthrene	ug/L	NV	NV	0.16 U	0.17 U	0.18 U	0.16 U	0.18 U	0.18 U
108-95-2	Phenol	ug/L	580	5800	0.12 U	0.13 U	0.14 U	0.12 U	0.14 U	0.14 U
129-00-0	Pyrene	ug/L	12	120	0.17 U	0.18 U	0.19 U	0.17 U	0.19 U	0.19 U
95-95-4	2,4,5-Trichlorophenol	ug/L	120	1200	1.9 U	2 U	2.2 U	1.9 U	2.2 U	2.2 U
88-06-2	2,4,6-Trichlorophenol	ug/L	1.2	4.1	1.7 U	1.8 U	2 U	1.7 U	2 U	2 U
	METALS - DISSOLVED									
7440-36-0	Antimony	ug/L	0.78	7.8	0.57 U	0.57 U	0.57 U	0.57 U	0.57 U	0.57 U
7440-38-2	Arsenic	ug/L	0.052	0.052	0.75 U	0.75 U	0.75 U	0.75 U	0.75 U	**23**
7440-41-7	Beryllium	ug/L	2.5	25	0.31 U	**0.31** J	0.31 U	0.31 U	0.31 U	0.31 U
7440-43-9	Cadmium	ug/L	0.92	9.2	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
7440-47-3	Chromium	ug/L	2200	22000	0.98 U	0.98 U	**5**	0.98 U	0.98 U	**1.2 J**
7440-50-8	Copper	ug/L	80	800	**11**	**2.5**	1.7 U	1.7 U	**4**	1.7 U
7439-92-1	Lead	ug/L	15	15	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U
7439-97-6	Mercury[2]	ug/L	0.063	0.63	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U

[1] - EPA Regional Screening Levels (RSLs) for tapwater (November 2020).
[2] - Reported standard is for elemental mercury.
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= Detected value exceeds RSL (HQ=0.1).
= Detected value exceeds RSL (HQ=1.0).

Bold text indicates detected value.
NTU = nephelometric turbidity unit
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J = Estimated value
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TABLE 13

OU-10 New Landfill Groundwater Monitoring Network Sampling Results
2020 Annual Site-Wide Groundwater, Surface Water, and Sediment Monitoring Report for OU-7, OU-10, and NTCRA Basins
Avtex Fibers Superfund Site
Front Royal, Virginia

FMC-Front Royal Avtex Fibers 2020 Sampling Event OU-10 NLF Groundwater Wells		Purpose:			**Upgradient Overburden Monitoring Well**	**Upgradient Shallow Bedrock Monitoring Wells**		**Downgradient Shallow Bedrock Monitoring Wells**		
		Location ID: Sample ID: Sampled:	Regional Screening Level[1] HQ=0.1	Regional Screening Level[1] HQ=1.0	GPW-03R 2020AN-GPW-03R 07/17/2020	128 2020AN-128 07/31/2020	130R 2020AN-130R 08/01/2020	MW-07 2020AN-MW-07 07/28/2020	MW-08 2020AN-MW-08 07/28/2020	133 2020AN-133 07/29/2020
CAS NO.	COMPOUND	UNITS:								
	METALS - DISSOLVED (CONTINUED)									
7440-02-0	Nickel	ug/L	39	390	**7.9**	1.5 U	1.5 U	1.5 U	1.5 U	**12**
7782-49-2	Selenium	ug/L	10	100	0.89 U	0.89 U	0.89 U	0.89 U	0.89 U	0.89 U
7440-28-0	Thallium	ug/L	0.02	0.20	0.2 U	**0.3 J**	0.2 U	0.2 U	0.2 U	0.2 U
7440-62-2	Vanadium	ug/L	8.6	86	0.82 U	0.82 U	0.82 U	0.82 U	0.82 U	0.82 U
7440-66-6	Zinc	ug/L	600	6000	**93**	**34**	15 U	**38**	**35**	**16 J**
	FIELD PARAMETERS									
	Temperature	°C	---	---	18.58	20.05	19.95	23.19	20.11	20.96
	Conductivity	uS/cm	---	---	0.64	1.35	0.52	1.39	1.04	4.83
	pH	s.u.	---	---	5.79	6.99	11.23	6.51	6.67	7.1
	ORP	mV	---	---	186.90	-150.80	-46.30	-67.40	-56.00	-189
	Turbidity	NTU	---	---	2.39	28.70	2.64	1.15	48.50	1.91
	Dissolved Oxygen	mg/L	---	---	4.30	1.79	4.71	0.23	0.49	2.81

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uS/cm = microsiemens per centimeter
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mg/L = miligrams per liter
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PARSONS

Table G-5: NTCRA Basin Groundwater Results – 2015

Source: 2015 Annual Report

TABLE 16

NTCRA Basins Groundwater Monitoring Results
2020 Annual Site-Wide Groundwater, Surface Water, and Sediment Monitoring Report for OU-7, OU-10, and NTCRA Basins
Avtex Fibers Superfund Site
Front Royal, Virginia

FMC-Front Royal Avtex Fibers 2020 Sampling Event Validated BSN Wells		Location ID: Sample Name: Well Type: Sampled:	Regional Screening Level[1]	Regional Screening Level[1]	008 2020AN-008 OMW 07/17/2020	012 2020AN-012 OMW 07/30/2020	013 2020AN-013 OMW 07/29/2020	014R 2020AN-014R OMW 07/29/2020	022 2020AN-022 OMW 07/28/2020	023 2020AN-023 OMW 08/01/2020
CAS NO.	COMPCUND	UNITS:	HQ=0.1	HQ=1.0						
	METALS - DISSOLVED									
7440-38-2	Arsenic	ug/L	0.052	0.052	0.75 U	0.75 U	0.75 U	**1100**	0.75 U	**1.1 J**
7440-41-7	Beryllium	ug/L	2.5	25	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U
7440-43-9	Cadmium	ug/L	0.92	9.2	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
7440-47-3	Chromium	ug/L	2200	22000	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U
7440-50-8	Copper	ug/L	80	800	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U	**3.2**
7439-92-1	Lead	ug/L	15	15	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U
7439-97-6	Mercury[2]	ug/L	0.063	0.63	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U
7440-02-0	Nickel	ug/L	39	390	1.5 U	**1.7 J**	**21**	**62**	1.5 U	**2.2**
7782-49-2	Selenium	ug/L	10	100	0.89 U	0.89 U	0.89 U	0.89 U	0.89 U	0.89 U
7440-66-6	Zinc	ug/L	600	6000	15 U	15 U	**23 J**	**22 J**	15 U	15 U
	OTHER									
7440-70-2	Calcium (dissolved)	mg/L	NV	NV	**220**	**170**	**290**	**310**	**86**	**120**
7439-95-4	Magnesium (dissolved)	mg/L	NV	NV	**30**	**24**	**37**	**88**	**12**	**74**
7440-23-5	Sodium (dissolved)	mg/L	NV	NV	**14**	**35**	**63**	**490**	**26**	**280**
16887-00-6	Chloride (As Cl)	mg/L	NV	NV	**46**	**42**	**31**	**69**	**14**	**11**
14808-79-8	Sulfate (As SO4)	mg/L	NV	NV	**370**	**340**	**680**	**1500**	**70**	**450**
	FIELD PARAMETERS									
	Temperature	°C	---	---	17.92	19.70	23.22	25.05	26.46	20.97
	Conductivity	uS/cm	---	---	1298.00	0.95	1.55	3.56	609.18	1.68
	pH	s.u.	---	---	6.96	6.96	6.54	6.91	7.01	7.18
	ORP	mV	---	---	-141.30	-67.60	-96.80	-115.00	-31.89	1.11
	Turbidity	NTU	---	---	18.60	49.90	37.00	56.30	2.73	4.86
	Dissolved Oxygen	mg/L	---	---	5.24	0.72	0.15	0.19	0.57	1.09

[1] - EPA Regional Screening Levels (RSLs) for tapwater (November 2020).

[2] - Reported standard is for elemental mercury.

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J = Estimated value (+ high bias - low bias)

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DUP = Duplicate

= Detected value exceeds RSL (HQ=0.1).

= Detected value exceeds RSL (HQ=1.0).

NTU = nephelometric turbidity unit

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uS/cm = microsiemens per centimeter

ug/L = micrograms per liter

mg/L = miligrams per liter

s.u = s.d. units

mV = millivolts

UJ = Not detected at estimated detection Limit

TABLE 16

NTCRA Basins Groundwater Monitoring Results
2020 Annual Site-Wide Groundwater, Surface Water, and Sediment Monitoring Report for OU-7, OU-10, and NTCRA Basins
Avtex Fibers Superfund Site
Front Royal, Virginia

FMC-Front Royal Avtex Fibers 2020 Sampling Event Validated BSN Wells		Location ID: Sample Name: Well Type: Sampled:	Regional Screening Level[1]	Regional Screening Level[1]	025R 2020AN-025R OMW 07/28/2020	029 2020AN-029 OMW 07/17/2020	029 (DUP) 2020AN-029D OMW 07/17/2020	108 2020AN-108 S BMW 07/17/2020	110 2020AN-110 S BMW 07/30/2020	112 2020AN-112 S BMW 07/30/2020	113 2020AN-113 S BMW 07/29/2020
CAS NO.	COMPOUND	UNITS:	HQ=0.1	HQ=1.0							
	METALS - DISSOLVED										
7440-38-2	Arsenic	ug/L	0.052	0.052	0.75 U	0.75 U	0.75 U	0.75 U	0.75 U	0.75 U	0.75 U
7440-41-7	Beryllium	ug/L	2.5	25	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U
7440-43-9	Cadmium	ug/L	0.92	9.2	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
7440-47-3	Chromium	ug/L	2200	22000	0.98 U	0.98 U	0.98 U	0.98 U	**1.9 J**	0.98 U	0.98 U
7440-50-8	Copper	ug/L	80	800	1.7 U	**8.5**	**7.6**	1.7 U	1.7 U	1.7 U	1.7 U
7439-92-1	Lead	ug/L	15	15	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U
7439-97-6	Mercury[2]	ug/L	0.063	0.63	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U
7440-02-0	Nickel	ug/L	39	390	1.5 U	**2**	**2**	1.5 U	**27**	**6.9**	1.5 U
7782-49-2	Selenium	ug/L	10	100	0.89 U	**1.1 J**	**1.2 J**	0.89 U	0.89 U	0.89 U	0.89 U
7440-66-6	Zinc	ug/L	600	6000	15 U	**88**	77	15 U	**83 J**	15 U	15 U
	OTHER										
7440-70-2	Calcium (dissolved)	mg/L	NV	NV	**96**	**140**	**140**	**180**	**190**	**380**	**87**
7439-95-4	Magnesium (dissolved)	mg/L	NV	NV	**19**	**18**	**18**	**17**	**35**	**48**	**10**
7440-23-5	Sodium (dissolved)	mg/L	NV	NV	**12**	**46**	**46**	**14**	**240**	**94**	**5.6**
16887-00-6	Chloride (As Cl)	mg/L	NV	NV	**4.7**	**45**	**45**	**14**	**22**	**65**	**1.4**
14808-79-8	Sulfate (As SO4)	mg/L	NV	NV	**19**	**320**	**310**	**240**	**760**	**990**	**7.1**
	FIELD PARAMETERS										
	Temperature	°C	---	---	27.84	19.52	19.52	26.01	23.41	25.00	25.59
	Conductivity	uS/cm	---	---	0.66	0.98	0.98	982.00	1.91	2.18	0.51
	pH	s.u.	---	---	6.90	6.16	6.16	7.01	6.92	6.53	7.60
	ORP	mV	---	---	-125.90	103.50	103.50	-142.40	-91.40	-74.40	-248.50
	Turbidity	NTU	---	---	18.98	22.80	22.80	100.00	67.90	5.88	10.60
	Dissolved Oxygen	mg/L	---	---	1.42	2.93	2.93	0.81	0.28	0.30	0.09

[1] - EPA Regional Screening Levels (RSLs) for tapwater (November 2020).

[2] - Reported standard is for elemental mercury.

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= Detected value exceeds RSL (HQ=0.1).

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s.u = std. units

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Avtex Fibers Superfund Site
Front Royal, Virginia

FMC-Front Royal Avtex Fibers 2020 Sampling Event Validated BSN Wells		Location ID: Sample Name: Well Type: Sampled:	Regional Screening Level[1] HQ=0.1	Regional Screening Level[1] HQ=1.0	114 2020AN-114 S BMW 07/29/2020	129 2020AN-129 S BMW 07/17/2020	132 2020AN-132 S BMW 07/27/2020	132 (DUP) 2020AN-132D S BMW 07/27/2020	B-48A 2020AN-B-48A OMW 07/30/2020	MW-12 2020AN-MW-12 OMW 07/29/2020
CAS NO.	COMPOUND	UNITS:								
	METALS - DISSOLVED									
7440-38-2	Arsenic	ug/L	0.052	0.052	0.75 U	0.75 U	0.75 U	0.75 U	0.75 U	**32**
7440-41-7	Beryllium	ug/L	2.5	25	0.31 U	0.31 U	**0.41 J**	**0.31 J**	0.31 U	0.31 U
7440-43-9	Cadmium	ug/L	0.92	9.2	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
7440-47-3	Chromium	ug/L	2200	22000	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	**1.2 J**
7440-50-8	Copper	ug/L	80	800	1.7 U	**5.3**	1.7 U	1.7 U	**1.9 J**	**230**
7439-92-1	Lead	ug/L	15	15	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U	**0.63 J**
7439-97-6	Mercury[2]	ug/L	0.063	0.63	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U
7440-02-0	Nickel	ug/L	39	390	**33**	1.5 U	1.5 U	1.5 U	**74**	**12**
7782-49-2	Selenium	ug/L	10	100	0.89 U	0.89 U	0.89 U	0.89 U	0.89 U	**1.4 J**
7440-66-6	Zinc	ug/L	600	6000	15 U	**29**	15 U	15 U	15 U	**650**
	OTHER									
7440-70-2	Calcium (dissolved)	mg/L	NV	NV	**270**	**30**	**280**	**280**	**180**	**16**
7439-95-4	Magnesium (dissolved)	mg/L	NV	NV	**58**	**2.7** J	**42**	**42**	**22**	**26**
7440-23-5	Sodium (dissolved)	mg/L	NV	NV	**140**	**2.2** J	**180**	**180**	**190**	**3700**
16887-00-6	Chloride (As Cl)	mg/L	NV	NV	**84**	**1.9**	**70**	**730**	**24**	**280**
14808-79-8	Sulfate (As SO4)	mg/L	NV	NV	**790**	**25**	**710**	**780**	**550**	**5500**
	FIELD PARAMETERS									
	Temperature	°C	---	---	27.94	18.88	23.01	23.01	24.34	23.01
	Conductivity	uS/cm	---	---	1.87	0.19	2.02	2.02	1.67	11.08
	pH	s.u.	---	---	6.68	7.01	6.52	6.52	6.77	8.10
	ORP	mV	---	---	-155.80	102.50	-70.10	-70.10	-30.80	0.10
	Turbidity	NTU	---	---	18.10	2.62	3.06	3.06	243.00	1.11
	Dissolved Oxygen	mg/L	---	---	0.14	6.44	3.80	3.80	0.42	1.69

[1] - EPA Regional Screening Levels (RSLs) for tapwater (November 2020).

[2] - Reported standard is for elemental mercury.

Bold text indicates detected value

U - Not detected, value indicates reporting limit

J = Estimated value (+ high bias - low bias)

NV - No Value Available

DUP = Duplicate

= Detected value exceeds RSL (HQ=0.1).

= Detected value exceeds RSL (HQ=1.0).

