UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 7
11201 Renner Boulevard
Lenexa, Kansas 66219

OCT 0 3 2017

Mr. Paul Rosasco, P.E.
Engineering Management Support, Inc.
25923 Gateway Drive
Golden, Colorado 80401

Re: EPA Comments on the September 6, 2017, Revised Storm Water Monitoring Plan, West Lake Landfill, Operable Unit 1, Bridgeton, Missouri

Dear Mr. Rosasco:

The U.S. Environmental Protection Agency has reviewed the above-referenced document and is providing the enclosed comments. This plan was submitted to the EPA on September 6, 2017, for review and approval in accordance with the Administrative Order on Consent, EPA Docket No. VII-93-F-0005.

Please provide the EPA with a revised version of the plan that fully addresses the enclosed comments within 7 calendar days of your receipt of this letter. If you have any questions pertaining to this letter or the enclosed comments, please contact me by phone at (913) 551-7416 or by email at mahler.tom@epa.gov.

Sincerely,

Tom Mahler

Tom Mahler
On-Scene Coordinator
Site Remediation Branch
Superfund Division

Enclosure

cc: Mr. Ryan Seabaugh, MDNR

Comments on the Revised Storm Water Monitoring Plan
West Lake Landfill, Operable Unit 1, Bridgeton, Missouri
September 6, 2017

OU-1 Stormwater Monitoring Points:

1. **Page 2:** Add additional text or a new paragraph to define and clarify the terminology used in the document for locations that are listed as "outfalls" and locations listed as "inspection/monitoring points." Additionally, revise the text to clarify that under the Comprehensive Environmental Response, Compensation, and Liability Act provisions, the specific Operable Unit 1, or OU-1, outfalls and monitoring points are all currently designated as "on-site."

2. **Page 2, Numbered Bullets, 1st bullet, OU1-001:** Revise this bullet or sentence to identify this location as being internal to the Site (similar to the description provided for OU1-003a).

3. **Page 2:** Add the following items to the list of outfalls/monitoring points:

    - **Outfall OU-1-012:** This new outfall is located along the eastern perimeter of Area 1, near the proposed National Pollutant Discharge Elimination System (NDPES) Bridgeton Landfill Outfall 008 where stormwater was previously sampled on December 28, 2015, and April 30, 2017. This outfall will be inspected and sampled per the Stormwater Monitoring Plan until such time as Best Management Practices (BMPs) and/or other Site actions have resolved potential commingling of stormwater from within the Area 1 fence and the North Quarry portions of Bridgeton Landfill.

    - **New Inspection Area, Western portion or boundary of Area 2 fence-line:** This area associated with the Area 2 boundary located near the Earth City Storm Retention system or pond shall be monitored just as the other boundaries of Area 2 are inspected and monitored.

4. **Page 2:** Delete the word "potential" from every statement referencing locations where stormwater discharge has been observed or documented. For the purposes of this plan, these locations are considered stormwater outfalls.

5. **Page 3, 1st full paragraph and the next paragraph:** Delete the two sentences in this section regarding vegetation density and muddy conditions as an "access constraint." The EPA expects the locations will be inspected and sampled appropriately during and following qualifying storm events.

6. **Page 3:** The text currently states, "In addition to sampling these eleven (11) designated stormwater monitoring points, the OU-1 Respondents will continue to perform visual inspections of potential points of stormwater discharge from the northwestern and northeastern boundaries of Area 2 to determine if stormwater discharge occurs in these areas, in accordance with EPA's April 4 and September 9, 2016 letters."

    Comment: Replace this text with "In addition to sampling these twelve (12) designated stormwater monitoring points, the OU-1 Respondents will continue to perform visual inspections of potential points of stormwater discharge from the eastern Area 1 fence-line and from the northwestern, northeastern, and western boundaries of Area 2 to determine if stormwater discharge occurs in these areas."

7. **Page 3:** The text currently states, "Specifically, the slope along the northeastern boundary of Area 2 will continue to be inspected for the presence of any stormwater flow that may be occurring down the slope to the perimeter drainage channel located between Area 2 and St. Charles Rock Road."

   Comment: Replace this text with, "Special attention will be given to the slope along the northeastern boundary of Area 2 down the slope to the perimeter drainage channel between Area 2 and St. Charles Rock Road."

8. **Page 3:** Previously, in a response to comments dated April 11, 2016, the PRPs stated "For example, the reported precipitation at Lambert-St. Louis International Airport on March 10, 2016, was 0.20 inches." and "Similarly, the reported precipitation at Lambert-St. Louis International Airport on March 30, 2016, was 0.41 inches."

   Comment: Please explain why Weldon Springs is identified in this plan as the Site to be used for meteorological information and not the closer Lambert Field location. Please continue to use the Lambert Field location and note that the National Oceanic and Atmospheric Administration website provides abundant data including data for Lambert Field. The web link for the Lambert Field met-station (CF6STL) information is: http://w1.weather.gov/data/obhistory/KSTL.html

9. **Footnote at Bottom of Page 3**: This footnote comments on an "eighth outfall" associated with the Missouri Department of Natural Resources draft NPDES permit for Bridgeton Landfill and clarifies that the OU-1-008 location is separate from the NPDES "eighth" outfall. It is the EPA's understanding that Bridgeton Landfill, LLC is planning to develop specific engineering controls at or near this area to better manage stormwater. Revise the text of the document to briefly include a discussion and, where possible, a reference to other documentation on planned efforts to control and manage stormwater flow. Explain that until these engineering controls are in place and working properly, this location will be designated as Outfall OU1-012 and will be monitored and sampled as an OU-1 Outfall under the provisions of this Stormwater Monitoring Plan. See comment o Page 2 OU-1 Monitoring Points for more information on this new outfall location.

10. **Page 5:** The text states: "Once a year's worth of monthly samples have been collected, the OU-1 Respondents may propose to reduce the stormwater inspection and sampling frequency from a monthly to a quarterly basis, consistent with the monitoring frequency required for the Bridgeton Landfill and other landfills in Missouri." And "After six months of data have been received, Respondents may propose to alter the analysis parameters."

    Comment: Delete and refer to comment 11 for replacement language.

Timing and Frequency of Stormwater Monitoring

11. **Page 6:** "EPA has directed the initiation of expedited notification for stormwater results that exceed Maximum Contaminant Limits applicable to drinking water or relevant standards. Respondents disagree that drinking water limits are applicable to assessment of stormwater discharge and EPA has not yet provided any 'relevant standards.' In response to EPA's directive, however, validated laboratory analytical results will be compared to existing MCLs, if available, or relevant standards if provided by EPA in the future."

Comment: Replace these statements with "Expedited notification will be provided to the EPA and DNR for validated stormwater results that exceed applicable stormwater standards/reporting limits as defined in [*insert appropriate reference to table(s) in approved QAAP*]. At minimum, these standards will continue to apply until the EPA approves changes to the monitoring frequency or the stormwater parameters or standards."

Best Management Practices

12. **Page 6**: "Currently, the only Best Management Practices (BMPs) employed for OU-1 are a soil berm along the margin of the Buffer Zone to prevent stormwater that accumulates on the Buffer Zone from spreading onto the adjacent Crossroad property."

    Comment:

    - Replace "are" with "is" and replace "soil" with "rock"
    - Revise this paragraph to describe all of the BMPs currently employed that relate to OU-1 outfalls, including specifically those BMPs associated with the OU-1 internal outfalls.
    - The narrative on this topic does not provide sufficient information or detail to address potential stormwater issues at the Site. Revise the document to include an OU-1 specific Stormwater Pollution Prevention Plan as an attachment to include site-specific descriptions of the watersheds, stormwater flow paths, engineering controls and BMPs to be utilized at the Site to address stormwater for OU-1. The OU-1 SWPP should include the requirements for routine inspections and implementation and operation and maintenance (O&M) of the stormwater BMPs. Please see the following web link for specific SWPP development guidance:

      https://www3.epa.gov/npdes/pubs/industrial_swppp_guide.pdf

13. **Figure 1**. Revise to include the new Outfall OU-1-012 and a new inspection area located along the Area 2 western boundary (see previous comments).

14. **Figure 2.** This figure provides a number of areas and locations that are denoted as "drains". The term "drains" is relatively generic and could be misinterpreted. Please add additional information and descriptors to Figure 2 to clarify and better distinguish between various drainage features located at the Site. This may include, but not be limited to, ditches, MSD sewer inlets, non-MSD drainage inlets, etc. Additionally, revise Figure 2 and its legend to display and label all stormwater culverts/features/water bodies/drop boxes, etc. on and near the Site.

