TETRA TECH

March 24, 2016

Mr. Bradley Vann
Remedial Project Manager
U.S. Environmental Protection Agency, Region 7
11201 Renner Boulevard
Lenexa, Kansas 66219

Subject: Quality Assurance Project Plan for Soil/Sediment Sampling of Drainage Features, Revision 01
West Lake Landfill Site, Bridgeton, Missouri
CERCLIS ID: MOD079900932
EPA Region 7, START 4, Contract No. EP-S7-13-06, Task Order No. 0007
Task Monitor: Bradley Vann, Remedial Project Manager

Dear Mr. Vann:

Tetra Tech, Inc. is submitting the attached revised Quality Assurance Project Plan for soil/sediment sampling of drainage features at the West Lake Landfill site (WLLS) in Bridgeton, Missouri. If you have any questions or comments, please contact the Project Manager at (816) 412-1775.

Sincerely,

Robert Monnig, PE
START Project Manager

Ted Faile, PG, CHMM
START Program Manager

Enclosures

cc: Tom Mahler, On-Scene Coordinator
Debra Dorsey, START Project Officer (cover letter only)

X9025.14.0007.000

415 Oak Street, Kansas City, MO 64106
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QUALITY ASSURANCE PROJECT PLAN FOR SOIL/SEDIMENT SAMPLING OF DRAINAGE FEATURES AT THE WEST LAKE LANDFILL SITE

Superfund Technical Assessment and Response Team (START) 4
Contract No. EP-S7-13-06, Task Order No. 0007

Prepared For:

U.S. Environmental Protection Agency
Region 7
Superfund Division
11201 Renner Blvd.
Lenexa, Kansas 66219

February 2, 2016
Revised March 24, 2016

Prepared By:

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Region 7 Superfund Program
Addendum to the Generic QAPP for Superfund Site Assessment and Targeted Brownfields Assessment Activities (October 2012) for the West Lake Landfill Site

Project Information:

Site Name: West Lake Landfill Site		**City:** Bridgeton	**State:** Missouri
EPA Project Manager: Bradley Vann		**START Project Manager:** Rob Monnig	
Approved By:		**Prepared For:** EPA Region 7 Superfund Division	
Title: START Project Manager	Date: 3/24/16		
Approved By:			
Title: START Program Manager	Date: 3/24/16		
Approved By: Kathy Homer		**Prepared By:** Rob Monnig **Date:** February 2016: revised March 24, 2016	
Title: START QA Manager	Date: 3/24/16		
Approved By:			
Title: EPA Project Manager	Date: 3/24/16	**Tetra Tech START Project Number:** X9025.14.0007.000	
Approved By:			
Title: EPA Region 7 QA Manager	Date:		

1.0 Project Management:

1.1 Distribution List:

EPA—Region 7: Bradley Vann, EPA Remedial Project Manager
Tom Mahler, EPA On-Scene Coordinator
Diane Harris, Region 7 QA Manager

START: Rob Monnig, Project Manager
Kathy Homer, QA Manager

1.2 Project/Task Organization:

Bradley Vann, of the EPA Region 7 Superfund Division, will serve as the EPA Project Manager for the activities described in this QAPP. Rob Monnig, of Tetra Tech, Inc., will serve as the START Project Manager.

1.3 Problem Definition/Background:

Description: This site-specific Quality Assurance Project Plan (QAPP) form is prepared as an addendum to the Generic QAPP for Superfund Site Assessment and Targeted Brownfields Assessment Programs (updated October 2012), and contains site-specific data quality objectives for the sampling activities described herein.

☒ Description attached.

☐ Description in referenced report: _____ Title _____ Date

1.4 Project/Task Description:

☐ CERCLA PA
☐ Other (description attached):
☐ CERCLA SI
☐ Pre-CERCLIS Site Screening
☐ Brownfields Assessment
☒ Removal Assessment

Schedule: Sampling is scheduled to occur in March and April 2016 and is anticipated to require 1 or 2 days to complete. Laboratory analysis of the samples is anticipated to require 28 days.