NTU = nephelometric turbidity unit

NV - No Value Available

uS/cm = microsiemens per centimeter

ug/L = micrograms per liter

mg/L = miligrams per liter

s.u = std. units

mV = millivolts

UJ = Not detected at estimated detection Limit

TABLE 16

NTCRA Basins Groundwater Monitoring Results
2020 Annual Site-Wide Groundwater, Surface Water, and Sediment Monitoring Report for OU-7, OU-10, and NTCRA Basins
Avtex Fibers Superfund Site
Front Royal, Virginia

FMC-Front Royal Avtex Fibers 2020 Sampling Event Validated BSN Wells		Location ID: Sample Name: Well Type: Sampled:	Regional Screening Level[1]	Regional Screening Level[1]	PZ-03 2020AN-PZ-03 S BMW 07/27/2020	PZ-06 2020AN-PZ-06 S BMW 07/31/2020	PZ-07 2020AN-PZ-07 S BMW 07/31/2020
CAS NO.	COMPOUND	UNITS:	HQ=0.1	HQ=1.0			
	METALS - DISSOLVED						
7440-38-2	Arsenic	ug/L	0.052	0.052	0.75 U	**1.8 J**	**2.5 J**
7440-41-7	Beryllium	ug/L	2.5	25	0.31 U	0.31 U	0.31 U
7440-43-9	Cadmium	ug/L	0.92	9.2	0.2 U	0.2 U	0.2 U
7440-47-3	Chromium	ug/L	2200	22000	0.98 U	**1.5 J**	**1.5 J**
7440-50-8	Copper	ug/L	80	800	1.7 U	**2.8**	1.7 U
7439-92-1	Lead	ug/L	15	15	0.45 U	0.45 U	0.45 U
7439-97-6	Mercury[2]	ug/L	0.063	0.63	0.13 U	0.13 U	0.13 U
7440-02-0	Nickel	ug/L	39	390	**2.2**	1.5 U	**16**
7782-49-2	Selenium	ug/L	10	100	0.89 U	0.89 U	0.89 U
7440-66-6	Zinc	ug/L	600	6000	15 U	15 U	15 U
	OTHER						
7440-70-2	Calcium (dissolved)	mg/L	NV	NV	**390**	**50**	**280**
7439-95-4	Magnesium (dissolved)	mg/L	NV	NV	**100**	**23**	**50**
7440-23-5	Sodium (dissolved)	mg/L	NV	NV	**980**	**90**	**200**
16887-00-6	Chloride (As Cl)	mg/L	NV	NV	**130**	**23**	**55**
14808-79-8	Sulfate (As SO4)	mg/L	NV	NV	**2800**	**120**	**870**
	FIELD PARAMETERS						
	Temperature	°C	---	---	20.26	22.14	17.01
	Conductivity	uS/cm	---	---	4.99	0.64	1.71
	pH	s.u.	---	---	6.72	7.60	7.11
	ORP	mV	---	---	-124.00	80.80	-204.10
	Turbidity	NTU	---	---	8.95	3.11	1.56
	Dissolved Oxygen	mg/L	---	---	3.03	7.60	0.19

[1] - EPA Regional Screening Levels (RSLs) for tapwater (November 2020).

[2] - Reported standard is for elemental mercury.

Bold text indicates detected value

U - Not detected, value indicates reporting limit

J = Estimated value (+ high bias - low bias)

NV - No Value Available

DUP = Duplicate

= Detected value exceeds RSL (HQ=0.1).

= Detected value exceeds RSL (HQ=1.0).

NTU = nephelometric turbidity unit

NV - No Value Available

uS/cm = microsiemens per centimeter

ug/L = micrograms per liter

mg/L = miligrams per liter

s.u = std. units

mV = millivolts

UJ = Not detected at estimated detection Limit

Table G-6: NTCRA Sumps Results – 2020

TABLE 17

NTCRA Basins Sump Monitoring Results
2020 Annual Site-Wide Groundwater, Surface Water, and Sediment Monitoring Report for OU-7, OU-10, and NTCRA Basins
Avtex Fibers Superfund Site
Front Royal, Virginia

FMC-Front Royal Avtex Fibers 2020 Sampling Event Validated BSN Sumps Groundwater Data		Location ID: Sample Name: Well Type: Sample Date:	Screening Criteria[1]	FAB 1-2 2020AN-FAB1-2 Sump 08/01/2020	FAB 3-1 2020AN-FAB3-1 Sump 08/01/2020	FAB 6-North 2020AN-FAB6-NORTH Sump 08/02/2020	FAB 6-South 2020AN-FAB6-SOUTH Sump 08/02/2020	SB 1-1 2020AN-SB1-1 Sump 08/01/2020	SB 1-2 2020AN-SB1-2 Sump 08/01/2020
CAS NO.	COMPOUND	UNITS:							
	METALS - DISSOLVED								
7440-38-2	Arsenic	ug/L	10	**17**	**6.1**	0.75 U	0.75 U	**4.5 J**	**3.4 J**
7440-41-7	Beryllium	ug/L	NV	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U
7440-43-9	Cadmium	ug/L	0.72	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
7440-47-3	Chromium[2]	ug/L	11	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U
7440-50-8	Copper	ug/L	9	**2.3**	**2.1**	**6.8**	**17**	**3.8**	**5**
7439-92-1	Lead	ug/L	11	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U
7439-97-6	Mercury	ug/L	0.77	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U
7440-02-0	Nickel	ug/L	20	**19**	**18**	**37**	**30**	1.5 U	1.5 U
7782-49-2	Selenium	ug/L	5	0.89 U	**1.4 J**	0.89 U	**12**	0.89 U	0.89 U
7440-66-6	Zinc	ug/L	120	15 U	15 U	**43**	44	15 U	15 U
	OTHER								
7440-70-2	Calcium, Dissolved	mg/L	NV	**160**	**94**	**270**	**280**	**35**	**51**
7439-95-4	Magnesium, Dissolved	mg/L	NV	**51**	**69**	**34**	**38**	**6.1**	**2.1 J**
7440-23-5	Sodium, Dissolved	mg/L	NV	**48**	**160**	**47**	**53**	**19**	**9**
16887-00-6	Chloride (As Cl)	mg/L	230	**18**	**23**	14	**13**	**2.3**	1.7
14808-79-8	Sulfate (As SO4)	mg/L	250	**620**	790	**480**	**460**	**29**	**14**
	FIELD PARAMETERS								
	Temperature	°C	---	29.54	29.9	24.91	21.84	24.06	23.98
	Conductivity	uS/cm	---	1.28	1.72	1.32	1.39	0.57	0.38
	pH	s.u.	---	8.16	8.41	7.07	6.83	8.58	8.97
	ORP	mV	---	28.2	4.3	-37.1	-7.1	12.7	-11.6
	Turbidity	NTU	---	2.77	1.47	23.8	6.93	165	583
	Dissolved Oxygen	mg/L	---	7.7	6.03	3.8	1.91	3.01	3.24

[1] - Screening value used for comparison is the lowest value of the freshwater aquatic life criterion or human health criterion.
[2] - Screening value is for Chromium (VI).
Bold text indicates detected value
U - Not detected, value indicates reporting limit
J = Estimated value (+ high bias - low bias)
NV - No Value Available
DUP = Duplicate
= Detected value exceeds Screening Criteria.

NTU = nephelometric turbidity unit
NV - No Value Available
uS/cm = microsiemens per centimeter
ug/L = micrograms per liter
mg/L = miligrams per liter
s.u = std. units
mV = millivolts

TABLE 17

NTCRA Basins Sump Monitoring Results
2020 Annual Site-Wide Groundwater, Surface Water, and Sediment Monitoring Report for OU-7, OU-10, and NTCRA Basins
Avtex Fibers Superfund Site
Front Royal, Virginia

FMC-Front Royal Avtex Fibers 2020 Sampling Event Validated BSN Sumps Groundwater Data		Location ID: Sample Name: Well Type: Sample Date:	Screening Criteria[1]	SB 1-3 2020AN-SB1-3 Sump 08/01/2020	SB 1-4 2020AN-SB1-4 Sump 08/01/2020	SB 3-1 2020AN-SB3-1 Sump 08/01/2020	SB 4-1 2020AN-SB4-1 Sump 08/01/2020	SB 4-2 2020AN-SB4-2 Sump 08/01/2020
CAS NO.	COMPOUND	UNITS:						
	METALS - DISSOLVED							
7440-38-2	Arsenic	ug/L	10	**5.9**	**8.2**	**2.3 J**	**1.5** J	**72**
7440-41-7	Beryllium	ug/L	NV	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U
7440-43-9	Cadmium	ug/L	0.72	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
7440-47-3	Chromium[2]	ug/L	11	**2.9**	0.98 U	0.98 U	0.98 U	0.98 U
7440-50-8	Copper	ug/L	9	**9.9**	**4.4**	1.7 U	**3.6**	1.7 U
7439-92-1	Lead	ug/L	11	0.45 U	**2.2**	0.45 U	0.45 U	0.45 U
7439-97-6	Mercury	ug/L	0.77	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U
7440-02-0	Nickel	ug/L	20	**11**	**19**	**3.5**	**6.6**	1.5 U
7782-49-2	Selenium	ug/L	5	0.89 U	**1.3 J**	0.89 U	0.89 U	0.89 U
7440-66-6	Zinc	ug/L	120	15 U	15 U	15 U	**69**	**25**
	OTHER							
7440-70-2	Calcium, Dissolved	mg/L	NV	**15**	**2.7 J**	**8.1**	**86**	**110**
7439-95-4	Magnesium, Dissolved	mg/L	NV	**50**	0.26 U	**42**	**53**	**32**
7440-23-5	Sodium, Dissolved	mg/L	NV	**720**	**320**	**150**	**120**	**68**
16887-00-6	Chloride (As Cl)	mg/L	230	**89**	**90**	**20**	**27**	**15**
14808-79-8	Sulfate (As SO4)	mg/L	250	**780**	**230**	75	**82**	**130**
	FIELD PARAMETERS							
	Temperature	°C	---	25.59	22.76	28.01	23.71	24.72
	Conductivity	uS/cm	---	3.36	1.45	0.88	1.16	0.99
	pH	s.u.	---	8.78	10.25	9.06	8.04	8.3
	ORP	mV	---	-47.1	-26.7	-1.3	14.2	-135.3
	Turbidity	NTU	---	1.62	11.6	4.39	31.9	10.9
	Dissolved Oxygen	mg/L	---	8.05	6.36	5.43	2.99	1.94

[1] - Screening value used for comparison is the lowest value of the freshwater aquatic life criterion or human health criterion.
[2] - Screening value is for Chromium (VI).
Bold text indicates detected value
U - Not detected, value indicates reporting limit
J = Estimated value (+ high bias - low bias)
NV - No Value Available
DUP = Duplicate
= Detected value exceeds Screening Criteria.

NTU = nephelometric turbidity unit
NV - No Value Available
uS/cm = microsiemens per centimeter
ug/L = micrograms per liter
mg/L = miligrams per liter
s.u = std. units
mV = millivolts

Table G-7: Influent Leachate Sampling Summary 2015-2016

Source: 2016 SITE-WIDE O&M REPORT

TABLE 7

Summary of Influent Sampling
Avtex Fibers Superfund Site
Front Royal, Virginia

Constituent	Units	TW-01								TW-02				
		7/24/2015	12/9/2015	8/9/2016	8/1/2017	7/31/2018	7/24/2019	8/3/2020	7/29/2021	7/23/2015	7/23/2015 (DUP)	12/9/2015	8/9/2016	8/1/2017
Carbon Disulfide	ug/L	1,200	360	190	27.7	0.0185	21	130	75	3,100	NR	3,600	847	994
Antimony	mg/L	0.0129	0.0055	0.00282 U^B	0.000828 J	0.000943 J	0.00064 J	0.0013 J	0.0014 J	0.0174	0.0165	0.0125	0.00478 ^ B	0.00319
Arsenic	mg/L	0.0847	0.0482	0.0157	0.00874	0.00729	0.0071	0.014	0.012	0.0886	0.0942	0.0102	0.0296	0.0291
Iron	mg/L	0.115 U	0.427	0.386	0.126	1.37	0.047 U	0.075 J	0.081 J	0.115 U	0.115 U	0.309	0.0513	0.122
Kjeldahyl Nitrogen	mg/L	2.9 J	0.83 J	NR	NR	NR	1.7 J	2.2 J	0.72	3.3 J	3.4 J	2.0	NR	NR
Total Nitrite/Nitrate Nitrogen	mg/L	0.40 U	0.40 U	NR	NR	NR	0.031 U	0.045 U	0.069	0.40 U	0.40 U	0.40 U	NR	NR
Total Nitrogen (NO2/NO3/TKN)	mg/L	2.9 J	0.83 J	2.68	0.693	2.91	1.7 J	2.2 J	0.79	3.3 J	3.4 J	2.0	1.03	1.6
Total Phosphorous as P	mg/L	1.3	0.98	0.576	0.334 J	0.305	0.36	0.56	0.59	1.65	1.6	1.8	0.824	0.907 J
Chemical Oxygen Demand (COD)	mg/L	368	287	120	105	90.9	87	110	110	375	386	483.0	212	182.0
Soluble COD	mg/L	247	300	125	91.8 J	89.1	87	110	99	408	391	522	137	57.9 J
Biological Oxygen Demand (BOD)	mg/L	242	135	82.6	61.6	45.9	39	59	60	227	227	204	114	112
Soluble BOD	mg/L	194	101	76.0	57.6	52.0	1.2 U	110	50	144	143	139	108	98
Total Alkalinity	mg/L as CaCO3	858	898	478	353	374	390	640	630	1,460	1,470	2,100	877	1,060
Carbonate Alkalinity	mg/L as CaCO3	NR	NR	11.5	353	31.3	NR	NR	NR	NR	NR	NR	37.9	1060
Bicarbonate Alkalinity	mg/L as CaCO3	NR	NR	466	5.00 U	342	NR	NR	NR	NR	NR	NR	839	5.00 U
Hydrxide Alkalinity	mg/L as CaCO3	NR	NR	5.00 U	5.00 U	5.00 U	NR	NR	NR	NR	NR	NR	5.00 U	5.00 U
Total Disolved Solids (TDS)	mg/L	1,880	1,500	957	860	813	910	1200	1200	3,620	3,350	3,540	1,780	2,420
Disolved Sulfide	mg/L	190	127	29.6	0.250 U	0.500 U	30	41 J	45	221	212	221	39	0.250 U
Sulfide as H2S	mg/L	3.8	5.4 U	NR	NR	NR	NR	NR	NR	11	11	2.2	NR	NR
Un-ionized H2S	mg/L	NR	NR	4.97	0.100 U	0.100 U	NR	NR	NR	NR	NR	NR	6.60	0.100 U
Density	g/ml	0.998	0.998	0.999	0.999	0.999	1	1	1	0.995	0.997	0.997	0.999	1
Specific Conductance	umhos/cm	3,260	2,230	1,580	1,137	1,200	1400	1900	1900	7,470	7,490	5,850	2,580	3,077
pH	Std. Units	8.9	9.2	8.47	8.25	9.01	8.4 J	8.1 J-	8.1 J	8.3	8.3	9.0	7.9	8.3
Temerature of pH	Deg. C	NR	19.7	NR	27.55	20.45	NR	NR	NR	NR	NR	19.7	NR	24.52

NR = Not Reported
NS = Not Sampled
DUP = Duplicate Sample
U = Not Detected
J = Estimated Value
J- = Estimated Value (Biased Low)
^ = Instrument related QC is outside acceptable limits
B = Constituent Detected in Blank Sample
F1 = MS and/or MSD recovery outside acceptable limits
H = Holding time exceeded

