Evaluation of TENORM in Drinking Water and Wastewater Treatment Systems Report

Tetra Tech Project# 117-8296103
DEQ EDMS Document No. 2023BCJ143

September 26, 2023

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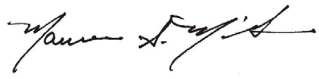

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ACRONYMS/ABBREVIATIONS

Acronyms/Abbreviations	Definition
%	Percent
%R	Percent recovery
DEQ	Department of Environmental Quality
DQOs	Data quality objectives
EPA	Environmental Protection Agency
HASP	Health and safety plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
IDAPA	Idaho Administrative Procedures Act
MDA	Minimum detectable activity
MDC	Minimum detectable concentration
NORM	Naturally occurring radioactive material
NRC	Nuclear Regulatory Commission
OSHA	Occupational Safety and Health Administration
PARCC	Precision, accuracy, representativeness, comparability, and completeness
pCi/g	picocuries per gram
PM	Project manager
PPE	Personal protective equipment
POTW	Publicly owned treatment works
QA	Quality assurance
QC	Quality control
QAM	Quality assurance manual
QAO	Quality assurance officer
QAPP	Quality assurance project plan
QA/QC	Quality assurance/quality control
QMP	Quality management plan
RPD	Relative percent difference
SOP	Standard operating procedure
TENORM	Technologically enhanced naturally occurring radioactive materials
TO	Task order
TPU	Total propagated uncertainty
US	United States

1.0 INTRODUCTION

Tetra Tech investigated the presence of technologically enhanced naturally occurring radioactive materials (TENORM) in water treatment residuals for the Idaho Department of Environmental Quality (DEQ) at participating communities in Idaho. The activities were performed to fulfill Task Order (TO) No. 50 of DEQ's Contract No. K306 with Tetra Tech.

Tetra Tech's scope of work under TO 50 includes:

- Prepare a site health and safety plan (SSHP) to guide field activities.
- Conduct sampling from up to 7 PWS and 6 POTW facilities;
- Perform data review and analysis including QA/QC review of data.
- Prepare a project report.

The project was conducted in general accordance with the project Quality Assurance Project Plan (QAPP) developed for the Site (Tetra Tech, 2023). **Section 1** of this report presents an introduction; **Section 2** provides background site information as well as the investigation methods; **Section 3** presents the site investigation methods; **Section 4** present site investigation results; **Section 5** discusses IDW management; **Section 6** presents results of a quality assurance review; **Section 7** presents a summary and recommendations; and **Section 8** includes references. **Appendix A** presents tabulated analytical data for samples obtained during this investigation. **Appendix B** provides copies of the field notes. **Appendix C** provides the laboratory analytical report for samples obtained during this investigation. **Appendix D** includes the data evaluation checklist.

2.0 BACKGROUND

All rocks and soils contain some trace amounts of Naturally Occurring Radioactive Materials (NORM). When a drinking water source, either surface or groundwater, comes in contact with NORM-bearing rocks and soils, radionuclides can accumulate in the source water. The most frequently occurring radionuclides of concern (and their decay products) found in source water are radium-226 and -228 (Ra-226 and Ra-228).

Technologically enhanced naturally occurring radioactive materials (TENORM) is NORM whose radionuclide concentrations were caused or increased by human practices. TENORM does not include background radiation or the natural radioactivity of rocks and soils. TENORM is not federal Nuclear Regulatory Commission (NRC) licensed material. TENORM is not nuclear waste.

IDAPA 58.01.10 (DEQ, 2022) prohibits disposal of TENORM at a Resource Conservation and Recovery Act (RCRA) Subtitle D landfill (a landfill that accepts nonhazardous waste and household waste). DEQ is evaluating TENORM-containing wastes generated by certain drinking water and wastewater treatment facilities in Idaho. The ultimate objective is to determine if IDAPA 58.01.10 should be modified to ensure TENORM management is protective of human health and the environment.

3.0 SITE INVESTIGATION METHODS

3.1 SAMPLING

The following section presents methods used to sample the various media from the treatment systems at participating communities. Sampling equipment included stainless steel spoons, stainless steel bowls, stainless steel augers and a Sludge Judge sampling system. Equipment was decontaminated between samples according

to method outlined in the Project QAPP (Tetra Tech, 2023). All samples were submitted to Pace and analyzed for Ra-226 and Ra-228.

3.1.1 Fruitland

Fruitland Water Treatment Facility

Tetra Tech obtained samples from the Fruitland water treatment facility on March 07, 2023. The facility has two drying ponds. The southern pond was completely dry and the northern pond contained approximately 4 feet of water at the time of sampling. The water treatment facility also has filter media but it was not due to be replaced therefore no sample of the media was collected.

The dry southern pond was divided into two equal area halves. Six subsamples were obtained from each half using a stainless steel spoon which were placed in a stainless steel bowl. The sample from the south half of the southern pond was labeled FRUITLAND-WT-SLUDGE-1. The sample was also used by the laboratory for the field duplicate FRUITLAND-WT-SLUDGE-DUP. The sampling equipment was decontaminated and a composite sample was obtained from the north half of the southern pond, placed into a 1-gallon Ziploc bag and labeled FRUITLAND-WT-SLUDGE-2. The bag was then placed into a 2-gallon Ziploc bags for shipment to the analytical laboratory.

A composite sample was obtained from the northern pond by obtaining six subsamples from the edge of the water filled pond using a stainless steel auger. Two subsamples were obtained from the ramp area using wading boots and a stainless steel bowl/spoon. The remaining four sub samples were obtained from the edge of the concrete pad, where the field scientist reached through the fence with the augur to collect the samples. The contents of each auger sample was poured into the bowl so as much liquid as possible could be drained off. The subsample locations were limited to this location due to the deep water and steep sides of the pond. The subsamples were placed into a one gallon Ziploc bag and labeled FRUITLAND-WT-SLUDGE-3. The bag was then placed into a 2-gallon Ziploc bag for shipment to the analytical laboratory.

Fruitland Waste Water Treatment Facility

Samples were obtained from the Waste Accumulation Settling (WAS) tank and the biosolids pile on March 07, 2023. A Fruitland Waste Water Treatment Facility employee used a Sludge Judge sampling system to collect the sediment from the bottom of the WAS tank. The relatively small diameter of Sludge Judge sampler requires numerous subsamples to obtain sufficient volume of material to comprise the composite sample. The Sludge Judge samples were placed into stainless steel bowls and decanted of free liquid. The solids in the bowls were then placed in two 1-gallon Ziplock bags and labeled FRUITLAND-WW-WASTANK-3. Each bag was then placed into 2-gallon Ziploc bags for shipment to the analytical laboratory.

Two composite samples were collected from the end product biosolid pile using a stainless steel spoon and stainless steel bowls. The Waste Water Treatment Facility employee indicated that the biosolids are taken to a landfill several times a week. Each composite sample from the biosolids consisted of six subsamples taken at random locations in the pile. The composite samples were placed in two 1-gallon Ziplock bags and labeled FRUITLAND-WW-BIOSOLIDS-1 and FRUITLAND-WW-BIOSOLIDS-2. The sample FRUITLAND-WW-BIOSOLIDS-1 was also used by the laboratory for the field duplicate (FRUITLAND-WW-BIOSOLIDS-DUP). Each bag was then placed into 2-gallon Ziploc bags for shipment to the analytical laboratory.

3.1.2 Glenns Ferry

Glenns Ferry Water Treatment Facility

Tetra Tech obtained samples from the Glenns Ferry water treatment facility on March 13, 2023. The water treatment facility also has filter media however it could not be sampled due to access issues. The system includes a former Poly Aluminum Chloride (PAC) basin located inside the facility building that is now reportedly only used as a water basin prior to chemical treatment.

A Sludge Judge sampling system was used to collect three 1-gallon Ziplock bags of sample which were labeled GLENNS FERRY-WT-PAC BASIN-1. The sample was also used by the laboratory for the field duplicate (GLENNSFERRY-WT-PAC BASIN-DUP). Each sample was then placed into 2-gallon Ziploc bags for shipment to the analytical laboratory.

Glenns Ferry Waste Water Treatment Facility

Samples were collected from the Glenns Ferry waste water treatment system on March 13, 2023. The waste water treatment facility consists of multiple settling ponds. Due to accessibility issues (i.e. steep slopes, concrete walls) and lack of sediment, only the first (eastern most) pond could be sampled.

A stainless steel auger was used to obtain subsamples along the sides of the pond. Each composite sample consisted of at least three subsamples. The first sample (GLENNSFERRY-WW-SLUDGE-1) consisted of raw solids/sewage collected along the north side of the pond, nearest the inflow of the pond. The sample was also used by the laboratory for the field duplicate (GLENNSFERRY-WW-SLUDGE-DUP). The samples were placed into three 1-gallon Ziplock bags of sample that was then placed into 2-gallon Ziploc bags for shipment to the analytical laboratory.

The second sample was taken from the westernmost banks of the settling pond (GLENNSFERRY-WW-SLUDGE-2). The third sample was taken from the southern bank of the pond (GLENNSFERRY-WW-SLUDGE-3). The outflow of the ponds to the river contained some moss but did not have sufficient solids volume for a sample.

3.1.3 Greenhill Estates

Tetra Tech field staff met with IES Waterworks (IES) personnel on March 2, 2023 and obtained water filter cartridges that were reportedly obtained from six residential homes that had high water usage. IES had recorded the gallons for each of the filters on the bag they had been placed into as 1200, 500, 2100, 500, 600, and 1000 gallons. The filters used to make the composite sample for GREENHILL-DW-RESIN-1 were marked 1200, 500, 2100, 500, 600, and 1000 gallons. Tetra Tech field staff transported to the Boise office and stored them over night in the sample refrigerator.

The following morning a pipe cutter was used to cut off the inlet end of the filter and approximately ½ of the contents (small beads) from each cartridge taken from the inlet side was removed using a decontaminated stainless steel spoon and placed in a stainless steel strainer inside of a plastic tub that was designed to capture any free water and any resin that may be spilled during sample collection. Paper towels were used to clean the tub and wipe down the strainer and spoon.

The resin from the six cartridges was composited in a new one-gallon sealable freezer bag. The process yielded an approximately 1-gallon volume of resin. The sample was labeled GREENHILL-DW-RESIN-1. The sample was also used by the laboratory for the field duplicate (GREENHILL-DW-RESIN-DUP). The sample was then placed inside of a 2 gallon freezer bag for shipment to the analytical laboratory.

The IES representative met again with Tetra Tech staff on March 3, 2023 and provided an additional 12 filters that were used to make two additional composite samples. Six of these filters were used for GREENHILL-DW-RESIN-DW-2 and were marked as 500, 1300, 1400, 800, 900, and 500 gallons. The sample time was 16:30. The remaining six filters were used for GREENHILL-DW-RESIN-3 and were marked as 1000, 1100, 400, 500, 500, and 1700 gallons. IES also provided one unused filter so that the lab can use the media for a control sample (GREENHILL FILTER MEDIA CONTROL SAMPLE). The samples were collected in 1-gallon Ziploc bags, labeled in the same method as described above then placed in 2-gallon Ziploc bags for shipment to the laboratory.

The remainder of the opened cartridges with resin, water that drained from the cartridges, used paper towels, and nitrile gloves worn during sample collection were packaged and returned to IES for disposal.

3.1.4 Moyie Springs

Moyie Springs Water Treatment Facility

Samples were obtained from the Moyie Springs water treatment facility on March 21, 2023. The water for this facility is from a clear well which flows into a sediment basin. A Sludge Judge was used to attempt to obtain a sample from the basin however the sandy sediment fell out before it was able to be collected. A stainless steel auger was then used in an attempt to collect a sample however it too fell out before the sample could be collected. A City of Moyie Springs employee used a backhoe to scrape the sandy sediment from the basin. Three samples were collected from the sandy sediment removed using the backhoe; MOYIE SPRINGS-WT-SLUDGE-1, MOYIE SPRINGS-WT-SLUDGE-2, and MOYIE SPRINGS-WT-SLUDGE-3. The sample MOYIE SPRINGS-WT-SLUDGE-1 was also used as a field duplicate (Moyie Springs-WT-Sludge-Dup). The samples were collected in 1-gallon Ziploc bags, labeled in the same method as described above then placed in 2-gallon Ziploc bags for shipment to the laboratory.

Moyie Springs Waste Water Treatment Facility

Samples were obtained from the Moyie Springs waste water treatment system on March 21, 2023. The waste water is collected in an 80 foot concrete basin/clarifier before entering a settling basin. The waste water system is comprised of an aerator basin with 3 feet of sludge and a settling pond that has 2 feet of sludge.

Two samples were collected from the aerator (clarifier) basin using a Sludge Judge sampling system; MOYIE SPRINGS-WW-SLUDGE-1 and MOYIE SPRINGS-WW-SLUDGE-2. The sample MOYIE SPRINGS-WW-SLUDGE-1 was also used as a field duplicate (MOYIE SPRINGS-WW-SLUDGE-DUP). The samples were collected in 1-gallon Ziploc bags, labeled, then placed in 2-gallon Ziploc bags for shipment to the laboratory.

One sample was obtained from the settling pond using the Sludge Judge sampling system. The sample consisted of several subsamples that were collected in a 1-gallon Ziploc bag, labeled as MOYIE SPRINGS-WW-SLUDGE-3, then placed in 2-gallon Ziploc bags for shipment to the laboratory.

3.1.5 Orofino

Orofino Water Treatment Facility

Samples were collected from the Orofino water treatment facility sediment retention basin system on March 20, 2023. A Sludge Judge was used to collect samples from three different locations across the basin; OROFINO-WT-SLUDGE-1, OROFINO-WT-SLUDGE-2, and OROFINO-WT-SLUDGE-3. Sludge Judge samples were placed into stainless steel bowls to decant off free liquid. The sample OROFINO-WT-SLUDGE-1 was also used as a field duplicate (OROFINO-WT-SLUDGE-DUP). Each was sample was then placed into 1-gallon Ziploc bags, labeled and then placed into 2-gallon Ziploc bags for shipment to the laboratory.

Orofino Waste Water Treatment Facility

Two biosolids samples were collected from the Orofino waste water treatment facility on March 20, 2023. The samples were collected from material on the conveyor belt that piles the sediment into a dump truck. The biosolid samples are the end product and are mixed with a polymer before disposal. Facility employees stated the dump truck is sent to the landfill every 2-3 days. Samples OROFINO-WW-BIOSOLIDS-1 and OROFINO-WW-BIOSOLIDS-2 and field duplicate OROFINO-WW-BIOSOLIDS-DUP were collected using stainless steel spoon and stainless steel bowls. Each was sample was then placed into 1-gallon Ziploc bags, labeled and then placed into 2-gallon Ziploc bags for shipment to the laboratory.

One sample was obtained from the Return Activated Sludge (RAS) sink inside the facility. The RAS sink receives the water/sediment that comes from the clarifiers. A stainless steel screen was used to collect solid sample from the sink and placed into 1-gallon Ziploc bags, labeled OROFINO-WW-RAS-3 and then placed into 2-gallon Ziploc bags for shipment to the laboratory.

3.1.6 Priest River

Priest River Water Treatment Facility

Samples were collected from the Priest River waste water treatment facility on March 21, 2023. The water treatment facility includes rapid sand filters that are changed bi-annually however they were not scheduled to be changed so a sample of the sand filters was not obtained. The waste water treatment facility samples were collected from two dry ponds located north of the facility using decontaminated stainless steel spoons and stainless steel bowls. The north pond was divided into roughly equal halves. Six subsamples were obtained from the north half of the north pond, composited, placed into a 1-gallon Ziploc bag and labeled PRIEST RIVER-WT-SLUDGE-1 and placed into a 2-gallon Ziploc bag for shipment to the laboratory. The sample PRIEST RIVER-WT-SLUDGE-1 was also used as a field duplicate (PRIEST RIVER-WT-SLUDGE-DUP).

Six subsamples were obtained from the south half of the north pond, composited, placed into a 1-gallon Ziploc bag and labeled PRIEST RIVER-WT-SLUDGE-2 and placed into a 2-gallon Ziploc bag for shipment to the laboratory.

Six subsamples were obtained from the south pond, composited, placed into a 1-gallon Ziploc bag and labeled PRIEST RIVER-WT-SLUDGE-3 and placed into a 2-gallon Ziploc bag for shipment to the laboratory.

Priest River Waste Water Treatment Facility

Three samples were obtained from the Priest River Waste Water treatment facility on March 21, 2023: one sample was taken from the belt press and biosolids pile; one sample was taken from the foam/aeration pond; and one sample was obtained from the clarifier pond.

The sample from the belt press and biosolids pile was collected using a stainless steel spoon and bowl. The sample was collected in Ziploc bags, labeled PRIEST RIVER-WW-BIOSOLIDS-1 and then placed in a 2-gallon Ziploc bag for shipment to the laboratory. The sample PRIEST RIVER-WT-BIOSOLIDS-1 was also used as a field duplicate (PRIEST RIVER-WT-BIOSOLIDS-DUP).

The sample from the foam/aeration pond was collected using a stainless steel spoon and bowl. The sample was collected in Ziploc bags, labeled PRIEST RIVER-WW-BIOSOLIDS-2 and then placed in a 2-gallon Ziploc bag for shipment to the laboratory.

The sample from the clarifier pond was collected using the Sludge Judge sampler. The subsamples were placed into a decontaminated stainless bowl and free liquid was decanted. The sample was collected in Ziploc bags, labeled PRIEST RIVER-WW-BIOSOLIDS-3 and then placed in 2-gallon Ziploc bag for shipment to the laboratory.

3.2 QUALITY ASSURANCE SAMPLE COLLECTION

Quality assurance samples consisted of the following natural samples and their corresponding field duplicates;

SDG:L1593797 Greenhill
DW-Resin-1/DW-Resin-Dup

SDG:L1593799 Fruitland
WT-Sludge-1/WT-Sludge-DUP
WW-Biosolids-1/WW-Biosolids-Dup

SDG:L1594711 Glennsferry
WT-Pacbasin1/WT-Pacbasin-Dup
WW-Sludgeg-1/ WW-Sludge-Dup

SDG:L159821 Orofino
WT-Sludge-1/WT-Sludge-Dup
WW-Biosolids-1/WW-Biosolids-Dup

SDG:1598520 Moyie Springs
WT-Sludge-1/WT-Sludge-Dup
WW-Sludge-1/WW-Sludge-Dup

SDG:L1598523 Priest River
WT-Sludge-1/WT-Sludge-Dup
WW-Biosolids-1/WW- Biosolids -Dup

4.0 INVESTIGATION RESULTS

4.1 ANALYTICAL RESULTS

The following presents analytical results for the various media that was obtained from the water treatment systems at the participating communities. Tabulated data for each of the systems at the participating communities is presented in Table 1 **(Appendix A**). **Appendix B** presents field notes and **Appendix C** provides a copy of the laboratory reports.

Water Treatment System Sludge Samples

Sludge samples were obtained from the water treatment facilities at the City of Moyie, Fruitland, Orofino and Priest River.

- Concentrations of Ra-228 ranged from 0.478 (±0.216) picocuries per gram (pCi/g) in the sample PRIESTRIVER-WT-SLUDGE-1 to 1.040 (±0.274) pCi/g in the sample FRUITLAND-WT-SLUDGE-2.
- Concentrations of Ra-226 ranged from 0.37 pCi/g (±0.0969) in the sample PRIESTRIVER-WT-SLUDGE-2 to 0.928 (±0.314) pCi/g in the sample OROFINO-WT-SLUDGE-2.

Waste Water Treatment System Sludge Samples

Sludge samples were obtained from waste water treatment facilities at City of Moyie, Glenns Ferry, and Orofino.

- Concentrations of Ra-228 ranged from 0.623 (±0.423) pCi/g in the sample MOYIE-WT-SLUDGE-3 to 1.52 (±0.615) pCi/g in the sample MOYIE-WT-SLUDGE-2.
- Concentrations of Ra-226 ranged from 0.344 pCi/g (±0.270) in the sample MOYIE-WT-SLUDGE-3 to 0.974 (±0.17) pCi/g in the sample GLENNSFERRY-WT-SLUDGE-1.

Waste Water Treatment System Biosolid Samples

Biosolids samples were obtained from waste water treatment facilities at Fruitland, Orofino and Priest River.

- Concentrations of Ra-228 ranged from 0.052 (±0.399) pCi/g in the sample OROFINO-WT-BIOSOLIDS-2 to 0.904 (±0.553) pCi/g in the sample PRIESTRIVER-WT-BIOSOLIDS-2.
- Concentrations of Ra-226 ranged from -0.0235 pCi/g (±0.0580) in the sample FRUITLAND-WT-BIOSOLIDS -2 to 0.669 (±0.309) pCi/g in the sample PRIESTRIVER-WT- BIOSOLIDS -1.

Drinking Water Treatment System Resin Samples

Resin samples were obtained from the drinking water treatment system at the community of Greenhill Estates.

- Concentrations of Ra-228 ranged from -0.0357 (±0.045) pCi/g in the sample GREENHILL-DW-RESIN-2 to 0.0404 (±0.972) pCi/g in the sample GREENHILL-DW-RESIN-1.
- Concentrations of Ra-226 ranged from -0.00413 (±0.0344) pCi/g in the sample GREENHILL-DW-RESIN-2 to 0.0428 (±0.0708) pCi/g in the sample GREENHILL-DW-RESIN-1.

4.2 COMPARISON TO EXPECTED SOIL BACKGROUND

The analytical results are summarized in Table 1 and compared to State of Idaho background surface soil concentrations from Myrick 1983. Radium-226 and radium-228 are naturally occurring radioactive isotopes that can be found in soil due to the decay of uranium and thorium minerals, which are also naturally present in the Earth's crust. Because some amount of soil or other materials derived from the Earth's crust could be expected to be present in the waste water and drinking water treatment residuals, the detection of radium-226 and radium-228 in the samples should not be unexpected. If radium-226 and radium-228 concentrations in the residual samples were elevated compared to expected soil background, this could be an indication that concentrations have been enhanced through the water treatment processes. As shown in Table 1, the radium concentrations in the samples do not exceed the range of concentrations found in Idaho surface soils determined by Myrick 1983.

Table 1. Comparison of analytical results to expected soil background radium concentrations. **Media**	**Range of Concentrations**	
	Radium-226 (pCi/g)	**Radium-228 (pCi/g)**
Water Treatment System Sludge Samples	0.37 – 0.928	0.478 – 1.040
Waste Water Treatment System Sludge Samples	0.344 – 0.974	0.623 – 1.52
Waste Water Treatment System Biosolid Samples	ND – 0.669	0.052 – 0.904
Drinking Water Treatment System Resin Samples	ND – 0.0428	ND – 0.972
State of Idaho Background Surface Soil Study by Meyrick 1983 (12-13 Samples)[1]	0.64 – 1.6	0.42 – 1.9

Notes

ND Nondetect

[1] State of Idaho background surface soil concentrations are from *Determination of Concentrations of Selected Radionuclides in Surface Soil in the U.S.* by T.E. Myrick, B.A. Berven, and F. F. Haywood. Published in *Health Physics* Vol 45, No. 3 (September), pp. 631-642, 1983. The background radium-228 concentration range listed is inferred from the thorium-232 concentrations reported in the study. Radium-228 concentrations are not reported in the study; however, approximate secular equilibrium between thorium-232, which is reported in the study, and its daughter radium-228 is expected for background soils.

