

Appendix A

General Methodology and Sampling and Analysis Plan

**General Methodology and Sampling and Analysis Plan**  
**Study of Radium 226 & 228 in Pennsylvania Landfill Leachate**

*November 2021*

*Revised January 2022*

## Table of Contents

	<b><u>Page</u></b>
1.0 Introduction	3
1.1 Scope	3
1.2 Background	3
1.3 Project Organization and Responsibility	3
1.3.1 PADEP Regional Office Solid Waste Managers	4
1.3.2 SAP Integration and Data Management	4
1.3.3 Laboratory Operations	4
2.0 Field Sampling Plan and Laboratory Analyses	5
2.1 Sampling Locations, Frequency, and Media	5
2.1.1 Sample Collections and Analyses	5
2.1.2 Sample Identification	6
2.2 Quality Control Samples	7
2.3 Chain of Custody Record	8
2.4 Handling and Disposition of Investigation-Derived Waste	8
2.5 Sample Handling, Packaging, and Shipping	8

### Tables

Table 1 – Pennsylvania Solid Waste Landfills to Be Sampled

### Attachments

Attachment A – Pace Radiological Work Plan for Analytical Samples

Attachment B – Typical Chain of Custody Record

Attachment C – Landfill Sampling Frequency (Excel File Provided Separately)

## **1.0 Introduction**

### **1.1 Scope**

The work described in this General Methodology and Sampling and Analysis Plan (SAP) supports the sampling and analysis efforts for radium 226 & 228 at active (permitted) landfills in the state of Pennsylvania. The sampling and analysis activities are being conducted in cooperation with the Pennsylvania Department of Environmental Protection (PADEP) and the Pennsylvania Waste Industries Association (PWIA), and in collaboration with the Environmental Research and Education Foundation (EREF). The project is designed to characterize radiological constituents of concern potentially present in landfill leachate. This SAP has been prepared in accordance with the appropriate PADEP management control procedures and the U.S. Environmental Protection Agency (EPA) guidance documents on the preparation of SAPs.

This SAP consists of two parts: a field sampling plan (FSP) describing the field activities that will occur and an analysis plan (AP) stipulating data production and management tasks consistent with the intended use of such data. The purpose of the FSP is to guide the PADEP field team in the collection and custody transfer of untreated (i.e., raw) leachate samples and other samples as may be required to properly interpret and reconcile leachate radiological contaminants of concern. The AP outlines sample analysis specifications, laboratory coordination, and data review activities.

### **1.2 Background**

PADEP previously investigated the potential for radiological impacts from oil and gas-derived waste received at disposal facilities and concluded in its 2016 TENORM Study Report (TENORM Study) that there were not significant differences between the radium levels in the leachate from landfills that accept oil and gas waste with those that do not. Nonetheless, at times since completion of the TENORM study, the presence of TENORM-containing waste in landfills and the potential presence of radiation in landfill leachate has continued to be raised as a concern.

There are a total of 49 solid waste landfills in Pennsylvania permitted for receipt of municipal, residual, sanitary, and construction/demolition debris that will be included in this study. These landfills feature leachate collection systems to capture liquids percolating through the landfill for subsequent wastewater treatment facility processing or treatment at the landfills with on-site discharge. Active landfill operators are required by PADEP regulations to periodically sample and characterize their leachate for a suite of non-radioactive contaminants of concern.

### **1.3 Project Organization and Responsibility**

Specific individuals will be assigned the following project positions during performance of the monitoring activities, as needed:

PADEP Solid Waste Point of Contact (POC) – Ali Tarquino Morris

Sampling Surveillance/Laboratory Shipments – PADEP Regional Offices

### 1.3.1 PADEP Regional Office Solid Waste Managers

Region I (Southeast) POC – Shawn Mountain

Region II (Northeast) POC – Roger Bellas

Region III (South Central) POC – Anthony Rathfon

Region IV (North Central) POC – Patrick Brennan

Region V (Southwest) POC – Sharon Svitek

Region VI (Northwest) POC – Christina Wilhelm

### 1.3.2 SAP Integration and Data Management

EREF POC – Suzie Boxman

Data Management/Reporting – Gabriel Vegh-Gaynor, Suzie Boxman

### 1.3.3 Laboratory Operations

Pace Analytical POC – Allison Queen

Gel Labs POC – Denni Grunstra

## 2.0 Field Sampling Plan and Laboratory Analyses

### 2.1 Sampling Locations, Frequency, and Media

Sampling and sample packaging for shipment will be performed by properly trained and qualified PADEP staff and witnessed by authorized PADEP representatives and landfill site representatives, as appropriate. The data from the landfills designated by PADEP will be collected as follows:

- A single grab sample of leachate from the leachate management system prior to treatment.
- Additional Quality Control (QC) samples of leachate, as determined necessary from the leachate management system prior to treatment.

