

Department of Environmental Quality
INL Oversight Program

**ENVIRONMENTAL SURVEILLANCE PROGRAM
QUARTERLY DATA REPORT**

April - June, 2024



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Table of Acronyms

aCi/L	-	attocuries per liter	nCi/L	-	nanocuries per liter
ATR	-	Advanced Test Reactor	NCRP	-	National Council on Radiation Protection and Measurements
BEA	-	Battelle Energy Alliance, LLC	NOAA	-	National Oceanic and Atmospheric Administration
BLR	-	Big Lost River	NRF	-	Naval Reactors Facility
CERCLA	-	Comprehensive Environmental Response, Compensation and Liability Act	PBF	-	Power Burst Facility
CFA	-	Central Facilities Area	pCi/g	-	picocuries per gram
CFR	-	Code of Federal Regulations	pCi/L	-	picocuries per liter
CITRC	-	Critical Infrastructure Test Range Complex	pCi/m ³	-	picocuries per cubic meter
DEQ-INL OP	-	The State of Idaho, Department of Environmental Quality, Idaho National Laboratory Oversight Program	QAPP	-	Quality Assurance Program Plan
DOE	-	U.S. Department of Energy	QA/QC	-	Quality Assurance/Quality Control
EBR I & II	-	Experimental Breeder Reactors I & II	RCRA	-	Resource Conservation and Recovery Act
EFS	-	Experimental Field Station	RPD	-	relative percent difference
EIC	-	electret ionization chamber	RTC	-	Reactor Technology Complex
EML	-	Environmental Monitoring Laboratory	RWMC	-	Radioactive Waste Management Complex
EPA	-	Environmental Protection Agency	SD	-	Sample standard deviation
ESER	-	Environmental Surveillance, Education and Research Program	SMC	-	Specific Manufacturing Capability
ESP	-	Environmental Surveillance Program	SMCL	-	secondary maximum contaminant level
ESRP	-	Eastern Snake River Plain	TAN	-	Test Area North
ESRPA	-	Eastern Snake River Plain Aquifer	TDS	-	total dissolved solids
Ft bls	-	feet below land surface	TMI	-	Three Mile Island
HPIC	-	high-pressure ion chamber	TRA	-	Test Reactor Area
IBL	-	Idaho Bureau of Laboratories	TSP	-	total suspended particulate
ICPP	-	Idaho Chemical Processing Plant	TSS	-	total suspended solids
ICP	-	Idaho Cleanup Project	USGS	-	U.S. Geological Survey
ISB	-	In-situ bioremediation	VOC	-	volatile organic compound
IDL	-	instrument detection limit	WLAP	-	Wastewater Land Application Permit
INL	-	Idaho National Laboratory			
INTEC	-	Idaho Nuclear Technology and Engineering Center			
ISU	-	Idaho State University			
LLD	-	lower limit of detection			
LSC	-	liquid scintillation counting			
MCL	-	maximum contaminant level			
MDA	-	minimum detectable activity			
MDC	-	minimum detectable concentration			
MFC	-	Materials and Fuels Complex			
µg/L	-	micrograms per liter			
mg/L	-	milligrams per liter			
MP	-	milepost			
mrem	-	millirem or 1/1000 th of a rem			
mR	-	milliRoentgen			
mR/hr	-	milliRoentgen per hour			
µR/hr	-	microRoentgen per hour			
MV	-	Magic Valley			
NIST	-	National Institute of Standards and Technology			

Introduction

The State of Idaho, Department of Environmental Quality, Idaho National Laboratory Oversight Program (DEQ-INL OP) conducts an Environmental Surveillance Program (ESP) at locations on the INL, near the boundaries of the INL, and at distant locations to the INL in accordance with accepted monitoring procedures and management practices. This program is designed to provide the people of the state of Idaho with independently evaluated information about the impacts of the Department of Energy's (DOE) activities in Idaho.

The primary objective for DEQ-INL OP's ESP is to maintain an independent environmental monitoring and verification program designed to verify and supplement DOE's environmental data and programs. This program also provides the citizens of Idaho with information on current and proposed DOE programs that has been independently evaluated to enable them to reach informed conclusions about DOE activities in Idaho and potential impacts to public health and the environment.

Results of the ESP are published using two distinct reporting formats: quarterly data reports and an annual ESP report. The annual ESP report is designed for a broad audience and summarizes the results of the ESP for the previous four quarters. The annual report's primary emphasis is to focus on trends, ascertain the impacts of DOE operations on the environment, and confirm the validity of DOE monitoring programs. This quarterly report is designed to document the results of the ESP on a quarterly basis and provide detailed data. It is organized according to the media sampled and also provides a quality assurance assessment.

Changes to Qualification and Reporting of Sample Results

Starting in the first quarter of 2024, DEQ-INL OP has changed the methods used for qualifying and reporting sample results. These changes apply primarily to low-level results. The changes listed below bring DEQ-INL OP's qualification and reporting conventions more closely in line with the INL contractors' methods.

For radiological results, the minimum detectable concentration (MDC) is no longer used as the criterion above which the result is considered a positive detection. The following criteria are used instead^{1,2,3}:

1. Results greater or equal to 3 SD are reported as positive detections, where SD is the sample standard deviation.
2. Results less than 3 SD are reported as non-detections (U qualifier).
3. Field sample results are reported together with the 1-SD value.

For non-radiological results, the qualification and reporting conventions followed by the sample analysis contractor, Idaho Bureau of Laboratories (IBL), are used. With each result, the IBL reports both the Method Detection Limit⁴ (MDL) and the higher Reporting Detection Limit⁵ (RDL).

¹ Idaho National Laboratory Site Environmental Surveillance Program Report, Third Quarter 2023, INL/RPT-24-77413, p.

² HANDBOOK FOR THE DEPARTMENT OF ENERGY'S MIXED ANALYTE PERFORMANCE EVALUATION PROGRAM (MAPEP), MAPEP-HB-1, July 6, 2022, p.30.

³ An Update of Hydrologic Conditions and Distribution of Selected Constituents in Water, Eastern Snake River Aquifer and Perched Groundwater Zones, Idaho National Laboratory, Idaho, Emphasis 2019–21, U. S. Geological Survey, DOE/ID-22261, p. 29.

⁴ The MDL is defined as the minimum concentration of substance that can be measured and reported with 99% confidence that an analyte concentration is greater than zero and is determined from an analysis of a sample in a given matrix containing the analyte.

⁵ IBL utilizes the Practical Quantitation Limit (PQL) as the Reporting Detection Limit (RDL) for final data reports. PQL represents a practical and routinely achievable quantitation limit with a high degree of certainty (> 99.9% confidence) that the result is a positive detection.

1. Results greater than MDL and greater than RDL are reported as positive detections.
2. Results greater than MDL but less than RDL are reported as detected estimates (J qualifier) with greater associated uncertainty.
3. Results less than MDL are non-detections and reported as less than (RDL value).

Appendix C, new for CY 2024, is a summary of the analyzing laboratories' MDCs for radiological analytes and RDLs for non-radiological analytes, together with the EPA Maximum Contaminant Levels (MCLs) and DOE Derived Concentration Standards (DCSs) for comparison. MDCs are a measure of method/instrument performance. They are not a criterion above which a result is considered a detection. DCSs and MCLs are listed only as reference values for comparison to typical MDC or RDL ranges. The MCLs are the most restrictive and do not necessarily apply to the environmental media sampled.

Air and Precipitation Monitoring Results

The ESP operated nine air monitoring stations on and near the INL as well as two monitoring stations distant from the INL during the second quarter, 2024 (**Figure 1**). The on-site locations include a new station at the MFC Guard House where data collection began the week of 5/16 – 5/23/24. These stations employed instrumentation for collecting airborne particulate matter, gaseous radioiodine, precipitation, and water vapor for tritium analysis (**Table 1**). The Shoshone-Bannock Tribes operated an air monitoring station located at Fort Hall. The Fort Hall station uses identical instrumentation and sampling protocol as the eleven stations operated by the ESP. The DEQ-INL OP reports the Fort Hall station data as an additional distant site.

Airborne particulate matter was sampled using both high-volume (8x10-inch filter) and low-volume (47-mm filter) total suspended particulate (TSP) air samplers. Weekly gross alpha and gross beta particulate radioactivity results for 47-mm filters from the low-volume TSP samplers are presented in **Appendix A** and summarized as a range of results in **Table 2**. Results are within the expected historical range.

Composites of 47-mm filters collected from low-volume TSP samplers during a calendar quarter are analyzed using gamma spectrometry. Composites of 8x10-inch filters collected from high-volume TSP samplers during each calendar month are also analyzed using gamma spectrometry. Typically, gamma spectrometry results are only reported by ISU-EML when exceeding their minimum detectable concentration (MDC). Gamma spectrometry results for the second quarter of 2024 for 47-mm and 8x10-inch TSP filters are presented in **Tables 3** and **4**. For the 47-mm filter composites, the only reported gamma-emitting radionuclide concentration greater than 3 SD was beryllium-7 (Be-7), a naturally occurring, cosmogenic radionuclide. For the 8x10-inch filter composites, the Cs-137 result was equal to 3 SD at the Experimental Field Station for the months of May and June. The Cs-134 results were equal to 3 SD at Sand Dunes Tower and Van Buren Avenue for the Month of April, and at Howe for the month of June. These results are all the minimum values (3 SD) for results to be considered detections. The minimum detectable Cs-134 results, and the absence of detectable Cs-137 at these locations, suggests that the Cs-134 values are statistical false positive results. The 1 SD value for cesium-137 (Cs-137) is also reported for all locations since Cs-137 is the most likely of the man-made gamma emitting radionuclides to be detected.

Quarterly composites of high-volume 8x10-inch TSP filters are analyzed using radiochemical separation techniques. Results from these composite filter analyses are typically presented in the following quarter's report. The samples are analyzed for Strontium-90, Plutonium-238, Plutonium-239/240, and Americium-241. Measurable quantities of these radionuclides are expected in the

environment due to historic above ground testing of nuclear weapons, and possibly from INL programs. DEQ-INL OP's action levels of 19 for Americium-241 (Am-241), 190 for Strontium-90 (Sr-90), 21 for Plutonium-238 (Pu-238), and 20 for Plutonium-239/240 (Pu-239/240) (in 1×10^{-5} pCi/m³) are 10 percent of the compliance values listed for the specific radionuclides in 40 CFR 61, Appendix E, Table 2. Field sample concentrations which exceed these levels require further investigation.

Radiochemical separation analysis results for 8x10-inch TSP particulate filter composites collected during first quarter 2024 are presented in **Table 5**. There were positive Sr-90 detections at the on-site locations Big Lost River Rest Area, Experimental Field Station, and Sand Dunes Tower, as well as boundary locations Howe and Montevue, and distant locations Fort Hall and Idaho Falls. These results were all greater-than-three sample standard deviations. This widespread distribution of detectable Sr-90 does not strongly suggest an INL source, although that is possible. All detections were well below DEQ-INL OP action levels.

Radioactive iodine samples are collected weekly. Samples are collected by drawing air through a canister filled with activated charcoal using a low-volume air pump. The activated charcoal contained in the canister traps the radioiodine by adsorption onto its porous surface. Each week, canisters are collected from all twelve air monitoring stations and analyzed together as a composite using gamma spectrometry (**Table 6**). If Iodine-131 is detected in this grouping, the canisters are individually analyzed. No radioactive isotopes of iodine, specifically Iodine-131, were detected on the weekly charcoal cartridges used to collect this nuclide during the second quarter of 2024.

Atmospheric moisture was collected by drawing air through hygroscopic media at each of the twelve monitoring stations. This moisture was stripped from the hygroscopic media and analyzed to calculate the atmospheric tritium (H-3) concentration. Reported values are the result of either a single sample or a weighted mean based upon the volume of air sampled when more than one atmospheric moisture sample was collected during the calendar quarter. Atmospheric tritium concentrations and their weighted quarterly means are presented in **Table 7**. Individual sample tritium concentrations exceeded 3 SD and are reported as positive detections at the following locations:

- On-Site – Big Lost River Rest Area (6/6 – 6/27/24). Experimental Field Station (5/2 – 6/13/24 and 6/13 – 6/27/24). Sand Dunes Tower (5/2 – 6/13/24). Van Buren Avenue (6/13 – 6/27/24).
- Boundary – Atomic City (6/13 – 6/27/24). Howe (5/16 – 6/6/24). Mud Lake (5/16 – 6/6/24).
- Distant – Craters of the Moon (5/9 – 6/6/24). Fort Hall (5/9 – 5/30/24 and 6/17 – 6/27/24). Idaho Falls (5/16 – 6/6/24 and 6/6 – 6/27/24).

The weighted mean concentration at Experimental Field Station was greater than 3 SD and is reported as a positive detection. All results are well below the DEQ-INL OP action level of 150 pCi/m³ (this action level is 10 percent of the compliance level in 40 CFR 61, Appendix E, Table 2).

Precipitation samples were collected at one on-site monitoring location (Big Lost River Rest Area), four boundary locations (Atomic City, Howe, Mud Lake, and Montevue) and one distant location (Idaho Falls) during the second quarter of 2024. Precipitation samples were analyzed for tritium and man-made gamma emitting radionuclides. Reported values were either the result of a single sample or a weighted mean when more than one precipitation sample was collected during the calendar quarter. Tritium and man-made gamma emitting radionuclides were not detected in precipitation collected during the quarter. Analysis results for tritium and Cesium-137, the most likely to be detected of man-made gamma emitting radionuclides, are presented in **Table 8**.

Table 1. Sampling locations and sample type.

Station Locations	Sample type ¹			
	TSP	Radioiodine	Water Vapor	Precipitation
On-site Locations				
Big Lost River Rest Area	<input type="checkbox"/>	<input type="checkbox"/>	■	■
Experimental Field Station	<input type="checkbox"/>	<input type="checkbox"/>	■	
MFC ³ Guard House	<input type="checkbox"/>	<input type="checkbox"/>	■	
Sand Dunes Tower	<input type="checkbox"/>	<input type="checkbox"/>	■	
Van Buren Avenue	<input type="checkbox"/>	<input type="checkbox"/>	■	
Boundary Locations				
Atomic City	<input type="checkbox"/>	<input type="checkbox"/>	■	■
Howe	<input type="checkbox"/>	<input type="checkbox"/>	■	■
Monteview	<input type="checkbox"/>	<input type="checkbox"/>	■	■
Mud Lake	<input type="checkbox"/>	<input type="checkbox"/>	■	■
Distant Locations				
Craters of the Moon	<input type="checkbox"/>	<input type="checkbox"/>	■	
Fort Hall ²	<input type="checkbox"/>	<input type="checkbox"/>	■	
Idaho Falls	<input type="checkbox"/>	<input type="checkbox"/>	■	■

¹ Samples collected weekly; ■ Samples collected quarterly, or more frequently if sample containers reach capacity.

² TSP and radioiodine samples collected by Shoshone-Bannock Tribes.

³ MFC – Materials and Fuels Complex. MFC Guard House is a new monitoring location. Data collection began here during the week of 5/16 - 5/23/24.

Table 2. Range of gross alpha and gross beta concentrations for 47-mm TSP filters, second quarter, 2024.

Station Location	Concentration					
	Gross Alpha			Gross Beta		
On-Site Locations						
Big Lost River Rest Area	0.4	-	1.8 J⁺²	11.4	-	28.8
Experimental Field Station	0.6 J³	-	2.1 J⁺²	11.3 J³	-	34.9
MFC Guard House ⁴	0.6	-	1.6	16.9	-	28.5
Sand Dunes Tower	0.3	-	2.1 J⁺²	10.6	-	24.0
Van Buren Avenue	0.5	-	1.5 J⁺²	11.8	-	29.1
Boundary Locations						
Atomic City	0.2	-	3.7	12.4	-	28.0
Howe	0.3 J ³	-	1.2	9.9	-	22.4
Monteview	0.4 J⁺²	-	1.4 J⁺²	10.4	-	26.3
Mud Lake	0.4	-	1.6 J⁺²	10.0	-	26.7
Distant Locations						
Craters of the Moon	0.2	-	1.3 J⁺²	11.4	-	27.2
Fort Hall ¹	0.6	-	1.4 J⁺²	10.6	-	28.5
Idaho Falls	0.6	-	1.6 J⁺²	10.1	-	27.8

Concentrations are expressed in 1×10^{-3} pCi/m³. **Bold** concentrations are positive detections, greater than or equal to 3 SD.

¹Operated by Shoshone-Bannock Tribes.

²The weekly blank filter gross alpha result was greater than or equal to 3 SD. Associated gross alpha results are qualified as biased-high estimates (J+).

³Partial sample due to planned power outage. Result is a usable estimate (J).

⁴MFC Guard House is a new monitoring location. Data collection began here during the week of 5/16 – 5/23/24.

Table 3. Gamma spectroscopy analysis data for 47-mm TSP filters, composite samples, second quarter, 2024.

Station Location	Naturally Occurring Radionuclide Beryllium-7			Man-Made Gamma Emitting Radionuclides		
	Concentration		1 SD	Concentration ²		1 SD ²
On-site Locations						
Big Lost River Rest Area	93.6	-	3.1	-0.01	U	0.03
Experimental Field Station	84.9	J ³	3.5	0.04	UJ ³	0.04
MFC Guard House ⁴	141.7	-	4.9	0.10	U	0.06
Sand Dunes Tower	97.3	J ⁶	3.2	0.01	UJ ⁶	0.03
Van Buren Avenue	89.8	-	3.6	0.04	U	0.04
Boundary Locations						
Atomic City	86.8	-	2.9	0.03	U	0.03
Howe	72.8	J ⁵	3.1	0.08	UJ ⁵	0.04
Monteview	83.9	-	3.4	0.01	U	0.03
Mud Lake	82.7	-	2.7	-0.03	U	0.03
Distant Locations						
Craters of the Moon	91.1	-	3.0	-0.01	U	0.03
Fort Hall ¹	84.2	-	2.8	-0.01	U	0.03
Idaho Falls	81.4	-	2.7	0.02	U	0.03

Concentrations are reported in 1×10^{-3} pCi/m³ with associated uncertainty (1 SD). **Bold** concentrations are positive detections, greater than or equal to 3 SD.

Data qualifiers: U = undetected, J = estimate, R = rejected, "+" or "-" after a J means that the estimated result is biased high or low, respectively.

¹Operated by Shoshone-Bannock Tribes.

²Concentration and uncertainty values are for Cs-137. No man-made gamma emitting radionuclides were detected.

³Partial samples for two of the weeks due to a planned power outage. Results are usable estimates (J).

⁴MFC Guard House is a new monitoring location. Data collection began here during the week of 5/16 – 5/23/24.

⁵Partial samples for two of the weeks due to a planned power outage and a mechanical failure. No sample for two of the weeks due to a mechanical failure. Results are usable estimates.

⁶Partial sample due to blocked air hose for one of the weeks. Result is a usable estimate (J).

Table 4. Gamma spectrometry analysis data for 8x10-inch TSP filters, monthly composite samples, second quarter, 2024.

Station Location	Month ³	Naturally Occurring Radionuclide Beryllium-7			Man-Made Gamma Emitting Radionuclides		
		Concentration		1 SD	Concentration ²		1 SD ²
On-site Locations							
Big Lost River Rest Area	Apr	147.2	-	4.2	0.01	U	0.01
	May	113.8	-	3.3	0.02	U	0.01
	Jun	135.1	-	4.2	0.03	U	0.02
Experimental Field Station	Apr	164.1	-	4.7	0.03	U	0.02
	May	93.2	-	2.9	0.03	-	0.01
	Jun	136.5	-	4.2	0.06	-	0.02
MFC Guard House	Apr	NS ⁵	-	NS	NS	-	NS
	May	143.9⁵	-	4.5	0.01	U	0.02
	Jun	149.2	-	4.3	0.04	U	0.02
Sand Dunes Tower	Apr	131.3	-	4.0	Cs-134 0.03⁴	-	0.01
	May	106.9	-	3.1	0.01	U	0.02
	Jun	156.4	-	4.5	0.01	U	0.02
Van Buren Avenue	Apr	141.4	-	4.3	Cs-134 0.03⁴	-	0.01
	May	100.7	-	3.1	0.00	U	0.01
	Jun	128.3	-	3.9	0.01	U	0.01
Boundary Locations							
Atomic City	Apr	150.5	-	4.4	0.04	U	0.02
	May	112.3	-	3.2	0.00	U	0.01
	Jun	132.0	-	4.1	0.02	U	0.01
Howe	Apr	173.8	-	5.0	0.00	U	0.02
	May	99.6	-	3.1	0.00	U	0.01
	Jun	142.8	-	4.4	Cs-134 0.03⁴	-	0.01
Montevieu	Apr	145.2	-	4.5	0.00	U	0.01
	May	99.4	-	3.1	-0.01	U	0.01
	Jun	148.4	-	4.6	0.01	U	0.01
Mud Lake	Apr	137.6	-	4.2	0.00	U	0.01
	May	111.5	-	3.2	0.00	U	0.01
	Jun	156.1	-	4.5	0.01	U	0.03
Distant Locations							
Craters of the Moon	Apr	149.2	-	4.6	-0.01	U	0.01
	May	104.3	-	3.2	0.01	U	0.01
	Jun	166.7	-	4.8	0.03	U	0.02
Fort Hall ¹	Apr	132.2	-	3.8	0.01	U	0.02
	May	97.7	-	2.8	0.02	U	0.01
	Jun	129.5	-	3.5	0.03	U	0.02
Idaho Falls	Apr	140.2	-	4.3	0.02	U	0.01
	May	119.2	-	3.4	0.03	U	0.02
	Jun	142.1	-	4.4	0.01	U	0.01

Concentrations are reported in 1×10^{-3} pCi/m³ with associated uncertainty (1 SD). **Bold** concentrations are positive detections, greater than or equal to 3 SD.

Data qualifiers: U = undetected, J = estimate, R = rejected, "+" or "-" after a J means that the estimated result is biased high or low, respectively.

¹Operated by Shoshone-Bannock Tribes.

²Concentration and SD values are for Cs-137 unless otherwise noted.

³Four filters/composite for April and June, five filters/composite for May unless otherwise noted.

⁴Cs-134 result was equal to 3 SD, where 3 SD is the minimum value for a result to be considered a detection. This minimum detectable result, and the absence of detectable Cs-137 at this location, suggest that the Cs-134 value is a statistical false positive result.

⁵MFC Guard House is a new monitoring location. Data collection began here during the week of 5/16 – 5/23/24, producing two filters for the May composite.

Table 5. Radiochemical separation analysis results for 8x10-inch TSP particulate filter composites collected during first quarter 2024.

Station Location	⁹⁰ Sr			²³⁸ Pu			^{239/240} Pu			²⁴¹ Am		
	Value ¹		1 SD	Value ¹		1 SD	Value ¹		1 SD	Value ¹		1 SD
On-Site Locations												
BLR ⁴ Rest Area	1.49	-	0.36	-0.02	U	0.04	0.01	U	0.01	0.01	U	0.04
EFS ³	2.16	-	0.46	-0.01	U	0.05	0.04	U	0.02	-0.04	U	0.05
Sand Dunes Tower	1.30	-	0.40	-0.06	U	0.03	-0.01	U	0.01	0.04	U	0.05
Van Buren Avenue	0.77	UJ ⁵	0.41	0.08	UJ ⁵	0.03	0.04	UJ ⁵	0.02	0.04	UJ ⁵	0.06
Boundary Locations												
Atomic City	0.57	U	0.37	0.04	U	0.04	0.03	U	0.02	0.02	U	0.06
Howe	2.51	-	0.49	0.01	U	0.03	0.03	U	0.02	-0.01	U	0.06
Monteview	1.39	-	0.34	0.15	U	0.06	0.02	U	0.02	0.02	U	0.04
Mud Lake	0.60	U	0.33	0.03	U	0.02	-0.02	U	0.03	0.01	U	0.04
Distant Locations												
Craters of the Moon	0.35	U	0.39	0.02	U	0.03	0.00	U	0.01	0.00	U	0.04
Fort Hall ²	1.92	-	0.48	-0.02	U	0.03	0.04	U	0.02	0.08	U	0.05
Idaho Falls	1.77	-	0.50	0.03	U	0.04	0.03	U	0.02	-0.05	U	0.05

Note: Concentrations are reported in 1 x 10⁻⁵ pCi/m³ with associated uncertainty (1 SD), and correspond to filter composites collected during the calendar quarter.

