

**FIRST FIVE-YEAR REVIEW REPORT FOR
DUPONT CHAMBERS WORKS FUSRAP SITE
SALEM COUNTY, NEW JERSEY**

FINAL



Prepared for:
United States Army Corps of Engineers, Philadelphia District
Formerly Utilized Sites Remedial Action Program

Prepared by:
Ramboll Americas Engineering Solutions, Inc.
Under Contract No. W912BU-16-D-001, Task Order 17

**FIRST FIVE-YEAR REVIEW REPORT FOR
DUPONT CHAMBERS WORKS FUSRAP SITE
SALEM COUNTY, NEW JERSEY**

PREPARED UNDER THE DIRECTION OF:

Daniel M. Sirkis, P.G.
Design Manager, DuPont Chambers
Works FUSRAP Site, Philadelphia District

Joseph M. Loeper, Ph.D.
Project Manager, DuPont Chambers
Works FUSRAP Site, Philadelphia District

APPROVED FOR SUBMITTAL BY:

Seth W. Cleaver, P.G.
Chief, Geo-Environmental Section
Philadelphia District

Barbara F. Moffatt, P.E.
Chief, Engineering Branch
Philadelphia District

Christine D. Clapp, P.E.
Deputy Chief, Engineering and Construction
Division, Philadelphia District

Andrew J. Schwaiger, P.E.
Chief, Engineering and Construction
Division, Philadelphia District

ENDORSED BY:

Ramon Brigantti, P.E.
Lieutenant Colonel
Commander, Philadelphia District

APPROVED BY:

Reinhard W. Koenig, P.E., SES
Programs Director
North Atlantic Division

Table of Contents

LIST OF ABBREVIATIONS & ACRONYMS.....	2
I. INTRODUCTION.....	4
FIVE-YEAR REVIEW SUMMARY FORM.....	5
II. RESPONSE ACTION SUMMARY	6
Basis for Taking Action.....	6
Response Actions.....	6
Status of Implementation.....	9
Institutional Controls.....	10
Systems Operations/Operation & Maintenance.....	10
III. PROGRESS SINCE THE LAST REVIEW	10
IV. FIVE-YEAR REVIEW PROCESS	10
Community Notification, Involvement & Site Interviews.....	10
Data Review	11
Site Inspection	11
V. TECHNICAL ASSESSMENT	12
QUESTION A: Is the remedy functioning as intended by the decision documents?.....	12
QUESTION B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?.....	12
QUESTION C: Has any other information come to light that could call into question the protectiveness of the remedy?.....	13
VI. ISSUES/RECOMMENDATIONS	13
VII. PROTECTIVENESS STATEMENT	14
VIII. NEXT REVIEW.....	14

List of Figures

Figure 1	Location of DuPont Chambers Works
Figure 2	FUSRAP Operable Units (OUs) and Areas of Concern (AOCs)

List of Appendices

Appendix A	Reference List
Appendix B	Site Chronology
Appendix C	Public Notice
Appendix D	Interview Forms
Appendix E	Site Inspection Form
Appendix F	RESRAD Updates

LIST OF ABBREVIATIONS & ACRONYMS

AEC	Atomic Energy Commission
AOC	Area of Concern
ARAR	Applicable or Relevant and Appropriate Requirement
BRA	Baseline Risk Assessment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	Constituent of Concern
CWTP	Construction Water Treatment Plant
CY	Cubic Yard
DCF	Dose Conversion Factor
DCGL	Derive Concentration Guideline Levels
DoD	Department of Defense
DOE	Department of Energy
ECC	Environmental Chemical Corporation
EPA	United States Environmental Protection Agency
ESD	Explanation of Significant Differences
FGR	Federal Guidance Report
FS	Feasibility Study
FSS	Final Status Survey
FSSR	Final Status Survey Report
FUSRAP	Formerly Utilized Sites Remedial Action Program
FYR	Five-Year Review
ICRP	International Commission on Radiological Protection
ICs	Institutional Controls
MED	Manhattan Engineer District
MNA	Monitored Natural Attenuation
mrem/year	millirem per year
NAAQS	National Ambient Air Quality Standard
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NJAC	New Jersey Administrative Code
NJDEP	New Jersey Department of Environmental Protection
NPL	National Priorities List
O&M	Operation and Maintenance
ORNL	Oak Ridge National Laboratory
OU	Operable Unit
pCi/g	picocuries/gram
PID	Photoionization Detector
RAO	Remedial Action Objectives
RAR	Remedial Action Report
RCRA	Resource Conservation and Recovery Act
RESRAD	RESidual RADioactivity
RI	Remedial Investigation
ROD	Record of Decision
SU	Survey Unit
TEL	Tetraethyl Lead
TO-15	Toxic Organics-15
UCL	Upper Confidence Limit
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
UU/UE	Unlimited Use and Unrestricted Exposure

VOCs	Volatile Organic Compounds
WCS	Waste Control Specialists, LLC
WTF	Waste Transfer Facility

I. INTRODUCTION

The purpose of a Five-Year Review (FYR) is to evaluate the implementation and performance of a remedy in order 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 five-year review reports such as this one. In addition, FYR reports identify issues found during the review, if any, and document recommendations to address them.

The United States Army Corps of Engineers (USACE) is preparing this five-year review pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121, consistent with the National Contingency Plan (NCP)(40 CFR Section 300.430(f)(4)(ii)), and considering United States Environmental Protection Agency (USEPA), Department of Defense (DoD), and USACE policy.

This is the first FYR for the DuPont Chambers Works Formerly Utilized Sites Remedial Action Program (FUSRAP) Site. The triggering action for this statutory review is the April 24, 2014 on-site mobilization date of the remedial action for Operable Unit (OU) 1 and OU 3. The FYR has been prepared due to the fact that hazardous substances, pollutants, or contaminants remain at the site above levels that allow for unlimited use and unrestricted exposure (UU/UE).

As described in the August 2013 Record of Decision (ROD; USACE, 2013) regarding the FUSRAP remedial action, the Site consists of three OUs to address FUSRAP-related contamination, which include the following Areas of Concern (AOCs):

- OU 1 consists of AOC 1, Former Building 845 and AOC 2, the F Corral. These include production areas where uranium recovery and processing took place between 1943 and 1947. Processing wastes were discharged into a wooden trough. The wooden trough, which is still in existence, collects storm water and discharges to the Central Drainage Ditch located in AOC 1. Production of uranium metal occurred in AOC 2 in former Building 708.
- OU 2 consists of AOC 3, Central Drainage Ditch and AOC 5, Building J-26 Area. These AOCs include the location of a former laboratory building (J-16) and the drainage ditches leading away from uranium production areas through which processing wastes were discharged.
- OU 3 consists of AOC 4, the Historical Lagoon and AOC 6, the East Area. These AOCs were primarily disposal areas for building rubble, discarded equipment, and process wastes. After MED activities began, the East Area was also used by DuPont for the production of fluorinated solvents and fluorinated lubricants. MED uranium processing did not take place in the East Area.

OU 1 (AOCs 1 and 2) and AOC 6 were initially identified for FUSRAP-related remediation as presented in the ROD due to elevated levels of radiological contamination in soil and groundwater. Subsequently, other areas have been identified for FUSRAP-related remediation based on additional information collected during remedial action implementation. A site location map is included as **Figure 1**. The FUSRAP OUs and AOCs addressed in the 2013 ROD are presented on **Figure 2**.

The DuPont Chambers Works FUSRAP Site FYR was led by USACE, Philadelphia District. USACE participants included Joe Loeper, Ph.D. (Project Manager), Dan Sirkis, P.G. (Project Technical Director), and Steve Rochette (Public Affairs Officer), with assistance from Ramboll (A/E Consultant). The review began on 9/21/2020.

Site Background

The DuPont Chambers Works FUSRAP Site is located in Deepwater, Salem County, New Jersey within the property boundaries of the active chemical manufacturing facility owned and operated by E.I. DuPont de Nemours & Company (DuPont, now known as Chemours). DuPont Chambers Works has operated at this

location for more than a century. Located within the Townships of Pennsville and Carneys Point on the southeastern shore of the Delaware River and north of the Interstate 295 Delaware Memorial Bridge, the facility extends 2.7 miles between the Salem Canal and Helms Cove. The Chambers Works Site occupies a portion of the former DuPont property and is adjacent to the former DuPont Carney's Point Works parcel.