5.0 IDW MANAGEMENT

IDW consisted predominantly of PPE such as nitrile gloves donned during sample collection at each site. The used gloves were placed into plastic trash bags and discarded as municipal waste. Water that was decanted from the samples was disposed of at the corresponding facility where the sample was obtained.

The remainder of the opened cartridges with resin, water that drained from the cartridges, used paper towels, and nitrile gloves worn during sample collection of the samples from the Greenhill Estates site were returned to IES personnel for disposal were packaged and returned to IES for disposal.

6.0 QUALITY ASSURANCE REVIEW

Appendix D provides copies of the Data Review, Data Verification and Data Validation checklist.

6.1 STAGE 2A DATA REVIEW, VERIFICATION, AND VALIDATION

A review of the chain of custody forms and laboratory case narratives indicate that proper chain of custody was maintained. The appropriate preparation and analysis methods were performed on the samples based on the

intended use of the data. All samples were received intact and in good condition. All samples were analyzed within method holding time requirements.

Laboratory quality control (QC) sample analyses performed for each analytical method are summarized as part of the laboratory analytical package, included as **Appendix D** of this report.

The following Stage 2A verification and manual validation checks were performed as part of this project

1. Requested methods were performed;
2. Method dates for handling, preparation and analysis were present, as appropriate;
3. Sample-related QC data and QC acceptance criteria were provided in the laboratory report and linked to the project samples including the field QC samples;
4. Requested spike analytes were added, as appropriate;
5. Sample holding times were evaluated;
6. Frequency of QC samples was checked and considered appropriate; and
7. Sample results were evaluated by comparing holding times and sample-related QC data to EPA and project data validation guidelines.

6.1.1 Precision

Precision is the measure of agreement among individual measurements of the same property under similar conditions. Precision for this project has been expressed in terms of the relative percent difference (RPD) between two samples. Duplicate samples can be evaluated quantitatively for precision only when contaminants are detected in both the sample and the duplicate. Duplicates with RPDs within the control limits indicate adequate sampling practices and/or good analytical precision. Duplicates with RPDs outside the control limits may result from inappropriate sampling procedures, matrix interferences, or non-homogeneity of the sample matrix. In addition, poor precision can be attributed to deviations from the analytical methodology or to poor reproducibility of target analyte concentrations at or near the detection limits.

Precision was evaluated for this project by comparing field duplicate results, and laboratory control sample/laboratory control sample duplicate (LCS/LCSD) RPD results for project samples. However, if the laboratory duplicate analysis was performed by the laboratory on samples for another client's project within the same method batch, any qualifiers applied to the data are not applicable to this project's samples as it could not be determined whether those samples were sufficiently similar.

All LCS/LCSD and field duplicate RPDs were within the QC limits or did not require qualification. Accuracy

The assessment of accuracy is evaluated by comparing the percent recoveries (%R) computed from the known concentration of analyte spikes and their recovered concentration versus the analytical method acceptance criteria. Spike recoveries provide an indication of bias, where the reported data may either overestimate or underestimate the actual concentration of detected compounds and/or the detection limits. Accuracy was assessed using LCS/LCSD recovery data. All LCS/LCSD and internal standard response and retention times were within control limits.

6.1.2 Representativeness

Representativeness of the environmental sample analytical data was assessed by evaluating holding times, trip blank, and laboratory method blank results.

- Holding Times. All samples were analyzed within the method-required preparation and analytical holding times.
- Method Blanks. All method blanks were free of contamination or did not require qualification.

6.1.3 Comparability

All samples were analyzed using appropriate EPA analytical methods. Sample results were reported in appropriate units. The analytical methods are considered acceptable for generating analytical data for the purpose of this project.

6.1.4 Completeness

Completeness is the quantitative measure of the amount of data obtained from a measurement process compared with the amount expected to be obtained under the conditions of measurement. It confirms that the contractor and laboratory have provided the deliverables required by the contract, method, and/or project plan. Data collection for this project segment are considered to be complete, although additional samples, provided by other wastewater treatment and water treatment facilities in Idaho, would provide additional useful information if samples can be acquired during a future project segment.

6.1.5 Sensitivity

MDL results were determined to be acceptable.

6.1.6 Summary

Overall, the analytical data are considered acceptable and have met the quality control and quality assurance objectives and goals of this project. No data were rejected. All results, as qualified, are considered usable for meeting project objectives. Qualifications made during this project are discussed above, provided within the data validation reports in **Appendix D**.

6.2 DEVIATIONS FROM THE QAPP

The following identifies changes to the scope of work presented in the QAPP:

- None

7.0 SUMMARY AND RECOMMENDATIONS

The ranges of results for both Ra-226 and Ra-228 in these waste residuals are within the normally encountered range for natural soils that show no TENORM influence. The uncertainty and minimum detectable activity (MDA) results shown for all samples, including the occasional less-than-zero reported results, are as expected for analyses at these low levels of radioactivity. The uncertainty and MDA data shown for the samples analyzed in duplicate indicate that sample preparation and analysis were performed properly, given that the uncertainty ranges overlap between the original and duplicate samples in all cases.

Because the number of facilities sampled for this study is small compared to the number of drinking water and wastewater treatment facilities in Idaho and because the number of background soil samples in the referenced background study (Myrick 1983) is small (12 samples), Tetra Tech recommends developing a scope of work for further study that may include additional sampling of treatment residuals as well as sampling various environmental media (for example soil, groundwater, and surface water) to assess background concentrations of isotopes of interest.

8.0 REFERENCES

Tetra Tech, 2023. Quality Assurance Project Plan, Evaluation of TENORM in Drinking Water and Waste Water Treatment Systems. Document submitted to the Idaho Department of Environmental Quality. February 6, 2023.

APPENDIX A - TABLES

TABLE 1
SUMMARY OF RADIOCHEMISTRY DATA
IDAHO TENORM INVESTIGATION

Location	Sample Type	Date Collected	Analyte			
			Ra-228	Uncertainty	Ra-226	Uncertainty
			pCi/g	+ / -	pCi/g	+ / -
City of Moiye	WT-Sludge-1	3/21/2023	0.916	0.207	0.725	0.135
	WT-Sludge-2	3/21/2023	0.927	0.235	0.639	0.159
	WT-Sludge-3	3/21/2023	0.536	0.114	0.400	0.0767
	WW-Sludge-1	3/21/2023	1.14	0.446	0.765	0.297
	WW-Sludge-2	3/21/2023	1.52	0.615	0.428	0.342
	WW-Sludge-3	3/21/2023	0.623	0.423	0.344	0.270
Fruitland	WT-Sludge-1	3/7/2023	0.913	0.255	0.465	0.16
	WT-Sludge-2	3/7/2023	1.04	0.274	0.615	0.167
	WT-Sludge-3	3/7/2023	0.719	0.121	0.223	0.0661
	WW-Biosolids-1	3/7/2023	0.0573	0.0967	0.0105	0.0627
	WW-Biosolids-2	3/7/2023	0.0748	0.0948	-0.0235	0.0580
	WW-Biosolids-3	3/7/2023	0.216	0.423	0.112	0.282
Glens Ferry	WT-PACBasin-1	3/13/2023	0.546	0.179	0.478	0.129
	WW-Sludge-1	3/13/2023	1.13	0.233	0.974	0.17
	WW-Sludge-2	3/13/2023	0.876	0.188	0.782	0.137
	WW-Sludge-3	3/13/2023	1.02	0.170	0.691	0.113
Greenhill Estate	DW-Resin-1	3/3/2023	0.0404	0.0972	0.0428	0.0708
	DW-Resin-2	3/3/2023	-0.0357	0.045	-0.00413	0.0344
	DW-Resin-3	3/3/2023	0.0332	0.114	0.0267	0.0802
	Filter Media Control Sample	3/7/2023	0.0126	0.0441	0.0323	0.0304
Orofino	WT-Sludge-1	3/20/2023	0.998	0.459	0.815	0.305
	WT-Sludge-2	3/20/2023	0.991	0.390	0.928	0.314
	WT-Sludge-3	3/20/2023	0.624	0.417	0.826	0.324
	WW-Biosolids-1	3/20/2023	0.645	0.447	0.559	0.294
	WW-Biosolids-2	3/20/2023	0.0520	0.399	0.0637	0.253
	WW-Biosolids-3	3/20/2023	0.581	0.446	0.580	0.290
Priest River	WT-Sludge-1	3/1/2023	0.478	0.216	0.416	0.149
	WT-Sludge-2	3/1/2023	0.563	0.146	0.370	0.0969
	WT-Sludge-3	3/1/2023	0.536	0.236	0.876	0.193
	WW-Biosolids-1	3/1/2023	0.598	0.434	0.669	0.309
	WW-Biosolids-2	3/1/2023	0.904	0.533	0.579	0.302
	WW-Biosolids-3	3/1/2023	0.573	0.760	0.251	0.448

Notes:

pCi/g - Picocuries per gram

WT: Water Treatment

WW: Waste Water

DW: Drinking Water

Colorado and North Dakota regulatory standard for disposal of Ra-228 plus Ra-226 is 50 pCi/g.

Montana regulatory standard for disposal of Ra-228 plus Ra-226 is 5 pCi/g.

APPENDIX B – FIELD NOTES

DAILY PROJECT REPORT

Project Name / Number: TENORM / 117-8296103

Date: March 2, 2023

Activity: PWS sampling

Tetra Tech Personnel: Ron Phillips

Visitors: None

Subcontractors: None, but worked with IES Waterworks

Weather: Overcast, chilly

Equipment Used: None

QAPP Deviations or Problems Encountered: None

Narrative: I purchased some supplies (bags and a strainer) earlier in the day. Thomas Krasowski with IES texted me at 15:40 asking me if I could be at Greenhill around 16:30. We talked on the just before I left and set up a meeting location.

I drove to the neighborhood and waited for Thomas and his helper to finish at the house they were at. Thomas then gave me a crate of nine filters he had collected throughout the day representing houses with the highest usage. Each was contained in a plastic bag with the gallons written on it. I asked Thomas which was the inlet side of the filter; he indicated it is the white end (the other end has a blue cap / pipe fitting).

I left at ~17:10 and returned to the office. I placed the crate with the filters in the storage room sample refrigerator for security overnight. I will process them tomorrow to start creating the laboratory samples.

Ron Phillips

DAILY PROJECT REPORT

Project Name / Number: TENORM / 117-8296103

Date: March 3, 2023

Activity: PWS sampling

Tetra Tech Personnel: Ron Phillips

Visitors: None

Subcontractors: None, but worked with IES Waterworks

Weather: Overcast, chilly

Equipment Used: Misc. sampling supplies

QAPP Deviations or Problems Encountered: None

Narrative: At the office, I created the first sample by making a composite from six of the filter units that Tom had given me yesterday. For each of the six filters, I used the pipe cutter to cut off the inlet end of the filter. I then used a clean, stainless steel spoon to scoop out approximately have of the resin (small beads) from the filter body into a stainless steel strainer so that any free water could drain off. There was little if any free water. I then dumped the resin into a one-gallon sealable freezer bag. This was repeated for each of the six filters used for this sample. The process yielded enough to almost fill the one gallon bag.

I attached a label to the bag with the sample name: Greenhill-DW-Resin-1 / Greenhill-DW-Resin-DUP. This sample will be used by the laboratory for the duplicate. The label included the project name (TENORM), project number (117-8296103), date (3-3-23), time (12:01) and required analysis (RA-226 and RA-228). I then placed the bag inside of a 2 gallon freezer bag for extra protection. I left this in the sample refrigerator for safe keeping.

I conducted the work over a plastic tub to contain any resin that was spilled while cutting the filters open. At the end, I used a paper towel to clean the tub clean by wiping the resin and water into one of the spent filter bags. I also used a paper towel to wipe down the strainer and spoon. I also placed the paper towels and the nitrile gloves I wore into one of the spent filter bags. The material will be returned to Thomas later today.

Thomas had marked the gallons for each of the filters on the bag he had placed them into. The filters used to make the composite sample for Greenhill-DW-Resin-1 were marked 1200, 500, 2100, 500, 600, and 1000 gallons.

Thomas texted me later in the day asking if I could meet around 3:30 to pick up the second set of filters. I met him near the well house, took the second set of nine filters from him, and left

him the six that I had already cut open. Thomas also gave me an unused filter so that the lab can use the media for a control sample.

I returned to the office and completed the process described above for the second and third samples. The six filters used for Greenhill-DW-Resin-2 were marked as 500, 1300, 1400, 800, 900, and 500 gallons. The sample time was 16:30. The six filters used for Greenhill-DW-Resin-3 were marked as 1000, 1100, 400, 500, 500, and 1700 gallons. The sample time was 17:07. I left these two samples in the sample refrigerator with sample 1 for safekeeping until they are sent to the laboratory.

Ron Phillips

DAILY PROJECT REPORT

Project Name / Number: TENORM / 117-8296103

Date: March 7, 2023

Activity: TENORM sampling

Tetra Tech Personnel: Lucas Kerner & Maureen McGraw

Visitors: None

Subcontractors: None

Weather: Overcast, chilly

Equipment Used: Sludge Judge and Stainless Steel Bowls/Spoons, Stainless Steel Augur

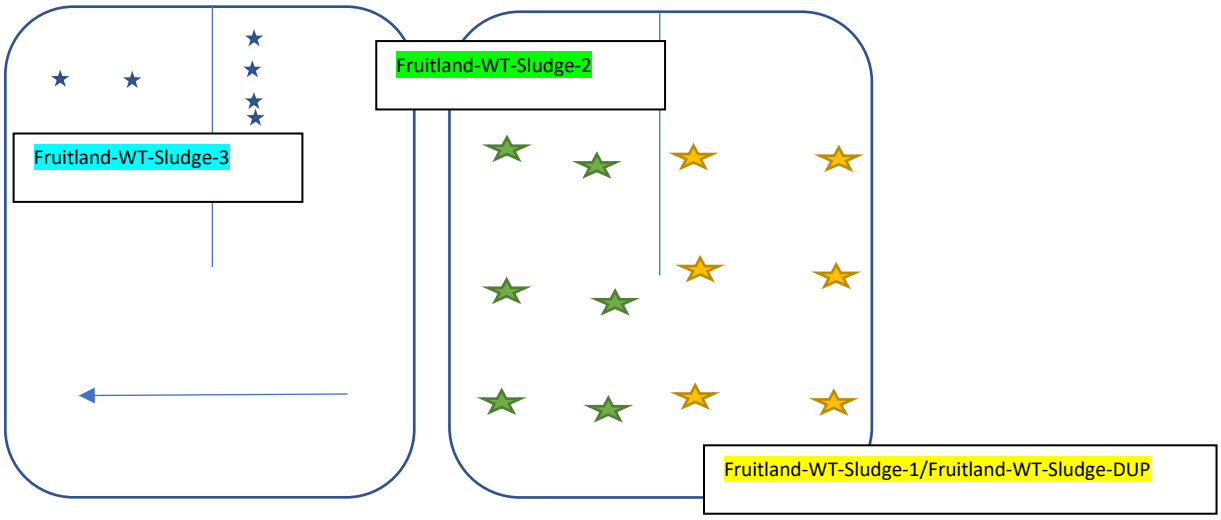
QAPP Deviations or Problems Encountered: None

Narrative:

I deconned all of the equipment at the office using a rinse, liquinox, rinse, nitric acid wash, followed by a triple rinse of distilled water. I then placed all the clean items into clean plastic bags for transportation. I loaded up the truck and headed to the site.

I arrived at the site at approximately 9:35. Maureen M. met me on site ~945. We did a quick talk about the project goals and requirements and discussed any health and safety issues that came to mind. At 955, Kenny Nelson opened the gate to the Dry bed ponds. One pond was dry, and one pond had approximately 4 feet of water in it. I started in the dry pond.

The figures below indicate the subsample locations for each of the samples. The arrow indicates the north direction.



I collected samples 1 & 2 by filling a stainless steel bowl with 6 subsamples from each sample location. The samples were then transferred from the bowl to a gallon bag. The gallon bag was then put into a 2 gallon bag.

Sample #3 required the use of a stainless steel augur. I collected the two most northern subsamples from the ramp using wading boots and a stainless steel bowl/spoon. The remaining 4 sub samples were taken from the edge of the concrete pad, where I would reach through the fence with the augur. I would then pour the contents of the augur into the bowls and drain off as much water as possible. The subsample locations were limited to this location due to the deep water and steep sides of the pond. Once all the material was collected, the sample was put into a gallon and 2 gallon bag. While finishing this third sample, Maureen contacted the WW plant to see if we could sample today vs the 8th. I began deconning equipment and loading up the truck before driving to the WW plant.

Before leaving the WT plant, I told Kenny he could lock the gate.

Upon arriving at the WW plant, Maureen and I received a tour of the plant. We are only able to collect samples from two locations. The sample locations are the final end product "Biosolids" and the sludge from WAS Tanks #1. Mike with the City of Fruitland aided in the sampling process. Mike used the cities "Sludge Judge" to collect very wet sludge samples from the bottom of the WAS Tank. Mike would fill the sludge judge with as much sludge as possible and then release it into stainless steel bowls. We would let the water/sludge separate before pouring off as much water as possible. Once the water was poured off, we were left with a watery sludge. We put this sludge into sample bags. Due to the liquid content, we filled three gallon bags with the sludge. The three gallon bags were then put into a 2 gallon bag. This sample was labeled "Fruitland-WW-WAS Tank-3".

While Maureen and Mike were collecting the sludge from WAS Tank#1, I collected samples from the end product biosolids. I randomly chose 6 locations across the large pile of biosolids for each sample. I filled a gallon bag with the sub samples. I labeled the sample "Fruitland-WW-Biosolids-1/Fruitland-WW-Biosolids-DUP". I repeated this process for the second sample and labeled it "Fruitland-WW-Biosolids-2".

Upon finishing sample collection, I deconned the equipment and packed up the truck. I then drove back to the office and purchased 5 gallon buckets. I then packed the 5 gallon buckets with the samples and printed the COCs. I shipped the samples on 03/08/2023.

DAILY PROJECT REPORT

Project Name / Number: TENORM / 117-8296103

Date: March 13, 2023

Activity: TENORM sampling – Glenns Ferry

Tetra Tech Personnel: Lucas Kerner

Visitors: None

Subcontractors: None

Weather: Overcast, chilly

Equipment Used: Sludge Judge and Stainless Steel Bowls/Spoons, Stainless Steel Augur

QAPP Deviations or Problems Encountered: None

Narrative:

I deconned all of the equipment at the office using a rinse, liquinox, rinse, nitric acid wash, followed by a triple rinse of distilled water. I then placed all the clean items into clean plastic bags for transportation. I loaded up the truck and headed to the site at ~0740.

I arrived at the site at approximately 08:45. I met with the City of GF employees, We did a walkthrough of the water treatment facility to assess where to sample. The following were unable to obtain a sample from:

- Contact Chamber
- Bar Screen
- Travelling Screen
- Sand Filter
- Floc Tank
- Membrane Plant
- Manhole to Sewer

We were however able to collect a sample from the PAC basin. The PAC basin used to have a mixer but that was disconnected several years ago. The PAC basin is the water that has not been treated yet.

0930 – I used the sludge Judge to collect sediment from the PAC basin. There wasn't much sediment in the basin and it was very liquidy.

1045 – I finished collecting the sample. I collected 3 x 1-gallon liquidy samples. I labeled the three bags "Glenns Ferry-WT-PAC Basin-1/GlennsFerry-WT-PACBasin-DUP"

I then put the samples into a secondary 2-gallon ziplock bag before loading up and driving to the WW plant.

1100. I arrive at the WW plant. Due to the steep slopes of the other ponds, I had to take all the samples from the initial settling pond. For each of the 3 samples, I took 6 subsamples each.

1115 I collect sample “GlennsFerry-WW-Sludge-1/GlennsFerry-WW-Sludge-DUP

1215 I collect sample “GlennsFerry-WW-Sludge-2”. This sample was taken from 6 locations along the north and west banks.

1230 I collect sample “GlennsFerry-WW-Sludge-3”. I took this sample from 6 sub samples along the south bank.

I drove around the WW facility trying to find sediment. There were no spots that were safely accessible that also had abundant sediment. I checked the outlet to the river but it only had moss and looked like it was frequently cleaned.

1240 – I deconned my gear then headed back to Boise to prep to ship samples.

Luke Kerner

DAILY PROJECT REPORT

Project Name / Number: TENORM / 117-8296103

Date: March 21,2023

Activity: TENORM sampling – Moyie Springs

Tetra Tech Personnel: Lucas Kerner

Visitors: None

Subcontractors: None

Weather: Overcast, chilly

Equipment Used: Sludge Judge and Stainless Steel Bowls/Spoons, stainless steel screen

QAPP Deviations or Problems Encountered: None

Narrative:

03/21/2023

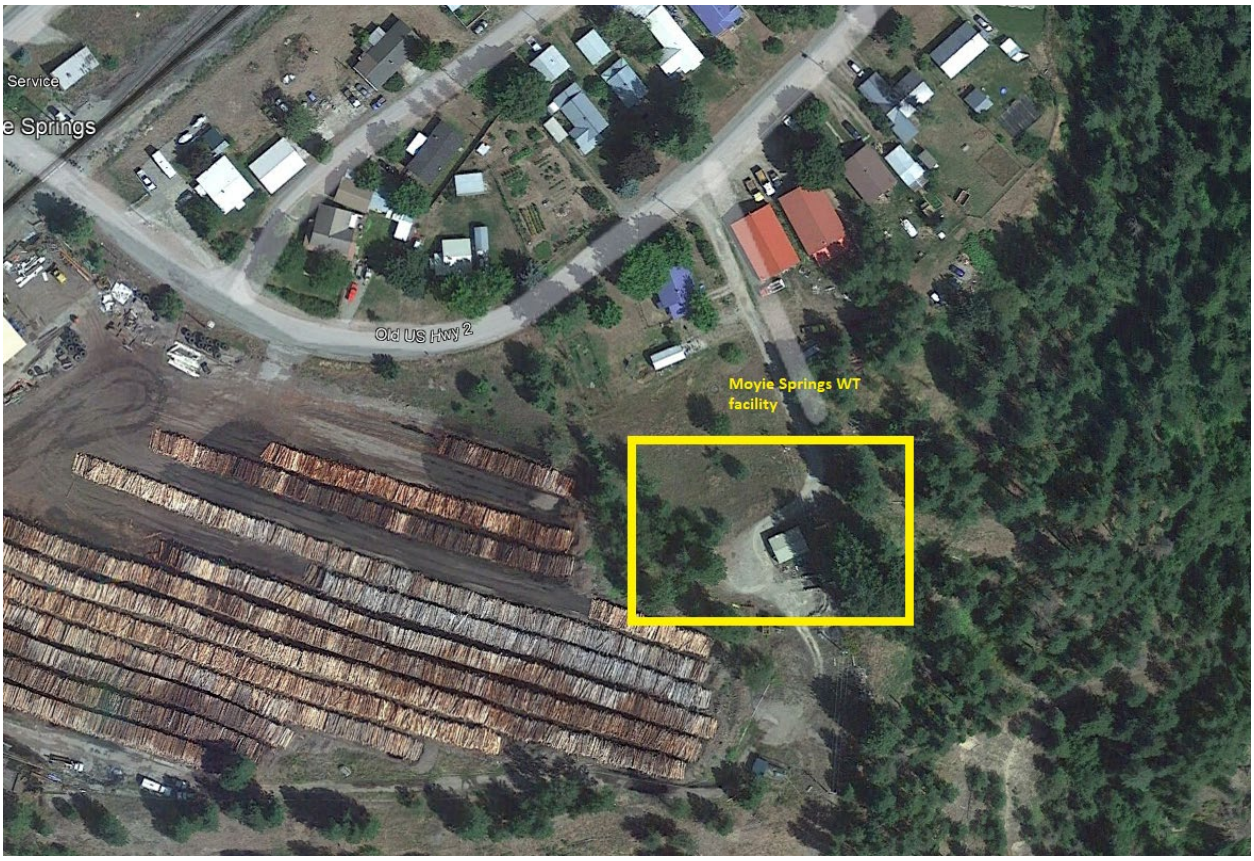
I deconned all of the equipment at the Priest River site before driving to Moyie Springs. I arrive at Moyie Springs and am led out to the Water Treatment well area by John Nelson.