Bold concentrations are positive detections, greater than or equal to 3 SD.

Data qualifiers: U = undetected, J = estimate, R = rejected, "+" or "-" after a J means that the estimated result is biased high or low, respectively.

¹ Measurable quantities of these radionuclides are expected in the environment due to historic above-ground testing of nuclear weapons, and possibly from INL programs. DEQ-INL OP's action levels of 19 for americium-241, 190 for strontium-90, 21 for plutonium-238, and 20 for plutonium-239/240 (in 1 x 10⁻⁵ pCi/m³) are 10 percent of the compliance values listed for the specific radionuclide in 40 CFR 61, Appendix E, Table 2.

² Operated by Shoshone-Bannock Tribes.

³ EFS - Experimental Field Station.

⁴BLR – Big Lost River.

⁵The February air volume was an estimate due mechanical malfunctions; the sampler was replaced. The resulting composite data are estimates (J).

Table 6. Iodine-131 activity in weekly charcoal filter composites, second quarter, 2024.

Start Date	Collection Date	Iodine-131 activity (pCi/composite)		
		Activity		1 SD
03/28/24	04/04/24	1.30	U	1.27
04/04/24	04/11/24	-1.28	U	1.14
04/11/24	04/18/24 ¹	0.64	U	1.17
04/11/24	04/19/24 ¹	1.11	U	0.96
04/18/24	04/25/24	-0.60	U	1.00
04/25/24	05/02/24	-0.56	U	0.91
05/02/24	05/09/24	0.64	U	1.17
05/09/24	05/16/24	-0.26	U	1.10
05/16/24	05/23/24	-0.07	U	0.97
05/23/24	05/30/24	0.12	U	0.84
05/30/24	06/06/24	-0.47	U	1.01
06/06/24	06/13/24	-0.24	U	0.95
06/13/24	06/20/24	-0.20	U	1.11
06/20/24	06/27/24	1.99	U	1.07

Activities are reported in pCi/composite with associated uncertainty (1 SD). **Bold activities** are positive detections, greater than or equal to 3 SD.

Data qualifiers: U = undetected, J = estimate, R = rejected, "+" or "-" after a J means that the estimated result is biased high or low, respectively.

¹The batch of nine cartridges collected and analyzed on 4/18/24 did not include Atomic City and Big Lost River Rest Area. The batch of two cartridges collected and analyzed on 4/19/24 consisted of those from Atomic City and Big Lost River Rest Area.

Table 7. Tritium concentrations in air from atmospheric moisture, second quarter, 2024.

Station Location	Start Date	Collection Date	Tritium		
			Concentration		1 SD
On-site Locations					
Big Lost River Rest Area	03-28-2024	04-19-2024	0.04	U	0.13
Big Lost River Rest Area	04-19-2024	05-16-2024	0.17	U	0.13
Big Lost River Rest Area	05-16-2024	06-06-2024	0.09	U	0.14
Big Lost River Rest Area	06-06-2024	06-27-2024	0.38	-	0.09
Big Lost River Rest Area Mean	03-28-2024	06-27-2024	0.17	U	0.12
Experimental Field Station	03-28-2024	05-02-2024	0.08	U	0.12
Experimental Field Station	05-02-2024	06-13-2024	0.75	-	0.14
Experimental Field Station	06-13-2024	06-27-2024	0.51	-	0.09
Experimental Field Station Mean	03-28-2024	06-27-2024	0.43	-	0.12
MFC ³ Guard House	05-16-2024	06-13-2024	0.19	U	0.09
MFC Guard House	06-13-2024	06-27-2024	0.21	U	0.08
MFC Guard House Mean	05-16-2024	06-27-2024	0.20	U	0.09
Sand Dunes Tower	03-28-2024	05-02-2024	0.24	U	0.12
Sand Dunes Tower	05-02-2024	06-13-2024	0.43	-	0.14
Sand Dunes Tower	06-13-2024	06-27-2024	0.23	U	0.14
Sand Dunes Tower Mean	03-28-2024	06-27-2024	0.32	U	0.13
Van Buren Avenue	03-28-2024	04-18-2024	0.33	U	0.12
Van Buren Avenue	04-18-2024	05-23-2024	0.32	U	0.12
Van Buren Avenue	05-23-2024	06-13-2024	0.05	U	0.10
Van Buren Avenue	06-13-2024	06-27-2024	0.37	-	0.08
Van Buren Avenue Mean	03-28-2024	06-27-2024	0.27	U	0.11
Boundary Locations					
Atomic City	03-28-2024	04-19-2024	0.25	U	0.12
Atomic City	04-19-2024	05-16-2024	0.26	U	0.13
Atomic City	05-16-2024	06-13-2024	0.19	U	0.10
Atomic City	06-13-2024	06-27-2024	0.31	-	0.09
Atomic City Mean	03-28-2024	06-27-2024	0.24	U	0.11
Howe	03-28-2024	04-25-2024	0.25	U	0.11
Howe	04-25-2024	05-16-2024	0.28	U	0.14
Howe	05-16-2024	06-06-2024	0.61	-	0.13
Howe	06-06-2024	06-13-2024	0.07	U	0.14
Howe	06-13-2024	06-27-2024	NS ¹	NS	NS
Howe Mean	03-28-2024	06-13-2024	0.35	U	0.13
Mud Lake	03-28-2024	04-18-2024	0.17	U	0.13
Mud Lake	04-18-2024	05-16-2024	0.33	U	0.19
Mud Lake	05-16-2024	06-06-2024	0.55	-	0.16
Mud Lake	06-06-2024	06-27-2024	-0.40	U	0.14
Mud Lake Mean	03-28-2024	06-27-2024	0.18	U	0.16
Montevieu	03-28-2024	04-18-2024	0.12	U	0.12
Montevieu	04-18-2024	05-16-2024	0.09	U	0.13
Montevieu	05-16-2024	06-13-2024	-0.17	U	0.11
Montevieu	06-13-2024	06-27-2024	-0.38	U	0.11
Montevieu Mean	03-28-2024	06-27-2024	-0.05	U	0.12

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Distant Locations					
Craters of the Moon	03-28-2024	05-09-2024	0.21	U	0.10
Craters of the Moon	05-09-2024	06-06-2024	0.42	-	0.13
Craters of the Moon	06-06-2024	06-27-2024	0.05	U	0.09
Craters of the Moon Mean	03-28-2024	06-27-2024	0.24	U	0.11
Fort Hall ²	03-28-2024	04-18-2024	-0.05	U	0.14
Fort Hall	04-18-2024	05-09-2024	0.41	U	0.14
Fort Hall	05-09-2024	05-30-2024	0.59	-	0.16
Fort Hall	05-30-2024	06-17-2024	0.07	U	0.20
Fort Hall	06-17-2024	06-27-2024	0.45	-	0.13
Fort Hall Mean	03-28-2024	06-27-2024	0.29	U	0.16
Idaho Falls	03-28-2024	04-18-2024	0.04	U	0.13
Idaho Falls	04-18-2024	05-16-2024	0.13	U	0.13
Idaho Falls	05-16-2024	06-06-2024	0.50	-	0.15
Idaho Falls	06-06-2024	06-27-2024	0.76	-	0.13
Idaho Falls Mean	03-28-2024	06-27-2024	0.34	U	0.13

Note: Concentrations are reported in pCi/m³ with associated uncertainty (1 SD). **Bold** concentrations are positive detections, greater than or equal to 3 SD.

Data qualifiers: U = undetected, J = estimate, R = rejected, "+" or "-" after a J means that the estimated result is biased high or low, respectively.

¹ NS - no sample for this period due to pump failure.

² Station operated by Shoshone-Bannock Tribes.

³ MFC – Materials and Fuels Complex. MFC Guard House is a new monitoring location. Sample collection began here during the week of 5/16/24.

Table 8. Tritium and gamma-emitting radionuclide concentrations from precipitation, second quarter, 2024.

Station Location	Start Date	Stop Date	Tritium			Cs-137		
			Concentration		1 SD	Concentration		1 SD
On-site Locations								
Big Lost River Rest Area	03/28/24	05/09/24	70	U	30	0.5	U	0.8
Big Lost River Rest Area	05/09/24	06/27/24	NS ¹	-	-	NS ¹	-	-
Big Lost River Rest Area Mean	03/28/24	06/27/24	70	U	30	0.5	U	0.8
Boundary Locations								
Atomic City	03/28/24	05/16/24	20	U	30	1.1	U	0.7
Atomic City	05/16/24	06/27/24	NS ¹	-	-	NS ¹	-	-
Atomic City Mean	03/28/24	06/27/24	20	U	30	1.1	U	0.7
Howe	03/28/24	05/16/24	70	U	30	-0.1	U	1.1
Howe	05/16/24	06/27/24	80	U	30	1.2	U	1.3
Howe Mean	03/28/24	06/27/24	70	U	30	0.0	U	1.1
Mud Lake	03/28/24	05/09/24	20	U	30	0.7	U	0.8
Mud Lake	05/09/24	06/27/24	NS ¹	-	-	NS ¹	-	-
Mud Lake Mean	03/28/24	06/27/24	20	U	30	0.7	U	0.8
Monteviu	03/28/24	06/27/24	50	U	30	1.8	U	1.0
Monteviu Mean	03/28/24	06/27/24	50	U	30	1.8	U	1.0
Distant Locations								
Idaho Falls	03/28/24	05/09/24	60	U	30	0.7	U	0.7
Idaho Falls	05/09/24	06/27/24	50	U	30	0.6	U	0.7
Idaho Falls Mean	03/28/24	06/27/24	58	U	30	0.7	U	0.7

Concentrations are reported in pCi/L with associated uncertainty (1 SD). **Bold** concentrations are positive detections, greater than or equal to 3 SD. Data qualifiers: U = undetected, J = estimate, R = rejected, "+" or "-" after a J means that the estimated result is biased high or low, respectively.

¹No precipitation or insufficient volume for a valid sample for the time period shown.

Environmental Radiation Monitoring Results

The ESP operated 13 environmental radiation stations during the second quarter of 2024 (**Figure 1**). To detect gamma radiation, each station is instrumented with triplicate electret ionization chambers (EIC), and 10 of the stations also are equipped with an EcoGamma gamma radiation monitor with low and high range Geiger–Müller detectors. (**Table 9**).

The Shoshone-Bannock Tribes operate an air monitoring station at Fort Hall which is also equipped with EICs and an EcoGamma, both of which are owned and operated by the DEQ-INL OP. The DEQ-INL OP reports these results as a distant site.

EcoGammas are instruments capable of real-time measurements and are sensitive enough to detect small changes in gamma radiation levels. The real-time gamma radiation measurements collected by the EcoGammas at each location are transmitted to DEQ-INL OP and presented graphically via the worldwide web at <https://www.deq.idaho.gov/idaho-national-laboratory-oversight/inl-oversight-program/gamma-radiation-measurements>. Historically, DEQ-INL OP has used high-pressure ion chambers (HPIC) for real-time gamma radiation measurements. We completed a change-over of removing the old HPICs and replacing them with EcoGammas at each of our monitoring stations in first quarter 2022. Slight differences between EcoGamma data and historical HPIC data are expected.

EICs are a passive-integrating system that provides a cumulative measure of environmental gamma radiation exposure in the field. EICs are deployed, collected, and analyzed quarterly. EICs offer an inexpensive methodology to measure gamma radiation over a wide area, particularly in regions which do not have a power source. EICs can also provide valuable gamma radiation data in the event of an emergency. For this reason, EICs are deployed at 67 locations by DEQ-INL OP in a widespread network around the INL measuring external radiation. This information is tabulated in **Appendix B**.

These two systems are used by DEQ-INL OP to measure external gamma radiation for various radiological monitoring objectives. **Table 10** lists the average and median radiation exposure rates and exposure rate ranges measured by EcoGammas for the second quarter of 2024. **Table 11** lists the EIC monitoring results for the second quarter of 2024. Overall exposure rates were within the expected historical range of values observed by DEQ-INL OP for background radiation.

Table 9. Summary of instrumentation at radiation monitoring stations.

Station Location	Instrument Type	
	EcoGamma	EIC
On-site Locations		
Base of Howe	■	■
Big Lost River Rest Area	■	■
Experimental Field Station		■
Rover	■	■
Sand Dunes Tower	■	■
Van Buren Avenue		■
Boundary Locations		
Atomic City	■	■
Howe Met Tower	■	■
Monteview	■	■
Mud Lake/Terreton	■	■
Distant Locations		
Craters of the Moon		■
Fort Hall	■	■
Idaho Falls	■	■
Big Southern Butte ¹	■	■

¹ The Big Southern Butte location has been re-categorized from a Boundary to a Distant location starting this quarter.

Table 10. Average, median, and range of gamma exposure rates, second quarter 2024, from EcoGamma network.

Station Location	Exposure Rate (µR/hr)			
	Quarterly Average*	1 SD	Median	Range**
On-site Locations				
Base of Howe ⁸	13.6	0.6	13.6	11.5 – 17.8
Big Lost River Rest Area ⁵	13.9	0.8	14.0	9.4 – 16.0
Rover ⁴	14.8	0.6	14.8	12.6 – 21.6
Sand Dunes Tower	14.0	0.6	14.0	12.1 – 19.7
Boundary Locations				
Atomic City ⁷	13.6	0.6	13.6	11.3 – 16.9
Howe Met. Tower ¹	12.8	0.5	12.7	11.1 – 14.9
Montevue ²	13.2	0.6	13.2	11.4 – 20.0
Mud Lake / Terreton	13.0	0.5	13.0	10.9 – 17.5
Distant Locations				
Fort Hall	12.2	0.6	12.2	10.2 – 17.6
Idaho Falls ⁶	14.1	0.6	14.1	12.1 – 18.1
Big Southern Butte ³	17.3	1.7	16.6	14.3 – 23.3

*EcoGammas are sensitive electronic devices that can experience intermittent malfunctions and/or interference; this typically results in characteristic positive and/or negative data spikes. These aberrations are removed from the data set based on the judgement of the data analyst.

**The range of background exposure rates from EcoGamma data collected to date is approximately 7 – 34 µR/hr.

¹ No data from the EcoGamma at this location for 4/20 – 6/30/24.

² No data from the EcoGamma at this location for 5/21 – 6/30/24.

³ No data from the Ecogamma at this location for 4/1 – 4/14/24 and 4/28 – 6/30/24.

⁴ No data from the EcoGamma at this location for 4/26 – 4/27/24, and 6/5 – 6/30/24.

⁵ The EcoGamma at this location was in operation intermittently, producing a comparatively small dataset.

⁶ No data from the EcoGamma at this location for 6/12 – 6/30/24.

⁷ No data from the EcoGamma at this location for 6/26 – 6/30/24.

⁸ No data from the EcoGamma at this location for 6/5 – 6/30/24.

Table 11. Electret ionization chamber (EIC) cumulative average exposure rates, second quarter, 2024.

Station Location	Exposure Rate (µR/hr)	
	Quarterly Average ¹	1 SD
On-Site Locations		
Base of Howe	12.7	1.8
Big Lost River Rest Area	13.9	1.2
Experimental Field Station	14.9	1.6
Rover	14.5	1.1
Sand Dunes Tower	13.1	2.0
Van Buren Avenue	10.7, 11.9	-
Boundary Locations		
Atomic City	11.1	0.5
Howe Met. Tower	13.3	1.5
Monteview	12.4	1.9
Mud Lake/ Terretton	12.0	0.6
Distant Locations		
Craters of the Moon	13.8	2.1
Fort Hall	11.9	2.3
Idaho Falls	9.1	0.4
Big Southern Butte	13.7	2.0

¹Results are the average of triplicate exposure rate measurements with the associated sample variability (1 SD), or the 2 measured exposure rates remaining after removal of an outlying value. One of the triplicate measurements is rejected if it is outside the average of the triplicate measurements ± 2 SD of the historical population variability. Typically, the two most consistent measurements are reported, based on judgment of the data analyst.

Water Monitoring Results

DEQ-INL OP collects groundwater samples from wells and springs located within, upgradient of, and downgradient of the INL to evaluate the effects of INL contaminants on water quality in the eastern Snake River Plain (ESRP) aquifer and verify the results of DOE and USGS monitoring. Each year, DEQ-INL OP samples approximately 85-90 locations concurrently with a DOE contractor or the USGS and 15-20 locations independently. Co-sampled locations are primarily on or near the INL Site and are usually sampled during the second and fourth calendar quarters. DEQ-INL OP publishes a comparison of its own analytical results with those obtained by co-samplers in the DEQ-INL Oversight Program Annual Report. Locations sampled independently by DEQ-INL OP are mostly in the Magic Valley and are typically sampled during the third calendar quarter.

Most water samples are collected from wells drilled into the aquifer or springs formed by the intersection of the aquifer water table with the surface. Each aquifer well or spring is categorized as upgradient, facility, boundary, or distant based on its location (**Figure 2** and **Figure 3**):

- *Upgradient* sites are situated north or northeast of INL facilities in areas that have not been affected by INL operations. They are used to monitor background concentrations in the aquifer.
- *Facility* sites are located near facility complexes within the INL, including the Advanced Test Reactor complex (ATR), the Central Facilities Area (CFA), the Idaho Nuclear Technology and Engineering Center (INTEC), the Materials and Fuels Complex (MFC), the Naval Reactors

Facility (NRF), the Radioactive Waste Management Complex (RWMC), and Test Area North (TAN). Facility sites are located within or immediately downgradient of known areas of contamination and are sampled to monitor the concentrations and migration of specific contaminants.

- *Boundary* sites are located near the southern boundary of the INL, downgradient of potential sources of INL contamination. These include several wells equipped with Westbay Multilevel Groundwater Monitoring Systems (“Westbay wells”), which offer a look at the vertical distribution of constituents in the aquifer.
- *Distant* sites are located farther downgradient of the INL, primarily in the Magic Valley, and include wells and springs used for agricultural, municipal, domestic, and industrial purposes.

A small number of samples are also collected each year from streams, waste-pond effluent, and wells drilled into perched groundwater (groundwater that sits above the aquifer).

Samples collected from water-monitoring sites are analyzed for radiological and non-radiological constituents, many of which are present in the aquifer both naturally and as a result of INL operations. All locations are sampled for gross alpha and gross beta radioactivity, manmade gamma-emitting nuclides, tritium, chloride, sulfate, chromium, and nitrate-plus-nitrite.⁶ Samples from locations at which tritium concentrations are too low to be detected by the standard method are re-analyzed for tritium using an electrolytic enrichment method (referred to as the low-level method), which has a minimum detectable concentration (MDC) about ten times lower than the standard method. Selected sites are also sampled for specific radionuclides—including uranium isotopes (²³⁴U, ²³⁵U, and ²³⁸U), plutonium isotopes (²³⁸Pu, ^{239/240}Pu), americium-241 (²⁴¹Am), strontium-90 (⁹⁰Sr), iodine-129 (¹²⁹I) and technetium-99 (⁹⁹Tc)—selected trace metals, common ions, total phosphorous, and/or volatile organic compounds (VOCs) based on past and present INL operations or a history of elevated concentrations. If unexpected levels of radioactivity are detected in gross measurements, additional samples will be collected and analyzed for specific radionuclides.

During the second quarter of 2024, DEQ-INL OP sampled groundwater from the aquifer at 30 facility locations, 15 boundary locations, five distant locations, and five upgradient locations. DEQ-INL OP also sampled water from three perched water well water locations. **Table 12** lists the sample date, co-sampler, well depth, and analyses requested for the locations sampled this quarter. Analytical results are reported in **Tables 14** through **25** and summarized below. The results of low-level tritium analyses for 11 samples are reported in **Table 16** and discussed below. A backlog of 19 low-level tritium analyses for samples taken during the second quarter of 2024 remains.

Table 13 shows the range of background concentrations for each constituent in the ESRP aquifer and the EPA drinking water maximum contaminant level (MCL) or secondary maximum contaminant level (SMCL). Background concentrations depend on local geology, and the concentrations of constituents at sites not influenced by INL activities may on occasion be higher than the given background ranges due to local factors and natural variability.

⁶ Distant locations Alpheus Spring, Bill Jones Hatchery, Clear Spring, Minidoka Water Supply, and Shoshone Water Supply and upgradient location Mud Lake Water Supply are sampled for gross alpha and gross beta radioactivity, gamma-emitting radionuclides, and tritium during the second quarter. In the fourth quarter, common ions, metals, nitrate-plus-nitrate, and other constituents are collected along with gross alpha and gross beta radioactivity, gamma-emitting radionuclides, and tritium.

Gross alpha and gross beta radioactivity

Gross alpha and gross beta analyses are used to screen for unexpectedly high levels of radioactivity in samples. DEQ-INL OP has determined from past sampling that background concentration ranges for gross alpha and gross beta radioactivity in the ESRP aquifer are approximately 0-5.6 pCi/L and 0-8.6 pCi/L, respectively. Occasional measurements of concentrations above these background ranges in uncontaminated samples are statistically probable due to uncertainties inherent in measuring low levels of radioactivity. Additionally, some samples will have levels of radioactivity slightly higher than background ranges due to higher-than-average concentrations of naturally occurring uranium, thorium, or potassium-40.

Gross alpha and beta radioactivity were detected at low levels in most samples (**Table 14**). Gross alpha radioactivity was measured within background ranges at all locations. ICPP-MON-A-230 is an aquifer well located at the INTEC facility and had the greatest gross alpha activity; measured at a concentration of 5.5 ± 0.8 pCi/L.

Gross beta activity was measured above background at TAN, INTEC, and ATR. TAN-2336 exhibited the maximum gross beta activity this quarter at 874 ± 20 pCi/L. Bioremediation efforts are ongoing at the TAN facility, and it is hypothesized that these remediation efforts are mobilizing known ^{90}Sr contamination in the aquifer. TAN-2271, TAN-28 and TAN-29 also exhibited elevated gross beta concentrations. ICPP-MON-A-230 displayed the highest gross beta concentration at the INTEC facility at 828 ± 3.4 pCi/L. This location has known ^{99}Tc contamination and the gross beta concentration detected at this well is within the historical range. The perched aquifer below the ATR facility has known contamination resulting from former disposal wells and percolation ponds. USGS-068 had a gross beta concentration in the perched aquifer at 19.1 ± 1.2 pCi/L, which is within historical ranges.

Manmade gamma-emitting radionuclides

TAN-2336 was the only location where cesium-137 (^{137}Cs) was detected. Results were 7.0 ± 1.4 pCi/L. Ongoing in-situ bioremediation (ISB) for VOCs at TAN cause cation concentrations (calcium, magnesium, sodium, and potassium) to increase. The increase in cations elevates ^{137}Cs and ^{90}Sr concentrations because they are all competing for sorption sites in the aquifer. As the cation concentrations decrease, it is expected that ^{137}Cs and ^{90}Sr concentrations will also decrease. Results for ^{137}Cs , the manmade gamma-emitter most likely to be detected in groundwater, are reported in **Table 14**.