Quality Assurance Project Plan (QAPP) Attachment

15. **General Comment to the submitted QAPP document:** The Quality Assurance Project Plan (QAPP) as submitted does not meet the minimum requirements for this type of submittal and cannot be approved as written. Revise the submittal per the guidance and instructions in the Uniform Federal Policy for Quality Assurance Project Plans Manual VI, dated March 2005. For more

information on this item please see the following web link: https://www.epa.gov/fedfac/assuring-quality-federal-cleanups

Additionally, the EPA is providing the enclosed draft QAPP document as an example of an acceptable QAPP format which includes consideration of specific radiological background information and potential action levels, including data quality objectives.

Specific QAPP comments

16. **Section A.1 Signature/Approval Sheet, page i:**

    Comment: Delete Department of Natural Resources (DNR) representatives from the signature/approval sheet.

17. **Section A.5 Project Definition/Background, page 2 states:** "NCC construction continued during this period up through June 6, 2016, at which time active construction activities ended."

    Comment: Replace with "NCC construction continued during this period up through June 6, 2016, at which time active construction activities were suspended."

18. **Section A.9 Documents and Records, Bullet 5, page 4**: "Photographic documentation of perimeter inspections"

    Comment: Since previously unmonitored discharge locations have been successfully identified by the PRPs, as evidenced by extensive photographic documentation, the effort to document perimeter inspections can now transition to more limited photographic documentation. Photographic documentation should be representative of site conditions within 24 hours of storm events.

19. **QAPP Table 2:** Update the table to be consistent with regulatory detection limit requirements and/or EPA-established standards, and at a minimum consistent with monitoring limits previously used/provided.

ENGINEERING FOR A BETTER WORLD
FEEZOR
ENGINEERING, INC.

Stormwater Monitoring
Quality Assurance Program Manual (QAPP)

West Lake Landfill Operable Unit 1

Bridgeton, Missouri

Revision 0

XXXXX XX,

2017

Project No. BT-162

Prepared By:

Feezor Engineering, Inc.
3377 Hollenberg Drive
Bridgeton, MO 63044

A.1 SIGNATURE / APPROVAL SHEET

Approved by:

______________________________ ____________

Tom Mahler - USEPA On-Site Scene Coordinator Date

______________________________ ____________

~~Ryan Seabaugh - Missouri Department of Natural Resources~~ Date

Formatted: Strikethrough

______________________________ ____________

Paul Rosasco - Engineering Management Support, Inc. Date

______________________________ ____________

Jonathan Wilkinson - Feezor Engineering, Inc. Date

A.2 TABLE OF CONTENTS

Forecast Office in Weldon Spring, MO (station KSLX)

Appendix C - Example Laboratory Chain of Custody (COC) documents

A.3 Distribution List

The following individuals will receive copies of the approved Stormwater Monitoring Quality Assurance Project Plan (QAPP) and subsequent revisions:

Christine Jump - United States Environmental Protection Agency, Region 7 (USEPA)

Lynn Juett - United States Environmental Protection Agency, Region 7 (USEPA)

Justin Barker - United States Environmental Protection Agency, Region 7 (USEPA)

Tom Mahler - United States Environmental Protection Agency, Region 7 (USEPA)

Ryan Seabaugh - Missouri Department of Natural Resources (MDNR)

John McGahren - Morgan, Lewis & Bockius LLP

Stephanie Feingold - Morgan, Lewis & Bockius LLP

Dale Guariglia - Bryan Cave

Scott Sklenar - Exelon Corporation

Bill Beck - Lathrop & Gage, LLP

Jessie Merrigan - Lathrop & Gage LLP

Sarah Lintecum - Lathrop & Gage LLP

Victoria Warren - Republic Services, Inc.

Erin Fanning - Bridgeton Landfill LLC

Dana Sincox - Bridgeton Landfill, LLC

Paul Rosasco - Engineering Management Support, Inc. (EMSI)

Cecilia Greene - Auxier & Associates, Inc. (A&A)

Dan Feezor - Feezor Engineering, Inc. (FEI)

Jonathan Wilkinson - Feezor Engineering, Inc. (FEI)

Courtesy copies will be provided to others, including Respondents and Respondents' individual contractors.

A.4 PROJECT TASK / ORGANIZATION

A project organization chart is provided as Figure 1. Contact information for the individuals listed below is provided in Table 1. The individuals participating in the project and their roles and responsibilities are discussed below:

Commented [A1]: It is noted that the list of individuals in the previous section is substantially longer than is addressed here.

Similarly, this section does not address key roles for the project such as data V&V and assessment, channels of communication with labs, corrective actions, notification of regulators, etc. Revise to include this information.

Paul Rosasco, PE, Project Coordinator; EMSI

Mr. Rosasco has overall responsibility for project implementation, and provides the interface between the USEPA, the MDNR, and the Respondents.

Jonathan Wilkinson, PE, Field Supervisor; FEI

Commented [A2]: Mr. Wilkinson is listed as being responsible for QA and all field operations. The QA manager must be independent of and unencumbered by conflicts that might arise with the operations he oversees. Please clarify if this is true for this role/person.

Mr. Wilkinson will have overall responsibility for project quality assurance, oversight of field sampling teams, field sampling equipment, and field coordination.

Cecilia Greene, Radiological Health and Safety Officer; A&A

Commented [A3]: Description of program areas should be included in the QAPP if this is a key individual.

Ms. Greene will be responsible for coordination of on-site A&A personnel to provide radiological health and safety assistance for field sampling team members.

Radiological Constituent Analysis Laboratory Project Manager

Commented [A4]: Clarify whether this is project staff or laboratory staff.

The laboratory's project manager for radiological constituent laboratory analysis of samples from the West Lake Landfill OU-1 facility ensures that the laboratory meets MQOs consistent with analytical protocol specifications and that the radiological constituent laboratory's analytical report is prepared consistent with the statement of work.

Physical / Chemical Constituent Analysis Laboratory Project Manager

Commented [A5]: Include whether this is project staff or laboratory staff.

The laboratory's project manager for physical/chemical constituent laboratory analysis of samples from the West Lake Landfill OU-1 facility ensures that the laboratory meets MQOs consistent with analytical protocol specifications and that the physical/chemical constituent laboratory's analytical report is prepared consistent with the statement of work.

Data Verification, Validation (V&V) and Assessment

The Data V&V Team Manager is an individual independent of the analytical laboratory verifies and validates analytical data from the West Lake Landfill OU-1 facility against established performance objectives and data quality

Commented [A6]: Include the title/name for whoever is responsible.

criteria to establish whether the obtained data meet MQOs and other analytical protocol specifications for the project.

A.5 PROJECT DEFINITION / BACKGROUND

Stormwater monitoring and reporting was initiated as an extension of Non-Combustible Cover (NCC) construction activities at the West Lake OU-1 facility. Stormwater sampling and reporting were required by USEPA and MDNR during NCC construction to comply with applicable or relevant and appropriate requirements (ARARs) of other environmental laws identified by the MDNR. USEPA instructed the OU-1 Respondents that "the State-identified ARARs associated with Storm Water will apply to the Surface Fire Mitigation Removal Action and should be complied with until this action is complete."

On February 23, 2016, on behalf of Cotter Corporation (N.S.L.}, Bridgeton Landfill, LLC, Rock Road Industries, Inc. (the OU-1 Respondents) and the United States Department of Energy (the Federal Respondent), EMSI submitted a proposed plan for performing stormwater monitoring during NCC construction. USEPA provided conditional approval for that plan on March 1, 2016. Implementation of the plan was expressly permitted while USEPA continued its evaluation of the plan. On April 4, 2016, USEPA provided comments to the February 23, 2016 stormwater monitoring plan.

The February 23, 2016 plan was revised to address the April 4, 2016 USEPA comments and was submitted to USEPA on April 11, 2016. NCC construction continued during this period up through June 6, 2016, at which time active construction activities ended. USEPA provided comments to the April 11, 2016 revised plan on July 5, 2016.

The April 11, 2016 plan was revised to address the July 5, 2016 USEPA comments and was submitted to USEPA on July 15, 2016. USEPA provided comments to the July 15, 2016 plan on September 9, 2016 and December 12, 2016. Per EPA's letter of December 12, 2016, the plan was to be revised to address stormwater monitoring during the period prior to implementation of a final remedy for OU-1. The July 15, 2016 plan was revised to address the September 9, 2016 and December 12, 2016 comments and was submitted to USEPA on March 22, 2017.

On June 16, 2017, USEPA specifically defined Radiologically Impacted

Material (RIM) at the West Lake Landfill Site in Section 6.2.6 of the RI Addendum. RIM was defined as the sum of the representative background concentrations and the appropriate risk-based remediation concentrations listed in the OSWER directives for radium and thorium and the methodology used at the SLAPS and SLDS sites for uranium. Based on Site background values, the criteria to be used to identify RIM are as follows:

- Radium-226+228 = 7.9 pCi/g
- Thorium-230+232 = 7.9 pCi/g
- Combined uranium = 54.5 pCi/g

USEPA provided comments to the March 22, 2017 plan on August 9, 2017. Comment #8 of the August 9, 2017 letter stated that because chemical and radiological sample collection is included in the Stormwater Monitoring Plan, a QAPP for stormwater sampling and analysis must be included in the revised Stormwater Monitoring Plan.

