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Rev. 1

Backfill and Restoration Plan for the Luckey Formerly Utilized Sites Remedial Action Program Remediation Project

U.S. Army Corps of Engineers
Buffalo District, Buffalo, New York

Applicability: Luckey FUSRAP Remediation	Effective Date: 10/20/2016	Owner: Project Manager
		Signature: [redacted]

History of Revisions

Revision	Issue Date	Action	Description
0	06/24/2016	New document	Initial issue.
1	10/20/2016	Revise document	Addressing comments from the Stakeholder review.

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ACRONYMS

ASTM	American Society for Testing and Materials
FSS	final status survey
FUSRAP	Formerly Utilized Sites Remedial Action Program
GPS	global positioning system
NAD83	North American Datum of 1983
NAVD88	North American Vertical Datum of 1988
RA	remedial action
SAP	sampling and analysis plan
UFGS	Unified Facilities Guide Specification
USACE	United States Army Corps of Engineers

1. INTRODUCTION

1.1 Background and Purpose

The United States Army Corps of Engineers (USACE) Buffalo District has selected Portage, Inc., (Portage) to remediate the Luckey Formerly Utilized Sites Remedial Action Program (FUSRAP) Site located in Luckey, Wood County, Ohio. Portage prepared this document in partial fulfillment of the requirements of Contract W912P4-15-D-0006, Task Order 0001. The Corps' Buffalo District will provide technical oversight for the tasks described in this document.

Portage will perform remedial action (RA) at the Luckey Site (hereinafter referred to as "the site"). This backfill and restoration plan describes the means and methods Portage will use to perform backfill and site restoration activities at the site, following RA. This document describes the overall plan in general; subsequent revision will capture changes that may be encountered as remediation progresses, such as the evolution of final grade plans based on materials removed.

A description of Portage's project organization, key personnel, and overall strategy for completing the RA at the site is presented in the *Site Operations Plan for the Luckey Formerly Utilized Sites Remedial Action Program Remediation Project* (USACE 2016a).

1.2 Site Information

The Luckey Site is located at 21200 Luckey Road, northwest of Luckey in Wood County, Ohio. The site encompasses 40 acres and contains a large production building and warehouse, two abandoned rail spurs, and several smaller process and support buildings. The site was used for beryllium processing in support of the National Defense Program. The Atomic Energy Commission performed beryllium production operations at the site from 1949 to 1961. During this period, the site received beryl ore, scrap beryllium, and radiologically contaminated scrap metal.

FUSRAP-related constituents of concern include beryllium, lead, radium-226, thorium-230, uranium-234, and uranium-238.

2. CIVIL SURVEYING

Portage will perform civil surveys under the supervision of a land surveyor registered in the State of Ohio. The company will record location and elevation measurements in sufficient quantity to produce drawings with 1-foot contour intervals. Survey data will be accurate to 0.1 ft. Land surveys will be completed using an optical or Global Positioning System (GPS)-based survey system.

Portage will plot civil survey data on D-size drawings showing a plan view and both north-south and east-west cross sections. The company will depict coordinates and elevations using feet as the unit of measure and will reference North American Datum of 1983 (NAD83), Ohio State Plane Coordinate System North Zone (horizontal) and North American Vertical Datum of 1988 (NAVD 88) (vertical).

2.1 Preexcavation Civil Survey

Prior to soil disturbance, Portage will perform a preexcavation civil survey to document existing site conditions. Personnel will adhere to the *Accident Prevention Plan/Site-Specific Health and Safety Plan for the Luckey Formerly Utilized Sites Remedial Action Program Remediation Project* (USACE 2016b) and *Chronic Beryllium Disease Prevention Plan for the Luckey Formerly Utilized Sites Remedial Action Program Remediation Project* (USACE 2016c) as surveys may be performed in beryllium-contaminated areas. Portage will use data collected during the preexcavation survey to develop excavation plans and quantify volumes of excavated materials.

2.2 Postexcavation Civil Survey

Portage will perform civil surveying in phases after remediation excavation and final status surveys (FSS) are complete and USACE has approved FSS results and authorized backfilling. The results of the civil survey will be compared to preexcavation surveys to determine the quantity of material excavated.