TABLE 7

Summary of Influent Sampling
Avtex Fibers Superfund Site
Front Royal, Virginia

		TW-02 (Cont'd)				TW-03								
Constituent	Units	7/31/2018	7/24/2019	12/9/2020	7/29/2021	7/23/2015	12/9/2015	12/9/2015 (DUP)	8/9/2016	8/1/2017	7/31/2018	7/24/2019	12/10/2020	7/29/2021
Carbon Disulfide	ug/L	0	830	320	130	9	2 J	NR	1.26	0.558	0.00213	0.56 J	0.28 U	0.59 U
Antimony	mg/L	0.00396	0.004	0.0047	0.0013 J	0.0017 U	0.00033 U	0.00033 U	0.000911 UJ^B	0.000800 U	0.000800 U	0.00057 U	0.00057 U	0.00057 U
Arsenic	mg/L	0.0426	0.037	0.037	0.0094	0.0017 U	0.00054 U	0.00054 U	0.000500 U	0.000956 J	0.00545	0.00075 U	0.00075 U	0.00075 U
Iron	mg/L	0.293	0.047 U	8.1	0.34	0.307 J	0.0524 J	0.0488 J	0.273	0.0561	11.2	0.047 U	0.047 U	0.55
Kjeldahyl Nitrogen	mg/L	NR	2.8 J	3.9 J	0.76	2.5 U	0.50 U	0.52 J	NR	NR	NR	1.6 U	5	0.46
Total Nitrite/Nitrate Nitrogen	mg/L	NR	0.031 U	0.031 U	0.075	0.40 U	0.046 J	0.40 U	NR	NR	NR	0.031 U	0.031 U	0.04 U
Total Nitrogen (NO2/NO3/TKN)	mg/L	1.7	2.8 J	3.9 J	0.8	2.5 U	0.50 U	0.52 J	0.499	0.543	0.749	1.6 U	5	0.5
Total Phosphorous as P	mg/L	1.23	0.28	1.4	0.61	0.05	0.050 U	0.050 U	0.0500 U	0.0500 UJ	0.0500 U	0.037 U	0.037 U	0.049 J
Chemical Oxygen Demand (COD)	mg/L	248.0	220	290	100	U	28.7 J	31.0 J	27.6	13.9 J	20.2	12	13	22
Soluble COD	mg/L	238	230	140	85	20.8 J		28.7 J	28.4	14.9 J	15.4 J	14	12	20
Biological Oxygen Demand (BOD)	mg/L	162	110	150	49	9.3	10.6	9.9	10.2	6.38	2.00 U	1.2 U	6.5 U	7.7
Soluble BOD	mg/L	68	64	83	38	7.4	6.9	7.5	6.74	4.27	20.0 U	1.2 U	1.2 U	12
Total Alkalinity	mg/L as CaCO3	1,350	1200	1100	910	176	267	269	257	262	259	230	240	290
Carbonate Alkalinity	mg/L as CaCO3	84.7	NR	NR	NR	NR	NR	NR	5.00 U	262	5.00 U	NR	NR	NR
Bicarbonate Alkalinity	mg/L as CaCO3	1270	NR	NR	NR	NR	NR	NR	257	5.00 U	259	NR	NR	NR
Hydrxide Alkalinity	mg/L as CaCO3	5.00 U	NR	NR	NR	NR	NR	NR	5.00 U	5.00 U	5.00 U	NR	NR	NR
Total Disolved Solids (TDS)	mg/L	2,690	2300	2200	1900	384	740	739	736	698	703	630	690	920
Disolved Sulfide	mg/L	0.500 U	78	92	39	6.8	8.2	8.6	3.79	0.250 U	0.500 U	2.8	3.9	7
Sulfide as H2S	mg/L	NR	NR	NR	NR	0.54	0.98	0.86	NR	NR	NR	NR	NR	NR
Un-ionized H2S	mg/L	0.100 U	NR	NR	NR	NR	NR	NR	0.100 U	0.100 U	0.136 J	NR	NR	NR
Density	g/ml	1	1	1	0.99	0.994	0.995	0.994	0.998	0.999	0.999	1	1	1
Specific Conductance	umhos/cm	3,560	3500	3700	2900	726	1,130	1,130	1,130	1,066	1,030	960	1200	1500
pH	Std. Units	7.9	8.4 J	8.2 J-	7.9 J	8.1	7.9	8.0	6.98	7.92	7.36	7.9 J	7.5 J-	8 J
Temerature of pH	Deg. C	20.32	NR	NR	NR	NR	21.2	21.1	NR	36.77	24.58	NR	NR	NR

NR = Not Reported
NS = Not Sampled
DUP = Duplicate Sample
U = Not Detected
J = Estimated Value
J- = Estimated Value (Biased Low)
^ = Instrument related QC is outside acceptable limits
B = Constituent Detected in Blank Sample
F1 = MS and/or MSD recovery outside acceptable limits
H = Holding time exceeded

TABLE 7

Summary of Influent Sampling
Avtex Fibers Superfund Site
Front Royal, Virginia

Constituent	Units	VB-09								VB-9-SUMP			VB-10		
		7/24/2015	12/9/2015	8/8/2016	1/31/2018	7/31/2018	7/29/2019	8/3/2020	7/30/2021	7/25/2019	8/3/2020	7/30/2021	7/24/2015	12/9/2015	8/9/2016
Carbon Disulfide	ug/L	33,000	5,400	5320 J	54	25.7	19	41		30	40	12	210,000	5,200	185
Antimony	mg/L	0.0152	0.0038	0.0106 J ^ B	0.00111 J	0.00161 J	0.00057 U	0.00074 J		0.0016 J	0.00072 J	0.00074 J	0.043	0.0032	0.0131 J ^ B
Arsenic	mg/L	0.0198	0.0116	0.00880 J	0.0329	0.0375	0.017	0.027		0.046	0.027	0.015	0.0896	0.063	0.0769
Iron	mg/L	0.612 J	3.9	0.832	0.0867	1.19	0.088 J	0.056 J		1.1	0.056 J	1.3	0.454 J	0.194 J	0.644
Kjeldahyl Nitrogen	mg/L	20.1	25.0 U	NR	NR	NR	21	7.3		5.6	6.7	17	10.3	25.0 U	NR
Total Nitrite/Nitrate Nitrogen	mg/L	0.80 U	<0.40	NR	NR	NR	0.031 U	0.031 U		0.031 U	0.035 J	0.24	1.9	0.40 U	NR
Total Nitrogen (NO2/NO3/TKN)	mg/L	20.1	25.0 U	10.3	3.87	4.08	21	7.3		5.6	6.7	17	12.2	25.0 U	5.5
Total Phosphorous as P	mg/L	5.8	0.44 J	0.299	0.333	0.391	0.2	0.47		0.51	0.46	0.82	0.2	1.0	1.53
Chemical Oxygen Demand (COD)	mg/L	8,070	3,820	2850 J	231	514	210	430		350	380	300	1,960	2,840	897
Soluble COD	mg/L	8,090	3,450	3570 J	254	485	160	380		400	420	280	1,360	2,810	508
Biological Oxygen Demand (BOD)	mg/L	5,000	1,890	1,970 JH	95.2	212	37 J	120 U		140	120 U	110	1,110	1,710	342
Soluble BOD	mg/L	4,240	1,710	1,930 JH	125	103	19 J	120 U		100	120 U	100	955	1,370	72.0
Total Alkalinity	mg/L as CaCO3	9,250	5,230	5.00 U	2500	2500	1900	3600	DRY	3500	3400	2100	5,920	5,280	5.00 U
Carbonate Alkalinity	mg/L as CaCO3	NR	NR	5.00 U	5.00 U	5.00 U	NR	NR		NR	NR	NR	NR	NR	5.00 U
Bicarbonate Alkalinity	mg/L as CaCO3	NR	NR	5.00 U	2500	2500	NR	NR		NR	NR	NR	NR	NR	5.00 U
Hydrxide Alkalinity	mg/L as CaCO3	NR	NR	5.00 U	5.00 U	5.00 U	NR	NR		NR	NR	NR	NR	NR	5.00 U
Total Disolved Solids (TDS)	mg/L	15,700	6,880	7,220	3,300	3,900	2600	3300		3900	3700	4000	10,100	7,560	7,930
Disolved Sulfide	mg/L	1,560	447	0.50 U	0.500 U	0.500 U	68	160 J		170	160 J	80	706	155	11.7
Sulfide as H2S	mg/L	234	22	NR	NR	NR	NR	NR		NR	NR	NR	0.054 U	10.9	NR
Un-ionized H2S	mg/L	NR	NR	0.100 U	0.250 J	0.247 J	NR	NR		NR	NR	NR	NR	NR	4.09
Density	g/ml	1.00	0.999	1.04	1	1	1	1		1	1	1	1.00	1.00	1.01
Specific Conductance	umhos/cm	20,700	11,300	8,180	4,600	5,490	3900	5700		5900	5600	5900	14,900	11,700	99,30
pH	Std. Units	7.7	8.3	7.61	7.21	6.91	6.9 J	7.1 J-		7.0 J	7.1 J-	6.9 J	9.1	8.1	8.07
Temerature of pH	Deg. C	NR	19.2	NR	2.87	23.36	NR	NR		NR	NR	NR	NR	19.3	NR

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TABLE 7

Summary of Influent Sampling
Avtex Fibers Superfund Site
Front Royal, Virginia

		VB-10 (Cont'd)				VB-10-SUMP					VB-11				
Constituent	Units	7/31/2018	7/29/2019	8/3/2020	7/30/2021	1/31/2018	7/31/2018	7/25/2019	8/3/2020	7/29/2021	7/24/2015	12/9/2015	8/9/2016	9/23/2020	7/30/2021
Carbon Disulfide	ug/L	5	1100	2,000		518	4	1500	2000	27	110	NS	45.8	0.49 J	
Antimony	mg/L	0.00437	0.0012 J	0.0024		0.00605	0.00557	0.003	0.0025	0.00057 U	0.00066 U	NS	0.00706 J ^ B	0.00057 U	
Arsenic	mg/L	0.0943	0.036	0.071		0.0705	0.1	0.075	0.074	0.0095	0.0286	NS	0.0314	0.0031 J	
Iron	mg/L	0.0797	0.048 J	0.17		0.432	0.0786	0.24	0.19	1.7	0.879 J	NS	4.46	8.5	
Kjeldahyl Nitrogen	mg/L	NR	9	15		NR	NR	6.7	19	14	4.1 J	NS	NR	6.7	
Total Nitrite/Nitrate Nitrogen	mg/L	NR	0.061	0.065		NR	NR	0.031 U	0.046 J	0.068	0.80 U	NS	NR	0.031 U	
Total Nitrogen (NO2/NO3/TKN)	mg/L	8.57	9.1	15		6.65	9.6	6.7	19	14	4.1 J	NS	1.19	6.7	
Total Phosphorous as P	mg/L	0.949	0.42	0.76		0.699	0.533	0.56	0.73	0.31	1.0	NS	0.4	0.42	
Chemical Oxygen Demand (COD)	mg/L	1,380	580	1700		415	1,520	1100	1500	240	205	NS	1,240	47	
Soluble COD	mg/L	1,240	580	1900		403	1,680	1200	1900	240	25.4 J	NS	137	43	
Biological Oxygen Demand (BOD)	mg/L	1000 U	154.40 J	530		243	1000 U	450	520	71	47.5	NS	49.1	15 J-	
Soluble BOD	mg/L	713.0	61 J	530	DRY	144.0	961.0	440	560	68	< 5.7	NS	11.7	1.2 UJ	DRY
Total Alkalinity	mg/L as CaCO3	2500	3300	5700		2500	2500	4700	5500	1500	1,840	NS	1,350	1500	
Carbonate Alkalinity	mg/L as CaCO3	5.00 U	NR	NR		5.00 U	5.00 U	NR	NR	NR	NR	NS	5.00 U	NR	
Bicarbonate Alkalinity	mg/L as CaCO3	2500	NR	NR		2500	2500	NR	NR	NR	NR	NS	1,350	NR	
Hydrxide Alkalinity	mg/L as CaCO3	5.00 U	NR	NR		5.00 U	5.00 U	NR	NR	NR	NR	NS	5.00 U	NR	
Total Disolved Solids (TDS)	mg/L	6,730	4100	5800		5,780	7,160	5700	5600	4500	2,260	NS	1,720	1500	
Disolved Sulfide	mg/L	0.500 U	290	330 J		0.500 U	0.500 U	430	330 J	73	30.8	NS	5	0.58 U	
Sulfide as H2S	mg/L	NR	NR	NR		NR	NR	NR	NR	NR	12.0	NS	NR	NR	
Un-ionized H2S	mg/L	0.222 J	NR	NR		0.140 J	0.193 J	NR	NR	NR	NR	NS	0.784 J	NR	
Density	g/ml	1.01	1	1		1.00	1.01	1	1	0.99	0.996	NS	1.03	1	
Specific Conductance	umhos/cm	8660	6000	8700		7620	10100	8100	8700	6100	3,990	NS	2,600	2600	
pH	Std. Units	7.03	7.0 J	7.1 J-		7.75	7.14	7.2 J	7.1 J-	6.9 J	7.2	NS	7	6.9 J	
Temerature of pH	Deg. C	19.76	NR	NR		1.36	19.18	NR	NR	NR	NR	NS	NR	NR	

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TABLE 7

Summary of Influent Sampling
Avtex Fibers Superfund Site
Front Royal, Virginia

Constituent	Units	VB-11-SUMP					LS-01							
		1/31/2018	7/31/2018	7/25/2019	9/23/2020	7/30/2021	7/28/2016	12/9/2015	8/9/2016	8/1/2017	08/09/2018	7/25/2019	8/3/2020	8/3/2020 (DUP)
Carbon Disulfide	ug/L	1.28	1.79	1.4	0.38 J	0.61 J	1 U	1 U	4.10	1.10 U	0.754	0.28 U	4	4.8
Antimony	mg/L	0.000800 U	0.000800 U	0.00057 U	0.00057 U	0.00057 U	0.00096 J	0.00043 J	0.00843 J ^ B	0.00197 J	0.000800 U	0.00078 J	0.00057 U	0.00057 U
Arsenic	mg/L	0.0049	0.00855	0.0041 J	0.0030 J	0.0027 J	0.0512	0.0177	0.117	0.186	0.0248	0.026	0.0013 J	0.00087 J
Iron	mg/L	2.08	1.73	20	8.1	14	4.91	1.74	11.9	7.79	10.1	1.7	0.46	0.45
Kjeldahyl Nitrogen	mg/L	NR	NR	10	7.3	5.8	2.8	0.99 J	NR	NR	NR	3.9 J	2.8 J	2.2 J
Total Nitrite/Nitrate Nitrogen	mg/L	NR	NR	0.031 U	0.031 U	0.02 U	0.053 J	< 0.40	NR	NR	NR	0.57	0.031 U	0.031 U
Total Nitrogen (NO2/NO3/TKN)	mg/L	3.64	6.28	10	7.3	5.8	2.9	0.99 J	3.05	5.5	2.07	4.5 J	2.8 J	2.2 J
Total Phosphorous as P	mg/L	0.2	0.0931 J	0.32	0.41	0.33	1.5	0.32	1.09	5.68	1.77 J	0.13	0.62	0.59
Chemical Oxygen Demand (COD)	mg/L	37	63	45	32	52	143	58.1	206	413	69.6	75	23	21
Soluble COD	mg/L	20.9	62.6	45	30	45	152	62.7	196	389	39.8	71	22	25
Biological Oxygen Demand (BOD)	mg/L	11.1	13.6	190	14 J-	9.7	9.2	< 6.0	10.6	20.0 U	4.59	1.2 U	1.2 U	3.7
Soluble BOD	mg/L	5.54	6.63	35	1.2 UJ	6	8.1 U	5.8 U	3.93	20.0 U	5.31	1.2 U	1.2 U	1.2 U
Total Alkalinity	mg/L as CaCO3	1,500	1,460	1400	1500	1500	2,590	1,320	5.00 U	5.00 U	883	1800	610	610
Carbonate Alkalinity	mg/L as CaCO3	5.00 U	5.00 U	NR	NR	NR	NR	NR	5.00 U	5.00 U	5.00 U	NR	NR	NR
Bicarbonate Alkalinity	mg/L as CaCO3	1,500	1,460	NR	NR	NR	NR	NR	5.00 U	5.00 U	883	NR	NR	NR
Hydrxide Alkalinity	mg/L as CaCO3	5.00 U	5.00 U	NR	NR	NR	NR	NR	5.00 U	5.00 U	5.00 U	NR	NR	NR
Total Disolved Solids (TDS)	mg/L	1,710	1,810	1600	1500	1600	4,640	2,110	6,830	10,600	1300	3000	1300	1300
Disolved Sulfide	mg/L	0.500 U	0.500 U	0.80 J	0.80 J	0.58 U	0.054 U	0.054 U	0.564 J	0.250 U	0.500 U	1	1.8 J	2.0 J
Sulfide as H2S	mg/L	NR	NR	NR	NR	NR	0.054 U	0.054 U	NR	NR	NR	NR	NR	NR
Un-ionized H2S	mg/L	0.345 J	0.347 J	NR	NR	NR	NR	NR	1.96	0.100 U	0.358 J	NR	NR	NR
Density	g/ml	1	1	1	1	1	1.00	0.996	1.04	1.01	0.999	1	1	0.99
Specific Conductance	umhos/cm	2,530	2,650	2400	2600	2500	7,400	3,870	8,560	13,967	2060	4500	2100	2100
pH	Std. Units	7	7	6.8 J	6.9 J	6.8 J	7.3	8	7.27	7.59	6.58	7.4 J	7.1 J-	7.0 J-
Temerature of pH	Deg. C	7.9	21.63	NR	NR	NR	NR	19.8	NR	27.9	19.78	NR	NR	NR

