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INL Oversight Program

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Table of Acronyms

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

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 have 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 Limit[4] (MDL) and the higher Reporting Detection Limit[5] (RDL).

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.

[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.

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 fourth quarter, 2024 (**Figure 1**). The on-site locations include a new station at the Materials and Fuels Complex (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 fourth quarter of 2024 for 47-mm and 8x10-inch TSP filters are presented in **Tables 3** and **4**. For the 47-mm filter composites, there was one reported gamma-emitting radionuclide (Cs-137) concentration greater than 3 SD at Fort Hall. For all locations, beryllium-7 (Be-7), a naturally occurring, cosmogenic radionuclide was reported. For the 8x10-inch filter composites, there were no cesium-137 (Cs-137) results greater than or equal to 3 SD at any location. 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. Beryllium-7 results were greater than 3 SD at all locations.

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/m^3) 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 third quarter 2024 are presented in **Table 5.** There were positive Sr-90 detections at all locations other than Craters of the Moon and Fort Hall. 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. There were positive Pu-239/240 detections at on-site location(s) Materials and Fuels Complex (MFC) and Van Buren Avenue, boundary location Mud Lake, and distant location Fort Hall. The 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 fourth 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.** Date specific airborne tritium concentrations equal to or exceeding three standard deviations were considered positive detections at the following locations:

- On-Site – Big Lost River Rest Area (10/24-11/21). Experimental Field Station (9/26-10/24). Sand Dunes Tower (11/21-12/26).
- Boundary – none.
- Distant – none.

No weighted mean concentrations of airborne tritium equal to or greater than three standard deviations were seen during the fourth quarter of 2024. Moreover, all DEQ-INL OP's detections were well below the action level of 150 pCi/m^3 which is 10 percent of the compliance standard set forth in 40 CFR 61, Appendix E, Table 2.

Precipitation was collected at one on-site monitoring location (Big Lost River Rest Area), four boundary locations (Atomic City, Howe, Mud Lake, and Monteview) and one distant location (Idaho Falls) during the fourth quarter of 2024. DEQ-INL OP's precipitation samples were then analyzed for Tritium and man-made gamma emitting radionuclides; neither was detected in any sample at equal to or greater than three standard deviations. Analysis results for Tritium and Cesium-137 are presented in **Table 8**.

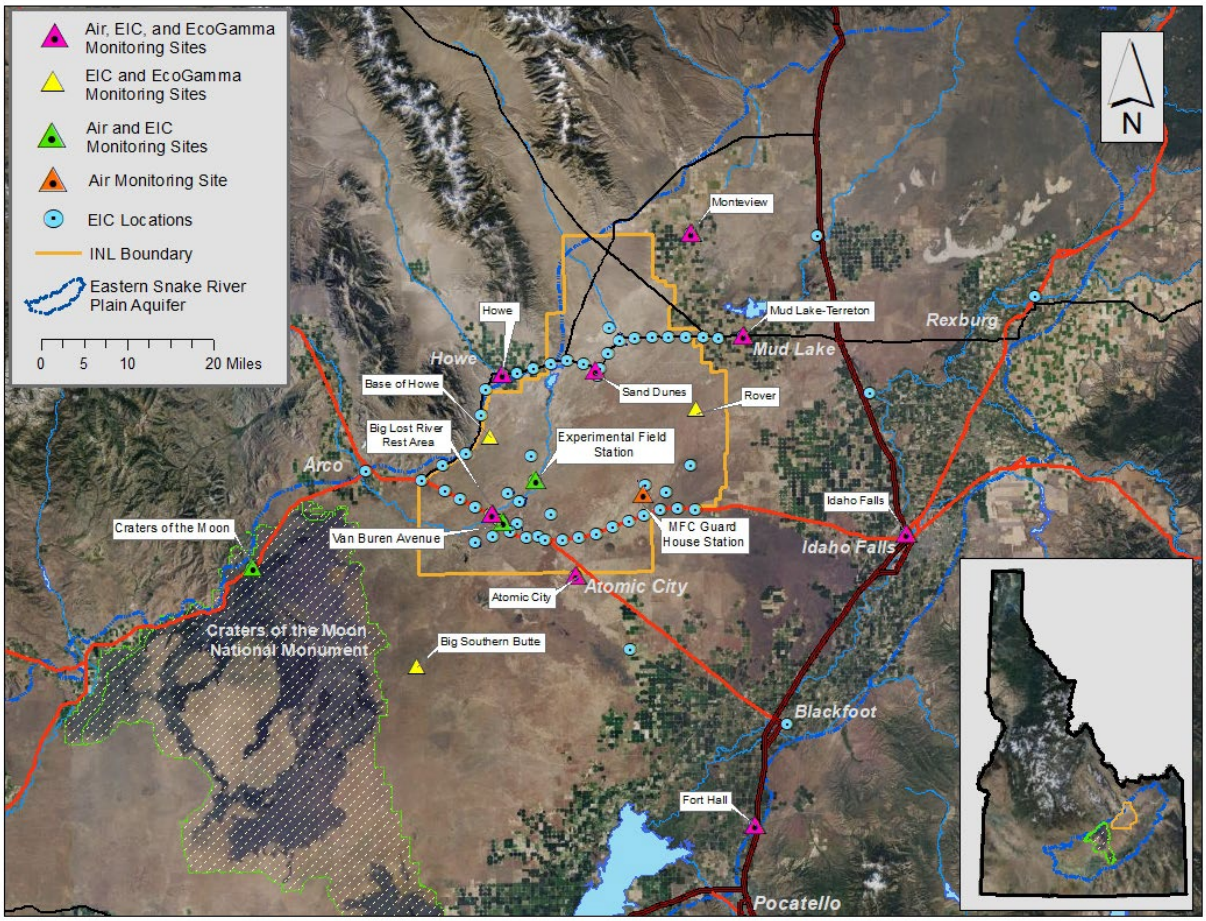


Figure 1. Air and radiation monitoring locations.

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	□	□	■	■
Experimental Field Station	□	□	■	
MFC[3] Guard House	□	□	■	
Sand Dunes Tower	□	□	■	
Van Buren Avenue	□	□	■	
Boundary Locations				
Atomic City	□	□	■	■
Howe	□	□	■	■
Monteview	□	□	■	■
Mud Lake	□	□	■	■
Distant Locations				
Craters of the Moon	□	□	■	
Fort Hall[2]	□	□	■	
Idaho Falls	□	□	■	■

[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, fourth quarter, 2024.

Station Location	Concentration					
	Gross Alpha			Gross Beta		
On-Site Locations						
Big Lost River Rest Area	0.1	-	**2.1**	**13.2**	-	**54.5**
Experimental Field Station	0.4	-	**2.7**	**14.0**	-	**59.9**
MFC Guard House[3]	0.2	-	**1.9**	**12.7**	-	**55.4**
Sand Dunes Tower	0.1	-	**2.0**	**12.8**	-	**66.4**
Van Buren Avenue	0.3	-	**2.3**	**12.6**	-	**56.2**
Boundary Locations						
Atomic City	0.5	-	**3.4**	**12.7**	-	**51.5** J[2]
Howe	0.4	-	**2.1**	**12.1**	-	**51.6**
Monteview	0.3	-	**2.6**	**14.0**	-	**60.4**
Mud Lake	0.4	-	**2.9**	**13.2**	-	**90.0**
Distant Locations						
Craters of the Moon	0.1	-	**2.1**	**12.1**	-	**41.1** J[2]
Fort Hall[1]	0.3	-	**2.2**	**13.1**	-	**47.2**
Idaho Falls	0.3	-	**2.4**	**13.5**	-	**52.9**

Concentrations are expressed in 1 x 10^{-3} pCi/m^3. **Bold** concentrations are positive detections, greater than or equal to 3 SD.
[1]Operated by Shoshone-Bannock Tribes.
[2] Sampler ran for 8 days 11/27 – 12/05/2024.
[3]MFC Guard House is a new monitoring location. Data collection began here during the week of 5/16 – 5/23/24.

Table 3. Gamma spectrometry analysis data for 47-mm TSP filters, quarterly composite samples, fourth 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	**63.8**	J[3]	2.1	-0.03	UJ[3]	0.03
Experimental Field Station	**62.3**	J[4]	2.5	0.05	UJ[4]	0.04
MFC Guard House[4]	**59.8**	-	2.0	-0.02	U	0.03
Sand Dunes Tower	**64.8**	J[5]	2.6	0.06	UJ[5]	0.03
Van Buren Avenue	**61.0**	J[5]	2.0	-0.01	UJ[5]	0.03
Boundary Locations						
Atomic City	**61.6**	-	2.5	0.04	U	0.03
Howe	**62.3**	-	2.0	0.03	U	0.03
Monteview	**61.8**	-	2.1	0.05	U	0.04
Mud Lake	**74.0**	-	2.3	0.04	U	0.05
Distant Locations						
Craters of the Moon	**62.5**	J[5]	2.0	0.02	UJ[5]	0.03
Fort Hall[1]	**62.5**	J[6]	2.5	**0.10**	J[6]	0.03
Idaho Falls	**65.1**	-	2.0	-0.02	U	0.03

Concentrations are reported in 1 x 10^{-3} pCi/m^3 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]Operated by Shoshone-Bannock Tribes.
[2]Concentration and uncertainty values are for Cs-137.
[3]Volume is an estimate for one week due to mechanical failure. Volume is less than expected for one week due to power outage. Results are considered a usable estimate (J).
[4]Volume is less than expected for two weeks due to power outage. Results are considered a usable estimate (J).
[5]Volume is less than expected for one week due to power outage. Results are considered a usable estimate (J).
[6]Volume is an estimate due to technician error. Results are considered a usable estimate (J).

Table 4. Gamma spectrometry analysis data for 8x10-inch TSP filters, monthly composite samples, fourth 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	Oct	**130.6**	-	4.0	0.00	U	0.02
	Nov	**58.1**	J[6]	2.0	0.05	UJ[6]	0.02
	Dec	**98.0**	-	2.8	0.02	U	0.02
Experimental Field Station	Oct	**129.2**	J[5]	4.4	0.02	UJ[5]	0.02
	Nov	**56.6**	-	1.9	0.01	U	0.02
	Dec	**81.1**	J[8]	2.7	0.01	UJ[8]	0.01
MFC Guard House[4]	Oct	**118.7**	-	3.7	0.02	U	0.01
	Nov	**69.2**	-	2.1	0.00	U	0.01
	Dec	**89.6**	-	2.6	0.03	U	0.02
Sand Dunes Tower	Oct	**153.2**	-	4.4	0.05	U	0.02
	Nov	**61.9**	J[6]	1.9	0.02	UJ[6]	0.02
	Dec	**72.2**	-	2.2	-0.03	U	0.02
Van Buren Avenue	Oct	**124.9**	-	3.9	-0.02	U	0.01
	Nov	**66.2**	J[6]	2.0	0.00	UJ[6]	0.01
	Dec	**94.8**	-	2.8	0.02	U	0.02
Boundary Locations							
Atomic City	Oct	**120.0**	-	4.1	0.02	U	0.02
	Nov	**54.2**	-	1.9	0.01	U	0.02
	Dec	**75.4**	-	2.3	-0.02	U	0.01
Howe	Oct	**135.2**	J[5]	4.2	0.01	UJ[5]	0.01
	Nov	**51.8**	-	1.6	0.01	U	0.01
	Dec	**81.9**	-	2.5	0.02	U	0.01
Monteview	Oct	**133.0**	-	4.5	0.01	U	0.02
	Nov	**54.7**	-	1.7	0.01	U	0.01
	Dec	**82.8**	-	2.6	0.00	U	0.01
Mud Lake	Oct	**139.1**	-	4.7	0.02	U	0.02
	Nov	**59.6**	-	1.9	-0.01	U	0.01
	Dec	**92.1**	-	3.1	0.00	U	0.02
Distant Locations							
Craters of the Moon	Oct	**155.0**	-	4.5	0.07	U	0.03
	Nov	**62.0**	-	1.9	0.01	U	0.01
	Dec	**80.4**	J[7]	2.7	0.01	UJ[7]	0.01
Fort Hall[1]	Oct	**100.0**	-	3.1	0.02	U	0.02
	Nov	**56.3**	-	2.0	0.04	U	0.02
	Dec	**68.2**	-	2.3	0.00	U	0.02
Idaho Falls	Oct	**155.5**	-	4.5	0.04	U	0.02
	Nov	**65.8**	-	2.3	0.00	U	0.01
	Dec	**78.9**	-	2.5	-0.01	U	0.01

Concentrations are reported in 1 x 10^{-3} pCi/m^3 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]Operated by Shoshone-Bannock Tribes.
[2] Concentration and SD values are for Cs-137 unless otherwise noted.
[3] Four filters/composite for October and December, five filters/composite for November unless otherwise noted.
[4]MFC Guard House is a new monitoring location. Data collection began here during the week of 5/16 – 5/23/24.
[5]The October air volume is less than expected due to a power outage one week. The resulting composite data are estimates (J).
[6]The November air volume is less than expected due to a power outage one week. The resulting composite data are estimates (J).
[7]The December air volume is less than expected due to a power outage one week. The resulting composite data are estimates (J).
[8]The December air volume is an estimate due to a technician error. The resulting composite data are estimates (J).

Table 5. Radiochemical separation analysis results for 8x10-inch TSP particulate filter composites collected during third 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	**1.98**	J[7]	0.36	0.05	UJ[7]	0.04	0.10	UJ[7]	0.04	0.09	UJ[7]	0.08
EFS[3]	**3.71**	J[6,9]	0.51	0.01	UJ[6,9]	0.04	0.14	J[6,9]	0.05	0.09	UJ[6,9]	0.09
MFC Guard House	**2.33**	-	0.38	0.02	U	0.04	**0.17**	-	0.05	-0.03	U	0.07
Sand Dunes Tower	**1.83**	J[7]	0.33	0.07	UJ[7]	0.04	0.08	UJ[7]	0.04	-0.04	UJ[7]	0.07
Van Buren Avenue	**1.81**	J[7]	0.40	0.09	UJ[7]	0.06	**0.12**	J[7]	0.04	0.01	UJ[7]	0.06
Boundary Locations												
Atomic City	**1.70**	-	0.39	0.06	U	0.07	0.02	U	0.04	0.07	U	0.07
Howe	**1.40**	J[6]	0.30	0.01	UJ[6]	0.06	0.04	UJ[6]	0.03	-0.04	UJ[6]	0.08
Monteview	**1.62**	-	0.33	0.05	U	0.05	0.11	U	0.04	0.10	U	0.07
Mud Lake	**1.92**	-	0.39	0.07	U	0.04	**0.09**	-	0.03	0.08	U	0.07
Distant Locations												
Craters of the Moon	0.91	UJ[8]	0.31	0.11	UJ[8]	0.04	0.05	UJ[8]	0.03	0.07	UJ[8]	0.08
Fort Hall[2]	0.44	U	0.28	0.00	U	0.05	**0.15**	-	0.05	0.17	U	0.08
Idaho Falls	**0.95**	-	0.29	0.02	U	0.04	0.09	U	0.04	0.06	U	0.08

Note: Concentrations are reported in 1 x 10^{-5} pCi/m^3 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/m^3) 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.

[4] BLR – Big Lost River.

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

[6] The October air volume is less than expected due to a power outage one week. The resulting composite data are estimates (J).

[7] The November air volume is less than expected due to a power outage one week. The resulting composite data are estimates (J).

[8] The December air volume is less than expected due to a power outage one week. The resulting composite data are estimates (J).

[9] The December air volume is an estimate due to a technician error. The resulting composite data are estimates (J).