Additionally, we expect that upon completion of excavation, groundwater will be present in the bottom of the excavation. As part of the excavation completion survey, the groundwater level will be allowed to stabilize, and Portage will survey the surface elevation of the groundwater to determine the volume of clean import backfill required before on-site place-back soil can be used as backfill. Portage will pump excavations dry, as practicable, before the start of backfilling.

In deeper excavations, it may not be advantageous to allow groundwater to stabilize in the excavation to determine the elevation. In these situations, Portage may rely on static water elevation data from site monitoring wells to determine the elevation at which place-back soils may be placed in the excavation.

2.3 Postbackfill Civil Surveys

When the required volume of backfill has been placed and compacted as discussed in Section 3, Portage will survey cross sections of the backfill area and compare them to the surveys performed before backfill placement, using the average end area method to determine the total quantity of import fill placed.

After all place-back soils have been placed and compacted, Portage will survey the cross sections of the backfill area again. The company will compare results of this survey to the surveys performed after the placement of the clean import fill, using the average end area method to determine the total quantity of place-back soil placed.

Portage will survey cross sections of the area after the required volume of topsoil has been placed and compacted. The company will compare survey results to similar prior surveys, using the average end area method to determine the total quantity of topsoil placed. Additionally, these civil surveys will be performed to show that the excavation area has been sufficiently backfilled to facilitate restoration and revegetation.

Portage will not perform a final site grading survey until sufficient areas have been remediated and the final grading plan has been developed and approved.

3. BACKFILL ACTIVITIES

Portage will perform backfill activities in phases as remediation objectives are met. This approach limits the area of open excavations on-site and minimizes the amount of groundwater that will need to be dewatered and treated during the RA. An additional benefit of a phased backfill placement approach is that backfill activities will be performed concurrently with excavation to the extent practicable, shortening the overall duration of the project and providing additional area for clean operations.

Backfill materials will be placed, graded, and compacted in remediation excavations to approximate the grade of adjacent areas, following rolling FSS and receipt of USACE approval to backfill. Following placement of the last lift of backfill, Portage will rough-grade the area of the FSS to ensure continuing functionality of erosion control measures. Erosion controls are described in detail in the *Water Management Plan for the Luckey Formerly Utilized Sites Remedial Action Program Remediation Project* (USACE 2016d). If necessary, these controls will be modified (with USACE contracting officer approval) using the new civil survey data.

Backfill materials will consist of suitable materials. Suitable backfill materials shall consist of GW, GP, GM, GC, SW, SP, SM, SC, ML, MH, CL, or CH soils as described by the Unified Soil Classification System. These soils shall not contain FUSRAP and chemical contaminants above the cleanup goals/criteria listed in Table 2.2-2 from Unified Facilities Guide Specification (UFGS), Section 02 61 13 (included herein as Appendix A), roots and other organic matter, trash, debris, snow, ice, frozen materials, or other undesirable material as determined by the USACE. The maximum particle size within the backfill shall be less than 6 inches. Materials classified as GW or GP shall not be used within 2 feet of the proposed final grade.

Portage will obtain backfill from one of two sources, as described below:

A. Place-back soils are those excavated soils that do not contain FUSRAP contaminants and chemical contaminants above the cleanup goals/criteria listed in Table 2.2-1 from UFGS, Section 02 61 13 (included herein as Appendix B). These place-back soils can be used if they meet the above requirements as determined by the USACE. Additionally, slag and recycled concrete, asphalt, man-made fill, trash, refuse, or any other recycled material will not be accepted.

B. Imported general fill will be obtained from off-site sources approved by the contracting officer/contracting officer's representative.

All backfill will be classified and tested in accordance with methods and frequency established in Table 2.2-2 from UFGS, Section 02 61 13 (Appendix A). All backfill material will be tested to show that it does not contain FUSRAP contaminants above the criteria listed in Table 2.2-2.