Tritium

Tritium was analyzed at all locations sampled this quarter (**Table 15**). Tritium was detected at 17 facility, 6 boundary, and one perched water wells using the standard analytical method. Detected tritium concentrations at the facility wells ranged from 1898 ± 56 pCi/L at CFA-1 to 126 ± 34 pCi/L at USGS-047. Tritium concentrations detected in the boundary wells ranged 674 ± 43 pCi/L at USGS-131A (616 ft bgs) to 121 ± 35 pCi/L at Middle-2051_(749 ft bgs). The highest detection in a perched water well this quarter was USGS-068, at a concentration of 147 ± 30 pCi/L.

Low-level tritium analysis was performed on four facility wells, two upgradient wells, two boundary wells, and two perched water wells. The results are reported in **Table 16**. Detections occurred at three facility locations, ranging from 62 ± 2.5 pCi/L at RWMC well A11A31 to 8 ± 2 pCi/L at NRF-09. The only detection at a boundary location was 25 ± 3 pCi/L at USGS-124. Two perched groundwater locations exhibited tritium concentrations of 103 ± 3 pCi/L at USGS-068 and 15 ± 3 pCi/L at USGS-062. Tritium was not detected in the upgradient locations.

All tritium concentrations were consistent with historical data and were well below the drinking water MCL of 20,000 pCi/L.

Strontium-90

Eighteen aquifer locations and two perched groundwater locations were sampled for ⁹⁰Sr this quarter (**Table 17**). Detectable concentrations were found in ten aquifer samples at TAN, INTEC, and CFA, with a maximum concentration of 341 ± 15 pCi/L at TAN-2336. Detectable concentrations were found in one ATR perched groundwater sample, with a concentration of 7.55 ± 0.42 pCi/L at USGS-068. Seven locations had ⁹⁰Sr concentrations that exceeded the MCL of 8 pCi/L. All elevated concentrations were measured in samples from areas of known contamination and are consistent with historical trends.

Technetium-99

Twelve facility locations at TAN, RWMC, INTEC and CFA, along with two boundary locations were sampled for ⁹⁹Tc (**Table 18**). ICPP-MON-A-230 exceeded the MCL for ⁹⁹Tc (900 pCi/L) with a concentration of 1350 ± 65 pCi/L. All wells with detections of ⁹⁹Tc were downgradient of ICPP-MON-A-230.

Plutonium Isotopes

One facility well (TAN-47) was sampled for plutonium isotopes (²³⁸Pu and ^{239/240}Pu) this quarter, resulting in non-detections for ²³⁸Pu and ^{239/240}Pu (**Table 19**).

Uranium Isotopes

Five TAN wells were sampled for uranium isotopes this quarter (**Table 20**). All wells sampled yielded detectable results for ²³⁴U. The highest concentrations were from TAN-28 at 5.26 ± 0.31 pCi/L and TAN-29 at 5.25 ± 0.26 pCi/L. Both values were within historical ranges. Detectable concentrations of ²³⁵U were found in three wells: TAN-28 at 0.255 ± 0.054 pCi/L, TAN-29 at 0.161 ± 0.031 pCi/L and TAN-42 at 0.0334 ± 0.0100 pCi/L. Four locations had detections for ²³⁸U this quarter. The maximum ²³⁸U concentration was 0.943 ± 0.074 pCi/L at TAN-29. All detections were consistent with historical data and trends.

Common ions, trace metals, and nutrients

Select locations were sampled for common ions (calcium, magnesium, sodium, potassium, chloride, sulfate, and alkalinity), trace metals, (arsenic, barium, chromium, iron, lead, and manganese.) and dissolved nutrients (nitrate-plus-nitrite, phosphorous) (**Tables 21, 22, and 23**).

The highest concentrations of chloride were measured at NRF, TAN, and RWMC. NRF-06 had the highest overall concentrations at 433 mg/L, which exceed the EPA's secondary MCL of 250 mg/L. TAN-28, TAN-29, TAN-2271 and TAN-2336 also exceeded background levels of chloride, with the highest at TAN-2336 (106 mg/L). ATR perched water well USGS-068 had the highest concentrations of sulfate at 328 mg/L, followed by ATR aquifer well USGS-065 at 134 mg/L. Concentrations of barium, arsenic, iron, lead, magnesium, calcium, manganese, sodium, sulfate, alkalinity, potassium, and phosphorous in samples from TAN were elevated above background likely due to ISB conditions, with TAN-2336 usually measuring the highest concentrations.

TAN-2336 displayed the highest chromium value this quarter, at 320 µg/L. The elevated result is likely the remobilization of chromium due to bioremediation injections. The highest chromium value for perched aquifer wells was 42 µg/L at USGS-068 located near ATR. The sample from RWMC well

M15S measured a chromium concentration of 95 µg/L, which is 65% higher than the previous maximum of 62 µg/L in 2023. This well, and downgradient well M6S, will be closely monitored in the future. Most boundary wells sampled this quarter measured chromium values slightly greater than the background range, with the highest value of 11 µg/L at USGS-131A (616 ft bgs).

Consistent with historical data, an arsenic level of 11 µg/L, which is above the MCL (10 µg/L), was measured at ATR perched groundwater well USGS-062. All other concentrations were consistent with past observations and within natural background ranges.

All nutrient results were below the MCL for this quarter. The highest nitrate + nitrite concentration was 8.6 mg/L at perched groundwater well USGS-068 (ATR). Results were consistent with 2023 results (9.8 mg/L). One sample at TAN-2336 had elevated levels of phosphorus with 38 mg/L, which is likely a direct result of bioremediation activity. All other concentrations were consistent with past observations and trends with most within natural background ranges.

Volatile organic compounds (VOCs)

VOCs were measured at 10 TAN wells and six RWMC wells (**Table 25**). All locations had detectable concentrations of at least one VOC, except for M1S and TAN-2312. Carbon tetrachloride, trichloroethene (TCE), and chloroform continue to be detected at RWMC wells at levels consistent with previous observations. TAN-2336 displayed a methyl ethyl ketone (MEK, 2-butanone) concentration of 1790 µg/L. Detections of MEK most likely represent a side reaction in the bioremediation process and are generally short-lived with a degradation time ranging from 13-128 days (Aronson, Dallas B., and Philip H. Howard. “Anaerobic Biodegradation of Organic Chemicals in Groundwater: A Summary of Field and Laboratory Studies,” 1997). Due to its short-lived nature, there is no immediate threat to human health and the environment. Concentrations of 2-hexanone at 32.1 µg/L were also observed at TAN-2336. This is the highest level of 2-hexanone detected at this location and will be closely monitored as remediation continues. Tetrachloroethene (PCE), trichloroethene (TCE), trans-1, 2-dichloroethene (trans-1, 2-DCE) and cis-1,2-dichloroethene (cis-1, 2-DCE) continue to be detected at TAN wells; however, notable MCL exceedances and/or changes from previous measurements include:

- TAN-29: TCE = 326 µg/L, down from 381 µg/L in 2023 (MCL is 5 µg/L)
- TAN-42: TCE = 124 µg/L, up from 46.8 µg/L in 2023 (MCL is 5 µg/L)
- TAN-42: PCE = 11.2 µg/L - This is the historical maximum at this location (MCL is 5 µg/L)
- TAN-44: TCE = 17.8 µg/L, down from 34.2 µg/L in 2023 (MCL is 5 µg/L)
- TAN-2271: Trans-1,2-DCE = 54.5 µg/L, down from 64.6 µg/L in 2023 (MCL is 100 µg/L)
- TAN-28: Trans-1,2-DCE = 53.3 µg/L, down from 65 µg/L in 2023 (MCL is 100 µg/L)

All other VOC detections were consistent with historical data and were measured in areas of known contamination.

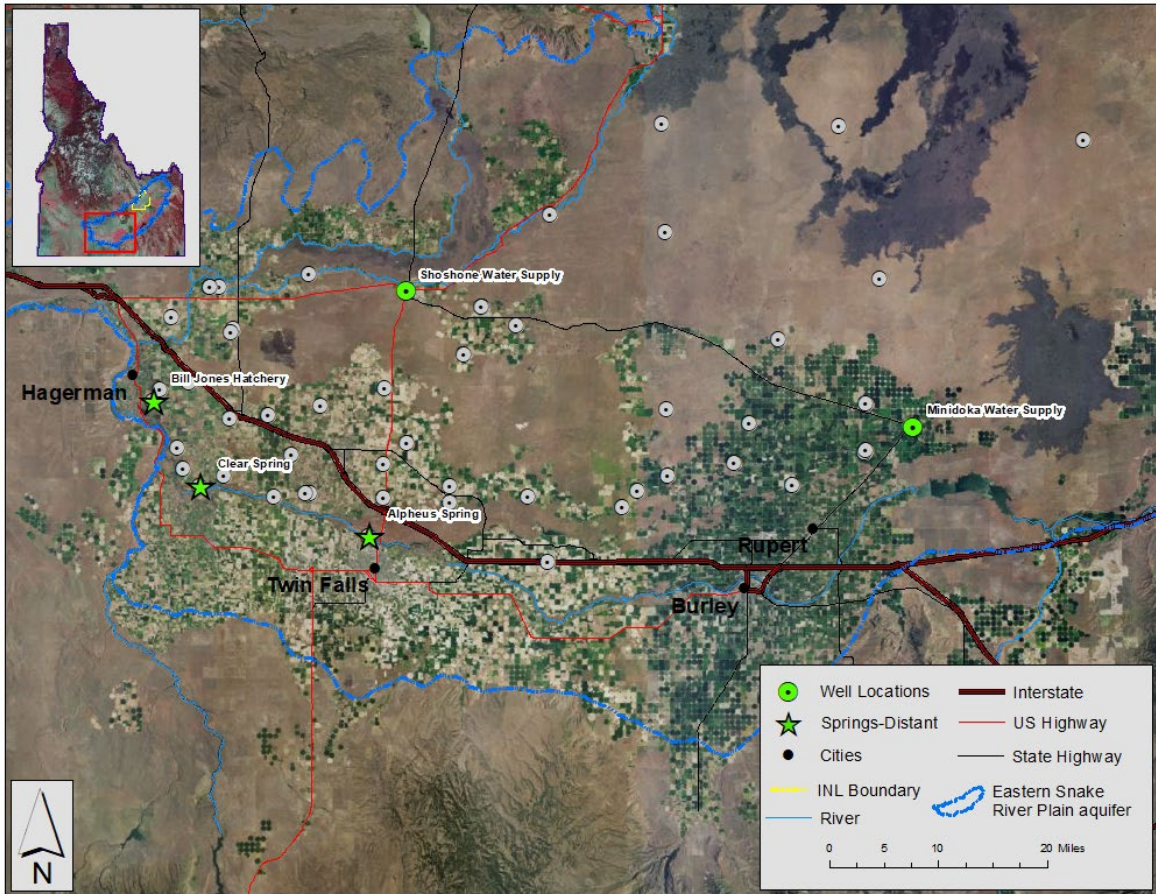


Figure 2. Distant water monitoring locations.

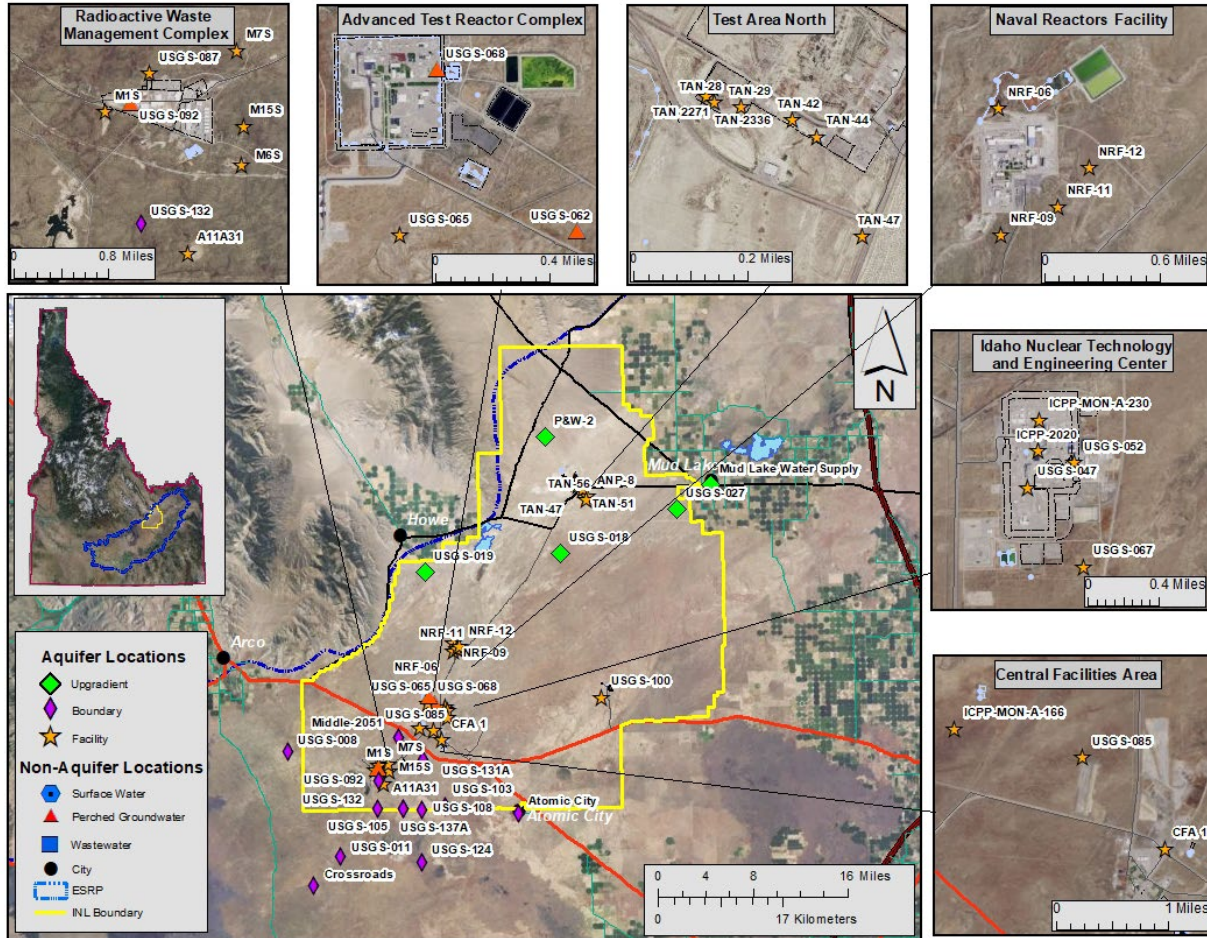


Figure 3. Upgradient, facility, boundary, perched groundwater (GW), surface water and wastewater monitoring locations.

Table 12. Locations sampled in water, second quarter, 2024.

Sample Location	Date Sampled	Co-sampler	Well Depth (ft bgs)	Analyses*
Aquifer Samples				
Facility				
<i>Advanced Test Reactor Complex</i>				
USGS-065	04/09/24	USGS	498	α, β, γ, ³ H, ⁹⁰ Sr, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂
<i>Idaho Nuclear Technology and Engineering Center</i>				
ICPP-2020	04/03/24	IEC	506	α, β, γ, ³ H, ⁹⁰ Sr, ⁹⁹ Tc, U iso, Pu iso, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂
ICPP-MON-A-230	04/03/24	IEC	n/a	α, β, γ, ³ H, ⁹⁰ Sr, ⁹⁹ Tc, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂
USGS-047	04/03/24	IEC	651	α, β, γ, ³ H, ⁹⁰ Sr, ⁹⁹ Tc, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂
USGS-052	04/02/24	IEC	650	α, β, γ, ³ H, ⁹⁰ Sr, ⁹⁹ Tc, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂
USGS-067	04/02/24	IEC	694	α, β, γ, ³ H, ⁹⁰ Sr, ⁹⁹ Tc, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂
<i>Radioactive Waste Management Complex</i>				
USGS-087	04/23/24	USGS	673	α, β, γ, ³ H, ⁹⁰ Sr, ⁹⁹ Tc, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂ , VOCs
M15S	05/13/24	IEC	620	α, β, γ, ³ H, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂ , VOCs
M1S	05/13/24	IEC	678	α, β, γ, ³ H, ⁹⁰ Sr, ⁹⁹ Tc, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂ , VOCs
M6S	05/14/24	IEC	697	α, β, γ, ³ H, ⁹⁰ Sr, ⁹⁹ Tc, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂ , VOCs
A11A31	05/14/24	IEC	678	α, β, γ, ³ H, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂ , VOCs
M7S	05/13/24	IEC	638	α, β, γ, ³ H, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂ , VOCs
<i>Test Area North</i>				
TAN-2336	04/18/24	IEC	255	α, β, γ, ³ H, ⁹⁰ Sr, U iso, com. ions, trace metals, NO ₃ +NO ₂ , P, VOCs
TAN-2271	04/18/24	IEC	289	α, β, γ, ³ H, ⁹⁰ Sr, com. ions, trace metals, NO ₃ +NO ₂ , VOCs
TAN-28	04/16/24	IEC	262	α, β, γ, ³ H, ⁹⁰ Sr, U iso, com. ions, trace metals, NO ₃ +NO ₂ , VOCs
TAN-29	04/16/24	IEC	253	α, β, γ, ³ H, ⁹⁰ Sr, U iso, com. ions, trace metals, NO ₃ +NO ₂ , VOCs
TAN-42	06/03/24	IEC	440	α, β, γ, ³ H, ⁹⁰ Sr, U iso, com. ions, trace metals, NO ₃ +NO ₂ , P, VOCs
TAN-44	04/16/24	IEC	442	α, β, γ, ³ H, ⁹⁰ Sr, U iso, com. ions, trace metals, NO ₃ +NO ₂ , VOCs
TAN-47	06/03/24	IEC	522	α, β, γ, ³ H, ⁹⁰ Sr, ⁹⁹ Tc, U iso, Pu iso, Cl-, SO ₄ ²⁻ , com. ions, trace metals, NO ₃ +NO ₂ , VOCs
TAN-51	06/04/24	IEC	470	α, β, γ, ³ H, Cl-, SO ₄ ²⁻ , com. ions, trace metals, NO ₃ +NO ₂ , VOCs
TAN-56	06/04/24	IEC	n/a	α, β, γ, ³ H, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂ , VOCs
ANP-8	06/03/24	IEC	309	α, β, γ, ³ H, Cl-, SO ₄ ²⁻ , com. ions, trace metals, NO ₃ +NO ₂ , VOCs
<i>Central Facilities Area</i>				
CFA 1	04/08/24	USGS	639	α, β, γ, ³ H, ⁹⁰ Sr, ⁹⁹ Tc, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂
ICPP-MON-A-166	04/09/24	USGS	527	α, β, γ, ³ H, ⁹⁹ Tc, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂
USGS-085	04/01/24	USGS	637	α, β, γ, ³ H, ⁹⁰ Sr, ⁹⁹ Tc, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂
<i>Materials and Fuels Complex</i>				
USGS-100	04/08/24	USGS	750	α, β, γ, ³ H, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂
<i>Naval Reactors Facility</i>				
NRF-06	05/20/24	USGS	417	α, β, γ, ³ H, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂
NRF-09	05/22/24	USGS	422	α, β, γ, ³ H, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂
NRF-11	05/22/24	USGS	417	α, β, γ, ³ H, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂
NRF-12	05/22/24	USGS	425	α, β, γ, ³ H, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂
Boundary				
Crossroads	04/11/24	USGS	796	α, β, γ, ³ H, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂
USGS-008	04/11/24	USGS	812	α, β, γ, ³ H, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂
USGS-011	04/17/24	USGS	704	α, β, γ, ³ H, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂
USGS-124	04/17/24	USGS	800	α, β, γ, ³ H, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂
Middle-2051 (749 ft bgs)	06/26/24	USGS	749	α, β, γ, ³ H, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂
Middle-2051 (1091 ft bgs)	06/26/24	USGS	1091	α, β, γ, ³ H, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂
Atomic City	05/07/24	None	639	α, β, γ, ³ H, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂
USGS-137A (747 ft bgs)	06/17/24	USGS	747	α, β, γ, ³ H, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂
USGS-132 (765 ft bgs)	06/13/24	USGS	765	α, β, γ, ³ H, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂

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Sample Location	Date Sampled	Co-sampler	Well Depth (ft bgs)	Analyses*
USGS-103 (1258 ft bgs)	06/27/24	USGS	1258	α, β, γ, ³ H, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂
USGS-131A (616 ft bgs)	06/25/24	USGS	616	α, β, γ, ³ H, ⁹⁹ Tc, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂
USGS-131A (812 ft bgs)	06/25/24	USGS	812	α, β, γ, ³ H, ⁹⁹ Tc, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂
USGS-105 (952 ft bgs)	06/18/24	USGS	952	α, β, γ, ³ H, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂
USGS-105 (1072 ft bgs)	06/18/24	USGS	1072	α, β, γ, ³ H, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂
USGS-108 (1172 ft bgs)	06/20/24	USGS	1172	α, β, γ, ³ H, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂
Upgradient				
P&W-2	04/10/24	USGS	386	α, β, γ, ³ H, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂
USGS-018	04/08/24	USGS	329	α, β, γ, ³ H, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂
USGS-019	04/10/24	USGS	405	α, β, γ, ³ H, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂
USGS-027	04/10/24	USGS	312	α, β, γ, ³ H, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂
Mud Lake Water Supply	05/07/24	None	330	α, β, γ, ³ H
Distant				
Alpheus Spring	05/06/24	None	n/a	α, β, γ, ³ H
Bill Jones Hatchery	05/06/24	None	n/a	α, β, γ, ³ H
Clear Spring	05/06/24	None	n/a	α, β, γ, ³ H
Minidoka Water Supply	05/06/24	None	282	α, β, γ, ³ H
Shoshone Water Supply	05/06/24	None	715	α, β, γ, ³ H
Other Samples				
Perched Groundwater				
Advanced Test Reactor & Radioactive Waste Management Complexes:				
USGS-062	04/09/24	USGS	165	α, β, γ, ³ H, ⁹⁰ Sr, Cr, com. ions, NO ₃ +NO ₂
USGS-092	04/08/24	USGS	214	α, β, γ
USGS-068	04/09/24	USGS	128	α, β, γ, ³ H, ⁹⁰ Sr, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂

ft bgs = feet below ground surface.

*α = gross alpha radioactivity; β = gross beta radioactivity; γ = manmade gamma-emitting radionuclides; ³H = tritium; ⁹⁰Sr = Strontium-90, ⁹⁹Tc = Technetium-99, Pu iso. = plutonium isotopes ²³⁸Pu, ^{239/240} Pu, Pu; U iso. = uranium isotopes ²³⁴U, ²³⁵U, ²³⁸U; Cl = chloride; Cr = chromium; com. ions = Ca²⁺, Mg²⁺, Na⁺, K⁺, Cl⁻, SO₄²⁻, alkalinity; trace metals (metals) = arsenic (As), barium (Ba), chromium (Cr), iron (Fe), manganese (Mn), lead (Pb), selenium (Se); NO₃+NO₂ = nitrate plus nitrite; P = phosphorus; and VOCs (volatile organic compounds).

n/a = well depth not available.

Table 13. Constituent background concentration ranges and EPA drinking water standards.

