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Alpha Spectrometry Results for Groundwater Samples Collected in Northern Iraq and a Summary of the Environmental Setting of the Adaya Burial Site

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ABSTRACT

The Radiation Protection Center (RPC) of the Iraqi Ministry of Environment continues to evaluate the potential health impacts associated with the Adaya Burial Site, which is located 33 kilometers (20.5 miles) southwest of Mosul. This report documents the radiological analyses of 16 groundwater samples collected from wells located in the vicinity of the Adaya Burial Site and at other sites in northern Iraq. The Adaya Burial Site is a high-risk dump site because a large volume of radioactive material and contaminated soil is located on an unsecure hillside above the village of Tall ar Ragrag.

The uranium activities for the 16 water samples in northern Iraq are considered to be naturally occurring and do not indicate artificial (man-made) contamination. With one exception, the alpha spectrometry results for the 16 wells that were sampled in 2019 indicate that the water quality concerning the three uranium isotopes (Uranium-233/234, Uranium-235/236, and Uranium-238) was acceptable for potable purposes (drinking and cooking). However, Well 7 in Mosul had a Uranium-233/234 activity concentration that slightly exceeded the World Health Organization guidance level. Eight of the 16 wells are located in the villages of Tall ar Ragrag and Adaya and had naturally occurring uranium concentrations.

Wells in the villages of Tall ar Ragrag and Adaya are located near the Adaya Burial Site and should be sampled on an annual schedule. The list of groundwater analytes should include metals, total uranium, isotopic uranium, gross alpha/beta, gamma spectroscopy, organic compounds, and standard water quality parameters. Our current understanding of the hydrogeologic setting in the vicinity of the Adaya Burial Site is solely based on villager's domestic wells, topographic maps, and satellite imagery. To better understand the hydrogeologic setting, a Groundwater Monitoring Program needs to be developed and should include the installation of twelve groundwater monitoring wells in the vicinity of Tall ar Ragrag and the Adaya Burial Site. Characterization of the limestone aquifer and overlying alluvium is needed.

RPC should continue to support health assessments for the villagers in Tall ar Ragrag and Adaya. Collecting samples for surface water (stormwater), airborne dust, vegetation, and washway sediment should be conducted on a routine basis. Human access to the Adaya Burial Site needs to be strictly limited. Livestock access on or near the burial site needs to be eliminated.

The surface-water exposure pathway is likely a greater threat than the groundwater exposure pathway. Installation of a surface-water diversion or collection system is recommended in order to reduce the potential for humans and livestock to come in contact with contaminated water and sediment.

To reduce exposure to villagers, groundwater treatment should be considered if elevated uranium or other contaminants are detected in drinking water. Installing water-treatment systems would likely be quicker to accomplish than remediation and excavation of the Adaya Burial Site.

The known potential for human exposure to uranium and metals (such as arsenic, chromium, selenium, and strontium) at the Adaya Burial Site is serious. Additional characterization, mitigation, and remediation efforts should be given a high priority.

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ACRONYMS AND ABBREVIATIONS

Bq/L	becquerels per liter
ºC	degrees Celsius
ESRI	Environmental Systems Research Institute
ºF	degrees Fahrenheit
g/L	grams per liter
GEL	General Laboratories LLC
GMP	Groundwater Monitoring Program
HASL	Health and Safety Laboratory
IAEA	International Atomic Energy Agency
IDP	Iraqi Decommissioning Program
m	meters
MDA	minimum detectable activity
mg/L	milligrams per liter
MoST	Ministry of Science and Technology
mrem/hr	millirem per hour
pCi/L	picocuries per liter
RPC	Radiation Protection Center
SNL	Sandia National Laboratories
TTU	Texas Tech University
TDS	total dissolved solids
U.S.	United States
UN	United Nations
WHO	World Health Organization

1.0 INTRODUCTION

In 2019, the RPC requested that Sandia National Laboratories (SNL) coordinate the analysis and reporting of alpha spectrometry data for groundwater samples collected in the vicinity of the Adaya Burial Site. This report documents the radiological analyses of groundwater samples collected by the Iraq Ministry of Environment Radiation Protection Center (RPC) in 2019 in the vicinity of the Adaya Burial Site and at other sites in northern Iraq. The International Atomic Energy Agency (IAEA) has determined that the Adaya Burial Site is a high-risk dump site because a large volume of radioactive material is located at an unsecure location on a hillside above the neighboring village of Tall ar Ragrag and washway-water samples contained elevated uranium concentrations (IAEA, 2013). Characterization missions performed by Texas Tech University (TTU) and SNL in 2011 further defined the priorities for decommissioning and remediation of the Adaya Burial Site and the Al-Tuwaitha Nuclear Research Center (IAEA, 2013).

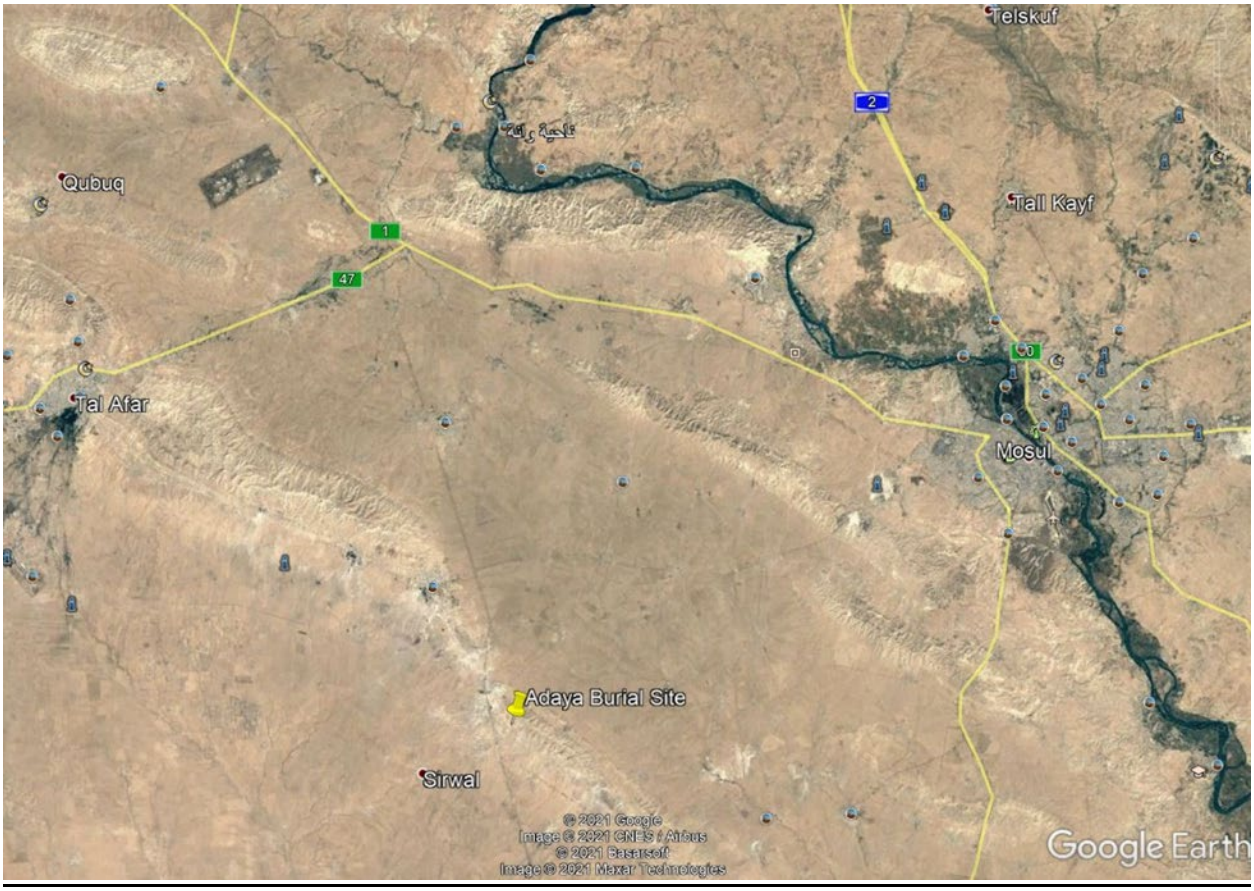
The most comprehensive field inspections available to the SNL authors are from Chesser (February 2011 and June 2011). The spelling of geographic features in this report is consistent with his inspections. This report also benefits from recently downloaded satellite imagery obtained from the Environmental Systems Research Institute (ESRI) website.

2.0 BACKGROUND OF THE ADAYA BURIAL SITE

The Adaya Burial Site is located approximately 33 kilometers (20.5 miles) southwest of Mosul in a sparsely populated region of desert (Figure 1). In February 1991, material from the Al Jesira uranium feedstock production facility was transported to a remote, previously undeveloped location which became known as the Adaya Burial Site. The material consisted of processing equipment and uranium products that were hastily buried in earthen trenches and covered with native soil in order to conceal the contents from Coalition Forces during Operation Desert Storm. United Nations (UN) Inspection Teams discovered the Adaya Burial Site in 1991 and some equipment was returned to the Al Jesira facility. However, an estimated 5,000 kilograms (11,000 pounds) of uranium compounds remain at the Adaya Burial Site. The uranium compounds consist of yellowcake, ammonium diuranate, uranium dioxide, uranium trioxide, and uranium tetrachloride (Chesser, June 2011). A timeline of Iraqi and International response activities conducted at the Adaya Burial Site is presented in Appendix A.

3.0 GEOGRAPHIC SETTING

Two villages are located near the Adaya Burial Site. The village of Tall ar Ragrag is located 2.1 kilometers (1.3 miles) southwest of the site and is topographically downslope of the Adaya Burial Site. The village of Adaya is located northwest and slightly closer at 1.5 kilometers (0.9 miles) from the Adaya Burial Site but is not downslope of the site. The populations of Tall ar Ragrag and Adaya are estimated at 500 to 1,000 villagers each. Hillsides located to the east of the villages are treeless with a minor amount of vegetation. Flatter terrain near the villages, especially north of Adaya, is mostly used for farming. A few small orchards are present in the vicinity of the villages. Most roads in the region are unpaved and there are no industrial facilities.



Location of the Adaya Burial Site in Northern Iraq (Google Earth, 2021)

The Adaya Burial Site consists of two separate dumping sites (a Northern Site and a Southern Site) that are covered with large mounds of soil, concrete rubble, crushed metal, corroded steel drums, and ceramic tiles. The debris is partially buried in a desert scrubland that slopes downward to the west (Chesser, June 2011 and IAEA, 2013). A ravine separates the two dumping sites (Figure 2).

Based upon SNL's interpretation of recent satellite imagery (ESRI, July 2019), the visually apparent surface area for the Adaya Burial Site is estimated at approximately 0.044 square kilometers (0.0164 square miles or 10.48 acres) (Table 1).

Table 1

Surface Areas of the Two Sites Within the Adaya Burial Site Based Upon Recent Interpretation of Satellite Imagery (Sandlin, June 2021)

Feature	Surface Area, square meters	Surface Area, square kilometers	Surface Area, square miles	Surface Area, acres
Northern Site	19,939	0.019939	0.0075	4.79
Southern Site	23,028	0.023028	0.0089	5.69
Total, Adaya Burial Site	44,286	0.044286	0.0164	10.48

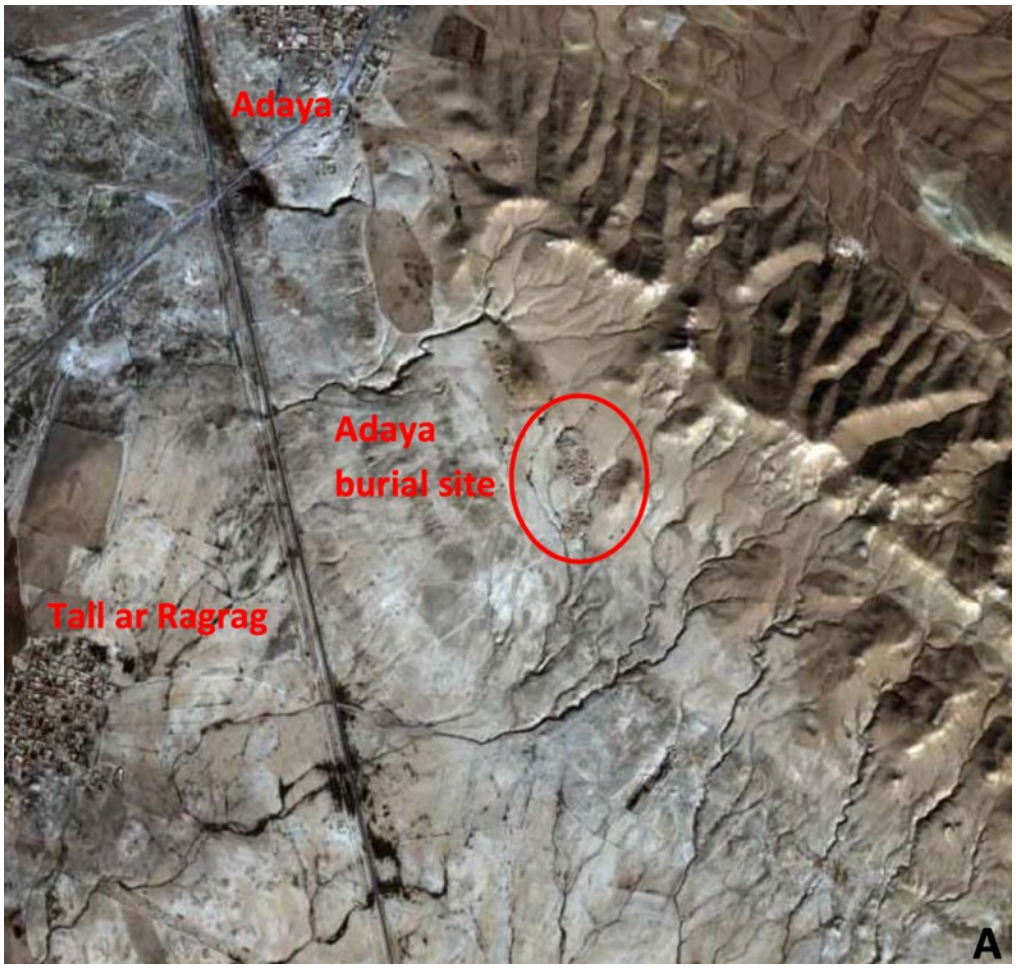


Figure 2
Location of the Adaya Burial Site near the Villages of Adaya and Tall ar Ragrag
(Chesser, February 2011)

Iraq has a hot, dry climate characterized by long, hot, dry summers and short, cool winters. Based on records available for the surrounding area, the annual rainfall at the Adaya Burial Site is estimated at 348 mm (13.7 inches).

The Adaya Burial Site is located within the Jezira Aquifer System (Jassim and Goff, 2006). Groundwater is present in beds of gypsum, marl (calcium carbonate rich-mudstone), and thin limestones. The main aquifer group is Miocene age (approximately 5 to 23 million years old) karstic gypsum. The primary water type is sulphate. The depth to water in the Tall ar Ragrag wells averages approximately 5 meters (16.5 feet). The direction of groundwater flow in the limestone aquifer near the Adaya Burial Site likely mimics the topography and thus is inferred to be towards the southwest.

At present, our poor understanding of the stratigraphy is a significant data gap near the Adaya Burial Site. Groundwater beneath the two nearby villages is known to be derived from a limestone aquifer. However, groundwater in limestone typically exists in fractures that can be difficult to map and interpret. The thickness and stratigraphic dip of the limestone aquifer are also not known. The presence of large fractures in the limestone aquifer near the Adaya Burial Site has not been explored.

Karstic (containing large voids and fractures) terrain has been mapped elsewhere in Iraq. If the limestone aquifer is karstic near Tall ar Ragrag, groundwater velocities could be significant and potentially allow contaminants to migrate at an increased rate. Higher groundwater velocities can therefore contribute to an additional risk to the local population. Another data gap concerns the thickness and saturation of alluvium that likely overlies the limestone unit. Because no wells are known to have been installed in the overlying alluvium, the authors assume that water in the alluvium occurs in meager amounts, is seasonal in nature, and/or has naturally poor quality. However, groundwater migration in alluvium typically occurs as porous flow and could have an important influence on the limestone aquifer.

4.0 SURFACE WATER AND TOPOGRAPHY

No perennial (year-round) streams or rivers are located within 20 kilometers (12.4 miles) of the two villages. Numerous typically dry drainages extend across the hillsides east of Tall ar Ragrag. The desert has infrequent rainfall. Surface water flowing across the land surface or accumulating in drainages is generally short-lived. Stormwater resulting from precipitation occasionally flows in the drainages towards Tall ar Ragrag. It should be noted that several different names (washways, arroyos, drainages, and channels) have been used by various authors for the same geomorphic feature in Iraq. For consistency with IAEA (2013), this report will use the term washway. Satellite imagery shows that at least two small artificial ponds are located in Tall ar Ragrag (ESRI, July 2019). RPC (2012) mentions the presence of artificial ponds near Tall ar Ragrag.

The Adaya Burial Site is located on a hillside that is dissected by ravines. Photographs in Chesser (June 2011) and RPC (2017) show that virtually no vegetation grows on the burial mounds. Precipitation can easily erode the burial mounds and flush contaminants down slope into the washways. Generally, an established washway will transmit water in a consistent pattern from year to year. However, in response to large precipitation events the washways could shift laterally and deepen.

Figure 3 shows the Chesser (2011) interpretation of the surface water (stormwater runoff) flow path from the Adaya Burial Site to Tall ar Ragrag. More recent 2019 satellite imagery with higher resolution is shown on Figure 4. Figure 5 presents a revised interpretation of surface-water flow paths and shows a more complex pattern of drainage channels, ponding, and irrigation ditches.

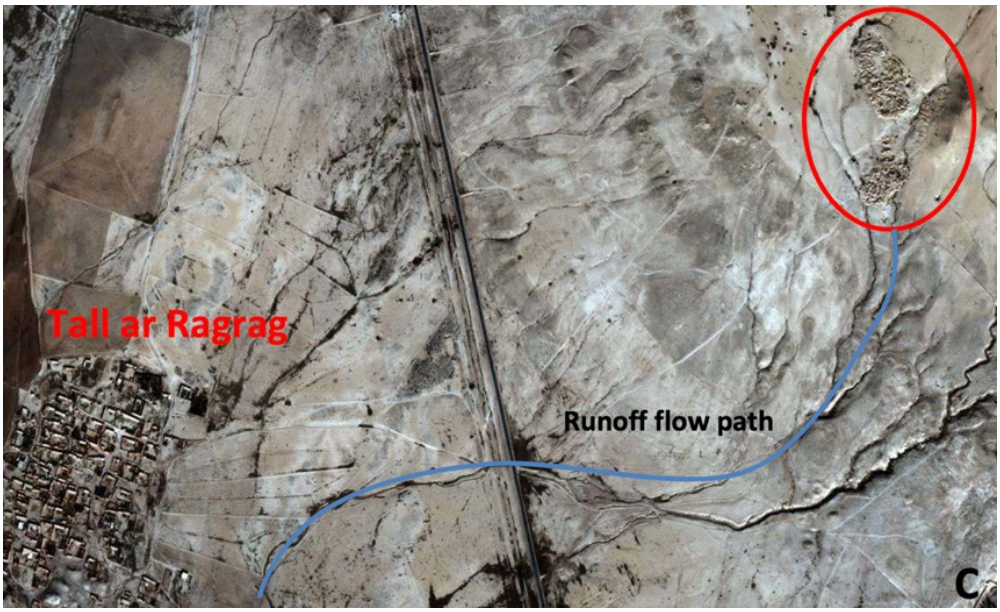


Figure 3

Stormwater Runoff Flow Path from the Adaya Burial Site to Tall ar Ragrag (Chesser, February 2011)

Figure 4
Satellite Imagery for the Vicinity of the Adaya Burial Site and Tall ar Ragrag (ESRI June 2019)

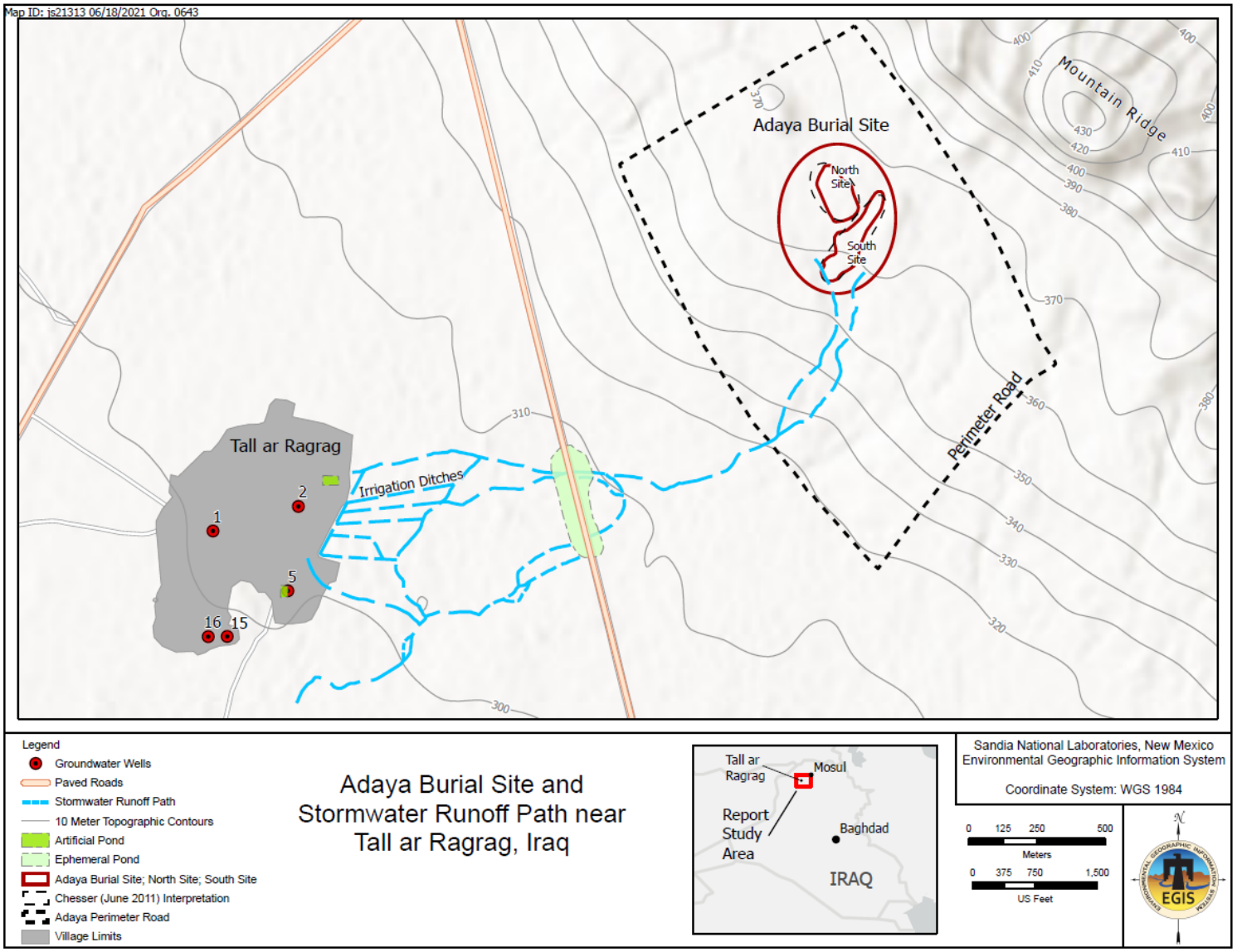


Figure 5

Interpretation of Revised Stormwater Runoff Flow Path from the Adaya Burial Site to Tall ar Ragrag

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5.0 RADIOLOGICAL CONCERNS

Chesser (June 2011) has presented the most detailed description of the Adaya Burial Site available to the authors of this report. His two-day, shoulder-to-shoulder walk-over survey with an estimated five to ten radiological technicians is probably the most comprehensive survey to date. The Adaya Burial Site was covered with large 2 to 5 meter (6.6 to 16.5 foot) high mounds of rubble (soil, concrete, ceramic tile, metal, etc.) surrounded by natural sloping terrain. Surface contamination with radioactive material was detected at over 100 locations. Hundreds of corroded, contaminated barrels (200 liter [55-gallon] steel drums) were exposed on the ground surface with radiation levels reading well above United States (U.S.) regulatory limits. Surface layers of radioactive yellowcake up to 15 centimeters (5.9 inches) deep were observed. Much of the surface debris and soil mounds appeared to be emplaced above a deeper horizon of drums that contained uranium compounds. Chesser (June 2011) observed that drums were buried at depths of up to 3 meters in the pre-existing excavations. Chesser (June 2011) estimated that the total volume of contaminated soil and debris to be removed during the proposed remediation activities would be approximately 500,000 cubic meters (650,000 cubic yards).

Chesser (June 2011) stated that there was no feasible way to determine the extent of the buried debris without conducting extensive excavations or using ground-penetrating radar or magnetometers. The greatest observed surface contamination appeared to be in a washway that suggested the ongoing potential for runoff and leaching of radioactive material. Chesser (June 2011) noted further that the washway leads down the hillside and connects with irrigation systems at the village of Tall ar Ragrag.

RPC (2012) estimated that up to three tons of yellowcake and uranium oxide remain at the Adaya Burial Site. The Adaya Burial Site contains an estimated 80 metric tons (80,000 kilograms; 176,370 pounds) of contaminated and destroyed equipment that were dumped into excavations and covered with soil. Most of the uranium is likely dispersed throughout the soil. The IAEA (2013) noted that the potential health hazards at the Adaya Burial Site consist of unsecured uranium, metals, and chemicals. As shown in Table 2, IAEA (2013) listed several 'extreme values' for washway water samples collected at the Adaya Burial Site. The authors of this report assume that these values represent the maximum concentrations for the metals of most concern. More than 200 samples were analyzed for twelve metals using Inductively Coupled Plasma Mass Spectrometry. Specific sample locations were not discussed in IAEA (2013). The uranium activity concentration of 378.88 micrograms per liter (µg/L) for the washway water sample is over twelve times greater than the World Health Organization (WHO, 2017) drinking-water guidance level of 30 µg/L for total uranium. Because surface water can flow faster than groundwater and can carry greater amounts of contaminated material, the surface-water pathway is likely the greater concern for human exposure.

Table 2
Maximum Metal Concentrations for Washway-water Samples collected in 2011 and 2012 at the Adaya Burial Site (IAEA, 2013)

Sample Type	Description	Uranium, µg/L	Strontium, µg/L	Arsenic, µg/L	Selenium, µg/L	Chromium, µg/L
Water	Washway water	378.88	9355.52	0.88	7.49	3.63
Water	WHO (2017) guidance	30	no value	10	40	50

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6.0 WELL DETAILS AND 2019 SAMPLE COLLECTION

In 2019, RPC personnel collected groundwater samples from 16 wells in northern Iraq (Figure 6). Appendix B presents the sampling, geographic, and well-construction details provided by the RPC. Appendix C organizes this information according to four geographic locations. Of most concern are Wells 1, 2, 5, 15, and 16 that are located inside the village of Tall ar Ragrag. Wells 3, 10, and 11 are located in the nearby village of Adaya. Wells 9 and 14 are located near the Al Jesira production facility and Wells 4, 6, 7, 8, 12, and 13 are located in the city of Mosul.

Table C-1 lists the usage for each well and its proximity to nearby bodies of water, the Adaya Burial Site, and to nearby villages or cities. The wells located in Tall ar Ragrag are used for livestock and irrigation purposes. These five wells are located between approximately 2.2 to 2.8 kilometers (1.4 to 1.7 miles) from the Adaya Burial Site. The three wells at the village of Adaya are used for similar purposes and are located slightly closer to the Adaya Burial Site; however, the three wells in Adaya are not downgradient (with respect to groundwater and surface water) of the Adaya Burial Site.

A recharge schematic depicting the groundwater and stormwater pathways from the Adaya Burial Site to Tall ar Ragrag is depicted on Figure 7. The limestone aquifer is assumed to extend across the region. Precipitation falling on the Adaya Burial Site can have multiple effects. Precipitation can leach contaminants from the debris and flush the contaminants downward to the water table. Hard rains can flush surface contaminants downslope along the ravines and washways. Precipitation can also recharge the limestone aquifer and increase the hydraulic gradient and groundwater velocity. A layer of alluvium is depicted on the recharge schematic, but its thickness and water quality are unknown.

As noted on Table C-1, the wells in Tall ar Ragrag are used for livestock and irrigation purposes. Where the villagers get their potable (drinking and cooking) water is not documented. As shown in Table C-2, the Tall ar Ragrag wells have shallow depths ranging from 17.4 to 20.4 meters (57.4 to 67.3 ft). Depths to water in the wells range from 4.1 to 6.4 meters (13.5 to 21.1 feet). Unfortunately, details concerning the drilling method and well installation process are not available to the authors of this report. One item of concern is the adequacy of annular seals (cement or bentonite slurry installed in a borehole between the well casing and the surrounding native soil/bedrock). This is a concern because surface water from nearby irrigation ditches could flow down through an ineffective seal and subsequently be withdrawn from the well and consumed.

Table C-3 lists the water-quality parameters that were measured either in the field or when the wells were sampled or later at the RPC laboratory. The salinity values can be compared to the criteria in Table C-4 and the total dissolved solids (TDS) values can be compared to the classification standards in Table C-5. Two of the Tall ar Ragrag wells yield fresh water suitable for potable purposes. The other three wells there have poor brackish water quality.