The water treatment plant uses a well to collect the water. The well is then piped to a settling basin that has several feet of sand settled out into the basin. I attempted to use the sludge judge to collect the sand but it was too fine and fell out of the bottom of the sludge judge. John Nelson used a backhoe bucket to scape all of the sand/sediment from the bottom of the basin and then I used stainless steel spoons and bowls to collect my samples.

1135 I collect “Moyie Springs-WT-Sludge-1/Moyie Springs-WT-Sludge-Dup”

1140 I collect “Moyie Springs-WT-Sludge-2”

1145 I collect “Moyie Springs-WT-Sludge-3”

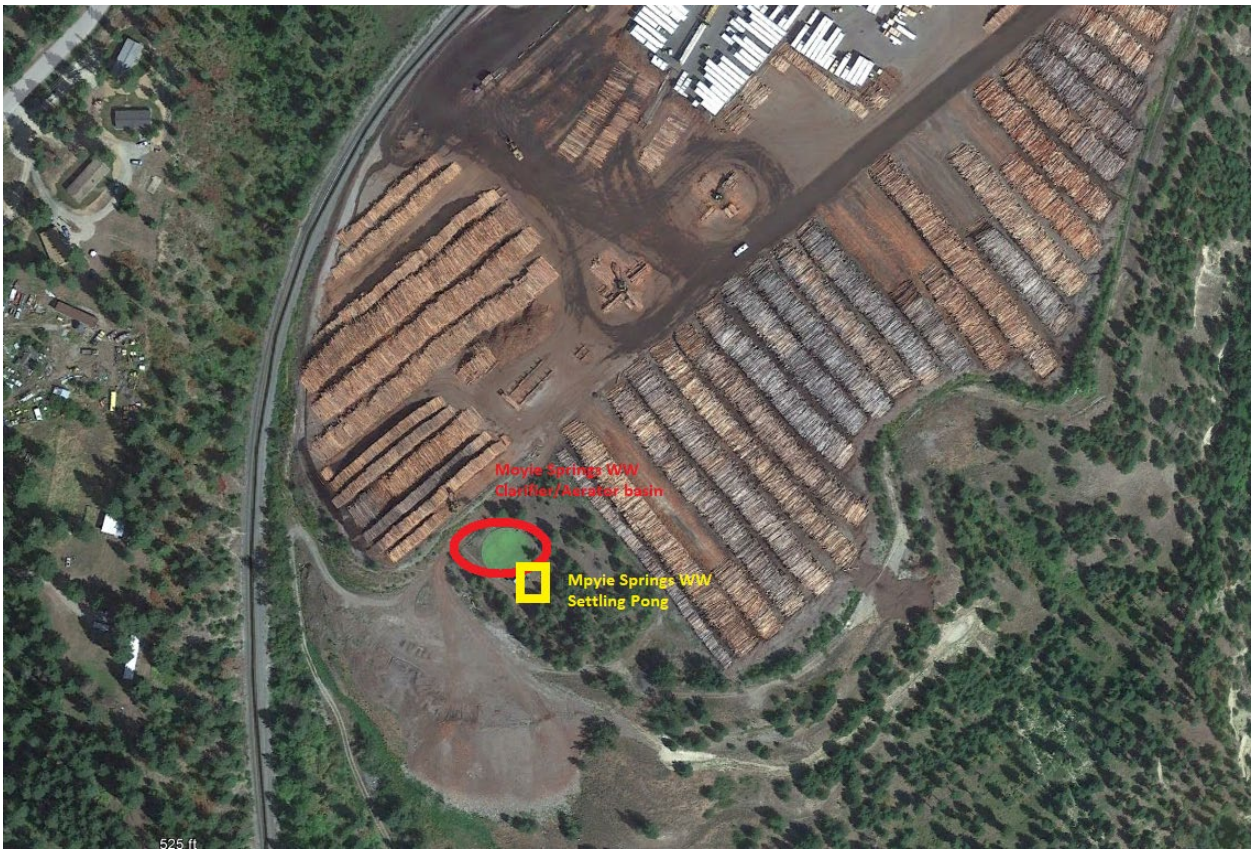


1150 I decon the equipment and then John leads me to the WW plant. There are two areas to collect sludge from. The 9’ deep aerator basin and the settling basin/pond. The settling pond has 2 feet of sludge and the aerator basin has 3 feet of sludge.

1245 I collect 2x1 gallon bags of sludge from the aerator basin using the sludge judge and a stainless steel screen. “Moyie Springs-WW-Sludge-1/Moyie Springs-WW-Sludge-Dup” (Clarifier)

1315 I collect 1x1 gallon bag of sludge with the sludge judge from the aerator basin. “Moyie Springs-WW-Sludge-2” (Clarifier)

1325 I collect 1x1 gallon from the settling pond using the sludge judge. “Moyie Springs-WW-Sludge-3”.



1345 – I decon my equipment.

1400 I lock the gate and go to talk with John.

1410 I leave the site to check into my hotel in Bonners Ferry.

1500 Check into hotel.

Luke Kerner

DAILY PROJECT REPORT

Project Name / Number: TENORM / 117-8296103

Date: March 19-20,2023

Activity: TENORM sampling – Orofino

Tetra Tech Personnel: Lucas Kerner

Visitors: None

Subcontractors: None

Weather: Overcast, chilly

Equipment Used: Sludge Judge and Stainless Steel Bowls/Spoons, stainless steel screen

QAPP Deviations or Problems Encountered: None

Narrative:

03/19/2023

I deconned all of the equipment at the office using a rinse, liquinox, rinse, nitric acid wash, followed by a triple rinse of distilled water. I then placed all the clean items into clean plastic bags for transportation. I loaded up the truck and left Boise for my hotel in Orofino. I checked in and arrived at 1700 PT.

03/20/2023

0715

I load up the truck after checking out of the hotel and head to the site.

0745 I meet with the city of Orofino crew and they show me the water treatment center. The only place I can collect sediment is the sediment retention basin that is the first basin the river water comes into.

0815 – I collect 2 – 1 gallon bags of liquidy sediment. “Orofino-WT-Sludge-1/Orofino-WT-Sludge-DUP. I decon the sludge judge then begin on the next sample.

0830 – I collect 1 x 1-gallon bag of liquidy sediment. “Orofino-WT-Sludge-2”

0900 – I collect 1 x 1-gallon ag of liquidy sediment. “Orofino-WT-Sludge-3”. I then begin decon of the stainless steel bowls before leaving for the Waste Water treatment plant.

0940 – I arrive at the Waste Water treatment plant. I tour the facility. I am going to take 2 biosolid samples from the conveyor belt that goes to the landfill. I call Maureen before taking the sample because the crew says they mix the sediment with a polymer. She said it won’t

effect the samples. The other place to take a sample is known as the RAC “Return Activated Sludge” which comes out of the clarifier. There is a sink in the facility that dispenses the sludgey liquid.

1000 – I collect sample from the conveyor belt. “ Orofino-WW-Biosolids-1 / Orofino-WW-Biosolids-DUP”.

1015 – I collect sample from the conveyor belt. “Orofino-WW-Biosolids-2”

1030 – Drive to family dollar to buy a screen to help with the RAC samples.

1045 – I use the RAC sink and the screen to collect sediment, allowing as much liquid as possible to drain off before putting the sample into the gallon bags.

1110 – Collect sample “Orofino-WW-RAS-3”

1120 – I clean up the site and decon my equipment.

1125 – I leave site to drive to Sandpoint where I will stay until I can sample in Priest River tomorrow. I stop in Moscow, ID to finish notes and eat lunch.

1700 – I arrive in sandpoint.

Luke Kerner

DAILY PROJECT REPORT

Project Name / Number: TENORM / 117-8296103

Date: March 21,2023

Activity: TENORM sampling – Priest River

Tetra Tech Personnel: Lucas Kerner

Visitors: None

Subcontractors: None

Weather: Overcast, chilly

Equipment Used: Sludge Judge and Stainless Steel Bowls/Spoons, stainless steel screen

QAPP Deviations or Problems Encountered: None

Narrative:

03/21/2023

I deconned all of the equipment at the Orofino site before leaving yesterday using a rinse, liquinox, rinse, nitric acid wash, followed by a triple rinse of distilled water. I then placed all the clean items into clean plastic bags for transportation.

0715 I pack up and leave my hotel in Sandpoint for Priest River.

0745 I arrive in Priest River and call Cory 208-306-9181. He meets me at the Exxon and I follow him to the Water treatment facility. The only places to collect a sample are the two ponds north of the treatment facility. I collect 3 total samples consisting of 6 subsamples each. The photo below demonstrates the locations of each sample and subsample.

0815 Collect Priest River-WT-Sludge-1 / Priest River-WT-Sludge-DUP

0825 Collect Priest River-WT-Sludge-2

0835 Collect Priest River-WT-Sludge-3.

0840 I decon the bowls and then head to the WW Facility around 8:45

0900 Arrive at the Wastewater treatment plant. I toured the facility with Cory. The clarifier doesn't have enough solids or sludge to collect a sample. I will attempt anyways. The belt press has plenty of biosolids. The aeration ponds have solids in the form of sludge/foam.

0925 – I collect the sample from the belt press and biosolids pile = "Priest River-WW-Biosolids-1/ Priest River-WW-Biosolids-DUP".

0930 I collect a sample from the foam/aeration ponds "Priest River-WW-Biosolids-2"

0945 I collect a liquidy sludge sample from the clarifier pond. “Priest River-WW-Biosolids-3” I used the sludge judge and took out as much sediment as possible. I was able to collect 2 gallon bags.

0950 I decon equipment and then head to Moyie Springs.

Luke Kerner

APPENDIX C – LABORATORY ANALYTICAL REPORTS

ANALYTICAL REPORT

April 07, 2023

Tetra Tech - Boise ID

Sample Delivery Group:	L1593797
Samples Received:	03/09/2023
Project Number:	117-8296103.300
Description:	TENOMR: (Greenhill Estates)

Report To: Maureen McGraw
3380 Americana Terrace, Ste 201
Boise, ID 83706

Entire Report Reviewed By:

Kelly Mercer
Project Manager

Results relate only to the items tested or calibrated and are reported as rounded values. This test report shall not be reproduced, except in full, without written approval of the laboratory. Where applicable, sampling conducted by Pace Analytical National is performed per guidance provided in laboratory standard operating procedures ENV-SOP-MTJL-0067 and ENV-SOP-MTJL-0068. Where sampling conducted by the customer, results relate to the accuracy of the information provided, and as the samples are received.

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GREENHILL-DW-RESIN-1 L1593797-01 Solids and Chemical Materials

Collected by: Ron Phillips | Collected date/time: 03/03/23 12:01 | Received date/time: 03/09/23 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)	WG2024837	1	03/16/23 12:12	04/06/23 14:12	ZRG	Mt. Juliet, TN

GREENHILL-DW-RESIN-DUP L1593797-02 Solids and Chemical Materials

Collected by: Ron Phillips | Collected date/time: 03/03/23 12:01 | Received date/time: 03/09/23 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)	WG2024837	1	03/16/23 12:12	04/06/23 15:30	ZRG	Mt. Juliet, TN

GREENHILL-DW-RESIN-2 L1593797-03 Solids and Chemical Materials

Collected by: Ron Phillips | Collected date/time: 03/03/23 16:30 | Received date/time: 03/09/23 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)	WG2024837	1	03/16/23 12:12	04/06/23 14:13	ZRG	Mt. Juliet, TN

GREENHILL-DW-RESIN-3 L1593797-04 Solids and Chemical Materials

Collected by: Ron Phillips | Collected date/time: 03/03/23 17:02 | Received date/time: 03/09/23 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)	WG2024837	1	03/16/23 12:12	04/06/23 14:27	ZRG	Mt. Juliet, TN

GREENHILL FILTER MEDIA CONTROL SAMPLE L1593797-05 Solids and Chemical Materials

Collected by: Ron Phillips | Collected date/time: 03/03/23 16:38 | Received date/time: 03/09/23 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)	WG2024837	1	03/16/23 12:12	04/06/23 14:49	ZRG	Mt. Juliet, TN

CASE NARRATIVE

All sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times, unless qualified or notated within the report. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All radiochemical sample results for solids are reported on a dry weight basis with the exception of tritium, carbon-14 and radon, unless wet weight was requested by the client. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.

Kelly Mercer
Project Manager

Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)

Analyte	Result pCi/g	Qualifier	Uncertainty + / -	MDA pCi/g	Analysis Date date / time	Batch
Actinium-228 (Ra-228)	0.0404	U	0.0972	0.236	04/06/2023 14:12	WG2024837
Bismuth-214 (Ra-226)	0.0428	U	0.0708	0.146	04/06/2023 14:12	WG2024837

Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)

Analyte	Result pCi/g	Qualifier	Uncertainty + / -	MDA pCi/g	Analysis Date date / time	Batch
Actinium-228 (Ra-228)	-0.0142	U	0.0568	0.146	04/06/2023 15:30	WG2024837
Bismuth-214 (Ra-226)	0.0262	U	0.0393	0.0728	04/06/2023 15:30	WG2024837

Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)

Analyte	Result pCi/g	Qualifier	Uncertainty + / -	MDA pCi/g	Analysis Date date / time	Batch
Actinium-228 (Ra-228)	-0.0357	U	0.0450	0.124	04/06/2023 14:13	WG2024837
Bismuth-214 (Ra-226)	-0.00413	U	0.0344	0.0709	04/06/2023 14:13	WG2024837

Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)

Analyte	Result pCi/g	Qualifier	Uncertainty + / -	MDA pCi/g	Analysis Date date / time	Batch
Actinium-228 (Ra-228)	0.0332	U	0.114	0.305	04/06/2023 14:27	WG2024837
Bismuth-214 (Ra-226)	0.0267	U	0.0802	0.165	04/06/2023 14:27	WG2024837

Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)

Analyte	Result pCi/g	Qualifier	Uncertainty + / -	MDA pCi/g	Analysis Date date / time	Batch
Actinium-228 (Ra-228)	0.0126	U	0.0441	0.117	04/06/2023 14:49	WG2024837
Bismuth-214 (Ra-226)	0.0323	J	0.0304	0.0587	04/06/2023 14:49	WG2024837

QUALITY CONTROL SUMMARY

L1593797-01,02,03,04,05

Method Blank (MB)

(MB) R3910312-1 04/06/23 14:07

Analyte	MB Result pCi/g	MB Qualifier	MB Uncertainty + / -	MB MDA pCi/g
Actinium-228 (Ra-228)	-0.00344	U	0.105	0.341
Americium-241	-0.0128	U	0.0869	0.162
Bismuth-214 (Ra-226)	0.0682	U	0.107	0.224
Cesium-137	0.0306	U	0.0577	0.118
Cobalt-60	0.0160	U	0.0486	0.172

L1593797-03 Original Sample (OS) • Duplicate (DUP)

(OS) L1593797-03 04/06/23 14:13 • (DUP) R3910312-4 04/06/23 15:27

Analyte	Original Result pCi/g	Original Uncertainty + / -	Original MDA pCi/g	DUP Result pCi/g	DUP Uncertainty + / -	DUP MDA pCi/g	Dilution	DUP RPD %	DUP RER	DUP Qualifier	DUP RPD Limits %	DUP RER Limit
Actinium-228 (Ra-228)	-0.0357	0.0450	0.124	-0.0113	0.105	0.124	1	0.000	0.213	U	20	3
Americium-241	0.429	0.154	0.256	0.221	0.154	0.256	1	63.8	0.931	J	20	3
Bismuth-214 (Ra-226)	-0.00413	0.0344	0.0709	0.0137	0.0719	0.0709	1	200	0.224	U	20	3
Cesium-137	-0.00269	0.0451	0.0859	0.0322	0.0451	0.0859	1	200	0.706	U	20	3
Cobalt-60	0.00232	0.0241	0.118	0.0154	0.0241	0.118	1	148	0.484	U	20	3

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3910312-2 04/06/23 14:08 • (LCSD) R3910312-3 04/06/23 14:28

Analyte	Spike Amount pCi/g	LCS Result pCi/g	LCSD Result pCi/g	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Americium-241	47.3	50.5	53.1	107	112	60.0-140			5.02	20
Cesium-137	72.4	79.0	81.1	109	112	80.0-120			2.56	20
Cobalt-60	86.9	89.8	91.0	103	105	80.0-120			1.37	20

GLOSSARY OF TERMS

Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

Results Disclaimer - Information that may be provided by the customer, and contained within this report, include Permit Limits, Project Name, Sample ID, Sample Matrix, Sample Preservation, Field Blanks, Field Spikes, Field Duplicates, On-Site Data, Sampling Collection Dates/Times, and Sampling Location. Results relate to the accuracy of this information provided, and as the samples are received.

Abbreviations and Definitions

MDA	Minimum Detectable Activity.
Rec.	Recovery.
RER	Replicate Error Ratio.
RPD	Relative Percent Difference.
SDG	Sample Delivery Group.
Analyte	The name of the particular compound or analysis performed. Some Analyses and Methods will have multiple analytes reported.
Dilution	If the sample matrix contains an interfering material, the sample preparation volume or weight values differ from the standard, or if concentrations of analytes in the sample are higher than the highest limit of concentration that the laboratory can accurately report, the sample may be diluted for analysis. If a value different than 1 is used in this field, the result reported has already been corrected for this factor.
Limits	These are the target % recovery ranges or % difference value that the laboratory has historically determined as normal for the method and analyte being reported. Successful QC Sample analysis will target all analytes recovered or duplicated within these ranges.
Original Sample	The non-spiked sample in the prep batch used to determine the Relative Percent Difference (RPD) from a quality control sample. The Original Sample may not be included within the reported SDG.
Qualifier	This column provides a letter and/or number designation that corresponds to additional information concerning the result reported. If a Qualifier is present, a definition per Qualifier is provided within the Glossary and Definitions page and potentially a discussion of possible implications of the Qualifier in the Case Narrative if applicable.
Result	The actual analytical final result (corrected for any sample specific characteristics) reported for your sample. If there was no measurable result returned for a specific analyte, the result in this column may state “ND” (Not Detected) or “BDL” (Below Detectable Levels). The information in the results column should always be accompanied by either an MDL (Method Detection Limit) or RDL (Reporting Detection Limit) that defines the lowest value that the laboratory could detect or report for this analyte.
Uncertainty (Radiochemistry)	Confidence level of 2 sigma.
Case Narrative (Cn)	A brief discussion about the included sample results, including a discussion of any non-conformances to protocol observed either at sample receipt by the laboratory from the field or during the analytical process. If present, there will be a section in the Case Narrative to discuss the meaning of any data qualifiers used in the report.
Quality Control Summary (Qc)	This section of the report includes the results of the laboratory quality control analyses required by procedure or analytical methods to assist in evaluating the validity of the results reported for your samples. These analyses are not being performed on your samples typically, but on laboratory generated material.
Sample Chain of Custody (Sc)	This is the document created in the field when your samples were initially collected. This is used to verify the time and date of collection, the person collecting the samples, and the analyses that the laboratory is requested to perform. This chain of custody also documents all persons (excluding commercial shippers) that have had control or possession of the samples from the time of collection until delivery to the laboratory for analysis.
Sample Results (Sr)	This section of your report will provide the results of all testing performed on your samples. These results are provided by sample ID and are separated by the analyses performed on each sample. The header line of each analysis section for each sample will provide the name and method number for the analysis reported.
Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.

Qualifier	Description
J	The identification of the analyte is acceptable; the reported value is an estimate.
U	Below Detectable Limits: Indicates that the analyte was not detected.

ACCREDITATIONS & LOCATIONS

Pace Analytical National 12065 Lebanon Rd Mount Juliet, TN 37122

Alabama	40660	Nebraska	NE-OS-15-05
Alaska	17-026	Nevada	TN000032021-1
Arizona	AZ0612	New Hampshire	2975
Arkansas	88-0469	New Jersey–NELAP	TN002
California	2932	New Mexico [1]	TN00003
Colorado	TN00003	New York	11742
Connecticut	PH-0197	North Carolina	Env375
Florida	E87487	North Carolina [1]	DW21704
Georgia	NELAP	North Carolina [3]	41
Georgia [1]	923	North Dakota	R-140
Idaho	TN00003	Ohio–VAP	CL0069
Illinois	200008	Oklahoma	9915
Indiana	C-TN-01	Oregon	TN200002
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LAO000356
Kentucky [1 6]	KY90010	South Carolina	84004002
Kentucky [2]	16	South Dakota	n/a
Louisiana	AI30792	Tennessee [1 4]	2006
Louisiana	LA018	Texas	T104704245-20-18
Maine	TN00003	Texas [5]	LAB0152
Maryland	324	Utah	TN000032021-11
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	110033
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	998093910
Montana	CERT0086	Wyoming	A2LA
A2LA – ISO 17025	1461.01	AIHA-LAP,LLC EMLAP	100789
A2LA – ISO 17025 [5]	1461.02	DOD	1461.01
Canada	1461.01	USDA	P330-15-00234
EPA–Crypto	TN00003		

[1] Drinking Water [2] Underground Storage Tanks [3] Aquatic Toxicity [4] Chemical/Microbiological [5] Mold [6] Wastewater n/a Accreditation not applicable

* Not all certifications held by the laboratory are applicable to the results reported in the attached report.

* Accreditation is only applicable to the test methods specified on each scope of accreditation held by Pace Analytical.