☐ Description in referenced report: _____ Title _____ Date

1.5 Quality Objectives and Criteria for Measurement Data:

Accuracy:	☒ Identified in attached table.
Precision:	☒ Identified in attached table.
Representativeness:	☒ Identified in attached table.
Completeness*:	☒ Identified in attached table.
Comparability:	☒ Identified in attached table.

Other Description:

*A completeness goal of 100 percent has been established for this project. However, if the completeness goal is not met, EPA may still be able to make site decisions based on any or all of the remaining validated data.

1.6 Special Training/Certification Requirements:

☒ OSHA 1910
☐ Special Equipment/Instrument Operator:
☐ Other (describe below):

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1.7 Documentation and Records:

☒ Field Sheets ☒ Site Log ☐ Trip Report ☒ Site Maps ☐ Video
☒ Chain of Custody ☒ Health and Safety Plan ☒ Letter Report ☒ Photos

☒ Sample documentation will follow EPA Region 7 SOP 2420.05.

☒ Other: Analytical information will be handled according to procedures identified in Table 2.

2.0 Measurement and Data Acquisition:

2.1 Sampling Process Design:

☐ Random Sampling ☐ Transect Sampling ☒ Biased/Judgmental Sampling ☐ Stratified Random Sampling
☐ Search Sampling ☐ Systematic Grid ☐ Systematic Random Sampling ☒ Definitive Sampling
☐ Screening w/o Definitive Confirmation ☐ Screening w/ Definitive Confirmation
☒ Sample Map Attached

The proposed sampling scheme is judgmental, in accordance with the Guidance for Performing Site Inspections Under CERCLA, OSWER Directive #9345.1-05, September 1992, and Removal Program Representative Sampling Guidance, Volume 1: Soil, OSWER Directive 9360.4-10, November 1991. Judgmental sampling is subjective (biased) selection of sampling locations based on historical information, visual inspection, and best professional judgment of the sampler(s). Surface soil will be field-screened for gamma radiation by use of real-time instruments, with soil samples submitted for laboratory radionuclide analysis. See Appendices A and B for additional site-specific information and a sample location map.

Sample Summary Location	Matrix	No. of Samples	Analysis
Discrete surficial soil/sediment samples will be collected at the West Lake Landfill and adjacent areas that contact surface water runoff from Areas 1 and 2 of Operable Unit 1 (OU1). Discrete surficial soil/sediment samples will be collected within the top 2 inches of these drainage features. Proposed sample locations are shown on Figure 1 in Appendix B.	Soil/sediment	8	Gamma scan (including radium-226), isotopic uranium, and thorium

2.2 Sample Methods Requirements:

Matrix	Sampling Method	EPA SOP(s)/Methods
Soil/sediment	At each location, approximately 1,000 grams of sample material will be collected within the top 2 inches of soil/sediment surface by use of a hand trowel.	SOP 4231.2012

2.3 Sample Handling and Custody Requirements:

☐ Samples will be packaged and preserved in accordance with procedures defined in Region 7 EPA SOP 2420.06.
☒ COC will be maintained as directed by Region 7 EPA SOP 2420.04.
☐ Samples will be accepted according to Region 7 EPA SOP 2420.01.
☒ Other (Describe): Samples will be packaged and accepted according to procedures established by a START-contracted laboratory.

2.4 Analytical Methods Requirements:

☒ Identified in attached table.
☒ Rationale: The requested analyses have been selected to provide an assessment of radionuclides of concern at the West Lake Landfill site, in soil/sediment samples collected from drainage pathways.
☐ Other (Describe):

2.5 Quality Control Requirements:

☐ Not Applicable
☐ Identified in attached table.
☐ In accordance with the Generic QAPP for Superfund Site Assessment and Targeted Brownfields Assessment Programs (updated October 2012).
☒ Describe Field QC Samples: No field QC samples will be required.
☐ Other (Describe):

2.6 Instrument/Equipment Testing, Inspection, and Maintenance Requirements:

☐ Not Applicable
☒ In accordance with the Generic QAPP for Superfund Site Assessment and Targeted Brownfields Assessment Programs (updated October 2012).
☒ Other (Describe): Testing, inspection, and maintenance of analytical instrumentation will proceed in accordance with the previously referenced SOPs and/or manufacturers' recommendations. Testing, inspection, and maintenance of field instruments (radiation screening instruments, GPS units, etc.) will proceed in accordance with manufacturers' recommendations.

