

Department of Environmental Quality
INL Oversight Program

**ENVIRONMENTAL SURVEILLANCE PROGRAM
QUARTERLY DATA REPORT**

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Table of Acronyms

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

Introduction

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

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

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

Air and Precipitation Monitoring Results

The ESP operated eight air monitoring stations on and near the INL as well as two monitoring stations distant from the INL during the second quarter, 2021 (**Figure 1**). 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 ten 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 high-volume total suspended particulate (TSP) air samplers. Many of these air samplers were found to be operating outside of their expected flow rate range in the second quarter, 2021. A calibrated flow rate gauge was taken into the field weekly to measure the sample start and stop flow rates of these samplers. The calibrated flow rate gauge measurements were used for the activity concentration calculations in the suspect measurements and results have been footnoted as estimates. Weekly gross alpha and gross beta particulate radioactivity results for filters from the 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 filters collected using TSP samplers during a calendar quarter are analyzed using gamma spectrometry. Typically, gamma spectrometry results are only reported when exceeding a minimum detectable activity (MDA) or minimum detectable concentration (MDC). Gamma spectrometry results for the second quarter of 2021 for TSP filters are presented in **Table 3**. The only reported gamma-emitting radionuclide was beryllium-7, a naturally occurring, cosmogenic radionuclide. The MDC for Cs-137 is also reported since Cs-137 is the most likely of the man-made gamma emitting radionuclides to be detected.

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 eleven air monitoring stations and analyzed together as a composite using gamma spectrometry (**Table 4**). If Iodine-131 is detected in this grouping, the canisters are individually analyzed. No radioactive isotopes of iodine, specifically Iodine-131, were detected on the weekly charcoal cartridges used to collect this nuclide during the second quarter of 2021.

Atmospheric moisture was collected by drawing air through hygroscopic media at each of the 11 monitoring stations. This moisture was stripped from the hygroscopic media and analyzed to calculate the atmospheric tritium concentration. Reported quarterly mean values are weighted based upon the volume of air sampled when more than one atmospheric moisture sample was collected during the calendar quarter. The two Big Lost River Rest Area individual samples and the quarterly mean exceeded their MDCs. The two Experimental Field Station individual samples and the quarterly mean exceeded their MDCs. One Sand Dunes Tower individual sample was equal to its MDC and was greater than three sample standard deviations. One Van Buren Avenue individual sample and the quarterly mean exceeded their MDCs. All these locations are on-site and strongly suggest an INL tritium source. All other locations had results less than MDCs. All results are well below the DEQ-INL OP action level of 150 pCi/m³ (40 CFR 61). Atmospheric tritium concentrations and their weighted quarterly means are presented in **Table 5**.

Precipitation samples were collected at six monitoring locations during the second quarter of 2021. These water samples were analyzed for tritium and man-made gamma emitting radionuclides. Reported values were either the result of a single sample or a weighted mean when more than one precipitation sample was collected during the calendar quarter. Tritium and man-made gamma emitting radionuclides were below MDCs in precipitation at all locations during the second quarter of 2021. Analysis results for Tritium (H-3) and Cesium-137, the most likely to be detected of man-made gamma emitting radionuclides, are presented in **Table 6**.

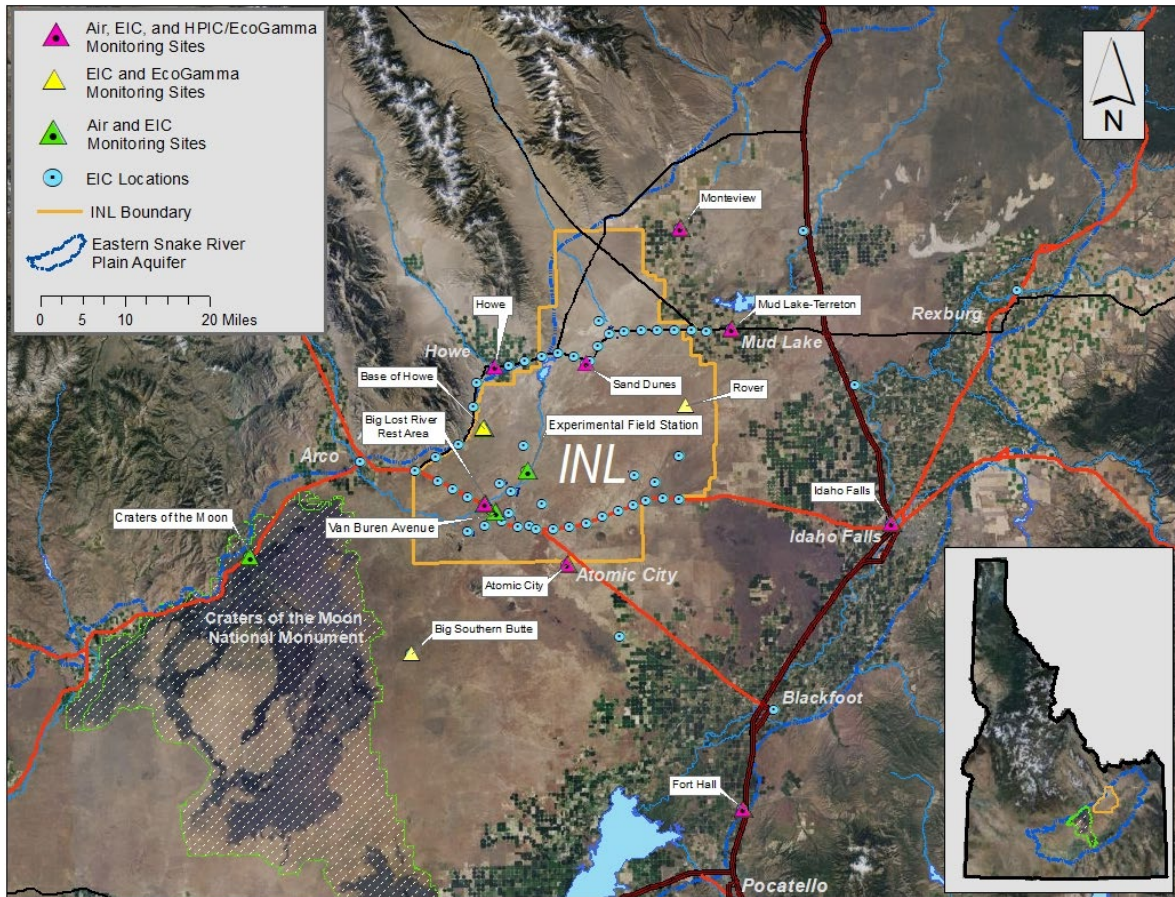


Figure 1. Air and radiation monitoring sites.

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	□	□	■	
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.

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

Table 2. Range of gross alpha and gross beta concentrations for TSP filters, second quarter, 2021.

Station Location	Concentration					
	Gross Alpha			Gross Beta		
On-Site Locations						
Big Lost River Rest Area	0.5	-	1.4	18.7	-	48.0
Experimental Field Station	0.5 J ²	-	1.6 J	15.9 J	-	32.9 J
Sand Dunes Tower	0.7 J ²	-	1.5 J	20.0 J	-	39.1 J
Van Buren Avenue	0.8 J ²	-	1.8 J	26.3 J	-	48.7 J
Boundary Locations						
Atomic City	0.8 J ²	-	1.6 J	24.4 J	-	36.9
Howe	1.0 J ²	-	1.9	23.6 J	-	41.6
Monteview	0.8	-	1.7	21.4 J	-	42.8
Mud Lake	0.4	-	2.4 J ²	21.7 J	-	47.7 J
Distant Locations						
Craters of the Moon	0.6 J ²	-	1.3 J	21.4 J	-	40.5 J
Fort Hall ¹	0.9 J ²	-	2.2 J	20.0	-	44.3 J
Idaho Falls	1.0 J ²	-	1.6 J	23.6 J	-	34.5 J
Idaho Falls Duplicate	0.6	-	1.7 J ²	20.4	-	37.2 J

¹Operated by Shoshone-Bannock Tribes.²Air volume was estimated. Results are J-flagged as estimates.Note: Concentrations are expressed in 1×10^{-3} pCi/m³. MDCs typically range from $(0.1 \text{ to } 0.5) \times 10^{-3}$ pCi/m³ for gross alpha and from $(0.7 \text{ to } 1.3) \times 10^{-3}$ pCi/m³ for gross beta.**Table 3. Gamma spectroscopy analysis data for TSP filters, composite samples, second quarter, 2021.**

Station Location	Naturally Occurring Radionuclide Beryllium-7			Man-Made Gamma Emitting Radionuclides		
	Concentration	± 2 SD	MDC	Concentration	± 2 SD	MDC ²
On-site Locations						
Big Lost River Rest Area	159.5	8.4	1.1	0.00	0.04	0.07
Experimental Field Station	143.0 J ³	7.6 J	1.6 J	0.01 J	0.05 J	0.09 J
Sand Dunes Tower	153.0 J	8.0 J	1.3 J	0.02 J	0.04 J	0.06 J
Van Buren Avenue	191.3 J	10.0 J	1.7 J	0.01 J	0.07 J	0.12 J
Boundary Locations						
Atomic City	206.7 J	10.5 J	1.1 J	0.04 J	0.05 J	0.09 J
Howe	213.9 J	10.9 J	1.1 J	0.06 J	0.06 J	0.09 J
Monteview	167.4 J	8.7 J	1.5 J	0.00 J	0.04 J	0.08 J
Mud Lake	151.0 J	7.9 J	1.1 J	0.02 J	0.04 J	0.07 J
Distant Locations						
Craters of the Moon	168.6 J	8.9 J	1.3 J	-0.04 J	0.05 J	0.10 J
Fort Hall ¹	158.2 J	8.1 J	0.9 J	0.00 J	0.04 J	0.06 J
Idaho Falls	143.6 J	7.5 J	1.3 J	-0.04 J	0.06 J	0.10 J
Idaho Falls Duplicate	158.2 J	8.3 J	1.5 J	0.01 J	0.05 J	0.09 J

¹Operated by Shoshone-Bannock Tribes.²MDC is for Cs-137. No man-made gamma emitting radionuclides were detected.³Air volume was estimated in at least one weekly TSP sample. Results are J-flagged as estimates.Note: Concentrations are reported in 1×10^{-3} pCi/m³ with associated uncertainty (± 2 SD) and minimum detectable concentration (MDC).

Table 4. Iodine-131 activity in weekly charcoal filter composites, second quarter, 2021.

Start Date	Collection Date	Iodine-131 activity (pCi/composite)		
		Activity	± 2 SD	MDA ¹
03/31/21	04/07/21	0.99	1.54	2.55
04/07/21	04/14/21	-0.26	1.41	2.42
04/14/21	04/21/21	1.31	1.60	2.63
04/21/21	04/28/21	0.44	1.60	2.68
04/28/21	05/05/21	-0.62	0.94	1.70
05/05/21	05/12/21	-0.42	1.28	2.23
05/12/21	05/19/21	0.07	1.64	2.77
05/19/21	05/26/21	0.85	1.22	2.01
05/26/21	06/02/21	-0.19	1.31	2.26
06/02/21	06/09/21	0.42	1.37	2.30
06/09/21	06/16/21	-0.22	1.14	1.99
06/16/21	06/23/21	-0.47	1.82	3.10
06/23/21	06/30/21	0.32	0.98	1.67

¹The minimum detectable activity (MDA) is established for the least efficient counting position in the eleven-cartridge composite. Based on a typical 20,000 ft³ (566 m³) air volume per cartridge, the highest I-131 MDA of 3.10 pCi/composite is equivalent to a maximum MDC of 5 x10⁻⁴ pCi/m³.

Table 5. Tritium concentrations in air from atmospheric moisture, second quarter, 2021.

Station Location	Start Date	Collection Date	Tritium		
			Concentration	± 2 SD	MDC
On-site Locations					
Big Lost River Rest Area	3/31/21	5/19/21	0.40	0.25	0.39
Big Lost River Rest Area	5/19/21	6/30/21	0.69	0.26	0.38
Big Lost River Rest Area Mean	3/31/21	6/30/21	0.54	0.25	0.39
Experimental Field Station	3/31/21	5/19/21	0.48	0.26	0.40
Experimental Field Station	5/19/21	7/02/21	1.03	0.33	0.48
Experimental Field Station Mean	3/31/21	7/02/21	0.75	0.30	0.44
Sand Dunes Tower	3/31/21	5/19/21	0.31	0.25	0.40
Sand Dunes Tower	5/19/21	6/30/21	0.40	0.25	0.40
Sand Dunes Tower Mean	3/31/21	6/30/21	0.35	0.25	0.40
Van Buren Avenue	3/31/21	5/19/21	0.36	0.24	0.38
Van Buren Avenue	5/19/21	7/02/21	0.58	0.25	0.38
Van Buren Avenue Mean	3/31/21	7/02/21	0.47	0.25	0.38
Boundary Locations					
Atomic City	3/31/21	5/19/21	0.12	0.25	0.42
Atomic City	5/19/21	7/02/21	0.10	0.17	0.29
Atomic City Mean	3/31/21	7/02/21	0.11	0.21	0.35
Howe	3/31/21	5/19/21	0.11	0.25	0.42
Howe	5/19/21	6/30/21	0.37	0.31	0.49
Howe Mean	3/31/21	6/30/21	0.23	0.28	0.45
Mud Lake	3/31/21	5/19/21	0.22	0.28	0.45
Mud Lake	5/19/21	6/30/21	0.19	0.29	0.49
Mud Lake Mean	3/31/21	6/30/21	0.20	0.28	0.47
Montevieu	3/31/21	5/19/21	0.08	0.25	0.43
Montevieu	5/19/21	6/30/21	0.18	0.33	0.55
Montevieu Mean	3/31/21	6/30/21	0.13	0.29	0.48
Distant Locations					
Craters of the Moon	3/31/21	5/19/21	0.27	0.20	0.33
Craters of the Moon	5/19/21	6/30/21	0.30	0.21	0.34
Craters of the Moon Mean	3/31/21	6/30/21	0.28	0.21	0.33
Fort Hall ¹	3/31/21	5/19/21	0.15	0.28	0.46
Fort Hall	5/19/21	7/02/21	0.22	0.27	0.44
Fort Hall Mean	3/31/21	7/02/21	0.18	0.27	0.45
Idaho Falls	3/31/21	5/19/21	0.15	0.28	0.47
Idaho Falls	5/19/21	6/30/21	0.26	0.30	0.50
Idaho Falls Mean	3/31/21	6/30/21	0.20	0.29	0.49

¹Operated by Shoshone-Bannock Tribes.

Note: Concentrations are reported in pCi/m³ with associated uncertainty (± 2 SD) and minimum detectable concentration (MDC).

Table 6. Tritium and gamma-emitting radionuclide concentrations from precipitation, second quarter, 2021.

Station Location	Tritium			Cesium-137		
	Concentration	± 2 SD	MDC	Concentration	± 2 SD	MDC
On-site Locations						
Big Lost River Rest Area	130	90	140	0.8	1.5	2.5
Boundary Locations						
Atomic City	20	90	150	0.4	1.3	2.1
Howe	110	90	140	0.2	1.7	3.0
Monteview	80	90	140	0.1	1.1	1.9
Mud Lake	80	90	140	0.3	2.1	3.5
Distant Locations						
Idaho Falls	50	90	140	-0.4	1.6	2.7

Note: Concentrations are reported in pCi/L with associated uncertainty (± 2 SD) and minimum detectable concentration (MDC).

Environmental Radiation Monitoring Results

The ESP operated 13 environmental radiation stations during the second quarter of 2021 (**Figure 1**). To detect gamma radiation, each station is instrumented with triplicate electret ionization chambers (EIC), and 10 of the stations also are equipped with an EcoGamma dual Geiger–Müller gamma radiation monitor. (**Table 7**).

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

EcoGammas are instruments capable of real-time measurements and are sensitive enough to detect small changes in gamma radiation levels. The real-time gamma radiation measurements collected by the EcoGammas at each location are transmitted to DEQ-INL OP and presented graphically via the worldwide web at <https://www.deq.idaho.gov/idaho-national-laboratory-oversight/inl-oversight-program/gamma-radiation-measurements>. Historically, DEQ-INL OP has used high-pressure ion chambers (HPIC) for real-time gamma radiation measurements. We completed a change-over of removing the old HPICs and replacing them with EcoGammas at each of our monitoring stations in first quarter 2021. Slight differences between EcoGamma data and historical HPIC data are expected.

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

These two systems are used by DEQ-INL OP to measure external gamma radiation for various radiological monitoring objectives. **Table 8** lists the average radiation exposure rates measured by the EcoGammas for second quarter 2021. **Table 9** lists the EIC monitoring results for second quarter 2021. Overall exposure rates were within the expected historical range of values observed by DEQ-INL OP for background radiation.