Constituent	Background ¹	MCL or SMCL ²
Radiological Constituents (pCi/L)		
Gross alpha	0-5.6 ^a	15
Gross beta	0-8.6 ^a	4 mrem/yr
Cesium-137	0	200
Tritium	0-33 ^a	20,000
Strontium-90	0	8
Technetium-99	0	900
Iodine-129	0.0000054 ^e	1
Uranium-234	0.043-1.9 ^b	30 µg/L (total U)
Uranium-235	0-0.048 ^b	
Uranium-238	0.021-0.719 ^b	
Plutonium-238	0	15 ^g
Plutonium-239/240	0	15 ^g
Americium-241	0	15 ^g
Non-radiological Constituents		
Common Ions (mg/L)		
Alkalinity (as CaCO ₃)	91-261 ^a	---
Calcium	23 – 71 ^a	---
Chloride	4.9 – 66.6 ^a	250*
Fluoride	0.1 – 1.50 ^a	4
Magnesium	10.1 – 27.4 ^a	---
Potassium	1.2 – 5.8 ^a	---
Sodium	2.6 – 27.0 ^a	---
Sulfate	9.6 – 40.4 ^a	250*
Trace Metals (µg/L)		
Arsenic	2 – 3 ^c	10
Barium	50 – 70 ^c	2000
Chromium	<1.0 – 5.2 ^a	100
Iron	4 – 16 ^d	300*
Lead	<5 ^c	15
Manganese	<1 – 4 ^a	50*
Selenium	<1 ^c	50
Zinc	<3 – 10.5 ^d	5000*
Nutrients (mg/L)		
Nitrate plus nitrite	<0.04 – 3.59 ^b	10 for NO ₃ ⁻ , 1 for NO ₂ ⁻
Phosphorus	<0.01 – 0.02 ^d	---
Volatile Organic Compounds (µg/L)		
Tetrachloroethene (PCE)	0	5
Trichloroethene (TCE)	0	5
1,1-Dichloroethene	0	7
cis-1,2-dichloroethene	0	70
trans-1,2-dichloroethene	0	100
Vinyl chloride	0	2
Carbon tetrachloride	0	5
Chloroform	0	80 ^f
Chloromethane	0	---
Methylene Chloride	0	5
Methyl Ethyl Ketone	0	---
1,1-Dichloroethane	0	---

¹ Sources for background ranges are: ^a DEQ data compiled from distant, boundary, and surface water sites from 1993-2018; ^b Bartholomay and Hall, 2016 (DOE/ID-22237); ^c Knobel and others, 1992; ^d Knobel and others, 1999 (DOE/ID-22164). ^e The actual background of I-129 in the aquifer from atmospheric deposition and rock weathering is 0.0000054 pCi/L per Cecil and others, 2003 (DOE/ID-22186); ^f MCL is for total trihalomethanes. ^g There are no specific MCLs for these nuclides. Listed MCLs are the gross alpha activity MCL. ² Maximum Contaminant Levels (MCLs) are the highest levels of contaminants legally allowed in public drinking water systems in Idaho. Most wells sampled by DEQ-INL OP are not used for drinking water. A * designates a Secondary MCL (SMCL), which is a guideline recommended by the EPA for constituents that may affect the taste, color, or odor of drinking water.

Table 14. Gross alpha, gross beta, and man-made gamma-emitting radionuclide concentrations (pCi/L) in water samples, second quarter, 2024.

Sample Location	Sample Date	Gross Alpha			Gross Beta			Cesium-137*		
		Concentration	1 SD		Concentration	1 SD		Concentration	1 SD	
Aquifer Samples										
Facility										
<i>Advanced Test Reactor Complex</i>										
USGS-065	04/09/24	0.8	U	0.4	3.3	-	0.4	-1.1	U	1.0
<i>Radioactive Waste Management Complex</i>										
USGS-087	04/23/24	1.0	U	0.4	3.7	-	0.4	1.0	U	0.7
M15S	05/13/24	1.0	U	0.4	3.0	-	0.4	0.8	U	1.4
M1S	05/13/24	1.4	-	0.4	1.1	-	0.4	1.2	U	0.8
M7S	05/13/24	1.2	-	0.4	2.9	-	0.4	2.6	U	1.1
A11A31	05/14/24	0.3	U	0.4	3.5	-	0.4	1.5	U	0.8
M6S	05/14/24	0.3	U	0.4	2.4	-	0.4	1.3	U	1.0
<i>Test Area North</i>										
TAN-28	04/16/24	2.6	U	0.9	249	-	2.4	-0.5	U	1.0
TAN-29	04/16/24	3.0	-	0.7	46.4	-	0.9	1.2	U	1.0
TAN-44	04/16/24	1.3	-	0.5	3.2	-	0.5	3.7	U	1.5
TAN 2271	04/18/24	0.5	U	0.5	353	-	2.0	2.1	U	1.2
TAN-2336	04/18/24	-15.1	U	9.5 ¹	874	-	20 ¹	7.0	-	1.4
ANP-8	06/03/24	0.7	U	0.4	2.4	-	0.4	1.2	U	1.4
TAN-42	06/03/24	0.3	U	0.5	3.2	-	0.5	0.3	U	0.8
TAN-47	06/03/24	-0.3	U	0.4	2.4	-	0.4	0.0	U	0.8
TAN-51	06/04/24	0.5	U	0.4	3.3	-	0.4	-1.7	U	1.3
TAN-56	06/04/24	1.9	-	0.5	3.4	-	0.5	-0.3	U	0.9
<i>Central Facilities Area</i>										
USGS-085	04/01/24	0.8	U	0.5	7.0	-	0.5	1.3	U	0.8
CFA 1	04/08/24	0.7	U	0.4	7.6	-	0.5	0.6	U	1.0
ICPP-MON-A-166	04/09/24	1.0	U	0.4	4.3	-	0.4	-0.4	U	0.9
<i>Idaho Nuclear Technology and Engineering Center</i>										
USGS-052	04/02/24	1.7	-	0.5	196.8	-	1.6	2.2	U	0.9
USGS-067	04/02/24	0.8	U	0.5	79.7	-	1.1	0.1	U	0.7
ICPP-2020	04/03/24	1.4	U	0.5	162.9	-	1.5	1.4	U	0.8
ICPP-MON-A-230	04/03/24	5.5	-	0.8	828.3	-	3.4	0.5	U	1.0
USGS-047	04/03/24	1.5	-	0.5	30	-	1	0.0	U	0.7
<i>Materials and Fuels Complex</i>										
USGS-100	04/08/24	0.4	U	0.2	3.6	-	0.35	-0.6	U	0.9
<i>Naval Reactors Facility</i>										
NRF-06	05/20/24	0.8	U	0.8	4.5	-	0.9	0.6	U	1.0
NRF-09	05/22/24	-0.3	U	0.5	2.0	-	0.5	-0.3	U	1.0
NRF-11	05/22/24	0.5	U	0.4	2.0	-	0.4	1.9	U	1.1
NRF-12	05/22/24	1.1	U	0.4	2.1	-	0.5	0.7	U	0.8
Boundary										
Crossroads	04/11/24	0.5	U	0.4	1.9	-	0.4	-0.2	U	0.6
USGS-008	04/11/24	1.5	-	0.5	2.1	-	0.4	0.5	U	1.1
USGS-011	04/17/24	1.1	U	0.5	2.9	-	0.4	-1.3	U	0.9
USGS-124	04/17/24	0.4	U	0.3	1.9	-	0.4	-0.1	U	0.6
Atomic City	05/07/24	0.5	U	0.4	1.8	-	0.4	1.4	U	1.0
USGS-132	06/13/24	0.4	U	0.4	2.3	-	0.4	1.5	U	1.5
USGS-137A	06/17/24	0.4	U	0.4	3.2	-	0.4	-0.0	U	1.0
USGS-105 (1072 ft bgs)	06/18/24	0.4	U	0.4	1.4	-	0.4	1.1	U	0.9
USGS-105 (952 ft bgs)	06/18/24	0.4	U	0.4	3.1	-	0.4	0.9	U	0.8
USGS-108	06/20/24	0.3	U	0.3	2.5	-	0.4	1.1	U	1.0
USGS-131A (616 ft bgs)	06/25/24	0.1	U	0.4	3.2	-	0.4	0.5	U	0.8
USGS-131A (812 ft bgs)	06/25/24	0.2	U	0.5	2.9	-	0.4	1.1	U	0.7
Middle-2051 (1091 ft bgs)	06/26/24	-0.8	U	0.6	2.5	-	0.5	1.4	U	0.9
Middle-2051 (749 ft bgs)	06/26/24	0.3	U	0.5	2.9	-	0.4	1.8	U	1.0
USGS-103	06/27/24	0.7	U	0.4	2.7	-	0.4	0.7	U	1.0
Upgradient										

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Sample Location	Sample Date	Gross Alpha			Gross Beta			Cesium-137*		
		Concentration		1 SD	Concentration		1 SD	Concentration		1 SD
USGS-018	04/08/24	1.4	-	0.4	2.9	-	0.4	1.1	U	0.9
P&W-2	04/10/24	1.2	-	0.4	2.4	-	0.4	-0.4	U	1.0
USGS-019	04/10/24	0.5	U	0.4	2.3	-	0.4	1.4	U	1.0
USGS-027	04/10/24	0.9	U	0.5	4.9	-	0.5	-0.3	U	1.1
Mud Lake Water Supply	05/07/24	0.2	U	0.3	2.0	-	0.4	0.1	U	0.8
Distant										
Alpheus Spring	05/06/24	1.4	U	0.6	6.8	-	0.5	0.1	U	0.7
Bill Jones Hatchery	05/06/24	0.0	U	0.4	2.9	-	0.4	1.9	U	1.2
Clear Spring	05/06/24	-0.1	U	0.4	2.1	-	0.4	0.6	U	1.1
Minidoka Water Supply	05/06/24	0.5	U	0.5	3.5	-	0.4	-0.2	U	0.9
Shoshone Water supply	05/06/24	1.3	U	0.6	2.2	-	0.4	2.3	U	0.9
Other Samples										
Perched Groundwater										
Advanced Test Reactor & Radioactive Waste Materials Complexes										
USGS-062	04/09/24	1.7	-	0.5	3.2	-	0.4	-0.9	U	1.0
USGS-068	04/09/24	-1.1	U	1.0	19.2	-	1.2	-0.7	U	1.0
USGS-092	04/08/24	1.8	U	0.7	8.7	-	0.8	1.1	U	1.5

Data qualifiers: U = undetected, J = estimate, R = rejected, "+" or "-" after a J means that the estimated result is biased high or low, respectively.

*ISU-EML analyzes water samples for all common manmade gamma-emitting radionuclides. If none are detected, only the results for ¹³⁷Cs, the manmade gamma-emitter most likely to be detected in groundwater, are reported in this table.

Bold concentrations are positive detections, greater than or equal to 3 SD.

¹ISU-EML reported that the elevated 1 SD for gross alpha and gross beta is attributable to the low aliquant of sample (0.010 L) that was required to keep the residual mass within the maximum value of 200 mg for which their mass correction formula is valid.

Table 15. Tritium concentrations (pCi/L) in water samples, second quarter, 2024.

Sample Location	Sample Date	Tritium		
		Concentration		1 SD
Aquifer Samples				
Facility				
<i>Advanced Test Reactor Complex</i>				
USGS-065	04/09/24	1053	-	45
<i>Idaho Nuclear Technology and Engineering Center</i>				
USGS-052	04/02/24	309	-	35
USGS-067	04/02/24	1106	-	45
ICPP-2020	04/03/24	1298	-	50
ICPP-MON-A-230	04/03/24	771	-	45
USGS-047	04/03/24	126	-	35
<i>Radioactive Waste Management Complex</i>				
USGS-087	04/23/24	311	-	35
M15S	05/13/24	41	U	30
M1S	05/13/24	-7	U	30
M7S	05/13/24	314	-	35
A11A31	05/14/24	-3	U	30
M6S	05/14/24	53	U	30
<i>Test Area North</i>				
TAN-28	04/16/24	482	-	40
TAN-29	04/16/24	651	-	40
TAN-44	04/16/24	336	-	35
TAN 2271	04/18/24	275	-	35
TAN-2336	04/18/24	190	-	35
ANP-8	06/03/24	77	U	30
TAN-42	06/03/24	327	-	35
TAN-47	06/03/24	38	U	30
TAN-51	06/04/24	358	-	35
TAN-56	06/04/24	21	U	30
<i>Central Facilities Area</i>				
USGS-085	04/01/24	330	-	35
CFA 1	04/08/24	1898	-	55
ICPP-MON-A-166	04/09/24	-3	U	30
<i>Materials and Fuels Complex</i>				
USGS-100	04/08/24	-15	U	30
<i>Naval Reactors Facility</i>				
NRF-06	05/20/24	-7	U	30
NRF-09	05/22/24	10	U	30
NRF-11	05/22/24	24	U	30
NRF-12	05/22/24	27	U	30
Boundary				
Crossroads	04/11/24	-31	U	30
USGS-008	04/11/24	24	U	30
USGS-011	04/17/24	-61	U	30
USGS-124	04/17/24	-7	U	30
Atomic City	05/07/24	33	U	30
USGS-132	06/13/24	129	-	35
USGS-137A	06/17/24	54	U	35
USGS-105 (1072 ft bgs)	06/18/24	177	-	35
USGS-105 (952 ft bgs)	06/18/24	171	-	35
USGS-108	06/20/24	11	U	35
USGS-131A (616 ft bgs)	06/25/24	674	-	45
USGS-131A (812 ft bgs)	06/25/24	622	-	40
Middle-2051 (1091 ft bgs)	06/26/24	96	U	35
Middle-2051 (749 ft bgs)	06/26/24	121	-	35
USGS-103	06/27/24	43	U	35
Upgradient				

Sample Location	Sample Date	Tritium		
		Concentration		1 SD
USGS-018	04/08/24	8	U	30
P&W-2	04/10/24	-27	U	30
USGS-019	04/10/24	-7	U	30
USGS-027	04/10/24	-27	U	30
Mud Lake Water Supply	05/07/24	3	U	30
Distant				
Alpheus Spring	05/06/24	-13	U	30
Bill Jones Hatchery	05/06/24	-67	U	30
Clear Spring	05/06/24	13	U	30
Minidoka Water Supply	05/06/24	30	U	30
Shoshone Water supply	05/06/24	33	U	30
Other Samples				
Perched Groundwater				
<i>Advanced Test Reactor Complex</i>				
USGS-062	04/09/24	-47	U	30
USGS-068	04/09/24	147	-	30

Data qualifiers: U = undetected, J = estimate, R = rejected, "+" or "-" after a J means that the estimated result is biased high or low, respectively.

Bold concentrations are positive detections, greater than or equal to 3 SD.

Table 16. Low-level tritium concentrations (pCi/L) in water samples collected during 2024 and analyzed using the electrolytic enrichment method, second quarter, 2024.

Sample Location	Sample Date	Tritium		
		Concentration		1 SD
Aquifer Samples				
Facility				
<i>Radioactive Waste Management Complex</i>				
A11A31	05/14/24	62	-	3
<i>Central Facilities Area</i>				
ICPP-MON-A-166	04/09/24	18	-	2
<i>Materials and Fuels Complex</i>				
USGS-100	04/08/24	5	U	3
<i>Naval Reactor Facilities</i>				
NRF-09	05/22/24	8	-	2
Boundary				
Atomic City	05/07/24	0	U	2
USGS-124	04/17/24	25	-	3
Upgradient				
P&W2	04/10/24	4	U	3
USGS-018	04/08/24	-3	U	2
Other Samples				
Perched Groundwater				
<i>Advanced Test Reactor Complex</i>				
USGS-068	04/09/24	103	-	3
USGS-062	04/09/24	15	-	3

Data qualifiers: U = undetected, J = estimate, R = rejected, "+" or "-" after a J means that the estimated result is biased high or low, respectively.

Bold concentrations are positive detections, greater than or equal to 3 SD.

Table 17. Strontium-90 concentrations (pCi/L) in water samples, second quarter, 2024.

Sample Location	Sample Date	Strontium-90		
		Concentration		1 SD
Aquifer Samples				
Facility				
Advanced Test Reactor Complex				
USGS-065	4/09/24	0.10	U	0.10
Test Area North				
TAN 2271	4/18/24	242	-	10
TAN-2336	4/18/24	341	-	15
TAN-28	4/16/24	184	-	8
TAN-29	4/16/24	14	-	1
TAN-42	6/03/24	0.39	U	0.13
TAN-44	4/16/24	0.17	U	0.13
TAN-47	6/3/2024	0.11	U	0.09
Idaho Nuclear Technology and Engineering Center				
ICPP-2020	4/03/24	8.11	-	0.50
ICPP-MON-A-230	4/03/24	1.95	-	0.22
USGS-047	4/03/24	11.4	-	0.6
USGS-052	4/02/24	2.53	-	0.28
USGS-067	4/02/24	9.84	-	0.56
Central Facilities Area				
CFA 1	4/08/24	0.34	U	0.12
USGS-085	4/01/24	2.12	-	0.24
Radioactive Waste Management Complex				
M1S	5/13/24	0.08	U	0.08
M6S	5/14/24	0.17	U	0.08
USGS-087	4/23/24	-0.15	U	0.08
Other Samples				
Perched Groundwater				
Advanced Test Reactor Complex				
USGS-062	4/09/24	0.34	U	0.15
USGS-068	4/09/24	7.55	-	0.42

Data qualifiers: U = undetected, J = estimate, R = rejected, "+" or "-" after a J means that the estimated result is biased high or low, respectively.

Bold concentrations are positive detections, greater than or equal to 3 SD.

Table 18. Technetium-99 concentrations (pCi/L) in water samples, second quarter, 2024.

Sample Location	Sample Date	Technetium-99		
		Concentration		1 SD
Aquifer Samples				
Facility				
<i>Central Facilities Area</i>				
CFA 1	04/08/24	6.62	-	0.48
ICPP-MON-A-166	04/09/24	0.90	U	0.29
USGS-085	04/01/24	0.22	U	0.29
<i>Radioactive Waste Management Complex</i>				
USGS-087	04/23/24	0.46	U	0.25
M6S	05/14/24	-0.37	U	0.30
M1S	05/13/24	-0.69	U	0.26
<i>Test Area North</i>				
TAN-47	06/03/24	-0.38	U	0.25
<i>Idaho Nuclear Technology and Engineering Center</i>				
ICPP-MON-A-230	04/03/24	1350	-	65
USGS-052	04/02/24	341	-	17
ICPP-2020	04/03/24	252	-	12
USGS-047	4/03/24	0.11	U	0.30
USGS-067	04/02/24	84.9	-	4.2
Boundary				
USGS-131A (812 ft bgs)	06/25/24	0.82	U	0.33
USGS-131A (616 ft bgs)	06/25/24	0.19	U	0.36

Data qualifiers: U = undetected, J = estimate, R = rejected, "+" or "-" after a J means that the estimated result is biased high or low, respectively.

Bold concentrations are positive detections, greater than or equal to 3 SD.

Table 19. Plutonium isotope concentrations (pCi/L) in water samples, second quarter, 2024.

Sample Location	Sample Date	Plutonium-238		Plutonium-239/240	
		Concentration	1 SD	Concentration	1 SD
Aquifer Samples					
Facility					
<i>Test Area North</i>					
TAN-47	06/03/24	0.000	U	0.003	0.000

Data qualifiers: U = undetected, J = estimate, R = rejected, "+" or "-" after a J means that the estimated result is biased high or low, respectively. **Bold** concentrations are positive detections, greater than or equal to 3 SD.

Table 20. Uranium isotope concentrations (pCi/L) in water samples, second quarter, 2024.

Sample Location	Sample Date	Uranium-234		Uranium-235		Uranium-238	
		Concentration	1 SD	Concentration	1 SD	Concentration	1 SD
Aquifer Samples							
Facility							
<i>Test Area North</i>							
TAN-29	04/16/24	5.25	-	0.26	0.161	-	0.031
TAN-28	04/16/24	5.26	-	0.31	0.255	-	0.054
TAN-2336	04/18/24	1.89	-	0.51	0.337	U	0.195
TAN-47	06/03/24	1.02	-	0.08	0.0193	U	0.0097
TAN-42	06/03/24	1.71	-	0.09	0.0334	-	0.0100

Data qualifiers: U = undetected, J = estimate, R = rejected, "+" or "-" after a J means that the estimated result is biased high or low, respectively.

Bold concentrations are positive detections, greater than or equal to 3 SD.

Table 21. Common ion concentrations (mg/L) in water samples, second quarter, 2024.

