

Evaluating Potential Contamination in Port Bay

Interim Report

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Evaluating the chemical levels of soil and groundwater at several sites near the tailings ponds in Rockport

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Executive Summary

We measured the levels of several chemicals, as possible indictors of contamination

from the tailings ponds near Port Bay, including mercury (Hg), uranium (U), radium-226

(Ra-226), as well as polycyclic aromatic hydrocarbons (PAHs). Soil and groundwater

samples (< 1m) were collected at five sites near the tailings ponds in November and

December 2022. Hg concentrations in groundwater were below the detection limit (0.0001

mg/L), U concentrations were in the range of < 0.001 - 0.039 mg/L, and Ra-226

concentrations were in the range of 1.19 - 2.06 pCi/L. These levels are generally lower than

the EPA drinking water standards, but the U concentration at one site was higher than EPA's

Maximum Contaminant Level (MCL, 0.03 mg/L), indicating possible contamination from

the ponds. Total concentrations of 16 US EPA PAHs ranged from 73.6 ng/g to 193.2 ng/g in

surface and deep soils at the sampling sites. These levels are slightly lower than those

reported in adjacent bays sediments, and significantly lower than regions with high

petroleum pollution. The composition of PAHs at these sites suggested that incomplete

combustion of coal and biomass may be the major contamination source. While these results

overall showed a low level of concern in terms of the potential contamination from the

tailings ponds, more chemicals such as arsenic and chromium need to be analyzed, and more

spatial and temporal coverage is also needed, to gain a comprehensive understanding of the

potential contamination to the Port Bay and surrounding areas.

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1. Introduction

In January 2022, an Aransas County Commissioner reached out to the Mission-Aransas NERR regarding long standing community concerns about potential contamination from the Sherwin Alumina storage ponds (i.e., tailings ponds) affecting Port Bay. These concerns were amplified following the release of a YouTube video (www.youtube.com/watch?v=H72F-TnDKps) in December 2021, which suggested that the powerful winds and storm surge associated with Hurricane Harvey may have mobilized contaminants from the tailings ponds into Port Bay, resulting in potential risks to ecological and human health.

Of the various pollutants released during aluminum production from bauxite, Mercury (Hg) and total petroleum hydrocarbons (TPHs) are relevant in the context of risk prioritization (Donoghue et al., 2014; Oral et al., 2019). Radionuclides such as Uranium (U) and Radium (Ra), which can be derived from bauxite (Oral et al., 2019), are also of concern. If environmental media in Port Bay are found to be contaminated, the characterization of these chemicals can provide useful information as to whether the Port Bay is of environmental concern, and whether the source of contamination may be from bauxite residues. Perhaps more importantly, a groundwater characterization study performed by Golder Associates Inc. in 2018 found that U and Ra exceeded action levels in groundwater adjacent to the ponds. Therefore, concentrations of these radionuclides in environmental media in Port Bay can be used as an indicator of bauxite contamination from the nearby tailings ponds, and there is a need for reevaluation.

In addition to radioactive nuclides, the generation of TPH, polycyclic aromatic hydrocarbons (PAHs) in particular, can also occur at different stages of the production of aluminum. For instance, the Hall-Héroult process could lead to production of PAHs from the carbon anodes used in the electrolysis cells (e.g., Kvande and Drabløs, 2014; Mercier et al., 2011). As PAHs are mutagenic and carcinogenic, can bioaccumulate in food chains, and thus eventually impact human health (Eisler, 1987; Kennish, 2002), monitoring their concentrations near the Port Bay regions will provide information on the potential effect of bauxite contamination from the tailings ponds.

While the production and treatment history of the ponds is relatively unknown, qualitative evidence from Google Earth satellite images suggests that the color of the ponds (attributed to bauxite) has been changing over time. Severe weather events can cause seepage, runoff, and complete failure of tailings ponds; thus the 2017 Hurricane Harvey may have been a major catalyst for the dramatic change in color observed in the ponds pre- and post-hurricane. Combined with the proximity of the ponds to Port Bay, the hydrology of the area, and the intensity of the storm surge and winds, it is reasonable to suggest that these color changes may be due to the redistribution of contaminated environmental media from the tailings ponds into nearby waters, soils and sediments. Alternatively, chemicals from the tailings ponds may be leached and percolated to Port Bay through the aquifer and groundwater, as groundwater discharge has long been considered an important pathway to export freshwater, with chemicals, to coastal ocean (Moore, 1996).

Unfortunately, there is a paucity of historical contaminant data for Port Bay, though TCEQ has been intermittently collecting water quality data at the bridge of TX-188 (no sediment data was collected). To our knowledge, there is no other data available for water or sediment in Port Bay to inform conclusions about potential risk. The goal of this project is to evaluate the potential contamination from the tailings ponds to the adjacent groundwater and soil. Specifically, we measured the levels of Hg, U, Ra and TPHs, in groundwater and soil samples from 5 locations near the tailings ponds.

2. Materials and Methods

2.1. Sampling Sites

Soil samples and groundwater samples were collected at 5 sites near the Port Bay in November and December of 2022. Specifically, Sites A (N28°0'49.6", W97°10'32.2") and B (N28°0'54.7", W97°12'9.7"), situated on the roadside in close proximity to the ponds, were visited on November 10, 2022, while Sites C (N28°0'16.1", W97°9'41.4"), D (N27°58'43.4", W97°10'60"), and E (N28°2'52.9", W97°9'29.5"), located along the coastal line of Port Bay (Figure 1), were sampled on December 6, 2022.

At each site, surface (ca. 5 cm) and deep (ca. 1 m deep) soil samples were collected using an auger (AMS Signature Series Soil Augers, Fondriest), placed in zip-loc bags, and transferred into a -20 °C freezer once returned to the lab within the same day. Depending on

the sampling sites, the waiting time for groundwater to partially fill the drilled hole varied from ca. 10 min to over 1 hour. Once the drilled holes were filled with water, triplicate samples of ca. 1.5 L groundwater were drawn using a pre-rinsed syringe into the bottles with preservatives, which were provided and prepared by PACE Analytical, an EPA-certified lab. Soil samples were used for total petroleum hydrocarbon (TPH) analysis at UTMSI. Groundwater samples were sent to PACE Analytical for concentrations of mercury (Hg), and activity levels of Uranium (U) and Radium-226 (Ra-226), within 7 days after collection. Prior to TPH analysis, a fraction of soil samples (ca. 10 g) was freeze-dried for at least 48 hours to remove residual water.

2.2. Analytical Methods

2.2.1. TPH extraction and analysis

TPH, including both polyaromatic hydrocarbons (PAHs) and n-alkanes, from soil samples were analyzed following the protocol of Wang et al. (2012). Briefly, approximately 5 g of freeze-dried soil samples were extracted with an accelerated solvent extraction (ASE300, DIONEX, USA) using a mixture of acetone and dichloromethane (2000 mL; 1:1 v/v). Deuterated hexadecane (Hex-d₃₄) and phenanthrene (Phe-d₁₀) were spiked into each sample as internal standards to calculate the recovery rates. The extraction cells were heated to 100 °C until the pressure of 10 MPa was reached. The static time was 5 min, with a flush volume of 60%, and a purge time of 90 s. The final volume of the extract was approximately 30-40 mL and was further concentrated with methylene chloride (DCM) to 2 mL by gently blowing the samples with N₂ gas.

Both PAHs and *n*-alkanes were analyzed using gas chromatography coupled with a mass spectrometer (GC-MS; Shimadzu, GCMS-QP2020). A siloxane-based column (SH-Rxi-5Sil; 30 m × 0.25 mm i.d., film thickness 0.25 μm) was used. For PAHs, 16 priority PAHs listed by the US EPA were measured under selective ion monitoring mode (SIM), including naphthalene (Nap), acenaphthene (Ace), acenaphthylene (Acy), fluorene (Flu), phenanthrene (Phe), anthracene (Ant), fluoranthene (Flua), pyrene (Pyr), benzo[a]anthracene (BaA), chrysene (Chr), benzo[b]fluoranthene (BbF), benzo[k,j]fluoranthene (BkF), benzo[a]pyrene (BaP), indeno[1-3]pyrene (InP), dibenzo[a,h]anthracene (DBA), and benzo[ghi]perylene (BgP). Helium (He) was used as carrier gas at a column flow rate of 2 mL min⁻¹, and a split ratio of 10 under linear velocity mode. The oven temperature was held

at 40 °C for 1 min, increased to 240 °C at a rate of 10 °C min⁻¹, then increased to 280 °C at a rate of 4 °C min⁻¹ and held for 10 min, and finally increased to 320 °C at a rate of 10 °C min⁻¹ and held for 5 min. The injection and ion source temperatures are set to be 250 °C and 260 °C, respectively. The injection volume was 1 μ L.

The *n*-alkanes with carbon number ranging from 8 to 39 (C₈–C₃₉) were monitored by the GC-MS under full scan mode with mass/charge ratios of 59. Helium was used as a carrier gas with a column flow rate of 2 mL min⁻¹, and the split ratio was 15 under linear velocity mode. The oven temperature was held at 50 °C for 1 min, increased to 280 °C at a rate of 8 °C min⁻¹ and held for 36 min, and then further increased to 320 °C at a rate of 10 °C min⁻¹. The injection and ion source temperatures are set to be 325 °C and 250 °C, respectively. The injection volume was 1 μL.

For quality assurance/quality control (QA/QC), a method blank was analyzed by the same procedure as the samples to determine any background contamination, and neither PAHs nor n-alkanes were detected. The average recovery rate was 103% for PAHs and 116% for n-alkanes based on spiked internal standards (Phe-d₁₀ and Hex-d₃₄; n=20).

2.2.2. Hg, U, and Ra-226 analyses

Groundwater samples were submitted to PACE lab to analyze mercury (Hg), Uranium (U), and Radium-226 (Ra-226). To be brief, the EPA method 7470A was used for Hg analysis (https://www.epa.gov/sites/default/files/2015-07/documents/epa-7470a.pdf). The EPA method D5174 was used for U analysis

(https://www.epa.gov/dwanalyticalmethods/approved-drinking-water-analytical-methods), and the Standard Method 7500-Ra B

(<u>https://www.nemi.gov/methods/method_summary/7616/</u>) was used for Ra-226 analysis.

Detection limit is 0.0001 mg/L for Hg analysis, 0.001 mg/L for U, and less than 0.09 pCi/L for Ra-226.

2.3. Statistical Analysis

Statistical analyses, including t test and analysis of variance (ANOVA), were conducted in Excel. Principal component analysis (PCA), which is a multivariate regression analysis examining compositional differences among samples, was conducted using R (version 4.2.3). Concentrations of each parameter (e.g., Hg, U, Ra-226, and different PAHs)

were standardized by subtracting the means and dividing by the standard deviations before PCA.

3. Results

3.1.Hg, U, and Ra-226 results in groundwater

Concentrations of Hg in the groundwater were below detection limit (< 0.0001 mg/L) at all 5 sites (Table 1). U concentrations ranged from below detection limit (< 0.001 mg/L) at Site D to ca. 0.039 mg/L at Site B, and were significantly different among the sites (ANOVA; p = 0.02). Subsequent t-test further confirmed that the U concentration at Site B was significantly higher than that at Site D (p = 0.04) and Site E (p = 0.05), and U concentration at Site C was significantly higher than that at Site D (p = 0.01).

Similar to U, the highest level of Ra-226 was found at Site B, with a range from 1.19 pCi/L at Sites C and E to 2.06 pCi/L at Site B. However, there were no differences in Ra-226 level among the 5 sites (ANOVA, p = 0.80).

The U concentrations measured at the 5 sites are lower than the EPA's Maximum Contaminant Level (MCL) of 0.03 mg/L for drinking water, except for Site B at a concentration of 0.039 mg/L. However, it should be noted that the EPA MCL standard applies specifically to drinking water and not necessarily to groundwater. The Ra-226 levels at all sampling sites were below EPA's MCL of 5 pCi/L.

3.2.TPH results in soil

Concentrations of PAHs in surface soil ranged from 73.6 ng/g dried soil at Site A to 140.6 ng/g at Site D. Concentrations of PAHs in deep soil (ca. 1 m deep) were generally higher than those in surface soil, ranging from 77.5 ppb at Site D to 148.5 ppb at Site B (Table 2; Figure 2). There was no difference among all surface samples (ANOVA, p = 0.1). However, the PAH concentration in the deep soil at Site C was lower than that at Site B (p = 0.03) and Site D (p = 0.04).

PAHs are often grouped according to their molecular weights or number of aromatic rings, those with 2 or 3 rings as low molecular weight (LMW) ones and 4 or above as high molecular weight (HMW) ones. PAHs in the soil samples were dominated by LMW PAHs, particularly phenanthrene and anthracene, accounting for ca. 65 - 100% of total PAHs. In contrast, HMW only constituted a minor fraction of total PAHs (0 – 35%). Fluoranthene and pyrene were the only detectable PAHs from the soil samples.

The concentrations of *n*-alkanes in surface soil ranged from 4184.8 ppb at Site B to 5981.2 ppb at Site D. Similar to PAHs, concentrations of *n*-alkanes were higher in deep soil than those in surface, ranging from 4562.3 ppb at Site C to 8145.1 ppb at Site E (Table 3; Figure 3). *n*-Alkanes were dominated by the ones with a carbon number ranging from 21 to 29.

4. Discussion

Uranium (U) is a naturally occurring radioactive element that existed when the Earth was born, or primordial. The Ra-226 is one element in the U-238 decay series, a decay product of thorium-230 (Th-230) and has a half-life of 1600 years. U and Ra-226 exist naturally and are soluble, but their concentrations in groundwater may depend on the types or ages of specific minerals. The U and Ra-226 measured from the groundwater at the five sampling sites were below the EPA MCL for drinking water. This result indicated that the groundwater quality is within acceptable limits in the aspect of these two chemicals.

To compare with published results, the Ra-226 levels measured in this work are within the reported range (1.2 - 11.4 pCi/L) in drinking water from five aquifers (Hickory, Gulf Coast, Dockum, Edwards-Trinity and Ogallala aquifers) in Texas (Landsberger and George, 2013), as well as in other regions (e.g., 0.05 - 13.3 pCi/L in Brazil, Almeida et al., 2004; generally 1 - 5 pCi/L in US, Michel and Jordana, 1987). In addition, the Ra-226 levels from this work agree with the 2019 Preliminary Groundwater Assessment Report (0 - 3.1 pCi/L) near the Port Bay region (Texas Commission on Environmental Quality, 2019). Concentrations of U from this work (< 0.001 - 0.039 mg/L) agree with the reported values in water wells of the Edwards-Trinity aquifer in Texas (< 0.001 - 0.154 mg/L, Hudak, 2018), as well as in the High Plains (HP) and Central Valley (CV) aquifers of US (mean concentration of ca. 0.01 mg/L, Nolan and Weber, 2015). The 2019 Preliminary Groundwater Assessment Report reported a U level of 0.0033 - 0.27 mg/L, with most sampled wells exceeding the MCL (Texas Commission on Environmental Quality, 2019). The results from this work are at the lower end of the range. However, U concentration at Site B was slightly higher than the MCL threshold of 0.03 mg/L, which warrants further attention.

TPHs, particularly PAHs, in the solid phase of the aquifer at the 5 sites were found to be at similar level as what were previously measured from other local bays, such as Corpus Christi, Mission-Aransas, and Matagorda bays (unpublished data in Liu Lab; Liu et al.,

2011). PAHs concentrations at the study sites were also comparable to those measured in the surface sediments from Gulf of Mexico (e.g., Wade et al., 2008). The reported concentrations in this study were also in the range, even though at the lower end, of soils collected over a much larger scale. A meta-study showed a range of 4.8 to 186000 ng/g of total PAHs in soils across the globe, with a rough mean of ca. 200 ng/g in the North American prairie regions (Wilcke, 2007). The dominance of naphthalene and phenanthrene in this study (Figure 2) is consistent with the findings of significant contributions of naphthalene and phenanthrene when total PAHs are relatively low (Wilcke, 2007).

In contrast, PAHs from soil samples in this work were roughly an order of magnitude lower than the surface sediment from Galveston bay (over 2000 ng/g, Santschi et al., 2001), a potentially heavily polluted water body. The nature of the sample (i.e., soil samples vs. sediment samples), as well as sampling locations (i.e., light-traffic roadside vs. highly industrialized seaport), may be the major causes of the observed discrepancies. For example, soil from deeper layers may have less exposure of PAHs deposition from the air, while sediments often receive such pollutants from air deposition through the water column (often in particulate forms), or direct contamination through petroleum or gasoline/diesel combustion due to shipping traffic.

