Final

Facility-wide Groundwater Monitoring Program Plan RVAAP-66 Facility-wide Groundwater Addendum for 2021

> Former Ravenna Army Ammunition Plant Portage and Trumbull Counties, Ohio

Contract No. W912QR-16-D-0003 Delivery Order No. W912QR-18-F-0337

Prepared for:



U.S. Army Corps of Engineers Louisville District

Prepared by:



8866 Commons Boulevard, Suite 201 Twinsburg, Ohio 44087

May 21, 2021

Final

Facility-wide Groundwater Monitoring Program Plan RVAAP-66 Facility-wide Groundwater Addendum for 2021

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Mike DeWine, Governor Jon Husted, Lt. Governor Laurie A. Stevenson, Director

July 9, 2021

TRANSMITTED ELECTRONICALLY

Mr. Kevin M. Sedlak Army National Guard Installation and Environment Clean-up Branch IPA Designation 1438 State Route 534 SW Newton Falls, OH 44444 RE: US Army Ammunition Plt RVAAP Remediation Response Project Records Remedial Response Portage County ID # 267000859036

Subject: Approval of the "Final Facility-Wide Groundwater Monitoring Program Plan RVAAP-66 Facility-Wide Groundwater Addendum for 2021"

Dear Mr. Sedlak:

The Ohio Environmental Protection Agency (Ohio EPA) has received the *Final Facility-Wide Groundwater Monitoring Program Plan RVAAP-66 Facility-Wide Groundwater Addendum for 2021* at the Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio, dated May 21, 2021. This document was received via email at Ohio EPA's Northeast District Office (NEDO), Division of Environmental Response and Revitalization (DERR) on May 22, 2021. The document was prepared for the U.S. Army Corps of Engineers on behalf of the Army National Guard Directorate by Leidos.

The final document was reviewed by personnel from Ohio EPA, DERR. Pursuant to the Director's Findings and Orders paragraph 39 (b), Ohio EPA considers the document final and approved.

This letter is an official response from Ohio EPA that will be maintained as a public record.

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U.S. ARMY RAVENNA AMMUNITION PLT. RVAAP JULY 9, 2021 PAGE 2 OF 2

If you have any questions, please contact me by email at <u>kevin.palombo@epa.ohio.gov</u>, or call me at (330) 963-1292.

Sincerely,

Kn Ml b

Kevin M. Palombo Environmental Specialist Division of Environmental Response and Revitalization

KP/sc

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CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

Leidos has completed the Facility-wide Groundwater Monitoring Program Plan, RVAAP-66 Facility-wide Groundwater Addendum for 2021 for the Ravenna Army Ammunition Plant Restoration Program. Notice is hereby given that an independent technical review has been conducted that is appropriate to the level of risk and complexity inherent in the project. During the independent technical review, compliance with established policy principles and procedures, utilizing justified and valid assumptions, was verified. This included review of data quality objectives; technical assumptions; methods, procedures, and materials to be used; the appropriateness of data used and level of data obtained; and reasonableness of the results, including whether the product meets the customer's needs consistent with law and existing U.S. Army Corps of Engineers (USACE) policy.

May 21, 2021 Catherine Huss Date

Study/Design Team Leader

Jed Thomas, P.E., PMP Independent Technical Review Team Leader May 21, 2021 Date

Significant concerns and the explanation of the resolution are documented within the project file. As noted above, all concerns resulting from independent technical review of the project have been considered.

Lisa Johes-Bateman, PMP, REM Senior Program Manager

May 21, 2021

Date

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Facility-wide Groundwater Monitoring Program Plan RVAAP-66 Facility-wide Groundwater Addendum for 2021

Former Ravenna Army Ammunition Plant Portage and Trumbull Counties, Ohio

Contract No. W912QR-16-D-0003 Delivery Order No. W912QR-18-F-0337

Prepared for:

U.S. Army Corps of Engineers 600 Martin Luther King, Jr. Place Louisville, Kentucky 40202

Prepared by: Leidos

8866 Commons Boulevard, Suite 201 Twinsburg, Ohio 44087

May 21, 2021

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ARNG = Army National Guard

CO = Central Office

I&E = Installations and Environment

NEDO = Northeast District Office

OHARNG = Ohio Army National Guard

Ohio EPA = Ohio Environmental Protection Agency

SWDO = Southwest District Office

USACE = U.S. Army Corps of Engineers

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Appendix A. Ohio EPA Comments

ACRONYMS AND ABBREVIATIONS

AOC	Area of Concern
Army	U.S. Department of the Army
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CJAG	Camp James A. Garfield
COC	Chemical of Concern
CSM	Conceptual Site Model
DFFO	Director's Final Findings and Orders
DoD	U.S. Department of Defense
FS	Feasibility Study
FWGW	Facility-wide Groundwater
FWGWMP	Facility-wide Groundwater Monitoring Program
IRP	Installation Restoration Program
MNA	Monitored Natural Attenuation
Ohio EPA	Ohio Environmental Protection Agency
P.E.	Professional Engineer
PCB	Polychlorinated Biphenyl
PMP	Project Management Professional
PP	Proposed Plan
PWS	Performance Work Statement
QAPP	Quality Assurance Project Plan
RCRA	Resource Conservation and Recovery Act
REM	Remedial Environmental Manager
RI	Remedial Investigation
RIWP	Remedial Investigation Work Plan
ROD	Record of Decision
RVAAP	Ravenna Army Ammunition Plant
SAP	Sampling and Analysis Plan
USACE	U.S. Army Corps of Engineers

1.0 INTRODUCTION

Leidos has been contracted by the U.S. Army Corps of Engineers (USACE), Louisville District to execute the performance work statement (PWS) titled "Groundwater Investigation and Reporting Services, Ravenna Army Ammunition Plant (RVAAP) Restoration Program, Camp James A. Garfield (CJAG) Joint Military Training Center, Portage and Trumbull Counties, Ohio." This work is being performed under a firm-fixed price basis in accordance with USACE, Louisville District Contract No. W912QR-16-D-0003, Delivery Order No. W912QR-18-F-0337. The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) investigation and cleanup are being conducted under the U.S. Department of Defense (DoD) Installation Restoration Program (IRP). Activities include monitoring an extensive network of groundwater monitoring wells to determine nature and extent of groundwater impacts, provide additional information in support of hydrogeologic and fate and transport models, evaluate potential exit pathways, and evaluate vertical contaminant distribution and/or particle inflow/outflow through the facility.

1.1 PURPOSE

The Director's Final Findings and Orders (DFFO) was issued to the U.S. Department of the Army (Army) on June 10, 2004 (Ohio EPA 2004). The purpose of the DFFO is for the Army to develop and implement:

- A Remedial Investigation/Feasibility Study (RI/FS), Proposed Plan (PP), Record of Decision (ROD), or other appropriate document and remedy for each area of concern (AOC) or appropriate group of AOCs at the former RVAAP; and
- A Facility-wide Groundwater (FWGW) investigation, monitoring, and remediation program at the former RVAAP.

Section 15 of the DFFO outlines the requirements of the Facility-wide Groundwater Monitoring Program (FWGWMP). The purpose of this 2021 Addendum is to satisfy the requirements of Section 15d that specify the FWGWMP Plan will "utilize an iterative process, with an annual review and revision cycle to accommodate the addition or deletion of wells from the groundwater monitoring network."

This Addendum provides an update to the FWGWMP Plan, including the identification of wells to be sampled as part of the FWGWMP in 2021.

1.2 OBJECTIVES

The primary objectives of the facility-wide monitoring well network in this 2021 Addendum are to assess potential exit pathways, monitor contaminant concentrations related to historical RVAAP activities (e.g., explosives/propellants) at selected source area wells for trend analysis, and sample wells to refine the conceptual site model (CSM) or contaminant distribution associated with the areas recommended for evaluation within the FS.

This 2021 Addendum is a supplement to the FWGWMP Plan and discusses the subset of currently existing monitoring wells at the former RVAAP that will be monitored in 2021, the frequency of samples to be collected, and the chemicals that will be evaluated at each selected well. Contaminant trend analysis of the 2020 sampling results was conducted by reviewing the well-specific sampling histories and time series graphs provided in the *Facility-wide Groundwater Monitoring Program RVAAP-66 Facility-wide Groundwater Annual Report for 2020* (2020 Annual Report) (Leidos 2020a). In addition, the recommendations of the *Draft Remedial Investigation Report for RVAAP-66 Facility-wide Groundwater* (Leidos 2020b) were considered and data collection to support the FS has been incorporated into the 2021 FWGWMP.

Wells were selected for inclusion in the 2021 FWGWMP based on the following criteria:

- **FWGWMP Criterion 1:** Wells representing critical exit pathway monitoring points (generally a carryover from the 2020 program).
- **FWGWMP Criterion 2:** Wells representing primary AOC-specific contaminant source area conditions indicated to be potentially increasing or otherwise potentially unstable plume conditions.
- **FWGWMP Criterion 3:** Co-located wells used to establish the vertical distribution of contaminants within the stratigraphic sequence.
- **FWGWMP Criterion 4 (new in 2021):** Wells refining the CSM or contaminant distribution associated with the areas recommended for evaluation within the FS.

Previous addenda contained a criterion for "wells with the most recent 2 years sampling results representing a historical (non-metal) maximum concentration above regulatory screening levels for one or more site-related chemicals in groundwater (based on AOC-specific sampling histories)." This criterion has been removed because wells identified under that criterion in recent years align with conclusions in the RI and are covered under other criteria. The FWGWMP investigation is refined to supporting recommendations within the RI Report and providing supplemental data for the FS.

1.3 REPORT ORGANIZATION

The remaining sections of this Addendum are organized as follows:

- Section 2.0. Background,
- Section 3.0. Scope of Work Under the Addendum,
- Section 4.0. Schedule, and
- Section 5.0. References.

2.0 BACKGROUND

In 2004, the Army and Ohio Environmental Protection Agency (Ohio EPA) finalized the *Facility-wide Groundwater Monitoring Program Plan for the Ravenna Army Ammunition Plant, Ravenna, Ohio* (Portage Environmental 2004) for the former RVAAP, now known as CJAG Joint Military Training Center. Figure 2-1 presents the general location of CJAG.

The FWGWMP was initiated in April 2005 with quarterly sampling of 36 FWGWMP monitoring wells. Fourteen of these wells were identified as "background wells," and the remaining wells were located at various AOCs at CJAG. Five wells historically known as Resource Conservation and Recovery Act (RCRA) wells (RQLmw-007, RQLmw-008, RQLmw-009, DETmw-003, and DETmw-004) were incorporated into the FWGWMP after May 2005 and are sampled semi-annually. The FWGWMP monitoring well network currently contains 301 permanent wells, 47 of which were sampled in 2020. In addition to these wells, 14 permanent wells at RVAAP-69 Building 1048 Fire Station and 3 permanent wells at RVAAP-74 Building 1034 Motor Pool Hydraulic Lift are not currently incorporated into the FWGWMP monitoring well network as they were installed and sampled to support their current site-specific investigations.

Since 2005, the results have been summarized in an annual report. In 2016, the *Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater* (herein referred to as the RIWP; TEC-Weston 2016) was developed. This RIWP serves as a supplement to the FWGWMP Plan and specifies aspects of the RI with the goal of adequately characterizing pertinent physical and chemical groundwater conditions in the multi-aquifer hydrostratigraphic units variably present across CJAG, so that potential current and future risks to potential human and environmental receptors can be ascertained, effectively managed, and mitigated as needed.

The *Draft Remedial Investigation Report for RVAAP-66 Facility-wide Groundwater* (Leidos 2020b) was submitted to Ohio EPA in July 2020, and Ohio EPA comments on the draft document are currently under review.

The 2021 Addendum presents information to support the continued monitoring of AOC-specific contaminant concentrations, as indicated by an analysis of results through 2020. Using data and results from the 2020 FWGWMP sampling events and findings of the Draft RI Report (Leidos 2020b), the following sections provide an assessment of sampling to be conducted in 2021.

To achieve this objective, 53 wells have been selected for sampling in 2021. Monitoring well sampling and analytical testing will be conducted in accordance with the Sampling and Analysis Plan (SAP) and Quality Assurance Project Plan (QAPP) updates provided with the RIWP (TEC-Weston 2016).

