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
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
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
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, 2018 (**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. During the 1st quarter of 2018 the HVP-3804 sampler at Idaho Falls air monitoring station failed and was replaced with a newer model HVP-4304 sampler. The second sampler is now being operated as a duplicate. 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 the course of a calendar quarter are analyzed using gamma spectroscopy. Typically, gamma spectroscopy results are only reported when exceeding a minimum detectable activity (MDA) or minimum detectable concentration (MDC). Gamma spectroscopy results for the third quarter of 2018 for TSP filters are presented in **Table 3**. The only reported gamma-emitting radionuclide was beryllium-7, a naturally occurring, cosmogenic radionuclide.

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. 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.

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 values are the result of either a single sample or a weighted mean based upon the volume of air sampled when more than one atmospheric moisture sample was collected during the calendar quarter. Weighted mean atmospheric tritium was below the minimum detectable concentration (MDC) during the third quarter of 2018. There is one individual sample within the weighted mean that exceeded MDC located at the Experimental Field Station sampling site: 1.25 pCi/m^3 (MDC 0.77 pCi/m^3).While this result is above MDC it is still well below the DEQ-INL OP action level of 150 pCi/m^3 (40 CFR 61). Average atmospheric tritium concentrations are presented in **Table 4**.

Precipitation samples were collected at six monitoring locations during the third quarter of 2018. Precipitation samples were analyzed for tritium and 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 gamma-emitting radionuclides were below minimum detectable concentration in precipitation collected during the third quarter of 2018. Tritium and Cesium-137 analysis results are presented in **Table 5**.

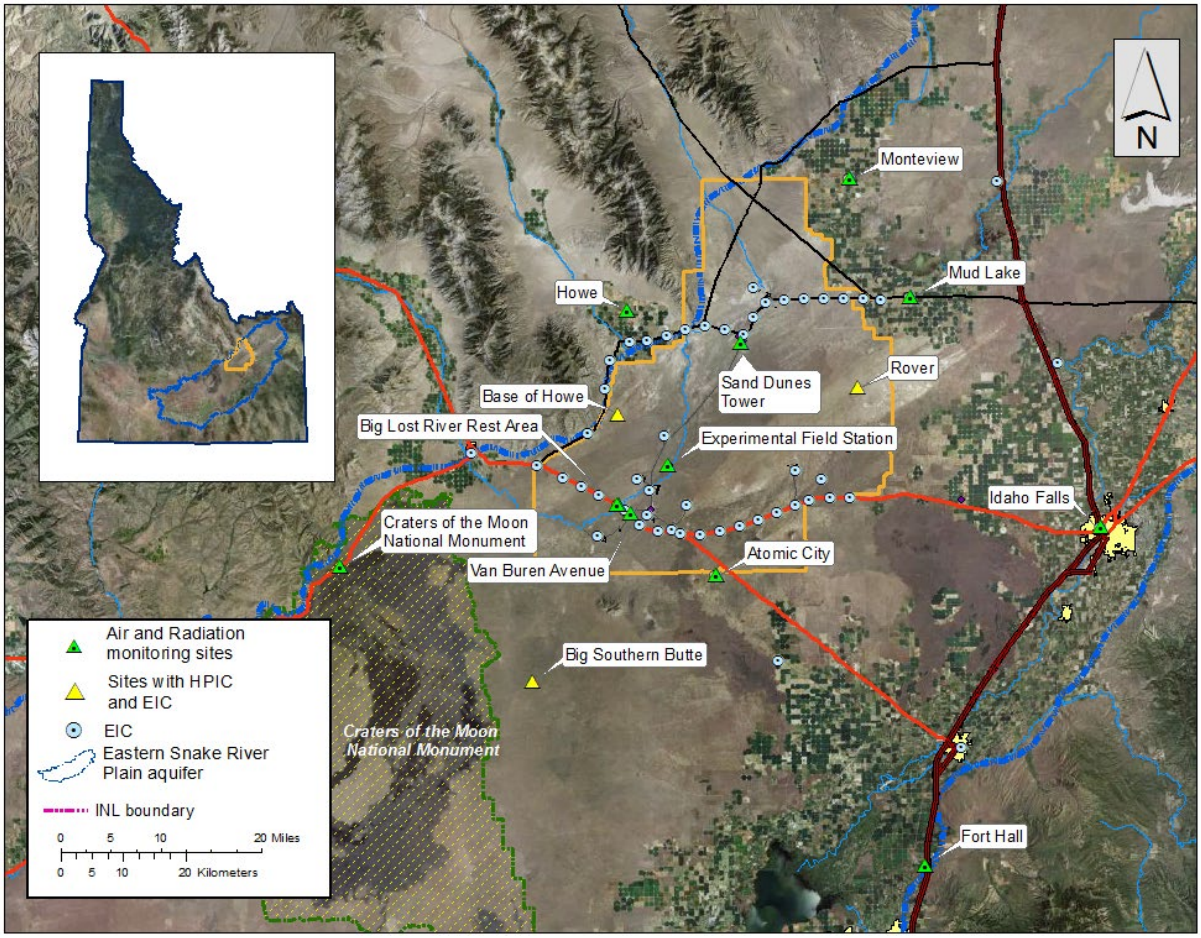

Figure 1. Air and radiation monitoring locations.

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, 2018.

Station Location	Concentration					
	Gross Alpha			Gross Beta		
On-Site Locations						
Big Lost River Rest Area	1.3	-	3.3	31.7	-	49.6
Experimental Field Station	1.1	-	2.6	23.9	-	37.3
Sand Dunes Tower	0.9	-	2.1	23.9	-	33.7
Van Buren Avenue	0.8	-	2.3	19.2	-	33.9
Boundary Locations						
Atomic City	1.4	-	2.2	30.2	-	52.7
Howe	0.7	-	2.1	18.1	-	37.0
Monteview	0.9	-	2.9	26.6	-	40.0
Mud Lake	1.3	-	3.7	29.2	-	48.6
Distant Locations						
Craters of the Moon	0.8	-	2.4	25.5	-	46.3
Fort Hall[1]	1.6	-	4.0	24.3	-	68.1
Idaho Falls – HVP 4304	1.2	-	1.9	27.2	-	52.7
Idaho Falls – HVP 4304[DP]	1.4	-	3.4	29.0	-	41.2

[1]Operated by Shoshone-Bannock Tribes.
[DP]The second HVP-4304 sampler is being run as a duplicate.
Note: Concentrations are expressed in 1 x 10^{-3} pCi/m^3.

Table 3. Gamma spectroscopy analysis data for TSP filters, composite samples, third quarter, 2018.

Station Location	Naturally Occurring Radionuclide Beryllium-7		Man-Made Gamma Emitting Radionuclides	
	Concentration	± 2 SD	Concentration	MDC
On-site Locations				
Big Lost River Rest Area	193.8	10.0	<MDC[2]	
Experimental Field Station	141.0	7.6	<MDC	
Sand Dunes Tower	128.3	6.8	<MDC	
Van Buren Avenue	120.9	6.3	<MDC	
Boundary Locations				
Atomic City	232.9	12.5	<MDC	
Howe	172.8	10.6	<MDC	
Monteview	147.8	7.8	<MDC	
Mud Lake	196.3	10.5	<MDC	
Distant Locations				
Craters of the Moon	156.7	8.4	<MDC	
Fort Hall[1]	221.2	11.4	<MDC	
Idaho Falls – HVP 4304	208.4	11.4	<MDC	
Idaho Falls – HVP 4304[DP]	160.8	8.5	<MDC	

[1]Operated by Shoshone-Bannock Tribes.
[2]MDC for Cs-137 typically (0.05-0.10) x 10^{-3} pCi/m^3.
[DP]The second HVP-4304 sampler is being run as a duplicate.
Note: Concentrations are reported in 1 x 10^{-3} pCi/m^3 with associated uncertainty (± 2 SD) and minimum detectable concentration (MDC).

Table 4. Tritium concentrations in air from atmospheric moisture, third quarter, 2018.

Station Location	Tritium		
	Concentration	± 2 SD	MDC
On-site Locations			
Big Lost River Rest Area	0.53	0.49	0.79
Experimental Field Station	0.67	0.59	0.97
Sand Dunes Tower	0.27	0.48	0.81
Van Buren Avenue	0.31	0.56	0.92
Boundary Locations			
Atomic City	0.19	0.55	0.94
Howe	0.22	0.69	1.17
Mud Lake	0.50	0.64	1.07
Monteview	0.15	0.72	1.23
Distant Locations			
Craters of the Moon	0.10	0.22	0.35
Fort Hall[1]	0.59	0.75	1.22
Idaho Falls	0.01	0.06	0.11

[1]Operated by Shoshone-Bannock Tribes.
Note: Concentrations are reported in pCi/m^3 with associated uncertainty (± 2 SD) and minimum detectable concentration (MDC).

Table 5. Tritium and Cesium-137 concentrations from precipitation, third quarter, 2018.

Station Location	Tritium			Cesium-137		
	Concentration	± 2 SD	MDC	Concentration	± 2 SD	MDC
On-site Locations						
Big Lost River Rest Area	30	110	190	0.3	1.7	2.9
Boundary Locations						
Atomic City	70	110	190	NS[1]	NS[1]	NS[1]
Howe	130	110	190	-0.8	1.5	2.6
Monteview	0	110	190	-0.3	1.6	2.8
Mud Lake	60	110	190	NS[1]	NS[1]	NS[1]
Distant Locations						
Idaho Falls	20	110	190	0.7	1.3	2.2

Note: Concentrations are reported in pCi/L with associated uncertainty (± 2 SD) and minimum detectable concentration (MDC).
[1]NS – Insufficient sample volume to perform gamma spectroscopy for Cs-137.