In the 1940s, the Manhattan Engineer District (MED) and the Atomic Energy Commission (AEC) contracted with DuPont to process uranium oxides and uranium scrap to produce uranium compounds and a small quantity of uranium metal. Additionally, DuPont performed research and development for the U.S. Government. These activities conducted for the federal government resulted in areas of radiological contamination at the site. Specifically, Buildings J-16, 708, and 845 were involved in MED activities. In 1948 and 1949, AEC conducted radiological surveys and decontamination of building surfaces consistent with the standard practices at the time. After these activities, AEC released the buildings back to DuPont and MED operations ceased at the site.

In the 1970s and 1980s, the Department of Energy (DOE) conducted additional radiation surveys and investigations to evaluate site conditions in relation to current regulatory standards and guidelines. As a result, DOE designated Chambers Works for further investigation and potential cleanup under FUSRAP. The DOE investigations are briefly summarized in the ROD and more information may be found in the Sitewide Remedial Investigation Report (USACE, 2011a).

In October 1997, the United States Army Corps of Engineers (USACE) assumed responsibilities from the DOE as lead agency for remedial actions at the Site. Under its authority to execute FUSRAP, USACE conducted the Remedial Investigation (RI), Baseline Risk Assessment (BRA), and Feasibility Study (FS) at the site. A detailed site chronology is presented in **Appendix B**.

Unrelated to the FUSRAP work, DuPont has been addressing widespread contamination related to its historic chemical manufacturing operations on the property by conducting Resource Conservation and Recovery Act (RCRA) corrective actions. Since the 1970s, DuPont has operated an extensive sitewide groundwater pump and treat system to address non-FUSRAP chemical contamination in groundwater. The DuPont system is designed to hydraulically contain contaminants present in site groundwater and as a result would prevent FUSRAP contaminants from migrating off-site, if they were mobile.

FIVE-YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION		
Site Name: DuPont Chambers Works FUSRAP Site		
EPA ID: NJD002385730		
Region: 2	State: NJ	City/County: Deepwater/Salem County
SITE STATUS		
NPL Status: Non-NPL		
Multiple OUs? Yes	Has the site achieved construction completion? No	
REVIEW STATUS		
Lead agency: Other Federal Agency <i>[If "Other Federal Agency", enter Agency name]:</i> U.S. Army Corps of Engineers		

Author name (Federal or State Project Manager): Joseph Loeper, PhD
Author affiliation: USACE International and Interagency Services/Environmental Programs Branch
Review period: 9/21/2020 - 9/30/2022*
Date of site inspection: 8/20/2021
Type of review: Statutory
Review number: 1
Triggering action date: 4/24/2014
Due date (<i>five years after triggering action date</i>): 4/24/2019**

* The data review cutoff for this FYR was 8/30/2021.

** FUSRAP remedial action work (which initially commenced in 2014) ceased in 2015 due to project funding and execution considerations. Remedial action work resumed in 2017 with a different remedial action contractor and has continued since that time.

II. RESPONSE ACTION SUMMARY

Basis for Taking Action

Constituents of concern (COCs) are uranium, thorium, and radium; specifically U-234, U-235, U-238, Th-230, and Ra-226. The construction worker receptor was selected as the most conservative receptor group upon which the soil remediation goal or cleanup goal was developed.

As part of the Baseline Risk Assessment, USACE conducted a Screening-Level Ecological Risk Assessment to determine the potential for adverse ecological impacts resulting from exposure to radionuclides and chemicals released into the environment from past operations.

The results of the Remedial Investigation and human health Baseline Risk Assessment identified unacceptable dose and risk at specific areas of the Site.

Response Actions

Pre-ROD Removal Activities

At the conclusion of MED activities at Chambers Works, the standard practice at Chambers Works was to demolish obsolete buildings, and utilize the rubble from these buildings as fill material. Historic building demolition activities and potential corresponding fill areas are identified as follows:

- Building J-16 was expanded sometime between 1943 and 1944, creating potentially 200 tons of contaminated debris. Several feet of earth were removed as part of the expansion. The debris and earth were placed in a berm along Historical Lagoon A (OU 3) (USACE, 2011a).
- DuPont demolished Building J-16 (AOC 5) after it was released by AEC and excavated several feet of soil from beneath the building (USDOE, 1996). The estimated demolition date of Building J-16 was approximately 1965. Building J-26 was subsequently constructed over the Building J-16 footprint, and is still present at this location.
- Based on available aerial photography, Building 708 and the building floor slab were demolished in the years between 1954 and 1956.

- Building 845 (AOC 1) was demolished by DuPont in 1999. Building debris and rubble were separated from structural steel components. The debris and rubble were cleared for on-site disposal in the Chambers Works Sanitary Landfill. The structural steel components were transported and disposed off-site by USACE at Waste Control Specialists, LLC (WCS) of Andrews County, Texas.

Remedial Action Objectives

The Remedial Action Objectives (RAOs) for soil and groundwater in OU 1 (AOC 1 and AOC 2) and AOC 6 are to:

- Eliminate or minimize potential human exposure to soils contaminated with FUSRAP-related COCs at levels that exceed the standards established in Applicable or Relevant and Appropriate Requirements (ARARs) or the site-specific remediation goals.
- Eliminate or minimize any further impact to groundwater (by minimizing the source of groundwater contamination)
- Eliminate or minimize potential human exposure to groundwater contaminated with FUSRAP-related COCs at levels that exceed the standards needed to be attained to meet ARARs or the site-specific remediation goals.

Remedy Components

The selected remedial action in the ROD for OU 1 and AOC 6 includes excavation and off-site disposal of contaminated soil combined with MNA of residual contaminants in groundwater. Major components of the selected remedy include, as defined in the ROD:

- Excavation of contaminated soil with total uranium concentrations above the remediation goal of 65 picocuries/gram (pCi/g). The remediation goal was determined for the most conservative receptor based on the acceptable dose criterion of 15 millirem per year (mrem/yr) (NJAC 7:28-12.8(a)(1)). The remediation goal for total uranium accounts for contributions from the other two COCs – Ra-226 and Th-230.
- Physical separation and management of excavated material containing non-FUSRAP hazardous substances that are commingled with FUSRAP-eligible contaminants. This material may require pretreatment prior to land disposal.
- Transportation of excavated soils by rail to an off-site, permitted disposal facility.
- Recovery of water and non-aqueous phase liquids (from construction activities).
- Performance of a final status survey to verify that the completed remedial action meets the soil remediation goal.
- Implementation of MNA to address residual uranium contamination in groundwater, after completing the soil response action. A defined groundwater monitoring program will be initiated to document the progress and effectiveness of the natural environmental processes (e.g., physical, chemical, biological, and radioactive decay) to decrease any residual uranium concentrations in groundwater.
- Evaluation of MNA data during the first five years after implementation to document 1) decreasing trends in uranium concentrations in groundwater over time and to determine if 2) the groundwater remediation goal has been achieved. Based on MNA sampling results, monitoring timeframes would be re-evaluated and refined as necessary. Monitoring would be continued until RAOs have been achieved. The timeframe for achieving RAOs is estimated to be less than 30 years, and may be achievable by the first 5-

year review.

- Implementation of land use controls to limit potential on-site exposure to contaminants during remedial action activities. Existing DuPont/Chemours land use controls and groundwater use restrictions consistent with the property's industrial land use are key features to this component of the response action.
- Implementation of additional land use controls by USACE will be required in the excavation and surrounding areas consistent with remedial construction operations (e.g., sign postings, road closures, additional security and access restrictions). At the conclusion of these remedial action activities, the land use controls normally imposed by DuPont (or a future property owner) will provide necessary protection to human health or the environment. At that time, no additional land use controls beyond those required by the property owner will be needed.
- A post-remediation dose and risk assessment will be performed to ensure compliance with both the acceptable dose criteria of 15 mrem/yr and acceptable dose criterion under "All Controls Fail" scenario. Under the "All Controls Fail" scenario, the dose associated with the residual contaminant concentrations in groundwater combined with the dose resulted from residual soil contamination at the site must be less than 100 mrem total annual effective dose equivalent, if all institutional and engineering controls failed.