Table 7. Summary of instrumentation at radiation monitoring stations.

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

Table 8. Average gamma exposure rates, second quarter, 2021, from EcoGamma network.

Station Location	Exposure Rate ($\mu\text{R/hr}$)	
	Quarterly Average*	± 2 SD
On-site Locations		
Base of Howe	19.1	1.5
Big Lost River Rest Area	16.2	1.3
Rover	17.3	1.4
Sand Dunes Tower	16.1	1.3
Boundary Locations		
Atomic City	16.1	1.4
Big Southern Butte	20.2	1.6
Howe Met Tower	15.0	1.6
Monteview	14.0	1.2
Mud Lake / Terreton	15.2	1.3
Distant Locations		
Fort Hall	14.5	1.2
Idaho Falls	16.5	1.3

*The 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.

Table 9. Electret ionization chamber (EIC) cumulative average exposure rates, second quarter, 2021.

Station Location	Exposure Rate ($\mu\text{R/hr}$)	
	Quarterly Average ¹	± 2 SD
On-Site Locations		
Base of Howe	14.1	3.2
Big Lost River Rest Area	15.4	3.5
Experimental Field Station	15.2	2.5
Rover	14.1	2.1
Sand Dunes Tower	13.7	2.4
Van Buren Avenue	17.3	2.4
Boundary Locations		
Atomic City	17.1, 19.3	-
Big Southern Butte	14.5	3.6
Howe Met Tower	13.6	4.3
Monteview	13.9	4.9
Mud Lake/Terreton	15.0	4.1
Distant Locations		
Craters of the Moon	14.7	3.1
Fort Hall	12.8	3.0
Idaho Falls	12.9	0.9

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

Water Monitoring Results

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

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

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

(TAN). Facility sites are located within or immediately downgradient of known areas of contamination and are sampled to monitor the concentrations and migration of specific contaminants.

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

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

Samples collected from water-monitoring sites are analyzed for radiological and non-radiological constituents, many of which are present in the aquifer both naturally and as a result of INL operations. All locations are sampled for gross alpha and gross beta radioactivity, manmade gamma-emitting nuclides, tritium, chloride, sulfate, chromium, and nitrate-plus-nitrite.¹ Samples from locations at which tritium concentrations are too low to be detected by the standard method are re-analyzed for tritium using an electrolytic enrichment method (referred to as the low-level method), which has a minimum detectable concentration (MDC) about ten times lower than the standard method. Selected sites are also sampled for specific radionuclides—including uranium isotopes (²³⁴U, ²³⁵U, and ²³⁸U), plutonium isotopes (²³⁸Pu, ^{239/240}Pu), americium-241 (²⁴¹Am), strontium-90 (⁹⁰Sr), iodine-129 (¹²⁹I) and technetium-99 (⁹⁹Tc)—selected trace metals, common ions, total phosphorous, and/or volatile organic compounds (VOCs) based on past and present INL operations or a history of elevated concentrations. If unexpected levels of radioactivity are detected in gross measurements, additional samples will be collected and analyzed for specific radionuclides.

During the second quarter of 2021, DEQ-INL OP sampled groundwater from the aquifer at 29 facility locations, 16 boundary locations, 6 distant locations, and 5 upgradient locations. DEQ-INL OP also sampled water from 3 perched well water locations and 2 wastewater locations. **Table 10** lists the sample date, co-sampler, well depth, and analyses requested for the locations sampled this quarter. Analytical results are reported in **Tables 12 through 24** and summarized below. The results of low-level tritium analyses for 25 samples collected in 2021 are reported in **Table 14** and discussed below.

Table 11 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

¹ Distant locations Alpheus Spring, Bill Jones Hatchery, Clear Spring, Minidoka Water Supply, and Shoshone Water Supply and upgradient location Mud Lake Water Supply are sampled for gross alpha and gross beta radioactivity, gamma-emitting radionuclides, and tritium during the second quarter. In the fourth quarter, common ions, metals, nitrate-plus-nitrate, and other constituents are collected along with gross alpha and gross beta radioactivity, gamma-emitting radionuclides, and tritium.

pCi/L, respectively. Occasional measurements of concentrations above these background ranges in uncontaminated samples are statistically probable due to uncertainties inherent in measuring low levels of radioactivity. Additionally, some samples will have levels of radioactivity slightly higher than background ranges due to higher-than-average concentrations of naturally occurring uranium, thorium, or potassium-40.

Gross alpha and beta radioactivity were detected at low levels in most samples (**Table 12**). Gross alpha radioactivity was measured at concentrations within the known background range at all locations, except for USGS-092 at RWMC. This is a perched well located at the RWMC facility that was added to the sampling schedule this year to determine if radionuclides are migrating from the surface disposal area into the aquifer. Water levels in this well were very low and because the well must be manually bailed, sediment was present in the samples. An elevated gross alpha concentration above background and MCL was detected at 18.6 ± 3.5 pCi/L. USGS-092 also had an elevated gross beta concentration above background that measured 18.7 ± 2.4 pCi/L. Because USGS-092 is a new well on the sampling list, it will be monitored closely with USGS. Overall gross beta results elevated above background were measured at TAN, RWMC, and INTEC, with a maximum of 930 ± 7.5 pCi/L at ICPP-MON-A-230 (INTEC). Although this concentration is a slight increase from 2020, which was 882.5 ± 7.2 pCi/L, it is consistent with historical trends, as were all other detectable concentrations.

Manmade gamma-emitting radionuclides

No manmade gamma-emitting radionuclides were detected at the locations sampled this quarter. Results for cesium-137 (^{137}Cs), the manmade gamma-emitter most likely to be detected in groundwater, are reported in **Table 12**.

Tritium

Tritium was analyzed for all locations sampled this quarter (**Table 13**). Using the standard analytical method, which typically has an MDC of 110 to 190 pCi/L, tritium was detected at 15 facility wells and three boundary aquifer wells. The detected tritium concentrations at the facility wells ranged from 330 ± 100 pCi/L at USGS-047 to 2340 ± 180 pCi/L at CFA-2. Tritium concentrations that exceeded background in the boundary wells ranged from 470 ± 120 pCi/L in USGS-104 to 760 ± 130 pCi/L in USGS-131A (812 ft bgs), indicating an INL source. All tritium concentrations were consistent with historical data and were measured in areas of known contamination related to INL waste disposal practices.

Samples from twenty-two aquifer and three perched well locations requiring low-level tritium analysis were analyzed this quarter, and the results are reported in **Table 14**. Nine samples were from facility wells, ten were from boundary wells, two were from upgradient wells, one was from a distant well, and three samples were from perched wells. All concentrations from upgradient and distant sites are within the background range (0-33 pCi/L). Four facility locations have elevated tritium concentrations, ranging from 48 ± 8 pCi/L at A11A31 to 402 ± 17 pCi/L at M7S and five boundary locations, ranging from 81 ± 10 pCi/L at USGS-137A (747 ft bgs) to 189 ± 13 pCi/L at Middle-2051 (749 ft bgs). In perched groundwater, elevated tritium concentrations ranged from 102 ± 11 pCi/L at USGS-092 to 141 ± 12 pCi/L at USGS-068. A backlog of three samples to be analyzed for low-level tritium, remains.

All tritium concentrations reported in this quarter are well below the drinking water MCL of 20,000 pCi/L.

Strontium-90

Sixteen aquifer locations and two perched groundwater locations were sampled for ^{90}Sr this quarter (**Table 15**). Detectable concentrations were found in nine aquifer samples from INTEC, TAN, and CFA, with a maximum concentration of 316 ± 74 pCi/L at TAN 2271. Detectable concentrations were also found in two ATR perched groundwater samples, with a maximum of 6.7 ± 1.6 at USGS-068. Six locations had ^{90}Sr concentrations that exceeded the MCL of 8 pCi/L. All elevated concentrations were measured in samples from areas of known contamination and are consistent with historical trends.

Technetium-99

Eight aquifer facility locations at INTEC and CFA, and one boundary location (USGS-104) were sampled for ^{99}Tc (**Table 16**). Detectable concentrations were found in four INTEC locations, with a maximum concentration of 1510 ± 240 at ICPP-MON-A-230. Although this is a slight increase from last year (1260 ± 200 pCi/L), it is a significant decrease in concentration from a previous sampling event in 2003, which had a concentration of 2418 ± 4 pCi/L. All concentrations, except for ICPP-MON-A-230 were below the drinking water MCL of 900 pCi/L and consistent with historical data and trends.

On October 14, 2020, the sample from boundary well USGS-104 resulted in a value of 8.2 ± 4.2 pCi/L (MDC = 5.5 pCi/L), which was above the historical range of about 0-2 pCi/L, but still far below the MCL of 900 pCi/L. A complete re-analysis of the USGS-104 water sample was performed on May 25, 2021, by the ISU vendor lab, producing a result of 3.7 ± 3.9 pCi/L (MDC = 6.2 pCi/L). This result was a non-detection, although it was within 3 sample standard deviations (3 SD) of the original result. On June 29, 2021, USGS-104 was re-sampled in duplicate for ^{99}Tc , resulting in non-detections of 1.4 ± 2.8 pCi/L (MDC = 4.9 pCi/L) and 2.2 ± 3.1 pCi/L (MDC = 5 pCi/L), consistent with historical data. USGS-104 is scheduled to be sampled in April 2022 and will be closely monitored.

Plutonium Isotopes

Nine facility locations – five at INTEC, and four at RWMC, including USGS-092, which is a perched groundwater location – were sampled for plutonium isotopes (^{238}Pu and $^{239/240}\text{Pu}$) this quarter (**Table 17**). In the aquifer there were no detectable concentrations for ^{238}Pu and one $^{239/240}\text{Pu}$ concentration of 0.012 ± 0.016 pCi/L, which was >MDC, found at ICPP-MON-A-230, located at INTEC. Because this result is less than two standard deviations, it is considered a non-detection. In perched water there was also a $^{239/240}\text{Pu}$ detection at RWMC well USGS-092, with a concentration of 0.18 ± 0.061 pCi/L (MDC = 0.095 pCi/L).

Americium-241

^{241}Am was analyzed in five samples – four at RWMC, including one perched groundwater location, and one at ATR – with no detectable concentrations (**Table 18**).

Uranium Isotopes

Eleven aquifer facility locations at INTEC, TAN, and RWMC and one perched groundwater location at RWMC (USGS-092) were sampled for uranium isotopes this quarter (**Table 19**). All locations yielded detectable results for ^{234}U . Five of these locations exceeded background concentrations, with a maximum of 8.4 ± 1.6 pCi/L at USGS-092. There were seven detections of ^{235}U and seven locations which exceeded background concentrations ranging from 0.064 ± 0.063 pCi/L at ICPP-MON-A-230 to 0.173 ± 0.091 pCi/L at TAN-29. Four locations (TAN-42, TAN-28, USGS-087, and USGS-092) were

less than three standard deviations, and therefore flagged as estimates. Two locations (USGS-047 and M6S) were greater than MDC but less than two standard deviations, and therefore considered non-detections. One location (USGS-067) was sampled in duplicate. The original sample of the duplicate pair yielded a detectable ^{235}U result of 0.137 ± 0.082 pCi/L (MDC = 0.031 pCi/L) but the duplicate sample yielded a non-detectable result of 0.026 ± 0.058 pCi/L (MDC = 0.087 pCi/L). These duplicate results met quality control criteria for agreement, so the original result is not qualified. All locations had detections for ^{238}U , with five exceeding background concentrations. The maximum concentrations of ^{234}U and ^{238}U were 8.4 ± 1.6 pCi/L and 4.9 ± 1.0 pCi/L, respectively, at USGS-092. TAN-29 resulted in the maximum concentration of ^{235}U at 0.173 ± 0.091 . The elevated $^{234}\text{U}/^{238}\text{U}$ activity ratios at TAN-28 and TAN-29 are greater than naturally occurring $^{234}\text{U}/^{238}\text{U}$ ratios of about 1.5-3.1, and therefore indicate an anthropogenic (INL) source. All detections were consistent with historical data and trends.

Common ions, trace metals, and nutrients

Select locations were sampled for common ions (calcium, magnesium, sodium, potassium, chloride, sulfate, and alkalinity), trace metals, (arsenic, barium, chromium, iron, lead, manganese, and selenium) and dissolved nutrients (nitrate-plus-nitrite, phosphorous) (**Tables 20, 21, and 22**).

Chloride was measured at 388 mg/L at NRF-06, exceeding the EPA's secondary MCL of 250 mg/L.

ATR well USGS-065 had the highest chromium value this quarter, at 78 µg/L. Chromium was also measured at NRF-06 at 66 µg/L, the highest concentration since 2009, but still well below the MCL of 100 µg/L. These elevated concentrations at ATR and NRF are consistent with historical data. Most boundary wells sampled this quarter had chromium values greater than the background range, with the highest value of 11 µg/L at USGS-131A (616 ft bgs). These elevated results indicate INL-sourced chromium at and beyond the southern boundary.

Levels of barium, iron, manganese, sodium, chloride, alkalinity, potassium, and phosphorous in samples from TAN were elevated above historical trends due to changing redox conditions and increased in-situ-bioremediation (ISB) conditions still present following well injections. An elevated arsenic level above background of 9.7 mg/L was measured at ATR perched groundwater well USGS-062. This result is consistent with past data. Elevated chromium levels above background of 76 µg/L at USGS-068, 66 µg/L at NRF-06, 48 µg/L at M15S, and 78 µg/L at USGS-065 were observed; however, the results are also consistent with past results. All other concentrations were consistent with past observations and trends with most within natural background ranges.

Most nutrient results were consistent with past results with some elevated compared to background concentrations. Three locations at INTEC (ICPP-2020, ICPP-MON-A-230, and USGS-067) had elevated nitrate + nitrite concentrations above background due to historical leaks from the underground tank farm. Two perched well locations had elevated nitrate + nitrite concentrations above background of 16.0 mg/L at USGS-092 (RWMC) and 9.3 mg/L at USGS-068 (ATR). All other concentrations were consistent with past observations and trends, with most within natural background ranges.

Volatile organic compounds (VOCs)

VOCs were measured at eight aquifer wells located at TAN and seven aquifer and perched groundwater wells located at RWMC (**Table 23**). All had detectable concentrations of at least one VOC, except for M1S, TAN-56, and TAN-2312. Carbon tetrachloride, trichloroethene (TCE), and chloroform continue to be detected at RWMC wells at levels consistent with previous observations. Tetrachloroethene (PCE), trichloroethene (TCE), and cis-1,2-dichloroethene continue to be detected at TAN wells ; however, notable MCL exceedances and/or changes from previous measurements include:

- TAN-28 TCE = 1.75 µg/L, down from 8.91µg/L in 2020 (MCL is 5 µg/L)
- TAN-28 cis-1,2-DCE = 13.2, down from 643 µg/L in 2020 (MCL is 70 µg/L)
- TAN-28 carbon disulfide = 0.62, up from <0.500 µg/L in 2020 (MCL is 2 µg/L)
- TAN-29 TCE = 401µg/L, down from 464 µg/L in 2020 (MCL is 5 µg/L)
- TAN-51 TCE = 83.8 µg/L, down from 165 µg/L in 2020 (MCL is 5 µg/L)

A new perched groundwater well located at RWMC (USGS-092) was added to the program to determine if the subsurface disposal area surrounding the well is potentially contributing contaminants to the aquifer. Detectable concentrations of tetrachloroethene (PCE), trichloroethene (TCE), 1,1,1—trichloroethane (1,1,1 TCA), carbon tetrachloride, and chloroform were present. Water levels were very low this year. Sampling is expected to continue in subsequent years if water is available.