Sample Location	Sample Date	Calcium*	Magnesium*	Sodium*	Potassium*	Chloride	Sulfate	Alkalinity†							
Aquifer Samples															
Facility															
<i>Idaho Nuclear Technology and Engineering Center</i>															
USGS-052	04/02/24	-	-	-	-	-	-	19.7	-	23.0	-	141	-		
USGS-067	04/02/24	-	-	-	-	-	-	33.4 ¹	-	25.2	-	134	-		
ICPP-2020	04/03/24	-	-	-	-	-	-	57.8 ²	-	33.5	-	135	-		
ICPP-MON-A-230	04/03/24	-	-	-	-	-	-	66.8 ²	-	33.6	-	129	-		
USGS-047	04/03/24	-	-	-	-	-	-	12.8	-	21.5	-	144	-		
<i>Advanced Test Reactor Complex</i>															
USGS-065	04/09/24	-	-	-	-	-	-	18.2	-	134 ²	-	131	-		
<i>Test Area North</i>															
TAN-28	04/16/24	97	-	45	-	91	-	6.0	-	95.3 ²	-	27.7	-	456	-
TAN-29	04/16/24	68	-	20	-	49	-	5.0	-	77.9 ²	-	37.8	-	213	-
TAN-44	04/16/24	61	-	17	-	22	-	3.2	-	58.3 ²	-	35.2	-	152	-
TAN 2271	04/18/24	57	-	49	-	100	-	7.8	-	102 ²	-	37.9	-	431	-
TAN-2336	04/18/24	45 ¹	-	120 ¹	-	5900 ¹	-	32 ¹	-	106 ⁴	-	3.99 ⁴	UJ	1050	-
ANP-8	06/03/24	45	-	15	-	7.2	-	3.1	-	17.0	-	32.1	-	136	-
TAN-42	06/03/24	55	-	15	-	16	-	2.7	-	34.6 ¹	-	32.9	-	158	-
TAN-47	06/03/24	32	-	13	-	5.9	-	2.9	-	12.3	-	20.2	-	114	-
TAN-51	06/04/24	52	-	15	-	7.2	-	3.0	-	34.3 ¹	-	31.0	-	131	-
TAN-56	06/04/24	-	-	-	-	-	-	-	-	11.8	-	29.6	-	134	-
<i>Central Facilities Area</i>															
USGS-085	04/01/24	-	-	-	-	-	-	-	-	12.3	-	39.8	-	152	-
CFA 1	04/08/24	-	-	-	-	-	-	-	-	60.2 ²	-	28.8	-	132	-
ICPP-MON-A-166	04/09/24	-	-	-	-	-	-	-	-	20.7	-	20.0	-	118	-
<i>Naval Reactors Facility</i>															
NRF-06	05/20/24	-	-	-	-	-	-	-	-	433 ⁴	-	76.4 ⁴	-	162	-
NRF-09	05/22/24	-	-	-	-	-	-	-	-	55.3 ¹	-	39.0 ¹	-	192	-
NRF-11	05/22/24	-	-	-	-	-	-	-	-	39.5 ¹	-	35.7 ¹	-	194	-
NRF-12	05/22/24	-	-	-	-	-	-	-	-	37.3 ¹	-	36.5 ¹	-	194	-
<i>Radioactive Waste Management Complex</i>															
USGS-087	04/23/24	-	-	-	-	-	-	-	-	20.9	-	24.4	-	121	-
M15S	05/13/24	-	-	-	-	-	-	-	-	75.8 ²	-	41.9	-	89.9	-
M1S	05/13/24	-	-	-	-	-	-	-	-	12.7	-	21.3	-	94.9	-
M7S	05/13/24	-	-	-	-	-	-	-	-	13.9	-	24.5	-	139	-
A11A31	05/14/24	-	-	-	-	-	-	-	-	28.3	-	47.3	-	130	-
M6S	05/14/24	-	-	-	-	-	-	-	-	24.6	-	53.6	-	100	-
<i>Materials and Fuels Complex</i>															
USGS-100	04/08/24	-	-	-	-	-	-	-	-	14.6	-	16.6	-	130	-
Boundary															
Crossroads	04/11/24	-	-	-	-	-	-	-	-	10.5	-	21.4	-	141	-
USGS-008	04/11/24	-	-	-	-	-	-	-	-	7.36	-	21.3	-	152	-
USGS-011	04/17/24	-	-	-	-	-	-	-	-	9.52	-	23.0	-	138	-
USGS-124	04/17/24	-	-	-	-	-	-	-	-	17.4	-	24.6	-	139	-
Atomic City	05/07/24	-	-	-	-	-	-	-	-	16.3	-	17.0	-	133	-
USGS-132	06/13/24	-	-	-	-	-	-	-	-	11.0	-	24.3	-	146	-
USGS-137A	06/17/24	-	-	-	-	-	-	-	-	12.3	-	25.4	-	145	-
USGS-105 (1072 ft bgs)	06/18/24	-	-	-	-	-	-	-	-	13.2	-	24.8	-	144	-
USGS-105 (952 ft bgs)	06/18/24	-	-	-	-	-	-	-	-	13.2	-	24.3	-	148	-
USGS-108	06/20/24	-	-	-	-	-	-	-	-	17.7	-	25.5	-	154	-
USGS-131A (616 ft bgs)	06/25/24	-	-	-	-	-	-	-	-	18.3	-	24.2	-	136	-
USGS-131A (812 ft bgs)	06/25/24	-	-	-	-	-	-	-	-	22.8	-	27.5	-	149	-

Sample Location	Sample Date	Calcium*		Magnesium*		Sodium*		Potassium*		Chloride		Sulfate		Alkalinity†	
Middle-2051 (1091 ft bgs)	06/26/24	-	-	-	-	-	-	-	-	11.8	-	23.4	-	147	-
Middle-2051 (749 ft bgs)	06/26/24	-	-	-	-	-	-	-	-	11.1	-	25.2	-	149	-
USGS-103	06/27/24	-	-	-	-	-	-	-	-	14.8	-	23.1	-	139	-
Upgradient															
USGS-018	04/08/24	-	-	-	-	-	-	-	-	11.1	-	25.4	-	134	-
P&W-2	04/10/24	-	-	-	-	-	-	-	-	5.92	-	24.9	-	146	-
USGS-019	04/10/24	-	-	-	-	-	-	-	-	12.7	-	23.2	-	162	-
USGS-027	04/10/24	-	-	-	-	-	-	-	-	42.6 ¹	-	37.0	-	156	-
Other Samples															
Perched Groundwater															
<i>Advanced Test Reactor Complex</i>															
USGS-062	04/09/24	60	-	19	-	12	-	3.1	-	14.4	-	76.7 ¹	-	156	-
USGS-068	04/09/24	-	-	-	-	-	-	-	-	66.2 ³	-	328 ³	-	195	-

Data qualifiers: U = undetected, J = estimate, R = rejected, "<" = less than detection limit, "+" or "-" after a J means that the estimated result is biased high or low, respectively.

† As CaCO₃.

"-" = not analyzed.

Note 1. Lab indicated that a 20:1 dilution of this sample was required for this analyte. Note 2. Lab indicated that a 5:1 dilution of this sample was required for this analyte. Note 3. Lab indicated that a 2:1 dilution of this sample was required for this analyte. Note 4. Lab indicated that a 50:1 dilution of this sample was required for this analyte.

Table 22. Dissolved metals concentrations (µg/L) in water samples, second quarter, 2024.

Sample Location	Sample Date	Arsenic	Barium	Chromium	Iron	Lead	Manganese
Aquifer Samples							
Facility							
<i>Advanced Test Reactor Complex</i>							
USGS-065	04/09/24	-	-	-	88	-	-
<i>Idaho Nuclear Technology and Engineering Center</i>							
ICPP-MON-A-230	04/03/24	-	-	-	5.3	-	-
ICPP-2020	04/03/24	-	-	-	7.0	-	-
USGS-047	04/03/24	-	-	-	7.3	-	-
USGS-067	04/02/24	-	-	-	6.6	-	-
USGS-052	04/02/24	-	-	-	7.0	-	-
<i>Radioactive Waste Management Complex</i>							
USGS-087	04/23/24	-	-	-	7.1	-	-
M1S	05/13/24	-	-	-	35	-	-
M6S	05/14/24	-	-	-	25	-	-
M15S	05/13/24	-	-	-	95	-	-
A11A31	05/14/24	-	-	-	13	-	-
M7S	05/13/24	-	-	-	11	-	-
<i>Test Area North</i>							
TAN-2336	04/18/24	<50 ³	UJ	1700 ¹	-	320 ³	-
TAN-2271	04/18/24	<2	UJ	560 ¹	-	1.4	-
TAN-28	04/16/24	<2	UJ	420 ²	-	2.7	-
TAN-29	04/16/24	<2	UJ	200 ¹	-	1.0	-
TAN-42	06/03/24	2.2	-	150	-	5.1	J
TAN-44	04/16/24	2.1	-	160	-	4.1	-
TAN-47	06/03/24	-	-	-	-	5.3	J
TAN-51	06/04/24	<2	UJ	89	-	5.1	J
TAN-56	06/04/24	-	-	-	-	3.7	-
ANP-8	06/03/24	<2	UJ	81	-	3.7	J
<i>Central Facilities Area</i>							
USGS-085	04/01/24	-	-	-	-	18	-
CFA 1	04/08/24	-	-	-	-	10	-
ICPP-MON-A-166	04/09/24	-	-	-	-	4.0	-

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Sample Location	Sample Date	Arsenic	Barium	Chromium	Iron	Lead	Manganese
Materials and Fuels Complex							
USGS-100	04/08/24	-	-	-	2.9	-	-
Naval Reactors Facility							
NRF-06	05/20/24	-	-	-	75	-	-
NRF-09	05/22/24	-	-	-	13	-	-
NRF-11	05/22/24	-	-	-	13	-	-
NRF-12	05/22/24	-	-	-	10	-	-
Boundary							
Crossroads	04/11/24	-	-	-	4.1	-	-
USGS-008	04/11/24	-	-	-	2.9	-	-
USGS-011	04/17/24	-	-	-	4.1	-	-
USGS-124	04/17/24	-	-	-	5.6	-	-
Atomic City	05/07/24	-	-	-	2.6	-	-
USGS-132	06/13/24	-	-	-	8.0	-	-
USGS-137A	06/17/24	-	-	-	7.6	-	-
USGS-105 (1072 ft bgs)	06/18/24	-	-	-	8.8	-	-
USGS-105 (952 ft bgs)	06/18/24	-	-	-	8.4	-	-
USGS-108	06/20/24	-	-	-	6.9	-	-
USGS-131A (616 ft bgs)	06/25/24	-	-	-	11	-	-
USGS-131A (812 ft bgs)	06/25/24	-	-	-	10	-	-
Middle-2051 (1091 ft bgs)	06/26/24	-	-	-	7.0	-	-
Middle-2051 (749 ft bgs)	06/26/24	-	-	-	7.1	-	-
USGS-103	06/27/24	-	-	-	6.6	-	-
Upgradient							
USGS-018	04/08/24	-	-	-	3.0	-	-
P&W-2	04/10/24	-	-	-	1.3	-	-
USGS-019	04/10/24	-	-	-	2.0	-	-
USGS-027	04/10/24	-	-	-	5.1	-	-
Other Samples							
Perched Groundwater							
Advanced Test Reactor Complex							
USGS-062	04/09/24	11	-	-	16	-	-
USGS-068	04/09/24	-	-	-	42	-	-

Note 1. Lab indicated that a 10:1 dilution of this sample was required for this analyte. Note 2. Lab indicated that a 20:1 dilution of this sample was required for this analyte. Note 3. Lab indicated that a 5:1 dilution of this sample was required for this analyte.

Table 23. Dissolved nutrient concentrations (mg/L) in water samples, second quarter, 2024.

Sample Location	Sample Date	Nitrate + Nitrite*	Total Phosphorus		
Aquifer Samples					
Facility					
<i>Advanced Test Reactor Complex</i>					
USGS-065	04/09/24	1.4	-	-	-
<i>Idaho Nuclear Technology and Engineering Center</i>					
ICPP-2020	04/03/24	5.3 ³	-	-	-
ICPP-MON-A-230	04/03/24	7.1 ³	-	-	-
USGS-047	04/03/24	1.4 ¹	-	-	-
USGS-052	04/02/24	2.0 ¹	-	-	-
USGS-067	04/02/24	4.9 ³	-	-	-
<i>Radioactive Waste Management Complex</i>					
USGS-087	04/23/24	0.65	-	-	-
M1S	05/13/24	1.0	-	-	-
M6S	05/14/24	1.7	-	-	-
M15S	05/13/24	1.5	-	-	-
A11A31	05/14/24	0.95	-	-	-
M7S	05/13/24	0.81 ⁵	-	-	-
<i>Test Area North</i>					
TAN-2336	04/18/24	0.34	-	38 ⁶	-
TAN-2271	04/18/24	<0.01	UJ	-	-
TAN-28	04/16/24	<0.01	U	-	-
TAN-29	04/16/24	2.6 ¹	-	-	-
TAN-42	06/03/24	1.3 ¹	-	0.04	-
TAN-44	04/16/24	2.0 ¹	-	-	-
TAN-47	06/03/24	0.7	-	-	-
TAN-56	06/04/24	0.77	-	-	-
TAN-51	06/04/24	1.2	-	-	-
ANP-8	06/03/24	0.98	-	-	-
<i>Central Facilities Area</i>					
USGS-085	04/01/24	0.98	-	-	-
CFA 1	04/08/24	2.3 ¹	-	-	-
ICPP-MON-A-166	04/09/24	0.34	-	-	-
<i>Materials and Fuels Complex</i>					
USGS-100	04/08/24	2.4 ¹	-	-	-
<i>Naval Reactors Facility</i>					
NRF-06	05/20/24	2.2 ¹	-	-	-
NRF-09	05/22/24	3.2 ¹	-	-	-
NRF-11	05/22/24	2.4 ²	-	-	-
NRF-12	05/22/24	2.3 ¹	-	-	-
Boundary					
Crossroads	04/11/24	0.74	-	-	-
USGS-008	04/11/24	1.0	-	-	-
USGS-011	04/17/24	0.74	-	-	-
USGS-124	04/17/24	0.86 ¹	-	-	-
Middle-2051 (749 ft bgs)	06/26/24	0.87	-	-	-
Middle-2051 (1091 ft bgs)	06/26/24	0.94	-	-	-
Atomic City	05/07/24	1.8 ¹	-	-	-
USGS-137A (747 ft bgs)	06/17/24	0.73	-	-	-
USGS-132 (765 ft bgs)	06/13/24	0.77	-	-	-
USGS-103 (1258 ft bgs)	06/27/24	0.85	-	-	-
USGS-131A (616 ft bgs)	06/25/24	1.2	-	-	-
USGS-131A (812 ft bgs)	06/25/24	1.0	-	-	-
USGS-105 (952 ft bgs)	06/18/24	0.86	-	-	-
USGS-105 (1075 ft bgs)	06/18/24	0.81	-	-	-
USGS-108 (1172 ft bgs)	06/20/24	1.1 ¹	-	-	-
Upgradient					
USGS-027	04/10/24	2.5 ¹	-	-	-

Sample Location	Sample Date	Nitrate + Nitrite*		Total Phosphorus	
P&W-2	04/10/24	0.53	-	-	-
USGS-019	04/10/24	1.2	-	-	-
USGS-018	04/08/24	0.64	-	-	-
Other Samples					
Perched Groundwater					
Advanced Test Reactor Complex					
USGS-068	04/09/24	8.6 ⁴	-	-	-
USGS-062	04/09/24	1.2	-	-	-

Data qualifiers: U = undetected, J = estimate, R = rejected. "<" = less than detection limit, "+" or "-" after a J means that the estimated result is biased high or low, respectively. ft bgs = feet below ground surface.

* As N.

"-" = not analyzed.

Note 1. Lab indicated that a 2:1 dilution of this sample was required for this analyte. Note 2. Lab indicated that a 4:1 dilution of this sample was required for this analyte. Note 3. Lab indicated that a 5:1 dilution of this sample was required for this analyte. Note 4. Lab indicated that a 10:1 dilution of this sample was required for this analyte. Note 5. Lab indicated that a 20:1 dilution of this sample was required for this analyte. Note 6. Lab indicated that a 100:1 dilution of this sample was required for this analyte.

Table 24. Volatile organic compound concentrations (µg/L) in water samples, second quarter, 2024. Only VOCs detected this quarter or in the recent past are shown.

Sample Location	Sample Date	PCE		TCE		1,1-DCE		cis-1,2-DCE		trans-1,2-DCE		Vinyl Chloride		1,1,1 TCA		2-Hexanone	
Aquifer Samples																	
Facility																	
Radioactive Waste Management Complex																	
USGS-087	04/23/24	<0.5	U	1.02	-	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U
M1S	05/13/24	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U
M6S	05/14/24	<0.5	U	0.82	-	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U
M15S	05/13/24	0.47	UJ	3.87	-	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U
A11A31	05/14/24	<0.5	U	1.5	-	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U
M7S	05/13/24	0.46	UJ	2.42	-	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U
Test Area North																	
TAN-2336	04/18/24	<0.5 ¹	U	<0.5 ¹	U	<0.5 ¹	U	<0.5 ¹	U	<0.5 ¹	U	<0.5 ¹	U	<0.5 ¹	U	32.1 ¹	-
TAN-2271	04/18/24	<0.5	U	0.63	-	<0.5	U	1.41	-	54.5 ¹	-	1.82	-	<0.5	U	<0.5	U
TAN-28	04/16/24	<0.5	U	1.67	-	<0.5	U	2.2	-	53.3 ¹	-	1.99	-	<0.5	U	<0.5	U
TAN-29	04/16/24	15.5	-	326 ³	-	0.58	-	28.0	-	6.56	-	0.56	-	<0.5	U	<0.5	U
TAN-42	06/03/24	11.2	-	124 ¹	-	0.70	-	3.62	-	0.74	-	<0.5	U	0.22	UJ	<0.5	U
TAN-44	04/16/24	2.15	-	17.8	-	<0.5	U	0.57	-	0.21	UJ	<0.5	U	<0.5	U	<0.5	U
TAN-47	06/03/24	4.34	-	19.6	-	<0.5	U	0.29	UJ	<0.5	U	<0.5	U	<0.5	U	<0.5	U
TAN-51	06/04/24	23.6	-	242 ²	-	0.61	-	4.04	-	1.55	-	<0.5	U	<0.5	U	<0.5	U
TAN-56	06/04/24	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U
ANP-8	06/03/24	3.07	-	18.9	-	<0.5	U	0.41	UJ	<0.5	U	<0.5	U	<0.5	U	<0.5	U

Table 24 cont. Volatile organic compound concentrations (µg/L) in water samples, second quarter, 2024. Only VOCs detected this quarter or in the recent past are shown.

Sample Location	Sample Date	Carbon Tetrachloride	Chloroform	Methylene Chloride	Chloroethane	1,1-DCA	Carbon Disulfide	Methyl Ethyl Ketone
Radioactive Waste Management Complex								
USGS-087	04/23/24	3.58	-	0.31	UJ	<0.5	U	<10
M1S	05/13/24	<0.5	U	<0.5	U	<0.5	U	<10
M6S	05/14/24	2.67	-	0.35	UJ	<0.5	U	<10
M15S	05/13/24	6.01	-	2.33	-	<0.5	U	<10
A11A31	05/14/24	3.26	-	0.72	-	<0.5	U	<10
M7S	05/13/24	4.20	-	1.03	-	<0.5	U	<10
Test Area North								
TAN-2336	04/18/24	<0.5 ¹	U	<0.5 ¹	U	<0.5 ¹	U	1790 ¹
TAN-2271	04/18/24	<0.5	U	<0.5	U	<0.5	U	<10
TAN-28	04/16/24	<0.5	U	<0.5	U	0.49	UJ	<10
TAN-29	04/16/24	<0.5	U	0.29	UJ	<0.5	U	<10
TAN-42	06/03/24	<0.5	U	0.29	UJ	1.78	-	<10
TAN-44	04/16/24	<0.5	U	<0.5	U	<0.5	U	<10
TAN-47	06/03/24	<0.5	U	<0.5	U	3.18	-	<10
TAN-51	06/04/24	<0.5	U	0.44	UJ	<0.5	U	<10
TAN-56	06/04/24	<0.5	U	<0.5	U	<0.5	U	<10
ANP-8	06/03/24	<0.5	U	<0.5	U	1.93	-	<10

Abbreviations: PCE = tetrachloroethene; TCE = trichloroethene; 1,1-DCE = 1,1-dichloroethene; cis-1,2-DCE = cis-1,2-dichloroethene; trans-1,2-DCE = trans-1,2-dichloroethene; 1,1-DCA = 1,1-dichloroethane; 1,1,1 TCA = 1,1,1-trichloroethane.

Data qualifiers: U = undetected, J = estimate, R = rejected, "<" = less than detection limit, "+" or "-" after a J means that the estimated result is biased high or low, respectively.

Note 1. Lab indicated that a 5:1 dilution of this sample was required for this analyte. Note 2. Lab indicated that a 10:1 dilution of this sample was required for this analyte. Note 3. Lab indicated that a 20:1 dilution of this sample was required for this analyte.

Terrestrial Monitoring Results

The DEQ-INL OP conducts terrestrial (soil and milk) monitoring to characterize deposition and migration of contaminants and provide independent verification of DOE’s terrestrial monitoring programs. Physical soil sampling and *in-situ* gamma spectrometry are used to characterize actual deposition and accumulation of radioactive contaminants in soils. No *in-situ* gamma spectroscopic measurements of soil were performed during the second calendar quarter of 2024, and no physical soil samples were collected during the quarter. Milk samples are collected to evaluate the potential for ingestion of radioactivity by the population around the INL. Eleven milk samples were analyzed during the quarter.

Milk

DEQ-INL OP monitors milk for the naturally occurring radionuclide potassium-40 (⁴⁰K) and man-made iodine-131 (¹³¹I). Milk samples are collected on a monthly basis. Results for analyses of milk samples are presented in **Table 25**. ⁴⁰K was detected in all samples within the expected range of concentration. ¹³¹I was not detected. Based on measurements of radionuclides in milk, there were no discernable impacts to the off-site environment from INL operations.

Table 25. Gamma spectrometry analysis data for milk samples, second quarter, 2024.

Sample Location/Dairy	Sample Date	Naturally occurring Potassium-40		Man-made Iodine-131		
		Concentration ²	1 SD	Concentration ²		1 SD
Monitoring Samples						
Gooding	04/18/24	1293	53	-1.1	U	0.6
Gooding	05/29/24	1352	57	1.1	U	1.0
Gooding	06/19/24	1346	56	0.4	U	0.8
Montevieu	05/02/24	1558	64	-0.1	U	1.8
Montevieu	05/23/24	1400	57	-1.5	U	1.4
Montevieu	06/20/24	1439	61	-1.0	U	1.1
Ucon	05/25/24	1567	62	0.4	U	0.9
Ucon	06/08/24	1514	63	0.9	U	1.1
Verification Samples¹						
Minidoka	04/15/24	1379	56	0.9	U	1.0
Rigby	05/21/24	1558	64	-0.1	U	1.3
Dietrich	06/17/24	1346	26	-1.0	U	1.0

¹ DEQ-INL OP samples collected by the off-site INL environmental surveillance contractor.

² Concentrations with associated uncertainties (1 SD) are expressed in pCi/L. **Bold** concentrations are positive detections, greater than or equal to 3 SD.

Data qualifiers: U = undetected, J = estimate, R = rejected, “+” or “-” after a J means that the estimated result is biased high or low, respectively.

Quality Assurance

Measurements of constituent concentrations in environmental media are subject to inaccuracy from errors that may be introduced during the collection, transportation, and analysis of samples, calibration of equipment, and recording and reporting of results. While it is impossible to quantify every error that may affect a result, a quality assurance (QA) program can evaluate the overall quality of a dataset and, in many cases, identify and address errors or inaccuracies. DEQ-INL OP's QA program is designed to (1) ensure sample integrity, (2) evaluate the precision and accuracy of analytical results, and (3) ensure that the environmental data are representative and complete.

This section summarizes the quality assurance assessment of the data collected by DEQ-INL OP in the second quarter of 2024. Included are the results of quality control (QC) samples (blanks, duplicates, and spikes) that DEQ-INL OP submitted to Idaho State University's Environmental Monitoring Laboratory (ISU-EML) for radiological analyses and to the Idaho Bureau of Laboratories-Boise (IBL) for non-radiological analyses during the quarter. The analytical results of QC samples are used to assess the precision, accuracy, and representativeness of the environmental data presented in this report. During the second quarter of 2024, DEQ-INL OP submitted 141 QC samples for various radiological and non-radiological analyses (**Table 26**).

All samples referenced in this report were collected in accordance with written procedures maintained by the DEQ-INL OP. Analytical methods and QC procedures used by the laboratories were performed in accordance with approved written procedures maintained by each lab. QC samples analyzed by the labs as part of each lab's internal QA program are not discussed in this report.

Blank Samples

Blank samples consist of matrices that contain immeasurable or acceptably low concentrations of the analyte(s) of interest. They are used to monitor contamination introduced during sample collection, storage, shipment, and analysis. For water matrices other than tritium, a blank sample consists of 18-megaohm deionized water from the DEQ-Idaho Falls Regional office. Mud Lake Well #2 serves as the water source for tritium analysis blanks, notable for its low atmospheric recharge, which results in tritium concentrations below detectable levels.

A blank sample is categorized as a field blank, equipment blank, or trip blank depending on how the blank is handled. A field blank is used to monitor for contamination introduced from the environment during sample collection, an equipment blank is used to monitor for contamination introduced by contaminated equipment, and a trip blank is used to monitor for contamination introduced during transportation of samples (trip blanks are typically only used for VOCs). Also, method blanks for airborne tritium are used to monitor for contamination introduced during processing of molecular sieve sample material. Most water blank samples submitted to laboratories by DEQ-INL OP are field blanks.

For all analyses a blank sample result is considered acceptable if it is less than or equal to three standard deviations (3 SD) of the result. If a blank result exceeds acceptance criteria, detected results in other samples collected, transported, or analyzed together with the failed blank may be qualified as biased high (J+) or rejected (R), or may remain unqualified, depending on the relative sizes of the blank detection and other sample results.