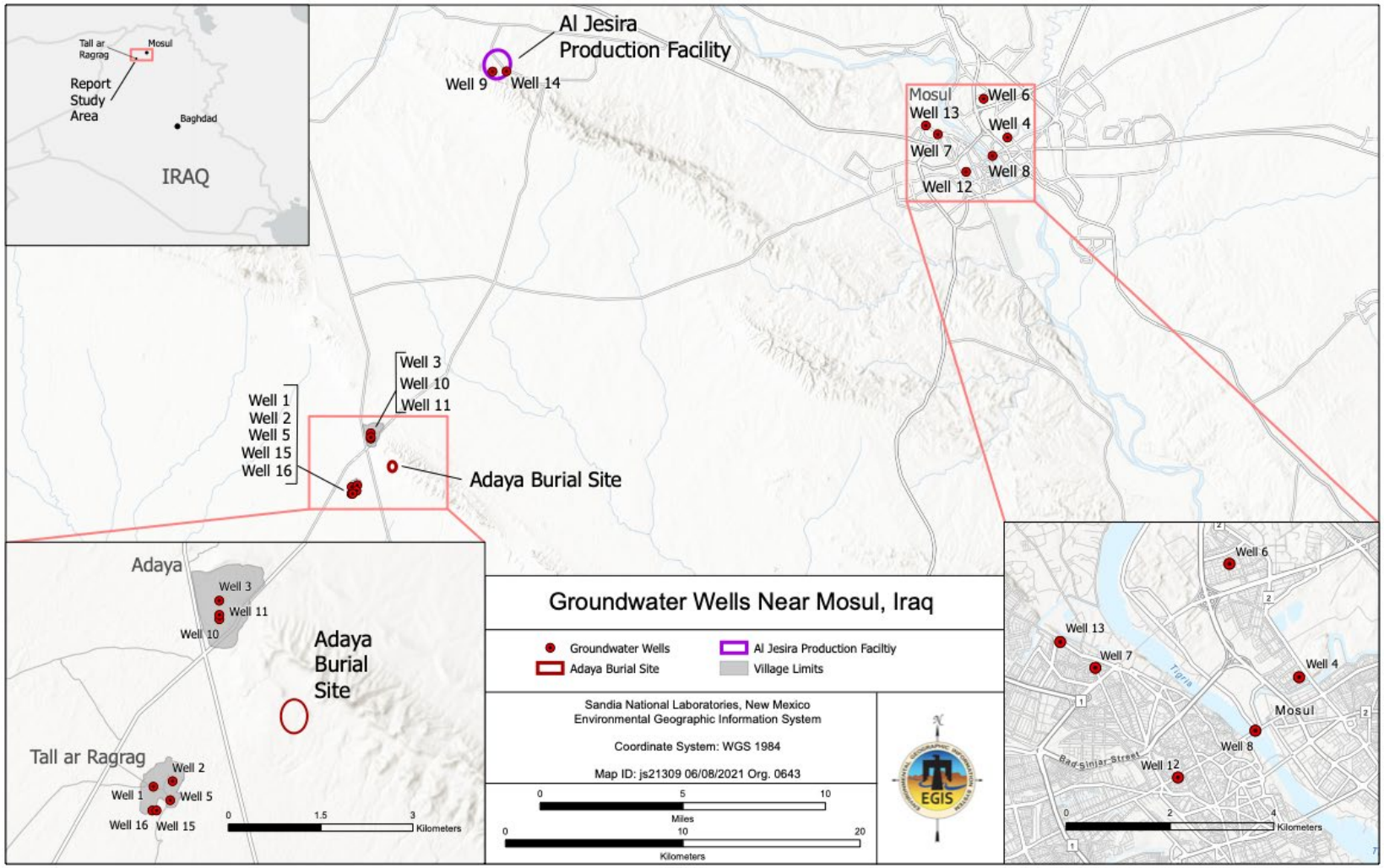

Figure 6
Locations of the Wells Sampled in Northern Iraq in 2019

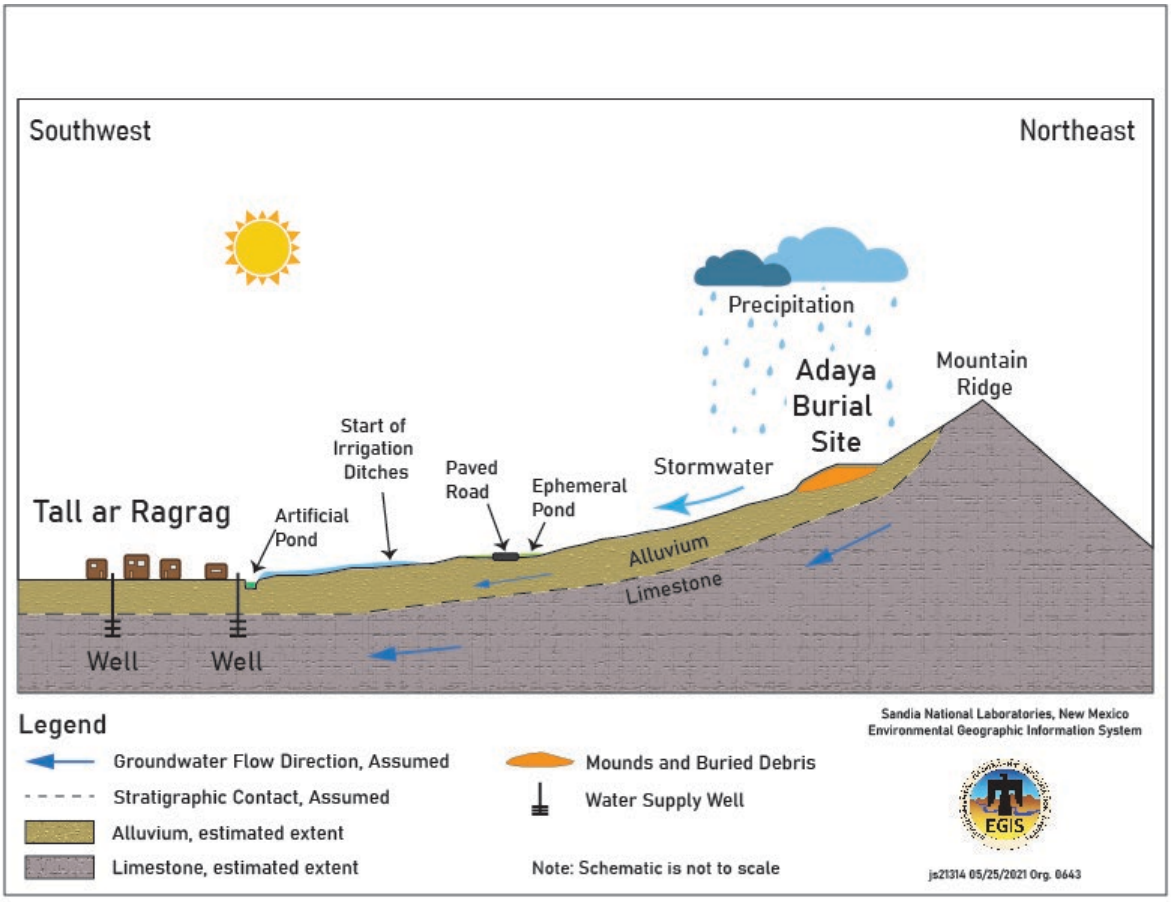

Figure 7
Recharge Schematic Depicting Groundwater and Surface-water Pathways from the Adaya Burial Site to the Village of Tall ar Ragrag

7.0 SAMPLE SHIPMENT AND INSPECTION

Samples from the 16 wells were shipped from Baghdad to Sandia National Laboratory in December 2020. The samples were inspected upon arrival and prepared for follow-on shipment to the General Laboratories (GEL) facility in Charleston, South Carolina where they were analyzed.

8.0 VALIDATION OF THE GEL ANALYTICAL REPORT

Appendix D presents the GEL analytical data report that includes analytical results, certificates of analyses, minimum detectable activity (MDA) values, critical levels for radiochemistry analyses, dates of analyses, results of quality control analyses, and data validation findings. The 16 samples were analyzed for Isotopic Uranium (Uranium-233/234, Uranium-235/236, and Uranium-238) using the Health and Safety Laboratory (HASL) 300 methodology (Department of Energy, 1997). Appendix E presents the Contract Verification Form that SNL compiled. The GEL report had no deficiencies.

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9.0 ALPHA SPECTROMETRY RESULTS FOR GROUNDWATER SAMPLES

Table 3 summarizes the alpha spectrometry results for the groundwater samples collected at the 16 wells. In general, the uranium activities for the Iraqi water samples are considered to be naturally occurring and do not indicate artificial (man-made) contamination. Typical concentrations of Uranium-238 in drinking water across the world range from 0 to 270 picocuries per liter (pCi/L) (UNSCEAR, 2000), and the Iraqi water samples are well within this range.

For additional comparison to international drinking-water standards, the authors of this report converted the GEL analytical data to becquerels per liter (Bq/L) as shown in Table 3. The WHO (2017) and IAEA (2016) have established guidance levels for two uranium isotopes with respect to drinking water. The Uranium-233/234 guidance level is 1 Bq/L and the Uranium-238 guidance level is 10 Bq/L. As shown in Table 3, only one Iraqi value exceeded the WHO (2017) guidance levels. Water from Well 7 in Mosul had a reported Uranium-233/234 activity of 1.010 Bq/L, which slightly exceeds the WHO guidance level of 1 Bq/L. The WHO (2017) considers the guidance levels to be highly conservative for radioactive exposure and cautions that radionuclides such as uranium also be evaluated for chemical toxicity.

Table 3
Summary of Alpha Spectrometry Results for the Sixteen Wells Sampled in 2019

Well	U-233/234, pCi/L	U-233/234, Bq/L	U-235/236, pCi/L	U-235/236, Bq/L	U-238, pCi/L	U-238, Bq/L
1	19.9 ±1.75	0.736	0.887 ± 0.152	0.033	17.9 ± 1.58	0.622
2	0.335 ±0.108	0.012	<MDA	n.a.	0.306 ± 0.0919	0.011
5	0.491 ± 0.117	0.018	<MDA	n.a.	0.572 ± 0.119	0.021
15	0.841 ± 0.155	0.031	<MDA	n.a.	0.613 ± 0.127	0.023
16	0.691 ± 0.120	0.026	0.0831 ± 0.0430	0.003	0.422 ± 0.895	0.016
3	1.36 ± 0.400	0.050	<MDA	n.a.	1.08 ± 0.334	0.040
10	1.47 ± 0.202	0.054	0.105 ± 0.0551	0.004	1.44 ± 0.193	0.053
11	6.92 ± 0.706	0.256	0.247 ± 0.0879	0.009	5.74 ± 0.601	0.212
9	1.19 ± 0.175	0.044	<MDA	n.a.	1.03 ± 0.157	0.038
14	3.48 ± 0.364	0.129	0.139 ± 0.0531	0.005	2.91 ± 0.313	0.108
4	0.431 ± 0.0959	0.016	<MDA	n.a.	0.271 ± 0.0731	0.010
6	2.48 ± 0.386	0.092	<MDA	n.a.	2.32 ± 0.361	0.086
7	27.3 ± 2.52	**1.010**	1.31 ± 0.224	0.048	25.2 ± 2.33	0.932
8	6.39 ± 0.626	0.236	0.272 ± 0.0800	0.010	5.80 ± 0.573	0.215
12	0.309 ± 0.0933	0.011	<MDA	n.a.	0.169 ± 0.0703	0.006
13	1.04 ± 0.159	0.038	<MDA	n.a.	1.01 ± 0.152	0.037
WHO GL	n.s.	1	n.s.	n.s.	n.s.	10

Note: Analytical values in the GEL analytical report (Appendix D) were reported in pCi/L. The authors of this report converted the values to Bq/L using a simple conversion factor.
<MDA = less than the minimum detectable activity.
Bold value exceeds the WHO (2017) guidance level.
Bq/L = becquerels per liter.
n.a. = not applicable.
n.s. = not specified.
pCi/L = picocuries per liter.
U = Uranium
WHO GL = World Health Organization (2017) guidance level for drinking water.

10.0 HEALTH ASSESSMENT FINDINGS

As noted in Appendix A, health assessments were conducted by the RPC in 2004, 2011, and 2012 (IAEA 2013). Additional health assessment may have been conducted since then, but those findings were not available to the authors of this report.

In May 2011, a health assessment was conducted by TTU, Iraq's Ministry of Science and Technology (MoST), and RPC personnel (Chesser, June 2011; Al-Musawi et al., September 2011). The investigators examined the potential contamination of water and food products in the villages of Tall ar Ragrag and Al Jesira. Samples of blood, hair, buccal (inner cheek) cells, and urine were collected from residents of Tall ar Ragrag. An on-site RPC laboratory was used to analyze the urine samples for creatinine clearance levels. Low creatinine levels in urine indicate possible kidney damage or improper kidney function. Chronic exposure to uranium could cause kidney damage. However, none of the villagers' urine samples showed low levels of creatinine (Chesser, June 2011).

In June and July 2012, the RPC conducted a health assessment at Tall ar Ragrag; the RPC advised villagers to not visit the Adaya Burial Site and not allow their animals into the area. Twenty-five environmental samples consisting of soil, plants, and groundwater were collected from different locations in and around the Adaya Burial Site and from Tall ar Ragrag, but the specific analytical results are not discussed in IAEA (2013) or other reports available to the authors.

11.0 CONCLUSIONS

In general, the uranium activities for the 16 groundwater samples are considered to be naturally occurring and do not indicate artificial (man-made) contamination. With one exception, the alpha spectrometry results for the 16 wells that were sampled in 2019 indicate that the water quality concerning the three uranium isotopes was acceptable for potable purposes (drinking and cooking). The range of uranium activities are indicative of naturally occurring conditions for 15 of the 16 wells. Well 7 in Mosul had a Uranium-233/234 activity concentration that slightly exceeded the WHO guidance level of 1 Bq/L and requires additional sampling. The authors of this report assume that the most important (as based on potential human exposure) and the most representative wells (for understanding the hydrogeologic setting) in the two villages of Tall ar Ragrag and Adaya were sampled by the RPC in 2019.

Analyses of washway water samples reported in previous studies indicate that the surface-water exposure pathway for humans is likely a greater threat than the groundwater exposure pathway.

12.0 RECOMMENDATIONS AND DATA GAPS

Several recommendations are proposed for the vicinity of the Adaya Burial Site and Tall ar Ragrag. The recommendations are organized below according to groundwater and site-remediation concerns:

<u>Groundwater Concern</u>

- Existing wells in the villages of Tall ar Ragrag and Adaya should be sampled on an annual schedule. The groundwater analyses should include metals, total uranium, isotopic uranium, gross alpha/beta, gamma spectroscopy, organics, and general water quality parameters (anions,

cations, and TDS). Samples of groundwater should be collected from wells that were sampled in 2019 and from any other wells that might be used for potable purposes. Quality-control samples such as duplicates and blanks also need to be collected during the sampling events.

- Our current understanding of the hydrogeologic setting in the vicinity of the Adaya Burial Site is solely based on villager's wells, topographic maps, and satellite imagery. To better understand the hydrogeologic setting, a Groundwater Monitoring Program (GMP) should be developed and should include the installation of up to 12 groundwater monitoring wells in the vicinity of Tall ar Ragrag and the Adaya Burial Site. Characterization of the limestone aquifer and overlying alluvium is needed. Such a GMP should incorporate the strategies that are discussed in the proposed Al-Tuwaitha Nuclear Research Center GMP (Copland and Cochran, 2013). For example, water levels in the proposed monitoring wells should be measured monthly.
- The authors recommend that the RPC conduct future radiological analyses of groundwater samples at their own laboratory if possible. As an alternative, European or Russian analytical laboratories are closer than analytical laboratories in the United States and should be used to obtain more timely results.
- Groundwater treatment should be considered if elevated uranium or other contaminants are detected in drinking water. Installing water-treatment systems would likely be quicker to accomplish than excavation/remediation of the burial site. IAEA (2013) lists several treatment methods such as coagulation, ion exchange, precipitation softening, reverse osmosis, and activated alumina.
- The sources of drinking water for the villages of Tall ar Ragrag and Adaya are not known to the authors. Appendix B mentions that the wells are only used for livestock, irrigation, and household (washing only) purposes. The drinking water sources need to be documented.
- Previous literature has focused on uranium and metals as the contaminants of concern for the Adaya Burial Site. Other analytes should be considered for future sampling plans involving groundwater, surface water, soil, sediment, and biota. The debris from the Al Jesira uranium feedstock production facility (Chesser June 2011) and the waste from the terrorist's petroleum fuel factories (RPC 2017) likely present additional chemical hazards. Analytical methods that incorporate petroleum hydrocarbons, organic compounds, and polychlorinated biphenyls should be used. More research of historical records should be conducted to determine that all chemicals are evaluated.

<u>Site-remediation Concern</u>

- The surface-water exposure pathway for humans is likely a greater threat than the groundwater exposure pathway. Because the planning and the excavation of the Adaya Burial Site will likely take several years, installation of a surface-water diversion or collection system is recommended to be conducted as soon as possible. Chesser (June 2011) presents a work-site layout design that incorporates surface-water controls and staging areas.
- During the rainy season, samples of washway water should be collected at several locations along the surface-water pathway, especially where ponding occurs and along the irrigation ditches near Tall ar Ragrag. The use of automated samplers would reduce how often personnel would need to visit the site. The timing and duration of standing water in washways and ponding areas have not been documented and are thus a significant data gap. The washway water samples should be analyzed for metals, total uranium, isotopic uranium, gross alpha/beta, gamma spectroscopy, organics, and standard water-quality parameters (cations, anions, TDS, etc.).

- SNL recommends that the RPC continue to support health assessments for the villages of Tall ar Ragrag and Adaya. In addition to continuing health assessments, collecting samples for surface water, airborne dust, vegetation, and washway sediment should be conducted on a routine basis.
- Human access to the Adaya Burial Site needs to be strictly limited. Livestock access on or near the burial site and in the vicinity of washways and areas of potential ponding needs to be eliminated.
- The known potential for human exposure to uranium and metallic (such as arsenic, chromium, selenium, and strontium) materials in the Adaya Burial Site is serious. Additional characterization, mitigation, and remediation efforts should be given a high priority.

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APPENDIX A

Timeline of Activities at the Adaya Burial Site

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The remoteness and ongoing security concerns at the Adaya Burial Site have limited the availability of literature in recent years. The following timeline presents the known events.

- February 1991. Al Jesira material (processing equipment, concrete rubble, and miscellaneous solid wastes) was hastily buried at the Adaya Burial Site. The site was apparently chosen based on its deep soil profile and remoteness.
- 1991. UN Inspection Team discovered several areas where uranium compounds were present inside damaged/corroded drums (barrels) and in the soil (Al-Musawi et al., September 2011).
- 1994. UN inspectors partially excavated the Adaya Burial Site and confirmed the presence of processing equipment and uranium compounds. Some machinery was removed (IAEA, 2013). Based on production and inventory records from Al Jesira, the UN inspectors estimated that about 5,000 kilograms (11,000 pounds) of uranium compounds remain buried.
- 1995-2003. No field investigations are known to have conducted at the Adaya Burial Site.
- February and June 2004. An extensive field inspection was conducted to determine if weapons of mass destruction were buried at the Adaya Burial Site; none were found. However, a variety of damaged equipment, piping, storage tanks, assorted debris, and corroded drums were excavated. Some material such as scrap metal was salvaged by a local contractor and shipped abroad. Radiation dose rates for the remaining debris were measured at 0.05 – 1 millirem per hour (mrem/hr), which is approximately 30 times background.
- September 2004. The RPC conducted a health assessment of Tall ar Ragrag village residents. Many contaminated drums were found to be exposed on the ground surface at the Adaya Burial Site. Some locations had high radiation levels at 0.5–70 microsieverts per hour. Layers of yellowcake were visible.
- 2007. For security reasons in the Ninewah governate, MoST delayed the Adaya Burial Site remediation project for five years (IAEA, 2013).
- February 2011. Personnel from TTU and the RPC conduct a joint inspection of the Adaya Burial Site and soil samples were collected. The field crew noted that substantial erosion had occurred in the previous 20 years. A health assessment was also conducted.
- June 2011. Personnel from RPC, MoST, TTU, and SNL conducted a field inspection (Chesser, June 2011; Al-Musawi et al., September 2011). Pieces of yellowcake were discovered to be scattered across the Adaya Burial Site. A health assessment of village residents was conducted at Tall ar Ragrag. A shoulder-to-shoulder walk-through survey of the Adaya Burial Site was conducted to identify and mark any significant surface contamination. Soil and water (drinking, well, and irrigation) samples were collected by the RPC (IAEA, 2013).
- April 2012. Fifty-five soil samples were collected at the Adaya Burial Site.
- June and July 2012. The RPC conducted a health assessment at Tall ar Ragrag to raise public awareness. Warning signs were placed around the Adaya Burial Site (IAEA, 2013). Radiological surveys and soil sampling were conducted. Uranium contamination was visible at the ground surface in a layer up to 10 centimeters (4 inches) thick (IAEA, 2013). In July

2012, soil samples were collected from the Adaya Burial Site and from a dry stream bed 100 meters (330 feet) located south of the site.

- May 2013. Escalation of violence in Mosul caused delays in work at the Adaya Burial Site (IAEA, 2013).
- 2015 - 2017. Terrorists built and used small fuel factories at the Adaya Burial Site to produce fuel for cars and generators. The perimeter fencing was removed. Dark colored waste, presumably from petroleum fuels, was dumped on the ground surface (RPC, 2017).
- August 2017. RPC conducted a brief inspection of the Adaya Burial Site (RPC, 2017). The small fuel factories and associated disposal sites were photographed. Contents of a damaged radioactive-waste drum emitted 0.2 – 1.0 mrem/hr at a distance of 5 centimeters (2 inches).
- Circa 2017. A perimeter road was graded to encompass the Adaya Burial Site and the surrounding hillsides (ESRI, July 2019). [Who and when the road was built is not known to the authors.] The rectangular area covers approximately 1.7 square kilometers (0.66 square miles or 420 acres). Several small unpaved roads were cut across the perimeter road. Numerous trenches inside and outside of the rectangle are visible on satellite imagery (ESRI, July 2019).
- 2019. RPC personnel collected groundwater samples from 16 wells in northern Iraq. Shipment of the groundwater samples was delayed due to the COVID-19 pandemic.
- December 2020. RPC shipped 16 groundwater samples to SNL.
- January 2021. SNL inspected the groundwater samples. The samples were repackaged and shipped to General Laboratories LLC (GEL) for alpha spectrometry analyses.

APPENDIX B

Original RPC (2019) Spreadsheet

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Well Name	Sample code	GPS coordinates (lat./long.)	Ground elevation, meters above sea level (feet)	Well use	Is well near a stream or water body?	Distance to uranium burial site, kilometers	Distance to village, kilometers	Well type	Well diameter, centimeters, Inchs	Well depth, meters	Depth to water in well, meters	Water bearing zone	Date consrtructed	How is water removed from well?	Quality of water	Sal.	TDS mg/l	µΩ	µs/cm	PH	T/°C	Gamma Spectromtry (K-40 in Bq/kg)
1	RPC.RG.W.1.18.19	36.17896249 43.73650465	1037	Livestock and Irrigation	No	1.8	Inside Tall ar Ragrag village	Steel pipe	8 inchs	57 ft	15.5 ft	Limestone	2004	Electric Pump	Salty with lettle bitter	0.1	425	0.002	428	7.8	25	45.2 ± 11.2
2	RPC.RG.W.2.18.19	36.17977564 43.73998566	1040	Livestock and Irrigation	No	1.7	Inside Tall ar Ragrag village	Steel pipe	8 inchs	67 ft	15 ft	Limestone	2008	Electric Pump	Salty with lettle bitter	1.4	> 2000	0.0	2.68	7.91	25	35.3 ± 2.1
3	RPC.RG.W.3.18.19		1145	Irrigation only	No	0.85	Inside Adaya village	Steel pipe	8 inchs	85 ft	5 ft	Limestone	2008	Hand hoist	Salty with lettle bitter	1.6	> 2000	0.0	3	7.63	25	32 ± 9.8
4	RPC.RG.W.4.18.19	38S 0333856 UTM 4025010	1283	Household (washing only)	Yes (1.3km)	Well in Mosil city	Well in Mosil city	Steel pipe	1.25 inchs	13 m	13 m	Silty sand	2016	Hand hoist	Salty	2.7	> 2000	0.0	5	7.93	25	28.5 ± 5.2
5	RPC.RG.W.6.18.19	36.1769865 43.73955914	1033	Livestock and Irrigation	No	2	Inside Tall ar Ragrag village	Steel pipe	8 inchs	61 ft	21 ft	Limestone	2002	Electric Pump	Salty with lettle bitter	1.5	> 2000	0.0	2.9	8.11	25	71.3 ± 3.5
6	RPC.RG.W.7.18.19	38S 0332564 UTM 4027224	1283	Household (washing only)	Yes (1.8km)	Well in Mosil city	Well in Mosil city	Steel pipe	1.25 inchs	8 m	8 m	Silty sand	2016	Electric Pump	Clear	0.1	412	0.002	415	7.83	25	24.9 ± 8.5
7	RPC.RG.W.8.18.19	38S 0329935 UTM 4025280	1283	Household (washing only)	Yes (0.83km)	Well in Mosil city	Well in Mosil city	Plastic pipe	8.5 inchs	60 m	25.8 m	Silty sand	2010	Electric Pump	Clear	1.7	> 2000	0.0	3.15	7.94	25	36.7 ± 5.4
8	RPC.RG.W.9.18.19	38S 0332991 UTM 4023999	1283	Washing only	Yes	Well in Mosil city	Well in Mosil city	Steel pipe	1.25 inchs	13 m	13 m	Silty sand	Not avilable	Electric Pump	Lettle salty	0.1	423	0.002	427	7.86	25	52.6 ± 7.2
9	RPC.RG.W.11.18.19	36,23,34,1 042,49,37,0	353 m	Livestock and Irrigation	No	Well near Al-Jezira site	0.7 km to Al-Jezira site	Plastic pipe	10 inchs	96 m	90 m	Gravel	2006	Electric Pump	Salty with lettle bitter	0.6	1298	0.001	1311	7.93	25	48.9 ± 9.5
10	RPC.RG.W.12.18.19	36.30350733 43.7484337	1020	Livestock and Irrigation	Yes	0.5	Inside Adaya village	Plastic pipe	8 inchs	59 ft	6 ft	Limestone	2007	Electric Pump	Salty with lettle bitter	1.5	> 2000	0.0	2.8	7.86	25	59.2 ± 3.5
11	RPC.RG.W.13.18.19		1201	Irrigation only	No	0.57	Inside Adaya village	Plastic pipe	8 inchs	42 ft	25 ft	Limestone	2008	Electric Pump	Salty	1.6	> 2000	0.0	3	7.88	25	33 ± 2.7
12	RPC.RG.W.14.18.19	38S 0331479 UTM 4023133	1283	Washing only	Yes (1.5km)	Well in Mosil city	Well in Mosil city	Plastic pipe	8.5 inchs	18 m	10 m	Silty sand	2014	Electric Pump	Salty	1.6	> 2000	0.0	3.1	7.91	25	50.9 ± 6
13	RPC.RG.W.15.18.19	38S 0329269 UTM 4025794	1283	Washing and Irrigation	Yes (1 km)	Well in Mosil city	Well in Mosil city	Plastic pipe	8.5 inchs	45 m	20 m	Silty sand	2016	Electric Pump	Salty	1.5	> 2000	0.0	2.8	7.84	25	22.1 ± 1.1
14	RPC.RG.W.16.18.19	N 36, 23, 24 E042,50,008	356 m	Livestock and Irrigation	No	Well near Al-Jezira site	0.16 km to Al-Jezira site	Plastic pipe	8 inchs	106 m	103 m	Gravel	2007	Electric Pump	Salty with lettle bitter	2	> 2000	0.0	3.7	8.31	25	79.3 ± 12.2
15	RPC.RG.W.17.18.19			Livestock and Irrigation	No	1.5	Inside Tall ar Ragrag village	Steel pipe	8 inchs	61 ft	21 ft	Limestone	2007	Hand hoist	Salty with lettle bitter	0.2	496	0.002	500	7.69	25	10.6 ± 3
16	RPC.RG.W.18.18.19	36.175472 43.73631211	1007	Livestock and Irrigation	No	2.2	Inside Tall ar Ragrag village	Steel pipe	8 inchs	61.5 ft	13.5 ft	Limestone	2007	Hand hoist	Salty with lettle bitter	1.5	> 2000	0.0	2.9	7.95	25	17.4 ± 2

APPENDIX C

Sampling, Well Construction, and Geographic Information

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Table C-1

Usage and Geographic Setting of the Sixteen Sampled Wells

Well Name	Ground Elevation, meters ASL	Well Use	Proximity to Stream or Other Water body	SNL calculated Distance to Adaya Burial Site, km**	Location	Well Coordinates (Latitude North / Longitude East)***
1	316	Livestock and Irrigation	No	2.56	Inside Tall ar Ragrag	36.178962 N / 42.736505 E
2	317	Livestock and Irrigation	No	2.24	Inside Tall ar Ragrag	36.179776 N / 42.739986 E
5	315	Livestock and Irrigation	No	2.43	Inside Tall ar Ragrag	36.176987 N / 42.739559 E
15	317*	Livestock and Irrigation	No	2.71	Inside Tall ar Ragrag	36.175479 N / 42.737085 E
16	307	Livestock and Irrigation	No	2.77	Inside Tall ar Ragrag	36.175472 N / 42.736312 E
3	349	Irrigation only	No	2.24	Inside Adaya village	36.206230 N / 42.748415 E
10	311	Livestock and Irrigation	Yes	1.99	Inside Adaya village	36.203507 N / 42.748434 E
11	366	Irrigation only	No	2.05	Inside Adaya village	36.204151 N / 42.748427 E
9	353	Livestock and Irrigation	No	22.96	At Al Jesira facility	36.203507 N / 42.748434 E
14	356	Livestock and Irrigation	No	23.18	At Al Jesira facility	36.390000 N / 42.833560 E
4	391	Household (washing only)	Yes (1.3 km)	39.33	Inside Mosul	36.355846 N / 43.148312 E
6	391	Household (washing only)	Yes (1.8 km)	39.26	Inside Mosul	36.375571 N / 43.133443 E
7	391	Household (washing only)	Yes (0.83 km)	36.01	Inside Mosul	36.357595 N / 43.104576 E
8	391	Washing only	Yes	38.10	Inside Mosul	36.346586 N /43.138894 E
12	391	Washing only	Yes (1.5 km)	36.36	Inside Mosul	36.338518 N / 43.122238 E
13	391	Washing and Irrigation	Yes (1 km)	35.70	Inside Mosul	36.362105 N / 43.097042 E

ASL = above sea level.

km = kilometers.