Accordingly, this QAPP addresses three overall goals:

- The QAPP defines the processes needed to monitor for and collect stormwater samples in the case of off-site discharges. The QAPP will help ensure that data generated will be complete and of sufficient quality to demonstrate that the Site is in compliance with Missouri Department of Natural Resources (MDNR) limits for radiological contaminants in stormwater effluents from the Site.
- The QAPP defines analytical processes needed to ensure that any analytical data generated will be of sufficient quality to support decisionmaking.
- The QAPP also defines the processes that will be used to determine: 1) whether the Site is in compliance with Missouri Department of Natural Resources (MDNR) limits for radiological contaminants in stormwater discharges from the Site; and 2) whether RIM, as defined in the RI Addendum dated June 16, 2017 (see above), is migrating from the site as a result of stormwater discharges.

Commented [A7]: Currently addresses only radiological items- needs additional input for the Physical/Chemical items. This is a concern throughout

Commented [A8]: Currently addresses radiological, but not the Physical/Chemical

A.6 Project Task / Description

The revised Stormwater Monitoring Plan and State of MDNR requirements state that the concentrations of gross alpha particle activity, gross beta, ^{226}Ra, ^{228}Ra, and combined uranium concentration in stormwater discharges from the Site be measured to determine whether they are in compliance with MDNR requirements for stormwater discharges from the Site. The MDNR action levels for site discharges are:

- The Safe Drinking Water Act (SDWA) Maximum Contaminant Level (MCL) values for *gross alpha particle activity excluding radon and uranium* of 15 pCi/L [40 CFR 141.66(c)];
- The SDWA MCL values for *beta particle and photon radioactivity* of 4 mrem/y [40 CFR 141.66(d)] *(Note that results greater than screening value of 50 pCi/L trigger isotopic speciation)*;
- The SDWA MCL values for *combined radium 226 + 228* (i.e., the summed isotopic activity of ^{226}Ra and ^{228}Ra) of 5 pCi/L [40 CFR 141.66(b)]; and
- The SDWA MCL values for *uranium* (i.e., the elemental concentration of uranium) of 30 ug/L [40 CFR 141.66(e)].

Additionally, measurements of the activity concentration of ^{226}Ra + ^{228}Ra, ^{230}Th + ^{232}Th, and total uranium (^{238}U + ^{235}U + ^{234}U) in stormwater samples will be evaluated to determine whether RIM is migrating from the Site as a result of stormwater discharges. The limits for RIM, as defined in the RI Addendum dated June 16, 2017 (see above), are:

- Radium-226+228 = 7.9 pCi/g
- Thorium-230+232 = 7.9 pCi/g
- Combined uranium = 54.5 pCi/g.

If the measured activity concentration of stormwater discharges exceeds these MCLs or RIM limits, action(s) will be taken.

The following activities will be performed to accomplish these goals.

- During or immediately after any precipitation event of 0.1 inches or greater:
  - Stormwater samples will be collected at all sampling locations at OU-1 Areas 1 and 2 designated in the Stormwater Monitoring

Commented [A9]: The action and notifications that needs to be taken needs to be defined to include more information such as data evaluations, and as appropriate site actions such as additional sampling, resampling, use of BMPs, etc, and per direction found in the site specific SWIPP and/or SMP.

Formatted: Highlight

Formatted: Highlight

Commented [A10]: Suggest listing the specific outfall locations for sampling in a table. If the decisions must be made about which locations to sample for any given storm event, the criteria to be used need to be included, too.

Plan where water is being discharged from the site.

- Points depicted on or along the inspection paths shown in Figure 2, will be monitored and samples collected if water is being discharged from the Site.
- Perimeter inspections of OU-1 Areas 1 and 2 will also be performed to identify any previously unidentified stormwater egress locations;
- Photographic documentation of each stormwater location will be captured at the time of sample collection / inspection;
- Stormwater samples for radiological constituents will be collected in plastic or glass containers consistent with radioanalytical laboratory protocols (i.e., sample volumes, containers, preservation, hold-times)
- Stormwater samples for radiological constituents will not be preserved in the field rather unpreserved samples will be shipped to a certified radioanalytical laboratory.[1] These samples will be sent to the lab as soon as practicable but sample receipt should be no later than 4 days from the time of sample collection to allow time to complete separation of phases and preserve the aqueous samples within 5 days of collection.
- Samples will be collected and documentation maintained consistent with requirements in Site procedures (i.e., maintaining chains-of-custody, measurement of field parameters such as pH and flow volumes). (see A.9)

- Once samples are received, the radioanalytical laboratory will separate stormwater samples being analyzed for radiological constituents into their respective liquid and suspended solid phases within 5 days of the time of sample collection as follows:
  - Each stormwater sample, in its entirety, will be passed through one or more tared standard glass-fiber filter to remove any suspended solids. Extraneous materials (e.g., vegetation,

Commented [A11]: Reference or include the specific documentation procedures. Refer to Section A.9 as appropriate.

Commented [A12]: Revise this QAPP to also include preservation and handling of the physical and chemical constituents.

Commented [A13]: Pore size? It is important to consider that a significant fraction of radionuclide activity may be associated with the finest particulate. A 0.45 µm is sometimes used as the upper cutoff for the liquid fraction, but finer pore sizes may make filtration quite difficult and time consuming. While this may practically impact the evaluation of what solid material may be moving from the site, both phases will be accounted for so in the final evaluation no activity will be lost based on pore size.

[1] SDWA certification only addresses drinking water samples. Certified laboratories recognized by the State of Missouri will be contracted for analysis of samples. At minimum, the laboratory must maintain certification for the SDWA-approved water methods used.

sticks, insects, non-soil-like solids, small rocks larger than ¼" diameter, etc.), if present, will be removed from the samples and noted in radioanalytical laboratory records. The volume of the filtered water will be measured and recorded.

- The filtered water will be transferred to its original container and preserved by acidification with nitric acid to pH < 2. The samples will be held for at least 16 hours prior to initiation of analytical testing. The acidification will be documented.
- Consistent with the approach presented in SM 2540 C., a portion of the aqueous filtrate (sufficient to produce residue between approximately 2.5 and 200 mg) will be transferred to a tared container and dried in an oven to constant mass at 180 ± 2 °C and weighed to determine the total mass of dissolved solids and container. The tare mass of the container will be subtracted from the total to produce the net mass of dissolved solids in the aliquot of filtered water. The *total dissolved solids* (TDS) will be calculated as milligrams of dry solid in the sample divided by the volume of the filtered sample in liters. TDS will be reported to the project in units of milligrams of dry dissolved solids per liter.
- Consistent with the approach presented in SM 2540 D., the filtered solids will be dried in an oven to constant mass at 104 ± 1 °C and weighed to determine the total mass of suspended solids and the filters used to catch them. The tare mass of the filter(s) will be subtracted from the total to produce the net mass of suspended solids removed from the water sample. The *total suspended solids* (TSS) will be calculated as milligrams of dry solid in the sample divided by the volume of the filtered sample in liters. TSS will be reported to the project in units of milligrams of dry suspended solids per liter.
- Before radioanalytical processing, the solids will be homogenized sufficiently so that representative subsamples can be taken for the different analyses. The dried solids will be stored in a new, clean container. If very low amounts of solids are obtained, the radioanalytical laboratory may need to perform a common digestion that can be split between the analyses. If a common digestion is needed, the laboratory will initiate batch

blank and LCS samples at this point and process these in parallel with the in the process.

- The aqueous and solid phases will be assigned a unique laboratory IDs that ensures traceability of results to the original sample.

- Radioanalytical Laboratory Analysis
  - The liquid and suspended solids, respectively, will be analyzed for required parameters by the radioanalytical laboratory. Acceptable methods (or in cases where there are no EPA approved reference methods, acceptable analytical approaches), Measurement Quality Objectives (MQOs) for detection capability for the different radioanalytical tests, and MCLs, are listed in Table 1 below.