Remedy Modifications

To date, modifications needed to be made to the remedial action have been identified as follows:

- Treated construction water (i.e., groundwater, accumulated rainwater, surface water, and decontaminated water) is being discharged to surface water instead of DuPont's on-site wastewater treatment plant.
- Excavations are not being backfilled with mulch or other similar organic material in the unsaturated zone, which was intended to promote and maintain reducing groundwater conditions. There was a concern that the mulch could create a geotechnical problem as it decays, and there was already a very good carbon source in the various chemicals that already exist in the subsurface.
- Additional FUSRAP areas have been identified as part of the remediation work and are being investigated to evaluate the potential need for and scope of remedial action.

Cleanup Levels

Table 1a: Soil Remediation Goals Defined in the ROD

Constituent of Concern	Remediation Goal
Total Uranium (includes contributions and considerations from all constituents of concern including U-234, U-235, U-238, Th-230, and Ra-226)	Acceptable Dose Criteria: 15 mrem/yr Site-Specific Risk-Based Remediation Goal: 65 pCi/g All Controls Fail Criteria: 100 mrem/yr

Table 1b: Groundwater Remediation Goals Defined in the ROD

Constituent of Concern	Remediation Goal
Total Uranium (includes contributions and considerations from all constituents of concern including U-234, U-235, U-238, Th-230, and Ra-226)	All Controls Fail Remediation Goal: 436 ug/L All Controls Fail Criteria: 100 mrem/yr

Notes:

1. Based on the current and future industrial land use assumptions, the groundwater pathway is not a complete exposure pathway for the remediation of the FUSRAP areas. Therefore, USACE did not identify any risk-based remediation goals for groundwater.
2. Under the “All Controls Fail” scenario, the dose associated with the residual contaminant concentrations in groundwater combined with the dose resulted from residual soil contamination at the site must be less than 100 mrem total annual effective dose equivalent, if all institutional and engineering controls failed.

Status of Implementation

Soil excavation was initially performed based on the extent of radiological contamination identified in the ROD for OU 1 (AOC 1 & 2) and OU 3 (AOC 6). Additional excavation work is being conducted as required, based on the identification of two new FUSRAP areas located within AOC 4 (Historical Lagoon), where it had been previously evaluated that FUSRAP remedial action was not warranted (as documented in the 2013 ROD).

The current status of the remediation work according to each OU/AOC is summarized below.

OU 1 (AOCs 1 and 2)

Soil remediation work commenced in June 2014 for AOC 1 and AOC 2. ECC was selected to implement the remedial action at this time. The work was suspended in 2015 based on funding limitations, and ECC demobilized in July 2015 leaving behind several partially excavated areas. Severson was selected to continue the remedial action work in 2017. Soil remediation for all known radiological contamination within AOC 1 and AOC 2 was completed in December 2018 and August 2019, respectively, and the excavation areas have been backfilled. In total, 16,142 cubic yards (CY) of radiological contaminated soils were excavated from AOC 1, and 11,259 CY of radiological contaminated soils were excavated from AOC 2.

As part of the remedial action for OU 1 AOC 1, FUSRAP materials extended from AOC 1 beneath the Central Drainage Ditch (CDD) and have been excavated and disposed off-site. Although the CDD is technically considered AOC 3, the remediation was considered part of AOC 1. After excavation was complete, all areas were backfilled and restored during the remediation work.

A Final Status Survey (FSS) was conducted for the excavation areas prior to backfill to confirm remediation goals were met. The Final Status Survey Report (FSSR) for OU 1 (AOCs 1 and 2) will be included in the Remedial Action Report (RAR) for these AOCs.

AOC 6

Soil remediation work commenced in June 2014 for AOC 6. ECC was selected to implement the remedial action at this time. Survey Unit (SU) 4 within AOC 6 was completed by ECC. The work was suspended in 2015 based on funding limitations, and ECC demobilized in July 2015 leaving behind a partially excavated area. Severson was selected to continue the remedial action work in 2017. Soil remediation for AOC 6 was completed in July 2020, and the excavation areas have been backfilled. In total, 7,387 CY of radiological contaminated soils were excavated for AOC 6.

A FSS was conducted for the excavation areas prior to backfill to confirm remediation goals were met. The FSSR for AOC 6 (all SUs) will be included in the RAR for AOC 6.

Additional FUSRAP Areas

Additional FUSRAP areas have been identified since the publication of the ROD based on a review of additional project information (including historic aerial photography), related project team discussions, and elevated uranium concentrations detected in several of the site groundwater wells. Specifically, FUSRAP contamination has been identified within and proximal to AOC 4, and other suspect areas are being investigated. Selective

excavation is currently being performed in AOC 4, in an area identified as SWMU-5. As of August 2021, an estimated 8,500 CY have been excavated from SWMU-5.

The information reviewed and data collected indicate that the source and nature of the contamination (i.e., FUSRAP-eligible COCs contained in building demolition materials historically disposed on-site) for the additional areas are the same as the AOCs identified in the ROD, and that excavation of the additional areas is appropriate to meet RAOs. The USACE has awarded a contract to complete an Explanation of Significant Differences (ESD) which will be issued to address the additional FUSRAP areas that require remediation.

Groundwater

Implementation of MNA to address residual uranium contamination in groundwater is planned after the completion of the soil response action in accordance with the ROD. Due to the extended project scope and duration for the soil remediation work, MNA has not yet been initiated.

Institutional Controls

The institutional controls (ICs) being implemented at the site include continued maintenance of DuPont's (Chemours') existing land use controls and groundwater use restrictions, and implementation of additional land use controls by USACE in the excavation and surrounding areas in accordance with the ROD. USACE land use controls include sign postings to identify construction areas and rad contamination areas, construction fencing around active work areas, and locked site trailers, conex boxes, and equipment to prevent unauthorized or unsafe access by other workers at the Chemours facility.

At the conclusion of the remedial action activities, the land use controls normally imposed by DuPont (or a future property owner) will provide necessary protection to human health or the environment. At that time, no additional land use controls beyond those required by the property owner will be needed.

Systems Operations/Operation & Maintenance

No remediation systems (e.g., groundwater engineering controls) are planned as part of the FUSRAP remedial action at the site. Temporary land use controls in place during active remediation have been maintained regularly and repaired on an as-needed basis.

III. PROGRESS SINCE THE LAST REVIEW

This is the first FYR for the DuPont Chambers Works site.

IV. FIVE-YEAR REVIEW PROCESS

Community Notification, Involvement & Site Interviews

A public notice was made available by news release through the USACE Philadelphia District Public Affairs-NAP e-mail distribution list and at the USACE Philadelphia District's website (www.nap.usace.army.mil/missions/fusrap), on 5/10/2021, stating that a FYR was being conducted. The email distribution list included over 300 recipients, including subscribers, elected officials, and communities surrounding the project (e.g., Pennsville, Carneys Point, Salem County). A copy of the public notice is included as **Appendix C**. The results of the review and the report will be made available at the Site information repository located at Pennsville Public Library (190 South Broadway, Pennsville, NJ 08070) and at the USACE Philadelphia District's website (www.nap.usace.army.mil/missions/fusrap).

During the FYR process, interviews were conducted to document any perceived problems or successes with the remedy that has been implemented to date. Interview questionnaire forms were sent via e-mail to relevant stakeholders in May 2021, following the issuance of the public notice. Recipients included Chemours, New Jersey Department of Environmental Protection (NJDEP), and U.S. Environmental Protection Agency (USEPA). The results of these questionnaires are summarized below.

As of August 2021, an interview questionnaire form was returned by Chemours. Chemours responses indicate that the project is progressing well from their perspective with no impact to their site operations. No problems were identified. The completed interview questionnaire form is provided in **Appendix D**.

Data Review

Data was reviewed from a FSSR by ECC dated March 2016, completed for AOC 6 SUs 4E, 4W, and 14W. The FSSRs document completion of the soil remedial actions in accordance with the cleanup levels and RAOs. The FSSRs for the remaining SUs in AOCs 1, 2, and 6 have been developed and are under review but have not yet been finalized. When finalized, these reports will be included in the RAR for AOCs 1, 2, and 6, documenting the completed remedial actions for these AOCs.