Company Name/Address:
Tetra Tech
3380 Americana Terrace
Suite 201
Boise, ID 83706

Billing Information:
Tetra Tech
2525 Palmer Street
Suite 2
Missoula, MT 59808
Attn: Jessica Cook

Report to: Maureen McGraw

Email To: maureen.mcgraw@tetratech.com

Project Description: TENORM: (Greenhill Estates)

City/State Collected: Meridian, ID

Please Circle: PT MT CT ET

Phone: 406-546-7839

Client Project # 117-8296103.300

Lab Project #

Collected by (print): Ron Phillips

Site/Facility ID #

P.O. #

Collected by (signature): Ron Phillips

Immediately Packed on Ice N X Y ___

Rush? (Lab MUST Be Notified)
___ Same Day ___ Five Day
___ Next Day ___ 5 Day (Rad Only)
___ Two Day ___ 10 Day (Rad Only)
___ Three Day

Quote #

Date Results Needed

Pres Chk: i-500 CPM

Analysis / Container / Preservative

Sample ID	Comp/Grab	Matrix*	Depth	Date	Time	No. of Cntrs	RA-226	RA-228	Remarks	Sample # (lab only)
Greenhill-DW-Resin-1 / Greenhill-DW-Resin-Dup	Comp	OT		3/3/2023	12:01	1	X	X	See below	-01
Greenhill-DW-Resin-2	Comp	OT		3/3/2023	16:30	1	X	X		-02
Greenhill-DW-Resin-3	Comp	OT		3/3/2023	17:02	1	X	X		-03
Greenhill Filter Media Control Sample	Grab	OT		3/7/2023	16:38	1	X	X		-04
										-05

Chain of Custody Page 1 of 1

Pace
PEOPLE ADVANCING SCIENCE

12065 Lebanon Rd Mount Juliet, TN 37122
Phone: 615-758-5858 Alt: 800-767-5859

Submitting a sample via this chain of custody constitutes acknowledgment and acceptance of the Pace Terms and Conditions found at: https://info.pacelabs.com/hubfs/pas-standard-terms.pdf

SDG # L693797

Table # B209

Acctnum:

Template:

Prelogin:

PM:

PB:

Shipped Via:

* Matrix:
SS - Soil AIR - Air F - Filter
GW - Groundwater B - Bioassay
WW - WasteWater
DW - Drinking Water
OT - Other Resin Filter Media

Remarks:
For sample Greenhill-DW-Resin 1 / Greenhill-DW Resin-DUP, please split into a natural sample (Greenhill-DW-Resin-1) and a duplicate (Greenhill-DW-Resin-DUP). Two tests from this one bag.

pH ____ Temp ____
Flow ____ Other ____

Samples returned via:
__ UPS __ FedEx __ Courier __ _____

Tracking # 6295 1088 1473

Sample Receipt Checklist

COC Seal Present/Intact:	NP Y N
COC Signed/Accurate:	Y N
Bottles arrive intact:	Y N
Correct bottles used:	Y N
Sufficient volume sent:	Y N
If Applicable	
VOA Zero Headspace:	Y N
Preservation Correct/Checked:	Y N
RAD Screen <0.5 mR/hr:	Y N

	Date:	Time:		
Relinquished by : (Signature) Ron Phillips	3-8-23	16:30	Received by: (Signature)	Trip Blank Received: Yes / No HCL / MeoH TBR
Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)	Temp: Amb °C Bottles Received: 4
Relinquished by : (Signature)	Date:	Time:	Received for lab by: (Signature)	Date: 7-10-23 Time: 9:00

If preservation required by Login: Date/Time

Hold:

Condition: NCF / OK

ANALYTICAL REPORT

April 10, 2023

Tetra Tech - Boise ID

Sample Delivery Group:	L1593799
Samples Received:	03/09/2023
Project Number:	117-8296103.300
Description:	TENORM: (Fruitland, ID)

Report To: Maureen McGraw
3380 Americana Terrace, Ste 201
Boise, ID 83706

Entire Report Reviewed By:

Kelly Mercer
Project Manager

Results relate only to the items tested or calibrated and are reported as rounded values. This test report shall not be reproduced, except in full, without written approval of the laboratory. Where applicable, sampling conducted by Pace Analytical National is performed per guidance provided in laboratory standard operating procedures ENV-SOP-MTJL-0067 and ENV-SOP-MTJL-0068. Where sampling conducted by the customer, results relate to the accuracy of the information provided, and as the samples are received.

Pace Analytical National
12065 Lebanon Rd Mount Juliet, TN 37122 615-758-5858 800-767-5859 www.pacenational.com

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FRUITLAND-WT-SLUDGE-1 L1593799-01 Solids and Chemical Materials

Collected by: Lucas Kerner | Collected date/time: 03/07/23 10:30 | Received date/time: 03/09/23 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)	WG2016144	1	03/16/23 09:44	03/16/23 12:08	ZRG	Mt. Juliet, TN

FRUITLAND-WT-SLUDGE-DUP L1593799-02 Solids and Chemical Materials

Collected by: Lucas Kerner | Collected date/time: 03/07/23 10:30 | Received date/time: 03/09/23 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)	WG2016144	1	03/16/23 09:44	03/16/23 13:13	ZRG	Mt. Juliet, TN

FRUITLAND-WT-SLUDGE-2 L1593799-03 Solids and Chemical Materials

Collected by: Lucas Kerner | Collected date/time: 03/07/23 10:45 | Received date/time: 03/09/23 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)	WG2016144	1	03/16/23 09:44	03/16/23 13:11	ZRG	Mt. Juliet, TN

FRUITLAND-WT-SLUDGE-3 L1593799-04 Solids and Chemical Materials

Collected by: Lucas Kerner | Collected date/time: 03/07/23 11:15 | Received date/time: 03/09/23 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)	WG2016144	1	03/16/23 09:44	03/16/23 13:12	ZRG	Mt. Juliet, TN

FRUITLAND-WW-BIOSOLIDS-1 L1593799-05 Solids and Chemical Materials

Collected by: Lucas Kerner | Collected date/time: 03/07/23 12:00 | Received date/time: 03/09/23 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)	WG2016144	1	03/16/23 09:44	03/16/23 16:05	ZRG	Mt. Juliet, TN

FRUITLAND-WW-BIOSOLIDS-DUP L1593799-06 Solids and Chemical Materials

Collected by: Lucas Kerner | Collected date/time: 03/07/23 12:00 | Received date/time: 03/09/23 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)	WG2016144	1	03/16/23 09:44	03/16/23 17:18	ZRG	Mt. Juliet, TN

FRUITLAND-WW-BIOSOLIDS-2 L1593799-07 Solids and Chemical Materials

Collected by: Lucas Kerner | Collected date/time: 03/07/23 12:15 | Received date/time: 03/09/23 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)	WG2016144	1	03/16/23 09:44	03/16/23 15:17	ZRG	Mt. Juliet, TN

FRUITLAND-WW-BIOSOLIDS-3 L1593799-08 Solids and Chemical Materials

Collected by: Lucas Kerner | Collected date/time: 03/07/23 12:30 | Received date/time: 03/09/23 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)	WG2016144	1	03/16/23 09:44	03/16/23 16:40	ZRG	Mt. Juliet, TN

CASE NARRATIVE

All sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times, unless qualified or notated within the report. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All radiochemical sample results for solids are reported on a dry weight basis with the exception of tritium, carbon-14 and radon, unless wet weight was requested by the client. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.

Kelly Mercer
Project Manager

Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)

Analyte	Result pCi/g	Qualifier	Uncertainty + / -	MDA pCi/g	Analysis Date date / time	Batch
Actinium-228 (Ra-228)	0.913		0.255	0.385	03/16/2023 12:08	WG2016144
Bismuth-214 (Ra-226)	0.465		0.160	0.240	03/16/2023 12:08	WG2016144

Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)

Analyte	Result	Qualifier	Uncertainty	MDA	Analysis Date	Batch
	pCi/g		+ / -	pCi/g	date / time	
Actinium-228 (Ra-228)	1.13		0.229	0.318	03/16/2023 13:13	WG2016144
Bismuth-214 (Ra-226)	0.597		0.135	0.157	03/16/2023 13:13	WG2016144

Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)

Analyte	Result	Qualifier	Uncertainty	MDA	Analysis Date	Batch
	pCi/g		+ / -	pCi/g	date / time	
Actinium-228 (Ra-228)	1.04		0.274	0.404	03/16/2023 13:11	WG2016144
Bismuth-214 (Ra-226)	0.615		0.167	0.225	03/16/2023 13:11	WG2016144

Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)

Analyte	Result	Qualifier	Uncertainty	MDA	Analysis Date	Batch
	pCi/g		+ / -	pCi/g	date / time	
Actinium-228 (Ra-228)	0.719		0.121	0.134	03/16/2023 13:12	WG2016144
Bismuth-214 (Ra-226)	0.223		0.0661	0.102	03/16/2023 13:12	WG2016144

Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)

Analyte	Result pCi/g	Qualifier	Uncertainty + / -	MDA pCi/g	Analysis Date date / time	Batch
Actinium-228 (Ra-228)	0.0573	U	0.0967	0.266	03/16/2023 16:05	WG2016144
Bismuth-214 (Ra-226)	0.0105	U	0.0627	0.129	03/16/2023 16:05	WG2016144

Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)

Analyte	Result pCi/g	Qualifier	Uncertainty + / -	MDA pCi/g	Analysis Date date / time	Batch
Actinium-228 (Ra-228)	0.104	U	0.126	0.295	03/16/2023 17:18	WG2016144
Bismuth-214 (Ra-226)	0.0481	U	0.0842	0.169	03/16/2023 17:18	WG2016144

Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)

Analyte	Result pCi/g	Qualifier	Uncertainty + / -	MDA pCi/g	Analysis Date date / time	Batch
Actinium-228 (Ra-228)	0.0748	U	0.0948	0.209	03/16/2023 15:17	WG2016144
Bismuth-214 (Ra-226)	-0.0235	U	0.0580	0.142	03/16/2023 15:17	WG2016144

Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)

Analyte	Result pCi/g	Qualifier	Uncertainty + / -	MDA pCi/g	Analysis Date date / time	Batch
Actinium-228 (Ra-228)	0.216	U	0.423	0.978	03/16/2023 16:40	WG2016144
Bismuth-214 (Ra-226)	0.112	U	0.282	0.639	03/16/2023 16:40	WG2016144

QUALITY CONTROL SUMMARY

L1593799-01,02,03,04,05,06,07,08

Method Blank (MB)

(MB) R3902191-1 03/16/23 11:04

Analyte	MB Result pCi/g	MB Qualifier	MB Uncertainty + / -	MB MDA pCi/g
Actinium-228 (Ra-228)	0.0477	U	0.116	0.343
Americium-241	0.0196	U	0.0905	0.164
Bismuth-214 (Ra-226)	0.00141	U	0.109	0.272
Cesium-137	0.00338	U	0.0592	0.132
Cobalt-60	-0.0219	U	0.0323	0.163

L1587723-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1587723-01 03/16/23 10:54 • (DUP) R3902191-2 03/16/23 11:57

Analyte	Original Result pCi/g	Original Uncertainty + / -	Original MDA pCi/g	DUP Result pCi/g	DUP Uncertainty + / -	DUP MDA pCi/g	Dilution	DUP RPD %	DUP RER	DUP Qualifier	DUP RPD Limits %	DUP RER Limit
Actinium-228 (Ra-228)	0.189	0.0796	0.159	0.0713	0.0802	0.159	1	90.6	1.04	U	20	3
Americium-241	0.0368	0.0727	0.131	-0.000151	0.0727	0.131	1	200	0.354	U	20	3
Bismuth-214 (Ra-226)	0.150	0.0531	0.0751	0.161	0.0625	0.0751	1	6.90	0.130		20	3
Cesium-137	-0.00256	0.0249	0.0521	0.00314	0.0249	0.0521	1	200	0.176	U	20	3
Cobalt-60	-0.0129	0.0176	0.0584	-0.00184	0.0176	0.0584	1	0.000	0.489	U	20	3

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3902191-3 03/16/23 14:32 • (LCSD) R3902191-4 03/16/23 15:11

Analyte	Spike Amount pCi/g	LCS Result pCi/g	LCSD Result pCi/g	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Americium-241	47.3	48.8	52.2	103	110	60.0-140			6.67	20
Cesium-137	72.4	75.9	79.1	105	109	80.0-120			4.17	20
Cobalt-60	86.9	93.1	88.3	107	102	80.0-120			5.25	20

Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

Results Disclaimer - Information that may be provided by the customer, and contained within this report, include Permit Limits, Project Name, Sample ID, Sample Matrix, Sample Preservation, Field Blanks, Field Spikes, Field Duplicates, On-Site Data, Sampling Collection Dates/Times, and Sampling Location. Results relate to the accuracy of this information provided, and as the samples are received.

Abbreviations and Definitions

MDA	Minimum Detectable Activity.
Rec.	Recovery.
RER	Replicate Error Ratio.
RPD	Relative Percent Difference.
SDG	Sample Delivery Group.
Analyte	The name of the particular compound or analysis performed. Some Analyses and Methods will have multiple analytes reported.
Dilution	If the sample matrix contains an interfering material, the sample preparation volume or weight values differ from the standard, or if concentrations of analytes in the sample are higher than the highest limit of concentration that the laboratory can accurately report, the sample may be diluted for analysis. If a value different than 1 is used in this field, the result reported has already been corrected for this factor.
Limits	These are the target % recovery ranges or % difference value that the laboratory has historically determined as normal for the method and analyte being reported. Successful QC Sample analysis will target all analytes recovered or duplicated within these ranges.
Original Sample	The non-spiked sample in the prep batch used to determine the Relative Percent Difference (RPD) from a quality control sample. The Original Sample may not be included within the reported SDG.
Qualifier	This column provides a letter and/or number designation that corresponds to additional information concerning the result reported. If a Qualifier is present, a definition per Qualifier is provided within the Glossary and Definitions page and potentially a discussion of possible implications of the Qualifier in the Case Narrative if applicable.
Result	The actual analytical final result (corrected for any sample specific characteristics) reported for your sample. If there was no measurable result returned for a specific analyte, the result in this column may state “ND” (Not Detected) or “BDL” (Below Detectable Levels). The information in the results column should always be accompanied by either an MDL (Method Detection Limit) or RDL (Reporting Detection Limit) that defines the lowest value that the laboratory could detect or report for this analyte.
Uncertainty (Radiochemistry)	Confidence level of 2 sigma.
Case Narrative (Cn)	A brief discussion about the included sample results, including a discussion of any non-conformances to protocol observed either at sample receipt by the laboratory from the field or during the analytical process. If present, there will be a section in the Case Narrative to discuss the meaning of any data qualifiers used in the report.
Quality Control Summary (Qc)	This section of the report includes the results of the laboratory quality control analyses required by procedure or analytical methods to assist in evaluating the validity of the results reported for your samples. These analyses are not being performed on your samples typically, but on laboratory generated material.
Sample Chain of Custody (Sc)	This is the document created in the field when your samples were initially collected. This is used to verify the time and date of collection, the person collecting the samples, and the analyses that the laboratory is requested to perform. This chain of custody also documents all persons (excluding commercial shippers) that have had control or possession of the samples from the time of collection until delivery to the laboratory for analysis.
Sample Results (Sr)	This section of your report will provide the results of all testing performed on your samples. These results are provided by sample ID and are separated by the analyses performed on each sample. The header line of each analysis section for each sample will provide the name and method number for the analysis reported.
Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.

Qualifier	Description
U	Below Detectable Limits: Indicates that the analyte was not detected.

ACCREDITATIONS & LOCATIONS

Pace Analytical National 12065 Lebanon Rd Mount Juliet, TN 37122

Alabama	40660	Nebraska	NE-OS-15-05
Alaska	17-026	Nevada	TN000032021-1
Arizona	AZ0612	New Hampshire	2975
Arkansas	88-0469	New Jersey–NELAP	TN002
California	2932	New Mexico [1]	TN00003
Colorado	TN00003	New York	11742
Connecticut	PH-0197	North Carolina	Env375
Florida	E87487	North Carolina [1]	DW21704
Georgia	NELAP	North Carolina [3]	41
Georgia [1]	923	North Dakota	R-140
Idaho	TN00003	Ohio–VAP	CL0069
Illinois	200008	Oklahoma	9915
Indiana	C-TN-01	Oregon	TN200002
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LAO000356
Kentucky [1 6]	KY90010	South Carolina	84004002
Kentucky [2]	16	South Dakota	n/a
Louisiana	AI30792	Tennessee [1 4]	2006
Louisiana	LA018	Texas	T104704245-20-18
Maine	TN00003	Texas [5]	LAB0152
Maryland	324	Utah	TN000032021-11
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	110033
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	998093910
Montana	CERT0086	Wyoming	A2LA
A2LA – ISO 17025	1461.01	AIHA-LAP,LLC EMLAP	100789
A2LA – ISO 17025 [5]	1461.02	DOD	1461.01
Canada	1461.01	USDA	P330-15-00234
EPA–Crypto	TN00003		

[1] Drinking Water [2] Underground Storage Tanks [3] Aquatic Toxicity [4] Chemical/Microbiological [5] Mold [6] Wastewater n/a Accreditation not applicable

* Not all certifications held by the laboratory are applicable to the results reported in the attached report.

* Accreditation is only applicable to the test methods specified on each scope of accreditation held by Pace Analytical.

Company Name/Address:
Tetra Tech
3380 Americana Terrace
Suite 201
Boise, ID 83706

Billing Information:
Tetra Tech
2525 Palmer Street
Suite 2
Missoula, MT 59808
Attn: Jessica Cook

Report to:
Maureen McGraw

Email To:
maureen.mcgraw@tetratech.com

Project Description:
TENORM: (Fruitland, ID)

City/State Collected: **Fruitland, ID**

Please Circle: PT (MT) CT ET

Phone: **406-546-7839**

Client Project #
117-8296103.300

Lab Project #

Collected by (print):
Lucas Kerner

Site/Facility ID #

P.O. #

Collected by (signature):

Immediately Packed on Ice N ___X___ Y ___

Rush? (Lab MUST Be Notified)
___ Same Day ___ Five Day
___ Next Day ___ 5 Day (Rad Only)
___ Two Day ___ 10 Day (Rad Only)
___ Three Day

Quote #

Date Results Needed

Analysis / Container / Preservative

Pres Chk: <500 cpm

Sample ID	Comp/Grab	Matrix*	Depth	Date	Time	No. of Cntrs	RA-226	RA-228	Remarks	Sample # (lab only)
Fruitland-WT-Sludge-1 /										-01
Fruitland-WT-Sludge-DUP	Comp	OT	--	3/7/2023	10:30	1	X	X	See Below	-02
Fruitland-WT-Sludge-2	Comp	OT	--	3/7/2023	10:45	1	X	X		-03
Fruitland-WT-Sludge-3	Comp	OT	--	3/7/2023	11:15	1	X	X		-04
Fruitland-WW-Biosolids-1 /										-05
Fruitland-WW-Biosolids-DUP	Comp	OT	--	3/7/2023	12:00	1	X	X	See Below	-06
Fruitland-WW-Biosolids-2	Comp	OT	--	3/7/2023	12:15	1	X	X		-07
Fruitland-WW-WASTank-3	Comp	OT	--	3/7/2023	12:30	3	X	X		-08

Chain of Custody Page ___ of ___

Pace
PEOPLE ADVANCING SCIENCE

12065 Lebanon Rd Mount Juliet, TN 37122
Phone: 615-758-5858 Alt: 800-767-5859

Submitting a sample via this chain of custody constitutes acknowledgment and acceptance of the Pace Terms and Conditions found at: https://info.pacelabs.com/hubfs/pas-standard-terms.pdf

SDG # L1513799
Table # B210
Acct #
Template:
Prelogin:
PM:
PB:
Shipped Via:

* Matrix:
SS - Soil **AIR** - Air **F** - Filter
GW - Groundwater **B** - Bioassay
WW - WasteWater
DW - Drinking Water
OT - Other_____

Remarks:
Please split into a natural sample and a duplicate. Two tests from each bag.

pH _____ Temp _____
Flow _____ Other _____

Samples returned via:
__ UPS __ FedEx __ Courier __ _____

Tracking # 6295 1088 1462

Sample Receipt Checklist
COC Seal Present/Intact: NP Y N
COC Signed/Accurate: Y N
Bottles arrive intact: Y N
Correct bottles used: Y N
Sufficient volume sent: Y N
If Applicable
VOA Zero Headspace: Y N
Preservation Correct/Checked: Y N
RAD Screen <0.5 mR/hr: Y N

Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)	Trip Blank Received: Yes / No HCL / MeoH TBR	If preservation required by Login: Date/Time
	3/8/2023	1345			
Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)	Temp: 4mb °C Bottles Received: 8	
Relinquished by : (Signature)	Date:	Time:	Received for lab by: (Signature)	Date: 3.9.23 Time: 9.00	Hold: Condition: NCF / OK

4593799

Tracking Numbers	Temperature
6295 1088 1462	Amb
6094 5474 9781	Amb

ANALYTICAL REPORT

April 10, 2023

Tetra Tech - Boise ID

Sample Delivery Group:	L1594711
Samples Received:	03/14/2023
Project Number:	117-8296103.300
Description:	TENORM: (Glenns Ferry, ID)

Report To: Maureen McGraw
3380 Americana Terrace, Ste 201
Boise, ID 83706

Entire Report Reviewed By:

Kelly Mercer
Project Manager

Results relate only to the items tested or calibrated and are reported as rounded values. This test report shall not be reproduced, except in full, without written approval of the laboratory. Where applicable, sampling conducted by Pace Analytical National is performed per guidance provided in laboratory standard operating procedures ENV-SOP-MTJL-0067 and ENV-SOP-MTJL-0068. Where sampling conducted by the customer, results relate to the accuracy of the information provided, and as the samples are received.

Pace Analytical National
12065 Lebanon Rd Mount Juliet, TN 37122 615-758-5858 800-767-5859 www.pacenational.com

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GLENNSFERRY-WT-PACBASIN1 L1594711-01 Solids and Chemical Materials

Collected by: Lucas Kerner | Collected date/time: 03/13/23 10:45 | Received date/time: 03/14/23 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)	WG2024837	1	03/17/23 11:35	04/06/23 15:29	ZRG	Mt. Juliet, TN

GLENNSFERRY-WT-PACBASIN-DUP L1594711-02 Solids and Chemical Materials

Collected by: Lucas Kerner | Collected date/time: 03/13/23 10:45 | Received date/time: 03/14/23 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)	WG2024837	1	03/17/23 11:35	04/06/23 16:34	ZRG	Mt. Juliet, TN

GLENNSFERRY-WW-SLUDGE-1 L1594711-03 Solids and Chemical Materials

Collected by: Lucas Kerner | Collected date/time: 03/13/23 11:15 | Received date/time: 03/14/23 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)	WG2024837	1	03/17/23 11:35	04/06/23 15:35	ZRG	Mt. Juliet, TN

GLENNSFERRY-WW-SLUDGE-DUP L1594711-04 Solids and Chemical Materials

Collected by: Lucas Kerner | Collected date/time: 03/13/23 11:15 | Received date/time: 03/14/23 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)	WG2024837	1	03/17/23 11:35	04/06/23 16:36	ZRG	Mt. Juliet, TN

GLENNSFERRY-WW-SLUDGE-2 L1594711-05 Solids and Chemical Materials

Collected by: Lucas Kerner | Collected date/time: 03/13/23 12:15 | Received date/time: 03/14/23 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)	WG2024837	1	03/17/23 11:35	04/06/23 16:36	ZRG	Mt. Juliet, TN

GLENNSFERRY-WW-SLUDGE-3 L1594711-06 Solids and Chemical Materials

Collected by: Lucas Kerner | Collected date/time: 03/13/23 12:30 | Received date/time: 03/14/23 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)	WG2024837	1	03/17/23 11:35	04/06/23 16:08	ZRG	Mt. Juliet, TN

CASE NARRATIVE

All sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times, unless qualified or notated within the report. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All radiochemical sample results for solids are reported on a dry weight basis with the exception of tritium, carbon-14 and radon, unless wet weight was requested by the client. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.