Table 1 – Required Radioanalytical Tests, Maximum Contaminant Levels, and MQOs for Stormwater Samples

Phase	Analyte	Approved Methods or Analytical Approach	Maximum Contaminant Level (MCL)	MQO (Required Detection Capability)	Notes
Aqueous (filtered)	Gross Alpha and Beta	EPA approved drinking water method for Gross Alpha and Beta per 40CFR141.25(a) Preferred method: EPA 900.0	Corrected Gross Alpha 15 pCi/L	SDWA DL[&] Gross Alpha 3 pCi/L	*The total uranium activity is subtracted from the Gross Alpha result to obtain a Corrected Gross Alpha result.*
			Beta particle and photon radioactivity 4 mrem/y	SDWA DL[&] Gross Beta 4 pCi/L	*Man-made radionuclides are not expected at the ~~Site.~~ Site.*
Aqueous (filtered)	^{226}Ra (isotopic)	EPA approved drinking water method for isotopic ^{226}Ra per 40CFR141.25(a) Preferred method: EPA 903.1 or SM 7500-Ra C.	Combined $^{226}Ra + ^{228}Ra$ 5 pCi/L	SDWA DL[&] 1 pCi/L	*Methods for Total Alpha-Emitting Radium such as EPA 903.0, SM 7500-Ra B, or SM 7500-Ra D may not be used unless at least 3 weeks is allowed to pass between separation and counting. Drinking water certification/protocols required.*
Aqueous (filtered)	^{228}Ra (isotopic)	EPA approved drinking water method for isotopic ^{228}Ra per 40CFR141.25(a) Preferred method: EPA 904.0 or SM 7500-Ra D.	Combined $^{226}Ra + ^{228}Ra$ 5 pCi/L	SDWA DL[&] 1 pCi/L	*Drinking water certification/protocols required.*

Phase	Analyte	Approved Methods or Analytical Approach	Maximum Contaminant Level (MCL)	MQO (Required Detection Capability)	Notes
Aqueous (filtered)	Uranium (isotopic ^{238}U, ^{235}U, & ^{234}U)	EPA approved drinking water method for isotopic uranium per 40CFR141.25(a) Preferred: SM 7500-U C. or ASTM D3972.	30 µg/L	SDWA DL& 0.33 pCi/L	*Methods for Total Alpha-Emitting Radium such as EPA 903.0 or SM 7500-Ra B. may not be used unless at least 3 weeks pass between separation and counting. Drinking water certification/protocols required.*
Aqueous (filtered)	Thorium (isotopic ^{232}Th & ^{230}Th)	Chemical separation with yield tracer (^{234}Th or ^{229}Th) followed by determination by alpha spectrometry.	n/a	Required MDC 0.33 pCi/L	Under SDWA, it is assumed that gross alpha will account for thorium activity. For this reason, there is no EPA-approved method for thorium.
Suspended Solids	Gross Alpha and Beta	Direct gas flow proportional count of solids deposited in stainless-steel planchet.	n/a See aqueous above	Required MDC Alpha 5 pCi/g Beta 10 pCi/g	No digestion/fusion. Results must be corrected for self-absorption based on deposited mass using same calibration nuclides as water.
Suspended Solids	^{226}Ra (isotopic)	Determination by radon emanation with yield by Ba ICP or ^{133}Ba tracer). –or – Determination by alpha spectrometry following chemical separation of radium with yield correction (e.g., ^{225}Ra or ^{133}Ba tracer).	n/a See aqueous above	Required MDC 0.4 pCi/g	Total dissolution with no residues (Digestion with HF or fusion.)
Suspended Solids	^{228}Ra (isotopic)	Determination by gas flow proportional count of separated ^{228}Ac with yield correction for radium (e.g., ^{133}Ba or ICP measurement of Ba) and actinium (e.g., yttrium carrier).	n/a See aqueous above	Required MDC 0.4 pCi/g	Total dissolution with no residues (Digestion with HF or fusion.)
Suspended Solids	Uranium (isotopic ^{238}U, ^{235}U, & ^{234}U)	Total dissolution followed by chemical separation with yield correction using ^{232}U. Determination by alpha spectrometry.	n/a See aqueous above	Required MDC each isotope 1.8 pCi/g	Total dissolution with no residues (Digestion with HF or fusion.)
Suspended Solids	Thorium (isotopic ^{232}Th & ^{230}Th)	Total dissolution followed by chemical separation with yield correction using ^{234}Th or ^{229}Th.Determination by alpha spectrometry	n/a See aqueous above	Required MDC each isotope 0.4 pCi/g	Total dissolution with no residues (Digestion with HF or fusion.)
Whole sample	Total Suspended Solids (TSS)	SM 2540 D. (or equivalent)	n/a	6 mg/L	Used to calculate combined activity of aqueous and solid phases

Phase	Analyte	Approved Methods or Analytical Approach	Maximum Contaminant Level (MCL)	MQO (Required Detection Capability)	Notes
Aqueous	Total Dissolved Solids (TDS)	SM 2540 C. (or equivalent)	n/a	6 mg/L	Used to calculate combined activity of aqueous and solid phases

& The SDWA Detection Limit (DL) is defined in 40 CFR 141.25 (c) and differs substantially from a minimum detectable concentration (MDC) value. The SDWA DL is generally less restrictive than the same MDC value.

The SDWA MCL targets man-made beta-gamma emitters. To this end, for example, +K is generally subtracted from the gross beta result prior to comparison to screening values. If beta emitters associated with isotopic radium, thorium, and uranium analyses (primary radionuclides and their likely short-lived decay progeny such as ^{228}Ac, ^{234}Th, ^{234m}Pa, etc.) do not account for the gross beta activity, additional analysis may be required to identify other (man-made) beta emitters in the sample. See 40 CFR 141.65(d)(2) for more details.

- The following items will be considered when setting up a contract or statement of work with the radioanalytical laboratory.
    - Where any SDWA-regulated parameter in water, the radioanalytical laboratory must use a USEPA-approved drinking water methods listed in 40 CFR141.25 (a) for which they maintain EPA SDWA certification. Radioanalytical methods used must be validated consistent with radioanalytical laboratory certification requirements.

      In contrast to water, EPA does not approve radioanalytical methods for solids. As a result, laboratories must develop and validate their own methods, or modify approaches found in literature. The *Multi-Agency Radiological Laboratory Analytical Protocols Manual*, MARLAP (EPA 402-B-04-001A, 2004), a cross-agency document developed and approved by eight federal agencies (USEPA, USDOD, USDOE, USDHS, USNRC, USFDA, USGS, and NIST), recognizes the need for performance-based methodology at radioanalytical laboratories. Performance-based methodology is beneficial since it allows laboratories to develop and modify technologies to address specific analytical challenges associated with different matrices beyond drinking water. MARLAP, in Chapter 6, provides guidance to laboratories, for validating laboratory-developed or

-modified methods to ensure that methods are fit-for-purpose. Similarly, radioanalytical laboratory accreditation standards, such as The NELAC Institute (TNI) Standard Module 6 (2009, 2017) require that radioanalytical laboratories using non-reference methods validate those methods prior to use.

The project will require that all non-reference methods be validated by the laboratory prior to use.

- The processes and timing for separating the solid and liquid phases will be communicated to the laboratory as part of the contracting process.
- All processes, equipment, and instrumentation used for aqueous sample analysis must satisfy laboratory certification requirements for drinking water and must be documented under the laboratory's quality system.

  In cases where certification does not address analytical requirements (e.g., or laboratory-developed or -modified methods for solids matrices), the laboratory should implement analytical systems that are consistent with guidance in MARLAP or requirements in the TNI Standard (2009 or 2016).
- *Gross alpha particle activity (excluding radon and uranium),*

  Gross Alpha testing screens for elevated levels of alpha emitters (e.g., ^{226}Ra, ^{228}Ra, and ^{230}Th, ^{232}Th, and uranium) in water samples. The MCL, consistent with its name, assumes that radon and uranium are excluded.

  Since the gross alpha measurement does not exclude uranium, the measured Gross Alpha result will be corrected prior to comparing to MCLs. The isotopic activity for the three uranium isotopes will be summed and the sum subtracted from the respective Gross Alpha result to yield a Corrected Gross Alpha result for each of the two sample phases.

  Although the calculation for corrected gross alpha can be done by the project using results reported by the laboratory, some laboratories can be contracted to perform this calculation.

  No correction to gross alpha is needed for ^{222}Rn since it and its short-lived decay products are driven off during sample preparation. Unfortunately, ^{222}Rn begins to grow back into the sample immediately following evaporation. The laboratory should minimize the time between evaporation and counting (observing time limitations in the approved method) to minimize bias from interfering radon.

- *Beta particle and photon radioactivity.*

  Under SDWA, the gross beta testing is a screen for man-made radionuclides in the sample. Man-made radionuclides such as ^{90}Sr, ^{3}H, or ^{137}Cs, however, are not expected at the Site, Gross Beta results greater than the screening value of 50 pCi/L may be obtained due to the presence of radionuclides related to radium, thorium and uranium (i.e., decay products).

  If the measured gross beta activity for a sample exceeds the screening value of 50 pCi/L, naturally-occurring ^{40}K (a natural radioactive isotope of natural potassium) should be determined and ^{40}K beta activity subtracted from the gross beta result prior to comparison the 50 pCi/L screening value. If the ^{40}K corrected gross beta result is still greater than 50 pCi/L, isotopic speciation of beta-gamma emitters needs to be performed (beginning with the radium, thorium and uranium results and any short-lived decay progeny that ingrow into samples) to determine the identity and activity of beta-gamma-emitting radionuclides present.