3.1 REVISIONS TO 2021 SAMPLING SCHEME

Forty-seven wells were sampled in 2020 under the FWGWMP. Nine wells sampled in 2020 are not recommended for sampling in 2021. This 2021 Addendum recommends that 53 wells be sampled in 2021, which includes an additional 15 wells not sampled in 2020. The rationale for notable differences in the number of wells sampled and the analyte list between 2020 and 2021 is presented below:

- Historically, pH and related anions were analyzed for in monitoring wells with pH outside typical background ranges. An evaluation of historical DoD operational impacts on groundwater pH is included in the Draft RI Report (Leidos 2020b). To support the FS, pH data will continue to be collected as a water quality parameter along with monitored natural attenuation (MNA) data during sample collection.
- With the exception of the two wells in the Open Demolition Area #2, metals analyses are not recommended for 2021. The Draft RI Report (Leidos 2020b) did not identify metals as chemicals of concern (COCs) in the AOCs evaluated, and as summarized in Table 3-1, few metal exceedances occurred in 2020. The 2020 exceedances were limited to manganese and arsenic, which are not considered site related contaminants.
- The Draft RI Report (Leidos 2020b) recommended five AOCs to be evaluated in the FS. Wells located in these AOCs will be analyzed to refine the CSM or contaminant distribution for evaluation within the FS. In addition, the sampling suite for some wells in these AOCs includes parameters to determine the effectiveness of MNA (anions, total organic carbon, alkalinity, pH, and expanded explosives, which include explosive daughter products) as a remedial option. These wells will be sampled during the Spring 2021 sampling event.

3.2 RCRA WELLS

Since 2005, five wells were referred to as the RCRA wells. These five wells were at RVAAP-01 Ramsdell Quarry Landfill (RQLmw-007, RQLmw-008, and RQLmw-009) and RVAAP-04 Open Demolition Area #2 (DETmw-003 and DETmw-004). Although these wells were designated as RCRA wells, they are being monitored as part of the CERCLA program at CJAG in accordance with the DFFO (Ohio EPA 2004). Moving forward, these wells will no longer be identified as RCRA wells.

The Draft RI Report (Leidos 2020b) indicated that no further action is required for groundwater at Ramsdell Quarry Landfill and the landfill is being closed; therefore, additional sampling of RQLmw-007, RQLmw-008, and RQLmw-009 is not recommended. The groundwater at Open Demolition Area #2 is being evaluated under a separate RI; consequently, monitoring wells DETmw-003 and DETmw-004 will be sampled semi-annually under the FWGWMP in 2021.

3.3 CERCLA WELLS

Selection of wells for the 2021 FWGWMP was made based on consideration of the following criteria:

- **FWGWMP Criterion 1**: Wells representing critical exit pathway monitoring points (i.e., located along the CJAG boundary or downgradient from AOC concentration areas).
 - Unconsolidated Aquifer: LL1mw-064, LL1mw-086, LL1mw-087, LL1mw-089, FWGmw-004, FWGmw-007, FWGmw-011, FWGmw-015
 - *Upper Sharon Aquifer*: LL2mw-059, FWGmw-012, FWGmw-016, FWGmw-020, FWGmw-021, FWGmw-024
 - Basal Sharon Conglomerate Aquifer: SCFmw-004, FWGmw-018.
- **FWGWMP Criterion 2**: Wells representing primary AOC-specific contaminant source area conditions routinely monitored or indicated to be potentially increasing or otherwise potentially unstable plume conditions.
 - Unconsolidated Aquifer: DETmw-003, DETmw-004, LL1mw-063, LL1mw-089, LL12mw-185, LL12mw-187, WBGmw-006, WBGmw-009
 - *Homewood Aquifer*: FBQmw-170, FBQmw-171, FBQmw-174, FBQmw-175
 - *Upper Sharon Aquifer*: LL1mw-080, LL1mw-081, LL1mw-083, LL1mw-084, LL3mw-237, LL3mw-238, LL3mw-239, LL3mw-241, LL10mw-003
 - Basal Sharon Conglomerate Aquifer: None currently proposed.
- **FWGWMP Criterion 3**: Co-located wells used to evaluate the vertical distribution of contaminants within the stratigraphic sequence (includes all wells installed to date).
 - *East of Ramsdell Quarry Landfill*: FWGmw-011 (Unconsolidated Aquifer), FWGmw-012 (Upper Sharon Aquifer)
 - Southeast of Load Line 1: LL1mw-087 (Unconsolidated Aquifer), SCFmw-004 (Basal Sharon Conglomerate Aquifer)
 - Post Boundary at Load Line 12: FWGmw-020 (Upper Sharon Aquifer), FWGmw-018 (Basal Sharon Conglomerate Aquifer)
 - Winklepeck Burning Grounds: WBGmw-009 (Unconsolidated Aquifer), WBGmw-020 (Upper Sharon Aquifer)
 - *Winklepeck Burning Grounds*: WBGmw-006 (Unconsolidated Aquifer), WBGmw-021 (Upper Sharon Aquifer)
 - *Post Boundary South of the CJAG Main Cantonment Area*: FWGmw-015 (Unconsolidated Aquifer), FWGmw-016 (Upper Sharon Aquifer).

- **FWGWMP Criterion 4**: Wells refining the CSM or contaminant distribution associated with the areas recommended for evaluation within the FS.
 - Winklepeck Burning Grounds: WBGmw-007, WBGmw-008, WBGmw-014, WBGmw-018, WGBmw-019
 - o Load Line 1: LL1mw-079, LL1mw-082, LL1mw-086, FWGmw-010
 - *Load Line 3*: LL3mw-245
 - o Load Line 12: LL12mw-244, LL12mw-245, LL12mw-246, FWGmw-018, FWGmw-020
 - Fuze and Booster Quarry: FBQmw-172, FBQmw-173; FWGmw-023

The list of analytes for 2021 reflects the potential COCs within certain areas or immediately downgradient from potential source areas, as appropriate. Table 3-1 provides a comprehensive summary of the proposed wells, 2020 results summary, and rationale for their inclusion in the 2021 FWGWMP sampling scheme. This table also presents results from wells sampled in 2020 that do not require additional analysis in 2021 (highlighted in gray). Figure 3-1 show the wells to be sampled during the 2021 FWGWMP.

The wells to be sampled in support of the FS (Criterion 4) will be sampled during the Spring 2021 sampling event. The remaining wells will be sampled semi-annually.

The refined analyte list is presented in Table 3-2. The analytical methods for these analytes are provided in Table 3-3. Evaluation of data collected during 2021 will be conducted in accordance with the Final FWGW RIWP, including the supporting SAP and QAPP updates (TEC-Weston 2016).

Table 3-1. Recommended FWGWMP	Wells for 2021
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No.	RVAAP-66 Area	Well Name	Aquifer	2020 FWGWMP Sampling Recommendations	2020 Sampling Results	2021 FWGV
	RVAAP-01 Ramsdell Quarry	RQLmw-007	Upper Sharon	 In the absence of VOCs, PAHs, phenols, PCBs, explosives, pesticides, cyanide, and phosphorus, additional sampling of these parameters is not warranted for the CERCLA investigation. However, in accordance with the DFFO, analytical parameters for this RCRA well in 2020 include VOCs, phthalates, PAHs, phenols, PCBs, explosives, pesticides, cyanide, phosphorus, and metals. 	 Phthalates, PAHs, phenols, PCBs, explosives, and pesticides were not detected. Phosphorus was detected at estimated concentrations of 0.031J mg/L in the primary sample and 0.033J mg/L in the field duplicate sample in Spring 2020 and at concentrations of 0.067 mg/L in the primary sample and 0.71 mg/L in the field duplicate sample in Fall 2020. Acetone was detected at a concentration of 80 µg/L in Spring 2020, below the MCL of 1,400 µg/L. Acetone was not detected in Fall 2020. All metals concentrations were below the screening level or background concentration, with the exception of arsenic, manganese, and nickel. Arsenic was detected at concentrations of 0.03 and 0.032 mg/L in the primary and field duplicate samples, respectively, in Fall 2020, exceeding the MCL of 0.01 mg/L. Arsenic was detected at estimated concentrations of 2.0J and 1.8J mg/L in the primary and field duplicate samples, was detected at a concentration of 2.3J mg/L in both the primary and field duplicate samples exceeded the background concentration of 0.039 mg/L. Nickel was detected at an estimated concentration of 0.039J mg/L in Spring 2020, at the RSL of 0.039 mg/L. Nickel did not exceed the RSL in Fall 2020. Cyanide was detected at low, estimated concentrations of 0.0056J and 0.0054J mg/L in the primary and field duplicate samples, respectively, in Fall 2020. 	 Additiona OHARNO Ramsdell Any curre Quarry La CERCLA this well i CERCLA
	RVAAP-01 Ramsdell Quarry	RQLmw-008	Upper Sharon	 In the absence of VOCs, phthalates, PAHs, phenols, PCBs, explosives, and pesticides, additional sampling of these parameters is not warranted for the CERCLA investigation. However, in accordance with the DFFO, analytical parameters for this RCRA well in 2020 include VOCs, phthalates, PAHs, phenols, PCBs, explosives, pesticides, cyanide, and metals. 	 VOCs, phthalates, phenols, PCBs, cyanide, explosives, and pesticides either were not detected or detected below screening criteria. All PAHs were below the screening level, with the exception of benzo(a)anthracene and dibenz(a,h)anthracene. Benz(a)anthracene was detected at a concentration of 0.2 μg/L in Fall 2020, exceeding the RSL of 0.03 μg/L. Benz(a)anthracene was not detected in Spring 2020. Dibenz(a,h)anthracene was detected at a concentration of 0.14 μg/L in Fall 2020, exceeding the RSL of 0.014 μg/L in Fall 2020, exceeding the RSL of 0.025 μg/L. Dibenz(a,h)anthracene was not detected in Spring 2020. All metals concentrations were below the screening level or background concentration, with the exception of arsenic and manganese. Arsenic was detected at a concentration of 0.016 mg/L in Spring 2020 and 0.03 mg/L in Fall 2020, exceeding the MCL of 0.01 mg/L. Manganese was detected at concentrations of 0.84 mg/L in Spring 2020 and 0.69J mg/L in Fall 2020, exceeding the background concentration of 0.198 mg/L. 	 Additiona OHARNO Ramsdell Any curre Quarry La CERCLA this well i CERCLA

WMP Sampling Recommendations al sampling is not recommended. G submitted the Final EOPCC for Quarry Landfill to the DMWM. ent and future sampling at Ramsdell andfill would be done to support the A process. Additional sampling of in 2021 is not needed to support A.	FWGWMP Sampling Criterion (See Section 3.3) NS
al sampling is not recommended. G submitted the Final EOPCC for Quarry Landfill to the DMWM. ent and future sampling at Ramsdell andfill would be done to support the A process. Additional sampling of in 2021 is not needed to support A.	NS