Sample results for blank 47-mm TSP filters submitted for gross alpha and gross beta screening in air for the second quarter of 2024 are presented in **Table 27**. The blank filter gross alpha result was equal to 3 SD for the weeks of 4/25 - 5/02/24 and 6/20 - 6/27/24. Associated gross alpha results for those weeks are qualified as biased-high estimates (J+). The blank filter gross beta result was greater than or equal to 3 SD for the weeks of 3/28 - 4/4, 4/18 - 4/25, 4/25 - 5/02, 5/02 - 5/09, 5/16 - 5/23, 5/23 - 5/30, 5/30 - 6/06,

6/13 – 6/20, and 6/20 – 6/27/24. Associated gross beta results for those weeks are significantly higher than the blank exceedances and are therefore not qualified.

Blank sample results for selected gamma emitters in air from 47-mm TSP filter quarterly composites and 8x10-inch monthly composites from second quarter 2024 are presented in **Table 28**. Blank sample results for radiochemical analysis of 8x10-inch TSP filter quarterly composites from first quarter 2024 are presented in **Table 29**. All blanks for composites met acceptance criteria.

Method blank and control sample analysis results used to assess data quality for tritium in water vapor in air are presented in **Table 30**. Method blanks are prepared by vaporizing tritium-free water and passing the air-vapor mixture through molecular sieve columns. The molecular sieve material is then processed identically to the field samples. Control samples are used to determine if tritium contamination is introduced into the samples from areas used for processing field samples and storage of the processed water. The tritium method blank result for 6/3 – 6/5/24 was equal to 3 SD, minimally exceeding acceptance criteria for the second quarter 2024. One other blank and a control sample analyzed on the same day met acceptance criteria. Therefore, associated field sample results were not qualified.

Blank sample results for radiological constituents in water are presented in **Table 31**. Blank sample results for metals in water are presented in **Table 32**. Blank sample results for common ions and nutrients in water are presented in **Table 33**. Blank sample results for VOCs in water are presented in **Table 34**. All blank sample results for water met acceptance criteria for second quarter 2024.

Duplicate Samples

A duplicate sample is one that is collected at the same location and approximately the same time as another sample (referred to as the “original” sample). Duplicate sample results are compared to the original sample’s results to evaluate reproducibility. Significant differences between the two could indicate poor analytical precision or a non-uniform sample matrix.

The difference between the results of an original and duplicate sample (referred to below as a “duplicate-sample pair”) is evaluated differently for radiological and non-radiological analyses. For radiological analyses, the results of a duplicate-sample pair are considered to be in agreement if their absolute difference is less than or equal to three times the pooled error of the results:

$$|R_1 - R_2| \leq 3\sqrt{SD_1^2 + SD_2^2}$$

R_1 = Original sample result

R_2 = Duplicate sample result

SD_1 = Analytical uncertainty (1 sample standard deviation) of the original result

SD_2 = Analytical uncertainty (1 sample standard deviation) of the duplicate result

Duplicate radiological results are also considered to be in agreement if their relative percent difference (RPD) is no more than ± 20 percent. RPD is calculated as:

$$RPD = \frac{R_1 - R_2}{(R_1 + R_2)/2} \times 100$$

For non-radiological analyses, the RPD is used to evaluate duplicate sample pairs in which both results exceed five times the reporting detection limit (RDL). An RPD of up to ± 20 percent is acceptable. If one or both sample results are less than five times the RDL, the results agree if their absolute difference is less than or equal to the RDL.

Duplicate sample results for selected gamma emitters in air from 8x10-inch monthly TSP filter composites from the Idaho Falls monitoring location are presented in **Table 35**. Duplicate sample results

for radiochemical analysis of 8x10-inch TSP filter quarterly composites from first quarter 2024, from the Idaho Falls monitoring location, are presented in **Table 36**. All TSP filter duplicate sample results met acceptance criteria for the second quarter 2024.

Duplicate results for quarterly average EcoGamma readings from the Big Southern Butte monitoring location are presented in **Table 37**. These duplicate sample results met acceptance criteria for the second quarter 2024.

Duplicate results for radiological analyses in groundwater and surface water are presented in **Table 38**. Duplicate results for metals, common ions and nutrients, and VOCs in groundwater are presented in **Tables 39, 40, and 41**. The ANP-8 duplicate results for chromium and iron did not meet acceptance criteria. The original ANP-8 chromium and iron results and associated sample results from TAN-42, TAN-47, and TAN-51 are qualified as estimates (J). All other duplicate water sample results met acceptance criteria for the second quarter 2024.

Spiked Samples

Spiked samples are samples to which known concentrations of specific analytes have been added. They are used to assess a laboratory's analytical accuracy. The percent recovery (%R) of each spiked-sample analysis is calculated as the ratio of the spike concentration determined by the lab to the known spike concentration. DEQ-INL OP considers the lab's result to be in control if the percent recovery is $100 \pm 25\%$. If the percent recovery of a spiked sample is 50-74%, detected results of samples analyzed in the same batch as the spiked sample may be qualified as low-biased estimates (J-), and undetected results may be qualified as undetected estimates (UJ). If the percent recovery of a spiked sample is 126-150%, detected results of associated samples may be qualified as high-biased estimates (J+), and undetected results may be qualified as undetected (U). If the percent recovery of a spiked sample is $<50\%$ or $>150\%$, the results of all associated samples may be qualified as rejected (R), except for undetected sample results associated with a spiked-sample analysis having a percent recovery $>150\%$, in which case the sample result remains qualified as undetected (U).

Spiked water samples were analyzed for metals, common ions and nutrients, and VOCs (**Tables 42, 43, and 44**). All spiked sample results were within control limits.

DEQ-INL OP also prepares additional "spike-like" quality control samples to assess ambient radiation measurement bias. Once per quarter, DEQ-INL OP irradiates several electret ionization chambers (EICs) at ISU to verify EIC response. Irradiations of EICs are conducted in a repeatable geometry to a known exposure of near 30 mR and two additional higher and lower exposures, ranging from 15 to 60 mR. EIC responses are compared directly with the exposure received from the NIST traceable cesium-137 source provided by ISU-EML. EIC response is considered acceptable if each measurement has a percent recovery of $100 \pm 25\%$ when compared to the known irradiated quantity. Overall response for each control set is considered acceptable if the average of the three individual results for the set has a percent recovery of $100 \pm 25\%$. Real-time pressure correction is used to calculate the net exposure measured by these EIC control sets. The ISU irradiation results for the second quarter 2024 are presented in **Table 45**. All individual EIC results and all EIC control set averages passed the DEQ-INL OP acceptance criterion.

Laboratory QC Issues

There were no laboratory QC issues in the second quarter of 2024.

DEQ-INL OP Equipment QC Issues

There were no DEQ-INL OP equipment QC issues in the second quarter of 2024.

Qualification of Low-Level Sample Results

Starting in the first quarter of 2024, INL-OP changed the methods used for qualifying and reporting sample results. These changes apply primarily to low-level results. The changes listed below bring INL-OP's qualification and reporting conventions in line with the INL contractors' methods.

For radiological results, the minimum detectable concentration (MDC) is no longer used as the criterion above which the result is considered a positive detection. The following criteria are used instead^{7,8,9}:

4. Results greater or equal to 3 SD are reported as positive detections, where SD is the sample standard deviation.
5. Results less than 3 SD are reported as non-detections (U qualifier).
6. Field sample results are reported together with the 1-SD value.

For non-radiological results, the qualification and reporting conventions followed by the sample analysis contractor, Idaho Bureau of Laboratories (IBL), are used. With each result, the IBL reports both the Method Detection Limit¹⁰ (MDL) and the higher Reporting Detection Limit¹¹ (RDL).

4. Results greater than MDL and greater than RDL are reported as positive detections.
5. Results greater than MDL but less than RDL are reported as detected estimates (J qualifier) with greater associated uncertainty.
7. Results less than MDL are non-detections and reported as less than (RDL value).

Analytical QA/QC Assessment

Other than those discussed above, no issues involving sample chain of custody, sample holding times, and the analysis of blank, duplicate, and spiked samples were observed during the second quarter of 2024 which significantly affected data quality. The ratio of total QC analyses to total field sample analyses of 14.1% is above the DEQ-INL OP minimum requirement of 10%. Methodologies and data reports issued by the contracting laboratories conformed to the requirements of DEQ-INL OP during the second quarter of 2024.

Data usability is the measure of field sample results that are not rejected divided by the total number of field sample results obtained. The overall data usability (non-rejected results divided by the total number of field sample results reported) of 100.0% for the second quarter of 2024 is well above the acceptable value of 90% for the DEQ-INL OP ESP and is summarized in **Table 26**. The overall data completeness (usable results divided by the total number of field sample results expected) of 99.5% is also well above the acceptable value of 90%.

Preventative Maintenance and Equipment Reliability

All equipment was calibrated and checked according to prescribed periodicity. Service reliability for air sampling equipment for the second quarter of 2024 is summarized in **Table 46**.

⁷ Idaho National Laboratory Site Environmental Surveillance Program Report, Third Quarter 2023, INL/RPT-24-77413, p. 3

⁸ HANDBOOK FOR THE DEPARTMENT OF ENERGY'S MIXED ANALYTE PERFORMANCE EVALUATION PROGRAM (MAPEP), MAPEP-HB-1, July 6, 2022, p.30.

⁹ An Update of Hydrologic Conditions and Distribution of Selected Constituents in Water, Eastern Snake River Aquifer and Perched Groundwater Zones, Idaho National Laboratory, Idaho, Emphasis 2019–21, U. S. Geological Survey, DOE/ID-22261, p. 29.

¹⁰ The MDL is defined as the minimum concentration of substance that can be measured and reported with 99% confidence that an analyte concentration is greater than zero, and is determined from an analysis of a sample in a given matrix containing the analyte.

¹¹ IBL utilizes the Practical Quantitation Limit (PQL) as the Reporting Detection Limit (RDL) for final data reports. PQL represents a practical and routinely achievable quantitation limit with a high degree of certainty (> 99.9% confidence) that the result is a positive detection.

Conclusion

All data collected for the second quarter of 2024 have been assigned the applicable qualifiers to designate the appropriate use of the data. The overall data usability of 100.0% and data completeness of 99.5% are well above the acceptable value of 90% for the quarter, with the data meeting the requirements and data quality objectives established by DEQ-INL OP.

Table 26. Summary of the analyses performed, second quarter, 2024.

Media Sampled	Collection Device	Analyte	Sample Analyses	Blank Analyses	Duplicate Analyses	Spike Analyses	Data Rejected ¹	Analyzing Lab ²
Air								
Total Suspended Particulate	47-mm filters	Gross alpha	154	13	0	0	0	ISU-EML
		Gross beta	154	13	0	0	0	ISU-EML
		Gamma emitters	12	1	0	0	0	ISU-EML
	8x10-inch filter	Gamma emitters	35	3	3	0	0	ISU-EML
		Radiochemical ⁶ :						
		Sr-90	11	1	1	0	0	ISU-Sub
		Pu-238, 239/240	11	1	1	0	0	ISU-Sub
Am-241	11	1	1	0	0	ISU-Sub		
Water Vapor	Desiccant column	Tritium	44	8 ⁸	0	0	0	ISU-EML
Gaseous	Charcoal filter	Iodine-131	13	0	0	0	0	ISU-EML
Precipitation	Poly bottle	Tritium	8	0	0	0	0	ISU-EML
		Gamma emitters	8	0	0	0	0	ISU-EML
Water								
Ground water, perched ground water, waste pond effluent, and surface water	Grab or composite	Gross alpha	58	5	5	0	0	ISU-EML
		Gross beta	58	5	5	0	0	ISU-EML
		Gamma emitters	58	5	5	0	0	ISU-EML
		Tritium	57	5	5	0	0	ISU-EML
		Low-level tritium	10	1	1	0	0	ISU-EML
		Radiochemical ⁷ :						
		Sr-90	20	2	1	0	0	ISU-Sub
		Tc-99	14	0	1	0	0	ISU-Sub
		U-234, 235,238	5	1	0	0	0	ISU-Sub
		Pu-238, 239/240	1	0	0	0	0	ISU-Sub
		Am-241	0	0	0	0	0	ISU-Sub
		I-129	0	0	0	0	0	ISU-Sub
		Metals	51	5	4	1	0	IBL
		Common Ions	51	5	4	1	0	IBL
		Nutrients	51	5	4	1	0	IBL
Volatile Organics	16	5	1	1	0	IBL		
Terrestrial								
Milk	Grab or composite	Gamma emitters	11	0	0	0	0	ISU-EML
Soil	<i>in situ</i>	Gamma emitters	0	0	0	0	0	DEQ-INL OP
	Grab – “puck”	Gamma emitters	0	0	0	0	0	ISU-EML
Radiation								
Ambient	EICs	Gamma Radiation	66	0	0	9	0	DEQ-INL OP
	EcoGamma	Gamma Radiation	11	NA	1	NA	0	DEQ-INL OP
Total analyses performed			999	85	43	13	0	
Total QC analyses performed (blanks, duplicates, and spikes)			141					
Ratio of total QC analyses to total sample analyses³			14.1%					
Data usability⁴, percent			100.0%					
Data completeness⁵, percent			99.5%					

¹ Combined Laboratory and DEQ-INL OP rejection criteria (data was rejected for any reason).

² ISU-EML = Idaho State University – Environmental Monitoring Laboratory; ISU Sub = Subcontract laboratory to ISU-EML; IBL = Idaho Bureau of Laboratories, Boise; IBL Sub = Subcontract laboratory to IBL; DEQ-INL OP = Analyzed by INL Oversight Program, Idaho Department of Environmental Quality.

³ DEQ-INL OP requires that the number of QC analyses performed be at least 10 percent of the number of sample analyses performed.

⁴ Data usability is calculated as [total analyses – rejected data]/[total analyses]. DEQ-INL OP considers a data usability rate of 90 percent or higher to be acceptable.

⁵ Data completeness is calculated as usable results divided by the total number of field sample results expected. DEQ-INL OP considers a data completeness rate of 90 percent or higher to be acceptable.

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⁶ Radiochemical analyses for these filter composites include Strontium-90 (Sr-90), Plutonium-238 and 239/240 (Pu-238, 239/240), and Americium-241 (Am-241).

⁷ Radiochemical analyses for these water samples may include Strontium-90, Technetium-99 (Tc-99), Uranium 234, 235, and 238 (U-234, 235, 238), Plutonium-238 and 239/240, Americium-241, and Iodine-129 (I-129).

⁸ Method blanks and control samples are included here.

Table 27. Blank analysis results for gross alpha and beta in 47-mm particulate air (TSP), second quarter, 2024.

Collection Period		Corrected volume (m ³) ¹	Gross alpha			Gross beta		
Start	Stop		Value		3 SD	Value		3 SD
03/28/24	04/04/24	575	0.2	U	0.3	1.6	-	0.9
04/04/24	04/11/24	575	-0.2	U	0.4	-0.5	U	1.0
04/11/24	04/18/24	575	-0.3	U	0.4	-0.1	U	0.9
04/18/24	04/25/24	575	0.2	U	0.3	0.7	-	0.6
04/25/24	05/02/24	575	0.3	-	0.3	1.0	-	0.7
05/02/24	05/09/24	575	0.1	U	0.4	1.4	-	0.7
05/09/24	05/16/24	575	0.0	U	0.4	0.0	U	0.9
05/16/24	05/23/24	575	0.2	U	0.3	1.3	-	0.7
05/23/24	05/30/24	575	0.0	U	0.3	0.9	-	0.7
05/30/24	06/06/24	575	0.2	U	0.4	0.8	-	0.8
06/06/24	06/13/24	575	0.0	U	0.4	-0.3	U	0.9
06/13/24	06/20/24	575	-0.1	U	0.4	1.1	-	0.7
06/20/24	06/27/24	575	0.4	-	0.4	1.1	-	0.7

Concentration values and associated uncertainty (3 SD) are expressed in 1×10^{-3} pCi/m³. **Bold** concentrations are positive detections, greater than or equal to 3 SD. Data qualifiers: U = undetected, J = estimate, R = rejected, "+" or "-" after a J means that the estimated result is biased high or low, respectively.

¹ A volume equal to the average of the weekly volumes collected through each valid field filter was used to compute "concentrations" for the blank for meaningful comparison to sample results. No air passed through the blank filters.

Table 28. Blank results for gamma spectrometry analysis of monthly composites of 8x10-inch TSP air filters, and quarterly composites of 47-mm TSP air filters, second quarter, 2024.

Time period	Beryllium-7			Ruthenium-106/ Rhodium-106			Antimony-125			Cesium-134			Cesium-137			
	Conc		3 SD	Conc		3 SD	Conc		3 SD	Conc		3 SD	Conc		3 SD	
Monthly composites¹ of 8x10-inch TSP air filters																
Apr	-9	U	162	-10	U	105	-3	U	12	1	U	6	3	U	6	
May	2	U	27	9	U	54	-1	U	6	1	U	3	-1	U	3	
Jun	18	U	45	-7	U	75	2	U	9	1	U	3	1	U	6	
Quarterly composite² of 47-mm TSP air filters																
1 st Qtr.	4	U	117	33	U	150	-2	U	21	3	U	9	-1	U	9	

Concentrations (Conc) are expressed in 1×10^{-5} pCi/m³ with associated uncertainty (3 SD) and minimum detectable concentration (MDC). **Bold** concentrations are positive detections, greater than or equal to 3 SD.

Data qualifiers: U = undetected, J = estimate, R = rejected, "+" or "-" after a J means that the estimated result is biased high or low, respectively.

¹These concentrations (Conc) are from blank 8x10-inch filters collected weekly, composited, and analyzed for the calendar month. ²These concentrations are from blank 47-mm filters collected weekly, composited, and analyzed for the calendar quarter. A composite volume equal to the sum of the weekly average volumes collected through each valid field filter was used to compute "air concentrations" for the blank for meaningful comparison to sample results. No air actually passed through the blank filters

Table 29. Blank results for radiochemical analysis of 8x10-inch TSP air filters, quarterly composite samples, from first quarter, 2024.

Sample Description	⁹⁰ Sr			²³⁸ Pu			²³⁹ Pu/ ²⁴⁰ Pu			²⁴¹ Am		
	Value ¹		3 SD	Value ¹		3 SD	Value ¹		3 SD	Value ¹		3 SD
1Q 24 Blank	0.24	U	1.02	-0.02	U	0.09	0.03	U	0.06	0.05	U	0.15

Concentrations are expressed in 1×10^{-5} pCi/m³ with associated uncertainty (3 SD). **Bold** concentrations are positive detections, greater than or equal to 3 SD.

Data qualifiers: U = undetected, J = estimate, R = rejected, "+" or "-" after a J means that the estimated result is biased high or low, respectively.

¹ These concentrations are from blank filters collected weekly, composited, and analyzed for the calendar quarter. A composite volume equal to the sum of the weekly average volumes collected through each valid field filter was used to compute "air concentrations" for the blank for meaningful comparison to sample results. No air was passed through the blank filters.

Table 30. Method blank and control sample analysis results for tritium in water vapor from air samples, second quarter, 2024.

Sample Number	Start Date	Collection Date	Analysis Date	Tritium		
				Concentration		3 SD
Method Blanks						
OP242ZTR01	04/10/24	04/12/24	04/24/24	0.05	U	0.09
OP242ZTR02	04/15/24	04/17/24	04/24/24	0.02	U	0.09
OP242ZTR03	06/03/24	06/05/24	06/26/24	0.09	-	0.09
OP242ZTR04	06/05/24	06/10/24	06/26/24	0.03	U	0.09
Control Samples						
Distilled Water	04/17/24	04/17/24	04/24/24	-0.03	U	0.09
Distilled Water	06/05/24	06/05/24	06/26/24	0.07	U	0.09
Refrigerator	04/01/24	06/28/24	07/08/24	0.00	U	0.06
Sink	04/01/24	06/28/24	07/08/24	-0.01	U	0.06

Concentrations are expressed in nCi/L with associated uncertainty (3 SD). **Bold** concentrations are positive detections, greater than or equal to 3 SD.

Data qualifiers: U = undetected, J = estimate, R = rejected, "+" or "-" after a J means that the estimated result is biased high or low, respectively.

Table 31. Blank analysis results (pCi/L) for radiological constituents in water, second quarter, 2024.

Sample Number	Sample Date	Blank Type	Concentration		3 SD	Within Blank Criteria?
Gross Alpha						
241W062	04/09/24	Field	-0.3	U	0.3	Yes
241W248	04/16/24	Field	0.1	U	0.3	Yes
241W264	05/14/24	Field	-0.1	U	0.3	Yes
241W392	06/27/24	Field	-0.1	U	0.3	Yes
241W451	06/20/24	Field	-0.1	U	0.3	Yes
Gross Beta						
241W062	04/09/24	Field	0.0	U	0.9	Yes
241W248	04/16/24	Field	0.4	U	0.9	Yes
241W264	05/14/24	Field	-0.2	U	0.9	Yes
241W392	06/27/24	Field	-0.1	U	0.9	Yes
241W451	06/20/24	Field	0.2	U	0.9	Yes
Cesium-137						
241W062	04/09/24	Field	3.1	U	4.5	Yes
241W248	04/16/24	Field	0.7	U	2.1	Yes
241W264	05/14/24	Field	0.2	U	2.1	Yes
241W392	06/27/24	Field	1.5	U	3.0	Yes
241W451	06/20/24	Field	1.4	U	3.3	Yes
Tritium (standard method)						
241W064	04/09/24	Field	-41	U	90	Yes
241W250	04/16/24	Field	-50	U	90	Yes
241W265	05/14/24	Field	-50	U	90	Yes
241W393	06/27/24	Field	40	U	90	Yes
241W452	06/20/24	Field	40	U	90	Yes
Tritium (low-level method)						
241W064	04/09/24	Field	-4	U	6	Yes
Strontium-90						
241W063	04/09/24	Field	0.005	U	0.256	Yes
241W249	04/16/24	Field	0.186	U	0.298	Yes
Uranium-234						
241W251	04/16/24	Field	0.004	U	0.035	Yes
Uranium-235						
241W251	04/16/24	Field	-0.005	U	0.025	Yes
Uranium-238						
241W251	04/16/24	Field	0.000	U	0.012	Yes

Concentrations are expressed in pCi/L with associated uncertainty (3 SD). **Bold** concentrations are positive detections, greater than or equal to 3 SD.

Data qualifiers: U = undetected, J = estimate, R = rejected, "+" or "-" after a J means that the estimated result is biased high or low, respectively.

Table 32. Blank analysis results (µg/L) for metals in water, second quarter, 2024.

Sample Number	Sample Date	Blank Type	Arsenic	Barium	Chromium	Iron	Lead	Manganese	Selenium	Zinc
241W066	04/09/2024	Field	<2.0	-	<1.0	-	-	-	-	-
241W253	04/16/24	Field	<2.0	<1.0	<1.0	<10	<1.0	<1.0	-	-
241W267	05/14/24	Field	-	-	<1.0	-	-	-	-	-
241W454	06/20/24	Field	-	-	<1.0	-	-	-	-	-
241W395	06/27/24	Field	-	-	<1.0	-	-	-	-	-

Table 33. Blank analysis results (mg/L) for common ions and nutrients in water, second quarter, 2024.

Sample Number	Sample Date	Blank Type	Calcium	Magnesium	Sodium	Potassium	Fluoride	Chloride	Sulfate	Alkalinity [†]	NO ₃ +NO ₂ [*]	Total Phosphorus
241W065, 066, 067	04/09/24	Field	<0.10	<0.10	<0.10	<0.10	-	<0.4	<0.8	<1.0	<0.01	-
241W252, 253, 254	04/16/24	Field	<0.10	<0.10	<0.10	<0.10	-	<0.4	<0.8	<1.0	<0.01	-
241W266, 268	05/14/24	Field	-	-	-	-	-	<0.4	<0.8	<1.0	<0.01	-
241W453, 455	06/20/24	Field	-	-	-	-	-	<0.4	<0.8	<1.0	<0.01	-
241W394, 396	06/27/24	Field	-	-	-	-	-	<0.4	<0.8	<1.0	<0.01	-

[†] As CaCO₃.

