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 second quarter, 2019 (**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 2019 the HVP-3804 sampler at Idaho Falls air monitoring station that was being operated as a duplicate was removed from service. DEQ-INL OP is currently operating one HVP-4304 sampler at the Idaho Falls air monitoring station. 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 2019 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. Six individual samples and two weighted means had tritium concentrations above the MDC, but all samples were 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 2019. 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 2019. Analysis results for Tritium (H-3) and Cesium-137, the most likely to be detected of manmade gamma-emitting radionuclides, are presented in **Table 5**.

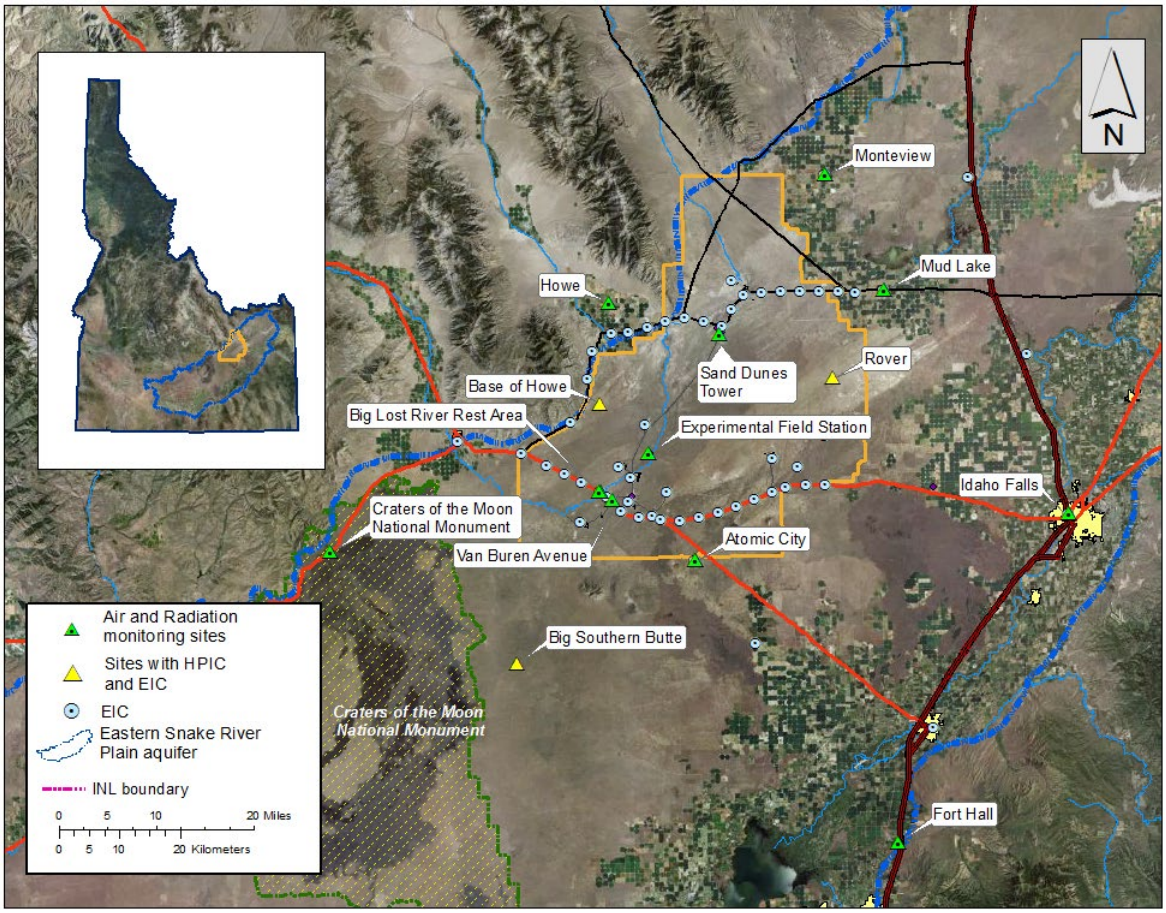

Figure 1. Air and radiation monitoring sites.

Table 1. Sampling locations and sample type.

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

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

Table 2. Range of gross alpha and gross beta concentrations for TSP filters, second quarter, 2019.

Station Location	Concentration					
	Gross Alpha			Gross Beta		
On-Site Locations						
Big Lost River Rest Area	0.4	-	1.3	13.8	-	41.8
Experimental Field Station	0.2	-	1.1	10.4	-	31.3
Sand Dunes Tower	0.1	-	0.6	7.5	-	24.9
Van Buren Avenue	0.2	-	1.0	6.9	-	24.3
Boundary Locations						
Atomic City	0.4	-	1.3	14.1	-	40.1
Howe	0.2	-	1.0	7.1	-	25.2
Monteview	0.4	-	1.2	10.4	-	32.2
Mud Lake	0.3	-	1.2	11.0	-	39.5
Distant Locations						
Craters of the Moon	0.1	-	1.1	7.2	-	31.8
Fort Hall[1]	0.5	-	1.7	12.5	-	42.8
Idaho Falls	0.4	-	2.6	13.1	-	49.7

[1]Operated by Shoshone-Bannock Tribes.
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, 2019.

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	151.8	7.8	<MDC[2]	
Experimental Field Station	116.0	6.1	<MDC	
Sand Dunes Tower	86.7	4.6	<MDC	
Van Buren Avenue	69.2	3.8	<MDC	
Boundary Locations				
Atomic City	137.2	7.1	<MDC	
Howe	87.6	4.6	<MDC	
Monteview	89.4	4.8	<MDC	
Mud Lake	135.5	7.0	<MDC	
Distant Locations				
Craters of the Moon	88.2	4.7	<MDC	
Fort Hall[1]	131.9	6.9	<MDC	
Idaho Falls	119.2	6.3	<MDC	

[1]Operated by Shoshone-Bannock Tribes.
[2]MDC for Cs-137 typically (0.05-0.10) x 10^{-3} pCi/m^3.
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, 2019.

Station Location	Tritium		
	Concentration	± 2 SD	MDC
On-site Locations			
Big Lost River Rest Area	0.53	0.36	0.56
Experimental Field Station	0.83	0.38	0.59
Sand Dunes Tower	0.25	0.26	0.43
Van Buren Avenue	0.66	0.38	0.59
Boundary Locations			
Atomic City	0.28	0.36	0.59
Howe	0.32	0.38	0.63
Mud Lake	0.03	0.04	0.07
Monteview	0.41	0.36	0.58
Distant Locations			
Craters of the Moon	0.23	0.32	0.52
Fort Hall[1]	0.26	0.40	0.66
Idaho Falls	0.19	0.19	0.31

[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, 2019.

Station Location	Tritium			Cesium-137		
	Concentration	± 2 SD	MDC	Concentration	± 2 SD	MDC
On-site Locations						
Big Lost River Rest Area	80	90	150	-1.2	2.0	3.5
Boundary Locations						
Atomic City	80	90	150	-0.6	1.2	2.2
Howe	120	90	150	0.6	1.5	2.6
Monteview	90	90	150	-0.3	1.2	2.1
Mud Lake	130	90	150	1.7	1.5	2.4
Distant Locations						
Idaho Falls	70	90	150	0.4	1.4	2.4

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 monitoring stations during the second quarter of 2019 (**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 2019. **Table 8** lists the EIC monitoring results for second quarter 2019. 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, 2019, 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	13.8	1.0
[1]Rover	-	-
[1]Sand Dunes Tower	-	-
Boundary Locations		
Atomic City	13.0	0.9
Big Southern Butte	13.0	2.0
Howe Met Tower	12.9	0.9
Monteview	12.8	0.9
Mud Lake / Terreton	12.1	2.1
Distant Locations		
Fort Hall	12.9	1.5
Idaho Falls	10.3	2.8

[1]No data available for these locations for second quarter 2019 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, second quarter, 2019.

Station Location	Exposure Rate (µR/hr)	
	Quarterly Average[1]	± 2 SD
On-Site Locations		
Base of Howe	9.4	0.7
Big Lost River Rest Area	11.1	3.4
Experimental Field Station	16.3, 14.7	-
Rover	12.7, 15.7	-
Sand Dunes Tower	11.7	2.3
Van Buren Avenue	12.5	0.9
Boundary Locations		
Atomic City	11.3	3.2
Big Southern Butte	6.6	3.4
Howe Met Tower	10.7	3.4
Monteview	9.5	1.8
Mud Lake/Terreton	11.5	2.3
Distant Locations		
Craters of the Moon	10.3	1.4
Fort Hall	13.2, 14.3	-
Idaho Falls	9.7	1.2

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

Water Monitoring Results

DEQ-INL OP collects groundwater samples from wells and springs located within, upgradient of, and downgradient of the INL in order to evaluate the effects of INL contaminants on water quality in the eastern Snake River Plain (ESRP) aquifer and verify the results of DOE and USGS monitoring. Each year, DEQ-INL OP samples approximately 80-85 locations concurrently with a DOE contractor or the USGS and 15-20 locations independently. Co-sampled locations are primarily on or near the INL Site and are usually sampled during the second and fourth calendar quarters. DEQ-INL OP publishes a comparison of its own analytical results with those obtained by co-samplers in the DEQ-INL Oversight Program Annual Report. Locations sampled independently by DEQ-INL OP are mostly in the Magic Valley and are typically sampled during the third calendar quarter.

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

- *Upgradient* sites are situated north or northeast of INL facilities in areas that have not been affected by INL operations. They are used to monitor background concentrations in the aquifer.

- *Facility* sites are located near facility complexes within the INL, including the Advanced Test Reactor complex (ATR), the Central Facilities Area (CFA), the Idaho Nuclear Technology and Engineering Center (INTEC), the Materials and Fuels Complex (MFC), the Naval Reactors Facility (NRF), the Radioactive Waste Management Complex (RWMC), and Test Area North

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

- *Boundary* sites are located near the southern boundary of the INL, downgradient of potential sources of INL contamination. These include several wells equipped with Westbay Multilevel Groundwater Monitoring Systems ("Westbay wells"), which offer a look at the vertical distribution of constituents in the aquifer.

- *Distant* sites are located farther downgradient of the INL, primarily in the Magic Valley, and include wells and springs used for agricultural, municipal, domestic, and industrial purposes.

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

Samples collected from water-monitoring sites are analyzed for radiological and non-radiological constituents, many of which are present in the aquifer both naturally and as a result of INL operations. All locations are sampled for gross alpha and gross beta radioactivity, manmade gamma-emitting nuclides, tritium, common ions,[1] and nitrate-plus-nitrite.[2] Samples from locations at which tritium concentrations are too low to be detected by the standard method are re-analyzed for tritium using an electrolytic enrichment method (referred to as the low-level method), which has a minimum detectable concentration (MDC) about ten times lower than the standard method. Selected sites are also sampled for specific radionuclides—including uranium isotopes (^{234}U, ^{235}U, and ^{238}U), plutonium isotopes (^{238}Pu, $^{239/240}$Pu), americium-241 (^{241}Am), strontium-90 (^{90}Sr), and technetium-99 (^{99}Tc)—selected trace metals, total phosphorous, and/or volatile organic compounds (VOCs) based on past and present INL operations or a history of elevated concentrations. If unexpected levels of radioactivity are detected in gross measurements, additional samples will be collected and analyzed for specific radionuclides.