Statistical analyses further revealed the compositional differences among sampling sites. Specifically, principal component analysis (PCA) is often used to distinguish compositional patterns among environment samples, particularly when many chemical parameters are available for the samples (e.g., Xue et al., 2011; Yunker et al., 1995). In the present work, the PCA based on the measured Hg, U, and Ra-226 shows that Site B is distinctly different from all the other sites, with much higher Ra-226 and U values (Figure 4). Considering that Site B is closer to the pond than the other 4 sites (Figure 1), Ra-226 and U levels at Site B indeed may have been influenced by the tailings ponds, although other possible sources (e.g., U naturally exists in soils and sediments) cannot be fully excluded. More spatial coverage is also needed to confirm this.

The PAH composition was also analyzed using PCA. With principal component 1 (PC 1) explaining over 43% of the variance, and the other 33% of the variance attributed to PC 2, the 5 sites are rather similar in terms of their PAH composition, as the major difference is between surface and deep samples (Figure 5). Higher levels of PAHs, high molecular

weight PAHs in particular, may be better preserved in deep soil samples due to either the blockage of sunlight that can photo-transform PAHs, or the abundance of clay minerals that HMW PAHs preferentially adsorb to (e.g., Zhao et al., 2023; Figures 2 and 5). Nevertheless, the similar PAHs concentrations and compositions among different sampling sites suggest that the influence from the tailings pond on PAHs may be minimal, if any. The lower levels of PAHs at these sites, when compared to adjacent regions, also point to the limited influence of tailings ponds in PAHs.

The composition of PAHs can be used to derive the contamination sources. For instance, the ratios of Ant to Ant + Phe and Flu to Flu + Pyr can help differentiate the sources of PAHs. An Ant to Ant + Phe ratio greater than 0.1 indicates that PAHs are sourced from incomplete combustion, while ratio smaller than 0.1 suggests sources of petroleum products (e.g., spilled oil; Wang et al., 2012; Yunker et al., 2002). Similarly, whether PAHs are originated from oil source, coal and biomass burning, or incomplete combustion of oil products can be determined by the Flu to Flu + Pyr ratio, with less than 0.4 indicating an oil source, exceeding 0.5 indicating coal and biomass burning, and between 0.4 and 0.5 indicating incomplete combustion of oil products. The high Ant to Ant + Phe ratios detected at the sampling sites in this work suggest that PAHs were generally from incomplete combustion. Together with the Flu to Flu + Pyr ratio, the results suggest that oil source or incomplete coal and biomass burning potentially may have a major effect on PAHs in the sampled soils (Figure 6), which could be a result of aluminum production from bauxite (e.g., Busetti et al., 2014; Oral et al., 2019), but could also originate from normal activities (e.g., cars, boats, etc.). Therefore, the composition of PAHs in the sampling sites did not provide a decisive linkage to the tailings ponds.

5. Conclusion

Our study showed that the concentrations of Hg (below detection limit of 0.0001 mg/L), U (< 0.001 - 0.039 mg/L), and Ra-226 (1.19 - 2.06 pCi/L) in the groundwater of the 5 sampling sites were generally lower than the EPA drinking water standards, suggesting an acceptable quality of groundwater. However, one sampling site closest to the tailings pond did show a higher level of contamination, suggesting the potential impact could not be excluded. Total concentrations of 16 US EPA PAHs 73.6 - 193.2 ng/g in surface and deep

soil samples. This concentration range is lower than previously reported PAHs level in local bay sediments and is significantly lower than regions with high petroleum pollution. While the compositions of PAHs in these sediments suggest incomplete combustion of coal and biomass may be the major source, more temporal and spatial coverages of the sampling stations would provide more information regarding the origins of the PAHs. Ancillary chemical parameters such as organic carbon contents, nutrient levels, as well as grain size distribution can also help to decipher the geochemical behaviors of the contaminants. Future work includes monitoring the contamination levels of waters and sediments in the Port Bay, which should offer further insights into sources of contamination. Other elements including chromium and arsenic will also be measured to be more comprehensive on the list of contaminants in Port Bay. These relevant data will be reported in the final report of this project, which is expected to be completed in March 2024.

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Table 1. Hg, Ra-226, and U concentrations in the groundwater from the 5 sites.

Sites	Hg (mg/L)	Ra-226 (pCi/L)	Uranium (mg/L)
Soil Site A	< 0.0001	1.254 ± 0.465	0.015 ± 0.023
Soil Site B	< 0.0001	2.062 ± 2.173	0.039 ± 0.015
Soil Site C	< 0.0001	1.193 ± 0.803	0.011 ± 0.002
Soil Site D	< 0.0001	1.940 ± 1.155	< 0.001
Soil Site E	< 0.0001	1.190 ± 0.125	0.004 ± 0.004

Table 2. Concentrations of PAHs at different sites. Unit: ppb or ng/g dried weight sediment. Surface refers to the depth of 0.05m,

while deep refers to~1m.

PAHs (ppb)	Site A	Site A	Site B	Site B	Site C	Site C	Site D	Site D	Site E	Site E
	Surface	Deep	Surface	Deep	Surface	Deep	Surface	Deep	Surface	Deep
Naphthalene	7.3 ± 10.3	13.5 ± 19.0	7.0 ± 9.9	26.4 ± 0.8	18.7 ± 0.2	7.6 ± 10.7	21.1 ± 0.6	24.7 ± 0.1	15.3 ± 0.2	16.0 ± 0.0
Acenaphthylene	0 ± 0	0 ± 0	7.1 ± 10.1	0 ± 0	9.1 ± 12.9	0 ± 0				
Acenaphthene	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
Fluorene	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
Phenanthrene	30.8 ± 0.9	55.5 ± 4.3	32.8 ± 0.3	57.9 ± 2.8	20.8 ± 29.5	33.3 ± 0.1	32.9 ± 1.1	48.9 ± 0.3	33.8 ± 0.9	34 ± 0.8
Anthracene	35.6 ± 0.3	61.6 ± 3.7	35.6 ± 0.2	64.2 ± 3.1	44.5 ± 0.1	36.6 ± 0.1	38.0 ± 2.2	53.6 ± 1.6	37.6 ± 1.1	37.7 ± 0.8
Fluoranthene	0 ± 0	0 ± 0	12.3 ± 17.3	0 ± 0	0 ± 0	0 ± 0	27.5 ± 1.0	38.3 ± 1.1	0 ± 0	26.5 ± 1.0
Pyrene	0 ± 0	0 ± 0	20.5 ± 0.2	0 ± 0	0 ± 0	0 ± 0	21.1 ± 0.6	31.7 ± 0.0	0 ± 0	11.1 ± 15.7
Benz[a]anthracene	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
Chrysene	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
Benzo[b]fluoranthene	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
Benzo[k]fluoranthene	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
Benzo[a]pyrene	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
Indeno[1,2,3-	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
cd]fluoranthene										
Dibenz[a,h]anthracene	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
Benzo[ghi]perylene	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0

Table 3. Concentrations of n-Alkanes at the 5 sites. Unit: ppb or ng/g dried weight sediment. Surface refers to the depth of 0.05m,

while deep refers to~1m.

<i>n</i> -Alkanes	Site A	Site A	Site B	Site B	Site C	Site C	Site D	Site D	Site E	Site E
(ppb)	Surface	Deep	Surface	Deep	Surface	Deep	Surface	Deep	Surface	Deep
C8	0 ± 0	63.6 ± 4.7	27.8 ± 39.3	37.8 ± 53.4	65.3 ± 5.5	25 ± 0.6	64.3 ± 2.3	63.1 ± 5.6	0 ± 0	45.5 ± 2.6
C9	64.0 ± 4.1	74.8 ± 3.4	48.7 ± 4.0	83.9 ± 2.7	60.9 ± 9.5	44.6 ± 0.0	62.1 ± 1.4	76.7 ± 9.9	0 ± 0	68.8 ± 2.7
C10	83.3 ± 1.8	89.3 ± 2.7	53.0 ± 1.3	94.8 ± 7.8	73.9 ± 4.1		63.2 ± 3.7	46.0 ± 65.1	0 ± 0	77 ± 0.6
C11	125.4 ± 4.8	127.8 ± 32.9	84.2 ± 4.1	126.7 ± 3.1	100.3 ± 3.4	95.7 ± 5.6	73.8 ± 5.7	127.5 ± 9.1	46.1 ± 65.2	98.1 ± 6.8
C12	137.1 ± 0.8	151.5 ± 15.3	132.1 ± 0.5	158.8 ± 3.4	133.4 ± 3.7	108.8 ± 1.9	92.8 ± 2.6	160.2 ± 7.9	0 ± 0	131.9 ± 8.9
C13	180.4 ± 1.8	182.1 ± 27.8	117.6 ± 3.9	179.7 ± 6.5	144.5 ± 11.1	127.0 ± 0.5	122.3 ± 1.5	194.3 ± 13.0	0 ± 0	0 ± 0
C14	203.8 ± 5.1	218.3 ± 17.3	238.9 ± 0.7	226.3 ± 10.8	218.5 ± 7.4	162.7 ± 5.2	141.0 ± 9.2	236.2 ± 4.6	180.9 ± 5.4	204.8 ± 8.0
C15	97.4 ±	122.1 ±	141.1 ± 6.5	106.8 ±	$184.7 \pm$	83.1 ±	137.3 ± 5.5	124.6 ±	97.6 ±	187.7 ±
	137.8	172.6		151.0	11.1	117.5		176.2	138.1	9.3
C16	216.4 ± 2.9	234.7 ± 24	289.2 ± 14.0	260.3 ± 10.1	236.7 ± 3.6	180.6 ± 0.6	173.3 ± 0.8	282.3 ± 11.6	210.1 ± 5.6	242.7 ± 2.8
C17	291.6 ± 101.5	155.7 ± 220.2	167.8 ± 0.4	351.3 ± 152.4	258.5 ± 11.8	188.7 ± 3.4	175.6 ± 0.7		225.2 ± 7.7	217.5 ± 10.1
C18	244.1 ± 0.5	271.7 ± 26.1	249.6 ± 5.5	284.3 ± 20.0	239.6 ± 17.4	199.5 ± 0.5	170.3 ± 16.3	314.7 ± 3.6	240.2 ± 5.0	250 ± 6.1
C19	0 ± 0	0 ± 0	78.8 ± 111.4	144.8 ± 204.8	221 ± 8.5	307.1 ± 0.8	175.8 ± 3.1	0 ± 0	0 ± 0	0 ± 0
C20	0 ± 0	0 ± 0	182.7 ± 7.3	300.5 ± 15.6	118.3 ± 167.3	0 ± 0	187.6 ± 12.2	0 ± 0	0 ± 0	260.7 ± 1.1
C21	0 ± 0	319.6 ± 31.8	194.4 ± 0.7	148.3 ± 209.7	242.2 ± 8.9	114.7 ± 162.2	198.0 ± 9.0	351.3 ± 9.1	279.5 ± 21.9	270.5 ± 0.7
C22	297.4 ± 0.8	354.6 ± 38.3	192.4 ± 7.2	158.9 ± 224.7	256.0 ± 13.4	239.6 ± 5.2	237.6 ± 17.9	369.9 ± 6.2	307.0 ± 18.3	335.9 ± 13.7
C23	341.4 ± 7.4	406.2 ± 42.3	213.1 ± 5.7	360.1 ± 23.9	304.4 ± 16.5	270.4 ± 1.9		459.1 ± 9.8	352.3 ± 13.7	429.5 ± 33.0
C24	431.4 ± 26.2	505.7 ± 45.5	260.2 ± 14	406.6 ± 41.2	354.5 ± 14.8	322.6 ± 12.4	486.7 ± 10.6	606.3 ± 16.3	444.6 ± 15.5	665.3 ± 31.8
C25	464.9 ±	43.3 600.0 ±	276.1 ±	426.1 ±	392.3 ±	349.6 ±	603.6 ±	687.0 ±	490.2 ± 4.7	840.4 ±
C23	35.5	51.2	15.9	19.4	31.7	18.1	10.2	12.1	770.2 ± 7.7	46.0
C26	485.6 ±	630.3 ±	288.5 ±	440.2 ±	401.9 ±	376.7 ± 7.4		702.3 ±	541.4 ±	40.0 846.7 ±
C20	35.6	51.4	13.5	23.1	24.2	310.1 ± 1.4	36.3	67.5	52.3	24.9

										Continued
<i>n</i> -Alkanes	Site A	Site A	Site B	Site B	Site C	Site C	Site D	Site D	Site E	Site E
(ppb)	Surface	Deep	Surface	Deep	Surface	Deep	Surface	Deep	Surface	Deep
C27	453.6 ±	578.1 ±	$267.4 \pm$	433.8 ±	404.3 ±	$356.0 \pm$	545.9 ±	626.5 ±	495.2 ± 0.3	730.8 ±
	23.3	19.8	13.5	27.5	20.9	19.2	22.3	75.2		63.4
C28	$410.9 \pm$	495 ± 29.2	238.1 ± 2.6	399.8 ± 7.1	360.7 ± 9.4	$328.3 \pm$	430.2 ± 9.8	548 ± 6.9	450.6 ± 17	$578.4 \pm$
	11.2					8.3				20.1
C29	$395.0 \pm$	$471.1 \pm$	235.6 ± 10	$406.4 \pm$	$335.4 \pm$	$318 \pm$	348.5 ± 9.8	$510.5 \pm$	$410.1 \pm$	462.7 ± 7.9
	10.9	54.9		21.9	44.1	12.9		42.9	34.1	
C30	374.9 ± 2.7	$429.4 \pm$	0 ± 0	0 ± 0	326 ± 30.3	$303.2 \pm$	$266.9 \pm$	471.2 ± 9.3	$189.1 \pm$	$380.9 \pm$
		36.6				8.6	31.8		267.4	20.0
C31	0 ± 0	$240.6 \pm$	0 ± 0	$234.3 \pm$	$157.6 \pm$	0 ± 0	281.1 ± 1.8	$236.2 \pm$	374.6 ± 5.2	365.9 ± 5.1
		340.3		331.3	222.9			334.0		
C32	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	$201.9 \pm$	0 ± 0
									285.6	
C33	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
C34	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
C35	0 ± 0	0 ± 0	$207.8 \pm$	0 ± 0	$292.2 \pm$	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
			293.8		413.3					
C36	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
C37	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	$324.6 \pm$	0 ± 0
									459.0	
C38	$390.8 \pm$	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
	552.7									
C39	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	$453.3 \pm$
										641.1



Figure 1. Sampling sites near the tailings ponds Port Bay area, Rockport, TX.

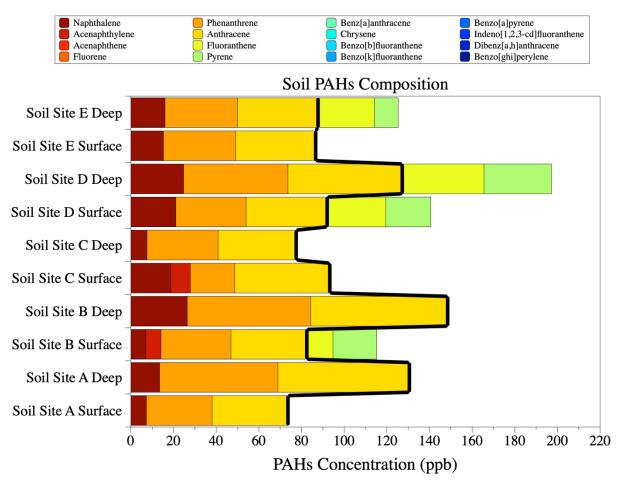


Figure 2. PAH concentrations and compositions at the 5 sampling sites near the tailings ponds. PAHs to the left of the black line are low molecular weight ones, while those to the right of the black line are high molecular weight ones.

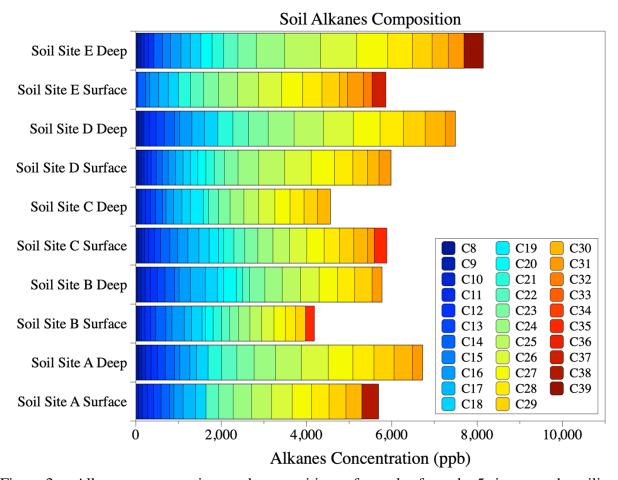


Figure 3. n-Alkanes concentrations and compositions of samples from the 5 sites near the tailings ponds.