Environmental Radiation Monitoring Results

The ESP operated 13 environmental radiation stations during the third quarter of 2018 (**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 a high-pressure ion chamber (HPIC) (**Table 6**).

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

HPICs 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 HPICs at each location are radioed to DEQ-INL OP and presented graphically via the worldwide web at http://www.deq.idaho.gov/inl-oversight/monitoring/gamma-radiation-measurements.aspx.

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 7** lists the average radiation exposure rates measured by the HPICs for third quarter 2018. **Table 8** lists the EIC monitoring results for third quarter 2018. Overall exposure rates were within the expected historical range of values observed by DEQ-INL OP for background radiation.

Table 6. 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 7. Average gamma exposure rates, third quarter, 2018, from HPIC* network.

Station Location	Exposure Rate (µR/hr)	
	Quarterly Average	± 2 SD
On-site Locations		
[1]Base of Howe	-	-
Big Lost River Rest Area	12.3	1.4
[1]Rover	-	-
Sand Dunes Tower	13.0	1.4
Boundary Locations		
Atomic City	14.6	1.2
Big Southern Butte	14.5	1.4
Howe Met Tower	12.3	0.9
[1]Monteview	-	-
[1]Mud Lake / Terreton	-	-
Distant Locations		
Fort Hall	12.4	2.4
Idaho Falls	9.5	3.5

[1]No data available for these locations for third quarter 2018 due to electronic malfunctions/failures in instrumentation.
*The HPIC's 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 8. Electret ionization chamber (EIC) cumulative average exposure rates, third quarter, 2018.

Station Location	Exposure Rate (µR/hr)	
	Quarterly Average[1]	± 2 SD
On-Site Locations		
Base of Howe	11.6	2.0
Big Lost River Rest Area	13.8	2.6
Experimental Field Station	14.0	1.8
Rover	13.5	2.7
Sand Dunes Tower	15.7	0.6
Van Buren Avenue	16.4	0.9
Boundary Locations		
Atomic City	12.0	1.0
Big Southern Butte	9.5	1.3
Howe Met Tower	10.3, 11.9	
Monteview	10.3, 13.7	
Mud Lake/Terreton	11.9, 13.0	
Distant Locations		
Craters of the Moon	12.8	1.5
Fort Hall	13.9	3.4
Idaho Falls	12.5	1.7

[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

The DEQ-INL OP collects water samples at sites within and downgradient from the INL in order to identify INL-related impacts to the eastern Snake River Plain aquifer, evaluate trends of known INL contaminants, and verify DOE and USGS monitoring results. Samples are collected from groundwater (wells and springs), surface water (streams), and wastewater, with the vast majority being from groundwater. Most sites sampled by DEQ-INL OP are sampled concurrently with a DOE contractor or the USGS. DEQ-INL OP annually compares its own analytical results with those obtained by co-samplers to evaluate consistency. A summary of this comparison is published in the annual ESP report.

Each water-monitoring site is categorized as upgradient, facility, boundary, distant, surface water, or wastewater depending on its location (**Figure 2** and **Figure 3**). Upgradient sites are situated north and northeast of INL facilities and have not been affected by INL operations. Facility sites are near facility complexes within the INL, including the Idaho Nuclear Technology and Engineering Center (INTEC), the Advanced Test Reactor Complex (ATR), Test Area North (TAN), the Radioactive Waste Management Complex (RWMC), the Central Facilities Area (CFA), the Materials and Fuels Complex (MFC), and the Naval Reactors Facility (NRF). Many facility sites are in areas of known contamination and are sampled to monitor trends of specific contaminants. Boundary sites are on or near the southern boundary of the INL, downgradient of potential sources of INL contamination. Distant sites are farther downgradient of the INL, primarily in the Magic Valley, and include wells and springs used for agricultural, municipal, domestic, and industrial purposes. Surface water and wastewater samples are collected from locations within and upgradient of the INL.

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, gamma-emitting radionuclides, tritium, common ions, trace metals, and nutrients.[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, which has a minimum detectable concentration (MDC) of about 10-14 pCi/L. 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)—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 may be collected and analyzed for specific radionuclides.

During the third quarter of 2018, DEQ-INL OP sampled water at one upgradient location and fifteen distant locations. Analytical results are reported in **Tables 9** through **14** and summarized below.

Gross alpha and gross beta radioactivity were detected at low levels in most samples (**Table 9**). All concentrations were consistent with historical trends, and concentrations at all locations except gross beta for Alpheus Spring were within the range of naturally occurring background concentrations determined from historical DEQ data. The gross beta concentration at Alpheus Spring (8.7 ± 1.1 pCi/L) was slightly above the natural background range typically observed in the aquifer but consistent with previous measurements at this location. No location had a gross alpha concentration that exceeded the EPA drinking water maximum contaminant level (MCL) for alpha particles of 15 pCi/L. The MCL for beta- and gamma-emitters is 4 mrem/year, which is equivalent to 8 pCi/L if the source is ^{90}Sr, 900 pCi/L if ^{99}Tc, 20,000 pCi/L if tritium (^{3}H), or 200 pCi/L if ^{137}Cs. Manmade gamma-emitting nuclides, including ^{137}Cs, were not detected at any location sampled this quarter (**Table 9**).

No locations were sampled for uranium isotopes, plutonium isotopes, ^{90}Sr, ^{99}Tc, or ^{241}Am this quarter. Tritium analyses were completed for all locations using the standard method, which typically has an MDC of about 130 pCi/L. Using the standard method, tritium was not detected at any of the locations sampled this quarter (**Table 10**). All tritium samples collected this quarter will be re-analyzed using the enrichment method at a future date. Enriched-tritium analyses for 15 samples collected in previous quarters were completed and are presented in **Table 11**. Of these, tritium concentrations were elevated above background levels in USGS-120 (near RWMC), ICPP-MON-A-166 (near the INTEC percolation pond), and USGS-125 (downgradient of RWMC along the southern INL boundary). All concentrations are consistent with historical data. A backlog of 43 samples to be analyzed by the enrichment method remains.

Samples from all locations were analyzed for metals, common ions, and nutrients (**Tables 12, 13,** and **14)**. All results were within or near expected ranges based on historical data. Manganese results for two locations—MV-02A and MV-51 were rejected based on an associated blank detection (see Quality Assurance section of this report).

No locations were sampled for VOCs this quarter.

[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 only for gross alpha and gross beta radioactivity, gamma-emitting radionuclides, and tritium during the second and fourth quarters. Samples for common ions, trace metals, and nutrients are collected at these locations during the third quarter.

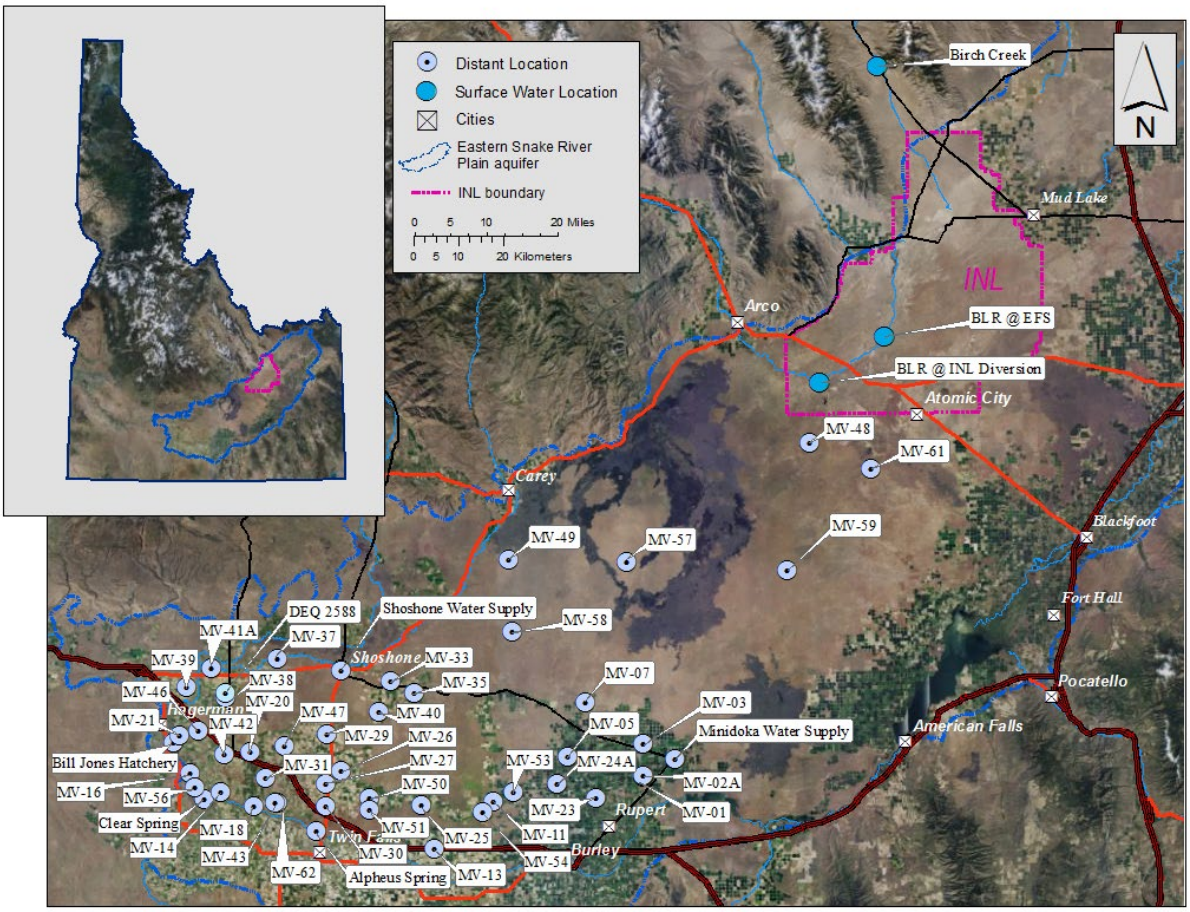

Figure 2. Distant and Surface Water monitoring locations.