Imported fill will be sampled, analyzed, and accepted by USACE in accordance with the *Sampling and Analysis Plan for the Luckey Formerly Utilized Sites Remedial Action Program Remediation Project* (SAP) (USACE 2016e), before it is imported to the site. Additional tests will be performed when a change in material texture or color occurs. As off-site sources are identified and backfill and/or topsoil are deemed necessary, Portage will send a field/sampling technician to the source(s) to collect a sample for the required analyses by the field laboratory. When such samples are needed, the field/sampling technician will obtain sampling materials from the field laboratory and travel to the source location using a site vehicle to collect a representative sample(s) per the SAP procedures. The technician will containerize, label, preserve, and document the samples before taking them to the field laboratory for analysis and off-site shipment. The site superintendent will provide the analytical results to the USACE for review and approval before bringing any off-site borrow sources on-site.

The following backfilling sequence will be used:

1. Place clean imported fill in the excavation. The exact quantity of clean imported fill to be placed will depend upon the water table surface, the depth of the excavation, and the quantity of available place-back fill.

2. Place any place-back soils above the clean imported fill. Place-back soils that contain minor concentrations of chemical contaminants (i.e. below the criteria listed in Table 2.2-1 (Appendix B)] will not be placed within 5 feet of the water-table surface. The maximum quantity of place-back fill that can be placed will be based on the total fill required, minus the required amount of clean import fill. If the potentially available place-back quantity is not available, additional clean imported fill may be required.

3. Place topsoil (minimum 4-inch thickness) above the place-back soils or imported fill (if place-back soils are not used).

Materials will be delivered to the site in dump trucks and stockpiled in designated areas. Backfill delivery vehicles will not enter the contamination-reduction zones or -exclusion zones.

Equipment used for backfilling activities will either not have been previously used on-site within exclusion zones, or will have been decontaminated and free-released before it handles backfill material.

When practicable, place-back soils shall be used in lieu of imported general fill. Following excavation and FSS, Portage will measure the quantity of place-back soil available and compare that to the quantity that can be placed in the excavation in accordance with the limitations imposed by the static water surface elevation in the excavation. Portage will only import the amount of fill required to completely backfill the excavation after place-back soils have been accounted for. Fill will be imported on an as-needed basis to complete backfill.

3.1 Backfill Materials

Portage anticipates using three types of backfill materials:

1. Material that is imported from off-site sources as general fill.

2. Material that is excavated during remediation and meets regulatory requirements for place-back in accordance with the *Final Scope of Work, Remediation of Soils Operable Unit, Luckey Site* (USACE 2014).

3. Topsoil.

3.1.1 Imported General Fill

Clean imported fill will be obtained from off-site sources approved by USACE and trucked to the site. Portage will classify the imported fill and test it in accordance with UFGS, Section 02 61 13, as described in the SAP, it will be free of roots and other organic material, trash, debris, snow, frozen materials or other undesirable materials.

When using place-back soils in conjunction with imported fill material, imported fill will be placed first and to an elevation above groundwater. All fill material (i.e., place-back or imported fill) will be placed in 8-inch loose lifts and compacted by haul trucks, a dozer, and if necessary, a smooth drum vibratory compactor. The compacting process will be aided by use of a dozer with a robotic total station or GPS survey equipment to confirm backfill lift heights. The robotic total

station or GPS will also be used to determine the elevation of the groundwater surface and to establish the top elevation for required clean imported fill.

Soil will be compacted to 90 percent of American Society for Testing and Materials (ASTM) D 698 maximum dry density. Portage will perform density tests at a frequency of one per 10,000 square feet per lift. A minimum of one density test will be performed on each lift of backfill placed. Field in-place dry density shall be determined in accordance with ASTM D1556, ASTM D2167, or ASTM D6938. If ASTM D6938 is used, a minimum of one in ten tests will be checked using ASTM D1556 or ASTM D2167. Test results from ASTM D1556 or ASTM D2167 shall govern if there is a discrepancy with the ASTM D6938 test results.

Hydraulic conductivity of the compacted backfill shall be less than or equal to the criteria listed in Table 2.2-2 (Appendix A).

3.1.2 Place-Back Soils

Portage will sample and screen soil excavated during remediation as described in the SAP. The company will stockpile soils that are below cleanup criteria in designated, demarcated areas on-site for placement back in the excavation after excavation and the FSS are completed, and USACE has approved backfill placement.