2.7 Instrument Calibration and Frequency:

☐ Not Applicable
☒ Inspection/acceptance requirements accord with the Generic QAPP for Superfund Site Assessment and Targeted Brownfields Assessment Programs (updated October 2012).
☒ Calibration of laboratory equipment will be performed as described in the SOPs and/or manufacturers' recommendations referenced in Table 1.
☒ Other (Describe): Calibration of field instruments (radiation screening instruments, etc) will be conducted in accordance with manufacturers' recommendations.

2.8 Inspection/Acceptance Requirements for Supplies and Consumables:

☐ Not Applicable
☒ In accordance with the Generic QAPP for Superfund Site Assessment and Targeted Brownfields Assessment Programs (updated October 2012).
☐ All sample containers will meet EPA criteria for cleaning procedures for low-level chemical analysis. Sample containers will have Level II certifications provided by the manufacturer in accordance with pre-cleaning criteria established by EPA in *Specifications and Guidelines for Obtaining Contaminant-Free Containers*.
☒ Other (Describe): Samples will be packaged in food-grade plastic containers or sealable bags.

2.9 Data Acquisition Requirements:

☐ Not Applicable
☒ In accordance with the Generic QAPP for Superfund Site Assessment and Targeted Brownfields Assessment Programs (updated October 2012).
☐ Previous data/information pertaining to the site (including other analytical data, reports, photos, maps, etc., which are referenced in this QAPP) have been compiled by EPA and/or its contractor(s) from other sources. Some of that data has not been verified by EPA and/or its contractor(s); however, the information will not be used for decision-making purposes by EPA without verification by an independent professional qualified to verify such data/information.
☐ Other (Describe):

2.10 Data Management:

☐ All laboratory data acquired will be managed in accordance with Region 7 EPA SOP 2410.01.
☒ Other (Describe): All laboratory data acquired will be managed according to procedures established by the START-contracted laboratory.

3.0 Assessment and Oversight:

3.1 Assessment and Response Actions:

☒ Peer Review ☒ Management Review ☐ Field Audit ☐ Lab Audit
☐ Assessment and response actions pertaining to analytical phases of the project are addressed in Region 7 EPA SOPs 2430.06 and 2430.12.
☐ Other (Describe):

3.1A Corrective Action:

☒ Corrective actions will be taken at the discretion of the EPA Project Manager whenever there appear to be problems that could adversely affect data quality and/or resulting decisions affecting future response actions pertaining to the site.
☐ Other (Describe):

3.2 Reports to Management:

☐ Audit Report ☒ Data Validation Report ☐ Project Status Report ☐ None Required
☒ A letter report describing the sampling techniques, locations, problems encountered (with resolutions to those problems), and interpretation of analytical results will be prepared by Tetra Tech START and submitted to the EPA.
☒ Reports will be prepared in accordance with the Generic QAPP for Superfund Site Assessment and Targeted Brownfields Assessment Programs (updated October 2012).
☐ Other (Describe):

4.0 Data Validation and Usability:

4.1 Data Review, Validation, and Verification Requirements:

☐ Identified in attached table:
☒ Data review and verification will accord with the Generic QAPP for Superfund Site Assessment and Targeted Brownfields Assessment Programs (updated October 2012).
☐ Data review and verification will be performed by a qualified analyst and the laboratory's section manager as described in Region 7 EPA SOPs 2430.06, 2410.10, and 2430.12.
☒ Other (Describe): Laboratory analysis by the START-contracted laboratory will accord with guidance in the Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP) (EPA 2004). START will request fully documented (Level IV) data packages from the laboratory. The data packages will be validated internally by the laboratory in accordance with MARLAP and the laboratory's established SOPs. A START chemist will conduct an external verification and validation of the laboratory data package in accordance with MARLAP.