No.	RVAAP-66 Area	Well Name	Aquifer	2020 FWGWMP Sampling Recommendations	2020 Sampling Results	2021 FWGWMP Sampling Recommendations	FWGWMP Sampling Criterion (See Section 3.3)
	RVAAP-01 Ramsdell Quarry	RQLmw-009	Upper Sharon	 In the absence of VOCs, phthalates, PAHs, phenols, PCBs, explosives, and pesticides, additional sampling of these parameters is not warranted for the CERCLA investigation. However, in accordance with the DFFO, analytical parameters for this RCRA well in 2020 include VOCs, phthalates, PAHs, phenols, PCBs, explosives, pesticides, cyanide, and metals. 	 VOCs, phthalates, PAHs, phenols, PCBs, explosives, cyanide, and pesticides were not detected. All metals concentrations were below the screening level or background concentration, with the exception of manganese. Manganese was detected at an estimated concentration of 0.89J mg/L in Fall 2020, exceeding the background concentration of 0.198 mg/L. Manganese did not exceed screening criteria in Spring 2020. 	 Additional sampling is not recommended. OHARNG submitted the Final EOPCC for Ramsdell Quarry Landfill to the DMWM. Any current and future sampling at Ramsdell Quarry Landfill would be done to support the CERCLA process. Additional sampling of this well in 2021 is not needed to support CERCLA. 	NS
	RVAAP-01 Ramsdell Quarry	RQLmw-011	Upper Sharon	• In consideration of the pH anomalies, continue to monitor for anions, pH, and alkalinity.	 Nitrate, nitrite, and sulfide were not detected. Alkalinity does not have a screening level and was detected at 51 mg/L in Fall 2020 and not detected in Spring 2020. Sulfate does not have a screening level and was detected at an estimated concentration of 87J mg/L in both the primary and field duplicate samples from Spring 2020 and at an estimated concentration of 160J mg/L in both the primary and field duplicate samples in Fall 2020. pH was 4.01 S.U. in Spring 2020 and 5.73 S.U. in Fall 2020 at the time of sample collection. 	 Additional sampling is not recommended. The evaluation of pH in Ramsdell Quarry is addressed in the Draft RI Report (Leidos 2020b). OHARNG submitted the Final EOPCC for Ramsdell Quarry Landfill to the DMWM. Any current and future sampling at Ramsdell Quarry Landfill would be done to support the CERCLA process. Additional sampling of this well in 2021 is not needed to support CERCLA. 	NS
	RVAAP-01 Ramsdell Quarry	RQLmw-013	Upper Sharon	• In consideration of the pH anomalies, continue to monitor for anions, pH, and alkalinity.	 Alkalinity, nitrate, and nitrite were not detected. Sulfate does not have a screening level and was detected at concentrations of 140 mg/L in Spring 2020 and 160 mg/L in Fall 2020. Sulfide does not have a screening level and was detected at an estimated concentration of 0.8J mg/L in Fall 2020. Sulfide was not detected in Spring 2020. pH was 4.23 S.U. in Spring 2020 and 4.31 S.U. in Fall 2020 at the time of sample collection. 	 Additional sampling is not recommended. The evaluation of pH in Ramsdell Quarry is addressed in the Draft RI Report (Leidos 2020b). OHARNG submitted the Final EOPCC for Ramsdell Quarry Landfill to the DMWM. Any current and future sampling at Ramsdell Quarry Landfill would be done to support the CERCLA process. Additional sampling of this well in 2021 is not needed to support CERCLA. 	NS

No	RVAAP-66	Well Name	A anifor	2020 FWGWMP Sampling	2020 Sompling Desults	2021 EW/CW/MD Sompling Decommondations	FWGWMP Sampling Criterion
1	RVAAP-04 Open Demolition Area #2	DETmw-003	Unconsolidated	 In the absence of phthalates, nitroaromatics, SVOCs, phenols, PCBs, PAHs, explosives, or pesticides, additional sampling of these parameters is not warranted for the CERCLA investigation. However, in accordance with the DFFO, analytical parameters for this RCRA well in 2020 include VOCs, phthalates, PAHs, phenols, PCBs, explosives, pesticides, cyanide, and metals. 	 Phthalates, nitroaromatics, SVOCs, PCBs, explosives, or pesticides were not detected. All VOC concentrations were below the screening level, with the exception of methylene chloride. Methylene chloride was detected at concentrations of 7.7 and 7.8 μg/L in the primary and field duplicate samples in Fall 2020, exceeding the MCL of 5 μg/L. Methylene chloride was not detected in Spring 2020. Cyanide was detected at a low, estimated concentration below the screening level in Spring 2020. Cyanide was not detected in Fall 2020. Phenol was detected at a low, estimated concentration, below the screening level in Spring 2020. Phenol was not detected in Fall 2020. All metals concentrations were below the screening level or background concentration, with the exception of arsenic and manganese. Arsenic was detected at a concentration of 0.013 mg/L in Fall 2020, exceeding the MCL of 0.01 mg/L. Arsenic did not exceed the screening level in Spring 2020. Manganese was detected at an estimated concentration of 0.26J mg/L in Spring 2020 and 0.25 mg/L in Fall 2020, exceeding the background concentration of 0.075 mg/L 	In accordance with the DFFO, analytical parameters for this well in 2021 include VOCs, phthalates, PAHs, phenols, PCBs, explosives, pesticides, cyanide, and metals.	2
2	RVAAP-04 Open Demolition Area #2	DETmw-004	Unconsolidated	• In accordance with the DFFO, analytical parameters for this RCRA well in 2020 include VOCs, phthalates, PAHs, phenols, PCBs, explosives, pesticides, cyanide, and metals.	 VOCs, phthalates, nitroaromatics, PAHs, PCBs, and pesticides were not detected. Cyanide was detected at a low, estimated concentration, below the screening level in Spring 2020. Cyanide was not detected in Fall 2020. Phenol was detected at a low concentration, below the screening level, in Spring 2020. Phenol was not detected in Fall 2020. All metals concentrations were below the screening level or background concentration, with the exception of manganese. Manganese was detected at an estimated concentration of 0.42J mg/L in Fall 2020, exceeding the background concentration in Spring 2020. All explosives concentrations were below the screening level, with the exception of RDX. RDX was detected at a concentration of 1.5 μg/L in Spring 2020, exceeding the RSL of 0.97 μg/L. RDX was not detected in Fall 2020. 	• In accordance with the DFFO, analytical parameters for this well in 2021 include VOCs, phthalates, PAHs, phenols, PCBs, explosives, pesticides, cyanide, and metals.	2
3	RVAAP-05 Winklepeck Burning Grounds	WBGmw-006	Unconsolidated	Continue to monitor for explosives.	 All explosives concentrations were below the screening level, with the exception of RDX. RDX was detected at concentrations of 13 μg/L in Spring 2020 and estimated at 7.4J μg/L in Fall 2020, exceeding the RSL of 0.97 μg/L. 	Continue to monitor for explosives.	2, 3
4	RVAAP-05 Winklepeck Burning Grounds	WBGmw-007	Unconsolidated	• Not sampled in 2020.	• Not sampled in 2020.	• Monitor for explosives to support the FS.	4
5	RVAAP-05 Winklepeck Burning Grounds	WBGmw-008	Unconsolidated	• Not sampled in 2020.	• Not sampled in 2020.	Monitor for explosives to support the FS.	4

No.	RVAAP-66 Area	Well Name	Aquifer	2020 FWGWMP Sampling Recommendations	2020 Sampling Results	2021 FWGWMP Sampling Recommendations	FWGWMP Sampling Criterion (See Section 3.3)
6	RVAAP-05 Winklepeck Burning Grounds	WBGmw-009	Unconsolidated	Continue to monitor for explosives.	 All explosives concentrations were below the screening level, with the exception of RDX. RDX was detected at concentrations of 1.9 µg/L in Spring 2020 and 3.9 µg/L in Fall 2020, exceeding the RSL of 0.97 µg/L. 	Continue to monitor for explosives.	2, 3
7	RVAAP-05 Winklepeck Burning Grounds	WBGmw-014	Unconsolidated	• Not sampled in 2020.	• Not sampled in 2020.	• Monitor for explosives to support the FS.	4
8	RVAAP-05 Winklepeck Burning Grounds	WBGmw-018	Unconsolidated	• Not sampled in 2020.	• Not sampled in 2020.	• Monitor for explosives to support the FS.	4
9	RVAAP-05 Winklepeck Burning Grounds	WBGmw-019	Upper Sharon	• Not sampled in 2020.	• Not sampled in 2020.	• Monitor for explosives to support the FS.	4
10	RVAAP-05 Winklepeck Burning Grounds	WBGmw-020	Upper Sharon	• Continue to monitor for explosives.	Explosives were not detected.	Continue to monitor for explosives.	3
11	RVAAP-05 Winklepeck Burning Grounds	WBGmw-021	Upper Sharon	• Continue to monitor for explosives.	Explosives were not detected.	Continue to monitor for explosives.	3
12	RVAAP-08 Load Line 1	LL1mw-063	Unconsolidated	 Continue to monitor for explosives. In consideration of the pH anomalies, continue to monitor for anions, pH, and alkalinity. 	 All explosives either were not detected or detected below the screening level. Nitrite was not detected. Nitrate was detected at concentrations of 0.7 mg/L in Spring 2020 and 0.22J mg/L in Fall 2020, below the MCL of 10 mg/L. Alkalinity does not have a screening level, but was detected at a concentration of 6.1J mg/L in Spring 2020. Alkalinity was not detected in Fall 2020. Sulfate does not have a screening level, but was detected at a concentrations of 100 mg/L in Spring 2020 and 73 mg/L in Fall 2020. Sulfate does not have a screening level, but was detected at an estimated concentration of 1.6J mg/L in Fall 2020. Sulfide was not detected in Spring 2020. pH was 4.82 S.U. in Spring 2020 and was not measured in Fall 2020 because the well was dry. 	Continue to monitor for explosives.	2
13	RVAAP-08 Load Line 1 (east of Load Line 1 fence)	LL1mw-064	Unconsolidated	• Continue to monitor for explosives and metals to monitor migration potential.	 All explosives either were not detected or detected below the screening level. All metals concentrations were below the screening level or background concentration with the exception of manganese. Manganese was detected at concentrations of 0.12 mg/L in Spring 2020 and 0.15J mg/L in Fall 2020, exceeding the background concentration of 0.075 mg/L. 	Continue to monitor for explosives in this exit pathway well.	1
14	RVAAP-08 Load Line 1	LL1mw-079	Upper Sharon	• Not sampled in 2020.	• Not sampled in 2020.	• Monitor for explosives to support the FS.	4

No.	RVAAP-66 Area	Well Name	Aquifer	2020 FWGWMP Sampling Recommendations	2020 Sampling Results	2021 FWGW
15	RVAAP-08 Load Line 1	LL1mw-080	Upper Sharon	Continue to monitor for explosives.	• All explosives concentrations were below the screening level, with the exception of RDX and 1,3-DNB. RDX was detected at concentrations of 11 μ g/L in Spring 2020 and 20 μ g/L in Fall 2020, exceeding the RSL of 0.97 μ g/L. 1,3-DNB was detected at an estimated concentration of 1.3J μ g/L in Fall 2020, exceeding the RSL of 0.2 μ g/L. 1,3-DNB did not exceed screening criteria in Spring 2020.	• Continue
16	RVAAP-08 Load Line 1	LL1mw-081	Upper Sharon	• Continue to monitor for explosives.	• All explosives concentrations either were not detected or detected below the screening level.	Continue
17	RVAAP-08 Load Line 1	LL1mw-082	Upper Sharon	• Not sampled in 2020.	• Not sampled in 2020.	• Monitor for (Please note the sampled in the inability to sam been selected
18	RVAAP-08 Load Line 1	LL1mw-083	Upper Sharon	Continue to monitor for explosives, anions, and alkalinity.	 Nitrite, sulfide, and alkalinity were not detected. Nitrate was detected at estimated concentrations of 0.43J mg/L in Spring 2020 and 0.26J mg/L in Fall 2020, below the MCL of 10 mg/L. Sulfate does not have a screening level and was detected at concentrations of 100 mg/L in Spring 2020 and 120 mg/L in Fall 2020. All explosives were below the screening level, with the exception of TNT; 1,3-DNB; 2,4-DNT; 2-amino-4,6-DNT and 4-amino-2,6-DNT. TNT was detected at an estimated concentration of 1.4J μg/L in Spring 2020, exceeding the RSL of 0.98 μg/L. TNT was not detected in Fall 2020. 1,3-DNB was detected at estimated concentrations of 0.78J μg/L in Spring 2020 and 0.89J μg/L in Fall 2020, exceeding the RSL of 0.2 μg/L. 2,4-DNT was detected at an estimated concentration of 2J μg/L in Spring 2020, exceeding the RSL of 0.2 μg/L. 2,4-DNT was detected at an estimated concentration of 2J μg/L in Spring 2020, exceeding the RSL of 3.9 μg/L. 2-Amino-4,6-DNT was not detected in Fall 2020, exceeding the RSL of 3.9 μg/L. 2-Amino-4,6-DNT was not detected in Fall 2020, exceeding the RSL of 3.9 μg/L. 2-Amino-4,6-DNT was not detected in Fall 2020, exceeding the RSL of 3.9 μg/L. 10 Spring 2020, exceeding the RSL of 3.9 μg/L in Spring 2020, exceeding the RSL of 3.9 μg/L. 2-Amino-4,6-DNT was not detected in Fall 2020, exceeding the RSL of 3.9 μg/L. 2-Amino-4,6-DNT was not detected in Fall 2020, exceeding the RSL of 3.9 μg/L. 2-Amino-4,6-DNT was not detected in Fall 2020, exceeding the RSL of 3.9 μg/L. 3.9 μg/L in Spring 2020, exceeding the RSL of 3.9 μg/L in Spring 2020, exceeding the RSL of 3.9 μg/L in Spring 2020, exceeding the RSL of 3.9 μg/L in Spring 2020, exceeding the RSL of 3.9 μg/L in Spring 2020, exceeding the RSL of 3.9 μg/L. 4-Amino-2,6-DNT was not detected in Fall 2020. 	• Continue
19	RVAAP-08 Load Line 1	LL1mw-084	Upper Sharon	Continue to monitor for explosives.	 All explosives were below the screening level, with the exception of 1,3-DNB, TNT, 2,4-DNT, 2-amino-4,6-DNT, 4-amino-2,6-DNT, and RDX. 1,3-DNB was detected at an estimated concentration of 0.65J µg/L in Spring 2020, exceeding the RSL of 0.2 µg/L. 1,3-DNB was not detected in Fall 2020. TNT was detected at concentrations of 2.3 µg/L in Spring 2020 and 3.4 µg/L in Fall 2020, exceeding the RSL of 0.98 µg/L. 2,4-DNT was detected at concentrations of 0.64J µg/L in Spring 2020 and 1.3 µg/L in Fall 2020, exceeding the RSL of 0.24 µg/L. 2-Amino-4,6-DNT was detected at concentrations of 7.3 µg/L in Spring 2020 and 8.1 µg/L in Fall 2020, exceeding the RSL of 3.9 µg/L. 4-Amino-2,6-DNT was detected at concentrations of 17 µg/L in both Spring and Fall 2020, exceeding the RSL of 3.9 µg/L. RDX was detected at an extension of 12.00 mg/L. 	• Continue

