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 $1/1000^{th}$ of a rem
mR - milliRoentgen
mR/hr - milliRoentgen per hour
µR/hr - microRoentgen per hour
MV - Magic Valley
NIST - National Institute of Standards and Technology
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 second 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 second 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 second 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. All results are below MDCs and 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 second 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 second quarter of 2018. Tritium and Cesium-137 analysis results are presented in **Table 5**.

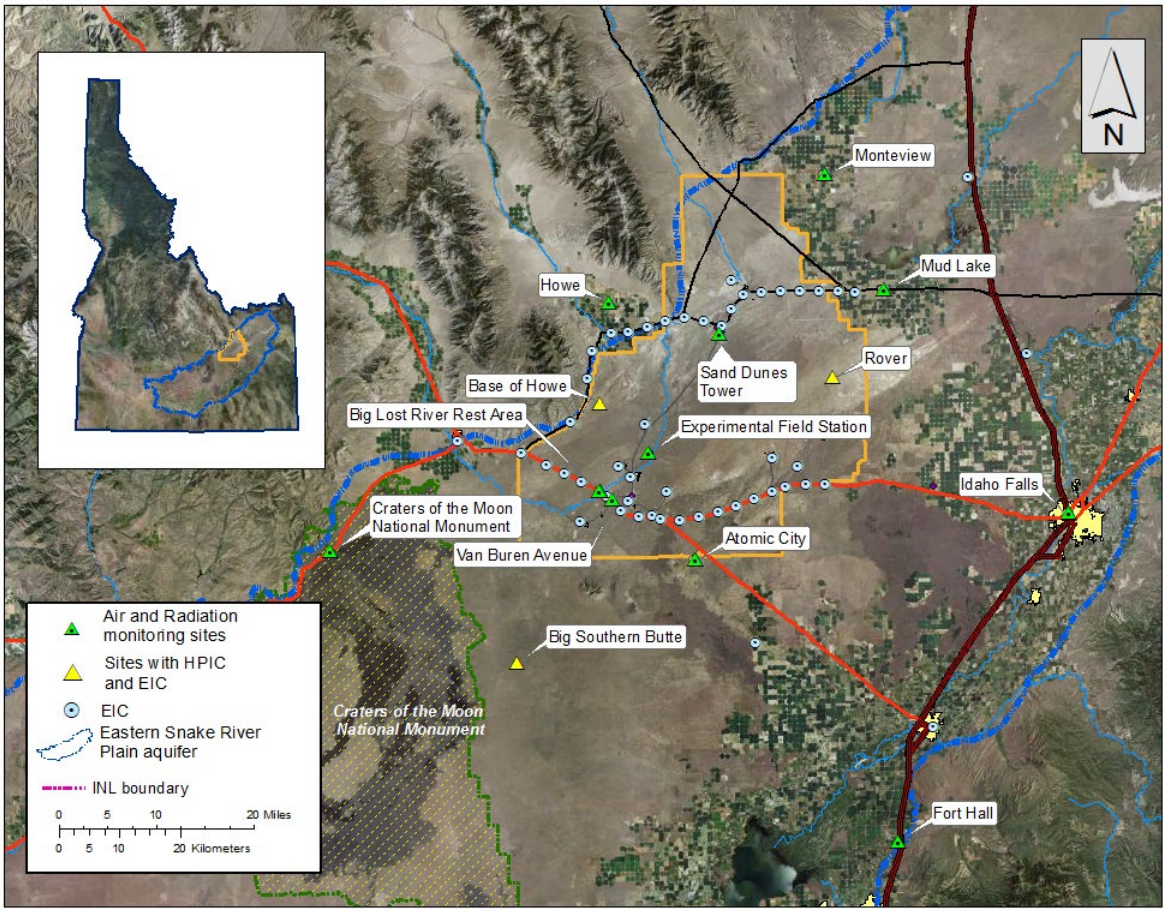

Figure 1. Air and radiation (Rad) monitoring sites.

Table 1. Sampling locations and sample type

Station Locations	Sample type[1]			
	TSP	Radioiodine	Water Vapor	Precipitation
On-site Locations				
Big Lost River Rest Area	□	□	■	■
Experimental Field Station	□	□	■	
Sand Dunes Tower	□	□	■	
Van Buren Avenue	□	□	■	
Boundary Locations				
Atomic City	□	□	■	■
Howe	□	□	■	■
Monteview	□	□	■	■
Mud Lake	□	□	■	■
Distant Locations				
Craters of the Moon	□	□	■	
Fort Hall[2]	□	□	■	
Idaho Falls	□	□	■	■

[1] □Samples collected weekly; ■ Samples collected quarterly.
[2]TSP and radioiodine samples collected by Shoshone-Bannock Tribes.

Table 2. Range of gross alpha and gross beta concentrations for TSP filters, second quarter, 2018.

Station Location	Concentration					
	Gross Alpha			Gross Beta		
On-Site Locations						
Big Lost River Rest Area	0.4	-	1.5	16.8	-	37.4
Experimental Field Station	0.3	-	1.0	10.2	-	27.5
Sand Dunes Tower	0.3	-	0.7	9.2	-	20.2
Van Buren Avenue	0.3	-	0.9	9.9	-	22.4
Boundary Locations						
Atomic City	0.5	-	1.2	14.1	-	36.5
Howe	0.2	-	1.1	9.5	-	23.8
Monteview	0.4	-	1.1	11.1	-	27.8
Mud Lake	0.7	-	1.3	14.7	-	33.4
Distant Locations						
Craters of the Moon	0.4	-	1.1	10.2	-	26.6
Fort Hall[1]	0.9	-	1.7	17.1	-	41.2
Idaho Falls – HVP 4304	0.6	-	1.7	12.4	-	52.4
Idaho Falls – HVP 4304[DP]	0.3	-	1.5	12.0	-	31.0

[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, second 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	166.0	8.6	<MDC[2]	
Experimental Field Station	114.5	6.2	<MDC	
Sand Dunes Tower	91.2	4.9	<MDC	
Van Buren Avenue	99.8	5.4	<MDC	
Boundary Locations				
Atomic City	125.0	6.7	<MDC	
Howe	96.0	5.2	<MDC	
Monteview	107.3	5.8	<MDC	
Mud Lake	144.7	7.6	<MDC	
Distant Locations				
Craters of the Moon	109.0	5.8	<MDC	
Fort Hall[1]	177.1	9.1	<MDC	
Idaho Falls – HVP 4304	140.9	7.4	<MDC	
Idaho Falls – HVP 4304[DP]	131.8	6.9	<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, second quarter, 2018

Station Location	Tritium		
	Concentration	± 2 SD	MDC
On-site Locations			
Big Lost River Rest Area	0.56	0.53	0.88
Experimental Field Station	0.72	0.67	1.05
Sand Dunes Tower	0.63	0.54	0.86
Van Buren Avenue	0.60	0.59	0.95
Boundary Locations			
Atomic City	0.24	0.23	0.38
Howe	0.19	0.61	1.03
Mud Lake	0.19	0.68	1.12
Monteview	0.15	0.38	0.64
Distant Locations			
Craters of the Moon	0.06	0.31	0.53
Fort Hall[1]	0.25	0.52	0.88
Idaho Falls	0.17	0.60	1.00

[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, second quarter, 2018

Station Location	Tritium			Cesium-137		
	Concentration	± 2 SD	MDC	Concentration	± 2 SD	MDC
On-site Locations						
Big Lost River Rest Area	80	90	150	0.1	1.5	2.6
Boundary Locations						
Atomic City	80	90	150	0.3	1.7	2.8
Howe	120	90	150	1.1	0.9	1.4
Monteview	90	90	150	0.7	1.2	2.0
Mud Lake	130	90	150	1.1	1.7	2.8
Distant Locations						
Idaho Falls	70	90	150	-0.7	2.4	4.2

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

Environmental Radiation Monitoring Results

The ESP operated 13 environmental radiation stations during the second quarter of 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 second quarter 2018. **Table 8** lists the EIC monitoring results for second 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, second 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	13.4	1.3
Rover	8.6	2.1
Sand Dunes Tower	13.5	6.1
Boundary Locations		
Atomic City	13.5	4.3
Big Southern Butte	14.0	2.5
Howe Met Tower	12.1	1.1
[1]Monteview	--	--
[1]Mud Lake / Terreton	--	--
Distant Locations		
Fort Hall	12.3	2.4
Idaho Falls	10.6	2.4

[1]No data available for this location for second quarter 2018 due to electronic malfunctions / failures in instrumentation.

Table 8. Electret ionization chamber (EIC) cumulative average exposure rates, second quarter, 2018.

Station Location	Exposure Rate (µR/hr)	
	Quarterly Average[1]	± 2 SD
On-Site Locations		
Base of Howe	14.7	0.8
Big Lost River Rest Area	14.0	1.2
Experimental Field Station	15.7	2.3
Rover	13.4	0.7
Sand Dunes Tower	15.3	3.2
Van Buren Avenue	15.1	3.4
Boundary Locations		
Atomic City	14.3	1.9
Big Southern Butte	13.4	1.7
Howe Met Tower	14.0	2.6
Monteview	14.5	1.6
Mud Lake/Terreton	14.2	1.7
Distant Locations		
Craters of the Moon	13.2	2.0
Fort Hall	16.9	1.5
Idaho Falls	12.4	1.9

[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 second quarter of 2018, DEQ-INL OP sampled water at 53 locations: 4 upgradient, 27 facility, 15 boundary, 5 distant, and 2 surface water. Analytical results are reported in **Tables 9** through **20** and summarized below.

Gross alpha and gross beta radioactivity were detected at low levels in most samples (**Table 9**). Concentrations at all upgradient, boundary, and distant locations were within the range of naturally occurring background concentrations determined by historical DEQ data. Above-background levels of gross alpha radioactivity were measured in the aquifer at TAN, with a maximum of 16.6 ± 3.1 pCi/L at TAN-28. Above-background levels of gross beta radioactivity were measured in the aquifer at TAN and INTEC and in perched groundwater at ATR, with a maximum of 995.1 ± 23.0 pCi/L at TAN-2272B. All detectable concentrations in groundwater were consistent with historical trends, and all elevated concentrations were in areas of known contamination. One location, TAN-28, had a gross alpha concentration that slightly exceeded the EPA drinking water maximum contaminant level (MCL) for alpha particles of 15 pCi/L. The MCL for beta radioactivity is 4 mrem/year, which is equivalent to 8 pCi/L if the source is ^{90}Sr, 900 pCi/L if ^{99}Tc, or 20,000 pCi/L if tritium (^{3}H).

Gross alpha and gross beta concentrations were also slightly above background in the two surface-water samples collected from the Big Lost River (**Table 9**). Reanalysis of BLR@EFS yielded results for gross alpha (6.4 ± 2.1 pCi/L) and gross beta (10.7 ± 1.3 pCi/L) consistent with the original results. Reanalysis of BLR@INL Diversion yielded results consistent with the original result for gross beta (2.9 ± 0.9 pCi/L) but not for gross alpha (2.1 ± 1.2 pCi/L). The lab noted visible sediment in the samples and cited difficulties in decanting a consistent amount of sediment as the probable cause of the inconsistency between gross alpha analyses. The slightly elevated gross alpha and gross beta concentrations are therefore probably due to failure to completely remove uranium- and potassium-bearing suspended sediments from the samples prior to analysis. If gross alpha and gross beta levels are found to be high in samples from the Big Lost River during the next scheduled sampling event (April 2019), then DEQ-INL OP will collect filtered duplicate samples from these locations in order to verify that gross alpha and gross beta radioactivity from dissolved constituents is within the background range.