Air monitoring was conducted during remediation activities to protect workers and minimize airborne migration of COCs off-site. Air monitoring results that were reviewed for this FYR include occupational personnel monitoring as well as perimeter air monitoring results for particulates, chemical contaminants, and radiological contaminants.

Personal dosimetry results have not identified elevated exposure to radiological contaminants. These have been consistently below the established Project Administrative Limits (100 mrem/yr). Other personal monitoring for chemicals (e.g., volatile organic compounds [VOCs]) has been conducted for safety purposes, primarily to determine the level of PPE required for site workers within or near excavation areas.

Perimeter dust monitoring results during excavation and material handling did not significantly differ from background data; only infrequent short duration exceedances of the National Ambient Air Quality Standard (NAAQS) have occurred which were not found to be associated with remediation activities. Likewise, no chemical exceedances at perimeter air monitoring locations have been identified as a result of remediation activities. The occasional dust and chemical exceedances that occurred were fully investigated to determine the source. These were found to be either an equipment issue from weather (e.g., rain, fog) or from another source based on wind direction or occurrence outside of work hours (the primary source of fugitive emissions at the site is during active excavation and/or loading). All radiological perimeter air monitoring results were found to be consistent with ambient background levels, therefore no radiological emissions have been detected at perimeter air monitoring locations throughout the duration of the project.

The data review cutoff date for this FYR was August 30, 2021. All documents reviewed for this FYR are listed in **Appendix A**.

Site Inspection

The inspection of the Site was conducted on 8/20/2021. In attendance were Dan Sirkis (USACE), Joe Loeper (USACE), Helen Dudar (NJDEP), Eleni Kavvadias (USEPA), Tom Cornuet (Ramboll), Lindsay Keller (Ramboll), and Steve Gillespie (Sevenson). The purpose of the inspection was to assess the current status and protectiveness of the remedy. The site owner has limitations regarding on-site photography, so photographs were not taken. However, NJDEP and EPA were on-site for the site inspection and no issues were identified regarding site conditions.

The site inspection was conducted by Ramboll on behalf of USACE. The site inspection included a project update for attending agencies, followed by a site walk to visually confirm and document the conditions of the remedy, site, and surrounding area. The site walk was focused on areas of interest for the FYR, which included

AOCs 1, 2, and 6 where remediation is complete, the Waste Transfer Facilities (WTFs) and the Construction Water Treatment Plan (CWTP) which are located within and/or adjacent to AOCs 1 and 2, and AOC 4 SWMU-5 where remediation is in progress.

A site inspection checklist was completed during the site inspection to document findings and site conditions. The completed site inspection checklist is included in **Appendix E**. No issues were observed that impact current or future protectiveness of the remedy.

V. TECHNICAL ASSESSMENT

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

Yes, the remedy is functioning as intended by the ROD.

Remedial Action Performance

The soil remedy defined in the ROD for OU 1 (AOC 1 and AOC 2) and AOC 6 is considered tentatively complete (subject to final remedial action reporting/documentation of the completed work for these AOCs), and additional soil investigation and excavation activities are ongoing in other identified FUSRAP contamination areas. Final survey and sampling information will be documented in FSSRs which will be included in the RAR for AOCs 1, 2, and 6.

Remedial activities began in 2014 but were halted in 2015 as funding issues led to the termination of the contract of the remedial contractor. Remedial activities resumed in late 2017 with a new remedial contractor and the soil excavations for OU 1 and AOC 6 were completed in 2020 after approximately 3 years of active remediation work. The original remedial timeframe estimate within the ROD was 1.5 years. As of August 2021, the remedial phase has been ongoing for 8 years and is estimated to extend an additional 3 to 4 years.

Implementation of Institutional Controls

Based on conditions observed during the site inspection, land use controls are in place and are proving to be effective in preventing exposure to MED contaminants. Mainly, the entire site is contained within a perimeter security fence system. Chemours also provided documentation that several site-wide institutional controls and engineering controls are maintained to contain and/or prevent exposure to chemical contamination at the site. Although these are in place for Chemours, some of these measures also help contain and/or prevent exposure to MED contaminants. It was concluded during the FYR that DuPont's existing land use controls and groundwater use restrictions have remained in place in accordance with the ROD.

Additional land use controls (i.e., signage, construction fencing) have been implemented by USACE's remedial action contractor in the excavation and surrounding areas and are performing their intended function.

Potential Remedy Problems

There are no known problems or access restrictions that interfere with the performance or the protectiveness of the remedial action.

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

Question B Summary:

The dose limit criterion of 15 mrem/yr was adopted as the protective standard for radiological exposures by the state of New Jersey (NJDEP, 2000) and therefore was identified as an ARAR for remedial action at the Chambers Works Site. Consequently, the 15 mrem/yr dose criterion was used to derive concentration guideline levels

(DCGLs) for each of the five radiological COCs. The resultant DCGLs were then coupled with activity fractions for each of the five COC isotopes to derive the 65 pCi/g remediation goal for total uranium.

Changes since issuance of the ROD do not materially affect the conclusions of the BRA and FS. Therefore, the cleanup levels and remedial action objectives used at the time of the remedy selection remain valid.

Changes in Risk Assessment Methods

The quantification of radiation doses and excess cancer risks for radiological constituents was conducted in the BRA via application of RESidual RADioactivity (RESRAD), Version 6.3 (Argonne National Laboratory 2005). Four subsequent versions of RESRAD have been released since Version 6.3, with modifications implemented in each successive edition. **Appendix F** summarizes these modifications, including a table that highlights the differences between the outputs of the RESRAD code from the version applied in the BRA and FS. The only applicable change is that a decrease in the dose conversion factor (DCF) would allow for an increase in the 65 pCi/g remediation goal for total uranium. As this change does not affect the protectiveness of the remedy, the updates to RESRAD are inconsequential.

Changes in Exposure Pathways

Exposure pathways that incorporate the linkages between radioactive decay products in Site media and human health and ecological receptors have not changed in a manner that would impact the protectiveness of the remedy, and therefore remain appropriate currently and for the foreseeable future. Additionally, while no newly identified FUSRAP contaminants or contaminant sources have been identified within AOCs 1, 2, and 6, a source of FUSRAP-related contaminants was recently identified in AOC 4 (a nearby area not addressed in the ROD). Physical conditions within the AOCs have not changed in ways that would impact the protectiveness of the remedy.

Expected Progress Towards Meeting RAOs

The general RAOs for OU 1 and AOC 6 are to eliminate or minimize potential human exposure to soils and groundwater with FUSRAP-related COCs at concentrations in excess of standards established in ARARs or site-specific remediation goals, and to minimize further impacts to groundwater. Although new FUSRAP areas requiring remediation have been identified post-ROD, the data indicate that the source and nature of the contamination in these areas are the same as identified in the ROD (i.e., FUSRAP impacts resulting from on-site filling/demolition debris placement of former MED building materials). As such, the RAOs are appropriate for the new FUSRAP areas within and proximal to AOC 4. However, the discovery of FUSRAP-related COCs in AOC 4 will delay achieving RAOs, due to the additional time needed to complete remediation.

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

No new information has been identified during this FYR that would question the protectiveness of the remedy.

