Department of Environmental Quality
INL Oversight Program

ENVIRONMENTAL SURVEILLANCE PROGRAM QUARTERLY DATA REPORT

July - September, 2021

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Table of Acronyms

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

Introduction

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

The primary objective for DEQ-INL OP's ESP is to maintain an independent environmental monitoring and verification program designed to verify and supplement DOE's environmental data and programs. This program also provides the citizens of Idaho with information on current and proposed DOE programs that 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 third 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 third 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. DEQ-INL OP decided to change sampler design from a 4 inch to an 8 x 10 inch filter geometry system. The change is an attempt to improve flow rate accuracy and increase sample volume. The Idaho Falls Duplicate location was the first, and only, sampler to be converted (start date 8/18/21) to this new system in the third quarter, 2021. The remaining locations will be converted in successive quarters until all high-volume TSP samplers have been changed over. 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**. A 4 inch diameter punch was taken for analysis of the 8 x 10 inch filters. All 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 third 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 third 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. One Big Lost River Rest Area individual sample result exceeded its MDC. Two Experimental Field Station (EFS) individual sample results and the quarterly mean exceeded their MDCs. One EFS individual sample result was equal to its MDC. Both locations are on-site, and these results 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/m^3 (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 third 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 third 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**.

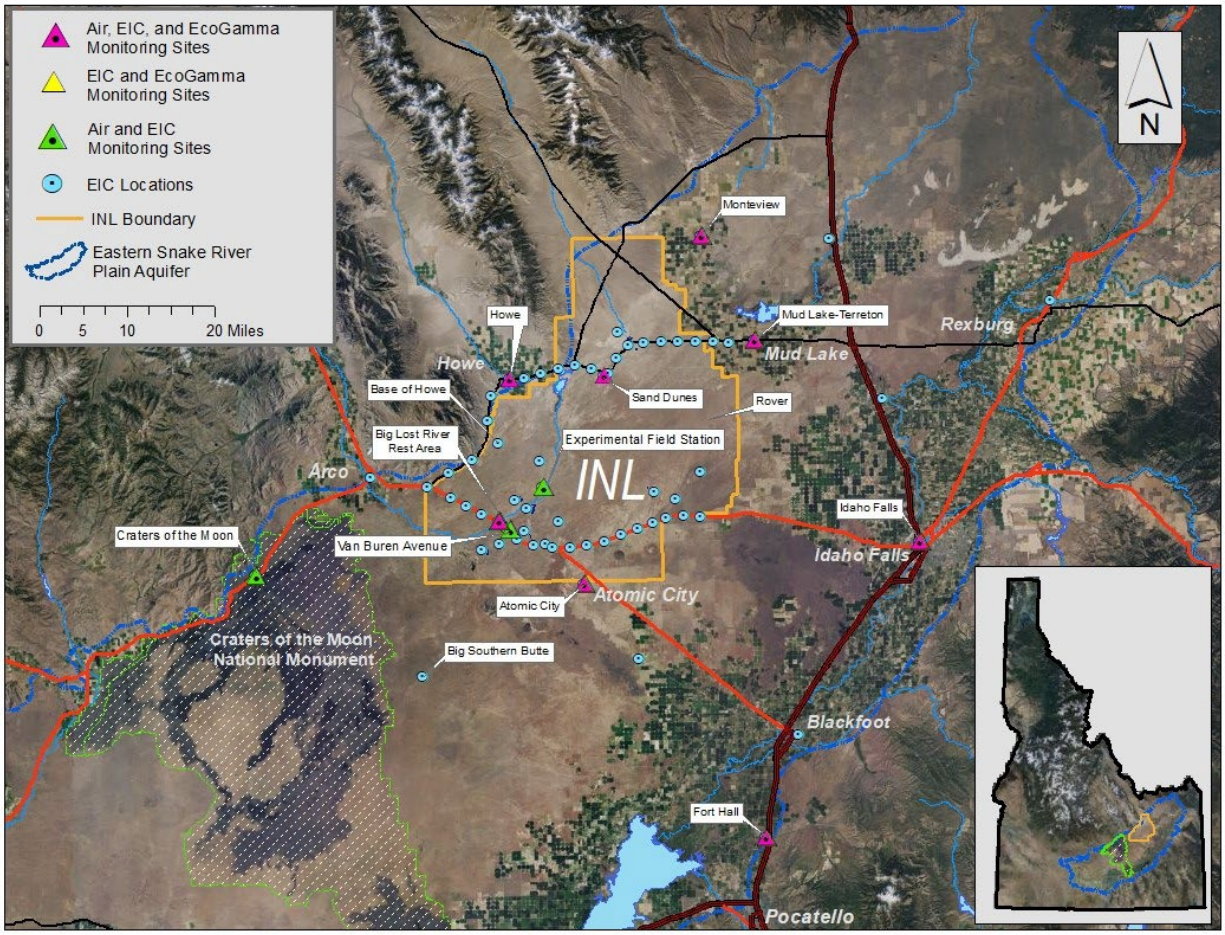

Figure 1. Air and radiation monitoring locations.

Table 1. Sampling locations and sample type

Station Locations	Sample type[1]			
	TSP	Radioiodine	Water Vapor	Precipitation
On-site Locations				
Big Lost River Rest Area	□	□	■	■
Experimental Field Station	□	□	■	
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, third quarter, 2021.

Station Location	Concentration					
	Gross Alpha			Gross Beta		
On-Site Locations						
Big Lost River Rest Area	0.4 J[2]	-	3.4 J	5.8 J	-	57.5 J
Experimental Field Station	1.8 J[2]	-	4.1 J	18.4 J	-	56.9 J
Sand Dunes Tower	0.8 J[2]	-	3.6 J	27.8 J	-	50.2
Van Buren Avenue	1.3 J[2]	-	4.0 J	37.5 J	-	64.0 J
Boundary Locations						
Atomic City	1.2 J[2]	-	3.6 J	34.0 J	-	54.0
Howe	1.6	-	4.8 J[2]	25.7 J	-	56.6
Monteview	1.2 J[2]	-	3.9 J	32.9 J	-	53.8 J
Mud Lake	1.5 J[2]	-	4.1	29.6	-	58.1 J
Distant Locations						
Craters of the Moon	0.8 J[2]	-	3.8 J	23.6 J	-	52.7 J
Fort Hall[1]	1.4	-	3.8	34.2 J[2]	-	45.6 J
Idaho Falls	1.1	-	3.7 J[2]	25.9 J	-	49.3 J
Idaho Falls Duplicate	0.9	-	2.7 J[2]	24.3	-	47.1

[1]Operated by Shoshone-Bannock Tribes.
[2]Air volume was estimated. Results are J-flagged as estimates.
Note: Concentrations are expressed in 1 x 10^{-3} pCi/m^3. MDCs typically range from (0.1 to 0.5) x 10^{-3} pCi/m^3 for gross alpha and from (0.7 to 1.3) x 10^{-3} pCi/m^3 for gross beta.

Table 3. Gamma spectroscopy analysis data for TSP filters, composite samples, third quarter, 2021.

Station Location	Naturally Occurring Radionuclide Beryllium-7		Man-Made Gamma Emitting Radionuclides[2]		
	Concentration	± 2 SD	Concentration	± 2 SD	MDC
On-site Locations					
Big Lost River Area	147.7 J[3]	7.9 J	1.7 J	0.02 J	0.06 J
Experimental Field Station	144.8 J	7.7 J	1.7 J	0.07 J	0.11 J
Sand Dunes Tower	198.0 J	10.9 J	2.3 J	0.11 J	0.09 J
Van Buren Avenue	178.0 J	9.6 J	1.7 J	0.06 J	0.07 J
Boundary Locations					
Atomic City	202.4 J	10.5 J	1.9 J	0.05 J	0.11 J
Howe	166.5 J	8.8 J	1.3 J	0.03 J	0.05 J
Monteview	160.5 J	8.6 J	1.3 J	0.01 J	0.07 J
Mud Lake	177.1 J	9.3 J	1.7 J	-0.02 J	0.05 J
Distant Locations					
Craters of the Moon	183.8 J	9.6 J	1.8 J	0.04 J	0.08 J
Fort Hall[1]	177.1 J	10.1 J	2.7 J	0.17 J	0.16 J
Idaho Falls	155.4 J	8.1 J	1.4 J	0.06 J	0.07 J
Idaho Falls Duplicate[3]	123.6 J	7.0 J	2.5 J	-0.06 J	0.09 J

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

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

Start Date	Collection Date	Iodine-131 activity (pCi/composite)		
		Activity	± 2 SD	MDA[1]
06/30/21	07/07/21	-0.26	1.21	2.10
07/07/21	07/14/21	-0.81	1.30	2.29
07/14/21	07/21/21	-0.47	1.26	2.20
07/21/21	07/28/21	-0.51	1.05	1.89
07/28/21	08/04/21	1.45	1.70	2.79
08/04/21	08/11/21	-0.11	1.01	1.76
08/11/21	08/18/21	0.56	1.15	1.92
08/18/21	08/25/21	0.09	1.28	2.18
08/25/21	09/01/21	-1.12	1.40	2.51
09/01/21	09/08/21	0.74	1.21	2.01
09/08/21	09/15/21	-1.24	1.88	3.26
09/15/21	09/22/21	-0.33	1.55	2.66
09/22/21	09/29/21	-0.04	1.08	2.86

[1]The minimum detectable activity (MDA) is established for the least efficient counting position in the eleven-cartridge composite. Based on a typical 20,000 ft^3 (566 m^3) air volume per cartridge, the highest I-131 MDA of 3.26 pCi/composite is equivalent to a maximum MDC of 5 $x10^{-4}$ pCi/m^3.