	FWGWMP
	Sampling Criterion
WMP Sampling Recommendations	(See Section 3.3)
e to monitor for explosives	2
to monitor for expressives.	-
· · · · · · · · · · · · · · · · · · ·	2
e to monitor for explosives.	2
	4
for explosives to support the FS.	4
hat LL1mw-085 was proposed to be	
e Draft 2021 Addendum. Due to the	
mple LL1mw-085, LL1mw-082 has	
for sampling to support the FS.)	
e to monitor for explosives.	2
_	
e to monitor for explosives.	2

RVAAP-66 2020 FWGWMP Sampling Well Name 2021 FWGV No. Aquifer Recommendations **2020 Sampling Results** Area estimated concentration of 2.3J µg/L in Spring 2020, exceeding the RSL of 0.97 µg/L. RDX was not detected in Fall 2020. RVAAP-08 Load LL1mw-086 20 Unconsolidated • In consideration of the pH • Nitrate, nitrite, and sulfide were not detected. Monitor Line 1 anomalies, continue to monitor for • Alkalinity does not have a screening level, but was detected at well. Alth (southeast of anions, pH, manganese, and concentrations of 190 mg/L in Spring 2020 and 170 mg/L in screening Load Line 1 alkalinity. Fall 2020. sampling fence) • Sulfate does not have a screening level, but was detected at a support of concentration of 89 mg/L in Spring 2020 and an estimated concentration of 87J mg/L in Fall 2020. • Manganese was the only metal sampled and was detected at concentrations of 0.45 mg/L (dissolved) and 0.57 mg/L (total) in Spring 2020, exceeding the background concentration of 0.075 mg/L. This well was not sampled for metals in Fall 2020. • pH was 7.53 S.U. in Spring 2020 and 7.27 S.U. in Fall 2020 at the time of sample collection. RVAAP-08 Load LL1mw-087 21 Unconsolidated • Explosives were not detected. • Continue to monitor for explosives • Continue Line 1 and metals to monitor migration. • All metals concentrations were below the screening level or pathway (southeast of • Analyze for perchlorate, as this is background concentration, with the exception of manganese. Load Line 1 identified as a potential data gap in Manganese was detected at an estimated concentration of fence) the RIWP (TEC-Weston 2016). 0.27J mg/L in Fall 2020, exceeding the background concentration of 0.075 mg/L. Manganese did not exceed the background concentration in Spring 2020. • Perchlorate was detected at concentrations below the RSL in both Spring and Fall 2020. 22 RVAAP-08 Load LL1mw-089 Unconsolidated • Explosives either were not detected or detected below screening • Continue to monitor for explosives • Continue Line 1 and metals in this exit pathway well. levels. pathway • In consideration of the pH anomalies, • Nitrite and sulfide were not detected. continue to monitor for anions, pH, • Nitrate was detected at an estimated concentration of 0.12J mg/L in and alkalinity. Spring 2020, below the MCL of 10 mg/L. Nitrate was not detected Fall 2020. • Alkalinity does not have a screening level, but was detected at estimated concentrations of 8.8J mg/L in Spring 2020 and 6.3J mg/L in Fall 2020. • Sulfate does not have a screening level, but was detected at concentrations of 25 mg/L in Spring 2020 and 26 mg/L in Fall 2020. • All metals concentrations were below the screening level or background concentration. • pH was 4.59 S.U. in Spring 2020 and 4.93 S.U. in Fall 2020 at the time of sample collection. 23 RVAAP-09 Load LL2mw-059 Upper Sharon • All explosives concentrations were below screening levels with the • Continue • Continue to monitor for explosives. Line 2 exceptions of 1,3-DNB and 2,4-DNT. 1,3-DNB was detected at an South estimated concentration of 0.6J µg/L in Fall 2020, exceeding the RSL of 0.2 µg/L. 1,3-DNB was not detected in Spring 2020. 2,4-DNT was detected at a concentration of 0.47 µg/L in Spring 2020 and 0.5 μ g/L in Fall 2020, exceeding the RSL of 0.24 μ g/L.

	FWGWMP
WMP Sampling Recommendations	(See Section 3.3)
for explosives in this exit pathway hough no historical exceedances of glevels have been detected, ongoing for explosives is recommended in f the FS.	1, 4
to monitor for explosives in this exit well.	1, 3
to monitor for explosives in this exit well.	1, 2
e to monitor for explosives.	1

	RVAAP-66			2020 FWGWMP Sampling			FWGWMP Sampling Criterion
No.	Area	Well Name	Aquifer	Recommendations	2020 Sampling Results	2021 FWGWMP Sampling Recommendations	(See Section 3.3)
	RVAAP-09 Load Line 2	LL2mw-267	Upper Sharon	 Continue to monitor for explosives. Although explosives never exceeded their screening levels in 2019, explosive exceedances were in the 2011-2016 datasets. 	 All explosives concentrations were below screening levels. Manganese was the only metal sampled and was detected at an estimated concentration of 0.56J mg/L in Spring 2020, exceeding the background concentration of 0.198 mg/L. Manganese was not analyzed in Fall 2020. 	 Additional sampling is not recommended. Explosives have not exceeded their screening levels during the last eight semi-annual sampling events (2017 through 2020). 	NS
24	RVAAP-10 Load Line 3	LL3mw-237	Upper Sharon	• Continue to monitor for explosives.	• All explosives concentrations either were not detected or detected below screening levels.	• Continue to monitor for explosives.	2
25	RVAAP-10 Load Line 3	LL3mw-238	Upper Sharon	 Monitor for explosives. Provide supplemental data for the RI regarding explosives at Load Line 3. 	• All explosives concentrations were below screening levels with the exceptions of TNT, 2-amino-4,6-DNT, 4-amino-2,6-DNT, and RDX. TNT was detected at concentrations of 24 μ g/L in Spring 2020 and 48 μ g/L in Fall 2020, exceeding the RSL of 0.98 μ g/L. 2-Amino-4,6-DNT was detected at a concentration of 6.6 μ g/L in Spring 2020 and an estimated concentration of 8.3J μ g/L in Fall 2020, exceeding the RSL of 3.9 μ g/L. 4-Amino-2,6-DNT was detected at concentrations of 15 μ g/L in Spring 2020 and 31 μ g/L in Fall 2020, exceeding the RSL of 3.9 μ g/L. RDX was detected at a concentration of 3 μ g/L in Spring 2020 and an estimated concentration of 8.51 μ g/L in Fall 2020, exceeding the RSL of 3.9 μ g/L. RDX was detected at a concentration of 3 μ g/L in Spring 2020 and an estimated concentration of 2.7J μ g/L in Fall 2020, exceeding the RSL of 0.97 μ g/L.	• Continue to monitor for explosives.	2
26	RVAAP-10 Load Line 3	LL3mw-239	Upper Sharon	 Monitor for explosives. Provide supplemental data for the RI regarding explosives at Load Line 3. 	 All explosives concentrations were below screening levels with the exception of RDX. RDX was detected at concentrations of 1.1 μg/L in Spring 2020 and 1.5 μg/L in Fall 2020, exceeding the RSL of 0.97 μg/L. 	• Continue to monitor for explosives.	2
27	RVAAP-10 Load Line 3	LL3mw-241	Upper Sharon	 Monitor for explosives. Provide supplemental data for the RI regarding explosives at Load Line 3. 	 All explosives concentrations were below screening levels with the exception of TNT and RDX. TNT was detected at concentrations of 5.4 µg/L in Spring 2020 and 2J µg/L in Fall 2020, exceeding the RSL of 0.98 µg/L. RDX was detected at a concentration of 1 µg/L in Spring 2020, exceeding the RSL of 0.97 µg/L. RDX did not exceed the screening level in Fall 2020. 	• Continue to monitor for explosives.	2
28	RVAAP-10 Load Line 3	LL3mw-245	Upper Sharon	• Not sampled in 2020.	• Not sampled in 2020.	• Monitor for explosives to support the FS.	4
29	RVAAP-12 Load Line 12	LL12mw-185	Unconsolidated	 Continue to monitor for nitrate. Analyze for ammonia to provide supplemental data for the RI. 	 Nitrate was detected at concentrations of 69 mg/L in Spring 2020 and 74 mg/L in Fall 2020, exceeding the MCL of 10 mg/L. Ammonia does not have a screening level, but was detected at an estimated concentration of 0.038J mg/L in Fall 2020. Ammonia was not detected in Spring 2020. 	• Continue to monitor for nitrate and ammonia.	2
30	RVAAP-12 Load Line 12	LL12mw-187	Unconsolidated	 Continue to monitor for nitrate. Analyze for ammonia to provide supplemental data for the RI. 	 Nitrate was detected at an estimated concentration of 1,600J mg/L in Spring 2020, exceeding the MCL of 10 mg/L. Nitrate was not detected in Fall 2020. Ammonia does not have a screening level, but was detected at concentrations of 720 mg/L in Spring 2020 and 11 mg/L in Fall 2020. 	• Continue to monitor for nitrate and ammonia.	2
31	RVAAP-12 Load Line 12	LL12mw-244	Unconsolidated	• Not sampled in 2020.	• Not sampled in 2020.	• Monitor for nitrate and ammonia to support the FS.	4
32	RVAAP-12 Load Line 12	LL12mw-245	Unconsolidated	• Not sampled in 2020.	• Not sampled in 2020.	• Monitor for nitrate and ammonia to support the FS.	4
33	RVAAP-12 Load Line 12	LL12mw-246	Unconsolidated	• Not sampled in 2020.	• Not sampled in 2020.	• Monitor for nitrate and ammonia to support the FS.	4