^{*} As N.

Table 34. Blank analysis results (µg/L) for VOCs in water, second quarter, 2024.

Sample Number	Sample Date	Blank Type	PCE	TCE	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	Vinyl Chloride	1,1-DCA	Carbon Tetrachloride	Methylene Chloride	Chloroform	Chloro-methane	MEK
241W080	04/18/24	Field	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10
241W255	04/16/24	Field	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10
241W269	05/14/24	Field	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10
241W343	05/13/24	Field	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10
241W391	06/04/24	Field	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10

Abbreviations: PCE = tetrachloroethene; TCE = trichloroethene; 1,1-DCE = 1,1-dichloroethene; cis-1,2-DCE = cis-1,2-dichloroethene; trans-1,2-DCE = trans-1,2-dichloroethene; 1,1-DCA = 1,1-dichloroethane
MEK = Methyl Ethyl Ketone

Table 35. Duplicate sample results for gamma emitters from monthly composited 8x10-inch TSP air filters, second quarter, 2024.

Month and Nuclide	Original Sample ID	Concentration (R ₁)	1 SD ₁	Duplicate Sample ID	Concentration (R ₂)	1 SD ₂	RPD (%)	R ₁ -R ₂	3(SD ₁ ² +SD ₂ ²) ^{1/2}	Within either criterion?
April 2024										
⁷ Be	Idaho Falls	140.2	4.3	Idaho Falls Dup	164.6	4.7	-16	24.4	19.1	Yes
¹⁰⁶ Ru/ ¹⁰⁶ Rh		0.12 U	0.27		0.15 U	0.34	-22	0.03	1.30	Yes
¹²⁵ Sb		-0.01 U	0.03		0.01 U	0.05	NA ¹	0.02	0.18	Yes
¹³⁴ Cs		-0.01 U	0.03		0.00 U	0.02	200	0.01	0.11	Yes
¹³⁷ Cs		0.02 U	0.01		0.03 U	0.02	-40	0.01	0.07	Yes
May 2024										
⁷ Be	Idaho Falls	119.3	3.4	Idaho Falls Dup	98.4	3.0	19	20.9	13.6	Yes
¹⁰⁶ Ru/ ¹⁰⁶ Rh		-0.06 U	0.23		-0.06 U	0.20	0	0.00	0.91	Yes
¹²⁵ Sb		-0.06 U	0.04		-0.05 U	0.03	18	0.01	0.15	Yes
¹³⁴ Cs		0.02 U	0.01		0.00 U	0.01	200	0.02	0.04	Yes
¹³⁷ Cs		0.03 U	0.02		0.00 U	0.01	200	0.03	0.07	Yes
June 2024										
⁷ Be	Idaho Falls	142.1	4.4	Idaho Falls Dup	160.0	4.6	-12	17.9	19.1	Yes
¹⁰⁶ Ru/ ¹⁰⁶ Rh		0.61 U	0.29		0.17 U	0.34	113	0.44	1.34	Yes
¹²⁵ Sb		0.01 U	0.04		0.05 U	0.06	-133	0.04	0.22	Yes
¹³⁴ Cs		0.01 U	0.02		0.05 U	0.06	-133	0.04	0.19	Yes
¹³⁷ Cs		0.01 U	0.01		0.06	0.02	-143	0.05	0.07	Yes

RPD = relative percent difference. Air concentrations and uncertainties (1 SD) are expressed in units of 10⁻³ pCi/m³. **Bold** concentrations are positive detections, greater than or equal to 3 SD.

Data qualifiers: U = undetected, J = estimate, R = rejected, "+" or "-" after a J means that the estimated result is biased high or low, respectively.

¹ RPD not defined due to division by zero.

Table 36. Duplicate sample results for radiochemical analyses of composited 8x10 inch TSP air filters from the second quarter of 2024.

Nuclide	Original Sample ID	Concentration (R ₁)	1 SD ₁	Duplicate Sample ID	Concentration (R ₂)	1 SD ₂	RPD (%)	R ₁ -R ₂	3(SD ₁ ² +SD ₂ ²) ^{1/2}	Within either criterion?
^{89/90} Sr	Idaho Falls	1.77	0.50	Idaho Falls Dup	2.85	0.43	-47	1.08	1.98	Yes
²³⁸ Pu		0.03 U	0.04		0.02 U	0.04	40	0.01	0.17	Yes
²³⁹ Pu/ ²⁴⁰ Pu		0.03 U	0.02		0.00 U	0.01	200	0.03	0.07	Yes
²⁴¹ Am		-0.05 U	0.05		-0.09 U	0.05	57	0.04	0.21	Yes

RPD = relative percent difference. Air concentrations and uncertainties (1 SD) are expressed in units of 10⁻⁵ pCi/m³. **Bold** concentrations are positive detections, greater than or equal to 3 SD.

Data qualifiers: U = undetected, J = estimate, R = rejected, "+" or "-" after a J means that the estimated result is biased high or low, respectively.

Table 37. Duplicate results for quarterly average EcoGamma readings ($\mu\text{R/hr}$) for the second quarter of 2024.

Primary EcoGamma ID	Quarterly Average (R_1)	1 SD_1	Duplicate EcoGamma ID	Quarterly Average (R_2)	1 SD_2	RPD (%)	$ R_1 - R_2 $	$3(SD_1^2 + SD_2^2)^{1/2}$	Within either criterion?
Big Southern Butte ¹	17.3	1.7	Big Southern Butte Dup ¹	15.4	2.1	12%	1.9	8.1	Yes

RPD = relative percent difference.

¹No data from the primary Ecogamma at this location from 4/28 – 6/30/24. No data from the duplicate (Dup) EcoGamma at this location for the time periods 4/1 – 4/13/24, 4/24 – 4/30/24, 5/2 – 5/19/24, 5/24 – 5/25/24, 6/1 – 6/5/24, and 6/14 – 6/24/24.

Table 38. Duplicate sample results (pCi/L) for radiological constituents in groundwater and/or surface water, second quarter, 2024.

Analysis/Sample Location	Original Sample Number	Concentration (R ₁)	1 SD ₁	Duplicate Sample Number	Concentration (R ₂)	1 SD ₂	RPD (%)	R ₁ -R ₂	3(SD ₁ ² +SD ₂ ²) ^{1/2}	Within either criterion?
Gross Alpha										
ICPP-2020	241W124	1.4	0.5	241W236	1.0	0.5	33	0.4	2.1	Yes
P&W-2	241W138	1.2	0.4	241W243	1.4	0.5	-15	0.2	1.9	Yes
Alpheus Spring	241W270	1.4	0.6	241W336	1.0	0.5	33	0.4	2.3	Yes
NRF-12	241W331	1.1	0.4	241W338	1.5	0.4	-31	0.4	1.7	Yes
ANP-8	241W349	0.7	0.4	241W355	0.1	0.4	200	0.6	1.2	Yes
Gross Beta										
ICPP-2020	241W124	162.9	1.5	241W236	170.6	1.5	-5	7.7	6.4	Yes
P&W-2	241W138	2.4	0.4	241W243	2.5	0.4	-4	0.1	1.7	Yes
Alpheus Spring	241W270	6.8	0.5	241W336	5.8	0.5	16	1.0	2.1	Yes
NRF-12	241W331	2.1	0.4	241W338	3.9	0.5	-60	1.8	1.9	Yes
ANP-8	241W349	2.4	0.4	241W355	3.0	0.4	-22	0.6	1.7	Yes
Cesium-137										
ICPP-2020	241W124	1.4	0.7	241W236	0.0	1.0	200	1.4	3.7	Yes
P&W-2	241W138	-0.4	1.0	241W243	0.1	1.0	333	0.5	4.2	Yes
Alpheus Spring	241W270	0.1	0.7	241W336	0.7	1.0	-150	0.6	3.7	Yes
NRF-12	241W331	0.7	0.8	241W338	-1.5	0.8	550	2.2	3.4	Yes
ANP-8	241W349	1.2	1.4	241W355	0.5	0.9	82	0.7	5.0	Yes
Tritium (standard method)										
ICPP-2020	241W127	1300	50	241W239	1260	50	3	40	212	Yes
P&W-2	241W139	-30	30	241W244	-40	30	29	10	127	Yes
Alpheus Spring	241W271	-10	30	241W337	-50	30	133	40	127	Yes
NRF-12	241W332	30	30	241W339	70	30	-80	40	127	Yes
ANP-8	241W350	80	30	241W356	20	30	200	60	127	Yes
Strontium-90										
ICPP-2020	241W125	8.11	0.50	241W237	8.36	0.49	-3	0.26	2.10	Yes
Technetium-99										
ICPP-2020	241W126	252	12	241W238	257	13	-2	5	53	Yes

Concentrations are reported in pCi/L with associated uncertainty (1 SD). **Bold** concentrations are positive detections, greater than or equal to 3 SD. Data qualifiers: U = undetected, J = estimate, R = rejected, "+" or "-" after a J means that the estimated result is biased high or low, respectively. RPD = Relative percent difference.

Table 39. Duplicate sample results for metals (µg/L) in groundwater, second quarter, 2024.

Sample Location	Sample Number	Sample Date	Arsenic	Barium	Chromium	Iron	Lead	Manganese	Selenium	Zinc
ICPP-2020	241W129	04/03/24	-	-	7.0	-	-	-	-	-
ICPP-2020	241W241	04/03/24	-	-	7.1	-	-	-	-	-
RPD (%)			-	-	-1.4	-	-	-	-	-
P&W-2	241W141	04/10/24	-	-	1.3	-	-	-	-	-
P&W-2	241W246	04/10/24	-	-	1.4	-	-	-	-	-
RPD (%)			-	-	-7.4	-	-	-	-	-
NRF-12	241W334	05/22/24	-	-	10	-	-	-	-	-
NRF-12	241W341	05/22/24	-	-	10	-	-	-	-	-
RPD (%)			-	-	0.0	-	-	-	-	-
ANP-8	241W352	06/03/24	1.6 UJ	81	3.7	41	<1	4.4	-	-
ANP-8	241W358	06/03/24	1.6 UJ	81	4.8	110	<1	4.1	-	-
RPD (%)			0.0	0.0	-25.9	-91.4	0.0	7.1	-	-

RPD = relative percent difference.

Table 40. Duplicate sample results for common ions and nutrients (mg/L) in groundwater, second quarter, 2024.

Sample Location	Sample Number	Sample Date	Calcium	Magnesium	Sodium	Potassium	Chloride	Sulfate	Total Alkalinity†	Total Nitrogen	Total Phosphorus
ICPP-2020	241W128, 130	04/03/24	-	-	-	-	57.8	33.5	135	5.3	-
ICPP-2020	241W240, 242	04/03/24	-	-	-	-	58.0	33.6	135	5.2	-
RPD (%)			-	-	-	-	-0.3	-0.3	0.0	1.9	-
P&W-2	241W140, 142	04/10/24	-	-	-	-	5.92	24.9	146	0.53	-
P&W-2	241W245, 247	04/10/24	-	-	-	-	5.90	24.8	146	0.52	-
RPD (%)			-	-	-	-	0.3	0.4	0.0	1.9	-
NRF-12	241W333, 335	05/22/24	-	-	-	-	37.3	36.5	194	2.3	-
NRF-12	241W340, 342	05/22/24	-	-	-	-	37.3	36.5	193	2.3	-
RPD (%)			-	-	-	-	0.0	0.0	0.5	0.0	-
ANP-8	241W351, 352, 353	06/03/24	45	15	7.2	3.1	17.0	32.1	136	0.98	-
ANP-8	241W357, 358, 359	06/03/24	44	15	7.1	3.1	17.0	32.1	137	0.98	-
RPD (%)			2.2	0.0	1.4	0.0	0.0	0.0	0.7	0.0	-

RPD = relative percent difference

† As CaCO₃.

Table 41. Duplicate sample results (µg/L) for VOCs in water, second quarter, 2024.

Location	Sample Number	Sample Date	PCE	TCE	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	Vinyl Chloride	1,1-DCA	Carbon Tetrachloride	Methylene Chloride	Chloro-methane	Styrene	Chloro-form	MEK
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ANP-8	241W354	06/03/24	3.07	18.9	<0.5	0.41 UJ	<0.5	<0.5	<0.5	<0.5	1.93	<0.5	<0.5	<0.5	<10
ANP-8	241W360	06/03/24	3.23	19.4	<0.5	0.41 UJ	<0.5	<0.5	<0.5	<0.5	1.83	<0.5	<0.5	<0.5	<10
RPD (%)			-5.1	-2.6	0.0	0.0	0.0	0.0	0.0	0.0	5.3	0.0	0.0	0.0	0.0

RPD = relative percent difference.

Abbreviations: PCE = tetrachloroethene; TCE = trichloroethene; 1,1-DCE = 1,1-dichloroethene; cis-1,2-DCE = cis-1,2-dichloroethene; trans-1,2-DCE = trans-1,2-dichloroethene; 1,1-DCA = 1,1-dichloroethane, MEK = Methyl Ethyl Ketone (2-Butanone).

Table 42. Spiked sample results (µg/L) for metals in water, second quarter, 2024.

Sample Number	Sample Date	Barium			Chromium			Lead			Manganese			Zinc		
		Spike	Result	%R	Spike	Result	%R	Spike	Result	%R	Spike	Result	%R	Spike	Result	%R
241W077	4/23/2024				45.8	45	98									

Table 43. Spiked sample results (mg/L) for common ions and nutrients in water, second quarter, 2024.

Sample Number	Sample Date	Chloride			Sulfate			Total Alkalinity			NO ₃ + NO ₂ *			Total Phosphorus		
		Spike	Result	%R	Spike	Result	%R	Spike	Result	%R	Spike	Result	%R	Spike	Result	%R
241W076, 078	4/23/2024	50.9	49.1	96	14.3	13.8	97	87.8	86.9	99	1.24	1.2	97	-	-	-

Table 44. Spiked sample results (µg/L) for VOCs in water, second quarter, 2024.

Sample Number	Sample Date	Carbon Tetrachloride			Styrene			Tetrachloroethene			Trichloroethene			Vinyl Chloride		
		Spike	Result	%R	Spike	Result	%R	Spike	Result	%R	Spike	Result	%R	Spike	Result	%R
241W079	04/23/24	14.1	13.9	99	10.6	9.51	90	5.86	5.65	96	15.2	14.2	93	8.00	8.25	103

Table 44 continued. Spiked sample results (µg/L) for VOCs in water, second quarter, 2024.

Sample Number	Sample Date	1,1-Dichloroethene			trans-1,2-Dichloroethene			cis-1,2-Dichloroethene			1,2-Dichloroethane			Methylene Chloride		
		Spike	Result	%R	Spike	Result	%R	Spike	Result	%R	Spike	Result	%R	Spike	Result	%R
231W079	04/23/24	7.99	8.04	101	9.21	9.51	103	18.3	16.5	90	8.41	8.89	106	15.1	15.9	105

Table 45. ISU-EML electret ionization chamber (EIC) irradiation results (categorized as spiked samples), second quarter, 2024.

Electret #	Exposure Received			Net Measured Exposure ¹			%R	Within Spec?
	(mR)	Uncertainty (1 SD, mR)		(mR)	Uncertainty (1 SD, mR)			

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SMV173	40.1	1.4	35.1	1.4	87.5%	Yes
SCL098	40.1	1.4	43.5	1.3	108.5%	Yes
SMV281	40.1	1.4	37.4	1.3	93.4%	Yes
Triplicate AVG:					96.5%	Yes
SCL118	30.0	1.1	34.6	1.3	115.4%	Yes
SCL236	30.0	1.1	29.1	1.4	96.9%	Yes
SCL233	30.0	1.1	29.9	1.4	99.7%	Yes
Triplicate AVG:					104.0%	Yes
SMV014	20.3	0.7	21.0	1.3	103.6%	Yes
SMV037	20.3	0.7	21.0	1.3	103.4%	Yes
SMD337	20.3	0.7	21.6	1.3	106.3%	Yes
Triplicate AVG:					104.4%	Yes

Note: A percent recovery (%R) of $100 \pm 25\%$ is considered acceptable.

¹ Net measured exposure estimate includes a correction for atmospheric pressure.

Table 46. Air sampling field equipment service reliability (percent operational), second quarter, 2024.

Station Locations	Sample Type				
	47-mm TSP	8x10-inch TSP	Radioiodine	Atmospheric Moisture	Precipitation
Onsite Locations					
Big Lost River Rest Area	100%	100%	100%	100%	100%
Experimental Field Station	100%	100%	100%	100%	NC ¹
MFC Guard House ⁴	100%	100%	100%	100%	NC ¹
Sand Dunes Tower	100%	100%	100%	100%	NC ¹
Van Buren Avenue	100%	100%	100%	100%	NC ¹
Boundary Locations					
Atomic City	100%	100%	100%	100%	100%
Howe	85%	100%	100%	85%	100%
Montevieu	100%	100%	100%	100%	100%
Mud Lake	100%	100%	100%	100%	100%
Distant Locations²					
Craters of the Moon	100%	100%	100%	100%	NC ¹
Idaho Falls	100%	100%	100%	100%	100%
Idaho Falls Duplicate ³	NC ¹	100%	-	-	-

Note: The values in this table were calculated by dividing the number of weeks the equipment was in operation by the number of weeks in the quarter.

¹ NC = Sample not collected at this location.

² Fort Hall Station, operated by the Shoshone-Bannock Tribes, is not included here.

³ A duplicate 8x10-inch filter TSP sampler is currently installed at the Idaho Falls location.

⁴ New monitoring location; sampling equipment deployed during the quarter.

Appendix A

Table A-1. Weekly concentrations (in 1×10^{-3} pCi/m³) for gross alpha and gross beta analyses of 47-mm TSP filters for all locations, second quarter, 2024.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	1 SD	Concentration	1 SD
On-Site Locations						
Big Lost River Rest Area	03/28/24	04/04/24	0.5	0.1	18.6	0.6
	04/04/24	04/11/24	0.4	0.2	13.2	0.6
	04/11/24	04/19/24 ¹	1.1	0.2	23.1	0.6
	04/19/24	04/25/24 ¹	0.9	0.2	23.0	0.7
	04/25/24	05/02/24	0.6 J+⁸	0.1	15.5	0.5
	05/02/24	05/09/24	0.9	0.2	11.4	0.5
	05/09/24	05/16/24	1.2	0.2	22.9	0.7
	05/16/24	05/23/24	1.1	0.2	19.1	0.6
	05/23/24	05/30/24	1.0	0.2	18.1	0.6
	05/30/24	06/06/24	0.8	0.2	18.3	0.6
	06/06/24	06/13/24	0.8	0.2	22.7	0.7
	06/13/24	06/20/24	1.1	0.2	20.7	0.6
	06/20/24	06/27/24	1.8 J+⁸	0.2	28.8 J	0.7
Experimental Field Station	03/28/24	04/04/24	0.6	0.1	17.8	0.6
	04/04/24	04/11/24	0.8	0.2	13.2	0.6
	04/11/24	04/18/24	1.0	0.2	34.9	0.8
	04/18/24	04/25/24	1.5	0.2	20.0	0.6
	04/25/24	05/02/24	1.0 J+⁸	0.2	14.4	0.5
	05/02/24	05/09/24	0.6 J³	0.2	11.3 J³	0.4
	05/09/24	05/16/24	0.7 J³	0.2	21.7 J³	0.7
	05/16/24	05/23/24	1.0	0.2	17.9	0.6
	05/23/24	05/30/24	1.2	0.2	17.0	0.6
	05/30/24	06/06/24	1.3	0.2	18.0	0.6
	06/06/24	06/13/24	0.8	0.2	21.9	0.6
	06/13/24	06/20/24	0.7	0.2	19.0	0.6
	06/20/24	06/27/24	2.1 J+⁸	0.2	27.8	0.7
MFC Guard House	03/28/24	04/04/24	NS ⁴	NS	NS	NS
	04/04/24	04/11/24	NS	NS	NS	NS
	04/11/24	04/19/24	NS	NS	NS	NS
	04/19/24	04/25/24	NS	NS	NS	NS
	04/25/24	05/02/24	NS	NS	NS	NS
	05/02/24	05/09/24	NS	NS	NS	NS
	05/09/24	05/16/24	NS	NS	NS	NS
	05/16/24	05/23/24	1.6	0.2	18.5	0.6
	05/23/24	05/30/24	0.8	0.2	17.4	0.6
	05/30/24	06/06/24	1.1	0.2	16.9	0.6
	06/06/24	06/13/24	0.6	0.2	22.3	0.6
	06/13/24	06/20/24	1.2	0.2	20.4	0.6
	06/20/24	06/27/24	1.1 J+⁸	0.2	28.5	0.7
Sand Dunes Tower	03/28/24	04/04/24	0.6	0.2	18.6	0.6
	04/04/24	04/11/24	0.6	0.2	14.9	0.6
	04/11/24	04/18/24	1.1	0.2	24.0	0.7
	04/18/24	04/25/24	1.1	0.2	20.6	0.6
	04/25/24	05/02/24	0.5 J+⁸	0.1	13.9	0.5
	05/02/24	05/09/24	0.3	0.1	10.6	0.5
	05/09/24	05/16/24	1.2	0.2	23.5	0.7
	05/16/24	05/23/24	0.9	0.2	19.6	0.6
	05/23/24	05/30/24	1.0	0.2	18.1	0.6
	05/30/24	06/06/24	1.0	0.2	17.7	0.6
	06/06/24	06/13/24	1.2	0.2	23.8	0.7
	06/13/24	06/20/24	1.0	0.2	20.7	0.6
	06/20/24	06/27/24	2.1 J+^{5,8}	0.3	41.0 J⁵	1.0

Table A-1 continued. Weekly concentrations (in 1×10^{-3} pCi/m³) for gross alpha and gross beta analyses of 47-mm TSP filters for all locations, second quarter, 2024.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	1 SD	Concentration	1 SD
Van Buren Avenue	03/28/24	04/04/24	0.5	0.1	16.8	0.6
	04/04/24	04/11/24	0.7	0.2	13.5	0.6
	04/11/24	04/18/24	0.5	0.2	21.2	0.7
	04/18/24	04/25/24	1.0	0.2	21.7	0.6
	04/25/24	05/02/24	0.8 J⁺⁸	0.2	14.7	0.5
	05/02/24	05/09/24	0.9	0.2	11.8	0.5
	05/09/24	05/16/24	1.0	0.2	22.0	0.7
	05/16/24	05/23/24	1.4	0.2	19.1	0.6
	05/23/24	05/30/24	0.9	0.2	19.1	0.6
	05/30/24	06/06/24	1.1	0.2	17.2	0.6
	06/06/24	06/13/24	1.0	0.2	25.2	0.7
	06/13/24	06/20/24	0.7	0.2	18.4	0.6
06/20/24	06/27/24	1.5 J⁺⁸	0.2	29.1	0.7	
Boundary Locations						
Atomic City	03/28/24	04/04/24	0.2	0.1	16.7	0.6
	04/04/24	04/11/24	0.5	0.2	12.4	0.6
	04/11/24	04/19/24 ¹	2.3	0.3	22.3	0.6
	04/19/24	04/25/24 ¹	1.3	0.2	21.6	0.6
	04/25/24	05/02/24	0.7 J⁺⁸	0.1	14.5	0.5
	05/02/24	05/09/24	1.9	0.2	12.7	0.5
	05/09/24	05/16/24	2.2	0.3	24.3	0.7
	05/16/24	05/23/24	3.7	0.3	22.6	0.6
	05/23/24	05/30/24	2.4	0.2	19.7	0.6
	05/30/24	06/06/24	2.2	0.2	20.2	0.6
	06/06/24	06/13/24	3.3	0.3	26.6	0.7
	06/13/24	06/20/24	2.3	0.3	21.9	0.6
06/20/24	06/27/24	1.8 J⁺⁸	0.2	28.0	0.7	
Howe	03/28/24	04/04/24	0.7	0.1	15.0	0.5
	04/04/24	04/11/24	0.3 J ³	0.2	11.8 J³	0.6
	04/11/24	04/18/24	0.6	0.2	22.4	0.6
	04/18/24	04/25/24	1.2	0.2	21.4	0.6
	04/25/24	05/02/24	0.8 J⁺⁸	0.2	14.4	0.5
	05/02/24	05/09/24	0.4	0.1	9.9	0.4
	05/09/24	05/16/24	0.7	0.2	19.1	0.6
	05/16/24	05/23/24	1.0	0.2	17.0	0.5
	05/23/24	05/30/24	0.6	0.1	17.3	0.5
	05/30/24	06/06/24	1.1	0.2	16.3	0.5
	06/06/24	06/13/24	0.7 J⁶	0.2	18.5 J⁶	0.6
	06/13/24	06/20/24	NS ⁷	NS ⁷	NS ⁷	NS ⁷
06/20/24	06/27/24	NS ⁷	NS ⁷	NS ⁷	NS ⁷	