Portage will not place place-back soils within 5 feet above the elevation of groundwater. It may be necessary, depending on the depth of excavation, to place imported fill ahead of place-back soils to ensure that place-back soils are located above the water table. Place-back soils will be compacted in manner similar to imported general fill. The final lift of place-back soils will be rough-graded to meet surrounding grade and promote drainage away from the remediated area.

3.1.3 Topsoil

Portage will surface backfilled areas with a minimum of 4 inches of topsoil. Portage will import topsoil from off-site sources approved by USACE, and the company will test it in accordance with UFGS, Section 02 61 13, as described in the SAP (USACE 2016e). Portage may stockpile topsoil in the support zone before placement over the backfilled areas. The company will place topsoil so that it meets existing grade and allows drainage. Topsoil will be wheel-rolled or dozer-tracked only to provide a base for seeding; it will not be overly compacted.

3.2 Final Grading

Portage will develop site grading plans as USACE issues task orders. As areas are remediated, grading of the backfilled areas will initially focus on rough-grading them to essentially protect the area from cross-contamination from the surrounding areas. Specifically, backfilled areas will be rough-graded to meet surrounding grade and promote drainage away from the remediated

area. As remediation progresses across the site, a final site grade will evolve, taking into account actual areas excavated, quantities excavated, etc.

3.3 Surface Water Sediment Controls

After incremental rough-grading of remediated areas and/or final grading, Portage will install stormwater and sediment controls to further protect the remediated areas. Such controls will be established according to the *Luckey Storm Water Pollution Prevention Plan for the Luckey Formerly Utilized Sites Remedial Action Program Remediation Project, Phase II: Mobilization* (USACE 2016f), and will include best management practices such as silt fencing, inlet protection, dust control, berms, liners, wastewater collection and treatment, and good housekeeping practices. As with all such control features, Portage will perform regular inspections and repairs to ensure their effectiveness.

4. SITE RESTORATION

4.1 Seeding and Mulching

Following placement of topsoil and postbackfill survey activities, Portage will seed and mulch backfilled areas to control erosion and return the site to its natural vegetative state. Seed will be applied by the broadcast method or by hydroseeding the disturbed soil areas after all final surface grades have been completed.

Hydroseeding will be performed using a bonded fiber matrix such as a flexible growth medium (e.g., Flextera FGM). The hydroseeding slurry will be transported in a tank, either truck or trailer mounted, and sprayed over the prepared ground. The application of hydroseeding, using a flexible growth medium, will promote quick growth and assist with erosion control. During the establishment period, seeded areas will be watered as necessary to ensure vegetation growth. Water will be applied at a rate that prevents runoff and puddling.

4.1.1 Seed Mixtures

Portage will work with the Corps of Engineers and local organizations to establish seeding mixtures that will work best for the Luckey Site, including proposed application rates. The seed will be of the latest season's crop and provided in original sealed packages bearing the producer's guaranteed analysis for percentages of mixture, purity, germination, hard seed, weed seed content, and inert material. Labels will be in conformance with Agricultural Marketing Service Seed Act and applicable state seed laws. The preferred permanent seeding window is between August 15 and October 15. If permanent seeding cannot be completed by October 15, it will be postponed until the following spring. The spring seeding window is March 1 to April 30.

In the event that permanent seeding cannot be performed immediately following placement of topsoil, the area may be covered in bonded fiber matrix to prevent erosion and weed growth.

Tentatively, the planned seed mixtures will be proportioned by weight as follows, based on a total pure live seed weight of 90 lbs:

- Creeping red fescue (40 lbs live seed weight).
- Red top (10 lbs live seed weight).
- Tall fescue (20 lbs live seed weight).
- Perennial ryegrass (20 lbs live seed weight).

Weed seed will not exceed 1 percent by weight of the total mixture. Wet, moldy, or otherwise damaged seed will be rejected. Seed having a date older than 9 months shall not be used.