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

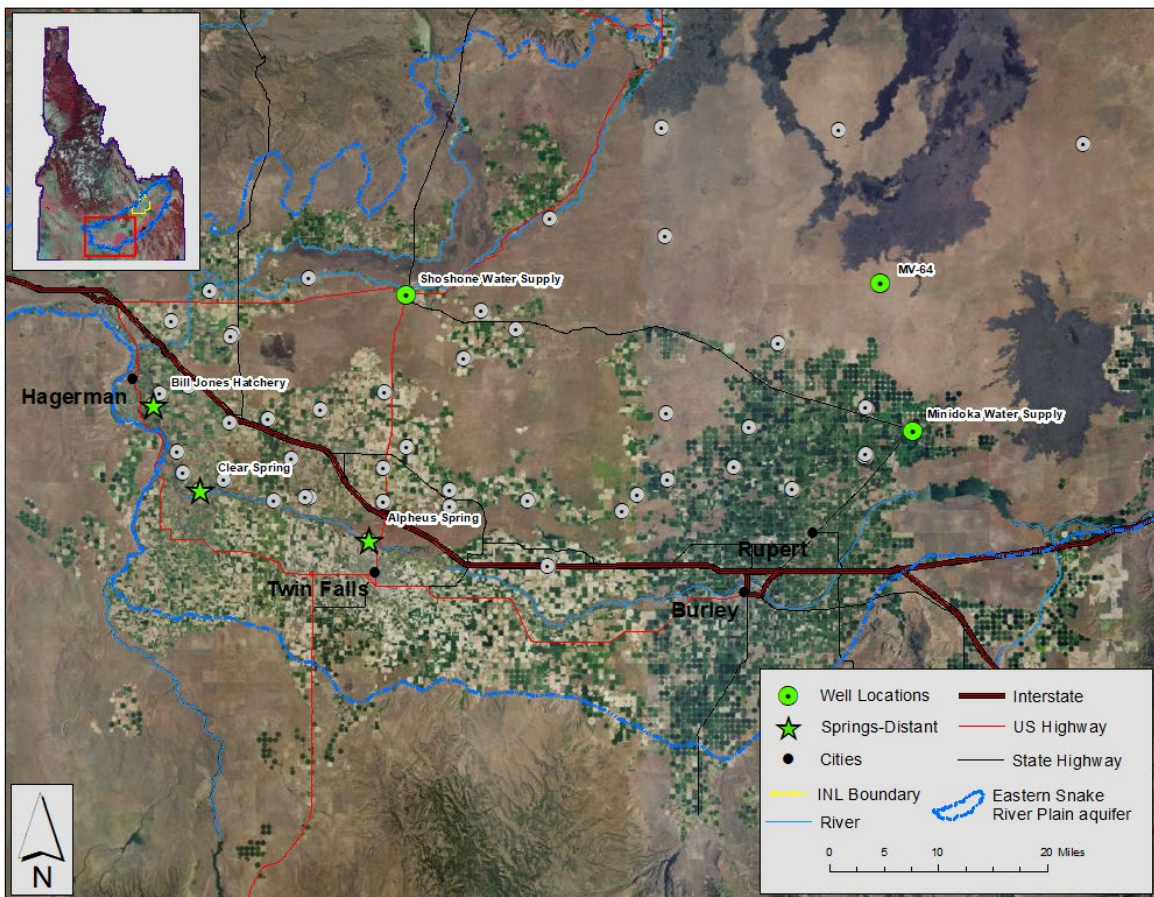


Figure 2. Distant water monitoring locations.

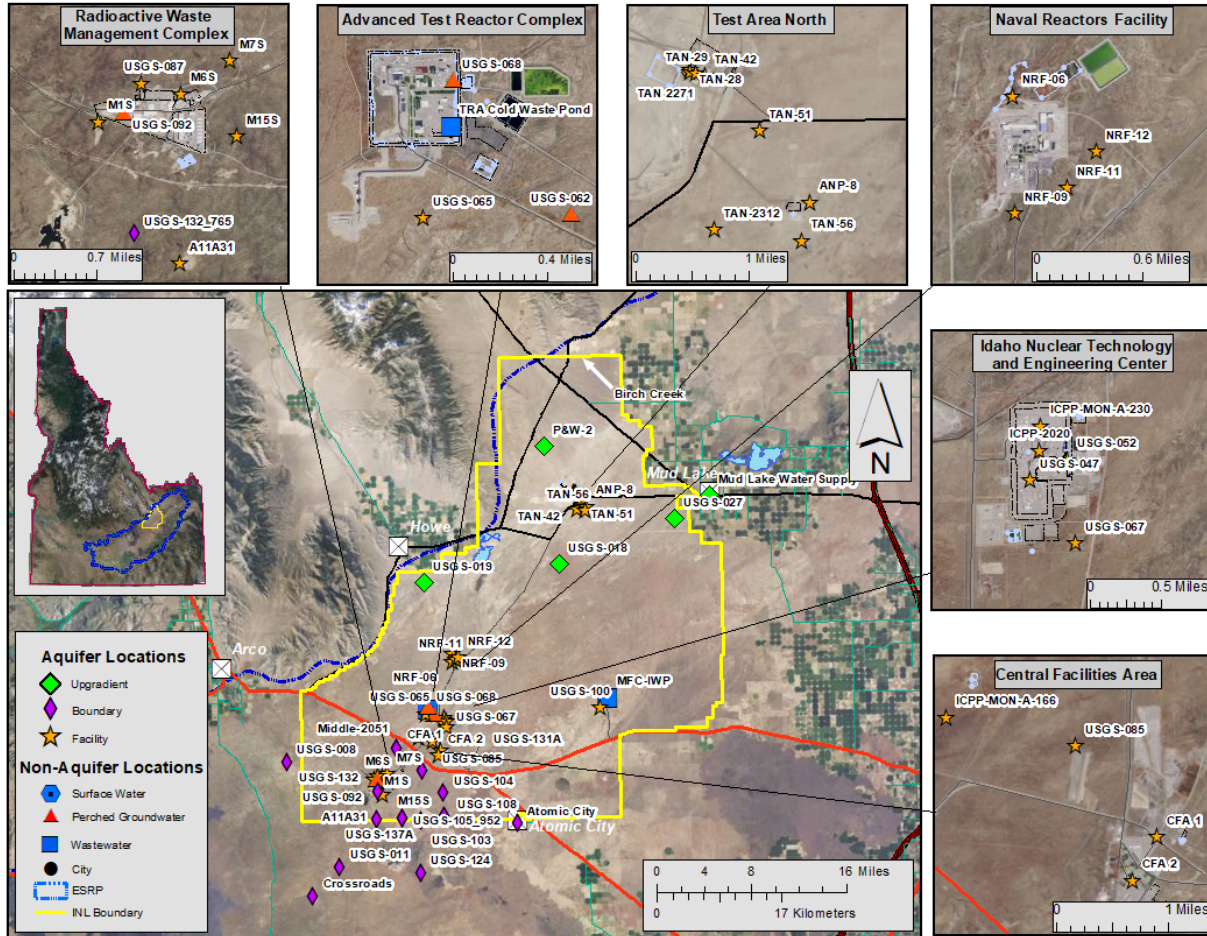


Figure 3. Upgradient, facility, boundary, perched groundwater (GW), surface water and wastewater monitoring locations.

Table 10. Locations sampled in water, second quarter, 2021.

Sample Location	Date Sampled	Co-sampler	Well Depth (ft bgs)	Analyses*
Aquifer Samples				
Facility				
Advanced Test Reactor Complex				
USGS-065	4/20/21	USGS	473	α, β, γ, ³ H, Am-241, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂
Idaho Nuclear Technology and Engineering Center				
ICPP-2020	4/6/21	Fluor	n/a	α, β, γ, ³ H, ⁹⁰ Sr, ⁹⁹ Tc, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂
ICPP-MON-A-230	4/6/21	Fluor	n/a	α, β, γ, ³ H, ⁹⁰ Sr, ⁹⁹ Tc, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂
USGS-067	4/6/21	Fluor	685	α, β, γ, ³ H, ⁹⁰ Sr, ⁹⁹ Tc, I-129, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂
USGS-047	4/7/21	Fluor	488	α, β, γ, ³ H, ⁹⁰ Sr, ⁹⁹ Tc, I-129, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂
USGS-052	4/7/21	Fluor	461	α, β, γ, ³ H, ⁹⁰ Sr, ⁹⁹ Tc, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂
Radioactive Waste Management Complex				
USGS-087	4/21/21	USGS	594	α, β, γ, ³ H, U iso, Pu iso, Am-241, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂ , VOCs
M15S	4/26/21	Fluor	n/a	α, β, γ, ³ H, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂ , VOCs
M1S	4/26/21	Fluor	638	α, β, γ, ³ H, U iso, Pu iso, Am-241, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂ , VOCs
M6S	4/26/21	Fluor	n/a	α, β, γ, ³ H, U iso, Pu iso, Am-241, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂ , VOCs
A11A31	4/28/21	Fluor	n/a	α, β, γ, ³ H, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂ , VOCs
M7S	4/28/21	Fluor	n/a	α, β, γ, ³ H, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂ , VOCs
Test Area North				
TAN-2271	4/14/21	Fluor	249	α, β, γ, ³ H, ⁹⁰ Sr, com. ions, trace metals, NO ₃ +NO ₂ , VOCs
TAN-28	4/14/21	Fluor	242	α, β, γ, ³ H, ⁹⁰ Sr, U iso, com. ions, trace metals, NO ₃ +NO ₂ , VOCs
TAN-29	4/14/21	Fluor	253	α, β, γ, ³ H, ⁹⁰ Sr, U iso, com. ions, trace metals, NO ₃ +NO ₂ , VOCs
TAN-42	4/14/21	Fluor	268	α, β, γ, ³ H, ⁹⁰ Sr, U iso, com. ions, trace metals, NO ₃ +NO ₂ , P, VOCs
ANP-8	5/17/21	Fluor	268	α, β, γ, ³ H, Cl-, SO ₄ ²⁻ , Cr, Fe, Mn, NO ₃ +NO ₂ , VOCs
TAN-2312	5/17/21	Fluor	384	α, β, γ, ³ H, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂ , VOCs
TAN-51	5/17/21	Fluor	240	α, β, γ, ³ H, Cl-, SO ₄ ²⁻ , Cr, Fe, Mn, NO ₃ +NO ₂ , VOCs
TAN-56	5/17/21	Fluor	n/a	α, β, γ, ³ H, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂ , VOCs
Central Facilities Area				
USGS-085	4/12/21	USGS	492	α, β, γ, ³ H, ⁹⁰ Sr, ⁹⁹ Tc, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂
CFA 1	4/20/21	USGS	577	α, β, γ, ³ H, ⁹⁰ Sr, ⁹⁹ Tc, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂
ICPP-MON-A-166	4/20/21	USGS	521	α, β, γ, ³ H, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂
CFA 2	6/29/21	USGS	n/a	α, β, γ, ³ H, ⁹⁹ Tc, Cl, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂
Materials and Fuels Complex				
USGS-100	4/20/21	USGS	684	α, β, γ, ³ H, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂
Naval Reactors Facility				
NRF-06	5/11/21	USGS	417	α, β, γ, ³ H, ⁹⁰ Sr, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂
NRF-09	5/11/21	USGS	422	α, β, γ, ³ H, ⁹⁰ Sr, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂
NRF-11	5/11/21	USGS	417	α, β, γ, ³ H, ⁹⁰ Sr, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂
NRF-12	5/11/21	USGS	425	α, β, γ, ³ H, ⁹⁰ Sr, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂
Boundary				
Crossroads	4/21/21	USGS	n/a	α, β, γ, ³ H, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂
USGS-008	4/21/21	USGS	773	α, β, γ, ³ H, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂
USGS-011	4/22/21	USGS	658	α, β, γ, ³ H, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂
USGS-124	4/22/21	USGS	687	α, β, γ, ³ H, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂
Middle-2051	6/10/21	USGS	1091	α, β, γ, ³ H, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂
Middle-2051	6/10/21	USGS	749	α, β, γ, ³ H, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂
Atomic City	6/14/21	USGS	n/a	α, β, γ, ³ H, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂
USGS-137A	6/14/21	USGS	747	α, β, γ, ³ H, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂
USGS-132	6/15/21	USGS	765	α, β, γ, ³ H, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂
USGS-103	6/16/21	USGS	1258	α, β, γ, ³ H, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂
USGS-131A	6/21/21	USGS	616	α, β, γ, ³ H, Cl-, SO ₄ ²⁻ , Cr, NO ₃ +NO ₂

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USGS-131A	6/21/21	USGS	812	α , β , γ , ^3H , Cl-, SO_4^{2-} , Cr, NO_3+NO_2
USGS-105	6/23/21	USGS	1072	α , β , γ , ^3H , Cl-, SO_4^{2-} , Cr, NO_3+NO_2
USGS-105	6/23/21	USGS	952	α , β , γ , ^3H , Cl-, SO_4^{2-} , Cr, NO_3+NO_2
USGS-108	6/24/21	USGS	1172	α , β , γ , ^3H , Cl-, SO_4^{2-} , Cr, NO_3+NO_2
USGS-104	6/23/21	USGS	n/a	α , β , γ , ^3H , Cl-, SO_4^{2-} , Cr, NO_3+NO_2
Upgradient				
P&W-2	4/19/21	USGS	342	α , β , γ , ^3H , Cl-, SO_4^{2-} , Cr, NO_3+NO_2
USGS-018	4/19/21	USGS	329	α , β , γ , ^3H , Cl-, SO_4^{2-} , Cr, NO_3+NO_2
USGS-019	4/19/21	USGS	281	α , β , γ , ^3H , Cl-, SO_4^{2-} , Cr, NO_3+NO_2
USGS-027	4/19/21	USGS	234	α , β , γ , ^3H , Cl-, SO_4^{2-} , Cr, NO_3+NO_2
Mud Lake Water Supply	5/12/21	None	n/a	α , β , γ , ^3H , com. ions, trace metals, NO_3+NO_2
Distant				
Alpheus Spring	5/10/21	None	0	α , β , γ , ^3H , com. ions, trace metals, NO_3+NO_2
Bill Jones Hatchery	5/10/21	None	0	α , β , γ , ^3H , com. ions, trace metals, NO_3+NO_2
Clear Spring	5/10/21	None	0	α , β , γ , ^3H , com. ions, trace metals, NO_3+NO_2
Minidoka Water Supply	5/10/21	None	282	α , β , γ , ^3H , com. ions, trace metals, NO_3+NO_2
Shoshone Water Supply	5/10/21	None	n/a	α , β , γ , ^3H , com. ions, trace metals, NO_3+NO_2
MV-64	5/12/21	IDWR	n/a	α , β , γ , ^3H , com. ions, trace metals, NO_3+NO_2
Other Samples				
Perched Groundwater				
<i>Advanced Test Reactor & Radioactive Waste Materials Complexes:</i>				
USGS-062	4/29/21	USGS	165	α , β , γ , ^3H , ^{90}Sr , Cl-, SO_4^{2-} , Cr, NO_3+NO_2
USGS-068	4/27/21	USGS	n/a	α , β , γ , ^3H , ^{90}Sr , Cl-, SO_4^{2-} , As, Cr, NO_3+NO_2
USGS-092	4/27/21	USGS	n/a	α , β , γ , ^3H , U iso, Pu iso, Am-241, Cl-, SO_4^{2-} , Cr, NO_3+NO_2 , VOCs
Wastewater				
MFC-IWP	5/13/21	BEA	n/a	α , β , γ , ^3H , com. ions, trace metals, NO_3+NO_2 , P
TRA Cold Waste Pond	6/8/21	BEA	n/a	α , β , γ , ^3H , com. ions, 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; ^3H = tritium; ^{90}Sr = Strontium-90, ^{99}Tc = Technetium-99, Pu iso. = plutonium isotopes ^{238}Pu , $^{239/240}\text{Pu}$, Pu; U iso. = uranium isotopes ^{234}U , ^{235}U , ^{238}U ; Cl = chloride; Cr = chromium; com. ions = Ca^{2+} , Mg^{2+} , Na^+ , K^+ , Cl-, SO_4^{2-} , alkalinity; trace metals (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).

n/a = well depth not available.

Table 11. 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
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		
<i>Common Ions (mg/L)</i>		
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*
<i>Trace Metals (µg/L)</i>		
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*
<i>Nutrients (mg/L)</i>		
Nitrate plus nitrite	<0.04 – 3.59 ^b	10 for NO ₃ ⁻ , 1 for NO ₂ ⁻
Phosphorous	<0.01 – 0.02 ^d	---
<i>Volatile Organic Compounds (µg/L)</i>		
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 ^e
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).

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. ^e MCL is for total trihalomethanes.

Table 12. Gross alpha, gross beta, and man-made gamma-emitting radionuclide concentrations (pCi/L) in water samples, second quarter, 2021.