No.	RVAAP-66 Area	Well Name	Aquifer	2020 FWGWMP Sampling Recommendations	2020 Sampling Results	2021 FWGWMP Sampling Recommendations	FWGWMP Sampling Criterion (See Section 3.3)
110.	RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-168	Unconsolidated	 Monitor for explosives. Most recent sample for explosives analysis was October 2016. Historical concentrations are all below screening levels. 	Explosives were not detected.	 Additional sampling is not recommended. Explosives concentrations have not exceeded their screening levels during the FWGMWP sampling events (2003 to 2020). 	NS
34	RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-170	Homewood	 Monitor for explosives. Most recent sample for explosives analysis was October 2011. Historical concentrations are all below screening levels. 	• Explosives were not detected.	• Continue to monitor for explosives.	2
35	RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-171	Homewood	 Monitor for explosives. Most recent sample for explosives analysis was October 2011. Historical concentrations are all below screening levels. 	 Explosives were not detected. pH was 5.80 S.U. in Spring 2020 and 5.70 S.U. in Fall 2020 at the time of sample collection. 	• Continue to monitor for explosives.	2
36	RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-172	Homewood	• Not sampled in 2020.	• Not sampled in 2020.	• Monitor for explosives to support the FS.	4
37	RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-173	Homewood	• Not sampled in 2020.	• Not sampled in 2020.	• Monitor for explosives to support the FS.	4
38	RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-174	Homewood	Continue to monitor for explosives.	 All explosives were below screening levels, with the exception of TNT, 2,4-DNT, 2-amino-4,6-DNT, 4-amino-2,6-DNT, and RDX. TNT was detected at concentrations of 16 µg/L in Spring 2020 and 2.3J µg/L in Fall 2020, exceeding the RSL of 0.98 µg/L. 2,4-DNT was detected at a concentration of 0.47 µg/L in Spring 2020, exceeding the RSL of 0.24 µg/L. 2,4-DNT was not detected in Fall 2020. 2-amino-2,4-DNT was detected at concentrations of 18 µg/L in Spring 2020 and 9J µg/L in Fall 2020, exceeding the RSL of 3.9 µg/L. 4-Amino-2,6-DNT was detected at concentrations of 18 µg/L in Spring 2020 and 22J µg/L in Fall 2020, exceeding the RSL of 3.9 µg/L. RDX was detected at an estimated concentration of 1J µg/L in Spring 2020, exceeding the RSL of 0.97 µg/L. RDX was not detected in Fall 2020. pH was 4.05 S.U. in Spring 2020 and 5.57 S.U. in Fall 2020 at the time of sample collection. 	Continue to monitor for explosives.	2
39	RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-175	Homewood	Monitor for explosives.	 Explosives were not detected. pH was 4.27 S.U. in Spring 2020 and 5.51 S.U. in Fall 2020 at the time of sample collection. 	Continue to monitor for explosives.	2
	RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-176	Unconsolidated	Monitor for explosives.	• Explosives were not detected.	 Additional sampling is not recommended. Explosives concentrations have not exceeded their screening levels during the FWGMWP sampling events (2003 to 2020). 	NS

No.	RVAAP-66 Area	Well Name	Aquifer	2020 FWGWMP Sampling Recommendations	2020 Sampling Results	2021 FWGWMP Sampling Recommendations	FWGWMP Sampling Criterion (See Section 3.3)
	RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-177	Unconsolidated	 Monitor for explosives. Most recent sample for explosives analysis was October 2011. Historical concentrations are all below screening levels. 	• Explosives were not detected.	 Additional sampling is not recommended. Explosives concentrations have not exceeded their screening levels during the FWGMWP sampling events (2003 to 2020). 	NS
40	RVAAP-43 Load Line 10	LL10mw-003	Homewood	• Continue to monitor for carbon tetrachloride to verify recent reduced concentrations.	• Carbon tetrachloride was detected at concentrations of 1.3J µg/L in Spring 2020 and 2.6 µg/L in Fall 2020, below the MCL of 5 µg/L.	• Continue to monitor for carbon tetrachloride to verify recent reduced concentrations.	2
41	RVAAP-66 Facility-wide Groundwater (southern portion of Administration Area)	FWGmw-004	Unconsolidated	• Continue to monitor for explosives and metals in this exit pathway well.	 Explosives were not detected. All metals were below the screening level or background concentration. 	• Continue to monitor for explosives in this exit pathway well.	1
42	RVAAP-66 Facility-wide Groundwater (southwestern portion of facility, south of NACA Test Area)	FWGmw-007	Unconsolidated	• Continue to monitor for explosives and metals in this exit pathway well.	 Explosives were not detected. All metals concentrations were below the screening level or background concentration with the exception of manganese. Manganese was detected at concentrations of 0.21 mg/L in Spring 2020 and 0.22 mg/L in Fall 2020, exceeding the background concentration of 0.075 mg/L. 	• Continue to monitor for explosives in this exit pathway well.	1
43	RVAAP-66 Facility-wide Groundwater (in DLA Main Ore Storage Area)	FWGmw-010	Unconsolidated	• Not sampled in 2020.	• Not sampled in 2020.	Monitor for explosives to support the FS.	4
44	RVAAP-66 Facility-wide Groundwater (near East Classification Yard)	FWGmw-011	Unconsolidated	• Continue to monitor for explosives and metals in this exit pathway well.	 All explosives concentrations were below screening levels with the exception of 4-nitrotoluene. 4-Nitrotoluene was detected at a concentration of 17 µg/L in Spring 2020, exceeding the screening level of 5.01 µg/L. 4-Nitrotoluene was not detected in Fall 2020. All metals concentrations were below the screening level or background concentration, with the exception of manganese. Manganese was detected at concentrations of 0.29J mg/L in Spring 2020 and 0.24 mg/L in Fall 2020, exceeding the background concentration of 0.075 mg/L. 	Continue to monitor for explosives in this exit pathway well.	1, 3
45	RVAAP-66 Facility-wide Groundwater (near East Classification Yard)	FWGmw-012	Upper Sharon	• Continue to monitor for explosives and metals in this exit pathway well.	 All explosives concentrations were below screening levels with the exception of 4-nitrotoluene. 4-Nitrotoluene was detected at a concentration of 11 µg/L in Spring 2020, exceeding the screening level of 5.01 µg/L. 4-Nitrotoluene was not detected in Fall 2020. All metals concentrations were below the screening level or background concentration. 	• Continue to monitor for explosives in this exit pathway well.	1, 3

No	RVAAP-66	Well Name	Aquifor	2020 FWGWMP Sampling Recommendations	2020 Sampling Results	2021 FWCWMP Sampling Recommendations	Sampling Criterion
46	RVAAP-66 Facility-wide Groundwater (southeast of Administration Area)	FWGmw-015	Unconsolidated	Continue to monitor for explosives and metals in this exit pathway well.	 Explosives were not detected. All metals concentrations were below the screening level or background concentration, with the exception of manganese. Manganese was detected at an estimated concentration of 0.54J mg/L in Fall 2020, exceeding the background concentration of 0.075 mg/L. Manganese did not exceed the screening level in Spring 2020. 	 Continue to monitor for explosives in this exit pathway well. 	1, 3
47	RVAAP-66 Facility-wide Groundwater (southeast of Administration Area)	FWGmw-016	Upper Sharon	• Continue to monitor for explosives and metals in this exit pathway well.	 Explosives were not detected. All metals concentrations were below the screening level or background concentration with the exception of manganese. Manganese was detected at concentrations of 0.22 mg/L in Spring 2020 and 0.20J mg/L in Fall 2020, exceeding the background concentration of 0.198 mg/L. 	• Continue to monitor for explosives in this exit pathway well.	1, 3
48	RVAAP-66 Facility-wide Groundwater (off-facility, south of State Route 5, south of Load Line 12)	FWGmw-018	Basal Sharon	• Continue to monitor for VOCs and metals in this exit pathway well.	 VOCs were not detected. All metals concentrations were below the screening level or background concentration. 	• Continue to monitor for VOCs in this exit pathway well. Monitor for nitrates to support the FS.	1, 3, 4
49	RVAAP-66 Facility-wide Groundwater (off-facility, south of State Route 5, south of Load Line 12)	FWGmw-020	Upper Sharon	• Continue to monitor for VOCs and metals in this exit pathway well.	 VOCs were not detected. All metals concentrations were below the screening level or background concentration with the exception of arsenic. Arsenic was detected at concentrations of 0.045 mg/L in the dissolve arsenic sample and 0.044 mg/L in the total arsenic sample in Spring 2020 and 0.029 mg/L in Fall 2020, exceeding the MCL of 0.01 mg/L. 	• Continue to monitor for VOCs in this exit pathway well. Monitor for nitrates to support the FS.	1, 3, 4
50	RVAAP-66 Facility-wide Groundwater (off-facility, south of State Route 5, south of Load Line 3)	FWGmw-021	Upper Sharon	• Continue to monitor for explosives and metals in this exit pathway well.	 All explosives concentrations were below the screening level. All metals concentrations were below the screening level or background concentration with the exception of manganese. Manganese was detected at estimated concentrations of 0.61J mg/L in the primary sample and 0.62J mg/L in the field duplicate sample in Spring 2020. Manganese was detected at estimated concentrations of 0.64J mg/L in the primary sample and 0.65J mg/L in the field duplicate sample in Fall 2020. All concentrations exceeded the background concentration of 0.198 mg/L. 	• Continue to monitor for explosives in this exit pathway well.	1
51	RVAAP-66 Facility-wide Groundwater (downgradient of Fuze and Booster Quarry Landfill/Ponds)	FWGmw-023	Upper Sharon	• Not sampled in 2020.	• Not sampled in 2020.	• Monitor for explosives to support the FS.	4
52	RVAAP-66 Facility-wide Groundwater (off-facility, south of State Route 5, south of Load Line 2)	FWGmw-024	Upper Sharon	• Continue to monitor for explosives and metals in this exit pathway well.	 Explosives were not detected. All metals concentrations were below the screening level or background concentration with the exception of manganese. Manganese was detected at estimated concentrations of 0.33J mg/L in Spring 2020 and 0.28J mg/L in Fall 2020, exceeding the background concentration of 0.198 mg/L. 	• Continue to monitor for explosives in this exit pathway well.	1

No.	RVAAP-66 Area	Well Name	Aquifer	2020 FWGWMP Sampling Recommendations	2020 Sampling Results	2021 FWGWMP Sampling Recommendations	FWGWMP Sampling Criterion (See Section 3.3)
53	RVAAP-66 Facility-wide Groundwater (southeastern portion of facility)	SCFmw-004	Basal Sharon	• Continue to monitor for explosives and metals in this exit pathway well.	 Explosives were not detected. All metals concentrations were below the screening level or background concentration. 	• Continue to monitor for explosives in this exit pathway well.	1, 3

	Denotes wells whe
	Denotes wells that

ere additional sampling is not recommended.

t were not sampled in 2020.

Table does not include a discussion of essential nutrients (calcium, chloride, iodine, iron, magnesium, potassium, phosphorus, and sodium).

CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act

DFFO = Director's Final Findings and Orders

DLA = Defense Logistics Agency

DNB = Dinitrobenzene

DNT = Dinitrotoluene

DMWM = Division of Materials and Waste Management

EOPCC = End of Post Closure Care Certification

FS = Feasibility Study

FWGWMP = Facility-wide Groundwater Monitoring Plan

MCL = Maximum Contaminant Level

mg/L = Milligrams per Liter

MNA = Monitored Natural Attenuation

NACA = National Advisory Committee on Aeronautics

NS = No Sampling Recommended

PAH = Polycyclic Aromatic Hydrocarbon PCB = Polychlorinated Biphenyl

RA = Resident Adult Facility-wide Cleanup Goal

RDX = Hexahydro-1,3,5-Trinitro-1,3,5-Triazine

RI = Remedial Investigation

RIWP = Remedial Investigation Work Plan

RSL = Regional Screening Level

RVAAP = Ravenna Army Ammunition Plant

S.U. = Standard Unit

SVOC = Semivolatile Organic Compound

TNT = 2,4,6-Trinitrotoluene

VOC = Volatile Organic Compound

 $\mu g/L = Micrograms per Liter$

Table 3-2. FWGWMP Wells with Analytical Testing Suite

						Expanded							MNA	
No.	RVAAP-66 Area	Well Name	Aquifer	Metals	Explosives	Explosives (1)	VOCs	SVOCs (2)	PCBs	Pesticides	Cyanide	Nitrate	Suite (3)	Other
1	RVAAP-04 Open Demolition Area #2	DETmw-003	Unconsolidated	Х	X		Х	X	Х	Х	Х			
2	RVAAP-04 Open Demolition Area #2	DETmw-004	Unconsolidated	Х	Х		Х	Х	Х	Х	Х			
3	RVAAP-05 Winklepeck Burning Grounds	WBGmw-006	Unconsolidated		Х	Х							Х	
4	RVAAP-05 Winklepeck Burning Grounds	WBGmw-007	Unconsolidated		Х	Х								
5	RVAAP-05 Winklepeck Burning Grounds	WBGmw-008	Unconsolidated		Х	Х								
6	RVAAP-05 Winklepeck Burning Grounds	WBGmw-009	Unconsolidated		Х	Х								
7	RVAAP-05 Winklepeck Burning Grounds	WBGmw-014	Unconsolidated		Х	Х								
8	RVAAP-05 Winklepeck Burning Grounds	WBGmw-018	Unconsolidated		Х	Х							Х	
9	RVAAP-05 Winklepeck Burning Grounds	WBGmw-019	Upper Sharon		Х	Х								
10	RVAAP-05 Winklepeck Burning Grounds	WBGmw-020	Upper Sharon		X	X								
11	RVAAP-05 Winklepeck Burning Grounds	WBGmw-021	Upper Sharon		X	X								
12	RVAAP-08 Load Line 1	LL1mw-063	Unconsolidated		X	X								
13	RVAAP-08 Load Line 1	LL1mw-064	Unconsolidated		X	X								
14	RVAAP-08 Load Line 1	LL1mw-079	Upper Sharon		X	X							Х	
15	RVAAP-08 Load Line 1	LL1mw-080	Upper Sharon		X	X								
16	RVAAP-08 Load Line 1	LL1mw-081	Upper Sharon		X	X								
17	RVAAP-08 Load Line 1	LL1mw-082	Upper Sharon		X	X								
18	RVAAP-08 Load Line 1	LL1mw-083	Upper Sharon		X	X								
19	RVAAP-08 Load Line 1	LL1mw-084	Upper Sharon		X	X							X	
20	RVAAP-08 Load Line 1	LL1mw-086	Unconsolidated		X	X								
20	RVAAP-08 Load Line 1	LL1mw-087	Unconsolidated		X	X								
21	RVAAP-08 Load Line 1	LL1mw-089	Unconsolidated		X	X								
22	RVAAP-09 Load Line 2	LL2mw-059	Upper Sharon		X	11								
23	RVAAP-10 Load Line 3	LL3mw-237	Upper Sharon		X	x								
25	RVAAP-10 Load Line 3	LL3mw-238	Upper Sharon		X	X							x	
25	RVAAP-10 Load Line 3	LL3mw-239	Upper Sharon		X	X							X	
20	RVAAP-10 Load Line 3	LL3mw-241	Upper Sharon		X	X							<u></u>	
28	RVAAP-10 Load Line 3	LL3mw-245	Upper Sharon		X	X								
20	RVAAP-12 Load Line 12	LL12mw-185	Unconsolidated			11						x		Ammonia
30	RVAAP-12 Load Line 12	LL12mw-187	Unconsolidated									X		Ammonia
31	RVAAP-12 Load Line 12	LL12mw-244	Unconsolidated									X		Ammonia
32	RVAAP-12 Load Line 12	LL12mw-245	Unconsolidated									X		Ammonia
33	RVAAP-12 Load Line 12	LL12mw-246	Unconsolidated									X		Ammonia
34	RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBOmw-170	Homewood		X	x						21		7 minioma
35	RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBOmw-171	Homewood		X	X								
36	RVA AP-16 Fuze and Booster Quarry Landfill/Ponds	FBOmw-172	Homewood		X	X								
37	RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBOmw-173	Homewood		X	X							x	
38	RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBOmw-174	Homewood		X	X							X	
39	RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBOmw-175	Homewood		X	X							<u></u>	
40	RVAAP-43 Load Line 10	I I 10mw-003	Homewood		24									Carbon Tetrachloride
40	RVAAP-66 Facility-wide Groundwater	EWGmw-004	Unconsolidated		x									
42	RVAAP-66 Facility-wide Groundwater	FWGmw-007	Unconsolidated		X									
43	RVAAP-66 Facility-wide Groundwater	FWGmw_010	Unconsolidated		X	x								
44	RVAAP-66 Facility-wide Groundwater	FWGmw_011	Unconsolidated		X	Λ								
45	RVAAP-66 Facility-wide Groundwater	FWGmw_012	Unner Sharon		X X									
46	RVAAP.66 Facility-wide Groundwater	FWGmw_012	Unconsolidated											
40	RVAAP.66 Facility-wide Groundwater	FWGmw_016	Unper Sharon											
18	RVAAP-66 Facility-wide Groundwater	FWGmw 019	Basal Sharon		Λ		v					v		
40	NVAAD 66 Facility wide Groundwater	FWGmw 020	Linner Sharen							+				
47	K v AAI -00 Facility-while Oroundwater	r wonw-020	Opper Sharon				Λ					Λ		

Table 3-2. FWGWMP Wells with Analytical Testing Suite (Continued)

						Expanded							MNA	
No.	RVAAP-66 Area	Well Name	Aquifer	Metals	Explosives	Explosives (1)	VOCs	SVOCs (2)	PCBs	Pesticides	Cyanide	Nitrate	Suite (3)	Other
50	RVAAP-66 Facility-wide Groundwater	FWGmw-021	Upper Sharon		Х									
51	RVAAP-66 Facility-wide Groundwater	FWGmw-023	Upper Sharon		Х	Х								
52	RVAAP-66 Facility-wide Groundwater	FWGmw-024	Upper Sharon		Х									
53	RVAAP-66 Facility-wide Groundwater	SCFmw-004	Basal Sharon		Х									

X = Indicates well or constituent to be sampled as part of the 2021 FWGWMP. Wells and constituents will be sampled semi-annually unless indicated by footnotes described below.

(1) Expanded Explosives list include 3,5-Dinitroanaline (3,5-DNA); Hexahydro-1,3,5-triazine (DNX); Hexahydro-1,3,5-triazine (D nitrotoluene (2,6-DANT).

(2) SVOCs include phthalates, nitroaromatics, polycyclic aromatic hydrocarbons, and phenols.

(3) MNA suite includes anions, total organic carbon, alkalinity, pH, and water quality parameters.

FWGWMP = Facility-wide Groundwater Monitoring Program

MNA = Monitored Natural Attenuation

PCB = Polychlorinated Biphenyl

RVAAP = Ravenna Army Ammunition Plant

SVOC = Semivolatile Organic Compound

VOC = Volatile Organic Compound

Constituents	Method ^a
PCBs	GC – SVOCs (8082A)
Pesticides	GC Semivolatile Organics (8081B)
SVOCs	GC/MS Semivolatile Organics (8270D)
Including Phthalates, Phenols, or Nitroaromatics	
PAHs	GC/MS 8270D SIM
VOCs	GC/MS Volatile Organics (8260B)
Nitroaromatics and Nitramines (Explosives)	Explosives by HPLC (8330)
Nitrate/Nitrites	General Chemistry (9056)
Sulfate	General Chemistry (9056A)
Sulfide	General Chemistry (9034)
Total Organic Compound	General Chemistry (9060)
Total Alkalinity	General Chemistry (SM2320B) ^b
Cyanide (Total)	General Chemistry (9012B)
Metals (Aluminum, Iron, Magnesium, Potassium,	Inductively Coupled Plasma (6010C)
Sodium, Phosphorus, Calcium)	
Metals (Antimony, Beryllium, Thallium, Zinc,	Inductively Coupled Plasma/Mass
Cadmium, Manganese, Barium, Nickel, Silver,	Spectrometry (6020A)
Vanadium, Chromium, Cobalt, Copper, Arsenic, Lead,	
Selenium)	
Hexavalent Chromium	General Chemistry (7196A)
Mercury	Liquid Waste Cold Vapor Technique
	(7470A)

Table 3-3. Analytical Laboratory Test Methods

^a USEPA SW846

^b Standard Methods for the Examination of Water and Wastewater

GC = Gas Chromatography

HPLC = High-Performance Liquid Chromatography

MS = Mass Spectrometry PAH = Polycyclic Aromatic Hydrocarbon PCB = Polychlorinated Biphenyl

SIM = Selective Ion Monitoring

SVOC = Semivolatile Organic Compound

USEPA = U.S. Environmental Protection Agency

VOC = Volatile Organic Compound

4.0 SCHEDULE

Groundwater Investigation and Reporting Services, Former RVAAP/Camp James A. Garfield Restoration Program 2021 FWGWMP Schedule																	
D	Task Name	Duration	Start	Finish	Predecessors						2021						2022
1	2021 Facility-wide Groundwater Monitoring Program	559 days	Mon 11/30/20	Sat 6/11/22		Sep	Nov	Jan	Mar	May	Jul	Sep	Nov	Jan	Mar	May	Ju
2	2021 FWGWMP Addendum	218 days	Mon 11/30/20	Mon 7/5/21										1			
3	Prepare and Submit Draft to Ohio EPA	75 days	M on 11/30/20	Fri 2/12/21			-	l		i I							
4	Army/Ohio EPA Review	42 days	Sat 2/13/21	Fri 3/26/21	3	_	i i	-	_ 1	I I				1			
5	Comment Resolution	41 days	Sat 3/27/21	Thu 5/6/21		-			-	-				1			
5	Army Develops and Submits Responses to Comments	14 days	Sat 3/27/21	Fri 4/9/21	4	_	i		_	i				i i			
7	Ohio EPA Review and Approval of Responses to Comments	27 days	Sat 4/10/21	Thu 5/6/21	б				_	-				1			
3	Prepare and Submit Final to Army/Ohio EPA	15 days	Fri 5/7/21	Fri 5/21/21	5	_				*				1			
,	Army/Ohio EPA Review and Approval	45 days	Sat 5/22/21	Mon 7/5/21	8	_					-			1			
0	Spring 2021 Semi-Annual Sampling	66 days	Mon 4/19/21	Wed 6/23/21		-			-		•			1			
1	Well Redevel opment	9 days	Mon 4/19/21	Tue 4/27/21		_											
2	Well Sampling	15 days	Mon 4/26/21	Mon 5/10/21			i i			-				1			
3	Laboratory Sampling and Analysis	30 days	Tue 5/11/21	Wed 6/9/21	12					*				1			
4	Data Validation	14 days	Thu 6/10/21	Wed 6/23/21	13	_				j 🛓	h			1			
5	Spring 2021 Semi-Annual Report	210 days	Thu 6/24/21	Wed 1/19/22		_					-						
б	Prepare and Submit Draft to Ohio EPA	90 days	Thu 6/24/21	Tue 9/21/21	14	_					-			1			
7	Army/Ohio EPA Review	45 days	Wed 9/22/21	Fri 11/5/21	16	_	i.			-		•	- 1	1			
3	Comment Resolution	15 days	Sat 11/6/21	Sat 11/20/21	17								–	1			
9	Prepare and Submit Final to Army/Ohio EPA	15 days	Sun 11/21/21	Sun 12/5/21	18	-				i I			_	1			
D	Army/Ohio EPA Review and Approval	45 days	Mon 12/6/21	Wed 1/19/22	19		i i			I I I			-	-			
1	Fall 2021 Semi-Annual Sampling	61 days	Mon 9/13/21	Fri 11/12/21		_						-		1			
2	Well Gauging	5 days	Mon 9/13/21	Fri 9/17/21		-	i			i I		•		I I			
3	Well Sampling	10 days	Mon 9/20/21	Wed 9/29/21		-						-		1			
!4	Laboratory Sampling and Analysis	30 days	Thu 9/30/21	Fri 10/29/21	23	-						-	h	1			
5	Data Validation	14 days	Sat 10/30/21	Fri 11/12/21	24	-				I I			έ η				
6	2021 Annual Report and 2022 FWGWMP Addendum	211 days	Sat 11/13/21	Sat 6/11/22		-							-	-			
7	Prepare and Submit Draft to Army/Ohio EPA	91 days	Sat 11/13/21	Fri 2/11/22	25	-				1			+	i			
8	Army/Ohio EPA Review	45 days	Sat 2/12/22	Mon 3/28/22	27	-								4	 _		
9	Comment Resolution	15 days	Tue 3/29/22	Tue 4/12/22	28	-								1	<mark>_</mark> _		
0	Prepare and Submit Final to Army/Ohio EPA	15 days	Wed 4/13/22	Wed 4/27/22	29	-				i i				i I I	-	h	
1	Army/Ohio EPA Review and Approval	45 days	Thu 4/28/22	Sat 6/11/22	30	-								1		<u> </u>	
	avenue R B & 2009 Schedule Task Summery 🛡		External Milestone	<u>ه</u> ا	Manual Task	\$	Manual St	mmary	•	E>	temal Tasks	\$	Di	eadline	Ŷ		
Fri	avenina r cx-2000 Screeuwe Split Project Summary		Inactive Milestone		Duration-only		Start-only		-	E>	ternal Milestone						

5.0 **REFERENCES**

Leidos 2020a. Facility-wide Groundwater Monitoring Program RVAAP-66 Facility-wide Groundwater Annual Report for 2020. December.