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

Station Location	Start Date	Collection Date	Tritium		
			Concentration	± 2 SD	MDC
On-site Locations					
Big Lost River Rest Area	06/30/21	07/28/21	0.72	0.41	0.63
Big Lost River Rest Area	07/28/21	08/18/21	0.31	0.28	0.45
Big Lost River Rest Area	08/18/21	09/22/21	0.26	0.33	0.54
Big Lost River Rest Area	09/22/21	10/06/21	0.28	0.32	0.52
Big Lost River Rest Area Mean	**06/30/21**	**10/06/21**	**0.41**	**0.34**	**0.54**
Experimental Field Station	07/02/21	07/28/21	0.75	0.38	0.58
Experimental Field Station	07/28/21	08/18/21	0.99	0.68	1.07
Experimental Field Station	08/18/21	09/22/21	0.78	0.38	0.58
Experimental Field Station	09/22/21	10/06/21	0.54	0.34	0.54
Experimental Field Station Mean	**07/02/21**	**10/06/21**	**0.78**	**0.43**	**0.67**
Sand Dunes Tower	06/30/21	07/28/21	0.67	0.51	0.82
Sand Dunes Tower	07/28/21	08/18/21	0.13	0.46	0.78
Sand Dunes Tower	08/18/21	09/22/21	0.25	0.31	0.51
Sand Dunes Tower	09/22/21	10/06/21	0.22	0.33	0.54
Sand Dunes Tower Mean	**06/30/21**	**10/06/21**	**0.30**	**0.39**	**0.65**
Van Buren Avenue	07/02/21	07/28/21	0.42	0.40	0.66
Van Buren Avenue	07/28/21	08/18/21	0.47	0.51	0.83
Van Buren Avenue	08/18/21	09/22/21	0.07	0.26	0.43
Van Buren Avenue	09/22/21	10/06/21	0.33	0.32	0.52
Van Buren Avenue Mean	**07/02/21**	**10/06/21**	**0.28**	**0.36**	**0.59**
Boundary Locations					
Atomic City	07/02/21	07/28/21	0.01	0.35	0.61
Atomic City	07/28/21	08/06/21	0.28 J[2]	0.80 J	1.36 J
Atomic City	08/06/21	09/22/21	0.07 J[2]	0.24 J	0.40 J
Atomic City	09/22/21	10/06/21	0.11	0.32	0.54
Atomic City Mean	**07/02/21**	**10/06/21**	**0.08 J[2]**	**0.34 J**	**0.57 J**
Howe	06/30/21	07/28/21	0.09	0.44	0.75
Howe	07/28/21	08/18/21	0.43	0.64	1.07

Howe	08/18/21	08/26/21	-0.30	0.53	0.94
Howe	08/26/21	09/22/21	0.06	0.39	0.66
Howe	09/22/21	10/06/21	0.40	0.71	1.19
Howe Mean	**06/30/21**	**10/06/21**	**0.16**	**0.51**	**0.86**
Mud Lake	06/30/21	07/21/21	-0.04	0.52	0.89
Mud Lake	07/21/21	08/05/21	-0.16 J[2]	0.74 J	1.29 J
Mud Lake	08/05/21	08/26/21	0.06 J[2]	0.59 J	1.01 J
Mud Lake	08/26/21	09/22/21	-0.14	0.44	0.76
Mud Lake	09/22/21	10/06/21	0.07	0.39	0.67
Mud Lake Mean	**06/30/21**	**10/06/21**	**-0.05 J[2]**	**0.53 J**	**0.91 J**
Monteview	06/30/21	07/21/21	0.08	0.53	0.91
Monteview	07/21/21	08/05/21	0.23 J[2]	0.71 J	1.20 J
Monteview	08/05/21	08/26/21	-0.17 J[2]	0.57 J	1.00 J
Monteview	08/26/21	09/22/21	0.04 J[2]	0.43 J	0.73 J
Monteview	09/22/21	10/06/21	0.37	0.41	0.67
Monteview Mean	**3/31/21**	**6/30/21**	**0.07 J[2]**	**0.52 J**	**0.89 J**
Distant Locations					
Craters of the Moon	06/30/21	07/28/21	0.14	0.32	0.54
Craters of the Moon	07/28/21	08/18/21	0.11	0.40	0.67
Craters of the Moon	08/18/21	09/22/21	0.17	0.27	0.44
Craters of the Moon	09/22/21	10/06/21	0.12	0.29	0.49
Craters of the Moon Mean	**06/30/21**	**10/06/21**	**0.14**	**0.31**	**0.53**
Fort Hall[1]	07/02/21	07/28/21	0.06	0.52	0.89
Fort Hall	07/28/21	08/18/21	0.35	0.66	1.11
Fort Hall	09/22/21	10/06/21	-0.12	0.43	0.75
Fort Hall	08/18/21	09/22/21	0.03	0.42	0.72
Fort Hall Mean	**07/02/21**	**09/22/21**	**0.06**	**0.51**	**0.87**
Idaho Falls	06/30/21	07/28/21	0.56	0.70	1.16
Idaho Falls	07/28/21	08/18/21	0.45	0.80	1.33
Idaho Falls	08/18/21	09/22/21	-0.18	0.43	0.75
Idaho Falls	09/22/21	10/06/21	0.63 J[2]	1.30 J	2.18 J
Idaho Falls Mean	**06/30/21**	**10/06/21**	**0.23 J[2]**	**0.69 J**	**1.17 J**

Note: Concentrations are reported in pCi/m^3 with associated uncertainty (± 2 SD) and minimum detectable concentration (MDC).
[1]Operated by Shoshone-Bannock Tribes.
[2]Air volume was estimated. Results and mean for this location are J-flagged as estimates.

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

Station Location	Start Date	Stop Date	Tritium			Cs-137		
			Concentration	± 2 SD	MDC	Concentration	± 2 SD	MDC
On-site Locations								
Big Lost River Rest Area	**06/30/21**	**10/06/21**	**80**	**90**	**150**	**0.8**	**0.7**	**2.2**
Boundary Locations								
Atomic City	07/02/21	09/22/21	-40	90	160	0.7	1.5	2.5
Atomic City	09/22/21	10/06/21	-70	90	160	0.4	0.9	3.2
Atomic City Mean	**07/02/21**	**10/06/21**	**-41**	**90**	**160**	**0.7**	**1.5**	**2.5**
Howe	**06/30/21**	**08/26/21**	**-30**	**90**	**150**	**-0.8**	**1.5**	**2.7**
Mud Lake	07/03/21	08/05/21	40	90	150	0.4	1.4	2.4
Mud Lake	08/05/21	10/06/21	10	90	150	0.1	0.7	2.3
Mud Lake Mean	**07/03/21**	**10/06/21**	**31**	**90**	**150**	**0.3**	**1.2**	**2.4**
Monteview	07/02/21	09/22/21	10	90	160	-0.1	1.5	2.5
Monteview	09/22/21	10/06/21	50	100	160	NS[1]	NS	NS
Monteview Mean	**07/02/21**	**10/06/21**	**10**	**90**	**160**	**-0.1**	**1.5**	**2.5**
Distant Locations								
Idaho Falls	07/02/21	08/26/21	10	90	150	0.8	1.3	2.1
Idaho Falls	08/26/21	10/06/21	100	90	150	0.1	0.7	2.4
Idaho Falls Mean	**07/02/21**	**10/06/21**	**23**	**90**	**150**	**0.7**	**1.2**	**2.1**

Note: Concentrations are reported in pCi/L with associated uncertainty (± 2 SD) and minimum detectable concentration (MDC).
[1]NS = no Cs-137 sample for the 09/22/21-10/06/21 time period. Mean Cs-137 value is identical to the 07/02/21-09/22/21 sample result.

Environmental Radiation Monitoring Results

The ESP operated 13 environmental radiation stations during the third 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 third quarter 2021. **Table 9** lists the EIC monitoring results for third 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	
	HPIC	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, third quarter 2021, from EcoGamma* network.

Station Location	Exposure Rate (µR/hr)	
	Weekly Average	± 2 SD
On-site Locations		
Base of Howe	19.3	1.8
Big Lost River Rest Area	16.2	1.3
Rover	17.4	1.5
Sand Dunes Tower	16.2	1.4
Boundary Locations		
Atomic City	16.2	1.4
Big Southern Butte	20.4	1.6
Howe Met Tower	15.4	1.5
Monteview	14.2	1.2
Mud Lake / Terreton	15.4	1.5
Distant Locations		
Fort Hall	14.6	1.2
Idaho Falls	16.4	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, third quarter, 2021.

Station Location	Exposure Rate (µR/hr)	
	Quarterly Average[1]	± 2 SD
On-Site Locations		
Base of Howe	13.9	0.8
Big Lost River Rest Area	14.8	3.9
Experimental Field Station	12.6	3.5
Rover	13.0	3.1
Sand Dunes Tower	12.6	1.7
Van Buren Avenue	12.6	1.0
Boundary Locations		
Atomic City	14.3	4.1
Big Southern Butte	14.4	1.5
Howe Met Tower	11.8	2.2
Monteview	13.1	2.2
Mud Lake/Terreton	14.7	2.7
Distant Location		
Craters of the Moon	15.4	2.8
Fort Hall	14.5	2.1
Idaho Falls	10.1	5.6

[1]Results 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 (^{234}U, ^{235}U, and ^{238}U), plutonium isotopes (^{238}Pu, $^{239/240}$Pu), americium-241 (^{241}Am), strontium-90 (^{90}Sr), and technetium-99 (^{99}Tc)—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 third quarter of 2021, DEQ-INL OP sampled groundwater from the aquifer at two facility locations, and nine distant 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 20** and summarized below. The results of low-level tritium analyses for three samples collected in second quarter 2021, along with eight samples collected in third quarter, 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 MCL. Background concentrations depend on local geology, and the concentrations of constituents at sites not influenced by INL activities may on occasion be higher than the given background ranges due to local factors and natural variability.