VI. ISSUES/RECOMMENDATIONS

Issues/Recommendations	
OU(s) without Issues/Recommendations Identified in the Five-Year Review:	
OU 1	

Issues and Recommendations Identified in the Five-Year Review:				
OU(s): OU 3	Issue Category: Other Discovery of new contamination area.			
	Issue: New FUSRAP contamination areas have been identified in AOC 4 since the issuance of the ROD. These areas require remediation in order to maintain protectiveness of the remedy.			
	Recommendation: Address in an ESD.			
Affect Current Protectiveness	Affect Future Protectiveness	Party Responsible	Oversight Party	Milestone Date
No	Yes	Other (USACE)	Other (USACE)	3/31/2023

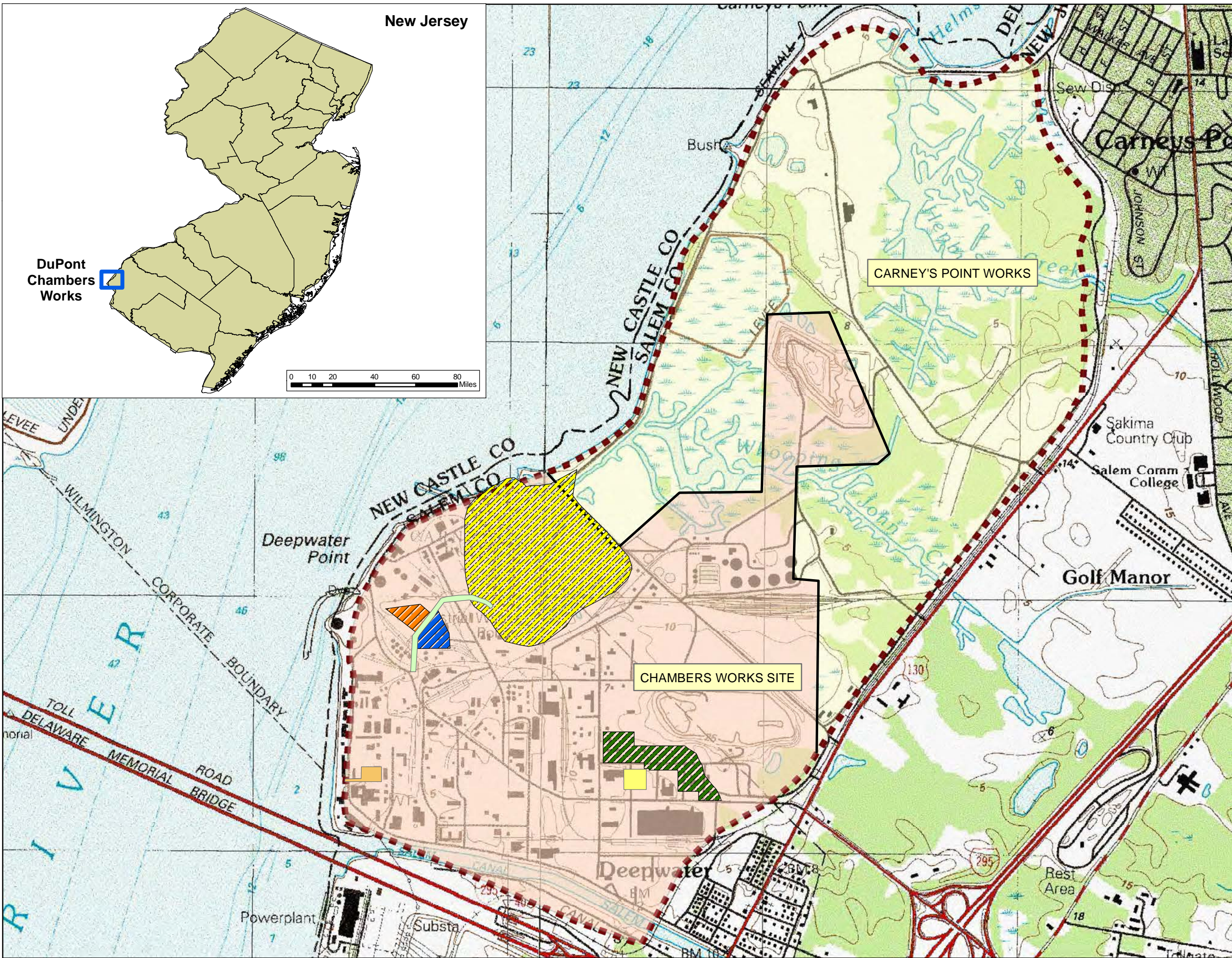
VII. PROTECTIVENESS STATEMENT

Protectiveness Statement(s)	
<i>Operable Unit:</i> OU 1 (AOCs 1 & 2) & OU 3 (AOCs 4 & 6)	<i>Protectiveness Determination:</i> Will be Protective
<i>Protectiveness Statement:</i> The remedy at OU 1 and OU 3 is expected to be protective of human health and the environment upon completion and once OU 3 (AOC 4) has been incorporated into the remedy through an ESD. In the interim, remedial activities completed to date have adequately addressed all exposure pathways that could result in unacceptable risks in these areas.	

VIII. NEXT REVIEW

The next five-year review report for the DuPont Chambers Works FUSRAP Site is required five years from the completion date of this review.

FIGURES



DuPont
Chambers
Works

New Jersey

CARNEY'S POINT WORKS

CHAMBERS WORKS SITE

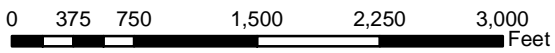


- Carney's Point Works
- Chambers Works Site
- DuPont Property Boundary

FUSRAP Areas

- OU1**
 - AOC 1
 - AOC 2
- OU2**
 - AOC 3
 - AOC 5
- OU3**
 - AOC 4
 - AOC 6
- Background Reference Area

Note:
Source: USGS 7.5" Series Quads.,
Wilmington South & Penns Grove, NJ, DEL 1967,
photorevised respectively 1987 & 1988

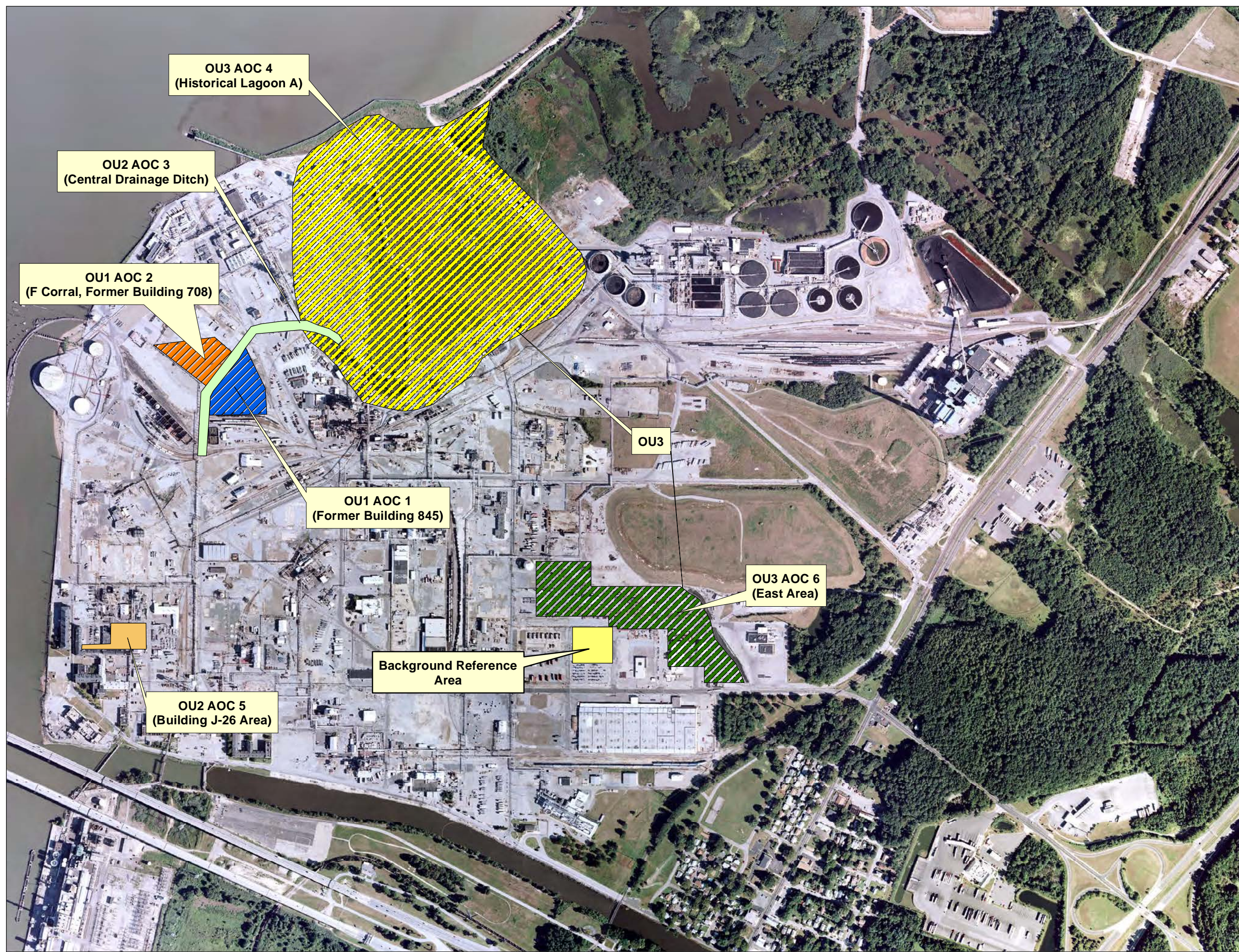


U.S. ARMY CORPS
OF ENGINEERS

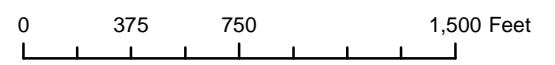
Cabrera Services
1106 N. Charles St
Suite 300
Baltimore, MD 21201