Table A-1 continued. Weekly concentrations (in 1×10^{-3} pCi/m³) for gross alpha and gross beta analyses for 47-mm TSP filters for all locations, second quarter, 2024.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	1 SD	Concentration	1 SD
Montevieu	03/28/24	04/04/24	0.7	0.2	16.9	0.6
	04/04/24	04/11/24	0.6	0.2	14.7	0.6
	04/11/24	04/18/24	0.6	0.2	21.8	0.7
	04/18/24	04/25/24	1.3	0.2	20.6	0.6
	04/25/24	05/02/24	0.4 J+⁸	0.1	14.5	0.5
	05/02/24	05/09/24	0.5	0.1	10.4	0.4
	05/09/24	05/16/24	0.9	0.2	19.4	0.6
	05/16/24	05/23/24	1.2	0.2	18.4	0.6
	05/23/24	05/30/24	1.0	0.2	14.8	0.5
	05/30/24	06/06/24	0.7	0.2	16.7	0.5
	06/06/24	06/13/24	0.8	0.2	20.7	0.6
	06/13/24	06/20/24	1.2	0.2	19.1	0.6
	06/20/24	06/27/24	1.4 J+⁸	0.2	26.3	0.7
Mud Lake	03/28/24	04/04/24	0.9	0.2	17.1	0.6
	04/04/24	04/11/24	0.6	0.2	13.1	0.6
	04/11/24	04/18/24	0.7	0.2	21.6	0.6
	04/18/24	04/25/24	1.3	0.2	19.8	0.6
	04/25/24	05/02/24	1.1 J+⁸	0.2	12.8	0.5
	05/02/24	05/09/24	0.4	0.1	10.0	0.4
	05/09/24	05/16/24	0.7	0.2	17.8	0.6
	05/16/24	05/23/24	1.0	0.2	16.8	0.5
	05/23/24	05/30/24	0.8	0.2	16.6	0.5
	05/30/24	06/06/24	0.9	0.2	17.7	0.6
	06/06/24	06/13/24	0.9	0.2	20.6	0.6
	06/13/24	06/20/24	0.8	0.2	18.0	0.6
	06/20/24	06/27/24	1.6 J+⁸	0.2	26.7	0.6
Distant Locations						
Craters of the Moon	03/28/24	04/04/24	0.5	0.1	16.3	0.6
	04/04/24	04/11/24	0.4	0.2	11.9	0.6
	04/11/24	04/18/24	0.5	0.2	23.2	0.7
	04/18/24	04/25/24	0.9	0.2	21.0	0.6
	04/25/24	05/02/24	0.8 J+⁸	0.2	15.3	0.5
	05/02/24	05/09/24	0.2	0.1	11.4	0.5
	05/09/24	05/16/24	0.4	0.2	22.0	0.6
	05/16/24	05/23/24	0.9	0.2	17.2	0.6
	05/23/24	05/30/24	1.1	0.2	18.1	0.6
	05/30/24	06/06/24	1.0	0.2	15.7	0.5
	06/06/24	06/13/24	0.8	0.2	24.0	0.7
	06/13/24	06/20/24	0.8	0.2	19.9	0.6
	06/20/24	06/27/24	1.3 J+⁸	0.2	27.2	0.7

Table A-1 continued. Weekly concentrations (in 1×10^{-3} pCi/m³) for gross alpha and gross beta analyses of 47-mm TSP filters for all locations, second quarter, 2024.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	1 SD	Concentration	1 SD
Fort Hall²	03/28/24	04/04/24	0.7	0.2	17.0	0.6
	04/04/24	04/11/24	0.6	0.2	11.9	0.5
	04/11/24	04/18/24	0.8	0.2	22.1	0.7
	04/18/24	04/25/24	1.0	0.2	19.0	0.5
	04/25/24	05/02/24	0.8 J+⁸	0.2	12.0	0.5
	05/02/24	05/09/24	0.6	0.2	10.6	0.4
	05/09/24	05/16/24	1.1	0.2	19.2	0.6
	05/16/24	05/23/24	1.0	0.2	17.3	0.6
	05/23/24	05/30/24	0.8	0.2	15.8	0.6
	05/30/24	06/06/24	0.8	0.2	16.1	0.5
	06/06/24	06/13/24	0.9	0.2	20.9	0.6
	06/13/24	06/20/24	0.7	0.2	19.9	0.6
06/20/24	06/27/24	1.4 J+⁸	0.2	28.5	0.7	
Idaho Falls	03/28/24	04/04/24	0.7	0.1	16.2	0.6
	04/04/24	04/11/24	0.7	0.2	13.8	0.6
	04/11/24	04/18/24	0.8	0.2	22.8	0.7
	04/18/24	04/25/24	1.4	0.2	20.4	0.6
	04/25/24	05/02/24	0.7 J+⁸	0.2	13.2	0.5
	05/02/24	05/09/24	0.6	0.2	10.1	0.4
	05/09/24	05/16/24	0.8	0.2	19.1	0.6
	05/16/24	05/23/24	1.0	0.2	16.6	0.5
	05/23/24	05/30/24	0.6	0.1	16.0	0.5
	05/30/24	06/06/24	1.3	0.2	16.8	0.5
	06/06/24	06/13/24	0.8	0.2	19.8	0.6
	06/13/24	06/20/24	0.9	0.2	18.4	0.6
06/20/24	06/27/24	1.6 J+⁸	0.2	27.8	0.7	

Note: **Bold** concentrations are positive detections, greater or equal to 3 SD.

¹ Sampler ran for 8 days 4/11 - 4/19/24. Sampler ran for 6 days 4/19 – 4/25/24.

² Operated by Shoshone-Bannock Tribes.

³ Partial sample due to planned power outage. Result is a usable estimate (J).

⁴ NS – No sample. Sampling equipment not yet deployed.

⁵ Partial sample due to blocked air hose. Result is a usable estimate (J).

⁶ Partial sample due to mechanical failure. Result is a usable estimate (J).

⁷ NS – No sample due to mechanical failure.

⁸ The blank filter gross alpha result was greater than or equal to 3 SD for the weeks of 4/25 - 5/02/24 and 6/20 – 6/27/24. Associated gross alpha results for those weeks are qualified as biased-high estimates (J+).

Appendix B

Table B-1. Results for all electret ionization chamber (EIC) locations, second quarter, 2024.

Sample Location	Net Corrected Exposure Rate ($\mu\text{R/hr}$) ¹	± 2 SD ($\mu\text{R/hr}$)
On-Site Locations		
Big Lost River Rest Area	13.9	1.2
Van Buren Avenue	10.7, 11.9	-
Experimental Field Station	14.9	1.6
Main Gate	15.2	0.7
Sand Dunes Tower	13.1	2.0
MP276 -20	11.2	1.3
MP274 -20	11.3	2.1
MP272 -20	11.9	0.7
MP270 -20	12.8	1.9
MP268 -20	11.5	1.7
MP266 -20	12.4	2.1
MP264 -20	10.6, 11.0	-
MP270 -20/26	13.9	0.7
MP268 -20/26	13.5	2.4
MP266 -20/26	12.3	1.8
MP263 -20/26	NS ²	NS ²
MP261 -20/26	13.6	1.3
MP259 -20/26	12.5	0.9
MP256 -20/26	12.3	1.3
MFC (EBR II)	13.2	1.4
EBR I	11.7	0.9
RWMC	12.9	1.1
CFA	14.2	0.5
CITRC (PBF)	15.5	1.5
INTEC	20.4	0.9
ATR (TRA)	12.3	0.7
NRF	12.3	1.1
TAN/SMC	10.0	1.5
MP39-33	12.8	0.5
MP37-33	14.2	1.4
MP35-33	12.4	1.3
MP33-33	13.7	1.9
MP31-33	11.0	2.3
MP29-33	10.8	1.1
MP27-33	14.6	1.6
MP25-33	13.8	0.8
MP23-33	11.2	2.2
Base of Howe	12.7	1.8
Rover	14.5	1.1
T4 North	14.5	1.0
T4 South	11.7	1.2
Boundary Locations		
Atomic City	11.1	0.5
Mud Lake/ Terreton	12.0	0.6
Montevue	12.4	1.9
Howe Met. Tower	13.3	1.5
MP282 -20	12.0	2.3
MP280 -20	12.7	2.3
MP278 -20	12.4	1.8
Mud Lake Bank of Commerce	12.8	1.4

Table B-1. continued. Results for all electret ionization chamber (EIC) locations, second quarter, 2024.

Sample Location	Net Corrected Exposure Rate ($\mu\text{R/hr}$) ¹	± 2 SD ($\mu\text{R/hr}$)
MP43-33	14.7	1.1
MP41-33	15.8	0.5
MP21-33	12.5	0.6
MP19-33	11.8	1.4
MP14-33	9.8	0.4
MP11-33	9.6	0.7
MP06-33	10.9	2.7
MP03-33	12.9	0.8
Distant Locations		
Arco	12.9	0.7
Craters of the Moon	13.8	2.1
Taber	15.2	0.9
Blackfoot	11.7	1.4
Fort Hall	11.9	2.3
Idaho Falls	9.1	0.4
Hamer	13.7	1.9
Sugar City	14.8	1.0
Roberts	12.8	0.2
Big Southern Butte	13.7	2.0

¹Results are the average of triplicate exposure rate measurements with the associated sample variability (1 SD), or the 2 measured exposure rates remaining after removal of an outlying value. One of the triplicate measurements is rejected if it is outside the average of the triplicate measurements ± 3 SD of the historical population variability. Typically, the two most consistent measurements are reported, based on judgment of the data analyst.

²EICs and mile post were missing from this location at quarterly change-out.

Appendix C

Table C-1. Summary of the minimum detectable concentrations (MDCs) for radiological analytes and reporting detection limits (RDLs) for non-radiological analytes, together with the EPA Maximum Contaminant Levels (MCLs) and DOE Derived Concentration Standards (DCSs) for comparison.

Media Sampled	Collection Device	Analyte	Typical MDC or RDL range ¹	Units	EPA Limit ^{2,3}	DOE DCS ⁴	Notes	
Air								
Total Suspended Particulate	47-mm filters	Gross alpha	$(0.3 - 0.7) \times 10^{-3}$	pCi/m ³	--	0.11	5	
		Gross beta	$(1 - 2) \times 10^{-3}$	pCi/m ³	1	9.6	5, 16	
		Gamma emitters	$(0.1 - 0.2) \times 10^{-3}$	pCi/m ³ (¹³⁷ Cs)	1.9×10^{-2}	38		
	8x10-inch filter	Gamma emitters	$(0.03 - 0.07) \times 10^{-5}$	pCi/m ³ (¹³⁷ Cs)	1.9×10^{-2}	38		
		Radiochemical:						
		Sr-90	$(0.4 - 0.7) \times 10^{-5}$	pCi/m ³	1.9×10^{-2}	9.6		
		Pu-238	$(0.05 - 0.2) \times 10^{-5}$	pCi/m ³	2.1×10^{-3}	0.12		
		Pu-239/240	$(0.03 - 0.1) \times 10^{-5}$	pCi/m ³	2.0×10^{-3}	0.11		
Am-241	$(0.2 - 0.4) \times 10^{-5}$	pCi/m ³	1.9×10^{-3}	0.13				
Water Vapor	Desiccant column	Tritium	0.3 - 0.6	pCi/m ³	1.5×10^3	1.3×10^5		
Gaseous	Charcoal filter	Iodine-131	$(6 - 8) \times 10^{-4}$	pCi/m ³	2.1×10^{-1}	4.5×10^2		
Precipitation	Plastic Carboy	Tritium	100 - 140	pCi/L	--	--	6	
		Gamma emitters	2 - 3	pCi/L (¹³⁷ Cs)	--	--	6	
Water								
Ground water, perched ground water, waste pond effluent, and surface water	Grab or composite	Gross alpha	0.3 - 1.9	pCi/L	15	4.0×10^2		
		Gross beta	0.8 - 1.9	pCi/L	4 mrem/yr	1.7×10^3		
		Gamma emitters	0.5 - 3.0	pCi/L (¹³⁷ Cs)	200	4.1×10^3		
		Tritium - standard analytical method	140 - 189	pCi/L	20,000	2.6×10^6		
		Tritium - low-level analytical method	5 - 15	pCi/L	20,000	2.6×10^6	7	
		Radiochemical:						
		Sr-90	0 - 0.8	pCi/L	8	1.7×10^3		
		Tc-99	0.8 - 1.4	pCi/L	900	3.9×10^5		
		U-234	0.01 - 0.8	pCi/L	30 µg/L (total U)	1.2×10^3	8	
		U-235	0.02 - 0.6	pCi/L		1.3×10^3		
		U-238	0.01 - 0.7	pCi/L		1.4×10^3		
		Pu-238	0.01 - 0.2	pCi/L		15		4.3×10^2
		Pu-239/240	0.01 - 0.2	pCi/L	15	4.0×10^2	9	
		Am-241	0.03 - 0.1	pCi/L	15	7.4×10^2	9	
		I-129	0.002	pCi/L	1	5.7×10^2		
		Metals						
		Arsenic	2	µg/L	10	--		
Barium	1	µg/L	2000	--				
Chromium	1	µg/L	100	--				

Media Sampled	Collection Device	Analyte	Typical MDC or RDL range ¹	Units	EPA Limit ^{2,3}	DOE DCS ⁴	Notes		
		Iron	10	µg/L	300*	--			
		Lead	1	µg/L	15	--			
		Manganese	1	µg/L	50*	--			
		Selenium	2	µg/L	50	--			
		Zinc	5	µg/L	5000*	--			
		Common Ions							
		Alkalinity (as CaCO ₃)	1.0	mg/L	--	--			
		Calcium	0.1	mg/L	--	--			
		Chloride	0.4	mg/L	250*	--			
		Magnesium	0.1	mg/L	--	--			
		Potassium	0.1	mg/L	--	--			
		Sodium	0.1	mg/L	--	--			
		Sulfate	0.8	mg/L	250*	--			
		Nutrients							
		Nitrate/Nitrite	0.01	mg/L	10 (NO ₃ ⁻), 1 (NO ₂ ⁻)	--			
		Total Phosphorus	0.005	mg/L	--	--			
		Volatile Organics							
		Tetrachloroethene (PCE)	0.5	µg/L	5	--			
		Trichloroethene (TCE)	0.5	µg/L	5	--			
		1,1-Dichloroethene	0.5	µg/L	7	--			
		cis-1,2-dichloroethene	0.5	µg/L	70	--			
		trans-1,2-dichloroethene	0.5	µg/L	100	--			
		Vinyl chloride	0.5	µg/L	2	--			
Carbon tetrachloride	0.5	µg/L	5	--					
Chloroform	0.5	µg/L	80	--	10				
Chloromethane	0.5	µg/L	--	--					
Methylene Chloride	0.5	µg/L	5	--					
Methyl Ethyl Ketone	10	µg/L	--	--					
1,1-Dichloroethane	0.5	µg/L	--	--					
Terrestrial									
Milk	Grab or composite	Gamma emitters	4.0	pCi/L (¹³¹ I)	4.59 x10 ³	1.0 x10 ⁴	11		
Soil	<i>in situ</i>	Gamma emitters	0.02 – 0.03	pCi/g (¹³⁷ Cs)	6.8	6.8	12		
	Grab	Gamma emitters	0.09	pCi/g (¹³⁷ Cs)	6.8	6.8	12		
Radiation									
Ambient	EICs	Gamma Radiation	5	mR	--	100 mrem/yr (103.5 mR/yr)	13, 14,		
	EcoGamma	Gamma Radiation	1	µR/hr	--	100 mrem/yr (103,500 µR/yr)	13, 15,		

Notes:

1. Minimum Detectable Concentrations (MDCs) are a measure of method/instrument performance. They are not a criterion above which a result is considered a detection. DOE Derived concentration standards (DCS) and EPA Maximum Contaminant Levels (MCLs) are listed here only as reference values for comparison to typical MDC or Reporting Detection Limit (RDL) ranges. The MCLs are the most restrictive and do not necessarily apply to the environmental media sampled. For example, the MCLs for water listed here are the highest levels of contaminants legally allowed in public drinking water systems in Idaho, but most wells sampled by DEQ-INL OP are not used for drinking water.
2. For radionuclides in water - EPA derived concentrations (pCi/l) of Beta and Photon Emitters in Drinking Water Yielding a Dose of 4 mrem/year to the Total Body or to any Critical Organ as defined in NBS Handbook 69. For non-radiological analytes – 40 CFR Part 141: National Primary Drinking Water Regulations. The Maximum Contaminant Levels (MCLs) listed here are the highest levels of contaminants legally allowed in public drinking water systems in Idaho. A * designates a Secondary MCL (SMCL), which is a guideline recommended by the EPA for constituents that may affect the taste, color, or odor of drinking water. The values listed are generally consistent with the Idaho Primary Constituent Standards (PCSs) and Secondary Constituent Standards in IDAPA 58.01.11, Ground Water Quality Rule, Tables II and III.
3. For radionuclides in air – EPA Concentration Levels for Environmental Compliance as defined in 40 CFR 61, subpart H -National Emission Standards for Emissions of Radionuclides Other Than Radon from Department of Energy Facilities, and Appendix E, Table 2.
4. Derived concentration standards (DCS) set by the DOE, represent reference values for radiation exposure. They are based on a radiation dose of 100 mrem/year for exposure through a particular exposure mode such as direct exposure, inhalation, or ingestion of water (DOE-STD-1196-2022).
5. Based on the most restrictive human-made alpha emitter (^{239}Pu) and beta-emitter (^{90}Sr) and the most restrictive absorption type in DOE-STD-1196-2022, Table 7.
6. There are no regulatory standards for precipitation. For comparison only, the EPA MCL is 20,000 pCi/L for tritium and 200 pCi/L for Cs-137.
7. Water samples from locations at which tritium concentrations are too low to be detected by the standard method are re-analyzed for tritium using an electrolytic enrichment method (referred to as the low-level method), which has a minimum detectable concentration (MDC) about ten times lower than the standard method.
8. Example: For natural uranium, 30 $\mu\text{g/L}$ (total U) is equivalent to approximately 10.3 pCi/L U-234, 0.468 pCi/L U-235, and 10.0 pCi/L U-238.
9. There are no specific MCLs for these nuclides. Listed MCLs are the gross alpha activity MCL.
10. MCL is for total trihalomethanes.
11. The Food and Drug Administration derived intervention level for I-131 in milk is 170 Bq/L or 4590 pCi/L. The DOE DCS for I-131 in milk is 1.0×10^4 pCi/L.
12. Recommended federal screening limit for surface soil is 6.8 pCi/g (NCRP Report No. 129, "Recommended Screening Limits for Contaminated Surface Soil and Review of Factors Relevant to Site-Specific Studies", Table 2.1, Agricultural (AG) land use).
13. Mrem/hr is converted to $\mu\text{R/yr}$ assuming 1.035 R/rad in muscle.
14. The "Typical MDC" for EICs is expressed as the EIC sensitivity for gamma radiation with less than a 10% error, which is 5 mR per the EPERM System Manual.
15. The "Typical MDC" for the EcoGamma is expressed as the lower end of EcoGamma low range.
16. Per the EPA RadNet Sampling and Analyses Schedules, Routine Sample Analyses [for air filters], "If the beta concentration is greater than 1 pCi/m³, gamma spectroscopy and possibly other analyses are performed."

Appendix D

Table D-1. List of volatile organic compounds (VOCs) analyzed for water samples.

Analyte	Minimum detectable concentrations (MDC) (expressed in µg/L)
Benzene	0.5
Carbon tetrachloride	0.5
Chlorobenzene	0.5
1,4-Dichlorobenzene	0.5
1,2-Dichlorobenzene	0.5
1,2-Dichloroethane	0.5
1,1-Dichloroethene	0.5
cis-1,2-Dichloroethene	0.5
trans-1,2-Dichloroethene	0.5
1,2-Dichloropropane	0.5
Ethylbenzene	0.5
Methylene Chloride	0.5
Styrene	0.5
Tetrachloroethene (PCE)	0.5
Toluene	0.5
1,2,4-Trichlorobenzene	0.5
1,1,1-Trichloroethane	0.5
1,1,2-Trichloroethane	0.5
Trichloroethylene	0.5
Vinyl chloride	0.5
Xylenes (total)	0.5
Bromodichloromethane	0.5
Dibromochloromethane	0.5
Bromoform	0.5
Chloroform	0.5
Bromobenzene	0.5
Bromochloromethane	0.5
Bromomethane	0.5
n-Butylbenzene	0.5
sec-Butylbenzene	1.0
tert-Butylbenzene	0.5
Chloroethane	0.5
Chloromethane	0.5
2-Chlorotoluene	0.5

Table D-1 continued. List of volatile organic compounds (VOCs) analyzed for water samples.

Analyte	Minimum detectable concentrations (MDC) (expressed in µg/L)
4-Chlorotoluene	0.5
1,2-Dibromo-3-chloropropane (DBCP)	0.5
1,2-Dibromoethane (EDB)	0.5
Dibromomethane	0.5
1,3-Dichlorobenzene	0.5
Dichlorodifluoromethane	0.5
1,1-Dichloroethane	0.5
1,3-Dichloropropane	0.5
2,2-Dichloropropane	0.5
1,1-Dichloropropene	0.5
cis-1,3-Dichloropropene	0.5
trans-1,3-Dichloropropene	1.0
Hexachlorobutadiene	0.5
Isopropylbenzene	0.5
p-Isopropyltoluene	0.5
Methyl Ethyl Ketone (MEK)	10
Methyl Tert Butyl Ether (MTBE)	0.5
Naphthalene	0.5
n-Propylbenzene	0.5
1,1,1,2-Tetrachloroethane	0.5
1,1,2,2-Tetrachloroethane	0.5
1,2,3-Trichlorobenzene	0.5
Trichlorofluoromethane	0.5
1,2,3-Trichloropropane	0.5
1,2,4-Trimethylbenzene	1.0
1,3,5-Trimethylbenzene	0.5