4.2 Validation and Verification Methods:

☐ Identified in attached table:
☐ The data will be validated in accordance with Region 7 EPA SOPs 2430.06, 2410.10, and 2430.12.
☒ Other (Describe): The data will be validated using methods consistent with validation procedures described in MARLAP (EPA 2004). The EPA Project Manager will be responsible for overall validation and final approval of the data, in accordance with the projected use of the results.

4.3 Reconciliation with User Requirements:

☐ Identified in attached table:
☒ If data quality indicators do not meet the project's requirements as outlined in this QAPP, the data may be discarded and re-sampling or re-analysis of the subject samples may be required by the EPA Project Manager.
☐ Other (Describe):

Region 7 Superfund Program Addendum to the Generic QAPP for Superfund Site Assessment and Targeted Brownfields Assessment Activities (October 2012) for the West Lake Landfill Site						
Table 1: Sample Summary						
Site Name: West Lake Landfill Site				**Location:** Bridgeton, Missouri		
START Project Manager: Rob Monnig				**Activity/ASR #:** NA	**Date:** February 2016; revised March 24, 2016	
No. of Samples	Matrix	Location	Purpose	Requested Analysis	Sampling Method	Analytical Method/SOP
8	Soil/sediment	Drainage features of the West Lake Landfill	Assess soil/sediment samples collected from drainage features receiving surface water runoff from OU1 of the West Lake Landfill for presence of radionuclides above site-specific reference levels that would indicate presence of radiological-impacted material (RIM) associated with the West Lake Landfill site.	Gamma spectroscopy, including Ra-226	SOP 4231.2012	LANL ER-130 Modified (or EML Ga-01-R Modified) preceded by 21-day in-growth of Ra-226 progeny
				Isotopic U (U-234, -235, -238)		EML U-02 Modified
				Isotopic Th (Th-228, -230, -232)		EML Th-01 Modified

Notes:

ASR	Analytical Services Request
EML	U.S. Department of Energy (DOE) Environmental Measurements Laboratory (EML) Procedures Manual
NA	Not applicable
LANL	Los Alamos National Laboratory
Ra	Radium
SOP	Standard Operating Procedure
Th	Thorium
U	Uranium

Region 7 Superfund Program
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Table 2: Data Quality Objective Summary

Site Name: West Lake Landfill Site					**Location:** Bridgeton, Missouri				
START Project Manager: Rob Monnig					**Activity/ASR #:** N/A (START-contracted laboratory)			**Date:** February 2016; revised March 24, 2016	
Analysis	Analytical Method	Data Quality Measurements						Sample Handling Procedures	Data Management Procedures
		Laboratory Detection Limit Goal	Accuracy	Precision	Representativeness	Completeness	Comparability		
Ra-226 (by gamma spectroscopy)	See Table 1	1 pCi/g	Per analytical method	Per analytical method	Surficial soil/sediment samples will be collected from areas likely in contact with surface water runoff or standing water.	The completeness goal is 100%; however, no individual samples have been identified as critical samples.	Standardized procedures will be used.	See Section 2.3 of QAPP form.	See Section 2.10 of QAPP form.
Other gamma-emitting radionuclides (by gamma spec.)	See Table 1	Per analytical method	Per analytical method	Per analytical method	Surficial soil/sediment samples will be collected from areas likely in contact with surface water runoff or standing water.	The completeness goal is 100%; however, no individual samples have been identified as critical samples.	Standardized procedures will be used.	See Section 2.3 of QAPP form.	See Section 2.10 of QAPP form.
Isotopic U (U-234, -235, -238)	See Table 1	1 pCi/g	Per analytical method	Per analytical method	Surficial soil/sediment samples will be collected from areas likely in contact with surface water runoff or standing water.	The completeness goal is 100%; however, no individual samples have been identified as critical samples.	Standardized procedures will be used.	See Section 2.3 of QAPP form.	See Section 2.10 of QAPP form.
Isotopic Th (Th-228, -230, -232)	See Table 1	1 pCi/g	Per analytical method	Per analytical method	Surficial soil/sediment samples will be collected from areas likely in contact with surface water runoff or standing water.	The completeness goal is 100%; however, no individual samples have been identified as critical samples.	Standardized procedures will be used.	See Section 2.3 of QAPP form.	See Section 2.10 of QAPP form.