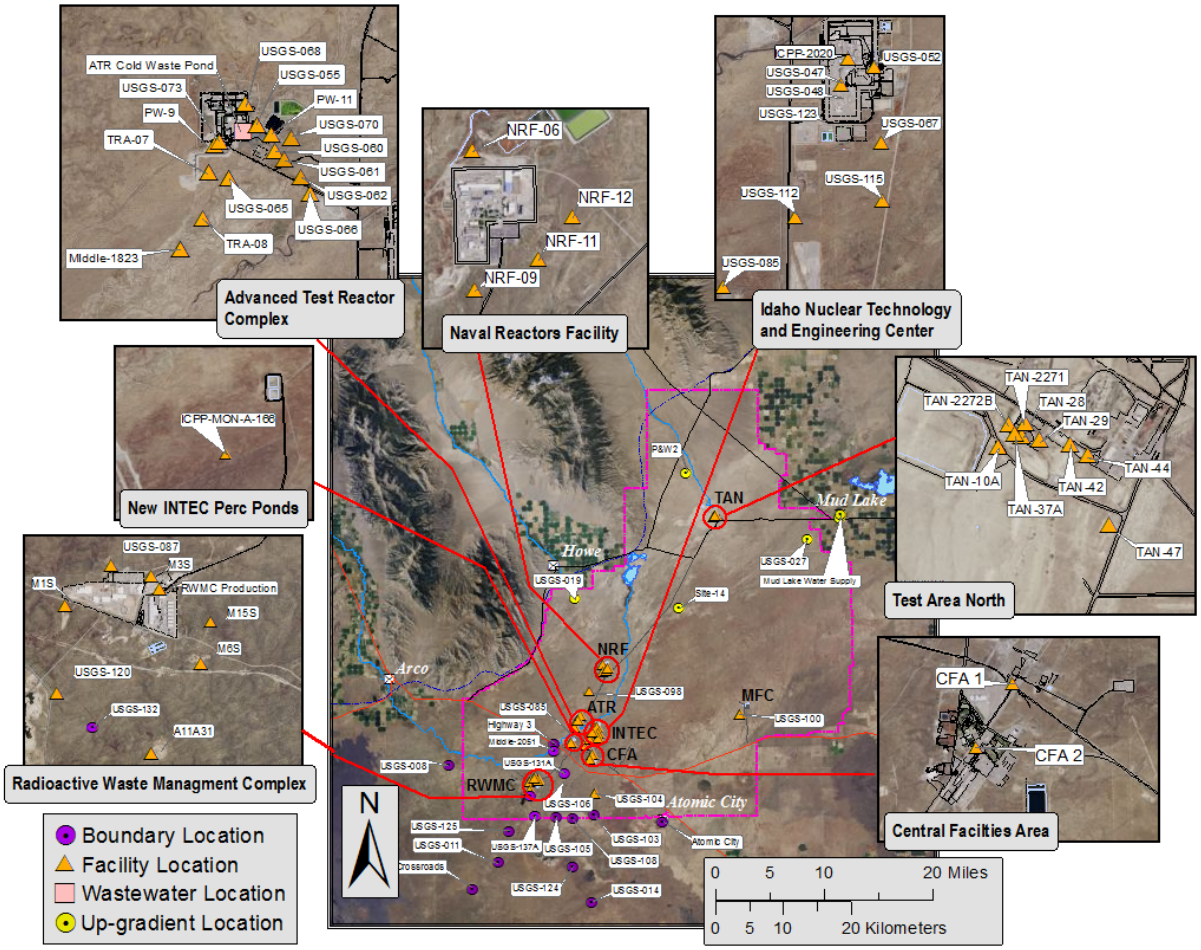

Figure 3. Up-gradient, facility, boundary, and wastewater monitoring locations.

Table 9. Gross alpha, gross beta, and gamma-emitting radionuclide concentrations (pCi/L) for water samples, third quarter, 2018.

Sample Location	Sample Date	Gross Alpha			Gross Beta			Cesium-137		
		Concentration		2 SD	Concentration		2 SD	Concentration		2 SD
Upgradient										
Mud Lake Water Supply	8/9/2018	2.9		1.0	4.9		0.9	-0.7	U	1.1
Distant										
Alpheus Spring	8/8/2018	3.1		1.2	8.7		1.1	0.2	U	1.6
Bill Jones Hatchery	8/8/2018	1.3		0.9	3.9		0.9	0.4	U	1.6
Clear Spring	8/8/2018	2.4		1.0	5.5		1.0	-0.2	U	1.6
Minidoka Water Supply	8/8/2018	1.9		0.9	4.4		1.0	-1.5	U	1.9
MV-02A	7/17/2018	0.8	U	1.0	7.5		1.1	-1.0	U	1.6
MV-14	7/18/2018	2.0		1.2	6.2		1.1	1.2	U	1.7
MV-26	7/17/2018	1.8		1.0	6.0		1.0	-0.1	U	1.5
MV-31	7/18/2018	1.1	U	1.1	6.9		1.1	0.2	U	1.5
MV-33	7/17/2018	1.3		0.8	2.7		0.8	0.6	U	1.3
MV-41A	7/17/2018	3.3		1.4	6.9		1.1	0.3	U	1.4
MV-42	7/18/2018	2.2		1.0	4.7		0.9	-0.4	U	1.6
MV-46	7/18/2018	0.6	U	0.7	3.5		0.8	0.8	U	1.7
MV-51	7/17/2018	1.9		1.1	6.4		1.4	-0.7	U	1.5
MV-54	7/17/2018	3.7		1.4	4.9		1.0	-0.8	U	1.4
Shoshone Water Supply	8/8/2018	0.5	U	0.5	5.0		0.8	0.4	U	1.6

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

Table 10. Tritium concentrations (pCi/L) for water samples, third quarter, 2018.

Sample Location	Sample Date	Tritium		
		Concentration		2 SD
Upgradient				
Mud Lake Water Supply	8/9/2018	-60	U	130
Distant				
Alpheus Spring	8/8/2018	30	U	130
Bill Jones Hatchery	8/8/2018	-30	U	130
Clear Spring	8/8/2018	10	U	130
Minidoka Water Supply	8/8/2018	20	U	130
MV-02A	7/17/2018	70	U	130
MV-14	7/18/2018	60	U	130
MV-26	7/17/2018	40	U	130
MV-31	7/18/2018	90	U	130
MV-33	7/17/2018	20	U	120
MV-41A	7/17/2018	40	U	130
MV-42	7/18/2018	60	U	130
MV-46	7/18/2018	70	U	130
MV-51	7/17/2018	10	U	120
MV-54	7/17/2018	20	U	130
Shoshone Water Supply	8/8/2018	110	U	130

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

Table 11. Enriched tritium concentrations (pCi/L) in water samples collected during various quarters and analyzed in the third quarter of 2018.

Sample Location	Sample Date	Enriched Tritium		
		Concentration		2 SD
Upgradient				
P&W-2	4/2/2018	17		7
USGS-019	4/2/2018	10		5
USGS-027	4/25/2017	0	U	4
USGS-027	4/2/2018	1	U	4
Facility				
ICPP-MON-A-166	4/3/2018	64		8
M1S	11/1/2016	4	U	7
NRF-11	5/9/2017	23		8
USGS-100	4/3/2018	10		6
USGS-120	10/11/2016	133		12
USGS-120	10/11/2017	120		11
Boundary				
Atomic City	4/9/2018	10		5
USGS-125	10/11/2016	34		8
USGS-125	10/11/2017	53		9
Surface Water				
BLR @ EFS	4/4/2018	20		6
BLR @ INL Diversion	4/3/2018	15		5

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

Table 12. Dissolved trace metals concentrations (µg/L) in water samples, third quarter, 2018.