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

Start Date	Collection Date	Iodine-131 activity (pCi/composite)		
		Activity		1 SD
09/26/24	10/03/24	-2.03	U	1.09
10/03/24	10/10/24	0.86	U	1.04
10/10/24	10/17/24	1.14	U	1.28
10/17/24	10/24/24	-0.18	U	0.63
10/24/24	10/31/24	-0.06	U	0.98
10/31/24	11/07/24	-0.30	U	0.83
11/07/24	11/14/24	-1.53	U	1.06
11/14/24	11/21/24	0.85	U	1.43
11/21/24	11/27/24[1]	0.51	U	0.94
11/27/24	12/05/24[2]	0.07	U	0.80
12/05/24	12/12/24	-0.68	U	1.24
12/12/24	12/19/24	0.57	U	0.84
12/19/24	12/26/24	0.42	U	0.62

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.
[1]Samples ran for one day shorter than expected due to holiday
[2]Samples ran for one day longer than expected due to holiday

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

Station Location	Start Date	Collection Date	Tritium		
			Concentration		1 SD
On-site Locations					
Big Lost River Rest Area	09/26/2024	10/24/2024	0.28	U	0.11
Big Lost River Rest Area	10/24/2025	11/21/2024	**0.35**	-	0.10
Big Lost River Rest Area	11/21/2024	12/26/2024	0.10	U	0.07
Big Lost River Rest Area Mean	09/26/2024	12/26/2024	0.23	U	0.09
Experimental Field Station	09/26/2024	10/24/2024	**0.46**	-	0.09
Experimental Field Station	10/24/2024	11/21/2024	0.04	U	0.07
Experimental Field Station	11/21/2024	12/26/2024	0.08 J[1]	U	0.13
Experimental Field Station Mean	09/26/2024	12/26/2024	0.20	U	0.10
MFC Guard House	09/26/2024	10/24/2024	0.29	U	0.11
MFC Guard House	10/24/2024	11/21/2024	0.03	U	0.07
MFC Guard House	11/21/2024	12/26/2024	0.20	U	0.07
MFC Guard House Mean	09/26/2024	12/26/2024	0.18	U	0.08
Sand Dunes Tower	09/19/2024	10/17/2024	0.29	U	0.13
Sand Dunes Tower	10/17/2024	11/21/2024	-0.04	U	0.07
Sand Dunes Tower	11/21/2024	12/26/2024	**0.29**	-	0.06
Sand Dunes Tower Mean	09/19/2024	12/26/2024	0.19	U	0.09
Van Buren Avenue	09/26/2024	11/14/2024	0.19	U	0.09
Van Buren Avenue	11/14/2024	12/26/2024	0.03	U	0.10
Van Buren Avenue Mean	09/26/2024	12/26/2024	0.12	U	0.09
Boundary Locations					
Atomic City	09/26/2024	10/24/2024	0.04	U	0.08
Atomic City	10/24/2024	12/05/2024	0.10	U	0.07
Atomic City	12/05/2024	12/26/2024	0.15	U	0.11
Atomic City Mean	09/26/2024	12/26/2024	0.09	U	0.08
Howe	09/19/2024	10/17/2024	0.08	U	0.08
Howe	10/17/2024	11/21/2024	0.10	U	0.07
Howe	11/21/2024	12/26/2024	-0.09	U	0.06
Howe Mean	09/19/2024	12/26/2024	0.03	U	0.07
Mud Lake	09/19/2024	10/17/2024	0.05	U	0.10
Mud Lake	10/17/2024	11/21/2024	0.19	U	0.07
Mud Lake	11/21/2024	12/26/2024	0.17	U	0.07
Mud Lake Mean	09/192024	12/26/2024	0.14	U	0.08
Monteview	09/26/2024	10/24/2024	0.21	U	0.08
Monteview	10/24/2024	12/05/2024	0.18	U	0.07
Monteview	12/05/2024	12/26/2024	0.03	U	0.07
Monteview Mean	09/26/2024	12/26/2024	0.16	U	0.07
Distant Locations					
Craters of the Moon	09/19/2024	10/17/2024	0.07	U	0.07
Craters of the Moon	10/17/2024	11/21/2024	0.03	U	0.06
Craters of the Moon	11/21/2024	12/26/2024	0.10	U	0.06
Craters of the Moon Mean	09/19/2024	12/26/2024	0.07	U	0.07
Fort Hall[2]	09/26/2024	10/24/2024	0.05	U	0.09
Fort Hall	10/24/2024	11/21/2024	0.16	U	0.08
Fort Hall	11/21/2024	12/26/2024	0.12 J[3]	U	0.12
Fort Hall Mean	09/26/2024	12/26/2024	0.11	U	0.10
Idaho Falls	09/26/2024	10/24/2024	0.05	U	0.09

Station Location	Start Date	Collection Date	Tritium		
			Concentration		1 SD
Idaho Falls	10/24/2024	12/05/2024	0.11	U	0.07
Idaho Falls	12/05/2024	12/26/2024	0.19	U	0.08
Idaho Falls Mean	09/26/2024	12/26/2024	0.11	U	0.08

Note: Concentrations are reported in pCi/m^3 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.
[1] Collected water volume was not determined by staff and therefore was estimated for the purpose of calculation.
[2] Station operated by Shoshone-Bannock Tribes.
[3] Collected water volume was not determined by staff and therefore was estimated for the purpose of calculation.

Table 8. Tritium and Cesium-137 concentrations in precipitation, fourth 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	09/26/2024	12/26/2024	-40	U	30	-0.4	U	0.5
Big Lost River Rest Area Mean	09/26/2024	12/26/2024	-40	U	30	-0.4	U	0.5
Boundary Locations								
Atomic City	09/26/2024	12/26/2024	-20	U	30	-1.1	U	0.6
Atomic City Mean	09/26/2024	12/26/2024	-20	U	30	-1.1	U	0.6
Howe	09/26/2024	12/26/2024	-30	U	30	1.2	U	0.6
Howe Mean	09/26/2024	12/26/2024	-30	U	30	1.2	U	0.6
Mud Lake	09/26/2024	12/26/2024	-40	U	30	-0.6	U	0.7
Mud Lake Mean	09/26/2024	12/26/2024	-40	U	30	-0.6	U	0.7
Monteview	09/26/2024	12/26/2024	-30	U	30	-1.4	U	0.7
Monteview Mean	09/26/2024	12/26/2024	-30	U	30	-1.4	U	0.7
Distant Locations								
Idaho Falls	09/26/2024	12/26/2024	10	U	30	0.7	U	0.8
Idaho Falls Mean	09/26/2024	12/26/2024	10	U	30	0.7	U	0.8

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.

Environmental Radiation Monitoring Results

The DEQ-INL OP operated 11 real-time environmental radiation monitoring stations during the fourth quarter of 2024 (**Figure 1**). To detect gamma radiation, each station is equipped with an EcoGamma gamma radiation monitor featuring both low- and high-range Geiger–Müller detectors, along with triplicate electret ionization chambers (EICs). (**Table 9**).

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

The EcoGammas provide real-time measurements and are sensitive enough to detect small changes in gamma radiation levels. The EcoGamma data from each location are transmitted to the DEQ-INL OP and are presented graphically on the DEQ website: https://www.deq.idaho.gov/idaho-national-laboratory-oversight/inl-oversight-program/gamma-radiation-measurements. Historically, DEQ-INL OP used high-pressure ion chambers (HPICs) for real-time gamma radiation monitoring. The transition from HPICs to EcoGammas at all monitoring stations was completed in the first quarter of 2022. Slight differences between EcoGamma and historical HPIC data are expected.

EICs are passive-integrating devices that provide cumulative measurements of environmental gamma radiation exposure. They are deployed, collected, and analyzed quarterly. EICs offer an economical method for monitoring gamma radiation across wide areas, particularly in regions without a power supply. They can also deliver critical gamma radiation data during emergencies. For these reasons, DEQ-INL OP has deployed EICs at 67 locations in a broad network around the INL to measure external radiation. These data are presented in **Appendix B.**

DEQ-INL OP uses both EcoGammas and EICs to monitor external gamma radiation for a variety of radiological objectives. **Table 10** presents the average, median, and range of radiation exposure rates measured by EcoGammas during the fourth quarter of 2024. **Table 11** presents the EIC monitoring results for the same period. Overall, exposure rates remained within the historical background radiation range observed by DEQ-INL OP.

Table 9. Summary of radiation detection instruments at real-time radiation monitoring stations and air monitoring stations.

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

[1]MFC – Materials and Fuels Complex. MFC Guard House is a new monitoring location. Air monitoring data collection began here during the week of 5/16 - 5/23/24. EIC data collection will begin during the third quarter of 2025.

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

Station Location	Exposure Rate (µR/hr)			
	Quarterly Average*	± 1 SD	Median	Range**
On-site Locations				
Base of Howe	13.6	0.8	13.6	10.8 – 21.0
Big Lost River Rest Area[1]	14.4	0.8	14.4	11.5 – 19.7
Rover	14.7	0.7	14.7	11.9 – 19.9
Sand Dunes Tower[2]	14.0	0.8	14.0	11.3 – 19.3
Boundary Locations				
Atomic City	13.6	0.8	13.6	10.6 – 19.1
Howe Met. Tower[1]	13.1	0.7	13.0	10.4 – 18.7
Monteview	13.1	0.8	13.1	10.3 – 21.5
Mud Lake / Terreton[3]	13.0	0.8	13.0	10.6 – 17.6
Distant Locations				
Big Southern Butte[4]	14.0	1.1	14.2	10.4 – 17.8
Fort Hall	12.4	0.7	12.4	10.2 – 17.6
Idaho Falls[5]	12.8	1.5	12.6	9.3 – 34.4

*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 valid data from the EcoGamma at this location 11/25 – 11/26/24.

[2]No valid data from the EcoGamma at this location 11/7 – 11/12/24 and 11/25 – 11/26/24.

[3]No valid data from the EcoGamma at this location 11/13 – 11/14/24.

[4]The EcoGamma was in operation intermittently at this location, producing several gaps in the dataset between 10/1 – 11/3/24.

[5]No valid data from the EcoGamma at this location 11/12 – 11/14/24

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Table 11. Electret ionization chamber (EIC) cumulative average exposure rates at real-time radiation monitoring stations and air monitoring stations, fourth quarter, 2024.

Station Location	Exposure Rate (µR/hr)	
	Quarterly Average[1]	± 1 SD
On-Site Locations		
Base of Howe	14.2	1.3
Big Lost River Rest Area	13.3	1.0
Experimental Field Station	16.0	0.5
MFC (EBR II)[2]	14.6	1.9
Rover	14.8	2.1
Sand Dunes Tower	14.6	0.9
Van Buren Avenue	13.2	2.3
Boundary Locations		
Atomic City	14.8	0.8
Howe Met. Tower	15.0	0.4
Monteview	16.1, 18.5	-
Mud Lake/ Terreton	13.9	2.1
Distant Locations		
Big Southern Butte	NS[3]	NS[3]
Craters of the Moon	14.6	1.4
Fort Hall	12.0	1.2
Idaho Falls	9.5	0.2

[1]Results 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.
[2]Nearest existing EIC triplicate location to new MFC Guard House air monitoring station. EIC data collection at the MFC Guard House air monitoring station will begin during the third quarter of 2025.
[3]NS = No sample. EICs could not be collected at the quarterly change-out due to heavy snow conditions on access roads.

Water Monitoring Results

DEQ-INL OP collects groundwater samples from wells and springs located within, upgradient of, and downgradient of the INL in order 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, 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 (^{234}U, ^{235}U, and ^{238}U), plutonium isotopes (^{238}Pu, $^{239/240}$Pu), americium-241 (^{241}Am), strontium-90 (^{90}Sr), iodine-129 (^{129}I), and technetium-99 (^{99}Tc)—selected trace metals, common ions, total phosphorus, and/or volatile organic compounds (VOCs) based

[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, samples are collected for common ions, metals, nitrate-plus-nitrate, and other constituents along with gross alpha and gross beta radioactivity, gamma-emitting radionuclides, and tritium.

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 fourth quarter of 2024, DEQ-INL OP sampled groundwater from the aquifer at 12 facility locations, 3 boundary locations, 5 distant locations, and 1 upgradient location. DEQ-INL OP also sampled water from 4 perched water locations, 2 surface water locations, and 2 wastewater 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 23** and summarized below. The results of low-level tritium analyses for ten samples collected this quarter and three samples collected in third quarter, 2024 are reported in **Table 16** and discussed below.

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.

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.

Low concentrations of gross alpha and beta radioactivity were detected in most samples **(Table 14)**. Gross alpha radioactivity was measured at concentrations within the known background range at all locations. TAN-37A saw a significant increase in gross beta concentration of 633.3 ± 16 pCi/L from 25.6 ± 0.7 pCi/L in 2023. TAN-37A is affected by volatile organic compound remediation media, which alters geochemical conditions and may mobilize previously adsorbed contaminants. Gross beta radioactivity elevated above the natural background was observed at ATR perched well PW-12 (56.2 ± 1.0 pCi/L) and INTEC aquifer wells USGS-112 (10.2 ± 0.5 pCi/L) and USGS-115 (10.2 ± 0.5 pCi/L). All results align with historical data.

Manmade gamma-emitting radionuclides

No manmade gamma-emitting radionuclides were detected at any location sampled this quarter. Results for cesium-137 (^{137}Cs), the manmade gamma-emitter most likely to be detected in groundwater, are reported in **Table 14**.

Tritium

Tritium was analyzed for all locations sampled during this quarter **(Table 15).** Elevated levels of tritium were detected in aquifer wells located at or near ATR, INTEC, RWMC, TAN, CFA, and the southern boundary of INL. The highest concentration of tritium was found in ATR facility well TRA-07 at 2532 ± 67 pCi/L. Despite being the quarter's highest concentration, it aligns with the downward trend at this well since 2010. Elevated but typical tritium concentrations were observed in CFA-2 at 1934 ± 55 pCi/L, ATR well USGS-140 at 741 ± 43 pCi/L, INTEC well USGS-115 at 661 ± 42 pCi/L, TAN-37A at 330 ± 39 pCi/L, RWMC Production well at 420 ± 36 pCi/L, and boundary well USGS-104 at 386 ± 40 pCi/L.

In ATR perched groundwater wells, all samples exhibited elevated tritium concentrations. The highest concentration was 2003 ± 62 pCi/L at PW-12, down from 3620 ± 45 pCi/L in 2023, and 986 ± 46 pCi/L at USGS-073, down from 1170 ± 40 pCi/L in 2023. The PW-11 tritium concentration was 404 ± 37 pCi/L, with the PW-09 tritium concentration at 500 ± 43 pCi/L. Observed results reflect historical values.

Three samples from third quarter 2024 and 10 samples from this quarter were analyzed for low-level tritium, with results reported in **Table 16**. All tritium concentrations reported in this quarter fell within expected ranges and were well below the drinking water MCL of 20,000 pCi/L.

Strontium-90

Nine aquifer facility wells and four ATR perched water wells were sampled for ^{90}Sr this quarter (**Table 17**)**.** TAN-37A exhibited the highest ^{90}Sr concentration this quarter at 312 ± 13 pCi/L. Given that this value exceeded the 2023 result of 180 ± 15 pCi/L, a second analysis was requested to confirm accuracy from the laboratory. The repeat analysis yielded a concentration of 280 ± 12 pCi/L, supporting the first result. TAN-37A is affected by volatile organic compound remediation media, which alters geochemical conditions and may mobilize previously adsorbed contaminants. PW-12 had an elevated ^{90}Sr concentration of 33.1 ± 1.6 pCi/L, consistent with the 2023 concentration of 34.1 ± 1.6 pCi/L. TRA-07 at 1.98 ± 0.33 pCi/L and TRA-08 at 0.338 ± 0.167 pCi/L both exceeded their 2023 values but were not the maximum observed historically. The ^{90}Sr concentration at USGS-140 was the highest on record for this well at 0.624 ± 0.135 pCi/L, where the average from previous years is 0.26 ± 0.27 pCi/L. Sampling of this well is planned for 2025, with close evaluation of the results.