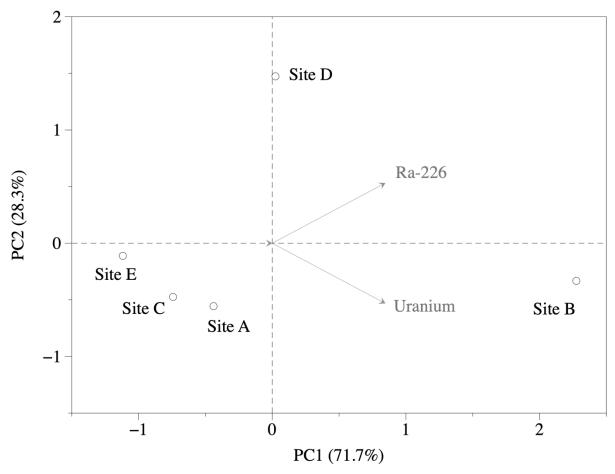


Figure 4. Principal component analysis (PCA) based on measured U and Ra-226 values.

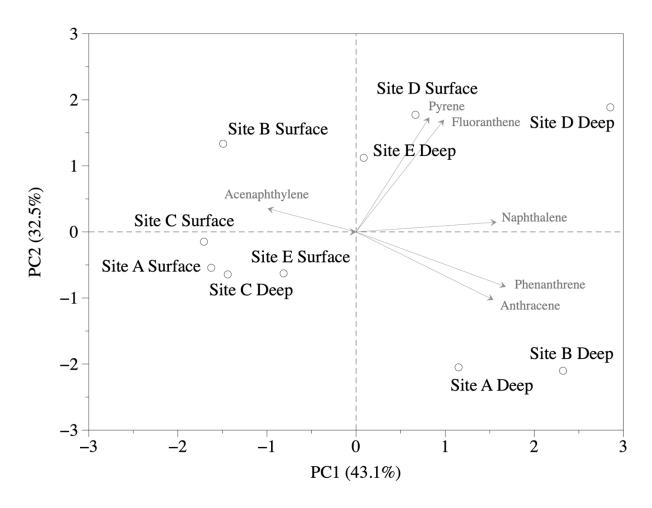


Figure 5. Principal component analysis (PCA) based on the composition of PAHs, with PC 1 explaining 43.1% of the variance, and PC2 32.5% of the rest.

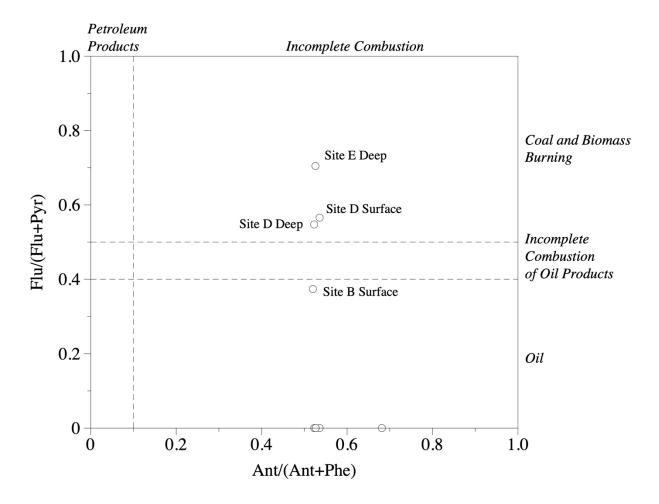


Figure 6. Diagnostics for distinguishing possible sources of PAHs.



Pace Analytical® ANALYTICAL REPORT

December 16, 2022

UTMSI - University of TX Marine Science

Sample Delivery Group: L1566481 Samples Received: 12/10/2022

Project Number:

Description:

Report To: Kaijun Lu

750 Channel View Drive

Port Aransas, TX 78373

Project Manager

















Entire Report Reviewed By: Lori A Vahrenkamp

Results relate only to the items tested or calibrated and are reported as rounded values. This test report shall not be ENV-SOP-MTJL-0068. Where sampling conducted by the customer, results relate to the accuracy of the information provided,

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 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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35

Sc: Sample Chain of Custody

SAMPLE SUMMARY

		_				
1A L1566481-01 Solid			Collected by	Collected date/time 12/08/22 13:00	Received date 12/10/22 10:0	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7471A	WG1973974	1	12/14/22 07:03	12/14/22 18:42	AKB	Mt. Juliet, TN
B L1566481-02 Solid			Collected by	Collected date/time 12/08/22 13:00	Received data	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7471A	WG1973974	1	12/14/22 07:03	12/14/22 18:45	AKB	Mt. Juliet, TN
C L1566481-03 Solid			Collected by	Collected date/time 12/08/22 13:00	Received data	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7471A	WG1973974	1	12/14/22 07:03	12/14/22 18:48	AKB	Mt. Juliet, TN
2A L1566481-04 Solid			Collected by	Collected date/time 12/08/22 11:00	Received data	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7471A	WG1973974	1	12/14/22 07:03	12/14/22 19:17	AKB	Mt. Juliet, TN
2B L1566481-05 Solid			Collected by	Collected date/time 12/08/22 11:00	Received data	
lethod	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7471A	WG1973974	1	12/14/22 07:03	12/14/22 19:20	AKB	Mt. Juliet, TN
2C L1566481-06 Solid			Collected by	Collected date/time 12/08/22 11:00	Received data	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7471A	WG1973974	1	12/14/22 07:03	12/14/22 19:22	AKB	Mt. Juliet, TN
3A L1566481-07 Solid			Collected by	Collected date/time 12/08/22 10:00	Received data	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7471A	WG1973974	1	12/14/22 07:03	12/14/22 19:24	AKB	Mt. Juliet, TN
BB L1566481-08 Solid			Collected by	Collected date/time 12/08/22 10:00	Received data	
Method	Batch	Dilution	Preparation date/time	Analysis	Analyst	Location
			date/time	date/time		



















Mercury by Method 7471A

WG1973974

12/14/22 07:03

AKB

Mt. Juliet, TN

12/14/22 19:27

SAMPLE SUMMARY

3C L1566481-09 Solid			Collected by	Collected date/time 12/08/22 10:00	Received da:	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7471A	WG1973974	1	12/14/22 07:03	12/14/22 19:30	AKB	Mt. Juliet, TN
4A L1566481-10 Solid			Collected by	Collected date/time 12/06/22 15:00	Received da: 12/10/22 10:0	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7471A	WG1973974	1	12/14/22 07:03	12/14/22 19:32	AKB	Mt. Juliet, TN
4B L1566481-11 Solid			Collected by	Collected date/time 12/06/22 15:00	Received da: 12/10/22 10:0	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7471A	WG1973974	1	12/14/22 07:03	12/14/22 19:35	AKB	Mt. Juliet, TN
1C L1566481-12 Solid			Collected by	Collected date/time 12/06/22 15:00	Received da: 12/10/22 10:0	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7471A	WG1973974	1	12/14/22 07:03	12/14/22 19:37	AKB	Mt. Juliet, TN
5A L1566481-13 Solid			Collected by	Collected date/time 12/06/22 16:40	Received da: 12/10/22 10:0	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
lercury by Method 7471A	WG1973974	1	12/14/22 07:03	12/14/22 19:40	AKB	Mt. Juliet, TN
5B L1566481-14 Solid			Collected by	Collected date/time 12/06/22 16:40	Received da: 12/10/22 10:0	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7471A	WG1973974	1	12/14/22 07:03	12/14/22 19:47	AKB	Mt. Juliet, TN
5C L1566481-15 Solid			Collected by	Collected date/time 12/06/22 16:40	Received da:	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7471A	WG1973974	1	12/14/22 07:03	12/14/22 19:50	AKB	Mt. Juliet, TN
6A L1566481-16 Solid			Collected by	Collected date/time 12/06/22 14:10	Received da: 12/10/22 10:0	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location



















Mercury by Method 7471A

WG1973974

12/14/22 07:03

AKB

Mt. Juliet, TN

12/14/22 19:52

4 of 37

SAMPLE SUMMARY

	97 (IVII EE (3 0 11111	,,, ,,, ,			
6B L1566481-17 Solid			Collected by	Collected date/time 12/06/22 14:10	Received da 12/10/22 10:0	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7471A	WG1973974	1	12/14/22 07:03	12/14/22 19:55	AKB	Mt. Juliet, TN
6C L1566481-18 Solid			Collected by	Collected date/time 12/06/22 14:10	Received da 12/10/22 10:0	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7471A	WG1973974	1	12/14/22 07:03	12/14/22 19:57	AKB	Mt. Juliet, TN
7A L1566481-19 Solid			Collected by	Collected date/time 12/06/22 13:50	Received da 12/10/22 10:0	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7471A	WG1973974	1	12/14/22 07:03	12/14/22 20:00	AKB	Mt. Juliet, TN
7B L1566481-20 Solid			Collected by	Collected date/time 12/06/22 13:50	Received da 12/10/22 10:0	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7471A	WG1973974	1	12/14/22 07:03	12/14/22 18:35	AKB	Mt. Juliet, TN
7C L1566481-21 Solid			Collected by	Collected date/time 12/06/22 13:50	Received da 12/10/22 10:0	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7471A	WG1973984	1	12/14/22 07:15	12/14/22 11:51	SRT	Mt. Juliet, TN
BA L1566481-22 Solid			Collected by	Collected date/time 12/06/22 13:30	Received da 12/10/22 10:0	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7471A	WG1973984	1	12/14/22 07:15	12/14/22 11:58	SRT	Mt. Juliet, TN
BB L1566481-23 Solid			Collected by	Collected date/time 12/06/22 13:30	Received da 12/10/22 10:0	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7471A	WG1973984	1	12/14/22 07:15	12/14/22 12:00	SRT	Mt. Juliet, TN
BC L1566481-24 Solid			Collected by	Collected date/time 12/06/22 13:30	Received da 12/10/22 10:0	
M ethod	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
			40/44/00 07 45	40/44/00 40 00	COT	



















Mercury by Method 7471A

WG1973984

1

12/14/22 07:15

SRT

Mt. Juliet, TN

12/14/22 12:03

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 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.

¹Cp

















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Lori A Vahrenkamp Project Manager

L1566481

12/16/22 14:14

1A

SAMPLE RESULTS - 01

Collected date/time: 12/08/22 13:00 L1566

	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
Analyte	mg/kg		mg/kg	mg/kg		date / time	
Mercury	<0.0180		0.0180	0.0400	1	12/14/2022 18:42	WG1973974



















1B

SAMPLE RESULTS - 02

Collected date/time: 12/08/22 13:00

	Result	Qualifier	MDL	RDL	Dilution	Analysis	<u>Batch</u>
Analyte	mg/kg		mg/kg	mg/kg		date / time	
Mercury	<0.0180		0.0180	0.0400	1	12/14/2022 18:45	WG1973974



















10

SAMPLE RESULTS - 03

Collected date/time: 12/08/22 13:00 L156

	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
Analyte	mg/kg		mg/kg	mg/kg		date / time	
Mercury	<0.0180		0.0180	0.0400	1	12/14/2022 18:48	WG1973974



















2A

SAMPLE RESULTS - 04

Collected date/time: 12/08/22 11:00 L15

	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
Analyte	mg/kg		mg/kg	mg/kg		date / time	
Mercury	<0.0180		0.0180	0.0400	1	12/14/2022 19:17	WG1973974



















SAMPLE RESULTS - 05

Collected date/time: 12/08/22 11:00

Mercury by Method 7471A

	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
Analyte	mg/kg		mg/kg	mg/kg		date / time	
Mercury	<0.0180		0.0180	0.0400	1	12/14/2022 19:20	WG1973974



















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SAMPLE RESULTS - 06

Collected date/time: 12/08/22 11:00

	Result	Qualifier	MDL	RDL	Dilution	Analysis	<u>Batch</u>	
Analyte	mg/kg		mg/kg	mg/kg		date / time		
Mercury	<0.0180		0.0180	0.0400	1	12/14/2022 19:22	WG1973974	



















3A

SAMPLE RESULTS - 07

Collected date/time: 12/08/22 10:00 L15

	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch	
Analyte	mg/kg		mg/kg	mg/kg		date / time		
Mercury	< 0.0180		0.0180	0.0400	1	12/14/2022 19:24	WG1973974	



















SAMPLE RESULTS - 08

Collected date/time: 12/08/22 10:00 L15

	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
Analyte	mg/kg		mg/kg	mg/kg		date / time	
Mercury	<0.0180		0.0180	0.0400	1	12/14/2022 19:27	WG1973974



















3C

SAMPLE RESULTS - 09

Collected date/time: 12/08/22 10:00 L156

	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
Analyte	mg/kg		mg/kg	mg/kg		date / time	
Mercury	<0.0180		0.0180	0.0400	1	12/14/2022 19:30	WG1973974



















4A

SAMPLE RESULTS - 10

Collected date/time: 12/06/22 15:00 L156

	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
Analyte	mg/kg		mg/kg	mg/kg		date / time	
Mercury	<0.0180		0.0180	0.0400	1	12/14/2022 19:32	WG1973974



















SAMPLE RESULTS - 11

Collected date/time: 12/06/22 15:00 L15

	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
Analyte	mg/kg		mg/kg	mg/kg		date / time	
Mercury	<0.0180		0.0180	0.0400	1	12/14/2022 19:35	WG1973974



















4C

SAMPLE RESULTS - 12

Collected date/time: 12/06/22 15:00

Mercury by Method 7471A

	Result	Qualifier	MDL	RDL	Dilution	Analysis	<u>Batch</u>
Analyte	mg/kg		mg/kg	mg/kg		date / time	
Mercury	<0.0180		0.0180	0.0400	1	12/14/2022 19:37	WG1973974



















18 of 37

5A

SAMPLE RESULTS - 13

Collected date/time: 12/06/22 16:40 L15

	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
Analyte	mg/kg		mg/kg	mg/kg		date / time	
Mercury	<0.0180		0.0180	0.0400	1	12/14/2022 19:40	WG1973974



















SAMPLE RESULTS - 14

Collected date/time: 12/06/22 16:40

Mercury by Method 7471A

	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
Analyte	mg/kg		mg/kg	mg/kg		date / time	
Mercury	<0.0180		0.0180	0.0400	1	12/14/2022 19:47	WG1973974



















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5C

SAMPLE RESULTS - 15

Collected date/time: 12/06/22 16:40

	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
Analyte	mg/kg		mg/kg	mg/kg		date / time	
Mercury	<0.0180		0.0180	0.0400	1	12/14/2022 19:50	WG1973974



















6A

SAMPLE RESULTS - 16

L15664

Collected date/time: 12/06/22 14:10 Mercury by Method 7471A

	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
Analyte	mg/kg		mg/kg	mg/kg		date / time	
Mercury	<0.0180		0.0180	0.0400	1	12/14/2022 19:52	WG1973974



















6B

SAMPLE RESULTS - 17

Collected date/time: 12/06/22 14:10 L1566481

	Result	Qualifier	MDL	RDL	Dilution	Analysis	<u>Batch</u>	
Analyte	mg/kg		mg/kg	mg/kg		date / time		
Mercury	< 0.0180		0.0180	0.0400	1	12/14/2022 19:55	WG1973974	



















6C

SAMPLE RESULTS - 18

Collected date/time: 12/06/22 14:10 L15

	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
Analyte	mg/kg		mg/kg	mg/kg		date / time	
Mercury	<0.0180		0.0180	0.0400	1	12/14/2022 19:57	WG1973974



















7A

SAMPLE RESULTS - 19

Collected date/time: 12/06/22 13:50 L15

	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
Analyte	mg/kg		mg/kg	mg/kg		date / time	
Mercury	<0.0180		0.0180	0.0400	1	12/14/2022 20:00	WG1973974



















7B

SAMPLE RESULTS - 20

Collected date/time: 12/06/22 13:50 L156648

	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
Analyte	mg/kg		mg/kg	mg/kg		date / time	
Mercury	<0.0180		0.0180	0.0400	1	12/14/2022 18:35	WG1973974



















7C

SAMPLE RESULTS - 21

Collected date/time: 12/06/22 13:50

	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
Analyte	mg/kg		mg/kg	mg/kg		date / time	
Mercury	<0.0180		0.0180	0.0400	1	12/14/2022 11:51	WG1973984



















88

SAMPLE RESULTS - 22

Collected date/time: 12/06/22 13:30 L1566481

	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch	
Analyte	mg/kg		mg/kg	mg/kg		date / time		
Mercury	< 0.0180		0.0180	0.0400	1	12/14/2022 11:58	WG1973984	



















8B

SAMPLE RESULTS - 23

Collected date/time: 12/06/22 13:30 L1566481

	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
Analyte	mg/kg		mg/kg	mg/kg		date / time	
Mercury	<0.0180		0.0180	0.0400	1	12/14/2022 12:00	WG1973984



















80

SAMPLE RESULTS - 24

Collected date/time: 12/06/22 13:30 L15

	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
Analyte	mg/kg		mg/kg	mg/kg		date / time	
Mercury	<0.0180		0.0180	0.0400	1	12/14/2022 12:03	WG1973984



