*The elevation for Well 15 was determined using ESRI (July 2019) satellite imagery because a value was not listed in the RPC (2019) spreadsheet.

**Distances to the Adaya Burial Site were calculated by SNL using ESRI ArcGIS software (Sandlin, June 2021). The center of the Chesser (June 2011) Adaya Burial Site oval was calculated at 36.189288 North latitude / 42.761961 East longitude and was used as the distance datum.

***The coordinates for Wells 1, 2, 5, 10, and 16 were revised because the RPC (2019) spreadsheet contained typographical errors. Coordinates for Wells 3, 11, and 15 were not available in RPC (2019); coordinates for these three wells were generated by SNL using other information in that reference. The RPC (2019) coordinate for Well 9 did not appear correct when plotted on satellite imagery; SNL generated a coordinate for this well using a distance provided in RPC (2019).

Table C-2

Well Construction Details for the Sixteen Sampled Wells (RPC, 2019)

Well Name	Well Type	Well Diameter, centimeters	Well Diameter, inches	Well Depth, meters	Depth to Water in Well, meters	Water-bearing Zone	Date Constructed	Distance to Location, kilometers
1	Steel pipe	20.3	8	17.4	4.7	Limestone	2004	Inside Tall ar Ragrag village
2	Steel pipe	20.3	8	20.4	4.6	Limestone	2008	Inside Tall ar Ragrag village
5	Steel pipe	20.3	8	18.6	6.4	Limestone	2002	Inside Tall ar Ragrag village
15	Steel pipe	20.3	8	18.6	6.4	Limestone	2007	Inside Tall ar Ragrag village
16	Steel pipe	20.3	8	18.7	4.1	Limestone	2007	Inside Tall ar Ragrag village
3	Steel pipe	20.3	8	25.9	1.5	Limestone	2008	Inside Adaya village
10	Plastic pipe	20.3	8	18.0	1.8	Limestone	2007	Inside Adaya village
11	Plastic pipe	20.3	8	12.8	7.6	Limestone	2008	Inside Adaya village
9	Plastic pipe	25.4	10	96.0	90	Gravel	2006	At Al Jesira facility
14	Plastic pipe	20.3	8	106.0	103	Gravel	2007	At Al Jesira facility
4	Steel pipe	3.2	1.25	13.0	13	Silty sand	2016	Inside Mosul
6	Steel pipe	3.2	1.25	8.0	8	Silty sand	2016	Inside Mosul
7	Plastic pipe	21.6	8.5	60.0	25.8	Silty sand	2010	Inside Mosul
8	Steel pipe	3.2	1.25	13.0	13	Silty sand	n.a.	Inside Mosul
12	Plastic pipe	21.6	8.5	18.0	10	Silty sand	2014	Inside Mosul
13	Plastic pipe	21.6	8.5	45.0	20	Silty sand	2016	Inside Mosul

n.a. = not available

Table C-3

Water Quality Measurements at the Sixteen Sampled Wells (RPC, 2019)

Well Name	Water-bearing zone	Sampling Method	Quality of Water, Taste	Salinity, g/L	Usefulness, Based on Table C-4	TDS, mg/L	Classification, Based on Table C-5	pH	Location
1	Limestone	Electric Pump	Salty and slightly bitter	0.1	Potable	425	Fresh	7.80	Inside Tall ar Ragrag
2	Limestone	Electric Pump	Salty and slightly bitter	1.4	Irrigation	> 2,000	Brackish	7.91	Inside Tall ar Ragrag
5	Limestone	Electric Pump	Salty and slightly bitter	1.5	Irrigation	> 2,000	Brackish	8.11	Inside Tall ar Ragrag
15	Limestone	Hand hoist	Salty and slightly bitter	0.2	Potable	496	Fresh	7.69	Inside Tall ar Ragrag
16	Limestone	Hand hoist	Salty and slightly bitter	1.5	Irrigation	> 2,000	Brackish	7.95	Inside Tall ar Ragrag
3	Limestone	Hand hoist	Salty and slightly bitter	1.6	Irrigation	> 2,000	Brackish	7.63	Inside Adaya village
10	Limestone	Electric Pump	Salty and slightly bitter	1.5	Irrigation	> 2,000	Brackish	7.86	Inside Adaya village
11	Limestone	Electric Pump	Salty	1.6	Irrigation	> 2,000	Brackish	7.88	Inside Adaya village
9	Gravel	Electric Pump	Salty and slightly bitter	0.6	Irrigation	1,298	Brackish	7.93	At Al Jesira facility
14	Gravel	Electric Pump	Salty and slightly bitter	2.0	Irrigation	> 2,000	Brackish	8.31	At Al Jesira facility
4	Silty sand	Hand hoist	Salty	2.7	Irrigation	> 2,000	Brackish	7.93	Inside Mosul
6	Silty sand	Electric Pump	Clear	0.1	Potable	412	Fresh	7.83	Inside Mosul
7	Silty sand	Electric Pump	Clear	1.7	Irrigation	> 2,000	Brackish	7.94	Inside Mosul
8	Silty sand	Electric Pump	Slightly salty	0.1	Potable	423	Fresh	7.86	Inside Mosul
12	Silty sand	Electric Pump	Salty	1.6	Irrigation	> 2,000	Brackish	7.91	Inside Mosul
13	Silty sand	Electric Pump	Salty	1.5	Irrigation	> 2,000	Brackish	7.84	Inside Mosul

> = greater than.
g/L = grams per liter.
mg/L = milligrams per liter.
pH = potential of hydrogen (negative logarithm of the hydrogen ion concentration)
TDS = total dissolved solids.

Table C-4

Usefulness of Water Quality Based on Salinity (Jassim and Goff, 2006)

Salinity, g/L	Usefulness
<1	Potable (drinking and cooking)
1-3	Irrigation
3-5	Limited irrigation
5-10	Seldom irrigation
10-20	Unusable
>50	Brine

g/L = grams per liter.
> = greater than.
< = less than.

Table C-5

Classification of Water Based on Total Dissolved Solids (Fetter, 2001)

TDS, mg/L	Class
0 - 1,000	Fresh
1,000 – 10,000	Brackish
10,000 – 100,000	Saline
>100,000	Brine

mg/L = milligrams per liter.
TDS = total dissolved solids.
< = less than.

APPENDIX D

GEL Analytical Data Report

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GEL Laboratories LLC
a member of The GEL Group INC

PO Box 30712 Charleston, SC 29417
2040 Savage Road Charleston, SC 29407
P 843.556.8171
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gel.com

February 01, 2021

Sandia National Laboratories
1515 Eubank SE,ORG 4142
BLDG. 1090/120, MS 1103
Albuquerque, New Mexico 87123
Attention: Wendy Palencia

Re: Groundwater, Level C Package
Work Order: 532167

Dear Ms. Palencia:

GEL Laboratories, LLC (GEL) appreciates the opportunity to provide the enclosed analytical results for the sample(s) we received on January 15, 2021. This original report has been prepared and reviewed in accordance with GEL's standard operating procedures.

Test results for NELAP or ISO 17025 accredited tests are verified to meet the requirements of those standards, with any exceptions noted. The results reported relate only to the items tested and to the sample as received by the laboratory. These results may not be reproduced except as full reports without approval by the laboratory. Copies of GEL's accreditations and certifications can be found on our website at www.gel.com.

Our policy is to provide high quality, personalized analytical services to enable you to meet your analytical needs on time every time. We trust that you will find everything in order and to your satisfaction. If you have any questions, please do not hesitate to call me at (843) 556-8171, ext. 4453.

Sincerely,

Clare Drennen for
Edith Kent
Project Manager

Purchase Order: 205798.01.01
Chain of Custody: 621708
Enclosures

CASE NARRATIVE
for
Sandia National Laboratories
ARCOC-621708
532167
Case No. 205798.01.01
Project Name: ADAYA GROUNDWATER

Table of Contents

Case Narrative

CASE NARRATIVE
for
Sandia National Laboratories
ARCOC-621708
532167
Case No. 205798.01.01
Project Name: ADAYA GROUNDWATER

February 01, 2021

Laboratory Identification:

GEL Laboratories, LLC
2040 Savage Road
Charleston, South Carolina 29407
(843) 556-8171

Summary

Sample receipt

The sample(s) arrived at GEL Laboratories, LLC, Charleston, South Carolina on January 15, 2021 for analysis. The samples were delivered with proper chain of custody documentation and signatures. All sample containers arrived without any visible signs of tampering or breakage. Shipping container temperatures were checked, documented, and within specifications. The samples were received at a pH>2 and were preserved on receipt.

Items of Note
There are no additional items of note concerning this SDG.

QC Issues
Any QC issues will be reported in the technical case narrative.

Sample Identification
The laboratory received the following samples:

Laboratory ID	Client ID
532167001	114195-001
532167002	114195-002
532167003	114195-003
532167004	114195-004
532167005	114195-005
532167006	114195-006
532167007	114195-007
532167008	114195-008
532167009	114195-009
532167010	114195-010
532167011	114195-011
532167012	114195-012
532167013	114195-013
532167014	114195-014
532167015	114195-015
532167016	114195-016

Case Narrative

Sample analyses were conducted using methodology as outlined in GEL Laboratories, LLC (GEL) Standard Operating Procedures. Any technical or administrative problems during analysis, data review, and reduction are contained in the analytical case narratives in the enclosed data package.

Data Package

The enclosed data package contains the following sections: Case Narrative, Chain of Custody, Cooler Receipt Checklist, Data Package Qualifier Definitions and data from the following fractions: Radiochemistry.

This data package, to the best of my knowledge, is in compliance with technical and administrative requirements.

Clare Drennen for
Edith Kent
Project Manager

GEL Laboratories LLC P.O. Box 30712 Charleston, SC 29417 2040 Savage Road Charleston, SC 29407 P 843.556.8171 F 843.766.1178 www.gel.com

Chain of Custody and Supporting Documentation

SMO 2012-ARCOC (4-2012)

CONTRACT LABORATORY
ANALYSIS REQUEST AND CHAIN OF CUSTODY

AOP 95-16

532167

Internal Lab

Page 1 of 3

Batch No.

SMO Use

AR/COC 621708

Project Name:	ADAYA GROUNDWATER	Date Samples Shipped:	1/14/21	SMO Authorization:	10
Project/Task Manager:	Douglas Osborn	Carrier/Waybill No.	324273	SMO Contact Phone:	Wendy Palencia/505-844-3132
Project/Task Number:	205798 .01.01	Lab Contact:	Edie Kent/843-769-7385		
Service Order:	CF692-21	Lab Destination:	GEL	Send Report to SMO:	Stephanie Montaño/505-284-2553
		Contract No.:	1983530		
Tech Area:		Operational Site:			
Building:	Room:				

☐ Waste Characterization
☐ RMA
☐ Released by COC No.
☑ 4° Celsius

Bill to: Sandia National Laboratories (Accounts Payable), P.O. Box 5800, MS-0154 Albuquerque, NM 87185-0154

Sample No.	Fraction	Sample Location Detail	Depth (ft)	Date/Time Collected	Sample Matrix	Container Type	Container Volume	Preservative	Collection Method	Sample Type	Parameter & Method Requested	Lab Sample ID
114195	001	Adaya Well	NA	12/14/20 12:01	GW	P	1 L	HNO3	G	SA	ISO U (HASL-300)	001
114195	002	Adaya Well	NA	12/14/20 12:02	GW	P	1 L	HNO3	G	SA	ISO U (HASL-300)	002
114195	003	Adaya Well	NA	12/14/20 12:03	GW	P	1 L	HNO3	G	SA	ISO U (HASL-300)	003
114195	004	Adaya Well	NA	12/14/20 12:04	GW	P	1 L	HNO3	G	SA	ISO U (HASL-300)	004
114195	005	Adaya Well	NA	12/14/20 12:05	GW	P	1 L	HNO3	G	SA	ISO U (HASL-300)	005
114195	006	Adaya Well	NA	12/14/20 12:06	GW	P	1 L	HNO3	G	SA	ISO U (HASL-300)	006
114195	007	Adaya Well	NA	12/14/20 12:07	GW	P	1 L	HNO3	G	SA	ISO U (HASL-300)	007
114195	008	Adaya Well	NA	12/14/20 12:08	GW	P	1 L	HNO3	G	SA	ISO U (HASL-300)	008
114195	009	Adaya Well	NA	12/14/20 12:09	GW	P	1 L	HNO3	G	SA	ISO U (HASL-300)	009
114195	010	Adaya Well	NA	12/14/20 12:10	GW	P	1 L	HNO3	G	SA	ISO U (HASL-300)	010

Last Chain:	☐ Yes	**Sample Tracking**	**SMO Use**
Validation Req'd:	☐ Yes	Date Entered:	
Background:	☐ Yes	Entered by:	
Confirmatory:	☐ Yes	QC inits.:	

Special Instructions/QC Requirements:

EDD	☑ Yes			
Turnaround Time	☐ 7-Day*	☐ 15-Day*	☑ 30-Day	
Negotiated TAT	☐			
Sample Disposal	☐ Return to Client	☑ Disposal by Lab		

Return Samples By:

Sample # 114195-008 transferred to new container due to broken lid.

Conditions on Receipt

Lab Use

Sample Team Members	Name	Signature	Init.	Company/Organization/Phone/Cell

Relinquished by	[signature]	Org.	0622	Date	1/14/21	Time	1115	Relinquished by	Org. Date Time
Received by	[signature]	Org.		Date	1 15 21	Time	735	Received by	Org. Date Time
Relinquished by		Org.		Date		Time		Relinquished by	Org. Date Time
Received by		Org.		Date		Time		Received by	Org. Date Time

*Prior confirmation with SMO required for 7 and 15 day TAT

SMO 2012-ARCOC (4-2012)

CONTRACT LABORATORY
ANALYSIS REQUEST AND CHAIN OF CUSTODY (Continuation)

AOP 95-16

AR/COC

Project Name:	Project/Task Manager:	Project/Task No.:	Lab use
Tech Area:			
Building: Room:			

Sample No.	Fraction	Sample Location Detail	Depth (ft)	Date/Time Collected	Sample Matrix	Container Type	Container Volume	Preserv-ative	Collection Method	Sample Type	Parameter & Method Requested	Lab Sample ID
114195	011	Adaya Well	NA	12/14/20 12:11	GW	P	1 L	HNO3	G	SA	ISO U (HASL-300)	011
114195	012	Adaya Well	NA	12/14/20 12:12	GW	P	1 L	HNO3	G	SA	ISO U (HASL-300)	012
114195	013	Adaya Well	NA	12/14/20 12:13	GW	P	1 L	HNO3	G	SA	ISO U (HASL-300)	013
114195	014	Adaya Well	NA	12/14/20 12:14	GW	P	1 L	HNO3	G	SA	ISO U (HASL-300)	014
114195	015	Adaya Well	NA	12/14/20 12:15	GW	P	1 L	HNO3	G	SA	ISO U (HASL-300)	015
114195	016	Adaya Well	NA	12/14/20 12:16	GW	P	1 L	HNO3	G	SA	ISO U (HASL-300)	

Recipient Initials_____

GEL Laboratories LLC

SAMPLE RECEIPT & REVIEW FORM

Client: SNLS	**SDG/AR/COC/Work Order:** 532167
Received By: STACY BOONE	**Date Received:** JANUARY 15, 2021
Carrier and Tracking Number	Circle Applicable: FedEx Express FedEx Ground UPS Field Services Courier Other 4442 3456 2484 1c 4442 3456 2500 1c 4442 3456 2495 1c

Suspected Hazard Information	Yes	No	
			*If Net Counts > 100cpm on samples not marked "radioactive", contact the Radiation Safety Group for further investigation.
A)Shipped as a DOT Hazardous?		✓	Hazard Class Shipped: UN#: If UN2910, Is the Radioactive Shipment Survey Compliant? Yes___ No___
B) Did the client designate the samples are to be received as radioactive?		✓	COC notation or radioactive stickers on containers equal client designation.
C) Did the RSO classify the samples as radioactive?		✓	Maximum Net Counts Observed* (Observed Counts - Area Background Counts): 0 CPM / mR/Hr **Classified as: Rad 1 Rad 2 Rad 3**
D) Did the client designate samples are hazardous?		✓	COC notation or hazard labels on containers equal client designation.
E) Did the RSO identify possible hazards?		✓	If D or E is yes, select Hazards below. PCB's Flammable Foreign Soil RCRA Asbestos Beryllium Other:

	Sample Receipt Criteria	Yes	NA	No	Comments/Qualifiers (Required for Non-Conforming Items)
1	Shipping containers received intact and sealed?	✓			Circle Applicable: Seals broken Damaged container Leaking container Other (describe)
2	Chain of custody documents included with shipment?	✓			Circle Applicable: Client contacted and provided COC COC created upon receipt
3	Samples requiring cold preservation within (0 ≤ 6 deg. C)?*	✓			Preservation Method: Wet Ice Ice Packs Dry ice None Other: *all temperatures are recorded in Celsius TEMP:_____
4	Daily check performed and passed on IR temperature gun?	✓			**Temperature Device Serial #:** IR1-20 Secondary Temperature Device Serial # (If Applicable):
5	Sample containers intact and sealed?	✓			Circle Applicable: Seals broken Damaged container Leaking container Other (describe)
6	Samples requiring chemical preservation at proper pH?			✓	Sample ID's and Containers Affected: 114195-001 → 016 If Preservation added, Lot#: 210111
7	Do any samples require Volatile Analysis?	✓			If Yes, are Encores or Soil Kits present for solids? Yes___ No___ NA___(If yes, take to VOA Freezer) Do liquid VOA vials contain acid preservation? Yes ✓ No ✓ NA___(If unknown, select No) Are liquid VOA vials free of headspace? Yes___ No___ NA___ Sample ID's and containers affected:
8	Samples received within holding time?	✓			ID's and tests affected:
9	Sample ID's on COC match ID's on bottles?	✓			ID's and containers affected:
10	Date & time on COC match date & time on bottles?	✓			Circle Applicable: No dates on containers No times on containers COC missing info Other (describe)
11	Number of containers received match number indicated on COC?	✓			Circle Applicable: No container count on COC Other (describe)
12	Are sample containers identifiable as GEL provided by use of GEL labels?			✓	
13	COC form is properly signed in relinquished/received sections?	✓			Circle Applicable: Not relinquished Other (describe)

Comments (Use Continuation Form if needed):

PM (or PMA) review: Initials CR Date 1/18/21 Page 1 of 1

GL-CHL-SR-001 Rev 7

Edie Kent

From: Edie Kent
Sent: Friday, January 15, 2021 9:12 AM
To: SMO@sandia.gov; Team Kent
Subject: ARCOC-621708, Adaya GW Receipt Issue
Attachments: 621708.pdf

Follow Up Flag: Follow up
Flag Status: Flagged

The pH of all the samples was >2. We preserved on receipt.

Edie

Edith M. Kent
Project Manager

GEL Laboratories LLC

2040 Savage Road, Charleston, SC 29407 | PO Box 30712, Charleston, SC 29417
Office Direct: 843.769.7385 | Office Main: 843.556.8171 | Fax: 843.766.1178
E-Mail: Edie.Kent@gel.com | Website: www.gel.com
Analytical Testing

Data Package Qualifier Definitions

GEL Laboratories, LLC

Data Review Qualifier Flag Definitions

The Level II Certificate of Analysis contains the following headings:

Client Sample ID:	Sample Identification
Sample ID:	This is the laboratory identification number
Matrix:	Sample matrix
Collect Date:	Date of sample collection
Receive Date:	Date of sample receipt by the laboratory
Collector:	Party responsible for sample collection

The detail on the Certificate includes the following:

Parameter:	Analyte or characteristic tested for in the sample
Qualifier:	Qualifier used for data interpretation**
Result:	Final result of each parameter. ND for non-radiochemistry (RAD) tests when result is less than the effective MDL.
DL:	Effective Method Detection Limit for non-Rad
Lc:	Actual critical level as defined in the contract for RAD
RL:	Effective Practical Quantitation Limit (PQL) for non-RAD
MDA:	MDA (as defined in the contract for RAD
Units:	Units of final result
DF:	Dilution factor
Analyst:	Initials of analyst who performed the test
Date:	Date of analysis
Time:	Time of analysis
Batch:	Analytical batch in which the sample was analyzed
Method:	Analytical method used for the analysis of the sample. Identified on the report numerically with a corresponding table.
Surrogate Recovery:	Provided for Organics analysis only. Surrogate compound identified
Test:	Analytical test associated with surrogate compound
Percent%:	Surrogate percent recovery

Acceptable Limits:	Limits established for surrogate recoveries based upon the method requirements

The QC Summary Report contains the following headings:

Parmname:	Analyte or characteristic tested for in the QC sample
NOM:	Nominal concentration of the spiking compound
Sample:	Amount of compound found in the sample associated with the QC sample
Qual:	Qualifier used for data interpretation**
QC:	Amount of compound found in the QC sample
Units:	Units of final result
RPD%:	Relative percent difference between the LCS and LCS DUP, the MS and the MS DUP and/or the Sample and DUP
RER%:	For Rad relative error ratio (RER) between the Sample and Dup
REC%:	Recovery for the control samples
Range:	Acceptance limits for the control samples. May not be applicable for certain matrices such as TCLP
Analyst:	Initials of analyst who performed the test
Date:	Date of analysis
Time:	Time of analysis

The calculations for Percent Recovery (REC%) and Relative Percent Difference (RPD%) are given below. These calculations are taken from the EPA Data Validation Guidelines.

Percent Recovery:

$$\frac{\text{(Value of Spiked Sample - Value of Unspiked Sample)}}{\text{Value of Added Spike}} \times 100$$

Value of Added Spike = "NOM" on the QC Summary Report
Value of Spiked Sample = "QC" on the QC Summary Report
Value of Unspiked Sample = "Sample" on the QC Summary Report

Relative Percent Difference:

$$\frac{(X_1 - X_2)}{(X_1 + X_2) / 2} \times 100$$

X_1 = Percent Recovery from Spike
X_2 = Percent Recovery from Spike Duplicate

Values reported for the RPD are calculated by LIMS from raw instrument values, preparation factors and dilutions. The values are then rounded and reported on the Quality Control (QC) Summary Report. Because of this, verification of the calculated result using the data presented on the report may give slightly different values. Verification of the percent recovery calculation (REC%) for PS and PSD using the data from the QC Summary Report is not possible for QC samples that have been diluted. The data can be obtained by contacting your Project Manager.
A percent recovery value of "N/A" indicates that the concentration of the original sample was greater than four times the amount spiked into the sample and is considered not applicable. This rule is referenced in EPA Data Validation Guidelines. It is footnoted on the very last page of the QC Summary Report.
The calculation for Relative Percent Error is found in the DOE-AL Statement of Work.

Types of QC samples that may be found on the QC Summary Report

Blank:	Results of the blank analysis for the sample batch
DUP:	Duplicate analysis of a sample
LCS:	Laboratory Control Sample
LCSD:	Laboratory Control Sample Duplicate
MS:	Matrix Spike
MSD:	Matrix Spike Duplicate
PS:	Post spike (spike that does not require prep or spiked after prep)
PSD:	Post Spike Duplicate
TS:	TCLP spike
SDILT:	Serial dilution (metals analysis only)

The matrix spike, matrix spike duplicate, and the sample duplicate will be reported on the QC Summary Report if the sample chosen for the matrix spike, matrix spike duplicate, or sample duplicate is a Sandia sample. It will only be reported in the EDD if part of the SDG. However, this QC is a Sandia contact requirement and the acceptabliity of the QC for batch in which the Sandia samples were analyzed will be addressed in the technical case narratives whether or not they are a part of the QC Summary.

The following are definitions of reporting limits used at GEL Laboratories, LLC

DL: Effective Detection Limit: The minimum level of an analyte that can be determined (identified not quantified) with 99% confidence. The values are normally achieved by preparing and analyzing seven aliquots of laboratory water spiked one (1) to five (5) times the estimated MDL, taking the standard deviation and multiplying it against the one-tailed t-statistics at 99%. This computed value is then verified for reasonableness by repeating the study using the concentration found in the initial study, calculating an F-ratio and computing the final limit. Sample specific preparation and dilution factors are applied to these limits when they are reported.
The detection limit is the minimum concentration of a substance that can be identified, measured and reported with 99% confidence that the analyte concentration is above zero. It answers the question "It is present?".

QL: Quantitation Limit (QL): The lowest concentration that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions. The QL is generally five (5) to ten (10) times the MDL. However, it may be nominally chosen within these guidelines to simplify data reporting. For many analytes the QL analyte concentration is selected as the lowest non-zero standard in the calibration curve.
Sample QLs are highly matrix-dependent. Sample specific preparation and dilution factors are applied to these limits when they are reported.
The QL is always ≥ DL

RL: Reporting Limit: Same as the QL except where driven by contract or client specifications. If the sample specific preparation and dilution factors cause the QL to be elevated above the RL, then the QL is used as the RL.
The quantitation limit is the lowest level at which a chemical may be accurately and reproducibly quantitated. It answers the question "How much is present?".

NOTE: **Per contract specification Sandia has requested that for radiochemistry samples only the actual critical level be reported on the EDD where the MDL would normally be reported and that the MDA be reported where the RL would normally be reported.**

Interpretation of the RESULT column on the Certificate of Analysis:
If the final concentration in the sample was found to be equal to or above the RL, then the value reported is reported without a qualifier; for RAD samples if the final concentration in the sample was found to be above the MDA, then the value is reported without a qualifer.
If the final concentration in the samples was found to be below the RL, but equal to or above the DL, then the value reported is qualified with a "J"; there are no "J" qualifiers reported for RAD data.
If the final concentration in the sample was found to be below the effective DL, the value is reported as "ND" and is qualified with a "U"; for RAD samples if the final concentration in the sample was found to be below the MDA, the value reported is qualified with a "U".
If the concentration of the compound is detected in the blank above the effective MDL, the sample result is qualified with a "B". There are no "B" qualifiers reported for RAD data.

Laboratory Certifications

List of current GEL Certifications as of 01 February 2021

State	Certification
Alabama	42200
Alaska	17−018
Alaska Drinking Water	SC00012
Arkansas	88−0651
CLIA	42D0904046
California	2940
Colorado	SC00012
Connecticut	PH−0169
DoD ELAP/ ISO17025 A2LA	2567.01
Florida NELAP	E87156
Foreign Soils Permit	P330−15−00283, P330−15−00253
Georgia	SC00012
Georgia SDWA	967
Hawaii	SC00012
Idaho	SC00012
Illinois NELAP	200029
Indiana	C−SC−01
Kansas NELAP	E−10332
Kentucky SDWA	90129
Kentucky Wastewater	90129
Louisiana Drinking Water	LA024
Louisiana NELAP	03046 (AI33904)
Maine	2019020
Maryland	270
Massachusetts	M−SC012
Massachusetts PFAS Approv	Letter
Michigan	9976
Mississippi	SC00012
Nebraska	NE−OS−26−13
Nevada	SC000122021−1
New Hampshire NELAP	2054
New Jersey NELAP	SC002
New Mexico	SC00012
New York NELAP	11501
North Carolina	233
North Carolina SDWA	45709
North Dakota	R−158
Oklahoma	2019−165
Pennsylvania NELAP	68−00485
Puerto Rico	SC00012
S. Carolina Radiochem	10120002
Sanitation Districts of L	9255651
South Carolina Chemistry	10120001
Tennessee	TN 02934
Texas NELAP	T104704235−20−17
Utah NELAP	SC000122020−34
Vermont	VT87156
Virginia NELAP	460202
Washington	C780

Radiological Analysis

Sample Data Summary

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Qualifier Definition Report
for

SNLS005 Sandia National Laboratories (1983530)

Client SDG: 532167 GEL Work Order: 532167

The Qualifiers in this report are defined as follows:

* Recovery or %RPD not within acceptance limits and/or spike amount not compatible with the sample or the duplicate RPD's are not applicable where the concentration falls below the effective PQL.

** Indicates analyte is a surrogate compound.

U Analyzed for but undetected

Review/Validation

GEL requires all analytical data to be verified by a qualified data reviewer. In addition, all CLP-like deliverables receive a third level review of the fractional data package.