4.1.2 Mulching

Mulch will consist of straw or hay and will be spread at the rate of 2 tons per acre on the same day as seeding activities. Mulch will be provided as cover to promote the growth of vegetation and assist with erosion controls where necessary. After mulch is spread, it will be anchored to the soil by tracking over it with a dozer or other appropriate equipment. Areas that are hydroseeded will not be mulched as a separate step, because a bonded fiber matrix, such as a flexible growth medium, will be applied during the hydroseeding application.

4.1.3 Emergent Wetlands

If remediation activities infringe upon any emergent wetlands, these wetlands will be restored to preexisting conditions.

4.2 Removal of Support Facilities and Final Inspection

Portage and USACE will complete a final phase quality control inspection of the site immediately prior to demobilization to verify that punch list items have been addressed. Upon completion of the project, Portage will remove the bulletin board, signs, barricades, haul roads, stormwater controls, and any other temporary products from the site. After removal of trailers, materials, and equipment from within the fenced area, Portage will remove the fence. Areas used by Portage for the storage of equipment or material, or other use, will be restored to the original or better condition. Gravel used to traverse grassed areas will be removed and the area restored to its original condition, including top soil and seeding as necessary.

5. REFERENCES

ASTM D698, *Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft^3 [600 kN-m/m^3])*, American Society for Testing and Materials, 2007.

ASTM D1556, *Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method*, American Society for Testing and Materials, 2015.

ASTM D2167, *Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method*, American Society for Testing and Materials, 2015.

ASTM D6938, *Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)*, American Society for Testing and Materials, 2015.

USACE, 2014, *Final Scope of Work, Remediation of Soils Operable Unit, Luckey Site*, U.S. Army Corps of Engineers, May 2014.

USACE, 2016a, *Site Operations Plan for the Luckey Formerly Utilized Sites Remedial Action Program Remediation Project,* PLN-5500, U.S. Army Corps of Engineers, Luckey, Ohio.

USACE, 2016b, *Accident Prevention Plan/Site-Specific Health and Safety Plan for the Luckey Formerly Utilized Sites Remedial Action Program Remediation Project,* PLN-5501, U.S. Army Corps of Engineers, Luckey, Ohio.

USACE, 2016c, *Chronic Beryllium Disease Prevention Plan for the Luckey Formerly Utilized Sites Remedial Action Program Remediation Project,* PLN-5512, U.S. Army Corps of Engineers, Luckey, Ohio.

USACE, 2016d, *Water Management Plan for the Luckey Formerly Utilized Sites Remedial Action Program Remediation Project*, PLN-5506, U.S. Army Corps of Engineers, Luckey, Ohio.

USACE, 2016e, *Sampling and Analysis Plan for the Luckey Formerly Utilized Sites Remedial Action Program Remediation Project*, PLN-5503, U.S. Army Corps of Engineers, Luckey, Ohio.

USACE 2016f, *Luckey Storm Water Pollution Prevention Plan for the Luckey Formerly Utilized Sites Remedial Action Program Remediation Project, Phase II: Mobilization,* PLN-5511, U.S. Army Corps of Engineers, Luckey, Ohio.

APPENDIX A
Table 2.2-2 from UFGS, Section 02 61 13

Table 2.2-2: Backfill and Contaminated Material Handling Areas Criteria

Physical / Chemical Parameter	Test Method	Testing Frequency			Criteria
		Off-Site Fill (1)	Place Back Soils (2)	Material Handling Areas (3)	
Geotechnical Parameters					
Grain Size	ASTM D 422	1 per source/ soil type	1 per stock pile	None	No criteria – test results used as a basis for classification
Soil Type (Classification)	ASTM 2487	1 per source/ soil type	1 per stock pile	None	GW, GP, GM, GC, SW, SP, SC, ML, MH, CL, or CH
Compaction	ASTM D 698	1/3,000 CY / soil type	1 per stock pile	None	90% of ASTM maximum dry density
Permeability	ASTM D 5084	1/3,000 CY / soil type	1 per stock pile	None	$\leq 10^{-4}$ cm/sec
FUSRAP Contaminants					See Note (4)
Ra_{226}	EPA 903.0 / 903.1	1/3,000 CY	1/100 CY	1/500 SF	3.75 pCi/g
Th_{230}	HASL 300 Th-01 mod.				7.91 pCi/g
U_{234}	HASL 300 U-02 mod.				27.48 pCi/g
U_{238}					27.63 pCi/g
Beryllium	SW846/6020A				131 mg.kg
Lead					400 mg/kg