WG1973974

QUALITY CONTROL SUMMARY

L1566481-01,02,03,04,05,06,07,08,09,10,11,12,13,14,15,16,17,18,19,20

Mercury by Method 7471A

Method Blank (MB) (MB) R3871925-1 12/14/22 18:30

	MB Result	MB Qualifier	MB MDL	MB RDL
Analyte	mg/kg		mg/kg	mg/kg
Mercury	<0.0180		0.0180	0.0400







[†]Cn



(LCS) R3871925-2	12/14/22 18:32
------------------	----------------

	Spike Amount	LCS Result	LCS Rec.	Rec. Limits	LCS Qualifier
Analyte	mg/kg	mg/kg	%	%	
Mercury	0.500	0.566	113	80.0-120	





⁶Qc



(OS) L1566481-20 12/14/22 18:35 • (MS) R3871925-3 12/14/22 18:37 • (MSD) R3871925-4 12/14/22 18:40

, ,	Spike Amount	Original Result	MS Result	MSD Result	MS Rec.	MSD Rec.	Dilution	Rec. Limits	MS Qualifier	MSD Qualifier	RPD	RPD Limits
Analyte	mg/kg	mg/kg	mg/kg	mg/kg	%	%		%			%	%
Mercury	0.500	<0.0180	0.432	0.440	86.5	87 9	1	75.0-125			169	20







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WG1973984

QUALITY CONTROL SUMMARY

L1566481-21,22,23,24

Mercury by Method 7471A

Method Blank (MB) (MB) R3871665-1 12/14/22 11:15

	MB Result	MB Qualifier	MB MDL	MB RDL
Analyte	mg/kg		mg/kg	mg/kg
Mercury	<0.0180		0.0180	0.0400









(LCS) R38/1665-2	12/14/22	11:18	
		Spike Amount	

	Spike Amount	LCS Result	LCS Rec.	Rec. Limits	LCS Qualifier
Analyte	mg/kg	mg/kg	%	%	
Mercury	0.500	0.457	91.4	80.0-120	









(OS) L1566600-01 12/14/22 11:20 • (MS) R3871665-3 12/14/22 11:28 • (MSD) R3871665-4 12/14/22 11:30

, ,	Spike Amount	Original Result	MS Result	MSD Result	MS Rec.	MSD Rec.	Dilution	Rec. Limits	MS Qualifier	MSD Qualifier	RPD	RPD Limits
Analyte	mg/kg	mg/kg	mg/kg	mg/kg	%	%		%			%	%
Mercury	0.500	0.0461	0.491	0.456	88 9	81.9	1	75.0-125			7 38	20







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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

MDL	Method Detection Limit.
RDL	Reported Detection Limit.
Rec.	Recovery.
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 resu 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 fo 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

The remainder of this page intentionally left blank, there are no qualifiers applied to this SDG.



















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
lowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LAO00356
Kentucky 16	KY90010	South Carolina	84004002
Kentucky ²	16	South Dakota	n/a
Louisiana	Al30792	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



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

TN00003

EPA-Crypto



















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

		Billing Info	ling Information:					Analysis	Container	/ Preservative		Chain of Custody Page of		
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750 Channel View Drive													PEOP	LE ADVANCING SCIENCE
Report to: Kaijun Lu			Email To: k	aijun.lu@utexas	.edu									ULIET, TN
Project Description:		City/State			Please C	ircle:							Submitting a sample constitutes acknowle	fount Juliet, TN 37122 via this chain of custody dgment and acceptance of the
	I Climat David	Collected:			PT MT								Pace Terms and Cond https://info.pacelabs. terms.pdf	litions found at: .com/hubfs/pas-standard-
Phone: 512-660-0718	Client Proje	Cheft Poject #		Lab Project #									SDG#	366481
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Packed on Ice N Y	Two	Day 10 Day e Day	ay (Rad Only)			No. of	zClr-						PM: 3587 - LO	ri A Vahrenkamp
Sample ID	Comp/Gra	b Matrix *	Depth	Date	Time	Cntrs	62							edEX Ground Sample # (lab only)
2202175613	IA	SS		12-08-2	2 13:00	1	X							1-01
2202175612	1B	SS		12-08-2	213:00	1	X							- 02
2202175616	10	SS		12-08-2	2 13:00	1	X							- 03
2202170617	2A	SS		12-08-12	11200	1	X							- 04
2202175615	28	SS		12-08-17	11200	1	X							-05
2202175614	>0	SS		12-08-2	2 11200	1	X							-06
2202170632	3A	SS		1208-2	2 19200	1	X							-07
2202175626	38	SS		12-08-2	2 10 200	1	X							-08
2202175652	30	SS		12-08-12	10200	1	X							-09
2202175641	14A	SS		12-06-27	15:00	1	X							1-10
* Matrix: SS - Soil AIR - Air F - Filter GW - Groundwater B - Bioassay WW - WasteWater	Remarks:								pH _ Flow _		emp	COC Seal	mple Receipt Ch Present/Intact: d/Accurate: rrive intact:	necklist Y N
DW - Drinking Water OT - Other	Samples returne	ed via: ix Courier		Track	ing# 60	94	504	0 76				Correct be Sufficient	ottles used: t volume sent:	le N
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Relinquished by : (Signature) Date:			Time:		yed for lab by:			4	Date: 12/10		ime: 1000	Hold:		Condition: NCF / OR

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Company Name/Address:			Billing Info	rmation:			-		Analysis	Container / Preservative		Chain of Custod	ly Page of
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Science				nnel View Dri	ve	Chk						18	7
			Port Ara	nsas, TX 7837	3							1	ace.
750 Channel View Drive												1 PEUPL	E ADVANCING SCIENCE
Report to:	14.0		Email To: k	caijun.lu@utexas	.edu							MTJ	ULIET, TN
Kaijun Lu													ria this chain of custody
Project Description:		City/State Collected:			Please C							Pace Terms and Condit	dgment and acceptance of the itions found at: com/hubfs/pas-standard-
Phone: 512-660-0718	Client Project	t#		Lab Project #								terms.pdf	O TOTAL CONTROL OF THE PROPERTY OF THE PROPERT
												SDG#	766481
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Packed on Ice N Y	Three I	Day				of	DZC					PB: BW	10/21
Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	Cntrs	HG 2					Shipped Via: Fo	edEX Ground Sample # (lab only)
2202170624	48	SS		12-06-22	15200	1	X					Nemuro .	To III
2202175643	4C	SS		(2-06-22		1	X						11
2202175698	M	SS		12-06-2			X						1-13
202175635	JB	SS					1000000						- 13 - 14
			-	12-06-22			X						1-19
2202175547	100	SS		12-06-2			X						- 15
2202175025	64	SS		12-06-22			X						- 16
202175648	68	SS		12-01-2	214=10	1	X						17
2202175011	60	SS		12-06-22	14:10	1	X						- 8
202175829	ZA	SS		12-06-2	413:50	1	X						1-19
2202170642	78	SS		12-06-27	13:50	1	X						1 20
* Matrix:	Remarks:										Samp	le Receipt Ch	ecklist
SS - Soil AIR - Air F - Filter GW - Groundwater B - Bioassay									pH _	Temp	COC Seal Pr	esent/Intact: Accurate:	NP Y N
WW - WasteWater									Flow	Other		ive intact:	Z N
DW - Drinking Water OT - Other	Samples returned			Track	ne# / all	1 ~	71	7-1 4	. ,			volume sent: If Applicabl	ZA _N
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desired of Marginature)			Time.	1	Al An	1	1	11	12/	10/22 1000) Illoid.		NCF / OR
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UTMSI - University of Science	TX Marine		Kaijun Lu 750 Char	u nnel View Driv	e	Pres Chk							_ (P	ace.		
750 Channel View Drive			Port Ara	nsas, TX 78373									PEOPL	LE ADVANCING SCIENCE		
Report to: Kaijun Lu			Email To: k	aijun.lu@utexas.e	du								12065 Lebanon Rd M	ULIET, TN Nount Juliet, TN 37122 via this chain of custody		
Project Description:		City/State Collected:		Please Circ PT MT CT									constitutes acknowled	dgment and acceptance of the		
Phone: 512-660-0718	Client Projec	t#		Lab Project #	Lab Project #										SDG #	366481
Collected by (print):	Site/Facility I	ID#		P.O. #									Table #			
Collected by (signature): Immediately Packed on Ice N Y	Same I	(Lab MUST Be Day Five bay 5 Day ay 10 Day	Day (Rad Only)	Quote # TO 108 & Date Result		No. of	2ozClr-NoPres							18553		
Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	Cntrs	HG 20						THE RESIDENCE OF THE PARTY OF T	edEX Ground Sample # (lab only)		
202175633	70	SS		12-06-22	13:50	1	X							1-21		
2202175627	8A	SS		12-06-22	13:30	1	X							- 22		
2021/5650	88	SS		12-06-22	13:30	1	X							-33		
2202175628	28	SS		12-06-22	13:30	1	X							_ 24		
2202175634	Empty	SS				1	X									
										1000						
* Matrix: SS - Soil AIR - Air F - Filter GW - Groundwater B - Bioassay WW - WasteWater	Remarks:								pH		Temp	Bottles a	ample Receipt Che Present/Intact ed/Accurate: arrive intact: bottles used:	necklist : Y N		
DW - Drinking Water OT - Other	Samples returnedUPSFedEx			Trackin	ng# 609	45	46	0 764	-6			Sufficient VOA Zero	nt volume sent: If Applicab Headspace:	le Y N		
Relinquished by : (Signature) Date: Time: Received by: (Signature)								ank Recei	ved: Yes No HCL / MeoH TBR	Preserva RAD Scree	tion Correct/Chen <0.5 mR/hr:	ecked: Y_N				
Relinquished by : (Signature)	Date: Time: Received by: (Signature)				ure)			Temp:	^	C Bottles Received:	If preserva	tion required by Lo	gin: Date/Time			
Relinquished by : (Signature) Date:			Time	The second secon	ed for lab by:		DOCUMENT OF THE PARTY OF THE PA	1	Date: 12/10/22 1000			Hold:		Condition:		



Pace Analytical® ANALYTICAL REPORT

December 12, 2022

UTMSI - University of TX Marine Science

L1559144 Sample Delivery Group: Samples Received: 11/17/2022

Project Number:

Description: Monitoring Water Quality South Texas Bays

Report To: Kaijun Lu

750 Channel View Drive

Port Aransas, TX 78373

Project Manager

















Entire Report Reviewed By: Lori A Vahrenkamp

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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Al: Accreditations & Locations	13
Sc: Sample Chain of Custody	14



















SAMPLE SUMMARY

			Collected by	Collected date/time		e/time
SITE 1 A L1559144-01 GW			KJ	11/10/22 00:00	11/17/22 11:00	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7470A	WG1961774	1	11/23/22 08:11	11/25/22 15:25	AKB	Mt. Juliet, TN
			Collected by	Collected date/time	Received date	e/time
SITE 1 B L1559144-02 GW			KJ	11/10/22 00:00	11/17/22 11:00	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7470A	WG1961774	1	11/23/22 08:11	11/25/22 15:27	AKB	Mt. Juliet, TN
SITE 1 C L1559144-03 GW			Collected by K J	Collected date/time 11/10/22 00:00	Received date 11/17/22 11:00	e/time
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7470A	WG1961774	1	11/23/22 08:11	11/25/22 15:30	AKB	Mt. Juliet, TN
SITE 2 A L1559144-04 GW			Collected by	Collected date/time 11/10/22 00:00	Received date 11/17/22 11:00	e/time
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7470A	WG1961774	1	11/23/22 08:11	11/25/22 15:32	AKB	Mt. Juliet, TN
SITE 2 B L1559144-05 GW			Collected by K J	Collected date/time 11/10/22 00:00	Received date 11/17/22 11:00	e/time
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7470A	WG1961774	1	11/23/22 08:11	11/25/22 15:34	AKB	Mt. Juliet, TN
			Collected by K J	Collected date/time 11/10/22 00:00	Received date 11/17/22 11:00	e/time
SITE 2 C L1559144-06 GW						
Method	Batch	Dilution	Preparation	Analysis	Analyst	Location



















WG1961774

date/time

11/23/22 08:11

date/time

11/25/22 15:41

AKB

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 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.

















PAGE:

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Lori A Vahrenkamp Project Manager

SITE 1 A

SAMPLE RESULTS - 01

Collected date/time: 11/10/22 00:00

	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch	
Analyte	mg/l		mg/l	mg/l		date / time		
Mercury	< 0.000100		0.000100	0.000200	1	11/25/2022 15:25	WG1961774	



















SITE 1 B

SAMPLE RESULTS - 02

Collected date/time: 11/10/22 00:00

	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch	
Analyte	mg/l		mg/l	mg/l		date / time		
Mercury	<0.000100		0.000100	0.000200	1	11/25/2022 15:27	WG1961774	



















SITE 1 C

SAMPLE RESULTS - 03

L1559

Collected date/time: 11/10/22 00:00 Mercury by Method 7470A

	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch	
Analyte	mg/l		mg/l	mg/l		date / time		
Mercury	< 0.000100		0.000100	0.000200	1	11/25/2022 15:30	WG1961774	



















SITE 2 A

SAMPLE RESULTS - 04

Collected date/time: 11/10/22 00:00

	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
Analyte	mg/l		mg/l	mg/l		date / time	
Mercury	<0.000100		0.000100	0.000200	1	11/25/2022 15:32	WG1961774



















SITE 2 B

SAMPLE RESULTS - 05

Collected date/time: 11/10/22 00:00

	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch	
Analyte	mg/l		mg/l	mg/l		date / time		
Mercury	<0.000100		0.000100	0.000200	1	11/25/2022 15:34	WG1961774	



















SITE 2 C

SAMPLE RESULTS - 06

Collected date/time: 11/10/22 00:00

Manager 1 7 170 A

	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
Analyte	mg/l		mg/l	mg/l		date / time	
Mercury	< 0.000100		0.000100	0.000200	1	11/25/2022 15:41	WG1961774



















WG1961774

QUALITY CONTROL SUMMARY

L1559144-01,02,03,04,05,06

Mercury by Method 7470A

Method Blank (MB)

(MB) R3865118-1 11/25	5/22 15:14			
	MB Result	MB Qualifier	MB MDL	MB RDL
Analyte	mg/l		mg/l	mg/l
Mercury	< 0.000100		0.000100	0.000200



³Ss

Laboratory Control Sample (LCS)

	Spike Amount	LCS Result LCS Rec.		Rec. Limits	LCS Qualifier	
Analyte	mg/l	mg/l	%	%		
Mercury	0.00300	0.00278	92.7	80.0-120		





⁶Qc

GI

L1559146-02 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1559146-02 11/25/22 15:19 • (MS) R3865118-3 11/25/22 15:21 • (MSD) R3865118-4 11/25/22 15:23

, ,	Spike Amount	Original Result	MS Result	MSD Result	MS Rec.	MSD Rec.	Dilution	Rec. Limits	MS Qualifier	MSD Qualifier	RPD	RPD Limits
Analyte	mg/l	mg/l	mg/l	mg/l	%	%		%			%	%
Mercury	0.00300	<0.000100	0.00304	0.00310	101	103	1	75 0-125			195	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

Appreviations an	d Delinitions
MDL	Method Detection Limit.
RDL	Reported Detection Limit.
Rec.	Recovery.
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

The remainder of this page intentionally left blank, there are no qualifiers applied to this SDG.



