Sample Location	Sample Date	Gross Alpha		Gross Beta		Cesium-137*				
		Concentration	2 SD	Concentration	2 SD	Concentration	2 SD			
Aquifer Samples										
Facility										
<i>Advanced Test Reactor Complex</i>										
USGS-065	4/20/21	1.5	U	1.2	3.3		1.0	0.3	U	1.4
<i>Idaho Nuclear Technology and Engineering Center</i>										
ICPP-MON-A-230	4/6/21	3.6		1.6	930.0		7.5	0.0	U	1.7
ICPP-2020	4/6/21	1.2	U	1.2	165.8		3.2	1.5	U	2.7
USGS-067	4/6/21	0.6	U	1.1	116.7		2.7	-0.2	U	1.5
USGS-052	4/7/21	2.8		1.0	199.9		3.3	0.6	U	1.2
USGS-047	4/7/21	1.9		1.1	39.5		1.7	0.7	U	1.5
<i>Radioactive Waste Management Complex</i>										
USGS-087	4/21/21	1.5		0.8	3.9		0.9	1.4	U	1.2
M1S	4/26/21	1.5		0.7	3.0		0.8	-1.1	U	1.7
M6S	4/26/21	0.4	U	0.9	3.9		0.9	0.5	U	1.9
M15S	4/26/21	0.6	U	1.0	5.5		1.0	0.9	U	1.5
A11A31	4/28/21	2.5		1.0	5.6		1.0	-0.8	U	1.6
M7S	4/28/21	1.7		0.8	3.4		0.9	-0.4	U	1.2
<i>Test Area North</i>										
TAN- 2271	4/14/21	0.8	U	2.8	801.2		11.0	1.1	U	1.4
TAN-28	4/14/21	2.6	U	3.2	510.9		9.0	1.1	U	1.9
TAN-29	4/14/21	3.4		1.6	51.0		2.0	-0.8	U	1.5
TAN-42	4/14/21	2.2		1.0	5.2		1.0	-0.3	U	1.1
TAN-51	5/17/21	1.7		0.8	2.9		0.9	-0.5	U	1.5
TAN-56	5/17/21	1.7		1.1	3.6		0.9	0.2	U	1.3
TAN-2312	5/17/21	0.4	U	0.9	3.7		0.9	0.0	U	1.2
ANP-8	5/17/21	2.1		0.9	2.6		0.9	0.4	U	2.1
<i>Central Facilities Area</i>										
USGS-085	4/12/2021	1.1	U	1.0	8.2		1.1	0.4	U	1.6
ICPP-MON-A-166	4/20/2021	1.2		0.7	4.0		0.9	1.0	U	1.6
CFA 1	4/20/2021	0.8	U	1.1	6.3		1.1	0.8	U	1.1
CFA 2	6/29/2021	1.0	U	0.9	2.4		0.9	-0.2	U	1.7
<i>Materials and Fuels Complex</i>										
USGS-100	4/20/21	1.5		1.0	3.6		0.9	0.6	U	1.3
<i>Naval Reactors Facility</i>										
NRF-06	5/11/21	4.2		2.6	6.4		2.5	0.7	U	1.1
NRF-09	5/11/21	1.1	U	1.0	3.5		1.0	-0.2	U	1.1
NRF-11	5/11/21	-0.1	U	1.1	3.0		1.0	-0.5	U	1.5
NRF-12	5/11/21	1.0	U	1.2	2.6		1.0	0.4	U	1.6
Boundary										
USGS-008	4/21/21	0.8	U	0.9	2.3		0.9	-0.3	U	1.3
Crossroads	4/21/21	1.8		0.8	3.5		0.9	0.6	U	1.4
USGS-124	4/22/21	2.2		0.9	3.2	J+	0.9	-0.3	U	1.9
USGS-011	4/22/21	2.1		0.8	2.9	J+	0.9	1.9	U	1.6
Middle-2051 (1091 ft bgs)	6/10/21	0.7	U	1.0	2.8		0.9	1.6	U	1.8
Middle-2051 (749 ft bgs)	6/10/21	1.0	U	1.0	2.3		0.9	0.8	U	1.4
USGS-137A (747 ft bgs)	6/14/21	0.4	U	0.9	2.9		0.9	0.5	U	1.3
Atomic City	6/14/21	0.2	U	1.0	2.3		0.9	1.8	U	1.4
USGS-132 (765 ft bgs)	6/15/21	0.6	U	0.9	1.8		0.8	0.2	U	1.2
USGS-103 (1258 ft bgs)	6/16/21	0.3	U	1.0	3.3		0.9	0.3	U	1.3
USGS-131A (812 ft bgs)	6/21/21	0.5	U	1.0	3.3		0.9	-0.1	U	1.6
USGS-131A (616 ft bgs)	6/21/21	0.7	U	1.2	3.4		1.0	-1.5	U	1.8
USGS-105 (1072 ft bgs)	6/23/21	1.0	U	1.0	3.3		0.9	0.5	U	1.4
USGS-105 (952 ft bgs)	6/23/21	0.2	U	1.0	3.1		0.9	1.0	U	1.4
USGS-108 (1172 ft bgs)	6/24/21	0.9	U	1.0	2.2		0.9	0.5	U	1.2
USGS-104	6/29/21	0.4	U	0.9	2.7		0.9	0.8	U	1.5

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Upgradient										
USGS-027	4/19/21	2.2		1.1	6.6		1.1	0.3	U	1.3
P&W-2	4/19/21	1.7		0.8	2.9		0.9	1.2	U	1.9
USGS-019	4/19/21	4.7		1.5	1.2	U	1.0	-1.6	U	1.6
USGS-018	4/19/21	1.5		1.0	3.2		0.9	0.2	U	1.5
Mud Lake Water Supply	5/12/21	0.2	U	0.4	3.8		0.8	0.4	U	1.4
Distant										
Alpheus Spring	5/10/21	1.2	U	1.2	8.1		1.1	-0.6	U	1.5
Clear Spring	5/10/21	1.9		1.1	4.0		1.0	1.1	U	1.4
Bill Jones Hatchery	5/10/21	0.1	U	0.8	4.6		0.9	-1.5	U	1.8
Shoshone Water Supply	5/10/21	1.7		0.8	3.3		0.9	0.6	U	1.7
Minidoka Water Supply	5/10/21	0.8	U	1.0	3.7		1.0	-1.0	U	1.6
MV-64	5/12/21	1.0		0.7	2.8		0.8	-0.7	U	1.3
Other Samples										
Perched Groundwater										
<i>Advanced Test Reactor & Radioactive Waste Materials Complexes</i>										
USGS-068	4/27/21	0.1	U	1.5	9.5		1.8	1.2	U	1.5
USGS-062	4/29/21	0.9	U	1.2	5.8		1.1	-0.7	U	1.7
USGS-092	4/27/21	5.3	J	2.7	20.2		2.3	1.7	U	1.6
Wastewater										
MFC-IWP	5/13/21	-0.1	U	0.8	3.5		0.9	1.1	U	1.3
TRA Cold Waste Pond	6/8/21	1.3	U	1.1	1.1	U	0.9	-1.9	U	1.8

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

MDC range (gross alpha) 0.9 - 5.4 pCi/L. MDC range (gross beta) 1.2 - 4.2 pCi/L. MDC range (Cs-137) 1.9 - 4.5 pCi/L.

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

Table 13. Tritium concentrations (pCi/L) in water samples, second quarter, 2021.

Sample Location	Sample Date	Tritium		
		Concentration		2 SD
Aquifer Samples				
Facility				
<i>Advanced Test Reactor Complex</i>				
USGS-065	4/20/21	1510		150
<i>Idaho Nuclear Technology and Engineering Center</i>				
ICPP-MON-A-230	4/6/21	940		130
ICPP-2020	4/6/21	1240		140
USGS-067	4/6/21	1520		160
USGS-052	4/7/21	420		110
USGS-047	4/7/21	330		100
<i>Radioactive Waste Management Complex</i>				
USGS-087	4/21/21	480		110
<i>Test Area North</i>				
TAN-2271	4/14/21	400		100
TAN-28	4/14/21	920		130
TAN-29	4/14/21	830		130
TAN-42	4/14/21	420		110
TAN-51	5/17/21	440		110
<i>Central Facilities Area</i>				
USGS-085	4/12/21	650		120
CFA 1	4/20/21	2260		170
CFA 2	6/29/21	2340		180
<i>Materials and Fuels Complex</i>				
USGS-100	4/20/21	-30	U	90
<i>Naval Reactors Facility</i>				
NRF-06	5/11/21	40	U	90
NRF-09	5/11/21	10	U	90
NRF-11	5/11/21	20	U	90
NRF-12	5/11/21	-10	U	90
Boundary				
USGS-131A (812 ft bgs)	6/21/21	760		130
USGS-131A (616 ft bgs)	6/21/21	750		130
USGS-104	6/29/21	470		120
Upgradient				
P&W-2	4/19/21	-20	U	90
USGS-018	4/19/21	0	U	90
Mud Lake Water Supply	5/12/21	-20	U	90
Distant				
Alpheus Spring	5/10/21	-50	U	80
Clear Spring	5/10/21	-50	U	80
Bill Jones Hatchery	5/10/21	50	U	90
Shoshone Water Supply	5/10/21	20	U	90
Minidoka Water Supply	5/10/21	40	U	90
MV-64	5/12/21	10	U	90
Other Samples				
Perched Groundwater				
<i>Advanced Test Reactor & Radioactive Waste Management Complexes</i>				
USGS-068	4/27/21	150	U	100
USGS-062	4/29/21	-70	U	90
USGS-092	4/27/21	120	U	90
Wastewater				
MFC-IWP	5/13/21	30	U	90
TRA Cold Waste Pond	6/8/21	30	U	90

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. MDC range 140 - 170 pCi/L.

Table 14. Low-level tritium concentrations (pCi/L) in water samples collected during 2021 and analyzed using the electrolytic enrichment method, second quarter, 2021.

Sample Location	Sample Date	Tritium		
		Concentration		2 SD
Aquifer Samples				
Facility				
<i>Radioactive Waste Management Complex</i>				
M6S	4/26/21	-1	U	7
M15S	4/26/21	53		10
M1S	4/26/21	-4	U	7
A11A31	4/28/21	48		8
M7S	4/28/21	402		17
<i>Test Area North</i>				
TAN-56	5/17/21	1	U	7
TAN-2312	5/17/21	3	U	7
ANP-8	5/17/21	55		9
<i>Central Facilities Area</i>				
ICPP-MON-A-166	4/20/21	33		8
Boundary				
USGS-008	4/21/21	13		7
Crossroads	4/21/21	7	U	7
USGS-124	4/22/21	32		9
USGS-011	4/22/21	9	U	7
Middle-2051 (1,091 ft bgs)	6/10/21	138		11
Middle-2051 (749 ft bgs)	6/10/21	189		13
USGS-137A (747 ft bgs)	6/14/21	81		10
Atomic City	6/14/21	5	U	6
USGS-132 (765 ft bgs)	6/15/21	176		13
USGS-103 (1,258 ft bgs)	6/16/21	122		12
Upgradient				
USGS-027	4/19/21	-1	U	7
USGS-019	4/19/21	-1	U	7
Distant				
MV-64	5/12/21	5	U	6
Other Samples				
Perched Groundwater				
<i>Advanced Test Reactor & Radioactive Waste Management Complexes</i>				
USGS-068	4/27/21	141		12
USGS-062	4/29/21	30		8
USGS-092	4/27/21	102		11

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.

Table 15. Strontium-90 concentrations (pCi/L) in water samples, second quarter, 2021.

Sample Location	Sample Date	Strontium-90		
		Concentration		2 SD
Aquifer Samples				
Facility				
<i>Idaho Nuclear Technology and Engineering Center</i>				
ICPP-MON-A-230	4/6/21	2.28		0.64
ICPP-2020	4/6/21	8.3		2
USGS-067	4/6/21	8.9		2.2
USGS-052	4/7/21	1.79		0.52
USGS-047	4/7/21	13.2		3.2
<i>Test Area North</i>				
TAN-2271	4/14/21	316		74
TAN-28	4/14/21	174		41
TAN-29	4/14/21	14.9		3.6
TAN-42	4/14/21	-0.05	U	0.2
<i>Central Facilities Area</i>				
USGS-085	4/12/21	1.53		0.45
CFA 2	6/29/21	0.02	U	0.13
<i>Naval Reactors Facility</i>				
NRF-06	5/11/21	0.07	U	0.16
NRF-09	5/11/21	0.03	U	0.15
NRF-11	5/11/21	0.19	U	0.16
NRF-12	5/11/21	0.14	U	0.17
Boundary				
USGS-104	6/29/21	0.03	U	0.13
Other Samples				
Perched Groundwater				
<i>Advanced Test Reactor Complex</i>				
USGS-068	4/27/21	6.7		1.6
USGS-062	4/29/21	0.73		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.
MDC range 0.21 – 1 pCi/L.

Table 16. Technetium-99 concentrations (pCi/L) in water samples, second quarter, 2021.

Sample Location	Sample Date	Technetium-99		
		Concentration		2 SD
Aquifer Samples				
Facility				
<i>Idaho Nuclear Technology and Engineering Center</i>				
ICPP-MON-A-230	4/6/21	1510		240
ICPP-2020	4/6/21	218		37
USGS-067	4/6/21	129		23
USGS-052	4/7/21	316		53
USGS-047	4/7/21	-0.5	U	3
<i>Central Facilities Area</i>				
USGS-085	4/12/21	1.8	U	3.5
CFA 1	7/8/21	-2.6	U	5.8
CFA 2	6/29/21	2.6	U	3.1
Boundary				
USGS-104	6/29/21	1.4	U	2.8

Data qualifiers: U = undetected, J = estimate, R = rejected, "+" or "-" after a J means that the estimated result is biased high or low, respectively.
MDC range 4.9 – 11.2 pCi/L.

Table 17. Plutonium isotope concentrations (pCi/L) in water samples, second quarter, 2021.

Sample Location	Sample Date	Plutonium-238		Plutonium-239/240			
		Concentration	2 SD	Concentration	2 SD		
Aquifer Samples							
Facility							
<i>Idaho Nuclear Technology and Engineering Center</i>							
ICPP-MON-A-230	4/6/21	0.001	U	0.016	0.012	U*	0.016
ICPP-2020	4/6/21	-0.001	U	0.015	0.004	U	0.015
USGS-067	4/6/21	0	U	0.016	-0.009	U	0.016
USGS-052	4/7/21	-0.002	U	0.016	0.009	U	0.016
USGS-047	4/7/21	0.007	U	0.016	0.001	U	0.016
<i>Radioactive Waste Management Complex</i>							
USGS-087	4/21/21	-0.007	U	0.016	-0.012	U	0.016
M1S	4/26/21	0.025	U	0.036	0.014	U	0.035
M6S	4/26/21	0.024	U	0.026	0.006	U	0.024
Other Samples							
Perched Groundwater							
<i>Radioactive Waste Materials Complex</i>							
USGS-092	4/27/21	0.059	U	0.087	0.18		0.061

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

*Result is >MDC but <2SD and is therefore considered a non-detection.

MDC range (Pu-238) 0.011 – 0.152 pCi/l. MDC range (Pu-239/240) 0.01 – 0.095 pCi/L.

Table 18. Americium-241 concentration (pCi/L) in water samples, second quarter, 2021.

Sample Location	Sample Date	Americium-241		
		Concentration	2 SD	
Aquifer Samples				
Facility				
<i>Advanced Test Reactor Complex</i>				
USGS-065	4/20/21	-0.007	U	0.022
<i>Radioactive Waste Management Complex</i>				
USGS-087	4/21/21	-0.005	U	0.023
M1S	4/26/21	-0.016	U	0.020
M6S	4/26/21	-0.007	U	0.016
Other Samples				
Perched Groundwater				
<i>Radioactive Waste Materials Complex</i>				
USGS-092	4/27/21	0.029	U	0.045

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

MDC range 0.039 – 0.075 pCi/L.

Table 19. Uranium isotope concentrations (pCi/L) in water samples, second quarter, 2021.

Sample Location	Sample Date	Uranium-234		Uranium-235		Uranium-238		
		Concentration	2 SD	Concentration	2 SD	Concentration	2 SD	
Aquifer Samples								
Facility								
<i>Idaho Nuclear Technology and Engineering Center</i>								
ICPP-MON-A-230	4/6/21	1.79	0.42	0.064	U	0.063	0.99	0.27
ICPP-2020	4/6/21	1.42	0.33	0.041	U	0.047	0.77	0.21
USGS-067	4/6/21	1.35	0.32	0.137		0.082	0.65	0.19
USGS-052	4/7/21	1.16	0.29	0.046	U	0.052	0.52	0.18
USGS-047	4/7/21	1.59	0.36	0.047	U*	0.048	0.46	0.16
<i>Radioactive Waste Management Complex</i>								
USGS-087	4/21/21	1.22	0.27	0.04	J#	0.036	0.48	0.14
M1S	4/26/21	0.76	0.21	0.01	U	0.039	0.40	0.13
M6S	4/26/21	1.24	0.27	0.033	U*	0.034	0.61	0.16
<i>Test Area North</i>								
TAN-28	4/14/21	1.95	0.44	0.119	J#	0.086	0.26	0.12
TAN-29	4/14/21	4.31	0.80	0.173		0.091	1	0.25
TAN-42	4/14/21	2.21	0.046	0.086	J#	0.066	0.95	0.24
Other Samples								
Perched Groundwater								
<i>Radioactive Waste Management Complex</i>								
USGS-092	4/27/21	8.4	1.6	0.16	J#	0.12	4.9	1

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

*Result is >MDC but <2SD and is therefore considered a non-detection.