The following data validator verified the information presented in this data report:

Signature:  **Name: Theresa Austin**

Date: 12 FEB 2021 **Title: Group Leader**

GEL LABORATORIES LLC
2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Company : Sandia National Laboratories
Address : 1515 Eubank SE,ORG 4142
BLDG. 1090/120, MS 1103
Albuquerque, New Mexico 87123
Report Date: February 12, 2021
Contact: Ms. Wendy Palencia
Project: Groundwater, Level C Package

Client Sample ID: 114195-001
Sample ID: 532167001
Matrix: AQUEOUS
Collect Date: 14-DEC-20
Receive Date: 15-JAN-21
Collector: Client

Project: SNLSGWtr
Client ID: SNLS005
Client Desc.: Adaya Well

Parameter	Qualifier	Result	Lc	TPU	MDA	Units	PF	DF	Analyst	Date	Time	Batch	Mtd.
Rad Alpha Spec Analysis													
Alphaspec U, Liquid "As Received"													
Uranium-233/234		19.9	0.0433	+/-1.75	0.0979	pCi/L			MXS2	01/22/21	1033	2082184	1
Uranium-235/236		0.887	0.0323	+/-0.152	0.0784	pCi/L							
Uranium-238		17.9	0.0407	+/-1.58	0.0925	pCi/L							

The following Analytical Methods were performed

Method	Description
1	DOE EML HASL-300, U-02-RC Modified

Surrogate/Tracer Recovery	Test	Batch ID	Recovery%	Acceptable Limits
Uranium-232 Tracer	Alphaspec U, Liquid "As Received"	2082184	81.6	(50%-105%)

Notes:

The MDC is a sample specific MDC.
TPU is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor
DL: Detection Limit
Lc/LC: Critical Level
MDA: Minimum Detectable Activity
MDC: Minimum Detectable Concentration
Mtd.: Method
PF: Prep Factor
RL: Reporting Limit
TPU: Total Propagated Uncertainty

GEL LABORATORIES LLC
2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Company : Sandia National Laboratories
Address : 1515 Eubank SE,ORG 4142
BLDG. 1090/120, MS 1103
Albuquerque, New Mexico 87123

Report Date: February 12, 2021

Contact: Ms. Wendy Palencia
Project: Groundwater, Level C Package

Client Sample ID: 114195-002
Sample ID: 532167002
Matrix: AQUEOUS
Collect Date: 14-DEC-20
Receive Date: 15-JAN-21
Collector: Client

Project: SNLSGWtr
Client ID: SNLS005

Client Desc.: Adaya Well

Parameter	Qualifier	Result	Lc	TPU	MDA	Units	PF	DF	Analyst	Date	Time	Batch	Mtd.
Rad Alpha Spec Analysis													
Alphaspec U, Liquid "As Received"													
Uranium-233/234		0.335	0.0643	+/-0.108	0.145	pCi/L			MXS2	01/22/21	1033	2082184	1
Uranium-235/236	U	0.0833	0.0480	+/-0.0540	0.116	pCi/L							
Uranium-238		0.306	0.0604	+/-0.0919	0.137	pCi/L							

The following Analytical Methods were performed

Method	Description
1	DOE EML HASL-300, U-02-RC Modified

Surrogate/Tracer Recovery	Test	Batch ID	Recovery%	Acceptable Limits
Uranium-232 Tracer	Alphaspec U, Liquid "As Received"	2082184	91.2	(50%-105%)

Notes:

The MDC is a sample specific MDC.
TPU is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor
DL: Detection Limit
Lc/LC: Critical Level
MDA: Minimum Detectable Activity
MDC: Minimum Detectable Concentration
Mtd.: Method
PF: Prep Factor
RL: Reporting Limit
TPU: Total Propagated Uncertainty

GEL LABORATORIES LLC
2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Company : Sandia National Laboratories
Address : 1515 Eubank SE,ORG 4142
BLDG. 1090/120, MS 1103
Albuquerque, New Mexico 87123

Report Date: February 12, 2021

Contact: Ms. Wendy Palencia
Project: Groundwater, Level C Package

Client Sample ID: 114195-003
Sample ID: 532167003
Matrix: AQUEOUS
Collect Date: 14-DEC-20
Receive Date: 15-JAN-21
Collector: Client

Project: SNLSGWtr
Client ID: SNLS005

Client Desc.: Adaya Well

Parameter	Qualifier	Result	Lc	TPU	MDA	Units	PF	DF	Analyst	Date	Time	Batch	Mtd.
Rad Alpha Spec Analysis													
Alphaspec U, Liquid "As Received"													
Uranium-233/234		1.36	0.219	+/-0.400	0.494	pCi/L			MXS2	01/22/21	1033	2082184	1
Uranium-235/236	U	0.206	0.163	+/-0.190	0.396	pCi/L							
Uranium-238		1.08	0.205	+/-0.334	0.467	pCi/L							

The following Analytical Methods were performed

Method	Description
1	DOE EML HASL-300, U-02-RC Modified

Surrogate/Tracer Recovery	Test	Batch ID	Recovery%	Acceptable Limits
Uranium-232 Tracer	Alphaspec U, Liquid "As Received"	2082184	80.4	(50%-105%)

Notes:

The MDC is a sample specific MDC.
TPU is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor
DL: Detection Limit
Lc/LC: Critical Level
MDA: Minimum Detectable Activity
MDC: Minimum Detectable Concentration
Mtd.: Method
PF: Prep Factor
RL: Reporting Limit
TPU: Total Propagated Uncertainty

GEL LABORATORIES LLC
2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Company : Sandia National Laboratories
Address : 1515 Eubank SE,ORG 4142
BLDG. 1090/120, MS 1103
Albuquerque, New Mexico 87123

Report Date: February 12, 2021

Contact: Ms. Wendy Palencia
Project: Groundwater, Level C Package

Client Sample ID: 114195-004
Sample ID: 532167004
Matrix: AQUEOUS
Collect Date: 14-DEC-20
Receive Date: 15-JAN-21
Collector: Client

Project: SNLSGWtr
Client ID: SNLS005

Client Desc.: Adaya Well

Parameter	Qualifier	Result	Lc	TPU	MDA	Units	PF	DF	Analyst	Date	Time	Batch	Mtd.
Rad Alpha Spec Analysis													
Alphaspec U, Liquid "As Received"													
Uranium-233/234		0.431	0.0407	+/-0.0959	0.0918	pCi/L			MXS2	01/22/21	1033	2082184	1
Uranium-235/236	U	0.0479	0.0303	+/-0.0377	0.0736	pCi/L							
Uranium-238		0.271	0.0382	+/-0.0731	0.0868	pCi/L							

The following Analytical Methods were performed

Method	Description
1	DOE EML HASL-300, U-02-RC Modified

Surrogate/Tracer Recovery	Test	Batch ID	Recovery%	Acceptable Limits
Uranium-232 Tracer	Alphaspec U, Liquid "As Received"	2082184	99.9	(50%-105%)

Notes:

The MDC is a sample specific MDC.
TPU is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor
DL: Detection Limit
Lc/LC: Critical Level
MDA: Minimum Detectable Activity
MDC: Minimum Detectable Concentration
Mtd.: Method
PF: Prep Factor
RL: Reporting Limit
TPU: Total Propagated Uncertainty

GEL LABORATORIES LLC
2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Company : Sandia National Laboratories
Address : 1515 Eubank SE,ORG 4142
BLDG. 1090/120, MS 1103
Albuquerque, New Mexico 87123

Report Date: February 12, 2021

Contact: Ms. Wendy Palencia
Project: Groundwater, Level C Package

Client Sample ID: 114195-005
Sample ID: 532167005
Matrix: AQUEOUS
Collect Date: 14-DEC-20
Receive Date: 15-JAN-21
Collector: Client

Project: SNLSGWtr
Client ID: SNLS005

Client Desc.: Adaya Well

Parameter	Qualifier	Result	Lc	TPU	MDA	Units	PF	DF	Analyst	Date	Time	Batch	Mtd.
Rad Alpha Spec Analysis													
Alphaspec U, Liquid "As Received"													
Uranium-233/234		0.491	0.0541	+/-0.117	0.122	pCi/L			MXS2	01/22/21	1033	2082184	1
Uranium-235/236	U	0.0764	0.0403	+/-0.0503	0.0980	pCi/L							
Uranium-238		0.572	0.0508	+/-0.119	0.115	pCi/L							

The following Analytical Methods were performed

Method	Description
1	DOE EML HASL-300, U-02-RC Modified

Surrogate/Tracer Recovery	Test	Batch ID	Recovery%	Acceptable Limits
Uranium-232 Tracer	Alphaspec U, Liquid "As Received"	2082184	87.2	(50%-105%)

Notes:

The MDC is a sample specific MDC.
TPU is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor
DL: Detection Limit
Lc/LC: Critical Level
MDA: Minimum Detectable Activity
MDC: Minimum Detectable Concentration
Mtd.: Method
PF: Prep Factor
RL: Reporting Limit
TPU: Total Propagated Uncertainty

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Certificate of Analysis

Company : Sandia National Laboratories
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BLDG. 1090/120, MS 1103
Albuquerque, New Mexico 87123

Report Date: February 12, 2021

Contact: Ms. Wendy Palencia
Project: Groundwater, Level C Package

Client Sample ID: 114195-006
Sample ID: 532167006
Matrix: AQUEOUS
Collect Date: 14-DEC-20
Receive Date: 15-JAN-21
Collector: Client

Project: SNLSGWtr
Client ID: SNLS005

Client Desc.: Adaya Well

Parameter	Qualifier	Result	Lc	TPU	MDA	Units	PF	DF	Analyst	Date	Time	Batch	Mtd.
Rad Alpha Spec Analysis													
Alphaspec U, Liquid "As Received"													
Uranium-233/234		2.48	0.106	+/-0.386	0.238	pCi/L			MXS2	01/22/21	1033	2082184	1
Uranium-235/236	U	0.112	0.0787	+/-0.0813	0.191	pCi/L							
Uranium-238		2.32	0.0991	+/-0.361	0.225	pCi/L							

The following Analytical Methods were performed

Method	Description
1	DOE EML HASL-300, U-02-RC Modified

Surrogate/Tracer Recovery	Test	Batch ID	Recovery%	Acceptable Limits
Uranium-232 Tracer	Alphaspec U, Liquid "As Received"	2082184	82.2	(50%-105%)

Notes:

The MDC is a sample specific MDC.
TPU is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor
DL: Detection Limit
Lc/LC: Critical Level
MDA: Minimum Detectable Activity
MDC: Minimum Detectable Concentration
Mtd.: Method
PF: Prep Factor
RL: Reporting Limit
TPU: Total Propagated Uncertainty

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Report Date: February 12, 2021

Contact: Ms. Wendy Palencia
Project: Groundwater, Level C Package

Client Sample ID: 114195-007
Sample ID: 532167007
Matrix: AQUEOUS
Collect Date: 14-DEC-20
Receive Date: 15-JAN-21
Collector: Client

Project: SNLSGWtr
Client ID: SNLS005

Client Desc.: Adaya Well

Parameter	Qualifier	Result	Lc	TPU	MDA	Units	PF	DF	Analyst	Date	Time	Batch	Mtd.
Rad Alpha Spec Analysis													
Alphaspec U, Liquid "As Received"													
Uranium-233/234		27.3	0.0624	+/-2.52	0.141	pCi/L			MXS2	01/22/21	1033	2082184	1
Uranium-235/236		1.31	0.0466	+/-0.224	0.113	pCi/L							
Uranium-238		25.2	0.0586	+/-2.33	0.133	pCi/L							

The following Analytical Methods were performed

Method	Description
1	DOE EML HASL-300, U-02-RC Modified

Surrogate/Tracer Recovery	Test	Batch ID	Recovery%	Acceptable Limits
Uranium-232 Tracer	Alphaspec U, Liquid "As Received"	2082184	70.4	(50%-105%)

Notes:

The MDC is a sample specific MDC.
TPU is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor
DL: Detection Limit
Lc/LC: Critical Level
MDA: Minimum Detectable Activity
MDC: Minimum Detectable Concentration
Mtd.: Method
PF: Prep Factor
RL: Reporting Limit
TPU: Total Propagated Uncertainty

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Report Date: February 12, 2021

Contact: Ms. Wendy Palencia
Project: Groundwater, Level C Package

Client Sample ID: 114195-008
Sample ID: 532167008
Matrix: AQUEOUS
Collect Date: 14-DEC-20
Receive Date: 15-JAN-21
Collector: Client

Project: SNLSGWtr
Client ID: SNLS005

Client Desc.: Adaya Well

Parameter	Qualifier	Result	Lc	TPU	MDA	Units	PF	DF	Analyst	Date	Time	Batch	Mtd.
Rad Alpha Spec Analysis													
Alphaspec U, Liquid "As Received"													
Uranium-233/234		6.39	0.0444	+/-0.626	0.100	pCi/L			MXS2	01/22/21	1033	2082184	1
Uranium-235/236		0.272	0.0331	+/-0.0800	0.0804	pCi/L							
Uranium-238		5.80	0.0417	+/-0.573	0.0949	pCi/L							

The following Analytical Methods were performed

Method	Description
1	DOE EML HASL-300, U-02-RC Modified

Surrogate/Tracer Recovery	Test	Batch ID	Recovery%	Acceptable Limits
Uranium-232 Tracer	Alphaspec U, Liquid "As Received"	2082184	83.4	(50%-105%)

Notes:

The MDC is a sample specific MDC.
TPU is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor
DL: Detection Limit
Lc/LC: Critical Level
MDA: Minimum Detectable Activity
MDC: Minimum Detectable Concentration
Mtd.: Method
PF: Prep Factor
RL: Reporting Limit
TPU: Total Propagated Uncertainty

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Report Date: February 12, 2021

Contact: Ms. Wendy Palencia
Project: Groundwater, Level C Package

Client Sample ID: 114195-009
Sample ID: 532167009
Matrix: AQUEOUS
Collect Date: 14-DEC-20
Receive Date: 15-JAN-21
Collector: Client

Project: SNLSGWtr
Client ID: SNLS005

Client Desc.: Adaya Well

Parameter	Qualifier	Result	Lc	TPU	MDA	Units	PF	DF	Analyst	Date	Time	Batch	Mtd.
Rad Alpha Spec Analysis													
Alphaspec U, Liquid "As Received"													
Uranium-233/234		1.19	0.0443	+/-0.175	0.100	pCi/L			MXS2	01/22/21	1033	2082184	1
Uranium-235/236	U	0.0417	0.0330	+/-0.0325	0.0802	pCi/L							
Uranium-238		1.03	0.0416	+/-0.157	0.0945	pCi/L							

The following Analytical Methods were performed

Method	Description
1	DOE EML HASL-300, U-02-RC Modified

Surrogate/Tracer Recovery	Test	Batch ID	Recovery%	Acceptable Limits
Uranium-232 Tracer	Alphaspec U, Liquid "As Received"	2082184	84.4	(50%-105%)

Notes:

The MDC is a sample specific MDC.
TPU is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor
DL: Detection Limit
Lc/LC: Critical Level
MDA: Minimum Detectable Activity
MDC: Minimum Detectable Concentration
Mtd.: Method
PF: Prep Factor
RL: Reporting Limit
TPU: Total Propagated Uncertainty

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Report Date: February 12, 2021

Contact: Ms. Wendy Palencia
Project: Groundwater, Level C Package

Client Sample ID: 114195-010
Sample ID: 532167010
Matrix: AQUEOUS
Collect Date: 14-DEC-20
Receive Date: 15-JAN-21
Collector: Client

Project: SNLSGWtr
Client ID: SNLS005

Client Desc.: Adaya Well

Parameter	Qualifier	Result	Lc	TPU	MDA	Units	PF	DF	Analyst	Date	Time	Batch	Mtd.
Rad Alpha Spec Analysis													
Alphaspec U, Liquid "As Received"													
Uranium-233/234		1.47	0.0423	+/-0.202	0.0956	pCi/L			MXS2	01/22/21	1033	2082184	1
Uranium-235/236		0.105	0.0316	+/-0.0551	0.0766	pCi/L							
Uranium-238		1.44	0.0397	+/-0.193	0.0904	pCi/L							

The following Analytical Methods were performed

Method	Description
1	DOE EML HASL-300, U-02-RC Modified

Surrogate/Tracer Recovery	Test	Batch ID	Recovery%	Acceptable Limits
Uranium-232 Tracer	Alphaspec U, Liquid "As Received"	2082184	92.8	(50%-105%)

Notes:

The MDC is a sample specific MDC.
TPU is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor
DL: Detection Limit
Lc/LC: Critical Level
MDA: Minimum Detectable Activity
MDC: Minimum Detectable Concentration
Mtd.: Method
PF: Prep Factor
RL: Reporting Limit
TPU: Total Propagated Uncertainty

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Report Date: February 12, 2021

Contact: Ms. Wendy Palencia
Project: Groundwater, Level C Package

Client Sample ID: 114195-011
Sample ID: 532167011
Matrix: AQUEOUS
Collect Date: 14-DEC-20
Receive Date: 15-JAN-21
Collector: Client

Project: SNLSGWtr
Client ID: SNLS005

Client Desc.: Adaya Well

Parameter	Qualifier	Result	Lc	TPU	MDA	Units	PF	DF	Analyst	Date	Time	Batch	Mtd.
Rad Alpha Spec Analysis													
Alphaspec U, Liquid "As Received"													
Uranium-233/234		6.92	0.0618	+/-0.706	0.139	pCi/L			MXS2	01/22/21	1033	2082184	1
Uranium-235/236		0.247	0.0461	+/-0.0879	0.112	pCi/L							
Uranium-238		5.74	0.0580	+/-0.601	0.132	pCi/L							

The following Analytical Methods were performed

Method	Description
1	DOE EML HASL-300, U-02-RC Modified

Surrogate/Tracer Recovery	Test	Batch ID	Recovery%	Acceptable Limits
Uranium-232 Tracer	Alphaspec U, Liquid "As Received"	2082184	81	(50%-105%)

Notes:

The MDC is a sample specific MDC.
TPU is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor
DL: Detection Limit
Lc/LC: Critical Level
MDA: Minimum Detectable Activity
MDC: Minimum Detectable Concentration
Mtd.: Method
PF: Prep Factor
RL: Reporting Limit
TPU: Total Propagated Uncertainty

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Report Date: February 12, 2021

Contact: Ms. Wendy Palencia
Project: Groundwater, Level C Package

Client Sample ID: 114195-012
Sample ID: 532167012
Matrix: AQUEOUS
Collect Date: 14-DEC-20
Receive Date: 15-JAN-21
Collector: Client

Project: SNLSGWtr
Client ID: SNLS005

Client Desc.: Adaya Well

Parameter	Qualifier	Result	Lc	TPU	MDA	Units	PF	DF	Analyst	Date	Time	Batch	Mtd.
Rad Alpha Spec Analysis													
Alphaspec U, Liquid "As Received"													
Uranium-233/234		0.309	0.0521	+/-0.0933	0.118	pCi/L			MXS2	01/22/21	1033	2082184	1
Uranium-235/236	U	0.0368	0.0389	+/-0.0382	0.0944	pCi/L							
Uranium-238		0.169	0.0489	+/-0.0703	0.111	pCi/L							

The following Analytical Methods were performed

Method	Description
1	DOE EML HASL-300, U-02-RC Modified

Surrogate/Tracer Recovery	Test	Batch ID	Recovery%	Acceptable Limits
Uranium-232 Tracer	Alphaspec U, Liquid "As Received"	2082184	75.5	(50%-105%)

Notes:

The MDC is a sample specific MDC.
TPU is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor
DL: Detection Limit
Lc/LC: Critical Level
MDA: Minimum Detectable Activity
MDC: Minimum Detectable Concentration
Mtd.: Method
PF: Prep Factor
RL: Reporting Limit
TPU: Total Propagated Uncertainty

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Report Date: February 12, 2021

Contact: Ms. Wendy Palencia
Project: Groundwater, Level C Package

Client Sample ID: 114195-013
Sample ID: 532167013
Matrix: AQUEOUS
Collect Date: 14-DEC-20
Receive Date: 15-JAN-21
Collector: Client

Project: SNLSGWtr
Client ID: SNLS005

Client Desc.: Adaya Well

Parameter	Qualifier	Result	Lc	TPU	MDA	Units	PF	DF	Analyst	Date	Time	Batch	Mtd.
Rad Alpha Spec Analysis													
Alphaspec U, Liquid "As Received"													
Uranium-233/234		1.04	0.0421	+/-0.159	0.0950	pCi/L			MXS2	01/22/21	1033	2082184	1
Uranium-235/236	U	0.0743	0.0314	+/-0.0470	0.0762	pCi/L							
Uranium-238		1.01	0.0395	+/-0.152	0.0898	pCi/L							

The following Analytical Methods were performed

Method	Description
1	DOE EML HASL-300, U-02-RC Modified

Surrogate/Tracer Recovery	Test	Batch ID	Recovery%	Acceptable Limits
Uranium-232 Tracer	Alphaspec U, Liquid "As Received"	2082184	79.8	(50%-105%)

Notes:

The MDC is a sample specific MDC.
TPU is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor
DL: Detection Limit
Lc/LC: Critical Level
MDA: Minimum Detectable Activity
MDC: Minimum Detectable Concentration
Mtd.: Method
PF: Prep Factor
RL: Reporting Limit
TPU: Total Propagated Uncertainty

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Report Date: February 12, 2021

Contact: Ms. Wendy Palencia
Project: Groundwater, Level C Package

Client Sample ID: 114195-014
Sample ID: 532167014
Matrix: AQUEOUS
Collect Date: 14-DEC-20
Receive Date: 15-JAN-21
Collector: Client

Project: SNLSGWtr
Client ID: SNLS005

Client Desc.: Adaya Well

Parameter	Qualifier	Result	Lc	TPU	MDA	Units	PF	DF	Analyst	Date	Time	Batch	Mtd.
Rad Alpha Spec Analysis													
Alphaspec U, Liquid "As Received"													
Uranium-233/234		3.48	0.0380	+/-0.364	0.0858	pCi/L			MXS2	01/22/21	1033	2082184	1
Uranium-235/236		0.139	0.0283	+/-0.0531	0.0688	pCi/L							
Uranium-238		2.91	0.0357	+/-0.313	0.0811	pCi/L							

The following Analytical Methods were performed

Method	Description
1	DOE EML HASL-300, U-02-RC Modified

Surrogate/Tracer Recovery	Test	Batch ID	Recovery%	Acceptable Limits
Uranium-232 Tracer	Alphaspec U, Liquid "As Received"	2082184	92.8	(50%-105%)

Notes:

The MDC is a sample specific MDC.
TPU is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor
DL: Detection Limit
Lc/LC: Critical Level
MDA: Minimum Detectable Activity
MDC: Minimum Detectable Concentration
Mtd.: Method
PF: Prep Factor
RL: Reporting Limit
TPU: Total Propagated Uncertainty

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Report Date: February 12, 2021

Contact: Ms. Wendy Palencia
Project: Groundwater, Level C Package

Client Sample ID: 114195-015
Sample ID: 532167015
Matrix: AQUEOUS
Collect Date: 14-DEC-20
Receive Date: 15-JAN-21
Collector: Client

Project: SNLSGWtr
Client ID: SNLS005

Client Desc.: Adaya Well

Parameter	Qualifier	Result	Lc	TPU	MDA	Units	PF	DF	Analyst	Date	Time	Batch	Mtd.
Rad Alpha Spec Analysis													
Alphaspec U, Liquid "As Received"													
Uranium-233/234		0.841	0.0551	+/-0.155	0.124	pCi/L			MXS2	01/22/21	1033	2082184	1
Uranium-235/236	U	0.0972	0.0411	+/-0.0559	0.0997	pCi/L							
Uranium-238		0.613	0.0517	+/-0.127	0.118	pCi/L							

The following Analytical Methods were performed

Method	Description
1	DOE EML HASL-300, U-02-RC Modified

Surrogate/Tracer Recovery	Test	Batch ID	Recovery%	Acceptable Limits
Uranium-232 Tracer	Alphaspec U, Liquid "As Received"	2082184	85.9	(50%-105%)

Notes:

The MDC is a sample specific MDC.
TPU is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor
DL: Detection Limit
Lc/LC: Critical Level
MDA: Minimum Detectable Activity
MDC: Minimum Detectable Concentration
Mtd.: Method
PF: Prep Factor
RL: Reporting Limit
TPU: Total Propagated Uncertainty

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Report Date: February 12, 2021

Contact: Ms. Wendy Palencia
Project: Groundwater, Level C Package

Client Sample ID: 114195-016
Sample ID: 532167016
Matrix: AQUEOUS
Collect Date: 14-DEC-20
Receive Date: 15-JAN-21
Collector: Client

Project: SNLSGWtr
Client ID: SNLS005

Client Desc.: Adaya Well

Parameter	Qualifier	Result	Lc	TPU	MDA	Units	PF	DF	Analyst	Date	Time	Batch	Mtd.
Rad Alpha Spec Analysis													
Alphaspec U, Liquid "As Received"													
Uranium-233/234		0.691	0.0392	+/-0.120	0.0886	pCi/L			MXS2	01/22/21	1033	2082184	1
Uranium-235/236		0.0831	0.0292	+/-0.0430	0.0710	pCi/L							
Uranium-238		0.422	0.0368	+/-0.0895	0.0837	pCi/L							

The following Analytical Methods were performed

Method	Description
1	DOE EML HASL-300, U-02-RC Modified

Surrogate/Tracer Recovery	Test	Batch ID	Recovery%	Acceptable Limits
Uranium-232 Tracer	Alphaspec U, Liquid "As Received"	2082184	89.7	(50%-105%)

Notes:

The MDC is a sample specific MDC.
TPU is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor
DL: Detection Limit
Lc/LC: Critical Level
MDA: Minimum Detectable Activity
MDC: Minimum Detectable Concentration
Mtd.: Method
PF: Prep Factor
RL: Reporting Limit
TPU: Total Propagated Uncertainty

Quality Control Summary

QC Summary

Report Date: February 12, 2021
Page 1 of 2

Client : **Sandia National Laboratories**
1515 Eubank SE,ORG 4142
BLDG. 1090/120, MS 1103
Albuquerque, New Mexico

Contact: **Ms. Wendy Palencia**

Workorder: **532167**

Parmname	NOM	Sample	Qual	QC	Units	RER	REC%	Range	Anlst	Date Time
Rad Alpha Spec										
Batch 2082184										
QC1204733211 LCS										
Uranium-233/234				2.93	pCi/L				MXS2	01/22/21 10:32
		TPU:		+/-0.315						
Uranium-235/236				0.128	pCi/L					
		TPU:		+/-0.0437						
Uranium-238	2.73			3.06	pCi/L		112	(80%-120%)		
		TPU:		+/-0.325						
**Uranium-232 Tracer	4.11			2.76	pCi/L		67.1	(50%-105%)		
		TPU:		+/-0.420						
QC1204733212 LCSD										
Uranium-233/234				2.93	pCi/L	0.000337		(0-1)	MXS2	01/22/21 10:32
		TPU:		+/-0.306						
Uranium-235/236				0.147	pCi/L	0.218		(0-1)		
		TPU:		+/-0.0451						
Uranium-238	2.73			2.90	pCi/L	0.259	106	(0-1)		
		TPU:		+/-0.301						
**Uranium-232 Tracer	4.11			3.13	pCi/L		76.1	(50%-105%)		
		TPU:		+/-0.409						
QC1204733210 MB										
Uranium-233/234			U	-0.00209	pCi/L				MXS2	01/22/21 10:33
		TPU:		+/-0.0116						
Uranium-235/236			U	0.0182	pCi/L					
		TPU:		+/-0.0144						
Uranium-238			U	0.00819	pCi/L					
		TPU:		+/-0.0107						
**Uranium-232 Tracer	4.11			3.59	pCi/L		87.3	(50%-105%)		
		TPU:		+/-0.378						

Notes:

TPU is calculated at the 95% confidence level (1.96-sigma).

QC Summary

Workorder: **532167**

Parmname	NOM	Sample	Qual	QC	Units	RER	REC%	Range	Anlst	Date Time

The Qualifiers in this report are defined as follows:

*	Recovery or %RPD not within acceptance limits and/or spike amount not compatible with the sample or the duplicate RPD's are not applicable where the concentration falls below the effective PQL.
**	Indicates analyte is a surrogate compound.
B	The analyte was found in the blank above the effective MDL.
H	Analytical holding time was exceeded
J	Estimated value, the analyte concentration fell above the effective MDL and below the effective PQL
L	Low Abundance Qualifier
N	Results associated with a spike analysis that was outside control limits.
U	The analyte was analyzed for but not detected below this concentration. For Organic and Inorganic analytes the result is less than the effective MDL. For radiochemical analytes the result is less than the MDA
X	Results are considered a false positive due to interference.
X	Results are considered a false positive due to low abundance.
X	Results are considered a false positive due to peak not meeting identification criteria.
X	Uncertain identification for gamma spectroscopy.
d	The 2:1 depletion requirement was not met for this sample
h	Prep holding time exceeded

N/A indicates that spike recovery limits do not apply when sample concentration exceeds spike conc. by a factor of 4 or more or %RPD not applicable.
** Indicates analyte is a surrogate/tracer compound.
^ The Relative Percent Difference (RPD) obtained from the sample duplicate (DUP) is evaluated against the acceptence criteria when the sample is greater than five times (5X) the contract required detection limit (RL). In cases where either the sample or duplicate value is less than 5X the RL, a control limit of +/- the RL is used to evaluate the DUP result.
For PS, PSD, and SDILT results, the values listed are the measured amounts, not final concentrations.

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the QC Summary.

Radiological Analysis

Case Narrative

Radiochemistry
Technical Case Narrative
Sandia National Laboratories
SDG #: 532167

Product: **Alphaspec U, Liquid**
Analytical Method: DOE EML HASL-300, U-02-RC Modified
Analytical Procedure: GL-RAD-A-011 REV# 28
Analytical Batch: 2082184

The following samples were analyzed using the above methods and analytical procedure(s).

GEL Sample ID#	Client Sample Identification	
532167001	114195-001	Adaya Well
532167002	114195-002	Adaya Well
532167003	114195-003	Adaya Well
532167004	114195-004	Adaya Well
532167005	114195-005	Adaya Well
532167006	114195-006	Adaya Well
532167007	114195-007	Adaya Well
532167008	114195-008	Adaya Well
532167009	114195-009	Adaya Well
532167010	114195-010	Adaya Well
532167011	114195-011	Adaya Well
532167012	114195-012	Adaya Well
532167013	114195-013	Adaya Well
532167014	114195-014	Adaya Well
532167015	114195-015	Adaya Well
532167016	114195-016	Adaya Well
1204733210	Method Blank (MB)	
1204733211	Laboratory Control Sample (LCS)	
1204733212	Laboratory Control Sample Duplicate (LCSD)	

The samples in this SDG were analyzed on an "as received" basis.

Data Summary:

All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable, with the following exceptions.

Quality Control (QC) Information

Blank Information
Aliquots for samples 1204733210 (MB), 1204733211 (LCS) and 1204733212 (LCSD) were changed to 1.0, and the MDCs (and Lc if requested) for all samples are calculated using a blank population per client request.

CSU
The blank (See Below) result is greater than 1.65 times the CSU but less than the MDC.

Sample	Analyte	Value
1204733210 (MB)	Uranium-235/236	Blank result > 1.65 CSU

RDL Met
Samples (See Below) did not meet the detection limits due to the high standard deviation. When a blank population is performed the MDC is greater than the RDL due to the high standard deviation. The samples were counted the maximum count time of in order to achieve the lowest possible MDAs.

Sample	Analyte	Value
532167003 (114195-003)	Uranium-235/236	Result 0.206 < MDA 0.396 > RDL 0.1 pCi/L
532167006 (114195-006)	Uranium-235/236	Result 0.112 < MDA 0.191 > RDL 0.1 pCi/L

Certification Statement

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless otherwise noted in the analytical case narrative.

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Qualifier Definition Report
for

SNLS005 Sandia National Laboratories (1983530)

Client SDG: 532167 GEL Work Order: 532167

The Qualifiers in this report are defined as follows:

* Recovery or %RPD not within acceptance limits and/or spike amount not compatible with the sample or the duplicate RPD's are not applicable where the concentration falls below the effective PQL.