During the second quarter of 2019, DEQ-INL OP sampled groundwater from the aquifer at 31 facility locations, 15 boundary locations, eight distant locations, five upgradient locations, and also two surface water locations, and two perched water locations. **Table 9** lists the sample date, co-sampler, well depth, and analyses requested for the locations sampled this quarter. Analytical results are reported in **Tables 11 through 22** and summarized below. The results of low-level tritium analyses for 15 samples collected in previous quarters are reported in **Table 13** and discussed below.

Table 10 shows the range of background concentrations for each constituent in the ESRP aquifer and the EPA drinking water maximum contaminant level (MCL) or secondary MCL. Background concentrations depend on local geology, and the concentrations of constituents at sites not influenced by INL activities may on occasion be higher than the given background ranges due to local factors and natural variability.

Gross alpha and gross beta radioactivity

Gross alpha and gross beta analyses are used to screen for unexpectedly high levels of radioactivity in samples. DEQ-INL OP has determined from past sampling that background concentration ranges for gross alpha and gross beta radioactivity in the ESRP aquifer are approximately 0-5.6 pCi/L and 0-8.6

[1] The common ions are calcium, magnesium, potassium, sodium, chloride, fluoride, sulfate, and bicarbonate (reported here as alkalinity).
[2] 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, nitrate-plus-nitrate, and other constituents are collected at these locations during the third quarter.

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

Gross alpha and beta radioactivity were detected at low levels in most samples. Gross alpha radioactivity was measured at concentrations within the known background range at TAN, ATR perched water and at NRF, while a perched water well, USGS-070, had a value of 5.9 ± 1.6 pCi/L which is slightly elevated with respect to background. Above background levels of gross beta radioactivity were detected at TAN, INTEC, NRF, ATR, and ATR perched groundwater (**Table 11**), with a maximum of 976 ± 11 pCi/L at TAN-2271. This location's sample did not, however, exceed the drinking water MCL for gross alpha radioactivity. The MCL for gross beta radioactivity is nuclide-dependent; see the Strontium-90 and Technetium-99 sections below for MCL values. The gross beta concentration at Alpheus Spring (9.6 ± 1.2 pCi/L) was slightly above the natural background range typically observed in the aquifer but consistent with previous measurements at this location. All other detectable concentrations in groundwater were consistent with historical trends, and all elevated concentrations at the INL were in areas of known contamination.

Manmade gamma-emitting radionuclides

No manmade gamma-emitting radionuclides were detected at the locations sampled this quarter. Results for cesium-137 (^{137}Cs), the manmade gamma-emitter most likely to be detected in groundwater, are reported in **Table 11**.

Tritium

Tritium was measured at all locations sampled this quarter (**Table 12**). Using the standard analytical method, which typically has an MDC of 110 to 190 pCi/L, tritium was detected at 20 facility locations, six boundary locations, and zero upgradient, distant, and surface water locations. The highest concentration measured was 2,510 ± 180 pCi/L in CFA-1whose tritium concentration has been declining steadily over the years of observation. An elevated perched groundwater tritium concentration was measured at 1,290 ± 140 pCi/L at USGS-055 whose tritium concentration is known to fluctuate widely and in correlation with water level (DOE/ID-22242). 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 1,258 feet below land surface (ft bls), with a maximum of 1100 ± 140 pCi/L at a depth of 812 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.

Samples from this quarter requiring low-level tritium analysis have not yet been analyzed by that method due to a sample backlog. Ten low-level tritium samples from 2018 and five from 2017 were analyzed in the second quarter of 2019, and the results are reported in **Table 13**. Three samples are from boundary wells, two are from facility wells, and the remaining ten are from distant, upgradient, and surface water locations. All reported concentrations are consistent with past results with only two concentrations slightly above background concentrations (46 ± 9 pCi/L at Highway 3 and 76 ± 10 pCi/L at ICPP-MON-A-166). A backlog of 48 samples to be analyzed for low-level tritium remains.

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

Strontium-90

Seventeen locations were sampled for ^{90}Sr during the second quarter 2019 (**Table 14**). Detectable concentrations were found in 12 aquifer samples from INTEC, TAN, ATR, and perched groundwater at ATR with a maximum concentration of 620 ± 150 pCi/L at TAN-37. Nine locations had ^{90}Sr concentrations that exceeded the MCL of 8 pCi/L. All elevated concentrations were measured in samples from areas of known contamination and are consistent with historical trends.

Technetium-99

Three upgradient and 13 facility locations were sampled for ^{99}Tc during this quarter (**Table 15**). Only four locations, all from INTEC, of the 16 sampled had detectable concentrations with a maximum of 1,040 ± 170 pCi/L at ICPP-MON-A-230. Although this is the maximum concentration this quarter, it is a significant decrease in concentration from the last sampling event in 2003 which had a concentration of 2,418 ± 4 pCi/L. All concentrations, except for that from ICPP-MON-A-230, were below the drinking water MCL of 900 pCi/L and consistent with historical data and trends.

Actinides

Seventeen locations – five at INTEC, five at RWMC, six at TAN, and one at ATR – were sampled and analyzed for uranium isotopes this quarter (**Table 16**). Uranium-234 (^{234}U) was detected in all locations sampled with three exceeding natural background concentrations. There were nine detections of uranium-235 (^{235}U), seven of which exceeded background concentrations; however, all but one were less than three standard deviations and were therefore qualified as estimates (J). There were 15 detections of uranium-238 (^{238}U) with seven exceeding background concentrations. The maximum concentrations of ^{234}U, ^{235}U, and ^{238}U were 8.8 ± 1.5 pCi/L, 0.41 ± 0.15 pCi/L, and 1.27 ± 0.29 pCi/L, respectively, all from TAN-28. Most detections were slightly above naturally occurring background concentrations, and all were consistent with historical observations.

Ten facility locations – five at INTEC, four at RWMC, and one at ATR – were sampled for plutonium isotopes (-238 and -239/240) this quarter with no detectable concentrations (**Table 17**). Similarly, ^{241}Am was also analyzed in five samples – four at RWMC and one at ATR – with no detectable concentrations (**Table 18**).

Common ions, trace metals, and nutrients

Select locations were sampled for common ions (calcium, magnesium, sodium, potassium, fluoride, chloride, sulfate, and alkalinity), trace metals, (arsenic, barium, chromium, iron, lead, manganese, selenium, and zinc) and dissolved nutrients (nitrate-plus-nitrite, phosphorous) (**Tables 19, 20, and 21**). Chloride was measured at 398 mg/L in NRF-06, exceeding the EPA's secondary MCL of 250 mg/L. Chromium was also measured in NRF-06 at 49 µg/L, the highest concentration since 2009, but still well below the MCL of 100 µg/L. These elevated concentrations at NRF are consistent with historical data. 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-37. All other concentrations were consistent with past observations and trends with most within natural background ranges.

Volatile organic compounds (VOCs)

VOCs were measured at 11 locations at TAN and six locations at RWMC this quarter. All had detectable concentrations of at least one VOC, with the exception of M1S and TAN-2312 where none were detected. Notable MCL exceedances and/or changes from previous measurements include:

- TAN-48 PCE = 3.87 µg/L, down from 17.5 µg/L in 2002
- TAN-48 TCE = 32.5 µg/L, down from 229 µg/L from 2002
- TAN-42 PCE = 10.4 µg/L, up almost 3x that of 2018
- TAN-42 TCE = 76.7 µg/L, up more than 3x that of 2018
- TAN-42 cis-1,2 DCE = 3.24 µg/L, up 5x that of 2007
- TAN-51 PCE = 28 µg/L, up more than 2x of 2015
- TAN-51 TCE = 161 µg/L, up 71 µg/L from 2015
- TAN-51 cis-1,2 DCE = 4.04 µg/L, up more than 2x that of 2015
- TAN-28 TCE = 209 µg/L, up 55 µg/L from 2018
- TAN-28 cis-1,2 DCE = 50.8 µg/L, up more than 2x that of 2018
- TAN-28 trans-1,2 DCE = 126 µg/L, up more than 2x that of 2018
- TAN-2271 trans-1,2 DCE = 114 µg/L, up from 85.2 µg/L in 2018
- A11A31 Carbon Tetrachloride = 4.89 µg/L, up more than 2x that of 2016

Well TAN-37 had a measured concentration of 1030 µg/L methyl ethyl ketone. This is the first and only time in 11 years of DEQ data that this analyte has been detected. It most likely represents a side reaction during reductive dechlorination and is highly degradable (Devinny, Deshusses, and Webster, 1999)[3] with reported environmental half-lives ranging from 13-128 days (Aaronson and Howard, 1997)[4]. Due to its short-lived nature, there is no immediate threat to human health and the environment. This analyte will be resampled in the spring of 2020 to verify expected decreasing concentrations.

All other VOC detections were consistent with historical data and were measured in areas of known contamination. **Table 22** shows VOCs that were detected this quarter.

[3] Devinny, J. S., Deshusses, M. A., & Webster, T. S. (1999). Biofiltration for air pollution control. New York, NY: Lewis Publishers.

[4] Aaronson, D., Philip H., & Howard, P. H. (1997). Anaerobic biodegradation of organic chemicals in groundwater: A summary of field and laboratory studies. Prepared for: American Petroleum Institute, Chemical Manufacturer's Association, National Council of the Paper Industry for Air and Stream Improvement, Edison Electric Institute, and American Forest and Paper Association. North Syracuse, NY: Environmental Science Center, Syracuse Research Corporation.