Sample Location	Sample Date	Arsenic		Barium		Chromium		Iron		Lead		Manganese		Selenium		Zinc	
Upgradient																	
Mud Lake Water Supply	8/9/2018	8.5		20		<1.0	U	<10	U	<1.0	U	36		<2.0	U	<5.0	U
Distant																	
Alpheus Spring	8/8/2018	2.6		82		1.5		<10	U	<1.0	U	<1.0	U	<2.0	U	<5.0	U
Bill Jones Hatchery	8/8/2018	2.2		22		3.3		<10	U	<1.0	U	<1.0	U	<2.0	U	<5.0	U
Clear Spring	8/8/2018	2.3		37		2.5		<10	U	<1.0	U	<1.0	U	<2.0	U	<5.0	U
Minidoka Water Supply	8/8/2018	<2.0	U	37		1.9		<10	U	<1.0	U	<1.0	U	<2.0	U	34	
MV-02A	7/17/2018	2.6		69		1.1		17		<1.0	U	12	R	<2.0	U	86	
MV-14	7/18/2018	2.3		49		2.3		<10	U	<1.0	U	<1.0	U	<2.0	U	<5.0	U
MV-26	7/17/2018	2.2		29		2.2		<10	U	<1.0	U	<1.0	U	<2.0	U	<5.0	U
MV-31	7/18/2018	2.2		56		2.2		<10	U	<1.0	U	<1.0	U	<2.0	U	<5.0	U
MV-33	7/17/2018	2.3		14		3.6		<10	U	<1.0	U	<1.0	U	<2.0	U	140	
MV-41A	7/17/2018	2.6		66		1.7		26		<1.0	U	<1.0	U	<2.0	U	75	
MV-42	7/18/2018	2.6		28		3.2		<10	U	<1.0	U	<1.0	U	<2.0	U	15	
MV-46	7/18/2018	2.0		18		3.9		<10	U	<1.0	U	<1.0	U	<2.0	U	<5.0	U
MV-51	7/17/2018	2.2		64		1.4		39		<1.0	U	2.0	R	<2.0	U	65	
MV-54	7/17/2018	2.3		100		2.1		<10	U	<1.0	U	<1.0	U	<2.0	U	150	
Shoshone Water Supply	8/8/2018	<2.0	U	41		2.0		<10	U	<1.0	U	<1.0	U	<2.0	U	6.5	

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.

Table 13. Common ion concentrations (mg/L) in water samples, third quarter, 2018.

Sample Location	Sample Date	Calcium*		Magnesium*		Sodium*		Potassium*		Fluoride		Chloride		Sulfate		Alkalinity†	
Upgradient																	
Mud Lake Water Supply	8/9/2018	8.9		2.8		30		4.8		0.531		4.68		8.21		93	
Distant																	
Alpheus Spring	8/8/2018	56		20		34		6.4		0.332		43.9		56.5		186	
Bill Jones Hatchery	8/8/2018	31		16		17		3.5		0.376		11.1		26.5		140	
Clear Spring	8/8/2018	44		19		25		4.1		0.513		34.1		46.2		152	
Minidoka Water Supply	8/8/2018	48		17		21		3.5		0.551		33.6		43.5		144	
MV-02A	7/17/2018	50		19		32		5.9		0.481		43.4		51.8		172	
MV-14	7/18/2018	51		21		30		4.5		0.515		42.5		58.7		166	
MV-26	7/17/2018	40		16		22		3.7		0.564		27.0		42.0		144	
MV-31	7/18/2018	55		21		32		4.7		0.470		45.9		61.4		173	
MV-33	7/17/2018	25		14		13		3.0		0.418		7.59		20.6		122	
MV-41A	7/17/2018	57		24		30		4.1		0.369		24.5		52.5		224	
MV-42	7/18/2018	39		20		21		3.8		0.413		19.1		38.6		164	
MV-46	7/18/2018	27		13		14		3.2		0.379		8.61		21.9		124	
MV-51	7/17/2018	57		23		38		5.5		0.420		43.9		65.0		200	
MV-54	7/17/2018	73		28		46		6.6		0.359		68.4		84.4		213	
Shoshone Water Supply	8/8/2018	45		14		14		2.8		0.220		6.73		17.9		174	

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.
* Sample was filtered in the field.
† As $CaCO_3$.

Table 14. Dissolved nutrient concentrations (mg/L) in water samples, third quarter, 2018.

Sample Location	Sample Date	Nitrate + Nitrite		Phosphorus	
Upgradient					
Mud Lake Water Supply	8/9/2018	<0.01	U	0.041	
Distant					
Alpheus Spring	8/8/2018	2.2		0.023	
Bill Jones Hatchery	8/8/2018	1.5		0.021	
Clear Spring	8/8/2018	1.9		0.029	
Minidoka Water Supply	8/8/2018	1.2		0.016	
MV-02A	7/17/2018	1.2		0.019	
MV-14	7/18/2018	2.5		0.025	
MV-26	7/17/2018	0.94		0.019	
MV-31	7/18/2018	2.2		0.022	
MV-33	7/17/2018	0.54		0.020	
MV-41A	7/17/2018	3.1		0.073	
MV-42	7/18/2018	2.8		0.036	
MV-46	7/18/2018	0.68		0.020	
MV-51	7/17/2018	2.6		0.048	
MV-54	7/17/2018	5.5		0.028	
Shoshone Water Supply	8/8/2018	1.4		0.033	

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.

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 during the third calendar quarter of 2018.

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 15**. ^{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 15. Gamma spectroscopy analysis data for milk samples, third quarter, 2018.

Sample Location/Dairy	Sample Date	Naturally occurring Potassium-40		Man-made Iodine-131[1]
		Concentration[3]	± 2 SD	
Monitoring Samples				
Riverside	07/08/2018	1767	135	<MDC
	08/05/2018	1844	145	<MDC
Gooding/Glanbia	07/19/2018	1513	126	<MDC
	09/10/2018	1393	120	<MDC
Verification Samples[2]				
Terreton	07/02/2018	1422	115	<MDC
Rupert	07/02/2018	1592	132	<MDC
Idaho Falls	08/07/2018	1473	125	<MDC
Dietrich	08/07/2018	1359	117	<MDC
Rupert	09/04/2018	1537	128	<MDC
Terreton	09/04/2018	1409	103	<MDC

[1] <MDC – Less than Minimum Detectable Concentration (approximately 4 pCi/L for iodine-131).
[2] DEQ-INL OP samples collected by the off-site INL environmental surveillance contractor.
[3] Concentrations with associated uncertainties (±2 SD) are expressed in pCi/L.

Soil

DEQ-INL OP monitors long-term radiological conditions via physical soil sampling as well as field instrumentation capable of identifying and measuring *in-situ* concentrations of gamma-emitting radionuclides in soil. Monitoring concentrations of gamma-emitting radionuclides in surface soil provides some insight to transport, deposition, and accumulation of radioactive material in the environment as a result of INL operations as well as historical above ground testing of nuclear weapons. Twenty four soil samples were collected and prepared in the field at twelve locations (**Figure 4**) during the third calendar quarter of 2018. ^{137}Cs was the only man made gamma emitting radionuclide detected. Analysis results for ^{137}Cs concentrations for physical soil samples are shown in **Table 16.**

Table 16. Gamma spectroscopy analysis results (^{137}Cs) for physical soil sampling, third quarter, 2018.

Location	Sample Type[1]	Sample Depth (cm)	Date Collected	Concentration[2]	±2 SD	MDC
Atomic City	Puck	0 to 5	7/24/2018	0.28	0.06	0.11
Atomic City	Puck	5 to 10	7/24/2018	0.18	0.05	0.08
Blackfoot	Puck	0 to 5	7/24/2018	0.19	0.05	0.09
Blackfoot	Puck	5 to 10	7/24/2018	0.12	0.04	0.09
Butte City	Puck	0 to 5	7/24/2018	0.24	0.05	0.08
Butte City	Puck	5 to 10	7/24/2018	0.06 U[3]	0.03	0.08
Carey	Puck	0 to 5	7/24/2018	0.56	0.09	0.11
Carey	Puck	5 to 10	7/24/2018	0.19	0.06	0.11
FAA Tower	Puck	0 to 5	7/24/2018	0.41	0.08	0.12
FAA Tower	Puck	5 to 10	7/24/2018	0.14	0.05	0.10
Frenchman's Cabin	Puck	0 to 5	7/24/2018	0.27	0.05	0.08
Frenchman's Cabin	Puck	5 to 10	7/24/2018	0.11	0.04	0.06
Howe	Puck	0 to 5	7/23/2018	0.19 J[4]	0.05	0.08
Howe	Puck	5 to 10	7/23/2018	0.29 J[4]	0.06	0.08
Monteview	Puck	0 to 5	7/23/2018	0.32	0.06	0.08
Monteview	Puck	5 to 10	7/23/2018	0.20	0.04	0.07
Mud Lake #1	Puck	0 to 5	7/23/2018	0.16	0.04	0.08
Mud Lake #1	Puck	5 to 10	7/23/2018	0.08	0.03	0.07
Mud Lake #2	Puck	0 to 5	7/23/2018	0.29	0.05	0.08
Mud Lake #2	Puck	5 to 10	7/23/2018	0.16	0.04	0.08
Reno Ranch	Puck	0 to 5	7/23/2018	0.40	0.07	0.09
Reno Ranch	Puck	5 to 10	7/23/2018	0.02 U[3]	0.03	0.07
St. Anthony	Puck	0 to 5	7/23/2018	0.57	0.08	0.10
St. Anthony	Puck	5 to 10	7/23/2018	0.39	0.07	0.10

[1]Soil samples were collected in a "puck" (a cylindrical plastic container with a diameter of 6.5 cm and a height of 2.2 cm) and prepared in the field for gamma spectroscopic analysis at ISU.
[2]Concentrations reported in pCi/g.
[3]U = Non-detection.
[4]J – estimate value. 0 to 5 cm depth historically has higher concentration and 5 to 10 cm lower concentration. Most likely cause of this anomaly is mislabeling of samples by operator this quarter.

The average Cesium-137 value was 0.24 picocuries per gram (pCi/g) with a minimum value of 0.02 pCi/g and a maximum of 0.57 pCi/g, well below the DEQ-INL OP action level of 6.4 pCi/g and the recommended federal screening limit for surface soil of 6.8 pCi/g (NCRP Report 129). Based upon terrestrial radiological measurements of soil and milk, there were no discernable impacts to the off-site environment from INL operations. Long-term accumulation of radionuclides observed by soil monitoring was consistent with historical measurements and was in the range of concentrations expected as a result of historic above-ground testing of nuclear weapons.