Location of DuPont Chambers Works

**RECORD OF DECISION
USACE - FUSRAP
DuPont Chambers Works
Deepwater, New Jersey**



- OU1**
- AOC 1
 - AOC 2
- OU2**
- AOC 3
 - AOC 5
- OU3**
- AOC 4
 - AOC 6
- Background Reference Area



Note: Aerial Photo taken in September 2005



U.S. ARMY CORPS
OF ENGINEERS



Cabrera Services
1106 N. Charles St
Suite 300
Baltimore, MD 21201

**FUSRAP Operable Units (OUs)
and Areas of Concern (AOCs)**

REOCD OF DECISION
USACE - FUSRAP
DuPont Chambers Works
Deepwater, New Jersey

APPENDIX A – REFERENCE LIST

- ECC, 2016. As Left Report. Remediation Services, Formerly Utilized Sites Remedial Action Program (FUSRAP) at the DuPont Chambers Works Site, Deepwater, New Jersey. March 2016.
- ECC, 2017. Safety and Health Phase-Out Report. Remediation Services, Formerly Utilized Sites Remedial Action Program (FUSRAP) at the DuPont Chambers Works Site, Deepwater, New Jersey. February 2017.
- Eckerman et. al., 1988. Federal Guidance Report (FGR) No. 11. Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion. EPA-520/1-88-020. September 1988.
- Eckerman and Ryman, 1993. FGR No. 12. External Exposure to Radionuclides in Air, Water, and Soil. EPA-402-R-93-081. September 1993.
- Eckerman et. al., 1999. FGR No. 13. Cancer Risk Coefficients for Environmental Exposure to Radionuclides. EPA 402-R-99-001. September 1999.
- ICRP, 1977. Recommendations of the ICRP. ICRP Publication 26. Ann. ICRP 1 (3). Adopted January 1977.
- ICRP, 1979. Limits for Intakes of Radionuclides by Workers. ICRP Publication 30 (Part 1). Ann. ICRP 2 (3-4). Adopted July 1978.
- ICRP, 1991. 1990 Recommendations of the International Commission on Radiological Protection. ICRP Publication 60. Ann. ICRP 21 (1-3). Adopted November 1990.
- ICRP, 1994. Dose Coefficients for Intakes of Radionuclides by Workers. ICRP Publication 68. Ann. ICRP 24 (4). Adopted July 1994.
- ICRP, 1995. Age-dependent Doses to the Members of the Public from Intake of Radionuclides – Part 5. Compilation of Ingestion and Inhalation Coefficients. ICRP Publication 72. Ann. ICRP 26 (1). Adopted September 1995. Published March 1996.
- Leggett and Eckerman, 2003. Dosimetric Significance of the ICRP's Updated Guidance and Models, 1989-2003, and Implications for U.S. Federal Guidance. ORNL-2003/207. August 2003.
- NJDEP, 2000. Final Rule: Soil Remediation Standards for Radioactive Materials N.J.A.C. 7:28. Subchapter 12.
- USACE, 2011a. Sitewide Remedial Investigation Report. June 2011.
- USACE, 2011b. Final Baseline Risk Assessment, DuPont Chambers Works FUSRAP Site, Deepwater, NJ. June 2011.
- USACE, 2012. Final Feasibility Study, DuPont Chambers Works FUSRAP Site, Deepwater, New Jersey. October 2012.
- USACE, 2013. DuPont Chambers Works FUSRAP Site Record of Decision. August 2013.
- USEPA, 1997. Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination. OSWER No. 9200.4-18. August 22, 1997.
- USEPA, 1999. Radiation Risk Assessment At CERCLA Sites: Q&A. OSWER No. 9200.4-31P. December 1999.

USEPA, 2014a. Radiation Risk Assessment At CERCLA Sites: Q&A. OSWER No. 9200.4-40. Dated May 2014. Transmitted June 2014.

USEPA, 2014b. Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors. OSWER Directive No. 9200.1-120. February 2014.

USDOE, 1996. DuPont Site – NHPA (Section 106) Determination. July 25, 1996.

Sevenson Progress Meeting Minutes #105, 149.

Weston, 2001. Technical Project Planning Meeting Brief: Phase I Records Review. DuPont Chambers Works, Deepwater, NJ. Originally prepared by URS Corporation, dated June 13, 2000. Updated by Roy F. Weston Inc. (Weston), dated July 2001.

APPENDIX B – SITE CHRONOLOGY

**DuPont Chambers Works FUSRAP Site
Deepwater, Salem County, New Jersey
Chronology of Site Events**

Event	Date(s)
MED contracts with DuPont to perform uranium-processing activities in support of the nation's early atomic bomb program.	1942
Building J-16 was expanded, creating potentially 200 tons of contaminated debris. Several feet of earth was also removed. The debris and earth were placed in a berm along Historical Lagoon A (OU 3).	1943 to 1944
MED activities are transferred to the AEC.	1946
AEC conducts radiological surveys and decontamination of building surfaces at the site.	1948 and 1949
AEC releases buildings back to DuPont based on existing radiological criteria.	1949
Building 708 was demolished (based on available aerial photography).	1954 to 1956
DuPont demolishes Building J-16 and excavated several feet of soil beneath the building. Building J-26 was subsequently constructed over the Building J-16 footprint, and is still present at this location.	1965 (est.)
Under the Department of Energy (DOE), Oak Ridge National Laboratory (ORNL) conducts a radiation survey of the site. Based on these results, the DOE designates Chambers Works as a FUSRAP site.	1977
Bechtel National, Inc. (BNI) performs a radiation survey of the site to define the areas and boundaries of contamination identified in 1977.	November 1983
Decontamination of Building 845 is conducted by the DOE.	1996
USACE assumes responsibilities from the DOE as lead agency for remedial actions at the site	October 1997
Demolition of Building 845 is conducted by DuPont, with onsite disposal of debris and rubble in the Chambers Works Sanitary Landfill. USACE transported and disposed of structural steel from Building 845.	1999
USACE completes phased multi-media Remedial Investigations (RIs) at three radiologically-contaminated operable units (OUs).	2002 to 2007
USACE issues the Sitewide Remedial Investigation Report (RIR) and Baseline Risk Assessment (BRA).	June 2011
USACE issues the Feasibility Study (FS).	October 2012
USACE issues the Proposed Plan (PP).	November 2012
USACE signs the Record of Decision (ROD) which identifies remediation requirements for OU 1 (AOCs 1 & 2) and AOC 6. The selected remedy was excavation of soil and offsite disposal combined with monitored natural attenuation (MNA) of residual contaminants in groundwater.	August 2013
Environmental Chemical Corporation (ECC) begins soil excavation and offsite disposal for OU 1 and AOC 6	June 2014
USACE suspends remediation work due to funding limitations; ECC demobilizes.	2015
Sevenson Environmental Services, Inc. (Sevenson) continues soil excavation and offsite disposal for OU 1 and AOC 6.	2017
Sevenson completes soil excavation and offsite disposal for AOC 1.	December 2018
Sevenson completes soil excavation and offsite disposal for AOC 2.	August 2019
Sevenson completes soil excavation and offsite disposal for AOC 6.	July 2020
Sevenson begins soil excavation and offsite disposal for AOC 4, where additional FUSRAP materials were identified.	October 2020

APPENDIX C – PUBLIC NOTICE



US Army Corps
of Engineers®

USACE Philadelphia District

News Release

Notice of Five-Year Review: Chemours Chambers Works FUSRAP Site Deepwater, NJ

Published May 10, 2021

DEEPWATER, NJ --

The U.S. Army Corps of Engineers (USACE), Philadelphia District, is addressing radiological contamination in specific areas of the Chemours Chambers Works site in Deepwater, New Jersey. In the 1940s, manufacturing operations for the federal government resulted in limited areas of soil and groundwater contamination. USACE is addressing site cleanup under the Formerly Utilized Sites Remedial Action Program (FUSRAP).