Notes:

ASR	Analytical Services Request
pCi/g	PicoCuries per gram
QAPP	Quality Assurance Project Plan
Ra	Radium
Th	Thorium
U	Uranium

APPENDIX A

SITE-SPECIFIC INFORMATION REGARDING SOIL/SEDIMENT SAMPLING

INTRODUCTION

The Tetra Tech, Inc. (Tetra Tech) Superfund Technical Assessment and Response Team (START) has been tasked by the U.S. Environmental Protection Agency (EPA) to assist with soil/sediment sampling within surface water runoff drainage features at the West Lake Landfill site (WLLS) in Bridgeton, Missouri. Rob Monnig of Tetra Tech will serve as the START Project Manager. He will be responsible for ensuring that the study proceeds as described in this Quality Assurance Project Plan (QAPP), and for providing periodic updates to the client concerning the status of the project, as needed. Bradley Vann will be the EPA Project Manager for this activity.

START's tasks will include, but will not be limited to: (1) engaging an analytical laboratory for radionuclide analysis of collected soil/sediment samples, (2) collecting samples and coordinating their shipment to the laboratory, (3) assisting EPA with data acquisition and management, and (4) documenting the sampling efforts. The Tetra Tech START Quality Assurance (QA) Manager will provide technical assistance, as needed, to ensure that necessary QA issues are adequately addressed.

START will adhere to this QAPP as much as possible, but may alter proposed activities in the field if warranted by site-specific conditions and unforeseen hindrances that prevent implementation of any aspect of this QAPP in a feasible manner. Such deviations will be recorded in the site logbook, as necessary. This QAPP will be available to the field team at all times during sampling activities to serve as a key reference for the proposed activities described herein.

PROBLEM DEFINITION, BACKGROUND, AND SITE DESCRIPTION

West Lake Landfill is an approximately 200-acre property that includes several closed solid waste landfill units which accepted wastes for landfilling from the 1940s or 1950s through 2004, plus a solid waste transfer station, a concrete plant, and an asphalt batch plant. The WLLS is at 13570 St. Charles Rock Road in Bridgeton, St. Louis County, Missouri, approximately 1 mile north of the intersection of Interstate 70 and Interstate 270 (see Appendix B, Figure 1). The WLLS was used for limestone quarrying and crushing operations from 1939 through 1988. Beginning in the late 1940s or early 1950s, portions of the quarried areas and adjacent areas were used for landfilling municipal refuse, industrial solid wastes, and construction/demolition debris. In 1973, approximately 8,700 tons of leached barium sulfate residues (a remnant from the Manhattan Engineer District/Atomic Energy Commission project) was reportedly mixed with approximately 39,000 tons of soil from the 9200 Latty Avenue site in Hazelwood, Missouri, transported to the WLLS, and used as daily or intermediate cover material. In December 2004, the Bridgeton Sanitary Landfill—the last landfill unit to receive solid waste—stopped receiving waste

pursuant to an agreement with the City of St. Louis to reduce potential for birds to interfere with Lambert Field International Airport operations.

EPA is planning to sample soil/sediment to assess presence of radiological-impacted material (RIM) derived from the West Lake Landfill site within selected drainages near the boundaries of Areas 1 and 2 of Operable Unit 1 (OU1). These drainages may have received erosional sediment, possibly containing RIM eroded and transported from Areas 1 and 2 via surface water runoff. Of particular concern is erosion that may have occurred during heavy rainfall in the St. Louis area between December 26 and 29, 2015, when the area received 10 inches of rain or more (University of Missouri 2016).

SAMPLING PROCESS DESIGN AND RATIONALE

Design of and rationale for the sampling process for this study are developed via the 7-step process of establishing data quality objectives (DQO). This process is described in the EPA documents *Data Quality Objectives Process for Hazardous Waste Site Investigations* (EPA QA/G-4HW, January 2000, EPA/600/R-00/007) and *Guidance for the Data Quality Objectives Process* (EPA QA/G-4, February 2006, EPA/240/B-06/001).