The sampling collection point may vary from facility to facility, depending on how leachate is managed at that facility. Landfill staff may assist with identifying a suitable location for collecting a sample of untreated leachate. PADEP will designate the appropriate landfill on the Chain of Custody (COC) records accompanying each batch of sample bottles. Additional details of each of these sampling methods are presented in the following subsections and Attachment A of this SAP.

#### 2.1.1 Sample Collections and Analyses

For each quarterly sampling round, PADEP regional offices will be provided with one cooler or other shipping container (i.e., shipping box), the requisite number of sample bottles, a COC form, bubble wrap or other packing material for return shipment of samples, and a return shipping label for each facility. PADEP staff will collect all samples for the duration of this study. Coolers or shipping containers, sample bottles and all supplies necessary for the collection of samples will be shipped to the identified PADEP regional or district offices, as appropriate. A landfill may choose to collect their own sample at the same time PADEP collects its sample (i.e., split sampling) for comparative purposes to the results obtained through this study; however, said sample collection and analysis must be handled separately by and between the landfill and the laboratory it has contracted with to conduct the analysis.

PADEP staff will collect samples of untreated leachate once per quarter for the two-year study period. Samples are collected by filling the sample bottle(s) to the top from the leachate collection point and sealing the bottle with the lid provided. Samples and QC samples are collected into a clean one-liter (1L) plastic sample bottle as a single grab. Each sample or QC sample will consist of two 1L bottles. When filling QC sample bottles, fill each type of bottle for the sample and duplicate in sequence. The samples will be analyzed for the following parameters:

<b>Liquid Sample Collection and Analysis Method</b>		
<b>Analysis</b>	<b>Sample Volume (L)</b>	<b>Laboratory Analysis</b>
<sup>226</sup> Ra and <sup>228</sup> Ra	1	Radium-226 & 228 (901.1 Modified)

Each landfill will be sampled at least once per quarter for a 2-year study period, commencing in the fourth quarter of 2021 and concluding with the fourth quarter of 2023. For each quarterly sampling round, at least one sample, consisting of two 1L bottles will be collected. At predetermined intervals, QC samples may also be collected during the quarterly sampling events. A landfill may be selected to have one additional QC sample collected (i.e., 1 sample of leachate and 1 duplicate sample) and up to three QC samples collected in a single quarterly sampling round (i.e., 1 sample of leachate, 1 duplicate sample, 1 triplicate sample, and 1 laboratory QC sample). Each sample container will be marked or labeled with the sample identification code as described below in Section 2.1.2. DEP Field Staff shall refer to the *PA Radium Sampling Frequency and Shipment Tracker* spreadsheet disseminated by Ali Tarquino Morris, or her designee, for the number of samples or QC samples to be collected for each quarterly sampling round.

Note that one liter of leachate is sufficient for the prescribed laboratory analysis above. However, the submission of the second 1L bottle is to be provided in case of breakage or if initial results warrant that additional analysis be performed via radiochemistry (EPA 903.0 and EPA 904.0). Determination of additional analysis will be made in consultation with PADEP.

All personnel handling samples will wear personal protective equipment (PPE) commensurate with the level of hazard and facility procedures. As with any sample collection event, gloves, safety glasses and proper attire – particularly boots – are recommended for collecting samples associated with this study. No special PPE is required based on the constituents of concern for this project.

### 2.1.2 Sample Identification

Systematic 8-character sample identification (ID) codes will be used to uniquely identify all samples. The ID code format is “AAAbbbbCd” meaning:

- AA – a two-digit landfill identification number: 01 through 49 (see Table 1, column “SAP ID”).
- bbbb – a four-digit project sequential sample number beginning 0001
- C – a single letter sample analysis laboratory designator: A (Pace), B (Gel), C (PADEP)
- d – a single-digit sample type designator: 1 (original), 2 (field QC duplicate), 3(field QC triplicate).