Gross alpha and gross beta radioactivity

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

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

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 facility and distant locations. Facility well TAN-2336 had the highest gross alpha concentration at 4.8 ± 3.2 pCi/L. TAN-2336 also had the highest gross beta concentration of 502.2 ± 7.7 pCi/L. This is a new well at the TAN facility, which has known groundwater contamination. The gross beta concentration is consistent with results from other aquifer wells located at the TAN facility. Most of the gross beta concentrations measured in the distant wells were within the known background range, with one exception. MV-54 had a slightly elevated gross beta concentration above background of 9.1 ± 1.2 pCi/L. Although slightly above background levels typically observed in the aquifer, it was consistent with historical ranges. All other detectable concentrations in groundwater were consistent with historical trends.

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 measured at 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 facility wells TAN-44 (552 ± 110 pCi/L) and TAN-2336 (693 ± 120 pCi/L). These values are typical of wells located at the TAN facility and the value for TAN-44 is consistent with previous results. There were no tritium detections using the standard analysis method for any of the distant wells sampled this quarter.

Three samples from second quarter 2021 and eight samples from third quarter 2021 requiring low-level tritium analyses were evaluated this quarter. Results are reported in **Table 14**. Three samples were from boundary wells and the remaining eight were from distant water locations. The highest concentrations of low-level tritium were 189 ± 13 pCi/L in USGS-105 (1,072 ft bgs) and 163 ± 12 pCi/L in USGS-105 (952 ft bgs), which are consistent with results from previous years. These elevated tritium concentrations in boundary wells indicate an INL tritium source. All reported concentrations for the distant wells are within the background range (< 33 pCi/L). A backlog of two 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

One aquifer facility location (TAN-2336) was sampled for ^{90}Sr this quarter (**Table 15**). An elevated concentration of 178 ± 42 pCi/L was measured in the sample, which is consistent with concentrations reported from other wells at the TAN facility.

Uranium Isotopes

Two aquifer locations at the TAN facility were sampled for uranium isotopes (^{234}U, ^{235}U, and ^{238}U) this quarter; TAN-44 and TAN-2336 (**Table 16**). Both locations exceeded background concentrations for ^{234}U with a maximum of 3.24 ± 0.66 pCi/L at TAN-2336. Both locations also exceeded background concentrations for ^{235}U with a maximum of 0.136 ± 0.095 pCi/L at TAN-2336. The TAN-44 location slightly exceeded the background concentration for ^{238}U at 0.82 ± 0.23 pCi/L. The elevated ^{234}U/^{238}U ratio of 7.2 at TAN-2336 indicates an anthropogenic uranium source. Although some of the ^{234}U, ^{235}U, and ^{238}U concentrations exceeded background values, they are consistent with historical values at the TAN facility.

Common ions, trace metals, and nutrients

All locations were sampled for chloride, chromium, and dissolved nutrients (nitrate-plus-nitrite). Three locations (TAN-44, TAN-2336, and MV-64) were sampled for other common ions. Two facility locations, TAN-44 and TAN-2336, were sampled for additional trace metals and TAN-2336 was sampled for phosphorus during the quarter (**Tables 17, 18, and 19**). TAN-2336 has received on-going bioremediation injections since it was drilled in 2021, to treat the groundwater. Sample matrix interference prevented the lab from analyzing dissolved metals and common ions, with the exception of alkalinity (expressed as $CaCO_3$).

Most results were consistent with past results. Some were elevated compared to background concentrations. The alkalinity and phosphorus concentrations at TAN-2336 were elevated, which likely resulted from bioremediation well injections. The TAN-44 barium level was elevated above background at 170 µg/L; however, this is consistent with past data and far below the EPA MCL of 2,000 µg/L. The highest concentration of chromium was found at distant well MV-33 at 4.1 µg/L, which is within the background concentration range. Distant well MV-54 had elevated concentrations of nitrate + nitrite (5.9 mg/L) and chloride (69 mg/L), above background concentrations. The nitrate + nitrite value is consistent with a 2018 value of 5.5 mg/L and the chloride value is also consistent with past results. The elevated concentration is consistent with trends at MV-54, which reflect an increase in nutrient concentration due to agricultural practices in the Magic Valley. All other concentrations were consistent with past observations.

Volatile organic compounds (VOCs)

VOCs were measured at two aquifer wells located at TAN: TAN-44 and TAN-2336 (**Table 20**). No VOCs were detected in the TAN-2336 sample. Cis-1,2-dichloroethene (cis-1,2-DCE), tetrachloroethene (PCE), and trichloroethene (TCE) continue to be detected at TAN-44. TCE (32.4 µg/L) exceeded its MCL of 5 µg/L in this well. There were no other notable MCL exceedances and/or significant changes from previous measurements. Appendix C provides a list of VOCs analyzed for water samples.

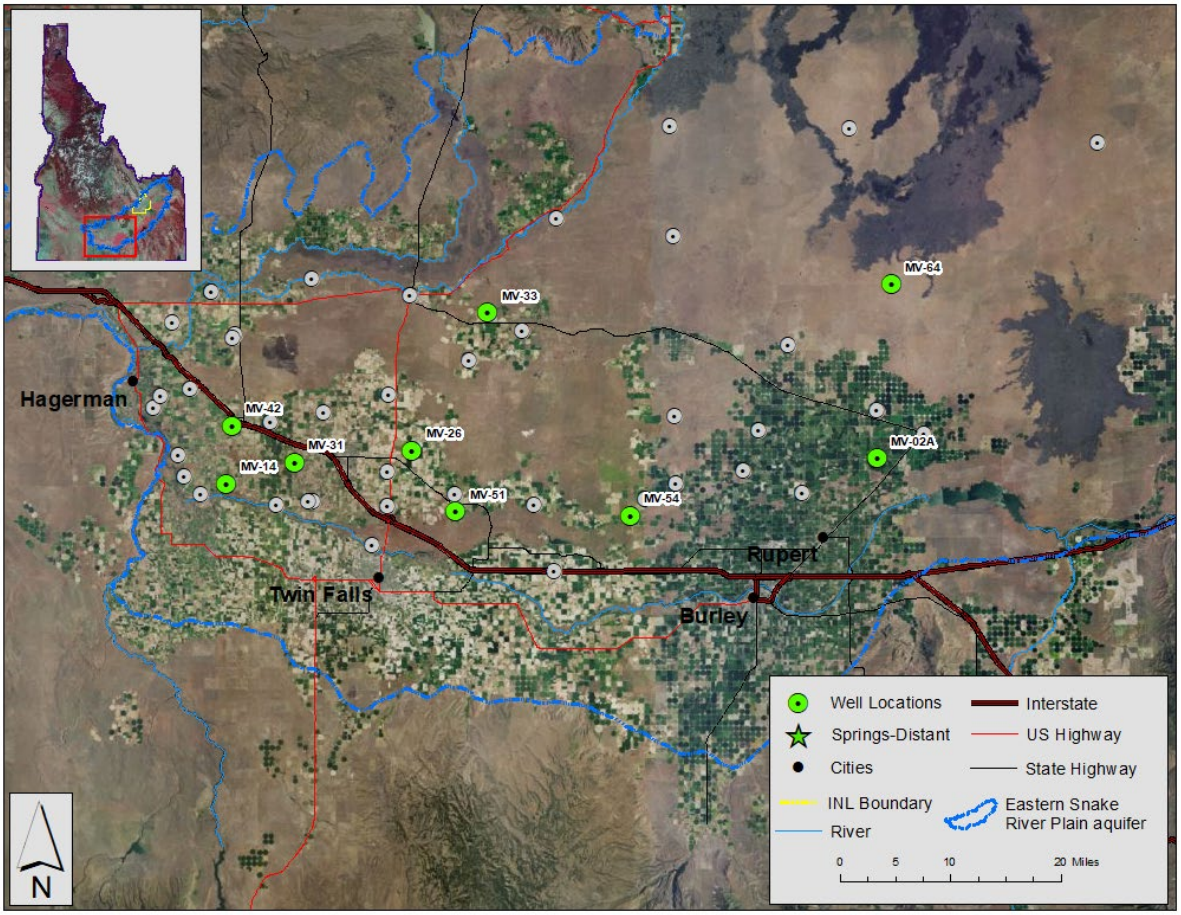

Figure 2. Distant and Surface Water monitoring locations.