Technetium-99

Three of six locations sampled for ^{99}Tc this quarter showed detections (**Table 18**). INTEC well USGS-115 exceeded the 2023 level of 3.87 ± 0.70 pCi/L with a concentration of 11.6 ± 0.8 pCi/L. The 2024 concentration is below the historical maximum of 16.1 ± 0.2 pCi/L in 2017.

The initial analysis of CFA-2 measured 2.17 ± 0.31 pCi/L, which was within the expected historical range. However, a new sample was collected and analyzed after a miscommunication with the contract laboratory. The result of the second sample (18.6 ± 1.0 pCi/L) was unexpectedly high and more than double the previous historical maximum . Despite the elevated result, the concentration remains well below the 900 pCi/L MCL. It is not clear what caused the disagreement between the samples, but continued monitoring of this location is planned next year. Other samples analyzed this quarter for ^{99}Tc resulted in non-detections.

Actinides

One location, TAN-37A, was analyzed for uranium isotopes this quarter (**Table 19**). TAN-37A exhibited an above background ^{234}U concentration of 4.51 ± 0.80 pCi/L, a typical concentration level for this well. For ^{235}U, the concentration was a non-detect and within background levels at 0.0 ± 0.31 pCi/L, as was the concentration for ^{238}U (0.41 ± 0.29 pCi/L). All results were within the expected ranges.

Common ions, trace metals, and nutrients

All locations were sampled for chloride, chromium, sulfate, alkalinity, and dissolved nutrients (nitrate-plus-nitrite). Six locations (Alpheus Spring, Clear Spring, Bill Jones Hatchery, Minidoka Water Supply, Mud Lake Water Supply and Shoshone Water Supply) were sampled for other common ions. Three locations (TAN-37A, TRA Cold Waste Pond, and MFC–Industrial Waste Pipe) were sampled for other common ions, trace metals, and phosphorus during the quarter (**Tables 20, 21, and 22**). Most analyses were within the historical range. Exceedances above background concentrations of chloride were seen in

CFA-2, USGS-073, TAN-37A, and PW-9. In 2023, PW-12 experienced a notable increase in chloride concentration (95.5 mg/L), however, this quarter's measurements indicate a return to typical levels (41.2 mg/L). Chloride levels at all other locations remained comparable to historical values. At TRA-07, sulfate was detected at 125 mg/L. Although this is above background concentrations (9.6 - 40.4 mg/L), it is consistent with previous results. Increased concentrations of magnesium, sodium, potassium, chloride and alkalinity were observed at TAN-37A. This is typical for this well and presumably caused by bioremediation activities at the TAN facility, which are known to alter groundwater chemistry beyond natural background levels.

Chromium concentrations were elevated above background levels in the following aquifer wells: TAN-37A (67 µg/L; MCL 100 µg/L), TRA-07 (94 µg/L), TRA-08 (18 µg/L), USGS-099 (6.0 µg/L), USGS-140 (17 µg/L), RWMC Production (11 µg/L), USGS-112 (11 µg/L), USGS-115 (6.6 µg/L), Middle-1823 (10 µg/L), CFA 2 (10 µg/L), USGS-120 (9.0 µg/L), and USGS-104 (7.8 µg/l). Results from the following perched water wells were above background chromium levels: USGS-073 (15 µg/L), PW-11 (21 µg/L), and PW-9 (11 µg/L). PW-9 experienced a significant decrease in chromium concentration this quarter compared to 2023 (50 µg/L). MFC-IWP saw a significant increase in iron concentration at 27 µg/L, up from 5.7 µg/L in 2023. Elevated concentrations of arsenic, iron, manganese, and barium were exhibited at TAN-37A, which are likely influenced by remediation efforts at the TAN facility.

ATR Perched well USGS-073 exhibited the highest nitrate + nitrite concentration observed to date at this well, surpassing background levels at 35 mg/L. TAN-37A displayed the highest phosphorous concentration observed to date at this well, exceeding both background levels and recorded values at 9.7 mg/L. On-going bioremediation efforts at the TAN facility are suspected to cause the increased concentration.

Volatile organic compounds (VOCs)

VOCs were analyzed in aquifer wells RWMC Production, USGS-120, and TAN-37A (**Table 23**). Chloromethane was reported for the first time at the RWMC Production well (0.31 µg/L) above the method detection level (0.18 µg/L), but below the reporting limit (0.50 µg/L), and is therefore considered a detected estimate (J qualifier). TAN-37A showed detections of 2-Butanone and Toluene, which have been detected intermittently over the last several years. Both are considered short-lived constituents especially when compared to more persistent VOCs, such as TCE. Carbon tetrachloride (1.08 µg/L) continues to be detected at USGS-120. At the RWMC Production well, carbon tetrachloride, trichloroethene (TCE), chloroform, and tetrachloroethene (PCE) continue to be detected at levels consistent with previous observations.

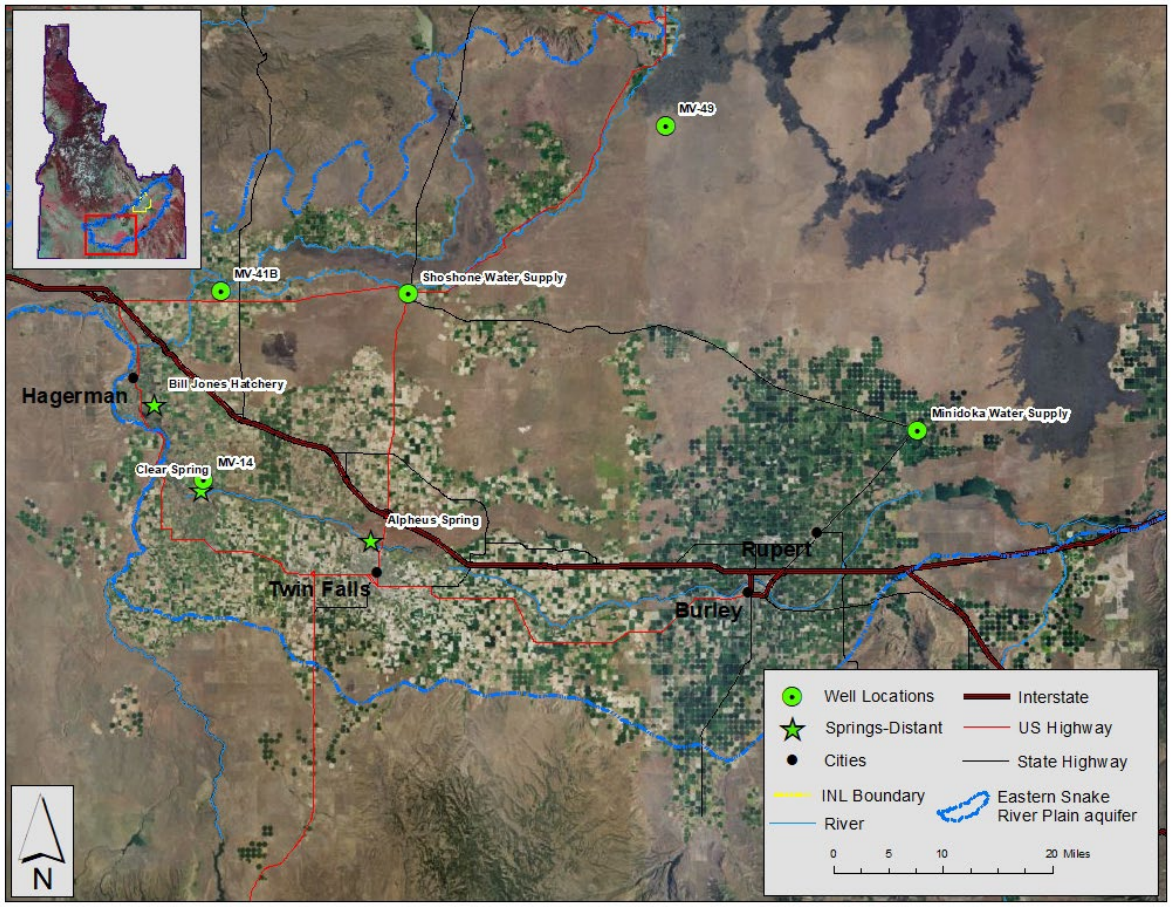


Figure 2. Distant water monitoring locations.

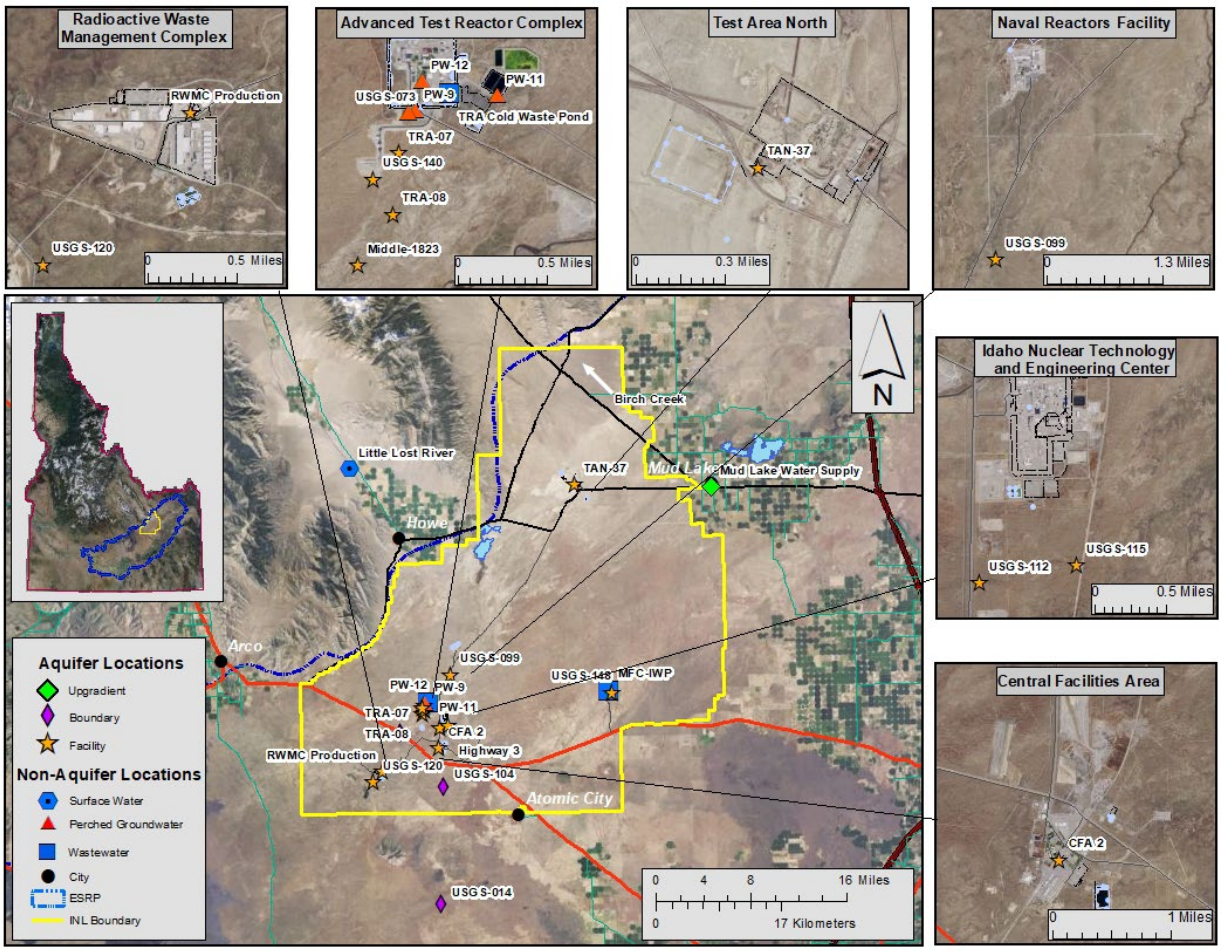


Figure 3. Up-gradient, facility, boundary, perched groundwater (GW), surface water, and wastewater monitoring locations.

Table 12. Locations sampled for water, fourth quarter, 2024.

Sample Location	Date Sampled	Co-sampler	Well Depth (ft bgs)	Analyses*
Aquifer Samples				
Upgradient				
Mud Lake Water Supply	11/14/2024	BEA	330	α, β, γ, ^{3}H, com. ions, Cr, As, NO_3+NO_2
Facility				
Advanced Test Reactor Complex:				
Middle-1823	10/07/2024	IEC	729.1	α, β, γ, ^{3}H, Cl^-, SO_4^{2-}, alkalinity, Cr, NO_3+NO_2
TRA-07	10/07/2024	IEC	484	α, β, γ, ^{3}H, ^{90}Sr, Cl^-, SO_4^{2-}, alkalinity, Cr, NO_3+NO_2
TRA-08	10/07/2024	IEC	501.5	α, β, γ, ^{3}H, ^{90}Sr, Cl^-, SO_4^{2-}, alkalinity, Cr, NO_3+NO_2
USGS-140	10/09/2024	USGS	546	α, β, γ, ^{3}H, ^{90}Sr, Cl^-, SO_4^{2-}, alkalinity, Cr, NO_3+NO_2
Idaho Nuclear Technology and Engineering Center:				
USGS-112	10/01/2024	USGS	507	α, β, γ, ^{3}H, ^{90}Sr, ^{99}Tc, U iso, Cl^-, SO_4^{2-}, alkalinity, Cr, NO_3+NO_2
USGS-115	10/01/2024	USGS	581	α, β, γ, ^{3}H, ^{90}Sr, ^{99}Tc, U Iso, Cl^-, SO_4^{2-}, alkalinity, Cr, NO_3+NO_2
Radioactive Waste Management Complex:				
RWMC Production	10/15/2024	USGS	685	α, β, γ, ^{3}H, ^{90}Sr, ^{99}Tc, Cl^-, SO_4^{2-}, alkalinity, Cr, NO_3+NO_2, VOCs
USGS-120	10/15/2024	USGS	705	α, β, γ, ^{3}H, ^{90}Sr, ^{99}Tc, Cl^-, SO_4^{2-}, alkalinity, Cr, NO_3+NO_2, VOCs
Test Area North:				
TAN-37A	10/23/2024	IEC	240	α, β, γ, ^{3}H, ^{90}Sr, U iso, com. ions, trace metals, NO_3+NO_2, P, VOCs
Central Facilities Area:				
CFA 2	10/17/2024	USGS	507	α, β, γ, ^{3}H, ^{90}Sr, Cl^-, SO_4^{2-}, alkalinity, Cr, NO_3+NO_2
Materials and Fuels Complex:				
USGS-148	10/17/2024	USGS	680	α, β, γ, ^{3}H, Cl^-, SO_4^{2-}, alkalinity, Cr, NO_3+NO_2
Naval Reactors Facility:				
USGS-099	10/16/2024	USGS	426	α, β, γ, ^{3}H, Cl^-, SO_4^{2-}, alkalinity, Cr, NO_3+NO_2
Boundary				
Highway 3	10/03/2024	USGS	750	α, β, γ, ^{3}H, ^{99}Tc, Cl^-, SO_4^{2-}, alkalinity, Cr, NO_3+NO_2
USGS-014	10/16/2024	USGS	751	α, β, γ, ^{3}H, Cl^-, SO_4^{2-}, alkalinity, Cr, NO_3+NO_2
USGS-104	10/16/2024	USGS	700	α, β, γ, ^{3}H, ^{99}Tc, Cl^-, SO_4^{2-}, alkalinity, Cr, NO_3+NO_2
Distant				
Alpheus Spring	11/12/2024	BEA	0	α, β, γ, ^{3}H, com. ions, Cr, NO_3+NO_2
Bill Jones Hatchery	11/12/2024	BEA	0	α, β, γ, ^{3}H, com. ions, Cr, NO_3+NO_2
Clear Spring	11/12/2024	BEA	0	α, β, γ, ^{3}H, com. ions, Cr, NO_3+NO_2
Minidoka Water Supply	11/12/2024	BEA	282	α, β, γ, ^{3}H, com. ions, Cr, NO_3+NO_2
Shoshone Water Supply	11/12/2024	BEA	n/a	α, β, γ, ^{3}H, com. ions, Cr, NO_3+NO_2
Other Samples				
Perched Groundwater				
Advanced Test Reactor Complex:				
PW-9	10/09/2024	USGS	200	α, β, γ, ^{3}H, ^{90}Sr, Cl^-, SO_4^{2-}, alkalinity, Cr, NO_3+NO_2
PW-11	10/08/2024	IEC	134.5	α, β, γ, ^{3}H, ^{90}Sr, Cl^-, SO_4^{2-}, alkalinity, Cr, NO_3+NO_2
PW-12	10/08/2024	IEC	128	α, β, γ, ^{3}H, ^{90}Sr, Cl^-, SO_4^{2-}, alkalinity, Cr, NO_3+NO_2
USGS-073	10/09/2024	USGS	127	α, β, γ, ^{3}H, ^{90}Sr, Cl^-, SO_4^{2-}, alkalinity, Cr, NO_3+NO_2
Surface Water				
Birch Creek	10/10/2024	USGS	0	α, β, γ, ^{3}H, Cl^-, SO_4^{2-}, alkalinity, Cr, NO_3+NO_2
Little Lost River	10/10/2024	USGS	0	α, β, γ, ^{3}H, Cl^-, SO_4^{2-}, alkalinity, Cr, NO_3+NO_2
Waste Water				
TRA Cold Waste Pond	10/08/2024	BEA	0	α, β, γ, ^{3}H, Cl^-, SO_4^{2-}, alkalinity, trace metals, NO_3+NO_2, P
MFC-Industrial Waste Pipeline (IWP)	10/15/2024	BEA	0	α, β, γ, ^{3}H, Cl^-, SO_4^{2-}, alkalinity, trace metals, NO_3+NO_2, P