Manmade gamma-emitting radionuclides, including ^{137}Cs, were not detected at any location sampled this quarter (**Table 9**). The MCL for beta/gamma-emitters is 4 mrem/year, which is equivalent to 200 pCi/L if the source is ^{137}Cs.

Thirteen facility locations—eight at TAN, four at INTEC, and one at ATR—were sampled for uranium isotopes (**Table 10**). All had detectable concentrations of ^{234}U, and all but TAN-2271 had detectable

[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.

concentrations of ^{238}U. Nine locations had detectable concentrations of ^{235}U; however, all but three of these were less than three standard deviations and were therefore qualified as estimates (J). Most detections were slightly above naturally occurring background concentrations, and all were consistent with historical observations. The highest concentrations were measured in samples from TAN, with a maximum ^{235}U concentration of 0.22 ± 0.12 pCi/L at TAN-28. As in previous years, $^{234}U/^{238}U$ activity ratios suggest an anthropogenic origin for the uranium in the groundwater at TAN wells TAN-28, TAN-29, TAN-37A, and TAN-2272B.

Five facility locations—four at INTEC and one at ATR—were sampled for plutonium isotopes (**Table 11**). No plutonium isotopes were detected. One site at ATR was sampled for ^{241}Am this quarter (**Table 12**). No ^{241}Am was detected.

Twenty-five facility locations were sampled for ^{90}Sr (**Table 13**). Detectable concentrations were found in fourteen samples from TAN, INTEC, and ATR, with a maximum concentration of 490 ± 120 pCi/L at TAN-37A. Nine locations had ^{90}Sr concentrations above the drinking water MCL of 8 pCi/L. All elevated concentrations were measured in samples from areas of known contamination and are consistent with historical trends.

Three upgradient and seven facility locations were sampled for ^{99}Tc (**Table 14**). All had detectable concentrations of ^{99}Tc. As in previous years, the highest concentrations were found at INTEC, with a maximum of 384 ± 1.8 pCi/L at USGS-052. All detections were consistent with historical data, and samples with elevated concentrations were from areas of known contamination. All concentrations were below the drinking water MCL of 900 pCi/L. The three up-gradient locations, which should have no ^{99}Tc, were sampled as part of an ongoing internal study to determine whether low-level ^{99}Tc detections result from analytical interference by naturally occurring beta activity.

Tritium was measured at all locations sampled this quarter (**Table 15**). Using the standard analytical method, which typically has an MDC of 110 to 190 pCi/L, tritium was detected at eighteen facility locations, four boundary locations, and zero upgradient, distant, and surface water locations. The highest concentration measured was 9,670 ± 470 pCi/L in USGS-055, a perched-groundwater well at ATR whose tritium concentration is known to fluctuate widely and in correlation with water level (DOE/ID-22242). The highest concentration measured in the aquifer was 2,610 ± 270 pCi/L at CFA 1. Each of the boundary-area detections was in a well equipped with a multi-level monitoring system, which allows samples to be collected from multiple depths. Elevated tritium concentrations in these wells were found at depths ranging from 616 to 1,091 feet below the surface (ft bls), with a maximum of 970 ± 190 pCi/L at a depth of 616 ft bls in USGS-131A. All tritium concentrations were consistent with historical data and were measured in areas of known contamination related to past INL waste disposal practices.

No samples collected during the current quarter were analyzed for tritium using the enrichment method; however, analyses for 25 samples collected in previous quarters were completed and are presented in **Table 16**. The results of all enriched analyses are consistent with historical trends at these locations, and none of the fifteen distant-location samples whose results are reported had a tritium concentration statistically above background levels. A backlog of 39 samples to be analyzed by the enrichment method remains.

Samples from all locations were analyzed for metals, common ions, and nutrients (**Tables 17, 18,** and **19)**. Levels of barium, iron, manganese, sodium, chloride, alkalinity, and phosphorous in samples from TAN were elevated above historical trends due to changing redox conditions and increased competition for cation adsorption sites caused by ongoing in-situ-bioremediation (ISB) injections at TAN-37A. Chloride was measured at a concentration of 415 mg/L in NRF-06, above EPA's Secondary Maximum Contaminant Level (SMCL) of 250 mg/L but consistent with historical values at this location. Sulfate

was measured at a concentration of 581 mg/L in USGS-068, a perched-groundwater well at ATR that had not previously been sampled by DEQ-INL OP. The SMCL for sulfate is 250 mg/L. Zinc, which has no MCL or SMCL, was measured at a concentration of 100 µg/L in a sample from the 749-ft-bls depth of boundary well Middle-2051. Elevated zinc concentrations have been measured at this location before, though not consistently. The source is unknown. All other metals, common ions, and nutrients results were within expected ranges at each location.

Seven facility locations—six at TAN and one at RWMC—were sampled for VOCs. All had detectable concentrations of at least two VOCs. All VOC detections were consistent with historical data and were measured in areas of known contamination. Trichloroethene (TCE) concentrations continue to decline at TAN-28 due to ISB injections immediately upgradient at TAN-37A, but remain approximately constant at TAN-29, which is farther downgradient from TAN-37A. The highest TCE concentration measured was 526 µg/L at TAN-29. **Table 20** shows VOCs that were detected this quarter or in a recent previous quarter in at least one location. A complete list of VOC analytes is shown in **Appendix C**.

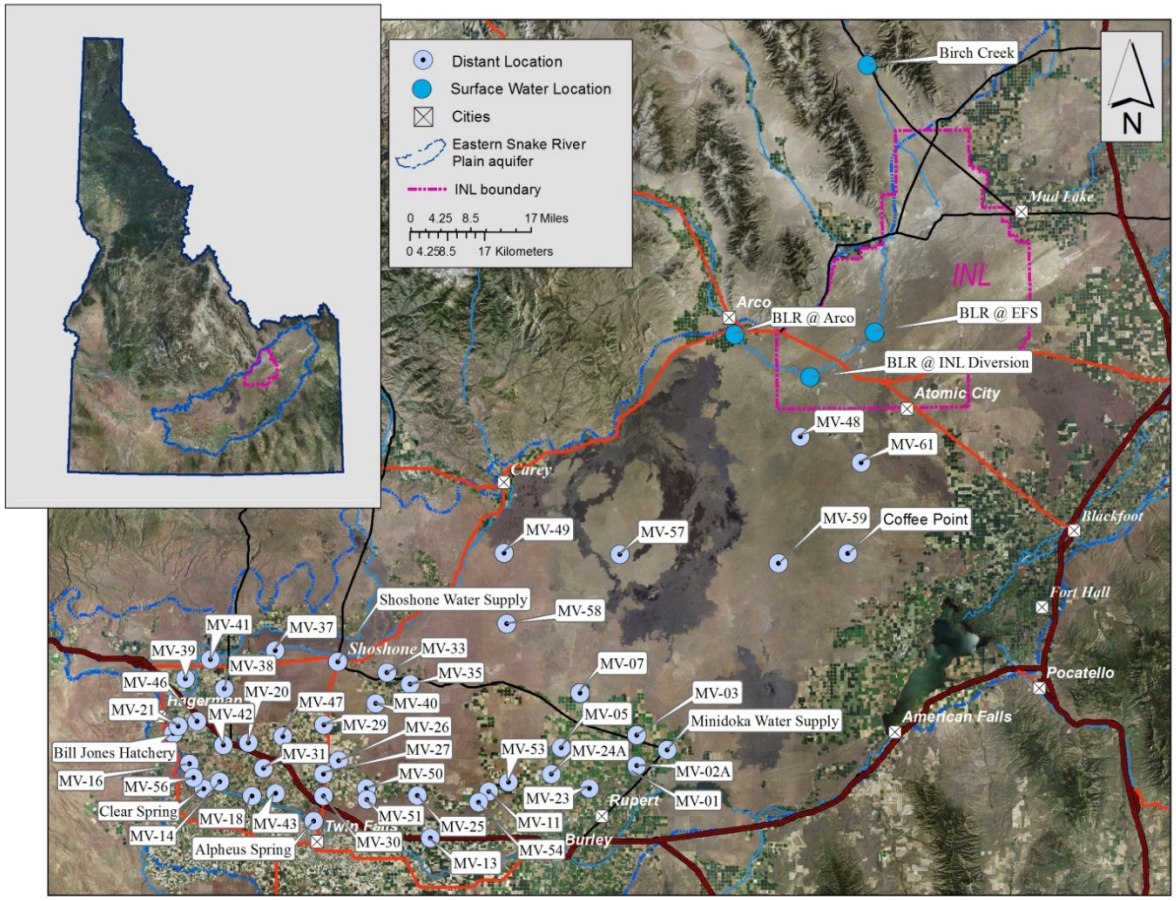

Figure 2. Distant and Surface Water monitoring locations.

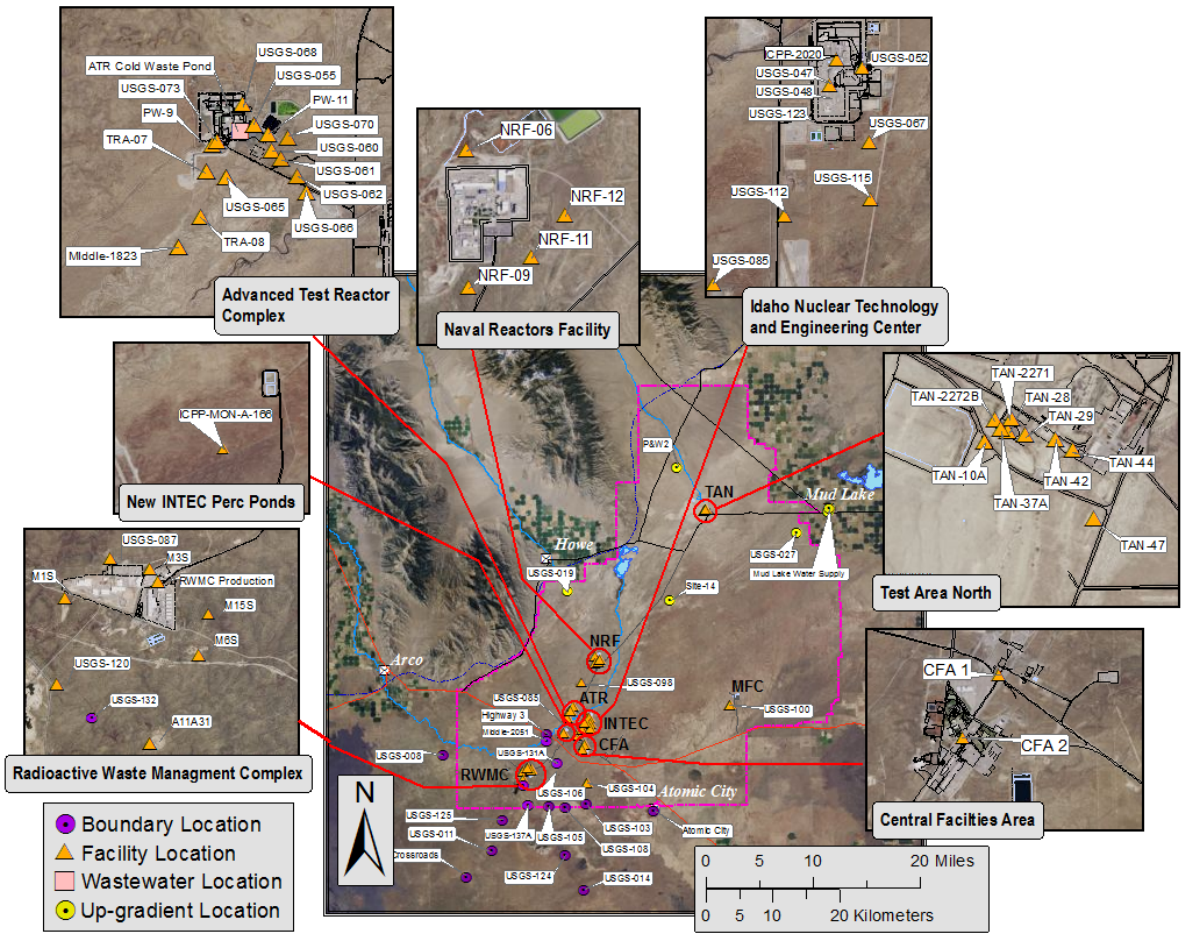

Figure 3. Upgradient, facility, boundary, and wastewater monitoring locations.