#Result is >MDC and >2SD but <3SD and is therefore considered questionable and J-flagged as an estimate.

MDC range (U-234) 0.04 – 0.2 pCi/L. MDC range (U-235) 0.023 – 0.09 pCi/L. MDC range (U-238) 0.02 – 0.12 pCi/L.

Table 20. Common ion concentrations (mg/L) in water samples, second quarter, 2021.

Sample Location	Sample Date	Calcium*	Magnesium*	Sodium*	Potassium*	Fluoride	Chloride	Sulfate	Alkalinity†
Aquifer Samples									
Facility									
<i>Idaho Nuclear Technology and Engineering Center</i>									
ICPP-MON-A-230	4/6/21	-	-	-	-	-	-	72	133
ICPP-2020	4/6/21	-	-	-	-	-	-	61.2	138
USGS-067	4/6/21	-	-	-	-	-	-	40.9	139
USGS-052	4/7/21	-	-	-	-	-	-	19.7	142
USGS-047	4/7/21	-	-	-	-	-	-	14.2	146
<i>Advanced Test Reactor Complex</i>									
USGS-065	4/20/21	-	-	-	-	-	-	20.3	127
<i>Test Area North</i>									
TAN-2271	4/14/21	-	-	-	-	-	-	117	494
TAN-28	4/14/21	-	-	-	-	-	-	111	600
TAN-29	4/14/21	-	-	-	-	-	-	81	210
TAN-42	4/14/21	-	-	-	-	-	-	64	154
TAN-51	5/17/21	-	-	-	-	-	-	36	134
TAN-56	5/17/21	-	-	-	-	-	-	11.2	135
TAN-2312	5/17/21	-	-	-	-	-	-	8.59	127
ANP-8	5/17/21	-	-	-	-	-	-	15.8	142
<i>Central Facilities Area</i>									
USGS-085	4/12/21	-	-	-	-	-	-	12.9	154
ICPP-MON-A-166	4/20/21	-	-	-	-	-	-	16.9	119
CFA 1	4/20/21	-	-	-	-	-	-	81.5	126
CFA 2	6/29/21	-	-	-	-	-	-	122	134
<i>Naval Reactors Facility</i>									
NRF-06	5/11/21	-	-	-	-	-	-	388	176

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NRF-09	5/11/21	-	-	-	-	-	-	-	-	-	-	-	51.8		40.8		200	
NRF-11	5/11/21	-	-	-	-	-	-	-	-	-	-	-	43.8		37.2		201	
NRF-12	5/11/21	-	-	-	-	-	-	-	-	-	-	-	35.8		36.4		201	
Radioactive Waste Management Complex																		
USGS-087	4/21/21	-	-	-	-	-	-	-	-	-	-	-	28	J+	28		122	
M1S	4/26/21	-	-	-	-	-	-	-	-	-	-	-	14.1		23		96	
M6S	4/26/21	-	-	-	-	-	-	-	-	-	-	-	28.8		63.4		97	
M15S	4/26/21	-	-	-	-	-	-	-	-	-	-	-	75.1		45.1		92	
A11A31	4/28/21	-	-	-	-	-	-	-	-	-	-	-	36.8		61.8		136	
M7S	4/28/21	-	-	-	-	-	-	-	-	-	-	-	15.4		26.6		140	
Materials and Fuels Complex																		
USGS-100	4/20/21	-	-	-	-	-	-	-	-	-	-	-	16.8		18.5		132	
Boundary																		
USGS-008	4/21/21	-	-	-	-	-	-	-	-	-	-	-	8.18		23.7		152	
Crossroads	4/21/21	-	-	-	-	-	-	-	-	-	-	-	9.27		22.6		142	
USGS-124	4/22/21	-	-	-	-	-	-	-	-	-	-	-	17.5		25.3		140	
USGS-011	4/22/21	-	-	-	-	-	-	-	-	-	-	-	9.91		24.1		141	
Middle-2051 (1,091 ft bgs)	6/10/21	-	-	-	-	-	-	-	-	-	-	-	12		23.7		149	
Middle-2051 (749 ft bgs)	6/10/21	-	-	-	-	-	-	-	-	-	-	-	11		25.8		152	
USGS-137A (747 ft bgs)	6/14/21	-	-	-	-	-	-	-	-	-	-	-	12.3		25.4		140	
Atomic City	6/14/21	33	-	13	-	17	-	3.4	-	-	-	-	16.8		17.7		135	
USGS-132 (765 ft bgs)	6/15/21	-	-	-	-	-	-	-	-	-	-	-	11		25.5		147	
USGS-103 (1,258 ft bgs)	6/16/21	-	-	-	-	-	-	-	-	-	-	-	15		23.5		139	
USGS-131A (812 ft bgs)	6/21/21	-	-	-	-	-	-	-	-	-	-	-	23.9		27.7		149	
USGS-131A (616 ft bgs)	6/21/21	-	-	-	-	-	-	-	-	-	-	-	18.3		24.2		139	
USGS-105 (952 ft bgs)	6/23/21	-	-	-	-	-	-	-	-	-	-	-	13		25.6		139	
USGS-105 (1,072 ft bgs)	6/23/21	-	-	-	-	-	-	-	-	-	-	-	13.1		25		141	
USGS-108 (1,172 ft bgs)	6/24/21	-	-	-	-	-	-	-	-	-	-	-	23		25.5		153	
USGS-104	6/29/21	-	-	-	-	-	-	-	-	-	-	-	15.2		21.8		130	
Upgradient																		
USGS-027	4/19/21	-	-	-	-	-	-	-	-	-	-	-	47.5		41.9		158	
P&W-2	4/19/21	-	-	-	-	-	-	-	-	-	-	-	7.78		29.2		143	
USGS-019	4/19/21	-	-	-	-	-	-	-	-	-	-	-	13.5		25.1		160	
USGS-018	4/19/21	-	-	-	-	-	-	-	-	-	-	-	12.4		28.3		133	
Distant																		
MV-64	5/12/21	30.08	-	13.51	-	16.72	-	3.26	-	-	-	-	14.6		25.9		121	
Other Samples																		
Perched Groundwater																		
Advanced Test Reactor & Radioactive Waste Management Complexes																		
USGS-068	4/27/21	-	-	-	-	-	-	-	-	-	-	-	88.3		395		216	
USGS-062	4/29/21	71.4	-	22.2	-	14.6	-	3.20	-	-	-	-	19		139		142	
USGS-092	4/27/21	-	-	-	-	-	-	-	-	-	-	-	111		61.7		207	
Wastewater																		
MFC-IWP	5/13/21	-	-	-	-	-	-	-	-	-	-	-	77.5		22.1		163	
TRA Cold Waste Pond	6/8/21	-	-	-	-	-	-	-	-	-	-	-	12		34.1		155	

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

* Sample was filtered in the field.

† As CaCO₃.

"-" = not analyzed.

Table 21. Dissolved metals concentrations (µg/L) in water samples, second quarter, 2021.

Sample Location	Sample Date	Arsenic	Barium	Chromium	Iron	Lead	Manganese	Selenium	Zinc
Aquifer Samples									
Facility									
<i>Advanced Test Reactor Complex</i>									
USGS-065	4/20/21	-	-	-	78	-	-	-	-
<i>Idaho Nuclear Technology and Engineering Center</i>									
ICPP-MON-A-230	4/6/21	-	-	-	6.1	-	-	-	-
ICPP-2020	4/6/21	-	-	-	7.8	-	-	-	-
USGS-067	4/6/21	-	-	-	7	-	-	-	-
USGS-052	4/7/21	-	-	-	6.7	-	-	-	-
USGS-047	4/7/21	-	-	-	7.2	-	-	-	-
<i>Radioactive Waste Management Complex</i>									
USGS-087	4/21/21	-	-	-	8	-	-	-	-
M1S	4/26/21	-	-	-	33	-	-	-	-
M6S	4/26/21	-	-	-	31	-	-	-	-
M15S	4/26/21	-	-	-	48	-	-	-	-
A11A31	4/28/21	-	-	-	15	-	-	-	-
M7S	4/28/21	-	-	-	10	-	-	-	-
<i>Test Area North</i>									
TAN-2271	4/14/21	0	U	650	1.4	1800	0	U	1100
TAN-28	4/14/21	0	U	500	4.4	1400	0	U	2600
TAN-29	4/14/21	0	U	200	1	0	U	0	140
TAN-42	4/14/21	2.2		180	4.2	0	U	0	0
TAN-51	5/17/21	0	U	94	4.6	0	U	0	0
TAN-56	5/17/21	-	-	-	3.5	-	-	-	-
TAN-2312	5/17/21	-	-	-	6.8	-	-	-	-
ANP-8	5/17/21	0	U	84	4.5	130	0	U	11
<i>Central Facilities Area</i>									
USGS-085	4/12/21	-	-	-	19	-	-	-	-
ICPP-MON-A-166	4/20/21	-	-	-	5.5	-	-	-	-
CFA 1	4/20/21	-	-	-	15	-	-	-	-
CFA 2	6/29/21	-	-	-	10	-	-	-	-
<i>Materials and Fuels Complex</i>									
USGS-100	4/20/21	-	-	-	4.2	-	-	-	-
<i>Naval Reactors Facility</i>									
NRF-06	5/11/21	-	-	-	66	-	-	-	-
NRF-09	5/11/21	-	-	-	12	-	-	-	-
NRF-11	5/11/21	-	-	-	14	-	-	-	-
NRF-12	5/11/21	-	-	-	9.8	-	-	-	-
Boundary									
USGS-008	4/21/21	-	-	-	2.8	-	-	-	-
Crossroads	4/21/21	-	-	-	3.6	-	-	-	-
USGS-124	4/22/21	-	-	-	6	-	-	-	-
USGS-011	4/22/21	-	-	-	4.1	-	-	-	-
Middle-2051 (1,091 ft bgs)	6/10/21	-	-	-	7.2	-	-	-	-
Middle-2051 (749 ft bgs)	6/10/21	-	-	-	7	-	-	-	-
USGS-137A (747 ft bgs)	6/14/21	-	-	-	7.6	-	-	-	-
Atomic City	6/14/21	-	-	-	2.7	-	2.1	-	-
USGS-132 (765 ft bgs)	6/15/21	-	-	-	7.8	-	-	-	-
USGS-103 (1,258 ft bgs)	6/16/21	-	-	-	6.5	-	-	-	-
USGS-131A (812 ft bgs)	6/21/21	-	-	-	10	-	-	-	-
USGS-131A (616 ft bgs)	6/21/21	-	-	-	11	-	-	-	-
USGS-105 (1,072 ft bgs)	6/23/21	-	-	-	8.7	-	-	-	-
USGS-105 (952 ft bgs)	6/23/21	-	-	-	8.4	-	-	-	-
USGS-108 (1,172 ft bgs)	6/24/21	-	-	-	6.6	-	-	-	-
USGS-104	6/29/21	-	-	-	7.8	-	-	-	-
Upgradient									

USGS-027	4/19/21	-	-	-	-	5.9	-	-	-	-	-	-	-	-	-	-	-
P&W-2	4/19/21	-	-	-	-	1.7	-	-	-	-	-	-	-	-	-	-	-
USGS-019	4/19/21	-	-	-	-	1.5	-	-	-	-	-	-	-	-	-	-	-
USGS-018	4/19/21	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-
Distant																	
MV-64	5/12/21	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-
Other Samples																	
Perched Groundwater																	
<i>Advanced Test Reactor & Radioactive Waste Management Complexes</i>																	
USGS-068	4/27/21	-	-	-	-	76	-	-	-	-	-	-	-	-	-	-	-
USGS-062	4/29/21	9.7	-	-	-	6.8	-	-	-	-	-	-	-	-	-	-	-
USGS-092	4/27/21	-	-	-	-	4.5	-	-	-	-	-	-	-	-	-	-	-
Wastewater																	
MFC-IWP	5/13/21	2.4		44		2.4		19		0	U	2.5		0	U	-	-
TRA Cold Waste Pond	6/8/21	0	U	49		4.3		0	U	0	U	0	U	0	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. ft bgs = feet below ground surface.

"-" = not analyzed.

Table 22. Dissolved nutrient concentrations (mg/L) in water samples, second quarter, 2021.

Sample Location	Sample Date	Nitrate + Nitrite*	Total Phosphorus
Aquifer Samples			
Facility			
<i>Advanced Test Reactor Complex</i>			
USGS-065	4/20/21	1.4	-
<i>Idaho Nuclear Technology and Engineering Center</i>			
ICPP-MON-A-230	4/6/21	7.3	-
ICPP-2020	4/6/21	4.4	-
USGS-067	4/6/21	5.3	-
USGS-052	4/7/21	1.9	-
USGS-047	4/7/21	2.3	-
<i>Radioactive Waste Management Complex</i>			
USGS-087	4/21/21	0.71	-
M1S	4/26/21	1	-
M6S	4/26/21	1.9	-
M15S	4/26/21	1.4	-
A11A31	4/28/21	1	-
M7S	4/28/21	0.83	-
<i>Test Area North</i>			
TAN-2271	4/14/21	0	U
TAN-28	4/14/21	0	U
TAN-29	4/14/21	2.5	-
TAN-42	4/14/21	1.9	0.036
TAN-51	5/17/21	1.2	-
TAN-56	5/17/21	0.72	-
TAN-2312	5/17/21	0.7	-
ANP-8	5/17/21	0.9	-
<i>Central Facilities Area</i>			
USGS-085	4/12/21	0.96	-
ICPP-MON-A-166	4/20/21	0.31	-
CFA 1	4/20/21	2.7	-
CFA 2	6/29/21	3.7	-
<i>Materials and Fuels Complex</i>			
USGS-100	4/20/21	2.3	-
<i>Naval Reactors Facility</i>			
NRF-06	5/11/21	2.2	-

NRF-09	5/11/21	3.1		-	-
NRF-11	5/11/21	2.4		-	-
NRF-12	5/11/21	2.3		-	-
Boundary					
USGS-008	4/21/21	0.96		-	-
Crossroads	4/21/21	0.8		-	-
USGS-124	4/22/21	0.86		-	-
USGS-011	4/22/21	0.73		-	-
Middle-2051 (1,091 ft bgs)	6/10/21	0.92		-	-
Middle-2051 (749 ft bgs)	6/10/21	0.84		-	-
USGS-137A (747 ft bgs)	6/14/21	0.72		-	-
Atomic City	6/14/21	1.7		-	-
USGS-132 (765 ft bgs)	6/15/21	0.78		-	-
USGS-103 (1,258 ft bgs)	6/16/21	0.82		-	-
USGS-131A (812 ft bgs)	6/21/21	1.2		-	-
USGS-131A (616 ft bgs)	6/21/21	0.97		-	-
USGS-105 (1,072 ft bgs)	6/23/21	0.73		-	-
USGS-105 (952 ft bgs)	6/23/21	0.79		-	-
USGS-108 (1,172 ft bgs)	6/24/21	1		-	-
USGS-104	6/29/21	0.89		-	-
Upgradient					
USGS-027	4/19/21	2.5		-	-
P&W-2	4/19/21	0.5		-	-
USGS-019	4/19/21	0.98		-	-
USGS-018	4/19/21	0.63		-	-
Distant					
MV-64	5/12/21	0.52		-	-
Other Samples					
Perched Groundwater					
<i>Advanced Test Reactor & Radioactive Waste Management Complexes</i>					
USGS-068	4/27/21	9.3		-	-
USGS-062	4/29/21	1.5		-	-
USGS-092	4/27/21	16		-	-
Wastewater					
MFC-IWP	5/13/21	3		0.62	
TRA Cold Waste Pond	6/8/21	0.94		0.4	

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. ft bgs = feet below ground surface.

* As N.

"-" = not analyzed.

Table 23. Volatile organic compound concentrations (µg/L) in water samples, second quarter, 2021. Only VOCs detected this quarter or in the recent past are shown.

Sample Location	Sample Date	PCE		TCE		1,1-DCE		cis-1,2-DCE		trans-1,2-DCE		Vinyl Chloride		1,1,1 TCA	
Aquifer Samples															
Facility															
<i>Radioactive Waste Management Complex</i>															
USGS-087	4/21/21	<0.5	U	1.28		<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U
M1S	4/26/21	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U
M6S	4/26/21	<0.5	U	0.83		<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U
M15S	4/26/21	0.54		3.58		<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U
A11A31	4/28/21	<0.5	U	2.42		<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U
M7S	4/28/21	<0.5	U	2.08		<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U
Test Area North															
TAN-2271	4/14/21	<0.5	U	1.37		<0.5	U	0.56		80.4 ¹		1	R	<0.5	U
TAN-28	4/14/21	<0.5	U	1.75		<0.5	U	13.2		86.3 ²		11.9	R	<0.5	U
TAN-29	4/14/21	17.8		401 ³		0.77		49.9 ¹		13.9		0.77	R	<0.5	U
TAN-42	4/14/21	3.92		33.3		<0.5	U	1.09		0.61		<0.5	U	<0.5	U
TAN-51	5/17/21	19.2		83.8 ²	J	<0.5	U	2.85		1		<0.5	U	<0.5	U
TAN-56	5/17/21	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U
TAN-2312	5/17/21	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U
ANP-8	5/17/21	2.88		17	J	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U
Other Samples															
Perched Groundwater															
<i>Radioactive Waste Management Complex</i>															
USGS-092	4/27/21	1.94		11.8		<0.5	U	<0.5	U	<0.5	U	<0.5	U	0.85	

Table 23 cont. Volatile organic compound concentrations (µg/L) in water samples, second quarter, 2021. Only VOCs detected this quarter or in the recent past are shown.