For example, Landfill A is designated with landfill identification number 67 and is scheduled to have two samples collected for this quarter, both samples going to PACE for analyses. Therefore, the two bottles collected for the first quarterly sample should be labeled as 67-0001-A1, and the two bottles collected for the second quarterly sample should be labeled as 67-0001-A2, because for this quarter, Landfill A is designated for one unique sample and one duplicate sample. The next quarter, the same landfill is designated for one unique sample with no QC samples, making the sample ID number 67-0002-A1 for both bottles (second unique sample: 0002, no duplicate). Each quarter, the sample sequence number increases by one for each site, creating a maximum of 8 samples in the two-year study period.

An Excel database will be used to record and maintain all pertinent information associated with each sample ID code marked/labeled on sample bottles and COC records issued to field personnel. EREF will manage this database and provide quarterly sampling results to PADEP Central Office for general review as well as any potential additional site-specific action required prior to completion of the study.

## 2.2 Quality Control (QC) Samples

Quality assurance objectives are specified so that the data produced are of a known and sufficient quality for determining whether a risk to human health or the environment exists. In the field, precision is affected by sample collection procedures and by the natural heterogeneity encountered in the environment. Overall, both field and laboratory precision will be evaluated by examining the results of field duplicate samples or triplicate samples, and laboratory QC samples. Field precision will be evaluated through collection of triplicate and duplicate samples at specified intervals and through ad-hoc sampling as determined by evaluation of sample results. The first sampling event will be comprised of duplicate samples with 20% of sites randomly selected for triplicate samples. Subsequent sampling events will consist of single samples with up to 20% of the sites selected for duplicates. Locations for duplicate sample collection for sampling events two through five have been pre-identified such that each landfill will be collected in duplicate once. The remaining duplicate samples will be completed on an ad-hoc bases depending on the quarterly results provided and allocated where additional samples are needed for quality control.

Laboratory precision will be determined through QC analyses at a secondary commercial laboratory. These additional samples will be analyzed for the same radiological parameters as the original paired samples. The laboratory QC duplicate sample load planned for this investigation is 10% of the total samples planned for the investigation. These samples will be identified at a later date based on the quarterly results and provided separately.

Trip blanks are unnecessary since no volatile organic compound (VOC) analyses are included in the FSP. The analytical laboratories (Pace – primary analytical laboratory, and GEL – secondary laboratory for laboratory QC samples) chosen for this investigation are accredited in accordance with the Environmental Laboratory Accreditation Act, 27 Pa C.S., Chapter 41 (Act 90 of 2002), and have extensive experience analyzing the contaminants of concern in the sample matrix presented in this FSP. Further, the laboratory maintains and implements an approved quality assurance program (QAP) to provide objective evidence that all measurements satisfy specific quality assurance objectives. Accordingly, performance evaluation (PE) samples (e.g., samples spiked with known concentrations of radionuclides in levels similar to those expected in the actual samples or blanks) will not be prepared beyond those included in the laboratories' QAP to further document the accuracy and precision of their measurements process.

### 2.3 Chain of Custody (COC) Record

The COC is a multiple-copy form that serves as a written record of sample handling from the field through laboratory receipt. COC documentation will be provided with each quarterly sampling event's bottle package shipment to the regional DEP offices, and will be pre-filled with the relevant information relating to required analysis, except for information specific to the facility being sampled, collector information and other information that is specific to the day of collection. A typical COC record is shown in Attachment B. When a collected sample changes custody, those relinquishing and receiving the sample will sign the COC record. Each change of possession will be documented.

Shipping companies (e.g. Federal Express, DHL, etc.) are not expected to sign the chain-of-custody form, as the chain of custody form will be packed inside the cooler or shipping container with samples prior to shipment. However, complete shipping documentation, including tracking numbers, becomes part of the chain-of-custody record. When using shipping companies, the last person to have custody of the samples must fill in both the relinquished section (as normal) as well as the received section (identifying the shipping company's name and the date and time when the shipment was given into custody of the shipping company).

### 2.4 Handling and Disposition of Investigation-Derived Waste

All waste dispositions will be coordinated with the appropriate landfill site representative to ensure compliance with applicable waste storage, characterization, treatment, and disposal requirements. The investigation-derived waste produced during sampling may include spent and unused sample material, personal protective equipment, miscellaneous sampling supplies, decontamination water, purge water, and samples. The landfill site or DEP representative will provide a determination for the disposition of all such waste materials.