  The radioactivity concentration in pCi/L for each beta-gamma emitter (except ^{40}K) is converted to dose (mrem/y) and the dose summed for each of the sample's two phases. The isotope-specific dose conversion factors used to convert radioactivity concentration (pCi/L) to dose (mrem/y) are found in *"Maximum Permissible Body Burdens and Maximum Permissible Concentrations of Radionuclides in Air and in Water for Occupational Exposure," NBS (National Bureau of Standards) Handbook 69 as amended August 1963, U.S. Department of Commerce.*

  Although the dose calculations can be done by the project using results reported by the laboratory, some laboratories can be contracted to perform this calculation.

- Combined ^{226}Ra + ^{228}Ra

  Some USEPA-approved methods for ^{226}Ra are not specific for ^{226}Ra. Precipitation methods for *Total Alpha-Emitting Radium* significantly overestimate the ^{226}Ra concentration unless sufficient time elapses between sample collection and counting to allow interfering ^{224}Ra to decay (e.g., 21 days). *Total Alpha-Emitting Radium* methods (including but are not limited to EPA 903.0, SM 7500-Ra B, and SM 7500-Ra D) will not be used for stormwater analysis unless the prepared sample test source is allowed to age for 3 weeks.

  Once results for ^{226}Ra and ^{228}Ra have been obtained from the laboratory, they can be added together to produce a Combined Radium 226 + 228 result for each of the sample's two phases.

  Although the calculation for Combined Radium 226 + 228 can be done by the project using results reported by the laboratory, some laboratories can be contracted to perform this calculation.

- Uranium

  The radioanalytical laboratory will be contracted to report results for each of the three uranium isotopes (^{238}U, ^{235}U, and ^{234}U) using alpha spectrometric methods and isotopic tracers (^{232}U) for quantification of results. These methods are much more robust and accurate than methods such as EPA 908.0. Radiochemical measurements also are capable of measuring ^{234}U which is not practicable using the mass-based instruments such as inductively-coupled plasma quadrupole mass spectrometry (ICP-MS) commonly available at laboratories.

  Once the results for the three isotopes, ^{238}U, ^{235}U, and ^{234}U, have been obtained, they must be processed to yield two values.

  Total Uranium Mass Concentration for Uranium:

  The activity concentration value measured for ^{238}U, ^{235}U, and ^{234}U are converted by multiplying by the measured activity concentration (pCi/L) by the specific activity (µg/pCi) listed in

Table 2 for the each of the three uranium isotopes to yield the mass concentration of that isotope in µg/L.

Table 2- Specific Activity Values for Uranium Isotopes

Isotope	Specific Activity
^{238}U	2.98 µg/pCi
^{235}U	0.463 µg/pCi
^{234}U	1.61×10^{-4} µg/pCi

The mass concentration for the three isotopes are summed to produce the total uranium concentration for each of the two phases the same units as the MCL (ug/L).

Total Uranium Activity Concentration for Evaluation of RIM Migration:

The activity concentration for ^{238}U, ^{235}U, and ^{234}U are added to produce a sum result for the total uranium activity for each of the two phases.

Although the calculation of total uranium activity from isotopic results can be done by the project using results reported by the laboratory, some laboratories can be contracted to perform this calculation.

- Thorium
  - Thorium is not directly regulated in drinking water and does not have an MCL of its own. Rather, under SDWA, it is left to the gross alpha MCL to detect samples with elevated levels of thorium.

    Thorium is determined using alpha spectrometric methods that rely on tracers for quantification of results. These methods are much more accurate and robust than methods such as EPA 907.0.

    Once the results for the two isotopes, ^{232}Th and ^{230}Th, have been obtained they are added together to provide the total thorium activity for each of the two phases.

- The laboratory will review and report results for the two respective phases separately (liquid phase in pCi/L and suspended solids in pCi/g dry weight).

- The Validation Team will verify and validate radioanalytical laboratory data reports based on guidance in MARLAP Chapter 8 and ANSI/ANS-41.5 *(Verification and Validation of Radiological Data for Use in Waste Management and Environmental Remediation).*
- The validated results for the five tests and two phases will be mathematically combined to produce results that reflect the total concentration of the respective analyte(s) in the stormwater sample, as received.
  - The combined results for corrected gross alpha (pCi/L), gross beta (mrem/y), combined Ra-226 + 228 (pCi/L), total uranium (238 + 235 + 234) (pCi/L), and total thorium (232 + 230) (pCi/L), in pCi/L, are calculated from the respective results for aqueous and solid phases as:

$$\mathrm{AC}_{combined} = AC_{Aq} + AC_{Sol} \times \frac{TSS}{1000}$$

Where:

$AC_{combined}$ is the mathematically combined result for the whole sample (aqueous + solids) for the, pCi/L

AC_{Aq} - measured result for the analyte in the aqueous fraction, pCi/L

AC_{Sol} - measured result for the analyte in dry suspended solids, pCi/g

TSS – concentration of total suspended solids in the sample, mg/L

- The Assessment Team will compare the calculated values for $AC_{combined}$ to the respective MCL values. If $AC_{combined}$ is greater than the MCL value the decision will be made that MCLs for Stormwater have been exceeded.

Commented [A14]: Term used for people responsible – revise term if/as appropriate.

Commented [A15]: Need to define or reference actions to take including required notifications.

  - The combined results are also used to assess whether results may indicate that off-site migration of RIM in stormwater is indicated. The approach used for this determination protectively calculates the activity concentration relative to the total concentration of solids being transported to ensure that dilution does not obscure the possible presence of radioactively impacted materials.

$$AC_{combined-dry} = AC_{Aq} \times \frac{1000}{TDS} + AC_{Sol}$$

Where:

$AC_{combined\text{-}dry}$ – activity concentration of analyte in the dry residue of the stormwater sample,
TS - total dissolved solids concentration, mg/L,

and other variables are as defined above.

- The Assessment Team will compare the calculated values for $AC_{combined\text{-}dry}$ to the respective RIM limits. If $AC_{combined}$ is greater than the RIM limit, the decision will be made that the data may indicate that material is migrating from the site in Stormwater.

Commented [A16]: Again, need to define actions to take including required notifications.

- The project will perform inspections of Best Management Practices (BMPs) to address stormwater and take corrective actions to the process as needed.

A.7 Quality Objectives And Criteria

The QA objective for this project is to develop and implement procedures for field sampling, chain-of-custody, radioanalytical laboratory analysis, and reporting that will provide reliable results from which compliance with 1) site stormwater discharge limits, and 2) the potential for offsite migration of RIM via stormwater, can be evaluated.

Samples will be separated into liquid and solid phases by passing the sample through one tared glass-fiber filters. The solids isolated from each sample will be dried to constant mass at 104 ± 1 °C, and the concentration of suspended solids (pCi/L) calculated and reported. The solids will be homogenized and a representative subsample analyzed and results reported for each sample in pCi/g (dry weight). Results for solids will be reported

In general, Data Quality Objectives (DQOs), Measurement Quality Objectives (MQOs), and Analytical Protocol Specifications (APS) for radionuclide analysis in water samples will be consistent with those defined in Chapter 6 of

USEPA's *Manual for Certification of Laboratories Analyzing, Drinking Water, Criteria and Procedures, Quality Assurance, Fifth Edition* (EPA 815-R-05-004, January, 2005) and the applicable version of The TNI Standard (2003, 2009, or 2016) as implemented under the laboratories' Standard Operating Procedures (SOPs). These requirements will be implemented in the radioanalytical laboratory SOPs governing the processes used for radiological sample preparation and analysis. All procedures used for the analysis will have been validated consistent with TNI validation requirements.

Specific procedures for sampling, chain-of-custody, radioanalytical laboratory instrument calibration, analysis, and reporting of data are described or referenced in the radioanalytical laboratory quality management plans in Appendix A and in other sections of this QAPP.

More detail is provided in Section B to this QAPP

A.8 SPECIAL TRAINING / CERTIFICATION

Field Supervisor and field technical staff (sampling crew} will have completed the following documented training:

- 40-hour HAZWOPER training and annual 8-hour HAZWOPER refresher courses in accordance with OSHA 29 CFR 1910.120(e}, as appropriate; and
- General Employee Radiological Training (GERT} and biennial refresher courses as appropriate.
- The sampling crew will be given the necessary training to ensure that the samples are properly collected. This documented training will address the stormwater sampling procedures and will include operation and care of sampling equipment, filtering and proper preservation of samples, proper procedures for maintenance of chains of custody, and the use of field instruments for measurements of applicable field parameters (pH, temperature, and conductance). This training is documented in procedures provided in Appendix A.
- Specialized training for laboratory personnel is described in the laboratory Quality Assurance Program Manuals provided in Appendix A.
- Project data assessors and validators will be trained on procedures for validating as documented in procedures provided in Appendix A.