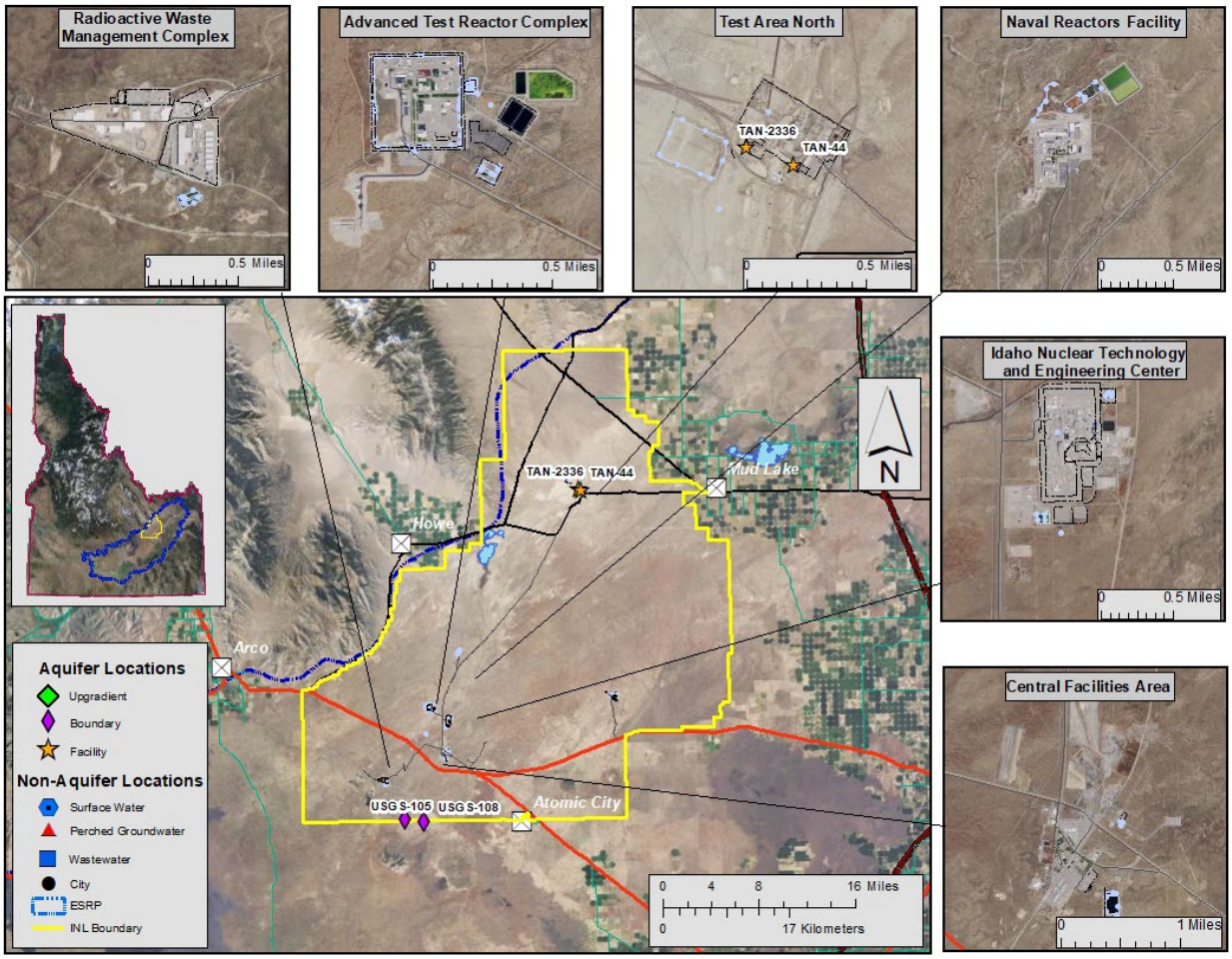

Figure 3. Up-gradient, facility, boundary, perched groundwater and wastewater monitoring locations.

Table 10. Locations sampled for water, third quarter, 2021.

Sample Location	Date Sampled	Co-sampler	Well Depth (ft bgs)	Analyses*
Aquifer Samples				
Facility				
Test Area North				
TAN-44	7/21/2021	Fluor	295	α, β, γ, ^{3}H, U iso, com.ions, trace metals, NO_3+NO_2, VOCs
TAN-2336	7/21/2021	Fluor	255	α, β, γ, ^{3}H, ^{90}Sr, U iso, com.ions, trace metals, NO_3+NO_2, P, VOCs
Distant				
MV-02A	7/19/2021	None	205	α, β, γ, ^{3}H, Cl^-, Cr, NO_3+NO_2
MV-14	7/19/2021	None	n/a	α, β, γ, ^{3}H, Cl^-, Cr, NO_3+NO_2
MV-26	7/19/2021	None	n/a	α, β, γ, ^{3}H, Cl^-, Cr, NO_3+NO_2
MV-31	7/19/2021	None	230	α, β, γ, ^{3}H, Cl^-, Cr, NO_3+NO_2
MV-33	7/19/2021	None	360	α, β, γ, ^{3}H, Cl^-, Cr, NO_3+NO_2
MV-42	7/19/2021	None	165	α, β, γ, ^{3}H, Cl^-, Cr, NO_3+NO_2
MV-51	7/19/2021	None	n/a	α, β, γ, ^{3}H, Cl^-, Cr, NO_3+NO_2
MV-54	7/19/2021	None	380	α, β, γ, ^{3}H, Cl^-, Cr, NO_3+NO_2
MV-64	8/23/2021	None	426	α, β, γ, ^{3}H, com. ions, Cr, NO_3+NO_2

ft bgs = feet below ground surface.
*α = gross alpha radioactivity; β = gross beta radioactivity; γ = manmade gamma-emitting radionuclides; ^{3}H = tritium; ^{90}Sr = Strontium-90, ^{99}Tc = Technetium-99, U iso. = ^{234}U, ^{235}U, ^{238}U; Cl^- = chloride; Cr = chromium; com. ions = calcium (Ca^{2+}), magnesium (Mg^{2+}), sodium (Na^+), potassium (K^+), chloride (Cl^-), sulfate (SO_4^{2-}), alkalinity; trace metals = arsenic (As), barium (Ba), chromium (Cr), iron (Fe), manganese (Mn), and lead (Pb); 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		
Common Ions (mg/L)		
Alkalinity (as $CaCO_3$)	91-261[a]	---
Calcium	23 – 71[a]	---
Chloride	4.9 – 66.6[a]	250*
Fluoride	0.1 – 1.50[a]	4
Magnesium	10.1 – 27.4[a]	---
Potassium	1.2 – 5.8[a]	---
Sodium	2.6 – 27.0[a]	---
Sulfate	9.6 – 40.4[a]	250*
Trace Metals (µg/L)		
Arsenic	2 – 3[c]	10
Barium	50 – 70[c]	2000
Chromium	<1.0 – 5.2[a]	100
Iron	4 – 16[d]	300*
Lead	<5[c]	15
Manganese	<1 – 4[a]	50*
Selenium	<1[c]	50
Zinc	<3 – 10.5[d]	5000*
Nutrients (mg/L)		
Nitrate plus nitrite	<0.04 – 3.59[b]	10 for NO_3^-, 1 for NO_2^-
Phosphorus	<0.01 – 0.02[d]	---
Volatile Organic Compounds (µg/L)		
Tetrachloroethene (PCE)	0	5
Trichloroethene (TCE)	0	5
1,1-Dichloroethene	0	7
cis-1,2-dichloroethene	0	70
trans-1,2-dichloroethene	0	100
Vinyl chloride	0	2
Carbon tetrachloride	0	5
Chloroform	0	80[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) for water samples, third quarter, 2021.

Sample Location	Sample Date	Gross Alpha			Gross Beta			Cesium-137*		
		Concentration		2 SD	Concentration		2 SD	Concentration		2 SD
Aquifer Samples										
Facility										
Test Area North										
TAN-44	7/21/2021	1.4	U	1.2	6.0		1.1	-0.2	U	1.6
TAN-2336	7/21/2021	4.8	U	3.2	502.2		7.7	2.5	U	1.7
Distant										
MV-02A	7/19/2021	1.5	U	1.0	5.5		1.2	1.2	U	1.2
MV-14	7/19/2021	1.5	U	1.1	5.3		1.0	0.6	U	1.8
MV-26	7/19/2021	0.7	U	1.1	4.9		1.1	1.4	U	1.5
MV-31	7/19/2021	1.1	U	1.1	6.2		1.1	-0.5	U	1.6
MV-33	7/19/2021	1.2		0.8	1.4		0.8	0.4	U	1.5
MV-42	7/19/2021	2.5		1.1	4.9		1.0	-0.5	U	1.5
MV-51	7/19/2021	3.6		1.7	4.6		1.5	0.5	U	1.5
MV-54	7/19/2021	1.8		1.2	9.1		1.2	0.1	U	1.6
MV-64	8/23/2021	1.3	U	1.0	2.8	J	0.9	0.6	U	1.5

Data qualifiers: U = undetected, J = estimate, R = rejected, "+" or "-" after a J means that the estimated result is biased high or low, respectively.
*ISU-EML analyzes water samples for all common manmade gamma-emitting radionuclides. If none are detected, only the results for ^{137}Cs, the manmade gamma-emitter most likely to be detected in groundwater, are reported in this table.
Typical MDC range (gross alpha) 1.2– 2.4 pCi/L. MDC range (gross beta) 1.2 – 2.2 pCi/L. MDC range (Cs-137) 2.0 – 3.0 pCi/L. MDCs for TAN-2336 gross alpha (5.4 pCi/L) and gross beta (4.4 pCi/L) were larger due to high dissolved/suspended solids requiring a smaller aliquot for analysis.

Table 13. Tritium concentrations (pCi/L) for water samples, third quarter, 2021.