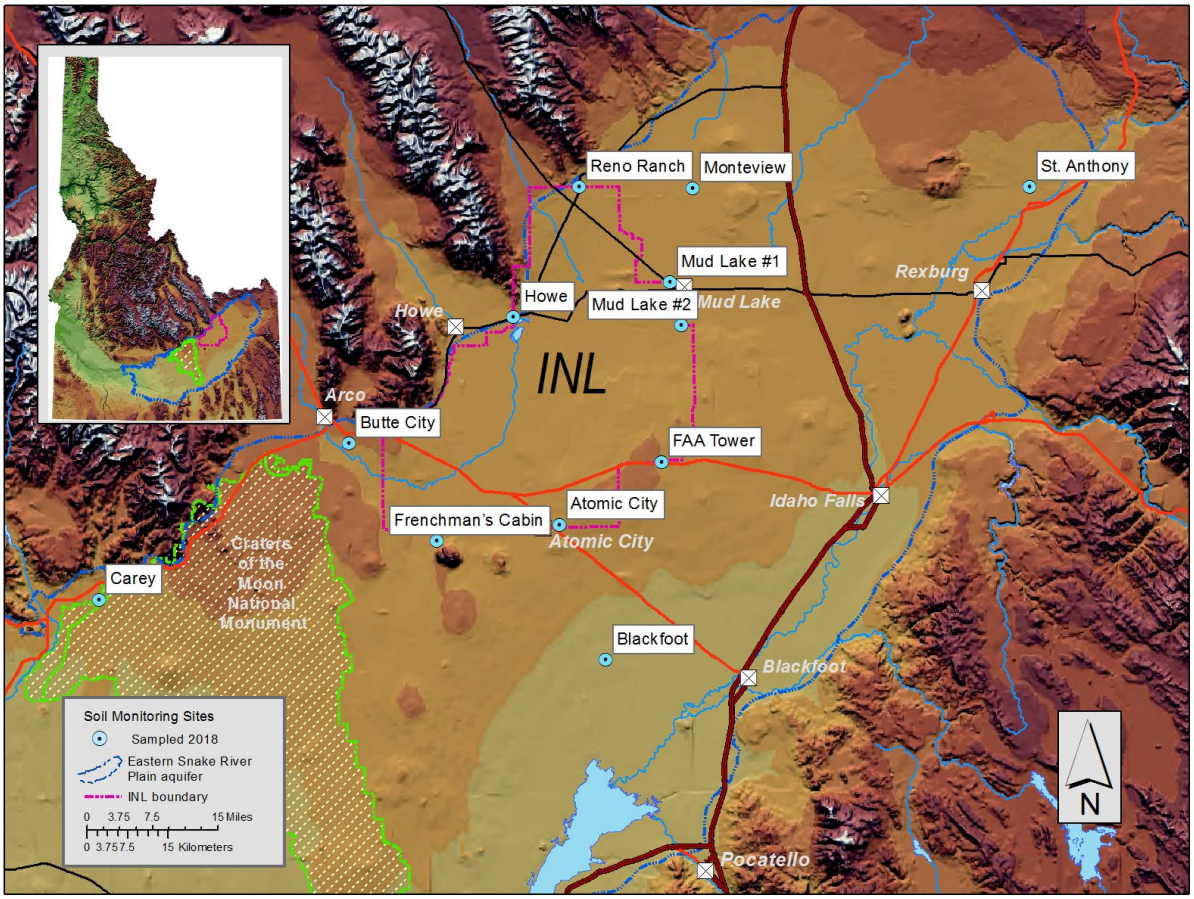

Figure 4. Physical soil monitoring sites.

Quality Assurance

The measurement of any physical quantity is subject to inaccuracy from errors that may be introduced during sample collection, measurement, calibration, and the reading and reporting of results. While all of these inaccuracies cannot be quantified with certainty for each analytical result, a quality assurance program can evaluate the overall quality of a dataset and, in many cases, identify and address errors or inaccuracies. The DEQ-INL OP quality assurance program is designed to (1) ensure sample integrity, (2) ensure precision and accuracy in the analytical results, and (3) ensure that the environmental data are representative and complete.

This section summarizes the results of the quality assurance (QA) assessment of the data collected for the third quarter of 2018 for the DEQ-INL OP's ESP (Environmental Surveillance Program). It also summarizes the quality control (QC) samples (spikes, blanks, and duplicates) submitted to the Idaho Bureau of Laboratories-Boise (IBL) for non-radiological analyses and to Idaho State University's Environmental Monitoring Laboratory (ISU-EML) for radiological analyses during the quarter. All analyses and QC measures at the analytical laboratories used by the ESP are performed in accordance with approved written procedures maintained by each respective analytical laboratory. Sample collection is performed in accordance with written procedures maintained by the DEQ-INL OP.

Analytical results for blanks, duplicates, and spikes are used to assess the representativeness, precision, and accuracy of results from analyzing laboratories. During the third quarter of 2018, the DEQ-INL OP submitted 70 QC samples for various radiological and non-radiological analyses (**Table 17**).

Blank Samples

Blank samples consist of matrices that have negligible, acceptably low, or immeasurable amounts of the analyte(s) of interest in them. They are used to monitor for contamination introduced during sample collection, storage, shipment, and analysis.

For all analyses except enriched tritium in water, a blank sample result is considered acceptable if it is less than or equal to the minimum detectable concentration (MDC). For enriched tritium analyses in water samples, a blank sample result is acceptable if it is less than or equal to 30 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.

Blank sample results submitted for gross alpha and gross beta screening in air for the third quarter of 2018 are presented in **Table 18**. Blank sample results for select gamma emitters in air from composited air filters are presented in **Table 19**. Data for blank analyses used to assess data quality for tritium in water vapor in air are presented in **Table 20**. Blank analyses results for radiological and non-radiological analytes in groundwater are presented in **Tables 21, 22,** and **23**.

Low levels of barium and manganese were detected in the one blank water sample analyzed this quarter. All water samples analyzed for barium on the same date as the blank had barium concentrations greater than ten times the concentration measured in the blank; therefore, no barium results were qualified as a result of this detection. Samples from two locations analyzed for manganese on the same date as the blank—MV-02A and MV-51—had manganese concentrations above the detection limit and less than or equal to the concentration measured in the blank. Manganese results reported in this quarter for both locations have been rejected (R) based on the blank detection.

[2] Cosmogenic tritium and tritium produced by above-ground testing of nuclear weapons during the 20th century occur at measureable concentrations in the water used by DEQ-INL OP to create blank samples. The highest tritium concentration that DEQ considers acceptable in a blank is calculated as the mean tritium concentration in DEQ blanks from 2012 to 2016 plus two standard deviations.

All other blank sample results passed acceptance criteria in the third quarter of 2018.

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 acceptable 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 of the sample results is less than five times the MDC, the results are in acceptable agreement if their absolute difference is less than or equal to the MDC.

Duplicate results for water samples are presented in **Table 24** for radiological analyses and **Table 25** and **Table 26** for non-radiological analyses. Duplicate results for radiological analyses of physical soil samples are presented in **Table 27.** All duplicate samples passed acceptance criteria in the third quarter of 2018.

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 acceptable 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 are qualified as low-biased estimates (J-), and below-MDC results are qualified as undetected estimates (UJ). If the percent recovery of a spiked sample is 126-150%, above-MDC results of associated samples are qualified as high-biased estimates (J+), and below-MDC results are qualified as undetected (U). If the percent recovery of a spiked sample is <50% or >150%, the results of all associated samples are 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 samples were analyzed during the third quarter of 2018.

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. The irradiation results for third quarter 2018 are presented in **Table 28**. 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 to report in the third quarter of 2018.

Analytical QA/QC Assessment

Other than those listed above, 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 2018 which significantly affected data quality. Methodologies and data reports issued by the contracting laboratories generally conformed to the requirements of DEQ-INL OP during the third quarter of 2018.

Data usability is the measure of field sample results that are not rejected divided by the total field sample results obtained. The overall data usability rate of 88.7% for the third quarter of 2018 is slightly below the acceptable value of 90% for the DEQ-INL OP ESP, and is summarized in **Table 17**. The low usability rate was primarily caused by 68 TSP filter results being rejected due to insufficient air sample volume. Fifty-four of the 68 filter data rejections were a result of excessive filter loading from wildfires. (See **Appendix A**.) The overall data completeness (non-qualified results divided by total field sample results expected) of 87.5% was also low, due primarily to the same cause. No corrective action is indicated since excessive filter loadings due to wildfires are unavoidable.

Preventative Maintenance and Equipment Reliability

All equipment was calibrated and checked according to prescribed periodicity. During the third quarter of 2018 the radioiodine pump and TSP blower were replaced at the Big Lost River Rest Area sampling station. Service reliability for air sampling equipment for the third quarter of 2018 is summarized in **Table 29**.

Conclusion

All data collected for the third quarter of 2018 have been verified and assigned the applicable qualifiers to designate the appropriate use of the data. Overall data usability of 88.7% and data completeness of 87.5% are somewhat low for the quarter, with the data otherwise meeting the requirements and data quality objectives established by DEQ-INL OP.

Table 17. Summary of the analytical performance and usability of the analyses performed for the DEQ-INL OP ESP, third quarter, 2018.