USACE is currently conducting a five-year review. The purpose of the review is to evaluate the implementation and performance of the site remedy to determine if the remedy is and will continue to protect human health and the environment. The remedial action includes soil excavation and monitored natural attenuation for groundwater to address radioactive contamination as defined in the Record of Decision published by USACE in August 2013. It is anticipated that the final five-year review report will be completed by December 2021.

For more information, visit: <https://www.nap.usace.army.mil/Missions/FUSRAP/> or contact the U.S. Army Corps of Engineers Philadelphia District at Philly@usace.army.mil

Related Link: [Chambers Works FUSRAP Webpage](https://www.nap.usace.army.mil/Missions/FUSRAP/)
<https://www.nap.usace.army.mil/Missions/FUSRAP/>

Contact

Steve Rochette

Stephen.Rochette@usace.army.mil

Release no. 21-011

DuPont Chemours Deepwater new jersey FUSRAP Chambers Works
environmental remediation

APPENDIX D – INTERVIEW FORMS

INTERVIEW DOCUMENTATION FORM

The following is a list of individuals interviewed for this five-year review. See the attached contact record(s) for a detailed summary of the interviews.

<u>Scott Northey</u> Name	<u>Environmental Manager</u> Title/Position	<u>Chemours</u> Organization	<u>7/27/2021</u> Date
_____ Name	_____ Title/Position	_____ Organization	_____ Date
_____ Name	_____ Title/Position	_____ Organization	_____ Date
_____ Name	_____ Title/Position	_____ Organization	_____ Date
_____ Name	_____ Title/Position	_____ Organization	_____ Date
_____ Name	_____ Title/Position	_____ Organization	_____ Date

INTERVIEW RECORD		
Site Name: Chemours Chambers Works		EPA ID No.:
Subject: Five Year Review		Time:
Date:		Time:
Type: <input type="checkbox"/> Telephone <input type="checkbox"/> Visit <input checked="" type="checkbox"/> Other (e-mail)		<input type="checkbox"/> Incoming <input type="checkbox"/> Outgoing
Location of Visit:		
Contact Made By:		
Name: Joe Loeper	Title: Project Manager	Organization: USACE
Individual Contacted:		
Name: Scott Northey	Title: Environmental Manager	Organization: Chemours
Telephone No: 856-540-2012	Street Address: 67 Canal Rd	
Fax No: 856-540-3203	City, State, Zip: Deepwater, NJ 08023	
E-Mail Address: scott.t.northey@chemours.com		
Summary Of Conversation		
<p><i>Note: Please answer "NA" if you cannot respond based upon your experience with the project.</i></p> <ol style="list-style-type: none"> 1. What is your overall impression of the project? (general sentiment) <i>Project is moving along well. ACOE and contractors have been very proactive and cooperative with Chemours with no impact to site operations.</i> 2. What is the current status of construction (e.g., budget and schedule)? <i>NA</i> 3. Have any problems been encountered which required, or will require, changes to this remedial design or ROD? <i>NA</i> 4. Have any problems or difficulties been encountered which have impacted construction progress or implementability? <i>NA</i> 5. Are you aware of any community concerns regarding the site or its operation and administration? If so, please give details. <i>No</i> 6. Do you have any comments, suggestions, or recommendations regarding the site's management or operation? <i>Only that this work is very important to Chemours and the site as Chemours attempts to identify new beneficial uses/reuses for the under-utilized portions of the facility.</i> 		

APPENDIX E – SITE INSPECTION FORM

Appendix D
Five-Year Review Site Inspection Checklist

Five-Year Review Site Inspection Checklist (Revised)

(Working document for site inspection. Information may be completed by hand and attached to the Five-Year Review report as supporting documentation of site status. "N/A" refers to "not applicable.")

I. SITE INFORMATION			
Site name: <u>Dupont Chambers Works</u>	Date of inspection: <u>8/20/21</u>		
Location and Region: <u>Deepwater, NJ</u>	EPA ID: _____		
Agency, office, or company leading the five-year review: <u>USACE</u>	Weather/temperature: <u>70s, overcast/rainy</u>		
Remedy Includes: (Check all that apply) <div style="display: flex; flex-wrap: wrap;"> <div style="width: 50%;"> <input type="checkbox"/> Landfill cover/containment <input type="checkbox"/> Access controls <input type="checkbox"/> Institutional controls <input type="checkbox"/> Groundwater pump and treatment <input type="checkbox"/> Surface water collection and treatment <input checked="" type="checkbox"/> Other <u>Excavation/off-site disposal</u> </div> <div style="width: 50%;"> <input checked="" type="checkbox"/> Monitored natural attenuation <input type="checkbox"/> Groundwater containment <input type="checkbox"/> Vertical barrier walls </div> </div>			
Site Inspection Attendees: <u>USACE - Dan Sirkis, Joe Loeper</u> <u>Ramboll - Lindsay Keller, Tom Cornuet</u> <u>EPA - Eleri Kavadias</u> <u>NJDEP - Helen Dudar</u> <u>Sevenson - Steve Gillespie</u>			
II. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)			
1.	Site-Specific Health and Safety Plan <input checked="" type="checkbox"/> Contingency plan/emergency response plan Remarks <u>Also PAMP, APP</u>	<input checked="" type="checkbox"/> Readily available <input checked="" type="checkbox"/> Readily available	<input checked="" type="checkbox"/> Up to date <input checked="" type="checkbox"/> Up to date <input type="checkbox"/> N/A <input type="checkbox"/> N/A
2.	OSHA Training Records Remarks <u>Kept on-site in H&S office, locked</u>	<input checked="" type="checkbox"/> Readily available	<input checked="" type="checkbox"/> Up to date <input type="checkbox"/> N/A
3.	Permits and Service Agreements <input type="checkbox"/> Air discharge permit <input checked="" type="checkbox"/> Effluent discharge <input type="checkbox"/> Waste disposal, POTW <input checked="" type="checkbox"/> Other permits <u>FHA, SESC, TWA</u> Remarks _____	<input type="checkbox"/> Readily available <input checked="" type="checkbox"/> Readily available <input type="checkbox"/> Readily available <input checked="" type="checkbox"/> Readily available	<input type="checkbox"/> Up to date <input checked="" type="checkbox"/> Up to date <input type="checkbox"/> Up to date <input checked="" type="checkbox"/> Up to date <input type="checkbox"/> N/A <input type="checkbox"/> N/A <input type="checkbox"/> N/A <input type="checkbox"/> N/A

4.	Discharge Compliance Records	<input type="checkbox"/> Air	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input type="checkbox"/> N/A
		<input checked="" type="checkbox"/> Water (effluent)	<input checked="" type="checkbox"/> Readily available	<input checked="" type="checkbox"/> Up to date	<input type="checkbox"/> N/A
	Remarks <u>2018-2021</u>				
5.	Daily Access/Security Logs	<input checked="" type="checkbox"/> Readily available	<input checked="" type="checkbox"/> Up to date	<input type="checkbox"/> N/A	
	Remarks <u>Secured facility, daily sign-in sheets</u> <u>↳ Dupont</u> <u>↳ Severson</u>				

III. ACCESS AND INSTITUTIONAL CONTROLS <input checked="" type="checkbox"/> Applicable <input type="checkbox"/> N/A					
A. Fencing					
1.	Fencing damaged	<input type="checkbox"/> Location shown on site map	<input checked="" type="checkbox"/> Gates secured	<input type="checkbox"/> N/A	
	Remarks <u>fencing around entire Dupont facility</u>				
B. Other Access Restrictions					
1.	Signs and other security measures	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> N/A		
	Remarks <u>Secure facility entry (Dupont),</u>				
C. Institutional Controls (ICs) <u>Land use controls by Dupont & USACE</u>					
1.	Implementation and enforcement				
	Site conditions imply ICs not properly implemented	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	<input type="checkbox"/> N/A	
	Site conditions imply ICs not being fully enforced	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	<input type="checkbox"/> N/A	
	Type of monitoring (e.g., self-reporting, drive by) <u>visual observation daily</u>				
	Frequency <u>Daily</u>				
	Responsible party/agency <u>USACE/Severson</u>				
	Contact				
	Name	Title	Date	Phone no.	
	Reporting is up-to-date		<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input checked="" type="checkbox"/> N/A
	Reports are verified by the lead agency		<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input checked="" type="checkbox"/> N/A
	Specific requirements in deed or decision documents have been met		<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
	Violations have been reported		<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input checked="" type="checkbox"/> N/A
	Other problems or suggestions: <input type="checkbox"/> Report attached				
2.	Adequacy	<input checked="" type="checkbox"/> ICs are adequate	<input type="checkbox"/> ICs are inadequate	<input type="checkbox"/> N/A	
	Remarks				