Sample Location	Sample Date	Tritium		
		Concentration		2 SD
Aquifer Samples				
Facility				
Test Area North				
TAN-44	7/21/2021	552		110
TAN-2336	7/21/2021	693		120
Distant				
MV-02A	7/19/2021	10	U	80
MV-14	7/19/2021	30	U	80
MV-26	7/19/2021	40	U	80
MV-31	7/19/2021	20	U	80
MV-33	7/19/2021	30	U	80
MV-42	7/19/2021	-20	U	80
MV-51	7/19/2021	-30	U	80
MV-54	7/19/2021	0	U	80
MV-64	8/23/2021	80	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.
MDC range 140 – 150 pCi/L.

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

Sample Location	Sample Date	Tritium		
		Concentration		2 SD
Aquifer Samples				
Boundary				
USGS-105 (1072 ft bgs)	6/23/2021	189		13
USGS-105 (952 ft bgs)	6/23/2021	163		12
USGS-108 (1172 ft bgs)	6/24/2021	43		8
Distant				
MV-02A	7/19/2021	11		7
MV-14	7/19/2021	6	U	7
MV-26	7/19/2021	6	U	8
MV-31	7/19/2021	7	U	7
MV-33	7/19/2021	4	U	7
MV-42	7/19/2021	1	U	6
MV-51	7/19/2021	21		8
MV-54	7/19/2021	11	U	8

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 11 – 12 pCi/L.

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

Sample Location	Sample Date	Strontium-90		
		Concentration		2 SD
Aquifer Samples				
Facility				
Idaho Nuclear Technology and Engineering Center				
TAN-2336	7/21/2021	178		42

Data qualifiers: U = undetected, J = estimate, R = rejected, "+" or "-" after a J means that the estimated result is biased high or low, respectively.
MDC 1.0 pCi/L.

Table 16. Uranium isotope concentrations (pCi/L) for water samples, third quarter, 2021.

Sample Location	Sample Date	Uranium-234			Uranium-235			Uranium-238		
		Concentration		2 SD	Concentration		2 SD	Concentration		2 SD
Aquifer Samples										
Facility										
Idaho Nuclear Technology and Engineering Center										
TAN-2336	07/21/2021	3.24		0.66	0.136	J#	0.095	0.45		0.16
TAN-44	07/21/2021	1.97		0.43	0.055	U	0.054	0.82		0.23

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 and >2SD but <3SD and is therefore considered questionable and J-flagged as an estimate.
MDC range (U-234) 0.06 – 0.08 pCi/L. MDC range (U-235) 0.065 – 0.103 pCi/L. MDC range (U-238) 0.08 – 0.09 pCi/L.

Table 17. Common ion concentrations (mg/L) in water samples, third quarter, 2021.

Sample Location	Sample Date	Calcium*	Magnesium*	Sodium*	Potassium*	Fluoride	Chloride	Sulfate	Alkalinity†
Aquifer Samples									
Facility									
Test Area North									
TAN-2336	07/21/2021	-	-	-	-	-	-	-	1260[1]
TAN-44	07/21/2021	60	16	22	3.3		63.3[3]	35.6	156
Distant									
MV-02A	7/19/2021	-	-	-	-	-	41.1[2]	-	-
MV-14	7/19/2021	-	-	-	-	-	42.0[2]	-	-
MV-26	7/19/2021	-	-	-	-	-	29.4	-	-
MV-31	7/19/2021	-	-	-	-	-	46.6[2]	-	-
MV-33	7/19/2021	-	-	-	-	-	7.52	-	-
MV-42	7/19/2021	-	-	-	-	-	18.3	-	-
MV-51	7/19/2021	-	-	-	-	-	44.4[2]	-	-
MV-54	7/19/2021	-	-	-	-	-	69.0[3]	-	-
MV-64	8/23/2021	28	13	17	3.2	-	16.2	27.5	121

Data qualifiers: U = undetected, J = estimate, R = rejected, "<" = less than detection limit, "+" or "-" after a J means that the estimated result is biased high or low, respectively.
† As $CaCO_3$.
"-" = not analyzed.
Note 1. Lab was only able to analyze for alkalinity due to sample matrix interference.
Note 2. Lab indicated that a 1:2 dilution of this sample was required for this analyte.
Note 3. Lab indicated that a 1:5 dilution of this sample was required for this analyte.

Table 18. Dissolved metals concentrations (µg/L) in water samples, third quarter, 2021.

Sample Location	Sample Date	Arsenic	Barium	Chromium	Iron	Lead	Manganese	Selenium	Zinc
Aquifer Samples									
Facility									
Test Area North									
TAN-2336[1]	07/21/2021	-	-	-	-	-	-	-	-
TAN-44	07/21/2021	2.0	170	3.8	0.0 U	0.0 U	0.82 UJ	-	-
Distant									
MV-02A	7/19/2021	-	-	1.1	-	-	-	-	-
MV-14	7/19/2021	-	-	2.4	-	-	-	-	-
MV-26	7/19/2021	-	-	2.0	-	-	-	-	-
MV-31	7/19/2021	-	-	1.4	-	-	-	-	-
MV-33	7/19/2021	-	-	4.1	-	-	-	-	-
MV-42	7/19/2021	-	-	3.4	-	-	-	-	-
MV-51	7/19/2021	-	-	1.2	-	-	-	-	-
MV-54	7/19/2021	-	-	2.1	-	-	-	-	-
MV-64	8/23/2021	-	-	3.5	-	-	-	-	-

Samples were filtered in the field unless otherwise noted.
Data qualifiers: U = undetected, J = estimate, R = rejected, "<" = less than detection limit, "+" or "-" after a J means that the estimated result is biased high or low, respectively.
"-" = not analyzed.
Note 1. Lab was not able to analyze for trace metals due to sample matrix interference.

Table 19. Dissolved nutrient concentrations (mg/L) in water samples, third quarter, 2021.

Sample Location	Sample Date	Nitrate + Nitrite*		Total Phosphorus	
Aquifer Samples					
Facility					
Test Area North					
TAN-2336	07/21/2021	0.0[3]	U	2.9[1]	
TAN-44	07/21/2021	1.9[3]		-	-
Distant					
MV-02A	7/19/2021	1.3[3]		-	-
MV-14	7/19/2021	2.3[3]		-	-
MV-26	7/19/2021	1.2		-	-
MV-31	7/19/2021	1.2		-	-
MV-33	7/19/2021	0.53		-	-
MV-42	7/19/2021	2.6[3]		-	-
MV-51	7/19/2021	2.6[3]		-	-
MV-54	7/19/2021	5.9[2]		-	-
MV-64	8/23/2021	0.52		-	-

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

* As N.
"-" = not analyzed.
Note 1. Lab indicated that a 1:10 dilution of this sample was required for this analyte. Note 2. Lab indicated that a 1:5 dilution of this sample was required for this analyte. Note 3. Lab indicated that a 1:2 dilution of this sample was required for this analyte.

Table 20. Volatile organic compound concentrations (µg/L) in water samples, third 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															
Test Area North															
TAN-2336	07/21/2021	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5		<0.5	U	<0.5	U
TAN-44	07/21/2021	3.26		32.4		<0.5	U	0.99		<0.5	U	<0.5	U	<0.5	U

Table 20 cont. Volatile organic compound concentrations (µg/L) in water samples, third 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													
Test Area North													
TAN-2336	7/21/21	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<10	U
TAN-44	7/21/21	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<10	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.

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 third 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 21**. ^{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 21. Gamma spectroscopy analysis data for milk samples, third 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	07/20/21	1721	142	0.4	2.0	3.4
	08/17/21	1498	131	-0.8	1.8	3.1
	09/14/21	1373	84	-0.6	2.2	3.7
Riverside	07/05/21	1456	87	1.2	1.7	2.8
	08/02/21	1417	126	0.7	1.9	3.1
Verification Samples[1]						
Terreton	07/06/21	1390	114	-0.2	1.6	2.7
Minidoka	07/06/21	1740	144	-2.9	3.0	5.1
Rigby	08/02/21	1775	100	-0.5	1.2	2.1
Dietrich	08/03/21	1489	89	0.4	1.7	2.9
Minidoka	09/07/21	1430	116	0.4	1.5	2.5
Howe	09/07/21	1373	84	0.0	1.0	1.6

[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 third 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 third quarter of 2021, DEQ-INL OP submitted 58 QC samples for various radiological and non-radiological analyses (**Table 22**).

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 third quarter of 2021 are presented in **Table 23**. Blank sample results for select gamma emitters in air from TSP filters composited for the quarter are presented in **Table 24**. Data for blank analyses used to assess data quality for tritium in water vapor in air are presented in **Table 25**. Blank sample results for radiological analytes in groundwater are presented in **Table 26**.

[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).

The TSP blank gross beta result for the week of 7/7-7/14/21 minimally exceeded the MDC. The associated TSP field results for that week were all greater than 30x the blank value and were not qualified. All other blank sample results passed acceptance criteria in the third 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

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

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

For non-radiological analyses, the RPD is used to evaluate duplicate sample pairs in which both results exceed five times the 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 27**. Duplicate results for metals, common ions and nutrients, and VOCs in groundwater are presented in **Tables 28, 29,** and **30.**

The gross beta duplicate results for MV-64 failed acceptance criteria, with their absolute difference minimally greater than three times the pooled error of the two results. The other duplicate gross beta results were acceptable. The MV-64 gross beta result was J-flagged as an estimate in the Water Monitoring section. All other duplicate results passed acceptance criteria in the third 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 ± 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).

No spiked water samples were analyzed during the third quarter of 2021.