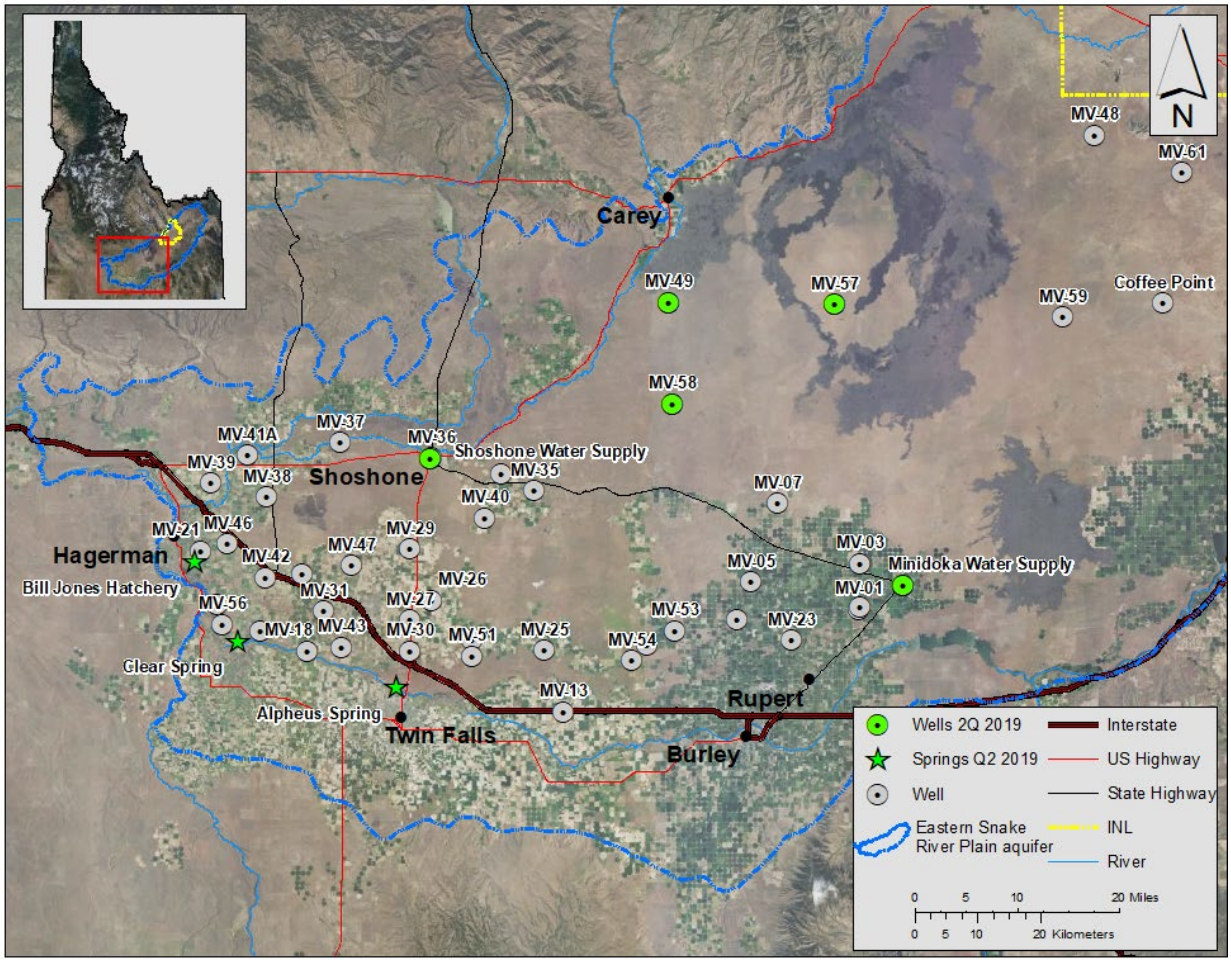

Figure 2. Distant and Surface Water monitoring locations.

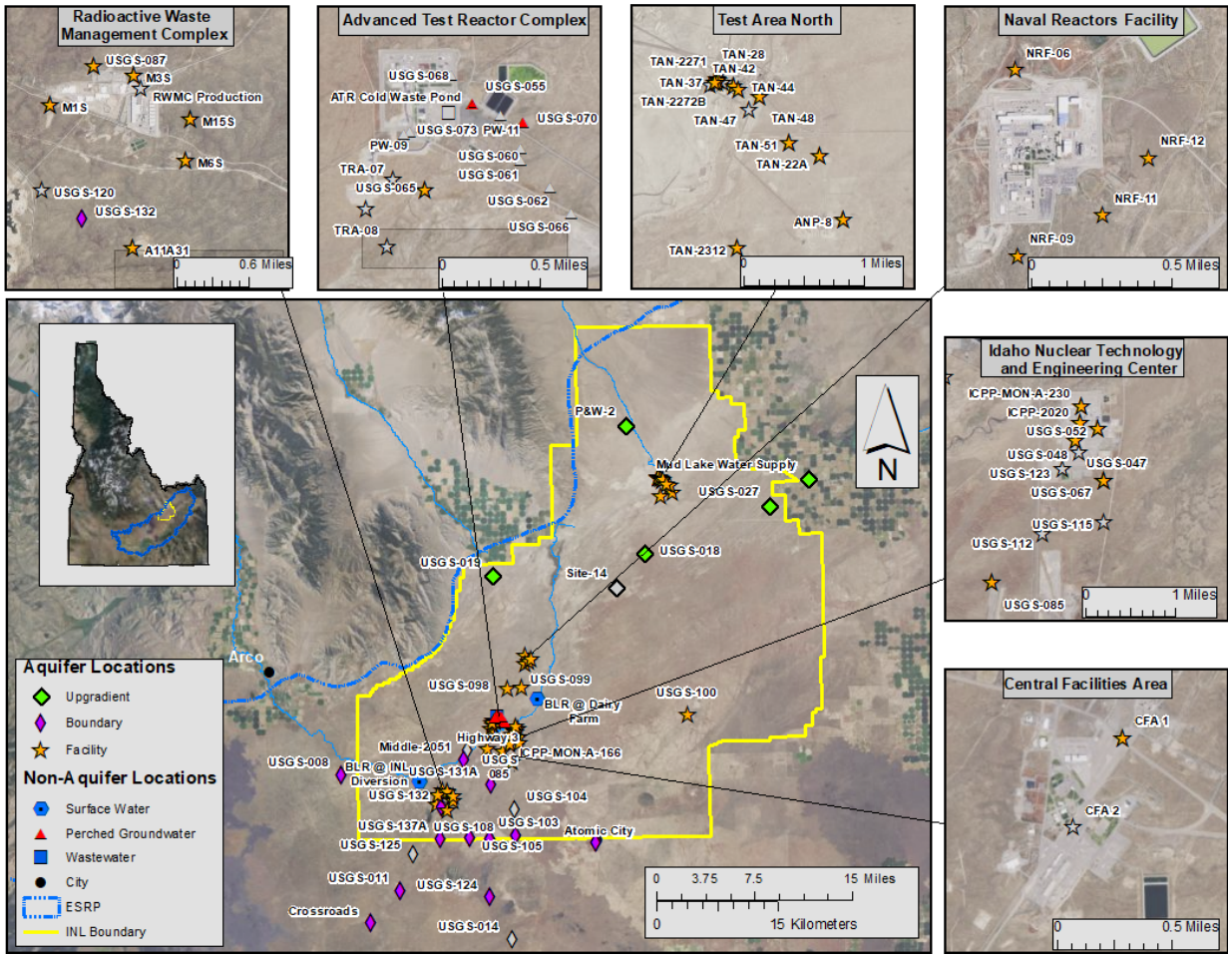

Figure 3. Upgradient, facility, boundary, perched groundwater (GW), and wastewater monitoring locations.

Table 9. Locations sampled for water, second quarter, 2019.

Sample Location	Date Sampled	Co-sampler	Well Depth (ft bgs)	Analyses*
Aquifer Samples				
Upgradient				
Mud Lake Water Supply	5/23/2019	None	330	α, β, γ, ^{3}H
P&W-2	4/8/2019	USGS	386	α, β, γ, ^{3}H, ^{99}Tc, com. ions, Cr, NO_3+NO_2
USGS-018	4/8/2019	USGS	329	α, β, γ, ^{3}H, com. ions, Cr, NO_3+NO_2
USGS-019	4/8/2019	USGS	405	α, β, γ, ^{3}H, ^{99}Tc, com. ions, Cr, NO_3+NO_2
USGS-027	4/8/2019	USGS	312	α, β, γ, ^{3}H, ^{99}Tc, com. ions, Cr, NO_3+NO_2
Facility				
Idaho Nuclear Technology and Engineering Center				
ICPP-2020	4/23/2019	Fluor	506	α, β, γ, ^{3}H, ^{90}Sr, ^{99}Tc, U iso, Pu iso, com. ions, Cr, NO_3+NO_2
ICPP-MON-A-166	4/17/2019	USGS	527	α, β, γ, ^{3}H, com. ions, Cr, NO_3+NO_2
ICPP-MON-A-230	4/23/2019	Fluor	n/a	α, β, γ, ^{3}H, ^{90}Sr, ^{99}Tc, U iso, Pu iso, com. ions, Cr, NO_3+NO_2
USGS-047	4/24/2019	Fluor	651	α, β, γ, ^{3}H, ^{90}Sr, ^{99}Tc, U iso, Pu iso, com. ions, Cr, NO_3+NO_2
USGS-052	4/24/2019	Fluor	650	α, β, γ, ^{3}H, ^{90}Sr, ^{99}Tc, U iso, Pu iso, com. ions, Cr, NO_3+NO_2
USGS-067	4/23/2019	Fluor	694	α, β, γ, ^{3}H, ^{90}Sr, ^{99}Tc, U iso, Pu iso, com. ions, Cr, NO_3+NO_2
USGS-085	4/1/2019	USGS	637	α, β, γ, ^{3}H, ^{90}Sr, ^{99}Tc, com. ions, Cr, NO_3+NO_2
Advanced Test Reactor Complex				
USGS-065	4/17/2019	USGS	498	α, β, γ, ^{3}H, ^{99}Tc, U iso, Pu iso, ^{241}Am, com. ions, NO_3+NO_2
Test Area North				
ANP-8	6/6/2019	Fluor	309	α, β, γ, ^{3}H, com. Ions, VOCs
TAN 2271	4/17/2019	Fluor	289	α, β, γ, ^{3}H, ^{90}Sr, U iso, com. ions, Cr, As, Ba, Fe, Pb, Mn, NO_3+NO_2, P, VOCs
TAN 2272B	4/17/2019	Fluor	287	α, β, γ, ^{3}H, ^{90}Sr, U iso, com. ions, Cr, As, Ba, Fe, Pb, Mn, NO_3+NO_2, P, VOCs
TAN-22A	6/3/2019	Fluor	539	α, β, γ, ^{3}H, com. ions, VOCs
TAN-2312	6/6/2019	Fluor	522	α, β, γ, ^{3}H, com. ions, VOCs
TAN-28	4/17/2019	Fluor	262	α, β, γ, ^{3}H, ^{90}Sr, U iso, com. ions, Cr, As, Ba, Fe, Pb, Mn, NO_3+NO_2, P, VOCs
TAN-37	4/17/2019	Fluor	416	α, β, γ, ^{3}H, ^{90}Sr, U iso, com. ions, Cr, As, Ba, Fe, Pb, Mn, NO_3+NO_2, P, VOCs
TAN-42	4/17/2019	Fluor	440	α, β, γ, ^{3}H, ^{90}Sr, U iso, com. ions, Cr, As, Ba, Fe, Pb, Mn, NO_3+NO_2, P, VOCs
TAN-44	4/17/2019	Fluor	442	α, β, γ, ^{3}H, ^{90}Sr, U iso, com. ions, Cr, As, Ba, Fe, Pb, Mn, NO_3+NO_2, P, VOCs
TAN-48	6/5/2019	Fluor	n/a	α, β, γ, ^{3}H, com. ions, VOCs
TAN-51	6/5/2019	Fluor	470	α, β, γ, ^{3}H, com. ions, VOCs
Central Facilities Area				
CFA 1	4/22/2019	USGS	639	α, β, γ, ^{3}H, ^{90}Sr, ^{99}Tc, com. ions, Cr, NO_3+NO_2
Naval Reactors Facility				
NRF-06	5/15/2019	USGS	417	α, β, γ, ^{3}H, com. ions, Cr, NO_3+NO_2
NRF-09	5/15/2019	USGS	425	α, β, γ, ^{3}H, com. ions, Cr, NO_3+NO_2
NRF-11	5/15/2019	USGS	425	α, β, γ, ^{3}H, com. ions, Cr, NO_3+NO_2
NRF-12	5/15/2019	USGS	425	α, β, γ, ^{3}H, com. ions, Cr, NO_3+NO_2
Radioactive Waste Management Complex				
A11A31	5/14/2019	Fluor	678	α, β, γ, ^{3}H, ^{99}Tc, U iso, com. ions, Cr, Pb, Zn, NO_3+NO_2 VOCs
M15S	5/14/2019	Fluor	n/a	α, β, γ, ^{3}H, ^{99}Tc, U iso, com. ions, Cr, NO_3+NO_2 VOCs
M1S	5/13/2019	Fluor	678	α, β, γ, ^{3}H, ^{99}Tc, U iso, Pu iso, ^{241}Am, com. ions, Cr, NO_3+NO_2, VOCs
M3S	5/13/2019	Fluor	660	α, β, γ, ^{3}H, ^{99}Tc, U iso, Pu iso, ^{241}Am, com. ions, Cr, NO_3+NO_2, VOCs
M6S	5/13/2019	Fluor	697	α, β, γ, ^{3}H, ^{99}Tc, U iso, Pu iso, ^{241}Am, com. ions, Cr, NO_3+NO_2, VOCs
USGS-087	4/17/2019	USGS	673	α, β, γ, ^{3}H, ^{90}Sr, ^{99}Tc, Pu iso, ^{241}Am, com. ions, Cr, Pb, NO_3+NO_2, VOCs