Kelly Mercer
Project Manager

Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)

Analyte	Result	Qualifier	Uncertainty	MDA	Analysis Date	Batch
	pCi/g		+ / -	pCi/g	date / time	
Actinium-228 (Ra-228)	0.546		0.179	0.343	04/06/2023 15:29	WG2024837
Bismuth-214 (Ra-226)	0.478		0.129	0.152	04/06/2023 15:29	WG2024837

Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)

Analyte	Result	Qualifier	Uncertainty	MDA	Analysis Date	Batch
	pCi/g		+ / -	pCi/g	date / time	
Actinium-228 (Ra-228)	0.381		0.109	0.195	04/06/2023 16:34	WG2024837
Bismuth-214 (Ra-226)	0.386		0.0750	0.0895	04/06/2023 16:34	WG2024837

Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)

Analyte	Result	Qualifier	Uncertainty	MDA	Analysis Date	Batch
	pCi/g		+ / -	pCi/g	date / time	
Actinium-228 (Ra-228)	1.13		0.233	0.350	04/06/2023 15:35	WG2024837
Bismuth-214 (Ra-226)	0.974		0.170	0.201	04/06/2023 15:35	WG2024837

Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)

Analyte	Result	Qualifier	Uncertainty	MDA	Analysis Date	Batch
	pCi/g		+ / -	pCi/g	date / time	
Actinium-228 (Ra-228)	0.503		0.137	0.217	04/06/2023 16:36	WG2024837
Bismuth-214 (Ra-226)	0.533		0.101	0.108	04/06/2023 16:36	WG2024837

Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)

Analyte	Result	Qualifier	Uncertainty	MDA	Analysis Date	Batch
	pCi/g		+ / -	pCi/g	date / time	
Actinium-228 (Ra-228)	0.876		0.188	0.287	04/06/2023 16:36	WG2024837
Bismuth-214 (Ra-226)	0.782		0.137	0.159	04/06/2023 16:36	WG2024837

Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)

Analyte	Result	Qualifier	Uncertainty	MDA	Analysis Date	Batch
	pCi/g		+ / -	pCi/g	date / time	
Actinium-228 (Ra-228)	1.02		0.170	0.224	04/06/2023 16:08	WG2024837
Bismuth-214 (Ra-226)	0.691		0.113	0.138	04/06/2023 16:08	WG2024837

QUALITY CONTROL SUMMARY

L1594711-01,02,03,04,05,06

Method Blank (MB)

(MB) R3910312-1 04/06/23 14:07

Analyte	MB Result pCi/g	MB Qualifier	MB Uncertainty + / -	MB MDA pCi/g
Actinium-228 (Ra-228)	-0.00344	U	0.105	0.341
Americium-241	-0.0128	U	0.0869	0.162
Bismuth-214 (Ra-226)	0.0682	U	0.107	0.224
Cesium-137	0.0306	U	0.0577	0.118
Cobalt-60	0.0160	U	0.0486	0.172

L1593797-03 Original Sample (OS) • Duplicate (DUP)

(OS) L1593797-03 04/06/23 14:13 • (DUP) R3910312-4 04/06/23 15:27

Analyte	Original Result pCi/g	Original Uncertainty + / -	Original MDA pCi/g	DUP Result pCi/g	DUP Uncertainty + / -	DUP MDA pCi/g	Dilution	DUP RPD %	DUP RER	DUP Qualifier	DUP RPD Limits %	DUP RER Limit
Actinium-228 (Ra-228)	-0.0357	0.0450	0.124	-0.0113	0.105	0.124	1	0.000	0.213	U	20	3
Americium-241	0.429	0.154	0.256	0.221	0.154	0.256	1	63.8	0.931	J	20	3
Bismuth-214 (Ra-226)	-0.00413	0.0344	0.0709	0.0137	0.0719	0.0709	1	200	0.224	U	20	3
Cesium-137	-0.00269	0.0451	0.0859	0.0322	0.0451	0.0859	1	200	0.706	U	20	3
Cobalt-60	0.00232	0.0241	0.118	0.0154	0.0241	0.118	1	148	0.484	U	20	3

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3910312-2 04/06/23 14:08 • (LCSD) R3910312-3 04/06/23 14:28

Analyte	Spike Amount pCi/g	LCS Result pCi/g	LCSD Result pCi/g	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Americium-241	47.3	50.5	53.1	107	112	60.0-140			5.02	20
Cesium-137	72.4	79.0	81.1	109	112	80.0-120			2.56	20
Cobalt-60	86.9	89.8	91.0	103	105	80.0-120			1.37	20

GLOSSARY OF TERMS

Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

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J	The identification of the analyte is acceptable; the reported value is an estimate.
U	Below Detectable Limits: Indicates that the analyte was not detected.

ACCREDITATIONS & LOCATIONS

Pace Analytical National 12065 Lebanon Rd Mount Juliet, TN 37122

Alabama	40660	Nebraska	NE-OS-15-05
Alaska	17-026	Nevada	TN000032021-1
Arizona	AZ0612	New Hampshire	2975
Arkansas	88-0469	New Jersey–NELAP	TN002
California	2932	New Mexico [1]	TN00003
Colorado	TN00003	New York	11742
Connecticut	PH-0197	North Carolina	Env375
Florida	E87487	North Carolina [1]	DW21704
Georgia	NELAP	North Carolina [3]	41
Georgia [1]	923	North Dakota	R-140
Idaho	TN00003	Ohio–VAP	CL0069
Illinois	200008	Oklahoma	9915
Indiana	C-TN-01	Oregon	TN200002
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LAO000356
Kentucky [1 6]	KY90010	South Carolina	84004002
Kentucky [2]	16	South Dakota	n/a
Louisiana	AI30792	Tennessee [1 4]	2006
Louisiana	LA018	Texas	T104704245-20-18
Maine	TN00003	Texas [5]	LAB0152
Maryland	324	Utah	TN000032021-11
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	110033
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	998093910
Montana	CERT0086	Wyoming	A2LA
A2LA – ISO 17025	1461.01	AIHA-LAP,LLC EMLAP	100789
A2LA – ISO 17025 [5]	1461.02	DOD	1461.01
Canada	1461.01	USDA	P330-15-00234
EPA–Crypto	TN00003		

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* Accreditation is only applicable to the test methods specified on each scope of accreditation held by Pace Analytical.

Company Name/Address:
Tetra Tech
3380 Americana Terrace
Suite 201
Boise, ID 83706

Billing Information:
Tetra Tech
2525 Palmer Street
Suite 2
Missoula, MT 59808
Attn: Jessica Cook

Report to: **Maureen McGraw**

Email To: **maureen.mcgraw@tetratech.com**

Project Description: TENORM: (Glenns Ferry, Idaho)

City/State Collected: **Glenns Ferry, ID**

Please Circle: PT (MT) CT ET

Phone: **406-546-7839**

Client Project # **117-8296103.300**

Lab Project #

Collected by (print): **Lucas Kerner**

Site/Facility ID #

P.O. #

Collected by (signature):

Immediately Packed on Ice N ___ X ___ Y ___

Rush? (Lab MUST Be Notified)
___ Same Day ___ Five Day
___ Next Day ___ 5 Day (Rad Only)
___ Two Day ___ 10 Day (Rad Only)
___ Three Day

Quote #

Date Results Needed

Analysis / Container / Preservative

Pres Chk

Sample ID	Comp/Grab	Matrix*	Depth	Date	Time	No. of Cntrs	RA-226	RA-228	Remarks	Sample # (lab only)
GlennsFerry-WT-PACBasin-1 / GlennsFerry-WT-PACBasin-DUP	Comp	SS	--	3/13/23	1045	3	X	X	See Below	-01 -02
GlennsFerry-WW-Sludge-1 / GlennsFerry-WW-Sludge-DUP	Comp	SS	--	3/13/23	1115	1	X	X	See Below	-03 -04
GlennsFerry-WW-Sludge-2	Comp	SS	--	3/13/23	1215	1	X	X		-05
GlennsFerry-WW-Sludge-3	Comp	SS	--	3/13/23	1230	1	X	X		-06

Chain of Custody Page ___ of ___

Pace
PEOPLE ADVANCING SCIENCE

12065 Lebanon Rd Mount Juliet, TN 37122
Phone: 615-758-5858 Alt: 800-767-5859

Submitting a sample via this chain of custody constitutes acknowledgment and acceptance of the Pace Terms and Conditions found at: https://info.pacelabs.com/hubfs/pas-standard-terms.pdf

SDG # L1594711

T E058

Acctnum:
Template:
Prelogin:
PM:
PB:
Shipped Via:

* Matrix:
SS - Soil **AIR** - Air **F** - Filter
GW - Groundwater **B** - Bioassay
WW - WasteWater
DW - Drinking Water
OT - Other_____

Remarks:
Please split into a natural sample a duplicate. Two tests from each bag.

pH _____ Temp _____
Flow _____ Other _____

Samples returned via:
__ UPS __ FedEx __ Courier __ _____

Tracking # 6053 3608 8947

Sample Receipt Checklist
COC Seal Present/Intact: __NP __Y __N
COC Signed/Accurate: __Y __N
Bottles arrive intact: __Y __N
Correct bottles used: __Y __N
Sufficient volume sent: __Y __N
If Applicable
VOA Zero Headspace: __Y __N
Preservation Correct/Checked: __Y __N
RAD Screen <0.5 mR/hr: __Y __N

Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)
	3/13/2023	1600	Fedex
Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)
Relinquished by : (Signature)	Date:	Time:	Received for lab by: (Signature)

Trip Blank Received: Yes / (No) HCL / MeoH TBR

Temp: °C Bottles Received:
GBA7 8.5+0=8.5 6

Date: 3/14/23 Time: 0900

If preservation required by Login: Date/Time

Hold:

Condition: NCF / (OK)

ANALYTICAL REPORT

April 26, 2023

Tetra Tech - Boise ID

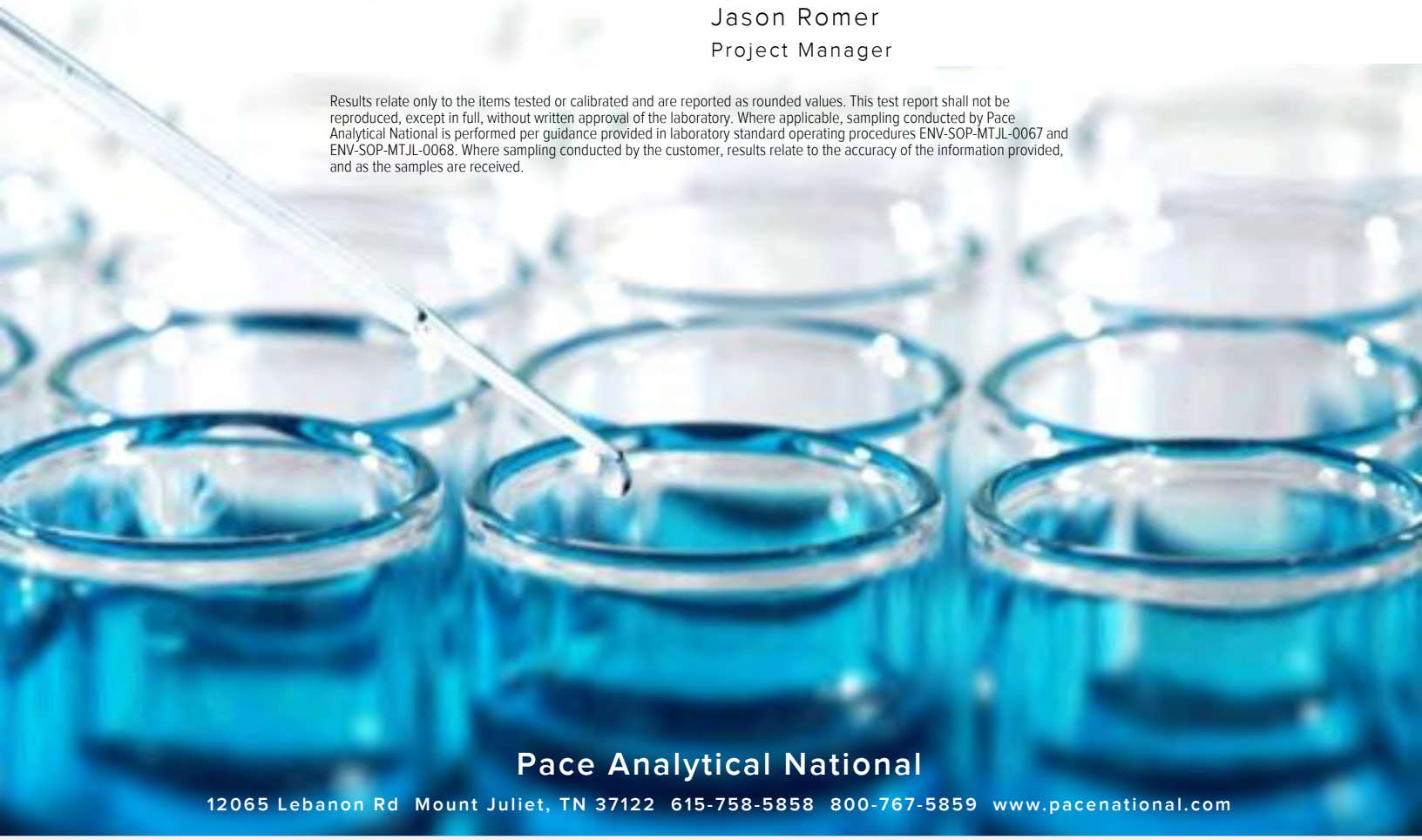
Sample Delivery Group:	L1598021
Samples Received:	03/24/2023
Project Number:	117-8296103
Description:	TENORM: Orofino, ID

Report To: Maureen McGraw
3380 Americana Terrace, Ste 201
Boise, ID 83706

Entire Report Reviewed By:

Jason Romer
Project Manager

Results relate only to the items tested or calibrated and are reported as rounded values. This test report shall not be reproduced, except in full, without written approval of the laboratory. Where applicable, sampling conducted by Pace Analytical National is performed per guidance provided in laboratory standard operating procedures ENV-SOP-MTJL-0067 and ENV-SOP-MTJL-0068. Where sampling conducted by the customer, results relate to the accuracy of the information provided, and as the samples are received.



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OROFINO-WT-SLUDGE-1 L1598021-01 Solids and Chemical Materials

Collected by: Lucas Kerner | Collected date/time: 03/20/23 08:15 | Received date/time: 03/24/23 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)	WG2035370	1	04/03/23 09:09	04/24/23 20:26	ZRG	Mt. Juliet, TN

OROFINO-WT-SLUDGE-DUP L1598021-02 Solids and Chemical Materials

Collected by: Lucas Kerner | Collected date/time: 03/20/23 08:15 | Received date/time: 03/24/23 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)	WG2035370	1	04/03/23 09:09	04/25/23 15:49	ZRG	Mt. Juliet, TN

OROFINO-WT-SLUDGE-2 L1598021-03 Solids and Chemical Materials

Collected by: Lucas Kerner | Collected date/time: 03/20/23 08:30 | Received date/time: 03/24/23 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)	WG2035370	1	04/03/23 09:09	04/24/23 21:00	ZRG	Mt. Juliet, TN

OROFINO-WT-SLUDGE-3 L1598021-04 Solids and Chemical Materials

Collected by: Lucas Kerner | Collected date/time: 03/20/23 09:00 | Received date/time: 03/24/23 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)	WG2035370	1	04/03/23 09:09	04/25/23 16:24	ZRG	Mt. Juliet, TN

OROFINO-WW-BIOSOLIDS-1 L1598021-05 Solids and Chemical Materials

Collected by: Lucas Kerner | Collected date/time: 03/20/23 10:00 | Received date/time: 03/24/23 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)	WG2035370	1	04/03/23 09:09	04/24/23 22:35	ZRG	Mt. Juliet, TN

OROFINO-WW-BIOSOLIDS-DUP L1598021-06 Solids and Chemical Materials

Collected by: Lucas Kerner | Collected date/time: 03/20/23 10:00 | Received date/time: 03/24/23 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)	WG2035370	1	04/03/23 09:09	04/25/23 14:44	ZRG	Mt. Juliet, TN

OROFINO-WW-BIOSOLIDS-2 L1598021-07 Solids and Chemical Materials

Collected by: Lucas Kerner | Collected date/time: 03/20/23 10:15 | Received date/time: 03/24/23 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)	WG2035370	1	04/03/23 09:09	04/25/23 14:19	ZRG	Mt. Juliet, TN

OROFINO-WW-BIOSOLIDS-3 L1598021-08 Solids and Chemical Materials

Collected by: Lucas Kerner | Collected date/time: 03/20/23 11:10 | Received date/time: 03/24/23 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)	WG2035370	1	04/03/23 09:09	04/25/23 15:21	ZRG	Mt. Juliet, TN

CASE NARRATIVE

All sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times, unless qualified or notated within the report. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All radiochemical sample results for solids are reported on a dry weight basis with the exception of tritium, carbon-14 and radon, unless wet weight was requested by the client. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.

Jason Romer
Project Manager

Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)

Analyte	Result	Qualifier	Uncertainty	MDA	Analysis Date	Batch
	pCi/g		+ / -	pCi/g	date / time	
Actinium-228 (Ra-228)	0.998		0.459	0.759	04/24/2023 20:26	WG2035370
Bismuth-214 (Ra-226)	0.815		0.305	0.442	04/24/2023 20:26	WG2035370

Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)

Analyte	Result	Qualifier	Uncertainty	MDA	Analysis Date	Batch
	pCi/g		+ / -	pCi/g	date / time	
Actinium-228 (Ra-228)	0.762	J	0.366	0.808	04/25/2023 15:49	WG2035370
Bismuth-214 (Ra-226)	0.655		0.265	0.431	04/25/2023 15:49	WG2035370

Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)

Analyte	Result	Qualifier	Uncertainty	MDA	Analysis Date	Batch
	pCi/g		+ / -	pCi/g	date / time	
Actinium-228 (Ra-228)	0.991		0.390	0.676	04/24/2023 21:00	WG2035370
Bismuth-214 (Ra-226)	0.928		0.314	0.474	04/24/2023 21:00	WG2035370

Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)

Analyte	Result pCi/g	Qualifier	Uncertainty + / -	MDA pCi/g	Analysis Date date / time	Batch
Actinium-228 (Ra-228)	0.624	J	0.417	0.767	04/25/2023 16:24	WG2035370
Bismuth-214 (Ra-226)	0.826		0.324	0.476	04/25/2023 16:24	WG2035370

Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)

Analyte	Result pCi/g	Qualifier	Uncertainty + / -	MDA pCi/g	Analysis Date date / time	Batch
Actinium-228 (Ra-228)	0.645	J	0.447	0.840	04/24/2023 22:35	WG2035370
Bismuth-214 (Ra-226)	0.559		0.294	0.502	04/24/2023 22:35	WG2035370

Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)

Analyte	Result pCi/g	Qualifier	Uncertainty + / -	MDA pCi/g	Analysis Date date / time	Batch
Actinium-228 (Ra-228)	0.257	U	0.321	0.820	04/25/2023 14:44	WG2035370
Bismuth-214 (Ra-226)	0.426		0.240	0.408	04/25/2023 14:44	WG2035370

Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)

Analyte	Result pCi/g	Qualifier	Uncertainty + / -	MDA pCi/g	Analysis Date date / time	Batch
Actinium-228 (Ra-228)	0.0520	U	0.399	1.02	04/25/2023 14:19	WG2035370
Bismuth-214 (Ra-226)	0.0637	U	0.253	0.585	04/25/2023 14:19	WG2035370

Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)

Analyte	Result pCi/g	Qualifier	Uncertainty + / -	MDA pCi/g	Analysis Date date / time	Batch
Actinium-228 (Ra-228)	0.581	J	0.446	1.02	04/25/2023 15:21	WG2035370
Bismuth-214 (Ra-226)	0.580		0.290	0.429	04/25/2023 15:21	WG2035370

Method Blank (MB)

(MB) R3917366-2 04/24/23 13:05

Analyte	MB Result pCi/g	MB Qualifier	MB Uncertainty + / -	MB MDA pCi/g
Actinium-228 (Ra-228)	0.0157	U	0.0704	0.187
Americium-241	-0.0132	U	0.110	0.205
Bismuth-214 (Ra-226)	0.0174	U	0.0583	0.128
Cesium-137	-0.00397	U	0.0360	0.0775
Cobalt-60	-0.000898	U	0.0226	0.0756

L1598520-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1598520-01 04/24/23 09:22 • (DUP) R3917366-4 04/24/23 14:46

Analyte	Original Result pCi/g	Original Uncertainty + / -	Original MDA pCi/g	DUP Result pCi/g	DUP Uncertainty + / -	DUP MDA pCi/g	Dilution	DUP RPD %	DUP RER	DUP Qualifier	DUP RPD Limits %	DUP RER Limit
Actinium-228 (Ra-228)	0.916	0.207	0.281	0.902	0.240	0.281	1	1.56	0.0448		20	3
Bismuth-214 (Ra-226)	0.725	0.135	0.142	0.673	0.154	0.142	1	7.42	0.253		20	3

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3917366-3 04/24/23 14:13 • (LCSD) R3917366-1 04/24/23 12:02

Analyte	Spike Amount pCi/g	LCS Result pCi/g	LCSD Result pCi/g	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Americium-241	47.3	50.0	53.8	106	114	60.0-140			7.27	20
Cesium-137	72.4	80.6	85.3	111	118	80.0-120			5.74	20
Cobalt-60	86.9	91.4	104	105	120	80.0-120			12.8	20

GLOSSARY OF TERMS

Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

Results Disclaimer - Information that may be provided by the customer, and contained within this report, include Permit Limits, Project Name, Sample ID, Sample Matrix, Sample Preservation, Field Blanks, Field Spikes, Field Duplicates, On-Site Data, Sampling Collection Dates/Times, and Sampling Location. Results relate to the accuracy of this information provided, and as the samples are received.

Abbreviations and Definitions

MDA	Minimum Detectable Activity.
Rec.	Recovery.
RER	Replicate Error Ratio.
RPD	Relative Percent Difference.
SDG	Sample Delivery Group.
Analyte	The name of the particular compound or analysis performed. Some Analyses and Methods will have multiple analytes reported.
Dilution	If the sample matrix contains an interfering material, the sample preparation volume or weight values differ from the standard, or if concentrations of analytes in the sample are higher than the highest limit of concentration that the laboratory can accurately report, the sample may be diluted for analysis. If a value different than 1 is used in this field, the result reported has already been corrected for this factor.
Limits	These are the target % recovery ranges or % difference value that the laboratory has historically determined as normal for the method and analyte being reported. Successful QC Sample analysis will target all analytes recovered or duplicated within these ranges.
Original Sample	The non-spiked sample in the prep batch used to determine the Relative Percent Difference (RPD) from a quality control sample. The Original Sample may not be included within the reported SDG.
Qualifier	This column provides a letter and/or number designation that corresponds to additional information concerning the result reported. If a Qualifier is present, a definition per Qualifier is provided within the Glossary and Definitions page and potentially a discussion of possible implications of the Qualifier in the Case Narrative if applicable.
Result	The actual analytical final result (corrected for any sample specific characteristics) reported for your sample. If there was no measurable result returned for a specific analyte, the result in this column may state “ND” (Not Detected) or “BDL” (Below Detectable Levels). The information in the results column should always be accompanied by either an MDL (Method Detection Limit) or RDL (Reporting Detection Limit) that defines the lowest value that the laboratory could detect or report for this analyte.
Uncertainty (Radiochemistry)	Confidence level of 2 sigma.
Case Narrative (Cn)	A brief discussion about the included sample results, including a discussion of any non-conformances to protocol observed either at sample receipt by the laboratory from the field or during the analytical process. If present, there will be a section in the Case Narrative to discuss the meaning of any data qualifiers used in the report.
Quality Control Summary (Qc)	This section of the report includes the results of the laboratory quality control analyses required by procedure or analytical methods to assist in evaluating the validity of the results reported for your samples. These analyses are not being performed on your samples typically, but on laboratory generated material.
Sample Chain of Custody (Sc)	This is the document created in the field when your samples were initially collected. This is used to verify the time and date of collection, the person collecting the samples, and the analyses that the laboratory is requested to perform. This chain of custody also documents all persons (excluding commercial shippers) that have had control or possession of the samples from the time of collection until delivery to the laboratory for analysis.
Sample Results (Sr)	This section of your report will provide the results of all testing performed on your samples. These results are provided by sample ID and are separated by the analyses performed on each sample. The header line of each analysis section for each sample will provide the name and method number for the analysis reported.
Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.