DEQ-INL OP also prepares additional "spike-like" quality control samples to assess ambient radiation measurement bias. Once per quarter, DEQ-INL OP irradiates a number of 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 ± 25% when compared to the known irradiated quantity. Overall response for each control set is considered acceptable if the average of the three individual results for the set has a percent recovery of 100 ± 25%. The irradiation results for third quarter 2021 are presented in **Table 31**. Real-time pressure correction is used to calculate the net exposure measured by these EIC control sets. Although two individual EIC readings did not pass acceptance criterion, all EIC averages passed the DEQ-INL OP acceptance criterion. A duplicate 30 mR EIC control set was also irradiated, with all results acceptable.

Laboratory QC Issues

There were no laboratory QC issues to report in the third 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 third 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 are considered (usable) estimates.

Qualification of Low Level Sample Results

Sample results >MDC are generally considered detections, with the following exceptions[3] that apply primarily to radionuclide concentrations in water samples:

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 detections and J-flagged as estimates.

Analytical QA/QC Assessment

No issues involving sample chain of custody, sample holding times, and the analysis of blank, duplicate, and spiked samples were observed during the third quarter of 2021 which significantly affected data quality. The ratio of total QC analyses to total field sample analyses of 10.1% is acceptable and 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 third 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 (non-rejected results divided by the total number

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

of field sample results reported) of 88.1% for the third quarter of 2021 is below the acceptable value of 90% for the DEQ-INL OP ESP and is summarized in **Table 22**. The overall data completeness (usable results divided by the total number of field sample results expected) of 86.9% is also below the acceptable value of 90%. These low values are primarily due to insufficient air volumes for valid analyses of 34 TSP filters, with those results R-qualified as rejected.

Preventative Maintenance and Equipment Reliability

All equipment was calibrated and checked according to prescribed periodicity. The Experimental Field Station TSP sampler power was off for the entire week of 9/15-9/22/21. The Fort Hall TSP sampler was out of service for repair from 8/25/21 to 9/29/21. Service reliability for air sampling equipment for the third quarter of 2021 is summarized in **Table 32**.

Conclusion

All data collected for the third quarter of 2021 have been assigned the applicable qualifiers to designate the appropriate use of the data. The overall data usability of 88.1% and data completeness of 86.9% are below the acceptable value of 90% for the quarter, with the data otherwise meeting the requirements and data quality objectives established by DEQ-INL OP.

Table 22. Summary of analyses in the third 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	150	13	0	0	34	ISU-EML
		Gross beta	150	13	0	0	34	ISU-EML
		Gamma emitters	12	1	0	0	0	ISU-EML
		Radiochemical	0	0	0	0	0	ISU Sub
Water Vapor	Desiccant column	Tritium	47	2	0	0	0	ISU-EML
Gaseous	Charcoal filter	Iodine-131	13	0	0	0	0	ISU-EML
Precipitation	Poly bottle	Tritium	9	0	0	0	0	ISU-EML
		Gamma emitters	10	0	0	0	0	ISU-EML
Water								
Groundwater & Surface Water	Grab or composite	Gross alpha	11	0	2	0	0	ISU-EML
		Gross beta	11	0	2	0	0	ISU-EML
		Gamma emitters	11	0	2	0	0	ISU-EML
		Tritium	11	0	2	0	0	ISU-EML
		Low-level tritium	11	1	0	0	0	ISU-EML
		Technetium-99	0	0	0	0	0	ISU Sub
		Radiochemical	3	0	1	0	0	ISU Sub
		Metals	11	0	2	0	0	IBL
		Common Ions	11	0	2	0	0	IBL
		Nutrients	11	0	2	0	0	IBL
		Volatile Organics	2	0	1	0	0	IBL
Terrestrial								
Milk	Grab or composite	Gamma emitters	11	0	0	0	0	ISU-EML
Soil	*in situ*	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	67	0	0	12	0	DEQ-INL OP
	EcoGammas	Gamma Radiation	11	NA	NA	NA	0	DEQ-INL OP
Total analyses performed			**573**	**30**	**16**	**12**	**68**	
Total QC analyses performed (blanks, duplicates, and spikes)			**58**					
Ratio of total QC analyses to total sample analyses[3]			**10.1%**					
Data usability[4], percent			**88.1%**					
Data completeness[5], percent			**86.9%**					

[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 23. Blank analysis results for gross alpha and beta in particulate air (TSP), third quarter, 2021.

Collection Period		Corrected volume (m^3)[1]	Gross alpha			Gross beta		
Start	Stop		Value	± 2 SD	MDC	Value	±2 SD	MDC
06/30/21	07/07/21	1750	0.1	0.2	0.3	-0.4	0.5	1.0
07/07/21	07/14/21	1750	-0.1	0.2	0.3	0.9	0.5	0.8
07/14/21	07/21/21	1750	0.0	0.2	0.3	0.3	0.6	0.9
07/21/21	07/28/21	1750	0.0	0.2	0.3	-0.4	0.6	1.0
07/28/21	08/04/21	1750	0.0	0.1	0.2	0.1	0.6	0.9
08/04/21	08/11/21	1750	0.0	0.2	0.4	0.8	0.6	1.0
08/11/21	08/18/21	1750	-0.1	0.2	0.3	-0.2	0.5	0.9
08/18/21	08/25/21	1750	-0.1	0.2	0.3	-0.3	0.6	1.0
08/25/21	09/01/21	1750	0.0	0.2	0.3	-0.1	0.5	0.9
09/01/21	09/08/21	1750	-0.1	0.2	0.3	0.0	0.6	0.9
09/08/21	09/15/21	1750	0.1	0.2	0.3	0.3	0.5	0.9
09/15/21	09/22/21	1750	0.1	0.2	0.3	0.5	0.6	0.9
09/22/21	09/29/21	1750	-0.1	0.2	0.3	0.3	0.5	0.9

Note: Concentrations, associated uncertainties (± 2 SD) and minimum detectable concentrations (MDC) are expressed in 1 x 10^{-3} pCi/m^3.

[1] A volume equal to the average of the 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 24. Blank analysis results for gamma spectroscopy for TSP air filters, composite samples, third 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
10/14/2021	23	49	81	-2	95	163	0	10	18

Analysis Date	Cesium-134			Cesium-137		
	Concentration[1]	± 2 SD	MDC	Concentration	± 2 SD	MDC
10/14/2021	2	5	7	0	5	8

Note: Concentrations are expressed in 1 x $10^{-5}$$pCi/m^3$ 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 actually passed through the blank filters.

Table 25. Blank analysis results for tritium in water vapor from air samples, third quarter, 2021.

Sample Number	Start Date	Collection Date	Analysis Date	Tritium		
				Concentration	± 2 SD	MDC
OP213 Sink	07/30/2021	10/22/2021	10/26/2021	0.02	0.09	0.16
OP213 Fridge	07/30/2021	10/22/2021	10/26/2021	-0.07	0.09	0.16

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

Table 26. Blank analysis results (pCi/L) for radiological constituents in water, third quarter, 2021.

Sample Number	Sample Date	Blank Type	Concentration	± 2 SD	MDC	Within Blank Criteria?
Tritium (low-level method)						
211W467	6/24/2021	Field	2	6	10	Yes

MDC = minimum detectable concentration.

Table 27. Duplicate sample results (pCi/L) for radiological constituents in groundwater and/or surface water, third quarter, 2021.

Analysis/Sample Location	Original Sample Number	Concentration	± 2 SD	Duplicate Sample Number	Concentration	± 2 SD	RPD	$\lvert R_1-R_2 \rvert$	$3(S_1^2+S_2^2)^{1/2}$	Within Criteria?
Gross Alpha										
TAN-44	211W558	1.4	1.2	211W565	1.6	1.2	-13	0.2	2.5	Yes
MV-64	211W572	1.3	1.0	211W577	1.0	0.9	26	0.3	2.0	Yes
Gross Beta										
TAN-44	211W558	6.0	1.1	211W565	4.7	1.0	24	1.3	5.7	Yes
MV-64	211W572	2.8	0.9	211W577	4.8	0.9	-53	2.0	1.9	No
Cesium-137										
TAN-44	211W558	-0.2	1.6	211W565	-0.6	1.2	-100	0.4	3.0	Yes
MV-64	211W572	0.6	1.5	211W577	-0.2	1.5	400	0.8	3.2	Yes
Tritium (standard method)										
TAN-44	211W559	550	110	211W566	630	110	-14	80	233	Yes
MV-64	211W573	80	90	211W578	20	90	120	60	191	Yes
U-234										
TAN-44	211W560	1.97	0.43	211W567	1.93	0.44	2	0.04	0.92	Yes
U-235										
TAN-44	211W560	0.055	0.054	211W567	0.095	0.074	-53	0.040	0.151	Yes
U-238										
TAN-44	211W560	0.82	0.23	211W567	0.67	0.21	20	0.15	0.47	Yes

RPD = relative percent difference.

Table 28. Duplicate results for metals (µg/L) in groundwater, third quarter, 2021.

Sample Location	Sample Number	Sample Date	Arsenic	Barium	Chromium	Iron	Lead	Manganese	Selenium	Zinc
TAN-44	211W562	7/21/2021	2	170	3.8	<10	<1.0	0.82 J	-	-
TAN-44	211W569	7/21/2021	2 J	170	3.8	<10	<1.0	0.76 J	-	-
RPD			**0**	**0**	**0**	**0**	**0**	**8**	**-**	**-**
MV-64	211W575	8/23/2021	-	-	3.5	-	-	-	-	-
MV-64	211W580	8/23/2021	-	-	3.3	-	-	-	-	-
RPD					**6**				**-**	**-**

RPD = relative percent difference.
Data qualifier: J = estimate.