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TABLE 7

Summary of Influent Sampling
Avtex Fibers Superfund Site
Front Royal, Virginia

		LS-01 (Cont'd)	LS-02									LS-03		
Constituent	Units	7/29/2021	7/28/2015	12/9/2015	8/9/2016	8/1/2017	08/09/2018	7/25/2019	8/3/2020	7/29/2021	7/29/2021 (DUP)	7/28/2015	12/9/2015	8/9/2016
Carbon Disulfide	ug/L	2.9	36	7	16.8	7.49	4.03	5.7	7.3	4.6	4.5	1 U	1 U	0.284 J
Antimony	mg/L	0.0016 J	0.00088 J	0.00072 J	0.0102 J ^ B	0.00424 J	0.000800 U	0.0027	0.004	0.0035	0.0035	0.00033 U	0.00033 U	0.000976 UJ^B
Arsenic	mg/L	0.16	0.0377	0.0673	0.199	0.263 J	0.0218	0.17	0.21	0.17	0.16	0.0020 J	0.0017 J	0.00134 J
Iron	mg/L	11	0.364	0.0909 J	0.275	0.165 J	0.213 U	0.27	0.43	0.18	0.16	11.0	4.89	16.4
Kjeldahyl Nitrogen	mg/L	4.8	1.2	1.2	NR	NR	NR	4.5 J	20 J	2.3 J	2.5	5.6	2.7	NR
Total Nitrite/Nitrate Nitrogen	mg/L	0.085	0.13	0.40 U	NR	NR	NR	0.031 U	0.045 J	0.087	0.084	0.040 U	0.040 U	NR
Total Nitrogen (NO2/NO3/TKN)	mg/L	4.9	1.3	1.2	2.19	4.24	0.644	4.5 J	20	2.4	2.6	5.6	2.7	4.62
Total Phosphorous as P	mg/L	4.4	1.0	2.2	4.12	8.12 J	0.214 J	3.6	7.7	4.7	5.2	1.5	0.54	1.48
Chemical Oxygen Demand (COD)	mg/L	380	73.7	135	238	399	30.4	210	320	300 J	360	39.2	40.0 J	45.9
Soluble COD	mg/L	340	87.5	149	235	371 J	24.9	210	350	270	280	48.4 J	49.1 J	40.8
Biological Oxygen Demand (BOD)	mg/L	60	5.6 U	6.1	5.18	20.0 U	2.00 U	36 U	10	60	60	10.4	8.5	11.8
Soluble BOD	mg/L	60	4.7 U	6.0 U	4.06	20.0 U	2.00 U	36 U	10	60	60	3.8 U	6.0 U	3.03
Total Alkalinity	mg/L as CaCO3	5400	1,280	2,340	5.00 U	5.00 U	682	4600	8800	5600	5700	554	664	623
Carbonate Alkalinity	mg/L as CaCO3	NR	NR	NR	434	5.00 U	5.00 U	NR	NR	NR	NR	NR	NR	5.00 U
Bicarbonate Alkalinity	mg/L as CaCO3	NR	NR	NR	5.00 U	1630	682	NR	NR	NR	NR	NR	NR	623
Hydrxide Alkalinity	mg/L as CaCO3	NR	NR	NR	5.00 U	5.00 U	5.00 U	NR	NR	NR	NR	NR	NR	5.00 U
Total Disolved Solids (TDS)	mg/L	8700	2,010	3,480	7,710	11,700	1090	7400	8900	8700	9100	1,920	1,350	1,220
Disolved Sulfide	mg/L	0.58 U	0.054 U	0.054 U	3.06	0.250 U	0.500 U	6.8	4.2 J	5.6	5.8	0.10 J	0.054 U	5.00 U
Sulfide as H2S	mg/L	NR	0.054 U	0.054 U	NR	NR	NR	NR	NR	NR	NR	0.080 J	0.054 U	NR
Un-ionized H2S	mg/L	NR	NR	NR	0.512 J	0.100 U	0.100 U	NR	NR	NR	NR	NR	NR	0.100 U
Density	g/ml	0.99	0.998	0.996	1.01	1.01	0.999	1	1	1	1	0.998	0.996	1.03
Specific Conductance	umhos/cm	12000	3,950	6,670	10,100	14,808	1690	10000	14000	13000	12000	2,980	2,220	1,870
pH	Std. Units	7.7 J	8.6	9.1	8.9	9.07	8.23	9.0 J	9.0 J-	9 J	9.1 J	6.5	7.2	6.52
Temerature of pH	Deg. C	NR	NR	19.7	NR	28.23	25.01	NR	NR	NR	NR	NR	19.8	NR

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TABLE 7

Summary of Influent Sampling
Avtex Fibers Superfund Site
Front Royal, Virginia

		LS-03 (Cont'd)							LS-04				
Constituent	Units	8/1/2017	8/1/2017 (DUP)	08/09/2018	7/24/2019	7/24/19 (DUP)	8/3/2020	7/29/2021	7/28/2015	12/9/2015	8/9/2016	8/9/2016 (DUP)	8/1/2017
Carbon Disulfide	ug/L	0.255 J	0.238 J	0.220 U	0.28 J	0.31 J	7.5 J	1.3	25	14	27.4	25.6	5.43
Antimony	mg/L	0.000800 U	0.000800 U	0.000800 U	0.00069 J	0.00057 U	0.00057 U	0.00073 J	0.00033 U	0.00033 U	0.00120 UJ^B	0.00103 UJ^B	0.000800 U
Arsenic	mg/L	0.00441	0.00472	0.00119 J	0.0019 J	0.0014 J	0.0023 J	0.0021 J	0.0106	0.0071	0.00775	0.00779	0.00192 J
Iron	mg/L	6.82	5.73	6.58	9.3	8.8	15	17	1.08	0.896	0.392 J F1	1.67 J	3.3
Kjeldahyl Nitrogen	mg/L	NR	NR	NR	7.3	7.3	6.2	4.9	4.6	1.4	NR	NR	NR
Total Nitrite/Nitrate Nitrogen	mg/L	NR	NR	NR	0.031 U	0.031 U	0.031 U	0.089	0.040 U	0.040 U	NR	NR	NR
Total Nitrogen (NO2/NO3/TKN)	mg/L	3.48	4.16	2.86	7.3	7.3	6.2	5	4.6	1.4	4.74	5.16	3.93
Total Phosphorous as P	mg/L	0.817 J	0.668 J	0.312 J	1.5	1.5	1.1	0.69	0.62	0.67	0.991 F1	1.02	2.04
Chemical Oxygen Demand (COD)	mg/L	39.8	28.3	26.5	54	55	32	42	193	64.9	199	195	28.3
Soluble COD	mg/L	39.1 J	4.00 UJ	25	53	57	35	37	205	71.7	37.2	196	28.3
Biological Oxygen Demand (BOD)	mg/L	6.89	5.4	4.19	6.9	1.2 U	1.2 U	24	14.3	6.0	39.2 J	122 J	2.00 U
Soluble BOD	mg/L	6.00 U	4.07	2.00 U	1.2 U	1.2 U	1.2 U	24	9.9 U	5.9 U	37.2	42.5	2.00 U
Total Alkalinity	mg/L as CaCO3	747	713	300	650	650	720	610	1,460	732	1,200	1,210	428
Carbonate Alkalinity	mg/L as CaCO3	747	713	5.00 U	NR	NR	NR	NR	NR	NR	5.00 U	5.00 U	428
Bicarbonate Alkalinity	mg/L as CaCO3	5.00 U	5.00 U	300	NR	NR	NR	NR	NR	NR	1,200	1,210	5.00 U
Hydrxide Alkalinity	mg/L as CaCO3	5.00 U	5.00 U	5.00 U	NR	NR	NR	NR	NR	NR	5.00 U	5.00 U	5.00 U
Total Disolved Solids (TDS)	mg/L	1,480	1,480	909	2000	2000	1300	1800	3,830	1,680	2,830	2,730	1,080
Disolved Sulfide	mg/L	0.250 U	0.250 U	0.500 U	0.58 U	0.60 J	0.58 U	0.58 U	7	3.3	17.8	24.4	0.250 U
Sulfide as H2S	mg/L	NR	NR	NR	NR	NR	NR	NR	3.1	0.83	NR	NR	NR
Un-ionized H2S	mg/L	0.213 J	0.213 J	0.347 J	NR	NR	NR	NR	NR	NR	2.98	3.11	0.100 U
Density	g/ml	1	1	0.998	1	1	1	1	1.00	0.996	1.03	1.00	1.00
Specific Conductance	umhos/cm	2,024	2,024	1210	2300	2300	1900	2200	6,560	2,900	3,750	3,810	0
pH	Std. Units	6.19	6.19	6.61	6.5 J	6.5 J	6.5 J-	6.4 J	7.1	7.5	7.34	7.34	7.3
Temerature of pH	Deg. C	22.35	22.35	25.12	NR	NR	NR	NR	NR	19.6	NR	NR	19.73

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TABLE 7

Summary of Influent Sampling
Avtex Fibers Superfund Site
Front Royal, Virginia

Constituent	Units	LS-04 (Cont'd)				
		08/09/2018	08/09/2018 (Dup)	7/24/2019	8/3/2020	7/29/2021
Carbon Disulfide	ug/L	7.43	9.25	9.1	8.3	1.1
Antimony	mg/L	0.000800 U	NR	0.00057 U	0.00057 U	0.00057 U
Arsenic	mg/L	0.0176	NR	0.0044 J	0.0040 J	0.0012 J
Iron	mg/L	3.94	NR	9.3	4.1	0.48
Kjeldahyl Nitrogen	mg/L	NR	NR	3.4 J	5	1.5
Total Nitrite/Nitrate Nitrogen	mg/L	NR	NR	0.031 U	0.031 U	0.04 U
Total Nitrogen (NO2/NO3/TKN)	mg/L	6.15	5.83	3.4 J	5	1.5
Total Phosphorous as P	mg/L	3.89 J	3.44 J	0.93	0.93	0.57
Chemical Oxygen Demand (COD)	mg/L	217	231	89	83	27
Soluble COD	mg/L	202	219	74	91	23
Biological Oxygen Demand (BOD)	mg/L	10.0 U	10.0 U	1.2 U	1.2 U	3.6
Soluble BOD	mg/L	10.0 U	10.0 U	1.2 U	1.2 U	6
Total Alkalinity	mg/L as CaCO3	1420	1460	940	990	580
Carbonate Alkalinity	mg/L as CaCO3	5.00 U	5.00 U	NR	NR	NR
Bicarbonate Alkalinity	mg/L as CaCO3	1420	1460	NR	NR	NR
Hydrxide Alkalinity	mg/L as CaCO3	5.00 U	5.00 U	NR	NR	NR
Total Disolved Solids (TDS)	mg/L	3440	3470	2100	2100	1300
Disolved Sulfide	mg/L	0.500 U	0.500 U	1.6	3.2 J	0.58 U
Sulfide as H2S	mg/L	NR	NR	NR	NR	NR
Un-ionized H2S	mg/L	0.193 J	0.193 J	NR	NR	NR
Density	g/ml	1	1	1	1	1
Specific Conductance	umhos/cm	4300	4410	3100	3200	2000
pH	Std. Units	7.1	7.1	7.1 J	7.1 J-	7.3 J
Temerature of pH	Deg. C	24.22	24.22	NR	NR	NR

NR = Not Reported
NS = Not Sampled
DUP = Duplicate Sample
U = Not Detected
J = Estimated Value
J- = Estimated Value (Biased Low)
^ = Instrument related QC is outside acceptable limits
B = Constituent Detected in Blank Sample
F1 = MS and/or MSD recovery outside acceptable limits
H = Holding time exceeded

APPENDIX H – DETAILED ARARs REVIEW

This FYR evaluates the chemical-specific applicable or relevant and appropriate requirements (ARARs) identified in site decision documents to determine if changes in chemical-specific standards affect the protectiveness of the Site's remedy.

OU2
The OU2 ROD, issued in 1990, identified EPA's Guidance on Remedial Action for Superfund Sites with PCB Contamination [EPA/540/G-90/007] and the Toxic Substances and Control Act (TSCA) PCB Cleanup Policy, 40 CFR 61, Subpart G as to-be-considered criteria for the PCB cleanup. The OU2 ROD selected a soil cleanup level of 10 ppm (or 10 mg/kg) based on recommendations in the guidance.

In 1999, EPA promulgated the TSCA rule at 40 CFR §761.61 which identifies cleanup levels for PCB remediation waste based on the kind of material and the potential exposure to PCBs left after cleanup is completed. Although the TSCA standards are not binding under CERCLA cleanups [see 40 CFR §761.61(a)(1)(ii)], EPA considers them relevant and appropriate. Under the TSCA rule soil is considered a bulk PCB remediation waste and a cleanup level of less than or equal to 25 ppm would be appropriate for a low occupancy area (i.e., industrial/commercial use). This cleanup level is less stringent than the cleanup level selected at the time EPA issued the OU2 ROD. The change does not affect the protectiveness of the remedy.

OU7
The OU7 ROD identified the National Primary Drinking Water Standards' MCLs for carcinogens and non-zero (MCLGs) for non-carcinogens as ARARs for the groundwater remedial action. This FYR compares the groundwater ARARs identified in Table 7 of the OU7 ROD to current federal standards to determine if any changes have occurred (Table H-1). There are no changes to MCLs or MCLGs since EPA issued the OU7 ROD.

Table H-1: OU7 Groundwater ARAR Comparison

COC[a]	2010 OU7 ROD MCL/MCLG (µg/L)[b]	2022 MCL/MCLG (µg/L)[c]	Change
VOCs			
acetone	--[c]	--	No change
carbon disulfide	--	--	No change
SVOCs			
2-methylphenol (o-cresol)	--	--	No change
4-methylphenol (p-cresol)	--	--	No change
bis(2-ethylhexyl)phthalate	6	6	No change
naphthalene	--	--	No change
pentachlorophenol	1	1	No change
phenol	--	--	No change
Metals			
aluminum	--	--	No change
antimony	6	6	No change
arsenic	10	10	No change
cadmium	5	5	No change
chromium	100	100	No change
cobalt	--	--	No change
cyanide, free	200	200	No change
iron	--	--	No change
lead	15	15	No change

COC[a]	2010 OU7 ROD MCL/MCLG (µg/L)[b]	2022 MCL/MCLG (µg/L)[c]	Change
manganese	--	--	No change
mercury	2	2	No change
nickel	--	--	No change
vanadium	--	--	No change
zinc	--	--	No change

Notes:
a. Groundwater COCs listed in Table 7 of the OU7 ROD.
b. MCLs in effect at the time of OU7 ROD signature, as listed in Table 7 of the OU7 ROD; cleanup goals for those COCs without MCLs/MCLGs were risk-based and are evaluated separately in this FYR.
c. National Primary Drinking Water Regulations available at: https://www.epa.gov/ground-water-and-drinking-water/table-regulated-drinking-water-contaminants
d. -- = MCL/MCLG not established

The OU7 ROD also identified TSCA 40 CFR 761.61(c), as an ARAR applicable to the cleanup of PCBs at the Site. EPA determined that the risk-based cleanup approach found in 40 CFR 761.61(c) is relevant and appropriate to the Site. The OU7 ROD selected a risk-based PCB cleanup goal of 25 mg/kg for soil. This FYR evaluates the protectiveness of the PCB cleanup goal in Appendix I.