Qualifier	Description
J	The identification of the analyte is acceptable; the reported value is an estimate.
U	Below Detectable Limits: Indicates that the analyte was not detected.

ACCREDITATIONS & LOCATIONS

Pace Analytical National 12065 Lebanon Rd Mount Juliet, TN 37122

Alabama	40660	Nebraska	NE-OS-15-05
Alaska	17-026	Nevada	TN000032021-1
Arizona	AZ0612	New Hampshire	2975
Arkansas	88-0469	New Jersey–NELAP	TN002
California	2932	New Mexico [1]	TN00003
Colorado	TN00003	New York	11742
Connecticut	PH-0197	North Carolina	Env375
Florida	E87487	North Carolina [1]	DW21704
Georgia	NELAP	North Carolina [3]	41
Georgia [1]	923	North Dakota	R-140
Idaho	TN00003	Ohio–VAP	CL0069
Illinois	200008	Oklahoma	9915
Indiana	C-TN-01	Oregon	TN200002
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LAO000356
Kentucky [1 6]	KY90010	South Carolina	84004002
Kentucky [2]	16	South Dakota	n/a
Louisiana	AI30792	Tennessee [1 4]	2006
Louisiana	LA018	Texas	T104704245-20-18
Maine	TN00003	Texas [5]	LAB0152
Maryland	324	Utah	TN000032021-11
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	110033
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	998093910
Montana	CERT0086	Wyoming	A2LA
A2LA – ISO 17025	1461.01	AIHA-LAP,LLC EMLAP	100789
A2LA – ISO 17025 [5]	1461.02	DOD	1461.01
Canada	1461.01	USDA	P330-15-00234
EPA–Crypto	TN00003		

[1] Drinking Water [2] Underground Storage Tanks [3] Aquatic Toxicity [4] Chemical/Microbiological [5] Mold [6] Wastewater n/a Accreditation not applicable

* Not all certifications held by the laboratory are applicable to the results reported in the attached report.

* Accreditation is only applicable to the test methods specified on each scope of accreditation held by Pace Analytical.

Company Name/Address:
Tetra Tech
3380 Americana Terrace
Suite 201
Boise, ID 83706

Billing Information:
Tetra Tech
2525 Palmer Street
Suite 2
Missoula, MT 59808
Attn: Jessica Cook

Pres Chk

Report to:
Maureen McGraw

Email To:
maureen.mcgraw@tetratech.com

Project Description:
TENORM: Orofino, ID

City/State Collected: Orofino, ID

Please Circle: PT MT CT ET

Phone: **406-546-7839**

Client Project #
117-8296103

Lab Project #

Collected by (print):
Lucas Hertz

Site/Facility ID #

P.O. #

Collected by (signature):

Immediately Packed on Ice N ___ X ___ Y ___

Rush? (Lab MUST Be Notified)
___ Same Day ___ Five Day
___ Next Day ___ 5 Day (Rad Only)
___ Two Day ___ 10 Day (Rad Only)
___ Three Day

Quote #

Date Results Needed

Analysis / Container / Preservative

Sample ID	Comp/Grab	Matrix*	Depth	Date	Time	No. of Cntrs	RA-226 by Gamma Spectroscopy	RA-228 by Gamma Spectroscopy	Remarks	Sample # (lab only)
Orofino-WT-Sludge-1/Orofino-WT-Sludge-DUP	Comp	OT	—	3/20/23	0815	2	X	X	See Below	-01, 02
Orofino-WT-Sludge-2	Comp	OT	—	3/20/23	0830	1	X	X		-03
Orofino-WT-Sludge-3	Comp	OT	—	3/20/23	0900	1	X	X		-04
~~Orofino-WW-Biosolids-1/Orofino-WW~~										
Orofino-WW-Biosolids-1										
Orofino-WW-Biosolids-DUP	Comp	OT	—	3/20/23	1000	1	X	X	See Below	-05, 06
Orofino-WW-Biosolids-2	Comp	OT	—	3/20/23	1015	1	X	X		-07
Orofino-WW-RAS-3	Comp	OT	—	3/20/23	1110	1	X	X		-08

Chain of Custody Page ___ of ___

Pace
PEOPLE ADVANCING SCIENCE

12065 Lebanon Rd Mount Juliet, TN 37122
Phone: 615-758-5858 Alt: 800-767-5859

Submitting a sample via this chain of custody constitutes acknowledgment and acceptance of the Pace Terms and Conditions found at: https://info.pacelabs.com/hubfs/pas-standard-terms.pdf

SDG # 1598021
Table # Hood
Acctnum:
Template:
Prelogin:
PM:
PB:
Shipped Via:

* Matrix:
SS - Soil **AIR** - Air **F** - Filter
GW - Groundwater **B** - Bioassay
WW - WasteWater
DW - Drinking Water
OT - Other_____

Remarks:
Please split into a natural and duplicate sample. ~500 cpm

pH _____ Temp _____
Flow _____ Other _____

Samples returned via:
__ UPS __ FedEx __ Courier __ _____

Tracking #

Sample Receipt Checklist
COC Seal Present/Intact: NP Y N
COC Signed/Accurate: Y N
Bottles arrive intact: Y N
Correct bottles used: Y N
Sufficient volume sent: Y N
If Applicable
VOA Zero Headspace: Y N
Preservation Correct/Checked: Y N
RAD Screen <0.5 mR/hr: Y N

Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Trip Blank Received: Yes / No HCL / MeoH TBR	
	3/23/23	1300			
Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)	Temp: Amb °C Bottles Received: 8	If preservation required by Login: Date/Time 3/24
Relinquished by : (Signature)	Date:	Time:	Received for lab by: (Signature)	Date: 3/24/23 Time: 0900	Hold: Condition: NCF / OK

ANALYTICAL REPORT

April 26, 2023

Tetra Tech - Boise ID

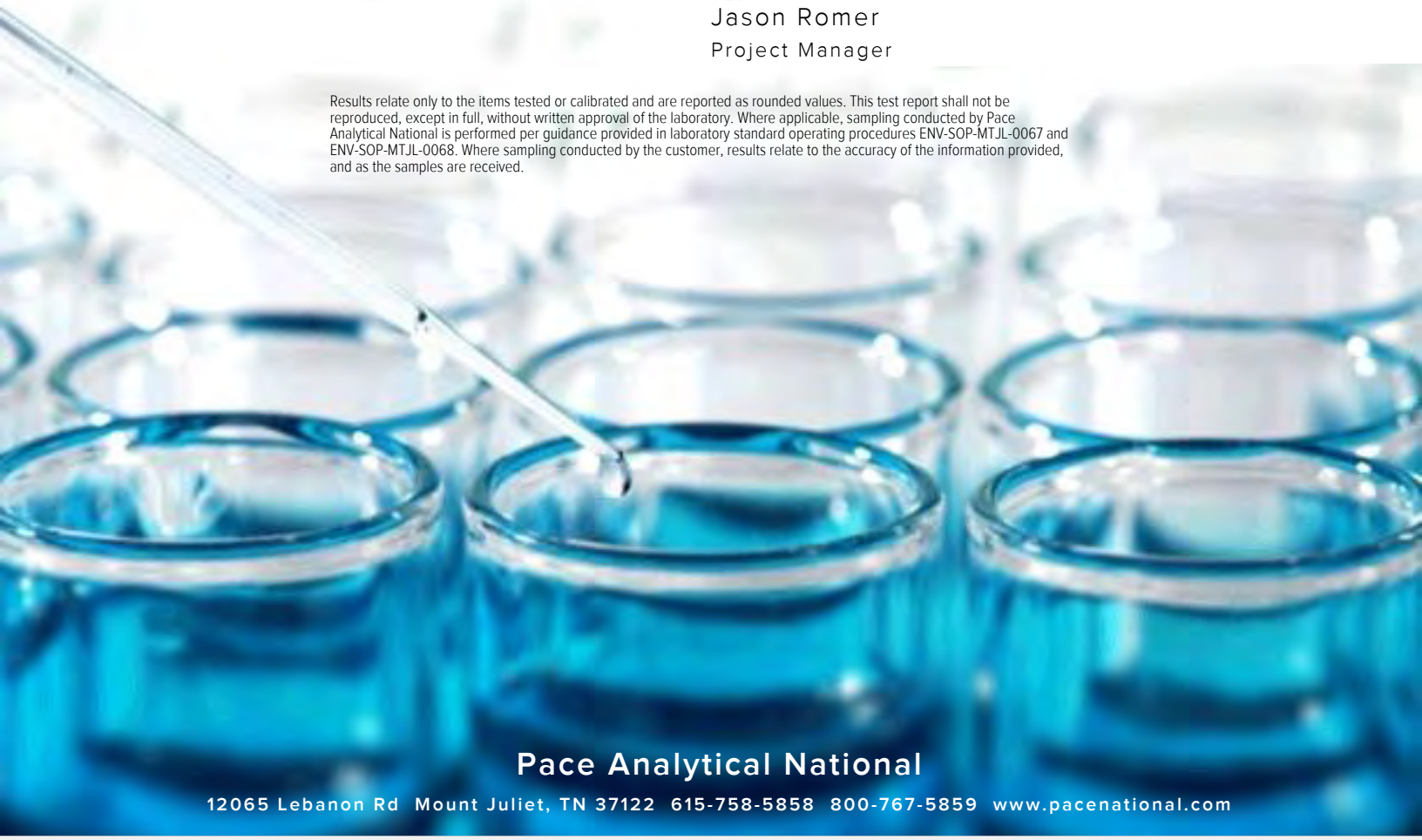
Sample Delivery Group:	L1598520
Samples Received:	03/25/2023
Project Number:	117-8296103
Description:	Tenorm:Moyie Springs, ID

Report To: Maureen McGraw
3380 Americana Terrace, Ste 201
Boise, ID 83706

Entire Report Reviewed By:

Jason Romer
Project Manager

Results relate only to the items tested or calibrated and are reported as rounded values. This test report shall not be reproduced, except in full, without written approval of the laboratory. Where applicable, sampling conducted by Pace Analytical National is performed per guidance provided in laboratory standard operating procedures ENV-SOP-MTJL-0067 and ENV-SOP-MTJL-0068. Where sampling conducted by the customer, results relate to the accuracy of the information provided, and as the samples are received.



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MOYIE SPRINGS-WT-SLUDGE-3 L1598520-04 8

MOYIE SPRINGS-WW-SLUDGE-1 L1598520-05 9

MOYIE SPRINGS-WW-SLUDGE-DUP L1598520-06 10

MOYIE SPRINGS-WW-SLUDGE-2 L1598520-07 11

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MOYIE SPRINGS-WT-SLUDGE-1 L1598520-01 Solids and Chemical Materials

Collected by: Lucas K | Collected date/time: 03/21/23 11:35 | Received date/time: 03/25/23 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)	WG2035370	1	04/03/23 10:12	04/24/23 09:22	ZRG	Mt. Juliet, TN

MOYIE SPRINGS-WT-SLUDGE-DUP L1598520-02 Solids and Chemical Materials

Collected by: Lucas K | Collected date/time: 03/21/23 11:35 | Received date/time: 03/25/23 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)	WG2035370	1	04/03/23 10:12	04/24/23 10:36	ZRG	Mt. Juliet, TN

MOYIE SPRINGS-WT-SLUDGE-2 L1598520-03 Solids and Chemical Materials

Collected by: Lucas K | Collected date/time: 03/21/23 11:40 | Received date/time: 03/25/23 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)	WG2035370	1	04/03/23 10:12	04/24/23 09:35	ZRG	Mt. Juliet, TN

MOYIE SPRINGS-WT-SLUDGE-3 L1598520-04 Solids and Chemical Materials

Collected by: Lucas K | Collected date/time: 03/21/23 11:45 | Received date/time: 03/25/23 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)	WG2035370	1	04/03/23 10:12	04/24/23 11:26	ZRG	Mt. Juliet, TN

MOYIE SPRINGS-WW-SLUDGE-1 L1598520-05 Solids and Chemical Materials

Collected by: Lucas K | Collected date/time: 03/21/23 12:45 | Received date/time: 03/25/23 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)	WG2035370	1	04/03/23 10:12	04/25/23 16:52	ZRG	Mt. Juliet, TN

MOYIE SPRINGS-WW-SLUDGE-DUP L1598520-06 Solids and Chemical Materials

Collected by: Lucas K | Collected date/time: 03/21/23 12:45 | Received date/time: 03/25/23 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)	WG2035370	1	04/03/23 10:12	04/25/23 18:34	ZRG	Mt. Juliet, TN

MOYIE SPRINGS-WW-SLUDGE-2 L1598520-07 Solids and Chemical Materials

Collected by: Lucas K | Collected date/time: 03/21/23 13:15 | Received date/time: 03/25/23 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)	WG2035370	1	04/03/23 10:12	04/25/23 17:30	ZRG	Mt. Juliet, TN

MOYIE SPRINGS-WW-SLUDGE-3 L1598520-08 Solids and Chemical Materials

Collected by: Lucas K | Collected date/time: 03/21/23 13:25 | Received date/time: 03/25/23 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)	WG2035370	1	04/03/23 10:12	04/25/23 17:58	ZRG	Mt. Juliet, TN

CASE NARRATIVE

All sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times, unless qualified or notated within the report. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All radiochemical sample results for solids are reported on a dry weight basis with the exception of tritium, carbon-14 and radon, unless wet weight was requested by the client. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.

Jason Romer
Project Manager

Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)

Analyte	Result	Qualifier	Uncertainty	MDA	Analysis Date	Batch
	pCi/g		+ / -	pCi/g	date / time	
Actinium-228 (Ra-228)	0.916		0.207	0.281	04/24/2023 09:22	WG2035370
Bismuth-214 (Ra-226)	0.725		0.135	0.142	04/24/2023 09:22	WG2035370

Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)

Analyte	Result pCi/g	Qualifier	Uncertainty + / -	MDA pCi/g	Analysis Date date / time	Batch
Actinium-228 (Ra-228)	1.11		0.264	0.388	04/24/2023 10:36	WG2035370
Bismuth-214 (Ra-226)	0.664		0.152	0.188	04/24/2023 10:36	WG2035370

Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)

Analyte	Result	Qualifier	Uncertainty	MDA	Analysis Date	Batch
	pCi/g		+ / -	pCi/g	date / time	
Actinium-228 (Ra-228)	0.927		0.235	0.321	04/24/2023 09:35	WG2035370
Bismuth-214 (Ra-226)	0.639		0.159	0.212	04/24/2023 09:35	WG2035370

Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)

Analyte	Result	Qualifier	Uncertainty	MDA	Analysis Date	Batch
	pCi/g		+ / -	pCi/g	date / time	
Actinium-228 (Ra-228)	0.536		0.114	0.157	04/24/2023 11:26	WG2035370
Bismuth-214 (Ra-226)	0.400		0.0767	0.0868	04/24/2023 11:26	WG2035370

Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)

Analyte	Result	Qualifier	Uncertainty	MDA	Analysis Date	Batch
	pCi/g		+ / -	pCi/g	date / time	
Actinium-228 (Ra-228)	1.14		0.446	0.947	04/25/2023 16:52	WG2035370
Bismuth-214 (Ra-226)	0.765		0.297	0.458	04/25/2023 16:52	WG2035370

Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)

Analyte	Result pCi/g	Qualifier	Uncertainty + / -	MDA pCi/g	Analysis Date date / time	Batch
Actinium-228 (Ra-228)	0.982	J	0.538	1.01	04/25/2023 18:34	WG2035370
Bismuth-214 (Ra-226)	0.718		0.333	0.491	04/25/2023 18:34	WG2035370

Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)

Analyte	Result pCi/g	Qualifier	Uncertainty + / -	MDA pCi/g	Analysis Date date / time	Batch
Actinium-228 (Ra-228)	1.52		0.615	0.962	04/25/2023 17:30	WG2035370
Bismuth-214 (Ra-226)	0.428	J	0.342	0.624	04/25/2023 17:30	WG2035370

Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)

Analyte	Result pCi/g	Qualifier	Uncertainty + / -	MDA pCi/g	Analysis Date date / time	Batch
Actinium-228 (Ra-228)	0.623	J	0.423	0.977	04/25/2023 17:58	WG2035370
Bismuth-214 (Ra-226)	0.344	J	0.270	0.503	04/25/2023 17:58	WG2035370

Method Blank (MB)

(MB) R3917366-2 04/24/23 13:05

Analyte	MB Result pCi/g	MB Qualifier	MB Uncertainty + / -	MB MDA pCi/g
Actinium-228 (Ra-228)	0.0157	U	0.0704	0.187
Americium-241	-0.0132	U	0.110	0.205
Bismuth-214 (Ra-226)	0.0174	U	0.0583	0.128
Cesium-137	-0.00397	U	0.0360	0.0775
Cobalt-60	-0.000898	U	0.0226	0.0756

L1598520-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1598520-01 04/24/23 09:22 • (DUP) R3917366-4 04/24/23 14:46

Analyte	Original Result pCi/g	Original Uncertainty + / -	Original MDA pCi/g	DUP Result pCi/g	DUP Uncertainty + / -	DUP MDA pCi/g	Dilution	DUP RPD %	DUP RER	DUP Qualifier	DUP RPD Limits %	DUP RER Limit
Actinium-228 (Ra-228)	0.916	0.207	0.281	0.902	0.240	0.281	1	1.56	0.0448		20	3
Bismuth-214 (Ra-226)	0.725	0.135	0.142	0.673	0.154	0.142	1	7.42	0.253		20	3

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3917366-3 04/24/23 14:13 • (LCSD) R3917366-1 04/24/23 12:02

Analyte	Spike Amount pCi/g	LCS Result pCi/g	LCSD Result pCi/g	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Americium-241	47.3	50.0	53.8	106	114	60.0-140			7.27	20
Cesium-137	72.4	80.6	85.3	111	118	80.0-120			5.74	20
Cobalt-60	86.9	91.4	104	105	120	80.0-120			12.8	20

Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

Results Disclaimer - Information that may be provided by the customer, and contained within this report, include Permit Limits, Project Name, Sample ID, Sample Matrix, Sample Preservation, Field Blanks, Field Spikes, Field Duplicates, On-Site Data, Sampling Collection Dates/Times, and Sampling Location. Results relate to the accuracy of this information provided, and as the samples are received.

Abbreviations and Definitions

MDA	Minimum Detectable Activity.
Rec.	Recovery.
RER	Replicate Error Ratio.
RPD	Relative Percent Difference.
SDG	Sample Delivery Group.
Analyte	The name of the particular compound or analysis performed. Some Analyses and Methods will have multiple analytes reported.
Dilution	If the sample matrix contains an interfering material, the sample preparation volume or weight values differ from the standard, or if concentrations of analytes in the sample are higher than the highest limit of concentration that the laboratory can accurately report, the sample may be diluted for analysis. If a value different than 1 is used in this field, the result reported has already been corrected for this factor.
Limits	These are the target % recovery ranges or % difference value that the laboratory has historically determined as normal for the method and analyte being reported. Successful QC Sample analysis will target all analytes recovered or duplicated within these ranges.
Original Sample	The non-spiked sample in the prep batch used to determine the Relative Percent Difference (RPD) from a quality control sample. The Original Sample may not be included within the reported SDG.
Qualifier	This column provides a letter and/or number designation that corresponds to additional information concerning the result reported. If a Qualifier is present, a definition per Qualifier is provided within the Glossary and Definitions page and potentially a discussion of possible implications of the Qualifier in the Case Narrative if applicable.
Result	The actual analytical final result (corrected for any sample specific characteristics) reported for your sample. If there was no measurable result returned for a specific analyte, the result in this column may state “ND” (Not Detected) or “BDL” (Below Detectable Levels). The information in the results column should always be accompanied by either an MDL (Method Detection Limit) or RDL (Reporting Detection Limit) that defines the lowest value that the laboratory could detect or report for this analyte.
Uncertainty (Radiochemistry)	Confidence level of 2 sigma.
Case Narrative (Cn)	A brief discussion about the included sample results, including a discussion of any non-conformances to protocol observed either at sample receipt by the laboratory from the field or during the analytical process. If present, there will be a section in the Case Narrative to discuss the meaning of any data qualifiers used in the report.
Quality Control Summary (Qc)	This section of the report includes the results of the laboratory quality control analyses required by procedure or analytical methods to assist in evaluating the validity of the results reported for your samples. These analyses are not being performed on your samples typically, but on laboratory generated material.
Sample Chain of Custody (Sc)	This is the document created in the field when your samples were initially collected. This is used to verify the time and date of collection, the person collecting the samples, and the analyses that the laboratory is requested to perform. This chain of custody also documents all persons (excluding commercial shippers) that have had control or possession of the samples from the time of collection until delivery to the laboratory for analysis.
Sample Results (Sr)	This section of your report will provide the results of all testing performed on your samples. These results are provided by sample ID and are separated by the analyses performed on each sample. The header line of each analysis section for each sample will provide the name and method number for the analysis reported.
Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.

Qualifier	Description
J	The identification of the analyte is acceptable; the reported value is an estimate.
U	Below Detectable Limits: Indicates that the analyte was not detected.

ACCREDITATIONS & LOCATIONS

Pace Analytical National 12065 Lebanon Rd Mount Juliet, TN 37122

Alabama	40660	Nebraska	NE-OS-15-05
Alaska	17-026	Nevada	TN000032021-1
Arizona	AZ0612	New Hampshire	2975
Arkansas	88-0469	New Jersey–NELAP	TN002
California	2932	New Mexico [1]	TN00003
Colorado	TN00003	New York	11742
Connecticut	PH-0197	North Carolina	Env375
Florida	E87487	North Carolina [1]	DW21704
Georgia	NELAP	North Carolina [3]	41
Georgia [1]	923	North Dakota	R-140
Idaho	TN00003	Ohio–VAP	CL0069
Illinois	200008	Oklahoma	9915
Indiana	C-TN-01	Oregon	TN200002
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LAO000356
Kentucky [1 6]	KY90010	South Carolina	84004002
Kentucky [2]	16	South Dakota	n/a
Louisiana	AI30792	Tennessee [1 4]	2006
Louisiana	LA018	Texas	T104704245-20-18
Maine	TN00003	Texas [5]	LAB0152
Maryland	324	Utah	TN000032021-11
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	110033
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	998093910
Montana	CERT0086	Wyoming	A2LA
A2LA – ISO 17025	1461.01	AIHA-LAP,LLC EMLAP	100789
A2LA – ISO 17025 [5]	1461.02	DOD	1461.01
Canada	1461.01	USDA	P330-15-00234
EPA–Crypto	TN00003		

[1] Drinking Water [2] Underground Storage Tanks [3] Aquatic Toxicity [4] Chemical/Microbiological [5] Mold [6] Wastewater n/a Accreditation not applicable

* Not all certifications held by the laboratory are applicable to the results reported in the attached report.

* Accreditation is only applicable to the test methods specified on each scope of accreditation held by Pace Analytical.