ft bgs = feet below ground surface.

*α = gross alpha radioactivity; β = gross beta radioactivity; γ = manmade gamma-emitting radionuclides; ^{3}H = tritium; ^{90}Sr = Strontium-90; ^{99}Tc = Technetium-99; ^{241}Am = Americium-241; P iso. = ^{238}Pu, $^{239/240}Pu$; ^{129}I = Iodine-129; U iso. = ^{234}U, ^{235}U, ^{238}U; Cl^- = chloride; Cr = chromium; com. ions = calcium (Ca^{2+}), magnesium (Mg^{2+}), sodium (Na^+), potassium (K^+), chloride (Cl^-), sulfate (SO_4^{2-}), alkalinity; trace metals = arsenic (As), barium (Ba), chromium (Cr), iron (Fe), manganese (Mn), lead (Pb); selenium (Se); NO_3+NO_2 = nitrate plus nitrite; P = phosphorus, and VOCs = volatile organic compounds.

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	---
Plutonium-239/240	0	---
Americium-241	0	---
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] Cecil and others, 2003 (DOE/ID-22186); [f]MCL is for total trihalomethanes.
[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) for water samples, fourth quarter, 2024.

Sample Location	Sample Date	Gross Alpha			Gross Beta			Cesium-137*		
		Concentration		1 SD	Concentration		1 SD	Concentration		1 SD
Aquifer Samples										
Upgradient										
Mud Lake Water Supply	11/14/2024	-0.1	U	0.3	**3.7**	-	0.4	0.6	U	0.7
Facility										
Advanced Test Reactor Complex										
Middle-1823	10/07/2024	0.4	U	0.3	**1.4**	-	0.4	0.1	U	0.5
TRA-07	10/07/2024	**3.4**	-	0.6	**5.7**	-	0.5	-1.1	U	0.9
TRA-08	10/07/2024	**1.1**	-	0.3	**1.9**	-	0.3	0.4	U	0.6
USGS-140	10/09/2024	**2.9**	-	0.5	**2.4**	-	0.4	-0.8	U	0.6
Idaho Nuclear Technology and Engineering Center										
USGS-112	10/01/2024	**1.2**	-	0.3	**10.2**	-	0.5	-0.5	U	0.6
USGS-115	10/01/2024	0.8	U	0.3	**10.2**	-	0.5	0.0	U	0.7
Radioactive Waste Management Complex										
RWMC Production	10/15/2024	1.2	-	0.4	**2.9**	-	0.4	0.9	U	0.8
USGS-120	10/15/2024	**1.7**	-	0.4	**2.1**	-	0.4	1.9	U	0.9
Test Area North										
TAN-37A	10/23/2024	-2.2	U	7.1	**633**	-	16	1.5	U	0.7
Central Facilities Area										
CFA 2	10/17/2024	0.5	U	0.3	**3.8**	-	0.4	1.3	U	0.8
Materials and Fuels Complex										
USGS-148	10/17/2024	**1.6**	-	0.5	**2.4**	-	0.5	0.1	U	0.6
Naval Reactors Facility										
USGS-099	10/16/2024	0.7	U	0.4	**8.6**	J	0.5	0.9	U	0.6
Boundary										
Highway 3	10/03/2024	**2.0**	-	0.5	**2.7**	-	0.5	0.2	U	0.6
USGS-014	10/16/2024	1.1	U	0.4	**2.1**	-	0.4	0.5	U	0.5
USGS-104	10/16/2024	0.5	U	0.3	**2.2**	-	0.4	1.0	U	0.6
Distant										
Alpheus Spring	11/12/2024	1.2	U	0.5	**7.5**	-	0.5	-0.2	U	0.6
Bill Jones Hatchery	11/12/2024	**1.7**	-	0.4	**3.4**	-	0.4	1.5	U	0.8
Clear Spring	11/12/2024	1.1	U	0.5	**4.8**	-	0.5	0.6	U	0.8
Minidoka Water Supply	11/12/2024	1.1	U	0.5	**4.0**	-	0.4	1.6	U	1.0
Shoshone Water Supply	11/12/2024	**2.7**	-	0.5	**2.7**	-	0.4	0.1	U	0.6
Other Samples										
Perched Groundwater										
Advanced Test Reactor Complex										
PW-11	10/08/2024	0.5	U	0.2	**1.5**	-	0.3	0.7	U	0.7
PW-12	10/08/2024	**2.4**	-	0.6	**56.2**	-	1.0	0.0	U	0.5
PW-9	10/09/2024	**1.4**	-	0.4	**3.1**	-	0.4	0.0	U	0.5
USGS-073	10/09/2024	2.3	U	0.8	**7.5**	-	0.8	-0.3	U	0.5
Surface Water										
Little Lost River	10/10/2024	0.7	U	0.3	0.9	U	0.3	0.2	U	0.8
Birch Creek	10/10/2024	**2.4**	-	0.4	1.1	U	0.4	0.1	U	0.9
Wastewater										
TRA Cold Waste Pond	10/08/2024	0.6	U	0.3	**2.2**	-	0.4	1.1	U	0.7
MFC-IWP	10/15/2024	0.8	U	0.4	**4.0**	-	0.4	1.7	U	0.7

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 ^{137}Cs, 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.

Table 15. Tritium concentrations (pCi/L) for water samples, fourth quarter, 2024.

Sample Location	Sample Date	Tritium		
		Concentration		1 SD
Aquifer Samples				
Upgradient				
Mud Lake Water Supply	11/14/2024	10	U	32
Facility				
Advanced Test Reactor Complex				
Middle-1823	10/07/2024	**417**	-	37
TRA-07	10/07/2024	**2532**	-	67
TRA-08	10/07/2024	**525**	-	39
USGS-140	10/09/2024	**741**	-	43
Idaho Nuclear Technology and Engineering Center				
USGS-112	10/01/2024	**229**	-	36
USGS-115	10/01/2024	**661**	-	42
Radioactive Waste Management Complex				
RWMC Production	10/15/2024	**420**	-	36
USGS-120	10/15/2024	88	U	37
Test Area North				
TAN-37A	10/23/2024	**329**	-	39
Central Facilities Area				
CFA 2	10/17/2024	**1934**	-	55
Materials and Fuels Complex				
USGS-148	10/17/2024	57	U	30
MFC-IWP	10/15/2024	47	U	30
Naval Reactors Facility				
USGS-099	10/16/2024	67	U	35
Boundary				
Highway 3	10/03/2024	75	U	33
USGS-014	10/16/2024	44	U	30
USGS-104	10/16/2024	**386**	-	38
Distant				
Alpheus Spring	11/12/2024	7	U	32
Bill Jones Hatchery	11/12/2024	-27	U	31
Clear Spring	11/12/2024	33	U	32
Minidoka Water Supply	11/12/2024	50	U	33
Shoshone Water Supply	11/12/2024	0	U	32
Other Samples				
Perched Groundwater				
Advanced Test Reactor Complex				
PW-11	10/08/2024	**404**	-	37
PW-12	10/08/2024	**2003**	-	62
PW-9	10/09/2024	**500**	-	43
USGS-073	10/09/2024	**986**	-	46
Surface Water				
Little Lost River	10/10/2024	14	U	32
Birch Creek	10/10/2024	0	U	32
Waste Water				
TRA Cold Waste Pond	10/08/2024	-24	U	30
MFC-IWP	10/15/2024	47	U	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.

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

Sample Location	Sample Date	Tritium		
		Concentration		1 SD
Aquifer Samples				
Upgradient				
Mud Lake Water Supply	11/14/2024	-5	U	2
Facility				
Materials and Fuels Complex				
USGS-148	10/17/2024	**6**	-	2
Naval Reactors Facility				
USGS-099	10/16/2024	4	U	2
Radioactive Waste Management Complex				
USGS-120	10/15/2024	**95**	-	3
Boundary				
Highway 3	10/03/2024	**36**	-	2.3
Distant				
Alpheus Spring	11/12/2024	**9**	-	2
Bill Jones Hatchery	11/12/2024	3	U	2
Clear Spring	11/12/2024	2	U	2
Minidoka Water Supply	11/12/2024	**5**	-	2
Shoshone Water Supply	11/12/2024	**5**	-	1
MV-14	07/16/2024	**7**	-	2
MV-41B	07/16/2024	**13**	-	2
MV-49	07/23/2024	**11**	-	2

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

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

Sample Location	Sample Date	Strontium-90		
		Concentration		1 SD
Aquifer Samples				
Facility				
Idaho Nuclear Technology and Engineering Center				
USGS-112	10/01/2024	**4.55**	-	0.31
USGS-115	10/01/2024	0.125	U	0.132
Test Area North				
TAN-37A	10/23/2024	**312**	-	13
Advanced Test Reactor Complex				
TRA-07	10/07/2024	**1.98**	-	0.33
TRA-08	10/07/2024	0.388	U	0.167
USGS-140	10/09/2024	**0.624**	-	0.135
Central Facilities Area				
CFA 2	10/17/2024	0.206	U	0.136
Radioactive Waste Management Complex				
RWMC Production	10/15/2024	0.125	U	0.149
USGS-120	10/15/2024	0.201	U	0.125
Other Samples				
Perched Groundwater				
Advanced Test Reactor Complex				
PW-11	10/08/2024	**0.802**	-	0.176
PW-12	10/08/2024	**33.1**	-	1.6
PW-9	10/09/2024	**0.808**	-	0.246
USGS-073	10/09/2024	**0.690**	-	0.139

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) for water samples, fourth quarter, 2024.

Sample Location	Sample Date	Technetium-99		
		Concentration		1 SD
Aquifer Samples				
Facility				
Idaho Nuclear Technology and Engineering Center				
USGS-112	10/01/2024	2.19	U	1.23
USGS-115	10/01/2024	**11.6**	-	0.8
Central Facilities Area				
CFA-2	10/17/2024	**2.17**	-	0.31
CFA-2	12/17/2024	**18.6**	-	1.0
Radioactive Waste Management Complex				
RWMC Production	10/15/2024	0.561	U	0.266
USGS-120	10/15/2024	-0.029	U	0.252
Boundary				
USGS-104	10/16/2024	-0.51	U	1.24

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. Uranium isotope concentrations (pCi/L) for water samples, fourth quarter, 2024.

Sample Location	Sample Date	Uranium-234			Uranium-235			Uranium-238		
		Concentration		1 SD	Concentration		1 SD	Concentration		1 SD
Aquifer Samples										
Test Area North										
TAN-37A	10/23/2024	**4.51**	-	0.80	0.00	U	0.31	0.41	U	0.29

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. Common ion concentrations (mg/L) in water samples, fourth quarter, 2024.

Sample Location	Sample Date	Calcium*		Magnesium*		Sodium*		Potassium*		Fluoride		Chloride		Sulfate		Alkalinity†	
Aquifer Samples																	
Upgradient																	
Mud Lake Water Supply	11/14/2024	8.1	-	2.6	-	28	-	4.6	-	-	-	4.92	-	8.60	-	90.6	-
Facility																	
Advanced Test Reactor Complex																	
Middle-1823	10/07/2024	-	-	-	-	-	-	-	-	-	-	11.1	-	31.2	-	169	-
TRA-07	10/07/2024	-	-	-	-	-	-	-	-	-	-	21.4	-	125[2]	-	128	-
TRA-08	10/07/2024	-	-	-	-	-	-	-	-	-	-	11.6	-	42.3	-	154	-
USGS-140	10/09/2024	-	-	-	-	-	-	-	-	-	-	15.4	-	33.3	-	166	-
Idaho Nuclear Technology and Engineering Center																	
USGS-112	10/01/2024	-	-	-	-	-	-	-	-	-	-	13.7	-	28.5	-	148	-
USGS-115	10/01/2024	-	-	-	-	-	-	-	-	-	-	38.8[1]	-	24.5	-	115	-
Radioactive Waste Management Complex																	
RWMC Production	10/15/2024	-	-	-	-	-		-	-	-	-	25.5	-	29.8	-	140	-
USGS-120	10/15/2024	-	-	-	-	-		-	-	-	-	15.0	-	30.7	-	147	-
Test Area North																	
TAN-37A	10/23/2024	57[2]	-	97[2]	-	1800[2]		35[2]	-	-	-	95.1[4]	-	3.64[4]	J	4700	-
Central Facilities Area																	
CFA 2	10/17/2024	-	-	-	-	-		-	-	-	-	131[2]	-	45.9	-	142	-
Materials and Fuels Complex																	
USGS-148	10/17/2024	-	-	-	-	-		-	-	-	-	15.6	-	18.2	-	136	-
Naval Reactors Facility																	
USGS-099	10/16/2024	-	-	-	-	-		-	-	-	-	20.5	-	27.6	-	195	-
Boundary																	
Highway 3	10/03/2024	-	-	-	-	-		-	-	-	-	6.25	-	21.1	-	145	-
USGS-014	10/16/2024	-	-	-	-	-		-	-	-	-	20.8	-	21.6	-	140	-
USGS-104	10/16/2024	-	-	-	-	-		-	-	-	-	15.4	-	21.6	-	128	-
Distant																	
Alpheus Spring	11/12/2024	54	-	20	-	33	-	6.2	-	-	-	40.9[1]	-	58	-	184	-
Clear Spring	11/12/2024	45	-	19	-	26	-	4.1	-	-	-	34.5	-	49.7	-	156	-
Bill Jones Hatchery	11/12/2024	31	-	16	-	17	-	3.5	-	-	-	12.8	-	28.8	-	137	-
Shoshone Water Supply	11/12/2024	41	-	14	-	14	-	2.8	-	-	-	7.80	-	18.8	-	173	-
Minidoka Water Supply	11/12/2024	48	-	17	-	21	-	3.6	-	-	-	37.5[1]	-	48.5	-	146	-
Other Samples																	
Perched Groundwater																	
Advanced Test Reactor Complex																	
PW-09	10/09/2024	-	-	-	-	-		-	-	-	-	86.0[2]		41.4	-	109	-
PW-12	10/08/2024	-	-	-	-	-		-	-	-	-	41.2[2]		24.4	-	195	-
USGS-073	10/09/2024	-	-	-	-	-		-	-	-	-	248[3]		45.1	-	136	-
Surface Water																	
Birch Creek	10/10/2024	-	-	-	-	-		-	-	-	-	4.79		25.2	-	147	-
Little Lost River	10/10/2024	-	-	-	-	-		-	-	-	-	5.69		17.0	-	154	-
Wastewater																	
TRA Cold Waste Pond	10/08/2024	46	-	17	-	8.8		1.7	-	-	-	10.8	-	31.8	-	165	-
MFC-Industrial Waste Pipeline	10/15/2024	48	-	16	-	29		4.7	-	-	-	30.3	-	27.0	-	181	-

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.
*Samples are filtered for calcium, magnesium, sodium, and potassium.
†As $CaCO_3$.
"-" = 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 5:1 dilution of this sample was required for this analyte.
Note 3. Lab indicated that a 10:1 dilution of this sample was required for this analyte.
Note 4. Lab indicated that a 20:1 dilution of this sample was required for this analyte.