Appendix A of the OU7 ROD also identifies several ARARs applicable to surface water, air and soil as it relates to protection of groundwater; however, chemical-specific values in effect at the time of ROD issuance were not included in the decision document. Therefore, a detailed evaluation of the criteria is unwarranted.

OU10
The OU10 ROD and OU10 ESD identified several ARARs for surface water, groundwater, air and soil, yet the decision documents presented specific cleanup values only for soil COCs.

The OU10 ROD set a PCB soil cleanup goal of 25 mg/kg total PCBs, based on commercial/industrial land use. This cleanup goal is risk-based and is consistent with the substantive requirements of 40 CFR 761.61(c). This FYR evaluates the protectiveness of the 25 mg/kg PCB cleanup goal in the risk section.

The OU10 ESD set a more stringent PCB soil cleanup goal of 1 mg/kg for the Expanded Plat Area Soils, based on recreational land use. This FYR evaluates the protectiveness of the risk-based 1 mg/kg PCB cleanup goal in the risk section. The cleanup goal is also consistent with EPA's Guidance Remedial Actions for Superfund Sites with PCB Contamination and with the substantive requirements of 40 CFR 761.61 for high occupancy areas.

The OU10 ROD also established soil cleanup standards for direct contact (soils 0 to 10 feet) and groundwater protection (entire depth of soil to the water table). The soil cleanup standards for groundwater protection are based on the non-zero MCLGs. In the absence of a non-zero MCLG, the MCL is used as the groundwater protection standard, when available. To determine compliance, soil samples would be collected and analyzed by the Synthetic Precipitation Leaching Procedure (SPLP) to determine the concentration of a contaminant that could be leached from the soil into pore water. The SPLP concentration would be divided by a dilution attenuation factor of 10. Remediation would be required when the SPLP concentration divided by 10 exceeds the ground water protection soil standard.

This FYR compares the ARARs used as soil cleanup standards for groundwater protection identified in Table 1 of the OU10 ROD to current federal standards (Table H-2). The current MCLG for chloroform is more stringent than the value listed in the OU10 ROD. This change does not call into question the protectiveness of the remedy because chloroform has not been detected in site groundwater during recent sampling events. All other MCLGs and MCLs have not changed.

Table H-2: OU10 Groundwater ARARs Used to Establish Soil Cleanup Standards for Groundwater Protection

COC[a]	2004 OU10 ROD MCL/MCLG (mg/L)[a]	2022 MCL/MCLG (mg/L)[b]	Change
VOCs			
1,1,2,2-tetrachloroethane	--	--	No change
1,1,1-trichloroethane	0.2	0.2	No change
1,1,2-trichloroethane	0.003	0.003	No change
1,1-dichloroethane	--	--	No change
1,1-dichloroethene	0.007	0.007	No change
1,2-dibromo-3-chloropropane	0.0002	0.0002	No change
1,2-dibromoethane	--	--	No change
1,2-dichloroethane	0.005	0.005	No change
1,2-dichlorobenzene	0.6	0.6	No change
1,2,4-trichlorobenzene	0.07	0.07	No change
1,3-dichlorobenzene	--	--	No change
1,4-dichlorobenzene	0.075	0.075	No change
1,2-dichloropropane	0.005	0.005	No change
2-butanone	--	--	No change
2-hexanone	--	--	No change
4-methyl-2-pentanone (MIBK)	--	--	No change
acetone	--	--	No change
benzene	0.005	0.005	No change
bromochloromethane	--	--	No change
bromodichloromethane	0.08	0.08	No change
bromoform	0.08	0.08	No change
carbon disulfide	--	--	No change
carbon tetrachloride	0.005	0.005	No change
chlorobenzene	0.1	0.1	No change
chloroethane	--	--	No change
chloroform	0.08	0.07 (MCLG)	2017 MCLG more stringent
chloromethane	--	--	No change
cis-1,2-dichloroethene	0.07	0.07	No change
cis-1,3-dichloropropene	--	--	No change
dibromochloromethane	0.06	0.06	No change
ethylbenzene	0.7	0.7	No change
methylene chloride	0.005	0.005	No change
styrene	0.1	0.1	No change
tetrachloroethene	0.005	0.005	No change
toluene	1	1	No change
trans-1,2-dichloroethene	0.1	0.1	No change
trans-1,3-dichloropropene	--	--	No change
trichloroethene	0.005	0.005	No change
vinyl chloride	0.002	0.002	No change
xylenes (total)	10	10	No change
SVOCS			
1,2-diphenylhydrazine	--	--	No change
2,2'oxybis(1-chloropropane)	--	--	No change
2,4,5-trichlorophenol	--	--	No change
2,4,6-trichlorophenol	--	--	No change
2,4-dichlorophenol	--	--	No change
2,4-dimethylphenol	--	--	No change
2,4-dinitrophenol	--	--	No change

COC[a]	2004 OU10 ROD MCL/MCLG (mg/L)[a]	2022 MCL/MCLG (mg/L)[b]	Change
2,4-dinitrotoluene	--	--	No change
2,6-dinitrotoluene	--	--	No change
2-chloronaphthalene	--	--	No change
2-chlorophenol	--	--	No change
2-methylnaphthalene	--	--	No change
2-nitroaniline	--	--	No change
2-nitrophenol	--	--	No change
3,3'-dichlorobenzidine	--	--	No change
3-nitroaniline	--	--	No change
4,6-dinitro-2-methylphenol	--	--	No change
4-bromophenyl phenyl ether	--	--	No change
4-chloroaniline	--	--	No change
4-chlorophenyl phenyl ether	--	--	No change
4-nitroaniline	--	--	No change
4-nitrophenol	--	--	No change
acenaphthene	--	--	No change
acenaphthylene	--	--	No change
anthracene	--	--	No change
benzidine	--	--	No change
benzo(a)anthracene	--	--	No change
benzo(a)pyrene	0.0002	0.0002	No change
benzo(b)fluoranthene	--	--	No change
benzo(g,h,i)perylene	--	--	No change
benzo(k)fluoranthene	--	--	No change
bis(2-chloroethoxy)methane	--	--	No change
bis(2-chloroisopropyl) ether	--	--	No change
bis(2-ethylhexyl)phthalate	0.006	0.006	No change
butyl benzyl phthalate	--	--	No change
carbazole	--	--	No change
p-chloro-m-cresol	--	--	No change
chrysene	--	--	No change
di-n-butylphthalate	--	--	No change
di-n-octyl phthalate	--	--	No change
dibenz(a,h)anthracene	--	--	No change
dibenzofuran	--	--	No change
diethyl phthalate	--	--	No change
dimethyl phthalate	--	--	No change
fluoranthene	--	--	No change
fluorene	--	--	No change
hexachlorobenzene	0.001	0.001	No change
hexachlorobutadiene	--	--	No change
hexachlorocyclopentadiene	0.05	0.05	No change
hexachloroethane	--	--	No change
indeno(1,2,3-cd)pyrene	--	--	No change
isophorone	--	--	No change
n-nitrosodiphenylamine	--	--	No change
n-nitrosodipropylamine	--	--	No change
naphthalene	--	--	No change
nitrobenzene	--	--	No change
p-chloro-m-cresol	--	--	No change
p-(dimethylamino)azobenzene	--	--	No change
pentachlorobenzene	--	--	No change
pentachlorophenol	0.001	0.001	No change
phenanthrene	--	--	No change

COC[a]	2004 OU10 ROD MCL/MCLG (mg/L)[a]	2022 MCL/MCLG (mg/L)[b]	Change
o-cresol/2-methylphenol	--	--	No change
p-cresol/4-methylphenol	--	--	No change
phenol	--	--	No change
pyrene	--	--	No change
Metals			
aluminum	--	--	No change
antimony	0.006	0.006	No change
arsenic	0.01	0.01	No change
barium	2	2	No change
beryllium	0.004	0.004	No change
cadmium	0.005	0.005	No change
calcium	--	--	No change
chromium	0.1	0.1	No change
cobalt	--	--	No change
copper	1.3	1.3	No change
iron	--	--	No change
lead	0.015	0.015	No change
magnesium	--	--	No change
manganese	--	--	No change
mercury	0.002	0.002	No change
nickel	--	--	No change
potassium	--	--	No change
selenium	0.05	0.05	No change
silver	--	--	No change
sodium	--	--	No change
thallium	0.0005	0.0005	No change
vanadium	--	--	No change
zinc	--	--	No change
cyanide, Free	0.2	0.2	No change
PCBs			
Arochlor 1016	0.0005	0.0005	No change
Arochlor 1221	0.0005	0.0005	No change
Arochlor 1232	0.0005	0.0005	No change
Arochlor 1242	0.0005	0.0005	No change
Arochlor 1248	0.0005	0.0005	No change
Arochlor 1254	0.0005	0.0005	No change
Arochlor 1260	0.0005	0.0005	No change

Notes:

a. Soil COCs listed in Table 1 of the OU10 ROD.

b. MCLs/MCLGs in effect at the time of OU10 ROD signature, as listed in Table 1 of the OU10 ROD; groundwater protection cleanup goals for those COCs without MCLs/MCLGs were risk-based and are evaluated separately in this FYR.

c. National Primary Drinking Water Regulations available at: https://www.epa.gov/ground-water-and-drinking-water/table-regulated-drinking-water-contaminants

-- = MCL/MCLG not established
mg/L = milligrams per liter

APPENDIX I – DETAILED TOXICITY REVIEW

Toxicity Review

OU2

The OU2 ROD selected a total PCBs soil cleanup goal of 10 mg/kg based on an anticipated industrial land use. Table I-1 evaluates the current validity of the cleanup goal using 2022 EPA RSLs; the RSLs incorporate current toxicity values and standard default exposure factors.

The evaluation demonstrates that the OU2 total PCBs cleanup goal of 10 mg/kg remains valid for commercial/industrial use as the concentration is within EPA's risk management range of 1 x 10^{-6} to 1 x 10^{-4}.

Table I-1: Review of OU2 Soil Remedial Goal – Total PCBs

COC	Soil Remedial Goal (mg/kg)	Composite Worker RSL[a]		Risk[b]	HQ[c]
		10^{-6} Risk	Hazard Quotient (HQ) = 1.0		
PCBs, total	10	9.4E-01[d]	NA	1.06E-05	NA

Notes:

a) EPA's soil RSLs, dated November 2022, available at Regional Screening Levels (RSLs) - Generic Tables | US EPA

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

c) Noncancer HQ calculated using the following equation: HQ = (cleanup goal ÷ noncancer RSL).

d) RSL for PCBs (high risk) used.

NA = EPA has not finalized a noncarcinogenic toxicity value for this group of compounds

OU7

The OU7 ROD selected MCLs and non-zero MCLGs as remedial goals for groundwater. In the absence of MCLs and non-zero MCLGs, risk-based concentrations were selected as the remedial goals. To determine if the risk-based remedial goals for groundwater remain protective, the remedial goals were compared to EPA's 2022 tapwater RSLs (Table I-2).

Based on the evaluation, remedial goals for carcinogenic COCs fall within EPA's acceptable risk management range of 1 x 10^{-6} to 1 x 10^{-4}. Remedial goals for 12 COCs result in HQs that exceed EPA's benchmark of 1 for noncarcinogens. Although the remedial goals exceed the noncarcinogenic benchmark, the OU7 ROD states that remediation of groundwater at the Site will continue until the respective MCLs for the COCs are attained and the excessive cancer risk associated with potential residential use of the groundwater is reduced to one in 10,000 (1 x 10^{-4}) and the hazard index is reduced to 1 for each specific organ. As cleanup progresses, EPA may wish to revisit the remediation goals to better align with the final groundwater cleanup goal. In the interim, there are no complete exposure pathways between contaminated groundwater and receptors.

Table I-2: Review of OU7 Groundwater Remedial Goals

COC	Risk-based Remedial Goal[a] (µg/L)	Tapwater RSL[b]		Risk[c]	HQ[d]
		10^{-6} Risk	HQ = 1.0		
acetone	22,000	--[f]	1.40E+04	--	**1.57E+00**
carbon disulfide	1,000	--	8.10E+02	--	**1.23E+00**
2-methylphenol	1,800	--	9.3E+02	--	**1.94E+00**
4-methylphenol	180	--	1.9E+03	--	9.47E-02
bis(2-ethylhexyl)phthalate	NA[e]	NA	NA	NA	NA

naphthalene	14	1.7E-01	6.1E+00	8.23E-05	**2.30E+00**
pentachlorophenol	NA	NA	NA	NA	NA
phenol	11,000	--	5.8E+03	--	**1.90E+00**
aluminum	37,000	--	2.0E+04	--	**1.85E+00**
antimony	NA	--	--	--	--
arsenic	NA	--	--	--	--
cadmium	NA	--	--	--	--
chromium	NA	--	--	--	--
cobalt	11	--	6.0E+00	--	**1.83E+00**
cyanide, free	NA	NA	NA	NA	NA
iron	26,000	--	1.4E+04	--	**1.86E+00**
lead	NA	NA	NA	NA	NA
manganese	880	--	4.30E+02	--	**2.05E+00**
mercury	NA	NA	NA	NA	NA
nickel	730	--	3.90E+02	--	**1.87E+00**
vanadium	260	--	8.6E+01	--	**3.02E+00**
zinc	11,000	--	6.0E+03	--	**1.83E+00**

Notes:
a) Risk-based remedial goal listed in Table 7 of the OU7 ROD; presented at cancer/hazard target benchmarks of 1 x 10^{-4} for carcinogens and 1 for noncarcinogens.
b) EPA's tapwater RSLs, dated November 2022, available at Regional Screening Levels (RSLs) - Generic Tables | US EPA
c) Cancer risk calculated using the following equation, based on the fact that RSLs are derived based on 1 x 10^{-6} risk: cancer risk = (remedial goal ÷ cancer-based RSL) × 10^{-6}.
d) Noncancer HQ calculated using the following equation: HQ = (remedial goal ÷ noncancer RSL).
NA = not applicable; remedial goal for this COC is the MCL or non-zero MCLG and is not a risk-based concentration
-- = EPA has not finalized a carcinogenic or noncarcinogenic toxicity value for this compound
Bold = HQ exceeds 1

The OU7 ROD also identified soil remedial goals for soil located outside the VB 9, 10 and 11 cover systems. All non-hazardous soil and sediment that did not exceed the groundwater protection standards but that exceeded the RSLs for industrial soil at a total excess cancer risk and/or EPA's Region 3 Ecologically Protective Backfill Values, as listed in Table 11 in the OU7 ROD and modified by the 2012 ESD, were to be excavated and placed into the basins under the cap. The OU7 ROD did not identify specific RSLs in effect at that time. However, Table 2 of the 2015 Remedial Action Report for the Viscose Basins 9-11 Cap System and Groundwater & Leachate Extraction Components of Operable Unit 7 listed the Revised Soil Cleanup Standards - Direct Contact and Ground Water Protection. This FYR compares the lower of the human health direct contact standards included in Table 2 of the OU7 Remedial Action Report to EPA's 2017 composite worker soil RSLs to determine if the standards remain protective for human health (Table I-3).

Based on the evaluation, soil standards based on direct contact for carcinogenic COCs fall within or below EPA's acceptable risk management range of 1 x 10^{-6} to 1 x 10^{-4}. The soil standard for mercury results in an HQ that slightly exceeds EPA's benchmark of 1 for noncarcinogens. However, it should be noted that EPA's default composite worker RSLs are based on a conservative ingestion rate of 100 mg/kg/day; the OU7 human health direct contact standards were calculated using a site-specific ingestion rate of 50 mg/kg/day. This finding does not affect the protectiveness of the remedy because all soils with concentrations above the standards listed in Table 2 of the 2015 Remedial Action Report were excavated and the areas were either covered with the VB 9-11 cap system, including the geomembrane barrier, or were covered with 2 feet of soil to mitigate the ecological pathway. There are no complete exposure pathways for human or ecological receptors.