Sample Location	Sample Date	Carbon Tetrachloride	Chloroform	Chloro-methane	1,1-DCA	Carbon Disulfide	Methyl Ethyl Ketone
Aquifer Samples							
Facility							
<i>Radioactive Waste Management Complex</i>							
USGS-087	4/21/21	4.61	J+ ⁴	<0.5	U	<0.5	U
M1S	4/26/21	<0.5	U	<0.5	U	<0.5	U
M6S	4/26/21	2.94		<0.5	U	<0.5	U
M15S	4/26/21	6.58		2.1		<0.5	U
A11A31	4/28/21	5.13		1.24		<0.5	U
M7S	4/28/21	4.16		0.81		<0.5	U
<i>Test Area North</i>							
TAN-2271	4/14/21	<0.5	U	<0.5	U	<0.5	U
TAN-28	4/14/21	<0.5	U	<0.5	U	<0.5	U
TAN-29	4/14/21	<0.5	U	<0.5	U	0.66	U
TAN-42	4/14/21	<0.5	U	<0.5	U	<0.5	U
TAN-51	5/17/21	<0.5	U	<0.5	U	<0.5	U
TAN-56	5/17/21	<0.5	U	<0.5	U	<0.5	U
TAN-2312	5/17/21	<0.5	U	<0.5	U	<0.5	U
ANP-8	5/17/21	<0.5	U	<0.5	U	<0.5	U
Other Samples							
Perched Groundwater							
<i>Radioactive Waste Management Complex</i>							
USGS-092	4/27/21	11.7		13.8		<0.5	U

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

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

Note 1. Lab indicated that a 1:5 dilution of this sample was required for this analyte. Note 2. Lab indicated that a 1:10 dilution of this sample was required for this analyte. Note 3. Lab indicated that a 1:20 dilution of this sample was required for this analyte. Note 4. The Lab matrix spike recovery for carbon tetrachloride was above the limit. Sample result is therefore qualified as a (high) estimate.

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. No *in-situ* gamma spectroscopic measurements were performed, nor were any soil samples physically collected during the second calendar quarter of 2021.

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 concentration. ^{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 spectrometry analysis data for milk samples, second quarter, 2021.

Sample Location/Dairy	Sample Date	Naturally occurring Potassium-40		Man-made Iodine-131		
		Concentration ²	± 2 SD	Concentration ²	± 2 SD	MDC
Monitoring Samples						
Gooding	04/22/21	1456	87	0.8	1.4	2.4
	05/19/21	1390	114	-0.5	1.1	1.9
	06/22/21	1477	129	2.6	2.5	4.1
Riverside	04/04/21	1740	144	0.9	2.1	3.5
	05/02/21	1721	142	1.4	2.3	3.7
	06/01/21	1777	146	-0.5	1.7	2.9
Verification Samples¹						
Dietrich	04/05/21	1443	117	-0.7	1.4	2.5
Terreton	04/06/21	1489	89	-0.4	8.9	1.5
Minidoka	05/03/21	1374	84	0.4	1.1	1.9
Idaho Falls	05/04/21	1430	116	0.5	1.2	2.1
Howe	06/01/21	1495	131	-0.7	1.9	3.3
Dietrich	06/01/21	1373	84	0.0	1.4	2.4

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

² Concentrations with associated uncertainties (± 2 SD) and minimum detectable concentrations (MDC) are expressed in pCi/L.

Quality Assurance

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

This section summarizes the quality assurance assessment of the data collected by DEQ-INL OP in the second quarter of 2021. Included are the results of quality control (QC) samples (blanks, duplicates, and spikes) that DEQ-INL OP submitted to Idaho State University's Environmental Monitoring Laboratory (ISU-EML) for radiological analyses and to the Idaho Bureau of Laboratories-Boise (IBL) for non-radiological analyses during the quarter. The analytical results of QC samples are used to assess the precision, accuracy, and representativeness of the environmental data presented in this report. During the second quarter of 2021, DEQ-INL OP submitted 137 QC samples for various radiological and non-radiological analyses (**Table 25**).

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 for contamination introduced during sample collection, storage, shipment, and analysis. For water matrices, a blank sample consists of 18-megaohm deionized water from the DEQ-Idaho Falls Regional office and 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). Most water blank samples submitted to laboratories by DEQ-INL OP are field blanks.

For all analyses except low-level tritium in water, a blank sample result is considered acceptable if it is less than or equal to the minimum detectable concentration (MDC). For low-level tritium analyses in water samples, a blank sample result is acceptable if it is less than or equal to 33 pCi/L.² If a blank result exceeds acceptance criteria, above-MDC 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 TSP filters submitted for gross alpha and gross beta screening in air for the second quarter of 2021 are presented in **Table 26**. Blank sample results for select gamma emitters in air from TSP filters composited for the quarter are presented in **Table 27**. Data for blank analyses used to assess data quality for tritium in water vapor in air are presented in **Table 28**. Blank sample results for

² The water used by DEQ-INL OP to create blank samples contains measurable concentrations of tritium produced cosmogenically and by above-ground testing of nuclear weapons during the twentieth century. The highest tritium concentration that DEQ considers acceptable in a blank is calculated as the mean tritium concentration in DEQ blanks from 2013 to 2017 plus two standard deviations (33 pCi/L).

radiological analytes in groundwater are presented in **Table 29**. Blank results for metals, common ions and nutrients, and VOCs in groundwater are presented in **Tables 30, 31, and 32**.

One blank water sample failed acceptance criteria for SO₄ with a value of 1.61 mg/L. All field sample results associated with the failed blank were greater than 10x the blank value and are therefore not qualified as estimates. One blank water sample gross beta result was equal to its MDC (1.0 pCi/L) and greater than three sample deviations. The two field sample results associated with this failed blank were qualified as biased high estimates (J+). All other blank sample results passed acceptance criteria in the second quarter of 2021.

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:

$$|R_1 - R_2| \leq 3\sqrt{S_1^2 + S_2^2}$$

R_1 = Original sample result

R_2 = Duplicate sample result

S_1 = Analytical uncertainty (1 SD) of the original result

S_2 = Analytical uncertainty (1 SD) of the duplicate result

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 MDC. An RPD of up to ± 20 percent is acceptable. If one or both sample results is less than five times the MDC, the results agree if their absolute difference is less than or equal to the MDC.

Duplicate results for radiological analyses in groundwater and surface water are presented in **Table 33**. Duplicate results for metals, common ions and nutrients, and VOCs in groundwater are presented in **Tables 34, 35, and 36**.

The TAN-51 duplicate water sample pair failed acceptance criteria for TCE (trichloroethene) with values of 83.8 and 120 $\mu\text{g/L}$ and a relative percent difference of -36%. Because of this disagreement between elevated values which are relatively easy to quantify, TAN-51 and associated field sample results greater than MDC were qualified as estimates (J). All other duplicate results passed acceptance criteria in the second quarter of 2021.

Spiked Samples

Spiked samples are samples to which known concentrations of specific analytes have been added. They are used to assess a laboratory's analytical accuracy. The percent recovery (%R) of each spiked-sample analysis is calculated as the ratio of the spike concentration determined by the lab to the known spike concentration. DEQ-INL OP considers the lab's result to be in control if the percent recovery is $100 \pm 25\%$. If the percent recovery of a spiked sample is 50-74%, above-MDC results of samples analyzed in the same batch as the spiked sample may be qualified as low-biased estimates (J-), and below-MDC results may be qualified as undetected estimates (UJ). If the percent recovery of a spiked sample is 126-150%, above-MDC results of associated samples may be qualified as high-biased estimates (J+), and below-MDC 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 sample results below MDC 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, common ions and nutrients, and VOCs in water are presented in **Tables 37, 38, and 39**.

The VOC-spiked water sample failed acceptance criteria for carbon tetrachloride (%R = 143) and vinyl chloride (%R = 158). Associated field sample carbon tetrachloride results were all less than MDC and were therefore qualified as undetected (U). Vinyl chloride results greater than MDC were qualified as rejected (R).

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) to verify EIC response. Irradiations of EICs are conducted in a repeatable geometry to a known exposure of near 30 mR and two additional higher and lower exposures, ranging from 15 to 60 mR. EIC responses are compared directly with the exposure received from the NIST traceable cesium-137 source provided by ISU-EML. EIC response is considered acceptable if each measurement has a percent recovery of $100 \pm 25\%$ when compared to the known irradiated quantity. The irradiation results for second quarter 2021 are presented in **Table 40**. Real-time pressure correction is used to calculate the net exposure measured by these EIC control sets. All EIC spiked samples passed the DEQ-INL OP criteria.

Laboratory QC Issues

There were no laboratory QC issues in the second quarter of 2021.

DEQ-INL OP Equipment QC Issue

Many of the TSP air samplers were found to be operating outside of their expected flow rate range in the second quarter, 2021. A calibrated flow rate gauge was taken into the field weekly to measure the sample start and stop flow rates of these samplers. The calibrated flow rate gauge measurements were used for the activity concentration calculations in the suspect measurements, and results have been qualified as (usable) estimates.

Qualification of Low-Level Sample Results

Sample results $>$ MDC are generally considered detections, with the following exceptions³ that apply primarily to radionuclide concentrations in water samples:

³ Monitoring and Surveillance Committee, Consistency in Reporting Results Subcommittee Meeting Summary, 2/5/04 and 4/1/04.

1. Results $>MDC$ but $< 2SD$ are considered non-detections and U-flagged as undetected, where SD is the sample standard deviation.
2. Results $>MDC$ and $>2SD$ but $<3SD$ are considered questionable and J-flagged as estimates.

Analytical QA/QC Assessment

Other than those discussed above, no issues involving sample chain of custody, sample holding times, and the analysis of blank, duplicate, and spiked samples were observed during the second quarter of 2021 which significantly affected data quality. The ratio of total QC analyses to total field sample analyses of 14.7% is acceptable and well above the DEQ-INL OP minimum requirement of 10%. Methodologies and data reports issued by the contracting laboratories generally conformed to the requirements of DEQ-INL OP during the second quarter of 2021.

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 of 98.6% for the second quarter of 2021 is well above the minimum acceptable value of 90% for the DEQ-INL OP ESP and is summarized in **Table 25**. The overall data completeness (usable results divided by the total number of field sample results expected) of 98.3% is also acceptable.

Preventative Maintenance and Equipment Reliability

All equipment was calibrated and checked according to prescribed periodicity. Service reliability for air sampling equipment for the second quarter of 2021 is summarized in **Table 41**.

Conclusion

All data collected for the second quarter of 2021 have been assigned the applicable qualifiers to designate the appropriate use of the data. The overall data usability of 98.6% and data completeness of 98.3% are acceptable for the quarter, with the data meeting the requirements and data quality objectives established by DEQ-INL OP.

Table 25. Summary of the analyses performed, second quarter, 2021.

Media Sampled	Collection Device	Analyte	Sample Analyses	Blank Analyses	Duplicate Analyses	Spike Analyses	Data Rejected ¹	Analyzing Lab ²
Air								
Particulate	4-inch filter	Gross alpha	154	13	0	0	5	ISU-EML
		Gross beta	154	13	0	0	5	ISU-EML
		Gamma emitters	12	1	0	0	0	ISU-EML
		Radiochemical	0	0	0	0	0	ISU Sub
Water Vapor	Desiccant column	Tritium	22	4	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								
Groundwater & Surface Water	Grab or composite	Gross alpha	61	5	6	0	0	ISU-EML
		Gross beta	61	5	6	0	0	ISU-EML
		Gamma emitters	61	5	6	0	0	ISU-EML
		Tritium	33	5	6	0	0	ISU-EML
		Low-level tritium	25	4	1	0	0	ISU-EML
		Technetium-99	9	0	3	0	0	ISU Sub
		Radiochemical	44	1	5	0	0	ISU Sub
		Metals	55	5	5	1	0	IBL
		Common Ions	55	5	5	1	0	IBL
		Nutrients	55	5	5	1	0	IBL
Volatile Organics	15	4	1	1	1	3	IBL	
Terrestrial								
Milk	Grab or composite	Gamma emitters	12	0	0	0	0	ISU-EML
Soil	<i>in situ</i>	Gamma emitters	0	0	0	0	0	DEQ-INL OP
	Grab – “puck”	Gamma emitters	0	0	0	0	0	ISU-EML
Radiation								
Ambient	EICs	Gamma Radiation	66	0	0	9	0	DEQ-INL OP
	Eco-Gammas	Gamma Radiation	11	NA	NA	NA	0	DEQ-INL OP
Total analyses performed			930	75	49	13	13	
Total QC analyses performed (blanks, duplicates, and spikes)			137					
Ratio of total QC analyses to total sample analyses³			14.7%					
Data usability⁴, percent			98.6%					
Data completeness⁵, percent			98.3%					

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.

Table 26. Blank analysis results for gross alpha and beta in particulate air (TSP), second quarter, 2021.

Collection Period		Corrected volume (m ³) ¹	Gross alpha			Gross beta		
Start	Stop		Value	± 2 SD	MDC	Value	±2 SD	MDC
03/31/2021	04/07/2021	2039	0.0	0.1	0.3	-0.4	0.5	0.8
04/07/2021	04/14/2021	2039	0.0	0.1	0.3	0.0	0.5	0.8
04/14/2021	04/21/2021	2039	0.1	0.1	0.2	0.0	0.5	0.8
04/21/2021	04/28/2021	2039	-0.1	0.1	0.3	0.6	0.5	0.8
04/28/2021	05/05/2021	2039	-0.1	0.1	0.2	0.2	0.5	0.8
05/05/2021	05/12/2021	2039	0.1	0.1	0.2	-0.8	0.5	0.9
05/12/2021	05/19/2021	2039	-0.1	0.1	0.2	0.0	0.5	0.8
05/19/2021	05/26/2021	2039	0.0	0.1	0.3	-0.2	0.5	0.8
05/26/2021	06/02/2021	2039	0.1	0.2	0.3	0.5	0.5	0.8
06/02/2021	06/09/2021	2039	-0.1	0.1	0.3	-0.3	0.5	0.9
06/09/2021	06/16/2021	2039	0.0	0.2	0.3	0.2	0.5	0.8
06/16/2021	06/23/2021	2039	0.0	0.1	0.3	0.7	0.5	0.8
06/23/2021	06/30/2021	2039	-0.1	0.1	0.3	-0.1	0.5	0.8

Note: Concentrations, associated uncertainties (± 2 SD), and minimum detectable concentrations (MDC) are expressed in 1 x 10⁻³ pCi/m³.

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 27. Blank analysis results for gamma spectroscopy for TSP air filters, composite samples, second quarter, 2021.

Analysis Date	Beryllium-7			Ruthenium-106/Rhodium-106			Antimony-125		
	Concentration ¹	± 2 SD	MDC	Concentration	± 2 SD	MDC	Concentration	± 2 SD	MDC
07/17/2021	-8	30	5	42	81	134	2	12	20
Analysis Date	Cesium-134			Cesium-137					
	Concentration ¹	± 2 SD	MDC	Concentration	± 2 SD	MDC			
07/17/2021	-1	3	6	2	4	6			

Note: Concentrations are expressed in 1 x 10⁻⁵pCi/m³ with associated uncertainty (± 2 SD) and minimum detectable concentration (MDC).

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 28. Blank analysis results for tritium in water vapor from air samples, second quarter, 2021.

Sample Number	Start Date	Collection Date	Analysis Date	Tritium		
				Concentration	± 2 SD	MDC
CONTROL A	06/13/2021	07/13/2021	07/23/2021	0.05	0.08	0.13
CONTROL B	06/13/2021	07/13/2021	07/23/2021	0.08	0.08	0.13
OP212 Sink	04/01/2021	07/02/2021	07/23/2021	0.06	0.08	0.13
OP212 Fridge	04/01/2021	07/02/2021	07/23/2021	0.05	0.08	0.13

Note: Concentrations are expressed in nCi/L with associated uncertainty (± 2 SD) and minimum detectable concentration (MDC).