Media Sampled	Collection Device	Analyte	Test Analyses	Blank Analyses	Duplicate Analyses	Spike Analyses	Data Rejected[1]	Analyzing Lab[2]
Air								
Particulate	4-inch filter	Gross alpha	156	13	0	0	34	ISU-EML
		Gross beta	156	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	37	3	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	4	0	0	0	0	ISU-EML
Water								
Groundwater & Surface Water	Grab or composite	Gross alpha	16	1	2	0	0	ISU-EML
		Gross beta	16	1	2	0	0	ISU-EML
		Gamma emitters	16	1	2	0	0	ISU-EML
		Tritium	16	1	2	0	0	ISU-EML
		Enriched tritium	15	1	1	0	0	ISU-EML
		Technetium-99	0	0	0	0	0	ISU-EML
		Radiochemical	0	0	0	0	0	ISU Sub
		Metals	16	1	2	0	2	IBL
		Common Ions	16	1	2	0	0	IBL
		Nutrients	16	1	2	0	0	IBL
		Volatile Organics	0	0	0	0	0	IBL
Terrestrial								
Milk	Grab or composite	Gamma emitters	10	0	0	0	0	ISU-EML
Soil	*in situ*	Gamma emitters	0	0	0	0	0	DEQ-INL OP
	Grab – "puck"	Gamma emitters	24	0	8	0	0	ISU-EML
Radiation								
Ambient	EICs	Gamma Radiation	67	0	0	9	0	DEQ-INL OP
	HPICs	Gamma Radiation	7	NA	NA	NA	0	DEQ-INL OP
Total Analyses			**619**	**38**	**23**	**9**	**70**	
Total QC Analyses (blanks, duplicates, and spikes)			**70**					
QC Analyses as a percentage of total Test Analyses[3]			**11.3%**					
Percentage of usable data[4]			**88.7%**					

[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] Analyzing quality control samples at a rate of approximately 5 to 10 percent of the total number of test analyses performed for the year is deemed appropriate for the DEQ-INL OP ESP.
[4] Data usability rate [total analyses – rejected data]/[total analyses] of 90 percent or higher is acceptable for the DEQ-INL OP ESP.

Table 18. Blank analysis results for gross alpha and beta in particulate air (TSP), third quarter, 2018.

Collection Period		Corrected volume (m^3)[1]	Gross alpha		Gross beta	
Start	Stop		Value	Uncertainty (± 2 SD)	Value	Uncertainty (± 2 SD)
06/28/18	07/06/18	2028	0.0	0.1	0.0	0.5
07/06/18	07/12/18	2028	0.0	0.1	-0.1	0.5
07/12/18	07/19/18	2028	0.1	0.1	-0.3	0.5
07/19/18	07/26/18	2028	0.0	0.1	-0.3	0.4
07/26/18	08/02/18	2028	0.0	0.1	-0.1	0.5
08/02/18	08/09/18	2028	0.0	0.1	0.2	0.4
08/09/18	08/16/18	2028	0.0	0.1	0.1	0.4
08/16/18	08/23/18	2028	0.1	0.1	0.2	0.5
08/23/18	08/30/18	2028	0.1	0.1	-0.2	0.5
08/30/18	09/06/18	2028	0.1	0.1	-0.4	0.5
09/06/18	09/13/18	2028	0.0	0.1	0.0	0.5
09/13/18	09/20/18	2028	0.0	0.1	0.4	0.4
09/20/18	09/27/18	2028	0.0	0.1	0.5	0.5

Note: Concentrations and associated uncertainties (± 2 SD) 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 19. Blank analysis results for gamma spectroscopy for TSP air filters, composite samples, third quarter, 2018.

Analysis Date	Beryllium-7			Ruthenium-106/Rhodium-106			Antimony-125		
	Concentration[1]	± 2 SD	MDC	Concentration	± 2 SD	MDC	Concentration	± 2 SD	MDC
10/17/18	-12	109	182	16	59	100	10	11	18

Analysis Date	Cesium-134			Cesium-137		
	Concentration[1]	± 2 SD	MDC	Concentration	± 2 SD	MDC
10/17/18	-6	5	9	-2	4	7

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 20. Blank analysis results for tritium in water vapor from air samples, third quarter, 2018.

Sample Number	Start Date	Collection Date	Analysis Date	Tritium		
				Concentration	± 2 SD	MDC
OP183ZTR01	07/24/18	07/25/18	09/18/18	-0.10	0.12	0.20
OP183ZTR02	07/24/18	07/25/18	10/19/18	0.03	0.09	0.15
OP183ZTR03	10/01/18	10/03/18	10/19/18	0.07	0.09	0.15

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

Table 21. Blank analysis results (pCi/L) for radiological constituents in water, third quarter, 2018.

Sample Number	Sample Date	Concentration	± 2 SD	MDC	Within Blank Criteria?
Gross Alpha					
181W426	7/17/2018	0.1	0.4	0.7	Yes
Gross Beta					
181W426	7/17/2018	0.0	0.6	1.0	Yes
Cesium-137					
181W426	7/17/2018	1.2	1.6	2.6	Yes
Tritium					
181W427	7/17/2018	40	130	140	Yes
Enriched Tritium					
171W580	10/16/2017	21	7	10	Yes

MDC = minimum detectable concentration.

Table 22. Blank analysis results (µg/L) for metals in groundwater and/or surface water, third quarter, 2018.

Sample Number	Sample Date	Arsenic	Barium	Chromium	Iron	Lead	Manganese	Selenium	Zinc
181W429	7/17/2018	<2.0	1.3	<1.0	<10	<1.0	12	<2.0	<5.0

Table 23. Blank analysis results (mg/L) for common ions and nutrients in groundwater and/or surface water, third quarter, 2018.

Sample Number	Sample Date	Calcium	Magnesium	Sodium	Potassium	Fluoride	Chloride	Sulfate	Total Alkalinity†	Total Nitrogen	Total Phosphorus
181W429,428	7/17/2018	<0.10	<0.10	<0.10	<0.10	<0.20	<0.40	<0.80	<1.0	<0.010	<0.0050

† As $CaCO_3$.

Table 24. Duplicate sample results (pCi/L) for radiological constituents in groundwater and/or surface water, third quarter, 2018.

Analysis/Sample Location	Original Sample Number	Concentration	± 2 SD	Duplicate Sample Number	Concentration	± 2 SD	$\lvert R_1-R_2 \rvert$	$3(S_1^2+S_2^2)^{1/2}$	Within Criteria?
Gross Alpha									
Clear Spring	181W496	2.4	1.0	181W502	3.2	1.3	0.8	2.5	Yes
MV-46	181W451	0.6	0.7	181W441	1.2	0.8	0.6	1.6	Yes
Gross Beta									
Clear Spring	181W496	5.5	1.0	181W502	5.0	1.0	0.5	2.1	Yes
MV-46	181W451	3.5	0.8	181W441	3.7	0.8	0.2	1.7	Yes
Cesium-137									
Clear Spring	181W496	-0.2	1.6	181W502	-0.6	1.3	0.4	3.1	Yes
MV-46	181W451	0.8	1.7	181W441	1.2	1.5	0.4	3.4	Yes
Tritium									
Clear Spring	181W498	10	130	181W504	60	140	50	287	Yes
MV-46	181W452	70	130	181W442	10	120	60	265	Yes
Enriched Tritium									
USGS-125	171W570	53	9	171W575*	46	10	7	20	Yes

*Result reported by ISU-EML in the second quarter of 2018.

Table 25. Duplicate results for metals (µg/L) in groundwater, third quarter, 2018.

Sample Location	Sample Number	Sample Date	Arsenic	Barium	Chromium	Iron	Lead	Manganese	Selenium	Zinc
Clear Spring	181W500	8/8/2018	2.3	37	2.5	<10	<1.0	<1.0	<2.0	<5.0
Clear Spring	181W506	8/8/2018	2.3	37	2.5	<10	<1.0	<1.0	<2.0	<5.0
RPD			**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
MV-46	181W454	7/18/2018	2.0	18	3.9	<10	<1.0	<1.0	<2.0	<5.0
MV-46	181W444	7/18/2018	2.0	18	3.8	<10	<1.0	<1.0	<2.0	<5.0
RPD			**0**	**0**	**3**	**0**	**0**	**0**	**0**	**0**

RPD = relative percent difference.

Table 26. Duplicate results for common ions and nutrients (mg/L) in groundwater, third quarter, 2018.

Sample Location	Sample Number	Sample Date	Calcium	Magnesium	Sodium	Potassium	Fluoride	Chloride	Sulfate	Total Alkalinity†	Total Nitrogen	Total Phosphorus
Clear Spring	181W500,499	8/8/2018	44	19	25	4.1	0.513	34.1	46.2	152	1.9	0.029
Clear Spring	181W506,505	8/8/2018	44	19	25	4.1	0.509	32.2	46.1	152	2.0	0.030
RPD			**0**	**0**	**0**	**0**	**1**	**6**	**0**	**0**	**-5**	**-3**
MV-46	181W454,453	7/18/2018	27	13	14	3.2	0.379	8.61	21.9	124	0.68	0.020
MV-34	181W444,443	7/18/2018	27	13	14	3.2	0.381	8.63	21.9	124	0.69	0.022
RPD			**0**	**0**	**0**	**0**	**-1**	**0**	**0**	**0**	**-1**	**-10**

RPD = relative percent difference.
† As $CaCO_3$.