Table 29. Duplicate sample results for common ions and nutrients (mg/L) in groundwater, third quarter, 2021.

Sample Location	Sample Number	Sample Date	Calcium	Magnesium	Sodium	Potassium	Fluoride	Chloride	Sulfate	Total Alkalinity†	Total Nitrogen	Total Phosphorus
TAN-44	211W561, 562, 563	7/21/2021	60	16	22	3.3	-	63.3	35.6	156	1.9	-
TAN-44	211W568, 569,570	7/21/2021	60	16	22	3.3	-	63.6	35.6	158	1.9	-
RPD			**0**	**0**	**0**	**0**	**-**	**-0.5**	**0**	**1**	**-1**	**-**
MV-64	211W574, 575, 576	8/23/2021	28	13	17	3.2	-	16.2	27.5	121	0.52	-
MV-64	211W579, 580, 581	8/23/2021	28	13	17	3.2	-	16.2	27.5	120	0.52	-
RPD			**0**	**0**	**0**	**0**	**-**	**0**	**0**	**1**	**0**	**-**

RPD = relative percent difference.

† As $CaCO_3$.

Table 30. Duplicate sample results (µg/L) for VOCs in water, third 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-44	211W564	7/21/2021	3.26	32.4	<0.5	0.99	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
TAN-44	211W571	7/21/2021	3.21	32.4	<0.5	0.99	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
RPD			**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

RPD = relative percent difference.

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

Table 31. Electret ionization chamber (EIC) irradiation results (categorized as spiked samples), third quarter, 2021.

Electret #	Exposure Received		Net Measured Exposure[1]		%R	Within Spec?
	(mR)	Uncertainty (±1 SD, mR)	(mR)	Uncertainty (±1 SD, mR)		
SKR554	40.0	2.0	32.2	1.4	80.4%	Yes
SKR306	40.0	2.0	32.7	1.4	81.8%	Yes
SKR502	40.0	2.0	35.5	1.4	88.7%	Yes
				Triplicate AVG:	**83.6%**	**Yes**
SKR522	30.4	1.5	26.4	1.4	86.8%	Yes
SKR270	30.4	1.5	20.7	1.4	68.1%	No
SKR509	30.4	1.5	25.6	1.4	84.1%	Yes
				Triplicate AVG:	**79.7%**	**Yes**
SKR489	30.9	1.6	27.1	1.4	87.9%	Yes
SKR259	30.9	1.6	24.1	1.3	78.1%	Yes
SKR543	30.9	1.6	24.3	1.4	78.8%	Yes
				Triplicate AVG:	**81.6%**	**Yes**
SKR489	19.8	1.0	17.6	1.4	89.1%	Yes
SKR259	19.8	1.0	13.7	1.3	69.4%	No
SKR543	19.8	1.0	19.8	1.4	72.4%	Yes
				Triplicate AVG:	**77.0%**	**Yes**

Note: A percent recovery (%R) of 100 ± 25 is considered acceptable.
[1] Net measured exposure estimate includes a correction for atmospheric pressure.

Table 32. Air sampling field equipment service reliability (percent operational), third 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	92%	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%
Monteview	100%	100%	100%	100%
Mud Lake	100%	100%	100%	100%
Distant Locations[2]				
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 x 10^{-3} pCi/m^3) for gross alpha and gross beta analyses for TSP filters for all locations, third quarter, 2021.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	±2 SD	Concentration	±2 SD
On-Site Locations						
Big Lost River Rest Area	06/30/21	07/07/21	1.1	0.3	34.1	1.3
	07/07/21	07/14/21[1]	1.3	0.4	26.8	1.4
	07/14/21	07/21/21[1]	1.8	0.4	38.3	1.6
	07/21/21	07/28/21[1]	2.5	0.4	32.8	1.6
	07/28/21	08/04/21[2]	0.6	0.3	5.8	1.1
	08/04/21	08/11/21[2]	0.4	0.4	6.2	1.1
	08/11/21	08/18/21[3]	1.2	0.4	13.9	1.4
	08/20/21	08/25/21[4]	R	R	R	R
	08/25/21	09/01/21[1]	3.4	0.6	52.1	2.1
	09/01/21	09/08/21[1]	3.0	0.6	57.5	2.4
	09/08/21	09/15/21	2.8	0.5	54.8	2.1
	09/15/21	09/22/21[2]	2.0	0.4	31.5	1.4
	09/22/21	09/29/21	1.6	0.4	48.9	2.0
Experimental Field Station	06/30/21	07/07/21	2.3	0.4	47.9	1.8
	07/07/21	07/14/21[5]	R	R	R	R
	07/14/21	07/21/21[5]	R	R	R	R
	07/21/21	07/28/21[1]	4.1	0.7	52.5	2.4
	07/28/21	08/04/21[2]	3.6	0.8	56.9	3.0
	08/04/21	08/11/21[3]	4.0	0.8	51.0	2.7
	08/11/21	08/18/21[5]	R	R	R	R
	08/18/21	08/25/21[1]	2.6	0.5	31.5	1.9
	08/25/21	09/01/21[3]	2.5	0.5	33.5	1.7
	09/01/21	09/08/21[3]	2.4	0.5	39.5	2.0
	09/08/21	09/15/21[5]	R	R	R	R
	09/15/21	09/22/21[7]	NS	NS	NS	NS
	09/22/21	09/29/21[3]	1.8	0.3	18.4	1.0
Sand Dunes Tower	06/30/21	07/07/21[5]	R	R	R	R
	07/07/21	07/14/21[5]	R	R	R	R
	07/14/21	07/21/21[5]	R	R	R	R
	07/21/21	07/28/21[1]	3.6	0.5	46.3	1.9
	07/28/21	08/04/21	2.3	0.5	42.8	2.0
	08/04/21	08/11/21[6]	R	R	R	R
	08/11/21	08/18/21[6]	R	R	R	R
	08/18/21	08/25/21[1]	1.8	0.4	27.8	1.7
	08/25/21	09/01/21[1]	2.7	0.5	39.0	1.9
	09/01/21	09/08/21[6]	R	R	R	R
	09/08/21	09/15/21	1.9	0.4	50.2	2.0
	09/15/21	09/22/21[2]	1.8	0.5	34.1	1.9
	09/22/21	09/29/21[2]	0.8	0.4	40.5	2.1

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

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	±2 SD	Concentration	±2 SD
Van Buren Avenue	06/30/21	07/07/21[2]	1.3	0.4	41.7	1.9
	07/07/21	07/14/21[2]	3.2	0.6	50.8	2.1
	07/14/21	07/21/21[2]	3.2	0.6	64.0	2.5
	07/21/21	07/28/21[2]	3.5	0.6	53.9	2.4
	07/28/21	08/04/21[2]	2.6	0.5	47.8	2.2
	08/04/21	08/11/21[2]	2.5	0.6	37.5	2.0
	08/11/21	08/18/21[2]	4.0	0.7	43.7	2.2
	08/20/21	08/25/21[6]	R	R	R	R
	08/25/21	09/01/21[6]	R	R	R	R
	09/01/21	09/08/21[6]	R	R	R	R
	09/08/21	09/15/21[6]	R	R	R	R
	09/15/21	09/22/21[6]	R	R	R	R
	09/22/21	09/29/21[6]	R	R	R	R
Boundary Locations						
Atomic City	06/30/21	07/07/21	1.4	0.3	41.6	1.4
	07/07/21	07/14/21[2]	2.4	0.7	48.7	2.8
	07/14/21	07/21/21[5]	R	R	R	R
	07/21/21	07/28/21[2]	3.6	0.6	48.7	2.3
	07/28/21	08/04/21[2]	2.3	0.5	41.3	2.1
	08/04/21	08/11/21[1]	2.9	0.6	43.9	2.0
	08/11/21	08/18/21[5]	R	R	R	R
	08/18/21	08/25/21[1]	2.2	0.5	36.7	2.0
	08/25/21	09/01/21[1]	3.3	0.6	46.2	2.0
	09/01/21	09/08/21[1]	3.2	0.7	50.3	2.5
	09/08/21	09/15/21	3.0	0.7	54.0	2.7
	09/15/21	09/22/21[2]	1.9	0.5	34.0	2.0
	09/22/21	09/29/21[2]	1.2	0.5	47.4	2.4
Howe	06/30/21	07/07/21	1.6	0.3	41.8	1.4
	07/07/21	07/14/21[1]	2.2	0.6	50.1	2.3
	07/14/21	07/21/21[1]	2.4	0.6	52.8	2.5
	07/21/21	07/28/21[1]	1.6	0.3	25.7	1.2
	07/28/21	08/04/21[5]	R	R	R	R
	08/04/21	08/11/21	2.0	0.5	39.1	1.9
	08/11/21	08/18/21	4.5	0.7	42.4	2.0
	08/18/21	08/25/21[1]	2.8	0.6	31.8	2.1
	08/25/21	09/01/21	2.5	0.5	43.0	2.0
	09/01/21	09/08/21[1]	4.8	0.7	45.9	2.1
	09/08/21	09/15/21	3.1	0.5	56.6	2.1
	09/15/21	09/22/21[2]	1.7	0.4	29.6	1.5
	09/22/21	09/29/21	2.0	0.5	42.9	1.9