Table 29. Blank analysis results (pCi/L) for radiological constituents in water, second quarter, 2021.

Sample Number	Sample Date	Blank Type	Concentration	± 2 SD	MDC	Within Blank Criteria?
Gross Alpha						
211W202	4/22/2021	Field	-0.1	0.3	0.6	Yes
211W283	4/27/2021	Field	-0.1	0.3	0.6	Yes
211W460	6/10/2021	Field	-0.2	0.4	0.7	Yes
211W466	6/24/2021	Field	-0.4	0.5	1.0	Yes
211W472	6/16/2021	Field	-0.3	0.2	0.5	Yes
Gross Beta						
211W202	4/22/2021	Field	1.0	0.6	1.0	Yes
211W283	4/27/2021	Field	0.6	0.6	0.9	Yes
211W460	6/10/2021	Field	-0.6	0.6	1.1	Yes
211W466	6/24/2021	Field	0.1	0.7	1.1	Yes
211W472	6/16/2021	Field	-0.8	0.6	1.0	Yes
Cesium-137						
211W202	4/22/2021	Field	-2.0	1.7	3.0	Yes
211W283	4/27/2021	Field	-0.5	1.5	2.6	Yes
211W460	6/10/2021	Field	0.6	1.5	2.5	Yes
211W466	6/24/2021	Field	0.1	1.5	2.6	Yes
211W472	6/16/2021	Field	-0.4	1.5	2.7	Yes
Tritium (standard method)						
211W203	4/22/2021	Field	-30	100	170	Yes
211W285	4/27/2021	Field	-20	100	170	Yes
211W461	6/10/2021	Field	-10	80	150	Yes
211W467	6/24/2021	Field	-10	90	160	Yes
211W473	6/16/2021	Field	-10	90	150	Yes
Tritium (low-level method)						
211W203	4/22/2021	Field	0	7	12	Yes
211W285	4/27/2021	Field	-1	7	13	Yes
211W461	6/10/2021	Field	5	7	11	Yes
211W473	6/16/2021	Field	1	6	10	Yes
Strontium-90						
211W284	4/27/2021	Field	0.10	0.24	0.51	Yes

MDC = minimum detectable concentration.

* Detections in this range are typical of the DI water used by DEQ to prepare blank samples.

Table 30. Blank analysis results (µg/L) for metals in water, second quarter, 2021.

Sample Number	Sample Date	Blank Type	Arsenic	Barium	Chromium	Iron	Lead	Manganese	Selenium	Zinc
211W205	4/22/2021	Field	-	-	<1.0	-	-	-	-	-
211W287	4/27/2021	Field	-	-	<1.0	-	-	-	-	-
211W463	6/10/2021	Field	-	-	<1.0	-	-	-	-	-
211W475	6/16/2021	Field	-	-	<1.0	-	-	-	-	-
211W469	6/24/2021	Field	-	-	<1.0	-	-	-	-	-

Table 31. Blank analysis results (mg/L) for common ions and nutrients in water, second quarter, 2021.

Sample Number	Sample Date	Blank Type	Calcium	Magnesium	Sodium	Potassium	Fluoride	Chloride	Sulfate	Alkalinity [†]	NO ₃ +NO ₂ [*]	Total Phosphorus
211W204,206	4/22/2021	Field	-	-	-	-	-	<0.4	<0.8	<1.0	<0.01	-
211W286,288	4/27/2021	Field	-	-	-	-	-	<0.4	<0.8	<1.0	<0.01	-
211W462,464	6/10/2021	Field	-	-	-	-	-	<0.4	<0.8	<1.0	<0.01	-
211W474,476	6/16/2021	Field	-	-	-	-	-	<0.4	<0.8	<1.0	<0.01	-
211W468,470	6/24/2021	Field	-	-	-	-	-	<0.4	1.61	<1.0	<0.01	-

[†] As CaCO₃.

^{*} As N.

Table 32. Blank analysis results (µg/L) for VOCs in water, second quarter, 2021.

Sample Number	Sample Date	Blank Type	PCE	TCE	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	Vinyl Chloride	1,1-DCA	Carbon Tetrachloride	Methylene Chloride	Chloroform	Chloromethane	MEK
211W135	4/21/2021	Trip	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10
211W201	4/21/2021	Trip	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10
211W282	4/26/2021	Trip	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10
211W378	5/17/2021	Trip	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10

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

MEK = Methyl Ethyl Ketone

Table 33. Duplicate sample results (pCi/L) for radiological constituents in groundwater and/or surface water, second quarter, 2021.

Analysis/Sample Location	Original Sample Number	Concentration	± 2 SD	Duplicate Sample Number	Concentration	± 2 SD	RPD	R ₁ -R ₂	3(S ₁ ² +S ₂ ²) ^{1/2}	Within Criteria?
Gross Alpha										
USGS-067	211W101	0.6	1.1	211W111	2.0	1.2	-108	1.4	2.4	Yes
USGS-085	211W121	1.1	1.0	211W128	2.1	0.9	-63	1.0	2.0	Yes
USGS-104	211W453	0.4	0.9	211W477	0.2	0.9	67	0.2	1.9	Yes
TAN-51	211W348	1.7	0.8	211W365	1.7	0.8	0	0.0	1.7	Yes
Minidoka Water	211W306	0.8	1.0	211W371	0.5	0.8	46	0.3	1.9	Yes
MV-64	211W294	1.0	0.7	211W360	0.4	0.9	86	0.6	1.7	Yes
Gross Beta										
USGS-067	211W101	116.7	2.7	211W111	117.2	2.7	-0.4	0.5	5.7	Yes
USGS-085	211W121	8.2	1.1	211W128	7.6	1.0	8	0.6	2.2	Yes
USGS-104	211W453	2.7	0.9	211W477	2.5	0.9	8	0.2	1.9	Yes
TAN-51	211W348	2.9	0.9	211W365	2.9	0.9	0	0.0	1.9	Yes
Minidoka Water	211W306	3.7	1.0	211W371	3.0	0.8	21	0.7	1.9	Yes
MV-64	211W294	2.8	0.8	211W360	2.6	0.9	7	0.2	1.8	Yes
Cesium-137										
USGS-067	211W101	-0.2	1.5	211W111	1.0	1.9	-300	1.2	3.6	Yes
USGS-085	211W121	0.4	1.6	211W128	0.3	1.2	29	0.1	3.0	Yes
USGS-104	211W453	0.8	1.5	211W477	-0.1	1.3	-48	0.9	2.0	Yes
TAN-51	211W348	-0.5	1.5	211W365	0.5	1.6	NA ¹	1.0	3.3	Yes
Minidoka Water	211W306	-1.0	1.6	211W371	0.1	1.5	-244	1.1	3.3	Yes
MV-64	211W294	-0.7	1.3	211W360	-0.2	1.4	111	0.5	2.9	Yes
Tritium (standard method)										
USGS-067	211W106	1520	160	211W116	1500	150	1	20	329	Yes
USGS-085	211W124	650	120	211W131	820	120	-23	170	255	Yes
USGS-104	211W456	470	120	211W480	500	120	-6	30	255	Yes
TAN-51	211W349	440	110	211W366	420	110	5	20	233	Yes
Minidoka Water	211W307	40	90	211W372	-20	90	600	60	191	Yes
MV-64	211W295	10	90	211W361	40	90	-120	30	191	Yes
Tritium (low-level method)										
MV-64	211W295	3	6	211W361	5	6	-50	2	13	Yes
Sr-90										
USGS-067	211W104	8.9	2.2	211W114	8.8	2.1	1	0.1	4.6	Yes
USGS-085	211W122	1.53	0.45	211W129	1.71	0.49	-11	0.18	1.00	Yes
USGS-104	211W454	0.03	0.13	211W478	0.02	0.14	40	0.01	0.29	Yes
Tc-99										
USGS-067	211W105	129	23	211W115	127	23	2	2	6	Yes
USGS-085	211W123	1.8	3.5	211W130	0.4	3.2	127	1.4	7.1	Yes

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USGS-104	211W455	1.4	2.8	211W479	2.2	3.1	-44	0.8	6.3	Yes
U-234										
USGS-067	211W107	1.35	0.32	211W117	1.53	0.39	-13	0.18	0.76	Yes
U-235										
USGS-067	211W107	0.137	0.082	211W117	0.026	0.058	136	0.111	0.151	Yes
U-238										
USGS-067	211W107	0.65	0.19	211W117	0.69	0.23	-6	0.04	0.45	Yes
Pu-238										
USGS-067	211W103	0.000	0.016	211W113	-0.001	0.027	-200	0.001	0.047	Yes
Pu-239/240										
USGS-067	211W103	-0.009	0.016	211W113	0.013	0.027	-1100	0.022	0.047	Yes

¹RPD calculation results in division by zero. Absolute difference in the duplicate sample results meets the $\leq 3(\text{pooled error})$ criterion.

Table 34. Duplicate sample results for metals (µg/L) in groundwater, second quarter, 2021.

Sample Location	Sample Number	Sample Date	Arsenic	Barium	Chromium	Iron	Lead	Manganese	Selenium	Zinc
USGS-067	211W109	5/6/2021	-	-	7.0	-	-	-	-	-
USGS-067	211W119	5/6/2021	-	-	6.9	-	-	-	-	-
RPD			-	-	1	-	-	-	-	-
USGS-085	211W126	4/12/2021	-	-	19	-	-	-	-	-
USGS-085	211W133	4/12/2021	-	-	19	-	-	-	-	-
RPD			-	-	0	-	-	-	-	-
MV-64	211W297	5/12/2021	-	-	3.0	-	-	-	-	-
MV-64	211W363	5/12/2021	-	-	3.1	-	-	-	-	-
RPD			-	-	-3	-	-	-	-	-
TAN-51	211W351	5/12/2021	<2.0	94	4.6	<10	<1.0	<1.0	-	-
TAN-51	211W368	5/12/2021	<2.0	94	4.7	<10	<1.0	<1.0	-	-
RPD			0	0	-2	0	0	0	-	-
USGS-104	211W458	6/29/2021	-	-	7.8	-	-	-	-	-
USGS-104	211W482	6/29/2021	-	-	7.7	-	-	-	-	-
RPD			-	-	1	-	-	-	-	-

RPD = relative percent difference

Table 35. Duplicate sample results for common ions and nutrients (mg/L) in groundwater, second quarter, 2021.

Sample Location	Sample Number	Sample Date	Calcium	Magnesium	Sodium	Potassium	Fluoride	Chloride	Sulfate	Total Alkalinity†	Total Nitrogen	Total Phosphorus
USGS-067	211W108, 110	4/6/2021	-	-	-	-	-	40.9	27.9	139	5.3	-
USGS-067	211W118, 120	4/6/2021	-	-	-	-	-	42.0	27.8	137	5.3	-
RPD			-	-	-	-	-	-3	0.4	1	0	-
USGS-085	211W125, 127	4/12/2021	-	-	-	-	-	12.9	43.7	154	0.96	-
USGS-085	211W132, 134	4/12/2021	-	-	-	-	-	13.0	43.9	152	0.95	-
RPD			-	-	-	-	-	-1	0.5	1	1	-
MV-64	211W296,298	5/12/2021	30	14	17	3.3	-	14.6	25.9	121	0.52	-
MV-64	211W362,364	5/12/2021	30	14	17	3.2	-	14.6	26.0	122	0.52	-
RPD			0	0	0	3	-	0	-0.4	-1	0	-
TAN-51	211W350,352	5/12/2021	55	15	7.0	2.9	-	36.0	31.0	134	1.2	-
TAN-51	211W367,369	5/12/2021	55	15	7.2	3.0	-	36.3	30.9	134	1.2	-
RPD			0	0	-1	-3	-	-1	0.3	0	0	-
USGS-104	211W457,459	6/29/2021	-	-	-	-	-	15.2	21.8	130	0.89	-
USGS-104	211W481,483	6/29/2021	-	-	-	-	-	15.3	21.8	124	0.90	-
RPD			-	-	-	-	-	-1	0	5	-1	-

RPD = relative percent difference.

† As CaCO₃.

Table 36. Duplicate sample results (µg/L) for VOCs in water, second quarter, 2021.

Location	Sample Number	Sample Date	PCE	TCE	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	Vinyl Chloride	1,1-DCA	Carbon Tetrachloride	Methylene Chloride	Chloro-methane	Styrene	Chloro-form
TAN-51	211W353	5/12/2021	19.2	83.8	<0.5	2.85	1.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
TAN-51	211W370	5/12/2021	22.5	120	<0.5	3.19	1.17	<0.5	0.55	<0.5	<0.5	<0.5	<0.5	<0.5
RPD			-16	-36	0	-11	-16	0	-10	0	0	0	0	0

RPD = relative percent difference

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

Table 37. Spiked sample results (µg/L) for metals in water, second quarter, 2021.

Sample Number	Sample Date	Barium			Chromium			Lead			Manganese			Zinc		
		Spike	Result	%R	Spike	Result	%R	Spike	Result	%R	Spike	Result	%R	Spike	Result	%R
211W022	4/4/2021	139	140	101	112	110	98	7.62	7.7	101	9.52	11	116	-	-	-

Table 38. Spiked sample results (mg/L) for common ions and nutrients in water, second quarter, 2021.

Sample Number	Sample Date	Calcium			Magnesium			Sodium			Potassium			Fluoride		
		Spike	Result	%R	Spike	Result	%R	Spike	Result	%R	Spike	Result	%R	Spike	Result	%R
211W022	4/14/2021	17.6	16	91	16.3	16	98	19.2	19	99	4.61	4.5	98	-	-	-

Table 38. (Continued). Spiked sample results (mg/L) for common ions and nutrients in water, second quarter, 2021.

Sample Number	Sample Date	Chloride			Sulfate			Total Alkalinity as CaCO ₃			Total Nitrogen			Total Phosphorus		
		Spike	Result	%R	Spike	Result	%R	Spike	Result	%R	Spike	Result	%R	Spike	Result	%R
211W021,023	4/14/2021	105	114	109	17.9	19.1	107	52.6	52.0	99	1.51	1.5	99	-	-	-

Table 39. Spiked sample results (µg/L) for VOCs in water, second quarter, 2021.

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
211W024	4/14/2021	6.22	8.88	143	19.9	18.1	91	12.1	14.6	121	11.0	13.5	123	12.0	18.9	158

Table 40. Electret ionization chamber (EIC) irradiation results (categorized as spiked samples), second quarter, 2021.

Electret #	Exposure Received		Net Measured Exposure ¹		%R	Within Spec?
	(mR)	Uncertainty (±1 SD, mR)	(mR)	Uncertainty (±1 SD, mR)		
SIR602	40.0	2.0	36.5	1.2	91.2%	Yes
SMD525	40.0	2.0	35.0	1.4	87.4%	Yes
SJW956	40.0	2.0	33.5	1.3	83.8%	Yes
Triplicate AVG:					87.5%	Yes
SKR407	30.0	1.5	25.3	1.4	84.3%	Yes
SJE027	30.0	1.5	27.8	1.3	92.5%	Yes
SJX007	30.0	1.5	25.5	1.3	85.1%	Yes
Triplicate AVG:					87.3%	Yes
SJX031	20.0	1.0	16.4	1.3	81.9%	Yes
SKR303	20.0	1.0	16.8	1.4	84.1%	Yes
SMD511	20.0	1.0	16.9	1.4	84.6%	Yes
Triplicate AVG:					83.5%	Yes

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

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

Table 41. Air sampling field equipment service reliability (percent operational), second quarter, 2021.

Station Locations	Sample Type			
	TSP	Radioiodine	Atmospheric Moisture	Precipitation
Onsite Locations				
Big Lost River Rest Area	100%	100%	100%	100%
Experimental Field Station	100%	100%	100%	NC ¹
Sand Dunes Tower	100%	100%	100%	NC ¹
Van Buren Avenue	100%	100%	100%	NC ¹
Boundary Locations				
Atomic City	100%	100%	100%	100%
Howe	100%	100%	100%	100%
Montevieu	100%	100%	100%	100%
Mud Lake	100%	100%	100%	100%
Distant Locations²				
Craters of the Moon	100%	100%	100%	NC ¹
Idaho Falls	100%	100%	100%	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 The Fort Hall Station, operated by the Shoshone-Bannock Tribes, is not included here.