Leidos 2020b. DRAFT Remedial Investigation Report for RVAAP-66 Facility-wide Groundwater. July 31.

- Ohio EPA (Ohio Environmental Protection Agency) 2004. Director's Final Findings and Orders for the Ravenna Army Ammunition Plant. June.
- Portage Environmental 2004. Facility-wide Groundwater Monitoring Program Plan for the Ravenna Army Ammunition Plant, Ravenna, Ohio. September.
- TEC-Weston 2016. Remedial Investigation Work Plan for Groundwater and Environmental Investigation Services for RVAAP-66 Facility-Wide Groundwater. December.

FIGURES



Figure 2-1. General Location and Orientation of the Former RVAAP/CJAG



Figure 3-1. 2021 FWGWMP Wells

APPENDIX A

Ohio EPA Comments



Mike DeWine, Governor Jon Husted, Lt. Governor Laurie A. Stevenson, Director

May 5, 2021

TRANSMITTED ELECTRONICALLY

Mr. Kevin Sedlak Restoration Program Manager ARNG-ILE Clean Up Camp James A. Garfield JTC 1438 State Route 534 SW Newton Falls, OH 44444 RE: US Army Ammunition Plt RVAAP Remediation Response Project Records Remedial Response Portage County ID # 267000859036

Subject: Response to Ohio EPA Comments on the "Draft Facility-wide Groundwater Monitoring Program Plan RVAAP-66 Facility-wide Groundwater Addendum for 2021" Dated April 8, 2021

Dear Mr. Sedlak:

The Ohio Environmental Protection Agency (Ohio EPA) has received and reviewed the "Response to Ohio EPA Comments on the Draft Facility-wide Groundwater Monitoring Program (FWGWMP) Plan RVAAP-66, Facility-wide Groundwater Addendum for 2021" for the former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio (Camp James A. Garfield). This document was received at Ohio EPA's Northeast District Office (NEDO), Division of Environmental Response and Revitalization (DERR) via email on April 9, 2021. The response was prepared for the United States Army Corps of Engineers (USACE) on behalf of the National Guard Bureau by Leidos under Contract Number W912QR-16-D-0003.

Based on our review of the Army National Guard's Response to Ohio EPA comments provided in in your letter dated April 8, 2021, we find the responses generally acceptable, and the document can be finalized. Please be sure that all agreed to changes, additions and clarifications are provided in the final document.

As a precautionary response to COVID-19, Ohio EPA is currently operating with most staff working remotely. During this time, we will not be issuing hard-copy mail. This letter is an official response from Ohio EPA that will be maintained as a public record.

RECEIVED MAY 0 5 2021 MR. KEVIN SEDLAK U.S. ARMY RAVENNA AMMUNITION PLT. RVAAP MAY 5, 2021 PAGE 2 OF 2

If you have questions, you can reach me via email at <u>kevin.palombo@epa.ohio.gov</u>, or at (330) 963-1292.

Sincerely,

Kn Ml 6

Kevin M. Palombo Environmental Specialist Division of Environmental Response and Revitalization

KP/sc

ec: Rebecca Shreffler, Chenega Tri-Services Katie Tait, OHARNG RTLS Steven Kvaal, USACE Louisville Nat Peters, USACE Louisville Bob Princic, Ohio EPA, NEDO, DERR Natalie Oryshkewych, Ohio EPA NEDO, DERR Liam McEvoy, Ohio EPA, NEDO, DERR Thomas Schneider, Ohio EPA, SWDO, DERR Carrie Rasik, Ohio EPA, CO, DERR



April 8, 2021

Ohio Environmental Protection Agency DERR-NEDO Attn: Mr. Kevin Palombo 2110 East Aurora Road Twinsburg, OH 44087-1924

Subject: Ravenna Army Ammunition Plant (RVAAP) Restoration Program, Portage/Trumbull Counties, RVAAP-66 Facility-Wide Groundwater, Responses to Comments on the Groundwater Monitoring Addendum for 2021 (Work Activity No. 267-000-859-036)

Dear Mr. Palombo:

The Army appreciates your time and comments on the *Draft Facility-Wide Groundwater Monitoring Program Plan Addendum for 2021*. Enclosed for your review are responses to your comments. Upon resolution of these comments, the Army will provide a Final version of the addendum for Ohio EPA concurrence.

These comment responses were prepared for the Army National Guard in support of the RVAAP Restoration Program. Please contact the undersigned at 614-336-6000, ext 2053 or <u>kevin.m.sedlak.ctr@mail.mil</u> if there are issues or concerns with this submission.

Sincerely,

SEDLAK.KEVIN.MIC Digitally signed by SEDLAK.KEVIN.MICHAEL.1254440 HAEL.1254440171 71 Date: 2021.04.08 13:49:17 -04'00'

Kevin M. Sedlak RVAAP Restoration Program Manager Army National Guard Directorate

cc: Natalie Oryshkewych, Ohio EPA, NEDO, DERR Bob Princic, Ohio EPA, NEDO, DERR Liam McEvoy, Ohio EPA, NEDO, DERR Megan Oravec, Ohio EPA, NEDO, DERR Thomas Schneider, Ohio EPA, SWDO, DERR Carrie Rasik, Ohio EPA, CO, DERR Katie Tait, OHARNG, Camp James A. Garfield Mark Leeper, ARNG Steve Kvaal, USACE Louisville Jay Trumble, USACE Louisville Vasu Peterson, Leidos Jed Thomas, Leidos Rebecca Shreffler, Chenega Tri-Services Subject: Former Ravenna Army Ammunition Plant (RVAAP) Restoration Program, Portage/Trumbull Counties, Facility-Wide Groundwater Addendum for 2021 (Work Activity No. 267-000-859-036)

GENERAL COMMENTS

<u>Comment 1</u>- Ramsdell Quarry Sample Discontinuation and Proposed Well Abandonments:

Wells formerly identified as RCRA wells since 2005 (RVAAP-01 Ramsdell Quarry Landfill wells RQLmw-007, RQLmw-008, and RQLmw-009, and RVAAP-04 Open Demolition Area #2 wells DETmw-003 and DETmw-004) are currently being monitored under the CERCLA program and will no longer be referred to as RCRA wells. The Draft RI Report (Leidos 2020b) indicated that no further action is required for ground water at Ramsdell Quarry Landfill and the landfill is being closed; therefore, additional sampling of RQLmw-007, RQLmw-008, and RQLmw-009 is not recommended. The ground water at Open Demolition Area #2 is being evaluated under a separate RI; consequently, monitoring wells DETmw-003 and DETmw-004 will be sampled semi-annually under the FWGWMP in 2021.

Per previous November 6, 2020 Ohio EPA comment on the Draft 2020 RI Report, Ohio EPA believes it is premature to begin the process of monitoring well abandonment and that abandonment activities should be deferred until after concurrence has been reached regarding the status of each AOC, until final remedies have been chosen, and a long-term facility-wide ground water monitoring program is established. Continued ground water monitoring of some of these AOC wells may be required to comply with applicable Division of Materials and Waste Management (DMWM) rules and regulations.

Additionally, please clarify why sampling is to be discontinued at RQLmw-008, as polycyclic aromatic hydrocarbons (PAHs) benzo(a)anthracene and dibenz (a, h) anthracene were detected above their respective Regional Screening Levels (RSLs) (i.e., is it in conjunction with the landfill being closed or the AOC investigation being completed).

Army Response: Clarification. The Army concurs that well abandonment is not required at this time. This Draft 2021 Addendum does not include a recommendation to abandon the wells at Ramsdell Quarry Landfill (RQL). OHARNG submitted the Final End of Post Closure Care Certification (EOPCC) for RQL to the Division of Materials and Waste Management (DMWM). Any current and future sampling at RQL would be done to support the CERCLA process.

The *Draft Remedial Investigation Report for RVAAP-66 Facility-wide Groundwater* (Leidos 2020) concluded that no further action is required for groundwater at RQL. There were no comments in the 06 November 2020 Ohio EPA comment letter on the Draft RI Report that refuted this conclusion. Similar to numerous other wells within CJAG, sampling of the RQL wells is not needed to complete the RI phase of the CERCLA process. If the Final RI Report is resolved such that additional sampling at RQL is required, the need for additional sampling of the current wells will be re-evaluated. This approach is applicable to RQLmw-008, as the Draft RI Report did not identify PAHs at RQL as COCs requiring evaluation in an FS. Additional collection of groundwater for PAH analysis is not required to complete the CERCLA process.

Subject: Former Ravenna Army Ammunition Plant (RVAAP) Restoration Program, Portage/Trumbull Counties, Facility-Wide Groundwater Addendum for 2021 (Work Activity No. 267-000-859-036)

<u>Comment 2</u> – Table 3-1 Discontinuation of Wells and Additional Wells:

Table 3-1 indicates that sampling was recommended to be discontinued at nine wells for the 2021 FWGWMP sampling. However, of the 53 wells listed for sampling, it was not clear on this table which six wells were added (from the 2020 number of 47) for the 2021 sampling. Please provide clarification on which six wells were added to the 2021 FWGWMP sampling and why.

The Army should verify that the discontinuation of these nine wells meet the discontinuation criteria specified in the 2016 RIWP (i.e., whether that criteria is statistical trend analysis of historical results, certain number of non-detect results, etc.). Table 3-1 does indicate that for one well (LL2mw-267) explosives have not exceeded the screening levels for eight consecutive semi-annual sampling events, which may be adequate demonstration for discontinuation of sampling. Other wells slated for discontinuation do not have that level of specificity, please provide complete justification for discontinuing the remaining wells.

Army Response: Clarification and agree. Nine wells were indeed recommended for discontinuation of sampling, and *fifteen wells* that were not sampled in 2020 are recommended for sampling in 2021. The first paragraph in Section 3.1 will be revised as follows:

"Forty-seven wells were sampled in 2020 under the FWGWMP. Nine wells sampled in 2020 are not recommended for sampling in 2021. This 2021 Addendum recommends that 53 wells be sampled in 2021, which includes an additional fifteen wells not sampled in 2020."

The newly added fifteen wells are identified in Table 3-1 by the "Not sampled in 2020" bullet in the cell summarizing the "2020 FWGWMP Sampling Recommendations". In addition, these rows will be highlighted in pink. For these specific wells, the rationale for sampling were provided in the "2021 FWGWMP Sampling Recommendations". As examples:

- WBGmw-006 was not sampled in 2020 and is recommended to be sampled in 2021 to "Monitor for explosives to support the FS".]
- LL12mw-244 was not sampled in 2020 and is recommended to be sampled in 2021 to "Monitor for nitrate and ammonia to support the FS".

The RI Work Plan does not provide discontinuation criteria for the annual FWGWMP sampling. The purpose of the Addendums are to serve as the annual modification to the FWGWMP sampling scheme. The current FWGWMP Criteria 1 to 4 are presented in Section 1.2 of the 2021 Addendum. The discontinued wells no longer meet the criterion for continued sampling.

Table 3-1 includes 2020 sampling results, as well as a column that describes 2021 sampling recommendations. The sampling recommendation provides justification for wells discontinued based on sampling results or other changes (e.g., RCRA wells). To expand the rationale for discontinuing sampling at the wells below, the following bullet will be added to "2021 FWGWMP Sampling Recommendations" for wells RQL RCRA wells:

• OHARNG submitted the Final End of Post Closure Care Certification (EOPCC) for RQL to the Division of Materials and Waste Management (DMWM). Any current and future sampling at RQL would be done to support the CERCLA process. Additional sampling of this well in 2021 is not needed to support CERCLA.

The following bullet will be added to "2021 FWGWMP Sampling Recommendations" for FBQmw-168, -176, and -177:

• Explosive concentrations have not exceeded their screening levels during the FWGMWP sampling events (2003 to 2020).