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
lowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LAO00356
Kentucky 1 6	KY90010	South Carolina	84004002
Kentucky ²	16	South Dakota	n/a
Louisiana	Al30792	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



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

TN00003

EPA-Crypto



















 $^{^* \, \}text{Accreditation is only applicable to the test methods specified on each scope of accreditation held by Pace Analytical.} \\$

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Pace Analytical® ANALYTICAL REPORT

December 14, 2022

UTMSI - University of TX Marine Science

Sample Delivery Group: L1566480 Samples Received: 12/10/2022

Project Number:

Description:

Report To: Kaijun Lu

750 Channel View Drive

Port Aransas, TX 78373

















Entire Report Reviewed By: Lori A Vahrenkamp

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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35

Sc: Sample Chain of Custody

SAMPLE SUMMARY

SITE 1A L1566480-01 GW			Collected by	Collected date/time 12/06/22 15:00	Received dat 12/10/22 10:0	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7470A	WG1972682	1	12/13/22 09:19	12/13/22 21:06	SRT	Mt. Juliet, TN
SITE 1B L1566480-02 GW			Collected by	Collected date/time 12/06/22 15:00	Received dat 12/10/22 10:0	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7470A	WG1972682	1	12/13/22 09:19	12/13/22 21:08	SRT	Mt. Juliet, TN
SITE 1C L1566480-03 GW			Collected by	Collected date/time 12/06/22 16:40	Received dat 12/10/22 10:0	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7470A	WG1972682	1	12/13/22 09:19	12/13/22 21:10	SRT	Mt. Juliet, TN
SITE 2A L1566480-04 GW			Collected by	Collected date/time 12/06/22 14:40	Received dat 12/10/22 10:0	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7470A	WG1972682	1	12/13/22 09:19	12/13/22 21:12	SRT	Mt. Juliet, TN
SITE 2B L1566480-05 GW			Collected by	Collected date/time 12/06/22 14:40	Received dat 12/10/22 10:0	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7470A	WG1972683	1	12/13/22 20:08	12/14/22 12:11	SRT	Mt. Juliet, TN
SITE 2C L1566480-06 GW			Collected by	Collected date/time 12/06/22 14:10	Received dat 12/10/22 10:0	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7470A	WG1972683	1	12/13/22 20:08	12/14/22 12:13	SRT	Mt. Juliet, TN
SITE 3A L1566480-07 GW			Collected by	Collected date/time 12/06/22 14:10	Received dat 12/10/22 10:0	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7470A	WG1972683	1	12/13/22 20:08	12/14/22 12:15	SRT	Mt. Juliet, TN
SITE 3B L1566480-08 GW			Collected by	Collected date/time 12/06/22 14:10	Received dat 12/10/22 10:0	
Method	Batch	Dilution	Preparation	Analysis	Analyst	Location
			date/time	date/time		





















Mercury by Method 7470A

WG1972683

12/13/22 20:08

SRT

Mt. Juliet, TN

12/14/22 12:21

SAMPLE SUMMARY

SITE 3C L1566480-09 GW			Collected by	Collected date/time 12/06/22 13:50	Received dat 12/10/22 10:0	
Method	Batch	Dilution	Preparation	Analysis	Analyst	Location
Mercury by Method 7470A	WG1972683	1	date/time 12/13/22 20:08	date/time 12/14/22 12:24	SRT	Mt. Juliet, TN
SITE 4-1 L1566480-10 GW			Collected by	Collected date/time 12/06/22 13:50	Received dat 12/10/22 10:0	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7470A	WG1972683	1	12/13/22 20:08	12/14/22 12:05	SRT	Mt. Juliet, TN
SITE 4-2 L1566480-11 GW			Collected by	Collected date/time 12/06/22 13:00	Received dat 12/10/22 10:0	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7470A	WG1972683	1	12/13/22 20:08	12/14/22 12:26	SRT	Mt. Juliet, TN
SITE 4-3 L1566480-12 GW			Collected by	Collected date/time 12/06/22 13:00	Received dat 12/10/22 10:0	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7470A	WG1972683	1	12/13/22 20:08	12/14/22 12:28	SRT	Mt. Juliet, TN
SITE 5-1 L1566480-13 GW			Collected by	Collected date/time 12/06/22 13:00	Received dat 12/10/22 10:0	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7470A	WG1972683	1	12/13/22 20:08	12/14/22 12:30	SRT	Mt. Juliet, TN
SITE 5-2 L1566480-14 GW			Collected by	Collected date/time 12/06/22 11:00	Received dat 12/10/22 10:0	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7470A	WG1972683	1	12/13/22 20:08	12/14/22 12:32	SRT	Mt. Juliet, TN
SITE 5-3 L1566480-15 GW			Collected by	Collected date/time 12/06/22 11:00	Received dat 12/10/22 10:0	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7470A	WG1972683	1	12/13/22 20:08	12/14/22 12:34	SRT	Mt. Juliet, TN
SITE 6-1 L1566480-16 GW			Collected by	Collected date/time 12/06/22 11:00	Received dat 12/10/22 10:0	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
M M	W046=					



















12/13/22 20:08

SRT

Mt. Juliet, TN

12/14/22 12:36

WG1972683

SAMPLE SUMMARY

SITE 6-2 L1566480-17 GW			Collected by	Collected date/time 12/06/22 10:00	Received dat 12/10/22 10:0	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7470A	WG1972683	1	12/13/22 20:08	12/14/22 12:54	SRT	Mt. Juliet, TN
SITE 6-3 L1566480-18 GW			Collected by	Collected date/time 12/06/22 10:00	Received dat 12/10/22 10:0	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
lercury by Method 7470A	WG1972683	1	12/13/22 20:08	12/14/22 12:56	SRT	Mt. Juliet, TN
SITE 7-1 L1566480-19 GW			Collected by	Collected date/time 12/06/22 10:00	Received dat 12/10/22 10:0	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7470A	WG1972683	1	12/13/22 20:08	12/14/22 12:58	SRT	Mt. Juliet, TN
SITE 7-2 L1566480-20 GW			Collected by	Collected date/time 12/06/22 15:00	Received dat 12/10/22 10:0	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7470A	WG1972683	1	12/13/22 20:08	12/14/22 13:00	SRT	Mt. Juliet, TN
SITE 7-3 L1566480-21 GW			Collected by	Collected date/time 12/06/22 13:50	Received dat 12/10/22 10:0	
lethod	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
lercury by Method 7470A	WG1972683	1	12/13/22 20:08	12/14/22 13:03	SRT	Mt. Juliet, TN
SITE 8-1 L1566480-22 GW			Collected by	Collected date/time 12/06/22 13:30	Received dat 12/10/22 10:0	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
lercury by Method 7470A	WG1972683	1	12/13/22 20:08	12/14/22 13:05	SRT	Mt. Juliet, TN
SITE 8-2 L1566480-23 GW			Collected by	Collected date/time 12/06/22 13:30	Received dat 12/10/22 10:0	
fethod	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7470A	WG1972683	1	12/13/22 20:08	12/14/22 13:07	SRT	Mt. Juliet, TN
SITE 8-3 L1566480-24 GW			Collected by	Collected date/time 12/06/22 13:30	Received dat 12/10/22 10:0	
<i>M</i> ethod	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location



















Mercury by Method 7470A

WG1972683

12/13/22 20:08

12/14/22 13:09

SRT

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 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.

¹Cp

















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Lori A Vahrenkamp Project Manager

SITE 1A

SAMPLE RESULTS - 01

Collected date/time: 12/06/22 15:00

L1566480

	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
Analyte	mg/l		mg/l	mg/l		date / time	
Mercury	<0.000100		0.000100	0.000200	1	12/13/2022 21:06	WG1972682



















SITE 1B

SAMPLE RESULTS - 02

Collected date/time: 12/06/22 15:00

L1566480

	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch	
Analyte	mg/l		mg/l	mg/l		date / time		
Mercury	<0.000100		0.000100	0.000200	1	12/13/2022 21:08	WG1972682	



















SITE 1C

SAMPLE RESULTS - 03

Collected date/time: 12/06/22 16:40 L1

	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch	
Analyte	mg/l		mg/l	mg/l		date / time		
Mercury	<0.000100		0.000100	0.000200	1	12/13/2022 21:10	WG1972682	



















SITE 2A

SAMPLE RESULTS - 04

Collected date/time: 12/06/22 14:40

	Result	Qualifier	MDL	RDL	Dilution	Analysis	<u>Batch</u>
Analyte	mg/l		mg/l	mg/l		date / time	
Mercury	< 0.000100		0.000100	0.000200	1	12/13/2022 21:12	WG1972682



















SITE 2B

SAMPLE RESULTS - 05

Collected date/time: 12/06/22 14:40

	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
Analyte	mg/l		mg/l	mg/l		date / time	
Mercury	<0.000100		0.000100	0.000200	1	12/14/2022 12:11	WG1972683



















SITE 2C

SAMPLE RESULTS - 06

Collected date/time: 12/06/22 14:10 L1

	Result	Qualifier	MDL	RDL	Dilution	Analysis	<u>Batch</u>
Analyte	mg/l		mg/l	mg/l		date / time	
Mercury	< 0.000100		0.000100	0.000200	1	12/14/2022 12:13	WG1972683



















SITE 3A

SAMPLE RESULTS - 07

Collected date/time: 12/06/22 14:10

	Result	Qualifier	MDL	RDL	Dilution	Analysis	<u>Batch</u>
Analyte	mg/l		mg/l	mg/l		date / time	
Mercury	<0.000100		0.000100	0.000200	1	12/14/2022 12:15	WG1972683



















SITE 3B

SAMPLE RESULTS - 08 L1566480

Collected date/time: 12/06/22 14:10

	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
Analyte	mg/l		mg/l	mg/l		date / time	
Mercury	<0.000100		0.000100	0.000200	1	12/14/2022 12:21	WG1972683



















SITE 3C

SAMPLE RESULTS - 09

L1566

Collected date/time: 12/06/22 13:50 Mercury by Method 7470A

	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch	
Analyte	mg/l		mg/l	mg/l		date / time		
Mercurv	<0.000100		0.000100	0.000200	1	12/14/2022 12:24	WG1972683	



















SITE 4-1

SAMPLE RESULTS - 10

L1566480

Collected date/time: 12/06/22 13:50 Mercury by Method 7470A

	Result	Qualifier	MDL	RDL	Dilution	Analysis	<u>Batch</u>
Analyte	mg/l		mg/l	mg/l		date / time	
Mercury	< 0.000100		0.000100	0.000200	1	12/14/2022 12:05	WG1972683



















SITE 4-2

SAMPLE RESULTS - 11

L1566

Collected date/time: 12/06/22 13:00 Mercury by Method 7470A

	Result	Qualifier	MDL	RDL	Dilution	Analysis	<u>Batch</u>	
Analyte	mg/l		mg/l	mg/l		date / time		
Mercury	< 0.000100		0.000100	0.000200	1	12/14/2022 12:26	WG1972683	



















SITE 4-3

SAMPLE RESULTS - 12 L1566480

Collected date/time: 12/06/22 13:00

	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch	
Analyte	mg/l		mg/l	mg/l		date / time		
Mercury	< 0.000100		0.000100	0.000200	1	12/14/2022 12:28	WG1972683	



















SITE 5-1

SAMPLE RESULTS - 13

Collected date/time: 12/06/22 13:00 L15

	Result	Qualifier	MDL	RDL	Dilution	Analysis	<u>Batch</u>
Analyte	mg/l		mg/l	mg/l		date / time	
Mercury	<0.000100		0.000100	0.000200	1	12/14/2022 12:30	WG1972683



















SITE 5-2

SAMPLE RESULTS - 14

L1566480

Collected date/time: 12/06/22 11:00 Mercury by Method 7470A

	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch	
Analyte	mg/l		mg/l	mg/l		date / time		
Mercury	< 0.000100		0.000100	0.000200	1	12/14/2022 12:32	WG1972683	



















SITE 5-3

SAMPLE RESULTS - 15

Collected date/time: 12/06/22 11:00 L1566480

111116. 12/00/22 11.0

Mercury by Method 7470A												
	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch					
Analyte	mg/l		mg/l	mg/l		date / time						
Mercury	<0.000100		0.000100	0.000200	1	12/14/2022 12:34	WG1972683					



















SITE 6-1

SAMPLE RESULTS - 16

Collected date/time: 12/06/22 11:00

	Result	Qualifier	MDL	RDL	Dilution	Analysis	<u>Batch</u>	
Analyte	mg/l		mg/l	mg/l		date / time		
Mercury	<0.000100		0.000100	0.000200	1	12/14/2022 12:36	WG1972683	



















SITE 6-2

SAMPLE RESULTS - 17

L1566480

Collected date/time: 12/06/22 10:00 Mercury by Method 7470A

	Result	Qualifier	MDL	RDL	Dilution	Analysis	<u>Batch</u>
Analyte	mg/l		mg/l	mg/l		date / time	
Mercury	< 0.000100		0.000100	0.000200	1	12/14/2022 12:54	WG1972683



















SITE 6-3

SAMPLE RESULTS - 18

L1566480

Collected date/time: 12/06/22 10:00 Mercury by Method 7470A

	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
Analyte	mg/l		mg/l	mg/l		date / time	
Mercury	<0.000100		0.000100	0.000200	1	12/14/2022 12:56	WG1972683



















SITE 7-1

SAMPLE RESULTS - 19

L15664

Collected date/time: 12/06/22 10:00 Mercury by Method 7470A

	Result	Qualifier	MDL	RDL	Dilution	Analysis	<u>Batch</u>
Analyte	mg/l		mg/l	mg/l		date / time	
Mercury	< 0.000100		0.000100	0.000200	1	12/14/2022 12:58	WG1972683



















SITE 7-2

SAMPLE RESULTS - 20

L1566

Collected date/time: 12/06/22 15:00 Mercury by Method 7470A

	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch	
Analyte	mg/l		mg/l	mg/l		date / time		
Mercury	< 0.000100		0.000100	0.000200	1	12/14/2022 13:00	WG1972683	



















SITE 7-3

SAMPLE RESULTS - 21 L1566480

Collected date/time: 12/06/22 13:50

Mercury by Method 7470	AC
------------------------	----

	Result	Qualifier	MDL	RDL	Dilution	Analysis	<u>Batch</u>	
Analyte	mg/l		mg/l	mg/l		date / time		
Mercury	<0.000100		0.000100	0.000200	1	12/14/2022 13:03	WG1972683	



















SITE 8-1

Mercury

SAMPLE RESULTS - 22

12/14/2022 13:05

WG1972683

Collected date/time: 12/06/22 13:30

< 0.000100

Mercury by Method 7470A

Mercury by Method 7470A										
	Result	Qualifier	MDL	RDL	Dilution	Analysis	<u>Batch</u>			
Analyte	mg/l		mg/l	mg/l		date / time				

0.000200

0.000100



















SITE 8-2

SAMPLE RESULTS - 23 L1566480

Collected date/time: 12/06/22 13:30

	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
Analyte	mg/l		mg/l	mg/l		date / time	
Mercury	<0.000100		0.000100	0.000200	1	12/14/2022 13:07	WG1972683



















SITE 8-3

SAMPLE RESULTS - 24

L1566480

Collected date/time: 12/06/22 13:30 Mercury by Method 7470A

	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch	
Analyte	mg/l		mg/l	mg/l		date / time		
Mercury	<0.000100		0.000100	0.000200	1	12/14/2022 13:09	WG1972683	



















WG1972682

QUALITY CONTROL SUMMARY

L1566480-01,02,03,04

Mercury by Method 7470A

Method Blank (MB)

Mercury

Analyte Mercury

(MB) R3871404-1 12/13/22 20:12 MB MDL MB RDL MB Result MB Qualifier Analyte mg/l mg/l mg/l



< 0.000100

0.000200

Ss

Laboratory Control Sample (LCS)

(LCS) R3871404-2 12/13/22 20:14

Spike Amount	LCS Result	LCS Rec.	Rec. Limits	LCS Qualifier
mg/l	mg/l	%	%	
0.00300	0.00301	100	80.0-120	

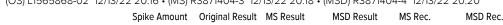
0.000100





L1565868-02 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1565868-02 12/13/22 20:16 • (MS) R3871404-3 12/13/22 20:18 • (MSD) R3871404-4 12/13/22 20:20





MSD Qualifier MSD Rec. Dilution Rec. Limits MS Qualifier RPD **RPD Limits** Analyte mg/l mg/l mg/l mg/l % % % % 0.00300 < 0.000100 0.00301 0.00298 100 99.5 75.0-125 0.964 20 1 Mercury



Sc

PAGE:

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WG1972683

QUALITY CONTROL SUMMARY

L1566480-05,06,07,08,09,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24

Mercury by Method 7470A

Method Blank (MB)

(MB) R3871700-1 12/1	14/22 12:01			
	MB Result	MB Qualifier	MB MDL	MB RDL
Analyte	mg/l		mg/l	mg/l
Mercury	<0.000100		0.000100	0.000200



Laboratory Control Sample (LCS)

(LCS) R3871700-2 12/14/22 12:03

	Spike Amount	LCS Result	LCS Rec.	Rec. Limits	LCS Qualifier
Analyte	mg/l	mg/l	%	%	
Mercury	0.00300	0.00332	111	80.0-120	



⁶Qc

L1566480-10 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1566480-10 12/14/22 12:05 • (MS) R3871700-3 12/14/22 12:07 • (MSD) R3871700-4 12/14/22 12:09

,	Spike Amount	Original Result	MS Result	MSD Result	MS Rec.	MSD Rec.	Dilution	Rec. Limits	MS Qualifier	MSD Qualifier	RPD	RPD Limits	
Analyte	mg/l	mg/l	mg/l	mg/l	%	%		%			%	%	
Mercury	0.00300	<0.000100	0.00350	0.00352	117	117	1	75 0-125			0.532	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

MDL	Method Detection Limit.					
RDL	Reported Detection Limit.					
Rec.	Recovery.					
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 resu 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 fo 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

The remainder of this page intentionally left blank, there are no qualifiers applied to this SDG.



