### 2.5 Sample Handling, Packaging, and Shipping

After collection and prior to packing the samples for shipment, the exterior of the sample container(s) should be decontaminated by wiping off excess leachate with a clean paper towel. Sample bottles should be packaged back into the provided coolers or shipping containers, along with the completed chain of custody form, and properly secured with bubble wrap or other packaging materials pending shipment. The sample custodian/shipper is responsible for ensuring that bottle caps are checked for tightness, and samples are properly packaged for custody transfer and shipment to the laboratory. Samples for radioactivity analysis do not require refrigeration or additional preservation.

When provided, the coolers will act as the shipping container for return shipment of samples to the laboratory. The coolers must be taped shut for shipping, with part of the shipping label over the seam of the cooler so that receiving personnel at the laboratory can readily identify if the cooler has been tampered with.

Packed coolers or shipping containers should be shipped the same day as sample collection, or as early as practicable after sampling. Coolers or shipping containers that have been prepared for shipping may be dropped off at a Federal Express

Drop Off location, scheduled for pick up by Federal Express at the PADEP regional or district office or from the collector's home office, as appropriate.

Table 1: Pennsylvania Solid Waste Landfills to Be Sampled.

<b>Active Municipal/Residual Landfill Facility Information</b>				
	<b>SAP ID</b>	<b>Facility Name</b>	<b>Facility Type</b>	<b>Mailing Address</b>
Northcentral Regional Office	1	Bradford County Landfill	MWLF	P.O. Box 10, Burlington, PA 18814
	2	Lycoming County Landfill	MWLF	447 Alexander Dr, Montgomery, PA 17752
	3	Phoenix Resources Landfill	RWLF	782 Antrim Rd, Wellsboro, PA 16901
	4	Wayne Township Landfill	MWLF	P.O. Box 209 McElhattan, PA 17748
	5	White Pines Landfill	RWLF	RR1 Box 69, Mileville, PA 16901
Northeast Regional Office	6	Alliance Landfill	MWLF	398 S Keyser Ave, Taylor, PA 18517
	7	Chrin Brothers Sanitary Landfill	MWLF	1225 Industrial Dr, Easton, PA 18042
	8	Commonwealth Environmental Systems	MWLF	99 Commonwealth Rd, Hegins, PA 17938
	9	Grand Central Sanitary Landfill	MWLF	1963 Pen Argyl Rd, Pen Argyl, PA 18072
	10	Keystone Sanitary Landfill	MWLF	249 Dunham Rd, Dunmore, PA 18512
	30	Blythe Recycling and Demolition Site (BRADS)	CDLF	1061 Burma Rd, New Philadelphia, PA 17959
Northwest Regional Office	11	Greentree Landfill	MWLF	635 Toby Rd, Kersey, PA 15846
	12	Lake View Landfill	MWLF	851 Robison Rd, Erie, PA 16509
	13	McKean County Landfill	MWLF	19 Ness Ln, Kane, PA 16735
	14	Northwest Sanitary Landfill	MWLF	1436 West Sunbury Rd, West Sunbury, PA 16061
	15	Seneca Landfill	MWLF	421 Hartman Rd, Evans City, PA 16033
	36	Evergreen Landfill	MWLF	Route 119 N & Luciousdoro Rd, Coral, PA 15731
Southcentral Regional Office	16	Advanced Disposal Services C&D Landfill	CDLF	2487 Cloverleaf Rd, Elizabethtown, PA 17022
	17	Advanced Disposal Services Sandy Run Landfill	MWLF	995 Landfill Rd, Hopewell, PA 16650
	18	Conestoga Landfill	MWLF	Harvey and Shiloh Rd, Morgantown, PA 19543
	19	Cumberland County Landfill	MWLF	135 Vaughn Rd, Shippensburg, PA 17257
	20	Greater Lebanon Refuse Authority Landfill	MWLF	1610 Russell Rd, Lebanon, PA 17046
	21	IESI Blue Ridge Landfill	MWLF	1578 Orchard Rd, Scotland, PA 17254
	22	IESI PA Bethlehem Landfill	MWLF	2335 Applebutter Rd, Bethlehem, PA 18018
	23	Lanchester Landfill	MWLF	7224 Division Hwy, Narvon, PA 17555
	24	LCSWMA Frey Farm Landfill	MWLF	3049 River Rd, Conestoga, PA 17516
	25	Modern Landfill	MWLF	4400 Mt. Pisgah Rd, York, PA 17402