Table 21. Dissolved metals concentrations (µg/L) in water samples, fourth quarter, 2024.

Sample Location	Sample Date	Arsenic		Barium		Chromium		Iron		Lead		Manganese		Selenium		Zinc	
Aquifer Samples																	
Upgradient																	
Mud Lake Water Supply	11/14/2024	9.1	-	-	-	0.43	J	-	-	-	-	-	-	-	-	-	-
Facility																	
Advanced Test Reactor Complex																	
Middle-1823	10/07/2024	-	-	-	-	10	-	-	-	-	-	-	-	-	-	-	-
TRA-07	10/07/2024	-	-		-	94	-	-	-	-	-	-	-	-	-	-	-
TRA-08	10/07/2024	-	-	-	-	18	-	-	-	-	-	-	-	-	-	-	-
USGS-140	10/09/2024	-	-	-	-	17	-	-	-	-	-	-	-	-	-	-	-
Idaho Nuclear Technology and Engineering Center																	
USGS-112	10/01/2024	-	-	-	-	11	-	-	-	-	-	-	-	-	-	-	-
USGS-115	10/01/2024	-	-	-	-	6.6	-	-	-	-	-	-	-	-	-	-	-
Radioactive Waste Management Complex																	
RWMC Production	10/15/2024	-	-	-	-	11	-	-	-	-	-	-	-	-	-	-	-
USGS-120	10/15/2024	-	-	-	-	9.0	-	-	-	-	-	-	-	-	-	-	-
Test Area North																	
TAN-37A	10/23/2024	5.4[1]	J	910[1]	-	67[1]	-	4100[1]	-	<5[1]	U	820[1]	-	-	-	-	-
Central Facilities Area																	
CFA 2	10/17/2024	-	-	-	-	10	-	-	-	-	-	-	-	-	-	-	-
Materials and Fuels Complex																	
USGS-148	10/17/2024	-	-	-	-	2.6	-	-	-	-	-	-	-	-	-	-	-
Naval Reactors Facility																	
USGS-099	10/16/2024	-	-	-	-	6.0	-	-	-	-	-	-	-	-	-	-	-
Boundary																	
Highway 3	10/03/2024	-	-	-	-	2.3	-	-	-	-	-	-	-	-	-	-	-
USGS-014	10/16/2024	-	-	-	-	3.1	-	-	-	-	-	-	-	-	-	-	-
USGS-104	10/16/2024	-	-	-	-	7.8	-	-	-	-	-	-	-	-	-	-	-
Distant																	
Alpheus Spring	11/12/2024	-	-	-	-	1.5	-	-	-	-	-	-	-	-	-	-	-
Clear Spring	11/12/2024	-	-	-	-	2.8	-	-	-	-	-	-	-	-	-	-	-
Bill Jones Hatchery	11/12/2024	-	-	-	-	3.6	-	-	-	-	-	-	-	-	-	-	-
Shoshone Water Supply	11/12/2024	-	-	-	-	2.4	-	-	-	-	-	-	-	-	-	-	-
Minidoka Water Supply	11/12/2024	-	-	-	-	2.2	-	-	-	-	-	-	-	-	-	-	-
Other Samples																	
Perched Groundwater																	
Advanced Test Reactor Complex																	
PW-9	10/09/2024	-	-	-	-	11	-	-	-	-	-	-	-	-	-	-	-
PW-11	10/08/2024	-	-	-	-	21	-	-	-	-	-	-	-	-	-	-	-
PW-12	10/08/2024	-	-	-	-	4.7	-	-	-	-	-	-	-	-	-	-	-
USGS-073	10/09/2024	-	-	-	-	15	-	-	-	-	-	-	-	-	-	-	-
Surface Water																	
Birch Creek	10/10/2024	-	-	-	-	0.90	J	-	-	-	-	-	-	-	-	-	-
Little Lost River	10/10/2024	-	-	-	-	0.84	J	-	-	-	-	-	-	-	-	-	-
Waste Water																	
TRA Cold Waste Pond	10/08/2024	1.6	J	49	-	3.8	-	<10	U	<1	U	<1	U	1.2	J	-	-
MFC-Industrial Waste Pipeline	10/15/2024	2.9	-	47	-	2.5	-	27	-	<1	U	1.8	-	0.8	J	-	-

Samples were filtered in the field unless otherwise noted.
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.
"-" = not analyzed.
Note 1. Lab indicated that a 5:1 dilution of this sample was required for this analyte. This raised the lab's reporting level by a factor of 5.

Table 22. Dissolved nutrient concentrations (mg/L) in water samples, fourth quarter, 2024.

Sample Location	Sample Date	Nitrate + Nitrite*		Total Phosphorus	
Aquifer Samples					
Facility					
Advanced Test Reactor Complex					
Middle-1823	10/07/2024	1.0	-	-	-
TRA-07	10/07/2024	0.97	-	-	-
TRA-08	10/07/2024	1.0	-	-	-
USGS-140	10/09/2024	1.1	-	-	-
Idaho Nuclear Technology and Engineering Center					
USGS-112	10/01/2024	0.83	-	-	-
USGS-115	10/01/2024	1.6	-	-	-
Radioactive Waste Management Complex					
RWMC Production	10/15/2024	1.0	-	-	-
USGS-120	10/15/2024	0.87	-	-	-
Test Area North					
TAN-37A	10/23/2024	0.015	-	9.7[4]	-
Central Facilities Area					
CFA-2	10/17/2024	3.8[1]	-	-	-
Materials and Fuels Complex					
USGS-148	10/17/2024	2.6[1]	-	-	-
Naval Reactors Facility					
USGS-099	10/16/2024	1.9[1]	-	-	-
Boundary					
Highway 3	10/03/2024	0.56	-	-	-
USGS-014	10/16/2024	1.3	-	-	-
USGS-104	10/16/2024	0.90	-	-	-
Distant					
Alpheus Spring	11/12/2024	2.2[1]	-	-	-
Clear Spring	11/12/2024	2.6[1]	-	-	-
Bill Jones Hatchery	11/12/2024	1.9	-	-	-
Shoshone Water Supply	11/12/2024	1.6	-	-	-
Minidoka Water Supply	11/12/2024	1.4	-	-	-
Other Samples					
Perched Groundwater					
Advanced Test Reactor Complex					
PW-9	10/09/2024	3.2[1]	-	-	-
PW-12	10/08/2024	2.1[1]	-	-	-
USGS-073	10/09/2024	35[4]	-	-	-
Surface Water					
Birch Creek	10/10/2024	0.21	-	-	-
Little Lost River (LLR)	10/10/2024	0.18	-	-	-
Wastewater					
TRA Cold Waste Pond	10/08/2024	0.97	-	0.071	-
MFC-Industrial Waste Pipeline	10/15/2024	3.6[2]	-	3.1[3]	-
Upgradient					
Mud Lake	11/14/2024	<0.01	U	-	-

Samples were filtered in the field unless otherwise noted.
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 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 10:1 dilution of this sample was required for this analyte.
Note 4. Lab indicated that a 20:1 dilution of this sample was required for this analyte.
.

Table 23. Volatile organic compound concentrations (µg/L) in water samples, fourth 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		Chloromethane		Carbon tetrachloride		Chloroform		2-Butanone		Toluene	
Aquifer Samples																					
Facility																					
Radioactive Waste Management Complex																					
RWMC Production	10/15/2024	0.39	J	2.95	-	<0.50	U	<0.50	U	<0.50	U	0.31	J	5.47	-	1.78	-	<0.50	U	<0.50	U
USGS-120	10/15/2024	<0.50	U	<0.50	U	<0.50	U	<0.50	U	<0.50	U	<0.50	U	1.08	-	<0.50	U	<0.50	U	<0.50	U
Test Area North																					
TAN-37A	10/23/2024	<0.50	U	<0.50	U	<0.50	U	<0.50	U	2.81	-	<0.50	U	<0.50	U	<0.50	U	1.13	J	1.42	-

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.
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.

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. Milk samples are collected to evaluate the potential for ingestion of radioactivity by the population around the INL. Twelve milk samples were analyzed during the quarter.

Milk

DEQ-INL OP monitors milk for the naturally occurring radionuclide potassium-40 (^{40}K) and man-made iodine-131 (^{131}I). Milk samples are collected on a monthly basis. Results for analyses of milk samples are presented in **Table 24**. ^{40}K was detected in all samples within the expected range of concentrations. ^{131}I was not detected. Based on measurements of radionuclides in milk, there were no discernable impacts to the off-site environment from INL operations.

Table 24. Gamma spectroscopy analysis data for milk samples, fourth 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	10/14/24	**1344**	58	-0.9	U	0.9
Gooding	11/19/24	**1396**	57	0.1	U	0.7
Gooding	12/17/24	**1431**	58	0.6	U	0.9
Monteview	10/15/24	**1283**	55	-1.7	U	1.2
Monteview	11/21/24	**1363**	57	0.1	U	0.7
Monteview	12/17/24	**1329**	56	1.4	U	1.1
Ucon	10/05/24	**1419**	58	-1.9	U	1.1
Ucon	11/02/24	**1216**	51	-0.5	U	0.9
Ucon	12/06/24	**1370**	57	0.2	U	0.9
Verification Samples[1]						
Monteview	10/14/24	**1387**	57	-0.9	U	0.8
Terreton	11/18/24	**1243**	54	-1.2	U	0.8
Dietrich	12/16/24	**1228**	53	0.1	U	0.8

[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.

Soil

DEQ-INL OP monitors long-term radiological conditions via physical soil sampling as well as field instrumentation capable of identifying and measuring *in-situ* concentrations of gamma-emitting radionuclides in soil. Monitoring concentrations of gamma-emitting radionuclides in surface soil provides some insight to transport, deposition, and accumulation of radioactive material in the environment as a result of INL operations as well as historical above ground testing of nuclear weapons. *In-Situ* gamma spectroscopic measurements were performed at 41

locations (see **Figure 4**) during the fourth calendar quarter of 2024. The gamma spectra were analyzed using a uniform homogeneous distribution of nuclides with depth as recommended by NCRP (NCRP report 129). ^{137}Cs was the only man-made gamma emitting radionuclide detected. Analysis results for ^{137}Cs concentrations for *in-situ* soil monitoring are shown in **Table 25**.

Table 25. In-Situ gamma spectroscopic analysis results (Cs-137) for soil, fourth quarter, 2024.

Location	Date Acquired	Concentration[1]	1-sigma
On Site Sampling Locations			
ESER Soil Site Atomic City	10/24/2024	**0.452**	0.038
Sand Dunes Air Station	10/25/2024	**0.347**	0.051
ESER Soil Site Mud Lake #2[2]	10/25/2024	0.169	0.061
ESER Soil Site FAA Tower	10/28/2024	**0.564**	0.059
Large Grid 18-8	10/28/2024	**0.452**	0.041
Large Grid 24-2	10/28/2024	**0.519**	0.052
Large Grid 24-7	10/28/2024	**0.307**	0.044
Large Grid 18-3	10/28/2024	**0.248**	0.026
Rover	10/28/2024	**0.266**	0.043
Large Grid 6-3	10/29/2024	**0.586**	0.059
INL Main Gate	10/29/2024	**0.339**	0.039
Large Grid 24-9	10/30/2024	**0.416**	0.051
Large Grid 24-8	10/30/2024	**0.600**	0.054
Large Grid 18-1	10/30/2024	**0.304**	0.049
Large Grid 18-7	10/30/2024	**0.306**	0.039
ESER Soil Site Reno Ranch	10/30/2024	**0.463**	0.023
Large Grid 30-1	10/30/2024	**0.446**	0.039
EFS[3] Air Station	10/31/2024	**0.700**	0.048
Van Buren Air Station	10/31/2024	**0.411**	0.026
Rest Area Air Station	10/31/2024	**0.324**	0.045
Base of Howe	10/31/2024	**0.472**	0.058
ESER Soil Site Howe	10/31/2024	**0.368**	0.021
Boundary Sampling Locations			
ESER Soil Site Frenchman's Cabin	10/23/2024	**0.372**	0.050
Large Grid 12-5	10/23/2024	**0.321**	0.061
Large Grid 12-4	10/23/2024	**0.417**	0.050
ESER Soil Site Butte City	10/24/2024	**0.241**	0.029
Atomic City Air Station	10/24/2024	**0.419**	0.062
ESER Soil Site Monteview	10/25/2024	**0.337**	0.034
Monteview Air Station	10/25/2024	**0.110**	0.031
Mud Lake Air Station	10/25/2024	**0.063**	0.019
Howe Met Tower Air Station	10/31/2024	**0.243**	0.036
Distant Sampling Locations			
IF Air Station[4]	10/21/2024	**0.147**	0.041
IF CMS[5]	10/21/2024	**0.186**	0.031
St Anthony	10/21/2024	**0.424**	0.056
Sage Junction	10/21/2024	**0.417**	0.047
Roberts Met Tower	10/21/2024	**0.371**	0.052
Big Southern Butte	10/23/2024	**0.180**	0.035
Large Grid 18-4	10/23/2024	**0.469**	0.052
ESER Soil Site Carey	10/24/2024	**0.468**	0.044
ESER Soil Site Blackfoot	10/29/2024	**0.297**	0.063
Crystal Ice Caves	10/29/2024	**0.437**	0.039

[1]Concentrations with associated uncertainties (± 1 SD) are reported in pCi/g. **Bold** concentrations are considered positive detections, greater than or equal to 3 SD.
[2]Only measurement not exceeding 3 SD thus not considered a positive detection.
[3]Experimental Field Station.
[4]DEQ-INL OP air monitoring station near airport, Idaho Falls, ID.
[5]DEQ-INL OP EcoGamma Community Monitoring Station (CMS) near John's Hole Bridge, Idaho Falls, ID.