Table I-3: Review of OU7 Soil Remedial Goals – Human Health Direct Contact

COC	HH Direct Contact Standard[a] ($1x10^{-6}$ Risk and/or HQ=1) (mg/kg)	Composite Worker RSL[b]		Risk[c]	HQ[d]
		10^{-6} Risk	HQ=1		
carbon disulfide	378	--	3,500	--	0.1
ethylbenzene	NV	NA	NA	NA	NA
styrene	NV	NA	NA	NA	NA
toluene	NV	NA	NA	NA	NA
xylenes (total)	NV	NA	NA	NA	NA
acenaphthene	NV	NA	NA	NA	NA
anthracene	NV	NA	NA	NA	NA
benzo(a)anthracene	7.8	21	--	3.7E-07	--
benzo(a)pyrene	0.78	2.1	--	3.7E-07	--
benzo(b)fluoranthene	7.8	21	--	3.7E-07	--
benzo(k)fluoranhene	78.4	210	--	3.7E-07	--
dibenz(a,h)anthracene	0.78	2.1	--	3.7E-07	--
fluoranthene	NV	NA	NA	NA	NA
fluorene	NV	NA	NA	NA	NA
indeno(1,2,3-cd)pyrene	7.8	21	--	3.7E-07	--
naphthalene	18	17	--	1.1E-06	--
phenanthrene	NV	NA	NA	NA	NA
pyrene	NV	NA	NA	NA	NA
PAHs, high molecular weight	NV	NA	NA	NA	NA
PAHs, low molecular weight	NV	NA	NA	NA	NA
PAHs, total	NV	NA	NA	NA	NA
aluminum	NV	NA	NA	NA	NA
antimony	81.8	--	470	--	1.74E-01
arsenic	3.8	3	480	1.3E-06	7.92E-03
barium	NV	NA	NA	NA	NA
cadmium	NV	NA	NA	NA	NA
chromium	NV	NA	NA	NA	NA
cobalt	60	1900	350	3.2E-08	1.71E-01
copper	8,180	--	47,000	--	1.74E-01
iron	143,000	--	820,000	--	1.74E-01
lead[e]	800	--	--	NA	NA
manganese	NV	NA	NA	NA	NA
mercury	61	--	46	--	**1.33E+00**
nickel	NV	NA	NA	NA	NA
selenium	1,020	--	5,800	--	1.76E-01
silver	NV	NA	NA	NA	NA
vanadium	1,030	--	5,800	--	1.78E-01
zinc	61,300	--	350,000	--	1.75E-01

Notes:

a) Direct contact cleanup standard listed in Table 2 of the OU7 Remedial Action Report; the lower of the direct contact standards is presented.

b) EPA's composite worker RSLs, dated November 2022, available at Regional Screening Levels (RSLs) - Generic Tables | US EPA

c) Cancer risk calculated using the following equation, based on the fact that RSLs are derived based on 1 x 10^{-6} risk: cancer risk = (remedial goal ÷ cancer-based RSL) × 10^{-6}.
d) Noncancer HQ calculated using the following equation: HQ = (remedial goal ÷ noncancer RSL).
e) The OU7 cleanup standard for lead is consistent with the current industrial RSL for lead of 800 mg/kg.

NV = no value available; cleanup standard for this COC is the ecologically protective soil value
NA = not applicable
-- = EPA has not finalized a carcinogenic or noncarcinogenic toxicity value for this compound
Bold = HQ exceeds 1

OU10

The OU10 ROD set soil cleanup goals for PCBs and additional COCs, based on commercial/industrial land use and protection of groundwater. The OU10 ROD states that soil cleanup standards for OU10 shall not exceed a cumulative excess cancer risk of 1 x 10^{-4} and the cumulative effect for non-carcinogens on any target organ shall not exceed a HQ of 1. A risk analysis of all the Plant Area Soils remaining on-site after the completion of the remedial action (based on over 500 post-excavation samples) was conducted in 2012 and demonstrated that the soils from zero to 10 feet bgs are protective of human health for an industrial/ commercial scenario and both the surface and the deeper soils are protective of groundwater. A 2014 SLERA on post remediation soils identified multiple chemicals of potential ecological concern. However, the assessment concluded that the magnitude and duration of ecological exposures are not expected to produce significant ecological risk due to the presence of relatively low-quality habitat that offers only limited foraging, cover or nesting opportunities. As future land use at the Plant Area Soils part of the Site is expected to be developed for commercial/industrial uses, the SLERA also concluded that such development will eliminate ecological habitat.

EPA concluded that while future use of the area is intended to be industrial/commercial, the potential for unacceptable ecological risk currently exists and will continue to exist into the future until exposure pathways are eliminated. The ecological risk assessment of the Plant Area Soils part of the Site had previously been delayed due to the promise of redevelopment. However, the area remains vacant and it is unclear when development will occur. EPA also noted that, even with development, it is unknown if such development would effectively mitigate the potential for unacceptable risks to ecological receptors. In order to prevent re-establishment of potential habitat in the future, FMC proposed to remove the old field / wooded habitat and replace with a vegetative cover that can be easily maintained (i.e., turf grass). Due to topography, drainage requirements, and other concerns, some areas may not be easily accessible for mowing and may require an alternative cover (e.g., mulch or gravel). The PRPs are currently carrying out this work under the approved 'Former Manufacturing Area Habitat Removal Work Plan.' The anticipated completion date is Spring 2023.

The OU10 ESD also set soil cleanup goals based on residential land use for the Expanded Plant Area Soils (Figure I-1). Table I-4 evaluates the current validity of the cleanup goals using EPA RSLs for residential soil. The lowest of the human health direct contact standards included in Table 1A of the OU10 ESD was used for the evaluation. The evaluation demonstrates that the direct contact cleanup goals remain valid for most COCs. Carcinogenic risks associated with the soil remedial goals for 1,1-dichloroethane, chloroform, ethylbenzene and chromium exceed the upper end of EPA's risk management range of 1 x 10^{-6} to 1 x 10^{-4}. The HQs associated with the soil remedial goals for 1,1-dichloroethene, 1,2,4-trichlorobenzene, 2-hexanone, carbon disulfide, total xylenes, hexachlorocyclopentadiene, naphthalene, chromium, cobalt, manganese and free cyanide exceed EPA's benchmark of 1 for noncarcinogens. In April 2006 FMC excavated contaminated Expanded Plant Area Soils from the Burnt Debris Area that contained COCs at concentrations above the established residential soil cleanup goals and disposed of it either off site or on-site, depending on the level of soil contamination. This FYR included review of the post-excavation soil characterization samples for Burnt Debris Area and comparison to current residential RSLs (Table I-5). Based on pre-excavation sampling results that showed most constituents were not detected or below screening criteria, post-excavation soil characterization samples were analyzed for lead, manganese and mercury only. Review of the post-excavation data determined that the soils remaining in the area do not pose an unacceptable risk to human health based on a residential exposure scenario.

Table I-4: Review of OU10 Residential Soil Cleanup Goals for the Expanded Plant Area Soils

COC	Soil Remedial Goal, Direct Contact[a] (mg/kg)	Residential RSL[b] (mg/kg)		Risk[c]	HQ[d]
		10^{-6} Risk	HQ = 1.0		
1,1,2,2-tetrachloroethane	3.2	0.6	1,600	5.3E-06	2.0E-03
1,1,1-trichloroethane	2,200	--	8,100	--	2.7E-01
1,1,2-trichloroethane	1.1	1.1	1.5	1.0E-06	7.3E-01
1,1-dichloroethane	1,600	3.6	16,000	**4.4E-04**	1.0E-01
1,1-dichloroethene	390	--	230	--	**1.7E+00**
1,2-dibromo-3-chloropropane	0.46	0.0053	4.7	8.7E-05	9.8E-02
1,2-dibromoethane	0.32	0.036	73	8.9E-06	4.4E-03
1,2-dichloroethane	7	0.46	31	1.5E-05	2.3E-01
1,2-dichlorobenzene	700	--	1,800	--	3.9E-01
1,2,4-trichlorobenzene	78	24	58	3.3E-06	**1.3E+00**
1,3-dichlorobenzene	23	--	--	--	--
1,4-dichlorobenzene	27	2.6	3,400	1.0E-05	7.9E-03
1,2-dichloropropane	9.4	0.28	16	3.4E-05	5.9E-01
2-butanone	4,700	--	27,000	--	1.7E-01
2-hexanone	313	--	200	--	**1.6E+00**
4-methyl-2-pentanone (MIBK)	NV	NA	33,000	NA	NA
acetone	7,000	--	61,000	--	1.1E-01
benzene	12	1.2	82	1.0E-05	1.5E-01
bromochloromethane	NV	NA	NA	NA	NA
bromodichloromethane	10	0.29	1,600	3.4E-05	6.3E-03
bromoform	81	19	1,600	4.3E-06	5.1E-02
carbon disulfide	780	--	770	--	**1.0E+00**
carbon tetrachloride	4.9	0.65	100	7.5E-06	4.9E-02
chlorobenzene	160	--	280	--	5.7E-01
chloroethane	220	--	14,000	--	1.6E-02
chloroform	78	0.32	200	**2.4E-04**	3.9E-01
chloromethane	NV	NA	NA	NA	NA
cis-1,2-dichloroethene	78.2	--	160	NA	4.9E-01
cis-1,3-dichloropropene	6.4	1.8	72	3.6E-06	8.9E-02
dibromochloromethane	7.6	8.3	1,600	9.2E-07	4.8E-03
ethylbenzene	780	5.8	3,400	**1.3E-04**	2.3E-01
methylene chloride	85	57	350	1.5E-06	2.4E-01
styrene	1,600	--	6,000	--	2.7E-01
tetrachloroethene	1.2	24	81	5.0E-08	1.5E-02
toluene	630	--	4,900	--	1.3E-01
trans-1,2-dichloroethene	160	--	1,600	--	1.0E-01
trans-1,3-dichloropropene	6.4	1.8	72	3.6E-06	8.9E-02
trichloroethene	1.6	0.94	4.1	1.7E-06	3.9E-01
vinyl chloride	0.09	0.059	70	1.5E-06	1.3E-03
xylenes (total)	1,600	--	580	--	**2.8E+00**
1,2-diphenylhydrazine	0.8	0.68	NA	1.2E-06	NA
2,2'oxybis(1-chloropropane)	NV	NA	NA	NA	NA

COC	Soil Remedial Goal, Direct Contact[a] (mg/kg)	Residential RSL[b] (mg/kg)		Risk[c]	HQ[d]
		10^{-6} Risk	HQ = 1.0		
2,4,5-trichlorophenol	780	--	6,300	--	1.2E-01
2,4,6-trichlorophenol	58	49	63	1.2E-06	9.2E-01
2,4-dichlorophenol	23	--	190	--	1.2E-01
2,4-dimethylphenol	160	--	1,300	--	1.2E-01
2,4-dinitrophenol	16	--	130	--	1.2E-01
2,4-dinitrotoluene	16	1.7	130	9.4E-06	1.2E-01
2,6-dinitrotoluene	7.8	0.36	19	2.2E-05	4.1E-01
2-chloronaphthalene	630	--	4,800	--	1.3E-01
2-chlorophenol	39	--	390	--	1.0E-01
2-methylnaphthalene	31	--	240	--	1.3E-01
2-nitroaniline	NV	--	630	--	--
2-nitrophenol	NV	NA	NA	NA	NA
3,3'-dichlorobenzidine	1.4	1.2	--	1.2E-06	--
3-nitroaniline	2.3	--	--	--	--
4,6-dinitro-2-methylphenol	0.78	--	5.1	--	1.5E-01
4-bromophenyl phenyl ether	NV	NA	NA	NA	NA
4-chloroaniline	31	2.7	250	1.1E-05	1.2E-01
4-chlorophenyl phenyl ether	NV	NA	NA	NA	NA
4-nitroaniline	23.5	27	250	8.7E-07	9.4E-02
4-nitrophenol	62.6	--	--	--	--
acenaphthene	470	--	3600	--	1.3E-01
acenaphthylene	NV	NA	NA	NA	NA
anthracene	2,300	--	18,000	--	1.3E-01
benzidine	0.0028	0.00053	190	5.3E-06	1.5E-05
benzo(a)anthracene	0.87	1.1	--	7.9E-07	--
benzo(a)pyrene	0.087	0.11	18	7.9E-07	4.8E-03
benzo(b)fluoranthene	0.87	1.1	--	7.9E-07	--
benzo(g,h,i)perylene	NV	NA	NA	NA	NA
benzo(k)fluoranhene	8.7	11	--	7.9E-07	--
bis(2-chloroethoxy)methane	0.58	--	190	--	3.1E-03
bis(2-chloroisopropyl) ether	9.1	--	--	--	--
bis(2-ethylhexyl)phthalate	46	39	1,300	1.2E-06	3.5E-02
butyl benzyl phthalate	340	290	13,000	1.2E-06	2.6E-02
carbazole	32	--	--	--	--
p-chloro-m-cresol	NV	NA	NA	NA	NA
chrysene	87	110	--	7.9E-07	--
di-n-butyl phthalate	780	--	6,300	--	1.2E-01
di-n-octyl phthalate	313	--	630	--	5.0E-01
dibenz(a,h)anthracene	0.087	0.11	--	7.9E-07	--
dibenzofuran	15.6	--	73	--	2.1E-01
diethyl phthalate	6,300	--	51,000	--	1.2E-01
dimethyl phthalate	78,200	--	--	--	--
fluoranthene	310	--	2,400	--	1.3E-01
fluorene	310	--	2,400	--	1.3E-01
hexachlorobenzene	0.4	0.21	63	1.9E-06	6.4E-03

COC	Soil Remedial Goal, Direct Contact[a] (mg/kg)	Residential RSL[b] (mg/kg)		Risk[c]	HQ[d]
		10^{-6} Risk	HQ = 1.0		
hexachlorobutadiene	1.56	1.2	78	1.3E-06	2.0E-02
hexachlorocyclopentadiene	47	--	1.8	--	**2.6E+01**
hexachloroethane	7.8	1.8	45	4.3E-06	1.7E-01
indeno(1,2,3-cd)pyrene	0.87	1.1	--	7.9E-07	--
isophorone	670	570	13,000	1.2E-06	5.2E-02
n-nitrosodiphenylamine	130	110	--	1.2E-06	--
n-nitrosodipropylamine	0.091	0.078	--	1.2E-06	--
naphthalene	160	3.8	130	4.2E-05	**1.2E+00**
nitrobenzene	3.9	5.1	130	7.6E-07	3.0E-02
p-chloro-m-cresol	NV	NA	NA	NA	NA
p-(dimethylamino)azobenzene	NV	NA	NA	NA	NA
pentachlorobenzene	6.3	--	63	--	1.0E-01
pentachlorophenol	2.5	1	250	2.5E-06	1.0E-02
phenanthrene	NV	NA	NA	NA	NA
o-cresol/2-methylphenol	390	--	3,200	--	1.2E-01
p-cresol/4-methylphenol	39	--	6,300	--	6.2E-03
phenol	2,300	--	19,000	--	1.2E-01
pyrene	230	--	1,800	--	1.3E-01
aluminum	7,820	--	77,000	--	1.0E-01
antimony	3.1	--	31	--	1.0E-01
arsenic	15.9	0.68	35	2.3E-05	4.5E-01
barium	1,600	--	15,000	--	1.1E-01
beryllium	16	1,600	160	1.0E-08	1.0E-01
cadmium	7.8	2,100	71	3.7E-09	1.1E-01
calcium	NV	NA	NA	NA	NA
chromium	233	0.3[e]	230[e]	**7.8E-04**	**1.0E+00**
cobalt	156	420	23	3.7E-07	**6.8E+00**
copper	310	--	3,100	--	1.0E-01
iron	2,300	--	55,000	--	4.2E-02
lead	400	--	NA	--	NA
magnesium	NV	NA	NA	NA	NA
manganese	2,272	NA	1,800	--	**1.3E+00**
mercury	0.78	NA	11	--	7.1E-02
nickel	160	15,000	1,500	1.1E-08	1.1E-01
potassium	NV	NA	NA	NA	NA
selenium	39	--	390	--	1.0E-01
silver	39	--	390	--	1.0E-01
sodium	NV	NA	NA	NA	NA
thallium	0.55	--	0.78	--	7.1E-01
vanadium	184	--	390	--	4.7E-01
zinc	2,300	--	23,000	--	1.0E-01
cyanide, free	1,600	--	23	--	**7.0E+01**
PCBs, total	1	0.23	--	4.3E-06	--
Arochlor 1016	5.5	6.7	4.1	--	--
Arochlor 1221	0.32	0.2	--	1.6E-06	--

COC	Soil Remedial Goal, Direct Contact[a] (mg/kg)	Residential RSL[b] (mg/kg)		Risk[c]	HQ[d]
		10^{-6} Risk	HQ = 1.0		
Arochlor 1232	0.32	0.17	--	1.9E-06	--
Arochlor 1242	0.32	0.23	--	1.4E-06	--
Arochlor 1248	0.32	0.23	--	1.4E-06	--
Arochlor 1254	0.32	0.24	--	1.3E-06	--
Arochlor 1260	0.32	0.24	--	1.3E-06	--

Notes:

a) Soil remedial goal is the lowest of the human health direct contact standards presented in Table 1A of the OU10 ESD.
b) EPA's residential soil RSLs, dated November 2022, available at Regional Screening Levels (RSLs) - Generic Tables | US EPA
c) Cancer risk calculated using the following equation, based on the fact that RSLs are derived based on 1 x 10^{-6} risk: Cancer risk = (cleanup goal ÷ cancer-based RSL) × 10^{-6}.
d) Noncancer HQ calculated using the following equation: HQ = (cleanup goal ÷ noncancer RSL).
e) RSL for hexavalent chromium.