Company Name/Address:
Tetra Tech
3380 Americana Terrace
Suite 201
Boise, ID 83706

Billing Information:
Tetra Tech
2525 Palmer Street
Suite 2
Missoula, MT 59808
Attn: Jessica Cook

Report to: **Maureen McGraw**

Email To: **maureen.mcgraw@tetratech.com**

Project Description: TENORM: Magic Springs, ID

City/State Collected: Magic Springs, ID

Please Circle: PT MT CT ET

Phone: **406-546-7839**

Client Project # **117-8296103**

Lab Project #

Collected by (print): Lucas Herr

Site/Facility ID #

P.O. #

Collected by (signature):

Immediately Packed on Ice N X Y

Rush? (Lab MUST Be Notified)
___ Same Day ___ Five Day
___ Next Day ___ 5 Day (Rad Only)
___ Two Day ___ 10 Day (Rad Only)
___ Three Day

Quote #

Date Results Needed

Analysis / Container / Preservative

Pres Chk

Sample ID	Comp/Grab	Matrix*	Depth	Date	Time	No. of Cntrs	RA-226 by Gamma Spectroscopy	RA-228 by Gamma Spectroscopy	Remarks	Sample # (lab only)
Magic Springs-WT-Sludge-1										-01
Magic Springs-WT-Sludge-Dup	Comp	OT	—	3/21/23	1135	1	X	X	See Below	-02
Magic Springs-WT-Sludge-2		OT	—	3/21/23	1140	1	X	X		-03
Magic Springs-WT-Sludge-3		OT	—	3/21/23	1145	1	X	X		-04
Magic Springs-WW-Sludge-1										-05
Magic Springs-WW-Sludge-Dup	Comp	OT	—	3/21/23	1245	2	X	X	See Below	-06
Magic Springs-WW-Sludge-2	Comp	OT	—	3/21/23	1315	1	X	X		-07
Magic Springs-WW-Sludge-3	Comp	OT	—	3/21/23	1325	1	X	X		-08
										-09

Chain of Custody Page ___ of ___

Pace
PEOPLE ADVANCING SCIENCE

12065 Lebanon Rd Mount Juliet, TN 37122
Phone: 615-758-5858 Alt: 800-767-5859

Submitting a sample via this chain of custody constitutes acknowledgment and acceptance of the Pace Terms and Conditions found at: https://info.pacelabs.com/hubfs/pas-standard-terms.pdf

SDG # L1598520
C196

Acctnum:
Template:
Prelogin:
PM:
PB:
Shipped Via:

* Matrix:
SS - Soil **AIR** - Air **F** - Filter
GW - Groundwater **B** - Bioassay
WW - WasteWater
DW - Drinking Water
OT - Other_____

Remarks: Split into natural & duplicate sample

pH _____ Temp _____

Flow _____ Other _____

Samples returned via:
__ UPS __ FedEx __ Courier __ _____

Tracking #

Sample Receipt Checklist
COC Seal Present/Intact: NP Y N
COC Signed/Accurate: Y N
Bottles arrive intact: Y N
Correct bottles used: Y N
Sufficient volume sent: Y N
If Applicable
VOA Zero Headspace: Y N
Preservation Correct/Checked: Y N
RAD Screen <0.5 mR/hr: Y N
<500 cpm

Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)	Trip Blank Received: Yes / No HCL / MeoH TBR
	3/23/23	1300		
Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)	Temp: °C Bottles Received: 7
Relinquished by : (Signature)	Date:	Time:	Received for lab by: (Signature) (7)	Date: 3.25.23 Time: 0900

If preservation required by Login: Date/Time

Hold:

Condition: NCF / OK

L1598520

Tracking Numbers	Temperature
6337 2239 0292	GBAG 15.5 +0 = 15.5
5719 6189 2006	GBAG 15.8+0 = 15.8

ANALYTICAL REPORT

April 26, 2023

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

Tetra Tech - Boise ID

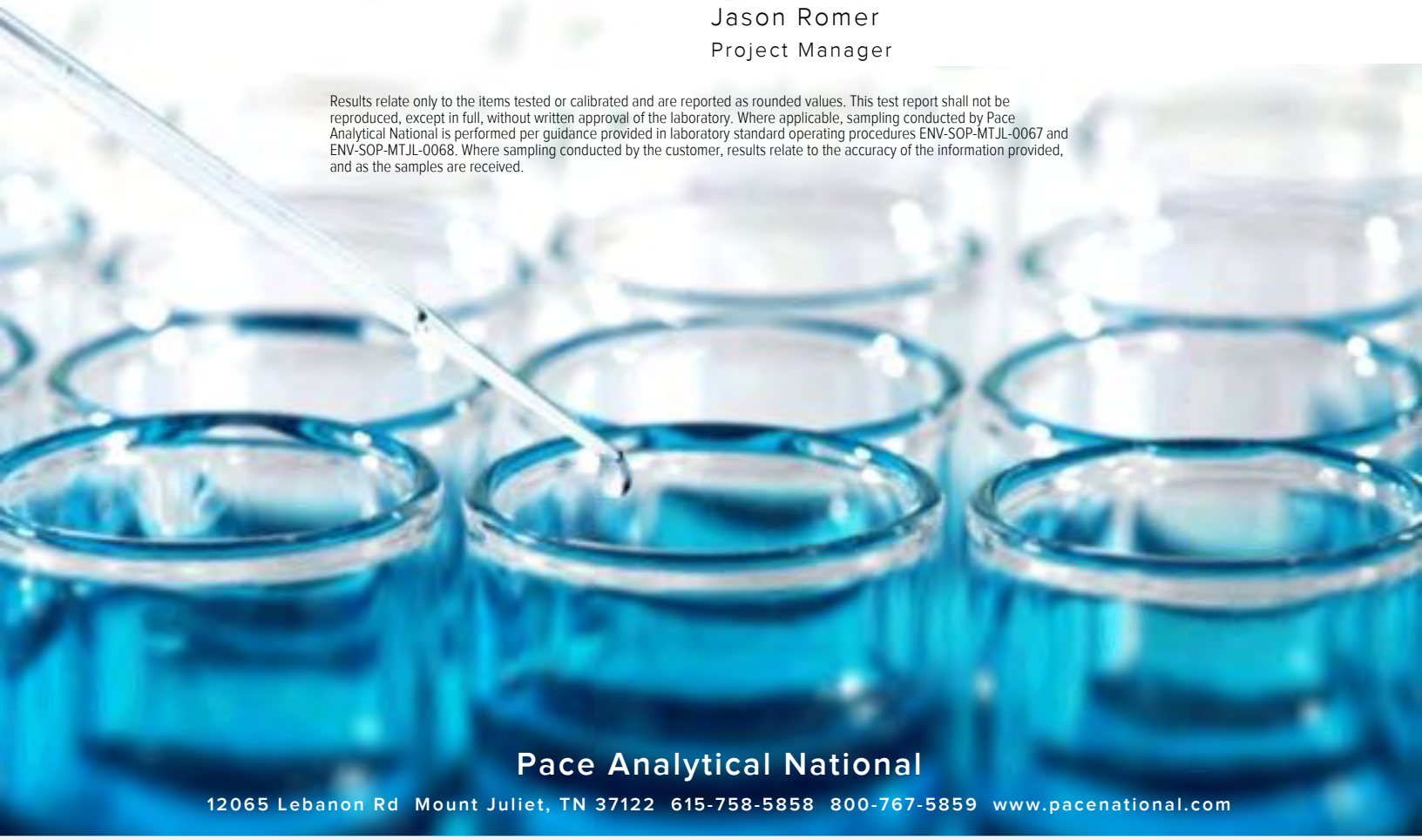
Sample Delivery Group:	L1598523
Samples Received:	03/25/2023
Project Number:	117-8296103
Description:	TENORM: Priest River,ID

Report To: Maureen McGraw
3380 Americana Terrace, Ste 201
Boise, ID 83706

Entire Report Reviewed By:

Jason Romer
Project Manager

Results relate only to the items tested or calibrated and are reported as rounded values. This test report shall not be reproduced, except in full, without written approval of the laboratory. Where applicable, sampling conducted by Pace Analytical National is performed per guidance provided in laboratory standard operating procedures ENV-SOP-MTJL-0067 and ENV-SOP-MTJL-0068. Where sampling conducted by the customer, results relate to the accuracy of the information provided, and as the samples are received.



Pace Analytical National
12065 Lebanon Rd Mount Juliet, TN 37122 615-758-5858 800-767-5859 www.pacenational.com

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PRIEST RIVER-WT-SLUDGE-1 L1598523-01 Solids and Chemical Materials

Collected by: Lucas K | Collected date/time: 03/01/23 08:15 | Received date/time: 03/25/23 08:15

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)	WG2035370	1	04/03/23 07:50	04/24/23 11:37	ZRG	Mt. Juliet, TN

PRIEST RIVER-WT-SLUDGE-DUP L1598523-02 Solids and Chemical Materials

Collected by: Lucas K | Collected date/time: 03/01/23 08:15 | Received date/time: 03/25/23 08:15

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)	WG2035370	1	04/03/23 07:50	04/24/23 13:17	ZRG	Mt. Juliet, TN

PRIEST RIVER-WT-SLUDGE-2 L1598523-03 Solids and Chemical Materials

Collected by: Lucas K | Collected date/time: 03/01/23 08:25 | Received date/time: 03/25/23 08:15

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)	WG2035370	1	04/03/23 07:50	04/24/23 12:13	ZRG	Mt. Juliet, TN

PRIEST RIVER-WT-SLUDGE-3 L1598523-04 Solids and Chemical Materials

Collected by: Lucas K | Collected date/time: 03/01/23 08:35 | Received date/time: 03/25/23 08:15

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)	WG2035370	1	04/03/23 07:50	04/24/23 13:04	ZRG	Mt. Juliet, TN

PRIEST RIVER-WW-BIOSOLIDS-1 L1598523-05 Solids and Chemical Materials

Collected by: Lucas K | Collected date/time: 03/01/23 09:25 | Received date/time: 03/25/23 08:15

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)	WG2035386	1	04/03/23 07:50	04/25/23 10:47	ZRG	Mt. Juliet, TN

PRIEST RIVER-WW-BIOSOLIDS-DUP L1598523-06 Solids and Chemical Materials

Collected by: Lucas K | Collected date/time: 03/01/23 09:25 | Received date/time: 03/25/23 08:15

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)	WG2035386	1	04/03/23 07:50	04/25/23 13:39	ZRG	Mt. Juliet, TN

PRIEST RIVER-WW-BIOSOLIDS-2 L1598523-07 Solids and Chemical Materials

Collected by: Lucas K | Collected date/time: 03/01/23 09:30 | Received date/time: 03/25/23 08:15

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)	WG2035386	1	04/03/23 07:50	04/25/23 12:05	ZRG	Mt. Juliet, TN

PRIEST RIVER-WW-BIOSOLIDS-3 L1598523-08 Solids and Chemical Materials

Collected by: Lucas K | Collected date/time: 03/01/23 09:45 | Received date/time: 03/25/23 08:15

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)	WG2035386	1	04/03/23 07:50	04/25/23 13:12	ZRG	Mt. Juliet, TN

CASE NARRATIVE

All sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times, unless qualified or notated within the report. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All radiochemical sample results for solids are reported on a dry weight basis with the exception of tritium, carbon-14 and radon, unless wet weight was requested by the client. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.

Jason Romer
Project Manager

Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)

Analyte	Result	Qualifier	Uncertainty	MDA	Analysis Date	Batch
	pCi/g		+ / -	pCi/g	date / time	
Actinium-228 (Ra-228)	0.478		0.216	0.375	04/24/2023 11:37	WG2035370
Bismuth-214 (Ra-226)	0.416		0.149	0.230	04/24/2023 11:37	WG2035370

Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)

Analyte	Result pCi/g	Qualifier	Uncertainty + / -	MDA pCi/g	Analysis Date date / time	Batch
Actinium-228 (Ra-228)	0.765		0.203	0.322	04/24/2023 13:17	WG2035370
Bismuth-214 (Ra-226)	0.797		0.147	0.173	04/24/2023 13:17	WG2035370

Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)

Analyte	Result	Qualifier	Uncertainty	MDA	Analysis Date	Batch
	pCi/g		+ / -	pCi/g	date / time	
Actinium-228 (Ra-228)	0.563		0.146	0.227	04/24/2023 12:13	WG2035370
Bismuth-214 (Ra-226)	0.370		0.0969	0.121	04/24/2023 12:13	WG2035370

Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)

Analyte	Result	Qualifier	Uncertainty	MDA	Analysis Date	Batch
	pCi/g		+ / -	pCi/g	date / time	
Actinium-228 (Ra-228)	0.536		0.236	0.398	04/24/2023 13:04	WG2035370
Bismuth-214 (Ra-226)	0.876		0.193	0.222	04/24/2023 13:04	WG2035370

Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)

Analyte	Result pCi/g	Qualifier	Uncertainty + / -	MDA pCi/g	Analysis Date date / time	Batch
Actinium-228 (Ra-228)	0.598	J	0.434	0.973	04/25/2023 10:47	WG2035386
Bismuth-214 (Ra-226)	0.669		0.309	0.476	04/25/2023 10:47	WG2035386

Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)

Analyte	Result pCi/g	Qualifier	Uncertainty + / -	MDA pCi/g	Analysis Date date / time	Batch
Actinium-228 (Ra-228)	0.984		0.395	0.790	04/25/2023 13:39	WG2035386
Bismuth-214 (Ra-226)	0.762		0.270	0.395	04/25/2023 13:39	WG2035386

Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)

Analyte	Result pCi/g	Qualifier	Uncertainty + / -	MDA pCi/g	Analysis Date date / time	Batch
Actinium-228 (Ra-228)	0.904	J	0.533	1.04	04/25/2023 12:05	WG2035386
Bismuth-214 (Ra-226)	0.579		0.302	0.468	04/25/2023 12:05	WG2035386

Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)

Analyte	Result pCi/g	Qualifier	Uncertainty + / -	MDA pCi/g	Analysis Date date / time	Batch
Actinium-228 (Ra-228)	0.573	U	0.760	1.76	04/25/2023 13:12	WG2035386
Bismuth-214 (Ra-226)	0.251	U	0.448	0.936	04/25/2023 13:12	WG2035386

Method Blank (MB)

(MB) R3917366-2 04/24/23 13:05

Analyte	MB Result pCi/g	MB Qualifier	MB Uncertainty + / -	MB MDA pCi/g
Actinium-228 (Ra-228)	0.0157	U	0.0704	0.187
Americium-241	-0.0132	U	0.110	0.205
Bismuth-214 (Ra-226)	0.0174	U	0.0583	0.128
Cesium-137	-0.00397	U	0.0360	0.0775
Cobalt-60	-0.000898	U	0.0226	0.0756

L1598520-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1598520-01 04/24/23 09:22 • (DUP) R3917366-4 04/24/23 14:46

Analyte	Original Result pCi/g	Original Uncertainty + / -	Original MDA pCi/g	DUP Result pCi/g	DUP Uncertainty + / -	DUP MDA pCi/g	Dilution	DUP RPD %	DUP RER	DUP Qualifier	DUP RPD Limits %	DUP RER Limit
Actinium-228 (Ra-228)	0.916	0.207	0.281	0.902	0.240	0.281	1	1.56	0.0448		20	3
Bismuth-214 (Ra-226)	0.725	0.135	0.142	0.673	0.154	0.142	1	7.42	0.253		20	3

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3917366-3 04/24/23 14:13 • (LCSD) R3917366-1 04/24/23 12:02

Analyte	Spike Amount pCi/g	LCS Result pCi/g	LCSD Result pCi/g	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Americium-241	47.3	50.0	53.8	106	114	60.0-140			7.27	20
Cesium-137	72.4	80.6	85.3	111	118	80.0-120			5.74	20
Cobalt-60	86.9	91.4	104	105	120	80.0-120			12.8	20

Method Blank (MB)

(MB) R3917108-1 04/24/23 18:34

Analyte	MB Result pCi/g	MB Qualifier	MB Uncertainty + / -	MB MDA pCi/g
Actinium-228 (Ra-228)	0.0625	U	0.0775	0.187
Americium-241	0.0538	U	0.107	0.192
Bismuth-214 (Ra-226)	0.0321	U	0.0545	0.104
Cesium-137	-0.0238	U	0.0338	0.0791
Cobalt-60	-0.00559	U	0.0183	0.0667

L1600099-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1600099-01 04/25/23 09:41 • (DUP) R3917108-4 04/25/23 13:38

Analyte	Original Result pCi/g	Original Uncertainty + / -	Original MDA pCi/g	DUP Result pCi/g	DUP Uncertainty + / -	DUP MDA pCi/g	Dilution	DUP RPD %	DUP RER	DUP Qualifier	DUP RPD Limits %	DUP RER Limit
Actinium-228 (Ra-228)	0.467	0.107	0.171	0.425	0.162	0.171	1	9.55	0.220		20	3
Bismuth-214 (Ra-226)	0.439	0.0762	0.0842	0.431	0.110	0.0842	1	1.82	0.0590		20	3

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3917108-2 04/24/23 19:03 • (LCSD) R3917108-3 04/24/23 20:24

Analyte	Spike Amount pCi/g	LCS Result pCi/g	LCSD Result pCi/g	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Americium-241	47.3	48.7	45.5	103	96.2	60.0-140			6.82	20
Cesium-137	72.4	76.6	70.8	106	97.8	80.0-120			7.85	20
Cobalt-60	86.9	89.1	74.9	103	86.2	80.0-120			17.3	20

GLOSSARY OF TERMS

Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

Results Disclaimer - Information that may be provided by the customer, and contained within this report, include Permit Limits, Project Name, Sample ID, Sample Matrix, Sample Preservation, Field Blanks, Field Spikes, Field Duplicates, On-Site Data, Sampling Collection Dates/Times, and Sampling Location. Results relate to the accuracy of this information provided, and as the samples are received.

Abbreviations and Definitions

MDA	Minimum Detectable Activity.
Rec.	Recovery.
RER	Replicate Error Ratio.
RPD	Relative Percent Difference.
SDG	Sample Delivery Group.
Analyte	The name of the particular compound or analysis performed. Some Analyses and Methods will have multiple analytes reported.
Dilution	If the sample matrix contains an interfering material, the sample preparation volume or weight values differ from the standard, or if concentrations of analytes in the sample are higher than the highest limit of concentration that the laboratory can accurately report, the sample may be diluted for analysis. If a value different than 1 is used in this field, the result reported has already been corrected for this factor.
Limits	These are the target % recovery ranges or % difference value that the laboratory has historically determined as normal for the method and analyte being reported. Successful QC Sample analysis will target all analytes recovered or duplicated within these ranges.
Original Sample	The non-spiked sample in the prep batch used to determine the Relative Percent Difference (RPD) from a quality control sample. The Original Sample may not be included within the reported SDG.
Qualifier	This column provides a letter and/or number designation that corresponds to additional information concerning the result reported. If a Qualifier is present, a definition per Qualifier is provided within the Glossary and Definitions page and potentially a discussion of possible implications of the Qualifier in the Case Narrative if applicable.
Result	The actual analytical final result (corrected for any sample specific characteristics) reported for your sample. If there was no measurable result returned for a specific analyte, the result in this column may state “ND” (Not Detected) or “BDL” (Below Detectable Levels). The information in the results column should always be accompanied by either an MDL (Method Detection Limit) or RDL (Reporting Detection Limit) that defines the lowest value that the laboratory could detect or report for this analyte.
Uncertainty (Radiochemistry)	Confidence level of 2 sigma.
Case Narrative (Cn)	A brief discussion about the included sample results, including a discussion of any non-conformances to protocol observed either at sample receipt by the laboratory from the field or during the analytical process. If present, there will be a section in the Case Narrative to discuss the meaning of any data qualifiers used in the report.
Quality Control Summary (Qc)	This section of the report includes the results of the laboratory quality control analyses required by procedure or analytical methods to assist in evaluating the validity of the results reported for your samples. These analyses are not being performed on your samples typically, but on laboratory generated material.
Sample Chain of Custody (Sc)	This is the document created in the field when your samples were initially collected. This is used to verify the time and date of collection, the person collecting the samples, and the analyses that the laboratory is requested to perform. This chain of custody also documents all persons (excluding commercial shippers) that have had control or possession of the samples from the time of collection until delivery to the laboratory for analysis.
Sample Results (Sr)	This section of your report will provide the results of all testing performed on your samples. These results are provided by sample ID and are separated by the analyses performed on each sample. The header line of each analysis section for each sample will provide the name and method number for the analysis reported.
Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.

Qualifier	Description
J	The identification of the analyte is acceptable; the reported value is an estimate.
U	Below Detectable Limits: Indicates that the analyte was not detected.

ACCREDITATIONS & LOCATIONS

Pace Analytical National 12065 Lebanon Rd Mount Juliet, TN 37122

Alabama	40660	Nebraska	NE-OS-15-05
Alaska	17-026	Nevada	TN000032021-1
Arizona	AZ0612	New Hampshire	2975
Arkansas	88-0469	New Jersey–NELAP	TN002
California	2932	New Mexico [1]	TN00003
Colorado	TN00003	New York	11742
Connecticut	PH-0197	North Carolina	Env375
Florida	E87487	North Carolina [1]	DW21704
Georgia	NELAP	North Carolina [3]	41
Georgia [1]	923	North Dakota	R-140
Idaho	TN00003	Ohio–VAP	CL0069
Illinois	200008	Oklahoma	9915
Indiana	C-TN-01	Oregon	TN200002
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LAO000356
Kentucky [1 6]	KY90010	South Carolina	84004002
Kentucky [2]	16	South Dakota	n/a
Louisiana	AI30792	Tennessee [1 4]	2006
Louisiana	LA018	Texas	T104704245-20-18
Maine	TN00003	Texas [5]	LAB0152
Maryland	324	Utah	TN000032021-11
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	110033
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	998093910
Montana	CERT0086	Wyoming	A2LA
A2LA – ISO 17025	1461.01	AIHA-LAP,LLC EMLAP	100789
A2LA – ISO 17025 [5]	1461.02	DOD	1461.01
Canada	1461.01	USDA	P330-15-00234
EPA–Crypto	TN00003		

[1] Drinking Water [2] Underground Storage Tanks [3] Aquatic Toxicity [4] Chemical/Microbiological [5] Mold [6] Wastewater n/a Accreditation not applicable

* Not all certifications held by the laboratory are applicable to the results reported in the attached report.

* Accreditation is only applicable to the test methods specified on each scope of accreditation held by Pace Analytical.