The average Cesium-137 value was 0.36 picocuries per gram (pCi/g) with a minimum value of 0.06 pCi/g and a maximum of 0.70 pCi/g, well below the DEQ-INL OP action level of 6.4 pCi/g and the recommended federal screening limit for surface soil of 6.8 pCi/g (NCRP Report 129).

Based upon terrestrial radiological measurements of soil, there were no discernable impacts to the off-site environment from INL operations. Long-term accumulation of radionuclides observed by soil monitoring was consistent with historical measurements and was in the range of concentrations expected as a result of historic above-ground testing of nuclear weapons.

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 fourth 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 fourth quarter of 2024, DEQ-INL OP and contracted laboratories performed 110 QC analyses on various radiological and non-radiological samples. (**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 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 fourth quarter of 2024 are presented in **Table 27**. The blank filter gross alpha result was equal to 3 SD for the week of 10/17 – 10/24/24. Associated gross alpha results for that week are qualified as biased-high estimates (J+). The blank filter gross beta result was equal to 3 SD for the week of 11/27 – 12/05/24. Associated gross beta results for that week are significantly higher than the blank 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 fourth quarter 2024 are presented in **Table 28**. Blank sample results for radiochemical analysis of 8x10-inch TSP filter quarterly composites from third quarter 2024 are presented in **Table 29**. All blank results 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. All results for tritium method blanks and control samples met acceptance criteria.

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 fourth 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 within ±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 third quarter 2024, from the Idaho Falls monitoring location, are presented in **Table 36.** All TSP filter duplicate sample results met acceptance criteria for the fourth quarter of 2024.

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

Duplicate results for radiological analyses in groundwater and surface water are presented in **Table 38**. Duplicate results for metals, common ions and nutrients in groundwater are presented in **Tables 39** and **40.** The gross beta duplicate results for USGS-099 were not in agreement. The original USGS-099 result was therefore qualified as an estimate (J). All other duplicate water sample results met acceptance criteria for the fourth quarter 2024.

Duplicate *in-situ* analyses of gamma emitting radionuclides in soil are presented in **Table 41.** All duplicate soil sample results met acceptance criteria for the fourth 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 ± 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 sample results for metals in water are presented in **Table 42.** Spiked sample results for common ions and nutrients in water are presented in **Table 43.** Spiked sample results for VOCs in water are presented in **Table 44**. The spiked sample results for styrene and methylene chloride did not meet acceptance criteria at 66% and 127% recovery, respectively. However, all field sample styrene and methylene chloride results were below detection levels and therefore not reported in **Table 34.**

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 ± 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 ± 25%. Real-time pressure correction is used to calculate the net exposure measured by

these EIC control sets. The ISU irradiation results for the fourth 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

None.

DEQ-INL OP Equipment QC Issues

None.

Qualification and Reporting of 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 will bring INL-OP's qualification and reporting conventions in line with the INL contractors' methods.

For radiological results, the minimum detectable concentration (MDC) will no longer be used as the criterion above which the result is considered a positive detection. The following criteria will be 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), will be used. With each result, the IBL reports both the Method Detection Limit[10] (MDL) and the higher Reporting Detection Limit[11] (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.
6. 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 fourth quarter of 2024 which significantly affected data quality. The ratio of total QC analyses to total field sample analyses of 13.4% 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 fourth 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

[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

of field sample results reported) of 99.8% for the fourth 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 99.6% 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 fourth quarter of 2024 is summarized in **Table 46.** A power outage at Sand Dunes Tower resulted in an insufficient air volume for a valid TSP sample during the week of 11/07-11/14/24. These gross alpha and beta results were therefore qualified as rejected (R).

Conclusion

All data collected for the fourth quarter of 2024 have been assigned the applicable qualifiers to designate the appropriate use of the data. The overall data usability of 99.8% and data completeness of 99.6% 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 in the fourth quarter, 2024.

Media Sampled	Collection Device	Analyte	Field Sample Analyses	QC Blank Analyses	QC Duplicate Analyses	QC Spike Analyses	Data Rejected[1]	Analyzing Lab[2]
Air								
Total Suspended Particulate	47-mm filters	Gross alpha	156	13	0	0	1	ISU-EML
		Gross beta	156	13	0	0	1	ISU-EML
		Gamma emitters	12	1	0	0	0	ISU-EML
	8x10-inch filter	Gamma emitters	36	3	3	0	0	ISU-EML
		Radiochemical[6]:						
		Sr-90	12	1	1	0	0	ISU-Sub
		Pu-238, 239/240	12	1	1	0	0	ISU-Sub
		Am-241	12	1	1	0	0	ISU-Sub
Water Vapor	Desiccant column	Tritium	35	10 [8]	0	0	0	ISU-EML
Gaseous	Charcoal filter	Iodine-131	13	0	0	0	0	ISU-EML
Precipitation	Poly bottle	Tritium	6	0	0	0	0	ISU-EML
		Gamma emitters	6	0	0	0	0	ISU-EML
Water								
Ground water, perched ground water, waste pond effluent, and surface water	Grab or composite	Gross alpha	29	2	3	0	0	ISU-EML
		Gross beta	29	2	3	0	0	ISU-EML
		Gamma emitters	29	2	3	0	0	ISU-EML
		Tritium	29	2	3	0	0	ISU-EML
		Low-level tritium	13	2	2	0	0	ISU-EML
		Radiochemical[7]:						
		Sr-90	13	1	1	0	0	ISU-Sub
		Tc-99	7	0	1	0	0	ISU-Sub
		U-234, 235,238	1	1	0	0	0	ISU-Sub
		Pu-238, 239/240	0	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	29	2	3	1	0	IBL
		Common Ions	28	2	3	1	0	IBL
		Nutrients	28	2	3	1	0	IBL
		Volatile Organics	3	1	0	1	0	IBL
Terrestrial								
Milk	Grab or composite	Gamma emitters	12	0	0	0	0	ISU-EML
Soil	*in situ*	Gamma emitters	41	0	3	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	0	0	DEQ-INL OP
Total analyses performed			**823**	**62**	**35**	**13**	**2**	
Total QC analyses performed (blanks, duplicates, and spikes)			**110**					
Ratio of total QC analyses to total sample analyses[3]			**13.4%**					
Data usability[4], percent			**99.8%**					
Data completeness[5], percent			**99.6%**					

[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.
[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 total suspended particulate (TSP) air filters, fourth quarter, 2024.

Collection Period		Corrected	Gross alpha			Gross beta		
Start	Stop	volume (m^3)[1]	Value		3 SD	Value		3 SD
09/26/24	10/03/24	596	-0.1	U	0.3	-0.3	U	0.9
10/03/24	10/10/24	596	0.0	U	0.3	-0.2	U	0.9
10/10/24	10/17/24	596	0.1	U	0.3	-0.2	U	0.9
10/17/24	10/24/24	596	**0.3**	-	0.3	0.0	U	0.9
10/24/24	10/31/24	596	-0.1	U	0.3	0.8	U	0.9
10/31/24	11/07/24	596	-0.2	U	0.3	0.3	U	0.9
11/07/24	11/14/24	596	0.1	U	0.3	0.1	U	0.9
11/14/24	11/21/24	596	0.2	U	0.3	-0.1	U	0.9
11/21/24	11/27/24	596	0.0	U	0.3	-0.3	U	0.9
11/27/24	12/05/24	596	0.0	U	0.6	**0.9**	-	0.9
12/05/24	12/12/24	596	0.0	U	0.3	0.5	U	0.9
12/12/24	12/19/24	596	0.0	U	0.3	0.0	U	0.9
12/19/24	12/26/24	596	0.0	U	0.3	-0.7	U	0.9

Concentration values and associated uncertainty (3 SD) are expressed in 1 x 10^{-3} pCi/m^3.
A blank sample result is acceptable if it is less than three standard deviations (3 SD) of the result. **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 was 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, fourth 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 composites[1] of 8x10-inch TSP air filters															
Oct	1	U	33	20	U	75	-3	U	9	0	U	3	1	U	3
Nov	-2	U	21	24	U	72	2	U	12	2	U	3	0	U	3
Dec	1	U	33	-17	U	75	-2	U	12	1	U	15	1	U	3
Quarterly composite[2] of 47-mm TSP air filters															
4th Qtr.	-18	U	75	6	U	276	8	U	15	-5	U	12	-2	U	12

Concentrations (Conc) are expressed in 1 x 10^{-5} pCi/m^3 with associated uncertainty (3 SD) and minimum detectable concentration (MDC).
A blank sample result is acceptable if it is less than three standard deviations (3 SD) of the result. **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 (Conc) are from blank 8x10-inch filters collected weekly, composited, and analyzed for the calendar month. [2]These 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 third 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
3Q 24 Blank	0.20	U	0.78	0.02	U	0.09	0.02	U	0.06	-0.02	U	0.27

Concentrations are expressed in 1 x 10^{-5} pCi/m^3 with associated uncertainty (3 SD).
A blank sample result is acceptable if it is less than three standard deviations (3 SD) of the result. **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, fourth quarter, 2024.

Sample Number	Start Date	Collection Date	Analysis Date	Tritium		
				Concentration		3 SD
Method Blanks						
OP244ZTR01	11/13/24	11/15/24	12/09/24	-0.01	U	0.06
OP244ZTR02	11/19/24	11/22/24	12/02/24	0.03	U	0.06
OP244ZTR03	01/15/25	01/17/25	01/27/25	-0.01	U	0.06
OP244ZTR04	01/21/25	01/23/25	01/27/25	0.02	U	0.06
A00TEST	10/09/24	10/16/24	10/24/24	0.01	U	0.06
Control Samples						
Distilled Retail	11/19/24	11/19/24	12/02/24	0.03	U	0.09
Distilled Retail	11/19/24	11/19/24	12/02/24	0.01	U	0.06
Refrigerator	10/21/24	01/24/25	01/27/25	0.02	U	0.09
Sink	10/21/24	01/24/25	01/27/25	0.00	U	0.06
Sink	10/21/24	01/24/25	01/27/25	0.03	U	0.06

Concentrations are expressed in nCi/L with associated uncertainty (3 SD).
A blank sample result is acceptable if it is less than three standard deviations (3 SD) of the result. **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, fourth quarter, 2024.

Sample Number	Sample Date	Blank Type	Concentration		3 SD	Within Blank Criteria?
Gross Alpha						
241W575	10/07/24	Field	0.0	U	0.3	Yes
241W647	10/23/24	Field	0.0	U	0.3	Yes
Gross Beta						
241W575	10/07/24	Field	0.2	U	0.6	Yes
241W647	10/23/24	Field	-0.4	U	0.9	Yes
Cesium-137						
241W575	10/07/24	Field	0.9	U	2.4	Yes
241W647	10/23/24	Field	-0.7	U	3.0	Yes
Tritium (standard method)						
241W576	10/07/24	Field	20	U	90	Yes
241W649	10/23/24	Field	70	U	90	Yes
Tritium (enriched method)						
241W522	07/16/24	Field	2	U	6	Yes
241W527	07/23/24	Field	-1	U	6	Yes
Strontium-90						
241W648	10/23/24	Field	0.31	U	1.10	Yes
Uranium-234						
241W650	10/23/24	Field	0.0596	U	0.0645	Yes
Uranium-235						
241W650	10/23/24	Field	0.0099	U	0.0297	Yes
Uranium-238						
241W650	10/23/24	Field	0.0357	U	0.0396	Yes

Concentrations are expressed in pCi/L with associated uncertainty (3 SD).
A blank sample result is acceptable if it is less than three standard deviations (3 SD) of the result. **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, fourth quarter, 2024.

Sample Number	Sample Date		Blank Type	Arsenic	Barium	Chromium	Iron	Lead	Manganese	Selenium	Zinc
241W578	10/07/24		Field	-	-	<1.0	-	-	-	-	-
241W652	10/23/24		Field	<2.0	<1.0	<1.0	<10	<1.0	<1.0	-	-

Blank results less than MDL (method detection limit) are acceptable and reported as <RDL (<reporting detection limit).

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

Sample Number	Sample Date	Blank Type	Calcium	Magnesium	Sodium	Potassium	Fluoride	Chloride	Sulfate	Alkalinity†	NO_3+NO_2*	Total Phosphorus
241W577, 579	10/07/24	Field	-	-	-	-	-	<0.4	<0.8	<1.0	<0.01	-
241W651, 652, 653	10/23/24	Field	<0.1	<0.1	<0.1	<0.1	-	<0.4	<0.8	<1.0	<0.01	<0.005

† As $CaCO_3$.
* As N.
Blank results less than MDL (method detection limit) are acceptable and reported as <RDL (<reporting detection limit).

Table 34. Blank analysis results (µg/L) for VOCs in water, fourth 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	Chloro-form	Chloro-methane	MEK
241W654	10/23/24	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.
Blank results less than MDL (method detection limit) are acceptable and reported as <RDL (<reporting detection limit).

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

Month and Nuclide	Original Sample ID	Concentration (R_1)	1 SD_1	Duplicate Sample ID	Concentration (R_2)	1 SD_2	RPD (%)	$\lvert R_1-R_2 \rvert$	$3(SD_1^2+SD_2^2)^{1/2}$	Within either criterion?
October 2024										
^{7}Be	Idaho Falls	**155.5**	4.5	Idaho Falls Dup	**132.0**	4.5	16	23.5	19.1	Yes
$^{106}Ru/^{106}Rh$		-0.23 U	0.42		-0.06 U	0.32	117	0.17	1.58	Yes
^{125}Sb		-0.08 U	0.08		0.04 U	0.05	600	0.12	0.28	Yes
^{134}Cs		0.04 U	0.03		0.00 U	0.03	200	0.04	0.13	Yes
^{137}Cs		0.04 U	0.02		0.02 U	0.02	67	0.02	0.08	Yes
November 2024										
^{7}Be	Idaho Falls	**65.8**	2.3	Idaho Falls Dup	**80.0**	2.4	-19	14.2	10.0	Yes
$^{106}Ru/^{106}Rh$		-0.26 U	0.25		-0.25 U	0.44	4	0.01	1.52	Yes
^{125}Sb		0.00 U	0.06		0.04 U	0.05	-200	0.04	0.23	Yes
^{134}Cs		0.01 U	0.02		0.00 U	0.01	200	0.01	0.04	Yes
^{137}Cs		0.00 U	0.01		0.02 U	0.02	-200	0.02	0.07	Yes
December 2024										
^{7}Be	Idaho Falls	**78.9**	2.5	Idaho Falls Dup	**87.0**	3.0	-10	8.1	11.7	Yes
$^{106}Ru/^{106}Rh$		0.18 U	0.22		-0.10 U	0.25	700	0.28	1.00	Yes
^{125}Sb		0.00 U	0.03		0.00 U	0.03	0	0.00	0.13	Yes
^{134}Cs		0.00 U	0.01		0.02 U	0.02	-200	0.02	0.07	Yes
^{137}Cs		-0.01 U	0.01		0.01 U	0.02	NA[1]	0.02	0.07	Yes

Air concentrations and uncertainties (1 SD) are expressed in units of 10^{-3} pCi/m^3. **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.
Criteria for duplicate agreement: RPD (relative percent difference) within ± 20% or $\lvert R_1-R_2 \rvert \leq 3(SD_1^2+SD_2^2)^{1/2}$.
[1] NA = Not applicable. RPD calculation results in division by zero.