Table 9. Gross alpha, gross beta, and gamma-emitting radionuclide concentrations (pCi/L) for water samples, second 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	5/23/2018	1.2		0.6	3.4		0.8	0.1	U	1.2
P&W-2	4/2/2018	2.8		0.9	1.2		0.8	0.2	U	1.4
USGS-019	4/2/2018	0.9	U	0.8	2.8		0.9	0.4	U	1.5
USGS-027	4/2/2018	2.9		1.0	7.5		1.1	0.9	U	1.6
Facility										
CFA 1	4/11/2018	1.2	U	1.1	10.5		1.2	0.3	U	1.5
ICPP-MON-A-166	4/3/2018	2.0		0.8	3.3		0.9	0.6	U	1.2
NRF-06	5/8/2018	4.1		2.4	11.1		2.1	-1.1	U	2.0
NRF-09	5/8/2018	6.4		1.8	4.6		1.1	0.5	U	1.5
NRF-11	5/8/2018	1.7	U	1.2	2.4		1.0	-0.8	U	1.3
NRF-12	5/8/2018	3.5		1.3	4.4		1.0	-0.4	U	1.4
TAN 2271	4/18/2018	1.3	U	1.9	734.1		9.5	2.6	U	1.8
TAN 2272B	4/18/2018	7.3	U	6.2	995.1		23.0	1.0	U	1.1
TAN-28	4/18/2018	16.6		3.1	458.3		7.3	-0.3	U	1.3
TAN-29	4/18/2018	11.7		2.8	55.3		3.3	0.3	U	1.2
TAN-37A	4/18/2018	1.7	U	2.0	777.2		18.1	0.5	U	2.1
TAN-42	4/24/2018	2.2		1.0	4.6		1.0	-0.3	U	1.5
TAN-44	4/24/2018	2.6		1.3	4.9		1.1	1.5	U	1.7
TAN-47	4/24/2018	1.5		0.9	4.0		0.9	0.2	U	1.3
USGS-047	5/15/2018	1.8		0.8	40.6		1.7	1.0	U	1.9
USGS-048	5/15/2018	2.1		0.9	26.1		1.4	0.1	U	1.5
USGS-052	5/14/2018	2.1		0.9	207.4		3.4	0.5	U	1.4
USGS-055	4/4/2018	6.8		1.5	61.8		2.1	-0.7	U	1.6
USGS-061	4/5/2018	4.6		1.1	4.5		0.9	0.0	U	1.3
USGS-062	4/5/2018	4.7		1.8	4.8		1.5	-1.0	U	1.2
USGS-065	4/4/2018	2.6		1.0	4.6		1.0	-0.4	U	1.2
USGS-067	5/14/2018	2.8		1.0	92.1		2.4	0.4	U	1.4
USGS-068	4/11/2018	2.3	U	1.8	8.3		1.9	-0.6	U	1.9
USGS-070	4/5/2018	6.3		1.3	39.9		1.7	-1.3	U	1.5
USGS-085	4/16/2018	2.3	J+	1.0	8.2		1.0	1.1	U	1.7
USGS-087	4/10/2018	2.1	J+	0.9	2.9		0.8	0.1	U	1.3
USGS-098	5/8/2018	2.3		1.0	2.1		0.9	1.3	U	1.9
USGS-100	4/3/2018	2.6		0.9	3.9		0.9	1.1	U	1.7
Boundary										
Atomic City	4/9/2018	2.1		0.9	7.3		1.0	0.2	U	1.4
Crossroads	4/10/2018	1.6		0.9	4.4		0.9	0.5	U	1.5
Middle-2051 (1091 ft bls)	6/13/2018	1.5		0.8	3.9		0.9	0.3	U	1.7
Middle-2051 (749 ft bls)	6/13/2018	1.9		0.9	3.5		0.9	-0.2	U	1.5
USGS-008	4/10/2018	0.8	U	0.8	3.5		0.9	-0.5	U	1.3
USGS-011	4/9/2018	2.1	J+	0.9	2.9		0.8	0.5	U	1.5
USGS-103 (1258 ft bls)	6/26/2018	1.7		0.9	4.3		0.9	0.7	U	1.3
USGS-105 (1072 ft bls)	6/27/2018	1.1	U	0.8	4.4		0.9	-0.2	U	1.5
USGS-105 (972 ft bls)	6/27/2018	3.4		1.1	4.5		0.9	-0.2	U	1.5
USGS-108 (1172 ft bls)	6/25/2018	1.8		0.9	3.2		0.9	-0.2	U	1.6
USGS-124	4/9/2018	5.0		1.3	2.9		0.9	0.6	U	1.3
USGS-131A (616 ft bls)	6/19/2018	4.2		1.1	4.0		0.9	-0.3	U	1.1
USGS-131A (812 ft bls)	6/19/2018	1.5		0.9	4.6		0.9	0.3	U	1.6
USGS-132 (765 ft bls)	6/20/2018	1.6		0.8	3.2		0.8	1.2	U	2.2
USGS-137A (747 ft bls)	6/18/2018	2.9		1.0	4.0		0.9	-0.3	U	1.3
Distant										
Alpheus Spring	5/22/2018	2.6		1.1	8.0		1.1	1.6	U	1.7
Bill Jones Hatchery	5/22/2018	0.8	U	0.6	5.5		0.9	0.6	U	1.9
Clear Spring	5/22/2018	2.6		1.0	4.8		1.0	-0.2	U	1.8
Minidoka Water Supply	5/22/2018	2.4		0.9	3.7		1.0	0.0	U	1.5
Shoshone Water Supply	5/22/2018	3.5		1.0	3.3		0.9	1.8	U	2.0
Surface Water										
BLR @ EFS	4/4/2018	9.1		1.8	11.6		1.2	0.3	U	1.2
BLR @ INL Diversion	4/3/2018	8.5		1.7	3.2		1.0	-0.7	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. Uranium isotopes concentrations (pCi/L) in water samples, second quarter, 2018.

Sample Location	Sample Date	Uranium-234			Uranium-235			Uranium-238		
		Concentration		2 SD	Concentration		2 SD	Concentration		2 SD
Facility										
TAN 2271	4/18/2018	0.150		0.081	0.024	U	0.043	0.023	U	0.037
TAN 2272B	4/18/2018	1.45		0.40	0.092	U	0.091	0.28		0.15
TAN-28	4/18/2018	9.4		1.7	0.22		0.12	1.41		0.34
TAN-29	4/18/2018	6.4		1.2	0.17		0.11	1.06		0.28
TAN-37A	4/18/2018	4.94		0.97	0.16		0.10	0.96		0.28
TAN-42	4/24/2018	2.07		0.47	0.121	J*	0.087	0.99		0.27
TAN-44	4/24/2018	1.72		0.41	0.072	J*	0.065	0.80		0.24
TAN-47	4/24/2018	1.07		0.29	0.056	J*	0.056	0.55		0.19
USGS-047	5/15/2018	1.56		0.35	0.073	J*	0.060	0.65		0.19
USGS-048	5/15/2018	1.56		0.35	0.032	U	0.039	0.74		0.20
USGS-052	5/14/2018	1.51		0.37	0.083	J*	0.069	0.63		0.20
USGS-065	4/4/2018	1.93		0.45	0.039	U	0.054	0.98		0.28
USGS-067	5/14/2018	1.63		0.38	0.067	J*	0.061	0.63		0.20

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 considered an estimate because it is less than 3xSD but greater than or equal to 2xSD.

Table 11. Plutonium isotopes concentrations (pCi/L) in water samples, second quarter, 2018.

Sample Location	Sample Date	Plutonium-238			Plutonium-239/240		
		Concentration		2 SD	Concentration		2 SD
Facility							
USGS-047	5/15/2018	0.041	U	0.086	-0.019	U	0.031
USGS-048	5/15/2018	0.039	U	0.096	-0.015	U	0.044
USGS-052	5/14/2018	-0.046	U	0.086	-0.017	U	0.037
USGS-065	4/4/2018	0.046	U	0.065	-0.008	U	0.026
USGS-067	5/14/2018	0.034	U	0.081	-0.011	U	0.034

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

Table 12. Americium-241 concentration (pCi/L) in water samples, second quarter, 2018.

Sample Location	Sample Date	Americium-241		
		Concentration		2 SD
Facility				
USGS-065	4/4/2018	0.013	U	0.024

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

Table 13. Strontium-90 concentrations (pCi/L) in water samples, second quarter, 2018.

Sample Location	Sample Date	Strontium-90		
		Concentration		2 SD
Facility				
CFA 1	4/11/2018	-0.15	U	0.23
NRF-06	5/8/2018	0.01	U	0.21
NRF-09	5/8/2018	0.03	U	0.23
NRF-11	5/8/2018	0.09	U	0.23
NRF-12	5/8/2018	-0.09	U	0.23
TAN 2271	4/18/2018	430		100
TAN 2272B	4/18/2018	480		110
TAN-28	4/18/2018	224		53
TAN-29	4/18/2018	21.4		5.1
TAN-37A	4/18/2018	490		120
TAN-42	4/24/2018	0.44	U	0.29
TAN-44	4/24/2018	0.04	U	0.25
TAN-47	4/24/2018	0.18	U	0.25
USGS-047	5/15/2018	16.2		3.9
USGS-048	5/15/2018	7.9		1.9
USGS-052	5/14/2018	2.89		0.78
USGS-055	4/4/2018	22.7		5.5
USGS-061	4/5/2018	0.16	U	0.28
USGS-062	4/5/2018	0.90		0.37
USGS-065	4/4/2018	0.04	U	0.26
USGS-067	5/14/2018	10.9		2.6
USGS-068	4/11/2018	6.7		1.6
USGS-070	4/5/2018	18.1		4.3
USGS-085	4/16/2018	2.21		0.66
USGS-087	4/10/2018	0.04	U	0.24
USGS-098	5/8/2018	0.10	U	0.31

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

Table 14. Technetium-99 concentrations (pCi/L) in water samples, second quarter, 2018.

Sample Location	Sample Date	Technetium-99		
		Concentration		2 SD
Upgradient				
P&W-2	4/2/2018	0.9		0.2
USGS-019	4/2/2018	0.2		0.1
USGS-027	4/2/2018	1.9		0.2
Facility				
CFA 1	4/11/2018	9.2		0.3
USGS-047	5/15/2018	1.8		0.2
USGS-048	5/15/2018	2.4		0.2
USGS-052	5/14/2018	384.0		1.8
USGS-067	5/14/2018	100.7		0.9
USGS-085	4/16/2018	1.0		0.2
USGS-087	4/10/2018	0.9		0.2

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

Table 15. Tritium concentrations (pCi/L) in water samples, second quarter, 2018.