Step 1 – State the Problem

Problem Statement

Information is needed to assess if RIM from OU1 has been eroded, transported, and deposited at outfall areas exiting OU1.

Conceptual Site Model of Environmental Hazard to be Evaluated

Precipitation events could cause erosion and transport of RIM from OU1. Sampling will occur to assess for presence of RIM within surface water drainages near the boundaries of Areas 1 and 2 of OU1.

Step 2 – Identify the Decision

Principal Study Question

Sampling data will be used to answer this principal study question:

> **Principal Study Question**: Do drainage features receiving surface water runoff from OU1 contain RIM that was possibly eroded and transported from OU1 and then subsequently deposited into the drainage features?

Decision Statement / Alternative Actions

The following decision statement presents alternative actions related to the principal study question:

> **Decision Statement**: If surficial soil/sediment samples collected from drainage features indicate presence of RIM, additional sampling will be proposed to determine the nature and extent of the apparent release of RIM cause by erosional runoff.

Step 3 – Identify Inputs to the Decision

The following information is needed to resolve the decision statement.

Sampling Locations

Sampling will target locations seemingly likely to contain variable amounts of deposited erosional sediment. General locations for sampling, described in Table A-1 and depicted on Figure 1 in Appendix B, were selected because they appear to be drainage features that likely receive surface water runoff from OU1 Areas 1 and 2.

Because deposited RIM is potentially identifiable by presence of elevated gross gamma radiation detectable by field instruments, START will begin by surveying surface soils at each of the selected drainage feature locations using a Ludlum Model 2221 rate meter with a Ludlum Model 44-20 sodium iodide (NaI) scintillation detector. Survey personnel will scan surface soil in a serpentine pattern. The detector will be held approximately 6 inches above ground surface while the surveyor moves the detector at approximately 1 to 2 feet per second. If elevated gross gamma radiation is detected, the area will be flagged for possible soil sampling. After completing the gamma survey, EPA and START will select a soil sampling location that appears most likely to contain deposited sediment. Selection of the sampling location will be based on the best professional judgement of the sampler(s) using results of the gamma survey, visual inspection of the area, and any historical information to inform the decision. Samples will be collected within the top 2 inches of soil/sediment by use of a disposable hand trowel and packaged in food-grade plastic containers or sealable bags. A new, disposable hand trowel will be used at each sample location. Samples will be dried and homogenized by the analytical laboratory before analysis.

TABLE A-1

SEDIMENT SAMPLING LOCATIONS
WEST LAKE LANDFILL, BRIDGETON, MISSOURI

Proposed Sample ID	Location Description	Rationale
Sediment 1A and 1B	Concrete drainage culverts near landfill entrance along St. Charles Rock Road	These drainage features likely receive surface water runoff from OU1 Areas 1 or 2 during high precipitation events.
Sediment 2	Concrete-lined drainage channel north of the blue scale/check office building (an approximate location for this sample is shown on Figure 1 in Appendix B; field personnel will select a location where sedimentation is apparent based on visual inspection)	This drainage feature likely receives surface water runoff from OU1 Area 1 during high precipitation events.
Sediment 3	Erosional drainage feature in the vicinity of Weir #9 or #8 (an approximate location for this sample is shown on Figure 1 in Appendix B; field personnel will select a location where sedimentation is apparent based on visual inspection)	This drainage feature likely receives surface water runoff from OU1 Area 2 during high precipitation events.
Sediment 4	Northwest side of OU1 Area 2 (Buffer Zone) along drainage between AAA Trailer property and Area 2	This drainage feature likely receives surface water runoff from OU1 Area 2 (as well as the AAA Trailer property) during high precipitation events.
Sediment 5	Northwest side of OU1 Area 2 (Buffer Zone) along drainage between AAA Trailer property and Area 2 or in earthen drainage swale between Old St. Charles Rock Road and Area 2.	This drainage feature likely receives surface water runoff from OU1 Area 2 during high precipitation events.
Sediment 6	West of OU1 Area 2 within a stormwater discharge culvert between AAA Trailer property and the Earth City drainage way.	This drainage feature receives surface runoff from the AAA Trailer property that itself may receive runoff from OU1 Area 2 during high precipitation events.
Sediment 7	Northeast side of OU1 Area 2 along drainage associated with a former settling pond.	This drainage feature likely receives surface water runoff from OU1 Area 2 during high precipitation events.