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

Nuclide	Original Sample ID	Concentration (R_1)	1 SD_1	Duplicate Sample ID	Concentration (R_2)	1 SD_2	RPD (%)	$\lvert R_1-R_2 \rvert$	$3(SD_1^2+SD_2^2)^{1/2}$	Within either criterion?
$^{89/90}Sr$	Idaho Falls	**0.95**	0.29	Idaho Falls Dup	**1.70**	0.37	-57	0.75	1.41	Yes
^{238}Pu		0.02 U	0.04		0.08 U	0.05	-120	0.06	0.19	Yes
$^{239}Pu/^{240}Pu$		0.09 U	0.04		0.08 U	0.04	12	0.01	0.17	Yes
^{241}Am		0.06 U	0.08		0.19 U	0.10	-104	0.13	0.38	Yes

Air concentrations and uncertainties (1 SD) are expressed in units of 10^{-5} pCi/m^3. **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.
Criteria for duplicate agreement: RPD (relative percent difference) within ± 20% or $\lvert R_1-R_2 \rvert \leq 3(SD_1^2+SD_2^2)^{1/2}$.

Table 37. Duplicate results for quarterly average EcoGamma readings (µR/hr) for the fourth quarter of 2024.

Primary EcoGamma ID	Quarterly Average (R_1)	1 SD_1	Duplicate EcoGamma ID	Quarterly Average (R_2)	1 SD_2	RPD (%)	$\lvert R_1-R_2 \rvert$	$3(SD_1^2+SD_2^2)^{1/2}$	Within either criterion?
Big Southern Butte	14.0	1.1	Big Southern Butte DUP	13.0	1.3	7	1.0	5.1	Yes

Criteria for duplicate agreement: RPD (relative percent difference) within ± 20% or $\lvert R_1-R_2 \rvert \leq 3(SD_1^2+SD_2^2)^{1/2}$.

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

Analysis/Sample Location	Original Sample Number	Concentration (R_1)	1 SD_1	Duplicate Sample Number	Concentration (R_2)	1 SD_2	RPD (%)	$\lvert R_1-R_2 \rvert$	$3(SD_1^2+SD_2^2)^{1/2}$	Within either criterion?
Gross Alpha										
USGS-112	241W619	**1.2**	0.3	241W633	0.6	0.3	67	0.6	1.3	Yes
USGS-099	241W712	0.7	0.4	241W717	0.3	0.4	60	0.4	1.7	Yes
Mud Lake[1]	241W752	-0.1	0.3	241W762	0.3	0.3	-400	0.4	1.3	Yes
Gross Beta										
USGS-112	241W619	**10.2**	0.5	241W633	**10.6**	0.5	-4	0.4	2.1	Yes
USGS-099	241W712	**8.6**	0.5	241W717	**2.3**	0.4	116	6.3	1.9	No
Mud Lake[1]	241W752	**3.7**	0.4	241W762	**3.3**	0.4	11	0.4	1.7	Yes
Cesium-137										
USGS-112	241W619	-0.5	0.6	241W633	-0.7	0.9	-33	0.2	3.2	Yes
USGS-099	241W712	0.9	0.6	241W717	0.7	0.5	25	0.2	2.3	Yes
Mud Lake[1]	241W752	0.6	0.7	241W762	0.3	0.6	67	0.3	2.8	Yes
Tritium (standard method)										
USGS-112	241W622	**230**	40	241W637	**260**	40	-12	30	170	Yes
USGS-099	241W713	70	30	241W718	70	30	0	0	127	Yes
Mud Lake[1]	241W753	10	30	241W763	0	30	200	10	127	Yes
Tritium (low-level method)										
USGS-099	241W713	2	2	241W718	4	2	-67	2	8	Yes
Mud Lake[1]	241W753	-5	2	241W763	0	2	200	5	8	Yes
Strontium-90										
USGS-112	241W620	**4.55**	0.31	241W634	**4.63**	0.33	-2	0.08	1.36	Yes
Technetium-99										
USGS-112	241W621	2.19	1.23	241W635	0.109	0.468	72	0.909	9.06	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.
Criteria for duplicate agreement: RPD (relative percent difference) within ± 20% or $\lvert R_1-R_2 \rvert \leq 3(SD_1^2+SD_2^2)^{1/2}$.
[1]Mud Lake Water Supply.

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

Sample Location	Sample Number	Sample Date	Arsenic	Barium	Chromium	Iron	Lead	Manganese	Selenium	Zinc
USGS-112	241W624	10/01/24	-	-	11	-	-	-	-	-
USGS-112	241W640	10/01/24	-	-	11	-	-	-	-	-
RPD (%)			**-**	**-**	**0.0**	**-**	**-**	**-**	**-**	**-**
USGS-099	241W715,	10/16/24	-	-	6.0	-	-	-	-	-
USGS-099	241W720,	10/16/24	-	-	5.9	-	-	-	-	-
RPD (%)			**-**	**-**	**1.7**	**-**	**-**	**-**	**-**	**-**
Mud Lake Water Supply	241W755	11/14/24	9.1	-	0.43J	-	-	-	-	-
Mud Lake Water Supply	241W765	11/14/24	9.1	-	0.38J	-	-	-	-	-
RPD (%)			**0.0**[1]	**-**	**12.0**[2]	**-**	**-**	**-**	**-**	**-**

Criteria for duplicate agreement: RPD (relative percent difference) within ± 20%. If one or both sample results are less than five times the RDL (reporting detection limit), the results agree if their absolute difference is less than or equal to the RDL.

[1] Both sample results are less than five times the RDL of 2.0 µg/L. Their absolute difference (0.0 µg/L) is less than the RDL. Duplicate results agree.

[2] Both sample results are less than five times the RDL of 1.0 µg/L. Their absolute difference (0.05 µg/L) is less than the RDL. Duplicate results agree.

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

Sample Location	Sample Number	Sample Date	Calcium	Magnesium	Sodium	Potassium	Chloride	Sulfate	Total Alkalinity†	Total Nitrogen	Total Phosphorus
USGS-112	241W623, 625	10/01/24	-	-	-	-	13.7	28.5	148	0.83	-
USGS-112	241W638, 641	10/01/24	-	-	-	-	13.7	28.5	147	0.83	-
RPD (%)			**-**	**-**	**-**	**-**	**0.0**	**0.0**	**0.7**	**0.0**	**-**
USGS-099	241W714, 716	10/16/24	-	-	-	-	20.5	27.8	195	1.9	-
USGS-099	241W719, 721	10/16/24	-	-	-	-	20.5	27.6	194	2.0	-
RPD (%)			**-**	**-**	**-**	**-**	**0.0**	**0.7**	**0.5**	**-5.1**	**-**
Mud Lake[1]	241W754, 756	11/14/24	8.1	2.6	28	4.6	4.92	8.60	90.6	<0.01	-
Mud Lake[1]	241W764, 766	11/14/24	8.0	2.6	28	4.7	4.91	8.58	91.7	<0.01	-
RPD (%)			**1.2**	**0.0**	**0.0**	**-2.2**	**0.2**	**0.2**	**-1.2**	**0.0**	

Criteria for duplicate agreement: RPD (relative percent difference) within ± 20%. If one or both sample results are less than five times the RDL (reporting detection limit), the results agree if their absolute difference is less than or equal to the RDL.

[1]Mud Lake Water Supply.

† As $CaCO_3$.

Table 41. Duplicate in-situ analyses of gamma emitting radionuclides in soil, fourth quarter, 2024.

Analysis/Sample Location	Sample Date	Original Result (pCi/g)	± 1 SD_1	Duplicate Result (pCi/g)	± 1 SD_2	RPD (%)	$\lvert R_1-R_2 \rvert$	$3(SD_1^2+SD_2^2)^{1/2}$	Within either criterion?
Cs-137									
Sage Junction	10/21/2024	**0.417**	0.047	**0.467**	0.041	-11	0.050	0.187	Yes
ESER Soil Site Butte City	10/24/2024	**0.241**	0.029	**0.319**	0.036	-28	0.078	0.139	Yes
ESER Soil Site Blackfoot	10/29/2024	**0.297**	0.063	**0.345**	0.045	-15	0.048	0.232	Yes
K-40									
Sage Junction	10/21/2024	**15.6**	0.4	**17.6**	0.5	-12	2.0	1.9	Yes
ESER Soil Site Butte City	10/24/2024	**20.3**	0.5	**20.0**	0.4	1	0.3	1.9	Yes
ESER Soil Site Blackfoot	10/29/2024	**17.5**	0.4	**18.2**	0.5	-4	0.7	1.9	Yes

Concentrations are reported in pCi/g 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. Criteria for duplicate agreement RPD (relative percent difference) within ± 20% or $\lvert R_1-R_2 \rvert \leq 3(SD_1^2+SD_2^2)^{1/2}$.

Table 42. Spiked sample results (µg/L) for metals in water, fourth 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
241W729	10/23/2024	-	-	-	14.6	14	96	-	-	-	-	-	-	-	-	-

A percent recovery (%R) of 100 ± 25% is considered acceptable.

Table 43. Spiked sample results (mg/L) for common ions and nutrients in water, fourth 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
241W728, 730	10/23/2024	40.1	41.8	104	17.1	17.5	102	153	154	101	3.54	3.6	102	-	-	-

*As N.
A percent recovery (%R) of 100 ± 25% is considered acceptable.

Table 44. Spiked sample results (µg/L) for VOCs in water, fourth 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
241W731	10/23/24	14.1	17.0	121	10.6	7.02	66	5.86	5.95	102	15.2	16.3	107	8.00	9.42	118

Table 44 continued. Spiked sample results (µg/L) for VOCs in water, fourth 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
231W731	1023/24	7.99	9,51	119	9.21	10.5	114	18.3	20.3	111	8.41	9.62	114	15.1	19.2	127

A percent recovery (%R) of 100 ± 25% is considered acceptable.

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

Electret #	Exposure Received		Net Measured Exposure[1]		%R	Within Spec?
	(mR)	Uncertainty (1 SD, mR)	(mR)	Uncertainty (1 SD, mR)		
SMV037	40.0	1.4	41.3	1.3	103.1%	Yes
SMV152	40.0	1.4	39.3	1.4	98.1%	Yes
SMV014	40.0	1.4	42.0	1.3	104.9%	Yes
				Triplicate AVG:	**102.1%**	**Yes**
SMV281	30.0	1.1	28.8	1.3	96.0%	Yes
SCL236	30.0	1.1	31.1	1.4	103.6%	Yes
SMV104	30.0	1.1	29.0	1.4	96.5%	Yes
				Triplicate AVG:	**98.7%**	**Yes**
SCL233	19.9	0.7	21.5	1.4	107.9%	Yes
SMV128	19.9	0.7	19.5	1.4	98.0%	Yes
SMV203	19.9	0.7	19.9	1.3	100.2%	Yes
				Triplicate AVG:	**102.0%**	**Yes**

A percent recovery (%R) of 100 ± 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), fourth 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	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	100%	100%	100%	100%	100%
Monteview	100%	100%	100%	100%	100%
Mud Lake	100%	100%	100%	100%	100%
Distant Locations[2]					
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.

Appendix A

Table A-1. Weekly concentrations (in 1 x 10^{-3} pCi/m^3) for gross alpha and gross beta analyses of 47-mm TSP filters for all locations, fourth 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	09/26/24	10/03/24	**1.7**	0.2	**39.1**	0.8
	10/03/24	10/10/24	**2.1**	0.2	**39.1**	0.8
	10/10/24	10/17/24	**2.1**	0.2	**51.3**	0.9
	10/17/24	10/24/24	**0.8** J+[3,4]	0.2	**28.9** J[4]	0.8
	10/24/24	10/31/24	**1.1**	0.2	**20.8**	0.6
	10/31/24	11/07/24	0.1	0.2	**13.2**	0.5
	11/07/24	11/14/24	**1.0** J[5]	0.2	**35.2** J[5]	0.8
	11/14/24	11/21/24	**0.3**	0.1	**14.3**	0.5
	11/21/24	11/27/24[1]	**0.6**	0.2	**21.7**	0.7
	11/27/24	12/05/24[1]	**1.1**	0.2	**50.4**	0.8
	12/05/24	12/12/24	**1.0**	0.2	**54.5**	0.9
	12/12/24	12/19/24	0.1	0.1	**19.5**	0.6
	12/19/24	12/26/24	**0.7**	0.2	**35.1**	0.8
Experimental Field Station	09/26/24	10/03/24	**2.0**	0.2	**38.8**	0.8
	10/03/24	10/10/24	**2.7**	0.3	**40.2**	0.8
	10/10/24	10/17/24	**2.6**	0.3	**46.7**	0.9
	10/17/24	10/24/24	**1.0** J+[3,5]	0.2	**23.1** J[5]	0.6
	10/24/24	10/31/24	**1.9** J[5]	0.2	**26.1** J[5]	0.7
	10/31/24	11/07/24	**1.1**	0.2	**14.0**	0.5
	11/07/24	11/14/24	**1.0**	0.2	**39.0**	0.8
	11/14/24	11/21/24	**0.6**	0.2	**15.4**	0.6
	11/21/24	11/27/24	**0.7**	0.2	**25.3**	0.7
	11/27/24	12/05/24	**2.1**	0.2	**53.4**	0.9
	12/05/24	12/12/24	**1.9**	0.2	**59.9**	1.0
	12/12/24	12/19/24	**0.6**	0.2	**21.9**	0.6
	12/19/24	12/26/24	0.4	0.2	**20.8**	0.6
MFC Guard House	09/26/24	10/03/24	**1.5**	0.2	**38.1**	0.8
	10/03/24	10/10/24	**1.7**	0.2	**30.6**	0.7
	10/10/24	10/17/24	**1.9**	0.2	**42.8**	0.8
	10/17/24	10/24/24	**0.9** J+[3]	0.2	**19.4**	0.6
	10/24/24	10/31/24	**1.1**	0.2	**20.7**	0.6
	10/31/24	11/07/24	0.4	0.2	**12.7**	0.5
	11/07/24	11/14/24	**0.8**	0.2	**31.5**	0.7
	11/14/24	11/21/24	0.2	0.2	**13.2**	0.5
	11/21/24	11/27/24	0.5	0.2	**20.2**	0.7
	11/27/24	12/05/24	**0.9**	0.2	**41.4**	0.7
	12/05/24	12/12/24	**1.2**	0.2	**55.4**	0.9
	12/12/24	12/19/24	**0.4**	0.1	**17.6**	0.6
	12/19/24	12/26/24	**0.6**	0.2	**32.7**	0.7