** Indicates analyte is a surrogate compound.

U Analyzed for but undetected

Review/Validation

GEL requires all analytical data to be verified by a qualified data reviewer. In addition, all CLP-like deliverables receive a third level review of the fractional data package.

The following data validator verified the information presented in this data report:

Signature:  **Name: Theresa Austin**

Date: 12 FEB 2021 **Title: Group Leader**

Alpha Spectroscopy
Raw Data

Blank Correction Report

Batch ID 2082184

GEL ID	Sample Type	Parameter	Aliquot	Result	TPU	MDA	Aliquot Corrected Blank Result	Units	Activity <5X Corrected Blank
1204733211	LCS	Uranium-232 Tracer	1.00 L	2.76	0.420	0.0518	3.59	pCi/L	YES
		Uranium-233/234	1.00 L	2.93	0.315	0.0630	-.00209	pCi/L	NO
		Uranium-235/236	1.00 L	0.128	0.0437	0.0505	.0182	pCi/L	NO
		Uranium-238	1.00 L	3.06	0.325	0.0596	.00819	pCi/L	NO
1204733212	LCSD	Uranium-232 Tracer	1.00 L	3.13	0.409	0.0433	3.59	pCi/L	YES
		Uranium-233/234	1.00 L	2.93	0.306	0.0566	-.00209	pCi/L	NO
		Uranium-235/236	1.00 L	0.147	0.0451	0.0454	.0182	pCi/L	NO
		Uranium-238	1.00 L	2.90	0.301	0.0535	.00819	pCi/L	NO
1204733210	MB	Uranium-232 Tracer	1.00 L	3.59	0.378	0.0418	3.59	pCi/L	YES
		Uranium-233/234	1.00 L	-0.00209	0.0116	0.0389	-.00209	pCi/L	NO
		Uranium-235/236	1.00 L	0.0182	0.0144	0.0312	.0182	pCi/L	YES
		Uranium-238	1.00 L	0.00819	0.0107	0.0367	.00819	pCi/L	YES
532167001	SAMPLE	Uranium-232 Tracer	0.400 L	8.41	0.947	0.0970	8.975	pCi/L	YES
		Uranium-233/234	0.400 L	19.9	1.75	0.0979	-.005225	pCi/L	NO
		Uranium-235/236	0.400 L	0.887	0.152	0.0784	.0455	pCi/L	NO
		Uranium-238	0.400 L	17.9	1.58	0.0925	.020475	pCi/L	NO
532167002	SAMPLE	Uranium-232 Tracer	0.300 L	12.5	1.29	0.144	11.9666667	pCi/L	YES
		Uranium-233/234	0.300 L	0.335	0.108	0.145	-.00696667	pCi/L	NO
		Uranium-235/236	0.300 L	0.0833	0.0540	0.116	.060666667	pCi/L	YES
		Uranium-238	0.300 L	0.306	0.0919	0.137	.0273	pCi/L	NO
532167003	SAMPLE	Uranium-232 Tracer	0.100 L	33.1	3.98	0.550	35.9	pCi/L	YES
		Uranium-233/234	0.100 L	1.36	0.400	0.494	-.0209	pCi/L	NO
		Uranium-235/236	0.100 L	0.206	0.190	0.396	.182	pCi/L	YES
		Uranium-238	0.100 L	1.08	0.334	0.467	.0819	pCi/L	NO
532167004	SAMPLE	Uranium-232 Tracer	0.400 L	10.3	0.938	0.102	8.975	pCi/L	YES
		Uranium-233/234	0.400 L	0.431	0.0959	0.0918	-.005225	pCi/L	NO
		Uranium-235/236	0.400 L	0.0479	0.0377	0.0736	.0455	pCi/L	YES
		Uranium-238	0.400 L	0.271	0.0731	0.0868	.020475	pCi/L	NO
532167005	SAMPLE	Uranium-232 Tracer	0.300 L	12.0	1.24	0.0676	11.9666667	pCi/L	YES
		Uranium-233/234	0.300 L	0.491	0.117	0.122	-.00696667	pCi/L	NO
		Uranium-235/236	0.300 L	0.0764	0.0503	0.0980	.060666667	pCi/L	YES
		Uranium-238	0.300 L	0.572	0.119	0.115	.0273	pCi/L	NO
532167006	SAMPLE	Uranium-232 Tracer	0.200 L	16.9	1.97	0.214	17.95	pCi/L	YES
		Uranium-233/234	0.200 L	2.48	0.386	0.238	-.01045	pCi/L	NO
		Uranium-235/236	0.200 L	0.112	0.0813	0.191	.091	pCi/L	YES
		Uranium-238	0.200 L	2.32	0.361	0.225	.04095	pCi/L	NO
532167007	SAMPLE	Uranium-232 Tracer	0.400 L	7.25	1.02	0.146	8.975	pCi/L	YES
		Uranium-233/234	0.400 L	27.3	2.52	0.141	-.005225	pCi/L	NO
		Uranium-235/236	0.400 L	1.31	0.224	0.113	.0455	pCi/L	NO

Blank Correction Report

GEL ID	Sample Type	Parameter	Aliquot	Result	TPU	MDA	Aliquot Corrected Blank Result	Units	Activity <5X Corrected Blank
532167007	SAMPLE	Uranium-238	0.400 L	25.2	2.33	0.133	.020475	pCi/L	NO
532167008	SAMPLE	Uranium-232 Tracer	0.400 L	8.58	0.955	0.139	8.975	pCi/L	YES
		Uranium-233/234	0.400 L	6.39	0.626	0.100	-.005225	pCi/L	NO
		Uranium-235/236	0.400 L	0.272	0.0800	0.0804	.0455	pCi/L	NO
		Uranium-238	0.400 L	5.80	0.573	0.0949	.020475	pCi/L	NO
532167009	SAMPLE	Uranium-232 Tracer	0.400 L	8.69	0.952	0.108	8.975	pCi/L	YES
		Uranium-233/234	0.400 L	1.19	0.175	0.100	-.005225	pCi/L	NO
		Uranium-235/236	0.400 L	0.0417	0.0325	0.0802	.0455	pCi/L	YES
		Uranium-238	0.400 L	1.03	0.157	0.0945	.020475	pCi/L	NO
532167010	SAMPLE	Uranium-232 Tracer	0.400 L	9.56	0.947	0.135	8.975	pCi/L	YES
		Uranium-233/234	0.400 L	1.47	0.202	0.0956	-.005225	pCi/L	NO
		Uranium-235/236	0.400 L	0.105	0.0551	0.0766	.0455	pCi/L	YES
		Uranium-238	0.400 L	1.44	0.193	0.0904	.020475	pCi/L	NO
532167011	SAMPLE	Uranium-232 Tracer	0.300 L	11.1	1.28	0.115	11.9666667	pCi/L	YES
		Uranium-233/234	0.300 L	6.92	0.706	0.139	-.00696667	pCi/L	NO
		Uranium-235/236	0.300 L	0.247	0.0879	0.112	.060666667	pCi/L	YES
		Uranium-238	0.300 L	5.74	0.601	0.132	.0273	pCi/L	NO
532167012	SAMPLE	Uranium-232 Tracer	0.400 L	7.77	0.986	0.144	8.975	pCi/L	YES
		Uranium-233/234	0.400 L	0.309	0.0933	0.118	-.005225	pCi/L	NO
		Uranium-235/236	0.400 L	0.0368	0.0382	0.0944	.0455	pCi/L	YES
		Uranium-238	0.400 L	0.169	0.0703	0.111	.020475	pCi/L	NO
532167013	SAMPLE	Uranium-232 Tracer	0.400 L	8.21	0.943	0.123	8.975	pCi/L	YES
		Uranium-233/234	0.400 L	1.04	0.159	0.0950	-.005225	pCi/L	NO
		Uranium-235/236	0.400 L	0.0743	0.0470	0.0762	.0455	pCi/L	YES
		Uranium-238	0.400 L	1.01	0.152	0.0898	.020475	pCi/L	NO
532167014	SAMPLE	Uranium-232 Tracer	0.400 L	9.55	0.926	0.111	8.975	pCi/L	YES
		Uranium-233/234	0.400 L	3.48	0.364	0.0858	-.005225	pCi/L	NO
		Uranium-235/236	0.400 L	0.139	0.0531	0.0688	.0455	pCi/L	YES
		Uranium-238	0.400 L	2.91	0.313	0.0811	.020475	pCi/L	NO
532167015	SAMPLE	Uranium-232 Tracer	0.300 L	11.8	1.25	0.146	11.9666667	pCi/L	YES
		Uranium-233/234	0.300 L	0.841	0.155	0.124	-.00696667	pCi/L	NO
		Uranium-235/236	0.300 L	0.0972	0.0559	0.0997	.060666667	pCi/L	YES
		Uranium-238	0.300 L	0.613	0.127	0.118	.0273	pCi/L	NO
532167016	SAMPLE	Uranium-232 Tracer	0.400 L	9.23	0.931	0.100	8.975	pCi/L	YES
		Uranium-233/234	0.400 L	0.691	0.120	0.0886	-.005225	pCi/L	NO
		Uranium-235/236	0.400 L	0.0831	0.0430	0.0710	.0455	pCi/L	YES
		Uranium-238	0.400 L	0.422	0.0895	0.0837	.020475	pCi/L	NO

Batch 2082184 Check-list

This check-list was completed on 25-JAN-21 by Melanie Aycock

This batch was reviewed by Melanie Aycock on 25-JAN-21, Scott Moreland on 01-FEB-21 and Jessica Downey on 12-FEB-21.

Batch ID: 2082184 **Product:** ASP__UUL **Description:** Alpha Spec Uranium

#	Criteria	Yes	No	Comments
Preparation Information				
1	Was the preservation correct for this analysis?	Yes		
Internal Checklist Information				
2	Are instrument source checks within limits?	Yes		
3	Have samples been blank corrected?		No	
4	Has an Aliquot Correction been completed for this batch?		No	
5	Have sample historical results been reviewed for this batch?	Yes		
Technical Information				
6	Were all the samples prepared/analyzed within the required holding time period?	Yes		
7	Are any sample results more negative than 3xTPU?		No	
Quality Control (QC) Information				
8	Was the method blank (MB) within the acceptance criteria?	Yes		
9	Is the blank result less than 1.65 times the CSU?		No	
10	Were all tracer/carrier recoveries within the required acceptance limits?	Yes		
11	Were the laboratory control sample (LCS/LCSD) recoveries within the acceptance limits?	Yes		
12	Were the relative percent differences and/or error (RPD/RER) between the LCS and the LCSD recoveries within the acceptance limits?	Yes		
13	Has the method required detection limit been met?		No	
Miscellaneous Information				
14	Were manual integrations performed on any sample or QC data files in this batch?		No	
15	Are sample-specific MDA/MDC calculated and reported?	Yes		

Prep Logbook

Uranium

Batch ID: **2082184**
Analyst: Matelon DeFreese (MXS2)
Method: DOE EML HASL−300, U−02−RC Modified
Lab SOP: GL−RAD−A−011 REV# 28
Instrument: ASP−33005595

Due Dates for Lab: 11−FEB−2021 Package: 12−FEB−2021 SDG: 14−FEB−2021

Type	Sample Id	Description	Serial Number	Spike Amount	Spike Units
LCS	1204733211	Uranium−238 AS SPIKE	1600−J	.1	mL
LCSD	1204733212	Uranium−238 AS SPIKE	1600−J	.1	mL

#	Sample ID	Prep Date	Min RDL (pCi/L)	Aliquot (L)
1	532167001	19−JAN−2021	.1	0.4
2	532167002	19−JAN−2021	.1	0.3
3	532167003	19−JAN−2021	.1	0.1
4	532167004	19−JAN−2021	.1	0.4
5	532167005	19−JAN−2021	.1	0.3
6	532167006	19−JAN−2021	.1	0.2
7	532167007	19−JAN−2021	.1	0.4
8	532167008	19−JAN−2021	.1	0.4
9	532167009	19−JAN−2021	.1	0.4
10	532167010	19−JAN−2021	.1	0.4
11	532167011	19−JAN−2021	.1	0.3
12	532167012	19−JAN−2021	.1	0.4
13	532167013	19−JAN−2021	.1	0.4
14	532167014	19−JAN−2021	.1	0.4
15	532167015	19−JAN−2021	.1	0.3
16	532167016	19−JAN−2021	.1	0.4
17	532168013	19−JAN−2021	.1	0.4
18	1204733210 MB	19−JAN−2021	.1	1
19	1204733211 LCS	19−JAN−2021	.1	1
20	1204733212 LCSD	19−JAN−2021	.1	1

Reagent/Solvent Lot ID	Description	Amount
WORK 1564−W	Uranium−232 AS TRACER	.2 mL

Comments:

Pipet ID: RAD−ASP−184002Z
Pu−236 Tracer Used: No
Analyzed With: N/A
Data Entry Date2: 19−JAN−2021 00:00

GEL Laboratories LLC
ALPHA SPECTROSCOPY REPORT

Instrument SOP: GL-RAD-I-009
Analytical SOP: GL-RAD-A-011

BATCH NUMBER : 2082184	CHAMBER : 001	LIB FILE : UU
SAMPLE ID : S0532167001_UU	DETECTOR S/N : 79451	BKG FILE : B001.CNF;2333
SAMPLE QTY : 0.400 L +/-0.500 %	AVERAGE %EFFICIENCY : 33.4381	BKG DATE : 16-Jan-2021
SAMPLE DATE : 14-Dec-2020 00:00:00	AVERAGE %EFF ERROR : 0.6481	BKG LIVE TIME(SEC) : 59999.99
ANALYST : MXS2	COUNT DATE : 22-Jan-2021 10:33:13	EFF FILE : W001.CNF;658
% YIELD : 81.6 +/-3.732 %	ELAPSED LIVE TIME(SEC) : 60000.00	CAL DATE : 04-Jan-2021

TRACER
ID : 1564-W
NUCLIDE : U-232
NOMINAL : 9.1430E+00 dpm
RESULTS : 7.4637E+00 dpm

NUCLIDE ACTIVITY SUMMARY

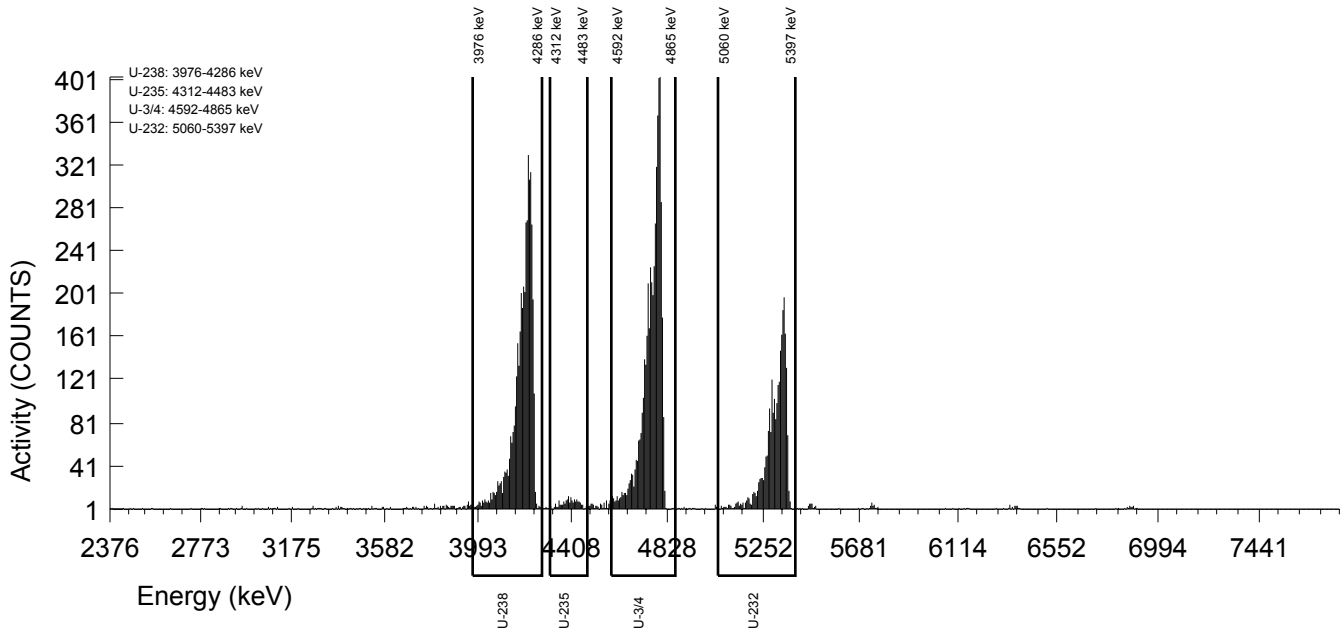
NUCLIDE	LIBRARY ENERGY	PEAK ENERGY	PEAK FWHM	GROSS AREA	NET AREA	BKG AREA	BKG StDev	%ABUN	ACTIVITY pCi/L	1.96-sigma TPU pCi/L	MDA pCi/L	Lc pCi/L	1.96-sigma cnt Unc pCi/L
U-232	5302.10	5308.89	64.090	2513.000	2493.000	20.000	4.4721	100.000	1.03E+01	9.47E-01	9.70E-02	4.29E-02	4.08E-01
U-3/4	4763.02	4764.23	59.139	4844.000	4831.782	4.000	4.5153	100.000	1.99E+01	1.75E+00	9.79E-02	4.33E-02	5.63E-01
U-235	4391.00	4405.64	0.000	174.000	174.000	0.000	2.7237	80.900	8.87E-01	1.52E-01	7.84E-02	3.23E-02	1.33E-01
U-238	4184.73	4192.91	56.133	4340.000	4336.000	4.000	4.2361	100.000	1.79E+01	1.58E+00	9.25E-02	4.07E-02	5.33E-01

NOTES:

* BKG StDev calculated via blank population. (StDev updated 12-Dec-2020)

* BKG StDev calculated as sqrt(BKG AREA) for U-232

* Correction made to the following net area due to tracer impurity:
U-3/4 (8.218 +/-0.247)



GEL Laboratories LLC
ALPHA SPECTROSCOPY REPORT

Instrument SOP: GL-RAD-I-009
Analytical SOP: GL-RAD-A-011

BATCH NUMBER : 2082184	CHAMBER : 002	LIB FILE : UU
SAMPLE ID : S0532167002_UU	DETECTOR S/N : 79452	BKG FILE : B002.CNF;2314
SAMPLE QTY : 0.300 L +/-0.500 %	AVERAGE %EFFICIENCY : 26.8826	BKG DATE : 16-Jan-2021
SAMPLE DATE : 14-Dec-2020 00:00:00	AVERAGE %EFF ERROR : 0.5236	BKG LIVE TIME(SEC) : 59999.99
ANALYST : MXS2	COUNT DATE : 22-Jan-2021 10:33:13	EFF FILE : W002.CNF;628
% YIELD : 91.2 +/-3.799 %	ELAPSED LIVE TIME(SEC) : 60000.00	CAL DATE : 04-Jan-2021

TRACER
ID : 1564-W
NUCLIDE : U-232
NOMINAL : 9.1430E+00 dpm
RESULTS : 8.3379E+00 dpm

NUCLIDE ACTIVITY SUMMARY

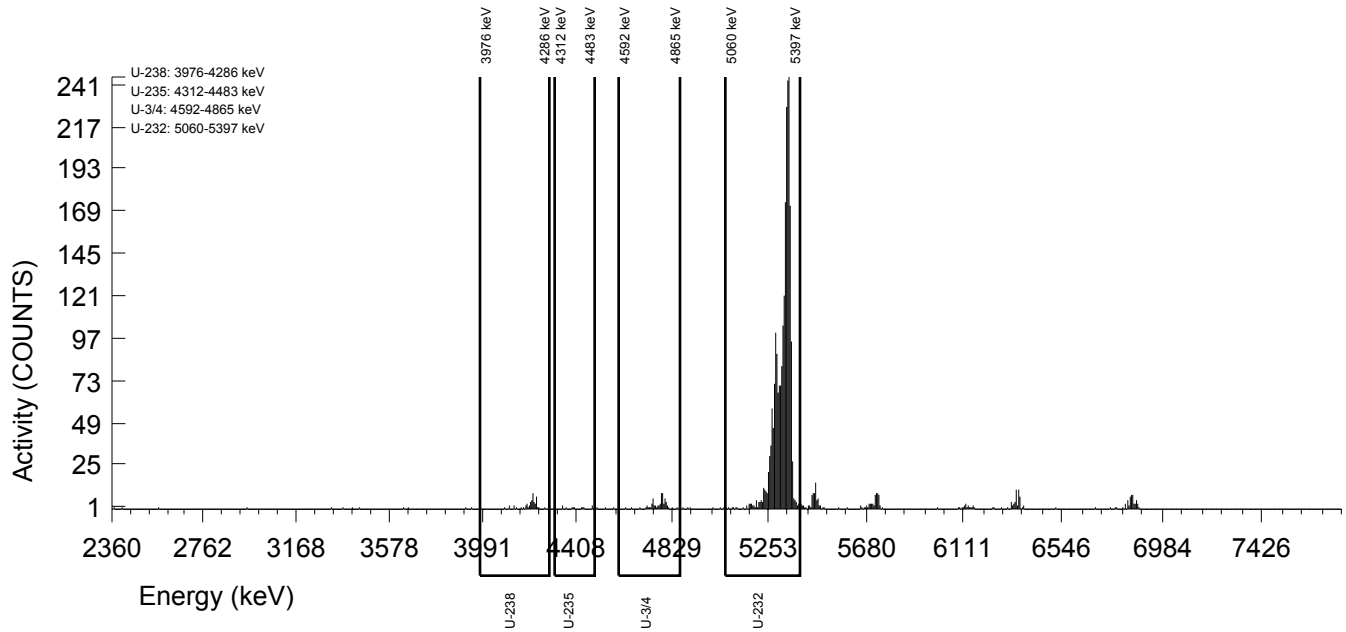
NUCLIDE	LIBRARY ENERGY	PEAK ENERGY	PEAK FWHM	GROSS AREA	NET AREA	BKG AREA	BKG StDev	%ABUN	ACTIVITY pCi/L	1.96-sigma TPU pCi/L	MDA pCi/L	Lc pCi/L	1.96-sigma cnt Unc pCi/L
U-232	5302.10	5315.97	28.123	2259.000	2239.000	20.000	4.4721	100.000	1.37E+01	1.29E+00	1.44E-01	6.37E-02	5.74E-01
U-3/4	4763.02	4769.95	56.350	67.000	54.620	5.000	4.5153	100.000	3.35E-01	1.08E-01	1.45E-01	6.43E-02	1.03E-01
U-235	4391.00	4407.77	130.231	11.000	11.000	0.000	2.7237	80.900	8.33E-02	5.40E-02	1.16E-01	4.80E-02	5.35E-02
U-238	4184.73	4201.93	24.627	51.000	50.000	1.000	4.2361	100.000	3.06E-01	9.19E-02	1.37E-01	6.04E-02	8.82E-02

NOTES:

* BKG StDev calculated via blank population. (StDev updated 12-Dec-2020)

* BKG StDev calculated as sqrt(BKG AREA) for U-232

* Correction made to the following net area due to tracer impurity:
U-3/4 (7.380 +/-0.221)



GEL Laboratories LLC
ALPHA SPECTROSCOPY REPORT

Instrument SOP: GL-RAD-I-009
Analytical SOP: GL-RAD-A-011

BATCH NUMBER : 2082184	CHAMBER : 003	LIB FILE : UU
SAMPLE ID : S0532167003_UU	DETECTOR S/N : 79453	BKG FILE : B003.CNF;2305
SAMPLE QTY : 0.100 L +/-0.500 %	AVERAGE %EFFICIENCY : 26.9088	BKG DATE : 16-Jan-2021
SAMPLE DATE : 14-Dec-2020 00:00:00	AVERAGE %EFF ERROR : 0.5242	BKG LIVE TIME(SEC) : 59999.99
ANALYST : MXS2	COUNT DATE : 22-Jan-2021 10:33:13	EFF FILE : W003.CNF;665
% YIELD : 80.4 +/-3.884 %	ELAPSED LIVE TIME(SEC) : 60000.00	CAL DATE : 04-Jan-2021

TRACER
ID : 1564-W
NUCLIDE : U-232
NOMINAL : 9.1430E+00 dpm
RESULTS : 7.3514E+00 dpm

NUCLIDE ACTIVITY SUMMARY

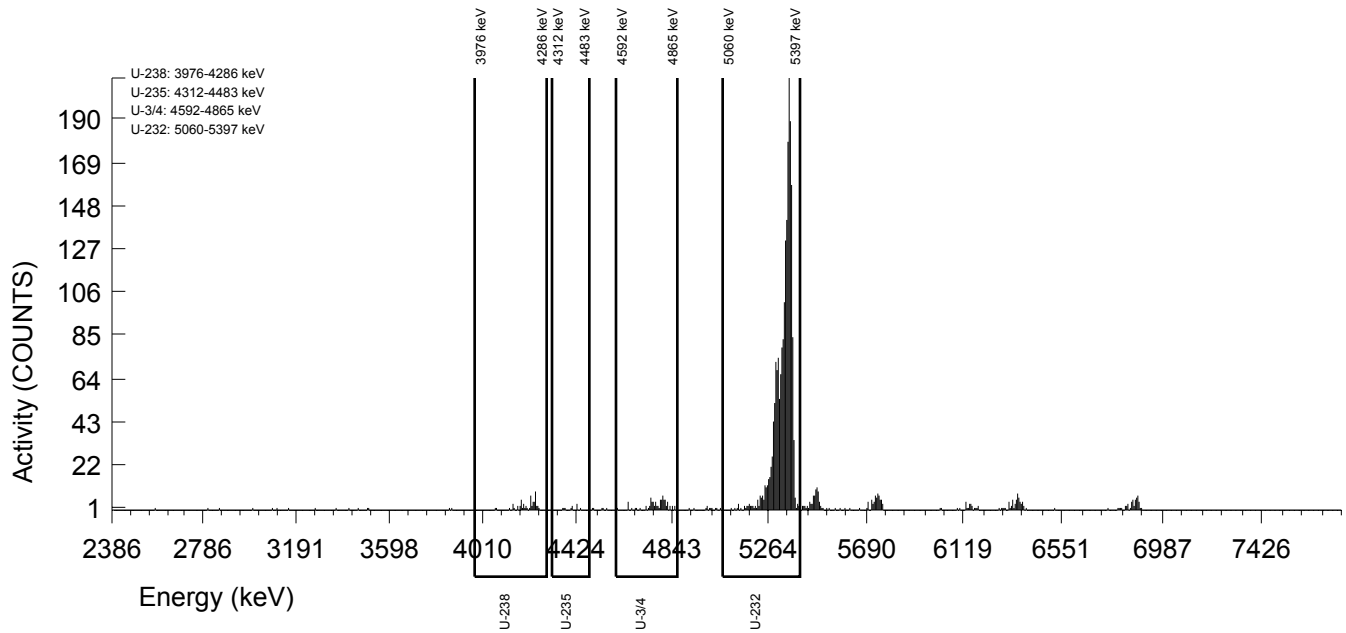
NUCLIDE	LIBRARY ENERGY	PEAK ENERGY	PEAK FWHM	GROSS AREA	NET AREA	BKG AREA	BKG StDev	%ABUN	ACTIVITY pCi/L	1.96-sigma TPU pCi/L	MDA pCi/L	Lc pCi/L	1.96-sigma cnt Unc pCi/L
U-232	5302.10	5330.86	32.824	2002.000	1976.000	26.000	5.0990	100.000	4.12E+01	3.98E+00	5.50E-01	2.47E-01	1.84E+00
U-3/4	4763.02	4772.21	165.794	78.000	65.486	6.000	4.5153	100.000	1.36E+00	4.00E-01	4.94E-01	2.19E-01	3.78E-01
U-235	4391.00	4401.96	24.931	10.000	8.000	2.000	2.7237	80.900	2.06E-01	1.90E-01	3.96E-01	1.63E-01	1.89E-01
U-238	4184.73	4205.87	63.872	56.000	52.000	4.000	4.2361	100.000	1.08E+00	3.34E-01	4.67E-01	2.05E-01	3.21E-01

NOTES:

* BKG StDev calculated via blank population. (StDev updated 12-Dec-2020)

* BKG StDev calculated as sqrt(BKG AREA) for U-232

* Correction made to the following net area due to tracer impurity:
U-3/4 (6.514 +/-0.195)



GEL Laboratories LLC
ALPHA SPECTROSCOPY REPORT

Instrument SOP: GL-RAD-I-009
Analytical SOP: GL-RAD-A-011

BATCH NUMBER : 2082184	CHAMBER : 004	LIB FILE : UU
SAMPLE ID : S0532167004_UU	DETECTOR S/N : 76389	BKG FILE : B004.CNF;2322
SAMPLE QTY : 0.400 L +/-0.500 %	AVERAGE %EFFICIENCY : 29.1181	BKG DATE : 16-Jan-2021
SAMPLE DATE : 14-Dec-2020 00:00:00	AVERAGE %EFF ERROR : 0.5662	BKG LIVE TIME(SEC) : 59999.99
ANALYST : MXS2	COUNT DATE : 22-Jan-2021 10:33:13	EFF FILE : W004.CNF;680
% YIELD : 99.9 +/-3.703 %	ELAPSED LIVE TIME(SEC) : 60000.00	CAL DATE : 04-Jan-2021