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
lowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LA000356
Kentucky 16	KY90010	South Carolina	84004002
Kentucky ²	16	South Dakota	n/a
Louisiana	Al30792	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



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

TN00003

EPA-Crypto



















 $^{^* \, \}text{Accreditation is only applicable to the test methods specified on each scope of accreditation held by Pace Analytical.} \\$

Company Name/Address:	Billing Information:				1	Analysis / Container / Preservative							Chain of Custody Page of 3				
UTMSI - University of Science 750 Channel View Drive	TX Marine	Kaijun Lu 750 Channel View Drive Port Aransas, TX 78373			Pres Chk								- Pa	RCCO* ADVANCING SCIENCE			
Report to:			Email To: kaijun.lu@utexas.e		kaijun.lu@utexas.edu									MT JU	JLIET, TN		
Kaijun Lu		City/State	<u> </u>	77 1 19 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Dlease C	e de c								Submitting a sample vi- constitutes acknowledge	this chain of custody ment and acceptance of the		
Project Description:		Collected:			Please C									Pace Terms and Condit https://info.pacelabs.co terms.pdf	ions found at: om/hubfs/pas-standard-		
Phone: 512-660-0718	Client Proje	ct#	B ^{TO}	Lab Project #												SDG# L156648	
Collected by (print):	Site/Facility	ID#												Acctnum: U11			
Collected by (signature): Immediately Packed on Ice N Y	Same	(Lab MUST Be Day Five Day 5 Day Day 10 Day	Day (Rad Only)	Quote # Date Result	ts Needed	No.	250mIHDPE-HNO3			24				Template: T21 Prelogin: P95	8554 8348 i A Vahrenkamp-/		
Sample ID	Comp/Gral	b Matrix *	Depth	Date	Time	Cntrs	HG 25							Shipped Via: Fe	Sample # (lab only)		
P948348 -08	48	GW		12-06-22	1000	1	X	54 3						100	- 01		
P958348 -23	4C	GW		12-06-22	1000	1	X						elter Sec		- 02		
P958348-02	AZ	GW		12-01-22	14:40	1	X								- 03		
P958348 -07	JB	GW		12-06-22	14:40	1	X								- 04		
P957348-21	20	GW		(2-01-22	14:40	1	X								- 05		
P958348 -24	6A	GW		12-06-22	14:10	1	X								- 06		
P958348 -04	6B	GW		12-06-22	(4:10	1	X								- 07		
P958348 -06	60	GW		12-06-22	14210	1	X								- 68		
P958348-09	FA	GW		12-06-22	13:50	1	X							to the second	- 69		
-11	78	GW		12-06-27	13:0	1	X								- 10		
* Matrix: SS - Soil AIR - Air F - Filter GW - Groundwater B - Bioassay WW - WasteWater	Remarks:					Action of the second				pH Flow		Temp	COC Seal COC Signe Bottles a Correct b	mple Receipt Ch Present/Intact: d/Accurate: rrive intact: ottles used:			
DW - Drinking Water OT - Other	Samples returned UPS Fed!	ed via: Ex Courier		Tracki	ng# 60	94	54	60	-			VOA Zero Headspac		If Applicabl	Y _ N		
Relinquished by : (Signature)		Date:	Time	: Receiv	ved by: (Signa	ture)			HCL/MeoH TBR		ion Correct/Che n <0.5 mR/hr:	cked: ZY _N					
Relinquished by : (Signature)		Date:	Time	: Receiv	ved by: (Signa	ture)	Temp: °C Bottles Received: If preservation		ion required by Log	in: Date/Time							
Relinquished by : (Signature)		Date:	Time			ab by: (Signature) Date: Time: Hold: L2/10/22 L0 3 0 0			Condition:								

Company Name/Address:	The State of State		Billing Info	lling Information:		Total	Т	- 324 3	,	Analysis / Container / Preservative					-	Chain of Custody Page 2 of 7					
UTMSI - University of Science 750 Channel View Drive	f TX Marin	е	Kaijun Lu 750 Channel View Drive Port Aransas, TX 78373			Pres Chk											P	Q ACE° LE ADVANCING			
Report to: Kaijun Lu		S8.1			: kaijun.lu@utexas.edu		un.lu@utexas.edu											MT		ULIET,	
Project Description:		City/State Collected:		Please Circ								28 28 38 8 3 3 3 8 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4					Submitting a sample constitutes acknowle Pace Terms and Concepts (https://info.pacelabs	via this chain of dgment and ac litions found at	ceptance of the		
Phone: 512-660-0718	Client Proje			Lab Project #		C1 L1		1000								1	SDG # LI				
Collected by (print):	Site/Facility	ID#		P.O. #			03										Table #				
Collected by (signature): Immediately Packed on Ice N Y	Same	(Lab MUST Be Day Five Day 5 Day Day 10 Day	Day y (Rad Only)	ly) Date Results Needed		d Only) Date Results Needed		No.	50mIHDPE-HNO									P	Prelogin: P95 PM: 3587 Lo PB: 10	18554 58348 ri Ą Vahre	enkamp /
Sample ID	Comp/Gral	Matrix *	Depth	Date	Time	Cntrs	HG 25										hipped Via: F	edEX G			
P958348 -13	IA	GW		12-08-22	13:00	1	X												11		
P958348 -19	(B	GW		12-08-22			X											-	12		
P958348 -20	(0	GW	1 2	12-08-2			X												15		
P958748 -03	24	GW		12-08-22			X												14		
P958348 -14	28	GW		12-08-22	(1500	1	X	2										_	15		
P958348 -10	2 C	GW		12-08-2	11200	1	X										-	_	16		
P958348 -18	3 A	GW		12-08-2			X											_	11		
P958748 -25	3 B	GW		12 -08-20	20-00	1	X						7					-	18		
P958348 -17	3 C	GW		12-08-12			X					2.1						L	19		
P958348 - 22	4A	GW		12-06-2	215:00	1	X							-1				-	20		
* Matrix: SS - Soil AIR - Air F - Filter GW - Groundwater B - Bioassay WW - WasteWater	Remarks:						2			pH _ Flow	a.	Temp Other		_	COC Sea. COC Sign Bottles	l Prese ned/Acc arrive	Receipt Chent/Intact curate: e intact:	necklist			
DW - Drinking Water OT - Other	Samples returneUPS V_FedE	d via: x Courier		Track	ing# 600	145	546	0 75	98	۶					Correct bottl Sufficient vo		lume sent: f Applicab	le -	Y N		
Relinquished by : (Signature)		Date:	Time	Recei	ved by: (Signat	STATE OF THE PERSON NAMED IN			TO SHARE	rip Blank	Receiv	Н	S / NB ICL / Me BR	оН	Preservation Correct/Checked: RAD Screen <0.5 mR/hr:		ecked:	Y N			
Relinquished by : (Signature)		Date:	Time	Recei	ved by: (Signal	ture)	/.	- 44	T	emp: 6 3 1-8	A Z°C	Bottle	ttles Received: If preservation required by Login:		gin: Date/	Time					
Relinquished by : (Signature)	1	Date:	Time		ved for lab by:		ure)		Date: Time: Hold: 12/10/22 [5:00			NCB NCB	IIII								

UTMSI - University of TX Marine	Billing Info			Pres			A	Analysis	Conta	iner / Pri	eservative			Chain of Custo	dy Page 2 of 3						
Science 750 Channel View Drive			1	u nnel View Driv Insas, TX 7837		Chk										- PEOP	ACE° LE ADVANCING SCIENCE				
Report to: Kaijun Lu			Email To:	kaijun.lu@utexas.	edu												JULIET, TN Mount Juliet, TN 37122				
Project Description:		City/State Collected:						Please Circle: PT MT CT ET												Submitting a sample constitutes acknowle Pace Terms and Cond	via this chain of custody dgment and acceptance of the
Phone: 512-660-0718	Client Proj	ect#	Lab Project #		ct#					-						SDG # L JS	66480				
Collected by (print):	Site/Facilit	y ID #		P.O. #			50mHDPE-HNO3								Table # Acctnum: UTMSIPATX.						
Collected by (signature): Immediately Packed on Ice N Y	Sam	P (Lab MUST Be e Day Five t Day 5 Day Day 10 Day e Day	Five Day 5 Day (Rad Only) Date Results Nee			eded No.										Template: T2 Prelogin: P9 !	18554				
Sample ID	Comp/Gra	ab Matrix *	Depth	Date	Time	Cntrs	HG 25									Shipped Via: F	Sample # (lab only)				
P95+34+ -01	70	GW		12-06-22	13:50	1	X										- 21				
P958348 -12 P958348 -05 P958348 -15	A8	GW		12-06-22	13:30	1	X					7, 1					- 35				
P958348 - 05	8B	GW		12-06-2	13:30	1	X										- 23				
P908348-15	80	GW		12-06-22	(3230	1	X										- 24				
P958348 -16	Empte	GW		1206-22	(3:30	1	X										-35 N				
					**																
					3																
* Matrix: SS - Soil AIR - Air F - Filter GW - Groundwater B - Bioassay WW - WasteWater	Remarks:				74					pH _		_ Temp _ Other		Bott	Seal Pr Signed/ les arr	ple Receipt Chresent/Intact /Accurate: rive intact: ttles used:	:/NP Y N				
DW - Drinking Water OT - Other	Samples returneUPS \(\subseteq \text{Fedit} \)	ed via: Ex Courier		Trackin	ng# 60	94	54	Lo	75	98		Suf			ficient	volume sent: If Applicab	Y_N				
elinquished by : (Signature) Date: Time:			Receiv	Received by: (Signature)				TOTAL PROPERTY.		Receiv		CL / MeoH	Pres	VOA Zero Headspace: Preservation Correct/Checked: RAD Screen <0.5 mR/hr: Y N N							
Relinquished by : (Signature)	quished by : (Signature) Date: Time:		Receiv	Received by: (Signature)			Temp: °C Bottles Received: 24				If preservation required by Login: Date/Time										
		eceived for lab by: (Signature)					Date: Time: Ho				Hold	Hold: Condition: (Net / OK									



Pace Analytical® ANALYTICAL REPORT

UTMSI - University of TX Marine Science

L1559148 Sample Delivery Group: Samples Received: 11/17/2022

Project Number:

Description: Monitoring Water Quality South Texas Bays

Report To: Kaijun Lu

750 Channel View Drive

Port Aransas, TX 78373

Project Manager

















Entire Report Reviewed By: Lori A Vahrenkamp

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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•	JAIVIT LL .		VIAIX I			
			Collected by	Collected date/time	Received da	nte/time
SITE 1 A L1559148-01 Non-Potable Water			KJ	11/10/22 00:00	11/17/22 11:00	0
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method D5174	WG1963825	1	11/22/22 14:12	12/01/22 15:34	SNR	Mt. Juliet, TN
Radiochemistry by Method SM7500Ra B M	WG1971832	1	12/19/22 15:10	12/22/22 14:49	RGT	Mt. Juliet, TN
			Collected by	Collected date/time	Received da	ite/time
SITE 1 B L1559148-02 Non-Potable Water			KJ	11/10/22 00:00	11/17/22 11:00	0
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method D5174	WG1963825	1	11/22/22 14:12	12/01/22 15:37	SNR	Mt. Juliet, TN
Radiochemistry by Method SM7500Ra B M	WG1971832	1	12/19/22 15:10	12/22/22 14:49	RGT	Mt. Juliet, TN
			Collected by	Collected date/time	Received da	ite/time
SITE 1 C L1559148-03 Non-Potable Water			KJ	11/10/22 00:00	11/17/22 11:00	0
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method D5174	WG1963825	1	11/22/22 14:12	12/01/22 15:39	SNR	Mt. Juliet, TN
Radiochemistry by Method SM7500Ra B M	WG1971832	1	12/19/22 15:10	12/22/22 14:49	RGT	Mt. Juliet, TN
			Collected by	Collected date/time	Received da	ate/time
SITE 2 A L1559148-04 Non-Potable Water			KJ	11/10/22 00:00	11/17/22 11:00	0
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method D5174	WG1963825	1	11/22/22 14:12	12/01/22 15:42	SNR	Mt. Juliet, TN
Radiochemistry by Method SM7500Ra B M	WG1971832	1	12/19/22 15:10	12/22/22 14:49	RGT	Mt. Juliet, TN
			Collected by	Collected date/time	Received da	ite/time
SITE 2 B L1559148-05 Non-Potable Water			KJ	11/10/22 00:00	11/17/22 11:00	0
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method D5174	WG1963825	1	11/22/22 14:12	12/01/22 15:44	SNR	Mt. Juliet, TN
Radiochemistry by Method SM7500Ra B M	WG1971832	1	12/19/22 15:10	12/22/22 14:49	RGT	Mt. Juliet, TN
			Collected by	Collected date/time	Received da	ite/time
SITE 2 C L1559148-06 Non-Potable Water			KJ	11/10/22 00:00	11/17/22 11:00	0
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method D5174	WG1963825	1	11/22/22 14:12	12/01/22 15:47	SNR	Mt. Juliet, TN
D. H. J. A. J. M. H. JONESCOD, D.M.		_			D.O.T.	



















Radiochemistry by Method SM7500Ra B M

12/19/22 15:10

12/20/22 12:30

WG1971832

RGT

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.





















Lori A Vahrenkamp Project Manager

Project Narrative

Due to the limited sample volume received, the laboratory proceeded with the KPA-U and Ra-226 analyses. The Ra-228 analysis was unable to be completed due the limited sample volume received.

SAMPLE RESULTS - 01

Collected date/time: 11/10/22 00:00

Radiochemistry by Method D5174

	Result	Qualifier	Uncertainty	RDL	Analysis Date	Batch
Analyte	mg/l		+ / -	mg/l	date / time	
Uranium	<0.00100			0.00100	12/01/2022 15:34	WG1963825



Radiochemistry by Method SM7500Ra B M

	Result	Qualifier	Uncertainty	MDA	Analysis Date	Batch
Analyte	pCi/l		+/-	pCi/l	date / time	
RADIUM-226	1.21		0.415	0.241	12/22/2022 14:49	WG1971832
(T) Barium-133	85.8			30.0-143	12/22/2022 14:49	WG1971832



Ss













SAMPLE RESULTS - 02

115591

Radiochemistry by Method D5174

Collected date/time: 11/10/22 00:00

	Result	Qualifier	Uncertainty	RDL	Analysis Date	Batch
Analyte	mg/l		+ / -	mg/l	date / time	
Uranium	0.0412		0.00133	0.00100	12/01/2022 15:37	WG1963825

²Tc

	Result	Qualifier	Uncertainty	MDA	Analysis Date	Batch
Analyte	pCi/l		+ / -	pCi/l	date / time	
RADIUM-226	0.813		0.390	0.339	12/22/2022 14:49	WG1971832
(T) Barium-133	83.9			30.0-143	12/22/2022 14:49	WG1971832















Analyte

RADIUM-226

(T) Barium-133

SAMPLE RESULTS - 03

Collected date/time: 11/10/22 00:00

Qualifier

Uncertainty

+/-

0.512

Radiochemistry by Method D5174

Radiochemistry by Method SM7500Ra B M

Result

pCi/l

1.74

83.6

	Result	Qualifier	Uncertainty	RDL	Analysis Date	<u>Batch</u>	
Analyte	mg/l		+ / -	mg/l	date / time		
Uranium	0.0389		0.00125	0.00100	12/01/2022 15:39	WG1963825	





Ss













	Result	Qualifier	Uncertainty	RDL	Analysis Date	Batch
Analyte	mg/l		+ / -	mg/l	date / time	
Uranium	0.0389		0.00125	0.00100	12/01/2022 15:39	WG1963825

MDA

pCi/l

0.278

30.0-143

Analysis Date

12/22/2022 14:49

12/22/2022 14:49

date / time

Batch

WG1971832 WG1971832

SITE 2 A

SAMPLE RESULTS - 04

Collected date/time: 11/10/22 00:00

Radiochemistry by Method D5174

	Result	Qualifier	Uncertainty	RDL	Analysis Date	Batch
Analyte	mg/l		+/-	mg/l	date / time	
Uranium	0.0558		0.00179	0.00100	12/01/2022 15:42	WG1963825





Ss

	Result	Qualifier	Uncertainty	MDA	Analysis Date	<u>Batch</u>
Analyte	pCi/I		+ / -	pCi/l	date / time	
RADIUM-226	4.50		0.772	0.279	12/22/2022 14:49	WG1971832
(T) Barium-133	91.7			30.0-143	12/22/2022 14:49	WG1971832















SAMPLE RESULTS - 05

L155914

Radiochemistry by Method D5174

Collected date/time: 11/10/22 00:00

	Result	Qualifier	Uncertainty	RDL	Analysis Date	Batch
Analyte	mg/l		+ / -	mg/l	date / time	
Uranium	0.0326		0.00105	0.00100	12/01/2022 15:44	WG1963825

²Tc

	Result	Qualifier	Uncertainty	MDA	Analysis Date	Batch
Analyte	pCi/l		+/-	pCi/l	date / time	
RADIUM-226	1.36		0.544	0.422	12/22/2022 14:49	WG1971832
(T) Barium-133	66.3			30.0-143	12/22/2022 14:49	WG1971832