Sand Dunes Tower	09/26/24	10/03/24	**1.9**	0.2	**38.9**	0.8
	10/03/24	10/10/24	**1.6**	0.2	**39.5**	0.8
	10/10/24	10/17/24	**2.0**	0.2	**49.2**	0.9
	10/17/24	10/24/24	**0.8** J+[3]	0.2	**22.0**	0.6
	10/24/24	10/31/24	**0.8**	0.2	**21.6**	0.6
	10/31/24	11/07/24	0.1	0.2	**12.8**	0.5
	11/07/24	11/14/24	0.4 J[5]	0.5	**14.2** J[5]	1.2
	11/14/24	11/21/24	0.5	0.2	**14.2**	0.5
	11/21/24	11/27/24	**0.6**	0.2	**25.5**	0.7
	11/27/24	12/05/24	**0.8**	0.2	**49.0**	0.8
	12/05/24	12/12/24	**1.3**	0.2	**66.4**	1.0
	12/12/24	12/19/24	**0.6**	0.2	**24.1**	0.6
	12/19/24	12/26/24	**0.9**	0.2	**45.4**	0.9
Van Buren	09/26/24	10/03/24	**2.1**	0.2	**37.0**	0.8
	10/03/24	10/10/24	**2.3**	0.2	**39.1**	0.8
	10/10/24	10/17/24	**2.2**	0.2	**48.6**	0.9
	10/17/24	10/24/24	**0.9** J+[3]	0.2	**23.6**	0.6
	10/24/24	10/31/24	**1.9**	0.2	**25.3**	0.6
	10/31/24	11/07/24	0.3	0.2	**12.6**	0.5
	11/07/24	11/14/24	**1.5** J[5]	0.2	**38.1** J[5]	0.8
	11/14/24	11/21/24	0.3	0.2	**13.4**	0.5
	11/21/24	11/27/24	**0.6**	0.2	**22.4**	0.7
	11/27/24	12/05/24	**1.5**	0.2	**52.1**	0.8
	12/05/24	12/12/24	**1.7**	0.2	**56.2**	0.9
	12/12/24	12/19/24	**0.9**	0.2	**22.3**	0.6
	12/19/24	12/26/24	**1.0**	0.2	**40.3**	0.8
Boundary Locations						
Atomic City	09/26/24	10/03/24	**2.0**	0.2	**38.5**	0.9
	10/03/24	10/10/24	**2.6**	0.3	**39.6**	0.8
	10/10/24	10/17/24	**3.1**	0.3	**49.7**	0.9
	10/17/24	10/24/24	**1.7** J+[3]	0.2	**23.7**	0.6
	10/24/24	10/31/24	**2.7**	0.3	**24.2**	0.6
	10/31/24	11/07/24	0.5	0.2	**12.7**	0.5
	11/07/24	11/14/24	**3.4**	0.3	**39.5**	0.8
	11/14/24	11/21/24	**1.5**	0.2	**15.3**	0.5
	11/21/24	11/27/24	**0.9**	0.2	**22.0**	0.7
	11/27/24	12/05/24	**2.1**	0.2	**51.5**	0.8
	12/05/24	12/12/24	**1.9**	0.2	**50.2**	0.9
	12/12/24	12/19/24	0.5	0.2	**21.6**	0.6
	12/19/24	12/26/24	**1.9**	0.2	**40.0**	0.8

Howe	09/26/24	10/03/24	**1.9**	0.2	**33.4**	0.8
	10/03/24	10/10/24	**2.1**	0.3	**35.1**	0.8
	10/10/24	10/17/24	**1.9**	0.2	**41.0**	0.8
	10/17/24	10/24/24	**1.1** J+[3]	0.2	**21.9**	0.7
	10/24/24	10/31/24	**0.9**	0.2	**20.3**	0.6
	10/31/24	11/07/24	0.4	0.2	**12.1**	0.6
	11/07/24	11/14/24	**1.3**	0.2	**38.3**	0.9
	11/14/24	11/21/24	0.4	0.2	**13.4**	0.5
	11/21/24	11/27/24	**0.8**	0.2	**22.5**	0.7
	11/27/24	12/05/24	**1.5**	0.2	**48.9**	0.9
	12/05/24	12/12/24	**1.3**	0.2	**51.6**	0.9
	12/12/24	12/19/24	**0.6**	0.2	**21.3**	0.6
	12/19/24	12/26/24	**0.7**	0.2	**37.8**	0.8
Monteview	09/26/24	10/03/24	**2.0**	0.2	**38.3**	0.8
	10/03/24	10/10/24	**2.0**	0.2	**36.0**	0.8
	10/10/24	10/17/24	**2.6**	0.2	**46.0**	0.8
	10/17/24	10/24/24	**0.9** J+[3]	0.2	**22.9**	0.6
	10/24/24	10/31/24	**1.0**	0.2	**21.8**	0.6
	10/31/24	11/07/24	0.3	0.2	**14.2**	0.5
	11/07/24	11/14/24	**1.2**	0.2	**30.1**	0.7
	11/14/24	11/21/24	0.3	0.2	**14.0**	0.5
	11/21/24	11/27/24	0.5	0.2	**23.4**	0.7
	11/27/24	12/05/24	**1.7**	0.2	**45.2**	0.8
	12/05/24	12/12/24	**2.1**	0.2	**60.4**	0.9
	12/12/24	12/19/24	**0.9**	0.2	**24.7**	0.6
	12/19/24	12/26/24	**1.0**	0.2	**44.8**	0.8
Mud Lake	09/26/24	10/03/24	**1.8**	0.2	**36.2**	0.8
	10/03/24	10/10/24	**1.8**	0.2	**35.4**	0.7
	10/10/24	10/17/24	**2.9**	0.3	**66.1**	1.1
	10/17/24	10/24/24	**1.3** J+[3]	0.2	**26.6**	0.8
	10/24/24	10/31/24	**1.5**	0.2	**28.2**	0.8
	10/31/24	11/07/24	**0.7**	0.2	**13.2**	0.6
	11/07/24	11/14/24	**1.6**	0.2	**48.4**	1.0
	11/14/24	11/21/24	0.4	0.2	**16.8**	0.7
	11/21/24	11/27/24	**1.2**	0.3	**32.0**	0.9
	11/27/24	12/05/24	**1.7**	0.3	**68.0**	1.1
	12/05/24	12/12/24	**2.5**	0.3	**90.0**	1.3
	12/12/24	12/19/24	**0.8**	0.2	**28.5**	0.8
	12/19/24	12/26/24	**1.0**	0.2	**56.2**	1.1

Distant Locations						
Craters of the Moon	09/26/24	10/03/24	**1.4**	0.2	**33.1**	0.8
	10/03/24	10/10/24	**2.1**	0.2	**33.2**	0.7
	10/10/24	10/17/24	**1.8**	0.2	**38.9**	0.8
	10/17/24	10/24/24	**0.4** J+[3]	0.1	**19.8**	0.6
	10/24/24	10/31/24	0.4	0.2	**16.4**	0.5
	10/31/24	11/07/24	**1.9**	0.3	**14.6**	0.5
	11/07/24	11/14/24	**0.6**	0.2	**31.0**	0.7
	11/14/24	11/21/24	0.1	0.1	**12.1**	0.5
	11/21/24	11/27/24[1]	**0.6**	0.2	**17.1**	0.6
	11/27/24	12/05/24[1]	**0.8**	0.2	**41.1**	0.8
	12/05/24	12/12/24	**0.8**	0.2	**39.0**	0.8
	12/12/24	12/19/24	**0.6** J[5]	0.2	**16.1** J[5]	0.6
	12/19/24	12/26/24	0.4	0.2	**20.3**	0.6
Fort Hall[2]	09/26/24	10/03/24	**1.9**	0.2	**35.9**	0.8
	10/03/24	10/10/24	**1.9**	0.2	**34.6**	0.8
	10/10/24	10/17/24	**2.2**	0.2	**47.2**	0.9
	10/17/24	10/24/24	**1.2** J+[3]	0.2	**20.1**	0.6
	10/24/24	10/31/24	**1.1**	0.2	**20.6**	0.6
	10/31/24	11/07/24	0.3	0.2	**13.1**	0.5
	11/07/24	11/14/24	**1.1**	0.2	**27.8**	0.7
	11/14/24	11/21/24	**0.6**	0.2	**14.9**	0.6
	11/21/24	11/27/24[1]	**0.8**	0.2	**21.0**	0.7
	11/27/24	12/05/24[1]	**1.2** J[6]	0.2	**45.1** J[6]	0.8
	12/05/24	12/12/24	**1.4**	0.2	**44.2**	0.9
	12/12/24	12/19/24	**0.6**	0.2	**17.1**	0.6
	12/19/24	12/26/24	**0.7**	0.2	**27.4**	0.7
Idaho Falls	09/26/24	10/03/24	**1.6**	0.2	**36.7**	0.8
	10/03/24	10/10/24	**2.1**	0.2	**35.8**	0.7
	10/10/24	10/17/24	**2.4**	0.2	**49.7**	0.9
	10/17/24	10/24/24	**1.1** J+[3]	0.2	**21.7**	0.6
	10/24/24	10/31/24	**1.4**	0.2	**22.0**	0.6
	10/31/24	11/07/24	0.3	0.2	**13.5**	0.5
	11/07/24	11/14/24	**1.1**	0.2	**34.4**	0.7
	11/14/24	11/21/24	**0.6**	0.2	**14.7**	0.5
	11/21/24	11/27/24[1]	**1.3**	0.2	**23.8**	0.7
	11/27/24	12/05/24[1]	**1.4**	0.2	**47.7**	0.8
	12/05/24	12/12/24	**1.8**	0.2	**52.9**	0.9
	12/12/24	12/19/24	**0.8**	0.2	**19.6**	0.6
	12/19/24	12/26/24	**0.7**	0.2	**34.7**	0.7

Note: **Bold** concentrations are positive detections, greater or equal to 3 SD.
[1]Sampler ran for 6 days 11/21 – 11/27/2024. Sampler ran for 8 days 11/27 – 12/05/2024.
[2]Operated by Shoshone-Bannock Tribes.
[3] The blank filter gross alpha result was greater than or equal to 3 SD for the week of 10/17 – 10/24/2024. Associated gross alpha results for that week are qualified as biased-high estimates (J+).
[4] Volume is an estimate due to mechanical failure. Result is a usable estimate (J).
[5] Volume is less than expected due to power outage but is considered to be a usable estimate. Result is a usable estimate (J).
[6] Volume is an estimate due to technician error. Result is a usable estimate (J).

Appendix B

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

Sample Location	Net Corrected Exposure Rate (µR/hr)[1]	1 SD (µR/hr)
On-Site Locations		
Big Lost River Rest Area	13.3	1.0
Van Buren Avenue	13.2	2.3
Experimental Field Station	16.0	0.5
Main Gate	13.4	2.5
Sand Dunes Tower	14.6	0.9
MP276 -20	12.6	1.6
MP274 -20	8.6, 10.4	-
MP272 -20	13.2	1.6
MP270 -20	12.7	1.0
MP268 -20	11.2	1.4
MP266 -20	10.4	1.3
MP264 -20	14.8	0.5
MP270 -20/26	14.7	0.3
MP268 -20/26	12.9, 14.3	-
MP266 -20/26	15.2	2.5
MP263 -20/26	NS[2]	NS[2]
MP261 -20/26	11.9	1.0
MP259 -20/26	12.8	0.6
MP256 -20/26	11.3	1.6
MFC (EBR II)	14.6	1.9
EBR I	11.9	2.6
RWMC	13.8	1.5
CFA	18.9	1.1
CITRC (PBF)	13.7	1.3
INTEC	17.6	0.7
ATR (TRA)	12.5	1.0
NRF	14.5	2.5
TAN/SMC	13.1	2.4
MP39-33	13.4	1.3
MP37-33	13.6	1.3
MP35-33	11.2, 12.9	-
MP33-33	13.6	2.0
MP31-33	11.9	1.5
MP29-33	13.9	2.8
MP27-33	15.5	2.6
MP25-33	12.2	2.0
MP23-33	12.8	0.5
Base of Howe	14.2	1.3
Rover	14.8	2.1
T4 North	16.0	1.7
T4 South	11.6	1.9
Boundary Locations		
Atomic City	14.8	0.8
Mud Lake/ Terreton	13.9	2.1
Monteview	16.1, 18.5	-
Howe Met. Tower	15.0	0.4
MP282 -20	10.4, 11.7	-

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

Sample Location	Net Corrected Exposure Rate (µR/hr)[1]	1 SD (µR/hr)
MP280 -20	11.2	1.2
MP278 -20	13.9	2.0
Mud Lake Bank of Commerce	13.7	2.5
MP43-33	17.6	0.8
MP41-33	15.9	1.0
MP21-33	9.7, 12.5	-
MP19-33	12.5	0.8
MP14-33	11.8	0.3
MP11-33	11.4	1.4
MP06-33	10.2	0.7
MP03-33	12.8	1.9
Distant Locations		
Arco	14.0	2.2
Craters of the Moon	14.6	1.4
Taber	10.8	1.7
Blackfoot	10.2	0.6
Fort Hall	12.0	1.2
Idaho Falls	9.5	0.2
Hamer	15.5	1.3
Sugar City	17.7, 20.4	-
Roberts	14.0	1.5
Big Southern Butte	NS[3]	NS[3]

[1]Results 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.

[2] NS = No sample. EICs and mile post were missing from this location at quarterly change-out.

[3] NS = No sample. EICs were not collected due to heavy snow conditions on access roads. These EICs will be collected at the next 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}	9
		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	--	
		Iron	10	µg/L	300*	--	

Media Sampled	Collection Device	Analyte	Typical MDC or RDL range[1]	Units	EPA Limit[2,3]	DOE DCS[4]	Notes
		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)	4.59×10^3	1.0×10^4	11
Soil	*in situ*	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,

Media Sampled	Collection Device	Analyte	Typical MDC or RDL range[1]	Units	EPA Limit[2,3]	DOE DCS[4]	Notes

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 µg/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 x10^4 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 µR/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/m^3, gamma spectroscopy and possibly other analyses are performed.”

Appendix D

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

Analyte	Reporting Detection Limit (RDL) (expressed in µg/L)
1,1,1,2-Tetrachloroethane	0.5
1,1,1-Trichloroethane	0.5
1,1,2,2-Tetrachloroethane	0.5
1,1,2-Trichloroethane	0.5
1,1-Dichloro-2-Propanone	5
1,1-Dichloroethane	0.5
1,1-Dichloroethene	0.5
1,1-Dichloropropene	0.5
1,2,3-Trichlorobenzene	0.5
1,2,3-Trichloropropane	0.5
1,2,4-Trichlorobenzene	0.5
1,2,4-Trimethylbenzene	1
1,2-Dibromo-3-chloropropane	0.5
1,2-Dibromoethane	0.5
1,2-Dichlorobenzene	0.5
1,2-Dichloroethane	0.5
1,2-Dichloropropane	0.5
1,3,5-Trimethylbenzene	0.5
1,3-Dichlorobenzene	0.5
1,3-Dichloropropane	0.5
1,4-Dichlorobenzene	0.5
1-Chlorobutane	0.5
2,2-Dichloropropane	0.5
2-Butanone	10
2-Chlorotoluene	0.5
2-Hexanone	2.5
2-Nitropropane	1
4-Chlorotoluene	0.5
Acrylonitrile	1
Allyl chloride	0.5
Benzene	0.5
Bromobenzene	0.5
Bromochloromethane	0.5
Bromodichloromethane	0.5

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

Analyte	Reporting Detection Limit (RDL) (expressed in µg/L)
Bromoform	0.5
Bromomethane	0.5
Carbon disulfide	0.5
Carbon tetrachloride	0.5
Chlorobenzene	0.5
Chloroethane	0.5
Chloroform	0.5
Chloromethane	0.5
Dibromochloromethane	0.5
Dibromomethane	0.5
Dichlorodifluoromethane	0.5
Diethyl ether	0.5
Ethyl methacrylate	0.5
Ethylbenzene	0.5
Hexachlorobutadiene	0.5
Hexachloroethane	0.5
Iodomethane	1
Isopropylbenzene (Cumene)	0.5
MTBE	0.5
Methacrylonitrile	0.5
Methyl Acrylate	0.5
Methyl Isobutyl Ketone	2.5
Methyl methacrylate	0.5
Methylene chloride	0.5
Naphthalene	0.5
Pentachloroethane	1
Propionitrile	0.5
Styrene	0.5
Tetrachloroethene	0.5
Tetrahydorfuran	1
Toluene	0.5
Trichloroethene	0.5
Trichlorofluoromethane	0.5
Vinyl chloride	0.5
cis-1,2-Dichloroethene	0.5
cis-1,3-Dichloropropene	0.5
m,p-Xylene	0.5
n-Butylbenzene	0.5
n-Propylbenzene	0.5
o-Xylene	0.5
p-Isopropyltoluene	0.5
sec-Butylbenzene	1

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

Analyte	Reporting Detection Limit (RDL) (expressed in µg/L)
tert-Butylbenzene	0.5
trans-1,2-Dichloroethene	0.5
trans-1,3-Dichloropropene	1
trans-1,4-Dichloro-2-Butene	0.5