NV = no value available
NA = not applicable
-- = EPA has not finalized a carcinogenic or noncarcinogenic toxicity value for this compound
Bold = risk exceeds EPA's risk management range of 10^{-6} to 10^{-4} or HQ exceeds 1

Table I-5: Screening-level Evaluation of Post-Remediation Soil – Burnt Debris Area of Expanded Plant Area Soils

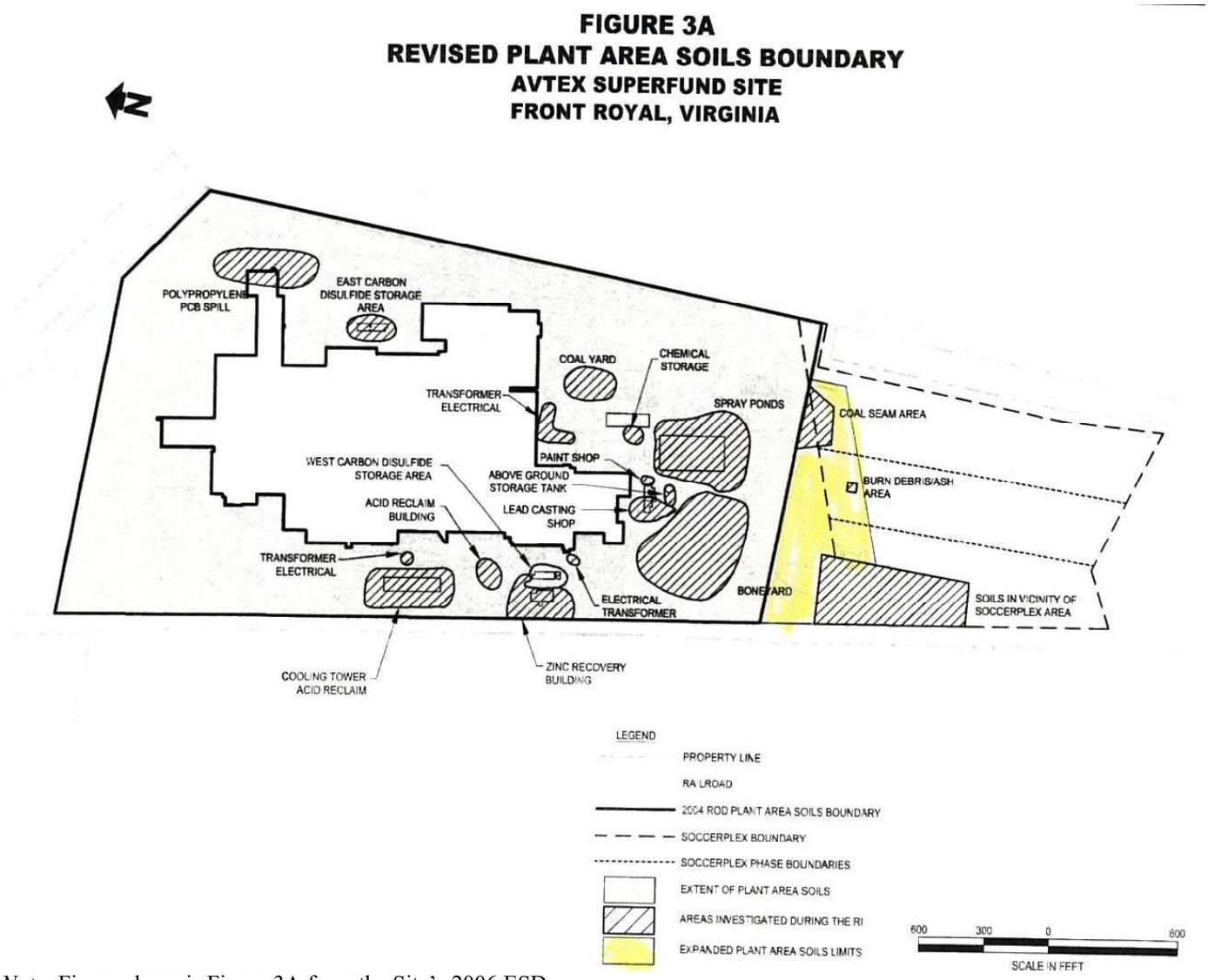
COC	Maximum Detected Concentration Remaining in Soil[a] (mg/kg)	Residential RSL[b] (mg/kg)		Risk[c]	HQ[d]
		10^{-6} Risk	HQ = 1.0		
lead[e]	11	--	NA	--	NA
manganese	1,730 J	NA	1,800	--	9.6E-01
mercury	0.0453J	NA	11	--	4.0E-03

Notes:

a) Maximum detected concentration from Table 1 of the Burnt Debris Area Post-Excavation Sample Results for the SoccerPlex Parcel, dated July 26, 2006
b) EPA's residential soil RSLs, dated November 2022, available at Regional Screening Levels (RSLs) - Generic Tables | US EPA
c) Cancer risk calculated using the following equation, based on the fact that RSLs are derived based on 1 x 10^{-6} risk: Cancer risk = (maximum detected concentration ÷ cancer-based RSL) × 10^{-6}.
d) Noncancer HQ calculated using the following equation: HQ = (maximum detected concentration ÷ noncancer RSL).
e) The maximum detected lead concentration is below the residential soil RSL of 400 mg/kg.

J = estimated value
NA = not applicable
-- = EPA has not finalized a carcinogenic or noncarcinogenic toxicity value for this compound

Figure I-1. Expanded Plant Area Soils Area – OU10



Note: Figure above is Figure 3A from the Site's 2006 ESD.

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APPENDIX J – INTERVIEW FORM

INTERVIEW RECORD

Site Name: AVTEX FIBERS SUPERFUND SITE	**EPA ID No.:**	
Subject: FYR Interview	**Time:** 2 PM	**Date:** 10/18/22
Type: X Telephone Visit Other - Email **Location of Visit:** N/A	Incoming X Outgoing	

Contact Made By:

Name: Katie Page	**Title:** CIC	**Organization:** EPA

Individual Contacted:

Name: Cortney Marquette	**Title:** Remedial Project Manager in the Office of Remedial Programs	**Organization:** VA DEQ
Telephone No: 804-774-9175 **E-Mail Address:** cortney.marquette@deq.virginia.gov	**Street Address:** 1111 East Main Street Richmond, VA 23219	

Summary Of Conversation

The CIC interviewed the VA Department of Environmental Quality Remedial Project Manager for this Five-Year Review interview. The Remedial Project Manager has been a member of this site team since January 2020 and believes that the overall operation at the site is going well. The pump and treat system continues to work well, the Potentially Responsible Parties are proactive, punctual, communicate well, and there are no other issues of concern at the site. The Remedial Project Manager is hopeful that the site could someday be deleted from the EPA National Priorities List. The Remedial Project Manager receives a quarterly report of the site and is aware and informed of all cleanup activities and timeline for activities at the site. Though there are not any reports of vandalism at the site, the Remedial Project Manager reported that the site team learned of potential trespassing at the site during the October 2022 site visit. The Remedial Project Manager conveyed that the communication from all of the agencies and parties working at this site is great and the site visit in October 2022 was a good opportunity to see people face-to-face. In closing, the Remedial Project Manager shared that everything at the site was running smoothly and that there is interest in the site for potential reuse. Though that reuse would be limited use, it could still be turned in to a resource that could be used by the surrounding community.

Note: Statements contained in the following interview forms were reviewed by EPA, but exclusively reflect the thoughts and opinions of the interviewees and have not been verified or adopted by EPA.

INTERVIEW RECORD

Site Name: AVTEX FIBERS SUPERFUND SITE	**EPA ID No.:**	
Subject: FYR Interview	**Time:** 12:45 PM	**Date:** 10/21/22
Type: X Telephone Visit Other - Email **Location of Visit:** N/A	Incoming X Outgoing	

Contact Made By:

Name: Katie Page	**Title:** CIC	**Organization:** EPA

Individual Contacted:

Name: Joe Petty	**Title:** Director of Economic Development	**Organization:** Economic Development Authority
Telephone No: 540-252-0050 **E-Mail Address:** jpetty@warrencountyva.gov	**Street Address:** 400 D Kendrick Lane, P.O. Box 445 Front Royal, VA 22630	

Summary Of Conversation

The CIC interviewed the Director of Economic Development for the Warren County Economic Development Authority. Though the Director is relatively new to the site, he mentioned that he grew up in Warren County and has been familiar with the site since the early days of the cleanup efforts. The Director's overall impression of the site is that the cleanup efforts are going very well. The Director framed the current status of the site as a success because of the significant improvements over the many years of cleanup efforts, and because it has restored the site back to a beautiful landscape with positive impacts to the nearby river. The Director has not heard much feedback from the surrounding community, but he believes this is because the site is relatively quiet and not much active work is going on currently. The Director has not heard of any instances of vandalism or trespassing at the site. One of goals of the Director is to install a bike and pedestrian path on the Superfund site property to connect neighboring communities and provide a beneficial use of the site to community members. The Director expressed an interest in sharing the success story of the site cleanup with community members to show the positive effects that the cleanup has had on human health and the environment over the many decades of cleanup activities.

Note: Statements contained in the following interview forms were reviewed by EPA, but exclusively reflect the thoughts and opinions of the interviewees and have not been verified or adopted by EPA.

INTERVIEW RECORD

Site Name: AVTEX FIBERS SUPERFUND SITE		**EPA ID No.:**	
Subject: FYR Interview		**Time:**	**Date:** 11/29/22
Type: Telephone Visit X Other - Email		Incoming X Outgoing	

Contact Made By:

Name: Katie Page	**Title:** CIC	**Organization:** EPA

Individual Contacted:

Name:	**Title:** Senior Scientist Superintendent	**Organization:** Parsons
Telephone No: **E-Mail Address:**	**Street Address:** 404 KENDRICK LANE, FRONT ROYAL VA 22630	

Summary Of Conversation

Three members of Parsons participated in the Avtex Fibers FYR interviews via email. The following is a summary of all three responses received. Parsons shared with the CIC that the operation, monitoring, and maintenance of the site continues to run smoothly. This is in part because the project is managed well, the staff are knowledgeable, and the public has a positive perception of the site work. Parsons' collective assessment of the current performance of the remedy at the site is that the remedy is effective. The results of various monitoring programs, including annual groundwater monitoring, surface water and sediment sampling, and GLTP system sampling show that the concentrations of contaminants in the recently collected data are generally stable or decreasing. The representatives from Parsons indicated that there have not been any complaints or inquiries from nearby residents regarding the site. The representatives also shared that they are not aware of any changes to state laws that might affect the protectiveness of the site's remedy, but also included that the project team regularly monitors state regulations that would affect site activities for potential changes.

All three Parsons representatives reflected that the site has frequent trespassers entering from wooded areas, river, and parks adjacent to the property. There has also been evidence of hunting on the site property multiple times, and local police and EDA have been notified of those incidences. The cable to the north entrance to the site has been cut at least once, and local law enforcement was notified. Two poachers who were hunting deer were arrested onsite as recently as 11/14/22 when project staff arrived at the site. That case is being handled by respective agencies.

In conclusion, the Parsons representatives are comfortable with the status of the institutional controls at the site, and any outstanding items are in the process for review and finalization. One Parsons interview respondent reflected that they would like to see more engagement and pro-active controls from the local EDA in response to the increase in trespassing and hunting-related unauthorized site access.

Note: Statements contained in the following interview forms were reviewed by EPA, but exclusively reflect the thoughts and opinions of the interviewees and have not been verified or adopted by EPA.

INTERVIEW RECORD			
Site Name: AVTEX FIBERS SUPERFUND SITE		**EPA ID No.:**	
Subject: FYR Interview		**Time:**	**Date: 1/24/23**
Type: Telephone Visit X Other- email **Location of Visit:**		X Incoming	Outgoing
Contact Made By:			
Name: Katie Page	**Title: CIC**	**Organization: EPA**	
Individual Contacted:			
Name: [redacted]	**Title: Former Resident**	**Organization: N/A**	
Telephone No: **E-Mail Address:** [redacted]		**Street Address: N/A**	

Summary Of Conversation

The following interview was collected from a participant who was a former resident of the Front Royal community. The participant continues to have concerns and interest in the site and wanted to offer his responses to the FYR interview on behalf of the students who attended Randolph Macon as his peers during the Avtex operation and clean up. The participant has been aware of the operation of the Ground Leachate Treatment Plant (GLTP) since 2015 and the quarterly/annual reports provided by Parsons for the site. The participant also expressed concern that the human health risk to the students and staff at the Randolph Macon Academy boarding school was not considered at any time. The boarding school shared a property line with Avtex, and he believes action was warranted because children were living next door to the site. He also noted that in the 2008 Baseline Human Health Assessment, the highest risks for cancer were calculated for a future child resident at 4.3E-03 and non-cancer risk of 5.2E+01. These are the highest cancer and non-cancer risk calculations in the report.

The participant acknowledged that EPA did a good job addressing contamination aboveground but has doubt regarding the contamination problem underground. He believes that it took too long for EPA to address the underground contamination and has concerns that this may have led to impacting the community. Though it took a long time for EPA to address the underground aspect of the cleanup, he shared that he was still glad to know that something is being done about it.

Regarding the GLTP, the participant shared that it is difficult to find any information in publicly available EPA reports about what the GLTP is doing and how it is performing. He requested that EPA make all of the GLTP data available to the public. There needs to be transparency and accountability on the effectiveness of the underground cleanup efforts, both past and ongoing.

Note: Statements contained in the following interview forms were reviewed by EPA, but exclusively reflect the thoughts and opinions of the interviewees and have not been verified or adopted by EPA.

What is your overall impression of the Avtex Fibers Superfund Site?