Appendix A

Table A-1. Weekly concentrations (in 1×10^{-3} pCi/m³) for gross alpha and gross beta analyses for TSP filters for all locations, second quarter, 2021.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	±2 SD	Concentration	±2 SD
On-Site Locations						
Big Lost River	03/31/21	04/07/21	1.4	0.4	48.0	2.1
Rest Area	04/07/21	04/14/21	0.9	0.4	28.6	1.7
	04/14/21	04/21/21	1.2	0.4	28.0	1.7
	04/21/21	04/28/21	0.7	0.4	28.3	1.7
	04/30/21	05/05/21	0.8	0.3	29.3	1.7
	05/05/21	05/12/21	1.1	0.3	23.7	1.5
	05/12/21	05/19/21	1.2	0.3	33.5	1.5
	05/19/21	05/26/21	0.6	0.3	20.5	1.4
	05/26/21	06/02/21	1.1	0.3	30.5	1.5
	06/02/21	06/09/21	1.3	0.3	29.5	1.2
	06/09/21	06/16/21	0.8	0.2	18.7	1.0
	06/16/21	06/23/21 ¹	0.9	0.3	30.4	1.3
	06/23/21	06/30/21	0.5	0.2	23.2	1.1
Experimental Field Station	03/31/21	04/07/21 ²	1.6	0.3	32.9	1.4
	04/07/21	04/14/21 ²	1.5	0.4	25.5	1.4
	04/14/21	04/21/21 ²	1.0	0.3	24.0	1.5
	04/21/21	04/28/21 ²	1.1	0.4	27.4	1.5
	04/28/21	05/05/21 ²	0.8	0.3	23.0	1.3
		NS ³	NS	NS	NS	NS
	05/05/21	05/19/21 ³	1.0	0.2	23.1	0.9
	05/19/21	05/26/21 ²	1.4	0.3	18.0	1.2
	05/26/21	06/02/21 ²	0.9	0.3	24.4	1.2
	06/02/21	06/09/21 ²	1.1	0.3	29.3	1.3
	06/09/21	06/16/21 ²	0.5	0.3	15.9	1.0
	06/16/21	06/23/21 ⁴	1.5	0.4	30.2	1.5
	06/23/21	06/30/21	R ⁵	R	R	R
Sand Dunes Tower	03/31/21	04/07/21 ²	1.4	0.3	39.1	1.4
	04/07/21	04/14/21 ²	0.9	0.2	27.6	1.2
	04/14/21	04/21/21 ²	0.7	0.2	24.6	1.1
	04/21/21	04/28/21 ²	0.7	0.2	26.4	1.2
	04/28/21	05/05/21 ²	0.7	0.2	22.6	1.1
	05/05/21	05/12/21 ²	0.7	0.2	23.1	1.1
	05/12/21	05/19/21 ²	1.5	0.3	32.2	1.3
	05/19/21	05/26/21 ²	0.7	0.2	20.0	1.0
	05/26/21	06/02/21 ²	0.8	0.2	26.4	1.1
	06/02/21	06/09/21 ²	1.2	0.3	35.4	1.3
	06/09/21	06/16/21 ²	1.0	0.3	23.7	1.1
	06/16/21	06/23/21 ²	1.1	0.3	30.5	1.2
	06/23/21	06/30/21	0.9	0.4	31.7	1.7

¹Partial sample. Power was off at some point.

²Estimated volume. Results are considered (usable) estimates.

³Sample was not picked up on 05/12/21 and ran until 05/19/21.

⁴Partial sample – estimated volume. Results are considered (usable) estimates.

⁵Insufficient sample for valid analysis. Results are rejected – R.

Table A-1 continued. Weekly concentrations (in 1×10^{-3} pCi/m³) for gross alpha and gross beta analyses for TSP filters for all locations, second quarter, 2021.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	±2 SD	Concentration	±2 SD
Van Buren Avenue	03/31/21	04/07/21 ¹	1.8	0.4	48.7	1.7
	04/07/21	04/14/21 ¹	1.3	0.3	31.4	1.4
	04/14/21	04/21/21 ¹	1.0	0.3	29.5	1.4
	04/21/21	04/28/21 ¹	1.3	0.3	35.0	1.6
	04/28/21	05/05/21 ¹	1.3	0.3	30.9	1.5
	05/05/21	05/12/21 ¹	1.3	0.3	29.9	1.6
	05/12/21	05/19/21	1.4	0.4	40.6	1.7
	05/19/21	05/26/21 ¹	0.8	0.3	26.3	1.5
	05/26/21	06/02/21 ¹	1.4	0.4	35.8	1.7
	06/02/21	06/09/21 ¹	1.8	0.4	45.9	2.0
	06/09/21	06/16/21 ¹	1.6	0.4	31.6	1.8
	06/16/21	06/23/21 ¹	1.6	0.4	37.9	1.8
	06/23/21	06/30/21 ¹	0.8	0.4	31.2	1.7
	Boundary Locations					
Atomic City	03/31/21	04/07/21	R ⁵	R	R	R
	04/07/21	04/14/21	R ⁵	R	R	R
	04/14/21	04/21/21	R ⁵	R	R	R
	04/21/21	04/28/21 ²	R ⁵	R	R	R
	04/30/21	05/05/21 ³	0.8	0.3	29.0	1.6
	05/05/21	05/12/21	1.1	0.2	26.0	1.2
	05/12/21	05/19/21	1.3	0.3	36.4	1.3
	05/19/21	05/26/21	0.9	0.3	24.4	1.2
	05/26/21	06/02/21	0.9	0.2	31.1	1.2
	06/02/21	06/09/21	1.1	0.3	36.9	1.3
	06/09/21	06/16/21	1.3	0.3	27.6	1.2
	06/16/21	06/23/21 ¹	1.6	0.3	35.4	1.4
	06/23/21	06/30/21	0.9	0.3	28.5	1.2
	Howe	03/31/21	04/07/21	1.9	0.4	41.6
04/07/21		04/14/21 ¹	1.9	0.4	35.1	1.4
		NS ⁴	NS	NS	NS	NS
04/14/21		04/28/21 ⁴	1.1	0.2	27.4	0.9
04/28/21		05/05/21 ¹	1.0	0.3	23.6	1.1
05/05/21		05/12/21 ¹	1.1	0.3	28.1	1.3
05/12/21		05/19/21 ¹	1.8	0.3	38.0	1.4
05/19/21		05/26/21 ¹	1.2	0.3	24.2	1.2
05/26/21		06/02/21 ¹	1.0	0.3	32.8	1.3
06/02/21		06/09/21 ¹	1.3	0.3	36.7	1.3
06/09/21		06/16/21 ¹	1.9	0.4	30.3	1.3
06/16/21		06/23/21 ¹	1.4	0.3	37.9	1.4
06/23/21	06/30/21	1.1	0.3	29.0	1.2	

¹Estimated volume. Results are considered (usable) estimates.

²Estimated volume – sampler pulled from service for re-calibration on 04/28/21.

³Estimated volume – sampler re-calibrated on 04/29/21; re-deployed on 04/30/21. Results are considered (usable) estimates.

⁴Sample was not picked up on 04/14/21 and ran until 04/28/21.

⁵Insufficient sample for valid analysis. Results are rejected – R.

Table A-1 continued. Weekly concentrations (in 1×10^{-3} pCi/m³) for gross alpha and gross beta analyses for TSP filters for all locations, second quarter, 2021.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	±2 SD	Concentration	±2 SD
Montevieu	03/31/21	04/07/21	1.7	0.3	42.8	1.6
	04/07/21	04/14/21	1.2	0.3	29.3	1.3
	04/14/21	04/21/21 ¹	1.3	0.3	26.8	1.3
	04/21/21	04/28/21 ¹	1.1	0.3	28.0	1.3
	04/28/21	05/05/21 ¹	0.9	0.3	24.2	1.2
	05/05/21	05/12/21 ¹	1.1	0.3	25.4	1.3
	05/12/21	05/19/21 ¹	1.3	0.3	35.9	1.4
	05/19/21	05/26/21 ¹	0.9	0.3	21.4	1.2
	05/26/21	06/02/21	0.8	0.3	29.2	1.3
	06/02/21	06/09/21 ¹	1.2	0.3	39.0	1.5
	06/09/21	06/16/21 ¹	1.4	0.3	26.2	1.3
	06/16/21	06/23/21 ¹	1.3	0.3	32.3	1.4
	06/23/21	06/30/21	1.0	0.3	28.2	1.3
Mud Lake	03/31/21	04/07/21 ¹	2.4	0.4	47.7	1.8
	04/07/21	04/14/21 ¹	2.0	0.4	28.7	1.5
	04/14/21	04/21/21 ¹	1.1	0.3	24.1	1.1
	04/21/21	04/28/21 ¹	0.9	0.2	22.7	1.1
	04/28/21	05/05/21 ¹	1.1	0.3	24.6	1.4
	05/05/21	05/12/21 ¹	1.3	0.3	23.2	1.3
	05/12/21	05/19/21 ¹	1.5	0.3	36.6	1.5
	05/19/21	05/26/21 ¹	0.9	0.3	21.7	1.3
	05/26/21	06/02/21	1.3	0.3	37.5	1.6
	06/02/21	06/09/21	1.2	0.3	32.4	1.3
	06/09/21	06/16/21 ¹	1.3	0.3	26.0	1.2
	06/16/21	06/23/21	1.5	0.3	30.8	1.3
	06/23/21	06/30/21	0.4	0.2	22.3	1.1
Distant Locations						
Craters of the Moon	03/31/21	04/07/21 ¹	1.2	0.4	40.5	1.8
	04/07/21	04/14/21 ¹	1.0	0.3	31.2	1.6
	04/14/21	04/21/21 ¹	0.9	0.3	24.8	1.4
	04/21/21	04/28/21 ¹	0.6	0.3	21.4	1.5
	04/28/21	05/05/21 ¹	0.8	0.3	26.6	1.6
	05/05/21	05/12/21 ¹	1.1	0.4	28.4	1.9
	05/12/21	05/19/21 ¹	0.9	0.4	39.1	2.0
	05/19/21	05/26/21 ²	0.9	0.4	26.4	1.7
	05/26/21	06/02/21 ¹	1.0	0.4	28.0	1.6
	06/02/21	06/09/21 ¹	1.3	0.4	34.8	1.7
	06/09/21	06/16/21 ²	0.9	0.4	22.1	1.5
	06/16/21	06/23/21 ¹	1.1	0.4	36.4	1.8
	06/23/21	06/30/21 ¹	0.6	0.3	28.3	1.6

¹Estimated volume. Results are considered (usable) estimates.

²Partial sample – estimated volume. Results are considered (usable) estimates.

Table A-1 continued. Weekly concentrations (in 1×10^{-3} pCi/m³) for gross alpha and gross beta analyses for TSP filters for all locations, second quarter, 2021.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	±2 SD	Concentration	±2 SD
Fort Hall²	03/31/21	04/07/21 ¹	1.8	0.3	44.3	1.4
	04/07/21	04/14/21 ¹	2.2	0.3	29.9	1.2
	04/14/21	04/21/21	1.5	0.3	28.6	1.2
	04/21/21	04/28/21 ¹	0.9	0.2	21.8	0.9
	04/28/21	05/05/21 ¹	1.0	0.2	20.8	0.8
	05/05/21	05/12/21	0.9	0.2	20.0	0.9
	05/12/21	05/19/21 ¹	1.2	0.2	26.8	1.0
	05/19/21	05/26/21 ¹	0.9	0.2	20.5	0.9
	05/26/21	06/02/21 ¹	1.0	0.3	24.1	1.1
	06/02/21	06/09/21 ¹	1.6	0.3	30.8	1.2
	06/09/21	06/16/21 ¹	1.4	0.3	28.6	1.4
	06/16/21	06/23/21 ¹	1.5	0.3	35.9	1.5
	06/23/21	06/30/21	1.5	0.3	30.2	1.3
Idaho Falls	03/31/21	04/07/21 ¹	1.6	0.3	34.5	1.3
	04/07/21	04/14/21 ¹	1.3	0.3	27.1	1.2
	04/14/21	04/21/21 ¹	1.0	0.3	25.6	1.2
	04/21/21	04/28/21 ¹	1.3	0.3	28.4	1.3
	04/28/21	05/05/21	1.4	0.3	25.0	1.2
	05/05/21	05/12/21 ¹	1.4	0.3	24.2	1.2
	05/12/21	05/19/21	1.4	0.3	30.7	1.2
	05/19/21	05/26/21 ¹	1.1	0.3	23.6	1.2
	05/26/21	06/02/21 ¹	1.3	0.3	29.8	1.3
	06/02/21	06/09/21 ¹	1.2	0.3	31.6	1.3
	06/09/21	06/16/21 ¹	1.3	0.3	25.7	1.1
	06/16/21	06/23/21 ¹	1.2	0.3	33.8	1.4
	06/23/21	06/30/21	1.0	0.3	29.2	1.3
Idaho Falls Duplicate	03/31/21	04/07/21 ¹	1.5	0.3	37.2	1.5
	04/07/21	04/14/21	1.1	0.2	24.5	1.1
	04/14/21	04/21/21	0.6	0.2	20.4	1.1
	04/21/21	04/28/21 ¹	1.4	0.3	30.1	1.5
	04/28/21	05/05/21 ¹	1.1	0.3	26.3	1.4
	05/05/21	05/12/21 ¹	1.0	0.3	24.2	1.3
	05/12/21	05/19/21 ¹	1.6	0.3	33.3	1.4
	05/19/21	05/26/21 ¹	0.9	0.3	22.2	1.2
	05/26/21	06/02/21	0.9	0.3	28.1	1.3
	06/02/21	06/09/21 ¹	1.0	0.3	33.9	1.5
	06/09/21	06/16/21 ¹	1.7	0.4	30.9	1.5
	06/16/21	06/23/21	1.7	0.3	34.1	1.4
	06/23/21	06/30/21	1.0	0.3	30.9	1.3

¹Estimated volume. Results are considered (usable) estimates.

²Operated by Shoshone Bannock-Tribes.

Appendix B

Table B-1. Results for all electret ionization chamber (EIC) locations, second quarter, 2021.

Sample Location	Net Corrected Exposure Rate ($\mu\text{R/hr}$) ¹	± 2 SD ($\mu\text{R/hr}$)
Arco	14.1	1.8
Craters of the Moon	14.7	3.1
Rest Area	15.4	3.5
Van Buren Avenue	17.3	2.4
Experimental Field Station	15.2	2.5
Main Gate	14.1	2.9
Atomic City	17.1, 19.3	-
Taber	15.7	3.0
Blackfoot	13.2	3.9
Ft. Hall	12.8	3.0
Idaho Falls	12.9	0.9
Mud Lake/ Terreton	15.0	4.1
Monteview	13.9	4.9
Sand Dunes	13.7	2.4
Howe Met. Tower	13.6	4.3
MP282 -20	14.8	4.0
MP280 -20	14.0	3.5
MP278 -20	13.8	4.5
MP276 -20	12.3	3.8
MP274 -20	12.9	3.2
MP272 -20	11.6	0.6
MP270 -20	13.8	3.5
MP268 -20	13.7, 15.5	-
MP266 -20	12.4	0.8
MP264 -20	13.0	2.1
MP270 -20/26	13.1	1.4
MP268 -20/26	11.7	2.4
MP266 -20/26	15.9	2.3
MP263 -20/26	16.5, 17.6	-
MP261 -20/26	13.1	2.4
MP259 -20/26	13.5	4.9
MP256 -20/26	11.0	3.1
MFC (EBR II)	15.9	4.4
EBR I	13.8, 16.4	-
RWMC	13.9	1.5
CFA	18.8, 21.5	-
CITRC (PBF)	17.5	1.3
INTEC	16.9	4.5
ATR (TRA)	16.7	2.8
NRF	16.9	4.3
TAN/SMC	10.1	3.7
Mud Lake Bank of Commerce	13.0	4.8
MP43-33	9.6, 11.6	-
MP41-33	13.3	2.9
MP39-33	11.9, 14.0	-
MP37-33	11.0	1.3
MP35-33	13.1, 15.3	-
MP33-33	13.6	2.3
MP31-33	10.3, 11.2	-
MP29-33	12.0	2.8
MP27-33	11.9	2.8

Table B-1. continued. Results for all electret ionization chamber (EIC) locations, second quarter, 2021.

Sample Location	Net Corrected Exposure Rate ($\mu\text{R/hr}$) ¹	± 2 SD ($\mu\text{R/hr}$)
MP25-33	13.3	1.5
MP23-33	10.7	3.2
MP21-33	13.2	4.4
MP19-33	NS ²	NS
MP14-33	9.1	2.2
MP11-33	14.2	4.1
MP06-33	12.4	4.2
MP03-33	11.9	3.9
Base of Howe	14.1	3.2
Rover	14.1	2.1
Hamer	16.7	3.7
Sugar City	19.7, 22.3	-
Roberts	14.9	4.0
Big Southern Butte	14.5	3.6
T4 North	15.9	4.0
T4 South	14.9	2.3

¹Results are the average of triplicate exposure rate measurements with the associated sample variability (± 2 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.

²No sample. EICs were missing upon arrival at the location.

Appendix C

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

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

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

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