Table 27. Duplicate analyses of gamma emitting radionuclides in soil, third quarter, 2018.

Sample Location	Sample Date	Original Result Cs-137 (pCi/g)	QA Result Cs-137 (pCi/g)	Cs-137 RPD (%)	Cs-137 less than 3 sigma test	Cs-137 meets either criterion?
Carey 0-5cm	07/24/18	0.56 ± 0.09	0.58 ± 0.09	3.5	In Spec	Yes
Carey 5-10cm	07/24/18	0.19 ± 0.06	0.19 ± 0.06	0.0	In Spec	Yes
FAA Tower 0-5cm	07/24/18	0.41 ± 0.08	0.43 ± 0.07	4.8	In Spec	Yes
FAA Tower 5-10cm	07/24/18	0.14 ± 0.05	0.13 ± 0.04	7.4	In Spec	Yes
Howe 0-5cm	07/23/18	0.19 ± 0.05 J[1]	0.16 ± 0.05 J[1]	17.1	In Spec	Yes
Howe 5-10cm	07/23/18	0.29 ± 0.06 J[1]	0.24 ± 0.05 J[1]	18.9	In Spec	Yes
St. Anthony 0-5cm	07/23/18	0.57 ± 0.08	0.57 ± 0.08	0.0	In Spec	Yes
St. Anthony 5-10cm	07/23/18	0.39 ± 0.07	0.43 ± 0.08	9.8	In Spec	Yes

Note: Concentrations are expressed in pCi/g with associated uncertainty (± 2 SD).
[1]J – estimate value. 0 to 5 cm depth historically has higher concentration and 5 to 10 cm lower concentration. Most likely cause of this anomaly is mislabeling of samples by operator this quarter.

Table 28. Electret ionization chamber (EIC) irradiation results (categorized as spiked samples), third quarter, 2018.

Electret #	Exposure Received		Net Measured Exposure[1]		%R	Within Spec?
	(mR)	Uncertainty (±1 SD, mR)	(mR)	Uncertainty (±1 SD, mR)		
SJE085	41.0	2.1	32.9	1.4	80.1	Y
SJE090	41.0	2.1	31.9	1.4	78.0	Y
SIR602	41.0	2.1	37.0	1.3	90.2	Y
				Triplicate AVG:	**82.7**	**Y**
SHV200	30.0	1.5	28.4	1.4	94.5	Y
SIR514	30.0	1.5	25.9	1.3	86.2	Y
SJE036	30.0	1.5	23.6	1.4	78.7	Y
				Triplicate AVG:	**86.5**	**Y**
SJW954	23.0	1.2	17.5	1.4	75.9	Y
SJE085	23.0	1.2	18.1	1.4	78.7	Y
SIR508	23.0	1.2	20.1	1.3	87.4	Y
				Triplicate AVG:	**80.67**	**Y**

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

Table 29. Air sampling field equipment service reliability (percent operational), third quarter, 2018.

Station Locations	Sample Type			
	TSP	Radioiodine	Atmospheric Moisture	Precipitation
Onsite Locations				
Big Lost River Rest Area	92%	92%	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%
Monteview	100%	100%	100%	100%
Mud Lake	100%	100%	100%	100%
Distant Locations				
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.

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, 2018.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	±2 SD	Concentration	±2 SD
On-Site Locations						
Big Lost River Rest Area	06/28/18	07/06/18	1.5	0.3	32.0	1.2
	07/06/18	07/12/18	3.3	0.4	40.0	1.5
	07/12/18	07/19/18	1.3	0.3	43.8	1.4
	07/19/18	07/26/18	2.0	0.3	42.5	1.4
	07/26/18	08/02/18	3.1	0.4	46.5	1.5
	08/02/18	08/09/18	2.9	0.4	41.8	1.5
	08/09/18	08/16/18	R[1]	R[1]	R[1]	R[1]
	08/16/18	08/23/18	2.9	0.4	43.6	1.4
	08/23/18	08/30/18	2.2	0.3	31.7	1.3
	08/30/18	09/06/18	1.9	0.3	45.1	1.5
	09/06/18	09/13/18	2.7	0.4	49.6	1.5
	09/13/18	09/20/18	1.5	0.3	48.6	1.5
	09/20/18	09/27/18	1.4	0.3	40.7	1.4
Experimental Field Station	06/28/18	07/06/18	1.3	0.3	23.9	1.1
	07/06/18	07/12/18	2.5	0.4	29.5	1.4
	07/12/18	07/19/18	1.3	0.3	35.9	1.5
	07/19/18	07/26/18	1.1	0.3	29.7	1.2
	07/26/18	08/02/18	2.0	0.3	32.2	1.3
	08/02/18	08/09/18	2.5	0.4	32.1	1.3
	08/09/18	08/16/18	2.0	0.3	34.0	1.3
	08/16/18	08/23/18	2.6	0.4	35.9	1.3
	08/23/18	08/30/18	1.9	0.3	24.9	1.2
	08/30/18	09/06/18	2.0	0.3	32.0	1.3
	09/06/18	09/13/18	2.2	0.3	37.3	1.4
	09/13/18	09/20/18	1.6	0.3	35.9	1.3
	09/20/18	09/27/18	1.6	0.3	30.0	1.2
Sand Dunes Tower	06/28/18	07/06/18	R[2]	R[2]	R[2]	R[2]
	07/06/18	07/12/18	1.5	0.3	24.7	1.2
	07/12/18	07/19/18	0.9	0.2	26.5	1.1
	07/19/18	07/26/18	0.9	0.2	23.9	1.1
	07/26/18	08/02/18	2.0	0.3	30.2	1.2
	08/02/18	08/09/18	2.1	0.3	29.8	1.2
	08/09/18	08/16/18	2.0	0.3	31.8	1.2
	08/16/18	08/23/18	1.9	0.3	33.2	1.3
	08/23/18	08/30/18	R[2]	R[2]	R[2]	R[2]
	08/30/18	09/06/18	1.2	0.2	27.4	1.1
	09/06/18	09/13/18	1.8	0.3	33.7	1.3
	09/13/18	09/20/18	0.9	0.2	28.7	1.1
	09/20/18	09/27/18	0.9	0.2	24.1	1.0

[1]R – Results rejected due to insufficient sample volume caused by equipment failure.
[2]R – Results rejected due to insufficient sample volume caused by power outage.

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, 2018.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	±2 SD	Concentration	±2 SD
Van Buren Avenue	06/28/18	07/06/18	0.9	0.2	19.2	0.9
	07/06/18	07/12/18	1.8	0.3	25.7	1.2
	07/12/18	07/19/18	1.1	0.2	25.3	1.1
	07/19/18	07/26/18	1.1	0.3	25.5	1.1
	07/26/18	08/02/18	2.3	0.3	30.9	1.2
	08/02/18	08/09/18	2.0	0.3	30.0	1.2
	08/09/18	08/16/18	2.1	0.3	32.1	1.2
	08/16/18	08/23/18	1.7	0.3	29.2	1.2
	08/23/18	08/30/18	1.3	0.3	21.6	1.1
	08/30/18	09/06/18	1.3	0.3	28.3	1.2
	09/06/18	09/13/18	1.7	0.3	33.9	1.3
	09/13/18	09/20/18	0.8	0.2	26.9	1.1
	09/20/18	09/27/18	0.8	0.2	23.7	1.1
Boundary Locations						
Atomic City	06/28/18	07/06/18	1.9	0.3	35.4	1.2
	07/06/18	07/12/18	R[1]	R[1]	R[1]	R[1]
	07/12/18	07/19/18	1.9	0.3	43.0	1.4
	07/19/18	07/26/18	1.6	0.4	46.6	1.8
	07/26/18	08/02/18	R[3]	R[3]	R[3]	R[3]
	08/02/18	08/09/18	R[3]	R[3]	R[3]	R[3]
	08/09/18	08/16/18	R[3]	R[3]	R[3]	R[3]
	08/16/18	08/23/18	R[3]	R[3]	R[3]	R[3]
	08/23/18	08/30/18	2.1	0.3	30.2	1.2
	08/30/18	09/06/18	2.2	0.3	46.7	1.5
	09/06/18	09/13/18	R[3]	R[3]	R[3]	R[3]
	09/13/18	09/20/18	1.9	0.3	52.7	1.5
	09/20/18	09/27/18	1.4	0.3	44.3	1.4
Howe	06/28/18	07/06/18	0.9	0.2	18.1	0.9
	07/06/18	07/12/18	1.8	0.3	23.7	1.2
	07/12/18	07/19/18	0.7	0.2	25.3	1.2
	07/19/18	07/26/18	0.7	0.2	23.3	1.1
	07/26/18	08/02/18	1.8	0.3	27.9	1.2
	08/02/18	08/09/18	2.1	0.3	25.3	1.2
	08/09/18	08/16/18	2.1	0.3	30.5	1.2
	08/16/18	08/23/18	1.8	0.3	37.0	1.3
	08/23/18	08/30/18	1.2	0.3	20.0	1.1
	08/30/18	09/06/18	1.1	0.2	25.2	1.2
	09/06/18	09/13/18	1.8	0.3	32.9	1.3
	09/13/18	09/20/18	0.9	0.2	28.1	1.2
	09/20/18	09/27/18	0.7	0.2	22.4	1.1

[1]R – Results rejected due to insufficient sample volume caused by equipment failure.
[3]R – Results rejected due to insufficient sample volume caused by filter loading from wildfires.