Sample Location	Sample Date	Tritium		
		Concentration		2 SD
Upgradient				
Mud Lake Water Supply	5/23/2018	-60	U	130
P&W-2	4/2/2018	100	U	130
USGS-019	4/2/2018	70	U	120
USGS-027	4/2/2018	70	U	120
Facility				
CFA 1	4/11/2018	2610		270
ICPP-MON-A-166	4/3/2018	120	U	130
NRF-06	5/8/2018	50	U	220
NRF-09	5/8/2018	80	U	140
NRF-11	5/8/2018	-50	U	130
NRF-12	5/8/2018	40	U	140
TAN 2271	4/18/2018	380		160
TAN 2272B	4/18/2018	550		170
TAN-28	4/18/2018	610		180
TAN-29	4/18/2018	1120		200
TAN-37A	4/18/2018	420		160
TAN-42	4/24/2018	680		170
TAN-44	4/24/2018	610		170
TAN-47	4/24/2018	0	U	130
USGS-047	5/15/2018	470		160
USGS-048	5/15/2018	610		170
USGS-052	5/14/2018	490		160
USGS-055	4/4/2018	9670		470
USGS-061	4/5/2018	720		180
USGS-062	4/5/2018	130	U	140
USGS-065	4/4/2018	1920		240
USGS-067	5/14/2018	1810		230
USGS-068	4/11/2018	130	U	140
USGS-070	4/5/2018	1140		200
USGS-085	4/16/2018	820		190
USGS-087	4/10/2018	540		170
USGS-098	5/8/2018	-10	U	130
USGS-100	4/3/2018	110	U	130
Boundary				
Atomic City	4/9/2018	110	U	140
Crossroads	4/10/2018	100	U	130
Middle-2051 (1091 ft bls)	6/13/2018	230		150
Middle-2051 (749 ft bls)	6/13/2018	240		150
USGS-008	4/10/2018	30	U	130
USGS-011	4/9/2018	140	U	140
USGS-103 (1258 ft bls)	6/26/2018	120	U	140
USGS-105 (1072 ft bls)	6/27/2018	260		150
USGS-105 (972 ft bls)	6/27/2018	200		150
USGS-108 (1172 ft bls)	6/25/2018	20	U	130
USGS-124	4/9/2018	110	U	140
USGS-131A (616 ft bls)	6/19/2018	870		190
USGS-131A (812 ft bls)	6/19/2018	970		190
USGS-132 (765 ft bls)	6/20/2018	160		140
USGS-137A (747 ft bls)	6/18/2018	50	U	130
Distant				
Alpheus Spring	5/22/2018	-10	U	130
Bill Jones Hatchery	5/22/2018	-40	U	130
Clear Spring	5/22/2018	0	U	130
Minidoka Water Supply	5/22/2018	-20	U	130
Shoshone Water Supply	5/22/2018	30	U	130
Surface Water				
BLR @ EFS	4/4/2018	100	U	130
BLR @ INL Diversion	4/3/2018	100	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 16. Enriched tritium concentrations (pCi/L) in water samples collected during various quarters and analyzed in the second quarter of 2018.

Sample Location	Sample Date	Enriched Tritium		
		Concentration		2 SD
Upgradient				
Mud Lake Water Supply	9/27/2017	-7	UJ	7
Facility				
M15S	11/2/2016	52		7
M6S	11/1/2016	9	U	8
NRF-09	5/9/2017	33		7
USGS-060	10/10/2017	11	U	9
Boundary				
USGS-011	4/19/2017	22		7
USGS-014	10/11/2017	3	U	5
USGS-125	10/11/2017	46		10
USGS-137A (747 ft bls)	6/13/2016	82		9
Distant				
Alpheus Spring	8/3/2017	39		8
Bill Jones Hatchery	8/3/2017	-4	U	7
Minidoka Water Supply	8/3/2017	-8	U	4
MV-01	7/25/2017	19		6
MV-02A	6/29/2015	13	U	10
MV-11	7/25/2017	15		6
MV-18	8/3/2017	28		8
MV-21	9/26/2017	2	U	6
MV-23	7/25/2017	24		8
MV-24A	7/25/2017	34		8
MV-29	8/3/2017	7	U	5
MV-37	9/26/2017	23		7
MV-43	9/26/2017	22		8
MV-59	6/27/2017	-1	U	7
Shoshone Water Supply	8/3/2017	11		6
Surface Water				
Birch Creek	10/16/2017	2	U	7

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 17. Dissolved metals concentrations (µg/L) in water samples, second quarter, 2018.

Sample Location	Sample Date	Arsenic		Barium		Chromium		Iron		Lead		Manganese		Selenium		Zinc	
Upgradient																	
P&W-2	4/2/2018	<2.0	U	44		1.5		<10	U	<1.0	U	<1.0	U	<2.0	U	<5.0	U
USGS-019	4/2/2018	<2.0	U	72		1.1		<10	U	<1.0	U	10		<2.0	U	<5.0	U
USGS-027	4/2/2018	2.7		80		5.6		38		<1.0	U	2.8		2.2		<5.0	U
Facility																	
CFA 1	4/11/2018	<2.0	U	88		12		<10	U	<1.0	U	<1.0	U	<2.0	U	<5.0	U
ICPP-MON-A-166	4/3/2018	<2.0	U	51		4.6		57		<1.0	U	7.5		<2.0	U	<5.0	U
NRF-06	5/8/2018	2.8		110		36		10		<1.0	U	<1.0	U	2.4		<5.0	U
NRF-09	5/8/2018	<2.0	U	150		13		13		<1.0	U	<1.0	U	2.7		<5.0	U
NRF-11	5/8/2018	<2.0	U	150		13		<10	U	<1.0	U	<1.0	U	2.2		<5.0	U
NRF-12	5/8/2018	<2.0	U	130		9.8		<10	U	<1.0	U	<1.0	U	2.1		<5.0	U
TAN 2271	4/18/2018	<2.0	U	720		3.4		4000		<1.0	U	1600		<2.0	U	<5.0	U
TAN 2272B	4/18/2018	2.9		1300		9.1		8000		<1.0	U	1400		<2.0	U	<5.0	U
TAN-28	4/18/2018	<2.0	U	340		2.5		35		<1.0	U	1400		<2.0	U	25	
TAN-29	4/18/2018	<2.0	U	240		1.2		12		<1.0	U	140		<2.0	U	14	
TAN-37A	4/18/2018	5.4		1100		57		21000		<1.0	U	2900		<2.0	U	7.3	
TAN-42	4/24/2018	2.2		180		4.7		11		<1.0	U	1.8		<2.0	U	<5.0	U
TAN-44	4/24/2018	2.1		180		3.7		<10	U	<1.0	U	<1.0	U	<2.0	U	<5.0	U
TAN-47	4/24/2018	<2.0	U	50		5.0		<10	U	<1.0	U	<1.0	U	<2.0	U	7	
USGS-047	5/15/2018	<2.0	U	63		6.3		<10	U	<1.0	U	<1.0	U	<2.0	U	<5.0	U
USGS-048	5/15/2018	<2.0	U	71		6.6		26		<1.0	U	<1.0	U	<2.0	U	<5.0	U
USGS-052	5/14/2018	<2.0	U	76		6.7		<10	U	<1.0	U	<1.0	U	<2.0	U	<5.0	U
USGS-055	4/4/2018	6.3		73		55		<10	U	<1.0	U	<1.0	U	<2.0	U	<5.0	U
USGS-061	4/5/2018	<2.0	U	58		4.9		60		<1.0	U	18		<2.0	U	<5.0	U
USGS-062	4/5/2018	9.6		48		8.4		<10	U	<1.0	U	<1.0	U	<2.0	U	<5.0	U
USGS-065	4/4/2018	<2.0	U	45		74		<10	U	<1.0	U	<1.0	U	<2.0	U	<5.0	U
USGS-067	5/14/2018	<2.0	U	110		6.8		<10	U	<1.0	U	<1.0	U	<2.0	U	<5.0	U
USGS-068	4/11/2018	<2.0	U	31		68		16		<1.0	U	<1.0	U	2.0		<5.0	U
USGS-070	4/5/2018	8.5		72		15		<10	U	<1.0	U	<1.0	U	<2.0	U	<5.0	U
USGS-085	4/16/2018	<2.0	U	87		19		<10	U	<1.0	U	<1.0	U	<2.0	U	<5.0	U
USGS-087	4/10/2018	<2.0	U	30		10		<10	U	<1.0	U	5.9		<2.0	U	8.1	
USGS-098	5/8/2018	<2.0	U	44		7.0		<10	U	<1.0	U	<1.0	U	<2.0	U	<5.0	U
USGS-100	4/3/2018	<2.0	U	34		3.1		11		<1.0	U	<1.0	U	<2.0	U	<5.0	U
Boundary																	
Atomic City	4/9/2018	2.4		35		2.3		<10	U	1.4		<1.0	U	<2.0	U	26	
Crossroads	4/10/2018	<2.0	U	26		<1.0	U	14		<1.0	U	20		<2.0	U	45	
Middle-2051 (1091 ft bls)	6/13/2018	<2.0	U	37		7.2		<10	U	<1.0	U	<1.0	U	<2.0	U	6.0	
Middle-2051 (749 ft bls)	6/13/2018	<2.0	U	60		6.5		<10	U	<1.0	U	3.6		<2.0	U	100	
USGS-008	4/10/2018	<2.0	U	83		2.5		75		<1.0	U	<1.0	U	<2.0	U	<5.0	U
USGS-011	4/9/2018	<2.0	U	52		3.8		<10	U	<1.0	U	<1.0	U	<2.0	U	<5.0	U
USGS-103 (1258 ft bls)	6/26/2018	<2.0	U	46		5.8		<10	U	<1.0	U	<1.0	U	<2.0	U	17	
USGS-105 (1072 ft bls)	6/27/2018	<2.0	U	36		8.1		<10	U	<1.0	U	<1.0	U	<2.0	U	6.3	
USGS-105 (972 ft bls)	6/27/2018	<2.0	U	35		7.4		<10	U	<1.0	U	<1.0	U	<2.0	U	8.1	

USGS-108 (1172 ft bls)	6/25/2018	<2.0	U	41		5.9		<10	U	<1.0	U	<1.0	U	<2.0	U	27	J
USGS-124	4/9/2018	<2.0	U	30		5.5		23		<1.0	U	5.3		<2.0	U	<5.0	U
USGS-131A (616 ft bls)	6/19/2018	<2.0	U	30		10		23		<1.0	U	<1.0	U	<2.0	U	<5.0	U
USGS-131A (812 ft bls)	6/19/2018	<2.0	U	54		10		<10	U	<1.0	U	<1.0	U	<2.0	U	12	
USGS-132 (765 ft bls)	6/20/2018	<2.0	U	45		8.1		<10	U	<1.0	U	<1.0	U	<2.0	U	5.2	
USGS-137A (747 ft bls)	6/18/2018	<2.0	U	34		7.1		12		<1.0	U	<1.0	U	<2.0	U	<5.0	U
Surface Water																	
BLR @ EFS	4/4/2018	<2.0	U	94		<1.0	U	24		<1.0	U	24		<2.0	U	<5.0	U
BLR @ INL Diversion	4/3/2018	<2.0	U	85		<1.0	U	35		<1.0	U	3.1		<2.0	U	<5.0	U

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

Table 18. Common ion concentrations (mg/L) in water samples, second quarter, 2018.