Notes:

OU Operable Unit

Reference Levels for Identifying RIM in Surface Soil

To determine if surface soil/sediment samples collected at the drainage feature locations are characteristic of RIM, laboratory analytical results from those samples will be compared to reference levels included in the *Supplemental Feasibility Study Report for West Lake Landfill OU-1* (Engineering Management Support, Inc. 2011), which are based on site background values and risk-based remediation concentrations listed in EPA Office of Solid Waste and Emergency Response (OSWER) directives. The reference levels are:

Radionuclide	Reference Level (picoCuries per gram)
Combined radium (radium-226 plus radium-228)	7.9
Combined thorium (thorium-230 plus thorium-232)	7.9
Total uranium	54.5

Soil/sediment samples with combined radium, combined thorium, or total uranium exceeding these reference levels will be considered potentially characteristic of RIM.

Confirm that Appropriate Measurement Methods Exist to Provide the Necessary Data

Detection and quantitation limits of laboratory methods identified in Tables 1 and 2 are appropriate for comparisons of analytical results to the identified reference levels.

Step 4 – Define the Boundaries of the Study

Target Population

The target population is surface soil/sediment from the drainage features identified in Table A-1 that convey surface water runoff from OU1 Areas 1 and 2.

Spatial and Temporal Boundaries

Soil/sediment samples will be collected from selected drainage features (identified in Table A-1) that appear likely to convey surface water runoff from Areas 1 or 2 of OU1 during high precipitation events. Temporal boundaries are not a significant aspect of this study.

Define the Scale of Decision Making

Individual soil/sediment samples containing combined radium, combined thorium, or total uranium exceeding the respective reference levels listed above will be considered potentially characteristic of RIM.

Practical Constraints on Acquiring the Data

No practical constraints have been identified.

Step 5 – Develop a Decision Rule

Individual soil/sediment samples with combined radium, combined thorium, or total uranium exceeding the respective reference levels will be considered potentially characteristic of RIM. If a sample collected from a drainage feature is potentially characteristic of RIM, additional sampling will be proposed to determine the nature and extent of the apparent release of RIM cause by erosional runoff.

Step 6 – Specify Tolerable Limits on Decision Errors

A decision error could occur if RIM is present within a studied drainage feature, but is not collected in the sample submitted for laboratory analysis. This type of error is not readily quantifiable for evaluation with respect to numerical tolerable limits, but will be controlled by performance of a surface soil gamma radiation survey (which would likely identify presence of RIM), and by taking care to collect samples from the top 2 inches of soil in accordance with the QAPP, within areas that appear most likely to contain deposited sediment derived from the West Lake site (if no elevated gross gamma readings are detected).

Step 7 – Optimize the Design for Obtaining Data

The data-collection design presented herein is anticipated to provide an effective balance between cost and ability to meet the DQOs. Collection of eight soil/sediment samples is anticipated for analysis at a START-contracted laboratory (to be determined).