Sample Location	Date Sampled	Co-sampler	Well Depth (ft bgs)	Analyses*
Materials and Fuels Complex				
USGS-100	4/15/2019	USGS	750	α, β, γ, ^{3}H, com. ions, Cr, Pb, NO_3+NO_2
Boundary				
Atomic City	4/18/2019	USGS	639	α, β, γ, ^{3}H, com. ions, Cr, Pb, NO_3+NO_2
Crossroads	4/16/2019	USGS	796	α, β, γ, ^{3}H, com. ions, Cr, NO_3+NO_2
Middle-2051	6/27/2019	USGS	1091	α, β, γ, ^{3}H, com. ions, Cr, NO_3+NO_2
Middle-2051	6/27/2019	USGS	749	α, β, γ, ^{3}H, com. ions, Cr, NO_3+NO_2
USGS-008	4/16/2019	USGS	812	α, β, γ, ^{3}H, com. ions, Cr, NO_3+NO_2
USGS-011	4/18/2019	USGS	704	α, β, γ, ^{3}H, com. ions, Cr, NO_3+NO_2
USGS-103	6/18/2019	USGS	1258	α, β, γ, ^{3}H, com. ions, Cr, NO_3+NO_2
USGS-105	6/26/2019	USGS	1072	α, β, γ, ^{3}H, com. ions, Cr, NO_3+NO_2
USGS-105	6/26/2019	USGS	952	α, β, γ, ^{3}H, com. ions, Cr, NO_3+NO_2
USGS-108	6/24/2019	USGS	1172	α, β, γ, ^{3}H, com. ions, Cr, NO_3+NO_2
USGS-124	4/18/2019	USGS	800	α, β, γ, ^{3}H, com. ions, Cr, NO_3+NO_2
USGS-131A	6/25/2019	USGS	616	α, β, γ, ^{3}H, com. ions, Cr, NO_3+NO_2
USGS-131A	6/25/2019	USGS	812	α, β, γ, ^{3}H, com. ions, Cr, NO_3+NO_2
USGS-132	6/19/2019	USGS	765	α, β, γ, ^{3}H, com. ions, Cr, NO_3+NO_2
USGS-137A	6/17/2019	USGS	747	α, β, γ, ^{3}H, com. ions, Cr, NO_3+NO_2
Distant				
Alpheus Spring	5/20/2019	None	0	α, β, γ, ^{3}H
Bill Jones Hatchery	5/20/2019	None	0	α, β, γ, ^{3}H
Clear Spring	5/20/2019	None	0	α, β, γ, ^{3}H
Minidoka Water Supply	5/20/2019	None	282	α, β, γ, ^{3}H
MV-49	6/20/2019	None	765	α, β, γ, ^{3}H, com. ions, Cr, As, NO_3+NO_2
MV-57	6/11/2019	None	652	α, β, γ, ^{3}H, com. ions, Cr, As, NO_3+NO_2
MV-58	6/20/2019	None	454	α, β, γ, ^{3}H, com. ions, Cr, As, NO_3+NO_2
Shoshone Water Supply	5/20/2019	None	n/a	α, β, γ, ^{3}H
Surface Water				
BLR @ Dairy Farm	4/17/2019	USGS	0	α, β, γ, ^{3}H, com. Ions, NO_3+NO_2
BLR @ INL Diversion	4/17/2019	USGS	0	α, β, γ, ^{3}H, com. Ions, NO_3+NO_2
Perched Water *Advanced Test Reactor Complex:*				
USGS-055	4/10/2019	USGS	81	α, β, γ, ^{3}H, ^{90}Sr, com. ions, Cr, As, NO_3+NO_2, P
USGS-070	4/10/2019	USGS	100	α, β, γ, ^{3}H, ^{90}Sr, com. ions, Cr, As, NO_3+NO_2, P

ft bgs = feet below ground surface.
*α = gross alpha radioactivity; β = gross beta radioactivity; γ = manmade gamma-emitting radionuclides; ^{3}H = tritium; U iso. = ^{234}U, ^{235}U, ^{238}U; com. ions = Ca^{2+}, Mg^{2+}, Na^{+}, K^{+}, Cl^{-}, SO_4^{2-}, alkalinity; NO_3+NO_2 = nitrate plus nitrite, P = phosphorous.

Table 10. Constituent background concentration ranges and EPA drinking water standards.

Constituent	Background[1]	MCL or SMCL[2]
Radiological Constituents (pCi/L)		
Gross alpha	0-5.6[a]	15
Gross beta	0-8.6[a]	4 mrem/yr
Cesium-137	0	200
Tritium	0-33[a]	20,000
Strontium-90	0	8
Technetium-99	0	900
Uranium-234	0.043-1.9[b]	30 µg/L (total U)
Uranium-235	0-0.048[b]	
Uranium-238	0.021-0.719[b]	
Plutonium-238	0	---
Plutonium-239/240	0	---
Americium-241	0	---
Non-radiological Constituents		
Common Ions (mg/L)		
Alkalinity (as $CaCO_3$)	91-261[a]	---
Calcium	23 – 71[a]	---
Chloride	4.9 – 66.6[a]	250*
Fluoride	0.1 – 1.50[a]	4
Magnesium	10.1 – 27.4[a]	---
Potassium	1.2 – 5.8[a]	---
Sodium	2.6 – 27.0[a]	---
Sulfate	9.6 – 40.4[a]	250*
Trace Metals (µg/L)		
Arsenic	2 – 3[c]	10
Barium	50 – 70[c]	2000
Chromium	<0.012 – 45[b]	100
Iron	4 – 16[d]	300*
Lead	<5[c]	15
Manganese	<1 – 4[a]	50*
Selenium	<1[c]	50
Zinc	<3 – 10.5[d]	5000*
Nutrients (mg/L)		
Nitrate plus nitrite	<0.04 – 3.59[b]	10 for NO_3^-, 1 for NO_2^-
Phosphorous	<0.01 – 0.02[d]	---
Volatile Organic Compounds (µg/L)		
Tetrachloroethene (PCE)	0	5
Trichloroethene (TCE)	0	5
1,1-Dichloroethene	0	7
cis-1,2-dichloroethene	0	70
trans-1,2-dichloroethene	0	100
Vinyl chloride	0	2
Carbon tetrachloride	0	5
Chloroform	0	80[e]
Chloromethane	0	---
Methylene Chloride	0	5
Methyl Ethyl Ketone	0	---
1,1-Dichloroethane	0	---

[1] Sources for background ranges are: [a] DEQ data compiled from distant, boundary, and surface water sites from 1993-2018;
[b] Bartholomay and Hall, 2016 (DOE/ID-22237); [c] Knobel and others, 1992; [d] Knobel and others, 1999 (DOE/ID-22164).
[2] Maximum Contaminant Levels (MCLs) are the highest levels of contaminants legally allowed in public drinking water systems in Idaho. Most wells sampled by DEQ-INL OP are not used for drinking water. A * designates a Secondary MCL (SMCL), which is a guideline recommended by the EPA for constituents that may affect the taste, color, or odor of drinking water. [e] MCL is for total trihalomethanes.

Table 11. Gross alpha, gross beta, and man-made gamma-emitting radionuclide concentrations (pCi/L) for water samples, second quarter, 2019.

Sample Location	Sample Date	Gross Alpha			Gross Beta			Cesium-137*		
		Concentration		2 SD	Concentration		2 SD	Concentration		2 SD
Aquifer Samples										
Upgradient										
Mud Lake Water Supply	5/23/2019	-0.2	U	0.6	4.2		0.8	1.1	U	1.7
P&W-2	4/8/2019	5.6		1.3	3.3		0.9	-0.2	U	1.4
USGS-018	4/8/2019	3.9		1.0	2.9		0.9	0.4	U	1.1
USGS-019	4/8/2019	4.5		1.2	1.4		0.9	0.7	U	2.3
USGS-027	4/8/2019	3.4		1.4	8.3		1.1	-0.5	U	1.7
Facility										
Idaho Nuclear Technology and Engineering Center										
ICPP-2020	4/23/2019	3.5		1.3	151		3.1	0.5	U	1.6
ICPP-MON-A-166	4/17/2019	0.8	U	0.7	3.3		0.9	0.2	U	1.6
ICPP-MON-A-230	4/23/2019	2.7		1.2	639		6	0.8	U	1.1
USGS-047	4/24/2019	2.4		1.1	39.7		1.7	-0.1	U	1.2
USGS-052	4/24/2019	2.2		1.1	221		4	0.7	U	1.2
USGS-067	4/23/2019	1.4	U	1.0	96.3		2.5	-0.7	U	2.1
USGS-085	4/1/2019	1.5	U	1.1	10.6		1.2	0.4	U	1.9
Advanced Test Reactor Complex										
USGS-065	4/17/2019	1.9		1.0	3.8		1.0	1.0	U	1.6
Test Area North										
ANP-8	6/6/2019	3.0		1.2	4.9		1.0	0.3	U	1.7
TAN 2271	4/17/2019	2.8	U	2.7	976		11	1.3	U	1.6
TAN 2272B	4/17/2019	1.4	U	6.9	701		21	0.4	U	1.4
TAN-22A	6/3/2019	4.2		1.2	4.25		1.0	-0.7	U	1.7
TAN-2312	6/6/2019	1.8		1.0	5.4		1.0	-0.3	U	1.6
TAN-28	4/17/2019	4.3	U	2.8	483		8.0	0.3	U	1.2
TAN-37	4/17/2019	1.9	U	3.0	229		7	2.3	U	1.8
TAN-42	4/17/2019	2.2		1.1	5.5		1.1	1.1	U	2.1
TAN-44	4/17/2019	1.5	U	1.1	5.3		1.1	0.7	U	1.8
TAN-48	6/5/2019	1.9		1.0	4.5		1.0	-0.3	U	1.6
TAN-51	6/5/2019	1.6	J-	1.1	5.7		1.0	-1.1	U	1.5
Central Facilities Area										
CFA 1	4/22/2019	3.1		1.3	7.7		1.2	-0.4	U	1.1
Naval Reactors Facility										
NRF-06	5/15/2019	2.9	U	3.1	10.6		2.6	0.6	U	1.7
NRF-09	5/15/2019	4.3		1.8	3.8		1.7	-0.8	U	1.5
NRF-11	5/15/2019	0.6	U	1.5	5.2		1.1	0.3	U	1.5
NRF-12	5/15/2019	1.6	U	1.5	4.4		1.7	0.5	U	1.6
Radioactive Waste Management Complex										
A11A31	5/14/2019	2.4		1.2	4.3		1.1	-0.9	U	1.4
M15S	5/14/2019	1.7		0.8	3.3		0.9	-1.5	U	2.1
M1S	5/13/2019	1.1	U	0.9	5.0		1.0	0.5	U	1.2
M3S	5/13/2019	2.8		1.1	3.8		1.0	0.9	U	1.2
M6S	5/13/2019	2.0		0.9	4.0		0.9	-0.3	U	1.6
USGS-087	4/17/2019	2.8		1.0	3.3		1.0	0.8	U	1.3
Materials and Fuels Complex										
USGS-100	4/15/2019	2.9		1.1	4.3		1.0	-0.3	U	1.3
Boundary										
Atomic City	4/18/2019	1.2	U	0.8	3.4		0.9	0.3	U	1.2
Crossroads	4/16/2019	3.9		1.0	3.2		0.9	-0.1	U	1.5
Middle-2051 (1091 ftbls)	6/27/2019	1.1	U	1.3	3.0		0.9	-0.3	U	1.1
Middle-2051 (749 ftbls)	6/27/2019	0.1	U	1.3	2.9		0.9	-0.2	U	1.6
USGS-008	4/16/2019	1.2		0.8	4.2		1.0	-0.1	U	1.1