Company Name/Address:
Tetra Tech
3380 Americana Terrace
Suite 201
Boise, ID 83706

Billing Information:
Tetra Tech
2525 Palmer Street
Suite 2
Missoula, MT 59808
Attn: Jessica Cook

Report to: **Maureen McGraw**

Email To: **maureen.mcgraw@tetratech.com**

Project Description: TENORM: Priest River, ID

City/State Collected: Priest River

Please Circle: PT MT CT ET

Phone: **406-546-7839**

Client Project # **117-8296103**

Lab Project #

Collected by (print): Lucas Kleve

Site/Facility ID #

P.O. #

Collected by (signature):

Immediately Packed on Ice N ___ X ___ Y ___

Rush? (Lab MUST Be Notified)
___ Same Day ___ Five Day
___ Next Day ___ 5 Day (Rad Only)
___ Two Day ___ 10 Day (Rad Only)
___ Three Day

Quote #

Date Results Needed

Analysis / Container / Preservative

Chain of Custody Page ___ of ___

Pace
PEOPLE ADVANCING SCIENCE

12065 Lebanon Rd Mount Juliet, TN 37122
Phone: 615-758-5858 Alt: 800-767-5859

Submitting a sample via this chain of custody constitutes acknowledgment and acceptance of the Pace Terms and Conditions found at: https://info.pacelabs.com/hubfs/pas-standard-terms.pdf

SDG # L1598523
C197

Acctnum:
Template:
Prelogin:
PM:
PB:
Shipped Via:

Sample ID	Comp/Grab	Matrix*	Depth	Date	Time	No. of Cntrs	RA-226 by Gamma Spectroscopy	RA-228 by Gamma Spectroscopy	Pres Chk	Remarks	Sample # (lab only)
Priest River-WT-Sludge-1/Priest River-WT-Sludge-Dup	Comp	OT	—	3/21/23	0815	1	X	X			-01
Priest River-WT-Sludge-2	Comp	OT	—	3/21/23	0825	1	X	X		See Below	-02
Priest River-WT-Sludge-3	Comp	OT	—	3/21/23	0835	1	X	X			-03
Priest River-WW-Biosolids-1/ Priest River-WW-Biosolids-Dup	Comp	OT	—	3/21/23	0925	1	X	X			-04 -05
Priest River-WW-Biosolids-2	Comp	OT	—	3/21/23	0930	1	X	X		See Below	-06
Priest River-WW-Biosolids-3	Comp	OT	—	3/21/23	0945	1	X	X			-07
											-08

* Matrix:
SS - Soil **AIR** - Air **F** - Filter
GW - Groundwater **B** - Bioassay
WW - WasteWater
DW - Drinking Water
OT - Other_____

Remarks: Split into a natural & duplicate sample.

pH _____ Temp _____

Flow _____ Other _____

Samples returned via:
__ UPS __ FedEx __ Courier __ _____

Tracking #

Sample Receipt Checklist
COC Seal Present/Intact: NP Y N
COC Signed/Accurate: Y N
Bottles arrive intact: Y N
Correct bottles used: Y N
Sufficient volume sent: Y N
If Applicable
VOA Zero Headspace: Y N
Preservation Correct/Checked: Y N
RAD Screen <0.5 mR/hr: Y N
2500 cpm

Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)
	3/23/23	1300	
Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)
Relinquished by : (Signature)	Date:	Time:	Received for lab by: (Signature)

Trip Blank Received: Yes / No HCl / MeoH TBR

Temp: °C Bottles Received: 6

Date: 3.25.23 Time: 0900

If preservation required by Login: Date/Time

Hold:

Condition: NCF / OK

L1598523

Tracking Numbers	Temperature
6337 2238 4676	GBA6 16.2+0 = 16.2
6357 9920 8790	GBA6 18.6+0 = 18.6

APPENDIX D – QUALITY CONTROL REVIEW

DATA REVIEW, VERIFICATION, & VALIDATION REPORT

1. INTRODUCTION

General Project Information			
Project Name:	TO50. TENORM sampling	**Date Validated:**	Robert Meyer
Tetra Tech Project Number:	117-8296103	**Data Validated By:**	5/18/23
Sample Start and End Dates:	Spring 2023	**Laboratory Name:**	Pace Laboratories
Sample Matrix:	Water treatment residues	**Laboratory Project ID#:**	See table below
Analytical Parameters:	Gamma spectrometry determination of Ra226 and Ra228 concentration		
Name & Date of Approved SAP, QAPP, Work Plan, Etc.	Quality Assurance Project Plan, Evaluation of TENORM in Drinking Water and Waste Water Treatment Systems. Dated February 24, 2023.		

2. LABORATORY METHODS AND SAMPLE HANDLING

The two lists directly below provide an overall summary of the Pace Laboratories sample analysis reports:

Each analysis report included the following:

- Cover page
- Table of Contents
- Sample summary
- Case narrative
- Sample results sheets
- Quality control summary
- Description of the radiochemistry method employed
- Glossary of terms
- Pace laboratory accreditations and locations
- Sample chain of custody

Each individual sample analysis was summarized by the laboratory as follows:

- Method employed: DOE Ga-01-R/901.1(21 day)
- Batch number
- Dilution employed
- Preparation date and time
- Analysis date and time
- Initials of the analyst
- Location: Mt. Juliet, TN

3. SUMMARY LIST OF SAMPLES VALIDATED IN THIS REPORT

List all samples in the sample delivery group that were validated in this report.

Validated Samples		
Field Sample ID; Number of Samples	**Laboratory Group ID#**	**Sample Type** (Natural, Duplicate, Field Blank, Etc.)
Greenhill; 5	L1593797	Resin1 & Dup., Resin2-4; Control
Fruitland; 8	L1593799	WT1&Dup., WT2-3; WW1&Dup., WW2-3
Glennsferry; 6	L1594711	WT1&Dup., WW1&Dup., WW2-3
Orofino; 8	L159821	WT1&Dup., WT2-3; WW1&Dup., WW2-3
Moyie Springs; 8	1598520	WT1&Dup., WT2-3; WW1&Dup., WW2-3
Priest River; 8	L1598523	WT1&Dup., WT2-3; WW1&Dup., WW2-3

.

Detailed sample list:

4/7/23	
SDG:L1593797 Greenhill	DW-Resin-1
	DW-Resin-Dup
	DW-Resin-2
	DW-Resin-3
	Filter media control sample
4/10/23	
SDG:L1593799 Fruitland	WT-Sludge-1
	WT-Sludge-DUP
	WT-Sludge-2
	WT-Sludge-3
	WW-Biosolids-1
	WW-Biosolids-Dup
	WW-Biosolids-2
	WW-Biosolids-3
4/10/23	
SDG:L1594711 Glennsferry	WT-Pacbasin1
	WT-Pacbasin-Dup
	WW-Sludgeg-1
	WW-Sludge-Dup
	WW-Sludge-2
	WW-Sludge-3
4/26/23	
SDG:L159821 Orofino	WT-Sludge-1
	WT-Sludge-Dup
	WT-Sludge-2
	WT-Sludgeg-3
	WW-Biosolids-1
	WW-Biosolids-Dup
	WW-Biosolids-2
	WW-Biosolids-3
4/26/23	
SDG:1598520 Moyie Springs	WT-Sludge-1
	WT-Sludge-Dup
	WT-Sludge-2
	WT-Sludge-3
	WW-Sludge-1
	WW-Sludge-Dup
	WW-Sludge-2
	WW-Sludge-3
4/26/23	
SDG:L1598523 Priest River	WT-Sludge-1
	WT-Sludge-Dup
	WT-Sludge-2
	WT-Sludge-3
	WW-Biosolids-1
	WW- Biosolids -Dup
	WW- Biosolids -2
	WW- Biosolids -3

4. FIELD COMPLIANCE WITH PROJECT REQUIREMENTS

Were all the required samples collected as specified in the SAP/QAPP and field and analytical methods? ***Discuss.***

Yes, all the required samples collected as specified in the QAPP.

5. DATA QUALIFIERS

Appropriate laboratory-specific data qualifiers are provided in each laboratory sample analysis report.

6. LABORATORY NARRATIVE, CHAIN-OF-CUSTODY, AND SAMPLE RECEIPT CHECKLIST

Was a laboratory narrative provided and were there any non-conformance issues with the analytical data? Identify and discuss.

Yes. Each group of samples was provided with a detailed case narrative as follows (typical example from the Pace reports):

> *"All sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times, unless qualified or notated within the report. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All radiochemical sample results for solids are reported on a dry weight basis with the exception of tritium, carbon-14 and radon, unless wet weight was requested by the client. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data. Signed by Jason Romer, project manager."*

Each sample was analyzed for Ra-228 and Ra-226 via Actinium-228 and Bismuth-214 gamma spectrometry, respectively. Results were reported as follows (typical example):

MOYIE SPRINGS-WT-SLUDGE-1 SAMPLE RESULTS - 01
Collected date/time: 03/21/23 11:35 L1598520

Radiochemistry by Method DOE Ga-01-R/901.1 (21 day)

Analyte	Result pCi/g	Qualifier	Uncertainty + / -	MDA pCi/g	Analysis Date date / time	Batch
Actinium-228 (Ra-228)	0.916		0.207	0.281	04/24/2023 09:22	WG2035370
Bismuth-214 (Ra-226)	0.725		0.135	0.142	04/24/2023 09:22	WG2035370

Each set of samples was accompanied by a Quality Control Summary as follows (typical example):

WG2035370 QUALITY CONTROL SUMMARY
Radiochemistry by Method DOE Ga-01-R/901.1 (21 day) L1598520-01,02,03,04,05,06,07,08

Method Blank (MB)

(MB) R3917366-2 04/24/23 13:05

Analyte	MB Result pCi/g	MB Qualifier	MB Uncertainty + / -	MB MDA pCi/g
Actinium-228 (Ra-228)	0.0157	U	0.0704	0.187
Americium-241	-0.0132	U	0.110	0.205
Bismuth-214 (Ra-226)	0.0174	U	0.0583	0.128
Cesium-137	-0.00397	U	0.0360	0.0775
Cobalt-60	-0.000898	U	0.0226	0.0756

L1598520-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1598520-01 04/24/23 09:22 • (DUP) R3917366-4 04/24/23 14:46

Analyte	Original Result pCi/g	Original Uncertainty + / -	Original MDA pCi/g	DUP Result pCi/g	DUP Uncertainty + / -	DUP MDA pCi/g	Dilution	DUP RPD %	DUP RER	DUP Qualifier	DUP RPD Limits %	DUP RER Limit
Actinium-228 (Ra-228)	0.916	0.207	0.281	0.902	0.240	0.281	1	1.56	0.0448		20	3
Bismuth-214 (Ra-226)	0.725	0.135	0.142	0.673	0.154	0.142	1	7.42	0.253		20	3

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3917366-3 04/24/23 14:13 • (LCSD) R3917366-1 04/24/23 12:02

Analyte	Spike Amount pCi/g	LCS Result pCi/g	LCSD Result pCi/g	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Americium-241	47.3	50.0	53.8	106	114	60.0-140			7.27	20
Cesium-137	72.4	80.6	85.3	111	118	80.0-120			5.74	20
Cobalt-60	86.9	91.4	104	105	120	80.0-120			12.8	20

The analysis results are summarized below:

Location	Sample Type	Date Collected	Analyte			
			Ra-228 pCi/g	Uncertainty + / -	Ra-226 pCi/g	Uncertainty + / -
City of Moiye	WT-Sludge-1	3/21/2023	0.916	0.207	0.725	0.135
	WT-Sludge-2	3/21/2023	0.927	0.235	0.639	0.159
	WT-Sludge-3	3/21/2023	0.536	0.114	0.400	0.0767
	WW-Sludge-1	3/21/2023	1.14	0.446	0.765	0.297
	WW-Sludge-2	3/21/2023	1.52	0.615	0.428	0.342
	WW-Sludge-3	3/21/2023	0.623	0.423	0.344	0.270
Fruitland	WT-Sludge-1	3/7/2023	0.913	0.255	0.465	0.16
	WT-Sludge-2	3/7/2023	1.04	0.274	0.615	0.167
	WT-Sludge-3	3/7/2023	0.719	0.121	0.223	0.0661
	WW-Biosolids-1	3/7/2023	0.0573	0.0967	0.0105	0.0627
	WW-Biosolids-2	3/7/2023	0.0748	0.0948	-0.0235	0.0580
	WW-Biosolids-3	3/7/2023	0.216	0.423	0.112	0.282
Glens Ferry	WT-PACBasin-1	3/13/2023	0.546	0.179	0.478	0.129
	WW-Sludge-1	3/13/2023	1.13	0.233	0.974	0.17
	WW-Sludge-2	3/13/2023	0.876	0.188	0.782	0.137
	WW-Sludge-3	3/13/2023	1.02	0.170	0.691	0.113
Greenhill Estate	DW-Resin-1	3/3/2023	0.0404	0.0972	0.0428	0.0708
	DW-Resin-2	3/3/2023	-0.0357	0.045	-0.00413	0.0344
	DW-Resin-3	3/3/2023	0.0332	0.114	0.0267	0.0802
	Filter Media Control Sample	3/7/2023	0.0126	0.0441	0.0323	0.0304
Orofino	WT-Sludge-1	3/20/2023	0.998	0.459	0.815	0.305
	WT-Sludge-2	3/20/2023	0.991	0.390	0.928	0.314
	WT-Sludge-3	3/20/2023	0.624	0.417	0.826	0.324
	WW-Biosolids-1	3/20/2023	0.645	0.447	0.559	0.294
	WW-Biosolids-2	3/20/2023	0.0520	0.399	0.0637	0.253
	WW-Biosolids-3	3/20/2023	0.581	0.446	0.580	0.290
Priest River	WT-Sludge-1	3/1/2023	0.478	0.216	0.416	0.149
	WT-Sludge-2	3/1/2023	0.563	0.146	0.370	0.0969
	WT-Sludge-3	3/1/2023	0.536	0.236	0.876	0.193
	WW-Biosolids-1	3/1/2023	0.598	0.434	0.669	0.309
	WW-Biosolids-2	3/1/2023	0.904	0.533	0.579	0.302
	WW-Biosolids-3	3/1/2023	0.573	0.760	0.251	0.448

Notes:
pCi/g - Picocuries per gram
WT: Water Treatment
WW: Waste Water
DW: Drinking Water
Colorado and North Dakota regulatory standard for disposal of Ra-228 plus Ra-226 is 50 pCi/g.
Montana regulatory standard for disposal of Ra-228 plus Ra-226 is 5 pCi/g.

Summary Discussion:

1) The ranges of results for both Ra-226 and Ra-228 are within the normally encountered range for natural soils with no TENORM influence. While the number of sampled facilities compared to the number of drinking water and wastewater treatment facilities in Idaho is small, the results indicate no radioactive materials contamination that would preclude their disposal in an ordinary landfill or as soil amendments on farmland or ranchland. Additional sampling, especially from the larger facilities found in Idaho's major cities, would help to determine whether TENORM contamination potential exists in other Idaho locations.

2) The Uncertainty and Minimum Detectable Activity (MDA) data shown for all analyzed samples are as expected for analyses at these relatively low levels of activity.

3) The Uncertainty and MDA data shown for the samples analyzed in duplicate indicate that the analyses were performed correctly, given that the Uncertainty values overlap between the original and duplicate samples in all cases.

4) The overall set of data and supporting information indicates that the overall sample receipt, processing, 21-day equilibration and spectrum analysis process was performed correctly.

Summary: The radioactive material concentration results as reported by Pace Laboratories here appear to be valid and useable without restriction.

Were any issues or discrepancies noted on the Sample Receipt Checklist (a.k.a. Non-Conformance Form)? Identify and discuss.

No issues or discrepancies were noted.

Were sample Chain-of-Custody (CoC) forms complete? Describe.

CofC forms were provided and are complete.

Were the requested analytical methods in compliance with project requirements (i.e., QAPP, SAP, etc.)? Explain and, if not in compliance, discuss how this affects the data.

Yes. The analytical methods used were as requested.

Were samples received in good condition within method specified requirements? Explain any exceptions and how sample conditions may affect the results.

Pace noted that the samples were received in good condition and met specified requirements..

7. LABORATORY COMPLIANCE WITH PROJECT REQUIREMENTS

Were samples analyzed within method-specified or technical holding times? Explain any exceptions and how this may affect the results.

Holding time requirements do not apply to these samples which were analyzed for long-half life radioactive constituents.

Do the laboratory reports include all constituents requested to be analyzed on the CoC or under the QAPP, SAP, or other applicable documents? Explain.

Yes. Samples were analyzed via gamma spectrometry for Ra226 and Ra228, after 21-day sealed radon equilibration, as requested.

Were reported units appropriate for the associated sample matrix/matrices and method(s) of analyses? Explain.

Yes.

Were detection limits reported by the laboratory in accordance with the project requirements? Discuss and list.

Yes: The detection limits reported are acceptable.

Results qualified by the laboratory based on the laboratory reporting limit. Discuss, as needed.

8. LABORATORY QA/QC

8a. Continuing Calibration Verification (CCV) Standard

Was there indication from the laboratory that the initial or CCV results were within acceptable limits? Explain and include discussion on how any out-of-control results affect the accuracy of the data.

The data sheets provide evidence that the analytical results were within acceptable limits.

8b. Laboratory Blank Samples

Was the total number of method blank samples prepared equal to at least 5% (1 in 20) of the total number of samples, or analyzed as required by the method? Explain.

Blank samples equaled more than 5% of the total number of samples.

Were laboratory blank samples free of analyte contamination? Explain.

Yes.

8c. Laboratory Control Samples (LCSs)

Was the reference material used for the laboratory control standard (LCSs) the correct matrix and concentration? Explain and include a discussion on how any matrix differences affects the accuracy of the data.

The Pace data sheets indicate that the LCS's were appropriate.

Was the total number of LCSs analyzed equal to at least 5% (1 in 20) of the total number of samples, or analyzed as required by the method? Explain.

Yes.

Were LCSs prepared the same way as the associated samples? Explain and include a discussion of how any deviations affect the accuracy of the data.

The Pace reports indicate no differences in LCS preparation vs primary sample preparation.

Were LCS/LCSD percent recoveries and LCS/LCSD RPDs within laboratory QC limits? Explain and discuss on how any out-of-control results affect the accuracy of the data.

Yes. There were no out of control results noted.

8d. Matrix Spike / Matrix Spike Duplicates

What project-specific samples were used to prepare the MS and MSD samples?

No. An MS/MSD sample was not required by the QAPP

Was the total number of MS samples prepared equal to at least 5% (1 in 20) of the total number of samples, or analyzed as required by the method? Explain.

NA.

Were MS percent recoveries and all MS/MSD relative percent differences (RPDs) within data validation or laboratory QC limits? Explain and include a discussion on how this affects the data.

NA.

8e. Laboratory Duplicates

Were laboratory duplicate RPD values within laboratory-specified limits? Explain and include discussion of how this affects the data.

Yes.

8f. Surrogates

Were surrogate recoveries within laboratory QC limits? Explain and include discussion on how this affects the data.

Surrogate recoveries were not reported. The Pace data sheets indicate that QC limits were met, showing no discrepancies.

9. FIELD QA/QC

9a. Trip and Field Blanks

Were the number of equipment, trip, or field blanks collected equal to at least 10% of the total number of samples, or as required by the project requirements, QAPP, or SAP? Explain and include how this affects the data.

No equipment, trip or field blanks were required by the QAPP.

Were the trip blank, field blank, and/or equipment blank samples free of analyte contamination? Explain and include discussion of how this affects the data.

NA.

9b. Field Duplicates

Were the field duplicates collected as required by the project requirements, QAPP or SAP? Identify the natural and duplicate pairs.

The following is a list of the natural sample and its corresponding field duplicate:

L1593797 Greenhill

DW-Resin-1/DW-Resin-Dup

L1593799 Fruitland

WT-Sludge-1/WT-Sludge-DUP
WW-Biosolids-1/WW-Biosolids-Dup

L1594711 Glennsferry

WT-Pacbasin1/WT-Pacbasin-Dup
WW-Sludgeg-1/WW-Sludge-Dup

L159821 Orofino

WT-Sludge-1/WT-Sludge-Dup
WW-Biosolids-1/WW-Biosolids-Dup

L1598520 - Moyie Springs

Moyie Springs-WW-Sludge-1/Moyie Springs-WW-Sludge-Dup
Moyie Springs-WT-Sludge-1/Moyie Springs-WT-Sludge-Dup

L1598523 Priest River

WT-Sludge-1/WT-Sludge-Dup
WW-Biosolids-1/WW- Biosolids -Dup

Were field duplicate RPD values within data validation QC limits? Explain and include discuss of how this affects the data.

Yes. The Pace data sheets demonstrate uncertainty results for the duplicate and primary sample analyses that overlapped.

10. OTHER

Did EPA or other entities collect split samples? If so, explain how those results compare to the natural sample.

No field-split samples were not collected. The Pace laboratory process for drying and splitting samples is more comprehensive than could be applied in the field.

Other comments or observations.

11. SUMMARY OF QUALIFIED DATA

None.

12. DEVIATIONS FROM THE QAPP

List and discuss deviations from the QAPP identified during this review.

The Pace laboratory analysis protocol met all applicable analytical standards.
No deviations from the QAPP regarding the field sampling procedures were noted.

13. ACCEPTABILITY AND USABILITY OF THE DATA

Review of the chain of custody forms and laboratory case narratives indicate that proper chain of custody was maintained. The appropriate preparation and analysis methods were performed on the samples based on the intended use of the data. The cooler temperatures were measured upon laboratory receipt and were within control limits. All samples were received preserved, in intact, and in good condition. All samples were analyzed within method holding time requirements.

Laboratory quality control (QC) sample analyses performed for each analytical method are summarized as part of the laboratory analytical package.

The overall set of procedures and the analytical methods and results associated with this study are considered to be essentially in compliance with applicable portions of EPA's SW-846 Method.

The following verification and manual validation checks were performed as part of this project:

1. Requested methods were performed;
2. Method dates for handling, preparation and analysis were present as appropriate;
3. Sample-related QC data and QC acceptance criteria were provided in the laboratory report and linked to the project samples including the field QC samples (trip blanks);
4. Spike analytes were utilized as appropriate;
5. Sample holding time review: Not applicable to the long half life radioactive analytes;
6. Frequency of QC sampling was checked and considered appropriate; and
7. Sample results were evaluated by comparing sample-related QC data to appropriate data validation guidelines.

Precision

Precision is the measure of agreement among individual measurements of the same property under similar conditions. Precision for this project has been expressed in terms of the relative percent difference (RPD) between two samples. Duplicate samples can be evaluated quantitatively for precision only when contaminants are detected in both the sample and the duplicate. Duplicates with RPDs within the control limits indicate adequate sampling practices and/or good analytical precision. Duplicates with RPDs outside the control limits may result from inappropriate sampling procedures, matrix interferences, or non-homogeneity of the sample matrix. In addition, poor precision can be attributed to deviations from the analytical methodology or to poor reproducibility of target analyte concentrations at or near the detection limits.

Precision was evaluated for this project by comparing field duplicate results and laboratory control sample/laboratory control sample duplicate (LCS/LCSD) RPD results for project samples.

Accuracy

The assessment of accuracy is evaluated by comparing the percent recoveries (%R) computed from the known concentration of analyte spikes and their recovered concentration versus the analytical method acceptance criteria. Spike recoveries provide an indication of bias, where the reported data may either overestimate or underestimate the actual concentration of detected

compounds and/or the detection limits. Accuracy was assessed using LCS/LCSD recovery data for project samples. All LCS/LCSD and internal standard results were within applicable limits.

Representativeness

Representativeness of the environmental sample analytical data was assessed by evaluating holding times and laboratory method blank results.

- All samples were analyzed within the method-required preparation. 21-day sealed equilibration for analysis of radon-generating samples is appropriate for these analyses of Ra226 and Ra228 concentrations.
- Method Blanks. All method blanks were free of contamination or did not require qualification.

Comparability

All samples were analyzed using appropriate analytical methods. Sample results were reported in appropriate units. The analytical methods are considered acceptable for generating analytical data for the purposes of this project.

Completeness

Completeness is the quantitative measure of the amount of data obtained from a measurement process compared with the amount expected to be obtained under the conditions of measurement. It confirms that the contractor and laboratory have provided the deliverables required by the contract, method, and/or project plan. Data collection for this project segment are considered to be complete, although additional samples, provided by other wastewater treatment and water treatment facilities in Idaho, would provide additional useful information if samples can be acquired during a future project segment.

Sensitivity

MDL results were determined to be acceptable.

Summary

The analytical data are considered acceptable and have met the quality control and quality assurance objectives and goals of this project. No data were rejected. All results, as qualified, are considered usable for meeting project objectives.