Sample Location	Sample Date	Calcium[1]		Magnesium[1]		Sodium[1]		Potassium[1]		Fluoride		Chloride		Sulfate		Alkalinity[2]	
Upgradient																	
P&W-2	4/2/2018	41		16		7		1.4		<0.20	U	6.54		27.4		145	
USGS-019	4/2/2018	45		17		9.6		1.4		<0.20	U	12.6		23.9		159	
USGS-027	4/2/2018	52		18		28		6.0		0.551		47.4		41.9		156	
Facility																	
CFA 1	4/11/2018	57		17		27		3.6		<0.20	U	77.9		32.4		129	
ICPP-MON-A-166	4/3/2018	35		13		9.9		2.8		0.225		15.9		20.2		122	
NRF-06	5/8/2018	130		35		150		5.5		<0.20	U	415		78.2		171	
NRF-09	5/8/2018	72		22		20		2.5		<0.20	U	53.2		41.4		197	
NRF-11	5/8/2018	67		21		18		2.4		<0.20	U	40.4		37.4		198	
NRF-12	5/8/2018	67		21		16		2.4		<0.20	U	36.5		36.9		197	
TAN 2271	4/18/2018	85		56		140		8.8		<0.20	U	122		27.4		540	
TAN 2272B	4/18/2018	120		130		330		8.2		1.91		125		0.985		1410	
TAN-28	4/18/2018	89		33		67		5.3		<0.20	U	114		39.6		333	
TAN-29	4/18/2018	70		20		54		5.1		<0.20	U	94.9		41.4		219	
TAN-37A	4/18/2018	120		55		1200		9.5		<2.0	U	99.5		52.6		1980	
TAN-42	4/24/2018	63		16		22		3.0		<0.20	U	62.2		33.9		156	
TAN-44	4/24/2018	64		17		23		3.2		<0.20	U	63.7		34.1		154	
TAN-47	4/24/2018	34		13		6.1		3.0		0.240		12.4		19.6		115	
USGS-047	5/15/2018	48		13		9.4		2.0		0.237		14.6		22.8		147	
USGS-048	5/15/2018	48		13		11		2.2		0.238		17.4		23.7		149	
USGS-052	5/14/2018	48		14		11		2.5		0.233		20.4		24.8		146	
USGS-055	4/4/2018	66		19		16		2.9		<0.20	U	16.4		82.6		163	
USGS-061	4/5/2018	73		16		12		2.3		<0.20	U	17.8		106		148	
USGS-062	4/5/2018	71		22		14		3.1		<0.20	U	19.5		128		149	
USGS-065	4/4/2018	81		18		14		3.5		<0.20	U	20.0		153		128	
USGS-067	5/14/2018	51		14		21		3.3		0.278		39.3		27.6		140	
USGS-068	4/11/2018	210		22		130		2.6		0.988		68.2		581		201	
USGS-070	4/5/2018	65		20		14		3.3		<0.20	U	17.1		100		155	
USGS-085	4/16/2018	55		15		9.9		2.4		<0.20	U	13.9		43.4		157	
USGS-087	4/10/2018	40		14		9.2		2.8		<0.20	U	14.9		24.7		132	
USGS-098	5/8/2018	43		17		11		2.3		<0.20	U	14.6		22.0		157	
USGS-100	4/3/2018	37		12		17		3.2		0.653		16.7		17.2		130	
Boundary																	
Atomic City	4/9/2018	34		13		17		3.2		0.555		17.0		17.4		134	
Crossroads	4/10/2018	29		12		7.9		2.3		<0.20	U	11.9		12.8		120	
Middle-2051 (1091 ft bls)	6/13/2018	39		18		7.7		2.4		<0.20	U	12.2		23.6		148	
Middle-2051 (749 ft bls)	6/13/2018	45		16		8.3		2.3		<0.20	U	11.1		25.9		157	
USGS-008	4/10/2018	47		14		6.7		1.7		<0.20	U	7.79		22.6		154	
USGS-011	4/9/2018	40		14		8.0		2.2		0.207		9.83		23.1		140	
USGS-103 (1258 ft bls)	6/26/2018	41		16		8.8		2.4		<0.20	U	15.2		23.7		140	
USGS-105 (1072 ft bls)	6/27/2018	40		15		11		2.8		<0.20	U	13.4		25.6		143	
USGS-105 (972 ft bls)	6/27/2018	41		16		10		2.7		<0.20	U	13.1		24.8		144	
USGS-108 (1172 ft bls)	6/25/2018	46		18		7.5		2.2		<0.20	U	17.3		25.1		155	
USGS-124	4/9/2018	40		16		9.9		2.4		0.349		16.5		24.0		138	

USGS-131A (616 ft bls)	6/19/2018	43		15		7.5		2.5		<0.20	U	17.3		23.6		140	
USGS-131A (812 ft bls)	6/19/2018	51		16		9.5		2.6		<0.20	U	25.6		27.7		154	
USGS-132 (765 ft bls)	6/20/2018	38		16		12		2.9		0.215		13.0		28.4		146	
USGS-137A (747 ft bls)	6/18/2018	40		15		11		2.7		0.217		12.8		25.7		145	
Surface Water																	
BLR @ EFS	4/4/2018	40		9.8		5.5		1.8		<0.20	U	3.63		19.2		130	
BLR @ INL Diversion	4/3/2018	37		9.4		5.4		2.1		<0.20	U	3.58		17.7		124	

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.

[1]Samples analyzed for calcium, magnesium, sodium, and potassium were filtered in the field.

[2]As $CaCO_3$.

Table 19. Dissolved nutrient concentrations (mg/L) in water samples, second quarter, 2018.

Sample Location	Sample Date	Nitrate + Nitrite		Phosphorus	
Upgradient					
P&W-2	4/2/2018	0.51		0.015	
USGS-019	4/2/2018	0.85		<0.005	U
USGS-027	4/2/2018	2.6		0.012	
Facility					
CFA 1	4/11/2018	2.7		0.020	
ICPP-MON-A-166	4/3/2018	0.27		0.022	
NRF-06	5/8/2018	2.0		0.074	
NRF-09	5/8/2018	3.0		0.035	
NRF-11	5/8/2018	2.2		0.028	
NRF-12	5/8/2018	2.1		0.028	
TAN 2271	4/18/2018	<0.01	U	0.94	
TAN 2272B	4/18/2018	<0.01	U	0.57	
TAN-28	4/18/2018	0.092		0.082	
TAN-29	4/18/2018	1.4		0.047	
TAN-37A	4/18/2018	0.82		5.9	
TAN-42	4/24/2018	1.7		0.036	
TAN-44	4/24/2018	1.7		0.035	
TAN-47	4/24/2018	0.7		0.019	
USGS-047	5/15/2018	2.1		0.031	
USGS-048	5/15/2018	1.6		0.028	
USGS-052	5/14/2018	1.9		0.024	
USGS-055	4/4/2018	2.9		0.210	
USGS-061	4/5/2018	1.3		0.028	
USGS-062	4/5/2018	1.5		0.160	
USGS-065	4/4/2018	1.4		0.022	
USGS-067	5/14/2018	4.7		0.022	
USGS-068	4/11/2018	8.7		0.045	
USGS-070	4/5/2018	1.5		0.270	
USGS-085	4/16/2018	1.0		0.028	
USGS-087	4/10/2018	0.78		0.014	
USGS-098	5/8/2018	1.1		0.023	
USGS-100	4/3/2018	2.1		0.015	
Boundary					
Atomic City	4/9/2018	1.6		0.017	
Crossroads	4/10/2018	0.023		<0.005	U
Middle-2051 (1091 ft bls)	6/13/2018	0.92		0.018	
Middle-2051 (749 ft bls)	6/13/2018	0.82		0.023	
USGS-008	4/10/2018	1.0		0.017	
USGS-011	4/9/2018	0.73		0.018	
USGS-103 (1258 ft bls)	6/26/2018	0.82		0.016	
USGS-105 (1072 ft bls)	6/27/2018	0.78		0.017	
USGS-105 (972 ft bls)	6/27/2018	0.82		0.017	
USGS-108 (1172 ft bls)	6/25/2018	1.1		0.019	
USGS-124	4/9/2018	0.88		0.015	
USGS-131A (616 ft bls)	6/19/2018	0.91		0.020	
USGS-131A (812 ft bls)	6/19/2018	1.3		0.017	
USGS-132 (765 ft bls)	6/20/2018	0.80		0.018	
USGS-137A (747 ft bls)	6/18/2018	0.71		0.016	
Surface Water					
BLR @ EFS	4/4/2018	0.15		0.026	
BLR @ INL Diversion	4/3/2018	0.10		0.042	

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 20. Volatile organic compound concentrations (µg/L) in water samples, second quarter, 2018.

Sample Location	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
TAN 2271	4/18/2018	<0.50 U	2.11	<0.50 U	1.39	85.2	1.24	<0.50 U	<0.50 U	<0.50 U	<0.50 U
TAN-28	4/18/2018	0.50	154	<0.50 U	18.1	59.2	3.77	<0.50 U	<0.50 U	<0.50 U	<0.50 U
TAN-29	4/18/2018	17.7	526	0.78	58.8	19.2	1.48	0.69	<0.50 U	<0.50 U	<0.50 U
TAN-42	4/24/2018	3.54	25.2	<0.50 U	0.66	<0.50 U	<0.50 U	<0.50 U	<0.50 U	<0.50 U	<0.50 U
TAN-44	4/24/2018	3.67	36.4	<0.50 U	1.07	<0.50 U	<0.50 U	<0.50 U	<0.50 U	<0.50 U	<0.50 U
TAN-47	4/24/2018	3.63	13.1	<0.50 U	<0.50 U	<0.50 U	<0.50 U	<0.50 U	<0.50 U	3.99	<0.50 U
USGS-087	4/10/2018	<0.50 U	1.24	<0.50 U	<0.50 U	<0.50 U	<0.50 U	<0.50 U	4.55	<0.50 U	<0.50 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

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 second 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 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, second quarter, 2018.

Sample Location/Dairy	Sample Date	Naturally occurring Potassium-40		Man-made Iodine-131[1]
		Concentration[3]	± 2 SD	
Monitoring Samples				
Gooding/Glanbia	04/12/2018	1430	115	<MDC
	05/15/2018	1381	105	<MDC
	06/07/2018	1543	115	<MDC
Riverside	04/09/2018	1631	131	<MDC
	05/06/2018	1903	147	<MDC
	06/03/2018	1822	126	<MDC
Verification Samples[2]				
Terreton	04/03/2018	1393	91	<MDC
Dietrich	04/02/2018	1451	120	<MDC
Idaho Falls	05/08/2018	1488	122	<MDC
Rupert	05/08/2018	1569	126	<MDC
Howe	06/05/2018	1467	110	<MDC
Dietrich	06/05/2018	1452	123	<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.

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 data set 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 second 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 precision, accuracy, and representativeness of results from analyzing laboratories. During the second quarter of 2018, the DEQ-INL OP submitted 114 QC samples for various radiological and non-radiological analyses (**Table 22**).

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

Results for blank samples submitted for gross alpha and gross beta screening in air for the second quarter of 2018 are presented in **Table 23**. Blank sample results for select gamma emitters in air from composited air filters 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 analyses results for radiological and non-radiological analytes in water are presented in **Tables 26, 27, 28,** and **29**.

Gross alpha radioactivity was detected at a concentration of 0.5 ± 0.2 pCi/L in one blank water sample. Gross alpha results for USGS-011, USGS-085, and USGS-087, which were analyzed on the same date as the failed blank, were qualified as high-biased estimates (J+). All other samples analyzed on the same date as the failed blank had gross alpha concentrations below MDC or greater than ten times the concentration measured in the blank.