TRACER
ID : 1564-W
NUCLIDE : U-232
NOMINAL : 9.1430E+00 dpm
RESULTS : 9.1315E+00 dpm

NUCLIDE ACTIVITY SUMMARY

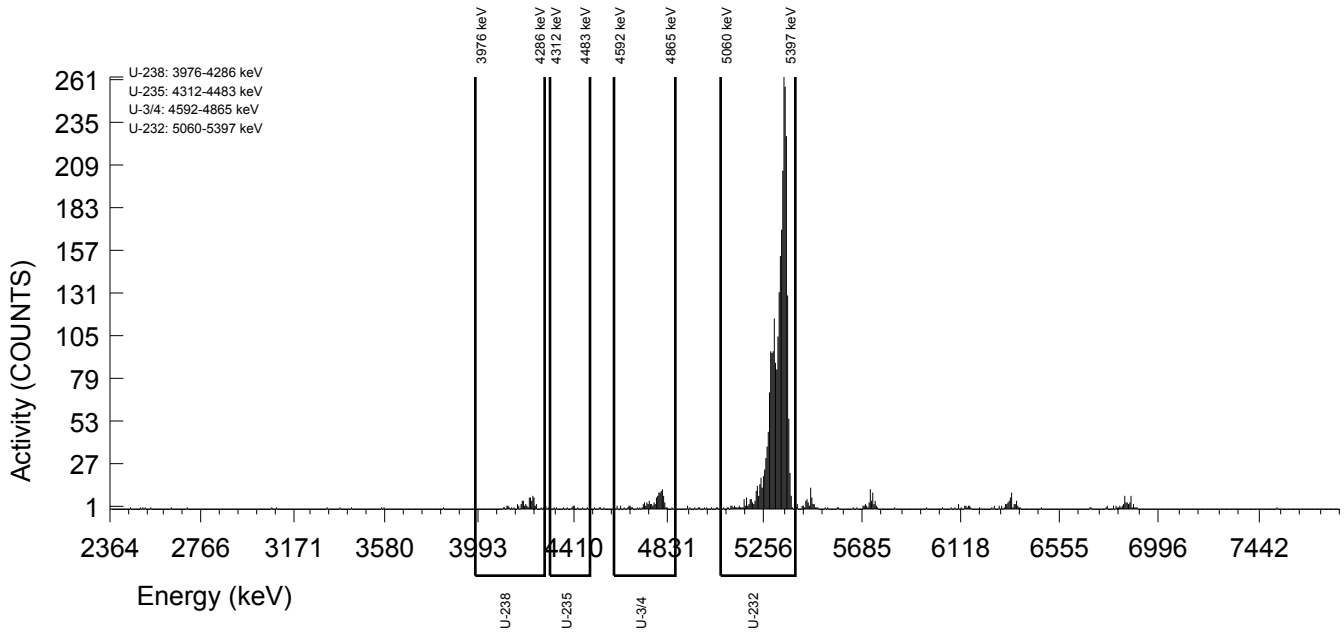
NUCLIDE	LIBRARY ENERGY	PEAK ENERGY	PEAK FWHM	GROSS AREA	NET AREA	BKG AREA	BKG StDev	%ABUN	ACTIVITY pCi/L	1.96-sigma TPU pCi/L	MDA pCi/L	Lc pCi/L	1.96-sigma cnt Unc pCi/L
U-232	5302.10	5317.10	34.932	2682.000	2656.000	26.000	5.0990	100.000	1.03E+01	9.38E-01	1.02E-01	4.59E-02	3.96E-01
U-3/4	4763.02	4766.84	33.670	126.000	111.245	6.000	4.5153	100.000	4.31E-01	9.59E-02	9.18E-02	4.07E-02	8.79E-02
U-235	4391.00	4402.06	12.470	12.000	10.000	2.000	2.7237	80.900	4.79E-02	3.77E-02	7.36E-02	3.03E-02	3.75E-02
U-238	4184.73	4203.55	55.368	76.000	70.000	6.000	4.2361	100.000	2.71E-01	7.31E-02	8.68E-02	3.82E-02	6.96E-02

NOTES:

* BKG StDev calculated via blank population. (StDev updated 12-Dec-2020)

* BKG StDev calculated as sqrt(BKG AREA) for U-232

* Correction made to the following net area due to tracer impurity:
U-3/4 (8.755 +/-0.263)



BATCH NUMBER : 2082184	CHAMBER : 005	LIB FILE : UU
SAMPLE ID : S0532167005_UU	DETECTOR S/N : 79454	BKG FILE : B005.CNF;2291
SAMPLE QTY : 0.300 L +/-0.500 %	AVERAGE %EFFICIENCY : 33.4104	BKG DATE : 16-Jan-2021
SAMPLE DATE : 14-Dec-2020 00:00:00	AVERAGE %EFF ERROR : 0.6477	BKG LIVE TIME(SEC) : 59999.99
ANALYST : MXS2	COUNT DATE : 22-Jan-2021 10:33:13	EFF FILE : W005.CNF;729
% YIELD : 87.2 +/-3.691 %	ELAPSED LIVE TIME(SEC) : 60000.00	CAL DATE : 04-Jan-2021

TRACER
ID : 1564-W
NUCLIDE : U-232
NOMINAL : 9.1430E+00 dpm
RESULTS : 7.9763E+00 dpm

NUCLIDE ACTIVITY SUMMARY

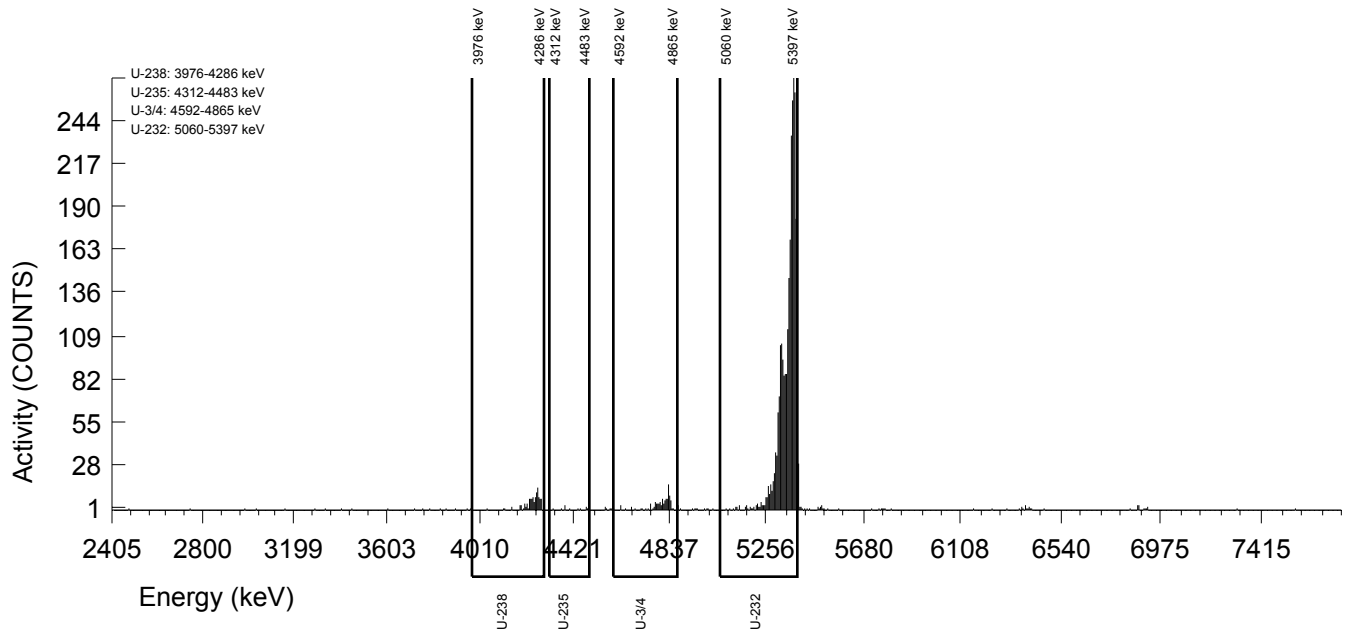
NUCLIDE	LIBRARY ENERGY	PEAK ENERGY	PEAK FWHM	GROSS AREA	NET AREA	BKG AREA	BKG StDev	%ABUN	ACTIVITY pCi/L	1.96-sigma TPU pCi/L	MDA pCi/L	Lc pCi/L	1.96-sigma cnt Unc pCi/L
U-232	5302.10	5352.92	33.629	2667.000	2662.000	5.000	2.2361	100.000	1.37E+01	1.24E+00	6.76E-02	2.68E-02	5.23E-01
U-3/4	4763.02	4795.38	10.915	108.000	95.225	4.000	4.5153	100.000	4.91E-01	1.17E-01	1.22E-01	5.41E-02	1.08E-01
U-235	4391.00	4423.63	0.000	13.000	12.000	1.000	2.7237	80.900	7.64E-02	5.03E-02	9.80E-02	4.03E-02	4.99E-02
U-238	4184.73	4238.44	34.382	113.000	111.000	2.000	4.2361	100.000	5.72E-01	1.19E-01	1.15E-01	5.08E-02	1.09E-01

NOTES:

* BKG StDev calculated via blank population. (StDev updated 12-Dec-2020)

* BKG StDev calculated as sqrt(BKG AREA) for U-232

* Correction made to the following net area due to tracer impurity:
U-3/4 (8.775 +/-0.263)



GEL Laboratories LLC
ALPHA SPECTROSCOPY REPORT

Instrument SOP: GL-RAD-I-009
Analytical SOP: GL-RAD-A-011

BATCH NUMBER : 2082184	CHAMBER : 006	LIB FILE : UU
SAMPLE ID : S0532167006_UU	DETECTOR S/N : 79455	BKG FILE : B006.CNF;2298
SAMPLE QTY : 0.200 L +/-0.500 %	AVERAGE %EFFICIENCY : 27.2668	BKG DATE : 16-Jan-2021
SAMPLE DATE : 14-Dec-2020 00:00:00	AVERAGE %EFF ERROR : 0.5309	BKG LIVE TIME(SEC) : 59999.99
ANALYST : MXS2	COUNT DATE : 22-Jan-2021 10:33:13	EFF FILE : W006.CNF;701
% YIELD : 82.2 +/-3.854 %	ELAPSED LIVE TIME(SEC) : 60000.00	CAL DATE : 04-Jan-2021

TRACER
ID : 1564-W
NUCLIDE : U-232
NOMINAL : 9.1430E+00 dpm
RESULTS : 7.5118E+00 dpm

NUCLIDE ACTIVITY SUMMARY

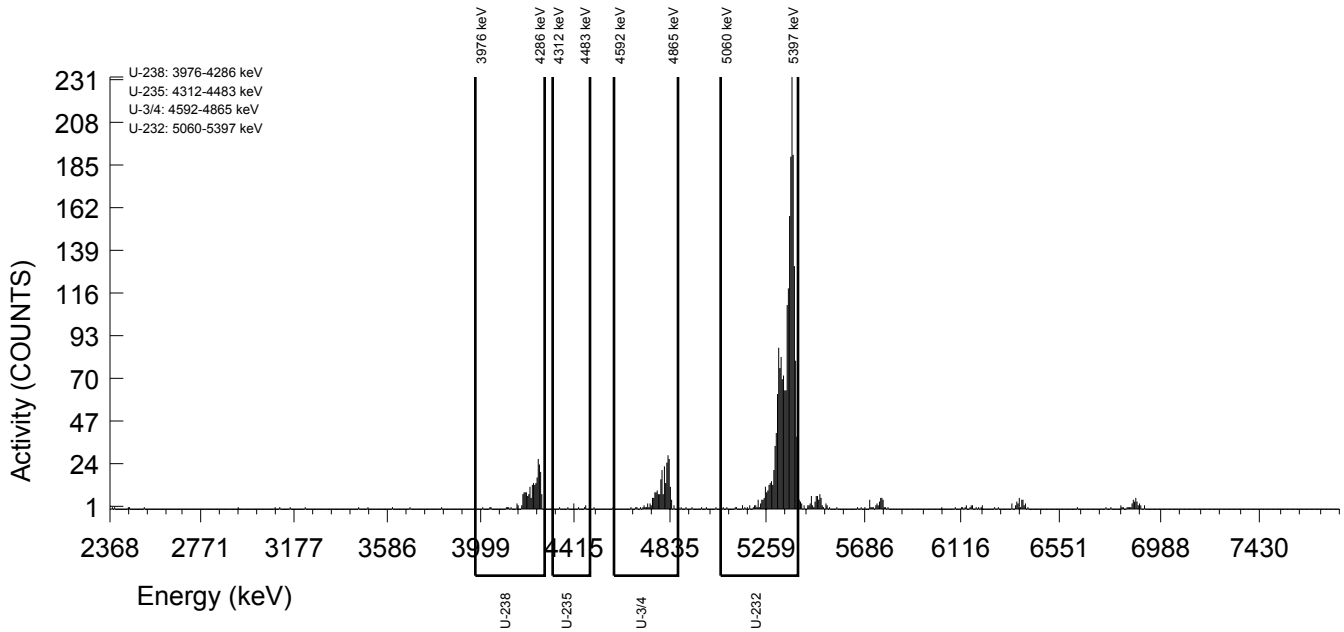
NUCLIDE	LIBRARY ENERGY	PEAK ENERGY	PEAK FWHM	GROSS AREA	NET AREA	BKG AREA	BKG StDev	%ABUN	ACTIVITY pCi/L	1.96-sigma TPU pCi/L	MDA pCi/L	Lc pCi/L	1.96-sigma cnt Unc pCi/L
U-232	5302.10	5345.78	27.840	2062.000	2046.000	16.000	4.0000	100.000	2.06E+01	1.97E+00	2.14E-01	9.36E-02	9.00E-01
U-3/4	4763.02	4800.72	40.147	257.000	246.256	4.000	4.5153	100.000	2.48E+00	3.86E-01	2.38E-01	1.06E-01	3.20E-01
U-235	4391.00	4419.23	53.808	9.000	9.000	0.000	2.7237	80.900	1.12E-01	8.13E-02	1.91E-01	7.87E-02	8.08E-02
U-238	4184.73	4228.46	35.246	232.000	231.000	1.000	4.2361	100.000	2.32E+00	3.61E-01	2.25E-01	9.91E-02	3.02E-01

NOTES:

* BKG StDev calculated via blank population. (StDev updated 12-Dec-2020)

* BKG StDev calculated as sqrt(BKG AREA) for U-232

* Correction made to the following net area due to tracer impurity:
U-3/4 (6.744 +/-0.202)



GEL Laboratories LLC
ALPHA SPECTROSCOPY REPORT

Instrument SOP: GL-RAD-I-009
Analytical SOP: GL-RAD-A-011

BATCH NUMBER : 2082184	CHAMBER : 007	LIB FILE : UU
SAMPLE ID : S0532167007_UU	DETECTOR S/N : 50-066Z1	BKG FILE : B007.CNF;2307
SAMPLE QTY : 0.400 L +/-0.500 %	AVERAGE %EFFICIENCY : 26.9185	BKG DATE : 16-Jan-2021
SAMPLE DATE : 14-Dec-2020 00:00:00	AVERAGE %EFF ERROR : 0.5244	BKG LIVE TIME(SEC) : 60000.00
ANALYST : MXS2	COUNT DATE : 22-Jan-2021 10:33:15	EFF FILE : W007.CNF;633
% YIELD : 70.4 +/-3.977 %	ELAPSED LIVE TIME(SEC) : 59999.99	CAL DATE : 04-Jan-2021

TRACER
ID : 1564-W
NUCLIDE : U-232
NOMINAL : 9.1430E+00 dpm
RESULTS : 6.4338E+00 dpm

NUCLIDE ACTIVITY SUMMARY

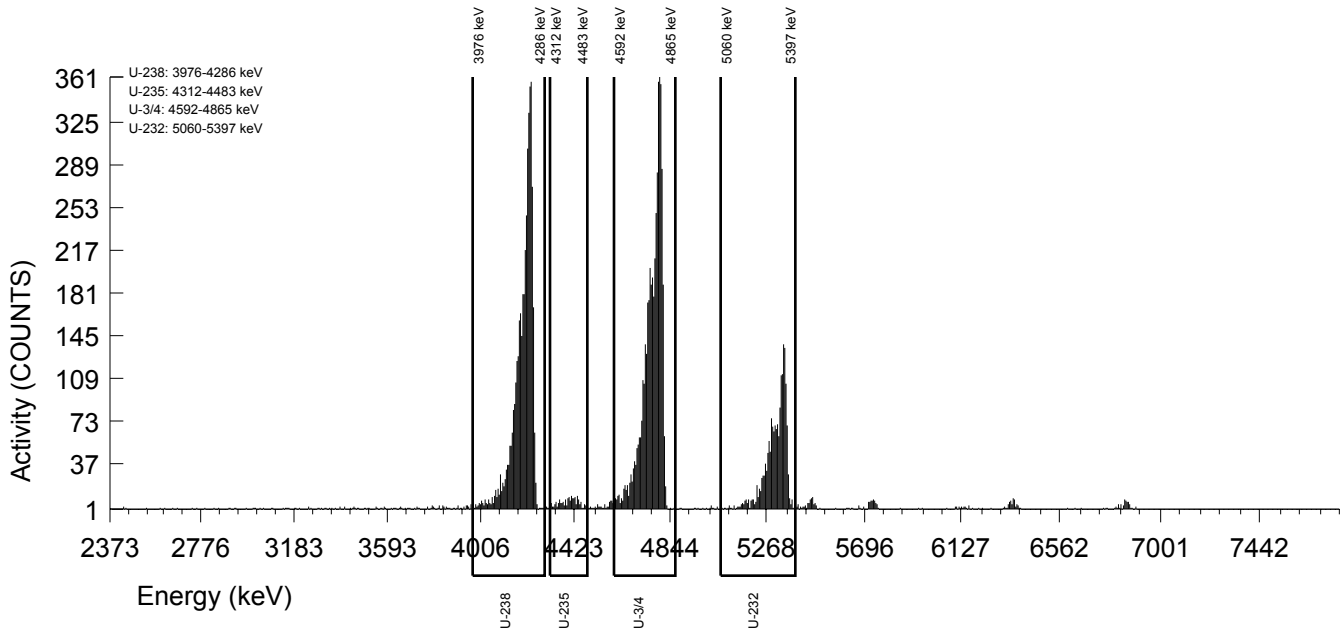
NUCLIDE	LIBRARY ENERGY	PEAK ENERGY	PEAK FWHM	GROSS AREA	NET AREA	BKG AREA	BKG StDev	%ABUN	ACTIVITY pCi/L	1.96-sigma TPU pCi/L	MDA pCi/L	Lc pCi/L	1.96-sigma cnt Unc pCi/L
U-232	5302.10	5307.35	66.565	1752.000	1730.000	22.000	4.6904	100.000	1.03E+01	1.02E+00	1.46E-01	6.49E-02	4.92E-01
U-3/4	4763.02	4763.34	59.336	4607.000	4598.297	3.000	4.5153	100.000	2.73E+01	2.52E+00	1.41E-01	6.24E-02	7.91E-01
U-235	4391.00	4399.42	107.060	178.000	178.000	0.000	2.7237	80.900	1.31E+00	2.24E-01	1.13E-01	4.66E-02	1.93E-01
U-238	4184.73	4194.05	44.777	4236.000	4232.000	4.000	4.2361	100.000	2.52E+01	2.33E+00	1.33E-01	5.86E-02	7.59E-01

NOTES:

* BKG StDev calculated via blank population. (StDev updated 12-Dec-2020)

* BKG StDev calculated as sqrt(BKG AREA) for U-232

* Correction made to the following net area due to tracer impurity:
U-3/4 (5.703 +/-0.171)



GEL Laboratories LLC
ALPHA SPECTROSCOPY REPORT

Instrument SOP: GL-RAD-I-009
Analytical SOP: GL-RAD-A-011

BATCH NUMBER : 2082184	CHAMBER : 008	LIB FILE : UU
SAMPLE ID : S0532167008_UU	DETECTOR S/N : 78788	BKG FILE : B008.CNF;2308
SAMPLE QTY : 0.400 L +/-0.500 %	AVERAGE %EFFICIENCY : 31.9288	BKG DATE : 16-Jan-2021
SAMPLE DATE : 14-Dec-2020 00:00:00	AVERAGE %EFF ERROR : 0.6195	BKG LIVE TIME(SEC) : 60000.00
ANALYST : MXS2	COUNT DATE : 22-Jan-2021 10:33:15	EFF FILE : W008.CNF;623
% YIELD : 83.4 +/-3.757 %	ELAPSED LIVE TIME(SEC) : 59999.99	CAL DATE : 04-Jan-2021

TRACER
ID : 1564-W
NUCLIDE : U-232
NOMINAL : 9.1430E+00 dpm
RESULTS : 7.6222E+00 dpm

NUCLIDE ACTIVITY SUMMARY

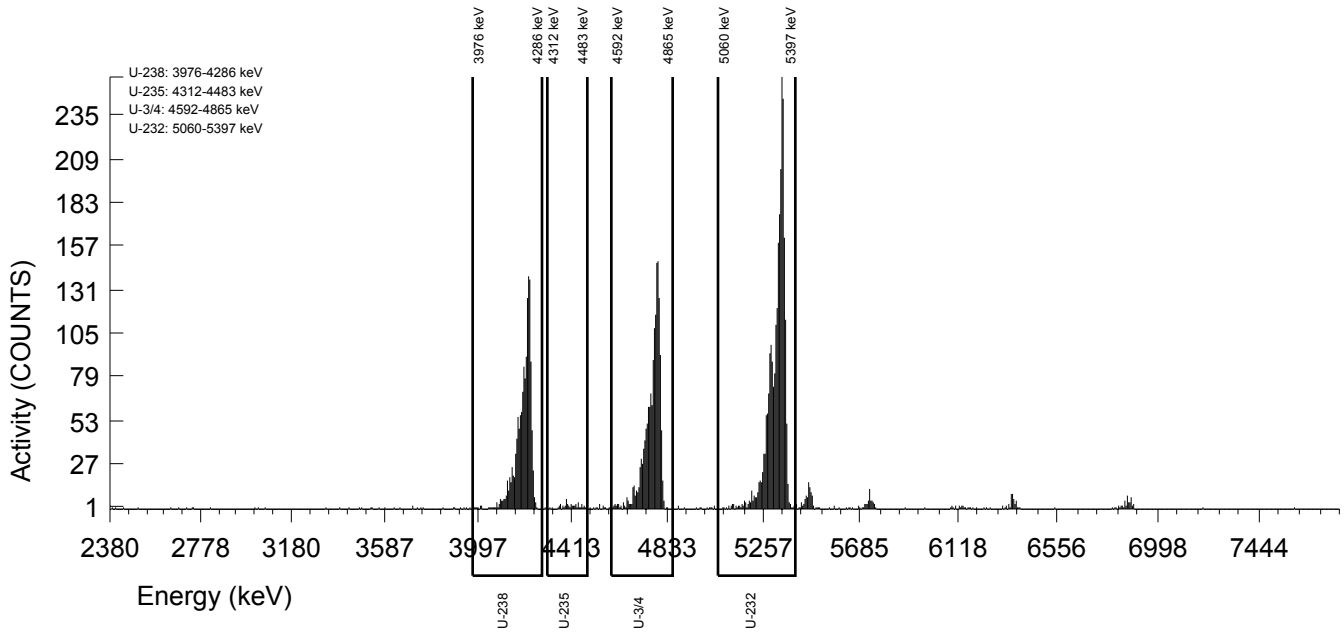
NUCLIDE	LIBRARY ENERGY	PEAK ENERGY	PEAK FWHM	GROSS AREA	NET AREA	BKG AREA	BKG StDev	%ABUN	ACTIVITY pCi/L	1.96-sigma TPU pCi/L	MDA pCi/L	Lc pCi/L	1.96-sigma cnt Unc pCi/L
U-232	5302.10	5317.37	31.845	2473.000	2431.000	42.000	6.4807	100.000	1.03E+01	9.55E-01	1.39E-01	6.38E-02	4.16E-01
U-3/4	4763.02	4768.99	34.379	1523.000	1509.987	5.000	4.5153	100.000	6.39E+00	6.26E-01	1.00E-01	4.44E-02	3.24E-01
U-235	4391.00	4413.34	54.782	53.000	52.000	1.000	2.7237	80.900	2.72E-01	8.00E-02	8.04E-02	3.31E-02	7.67E-02
U-238	4184.73	4201.09	37.035	1374.000	1370.000	4.000	4.2361	100.000	5.80E+00	5.73E-01	9.49E-02	4.17E-02	3.08E-01

NOTES:

* BKG StDev calculated via blank population. (StDev updated 12-Dec-2020)

* BKG StDev calculated as sqrt(BKG AREA) for U-232

* Correction made to the following net area due to tracer impurity:
U-3/4 (8.013 +/-0.240)



GEL Laboratories LLC
ALPHA SPECTROSCOPY REPORT

Instrument SOP: GL-RAD-I-009
Analytical SOP: GL-RAD-A-011

BATCH NUMBER : 2082184	CHAMBER : 009	LIB FILE : UU
SAMPLE ID : S0532167009_UU	DETECTOR S/N : 72528	BKG FILE : B009.CNF;2300
SAMPLE QTY : 0.400 L +/-0.500 %	AVERAGE %EFFICIENCY : 31.6238	BKG DATE : 16-Jan-2021
SAMPLE DATE : 14-Dec-2020 00:00:00	AVERAGE %EFF ERROR : 0.6137	BKG LIVE TIME(SEC) : 60000.00
ANALYST : MXS2	COUNT DATE : 22-Jan-2021 10:33:15	EFF FILE : W009.CNF;622
% YIELD : 84.4 +/-3.747 %	ELAPSED LIVE TIME(SEC) : 59999.99	CAL DATE : 04-Jan-2021

TRACER
ID : 1564-W
NUCLIDE : U-232
NOMINAL : 9.1430E+00 dpm
RESULTS : 7.7210E+00 dpm

NUCLIDE ACTIVITY SUMMARY

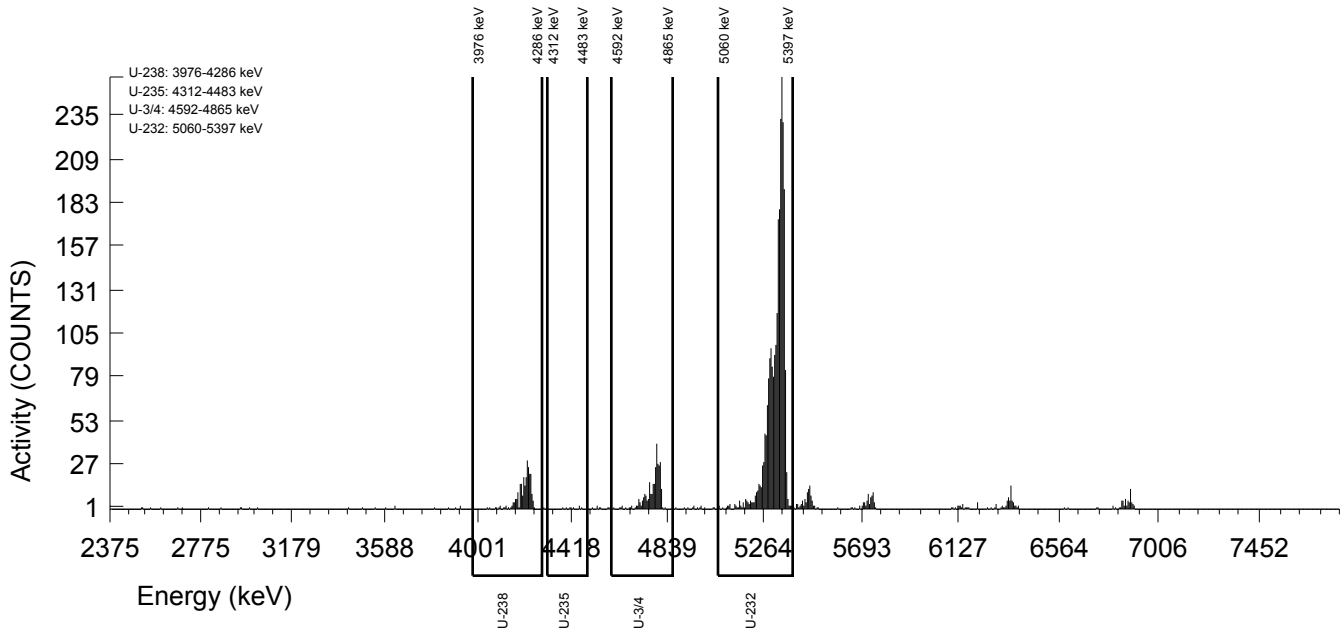
NUCLIDE	LIBRARY ENERGY	PEAK ENERGY	PEAK FWHM	GROSS AREA	NET AREA	BKG AREA	BKG StDev	%ABUN	ACTIVITY pCi/L	1.96-sigma TPU pCi/L	MDA pCi/L	Lc pCi/L	1.96-sigma cnt Unc pCi/L
U-232	5302.10	5318.57	31.646	2463.000	2439.000	24.000	4.8990	100.000	1.03E+01	9.52E-01	1.08E-01	4.81E-02	4.13E-01
U-3/4	4763.02	4773.83	25.284	291.000	281.960	1.000	4.5153	100.000	1.19E+00	1.75E-01	1.00E-01	4.43E-02	1.42E-01
U-235	4391.00	4420.80	4.976	8.000	8.000	0.000	2.7237	80.900	4.17E-02	3.25E-02	8.02E-02	3.30E-02	3.23E-02
U-238	4184.73	4203.86	47.656	247.000	245.000	2.000	4.2361	100.000	1.03E+00	1.57E-01	9.45E-02	4.16E-02	1.31E-01

NOTES:

* BKG StDev calculated via blank population. (StDev updated 12-Dec-2020)

* BKG StDev calculated as sqrt(BKG AREA) for U-232

* Correction made to the following net area due to tracer impurity:
U-3/4 (8.040 +/-0.241)



GEL Laboratories LLC
ALPHA SPECTROSCOPY REPORT

Instrument SOP: GL-RAD-I-009
Analytical SOP: GL-RAD-A-011

BATCH NUMBER : 2082184	CHAMBER : 010	LIB FILE : UU
SAMPLE ID : S0532167010_UU	DETECTOR S/N : 72529	BKG FILE : B010.CNF;2327
SAMPLE QTY : 0.400 L +/-0.500 %	AVERAGE %EFFICIENCY : 30.1016	BKG DATE : 16-Jan-2021
SAMPLE DATE : 14-Dec-2020 00:00:00	AVERAGE %EFF ERROR : 0.5848	BKG LIVE TIME(SEC) : 60000.00
ANALYST : MXS2	COUNT DATE : 22-Jan-2021 10:33:15	EFF FILE : W010.CNF;629
% YIELD : 92.8 +/-3.731 %	ELAPSED LIVE TIME(SEC) : 59999.99	CAL DATE : 04-Jan-2021