**Active Municipal/Residual Landfill Facility Information**

	<b>SAP ID</b>	<b>Facility Name</b>	<b>Facility Type</b>	<b>Mailing Address</b>
	26	Mountain View Reclamation	MWLF	9446 Letzburg Rd, Greencastle, PA 17225
	27	Pioneer Crossing	MWLF	727 Red Lane Rd, Birdsboro, PA 19508
	28	Rolling Hills Landfill	MWLF	583 Longview Rd, Boyertown, PA 19512
	29	Western Berks Landfill	MWLF	455 Poplar Neck Rd, Birdsboro, PA 19508
Southeast Regional Office	31	Fairless Landfill	MWLF	1000 New Ford Mill Rd, Morrisville, PA 19067
	32	SECCRA Landfill	MWLF	261 Street Rd, West Grove, PA 19390
Southwest Regional Office	33	Alex Paris Landfill	RWLF	Frankfort Springs Rd, Hookstown, PA 15050
	34	Arden Landfill	MWLF	200 Rangos Ln, Washington, PA 15301
	35	Chestnut Valley Landfill	MWLF	Route 21, McClellandtown, PA 15458
	37	Greenridge Reclamation	MWLF	Landfill Rd, Scottsdale, PA 15683
	38	Imperial Landfill	MWLF	Route 980, 11 Boggs Rd, Imperial, PA 15126
	39	J.J. Brunner, Inc. Landfill	MWLF	211 Brunner Rd, Zelienople, PA 16063
	40	Kelly Run Sanitation	MWLF	1500 Hayden Blvd, Elizabeth, PA 15037
	41	Laurel Highland Landfill	MWLF	260 Laurel Ridge Rd, Johnstown, PA 15909
	42	Max Environmental Technologies, Yukon	RWLF	233 Max Lane, Yukon, PA 15698
	43	Monroeville Landfill	MWLF	Thomas St, Monroeville, PA 15146
	44	Mostoller Landfill	MWLF	7095 Glades Pike, Somerset, PA 15501
	45	Shade Landfill	MWLF	1176 No. 1 Rd, Cairnbrook, PA 15924
	46	South Hills Landfill	MWLF	3100 Hill Rd, South Park, PA 15129
	47	Southern Alleghenies	MWLF	843 Miller Picking Rd, Davidsville, PA 15928
	48	Tervita Sanitary Landfill	MWLF	900 Tyrol Blvd, Belle Vernon, PA 15012
	49	Valley Landfill	MWLF	6015 Pleasant Valley Rd, Irwin, PA, 15642

## Attachment A: Pace Radiological Work Plan for Analytical Samples

Pace Analytical Services, LLC looks forward to supporting your Radiochemistry needs for landfills in the state of Pennsylvania. Our laboratory in Greensburg, PA will be the primary lab supporting your project.

Pace will provide the appropriate sample containers, bubble wrap or packaging material, and a return shipping label in a cooler or shipping container to each of your locations as scheduled. Collection instructions are listed below:

1. Two 1L containers will be provided in a cooler or shipping container and shipped Fed Ex Ground to each of the PADEP offices. One-liter volume is sufficient, but the second liter is for requested in case of breakage or a quality control failure requiring reanalysis.
2. Complete the Chain of Custody and sample labels included in the cooler or shipping container. Apply the labels to the bottles and return the completed Chain of Custody to the zip loc bag and place in the cooler or shipping container.
3. Please fill the containers provided, pack well with bubble wrap so the containers do not touch the other containers or the sides of the cooler or shipping container. There should also be no headspace in the cooler or shipping container for the samples to shift during shipment and break. Please see Pace's Cooler Packing Instructions flier.
4. Radiological samples do not have a temperature requirement like some analytical samples, so **NO ICE** is required in the cooler or shipping container.
5. Samples should be shipped by Fed Ex Ground to the laboratory at the following address:  
Shipping and Receiving  
Pace Analytical Services  
1638 Roseytown Rd, Suites 2, 3, 4  
Greensburg, PA 15601
6. Please use your tracking number to determine if your shipment was delivered to the lab.
7. You should receive a sample receipt acknowledgement form once samples are logged in to our system. Please contact Gabriel Vegh-Gaynor or Suzie Boxman at EREF should you not receive this.