[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.

Total nitrogen was detected at a concentration of 0.018 mg/L in one blank water sample. All samples analyzed on the same date as the failed blank had total nitrogen concentrations greater than ten times the concentration measured in the blank; therefore, no results were qualified or rejected.

All other blank-sample results passed acceptance criteria in the second 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 groundwater are presented in **Table 30** for radiological analyses and **Table 31**, **32**, and **33** for non-radiological analyses. One duplicate analysis for enriched tritium and one duplicate analysis for dissolved zinc did not pass acceptance criteria. Results for each of these samples were qualified as estimates and flagged with a "J." The results of samples analyzed together with these duplicates were consistent with historical data and were not qualified.

Four duplicate samples for ^{99}Tc were analyzed by a different laboratory (ALS) than the corresponding original samples in order to investigate whether the analytical method used by ISU-EML introduces a systematic bias to ^{99}Tc results. Due to significantly higher MDCs for the analyses performed by ALS, two duplicate samples had below-MDC concentrations. Of the duplicate pairs with ^{99}Tc concentrations above the MDCs of both labs, the result reported by ISU-EML was higher in both cases, with RPDs of 24.1% and 16.6%. One duplicate pair did not meet DEQ-INL OP's acceptance criteria. Because the number of

cross-laboratory duplicate-sample comparisons was small, and because it is unknown which laboratory's method produces a more accurate result, no sample was qualified as a result of this failure. However, DEQ-INL OP will continue to investigate this matter going forward.

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 second 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 second quarter 2018 are presented in **Table 34**. Real-time pressure correction is used to calculate the net exposure measured by these EIC control sets. All EIC spiked samples passed the DEQ-INL OP criteria.

Laboratory QC Issues

There were no laboratory QC issues in the second quarter of 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 second quarter of 2018 which significantly affected data quality. Methodologies and data reports issued by the contracting laboratories conformed to the requirements of DEQ-INL OP during the second quarter of 2018 with one exception: the laboratory contracted by ISU-EML to perform analyses requiring radiochemical separation techniques was unable to meet the requested MDC of 0.1 pCi/L for Pu-238 due to trace concentrations of Pu-238 in vendor-supplied isotopic standards. Reported MDCs for Pu-238 analyses ranged from 0.107 to 0.164 pCi/L.

Data usability is the measure of data that is not rejected compared to the amount that was obtained. The overall data usability rate for the second quarter of 2018 met the minimum criteria of the DEQ-INL OP ESP and is summarized in **Table 22**.

Preventative Maintenance and Equipment Reliability

All equipment was calibrated and checked according to prescribed periodicity. During the second quarter of 2018, the radioiodine pump was replaced at the Howe sampling station and the TSP sampler was replaced at Atomic City. Service reliability for air sampling equipment for the second quarter of 2018 is summarized in **Table 35**.

Conclusion

All data collected for the second quarter of 2018 have been assigned the applicable qualifiers to designate the appropriate use of the data. In addition, all data have been verified and deemed complete, meeting the requirements and data quality objectives established by DEQ-INL OP.

Table 22. Summary of the analytical performance and usability of the analyses performed for the DEQ-INL OP ESP, second 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	153	13	0	0	1	ISU-EML
		Gross beta	153	13	0	0	1	ISU-EML
		Gamma emitters	12	1	0	0	0	ISU-EML
		Radiochemical	0	0	0	0	0	ISU Sub
Water Vapor	Desiccant column	Tritium	39	4	0	0	0	ISU-EML
Gaseous	Charcoal filter	Iodine-131	13	0	0	0	0	ISU-EML
Precipitation	Poly bottle	Tritium	6	0	0	0	0	ISU-EML
		Gamma emitters	6	0	0	0	0	ISU-EML
Water								
Groundwater & Surface Water	Grab or composite	Gross alpha	54	4	4	0	0	ISU-EML
		Gross beta	54	4	4	0	0	ISU-EML
		Gamma emitters	54	4	4	0	0	ISU-EML
		Tritium	54	4	4	0	0	ISU-EML
		Enriched tritium	25	1	3	0	0	ISU-EML
		Technetium-99	10	1	5	0	0	ISU-EML
		Radiochemical	45	3	5	0	0	ISU Sub
		Metals	48	3	4	0	0	IBL
		Common Ions	48	3	4	0	0	IBL
		Nutrients	48	3	4	0	0	IBL
		Volatile Organics	7	2	1	0	0	IBL
Terrestrial								
Milk	Grab or composite	Gamma emitters	12	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	65	0	0	9	0	DEQ-INL OP
	HPICs	Gamma Radiation	10	NA	NA	NA	0	DEQ-INL OP
Total Analyses			**916**	**63**	**42**	**9**	**2**	
Total QC Analyses (blanks, duplicates, and spikes)			**114**					
QC Analyses as a percentage of total Test Analyses[3]			**12.4%**					
Percentage of usable data[4]			**99.8%**					

[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 23. Blank analysis results for gross alpha and beta in particulate air (TSP), second quarter, 2018.

Collection Period		Corrected volume (m^3)[1]	Gross alpha		Gross beta	
Start	Stop		Value	Uncertainty (± 2 SD)	Value	Uncertainty (± 2 SD)
03/29/18	04/05/18	2040	0.0	0.1	0.1	0.5
04/05/18	04/12/18	2040	-0.2	0.1	-0.4	0.5
04/12/18	04/19/18	2040	-0.1	0.1	-0.6	0.5
04/19/18	04/26/18	2040	-0.1	0.1	0.0	0.5
04/26/18	05/03/18	2040	0.0	0.1	0.1	0.5
05/03/18	05/10/18	2040	0.1	0.1	-0.2	0.5
05/10/18	05/17/18	2040	0.0	0.1	-0.1	0.5
05/17/18	05/24/18	2040	0.1	0.1	0.1	0.4
05/24/18	05/31/18	2040	-0.1	0.1	-0.2	0.5
05/31/18	06/07/18	2040	0.0	0.1	0.2	0.5
06/07/18	06/14/18	2040	-0.1	0.1	0.1	0.4
06/14/18	06/21/18	2040	0.0	0.1	-0.2	0.4
06/21/18	06/28/18	2040	0.0	0.1	0.0	0.4

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 24. Blank analysis results for gamma spectroscopy for TSP air filters, composite samples, second 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
07/23/18	28	38	63	17	55	123	8	26	19
Analysis Date	**Cesium-134**			**Cesium-137**		
	Concentration[1]	**± 2 SD**	**MDC**	**Concentration**	**± 2 SD**	**MDC**
07/23/18	1	4	6	4	4	6

Note: Concentrations are expressed in 1 x 10^{-3}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, second quarter, 2018.

Sample Number	Start Date	Collection Date	Analysis Date	Tritium		
				Concentration	± 2 SD	MDC
OP182ZTR01	06/19/18	07/18/18	08/03/18	0.06	0.11	0.19
OP182ZTR02	07/09/18	07/17/18	08/03/18	0.04	0.11	0.19
OP182ZTR03	07/09/18	07/18/18	07/27/18	-0.06	0.09	0.16
OP182ZTR04	07/09/18	07/18/18	08/03/18	0.09	0.11	0.19

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, second quarter, 2018.

Sample Number	Sample Date	Concentration	± 2 SD	MDC	Within Blank Criteria?
Gross Alpha					
181W086	4/10/2018	-0.1	0.2	0.4	Yes
181W354	6/19/2018	0.2	0.2	0.4	Yes
181W154	4/18/2018	0.5	0.2	0.3	No
181W335	5/22/2018	0.2	0.2	0.3	Yes
Gross Beta					
181W086	4/10/2018	0.2	0.5	0.9	Yes
181W354	6/19/2018	-0.3	0.6	0.9	Yes
181W154	4/18/2018	0.4	0.6	0.9	Yes
181W335	5/22/2018	-0.1	0.6	0.9	Yes
Cesium-137					
181W086	4/10/2018	-0.5	1.8	3.2	Yes
181W354	6/19/2018	0.4	1.2	2.0	Yes
181W154	4/18/2018	1.2	1.9	3.1	Yes
181W335	5/22/2018	0.2	1.2	2.0	Yes
Tritium					
181W089	4/10/2018	110	140	150	Yes
181W355	6/19/2018	60	130	150	Yes
181W156	4/18/2018	20	140	150	Yes
181W336	5/22/2018	20	130	150	Yes
Enriched Tritium					
171W002	4/17/2018	18	8	13	Yes*
Strontium-90					
181W087	4/10/2018	0.12	0.33	0.74	Yes
181W155	4/18/2018	0.07	0.26	0.60	Yes
Technetium-99					
181W088	4/10/2018	0.1	0.1	0.2	Yes
Uranium-234					
181W157	4/18/2018	0.055	0.066	0.107	Yes
Uranium-235					
181W157	4/18/2018	0.044	0.062	0.092	Yes
Uranium-238					
181W157	4/18/2018	0.018	0.052	0.094	Yes

MDC = minimum detectable concentration
* Detections in this range are typical of the DI water used by DEQ to prepare blank samples.

Table 27. Blank analysis results (µg/L) for metals in groundwater and/or surface water, second quarter, 2018.

Sample Number	Sample Date	Arsenic	Barium	Chromium	Iron	Lead	Manganese	Selenium	Zinc
181W091	4/10/2018	<2.0	<1.0	<1.0	<10	<1.0	<1.0	<2.0	<5.0
181W357	6/19/2018	<2.0	<1.0	<1.0	<10	<1.0	<1.0	<2.0	<5.0
181W159	4/18/2018	<2.0	<1.0	<1.0	<10	<1.0	<1.0	<2.0	<5.0

Table 28. Blank analysis results (mg/L) for common ions and nutrients in groundwater and/or surface water, second quarter, 2018.

Sample Number	Sample Date	Calcium	Magnesium	Sodium	Potassium	Fluoride	Chloride	Sulfate	Total Alkalinity†	Total Nitrogen	Total Phosphorus
181W091,090	4/10/2018	<0.10	<0.10	<0.10	<0.10	<0.20	<0.40	<0.80	<1.0	<0.010	<0.0050
181W357,356	6/19/2018	<0.10	<0.10	<0.10	<0.10	<0.20	<0.40	<0.80	<1.0	0.018	<0.0050
181W159,158	4/18/2018	<0.10	<0.10	<0.10	<0.10	<0.20	<0.40	<0.80	<1.0	<0.010	<0.0050

† As $CaCO_3$

Table 29. Blank analysis results (µg/L) for VOCs in groundwater and/or surface water, second quarter, 2018.