SAMPLE RESULTS - 06

Collected date/time: 11/10/22 00:00

Radiochemistry by Method D5174

	Result	Qualifier	Uncertainty	RDL	Analysis Date	Batch
Analyte	mg/l		+ / -	mg/l	date / time	
Uranium	0.0284		0.000913	0.00100	12/01/2022 15:47	WG1963825

	Result	Qualifier	Uncertainty	MDA	Analysis Date	Batch
Analyte	pCi/l		+ / -	pCi/l	date / time	
RADIUM-226	0.327		0.240	0.265	12/20/2022 12:30	WG1971832
(T) Barium-133	102			30.0-143	12/20/2022 12:30	WG1971832















WG1963825

QUALITY CONTROL SUMMARY

Radiochemistry by Method D5174

L1559148-01,02,03,04,05,06

Method Blank (MB)

(MB) R3868327-1 12/01/2	22 14:57			
	MB Result	MB Qualifier	MB MDL	MB RDL
Analyte	mg/l		mg/l	mg/l
Uranium	< 0.00100		0.00100	0.00100







L1559148-04 Original Sample (OS) • Duplicate (DUP)

(OS) L1559148-04 12/01/22 15:42 • (DUP) R3868327-5 12/01/22 15:06

	Original Result	DUP Result	Dilution	DUP RPD	DUP Qualifier	DUP RPD Limits
Analyte	mg/l	mg/l		%		%
Uranium	0.0558	0.0481	1	14.7		20



⁶Qc

Laboratory Control Sample (LCS)

(LCS) R3868327-2 12/01/22 14:59

(/::::::::::::::::::::::::::::::::::					
	Spike Amount	LCS Result	LCS Rec.	Rec. Limits	LCS Qualifier
Analyte	mg/l	mg/l	%	%	
Uranium	0.0300	0.0315	105	80.0-120	





L1552490-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1552490-01 12/01/22 15:09 • (MS) R3868327-3 12/01/22 15:01 • (MSD) R3868327-4 12/01/22 15:04

	Spike Amount	Original Result	MS Result	MSD Result	MS Rec.	MSD Rec.	Dilution	Rec. Limits	MS Qualifier	MSD Qualifier	RPD	RPD Limits
Analyte	mg/l	mg/l	mg/l	mg/l	%	%		%			%	%
Uranium	0.0200	<0.00100	0.0129	0.0126	64.6	62.8	1	75.0-125	<u>J6</u>	<u>J6</u>	2.70	20

WG1971832

QUALITY CONTROL SUMMARY

Radiochemistry by Method SM7500Ra B M

L1559148-01,02,03,04,05,06

Method Blank (MB)

(MB) R38/5288-1 12/20/22	12:30			
	MB Result	MB Qualifier	MB Uncertainty	MB MDA
Analyte	pCi/l		+/-	pCi/l
Radium-226	0.0554	<u>J</u>	0.0556	0.0721
(T) Barium-133	95.9		95.9	







L1557819-10 Original Sample (OS) • Duplicate (DUP)

(OS) L1557819-10 12/20/22 12:30 • (DUP) R3875288-5 12/20/22 12:30

(,												
	Original Result	Original Uncertainty	Original MDA	DUP Result	DUP Uncertainty	DUP MDA	Dilution	DUP RPD	DUP RER	DUP Qualifier	DUP RPD Limits	DUP RER Limit
Analyte	pCi/l	+ / -	pCi/I	pCi/l	+/-	pCi/l		%			%	
Radium-226	0.429	0.294	0.318	0.558	0.272	0.318	1	26.0	0.321		20	3
(T) Barium-133	96.5			97.9	97.9							









Laboratory Control Sample (LCS)

(I CS) P3875288-2 12/20/22 12:30

(LCS) R36/5266-2 12/20	23) R30/5200-2 12/20/22 12.30								
	Spike Amount	LCS Result	LCS Rec.	Rec. Limits	LCS Qualifier				
Analyte	pCi/I	pCi/l	%	%					
Radium-226	5.02	5.33	106	80.0-120					
(T) Barium-133			92.3						





L1557819-02 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1557819-02 12/20/22 12:30 • (MS) R3875288-3 12/20/22 12:30 • (MSD) R3875288-4 12/20/22 12:30

(00) [100/010 02 12/2	(03) 21337013 02 12120122 12.30 · (1113) 1(3073200 3 · 12120122 12.30 · (1113) 1(3073200 4 · 12120122 12.30												
	Spike Amount	Original Result	MS Result	MSD Result	MS Rec.	MSD Rec.	Dilution	Rec. Limits	MS Qualifier	MSD Qualifier	RPD	MS RER	RPD Limits
Analyte	pCi/l	pCi/l	pCi/l	pCi/l	%	%		%			%		%
Radium-226	20.0	0.407	16.2	18.8	79.0	92.1	1	75.0-125			15.0		20
(T) Barium-133		101			98.2	95.5							

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

Apple viations and	Definitions
MDA	Minimum Detectable Activity.
MDL	Method Detection Limit.
RDL	Reported Detection Limit.
Rec.	Recovery.
RER	Replicate Error Ratio.
RPD	Relative Percent Difference.
SDG	Sample Delivery Group.
(T)	Tracer - A radioisotope of known concentration added to a solution of chemically equivalent radioisotopes at a known concentration to assist in monitoring the yield of the chemical separation.
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> </u>	Beschption
J	The identification of the analyte is acceptable; the reported value is an estimate.
J6	The sample matrix interfered with the ability to make any accurate determination; spike value is low.



















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	LAO00356
Kentucky ^{1 6}	KY90010	South Carolina	84004002
Kentucky ²	16	South Dakota	n/a
Louisiana	Al30792	Tennessee 14	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



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

TN00003

EPA-Crypto



















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

Company Name/Address:	Billing Information:						Analysis / Container / Preservative				Chain of Custody Page			y Page of _			
UTMSI - University of Science	f TX Marin	e	Kaijun Lu 750 Channel View Drive			Pres Chk		11,160,-30				At a see And	144	i de esta de la companya della companya della companya de la companya de la companya della compa	eren etan ta	B)
750 Channel View Drive			Port Ara	Port Aransas, TX 78373											PEOPL	E ADVANCING SCIENCE	
Report to: Kaijun Lu			Email To: k	Email To: kaijun.lu@utexas.edu										MT JULIET, TN 12065 Lebanon Rd Mount Juliet, TN 37122 Submitting a sample via this chain of custody		ount Juliet, TN 37122	
Project Description: City/State Monitoring Water Quality South Texas Bays Collected:		Collected:	Aransa Tex		PT MT				HNO3					Pace Terms and Conditions of Course of Pace Terms and Conditions found at: https://info.pacelabs.com/hubls/pas-stand-terms.pdf		tions found at:	
one: 512-660-0718 Client Project #		ect#	Lab Project #					03			08 1		SDG#11569148		59148		
ollected by (print): Ka', w.L.			P.O. #				HNO3	VH PP	1L-HDPE-Add			F177					
collected by (signature): Compared to the control of the control	Same	(Lab MUST Be Day Five Day 5 Day Day 10 Do	Day y (Rad Only)		18-94 desults Needed	No. of	250mIHDPE-HNO3	RA-226 1L-HDPE-Add HNO3	KPA-U				Acctnum: UTMSIPATX. Template:T218544 Prelogin: P958341 PM: 3587 - Lori A Vahrenkamp PB: BW 1021				
Sample ID	Comp/Gra	b Matrix *	Depth	Date	Time	Cntrs	HG 2	RA-2.	RA-228,				_	ned Via: For Remarks	Sample # (lab only		
Site 1 A	ite I A GW		1m	11-10-	-22	28	X	X	X							1	-01
Site 1 B		GW	100	11-10-	-12	В	X	Х	X	-						1:7	-02
Site 1 C GW		1 m	(1-10-	22	3	X	Х	X								-03	
Site 2 A GW		GW	1m	11-10-	-22	В	X	X	X								-04
site 2 B		GW	Im	11-10.	-22	1	X	Х	X								-05
Site 20		GW	Im	11-00-	rz	3	X	X	X							* * * * * * * * * * * * * * * * * * *	-06
				1		+									-		
Matrix: 5 - Soil AIR - Air F - Filter W - Groundwater B - Bioassay /W - WasteWater	Remarks:						pH Temp					COC Sea COC Sig Bottles	Sample Receipt Checklist COC Seal Present/Intact: MP Y N COC Signed/Accurate: Bottles arrive intact: N Correct bottles used: N				
DW - Drinking Water OT - Other Samples returned via: UPS V FedEx Courier Tracking # 609.				45	460	76						Suffic: VOA Ze:	ient volume <u>If A</u> ro Headspace	e sent: pplicabl ce:	_Y _N		
Relinquished by : (Signature) Date:		Time:	Re	eceived by: (Signa	ture)				Trip Blank	Receiv	ved: Yes / HCL TBR	No / MeoH	Preservation Correct/Checked:N RAD Screen <0.5 mR/hr:N				
elinquished by : (Signature)		Date:	Time:	Re	eceived by: (Signa	ture)				Temp:MS	6 A 9	The second liverage and the se	eceived:	If preservation required by Login: Date/Time			
Relinquished by : (Signature) Date:		Time:	Re	eceived for lab by:	(Signatu	ture)			Date: Time:		Hold:			Condition: NCF OK			



Pace Analytical® ANALYTICAL REPORT

April 10, 2023

Revised Report

UTMSI - University of TX Marine Science

L1569444 Sample Delivery Group: Samples Received: 12/10/2022

Project Number:

Description: Monitoring Water Quality South Texas Bays

Report To: Kaijun Lu

750 Channel View Drive

Port Aransas, TX 78373

















Entire Report Reviewed By: Lori A Vahrenkamp

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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31

Sc: Sample Chain of Custody

SOIL SITE C1 L1569444-01 GW			Collected by	Collected date/time 12/06/22 09:30	Received da 12/10/22 10:0	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7470A	WG1977462	10	12/21/22 08:21	12/21/22 14:20	SRT	Mt. Juliet, TN
SOIL SITE C1 L1569444-02 Non-Potable Water			Collected by	Collected date/time 12/06/22 09:30	Received da 12/10/22 10:0	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method D5174 Radiochemistry by Method SM7500Ra B M	WG1979170 WG1977878	1 1	12/23/22 13:49 01/04/23 16:26	12/28/22 13:32 01/10/23 19:03	SNR DME	Mt. Juliet, TN Mt. Juliet, TN
SOIL SITE C2 L1569444-03 GW			Collected by	Collected date/time 12/06/22 09:30	Received da 12/10/22 10:0	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7470A	WG1977462	10	12/21/22 08:21	12/21/22 14:28	SRT	Mt. Juliet, TN
SOIL SITE C2 L1569444-04 Non-Potable Water			Collected by	Collected date/time 12/06/22 09:30	Received da 12/10/22 10:0	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method D5174 Radiochemistry by Method SM7500Ra B M	WG1979170 WG1977878	1	12/23/22 13:49 01/04/23 16:26	12/28/22 13:35 01/10/23 19:03	SNR DME	Mt. Juliet, TN Mt. Juliet, TN
SOIL SITE C3 L1569444-05 GW			Collected by	Collected date/time 12/06/22 09:30	Received da 12/10/22 10:0	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7470A	WG1977462	10	12/21/22 08:21	12/21/22 14:30	SRT	Mt. Juliet, TN
SOIL SITE C3 L1569444-06 Non-Potable Water			Collected by	Collected date/time 12/06/22 09:30	Received da 12/10/22 10:0	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method D5174 Radiochemistry by Method SM7500Ra B M	WG1979170 WG1977878	1	12/23/22 13:49 01/09/23 08:00	12/28/22 13:37 01/10/23 19:03	SNR DME	Mt. Juliet, TN Mt. Juliet, TN
SOIL SITE D1 L1569444-07 GW			Collected by	Collected date/time 12/08/22 14:30	Received da 12/10/22 10:0	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7470A	WG1977462	10	12/21/22 08:21	12/21/22 14:32	SRT	Mt. Juliet, TN
SOIL SITE D1 L1569444-08 Non-Potable Water			Collected by	Collected date/time 12/08/22 14:30	Received da 12/10/22 10:0	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method D5174 Radiochemistry by Method SM7500Ra B M	WG1979170 WG1977878	1 1	12/23/22 13:49 01/04/23 16:26	12/28/22 13:40 01/10/23 19:03	SNR DME	Mt. Juliet, TN Mt. Juliet, TN



















SOIL SITE D2 L1569444-09 GW			Collected by	Collected date/time 12/08/22 14:30	Received da 12/10/22 10:0	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7470A	WG1977462	10	12/21/22 08:21	12/21/22 14:34	SRT	Mt. Juliet, TN
SOIL SITE D2 L1569444-10 Non-Potable Water			Collected by	Collected date/time 12/08/22 14:30	Received da 12/10/22 10:0	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method D5174 Radiochemistry by Method SM7500Ra B M	WG1979170 WG1977878	1	12/23/22 13:49 01/04/23 16:26	12/28/22 13:42 01/10/23 19:03	SNR DME	Mt. Juliet, TN Mt. Juliet, TN
SOIL SITE D3 L1569444-11 GW			Collected by	Collected date/time 12/08/22 14:30	Received da 12/10/22 10:0	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7470A	WG1977462	10	12/21/22 08:21	12/21/22 14:36	SRT	Mt. Juliet, TN
SOIL SITE D3 L1569444-12 Non-Potable Water			Collected by	Collected date/time 12/08/22 14:30	Received da 12/10/22 10:0	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method D5174 Radiochemistry by Method SM7500Ra B M	WG1979170 WG1977878	1	12/23/22 13:49 01/04/23 16:26	12/28/22 13:45 01/10/23 19:03	SNR DME	Mt. Juliet, TN Mt. Juliet, TN
SOIL SITE C1 L1569444-13 GW			Collected by	Collected date/time 12/06/22 09:30	Received da 12/10/22 10:0	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7470A	WG1977462	10	12/21/22 08:21	12/21/22 14:39	SRT	Mt. Juliet, TN
SOIL SITE C1 L1569444-14 Non-Potable Water			Collected by	Collected date/time 12/06/22 09:30	Received da 12/10/22 10:0	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method D5174 Radiochemistry by Method SM7500Ra B M	WG1979170 WG1979908	1	12/23/22 13:49 12/29/22 11:49	12/28/22 13:53 01/06/23 15:41	SNR RGT	Mt. Juliet, TN Mt. Juliet, TN
SOIL SITE C2 L1569444-15 GW			Collected by	Collected date/time 12/06/22 10:00	Received da 12/10/22 10:0	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7470A	WG1977462	10	12/21/22 08:21	12/21/22 14:43	SRT	Mt. Juliet, TN
SOIL SITE C2 L1569444-16 Non-Potable Water			Collected by	Collected date/time 12/06/22 10:00	Received da 12/10/22 10:0	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method D5174 Radiochemistry by Method SM7500Ra B M	WG1979170 WG1979908	1	12/23/22 13:49 12/29/22 11:49	12/28/22 13:55 01/06/23 15:41	SNR RGT	Mt. Juliet, TN Mt. Juliet, TN



















CON CITE CO 145CO 444 47 CW			Collected by	Collected date/time 12/06/22 10:30	Received da 12/10/22 10:0	
SOIL SITE C3 L1569444-17 GW Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7470A	WG1977462	10	12/21/22 08:21	12/21/22 14:45	SRT	Mt. Juliet, TN
SOIL SITE C3 L1569444-18 Non-Potable Water			Collected by	Collected date/time 12/06/22 10:30	Received da 12/10/22 10:0	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method D5174 Radiochemistry by Method SM7500Ra B M	WG1979170 WG1979908	1	12/23/22 13:49 12/29/22 11:49	12/28/22 13:58 01/06/23 15:41	SNR RGT	Mt. Juliet, TN 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.





















Lori A Vahrenkamp Project Manager

Report Revision History

Level II Report - Version 1: 01/17/23 16:56

Project Narrative

Revised Report Issued 04-10-23.