Sample Location	Sample Date	Gross Alpha			Gross Beta			Cesium-137*		
		Concentration		2 SD	Concentration		2 SD	Concentration		2 SD
USGS-011	4/18/2019	3.2		1.3	2.6		1.0	0.9	U	1.3
USGS-103	6/18/2019	2.1		1.1	2.7		1.0	-0.5	U	1.6
USGS-105 (1072 ftbls)	6/26/2019	1.2	U	1.3	3.3		0.9	0.9	U	1.1
USGS-105 (952 ftbls)	6/26/2019	1.0	U	1.3	3.7		0.9	0.6	U	1.1
USGS-108	6/24/2019	1.5	U	1.1	3.0		1.0	-0.6	U	1.4
USGS-124	4/18/2019	1.9		1.0	3.7		0.9	1.6	U	1.9
USGS-131A (616 ftbls)	6/25/2019	3.4		1.3	3.1		1.0	0.2	U	1.5
USGS-131A (812 ftbls)	6/25/2019	0.7	U	1.0	3.9		1.0	-0.9	U	1.7
USGS-132	6/19/2019	2.2		1.2	2.9		0.9	0.2	U	1.9
USGS-137A	6/17/2019	1.5		1.0	2.4		0.9	0.0	U	1.6
Distant										
Alpheus Spring	5/20/2019	0.4	U	1.4	9.6		1.2	1.8	U	1.6
Bill Jones Hatchery	5/20/2019	0.3	U	1.0	5.5		1.0	-0.2	U	1.5
Clear Spring	5/20/2019	0.5	U	1.2	6.6		1.1	1.1	U	1.3
Minidoka Water Supply	5/20/2019	1.4	U	1.3	4.5		1.0	-0.8	U	1.8
MV-49	6/20/2019	1.6	J-	1.1	3.3		1.0	-0.4	U	1.7
MV-57	6/11/2019	1.0	U	0.9	2.2		0.8	0.3	U	1.2
MV-58	6/20/2019	0.8	U	0.7	2.4		0.8	-0.3	U	1.1
Shoshone Water Supply	5/20/2019	0.7	U	1.1	4.7		1.0	0.3	U	1.2
Surface Water										
BLR @ Dairy Farm	4/17/2019	2.9		1.0	2.8		0.9	0.0	U	1.4
BLR @ INL Diversion	4/17/2019	2.6		1.0	2.2		0.9	0.8	U	1.6
Perched Water *Advanced Test Reactor Complex:*										
USGS-055	4/10/2019	3.3		1.1	74.0		2.2	0.3	U	1.1
USGS-070	4/10/2019	5.9		1.6	44.6		1.8	1.1	U	2.0

Data qualifiers: U = undetected, J = estimate, R = rejected, "+" or "-" after a J means that the estimated result is biased high or low, respectively.
*ISU-EML analyzes water samples for all common manmade gamma-emitting radionuclides. If none are detected, only the results for ^{137}Cs, the manmade gamma-emitter most likely to be detected in groundwater, are reported in this table.

Table 12. Tritium concentrations (pCi/L) for water samples, second quarter, 2019.

Sample Location	Sample Date	Tritium		
		Concentration		2 SD
Aquifer Samples				
Upgradient				
Mud Lake Water Supply	5/23/2019	90	U	110
P&W-2	4/8/2019	10	U	90
USGS-018	4/8/2019	20	U	90
USGS-019	4/8/2019	30	U	90
USGS-027	4/8/2019	-10	U	90
Facility				
Idaho Nuclear Technology and Engineering Center				
ICPP-2020	4/23/2019	1430		140
ICPP-MON-A-166	4/17/2019	0	U	90
ICPP-MON-A-230	4/23/2019	720		120
USGS-047	4/24/2019	220		100
USGS-052	4/24/2019	460		110
USGS-067	4/23/2019	1700		150
USGS-085	4/1/2019	830		120
Advanced Test Reactor Complex				
USGS-065	4/17/2019	1660		160
Test Area North				
ANP-8	6/6/2019	60	U	120
TAN 2271	4/17/2019	490		110
TAN 2272B	4/17/2019	590		110
TAN-22A	6/3/2019	10	U	120
TAN-2312	6/6/2019	0	U	120
TAN-28	4/17/2019	770		120
TAN-37	4/17/2019	410		110
TAN-42	4/17/2019	400		110
TAN-44	4/17/2019	570		110
TAN-48	6/5/2019	90	U	120
TAN-51	6/5/2019	310		120
Central Facilities Area				
CFA 1	4/22/2019	2510		180
Naval Reactors Facility				
NRF-06	5/15/2019	90	U	90
NRF-09	5/15/2019	80	U	90
NRF-11	5/15/2019	50	U	90
NRF-12	5/15/2019	140	U	90
Radioactive Waste Management Complex				
A11A31	5/14/2019	170		90
M15S	5/14/2019	60	U	90
M1S	5/13/2019	-20	U	80
M3S	5/13/2019	500		110
M6S	5/13/2019	90	U	90
USGS-087	4/17/2019	440		110
Materials and Fuels Complex				
USGS-100	4/15/2019	10	U	90
Boundary				
Atomic City	4/18/2019	-50	U	80
Crossroads	4/16/2019	-20	U	90
Middle-2051 (1091 ftbls)	6/27/2019	150	U	120
Middle-2051 (749 ftbls)	6/27/2019	290		110
USGS-008	4/16/2019	-80	U	80
USGS-011	4/18/2019	10	U	90
USGS-103	6/18/2019	220		100

Sample Location	Sample Date	Tritium		
		Concentration		2 SD
USGS-105 (1072 ftbls)	6/26/2019	300		110
USGS-105 (952 ftbls)	6/26/2019	40	U	120
USGS-108	6/24/2019	170	U	120
USGS-124	4/18/2019	10	U	90
USGS-131A (616 ftbls)	6/25/2019	790		130
USGS-131A (812 ftbls)	6/25/2019	1100		140
USGS-132	6/19/2019	190		100
USGS-137A	6/17/2019	50	U	120
Distant				
Alpheus Spring	5/20/2019	90	U	110
Bill Jones Hatchery	5/20/2019	30	U	120
Clear Spring	5/20/2019	20	U	120
Minidoka Water Supply	5/20/2019	100	U	110
MV-49	6/20/2019	30	U	110
MV-57	6/11/2019	90	U	110
MV-58	6/20/2019	-20	U	90
Shoshone Water Supply	5/20/2019	-10	U	120
Surface Water				
BLR @ Dairy Farm	4/17/2019	10	U	90
BLR @ INL Diversion	4/17/2019	30	U	90
Perched Water *Advanced Test Reactor Complex:*				
USGS-055	4/10/2019	1290		140
USGS-070	4/10/2019	260		100

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

Table 13. Low-level tritium concentrations (pCi/L) for water samples collected during 2017-2018 and analyzed using the electrolytic enrichment method, second quarter, 2019.

Sample Location	Sample Date	Tritium		
		Concentration		2 SD
Aquifer Samples				
Upgradient				
Mud Lake Water Supply	8/9/2018	6	U	6
Site-14	10/10/2017	1	U	7
Site-14	10/10/2018	2	U	7
Facility				
ICPP-MON-A-166	4/24/2017	76		10
USGS-100	4/24/2017	12		8
Boundary				
Crossroads	4/20/2017	11		7
Highway 3	10/16/2018	46		9
USGS-014	10/9/2018	6	U	6
Distant				
Minidoka Water Supply	8/3/2017	8	U	7
MV-34	7/18/2018	1	U	7
MV-41A	7/17/2018	14		9
MV-46	7/18/2018	-2	U	7
MV-51	7/17/2018	17		8
MV-54	7/17/2018	12		8
Surface Water				
Birch Creek	10/15/2018	9	U	8

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

Table 14. Strontium-90 concentrations (pCi/L) for water samples, second quarter, 2019.

Sample Location	Sample Date	Strontium-90		
		Concentration		2 SD
Aquifer Samples				
Facility				
Idaho Nuclear Technology and Engineering Center				
ICPP-2020	4/23/2019	9.20		2.20
ICPP-MON-A-230	4/23/2019	1.85		0.58
USGS-047	4/24/2019	14.6		3.5
USGS-052	4/24/2019	2.29		0.65
USGS-067	4/23/2019	11.5		2.8
USGS-085	4/1/2019	1.95		0.63
Advanced Test Reactor Complex				
USGS-065	4/17/2019	0.00	U	0.26
Test Area North				
TAN 2271	4/17/2019	359		84
TAN 2272B	4/17/2019	394		93
TAN-28	4/17/2019	195		46
TAN-37	4/17/2019	620		150
TAN-42	4/17/2019	-0.04	U	0.23
TAN-44	4/17/2019	0.39	U	0.32
Central Facilities Area				
CFA 1	4/22/2019	-0.09	U	0.25
Radioactive Waste Management Complex				
USGS-087	4/17/2019	0.28	U	0.30
Perched Water *Advanced Test Reactor Complex:*				
USGS-055	4/10/2019	28.2		6.7
USGS-070	4/10/2019	14.3		3.5

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. Technetium-99 concentrations (pCi/L) for water samples, second quarter, 2019.