TRACER
ID : 1564-W
NUCLIDE : U-232
NOMINAL : 9.1430E+00 dpm
RESULTS : 8.4872E+00 dpm

NUCLIDE ACTIVITY SUMMARY

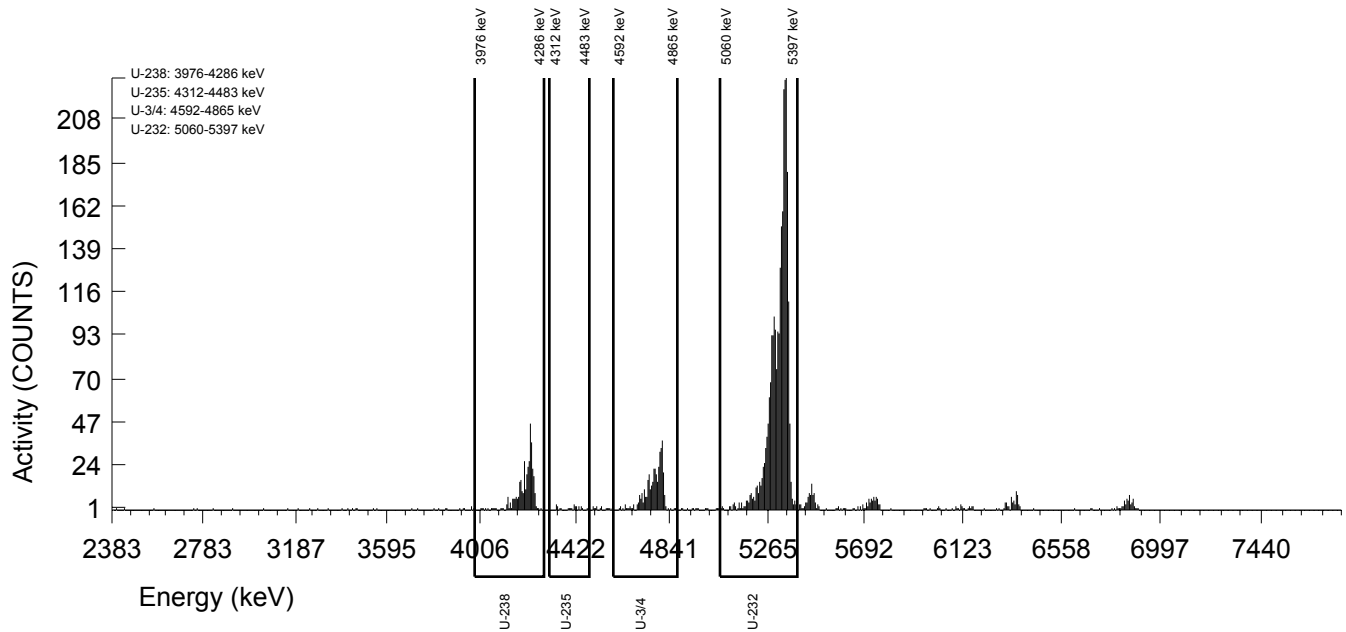
NUCLIDE	LIBRARY ENERGY	PEAK ENERGY	PEAK FWHM	GROSS AREA	NET AREA	BKG AREA	BKG StDev	%ABUN	ACTIVITY pCi/L	1.96-sigma TPU pCi/L	MDA pCi/L	Lc pCi/L	1.96-sigma cnt Unc pCi/L
U-232	5302.10	5315.85	36.518	2596.000	2552.000	44.000	6.6332	100.000	1.03E+01	9.47E-01	1.35E-01	6.22E-02	4.06E-01
U-3/4	4763.02	4766.97	61.137	386.000	365.588	12.000	4.5153	100.000	1.47E+00	2.02E-01	9.56E-02	4.23E-02	1.58E-01
U-235	4391.00	4405.53	109.425	25.000	21.000	4.000	2.7237	80.900	1.05E-01	5.51E-02	7.66E-02	3.16E-02	5.44E-02
U-238	4184.73	4198.33	35.339	360.000	358.000	2.000	4.2361	100.000	1.44E+00	1.93E-01	9.04E-02	3.97E-02	1.51E-01

NOTES:

* BKG StDev calculated via blank population. (StDev updated 12-Dec-2020)

* BKG StDev calculated as sqrt(BKG AREA) for U-232

* Correction made to the following net area due to tracer impurity:
U-3/4 (8.412 +/-0.252)



GEL Laboratories LLC
ALPHA SPECTROSCOPY REPORT

Instrument SOP: GL-RAD-I-009
Analytical SOP: GL-RAD-A-011

BATCH NUMBER : 2082184	CHAMBER : 011	LIB FILE : UU
SAMPLE ID : S0532167011_UU	DETECTOR S/N : 72531	BKG FILE : B011.CNF;2323
SAMPLE QTY : 0.300 L +/-0.500 %	AVERAGE %EFFICIENCY : 31.5340	BKG DATE : 16-Jan-2021
SAMPLE DATE : 14-Dec-2020 00:00:00	AVERAGE %EFF ERROR : 0.6120	BKG LIVE TIME(SEC) : 60000.00
ANALYST : MXS2	COUNT DATE : 22-Jan-2021 10:33:15	EFF FILE : W011.CNF;638
% YIELD : 81.0 +/-3.768 %	ELAPSED LIVE TIME(SEC) : 59999.99	CAL DATE : 04-Jan-2021

TRACER
ID : 1564-W
NUCLIDE : U-232
NOMINAL : 9.1430E+00 dpm
RESULTS : 7.4033E+00 dpm

NUCLIDE ACTIVITY SUMMARY

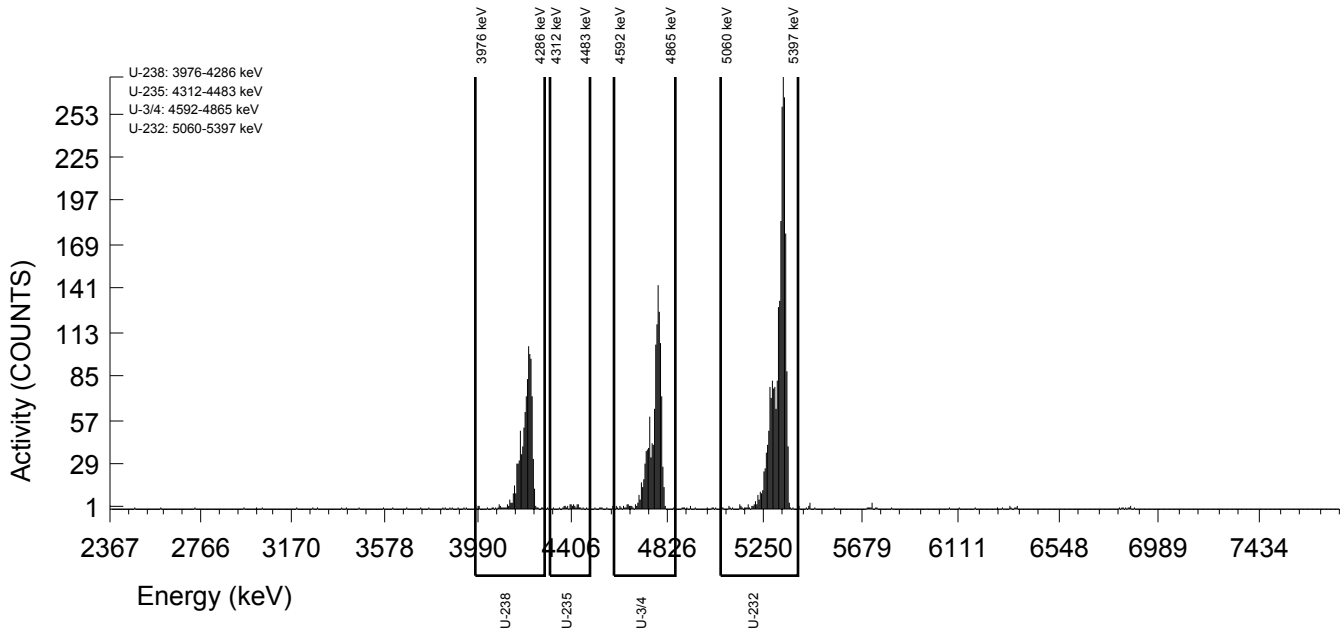
NUCLIDE	LIBRARY ENERGY	PEAK ENERGY	PEAK FWHM	GROSS AREA	NET AREA	BKG AREA	BKG StDev	%ABUN	ACTIVITY pCi/L	1.96-sigma TPU pCi/L	MDA pCi/L	Lc pCi/L	1.96-sigma cnt Unc pCi/L
U-232	5302.10	5314.56	26.493	2345.000	2332.000	13.000	3.6056	100.000	1.37E+01	1.28E+00	1.15E-01	4.93E-02	5.61E-01
U-3/4	4763.02	4767.04	28.949	1193.000	1176.313	9.000	4.5153	100.000	6.92E+00	7.06E-01	1.39E-01	6.18E-02	4.00E-01
U-235	4391.00	4403.85	65.813	34.000	34.000	0.000	2.7237	80.900	2.47E-01	8.79E-02	1.12E-01	4.61E-02	8.55E-02
U-238	4184.73	4197.75	37.253	981.000	976.000	5.000	4.2361	100.000	5.74E+00	6.01E-01	1.32E-01	5.80E-02	3.62E-01

NOTES:

* BKG StDev calculated via blank population. (StDev updated 12-Dec-2020)

* BKG StDev calculated as sqrt(BKG AREA) for U-232

* Correction made to the following net area due to tracer impurity:
U-3/4 (7.687 +/-0.231)



GEL Laboratories LLC
ALPHA SPECTROSCOPY REPORT

Instrument SOP: GL-RAD-I-009
Analytical SOP: GL-RAD-A-011

BATCH NUMBER : 2082184	CHAMBER : 012	LIB FILE : UU
SAMPLE ID : S0532167012_UU	DETECTOR S/N : 80054	BKG FILE : B012.CNF;2307
SAMPLE QTY : 0.400 L +/-0.500 %	AVERAGE %EFFICIENCY : 30.0663	BKG DATE : 16-Jan-2021
SAMPLE DATE : 14-Dec-2020 00:00:00	AVERAGE %EFF ERROR : 0.5842	BKG LIVE TIME(SEC) : 60000.00
ANALYST : MXS2	COUNT DATE : 22-Jan-2021 10:33:15	EFF FILE : W012.CNF;608
% YIELD : 75.5 +/-3.853 %	ELAPSED LIVE TIME(SEC) : 59999.99	CAL DATE : 04-Jan-2021

TRACER
ID : 1564-W
NUCLIDE : U-232
NOMINAL : 9.1430E+00 dpm
RESULTS : 6.8990E+00 dpm

NUCLIDE ACTIVITY SUMMARY

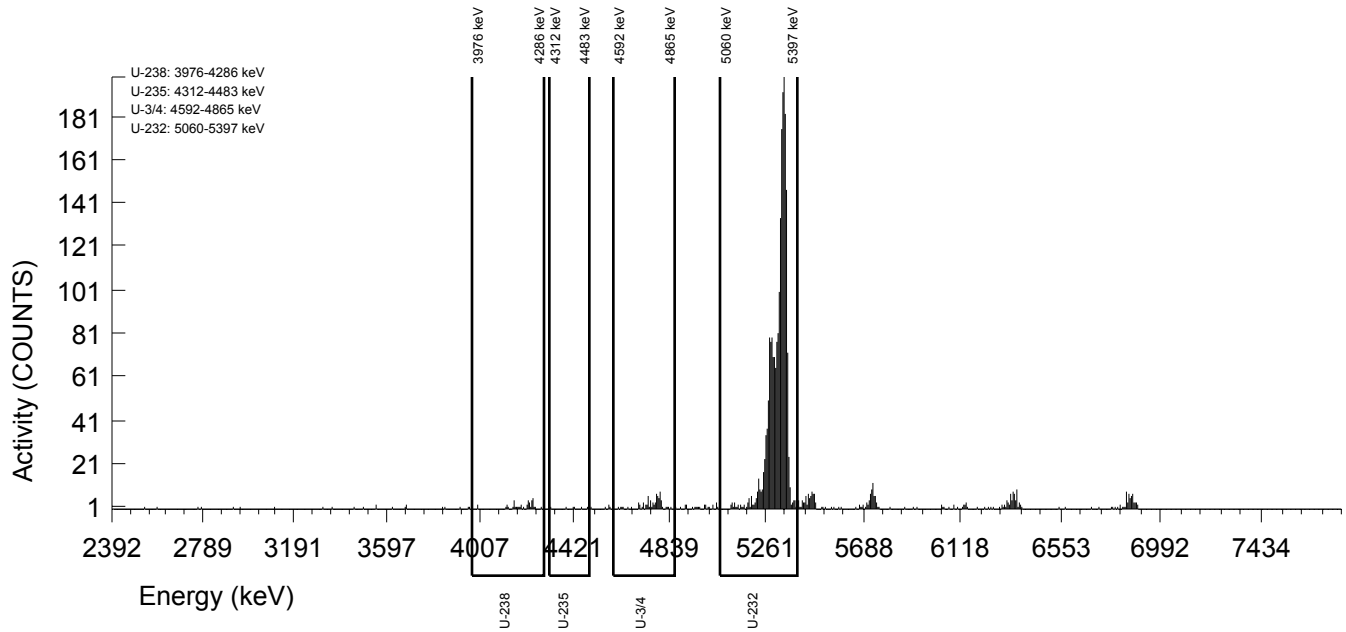
NUCLIDE	LIBRARY ENERGY	PEAK ENERGY	PEAK FWHM	GROSS AREA	NET AREA	BKG AREA	BKG StDev	%ABUN	ACTIVITY pCi/L	1.96-sigma TPU pCi/L	MDA pCi/L	Lc pCi/L	1.96-sigma cnt Unc pCi/L
U-232	5302.10	5314.98	32.930	2104.000	2072.000	32.000	5.6569	100.000	1.03E+01	9.86E-01	1.44E-01	6.53E-02	4.50E-01
U-3/4	4763.02	4761.26	56.864	75.000	62.170	6.000	4.5153	100.000	3.09E-01	9.33E-02	1.18E-01	5.21E-02	8.86E-02
U-235	4391.00	4421.69	0.000	7.000	6.000	1.000	2.7237	80.900	3.68E-02	3.82E-02	9.44E-02	3.89E-02	3.80E-02
U-238	4184.73	4190.42	84.678	41.000	34.000	7.000	4.2361	100.000	1.69E-01	7.03E-02	1.11E-01	4.89E-02	6.88E-02

NOTES:

* BKG StDev calculated via blank population. (StDev updated 12-Dec-2020)

* BKG StDev calculated as sqrt(BKG AREA) for U-232

* Correction made to the following net area due to tracer impurity:
U-3/4 (6.830 +/-0.205)



GEL Laboratories LLC
ALPHA SPECTROSCOPY REPORT

Instrument SOP: GL-RAD-I-009
Analytical SOP: GL-RAD-A-011

BATCH NUMBER : 2082184	CHAMBER : 013	LIB FILE : UU
SAMPLE ID : S0532167013_UU	DETECTOR S/N : 78790	BKG FILE : B013.CNF;2273
SAMPLE QTY : 0.400 L +/-0.500 %	AVERAGE %EFFICIENCY : 35.2397	BKG DATE : 16-Jan-2021
SAMPLE DATE : 14-Dec-2020 00:00:00	AVERAGE %EFF ERROR : 0.6825	BKG LIVE TIME(SEC) : 60000.00
ANALYST : MXS2	COUNT DATE : 22-Jan-2021 10:33:17	EFF FILE : W013.CNF;621
% YIELD : 79.8 +/-3.721 %	ELAPSED LIVE TIME(SEC) : 60000.00	CAL DATE : 04-Jan-2021

TRACER
ID : 1564-W
NUCLIDE : U-232
NOMINAL : 9.1430E+00 dpm
RESULTS : 7.2924E+00 dpm

NUCLIDE ACTIVITY SUMMARY

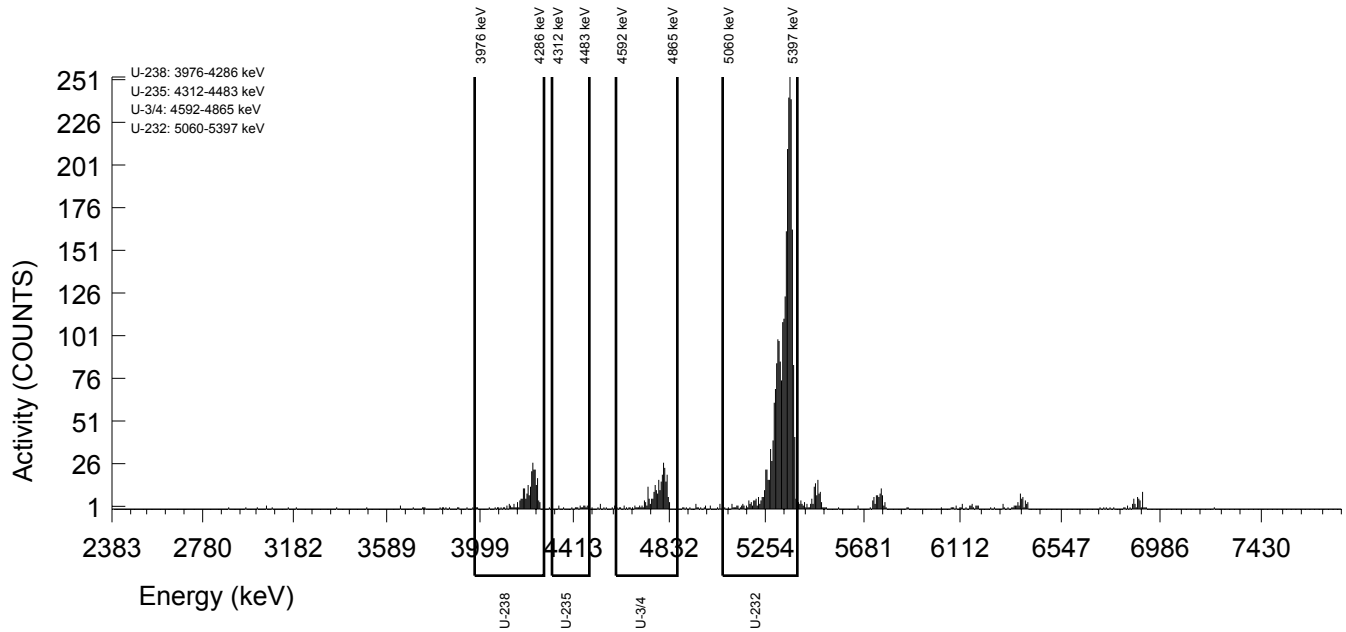
NUCLIDE	LIBRARY ENERGY	PEAK ENERGY	PEAK FWHM	GROSS AREA	NET AREA	BKG AREA	BKG StDev	%ABUN	ACTIVITY pCi/L	1.96-sigma TPU pCi/L	MDA pCi/L	Lc pCi/L	1.96-sigma cnt Unc pCi/L
U-232	5302.10	5333.13	31.732	2603.000	2567.000	36.000	6.0000	100.000	1.03E+01	9.43E-01	1.23E-01	5.59E-02	4.04E-01
U-3/4	4763.02	4777.07	52.550	274.000	260.538	5.000	4.5153	100.000	1.04E+00	1.59E-01	9.50E-02	4.21E-02	1.32E-01
U-235	4391.00	4429.87	123.648	18.000	15.000	3.000	2.7237	80.900	7.43E-02	4.70E-02	7.62E-02	3.14E-02	4.66E-02
U-238	4184.73	4212.39	41.774	256.000	253.000	3.000	4.2361	100.000	1.01E+00	1.52E-01	8.98E-02	3.95E-02	1.27E-01

NOTES:

* BKG StDev calculated via blank population. (StDev updated 12-Dec-2020)

* BKG StDev calculated as sqrt(BKG AREA) for U-232

* Correction made to the following net area due to tracer impurity:
U-3/4 (8.462 +/-0.254)



GEL Laboratories LLC
ALPHA SPECTROSCOPY REPORT

Instrument SOP: GL-RAD-I-009
Analytical SOP: GL-RAD-A-011

BATCH NUMBER : 2082184	CHAMBER : 014	LIB FILE : UU
SAMPLE ID : S0532167014_UU	DETECTOR S/N : 83289	BKG FILE : B014.CNF;2274
SAMPLE QTY : 0.400 L +/-0.500 %	AVERAGE %EFFICIENCY : 33.5450	BKG DATE : 16-Jan-2021
SAMPLE DATE : 14-Dec-2020 00:00:00	AVERAGE %EFF ERROR : 0.6501	BKG LIVE TIME(SEC) : 60000.00
ANALYST : MXS2	COUNT DATE : 22-Jan-2021 10:33:17	EFF FILE : W014.CNF;637
% YIELD : 92.8 +/-3.668 %	ELAPSED LIVE TIME(SEC) : 60000.00	CAL DATE : 04-Jan-2021

TRACER
ID : 1564-W
NUCLIDE : U-232
NOMINAL : 9.1430E+00 dpm
RESULTS : 8.4815E+00 dpm

NUCLIDE ACTIVITY SUMMARY

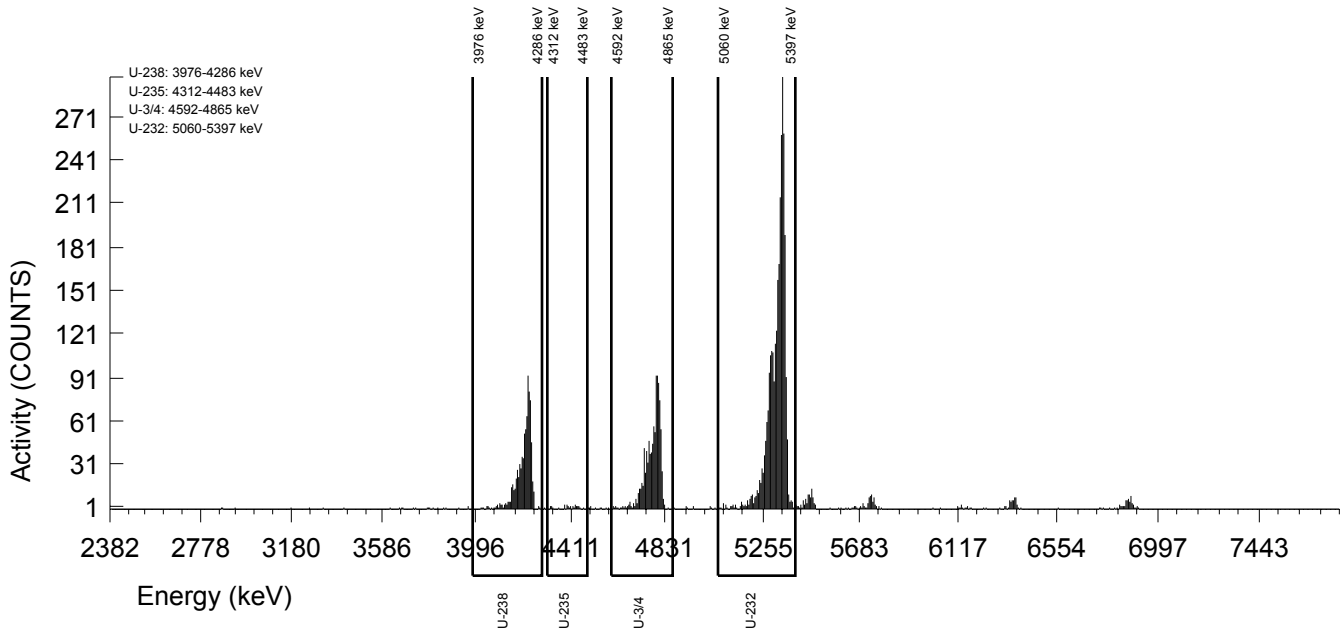
NUCLIDE	LIBRARY ENERGY	PEAK ENERGY	PEAK FWHM	GROSS AREA	NET AREA	BKG AREA	BKG StDev	%ABUN	ACTIVITY pCi/L	1.96-sigma TPU pCi/L	MDA pCi/L	Lc pCi/L	1.96-sigma cnt Unc pCi/L
U-232	5302.10	5318.99	32.869	2878.000	2842.000	36.000	6.0000	100.000	1.03E+01	9.26E-01	1.11E-01	5.05E-02	3.83E-01
U-3/4	4763.02	4771.41	51.173	975.000	961.632	4.000	4.5153	100.000	3.48E+00	3.64E-01	8.58E-02	3.80E-02	2.22E-01
U-235	4391.00	4405.92	122.051	32.000	31.000	1.000	2.7237	80.900	1.39E-01	5.31E-02	6.88E-02	2.83E-02	5.19E-02
U-238	4184.73	4203.79	31.329	812.000	805.000	7.000	4.2361	100.000	2.91E+00	3.13E-01	8.11E-02	3.57E-02	2.03E-01

NOTES:

* BKG StDev calculated via blank population. (StDev updated 12-Dec-2020)

* BKG StDev calculated as sqrt(BKG AREA) for U-232

* Correction made to the following net area due to tracer impurity:
U-3/4 (9.368 +/-0.281)



GEL Laboratories LLC
ALPHA SPECTROSCOPY REPORT

Instrument SOP: GL-RAD-I-009
Analytical SOP: GL-RAD-A-011

BATCH NUMBER : 2082184	CHAMBER : 015	LIB FILE : UU
SAMPLE ID : S0532167015_UU	DETECTOR S/N : 80055	BKG FILE : B015.CNF;2307
SAMPLE QTY : 0.300 L +/-0.500 %	AVERAGE %EFFICIENCY : 33.3489	BKG DATE : 16-Jan-2021
SAMPLE DATE : 14-Dec-2020 00:00:00	AVERAGE %EFF ERROR : 0.6465	BKG LIVE TIME(SEC) : 60000.00
ANALYST : MXS2	COUNT DATE : 22-Jan-2021 10:33:17	EFF FILE : W015.CNF;652
% YIELD : 85.9 +/-3.709 %	ELAPSED LIVE TIME(SEC) : 60000.00	CAL DATE : 04-Jan-2021

TRACER
ID : 1564-W
NUCLIDE : U-232
NOMINAL : 9.1430E+00 dpm
RESULTS : 7.8529E+00 dpm

NUCLIDE ACTIVITY SUMMARY

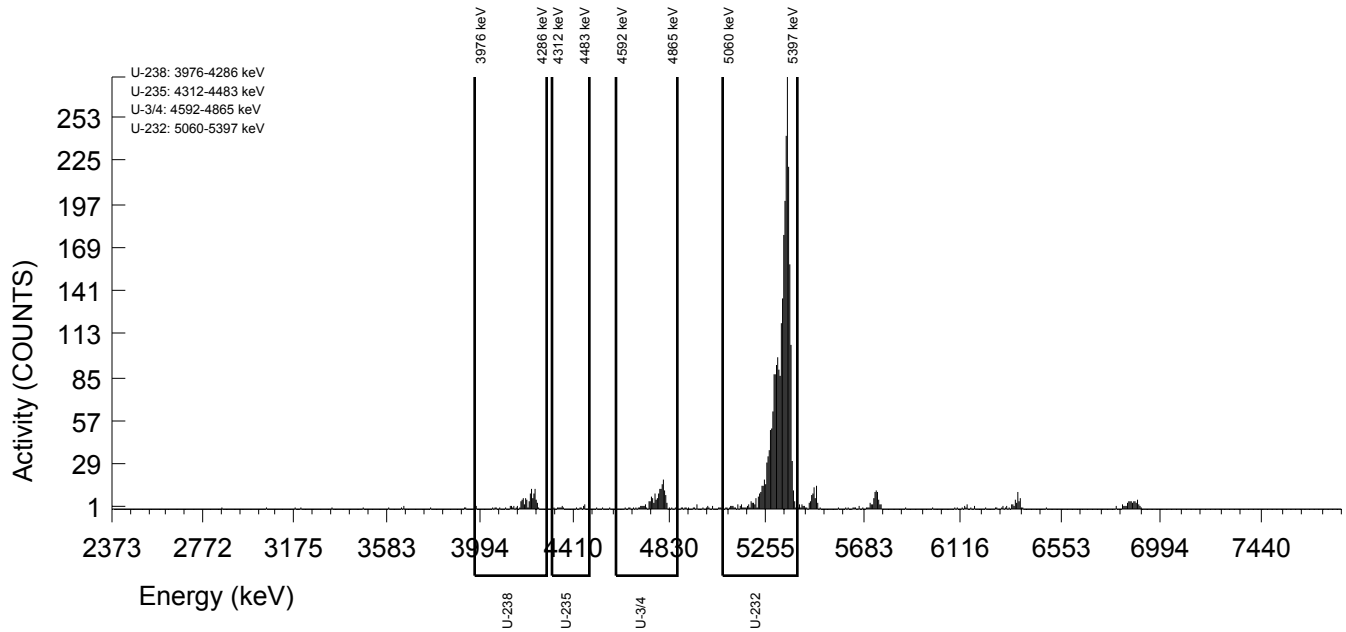
NUCLIDE	LIBRARY ENERGY	PEAK ENERGY	PEAK FWHM	GROSS AREA	NET AREA	BKG AREA	BKG StDev	%ABUN	ACTIVITY pCi/L	1.96-sigma TPU pCi/L	MDA pCi/L	Lc pCi/L	1.96-sigma cnt Unc pCi/L
U-232	5302.10	5323.72	31.103	2645.000	2616.000	29.000	5.3852	100.000	1.37E+01	1.25E+00	1.46E-01	6.57E-02	5.32E-01
U-3/4	4763.02	4776.63	44.229	172.000	160.377	3.000	4.5153	100.000	8.41E-01	1.55E-01	1.24E-01	5.51E-02	1.37E-01
U-235	4391.00	4397.27	99.204	16.000	15.000	1.000	2.7237	80.900	9.72E-02	5.59E-02	9.97E-02	4.11E-02	5.54E-02
U-238	4184.73	4200.26	56.688	122.000	117.000	5.000	4.2361	100.000	6.13E-01	1.27E-01	1.18E-01	5.17E-02	1.17E-01

NOTES:

* BKG StDev calculated via blank population. (StDev updated 12-Dec-2020)

* BKG StDev calculated as sqrt(BKG AREA) for U-232

* Correction made to the following net area due to tracer impurity:
U-3/4 (8.623 +/-0.259)