Subject: Former Ravenna Army Ammunition Plant (RVAAP) Restoration Program, Portage/Trumbull Counties, Facility-Wide Groundwater Addendum for 2021 (Work Activity No. 267-000-859-036)

<u>Comment 3</u> – Table 3-1 Reduction in Contaminant Analyses:

Table 3-1 also indicates that a reduction in contaminant analyses would be conducted at numerous other wells on the table. Specifically, decreased analytical suites include the elimination of all metals analyses (with the exception of two wells from Open Demolition Area #2), presumably based on comparison of 2020 data results with background metals results as presented in the 2019 Background Study for Metals produced by Leidos (the use of calculated metals background levels resulted in fewer metals exceedances and thus fewer wells requiring additional metals analyses). Additionally, it was presented that the 2020 exceedances were limited to manganese and arsenic, which were not considered site related contaminants.

The Army should verify that the reduced sampling/analysis for the remaining FWGWMP wells for 2021 will not result in the necessity to modify the existing 2016 RIWP. If reduced sampling would change the 2016 RIWP, then a plan or schedule for such modification procedures should be contemplated and relayed to Ohio EPA for concurrence.

Ohio EPA DERR is in general concurrence with the proposed reduction in monitoring, but also recommends that the Army verify the reduction in well analyses for 2021 will not result in significant data gaps in the vertical or horizontal delineation directions around each affected AOC. Understandably, most of these wells proposed for discontinuation have had non-detects, but if additional delineation or confirmation is required at a later date, these wells may need to be resampled.

Army Response: Clarification. The Army verified that the reduced sampling/analysis for the remaining 2021 FWGWMP wells will not result in the necessity to modify the existing 2016 RIWP. The purpose of the Addendums are to serve as the annual modification to the FWGWMP sampling scheme; therefore, upon approval of this Addendum, modifications to the RI Work Plan will not be necessary.

The recommendations provided in the Draft 2021 Addendum supplement the conclusions provided in the Draft RI Report. If the comment resolution process of the RI Report identifies additional sampling and analysis to complete the RI phase of the CERCLA process, the need for additional sampling will be re-evaluated. The recommendations in the Draft 2021 Addendum also provide a sampling scheme to proactively acquire data for the upcoming feasibility study.



Mike DeWine, Governor Jon Husted, Lt. Governor Laurie A. Stevenson, Director

March 26, 2021

TRANSMITTED ELECTRONICALLY

Mr. Kevin Sedlak Restoration Program Manager ARNG-ILE Clean Up Camp James A. Garfield JTC 1438 State Route 534 SW Newton Falls, OH 44444 RE: US Army Ammunition Plt RVAAP Remediation Response Project Records Remedial Response Portage County ID # 267000859036

Subject: Ohio EPA Comments on the "Draft Facility-wide Groundwater Monitoring Program Plan RVAAP-66 Facility-wide Groundwater Addendum for 2021" Dated February 11, 2021

Dear Mr. Sedlak:

The Ohio Environmental Protection Agency (Ohio EPA) has received and reviewed the "Draft Facility-wide Groundwater Monitoring Program Plan RVAAP-66 Facility-wide Groundwater Addendum for 2021" for the Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio (Camp James A. Garfield). This document was received via email at Ohio EPA's Northeast District Office (NEDO), Division of Environmental Response and Revitalization (DERR) on February 11, 2021. The report was prepared for the United States Army Corps of Engineers (USACE) on behalf of the National Guard Bureau by Leidos under Contract Number W912QR-16-D-0003. Comments on the document based on Ohio EPA review are provided below. Please provide responses to the enclosed comments in accordance with the Directors Findings and Orders.

Facility-wide Groundwater Monitoring Program (FWGWMP) Plan Addendum for 2021

The Draft FWGWMP Addendum for 2021 summarizes ground water monitoring objectives to be conducted during the 2021 sampling events, including:

As an update to the FWGWMP Plan for 2020, wells selected for inclusion in the 2021 sampling events will be based on wells representing critical exit pathway monitoring points (generally a carryover from the 2020 program), wells representing primary area of concern (AOC)-specific contaminant source area conditions that are potentially increasing or have unstable plume conditions, wells co-located to establish vertical extent of contaminants within the stratigraphic sequence, and wells refining the Conceptual Site Model (CSM) or defining contaminant distribution within areas recommended for evaluation under the Feasibility Study (FS).

RECEIVED MAR 2 6 2021 MR. KEVIN SEDLAK U.S. ARMY RAVENNA AMMUNITION PLT. RVAAP MARCH 26, 2021 PAGE 2 OF 5

- Wells sampled in 2020 that no longer meet the above criteria will not be recommended for sampling in 2021.
- Previous 2020 criterion of including wells demonstrating the last two years of sampling results with historical (non-metal) maximum concentrations of one or more site related compounds (SRCs) has been removed because the wells identified under that criterion were found to support the conclusions in the Remedial Investigation (RI) and were additionally covered under other criteria mentioned above. The FWGWMP investigation continues to be refined to support recommendations within the RI Report and provide supplemental data for the FS.
- Wells formerly identified as Resource Conservation and Recovery Act (RCRA) wells since 2005 (RVAAP-01 Ramsdell Quarry Landfill wells RQLmw-007, RQLmw-008, and RQLmw-009, and RVAAP-04 Open Demolition Area #2 wells DETmw-003 and DETmw-004) are currently being monitored under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) program and will no longer be referred to as RCRA wells. The Draft RI Report (Leidos 2020b) indicated that no further action is required for ground water at Ramsdell Quarry Landfill and the landfill is being closed; therefore, additional sampling of RQLmw-007, RQLmw-008, and RQLmw-009 is not recommended. Per previous November 6, 2020 Ohio EPA comment on the Draft 2020 RI Report, Ohio EPA believes it is premature to begin the process of monitoring well abandonment until a long-term ground water monitoring system is developed. The ground water at Open Demolition Area #2 is being evaluated under a separate RI; consequently, monitoring wells DETmw-003 and DETmw-004 will be sampled semi-annually under the FWGWMP in 2021.
- A total of 53 wells (including five RCRA wells) have been selected for sampling during 2021 (this is up from the previous 47 wells selected for sampling in 2020). This increase in sampling appears based on lack of some sampling data from 2020 and the need to have more recent data to compare with historical results. Decreased analytical suites include the elimination of metals analyses (with the exception of two wells from Open Demolition Area #2) based on comparison of 2020 data results with background metals results as presented in the 2019 Background Study for Metals produced by Leidos. The use of calculated metals background levels resulted in fewer metals exceedances and thus fewer wells requiring additional metals analyses. Additionally, it was presented that the 2020 exceedances were limited to manganese and arsenic, which were not considered site related contaminants.
- Monitoring well sampling and analytical testing is to be completed in accordance with the Sampling and Analysis Plan (SAP) and Quality Assurance Project Plan (QAPP) updates provided within the TEC-Weston 2016 Remedial Investigation Work Plan (RIWP).
- Table 3-1 provides a summary of the proposed wells to be sampled during 2021, and rationale for inclusion into (or removal from) the FWGWMP.

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- Nine wells were denoted on Table 3-1 as not being recommended for additional sampling during the 2021 FWGWMP. It was not clear on this table which wells were added for the 2021 sampling.
- Table 3-2 presents the proposed analytical testing suites for each well, based on the rationales presented in Table 3-1.
- Table 3-3 presents the proposed analytical laboratory testing methods.

COMMENTS

1. Ramsdell Quarry Sample Discontinuation and Proposed Well Abandonments:

Wells formerly identified as RCRA wells since 2005 (RVAAP-01 Ramsdell Quarry Landfill wells RQLmw-007, RQLmw-008, and RQLmw-009, and RVAAP-04 Open Demolition Area #2 wells DETmw-003 and DETmw-004) are currently being monitored under the CERCLA program and will no longer be referred to as RCRA wells. The Draft RI Report (Leidos 2020b) indicated that no further action is required for ground water at Ramsdell Quarry Landfill and the landfill is being closed; therefore, additional sampling of RQLmw-007, RQLmw-008, and RQLmw-009 is not recommended. The ground water at Open Demolition Area #2 is being evaluated under a separate RI; consequently, monitoring wells DETmw-003 and DETmw-004 will be sampled semi-annually under the FWGWMP in 2021.

Per previous November 6, 2020 Ohio EPA comment on the Draft 2020 RI Report, Ohio EPA believes it is premature to begin the process of monitoring well abandonment and that abandonment activities should be deferred until after concurrence has been reached regarding the status of each AOC, until final remedies have been chosen, and a long-term facility-wide ground water monitoring program is established. Continued ground water monitoring of some of these AOC wells may be required to comply with applicable Division of Materials and Waste Management (DMWM) rules and regulations.

Additionally, please clarify why sampling is to be discontinued at RQLmw-008, as polycyclic aromatic hydrocarbons (PAHs) benzo(a)anthracene and dibenz (a, h) anthracene were detected above their respective Regional Screening Levels (RSLs) (i.e., is it in conjunction with the landfill being closed or the AOC investigation being completed).

2. Table 3-1 – Discontinuation of Wells and Additional Wells:

Table 3-1 indicates that sampling was recommended to be discontinued at nine wells for the 2021 FWGWMP sampling. However, of the 53 wells listed for sampling, it was not clear on this table which six wells were added (from the 2020 number of 47) for the 2021 sampling.

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Please provide clarification on which six wells were added to the 2021 FWGWMP sampling and why.

The Army should verify that the discontinuation of these nine wells meet the discontinuation criteria specified in the 2016 RIWP (i.e., whether that criteria is statistical trend analysis of historical results, certain number of non-detect results, etc.). Table 3-1 does indicate that for one well (LL2mw-267) explosives have not exceeded the screening levels for eight consecutive semi-annual sampling events, which may be adequate demonstration for discontinuation of sampling. Other wells slated for discontinuation do not have that level of specificity, please provide complete justification for discontinuing the remaining wells.

3. Table 3-1 – Reduction in Contaminant Analyses:

Table 3-1 also indicates that a reduction in contaminant analyses would be conducted at numerous other wells on the table. Specifically, decreased analytical suites include the elimination of all metals analyses (with the exception of two wells from Open Demolition Area #2), presumably based on comparison of 2020 data results with background metals results as presented in the 2019 Background Study for Metals produced by Leidos (the use of calculated metals background levels resulted in fewer metals exceedances and thus fewer wells requiring additional metals analyses). Additionally, it was presented that the 2020 exceedances were limited to manganese and arsenic, which were not considered site related contaminants.

The Army should verify that the reduced sampling/analysis for the remaining FWGWMP wells for 2021 will not result in the necessity to modify the existing 2016 RIWP. If reduced sampling would change the 2016 RIWP, then a plan or schedule for such modification procedures should be contemplated and relayed to Ohio EPA for concurrence.

Ohio EPA DERR is in general concurrence with the proposed reduction in monitoring, but also recommends that the Army verify the reduction in well analyses for 2021 will not result in significant data gaps in the vertical or horizontal delineation directions around each affected AOC. Understandably, most of these wells proposed for discontinuation have had non-detects, but if additional delineation or confirmation is required at a later date, these wells may need to be resampled.

As a precautionary response to COVID-19, Ohio EPA is currently operating with most staff working remotely. During this time, we will not be issuing hard-copy mail. This letter is an official response from Ohio EPA that will be maintained as a public record.

This "Draft Facility-wide Groundwater Monitoring Program Plan RVAAP-66 Facility-wide Groundwater Addendum for 2021" was reviewed by personnel from Ohio EPA. Additional information is necessary to approve the document.

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If you have questions or would like to set up a meeting to discuss these comments, you can reach me by email at <u>kevin.palombo@epa.ohio.gov</u>, or at (330) 963-1292.

Sincerely,

Kn Ml h

Kevin M. Palombo Environmental Specialist Division of Environmental Response and Revitalization

KP/sc

ec: Rebecca Shreffler, Chenega Tri-Services Katie Tait, OHARNG RTLS Steven Kvaal, USACE Louisville Nat Peters, USACE Louisville Mark Leeper, ARNG Bob Princic, Ohio EPA, NEDO, DERR Megan Oravec, Ohio EPA, NEDO, DERR Natalie Oryshkewych, Ohio EPA, NEDO, DERR Liam McEvoy, Ohio EPA, NEDO, DERR Thomas Schneider, Ohio EPA, SWDO, DERR Carrie Rasik, Ohio EPA, CO, DERR