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

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	±2 SD	Concentration	±2 SD
Monteview	06/30/21	07/07/21[2]	1.2	0.3	41.4	1.5
	07/07/21	07/14/21[3]	2.7	0.5	42.8	1.8
	07/14/21	07/21/21[2]	2.5	0.4	51.7	1.7
	07/21/21	07/28/21[1]	2.6	0.4	37.6	1.5
	07/28/21	08/04/21[6]	R	R	R	R
	08/04/21	08/11/21[2]	1.5	0.5	38.8	2.0
	08/11/21	08/18/21[2]	3.7	0.6	41.0	2.1
	08/18/21	08/25/21[3]	2.6	0.6	32.9	2.0
	08/25/21	09/01/21[3]	2.8	0.6	43.9	2.1
	09/01/21	09/08/21[2]	3.9	0.7	53.8	2.3
	09/08/21	09/15/21[2]	3.1	0.5	51.1	2.2
	09/15/21	09/22/21[2]	2.7	0.5	33.5	1.8
	09/22/21	09/29/21[2]	1.7	0.5	39.3	1.9
Mud Lake	06/30/21	07/07/21[2]	1.5	0.3	39.3	1.4
	07/07/21	07/14/21[5]	R	R	R	R
	07/14/21	07/21/21[2]	2.7	0.4	52.8	1.7
	07/21/21	07/28/21[1]	2.2	0.4	38.3	1.4
	07/28/21	08/04/21[2]	2.6	0.5	40.2	2.2
	08/04/21	08/11/21[3]	2.4	0.5	45.8	2.0
	08/11/21	08/18/21[2]	4.1	0.6	39.8	1.7
	08/18/21	08/25/21[5]	R	R	R	R
	08/25/21	09/01/21[5]	R	R	R	R
	09/01/21	09/08/21[3]	3.5	0.6	58.1	2.3
	09/08/21	09/15/21	2.9	0.4	53.5	1.8
	09/15/21	09/22/21	1.8	0.4	29.6	1.4
	09/22/21	09/29/21	2.2	0.4	44.4	1.6
Distant Locations						
Craters of the Moon	06/30/21	07/07/21[2]	0.8	0.3	34.5	1.6
	07/07/21	07/14/21[1]	2.2	0.5	34.4	1.7
	07/14/21	07/21/21[2]	2.2	0.4	52.7	1.8
	07/21/21	07/28/21[1]	1.7	0.3	27.8	1.2
	07/28/21	08/04/21[2]	1.8	0.4	32.6	1.9
	08/04/21	08/11/21[2]	1.7	0.4	32.3	1.6
	08/11/21	08/18/21[1]	2.5	0.4	23.6	1.3
	08/18/21	08/25/21[2]	3.8	0.7	49.2	2.4
	08/25/21	09/01/21[6]	R	R	R	R
	09/01/21	09/08/21[5]	R	R	R	R
	09/08/21	09/15/21[2]	2.0	0.5	46.4	2.2
	09/15/21	09/22/21[2]	1.2	0.5	26.0	2.0
	09/22/21	09/29/21[5]	R	R	R	R

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

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	±2 SD	Concentration	±2 SD
Fort Hall[8]	06/30/21	07/07/21	1.4	0.3	38.5	1.4
	07/07/21	07/14/21[1]	3.4	0.5	45.6	1.7
	07/14/21	07/21/21[5]	R	R	R	R
	07/21/21	07/28/21[1]	2.2	0.5	40.8	1.9
	07/28/21	08/04/21[5]	R	R	R	R
	08/04/21	08/11/21[3]	1.9	0.5	34.2	1.7
	08/11/21	08/18/21	3.8	0.6	37.1	1.8
	08/18/21	08/25/21[4]	R	R	R	R
	08/25/21	09/01/21[10]	NS	NS	NS	NS
	09/01/21	09/08/21[10]	NS	NS	NS	NS
	09/08/21	09/15/21[10]	NS	NS	NS	NS
	09/15/21	09/22/21[10]	NS	NS	NS	NS
	09/22/21	09/29/21[10]	NS	NS	NS	NS
Idaho Falls	06/30/21	07/07/21	1.1	0.3	34.5	1.3
	07/07/21	07/14/21[1]	2.6	0.5	36.6	1.6
	07/14/21	07/21/21	2.3	0.5	35.8	1.7
	07/21/21	07/28/21	2.0	0.4	36.9	1.5
	07/28/21	08/04/21	1.8	0.4	31.4	1.5
	08/04/21	08/11/21	1.8	0.4	33.2	1.6
	08/11/21	08/18/21[1]	3.1	0.5	32.9	1.5
	08/18/21	08/25/21[2]	3.7	0.7	49.3	2.5
	08/25/21	09/01/21[6]	R	R	R	R
	09/01/21	09/08/21[2]	3.6	0.6	48.5	2.0
	09/08/21	09/15/21	1.6	0.4	38.1	1.6
	09/15/21	09/22/21[2]	1.6	0.4	25.9	1.4
	09/22/21	09/29/21	1.3	0.4	30.9	1.5
Idaho Falls Duplicates	06/30/21	07/07/21	0.9	0.2	31.2	1.2
	07/07/21	07/14/21[1]	2.7	0.5	38.6	1.7
	07/14/21	07/21/21[5]	R	R	R	R
	07/21/21	07/28/21[1]	2.0	0.5	35.8	2.0
	07/28/21	08/04/21	1.5	0.4	35.0	1.8
	08/04/21	08/11/21[5]	R	R	R	R
	08/11/21	08/18/21[5]	R	R	R	R
	08/18/21	08/25/21[9]	2.0	0.8	31.9	2.9
	08/25/21	09/01/21[9]	2.3	0.6	42.7	2.3
	09/01/21	09/08/21[9]	2.5	0.6	47.1	2.4
	09/08/21	09/15/21[9]	1.7	0.5	41.4	2.2
	09/15/21	09/22/21[9]	1.3	0.5	24.3	2.0
	09/22/21	09/29/21[9]	1.1	0.6	28.9	2.0

[1]Partial sample. Motor was off upon arrival. Results are considered (usable) estimates.
[2]Estimated volume. Results are considered (usable) estimates.
[3] Partial sample. Motor was off upon arrival. Estimated volume. Results are considered (usable) estimates.
[4]Partial sample due to mechanical failure. Results are rejected (R) due to insufficient sample volume for a valid analysis.
[5]Partial sample. Motor was off upon arrival. Insufficient sample volume for valid analysis. Results are rejected – R.
[6]Insufficient sample volume for a valid analysis. Results are rejected – R.
[7]No sample – NS. Power was off for entire sampling period.
[8]Operated by Shoshone-Bannock Tribes.
[9]Four inch diameter punch taken from an 8 x 10 inch sampler filter.
[10]No sample – NS. Sampler was out of service for repair.

Appendix B

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

Sample Location	Net Corrected Exposure Rate (µR/hr)[1]	± 2 SD (µR/hr)
Arco	12.6	0.3
Craters of the Moon	15.4	2.8
Big Lost River Rest Area	14.8	3.9
Van Buren Avenue	12.6	1.0
Experimental Field Station	12.6	3.5
Main Gate	14.5	1.9
Atomic City	14.3	4.1
Taber	11.5	2.9
Blackfoot	13.3, 14.8	-
Ft. Hall	14.5	2.1
Idaho Falls	10.1	5.6
Mud Lake/ Terreton	14.7	2.7
Monteview	13.1	2.2
Sand Dunes	12.6	1.7
Howe Met. Tower	11.8	2.2
MP282 -20	14.3	3.7
MP280 -20	11.0	5.0
MP278 -20	12.6, 14.3	-
MP276 -20	15.7	1.9
MP274 -20	12.0	1.3
MP272 -20	11.6, 12.5	-
MP270 -20	12.7	4.1
MP268 -20	11.8	2.4
MP266 -20	14.8	4.3
MP264 -20	15.5, 20.9	-
MP270 -20/26	19.0	1.3
MP268 -20/26	13.3	3.2
MP266 -20/26	14.3	3.4
MP263 -20/26	15.9	2.2
MP261 -20/26	16.1, 18.8	-
MP259 -20/26	10.0	1.5
MP256 -20/26	12.0	3.9
MFC (EBR II)	12.3	3.2
EBR I	14.1	3.8
RWMC	12.0, 12.1	-
CFA	13.1	4.3
CITRC (PBF)	15.3	2.1
INTEC	17.3	4.2
ATR (TRA)	12.3	5.4
NRF	13.4	2.2
TAN/SMC	12.2, 12.8	-
Mud Lake Bank of Commerce	13.1	2.2
MP43-33	16.1, 19.0	-
MP41-33	13.8	2.9
MP39-33	14.8	1.5

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

Sample Location	Net Corrected Exposure Rate (µR/hr)[1]	± 2 SD (µR/hr)
MP37-33	11.9	3.1
MP35-33	12.7	0.9
MP33-33	16.7	4.5
MP31-33	10.7	2.6
MP29-33	14.0	2.7
MP27-33	12.6, 14.0	-
MP25-33	12.5	4.0
MP23-33	21.1, 22.8	-
MP21-33	8.8, 9.8	-
MP19-33	12.6	4.7
MP14-33	10.3	2.3
MP11-33	14.5, 18.8	-
MP06-33	10.7	4.9
MP03-33	11.6	4.8
Base of Howe	13.9	0.8
Rover	13.0	3.1
Hamer	15.3, 17.7	-
Sugar City	16.1	3.1
Roberts	10.9, 12.6	-
Big Southern Butte	14.4	1.5
T4 North	15.8	4.7
T4 South	10.9, 11.6	-

[1]Results 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.

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