D. General	
1. Vandalism/trespassing	<input type="checkbox"/> Location shown on site map <input checked="" type="checkbox"/> No vandalism evident
Remarks _____	
2. Land use changes on site	<input type="checkbox"/> N/A
Remarks <u>none</u>	
3. Land use changes off site	<input checked="" type="checkbox"/> N/A
Remarks _____	

IV. GENERAL SITE CONDITIONS	
A. Roads	<input checked="" type="checkbox"/> Applicable <input type="checkbox"/> N/A
1. Roads damaged	<input type="checkbox"/> Location shown on site map <input checked="" type="checkbox"/> Roads adequate <input type="checkbox"/> N/A
Remarks <u>Roads maintained by Dept</u>	
B. Other Site Conditions	
Remarks _____	

V. GROUNDWATER/SURFACE WATER REMEDIES <input checked="" type="checkbox"/> Applicable <input type="checkbox"/> N/A	
A. Monitored Natural Attenuation	
1. Monitoring Wells (natural attenuation remedy)	<input type="checkbox"/> Properly secured/locked <input type="checkbox"/> Functioning <input type="checkbox"/> Routinely sampled <input type="checkbox"/> Good condition
	<input type="checkbox"/> All required wells located <input type="checkbox"/> Needs Maintenance <input checked="" type="checkbox"/> N/A
Remarks <u>MNA not yet started - to be implemented following completion of the soil RA</u>	

VI. SOIL REMEDIATION STATUS	
A. AOC 1 Soil Excavation	

	Remarks Remediation (excavation) complete Houses AWWTF - will need to confirm addl. remediation not req. at this location when work is finished Good existing site conditions - stone /asphalt cover
B.	AOC 2 Soil Excavation Remarks Remediation (excavation) complete Houses CWWTF & WTP - will need to confirm addl. remediation not required within these areas when work is finished Good existing site conditions - stone /asphalt cover
C.	AOC 6 Soil Excavation Remarks Remediation (excavation) complete Good existing site conditions - stone cover
D.	Other Areas Remarks CWWTF - active for AOC4 SWMU-5 reined. WTP / AWWTF - using odor control foams AOC 4 SWMU-5 - remediation (excavation) in progress Excavation areas roped off w/ signage Signs for open excavations & radioactive materials areas Some completed areas - good site conditions (backfilled) Vibration monitoring, air monitoring being conducted
VII. 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 to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.). Remedy removing contamination. Effective & functioning as designed. PSS being conducted in accordance w/ MARSSIM to confirm excavation extents meet remediation goals.

	<hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>
B.	Early Indicators of Potential Remedy Problems
	<p>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.</p> <p><u>O&M not applicable</u></p> <p><u>No other indication of remedy protectiveness issues</u></p> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>
C.	Opportunities for Optimization
	<p>Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.</p> <p><u>O&M not applicable</u></p> <p><u>No other notable opportunities for optimization</u></p> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>

APPENDIX F – RESRAD UPDATES

Since the ROD was issued in August 2013, there have been changes to risk assessment methods that were reviewed for this FYR. Specifically, four subsequent versions of RESRAD, the computer code used in the BRA to quantify radiation doses and excess cancer risks for radiological constituents and to develop the site-specific cleanup goal for total uranium in soils, have been released. The inset table included below (**Table 1**), highlights the differences between the outputs of the RESRAD code from the version applied in the BRA and FS (RESRAD Version 6.3 [Argonne National Laboratory 2005]) to the latest version (RESRAD-ONSITE Version 7.2) released in 2016. The majority of these changes do not impact the dose calculations included in the BRA (for example updates to RESRAD's calculation of carbon-14 doses, as carbon-14 is not a radionuclide of concern at the site). As detailed below, changes to the code that are applicable, do not impact the Site remedial criteria as calculated in the BRA and FS.

Table 1. Summary of RESRAD Version History, as Prepared by Argonne National Laboratory		
RESRAD Version	Date of Release	Summary of Updates
RESRAD 6.4	12/20/2007	<ul style="list-style-type: none"> Added ICRP 72 age-dependent DCFs Improved data storage and retrieval, user specified directories. User specified ground DCF's now possible. C-14 inhalation dose and risk improved.
RESRAD 6.5	10/30/2009	<ul style="list-style-type: none"> C-14 gaseous and particulate contributions to dose and risk available Partially or fully submerged contaminated zone now treated Choice between ICRP60 or FGR12 for External dose factors added 64-bit and Vista computers now supported
RESRAD 7.0	4/4/2014	<ul style="list-style-type: none"> Extend DCF Database and software capability for ICRP 107; added Reference Person DCF's as an option Use of different cover and depth factors for photosynthesis and root uptake for C-14 Updated Help for RESRAD and for DCF Editor Fix problem in graphics with multiply threaded progeny
RESRAD ONSITE 7.2	7/20/2016	<ul style="list-style-type: none"> Improved ICRP-107 radionuclide decay chain threads condensing routine to reduce computation time. Provided options to choose between the ICRP-38 radionuclide decay database and the ICRP107 radionuclide decay database. <ul style="list-style-type: none"> Support to use either ICRP-26/30 or ICRP-60/72 based dose coefficients with the first option. Support to use ICRP60 based dose coefficients from DCFPAK 3.02 with the second option.
Argonne National Laboratory. 2022. RESRAD-ONSITE Version History. https://resrad.evns.anl.gov/codes/resrad-onsite/history.cfm . Accessed September 16, 2022.		

RESRAD codes provide a model for calculating pathway-specific radiation exposures for on-site human receptors in accordance with user-defined inputs for various physical and receptor-specific parameters that are reflective of current and future land uses and site-specific conditions. RESRAD Version 6.3 calculated radiological doses resulting from exposures experienced by on-site receptors using DCFs extracted from FGR document No. 11 (FGR 11) (Eckerman et al., 1988) and exposure-to-dose coefficients extracted from FGR No. 12 (FGR 12) (Eckerman and Ryman, 1993), and based on a series of publications by the International Commission on Radiological Protection (ICRP). RESRAD codes remain the industry standard for quantifying radiation dose and excess cancer risk at sites contaminated with residual radionuclides.

The user-defined inputs in RESRAD for the exposure assumptions for the five receptor populations tabulated in Appendix C of the BRA (USACE, 2011b) were reviewed; these values are judged to be appropriately conservative and generally consistent with current USEPA risk assessment recommendations for exposure, as

defined in USEPA's Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors (USEPA, 2014). It is also noted that USEPA's ProUCL Version 4.0 was used to calculate soil exposure point concentrations (95% upper confidence limit [UCL] of the mean) of total uranium for the receptors selected for quantitative risk evaluation in the BRA, and to quantify residual soil concentrations of radionuclides under the various remediation scenarios in the FS. Although ProUCL has been updated to incorporate enhancements to estimating statistical trend lines and decisions for selecting UCLs, application of the current version of ProUCL (Version 5.1) is expected to have a negligible effect on the exposure point concentrations, and accordant risks, calculated in the BRA.

To verify that predicted doses for workers would decline if the dose assessment were updated using the dose assessment approach in ICRP 60 and 68, the inputs for the construction worker scenario in Appendix C of the BRA were evaluated with the current RESRAD version (RESRAD-ONSITE Version 7.2), selecting the option for ICRP-60 DCFs. Predicted doses were lower than those predicted in the BRA, as expected given the findings of Leggett and Eckerman. Calculation of cancer risk in RESRAD continues to be based on FGR 13, as it was in the BRA and FS.