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
181W093	4/10/2018	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
181W161	4/18/2018	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50

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 30. Duplicate radiological analysis results in pCi/L for groundwater and/or surface water, second 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									
TAN-44	181W186	2.6	1.3	181W218	3.7	1.4	1.1	2.9	Yes
USGS-061	181W068	4.6	1.1	181W080	3.4	1.1	1.2	2.3	Yes
USGS-067	181W273	2.8	1.0	181W309	2.9	1.0	0.1	2.1	Yes
USGS-108	181W381	1.8	0.9	181W391	1.2	0.8	0.6	1.8	Yes
Gross Beta									
TAN-44	181W186	4.9	1.1	181W218	3.5	1.0	1.4	2.2	Yes
USGS-061	181W068	4.5	0.9	181W080	3.7	0.9	0.8	1.9	Yes
USGS-067	181W273	92.1	2.4	181W309	90.5	2.4	1.6	5.1	Yes
USGS-108	181W381	3.2	0.9	181W391	2.0	0.8	1.2	1.8	Yes
Cesium-137									
TAN-44	181W186	1.5	1.7	181W218	0.1	1.7	1.4	3.6	Yes
USGS-061	181W068	0.0	1.3	181W080	-1.1	1.6	1.1	3.1	Yes
USGS-067	181W273	0.4	1.4	181W309	1.5	1.9	1.1	3.5	Yes
USGS-108	181W381	-0.2	1.6	181W391	0.8	1.2	1.0	3.0	Yes
Tritium									
TAN-44	181W188	610	170	181W220	800	190	190	382	Yes
USGS-061	181W070	720	180	181W082	770	180	50	382	Yes
USGS-067	181W277	1810	230	181W313	1780	230	30	488	Yes
USGS-108	181W382	20	130	181W393	70	140	50	287	Yes
Enriched Tritium									
USGS-019[a]	171W137	5	7	171W105	6	6	1	14	Yes
MV-30[a]	171W416	13	8	171W380	18	6	5	15	Yes
Mud Lake WS	171W488	-7	7	171W434	15	8	22	16	No
Strontium-90									
TAN-44	181W187	0.04	0.25	181W219	-0.12	0.23	0.16	0.51	Yes
USGS-061	181W069	0.16	0.28	181W081	0.19	0.26	0.03	0.57	Yes
USGS-067	181W275	10.9	2.6	181W311	10.0	2.4	0.9	5.3	Yes
Technetium-99									
USGS-067	181W276	100.7	0.9	181W312	101.6	0.9	0.9	1.9	Yes
				181W321[b]	79	14	22	21	No
USGS-047	181W285	1.8	0.2	181W318[b]	2.1	4.2	0.3	6.3	Yes
USGS-048	181W294	2.4	0.2	181W319[b]	2.4	4.1	0.0	6.2	Yes
USGS-052	181W303	384.0	1.8	181W320[b]	325	52	59	78	Yes
Uranium-234									
TAN-44	181W189	1.72	0.41	181W221	1.72	0.40	0.00	0.86	Yes
USGS-067	181W278	1.63	0.38	181W314	1.44	0.33	0.19	0.75	Yes
Uranium-235									
TAN-44	181W189	0.072 J	0.065	181W221	0.043 U	0.053	0.029	0.13	Yes
USGS-067	181W278	0.067 J	0.061	181W314	0.046 U	0.047	0.021	0.12	Yes
Uranium-238									
TAN-44	181W189	0.80	0.24	181W221	0.98	0.27	0.18	0.54	Yes
USGS-067	181W278	0.63	0.20	181W314	0.69	0.20	0.06	0.42	Yes

[a]Result reported in the first-quarter 2018 Environmental Sampling Program Quarterly Data Report.
[b]Duplicate analyzed by a different laboratory than the original sample.

Table 31. Duplicate results for metals (µg/L) in groundwater, second quarter, 2018.

Sample Location	Sample Number	Sample Date	Arsenic	Barium	Chromium	Iron	Lead	Manganese	Selenium	Zinc
TAN-44	181W191	4/24/2018	2.1	180	3.7	<10	<1.0	<1.0	<2.0	<5.0
TAN-44	181W223	4/24/2018	2.1	180	4.0	<10	<1.0	<1.0	<2.0	<5.0
RPD			**0**	**0**	**-8**	**0**	**0**	**0**	**0**	**0**
USGS-061	181W072	4/5/2018	<2.0	58	4.9	60	<1.0	18	<2.0	<5.0
USGS-061	181W084	4/5/2018	<2.0	57	4.5	57	<1.0	17	<2.0	<5.0
RPD			**0**	**2**	**9**	**5**	**0**	**6**	**0**	**0**
USGS-067	181W280	5/14/2018	<2.0	110	6.8	<10	<1.0	<1.0	<2.0	<5.0
USGS-067	181W316	5/14/2018	<2.0	110	6.6	<10	<1.0	<1.0	<2.0	<5.0
RPD			**0**	**0**	**3**	**0**	**0**	**0**	**0**	**0**
USGS-108 (1172 ft bls)	181W384	6/25/2018	<2.0	41	5.9	<10	<1.0	<1.0	<2.0	27
USGS-108 (1172 ft bls)	181W397	6/25/2018	<2.0	41	5.9	<10	<1.0	<1.0	<2.0	40
RPD			**0**	**0**	**0**	**0**	**0**	**0**	**0**	**-39**

RPD = relative percent difference

Table 32. Duplicate results for common ions and nutrients (mg/L) in groundwater, second quarter, 2018.

Sample Location	Sample Number	Sample Date	Calcium	Magnesium	Sodium	Potassium	Fluoride	Chloride	Sulfate	Total Alkalinity†	Total Nitrogen	Total Phosphorus
TAN-44	181W191,190	4/24/2018	64	17	23	3.2	<0.20	63.7	34.1	154	1.7	0.035
TAN-44	181W223,222	4/24/2018	64	17	23	3.2	<0.20	63.4	34.1	157	1.7	0.034
RPD			**0**	**0**	**0**	**0**	**0**	**0**	**0**	**-2**	**0**	**3**
USGS-061	181W072,071	4/5/2018	73	16	12	2.3	<0.20	17.8	106	148	1.3	0.028
USGS-061	181W084,083	4/5/2018	73	16	12	2.3	<0.20	17.9	103	150	1.3	0.030
RPD			**0**	**0**	**0**	**0**	**0**	**-1**	**3**	**-1**	**0**	**-7**
USGS-067	181W280,279	5/14/2018	51	14	21	3.3	0.278	39.3	27.6	140	4.7	0.022
USGS-067	181W316,315	5/14/2018	51	14	20	3.3	0.276	39.3	27.6	140	4.7	0.025
RPD			**0**	**0**	**5**	**0**	**1**	**0**	**0**	**0**	**0**	**-13**
USGS-108	181W384,383	6/25/2018	46	18	7.5	2.2	<0.20	17.3	25.1	155	1.1	0.019
USGS-108	181W397,395	6/25/2018	46	18	7.5	2.2	<0.20	17.3	25.1	156	1.1	0.019
RPD			**0**	**0**	**0**	**0**	**0**	**0**	**0**	**-1**	**0**	**0**

RPD = relative percent difference
† As $CaCO_3$

Table 33. Duplicate results for VOCs (µg/L) in groundwater, second quarter, 2018.

Sample 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
TAN-44	181W193	4/24/2018	3.67	36.4	<0.50	1.07	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
TAN-44	181W225	4/24/2018	3.44	32.2	<0.50	0.91	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
RPD			**6**	**12**	**0**	**16**	**0**	**0**	**0**	**0**	**0**	**0**

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; RPD = relative percent difference

Table 34. Electret ionization chamber (EIC) irradiation results (categorized as spiked samples), second quarter, 2018.

Electret #	Exposure Received		Net Measured Exposure[1]		%R	Within Spec?
	(mR)	Uncertainty (±1 SD, mR)	(mR)	Uncertainty (±1 SD, mR)		
SJE044	41.8	2.1	37.0	1.4	88.5	Y
SJE084	41.8	2.1	36.2	1.4	86.6	Y
SJW979	41.8	2.1	34.6	1.4	82.7	Y
				Triplicate AVG:	**85.9**	**Y**
SJE009	30.0	1.5	26.2	1.4	87.2	Y
SHY840	30.0	1.5	28.8	1.3	96	Y
SJE145	30.0	1.5	26.1	1.4	86.9	Y
				Triplicate AVG:	**90.1**	**Y**
SIR544	20.7	1.0	19.3	1.3	93.2	Y
SJW991	20.7	1.0	18.2	1.4	87.8	Y
SJE130	20.7	1.0	19.0	1.4	91.8	Y
				Triplicate AVG:	**90.9**	**Y**

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

Table 35. Air sampling field equipment service reliability (percent operational), second quarter, 2018.

Station Locations	Sample Type			
	TSP	Radioiodine	Atmospheric Moisture	Precipitation
Onsite Locations				
Big Lost River Rest Area	100%	100%	100%	100%
Experimental Field Station	100%	100%	100%	NC[1]
Sand Dunes Tower	100%	100%	100%	NC[1]
Van Buren Avenue	100%	100%	100%	NC[1]
Boundary Locations				
Atomic City	92%	100%	100%	100%
Howe	100%	92%	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, second 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	03/29/18	04/05/18	0.8	0.2	26.6	1.1
	04/05/18	04/12/18	0.4	0.2	18.3	1.0
	04/12/18	04/19/18	0.7	0.2	16.8	1.0
	04/19/18	04/26/18	0.9	0.2	31.0	1.2
	04/26/18	05/03/18	1.1	0.2	28.9	1.2
	05/03/18	05/10/18	1.5	0.3	36.9	1.3
	05/10/18	05/17/18	0.6	0.2	24.3	1.1
	05/17/18	05/24/18	1.0	0.2	37.4	1.3
	05/24/18	05/31/18	1.1	0.3	35.4	1.3
	05/31/18	06/07/18	1.0	0.2	34.2	1.3
	06/07/18	06/14/18	1.3	0.3	35.5	1.3
	06/14/18	06/21/18	0.9	0.2	27.6	1.2
	06/21/18	06/28/18	1.0	0.2	34.1	1.3
Experimental Field Station	03/29/18	04/05/18	0.7	0.4	19.3	1.9
	04/05/18	04/12/18	0.4	0.2	12.3	0.9
	04/12/18	04/19/18	0.3	0.2	10.9	0.9
	04/19/18	04/26/18	0.7	0.2	21.4	1.1
	04/26/18	05/03/18	0.8	0.2	20.8	1.1
	05/03/18	05/10/18	0.9	0.2	27.5	1.2
	05/10/18	05/17/18	0.4	0.4	10.2	1.5
	05/17/18	05/24/18	R[1]	R[1]	R[1]	R[1]
	05/24/18	05/31/18	0.8	0.3	26.6	1.6
	05/31/18	06/07/18	0.9	0.2	27.5	1.2
	06/07/18	06/14/18	1.0	0.3	25.0	1.1
	06/14/18	06/21/18	0.9	0.2	18.9	1.0
	06/21/18	06/28/18	0.7	0.2	22.7	1.1
Sand Dunes Tower	03/29/18	04/05/18	0.5	0.2	15.5	0.9
	04/05/18	04/12/18	0.3	0.2	10.2	0.8
	04/12/18	04/19/18	0.3	0.2	9.2	0.8
	04/19/18	04/26/18	0.5	0.2	19.8	1.0
	04/26/18	05/03/18	0.5	0.2	17.6	0.9
	05/03/18	05/10/18	0.4	0.3	19.1	1.7
	05/10/18	05/17/18	0.3	0.2	13.7	0.8
	05/17/18	05/24/18	0.7	0.2	20.2	1.0
	05/24/18	05/31/18	0.5	0.2	20.1	1.0
	05/31/18	06/07/18	0.5	0.2	18.5	0.9
	06/07/18	06/14/18	0.6	0.2	18.4	0.9
	06/14/18	06/21/18	0.3	0.2	15.3	0.9
	06/21/18	06/28/18	0.5	0.2	18.8	0.9