APPENDIX B
Table 2.2-1 from UFGS, Section 02 61 13

Parameter	CAS No.	Units	Place-back Standard	Reference
Volatile Organic Compounds				
Benzene	71-43-2	mg/kg	26	1
Ethylbenzene	100-41-4	mg/kg	130	1
Semivolatile Organic Compounds				
Anthracene	120-12-7	mg/kg	34,000	1
Benzo(a)anthracene	56-55-3	mg/kg	12	1
Benzo(a)pyrene	50-32-8	mg/kg	1.2	1
Benzo(b)fluoranthene	205-99-2	mg/kg	12	1
Benzo(k)fluoranthene	207-08-9	mg/kg	120	1
Chrysene	218-01-9	mg/kg	1,200	1
Dibenz(a,h)anthracene	53-70-3	mg/kg	1.2	1
Fluoranthene	206-44-0	mg/kg	4,600	1
Fluorene	86-73-7	mg/kg	4,600	1
Indeno(1,2,3-c,d)pyrene	193-39-5	mg/kg	12	1
2-Methylnaphthalene	91-57-6	mg/kg	460	1
Naphthalene	91-20-3	mg/kg	90	1
Pyrene	129-00-0	mg/kg	3,400	1
Polychlorinated Biphenyls (PCBs)				
Aroclor-1221	11104-28-2	mg/kg	3.1	1
Aroclor-1248	12672-29-6	mg/kg	4.4	1
Aroclor-1254	11097-69-1	mg/kg	2.2	1
Aroclor-1260	11096-82-5	mg/kg	4.4	1
Inorganics				
Beryllium (FUSRAP Contaminant)	7440-41-7	mg/kg	131	2
Cadmium	7440-43-9	mg/kg	140	1
Lead (FUSRAP Contaminant)	7439-92-1	mg/kg	400	2
Mercury	7439-97-6	mg/kg	3.1	1
Zinc	7440-66-6	mg/kg	47,000	1
Radionuclides				
Radium-226 (FUSRAP Contaminant)	7440-14-4	pCi/g	3.75	2
Thorium-230 (FUSRAP Contaminant)	14269-63-7	pCi/g	7.91	2
Uranium-234 (FUSRAP Contaminant)	13966-29-5	pCi/g	27.48	2
Uranium-238 (FUSRAP Contaminant)	7440-61-1	pCi/g	27.63	2

References:

1. OAC 3745-300-08 Voluntary Action Program, Generic Numerical Standards, Residential Land Use Category, Standard for Single Chemical. Pursuant to Paragraph (A)(2)(b) of this rule, when more than one chemical of concern is present in each media within an identified area and an applicable generic standard for each of the

chemicals of concern is contained in this rule, the standard for each chemical of concern must be adjusted for the presence of multiple chemicals in order to meet the risk and hazard levels described in Paragraph (A)(2)(a) of this rule. The list of parameters includes constituents that have been detected in statistically significant number of samples during investigations at the Luckey Site and is not all inclusive.

2. Soil cleanup goals for radionuclides represent activity levels above site background corresponding to 25 mrem/yr (10 CFR 20 Subpart E, and OAC 3701:1-38-22). If a mixture of radionuclides is present, then the sum of ratios applies per MARSSIM and the ratio should not exceed unity. For example, use the 25 mrem/yr cleanup goals for unrestricted use by the critical group, which has been identified as the subsistence farmer for the Luckey site, for soil to obtain the following SOR equation:

$$SOR = \frac{Ra226}{2.0\ \mathrm{pCi/g}} + \frac{Th230}{5.80\ \mathrm{pCi/g}} + \frac{U234}{26\ \mathrm{pCi/g}} + \frac{U238}{26\ \mathrm{pCi/g}}$$

where:

SOR = sum of ratios

Ra226 = Ra-226 concentrations

Th230 = Th-230 concentrations

U234 = U-234 concentrations

U238 = U-238 concentrations.