At the publishing of the Fifth Year Review in 2023 it will be 37 years since Avtex Fibers Front Royal was added to the superfund National Priority List (NPL) in 1986. It is now foreseeable that Avtex will require a year of cleanup for every year it operated (49 years, from 1940 to 1989). The cleanup of Avtex has been lengthy, costly, and complicated. Instead of calling the Avtex Fibers Superfund Site a success, it may be best to posit it as a cautionary tale: Six Steps to Ecological Disaster:
Step 1: Locate 440 acres, where just below the surface, an underground water delivery system, perfected over millennia, steadily drains water through the bedrock.
Step 2: Construct 23 landfills with no protective barrier between the landfill and bedrock. Fill these landfills with 85 million cubic feet of sludge (165 football fields filled 1ft. deep)
Step 3: Incorporate into that sludge some of the most toxic compounds in existence including, PCBs, Hexavalent Chromium, PAH, PCBs, Phenols, Phthalates, Brominated Flame Retardants, Chlorobenzenes, Chlorinated solvents, Chlorophenols, and Coal combustion residuals. a. Also add heavy metals like Lead, Mercury, Cadmium, Chromium, Zinc, Sodium, and Arsenic.
Step 4: Manufacture a semi-synthetic carbohydrate (impervious to water, sunlight, and oxygen) by using 89,000 lbs. of carbon disulfide a day, a solvent 403 times stronger than acetone.
Step 5: Combine the carbohydrate, compounds, and solvent together in an alkaline solution. This Frankenstein concoction will keep the chemicals perpetually alive, reacting and interacting with each for decades beneath the surface.

These steps led to the extreme contamination of soil, sediment, and groundwater at the Avtex Fibers Superfund Site making it one of the most dangerous and complicated superfund sites in United States History. Long term exposure to the contaminates left behind at Avtex poses a substantial risk to human health for the surrounding community. Thirty-seven years of remediation at the Avtex Fibers superfund site can be summed up as an underground problem and an aboveground problem.

The Aboveground Problem

On November 10th, 1989, when Avtex abandoned its 440-acre site to the EPA, the manufacturing plant (twice as large as the Pentagon) was dissolving from the inside out and had been for some time. Since 1976 when FMC sold its fiber division (at a loss) to John N. Gregg for $44M, its aging plants had already exceeded their life expectancy. Avtex closed the Marcus Hook (PA) plant in 1977, Nitro (WV) in 1980, and Meadville (PA) in 1985.

FMC (who operated the plant from 1963-1976) and Avtex (from 1976-1989) failed to take steps to minimize the risks associated with their chemicals. Had they reinvested in the aging plant, or upfitted their environmental controls they could have prevented the uncontrolled releases that led to revocation of their permit to discharge into the South Fork of the Shenandoah River. While it was in operation, Avtex Fibers Front Royal released 5,000 lbs. of carbon disulfide per hour into the air. In the early 80's Avtex removed carbon filters from their fume stack designed to trap carbon disulfide. This led to the release of 51 million pounds of carbon disulfide into Front Royal in 1987. Failures of the plant also caused cascading water violations. From 1980-1989 Avtex violated its permit to discharge effluent into the South Fork of the Shenandoah over 2,000 times. When the concentration of its waste exceeded the capability of the wastewater treatment plant, it reverted to dumping raw waste in the South Fork of the Shenandoah River. They repeated exceeded their permit requirements even though the Virginia State Water Board relaxed them several times. In 1987 Avtex released 80 million gallons of regulated chemicals into the South Fork of the Shenandoah River. 1987 was the only full year Avtex reported its air and water releases. It can be assumed that this was the standard practice for 49 years.

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The aboveground problem was so bad that in 1988 Avtex shut itself down. Fed up with fines from EPA, OSHA, and the Commonwealth of Virginia, Avtex sought to go on making high grade Rayon for United States Government unobstructed or go out of business. The National Security Council (NSC) approved a bailout for Avtex on November 29th, 1988, giving them upwards of $40M for a 2-year supply of high-grade Rayon. Avtex manufactured this two-year supply in 9 months. During its final 9 months of operation, with EPA regulators off their backs, Avtex operated with impunity, ensuring an impending ecological disaster. They ran their plant ragged, failed to report hazardous chemicals used in their production, and downplayed the danger or PCBs found on the site and in the South Fork of the Shenandoah River.

In a final fait accompli, John N. Gregg sabotaged Avtex just before he abandoned it. He alluded to this in a memo he sent to the Deputy Attorney General for Virginia, Claire Guthrie on November 10th, 1989, he said,

"It's going to be an ecological disaster for someone to try to clean up after viscose sets. The other problem obviously is that we have on hand a substantial inventory of heavy chemicals, acids, caustics, plus CS2(carbon disulfide). Once power has been shut off, we no longer have the ability to do the work necessary to clean these liquids from the Front Royal Site. I have instructed our people to shut this plant down unless we get an extension, and it essentially means a walk-away…"

When John N. Gregg cut power to Avtex and walked away, he left behind 5,000 drums of toxic chemicals, 2,000 tons of manufacturing chemicals, 2 million gallons of sulphuric acid and carbon disulfide, and 8,000 tons of contaminated soil. Fulfilling his promise, he filled most of the 12 miles of sewer lines with viscose that calcified within days. He entombed the site, ensuring it would be septic and overflow. He accomplished the final step to an ecological disaster.

Step 6: Walk away.

It would take 20 years (from 1989-2010) to undo the aboveground problem. However, the underground problem was far worse and would wait till 2015, 25 years later to be addressed by the construction of the Ground Leachate Treatment Plant (GLTP) in 2015.

The Underground Problem

Beneath the Avtex site, 23 unlined basins were leaking into the bedrock. These basins stored upwards of 3 million cubic feet of waste that had accumulated for 49 years. However, to fully grasp the nature of the underground problem it is important to understand that waste at Avtex had changed during its last 10 years of operation. The waste is the basins, and its principal chemical threat are characterized below.

Name	Quantity	Principal constituents	Cubic Feet/ Comparison
Sulfite Basins 1-6	936,000 cubic yards	Zinc, lead, cadmium, carbon disulfide, BTEX, Phenol, PAHs, BEHP, Pesticides, PCBs, Arsenic, Chromium	25,272,000 (44 football fields)
Emergency Pond	12,000 cubic yards	Zinc Hydroxide, Carbon disulfide, Phenol, PCBs, Lead, Zinc, Methylene chloride, BTEX, PAH, (bis2-ethylhexyl) phthalate, ketones, 4-methylphenol, 2methylnaphthalene, pesticides, arsenic, cadmium, chromium	324,000 (.5 football field)

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Polishing Basin 1-2	16,500 cubic yards	Zinc, PAHs, BEHP, methylene chloride, 2-methylnaphthalene, arsenic, cadmium, chromium, lead	445,500 (.75 football field)
Fly Ash Basins	1,300,000 cubic yards	Arsenic, Carbon disulfide, BTEX, Chloroform, trichloroethene, PAH, bis(2ethylhexyl) phthalate, 2methylnaphthalene, pesticides.	35,100,000 (61 football fields)
Landfill	54,000 cubic yards	PAHs, bis (2-ethylhexyl) phthalate, phenols, arsenic, lead, zinc, PCBs, ketones, cadmium, chromium.	10,907,000 (19 football fields)
Viscose Basins 1-8	527,000 cubic yards	Carbon disulfide, phenol, pyrene, PAH, BTEX,	14,229,000 (25 football fields)
Viscose Basin 9-11	306,419 cubic yards	Carbon disulfide, phenol, zinc, PAH, ketones, methylene chloride, 4-methylphenol, pesticides, arsenic, chromium, lead.	8,273,300 (14.5 football fields)
Totals	3,151,919 cubic yards	85,102,000 cubic ft.	165 football fields 1 ft. deep

During its final 10 years of operation, Avtex devoted most of its manufacturing to high grade Rayon for the United States Government and specialty polypropylene. Within its R&D laboratories in Front Royal, Avtex patented and perfected FM5055G (a carbon-phenolic rayon) and FM5822A (a phenolic rayon) used by the Department of Defense (for its MX and Trident ICBMs), at NASA (in its Delta, Atlas, and Titan Launch Vehicles), and the USAF (in its AAMRAM, SRAM-2, Stinger and Tomahawk Cruise Missiles). It also patented and produced high-grade polypropylene.

High grade Rayons and specialty polypropylene added hundreds more chemicals to the already heavy chemical loading. Many of these chemicals were regulated, some of them were highly toxic. As it did so, the plant progressively lost containment of its waste. Tight manufacturing tolerances led to increased off-spec waste discarded in landfills that were already full. In 1982 off-spec waste was diverted from landfills to the wastewater treatment plant. The wastewater treatment plant primarily treated chemicals by dilution. Waste waited in the basins for rainwater or flooding from the South Fork to dilute them the low enough levels for discharge under State requirements. The ineffectiveness of the water treatment led to more than 2,000 violations of its permit to discharge into the South Fork of the Shenandoah from 1980-1989. Additionally, high-grade products added polyhalogenated compounds to the metallic/caustic/alkaline mix. It was during the switchover to high grade products that waste from the landfills started to show up in residential wells on the west side of the South Fork of the Shenandoah River.

Further complicating and explaining how this waste migrated, is a southwesterly crack in the bedrock beneath these landfills (an anticline axis in the Martinsburg formation). This crack converted the storage basins into an effective chemical delivery system. Just three of the basins (viscose basins 9-11) are estimated to have leaked 700,000 gallons per year into the groundwater. From 1989 to 2015 these three basins would have leaked an estimated 17.5 million gallons of untreated waste into the ground water. Even though the basins were leaking southwest, downgradient water samples were only taken twice (in 1994 and 2003).

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The reports showed major problems at and beneath the surface. The underground carbon disulfide readings from Viscose Basin 9 in were 6.34 million micrograms per liter (634,000 ppm) in 1993, even though the basin had been closed for 30 years. Surface carbon disulfide readings from Sulfite Basin 5, (meters from the South Fork) were 1.4 million micrograms per liter (about half the weight of a penny per liter). This was 467 times the acute toxicity of carbon disulfide in freshwater. In 2004 reports, carbon disulfide levels in Viscose Basin 7 (well BH-30) were 56,000 micrograms per liter even though the basin had been closed since 1959. If chemicals were decreasing but not going away in the old basins, what could be expected in the recent ones with more toxic chemistry?
Carbon disulfide was just one of many problems. The 1993 water sampling showed that deep wells, bedrock, and surface samples all contained polyhalogenated compounds. This was far more compounds than could be accounted for Avtex story of a single electric transformer explosion in 1989. The electrical transformer story was hard to believe anyway since PCB's used in transformers had been banned in the United States since 1970 and Tetra-PCBs were found of the site 200X more than the mono-PCBs. There are also vastly more toxic. Had Avtex been using PCB in manufacturing, this would have violated the Toxic Substances Control Act.

In the 1993 and 2004 well reports there was also evidence that chemical reactions under the surface were created new chemicals. High levels of chlorines, phenols, and heavy metals were interacting forming dioxin-like compounds (like dibenzofuran), one of the most dangerous compounds in existence to human health. There was also a cache of outlawed chemicals underground such as: Hexachlorobenzene (HCB), 1,1,2,2-tetrachloroethane, trans-1,3-dichloropropene (t-1,3-DCP), 2,4,6-Trichlorophenol (2,4,6-TCP), and Pentachlorophenol (PCP).

In 1993 the site exceeded Virginia's fresh and chronic water standards in nearly found chemical category including inorganic, pesticide, semi-volatile inorganic compound (SVOC), Volatile Organic Compound (VOC), and poly-halogenated chemical (PAH) that was found onsite. This included subtypes of polyhalogenated chemicals including polychlorinated biphenyls (PCBs), dibenzofurans (PCDFs), polybrominated diphenyl ethers (PBDEs), polybrominated biphenyls (PBBs), and perfluorinated compounds (PFOAs) like benzene-dicarboxylic acid. Unregulated chemicals were also found on the site that had no standards.

Even with limited water sampling, the underground problem at Avtex was abundantly clear. It was also urgent. Therefore, it is hard to understand why it took 25 years to address the underground problem through the GLTP. From 2009-2014 when the Feasibility Study was undertaken for the construction of the GLTP, new water tests confirmed chemical levels were decreasing, but not enough. The GLTP's deep wells confirmed a substantial amount of chemicals and compounds remained underground. It necessitated going forward with construction of the $50M GLTP, $1M annual operating costs, and a life expectancy of 25 years (till 2040). Since 2015 the GLTP (which is not permitted by the State of Virginia) discharges around 2 million gallons of treated effluent monthly into the South Fork of the Shenandoah River.

<u>Conclusion: Immunity</u>

It is time to move on from the history of Avtex Fibers as the largest Rayon manufacturer in the world to the reality of the ecological and human health disaster it left behind. For 15 years the Front Royal Economic Development Authority has sought a brownfield developer for the site. None are interested. Risky bets they did take on fraudulent developers cost Front Royal millions of dollars. Avtex is still an eyesore. Their hope for a beltway company to establish a tech-hub on the site are Pollyanna. To this day the topography changes every 5 years as the semisolid waste moves beneath the surface. If outside developers have doubts about whether remediation is complete, so should the town.

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Both FMC and the State of Virginia successfully sued the Federal Government for its culpability in this disaster. In 1992 FMC sought to hold the United States Government jointly responsible for the cleanup costs at Avtex which at that time were estimated to be up to $78M (they have turned out to be 3 times that amount). Even though the United States Government was found "jointly and severally liable for the costs…..responding to such release or threatened release of hazardous substances." (*FMC Corp. v. United States Department of Commerce)*. This decision was later vacated by the Third District Appellate Court in 1997. In the opinion of the appellate court was that government retained immunity for the help it gave Avtex over the years. However, that doesn't mean the public should be kept in the dark or chemicals should be kept underground for 25 years.

Immunity can quickly turn to impunity. The Avtex Fibers Superfund Site might be the type of site you would expect if had immunity. The site still has an enough toxic chemicals within it to present serious risk to human health. The only thing those chemicals are missing is a pathway via air, water, or soil. While thousands of pages of Remedial Investigations (RI), Feasibility Studies, Human Health Assessments, Technical Memorandums, Operable Units (OU), and Records of Decision (ROD) conclude there is no pathway, what if there was? Would it make a difference, or would it be stalled by inaction, obfuscated by details, and drowned in bureaucracy? If everything is fine, while construct the GLTP?

This is speculation, but one potential pathway would have been to look for chemicals in the South Fork in the opposite direction of the flow. PAHs from Avtex were found 30 miles north in Harpers Ferry (the direction the South Fork flows). However, if these chemicals had migrated just 3,000ft southwest (in the direction of the underground strike) they would have been well in range of raw water input for Front Royal, Lynnwood, and Timberville. To my knowledge this possibility was never explored.

The future, just like the past, depends on the power of the South Fork of the Shenandoah, a 5th order stream supplying 7% of the Chesapeake Bay Watershed, to wash away the past and supply the future. Data from the GLTP should be made public and not have to be obtained under FOIA. The future rests on its effectiveness to solve the underground problem.

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APPENDIX K – PRESS NOTICE AND POSTCARD

EPA PUBLIC NOTICE

EPA REVIEWS CLEANUP

AVTEX FIBERS, INC. SUPERFUND SITE

The U.S. Environmental Protection Agency (EPA) is reviewing the cleanup that was conducted at the Avtex Fibers, Inc. Superfund Site located in Front Royal, Virginia. EPA conducts Five-Year Reviews to ensure that cleanups continue to protect public health and the environment. EPA conducted the previous Five-Year Review in 2018 and concluded that the remedy was working as designed and was protective in the short-term. EPA will make the findings from this Five-Year Review available in March 2023.

To access site information, including the Five-Year Review, visit:
www.epa.gov/superfund/avtex

For questions or to provide site-related information for the review, contact:
Katie Page, EPA Community Involvement Coordinator
215-814-2409 or page.katherine@epa.gov

Avtex Fibers, Inc. Superfund Site

Site Update | November 2022

INTERESTED IN PROVIDING FEEDBACK?

EPA conducts interviews with community members living near Superfund sites to encourage meaningful community participation during the Superfund process. Contact Katie to schedule an interview!

Findings from the current review will be available by March 2023. For more information, scan the QR Code with your smartphone or visit the website.

epa.gov/superfund/Avtex

EPA

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EPA conducted the last review in 2018 and concluded that the remedies for all Operable Units are functioning as designed. While the remedies at Operable Units 7 and 10 were determined to be protective of human health and the environment in the short term, EPA noted that additional actions are needed in these areas to be fully protective in the long-term.

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