[1]R – Results rejected due to insufficient sample volume

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, second quarter, 2018.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	±2 SD	Concentration	±2 SD
Van Buren Avenue	03/29/18	04/05/18	0.5	0.2	15.8	0.9
	04/05/18	04/12/18	0.3	0.2	10.4	0.8
	04/12/18	04/19/18	0.3	0.2	9.9	0.8
	04/19/18	04/26/18	0.6	0.2	17.6	1.0
	04/26/18	05/03/18	0.8	0.2	18.1	1.0
	05/03/18	05/10/18	0.9	0.2	22.1	1.1
	05/10/18	05/17/18	0.3	0.2	12.9	0.8
	05/17/18	05/24/18	0.5	0.2	21.6	1.0
	05/24/18	05/31/18	0.8	0.2	22.4	1.1
	05/31/18	06/07/18	0.7	0.2	22.3	1.1
	06/07/18	06/14/18	0.7	0.2	21.4	1.0
	06/14/18	06/21/18	0.5	0.2	16.0	0.9
	06/21/18	06/28/18	0.6	0.2	20.7	1.0
Boundary Locations						
Atomic City	03/29/18	04/05/18	0.7	0.2	25.5	1.1
	04/05/18	04/12/18	0.5	0.2	16.3	0.9
	04/12/18	04/19/18	0.5	0.2	14.1	0.9
	04/19/18	04/26/18	1.1	0.2	27.7	1.2
	04/26/18	05/03/18	0.9	0.2	23.9	1.1
	05/03/18	05/10/18	1.2	0.3	36.5	1.3
	05/10/18	05/17/18	0.5	0.2	17.3	1.0
	05/17/18	05/24/18	1.0	0.2	29.8	1.2
	05/24/18	05/31/18	1.0	0.2	30.2	1.2
	05/31/18	06/07/18	1.0	0.2	31.6	1.2
	06/07/18	06/14/18	0.9	0.3	25.7	1.5
	06/14/18	06/21/18	NS[1]	NS[1]	NS[1]	NS[1]
	06/21/18	06/28/18	1.1	0.2	32.6	1.2
Howe	03/29/18	04/05/18	0.7	0.2	15.8	1.0
	04/05/18	04/12/18	0.5	0.2	9.8	0.8
	04/12/18	04/19/18	0.4	0.2	9.5	0.8
	04/19/18	04/26/18	0.7	0.2	18.9	1.0
	04/26/18	05/03/18	0.7	0.2	17.7	1.0
	05/03/18	05/10/18	1.1	0.3	23.8	1.1
	05/10/18	05/17/18	0.4	0.2	14.7	0.9
	05/17/18	05/24/18	0.7	0.2	20.6	1.1
	05/24/18	05/31/18	0.5	0.2	22.8	1.1
	05/31/18	06/07/18	0.7	0.2	21.6	1.1
	06/07/18	06/14/18	0.6	0.2	20.5	1.0
	06/14/18	06/21/18	0.2	0.1	14.7	0.9
	06/21/18	06/28/18	0.6	0.2	19.3	1.0

[1]NS – No sample - failed TSP sampler replaced on 06/21/2018.

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, second quarter, 2018.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	±2 SD	Concentration	±2 SD
Monteview	03/29/18	04/05/18	0.6	0.2	21.1	1.0
	04/05/18	04/12/18	0.4	0.2	12.5	0.9
	04/12/18	04/19/18	0.4	0.2	11.1	0.9
	04/19/18	04/26/18	0.8	0.2	19.4	1.0
	04/26/18	05/03/18	0.9	0.2	22.9	1.1
	05/03/18	05/10/18	1.1	0.2	27.4	1.2
	05/10/18	05/17/18	0.7	0.2	19.3	1.0
	05/17/18	05/24/18	0.7	0.2	23.4	1.1
	05/24/18	05/31/18	NS[1]	NS[1]	NS[1]	NS[1]
	05/31/18	06/07/18	0.7	0.2	23.4	1.1
	06/07/18	06/14/18	0.9	0.2	22.8	1.1
	06/14/18	06/21/18	0.9	0.3	20.6	1.5
	06/21/18	06/28/18	0.9	0.4	27.8	1.9
Mud Lake	03/29/18	04/05/18	1.3	0.3	22.2	1.3
	04/05/18	04/12/18	0.7	0.2	16.1	0.9
	04/12/18	04/19/18	0.8	0.2	14.7	0.9
	04/19/18	04/26/18	0.9	0.2	25.7	1.1
	04/26/18	05/03/18	1.2	0.3	25.5	1.1
	05/03/18	05/10/18	1.3	0.3	33.4	1.3
	05/10/18	05/17/18	0.9	0.2	22.9	1.1
	05/17/18	05/24/18	0.9	0.2	31.0	1.2
	05/24/18	05/31/18	0.7	0.2	30.3	1.2
	05/31/18	06/07/18	0.9	0.2	31.9	1.2
	06/07/18	06/14/18	1.3	0.3	28.8	1.2
	06/14/18	06/21/18	0.9	0.2	22.9	1.1
	06/21/18	06/28/18	1.1	0.3	26.7	1.2
Distant Locations						
Craters of the Moon	03/29/18	04/05/18	0.5	0.2	16.3	0.9
	04/05/18	04/12/18	0.5	0.2	10.2	0.8
	04/12/18	04/19/18	0.5	0.2	12.9	0.9
	04/19/18	04/26/18	0.7	0.2	22.2	1.1
	04/26/18	05/03/18	1.1	0.2	19.2	1.0
	05/03/18	05/10/18	1.0	0.2	24.8	1.1
	05/10/18	05/17/18	0.6	0.2	14.4	0.9
	05/17/18	05/24/18	0.7	0.2	25.0	1.1
	05/24/18	05/31/18	0.7	0.2	26.6	1.2
	05/31/18	06/07/18	0.6	0.2	24.5	1.1
	06/07/18	06/14/18	0.7	0.2	22.1	1.0
	06/14/18	06/21/18	0.4	0.2	19.1	1.0
	06/21/18	06/28/18	0.6	0.2	24.5	1.1

[1]NS – No sample – sampler not restarted previous week.

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, second quarter, 2018.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	±2 SD	Concentration	±2 SD
Fort Hall[1]	03/29/18	04/05/18	1.4	0.3	26.2	1.1
	04/05/18	04/12/18	1.1	0.3	20.2	1.0
	04/12/18	04/19/18	1.1	0.3	17.1	1.0
	04/19/18	04/26/18	1.2	0.3	30.8	1.2
	04/26/18	05/03/18	1.2	0.3	31.1	1.2
	05/03/18	05/10/18	1.7	0.3	37.4	1.3
	05/10/18	05/17/18	1.0	0.2	25.4	1.1
	05/17/18	05/24/18	1.6	0.3	41.2	1.4
	05/24/18	05/31/18	1.5	0.3	38.1	1.3
	05/31/18	06/07/18	1.3	0.3	38.2	1.3
	06/07/18	06/14/18	1.4	0.3	35.4	1.3
	06/14/18	06/21/18	0.9	0.2	30.0	1.2
	06/21/18	06/28/18	1.1	0.2	34.2	1.3
Idaho Falls - HVP 4304	03/29/18	04/05/18	1.3	0.3	25.3	1.1
	04/05/18	04/12/18	0.8	0.2	14.7	0.9
	04/12/18	04/19/18	0.6	0.2	12.4	0.9
	04/19/18	04/26/18	1.0	0.2	24.1	1.1
	04/26/18	05/03/18	0.9	0.2	24.1	1.1
	05/03/18	05/10/18	1.6	0.3	31.1	1.2
	05/10/18	05/17/18	NS[3]	NS[3]	NS[3]	NS[3]
	05/17/18	05/24/18	1.1	0.2	31.9	1.2
	05/24/18	05/31/18	0.7	0.2	21.3	1.1
	05/31/18	06/07/18	0.8	0.2	20.0	1.0
	06/07/18	06/14/18	1.7	0.5	52.4	2.4
	06/14/18	06/21/18	0.9	0.2	25.5	1.1
	06/21/18	06/28/18	1.2	0.3	33.4	1.3
Idaho Falls - HVP 4304[2]	03/29/18	04/05/18	0.7	0.2	16.2	0.9
	04/05/18	04/12/18	0.5	0.2	13.3	0.9
	04/12/18	04/19/18	0.3	0.2	12.0	0.9
	04/19/18	04/26/18	0.7	0.2	21.8	1.1
	04/26/18	05/03/18	1.0	0.2	23.4	1.1
	05/03/18	05/10/18	1.5	0.3	27.7	1.2
	05/10/18	05/17/18	0.6	0.2	19.0	1.0
	05/17/18	05/24/18	1.0	0.2	31.0	1.2
	05/24/18	05/31/18	1.1	0.2	29.5	1.2
	05/31/18	06/07/18	1.0	0.2	30.7	1.2
	06/07/18	06/14/18	1.2	0.3	27.7	1.2
	06/14/18	06/21/18	0.8	0.2	21.7	1.0
	06/21/18	06/28/18	0.9	0.2	28.8	1.2

[1] Operated by Shoshone Bannock-Tribes.
[2] HVP 4304 – This is a duplicate sampler.
[3] NS – No sample due to special project..

Appendix B

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

Sample Location	Net Corrected Exposure Rate (µR/hr)[1]	± 2 SD (µR/hr)
Arco	12.1	2.9
Craters of the Moon	13.2	2.0
Rest Area	14.0	1.2
Van Buren Avenue	15.1	3.4
Experimental Field Station	15.7	2.3
Main Gate	12.7	1.5
Atomic City	14.3	1.9
Taber	13.6	3.3
Blackfoot	9.9	1.3
Ft. Hall	16.9	1.5
Idaho Falls	12.4	1.9
Mud Lake/ Terreton	14.2	1.7
Monteview	14.5	1.6
Sand Dunes	15.3	3.2
Howe Met. Tower	14.0	2.6
MP282 -20	9.8	0.8
MP280 -20	12.7, 14.6	
MP278 -20	12.9	2.7
MP276 -20	11.0	2.9
MP274 -20	10.0	2.9
MP272 -20	11.1	2.3
MP270 -20	11.5	0.7
MP268 -20	12.1	2.8
MP266 -20	12.6, 13.0	
MP264 -20	9.8, 10.4	
MP270 -20/26	11.8	1.5
MP268 -20/26	14.6	2.8
MP266 -20/26	12.0	2.4
MP263 -20/26	12.4	3.0
MP261 -20/26	10.9	3.5
MP259 -20/26	12.6	3.9
MP256 -20/26	8.6	0.8
MFC (EBR II)	13.3	2.6
EBR I	11.3, 14.0	
RWMC	12.1	2.9
CFA	15.3	1.4
CITRC (PBF)	17.3	2.9
INTEC	17.3	2.3
ATR (TRA)	14.4	3.3
NRF	15.3	2.8
TAN/SMC	8.6, 9.6	
Mud Lake Bank of Commerce	12.3	2.4
MP43-33	12.4, 13.9	
MP41-33	13.6	3.0
MP39-33	13.0, 15.5	
MP37-33	11.6	3.1
MP35-33	10.8	0.2
MP33-33	14.9	0.8
MP31-33	12.4, 14.8	
MP29-33	13.5	1.7
MP27-33	14.8	1.1

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

Sample Location	Net Corrected Exposure Rate (µR/hr)[1]	± 2 SD (µR/hr)
MP25-33	13.0	2.8
MP23-33	8.7, 9.2	
MP21-33	8.5, 9.6	
MP19-33	13.2	2.1
MP14-33	12.3	1.0
MP11-33	12.6	3.3
MP06-33	9.7	3.7
MP03-33	14.8, 15.0	
Base of Howe	14.7	0.8
Rover	13.4	0.7
Hamer	14.0	3.4
Sugar City	14.4	3.1
Roberts	12.5	1.9
Big Southern Butte	13.4	1.7
T4 North	12.6	1.1
T4 South	13.4, 13.7	

[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.

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 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