REFERENCES

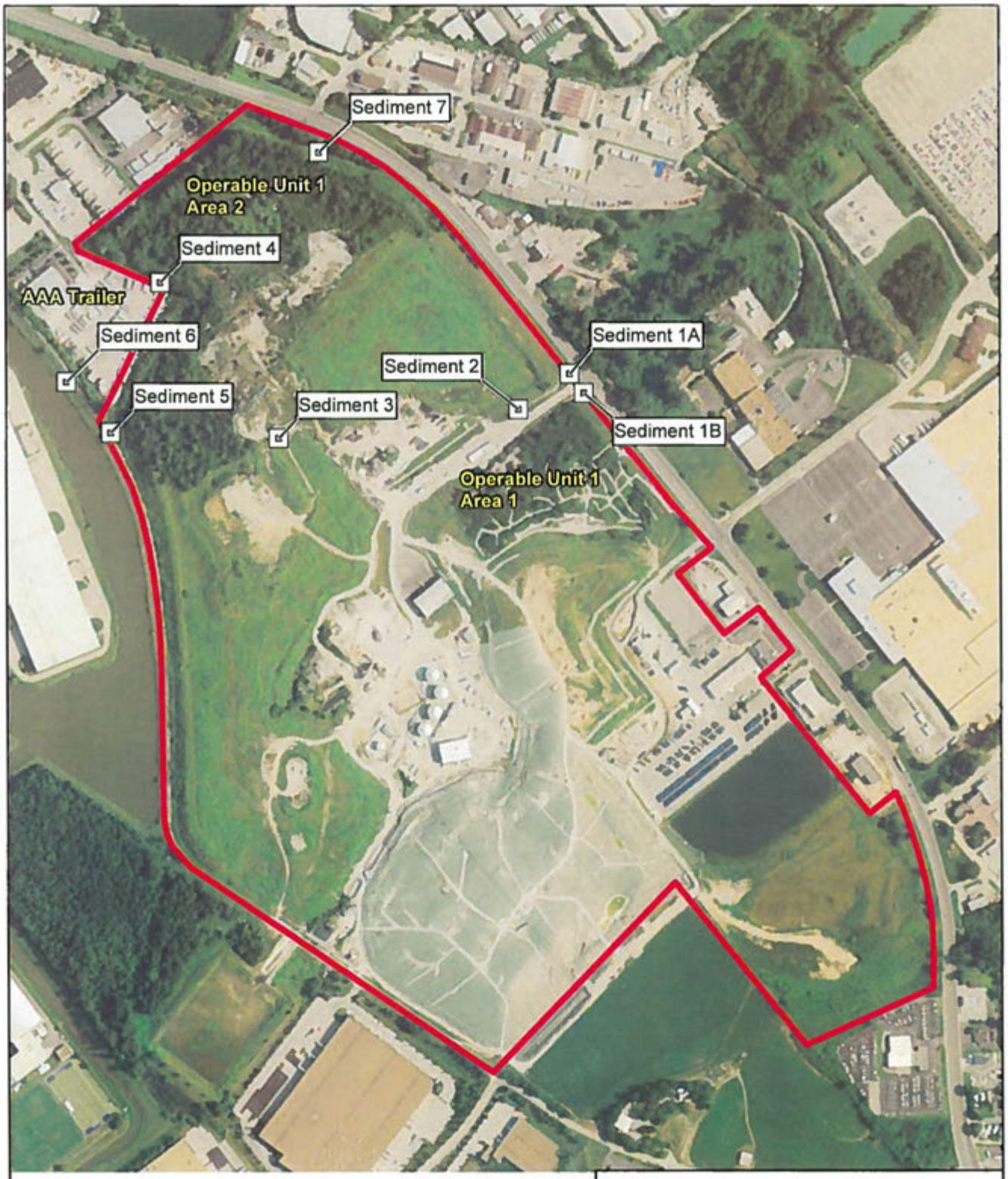
Engineering Management Support, Inc. 2011. Supplemental Feasibility Study, Radiological-Impacted Material Excavation Alternatives Analysis, West Lake Landfill Operable Unit-1. Final. December 28.

U.S. Environmental Protection Agency. 2004. Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP). USEPA 402-B-04-001A. July.

University of Missouri, Missouri Climate Center. 2016. December 2015 Weather and Its Impacts on Missouri. http://climate.missouri.edu/ Accessed January 25, 2016.

APPENDIX B

FIGURE



Legend

Proposed Sediment Sample Location

West Lake Landfill

N

0 350 700

Feet

Source: ESRI, ArcGIS Online, World Imagery, 2014

West Lake Landfill
Bridgeton, Missouri

Figure 1

Proposed Sediment Sampling Locations

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Date: 3/1/2016 Drawn By: Clayton Hayes Project No: X9025 0007 000