Sample Location	Sample Date	Technetium-99		
		Concentration		2 SD
Aquifer Samples				
Upgradient				
P&W-2	4/8/2019	-0.3	U	1.2
USGS-019	4/8/2019	-1.31	U	0.99
USGS-027	4/8/2019	-0.3	U	1.1
Facility				
Idaho Nuclear Technology and Engineering Center				
ICPP-2020	4/23/2019	240		41
ICPP-MON-A-230	4/23/2019	1040		170
USGS-047	4/24/2019	2.5	U	3.6
USGS-052	4/24/2019	371		62
USGS-067	4/23/2019	99		19
USGS-085	4/1/2019	-1.1	U	1.1
Central Facilities Area				
CFA 1	4/22/2019	4.8	U	4.0
Radioactive Waste Management Complex				
A11A31	5/14/2019	0.1	U	3.7
M15S	5/14/2019	-1.0	U	2.5
M1S	5/13/2019	-1.2	U	2.7
M3S	5/13/2019	0.7	U	3.0
M6S	5/13/2019	-0.6	U	3.3
USGS-087	4/17/2019	-1.5	U	3.1

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. Uranium isotopes concentrations (pCi/L) for water samples, second quarter, 2019.

Sample Location	Sample Date	Uranium-234			Uranium-235			Uranium-238		
		Concentration		2 SD	Concentration		2 SD	Concentration		2 SD
Aquifer Samples										
Facility										
Idaho Nuclear Technology and Engineering Center										
ICPP-2020	4/23/2019	1.89		0.41	0.065	J*	0.058	0.95		0.25
ICPP-MON-A-230	4/23/2019	1.78		0.41	0.061	U	0.060	0.92		0.26
USGS-047	4/24/2019	1.43		0.34	0.048	J*	0.049	0.60		0.18
USGS-052	4/24/2019	1.48		0.35	0.103	J*	0.078	0.65	U	0.20
USGS-067	4/23/2019	1.55		0.35	0.018	U	0.042	0.81		0.22
Advanced Test Reactor Complex										
USGS-065	4/17/2019	1.99		0.45	0.081	J*	0.068	0.97		0.27
Test Area North										
TAN 2271	4/17/2019	0.088		0.063	0.011	U	0.041	0.050	U	0.048
TAN 2272B	4/17/2019	0.93		0.24	0.057	J*	0.052	0.151		0.082
TAN-28	4/17/2019	8.8		1.5	0.41		0.15	1.27		0.29
TAN-37	4/17/2019	0.51		0.25	0.05	U	0.10	0.19		0.15
TAN-42	4/17/2019	2.04		0.44	0.054	U	0.053	1.06		0.27
TAN-44	4/17/2019	1.68		0.38	0.052	U	0.057	0.82		0.23
Radioactive Waste Management Complex										
A11A31	5/14/2019	1.36		0.32	0.068	J*	0.057	0.69		0.20
M15S	5/14/2019	1.09		0.28	0.024	U	0.044	0.56		0.18
M1S	5/13/2019	0.76		0.21	0.043	J*	0.044	0.47		0.15
M3S	5/13/2019	1.65		0.37	0.084	J*	0.065	0.60		0.19
M6S	5/13/2019	1.46		0.34	0.032	U	0.046	0.65		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.

Table 17. Plutonium isotope concentrations (pCi/L) for water samples, second quarter, 2019.

Sample Location	Sample Date	Plutonium-238			Plutonium-239/240		
		Concentration		2 SD	Concentration		2 SD
Aquifer Samples							
Facility							
Idaho Nuclear Technology and Engineering Center							
ICPP-2020	4/23/2019	0.007	U	0.027	0.003	U	0.027
ICPP-MON-A-230	4/23/2019	0.000	U	0.025	0.003	U	0.025
USGS-047	4/24/2019	0.015	U	0.025	0.000	U	0.025
USGS-052	4/24/2019	-0.011	U	0.025	0.000	U	0.024
USGS-067	4/23/2019	-0.011	U	0.025	0.002	U	0.025
Advanced Test Reactor Complex							
USGS-065	4/17/2019	-0.007	U	0.024	-0.007	U	0.023
Radioactive Waste Management Complex							
USGS-087	4/17/2019	0.002	U	0.023	0.006	U	0.023
M1S	5/13/2019	0.010	U	0.029	-0.003	U	0.028
M3S	5/13/2019	-0.008	U	0.028	0.016	U	0.028
M6S	5/13/2019	0.003	U	0.030	0.007	U	0.030

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

Table 18. Americium-241 concentration (pCi/L) for water samples, second quarter, 2019.

Sample Location	Sample Date	Americium-241		
		Concentration		2 SD
Aquifer Samples				
Facility				
Advanced Test Reactor Complex				
USGS-065	4/17/2019	-0.010	U	0.027
Radioactive Waste Management Complex				
USGS-087	4/17/2019	-0.007	U	0.024
M1S	5/13/2019	-0.014	U	0.023
M3S	5/13/2019	-0.026	U	0.023
M6S	5/13/2019	0.000	U	0.028

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

Table 19. Common ion concentrations (mg/L) for water samples, second quarter, 2019.

Sample Location	Sample Date	Calcium*	Magnesium*	Sodium*	Potassium*	Fluoride	Chloride	Sulfate	Alkalinity†
Aquifer Samples									
Upgradient									
P&W-2	4/8/2019	40	15	6.7	1.4	-	6.24	25.9	144
USGS-018	4/8/2019	33	16	12	2.9	-	11.7	26.7	135
USGS-019	4/8/2019	44	16	9.2	1.3	-	11.6	22.7	160
USGS-027	4/8/2019	51	18	27	5.7	-	45.9	39.6	156
Facility									
Idaho Nuclear Technology and Engineering Center									
ICPP-2020	4/23/2019	61	18	20	3.1	-	59.9	36.3	139
ICPP-MON-A-166	4/17/2019	35	12	9.5	2.7	-	16.1	18.8	122
ICPP-MON-A-230	4/23/2019	58	18	19	3.6	-	54.1	31.4	136
USGS-047	4/24/2019	47	13	8.5	1.9	-	12.4	21.8	149
USGS-052	4/24/2019	48	14	10	2.5	-	19.9	24.1	144
USGS-067	4/23/2019	51	14	20	3.2	-	36.7	27.1	139
USGS-085	4/1/2019	54	15	9.7	2.4	-	12.9	42.3	156
Advanced Test Reactor Complex									
USGS-065	4/17/2019	84	18	14	3.5	-	19.1	144	130
Test Area North									
ANP-8	6/6/2019	46	15	7.2	3.2	-	16.3	32.6	141
TAN 2271	4/17/2019	78	53	120	8.2	<0.20 U	115	31.8	528

Sample Location	Sample Date	Calcium*		Magnesium*		Sodium*		Potassium*		Fluoride		Chloride		Sulfate		Alkalinity†	
TAN-22A	6/3/2019	36		13		14		3.1		-	-	11.2		27.0		136	
TAN-2312	6/6/2019	34		13		10		3.5		-	-	8.86		26.5		126	
TAN-28	4/17/2019	97		32		75		5.4		<0.20	U	106		35.7		366	
TAN-42	4/17/2019	60		15		19		2.9		<0.20	U	42.3		32.9		162	
TAN-44	4/17/2019	63		16		22		3.1		<0.20	U	56.8		34.2		158	
TAN-48	6/5/2019	30		17		8.5		2.9		-	-	13.3		25.8		128	
TAN-51	6/5/2019	54		15		7.0		3.0		-	-	36.4		32.1		133	
Central Facilities Area																	
CFA 1	4/22/2019	56		17		29		3.7		-	-	77.4		34.1		127	
Naval Reactors Facility																	
NRF-06	5/15/2019	120		33		150		5.3		-	-	398		77.3		176	
NRF-09	5/15/2019	72		22		20		2.5		-	-	52.7		42.2		198	
NRF-11	5/15/2019	68		21		18		2.4		-	-	42.9		38.4		200	
NRF-12	5/15/2019	66		21		16		2.3		-	-	37.2		37.1		200	
Radioactive Waste Management Complex																	
A11A31	5/14/2019	39		17		23		3.7		-	-	29.3		48.2		137	
M15S	5/14/2019	40		19		16		3.7		-	-	58.7		40.7		97.0	
M1S	5/13/2019	26		11		11		2.3		-	-	13.8		22.7		97.0	
M3S	5/13/2019	43		15		8.1		2.6		-	-	16.1		27.6		143	
M6S	5/13/2019	35		17		13		3.0		-	-	25.7		52.5		98.9	
USGS-087	4/17/2019	36		14		12		3.0		-	-	22.0		25.0		122	
Materials and Fuels Complex																	
USGS-100	4/15/2019	36		12		16		3.1		-	-	15.7		16.8		132	
Boundary																	
Atomic City	4/18/2019	34		13		16		3.2		-	-	16.7		17.2		134	
Crossroads	4/16/2019	30		12		7.7		2.2		-	-	11.2		17.1		116	
Middle-2051 (1091 ftbls)	6/27/2019	38		18		7.5		2.4		-	-	11.9		23.3		149	
Middle-2051 (749 ftbls)	6/27/2019	44		15		8.0		2.2		-	-	10.6		25.4		156	
USGS-008	4/16/2019	46		14		6.7		1.7		-	-	7.48		22.0		158	
USGS-011	4/18/2019	40		14		7.9		2.2		-	-	9.35		22.6		141	
USGS-103	6/18/2019	40		15		8.8		2.4		-	-	15.4		24.4		139	
USGS-105 (1072 ftbls)	6/26/2019	39		15		11		2.8		-	-	13.3		25.8		143	
USGS-105 (952 ftbls)	6/26/2019	39		15		10		2.7		-	-	13.0		24.9		147	
USGS-108	6/24/2019	44		18		7.9		2.2		-	-	17.8		25.5		154	
USGS-124	4/18/2019	39		16		9.6		2.3		-	-	16.4		23.8		140	
USGS-131A (616 ftbls)	6/25/2019	43		15		7.4		2.4		-	-	17.4		23.6		141	
USGS-131A (812 ftbls)	6/25/2019	50		16		9.5		2.6		-	-	23.9		26.6		147	
USGS-132	6/19/2019	40		15		10		2.6		-	-	12.0		27.8		144	
USGS-137A	6/17/2019	39		15		11		2.6		-	-	12.8		26.5		139	
Distant																	
MV-49	6/20/2019	51		15		7.6		2.1		-	-	4.55		19.6		183	
MV-57	6/11/2019	22		11		11		2.4		-	-	6.41		17.0		103	
MV-58	6/20/2019	22		10		15		2.6		-	-	7.54		11.3		109	
Surface Water																	
BLR @ Dairy Farm	4/17/2019	44		10		5.6		1.2		-	-	3.43		20.2		139	
BLR @ INL Diversion	4/17/2019	42		10		5.4		1.2		-	-	3.33		19.4		133	
Perched Water *Advanced Test Reactor Complex:*																	
USGS-055	4/10/2019	60		18		13		2.9		-	-	14.7		69.3		161	
USGS-070	4/10/2019	60		18		13		3.1		-	-	14.8		75.7		153	

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 $CaCO_3$.
"-" = not analyzed.

Table 20. Dissolved metals concentrations (µg/L) for water samples, second quarter, 2019.