SAMPLE RESULTS - 01

Collected date/time: 12/06/22 09:30

Mercury by Method 7470A

	Result	Qualifier	MDL	RDL	Dilution	Analysis	<u>Batch</u>	
Analyte	mg/l		mg/l	mg/l		date / time		
Mercury	<0.00100		0.00100	0.00200	10	12/21/2022 14:20	WG1977462	



















SAMPLE RESULTS - 02

Radiochemistry by Method D5174

Collected date/time: 12/06/22 09:30

	Result	Qualifier	Uncertainty	RDL	Analysis Date	Batch
Analyte	mg/l		+ / -	mg/l	date / time	
Uranium	0.00634		0.000314	0.00100	12/28/2022 13:32	WG1979170





Ss













	Result	Qualifier	Uncertainty	MDA	Analysis Date	<u>Batch</u>
Analyte	pCi/l		+ / -	pCi/l	date / time	
RADIUM-226	1.09		0.540	0.396	01/10/2023 19:03	WG1977878
(T) Barium-133	44.2			30.0-143	01/10/2023 19:03	WG1977878

SAMPLE RESULTS - 03

Collected date/time: 12/06/22 09:30

Mercury by Method 7470A

	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch	
Analyte	mg/l		mg/l	mg/l		date / time		
Mercury	<0.00100		0.00100	0.00200	10	12/21/2022 14:28	WG1977462	



















SAMPLE RESULTS - 04

Collected date/time: 12/06/22 09:30

L1569444

Radiochemistry by Method D5174

	Result	Qualifier	Uncertainty	RDL	Analysis Date	Batch
Analyte	mg/l		+/-	mg/l	date / time	
Uranium	<0.00100			0.00100	12/28/2022 13:35	WG1979170

²Tc

	Result	Qualifier	Uncertainty	MDA	Analysis Date	Batch
Analyte	pCi/I		+ / -	pCi/l	date / time	
RADIUM-226	1.15		0.574	0.335	01/10/2023 19:03	WG1977878
(T) Barium-133	41.6			30.0-143	01/10/2023 19:03	WG1977878















SAMPLE RESULTS - 05

Collected date/time: 12/06/22 09:30

Mercury by Method 7470A

	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
Analyte	mg/l		mg/l	mg/l		date / time	
Mercury	<0.00100		0.00100	0.00200	10	12/21/2022 14:30	WG1977462



















SAMPLE RESULTS - 06

Collected date/time: 12/06/22 09:30 Radiochemistry by Method D5174

	Result	Qualifier	Uncertainty	RDL	Analysis Date	<u>Batch</u>	
Analyte	mg/l		+ / -	mg/l	date / time		
Uranium	0.00643		0.000323	0.00100	12/28/2022 13:37	WG1979170	



Radiochemistry by Method SM7500Ra B M

	Result	Qualifier	Uncertainty	MDA	Analysis Date	Batch
Analyte	pCi/l		+ / -	pCi/l	date / time	
RADIUM-226	1.33		0.594	0.485	01/10/2023 19:03	WG1977878
(T) Barium-133	60.6			30.0-143	01/10/2023 19:03	WG1977878



Ss













SAMPLE RESULTS - 07

Collected date/time: 12/08/22 14:30

Mercury by Method 7470A

	Result	Qualifier	MDL	RDL	Dilution	Analysis	<u>Batch</u>
Analyte	mg/l		mg/l	mg/l		date / time	
Mercury	<0.00100		0.00100	0.00200	10	12/21/2022 14:32	WG1977462



















Analyte

RADIUM-226

(T) Barium-133

SAMPLE RESULTS - 08

Collected date/time: 12/08/22 14:30

Qualifier

Uncertainty

+/-

0.384

Radiochemistry by Method D5174

Radiochemistry by Method SM7500Ra B M

Result

pCi/l

1.07

85.3

	Result	Qualifier	Uncertainty	RDL	Analysis Date	<u>Batch</u>
Analyte	mg/l		+ / -	mg/l	date / time	
Uranium	< 0.00100			0.00100	12/28/2022 13:40	WG1979170

















Analyte	mg/l	+ / -	mg/l	date / time	
Uranium	<0.00100		0.00100	12/28/2022 13:40	WG1979170

MDA

pCi/l

0.185

30.0-143

Analysis Date

01/10/2023 19:03

01/10/2023 19:03

date / time

Batch

WG1977878 WG1977878

ACCOUNT:

UTMSI - University of TX Marine Science

SAMPLE RESULTS - 09

Collected date/time: 12/08/22 14:30

Mercury by Method 7470A

	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch	
Analyte	mg/l		mg/l	mg/l		date / time		
Mercury	<0.00100		0.00100	0.00200	10	12/21/2022 14:34	WG1977462	



















Analyte

RADIUM-226

(T) Barium-133

SAMPLE RESULTS - 10

Collected date/time: 12/08/22 14:30

Result

pCi/l

3.25

68.5

Qualifier

Uncertainty

+/-

0.795

Radiochemistry by Method D5174

Radiochemistry by Method SM7500Ra B M

	Result	Qualifier	Uncertainty	RDL	Analysis Date	Batch
Analyte	mg/l		+ / -	mg/l	date / time	
Uranium	<0.00100			0.00100	12/28/2022 13:42	WG1979170

MDA

pCi/l

0.424

30.0-143

Analysis Date

01/10/2023 19:03

01/10/2023 19:03

date / time

Batch

WG1977878 WG1977878





Ss















SAMPLE RESULTS - 11

L156

Collected date/time: 12/08/22 14:30 Mercury by Method 7470A

	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch	
Analyte	mg/l		mg/l	mg/l		date / time		
Mercury	<0.00100		0.00100	0.00200	10	12/21/2022 14:36	WG1977462	



















SAMPLE RESULTS - 12

Collected date/time: 12/08/22 14:30

Radiochemistry by Method D5174

	Result	Qualifier	Uncertainty	RDL	Analysis Date	Batch
Analyte	mg/l		+ / -	mg/l	date / time	
Uranium	<0.00100			0.00100	12/28/2022 13:45	WG1979170





Ss















	Result	Qualifier	Uncertainty	MDA	Analysis Date	Batch
Analyte	pCi/l		+/-	pCi/l	date / time	
RADIUM-226	1.50		0.562	0.392	01/10/2023 19:03	WG1977878
(T) Barium-133	67.8			30.0-143	01/10/2023 19:03	WG1977878

SAMPLE RESULTS - 13

L1569444

Collected date/time: 12/06/22 09:30 Mercury by Method 7470A

	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch	
Analyte	mg/l		mg/l	mg/l		date / time		
Mercury	<0.00100		0.00100	0.00200	10	12/21/2022 14:39	WG1977462	



















SAMPLE RESULTS - 14

Radiochemistry by Method D5174

Collected date/time: 12/06/22 09:30

	Result	Qualifier	Uncertainty	RDL	Analysis Date	Batch
Analyte	mg/l		+ / -	mg/l	date / time	
Uranium	0.00872		0.000434	0.00100	12/28/2022 13:53	WG1979170





Ss















	Result	Qualifier	Uncertainty	MDA	Analysis Date	Batch
Analyte	pCi/I		+/-	pCi/l	date / time	
RADIUM-226	1.73		0.521	0.304	01/06/2023 15:41	WG1979908
(T) Barium-133	87.0			30.0-143	01/06/2023 15:41	WG1979908

SAMPLE RESULTS - 15 L1569444

Collected date/time: 12/06/22 10:00

Mercury by Method 7470A

-	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
Analyte	mg/l		mg/l	mg/l		date / time	
Mercury	<0.00100		0.00100	0.00200	10	12/21/2022 14:43	WG1977462



















SAMPLE RESULTS - 16

L1569444

Radiochemistry by Method D5174

Collected date/time: 12/06/22 10:00

	Result	Qualifier	Uncertainty	RDL	Analysis Date	Batch
Analyte	mg/l		+ / -	mg/l	date / time	
Uranium	0.0123		0.000610	0.00100	12/28/2022 13:55	WG1979170

²Tc



	Result	Qualifier	Uncertainty	MDA	Analysis Date	Batch
Analyte	pCi/l		+/-	pCi/l	date / time	
RADIUM-226	1.58		0.536	0.418	01/06/2023 15:41	WG1979908
(T) Barium-133	83.1			30.0-143	01/06/2023 15:41	WG1979908















SAMPLE RESULTS - 17

L1569444

Collected date/time: 12/06/22 10:30 Mercury by Method 7470A

	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
Analyte	mg/l		mg/l	mg/l		date / time	
Mercury	<0.00100		0.00100	0.00200	10	12/21/2022 14:45	WG1977462



















SAMPLE RESULTS - 18

Radiochemistry by Method D5174

Collected date/time: 12/06/22 10:30

	Result	Qualifier	Uncertainty	RDL	Analysis Date	<u>Batch</u>
Analyte	mg/l		+/-	mg/l	date / time	
Uranium	0.0130		0.000644	0.00100	12/28/2022 13:58	WG1979170





Ss















	Result	Qualifier	Uncertainty	MDA	Analysis Date	Batch
Analyte	pCi/l		+ / -	pCi/l	date / time	
RADIUM-226	0.270	<u>J3</u>	0.227	0.255	01/06/2023 15:41	WG1979908
(T) Barium-133	81.3			30.0-143	01/06/2023 15:41	WG1979908

QUALITY CONTROL SUMMARY

L1569444-02,04,06,08,10,12,14,16,18

Radiochemistry by Method D5174

Method Blank (MB)

(MB) R3876550-1 12/28/22 12:45

MB Result MB Qualifier MB MDL M

 MB Result
 MB Qualifier
 MB MDL
 MB RDL

 Analyte
 mg/l
 mg/l
 mg/l

 Uranium
 <0.00100</td>
 0.00100
 0.00100



²Tc



L1569444-04 Original Sample (OS) • Duplicate (DUP)

(OS) L1569444-04 12/28/22 13:35 • (DUP) R3876550-5 12/28/22 12:56

	Original Result	DUP Result	Dilution	DUP RPD	DUP Qualifier	DUP RPD Limits
Analyte	mg/l	mg/l		%		%
Uranium	<0.00100	<0.00100	1	0.000		20





⁶Qc

Laboratory Control Sample (LCS)

(LCS) R3876550-2 12/28/22 12:48

	Spike Amount	LCS Result	LCS Rec.	Rec. Limits
Analyte	mg/l	mg/l	%	%
Uranium	0.0300	0.0284	94.8	80 0-120





L1566524-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1566524-01 12/28/22 12:58 • (MS) R3876550-3 12/28/22 12:51 • (MSD) R3876550-4 12/28/22 12:53

(03) 11300324 01	12/20/22 12.50 - (1415) 1	13070330 3 12	2/20/22 12.01	· (IVISB) 1(5070	330 + 12/20/	22 12.55							
	Spike Amount	Original Result	MS Result	MSD Result	MS Rec.	MSD Rec.	Dilution	Rec. Limits	MS Qualifier	MSD Qualifier	RPD	RPD Limits	
Analyte	mg/l	mg/l	mg/l	mg/l	%	%		%			%	%	
Uranium	0.0200	<0.00100	0.0170	0.0176	84.9	88.2	1	75.0-125			3.83	20	

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QUALITY CONTROL SUMMARY

Radiochemistry by Method SM7500Ra B M

L1569444-02,04,06,08,10,12

Method Blank (MB)

(MB) R3880744-1 01/10/2	23 19:03			
	MB Result	MB Qualifier	MB Uncertain	ty MB MDA
Analyte	pCi/I		+ / -	pCi/I
Radium-226	0.0132	<u>U</u>	0.0471	0.0859
(T) Barium-133	84.9		84.9	





L1564686-02 Original Sample (OS) • Duplicate (DUP)

(OS) L1564686-02 01/10/23 19:03 • (DUP) R3880744-5 01/10/23 19:0	(OS) L1564686-02	01/10/23 19:03 •	(DUP) R3880744-5	01/10/23 19:03
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	Original Result	Original Uncertainty	Original MDA	DUP Result	DUP Uncertainty	DUP MDA	Dilution	DUP RPD	DUP RER	DUP Qualifier	DUP RPD Limits	DUP RER Limit
Analyte	pCi/l	+ / -	pCi/l	pCi/l	+/-	pCi/l		%			%	
Radium-226	0.640	0.294	0.211	0.118	0.187	0.211	1	138	1.50	<u>J</u>	20	3
(T) Barium-133	87.2			93.2	93.2							







Laboratory Control Sample (LCS)

	01/10/23 19:03

(LCS) R3000/44-2 01/1	10/23 19.03				
	Spike Amount	LCS Result	LCS Rec.	Rec. Limits	LCS Qualifier
Analyte	pCi/l	pCi/l	%	%	
Radium-226	5.02	5.37	107	80.0-120	
(T) Barium-133			87.4		





L1564686-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1564686-01 01/10/23 19:03 • (MS) R3880744-3 01/10/23 19:03 • (MSD) R3880744-4 01/10/23 19:03

(03) 1304000-01 01/1	0/25 15.05 (1015) 1	13000744-3 0	1/10/23 13.03	(IVISD) 1(3000)	77-7 01/10/2	3 13.03							
	Spike Amount	Original Result	MS Result	MSD Result	MS Rec.	MSD Rec.	Dilution	Rec. Limits	MS Qualifier	MSD Qualifier	RPD	MS RER	RPD Limits
Analyte	pCi/l	pCi/l	pCi/I	pCi/l	%	%		%			%		%
Radium-226	20.0	0.768	22.6	20.5	109	98.6	1	75.0-125			9.62		20
(T) Barium-133		83.3			84.1	92.0							

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QUALITY CONTROL SUMMARY

Radiochemistry by Method SM7500Ra B M

L1569444-14,16,18

Method Blank (MB)

(MB) R3879328-1 01/06/23	3 15:41			
	MB Result	MB Qualifier	MB Uncertaint	y MB MDA
Analyte	pCi/l		+/-	pCi/l
Radium-226	-0.00738	<u>U</u>	0.0145	0.0488
(T) Barium-133	102		102	





L1569444-18 Original Sample (OS) • Duplicate (DUP)

. ,	Original Result	Original Uncertainty	Original MDA	DUP Result	DUP Uncertainty	DUP MDA	Dilution	DUP RPD	DUP RER	DUP Qualifier	DUP RPD Limits	DUP RER Limit
Analyte	pCi/l	+ / -	pCi/I	pCi/l	+ / -	pCi/l		%			%	
Radium-226	0.270	0.227	0.255	2.88	0.701	0.255	1	166	3.54	<u>J3</u>	20	3
(T) Barium-133	81.3			87.1	87.1							







⁷Gl

Laboratory Control Sample (LCS)

(LCS) R3879328-2 01	/06/23 15:41
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(LCS) 1(30733202 0	1/00/25 15.41				
	Spike Amount	LCS Result	LCS Rec.	Rec. Limits	LCS Qualifier
Analyte	pCi/l	pCi/l	%	%	
Radium-226	5.02	5.61	112	80.0-120	
(T) Barium-133			109		





L1569496-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

 $(OS) \, L1569496-O1 \ \, O1/O6/23 \, 15:41 \bullet (MS) \, R3879328-3 \ \, O1/O6/23 \, 15:41 \bullet (MSD) \, R3879328-4 \ \, O1/O6/23 \, 15:41 \bullet (MSD) \, R3879328-4 \, \, O1/O6/23 \, \, O$

` '	, ,			, ,									
	Spike Amount	Original Result	MS Result	MSD Result	MS Rec.	MSD Rec.	Dilution	Rec. Limits	MS Qualifier	MSD Qualifier	RPD	MS RER	RPD Limits
Analyte	pCi/l	pCi/l	pCi/l	pCi/l	%	%		%			%		%
Radium-226	20.0	1.92	21.6	22.5	98.5	103	1	75.0-125			3.81		20
(T) Barium-133					105	102							

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QUALITY CONTROL SUMMARY

L1569444-01,03,05,07,09,11,13,15,17

Mercury by Method 7470A Method Blank (MB)





Ss

Laboratory Control Sample (LCS)

(LCS) R3874436-2 12/21/22 13:56

	Spike Amount	LCS Result	LCS Rec.	Rec. Limits	LCS Qualifier
Analyte	mg/l	mg/l	%	%	
Mercury	0.00300	0.00253	84.2	80.0-120	



L1569368-03 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1569368-03 12/21/22 14:02 • (MS) R3874436-3 12/21/22 14:04 • (MSD) R3874436-4 12/21/22 14:06

(,		Original Result		MSD Result	MS Rec.	MSD Rec.	Dilution	Rec. Limits	MS Qualifier	MSD Qualifier	RPD	RPD Limits
Analyte	mg/l	mg/l	mg/l	mg/l	%	%		%			%	%
Mercury	0.00300	< 0.000100	0.00283	0.00284	94.4	94.5	1	75.0-125			0.176	20







PAGE:

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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.
MDL	Method Detection Limit.
RDL	Reported Detection Limit.
Rec.	Recovery.
RER	Replicate Error Ratio.
RPD	Relative Percent Difference.
SDG	Sample Delivery Group.
(T)	Tracer - A radioisotope of known concentration added to a solution of chemically equivalent radioisotopes at a known concentration to assist in monitoring the yield of the chemical separation.
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.

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ription

J	The identification of the analyte is acceptable; the reported value is an estimate.
J3	The associated batch QC was outside the established quality control range for precision.
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
lowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LA000356
Kentucky 16	KY90010	South Carolina	84004002
Kentucky ²	16	South Dakota	n/a
Louisiana	Al30792	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



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

TN00003

EPA-Crypto



















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

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