Commented [A17]: Specific sampling procedures should be referenced or discussed. Include in appendices. Refer to B.1.

Commented [A18]: Need more detail – add a reference to site specific procedures and training for appendix A.

A.9 Documents And Records

Records for this project will consist of monthly stormwater activities memoranda to support Monthly Status Reports for West Lake OU-1. Validated sampling and monitoring data will be submitted in an electronic data deliverable (EDD} format.

Monthly stormwater activities memoranda will include:

- Dates / times / field data for collected stormwater samples;
- Dates / times of inspections of dry stormwater locations;
- Photographic documentation of stormwater locations;
- Dates and times of perimeter inspections;
- Photographic documentation of perimeter inspections;
- Monthly summary of daily precipitation results from the National Weather Service Forecast Office in Weldon Spring, MO (station KSLX}, example provided in Appendix B;
- Descriptions / routine inspection results of stormwater controls and Best Management Practices (BMPs); and
- Tabular summary of stormwater analytical data.

B.1 Sampling Process Design

During or immediately after any precipitation event of 0.1" or greater, stormwater samples will be collected at any sampling location in OU-1 Areas 1 and 2 where water is being discharged from the site. Stormwater sampling points are designated in Figure 2. The stormwater sampling points are locations where off-site stormwater flow previously has occurred.

Commented [A19]: Provide a table listing these points to minimize confusion.

Additionally, points depicted on or along the inspection paths shown in Figure 2, will be monitored and samples collected if water is being discharged from the Site. Perimeter inspections of OU-1 Areas 1 and 2 will also be performed to identify any previously unidentified stormwater egress locations;

Stormwater samples will be collected in plastic or glass containers consistent with

Commented [A20]: If written SOPs for sample collection exist include as appendix.

laboratory protocols (i.e., sample volumes, containers, preservation, hold-times). Samples will be collected and documentation maintained consistent with requirements in Site procedures (i.e., maintaining chains-of-custody, measurement of field parameters such as pH and flow volumes). Photographic documentation of each stormwater location will be captured at the time of sample collection / inspection;

Stormwater samples will not be preserved in the field rather unpreserved samples will be shipped to a certified radioanalytical laboratory. Although samples should be sent to the lab as soon as practicable, sample receipt will be no later than 4 days from the time of sample collection so that the laboratory can complete separation of the suspended solid and aqueous phases and preserve the aqueous samples within 5 days of collection.

The two phases for collected stormwater samples will be analyzed for the constituents and MQOs listed in Table 1.

B.2 Sampling Methods

Prior to each monitoring period, the field supervisor and field sampling team will coordinate with the analytical laboratories to obtain appropriate empty containers for analysis of the constituents listed in Table 1..

Field measurements of pH will be performed with an Oakton Waterproof *pH Testr 30* (or equivalent) digital field pH meter. Prior to mobilization to the site for collection of stormwater samples, the meter will be calibrated according to manufacturer recommendations. The field crew will verify that calibration solutions are not used past the factory-labeled expiration dates. Lot numbers and expiration dates will be recorded in field logbooks each time the instruments are used.

Field measurements of volumetric flow rate will be calculated from channel measurements (length x, width x, linear flow rate) at each stormwater location.

At least one equipment blank will be taken each day per sampling crew, and submitted as an analytical sample to be analyzed for all analytical parameters to provide data to verify the integrity of equipment used for sampling. The results of the equipment blank will be one of the quality-indicating parameter during assessment of data quality and usability. If the result indicates potential negative impact of sampling on data quality, results should be qualified and documented corrective action taken.

B.3 Sample Handling And Custody

Sample bottles will be labeled using permanent ink and an adhesive label. The following information will be indicated on the label:

- Collector's name;
- Date and time of sampling;
- Sample point identification;
- Sample preservative; and Tests to be performed.

Samples will be placed in a cooler or other sample shuttle immediately upon collection.

Samples for analysis of physical and chemical analytes will be maintained at approximately 4 °C with ice (i.e., >0 °C and less than 6 °C). Sample bottles requiring chemical preservatives will be preserved by the physical and chemical laboratory prior to shipment to the site. The correct type and number of sample bottles with the correct and premeasured preservatives will be provided by the analytical laboratory for the types of analyses to be performed.

Containers for analysis of radiological parameters will not be preserved in the field rather unpreserved samples will be shipped to the radioanalytical laboratory as soon as practicable, Sample receipt will occur no later than 4 days after sample collection so that the radioanalytical laboratory can complete separation of the suspended solid and preserve the aqueous samples within 5 days of sample collection. Following preservation with acid, the aqueous fraction of the samples will be stored for at least 16 hours prior to initiating analytical testing.

The following documentation will accompany samples to the laboratory:

- Chain-of-Custody (COC) records
    - These records document in a legally defensible manner the history of collection, transfer, and transport of each sample. The COC record facilitates tracing the possession and handling of each sample from the time of field collection through receipt of samples at the laboratory facility. Once received by the laboratory, the laboratory's internal COC ensure that the samples are maintained in a secure, and controlled, and well-documented manner through laboratory analysis.
    - Each individual responsible for the samples from the time of collection until they are received by the laboratory will be consecutively documented on the COC record. It is the responsibility of the sampler to protect the integrity of the samples until laboratory personnel accept this responsibility by signing

the COC. When a common carrier, such as FedEx or UPS, is used to ship a sealed container of samples to the laboratory (together with the COC), the shipping bill and documentation are also as crucial part of the COC record because they document custody from the point the container is transferred to the carrier until the carrier relinquishes it to receiving personnel at the laboratory.

- Final disposition of the samples is the responsibility of the laboratory and will be documented by the laboratory according to its specific procedures.
- Each sample shipped will be identified on the COC. Examples of laboratory COCs are provided in Appendix C. The following information will be provided on a Chain of Custody:
    - Unique identifiers for all samples
    - Collector's name;
    - Date and time of sampling;
    - Sample source (e.g., stormwater location name);
    - Sample preservative(s);
    - Tests to be performed;
    - Dates, times and signatures for all transfers of custody.

- Sample labels
    - Identify samples in a unique manner. Sample labels should include the:
        - name of the site;
        - name of sampler(s);
        - stormwater location designation;
        - date and time of sample collection;
        - any added preservatives;
        - Analyses requested.
- Custody seals
    - These adhesive seals are placed over the opening of each sample shipping container (i.e., shuttle or cooler) prior to shipping to the laboratory to ensure that tampering with the samples during delivery will be detected. Custody seals will have:
        - the signature of the sampler;
        - the date signed; and
        - Must be visibly placed beneath clear packing tape to ensure that the

seals cannot be peeled off or replaced *en route*.

- Alternatively, in lieu of or in addition to sample custody seals, individual bottles may have custody seals placed on them to ensure sample integrity.

B.4 ANALYTICAL METHODS

Preparation protocols for radioanalytical samples involve the separation of samples by filtration to 0.45 µm to isolate the aqueous phase from suspended solids. This process is described in Section A.6. The liquid and suspended solids, respectively, will be analyzed for required parameters by the radioanalytical laboratory.

Where applicable, the radioanalytical laboratory must use USEPA-approved drinking water methods listed in 40 CFR 141.25 (a) for which they maintain certification. Radioanalytical methods used must be validated consistent with laboratory certification requirements.

In contrast to water, EPA does not approve radioanalytical methods for solid matrices. As a result, radioanalytical laboratories must often develop and validate their own methods, or modify analytical approaches found in literature. The *Multi-Agency Radiological Laboratory Analytical Protocols Manual*, MARLAP (EPA 402-B-04-001A, 2004), a cross-agency document developed and approved by eight federal agencies (USEPA, USDOD, USDOE, USDHS, USNRC, USFDA, USGS, and NIST), recognizes the need for performance-based methodology at radioanalytical laboratories. Performance-based methodology is beneficial since it allows laboratories to develop and modify technologies to address specific analytical challenges associated with matrices beyond drinking water. MARLAP Chapter 6 provides guidance to laboratories, for validating laboratory-developed or -modified methods to ensure that methods are fit-for-purpose. Similarly, radioanalytical laboratory accreditation standards, such as The NELAC Institute (TNI) Standard Module 6 (2009, 2017) require that radioanalytical laboratories using non-reference methods validate those methods prior to use. The project will require that all non-reference methods be validated by the radioanalytical laboratory prior to use.

Acceptable methods and analytical approaches (in cases where there are no approved methods), Measurement Quality Objectives (MQOs) for detection capability requirements for the different radiochemical tests, and MCLs are listed in Table 1.

Laboratory Standard Operating Procedures (SOPs) are described in the Quality

Commented [A21]: Check and Resolve - Do these SOPs address solids analysis or do they need to be updated?.