GEL Laboratories LLC
ALPHA SPECTROSCOPY REPORT

Instrument SOP: GL-RAD-I-009
Analytical SOP: GL-RAD-A-011

BATCH NUMBER : 2082184	CHAMBER : 016	LIB FILE : UU
SAMPLE ID : S0532167016_UU	DETECTOR S/N : 78774	BKG FILE : B016.CNF;2296
SAMPLE QTY : 0.400 L +/-0.500 %	AVERAGE %EFFICIENCY : 33.6352	BKG DATE : 16-Jan-2021
SAMPLE DATE : 14-Dec-2020 00:00:00	AVERAGE %EFF ERROR : 0.6518	BKG LIVE TIME(SEC) : 60000.00
ANALYST : MXS2	COUNT DATE : 22-Jan-2021 10:33:17	EFF FILE : W016.CNF;618
% YIELD : 89.7 +/-3.681 %	ELAPSED LIVE TIME(SEC) : 60000.00	CAL DATE : 04-Jan-2021

TRACER
ID : 1564-W
NUCLIDE : U-232
NOMINAL : 9.1430E+00 dpm
RESULTS : 8.1968E+00 dpm

NUCLIDE ACTIVITY SUMMARY

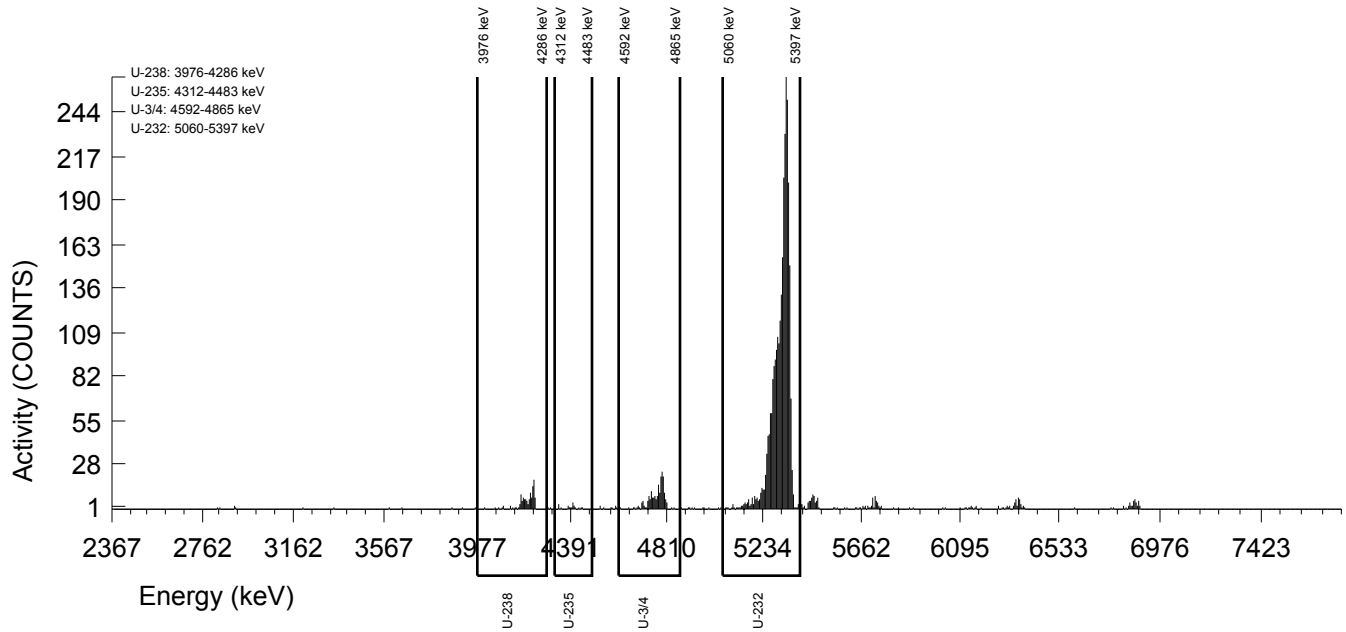
NUCLIDE	LIBRARY ENERGY	PEAK ENERGY	PEAK FWHM	GROSS AREA	NET AREA	BKG AREA	BKG StDev	%ABUN	ACTIVITY pCi/L	1.96-sigma TPU pCi/L	MDA pCi/L	Lc pCi/L	1.96-sigma cnt Unc pCi/L
U-232	5302.10	5311.09	35.189	2781.000	2754.000	27.000	5.1962	100.000	1.03E+01	9.31E-01	1.00E-01	4.51E-02	3.88E-01
U-3/4	4763.02	4764.57	26.280	197.000	184.922	3.000	4.5153	100.000	6.91E-01	1.20E-01	8.86E-02	3.92E-02	1.04E-01
U-235	4391.00	4386.28	65.494	19.000	18.000	1.000	2.7237	80.900	8.31E-02	4.30E-02	7.10E-02	2.92E-02	4.24E-02
U-238	4184.73	4192.79	19.983	119.000	113.000	6.000	4.2361	100.000	4.22E-01	8.95E-02	8.37E-02	3.68E-02	8.25E-02

NOTES:

* BKG StDev calculated via blank population. (StDev updated 12-Dec-2020)

* BKG StDev calculated as sqrt(BKG AREA) for U-232

* Correction made to the following net area due to tracer impurity:
U-3/4 (9.078 +/-0.272)



GEL Laboratories LLC
ALPHA SPECTROSCOPY REPORT

Instrument SOP: GL-RAD-I-009
Analytical SOP: GL-RAD-A-011

BATCH NUMBER : 2082184	CHAMBER : 018	LIB FILE : UU
SAMPLE ID : S1204733210_UU	DETECTOR S/N : 78782	BKG FILE : B018.CNF;2276
SAMPLE QTY : 1.000 L +/-0.500 %	AVERAGE %EFFICIENCY : 31.5096	BKG DATE : 16-Jan-2021
SAMPLE DATE : 19-Jan-2021 00:00:00	AVERAGE %EFF ERROR : 0.6115	BKG LIVE TIME(SEC) : 60000.00
ANALYST : MXS2	COUNT DATE : 22-Jan-2021 10:33:17	EFF FILE : W018.CNF;634
% YIELD : 87.3 +/-3.731 %	ELAPSED LIVE TIME(SEC) : 60000.00	CAL DATE : 04-Jan-2021

TRACER
ID : 1564-W
NUCLIDE : U-232
NOMINAL : 9.1340E+00 dpm
RESULTS : 7.9698E+00 dpm

NUCLIDE ACTIVITY SUMMARY

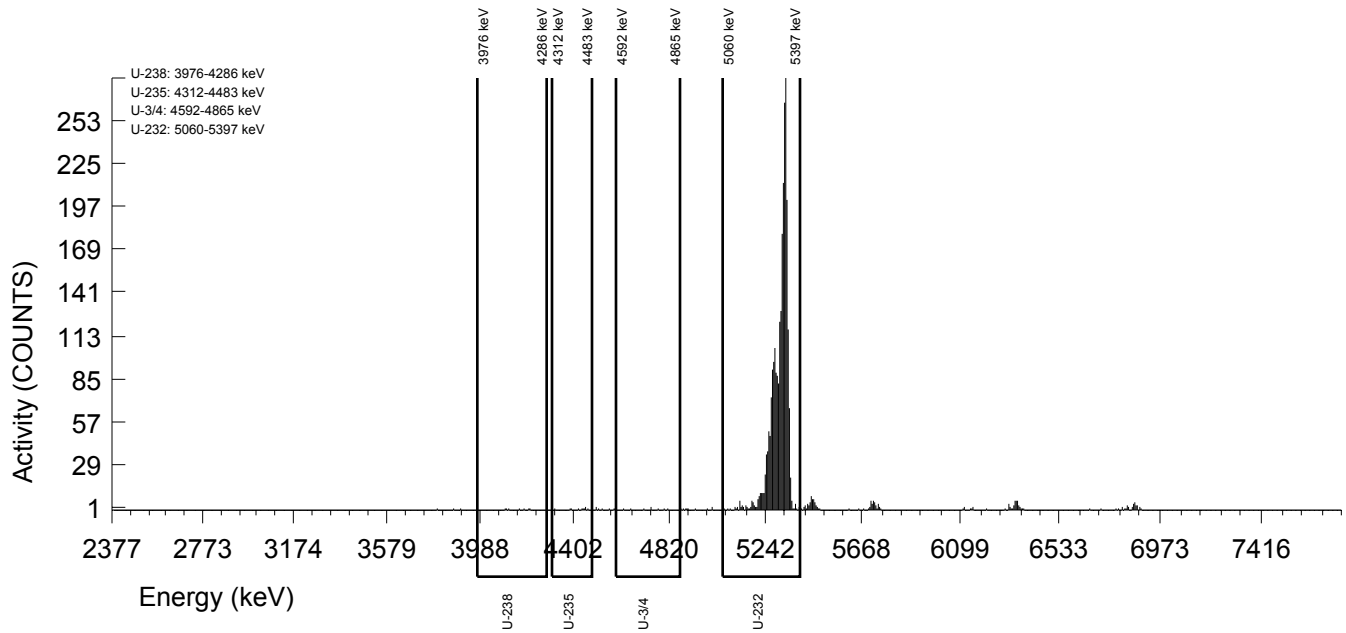
NUCLIDE	LIBRARY ENERGY	PEAK ENERGY	PEAK FWHM	GROSS AREA	NET AREA	BKG AREA	BKG StDev	%ABUN	ACTIVITY pCi/L	1.96-sigma TPU pCi/L	MDA pCi/L	Lc pCi/L	1.96-sigma cnt Unc pCi/L
U-232	5302.10	5305.06	27.138	2535.000	2511.000	24.000	4.8990	100.000	4.11E+00	3.78E-01	4.18E-02	1.87E-02	1.63E-01
U-3/4	4763.02	4746.10	4.929	9.000	-1.277	2.000	4.5153	100.000	-2.09E-03	1.16E-02	3.89E-02	1.72E-02	1.16E-02
U-235	4391.00	4421.99	7.393	10.000	9.000	1.000	2.7237	80.900	1.82E-02	1.44E-02	3.12E-02	1.28E-02	1.43E-02
U-238	4184.73	4155.29	108.431	7.000	5.000	2.000	4.2361	100.000	8.19E-03	1.07E-02	3.67E-02	1.61E-02	1.07E-02

NOTES:

* BKG StDev calculated via blank population. (StDev updated 12-Dec-2020)

* BKG StDev calculated as sqrt(BKG AREA) for U-232

* Correction made to the following net area due to tracer impurity:
U-3/4 (8.277 +/-0.248)



GEL Laboratories LLC
ALPHA SPECTROSCOPY REPORT

Instrument SOP: GL-RAD-I-009
Analytical SOP: GL-RAD-A-011

BATCH NUMBER : 2082184	CHAMBER : 123	LIB FILE : UU
SAMPLE ID : S1204733211_UU	DETECTOR S/N : 45-142V3	BKG FILE : B123.CNF;1647
SAMPLE QTY : 1.000 L +/-0.500 %	AVERAGE %EFFICIENCY : 25.2562	BKG DATE : 16-Jan-2021
SAMPLE DATE : 19-Jan-2021 00:00:00	AVERAGE %EFF ERROR : 0.4928	BKG LIVE TIME(SEC) : 60000.00
ANALYST : MXS2	COUNT DATE : 22-Jan-2021 10:32:54	EFF FILE : W123.CNF;452
% YIELD : 67.1 +/-4.059 %	ELAPSED LIVE TIME(SEC) : 60000.00	CAL DATE : 19-Jan-2021

TRACER		LCS	
ID	1564-W	ID	1600-J
NUCLIDE	U-232	NUCLIDE	U-238
NOMINAL	9.1340E+00 dpm	NOMINAL (pCi/L)	2.7278E+00
RESULTS	6.1298E+00 dpm	% RECOVERY	112.137

NUCLIDE ACTIVITY SUMMARY

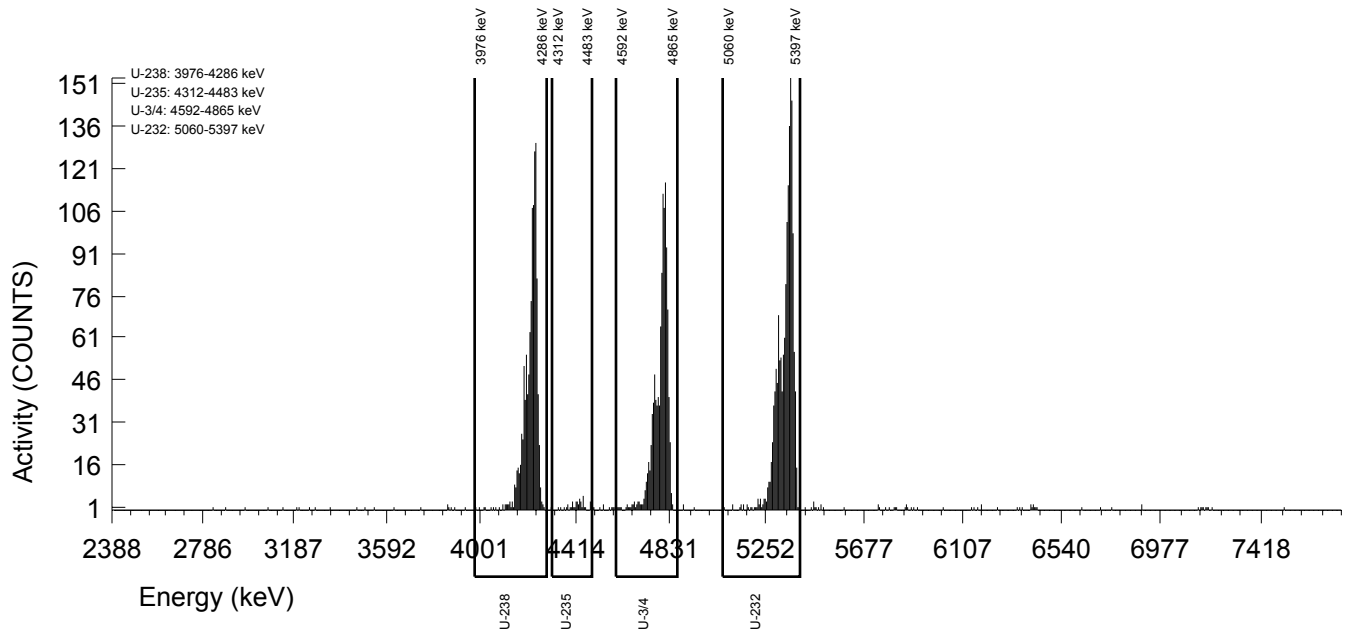
NUCLIDE	LIBRARY ENERGY	PEAK ENERGY	PEAK FWHM	GROSS AREA	NET AREA	BKG AREA	BKG StDev	%ABUN	ACTIVITY pCi/L	1.96-sigma TPU pCi/L	MDA pCi/L	Lc pCi/L	1.96-sigma cnt Unc pCi/L
U-232	5302.10	5333.61	33.062	1561.000	1548.000	13.000	3.6056	100.000	4.11E+00	4.20E-01	5.18E-02	2.23E-02	2.07E-01
U-3/4	4763.02	4787.99	32.930	1115.000	1103.897	6.000	4.5153	100.000	2.93E+00	3.15E-01	6.30E-02	2.79E-02	1.75E-01
U-235	4391.00	4421.07	0.000	40.000	39.000	1.000	2.7237	80.900	1.28E-01	4.37E-02	5.05E-02	2.08E-02	4.22E-02
U-238	4184.73	4219.21	30.775	1156.000	1151.000	5.000	4.2361	100.000	3.06E+00	3.25E-01	5.96E-02	2.62E-02	1.78E-01

NOTES:

* BKG StDev calculated via blank population. (StDev updated 12-Dec-2020)

* BKG StDev calculated as sqrt(BKG AREA) for U-232

* Correction made to the following net area due to tracer impurity:
U-3/4 (5.103 +/-0.153)



GEL Laboratories LLC
ALPHA SPECTROSCOPY REPORT

Instrument SOP: GL-RAD-I-009
Analytical SOP: GL-RAD-A-011

BATCH NUMBER : 2082184	CHAMBER : 124	LIB FILE : UU
SAMPLE ID : S1204733212_UU	DETECTOR S/N : 80053	BKG FILE : B124.CNF;1612
SAMPLE QTY : 1.000 L +/-0.500 %	AVERAGE %EFFICIENCY : 24.8080	BKG DATE : 16-Jan-2021
SAMPLE DATE : 19-Jan-2021 00:00:00	AVERAGE %EFF ERROR : 0.4843	BKG LIVE TIME(SEC) : 60000.00
ANALYST : MXS2	COUNT DATE : 22-Jan-2021 10:32:56	EFF FILE : W124.CNF;418
% YIELD : 76.1 +/-3.973 %	ELAPSED LIVE TIME(SEC) : 60000.00	CAL DATE : 19-Jan-2021

TRACER		LCSD	
ID	: 1564-W	ID	1600-J
NUCLIDE	: U-232	NUCLIDE	U-238
NOMINAL	: 9.1340E+00 dpm	NOMINAL (pCi/L)	2.7278E+00
RESULTS	: 6.9501E+00 dpm	% RECOVERY	106.200

NUCLIDE ACTIVITY SUMMARY

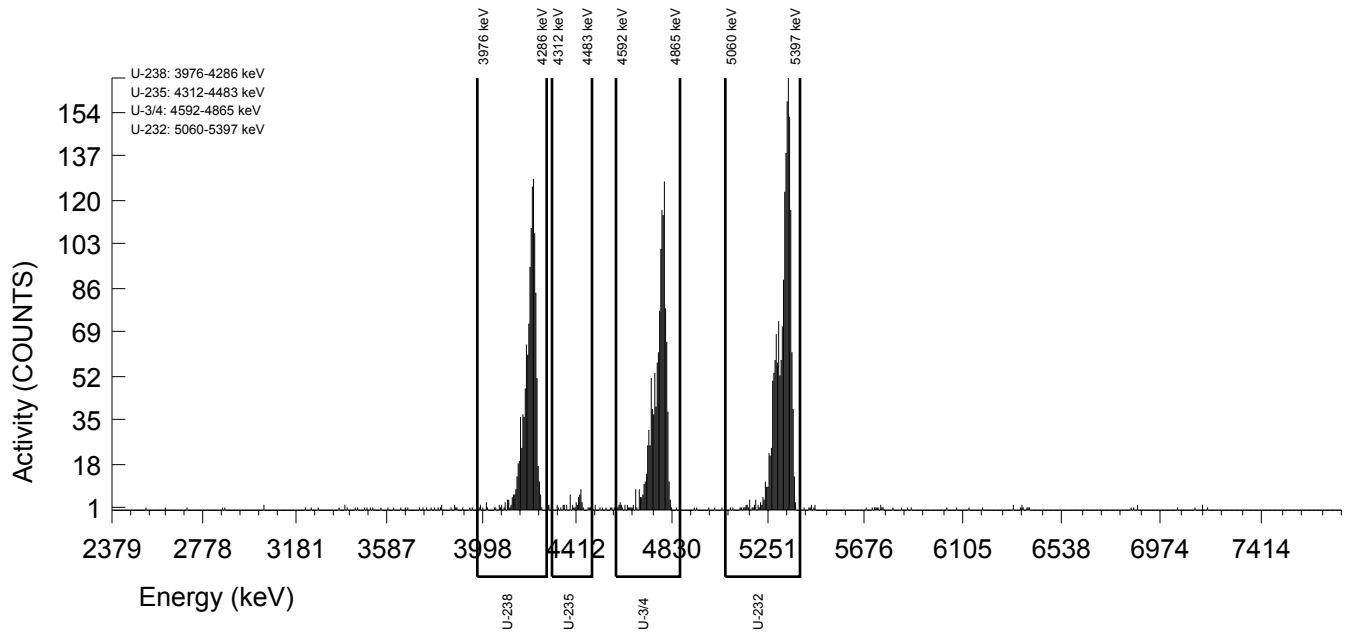
NUCLIDE	LIBRARY ENERGY	PEAK ENERGY	PEAK FWHM	GROSS AREA	NET AREA	BKG AREA	BKG StDev	%ABUN	ACTIVITY pCi/L	1.96-sigma TPU pCi/L	MDA pCi/L	Lc pCi/L	1.96-sigma cnt Unc pCi/L
U-232	5302.10	5317.42	34.255	1735.000	1724.000	11.000	3.3166	100.000	4.11E+00	4.09E-01	4.33E-02	1.84E-02	1.96E-01
U-3/4	4763.02	4772.37	34.270	1239.000	1229.317	4.000	4.5153	100.000	2.93E+00	3.06E-01	5.66E-02	2.51E-02	1.65E-01
U-235	4391.00	4409.11	50.333	52.000	50.000	2.000	2.7237	80.900	1.47E-01	4.51E-02	4.54E-02	1.87E-02	4.33E-02
U-238	4184.73	4206.08	36.124	1217.000	1214.000	3.000	4.2361	100.000	2.90E+00	3.01E-01	5.35E-02	2.35E-02	1.63E-01

NOTES:

* BKG StDev calculated via blank population. (StDev updated 12-Dec-2020)

* BKG StDev calculated as sqrt(BKG AREA) for U-232

* Correction made to the following net area due to tracer impurity:
U-3/4 (5.683 +/-0.170)



Runlogs

Instrument Run Log

Instrument Type: ALPHA SPECTROMETER **Batch ID: 2082184**

Sample ID	Sample Type	Analyst	Instrument	Run Date	Status	Geometry	Calibration Date
1204733211	LCS	MXS2	1123	JAN-22-21 10:32:54	DONE		19-JAN-21 11:56
1204733212	LCSD	MXS2	1124	JAN-22-21 10:32:56	DONE		19-JAN-21 11:56
532167001	SAMPLE	MXS2	1001	JAN-22-21 10:33:13	DONE		04-JAN-21 12:04
532167002	SAMPLE	MXS2	1002	JAN-22-21 10:33:13	DONE		04-JAN-21 12:04
532167003	SAMPLE	MXS2	1003	JAN-22-21 10:33:13	DONE		05-JAN-21 08:16
532167004	SAMPLE	MXS2	1004	JAN-22-21 10:33:13	DONE		04-JAN-21 12:04
532167005	SAMPLE	MXS2	1005	JAN-22-21 10:33:13	DONE		04-JAN-21 12:04
532167006	SAMPLE	MXS2	1006	JAN-22-21 10:33:13	DONE		04-JAN-21 12:05
532167007	SAMPLE	MXS2	1007	JAN-22-21 10:33:15	DONE		04-JAN-21 12:05
532167008	SAMPLE	MXS2	1008	JAN-22-21 10:33:15	DONE		04-JAN-21 12:06
532167009	SAMPLE	MXS2	1009	JAN-22-21 10:33:15	DONE		04-JAN-21 12:06
532167010	SAMPLE	MXS2	1010	JAN-22-21 10:33:15	DONE		04-JAN-21 12:06
532167011	SAMPLE	MXS2	1011	JAN-22-21 10:33:15	DONE		04-JAN-21 12:07
532167012	SAMPLE	MXS2	1012	JAN-22-21 10:33:15	DONE		04-JAN-21 12:07
532167013	SAMPLE	MXS2	1013	JAN-22-21 10:33:17	DONE		04-JAN-21 12:07
532167014	SAMPLE	MXS2	1014	JAN-22-21 10:33:17	DONE		04-JAN-21 12:07
532167015	SAMPLE	MXS2	1015	JAN-22-21 10:33:17	DONE		04-JAN-21 12:08
532167016	SAMPLE	MXS2	1016	JAN-22-21 10:33:17	DONE		04-JAN-21 12:08
532168013	SAMPLE	MXS2	1017	JAN-22-21 10:33:17	DONE		04-JAN-21 12:08
1204733210	MB	MXS2	1018	JAN-22-21 10:33:17	DONE		04-JAN-21 12:08

APPENDIX E

SNL Contract Verification Form

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Contract Verification Form (CVR)

Project Leader OSBORN **Project Name** ADAYA GROUNDWATER **Project/Task No.** 205798_01.01

ARCOC No. 621708 **Analytical Lab** GEL **SDG No.** 532167

In the tables below, mark any information that is missing or incorrect and give an explanation.

1.0 Analysis Request and Chain of Custody Record and Log-In Information

Line No.	Item	Complete?		If no, explain
		Yes	No	
1.1	All items on ARCOC complete - data entry clerk initialed and dated	X		
1.2	Container type(s) correct for analyses requested	X		
1.3	Sample volume adequate for # and types of analyses requested	X		
1.4	Preservative correct for analyses requested	X		
1.5	Custody records continuous and complete	X		
1.6	Lab sample number(s) provided and SNL sample number(s) cross referenced and correct	X		
1.7	Date samples received	X		
1.8	Condition upon receipt information provided	X		

2.0 Analytical Laboratory Report

Line No.	Item	Complete?		If no, explain
		Yes	No	
2.1	Data reviewed, signature	X		
2.2	Method reference number(s) complete and correct	X		
2.3	QC analysis and acceptance limits provided (MB, LCS, Replicate)	X		
2.4	Matrix spike/matrix spike duplicate data provided	N/A		
2.5	Detection limits provided; PQL and MDL(or IDL), MDA and Lc	X		Samples 114195-003 and 114195-006 did not meet RDL for Uranium-235/236

Line No.	Item	Complete?		If no, explain
		Yes	No	
2.6	QC batch numbers provided	X		
2.7	Dilution factors provided and all dilution levels reported	X		
2.8	Data reported in appropriate units and using correct significant figures	X		
2.9	Radiochemistry analysis uncertainty (2-sigma error or 1-sigma for bioassay) and tracer recovery (if applicable) reported	X		
2.10	Narrative provided	X		
2.11	TAT met	X		
2.12	Holding times met	X		
2.13	Contractual qualifiers provided	X		
2.14	All requested result and TIC (if requested) data provided	X		

3.0 Data Quality Evaluation

Line No.	Item	Yes	No	If no, Sample ID No./Fraction(s) and Analysis
3.1	Are reporting units appropriate for the matrix and meet contract specified or project-specific requirements? Inorganics and metals reported as ppm (mg/liter or mg/Kg)? Tritium reported in picocuries per liter with percent moisture for soil samples? Units consistent between QC samples and sample data	X		
3.2	Quantitation limit met for all samples	X		
3.3	Accuracy a) Laboratory control sample accuracy reported and met for all samples	X		
	b) Surrogate data reported and met for all organic samples analyzed by a gas chromatography technique	N/A		
	c) Matrix spike recovery data reported and met	N/A		
3.4	Precision a) Replicate sample precision reported and met for all inorganic and radiochemistry samples	N/A		

Line No.	Item	Yes	No	If no, Sample ID No./Fraction(s) and Analysis
	b) Matrix spike duplicate RPD data reported and met for all organic samples	N/A		
	c) Laboratory control sample duplicate RPD data reported and met for other analyses	X		
3.5	Blank data a) Method or reagent blank data reported and met for all samples	X		
	b) Sampling blank (e.g., field, trip, and equipment) data reported and met	N/A		
3.6	Contractual qualifiers provided: "J"- estimated quantity; "B"- analyte found in method blank above the MDL for organic and inorganic; "U"- analyte undetected (results are below the MDL, IDL, or MDA (radiochemical)); "H"- analysis done beyond the holding time; "h" - analysis done beyond the extraction/preparation holding time; "N" - result associated with spike analysis outside control limits	X		
3.7	Narrative addresses planchet flaming for gross alpha/beta	N/A		
3.8	Narrative included, correct, and complete	X		
3.9	Second column confirmation data provided for methods 8330 (high explosives), pesticides/PCBs 8081 and 8082 and herbicides 8151.	N/A		

4.0 Calibration and Validation Documentation

Line No.	Item	Yes	No	Comments
4.1	GC/MS (8260 and 8270 and TO-15) a) 12-hour tune check provided	N/A		
	b) Initial calibration provided	N/A		
	c) Continuing calibration provided	N/A		
	d) Internal standard performance data provided	N/A		
	e) Instrument run logs provided	N/A		

Line No.	Item	Yes	No	Comments
4.2	GC/HPLC (8330, 8082, 9070A, and 8010) a) Initial calibration provided	N/A		
	b) Continuing calibration provided	N/A		
	c) Instrument run logs provided	N/A		
4.3	HRGC/HRMS (1668 and 8290) a) 12-hour tune check provided	N/A		
	b) Initial calibration provided	N/A		
	c) Continuing calibration provided	N/A		
	d) Internal standard performance data provided	N/A		
	e) Labeled compound recovery data provided	N/A		
	f) RRTs for samples and standards provided	N/A		
	g) Ion abundance ratios for samples and standards provided	N/A		
	h) Instrument run logs provided	N/A		
4.4	LC/MS/MS (6850 and 8330) a) Initial calibration provided	N/A		
	b) Continuing calibration provided	N/A		
	c) CRI provided	N/A		
	d) Internal standard performance data provided	N/A		
	e) Chlorine isotope ratios provided (perchlorate only)	N/A		
	f) ICS provided (perchlorate only)	N/A		
4.5	Inorganics (metals) a) Initial calibration provided	N/A		
	b) Continuing calibration provided	N/A		
	c) ICP interference check sample data provided	N/A		
	d) ICP serial dilution provided	N/A		
	e) Instrument run logs provided	N/A		

Line No.	Item	Yes	No	Comments
4.6	Radiochemistry and General Chemistry a) Instrument run logs provided	X		

5.0 Data Anomaly Report

Line No.	Item	Yes	No	If no, explain
5.1	DAR completed for monitoring and surveillance sample data	N/A		
5.2	Problems or outliers noted	N/A		
5.3	Verification or reanalysis requested from lab	N/A		

6.0 Problem Resolution

Summarize the findings in the table below. List only samples/fractions for which deficiencies has been noted.

Sample/Fraction No.	Analysis	Problems/Comments/Resolutions

Were deficiencies unresolved? ○ Yes ◉ No

Based on the review, this data package is complete. ◉ Yes ○ No

Reviewed by: Wendy Palencia Date: 02-18-2021 13:16:00

Closed by: Wendy Palencia Date: 02-18-2021 13:16:00

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