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, 2018.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	±2 SD	Concentration	±2 SD
Monteview	06/28/18	07/06/18	1.7	0.4	28.9	1.6
	07/06/18	07/12/18	1.5	0.3	29.4	1.3
	07/12/18	07/19/18	1.1	0.3	31.4	1.4
	07/19/18	07/26/18	0.9	0.3	29.7	1.2
	07/26/18	08/02/18	2.2	0.3	35.7	1.3
	08/02/18	08/09/18	2.8	0.4	36.5	1.3
	08/09/18	08/16/18	2.9	0.4	37.6	1.4
	08/16/18	08/23/18	2.2	0.3	33.1	1.3
	08/23/18	08/30/18	1.6	0.3	26.6	1.2
	08/30/18	09/06/18	2.0	0.3	33.6	1.3
	09/06/18	09/13/18	2.7	0.4	40.0	1.4
	09/13/18	09/20/18	1.4	0.3	31.9	1.2
	09/20/18	09/27/18	1.3	0.3	29.4	1.2
Mud Lake	06/28/18	07/06/18	1.3	0.2	29.2	1.1
	07/06/18	07/12/18	2.4	0.4	38.5	1.5
	07/12/18	07/19/18	1.6	0.3	44.7	1.4
	07/19/18	07/26/18	1.6	0.3	38.5	1.4
	07/26/18	08/02/18	3.7	0.6	38.4	1.9
	08/02/18	08/09/18	2.8	0.5	44.4	1.9
	08/09/18	08/16/18	3.0	0.4	46.9	1.6
	08/16/18	08/23/18	2.2	0.3	40.9	1.4
	08/23/18	08/30/18	R[3]	R[3]	R[3]	R[3]
	08/30/18	09/06/18	1.9	0.3	39.0	1.4
	09/06/18	09/13/18	2.9	0.4	48.6	1.5
	09/13/18	09/20/18	1.6	0.3	48.2	1.5
	09/20/18	09/27/18	1.6	0.3	40.4	1.4
Distant Locations						
Craters of the Moon	06/28/18	07/06/18	0.8	0.2	25.6	1.0
	07/06/18	07/12/18	R[2]	R[2]	R[2]	R[2]
	07/12/18	07/19/18	1.3	0.3	31.4	1.2
	07/19/18	07/26/18	0.8	0.3	30.7	1.4
	07/26/18	08/02/18	R[3]	R[3]	R[3]	R[3]
	08/02/18	08/09/18	R[3]	R[3]	R[3]	R[3]
	08/09/18	08/16/18	R[3]	R[3]	R[3]	R[3]
	08/16/18	08/23/18	R[3]	R[3]	R[3]	R[3]
	08/23/18	08/30/18	R[3]	R[3]	R[3]	R[3]
	08/30/18	09/06/18	1.7	0.4	35.5	2.0
	09/06/18	09/13/18	2.4	0.5	46.3	2.2
	09/13/18	09/20/18	1.1	0.2	32.8	1.2
	09/20/18	09/27/18	0.9	0.2	25.5	1.1

[2]R – Results rejected due to insufficient sample volume caused by power outage.
[3]R – Results rejected due to insufficient sample volume caused by filter loading from wildfires.

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, 2018.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	±2 SD	Concentration	±2 SD
Fort Hall[1]	06/28/18	07/06/18	1.6	0.3	32.5	1.1
	07/06/18	07/12/18	R[2]	R[2]	R[2]	R[2]
	07/12/18	07/19/18	1.7	0.3	44.9	1.4
	07/19/18	07/26/18	1.8	0.3	45.7	1.4
	07/26/18	08/02/18	3.6	0.6	52.1	2.1
	08/02/18	08/09/18	R[3]	R[3]	R[3]	R[3]
	08/09/18	08/16/18	R[3]	R[3]	R[3]	R[3]
	08/16/18	08/23/18	R[3]	R[3]	R[3]	R[3]
	08/23/18	08/30/18	2.1	0.3	24.3	1.1
	08/30/18	09/06/18	2.3	0.4	44.9	1.6
	09/06/18	09/13/18	4.0	0.5	68.1	2.1
	09/13/18	09/20/18	2.7	0.4	54.6	1.7
	09/20/18	09/27/18	2.0	0.3	41.3	1.4
Idaho Falls - HVP 4304	06/28/18	07/06/18	1.2	0.2	27.2	1.1
	07/06/18	07/12/18	R[2]	R[2]	R[2]	R[2]
	07/12/18	07/19/18	1.7	0.3	41.3	1.4
	07/19/18	07/26/18	1.9	0.4	52.7	2.0
	07/26/18	08/02/18	R[3]	R[3]	R[3]	R[3]
	08/02/18	08/09/18	R[3]	R[3]	R[3]	R[3]
	08/09/18	08/16/18	R[3]	R[3]	R[3]	R[3]
	08/16/18	08/23/18	R[3]	R[3]	R[3]	R[3]
	08/23/18	08/30/18	R[3]	R[3]	R[3]	R[3]
	08/30/18	09/06/18	R[3]	R[3]	R[3]	R[3]
	09/06/18	09/13/18	R[3]	R[3]	R[3]	R[3]
	09/13/18	09/20/18	R[3]	R[3]	R[3]	R[3]
	09/20/18	09/27/18	1.9	0.3	42.1	1.4
Idaho Falls - HVP 4304^{DP}	06/28/18	07/06/18	1.4	0.2	29.0	1.1
	07/06/18	07/12/18	2.1	0.3	30.2	1.3
	07/12/18	07/19/18	1.7	0.3	37.1	1.3
	07/19/18	07/26/18	1.6	0.3	37.7	1.3
	07/26/18	08/02/18	3.4	0.5	36.1	1.8
	08/02/18	08/09/18	R[3]	R[3]	R[3]	R[3]
	08/09/18	08/16/18	R[3]	R[3]	R[3]	R[3]
	08/16/18	08/23/18	R[3]	R[3]	R[3]	R[3]
	08/23/18	08/30/18	R[3]	R[3]	R[3]	R[3]
	08/30/18	09/06/18	1.6	0.3	33.0	1.3
	09/06/18	09/13/18	R[3]	R[3]	R[3]	R[3]
	09/13/18	09/20/18	2.0	0.4	41.2	1.8
	09/20/18	09/27/18	1.9	0.3	33.9	1.3

HVP 4304^{DP} – This is a duplicate sampler.
[1] Operated by Shoshone Bannock-Tribes.
[2]R – Results rejected due to insufficient sample volume caused by power outage.
[3]R – Results rejected due to insufficient sample volume caused by filter loading from wildfires.

Appendix B

Table B.1. Results for all electret ionization chamber (EIC) locations, third quarter, 2018.

Sample Location	Net Corrected Exposure Rate (µR/hr)[1]	± 2 SD (µR/hr)
Arco	11.3, 13.7	
Craters of the Moon	12.8	1.5
Rest Area	13.8	2.6
Van Buren Avenue	16.4	0.9
Experimental Field Station	14.0	1.8
Main Gate	16.9	2.2
Atomic City	12.0	1.0
Taber	17.4	1.3
Blackfoot	10.0, 10.7	
Ft. Hall	13.9	3.4
Idaho Falls	12.5	1.7
Mud Lake/ Terreton	11.9, 13.0	
Monteview	10.3, 13.7	
Sand Dunes	15.7	0.6
Howe Met. Tower	10.3, 11.9	
MP282 -20	15.3	2.4
MP280 -20	12.7	1.5
MP278 -20	15.2, 17.2	
MP276 -20	13.7	0.5
MP274 -20	8.9, 10.6	
MP272 -20	11.8, 13.3	
MP270 -20	13.6	3.0
MP268 -20	13.5	1.3
MP266 -20	11.2, 14.0	
MP264 -20	16.0, 16.3	
MP270 -20/26	13.7	1.5
MP268 -20/26	12.7, 13.2	
MP266 -20/26	15.6	0.5
MP263 -20/26	13.5	2.4
MP261 -20/26	11.3, 11.4	
MP259 -20/26	13.7	2.6
MP256 -20/26	10.8	1.7
MFC (EBR II)	16.0	3.6
EBR I	12.2	1.7
RWMC	13.5	3.3
CFA	19.5, 19.9	
CITRC (PBF)	13.6	2.2
INTEC	18.3	1.3
ATR (TRA)	15.5, 16.0	
NRF	11.9, 12.1	
TAN/SMC	13.1, 13.3	
Mud Lake Bank of Commerce	14.7	2.7
MP43-33	19.6, 20.5	
MP41-33	13.2	1.6

Table B.1. continued. Results for all electret ionization chamber (EIC) locations, third quarter, 2018.

Sample Location	Net Corrected Exposure Rate (µR/hr)[1]	± 2 SD (µR/hr)
MP39-33	14.1	2.8
MP37-33	12.9	0.9
MP35-33	12.8	2.4
MP33-33	18.0	2.9
MP31-33	13.0	0.3
MP29-33	13.0	0.9
MP27-33	16.5, 17.6	
MP25-33	13.2	2.8
MP23-33	11.2, 13.7	
MP21-33	10.1	1.5
MP19-33	10.6	1.7
MP14-33	10.7, 11.2	
MP11-33	12.9	2.3
MP06-33	10.5	3.5
MP03-33	13.4, 14.0	
Base of Howe	11.6	2.0
Rover	13.5	2.7
Hamer	13.6, 13.9	
Sugar City	15.9	3.1
Roberts	13.3	1.7
Big Southern Butte	9.5	1.3
T4 North	13.9	1.8
T4 South	15.3	3.4

[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.