Sample Location	Sample Date	Arsenic		Barium		Chromium		Iron		Lead		Manganese		Selenium		Zinc	
Aquifer Samples																	
Upgradient																	
P&W 2	4/8/2019	-	-	-	-	1.3		-	-	-	-	-	-	-	-	-	-
USGS-018	4/8/2019	-	-	-	-	3.0		-	-	-	-	-	-	-	-	-	-
USGS-019	4/8/2019	-	-	-	-	1.9		-	-	-	-	-	-	-	-	-	-
USGS-027	4/8/2019	-	-	-	-	5.3		-	-	-	-	-	-	-	-	-	-
Facility																	
Idaho Nuclear Technology and Engineering Center																	
ICPP-2020	4/23/2019	-	-	-	-	6.2		-	-	-	-	-	-	-	-	-	-
ICPP-MON-A-166	4/17/2019	-	-	-	-	4.3		-	-	-	-	-	-	-	-	-	-
ICPP-MON-A-230	4/23/2019	-	-	-	-	5.5		-	-	-	-	-	-	-	-	-	-
USGS-047	4/24/2019	-	-	-	-	7.0		-	-	-	-	-	-	-	-	-	-
USGS-052	4/24/2019	-	-	-	-	7.1		-	-	-	-	-	-	-	-	-	-
USGS-067	4/23/2019	-	-	-	-	7.7		-	-	-	-	-	-	-	-	-	-
USGS-085	4/1/2019	-	-	-	-	19		-	-	-	-	-	-	-	-	-	-
Advanced Test Reactor Complex																	
USGS-065	4/17/2019	<2.0	U	45		78		16		<1.0	U	<1.0	U	<2.0	U	<5.0	U
Test Area North																	
TAN 2271	4/17/2019	<2.0	U	720		2.2		3100		<1.0	U	1500		-	-	-	-
TAN-28	4/17/2019	<2.0	U	360		1.6		20		<1.0	U	1800		-	-	-	-
TAN-42	4/17/2019	2.1		160		4.9		<10	U	<1.0	U	<1.0	U	-	-	-	-
TAN-44	4/17/2019	2.0		170		4.7		<10	U	<1.0	U	<1.0	U	-	-	-	-
Central Facilities Area																	
CFA 1	4/22/2019	-	-	-	-	15		-	-	-	-	-	-	-	-	-	-
Naval Reactors Facility																	
NRF-06	5/15/2019	-	-	-	-	49		-	-	-	-	-	-	-	-	-	-
NRF-09	5/15/2019	-	-	-	-	11		-	-	-	-	-	-	-	-	-	-
NRF-11	5/15/2019	-	-	-	-	14		-	-	-	-	-	-	-	-	-	-
NRF-12	5/15/2019	-	-	-	-	10		-	-	-	-	-	-	-	-	-	-
Radioactive Waste Management Complex																	
A11A31	5/14/2019	-	-	-	-	14		-	-	<1.0	U	-	-	-	-	73	
M15S	5/14/2019	-	-	-	-	25		-	-	-	-	-	-	-	-	-	-
M1S	5/13/2019	-	-	-	-	34		-	-	-	-	-	-	-	-	-	-
M3S	5/13/2019	-	-	-	-	11		-	-	-	-	-	-	-	-	-	-
M6S	5/13/2019	-	-	-	-	26		-	-	-	-	-	-	-	-	-	-
USGS-087	4/17/2019	-	-	-	-	7.3		-	-	<1.0	U	-	-	-	-	-	-
Materials and Fuels Complex																	
USGS-100	4/15/2019	-	-	-	-	5.0		-	-	<1.0	U	-	-	-	-	-	-
Boundary																	
Atomic City	4/18/2019	-	-	-	-	2.8		-	-	1.1		-	-	-	-	-	-
Crossroads	4/16/2019	-	-	-	-	<1.0	U	-	-	-	-	-	-	-	-	-	-
Middle-2051 (1091 ftbls)	6/27/2019	-	-	-	-	6.9		-	-	-	-	-	-	-	-	-	-
Middle-2051 (749 ftbls)	6/27/2019	-	-	-	-	6.4		-	-	-	-	-	-	-	-	-	-
USGS-008	4/16/2019	-	-	-	-	3.1		-	-	-	-	-	-	-	-	-	-
USGS-011	4/18/2019	-	-	-	-	4.5		-	-	-	-	-	-	-	-	-	-
USGS-103	6/18/2019	-	-	-	-	6.0		-	-	-	-	-	-	-	-	-	-
USGS-105 (1072 ftbls)	6/26/2019	-	-	-	-	8.6		-	-	-	-	-	-	-	-	-	-
USGS-105 (952 ftbls)	6/26/2019	-	-	-	-	8.0		-	-	-	-	-	-	-	-	-	-
USGS-108	6/24/2019	-	-	-	-	6.5		-	-	-	-	-	-	-	-	-	-
USGS-124	4/18/2019	-	-	-	-	6.5		-	-	-	-	-	-	-	-	-	-
USGS-131A (616 ftbls)	6/25/2019	-	-	-	-	11		-	-	-	-	-	-	-	-	-	-
USGS-131A (812 ftbls)	6/25/2019	-	-	-	-	10		-	-	-	-	-	-	-	-	-	-
USGS-132	6/19/2019	-	-	-	-	7.7		-	-	-	-	-	-	-	-	-	-
USGS-137A	6/17/2019	-	-	-	-	6.9		-	-	-	-	-	-	-	-	-	-
Distant																	
MV-49	6/20/2019	<2.0	U	-	-	1.7		-	-	-	-	-	-	-	-	-	-

Sample Location	Sample Date	Arsenic		Barium		Chromium		Iron		Lead		Manganese		Selenium		Zinc	
MV-57	6/11/2019	<2.0	U	-	-	3.4		-	-	-	-	-	-	-	-	-	-
MV-58	6/20/2019	2.6		-	-	3.0		-	-	-	-	-	-	-	-	-	-
Perched Water *Advanced Test Reactor Complex:*																	
USGS-055	4/10/2019	8.1		-	-	17		-	-	-	-	-	-	-	-	-	-
USGS-070	4/10/2019	8.8		-	-	7.4		-	-	-	-	-	-	-	-	-	-

Samples were filtered in the field unless otherwise noted.
Data qualifiers: U = undetected, J = estimate, R = rejected, "<" = less than detection limit, "+" or "-" after a J means that the estimated result is biased high or low, respectively.
"-" = not analyzed.

Table 21. Dissolved nutrient concentrations (mg/L) for water samples, second quarter, 2019.

Sample Location	Sample Date	Nitrate + Nitrite*		Total Phosphorus	
Aquifer Samples					
Upgradient					
P&W 2	4/8/2019	0.49		-	-
USGS-018	4/8/2019	0.64		-	-
USGS-019	4/8/2019	0.87		-	-
USGS-027	4/8/2019	2.5		-	-
Facility					
Idaho Nuclear Technology and Engineering Center					
ICPP-2020	4/23/2019	4.4		-	-
ICPP-MON-A-166	4/17/2019	0.28		-	-
ICPP-MON-A-230	4/23/2019	5.4		-	-
USGS-047	4/24/2019	1.0		-	-
USGS-052	4/24/2019	2.0		-	-
USGS-067	4/23/2019	5.0		-	-
USGS-085	4/1/2019	1.0		-	-
Advanced Test Reactor Complex					
USGS-065	4/17/2019	1.4		-	-
Test Area North					
TAN 2271	4/17/2019	<0.010	U	0.83	
TAN-28	4/17/2019	0.023		0.060	
TAN-42	4/17/2019	1.3		0.040	
TAN-44	4/17/2019	1.7		0.034	
Central Facilities Area					
CFA 1	4/22/2019	2.6		-	-
Naval Reactors Facility					
NRF-06	5/15/2019	2.1		-	-
NRF-09	5/15/2019	3.0		-	-
NRF-11	5/15/2019	2.3		-	-
NRF-12	5/15/2019	2.2		-	-
Radioactive Waste Management Complex					
A11A31	5/14/2019	1.1		-	-
M15S	5/14/2019	1.2		-	-
M1S	5/13/2019	0.98		-	-
M3S	5/13/2019	0.84		-	-
M6S	5/13/2019	1.5		-	-
USGS-087	4/17/2019	0.66		-	-
Materials and Fuels Complex					
USGS-100	4/15/2019	2.2		-	-
Boundary					
Atomic City	4/18/2019	1.6		-	-
Crossroads	4/16/2019	0.28		-	-
Middle-2051 (1091 ftbls)	6/27/2019	0.90		-	-

Sample Location	Sample Date	Nitrate + Nitrite*		Total Phosphorus	
Middle-2051 (749 ftbls)	6/27/2019	0.81		-	-
USGS-008	4/16/2019	0.99		-	-
USGS-011	4/18/2019	0.70		-	-
USGS-103	6/18/2019	0.78		-	-
USGS-105 (1072 ftbls)	6/26/2019	0.74		-	-
USGS-105 (952 ftbls)	6/26/2019	0.76		-	-
USGS-108	6/24/2019	1.0		-	-
USGS-124	4/18/2019	0.85		-	-
USGS-131A (616 ftbls)	6/25/2019	0.91		-	-
USGS-131A (812 ftbls)	6/25/2019	1.2		-	-
USGS-132	6/19/2019	0.75		-	-
USGS-137A	6/17/2019	0.68		-	-
Distant					
MV-49	6/20/2019	2.0		0.044	
MV-57	6/11/2019	0.45		0.020	
MV-58	6/20/2019	1.7		0.024	
Surface Water					
BLR @ Dairy Farm	4/17/2019	0.17		-	-
BLR @ INL Diversion	4/17/2019	0.14		-	-
Perched Water *Advanced Test Reactor Complex:*					
USGS-055	4/10/2019	1.4		0.28	
USGS-070	4/10/2019	1.4		0.30	

Samples were filtered in the field unless otherwise noted.
Data qualifiers: U = undetected, J = estimate, R = rejected, "<" = less than detection limit, "+" or "-" after a J means that the estimated result is biased high or low, respectively.
* As N.
"-" = not analyzed.

Table 22. Volatile organic compound concentrations (µg/L) for water samples, second quarter, 2019.

Sample Location	Sample Date	PCE		TCE		Vinyl Chloride		Carbon tetrachloride		Methylene Chloride		Chloro-methane	
A11A31	05/14/2019	<0.5	U	1.76		<0.5	U	4.89		<0.5	U	<0.5	U
M15S	05/14/2019	<0.5	U	2.5		<0.5	U	4.84		<0.5	U	<0.5	U
M1S	05/13/2019	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U
M3S	05/13/2019	<0.5	U	1.13		<0.5	U	3.86		<0.5	U	<0.5	U
M6S	05/13/2019	<0.5	U	0.77		<0.5	U	2.57		<0.5	U	<0.5	U
ANP-8	06/06/2019	2.67		16.7		<0.5	U	<0.5	U	<0.5	U	<0.5	U
TAN 2271	04/17/2019	<2.13*	U	<2.13*	U	<2.13*	U	<2.13*	U	<2.13*	U	<2.13*	U
TAN-2272B	04/17/2019	<2.13*	U	<2.13*	U	<2.13*	U	<2.13*	U	<2.13*	U	<2.13*	U
TAN-22A	06/03/2019	<0.5	U	<0.5	U	<0.5	U	<0.5	U	1.67		<0.5	U
TAN-2312	06/06/2019	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U
TAN-28	04/17/2019	<21.4*	U	209		<21.4*	U	<21.4*	U	<21.4*	U	<21.4*	U
TAN-37	04/17/2019	<21*	U	<21*	U	<21*	U	<21*	U	<21*	U	<21*	U
TAN-42	04/17/2019	10.7		76.7		<2.13*	U	<2.13*	U	<2.13*	U	<2.13*	U
TAN-44	04/17/2019	3.31		30.7		<2.12*	U	<2.12*	U	<2.12*	U	<2.12*	U
TAN-48	06/05/2019	3.87		32.5		<0.5	U	<0.5	U	<0.5	U	<0.5	U
TAN-51	06/05/2019	28		161		<0.5	U	<0.5	U	<0.5	U	<0.5	U
USGS-087	04/17/2019	<2.12*	U	<2.12*	U	<2.12*	U	4.23		<2.12*	U	<2.12*	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.
*Sample diluted prior to analysis.