Commented [A22R21]: Shouldn't we check??

Assurance Program Manuals provided in Appendix A.

B.5 QUALITY CONTROL

All processes, equipment, and instrumentation used for aqueous sample analysis must satisfy laboratory certification requirements for drinking water and must be documented under the laboratory's quality system. At minimum, batch quality control samples for aqueous samples will be run and evaluated as specified in section 7 of Chapter 6 of USEPA's *Manual for the Certification of Laboratories Analyzing Drinking Water Criteria and Procedures Quality Assurance, Fifth Edition* (EPA 815-R-05-004, January 2005).

In cases where radioanalytical laboratory certification requirements do not address analytical requirements (e.g., or laboratory-developed or -modified methods for solids matrices), the radioanalytical laboratory will implement analytical systems that are consistent with guidance in MARLAP or requirements in the TNI Standard Module 6 (2009 or 2016). Quality controls for the West Lake OU-1 stormwater monitoring program are described in the laboratory Quality Assurance Program Manuals provided in Appendix A.

All radioanalytical methods for solids must have been validated by the laboratory prior to use. MARLAP, in Chapter 6, provides guidance to laboratories, for validating laboratory-developed or -modified methods to ensure that methods are fit-for-purpose. Similarly, radioanalytical laboratory accreditation standards, such as The NELAC Institute (TNI) Standard Module 6 (2009, 2017) specify requirements that radioanalytical laboratories can use.

B.6 INSTRUMENTATION / EQUIPMENT TESTING, INSPECTION, & MAINTENANCE

Instrumentation and equipment for the West Lake OU-1 stormwater monitoring program consists of laboratory instrumentation, field-use digital pH meters, and sampling apparatus (clean polyethylene cups, clean beakers, and field-use peristaltic pump with disposable tubing). Field-use pH meters (Oakton Waterproof pH Testr 30 or equivalent), tape measures (for flow channel measurements), and field-use peristaltic pumps will be inspected and maintained by the stormwater sampling field crew according to manufacturer specifications.

New, clean, polyethylene cups, beakers, and disposable peristaltic pump tubing will be stored in a clean, readily accessible area. Equipment blanks will be run at a frequency of one per day per sampling crew. The results of the equipment blank will be one of the quality-indicating parameter during assessment of data quality and usability. If the result indicates potential negative impact of sampling on data quality, results should be qualified and documented corrective action taken.

A variety of laboratory instrumentation / equipment will be used at the laboratory. All processes, equipment, and instrumentation used for aqueous sample analysis must satisfy radioanalytical laboratory certification requirements for drinking water. This includes requirements established in Chapter 6 of USEPA's *Manual for the Certification of Laboratories Analyzing Drinking Water Criteria and Procedures Quality Assurance, Fifth Edition* (EPA 815-R-05-004, January 2005). In cases where certification requirements do not address analytical requirements (e.g., or laboratory-developed or -modified methods for solids matrices), the laboratory should implement analytical systems that are consistent with guidance in MARLAP or requirements in the TNI Standard Module 6 (2009 or 2016).

Testing, inspection, maintenance, and quality controls will be performed for each instrument or piece of equipment as described in the radioanalytical laboratory Quality Assurance Program Manuals provided in Appendix A.

B.7 INSTRUMENT/ EQUIPMENT CALIBRATION AND FREQUENCY

Instrumentation / equipment requiring calibration for the West Lake OU-1 storm water monitoring program consists of laboratory instrumentation and field-use digital pH meters. Calibration of field-use pH meters {Oakton Waterproof pH Testr 30 or equivalent) will be verified prior to mobilization to the site for collection of stormwater samples. If the pH meter does not conform to the manufacturer-specified calibration criteria, the meter will be replaced with a unit that meets the specified criteria.

A variety of laboratory instrumentation / equipment will be used at the radioanalytical laboratory. All processes, equipment, and instrumentation used for aqueous sample analysis must satisfy radioanalytical laboratory certification requirements for drinking water. This includes requirements established in Chapter 6 of USEPA's *Manual for the Certification of Laboratories Analyzing Drinking Water Criteria and Procedures Quality Assurance, Fifth Edition* (EPA 815-R-05-004, January 2005). In cases where certification requirements do not address analytical requirements (e.g., or laboratory-developed or -modified methods for solids matrices), the radioanalytical laboratory will implement analytical systems that are consistent with guidance in MARLAP or requirements in the TNI Standard (2009 or 2016).

Laboratory instrumentation testing, inspection, and maintenance will be performed as described in the laboratory Quality Assurance Program Manuals provided in Appendix A.

B.8 Inspection / Acceptance Of Supplies And Consumables

Field-use supplies and consumables consist of field-use pH meter calibration solutions, field-use tape measures, and sample collection equipment (i.e., new, clean polyethylene cups, beakers, and disposable peristaltic pump tubing).

- The stormwater sampling field crew will use only new, clean, disposable polyethylene cups, beakers, and peristaltic pump tubing. These supplies will be stored in a clean, readily-accessible area.
- Prior to use, the stormwater sampling field crew will verify that calibration solutions are not used past the factory-labeled expiration dates. Lot numbers and expiration dates will be recorded in field logbooks each time the instruments are used.

Inspection/acceptance of laboratory supplies and consumables will be performed as described by the laboratory Quality Assurance Program Manuals provided in in Appendix A. At minimum, this will include:

- At minimum, radioanalytical standards will be verified against traceable standards obtained from an independent source;

B.9 NON-DIRECT MEASUREMENTS

Non-direct measurements for the West Lake OU-1 stormwater monitoring program consist of data indicating when significant precipitation is observed at the site. Results of these measurements will be obtained from available US-government sources and will consist of Preliminary Monthly Climate Data precipitation records provided by the National Weather Service Forecast Office in Weldon Spring, MO (station KSLX), available at: http://w2.weather.gov/climate/index.php?wfo=lsx.

Commented [A23]: Specify exactly what data is being used (i.e Rain, snow, etc.). Is snowmelt of concern?

B.10 DATA MANAGEMENT

- Field Data Management
  - The original records will be provided to the individual responsible for preparation of monthly stormwater activities memoranda.
  - Recordkeeping and retention for Stormwater Monitoring related activities will be performed will be maintained by the field sampling crew consistent with Stormwater Project policies and procedures. These records include but are not limited to:
    - Sampling documentation;
    - Documentation of field measurements
      - Calibration of instrumentation
      - pH and volumetric flow rate measurements
      - Photographs of sample collection locations and inspections;
    - Completed chains-of-custody;
    - Corrective actions.
  - All records documenting field-related activities will be archived and retrievable upon request for a minimum of XXX years following completion of work.
- Laboratory Documentation Data Management
  - Recordkeeping and document retention for project-related activities will be performed as described in the respective Laboratory Quality Assurance Program Manuals (see **Appendix A**). These include but are not limited to records of:
    - The receipt, storage, handling, and disposal, of samples and associated wastes.

    - Initial calibration of any instrumentation used to quantify samples (sufficient to recreate results);
    - Preparation and traceability of standards;
    - Preparation of reagents;
    - Filtration and separation of phases
    - Radiochemical separation and preparation of sample test sources;
    - Raw data output of instrumentation;
    - Ongoing quality control data and control charts for analytical and support instrumentation;
    - Batch quality control data and control charts;
    - Training and capability for analysts;
    - Corrective actions;
    - Critical correspondence between the laboratory and the Project;
    - Finalized laboratory analytical reports transmitted to the Project Coordinator and Field Supervisor via electronic mail.
  - All records will be maintained in hard-copy or electronic form (in a retrievable format) and archived and retrievable upon request for a minimum of XXX years following completion of work.

Commented [A24]: Fill in with the required number.

- Monthly stormwater activities memoranda will be prepared and submitted as attachments to the West Lake Landfill Operable Unit 1 Monthly Status Reports. Monthly stormwater activities memoranda will include:
  - Dates / times of sample collection and inspections;
  - Results of field measurements and pH and volumetric flow rate;
  - Preliminary Monthly Climate Data precipitation records described in Section B.9; and
  - Discussion of stormwater BMPs at the site.

C.1 ASSESSMENT AND ~~RESPONSE ACTIONS~~RESPONSE ACTIONS

Laboratory assessment and response actions will be performed as described in the laboratory Quality Assurance Program Manuals provided in Appendix A. Due to the limited number of samples collected under the scope of this QAPP, no other assessment activities are required.

C.2 REPORTS TO MANAGEMENT

Information gathered as part of the stormwater activities described in this QAPP will be provided to USEPA and MDNR in OU-1 Monthly Reports.

C.3 DATA VERIFICATION AND VALIDATION

Verification, and validation of laboratory data are provided in the laboratory Quality Assurance Program Manuals provided in Appendix A. Verification and validation will be performed in accordance with MARLAP, the applicable version of the TNI Standard, and EPA Functional Guidelines for Data Validation.

C.4 RECONCILIATION WITH USER REQUIREMENTS

Data and results collected within the scope of this QAPP will be provided in monthly OU-1 Progress Reports.

Table 3 - Project Personnel Contact Information

West Lake Operable Unit 1 (OU1) Stormwater Monitoring						
Personnel	Paul Rosasco	Jonathan Wilkinson	Cecilia Greene	Lab 1	Lab 2	V&V
Company	Engineering Management Support, Inc.	Feezor Engineering, Inc.	Auxier & Associates, Inc.	??	??	??
Project Role	Project Coordinator	Field Supervisor	Radiological Health and Safety Officer	??	??	??
Street Address	Gateway Drive	3377 Hollenberg Dr	9821 Codgill Rd Suite 1	??	??	??
City	Golden	Bridgeton	Knoxville	??	??	??
State, ZIP	CO, 80401	MO, 63304	TN, 37932	??	??	??
Telephone	(303) 808-7227	(636) 578-8635	(865) 675-3669	??	??	??
Email	paulrosasco@emsidenver.com	jwilkinson@feezorengineering.com	cgreene@auxier.com	??	??	??

Commented [A25]: There was a very long list of contacts in A2. Ensure that this table is complete- at minimum, V&V and labs as well as EPA and MDNR contacts, need to be added.

Table 4 - West Lake Operable Unit 1 (OU1) Stormwater Monitoring Analytes, Reporting Limits, and Analytical Methods

Constituent	Unit	Reporting Limit[1]	Method
Daily Rainfall, 24 hour total	Inches	n/a	NWS Station
Estimated Flow	MGD	n/a	Field
pH - standard units	SU	n/a	Field
Biochemical Oxygen Demand (BOD)	mg/L	5	SM 5210
Chemical Oxygen Demand (COD)	mg/L	50	SM 5220
Total Suspended Solids (TSS)	mg/L	6	SM 2540 D
Settable Solids	mL/L	0.1	SM 2540 F
Oil & Grease (Hexane Extractable Material)	mg/L	5	EPA 1664A
Ammonia as N	mg/L	0.1	SM 4500-NH3
Chloride	mg/L	5	EPA 600
Sulfate	mg/L	10	SM 4500-CL
Total Hardness (as $CaCO_3$)	mg/L	1	SM 2340
Aluminum, Total	µg/L	25	EPA 200.7
Antimony, Total	µg/L	50	EPA 200.7
Arsenic, Total	µg/L	25	EPA 200.7
Beryllium, Total	µg/L	0.5	EPA 200.7
Cadmium, Total	µg/L	2	EPA 200.7
Chromium (III), Total	µg/L	10	SM 3500-CR
Chromium (VI), Dissolved	µg/L	5	SM 3500-CR
Cobalt, Total	µg/L	5	EPA 200.7
Copper, Total	µg/L	5	EPA 200.7
Iron, Total	µg/L	20	EPA 200.7
Lead, Total	µg/L	15	EPA 200.7
Magnesium, Total	µg/L	50	EPA 200.7
Mercury, Total	µg/L	0.2	EPA 245.1
Nickel, Total	µg/L	5	EPA 200.7
Selenium, Total	µg/L	40	EPA 200.7
Silver, Total	µg/L	5	EPA 200.7
Thallium, Total	µg/L	50	EPA 200.7
Zinc, Total	µg/L	10	EPA 200.7
Benzene	µg/L	2	EPA 624
Ethylbenzene	µg/L	5	EPA 624
Radionuclides – Refer to Table 1 for radionuclides			

Notes:

[1] Reporting Limits subject to sample condition, e.g. matrix interference effects

Commented [A26]: There was no information in the QAPP about any of the tests from BOD downward. This needs to be addressed.

Commented [A27]: This footnote is unclear. Clarify or delete.

Figure 1 - Site Map with OU-1 Stormwater Sampling and Monitoring Points

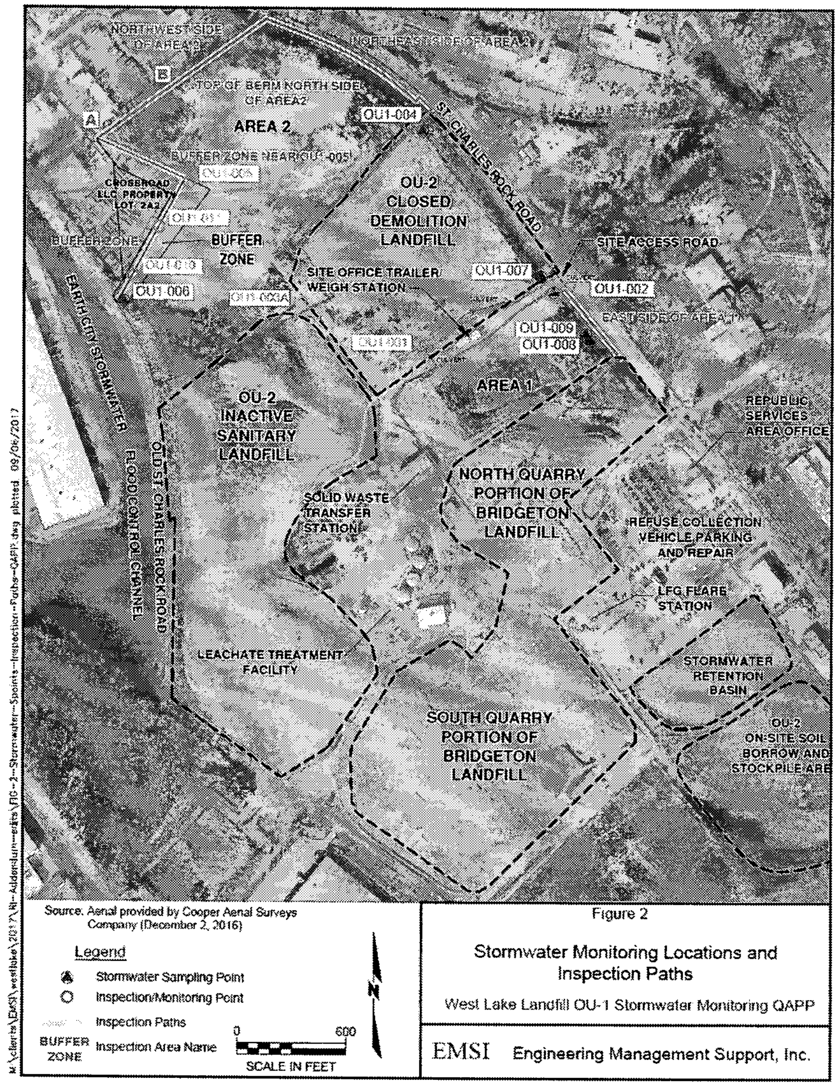
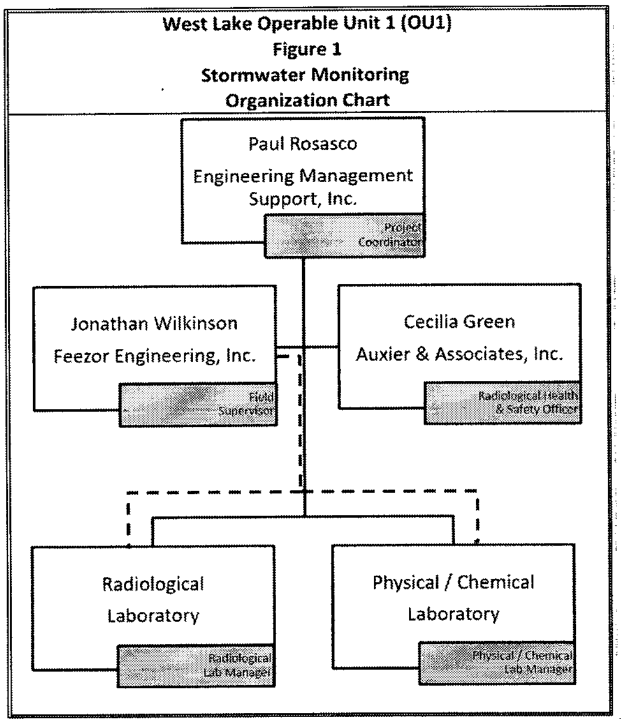


Figure 2 - West Lake Operable Unit 1 (OU-1) Stormwater Monitoring Organization Chart



Commented [A28]: This is very generic and does not provide sufficient detail to show key individuals responsible for different tasks addressed in the QAPP. Update.

Mr. Wilkinson is listed as being responsible for QA and all field operations. It is a concern that the QA manager is not independent of and unencumbered by the operations he oversees.

It is unclear who is responsible for data V&V and assessment. State who the key people responsible for sampling teams (beyond JW) are. Clarify and revise.

Appendix A