Table 22 cont. Volatile organic compound concentrations (µg/L) in water samples, second quarter, 2019.

Sample Location	Sample Date	1,1-DCE		cis-1,2-DCE		trans-1,2-DCE		1,1-DCA		Chloroform		Methyl Ethyl Ketone	
A11A31	05/14/2019	<0.5	U	<0.5	U	<0.5	U	<0.5	U	0.80	U	<10	U
M15S	05/14/2019	<0.5	U	<0.5	U	<0.5	U	<0.5	U	1.31		<10	U
M1S	05/13/2019	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<10	U
M3S	05/13/2019	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<10	U
M6S	05/13/2019	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<10	U
ANP-8	06/06/2019	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<10	U
TAN 2271	04/17/2019	<2.13*	U	<2.13*	U	114		<2.13*	U	<2.13*	U	<42.5*	U
TAN-2272B	04/17/2019	<2.13*	U	<2.13*	U	64		<2.13*	U	<2.13*	U	<42.6*	U
TAN-22A	06/03/2019	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<10	U
TAN-2312	06/06/2019	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<10	U
TAN-28	04/17/2019	<21.4*	U	50.8		126		<21.4*	U	<21.4*	U	<427*	U
TAN-37	04/17/2019	<21*	U	<21*	U	<21*	U	<21*	U	<21*	U	1030	
TAN-42	04/17/2019	<2.13*	U	3.24		<2.13*	U	<2.13*	U	<2.13*	U	<42.6*	U
TAN-44	04/17/2019	<2.12*	U	<2.12*	U	<2.12*	U	<2.12*	U	<2.12*	U	<42.4*	U
TAN-48	06/05/2019	<0.5	U	8.29		1.11		<0.5	U	<0.5	U	<10	U
TAN-51	06/05/2019	0.69		4.04		1.25		0.63		<0.5	U	<10	U
USGS-087	04/17/2019	<2.12*	U	<2.12*	U	<2.12*	U	<2.12*	U	<2.12*	U	<42.3*	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.
*Sample diluted prior to analysis.

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 2019.

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 23**. ^{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 23. Gamma spectroscopy analysis data for milk samples, second quarter, 2019.

Sample Location/Dairy	Sample Date	Naturally occurring Potassium-40		Man-made Iodine-131[1]
		Concentration[3]	± 2 SD	
Monitoring Samples				
Gooding/Glanbia	04/09/2019	1292	83	<MDC
	05/07/2019	1403	85	<MDC
Riverside	04/07/2019	1660	95	<MDC
	05/05/2019	1528	90	<MDC
	06/02/2019	1853	146	<MDC
Verification Samples[2]				
Terreton	04/02/2019	1482	88	<MDC
Dietrich	04/02/2019	1351	117	<MDC
Idaho Falls	05/07/2019	1419	116	<MDC
Rupert	05/07/2019	1464	88	<MDC
Rupert	06/04/2019	1511	90	<MDC
Howe	06/04/2018	1406	121	<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

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

This section summarizes the quality assurance assessment of the data collected by DEQ-INL OP in the second quarter of 2019. Included are the results of quality control (QC) samples (blanks, duplicates, and spikes) that DEQ-INL OP submitted to Idaho State University's Environmental Monitoring Laboratory (ISU-EML) for radiological analyses and to the Idaho Bureau of Laboratories-Boise (IBL) for non-radiological analyses during the quarter. The analytical results of QC samples are used to assess the precision, accuracy, and representativeness of the environmental data presented in this report. During the second quarter of 2019, DEQ-INL OP submitted 104 QC samples for various radiological and non-radiological analyses (**Table 24**).

All samples referenced in this report were collected in accordance with written procedures maintained by the DEQ-INL OP. Analytical methods and QC procedures used by the laboratories were performed in accordance with approved written procedures maintained by each lab. QC samples analyzed by the labs as part of each lab's internal QA program are not discussed in this report.

Blank Samples

Blank samples consist of matrices that contain immeasurable or acceptably low concentrations of the analyte(s) of interest. They are used to monitor for contamination introduced during sample collection, storage, shipment, and analysis. For water matrices, a blank sample consists of 18-megaohm deionized water from the DEQ-Idaho Falls Regional office and is categorized as a field blank, equipment blank, or trip blank depending on how the blank is handled. A field blank is used to monitor for contamination introduced from the environment during sample collection, an equipment blank is used to monitor for contamination introduced by contaminated equipment, and a trip blank is used to monitor for contamination introduced during transportation of samples (trip blanks are typically only used for VOCs). Most water blank samples submitted to laboratories by DEQ-INL OP are field blanks.

For all analyses except low-level tritium in water, a blank sample result is considered acceptable if it is less than or equal to the minimum detectable concentration (MDC). For low-level tritium analyses in water samples, a blank sample result is acceptable if it is less than or equal to 33 pCi/L.[5] 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 second quarter of 2019 are presented in **Table 25**. Blank sample results for select gamma emitters in air from composited air filters are presented in **Table 26**. Data for blank analyses used to assess data quality for tritium in water vapor in air are presented in **Table 27**. Blank sample results for radiological and non-radiological analytes in ground and surface water are presented in **Tables 28-31**.

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

Gross beta radioactivity was detected just above the MDC in one blank water sample (sample #191W361). Because the gross beta concentration of three samples associated with this blank (#191W351, #191W355, #191W359) are less than five times, but greater than three times the concentration of that of the blank, these have been qualified as biased high (J+).

Another blank sample (191W411) was measured to have 1.0 mg/L alkalinity (as $CaCO_3$). This is equal to the detection limit for total alkalinity. Also, all other samples analyzed on the same date as the failed blank had dissolved alkalinity concentrations greater than 100x the concentration measured in the blank. Therefore, no results were qualified or rejected based on this sample.

All other blank sample results passed acceptance criteria in the second quarter of 2019.

Duplicate Samples

A duplicate sample is one that is collected at the same location and approximately the same time as another sample (referred to as the "original" sample). Duplicate sample results are compared to the original sample's results to evaluate reproducibility. Significant differences between the two could indicate poor analytical precision or a non-uniform sample matrix.

The difference between the results of an original and duplicate sample (referred to below as a "duplicate-sample pair") is evaluated differently for radiological and non-radiological analyses. For radiological analyses, the results of a duplicate-sample pair are considered to be in agreement if their absolute difference is less than or equal to three times the pooled error of the results:

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

R_1 = Original sample result
R_2 = Duplicate sample result
S_1 = Analytical uncertainty (1 SD) of the original result
S_2 = Analytical uncertainty (1 SD) of the duplicate result

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

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

For non-radiological analyses, the RPD is used to evaluate duplicate sample pairs in which both results exceed five times the MDC. An RPD of up to ±20 percent is acceptable. If one or both of the sample results is less than five times the MDC, the results are in agreement if their absolute difference is less than or equal to the MDC.

Duplicate results for radiological analyses in groundwater and surface water are presented in **Table 32-35**.

Duplicate results for gross alpha radioactivity in water from well USGS-070 did not pass acceptance criteria. Discordance between an original sample and duplicate sample in groundwater could result from variability in the water coming out of the well during sampling and is not necessarily indicative of methodological imprecision. As such, no samples were qualified as a result of this duplicate failure. All other duplicate results passed acceptance criteria in the second quarter of 2019.

Spiked Samples

Spiked samples are samples to which known concentrations of specific analytes have been added. They are used to assess a laboratory's analytical accuracy. The percent recovery (%R) of each spiked-sample analysis is calculated as the ratio of the spike concentration determined by the lab to the known spike concentration. DEQ-INL OP considers the lab's result to be in control if the percent recovery is 100 ± 25%. If the percent recovery of a spiked sample is 50-74%, above-MDC results of samples analyzed in the same batch as the spiked sample may be qualified as low-biased estimates (J-), and below-MDC results may be qualified as undetected estimates (UJ). If the percent recovery of a spiked sample is 126-150%, above-MDC results of associated samples may be qualified as high-biased estimates (J+), and below-MDC results may be qualified as undetected (U). If the percent recovery of a spiked sample is <50% or >150%, the results of all associated samples may be qualified as rejected (R), except for sample results below MDC associated with a spiked-sample analysis having a percent recovery >150%, in which case the sample result remains qualified as undetected (U).

No spiked water samples were analyzed during the second quarter of 2019.

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 2019 are presented in **Table 36**. 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 2019.

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 2019 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 second quarter of 2019.

Data usability is the measure of field sample results that are not rejected divided by the total number of field sample results obtained. The overall data usability of 100% for the second quarter of 2019 is well above the acceptable value of 90% for the DEQ-INL OP ESP and is summarized in **Table 24**. The overall data completeness (non-qualified results divided by the total number of field sample results expected) of 99.2% is also acceptable.

Preventative Maintenance and Equipment Reliability

All equipment was calibrated and checked according to prescribed periodicity. During the second quarter of 2019 the TSP blower at the Van Buren sampling station was replaced. Service reliability for air sampling equipment for the second quarter of 2019 is summarized in **Table 37**.

Conclusion

All data collected for the second quarter of 2019 have been assigned the applicable qualifiers to designate the appropriate use of the data. The overall data usability of 100% and data completeness of 99.2% are acceptable for the quarter, with the data meeting the requirements and data quality objectives established by DEQ-INL OP.

Table 24. Summary of the analytical performance and usability of the analyses performed for the DEQ-INL OP ESP, second quarter, 2019.

Media Sampled	Collection Device	Analyte	Sample Analyses	Blank Analyses	Duplicate Analyses	Spike Analyses	Data Rejected[1]	Analyzing Lab[2]
Air								
Particulate	4-inch filter	Gross alpha	142	13	0	0	0	ISU-EML
		Gross beta	142	13	0	0	0	ISU-EML
		Gamma emitters	11	1		0	0	ISU-EML
		Radiochemical	0	0	0	0	0	ISU Sub
Water Vapor	Desiccant column	Tritium	29	5	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	63	4	3	0	0	ISU-EML
		Gross beta	63	4	3	0	1	ISU-EML
		Gamma emitters	63	4	3	0	0	ISU-EML
		Tritium	63	4	3	0	0	ISU-EML
		Low-level tritium	15	1	0	0	0	ISU-EML
		Technetium-99	16	1	1	0	0	ISU-Sub
		Radiochemical	49	6	6	0	0	ISU Sub
		Metals	48	3	3	0	0	IBL
		Common Ions	55	3	3	0	0	IBL
		Nutrients	50	3	3	0	0	IBL
		Volatile Organics	17	1	1	0	0	IBL
Terrestrial								
Milk	Grab or composite	Gamma emitters	11	0	0	0	0	ISU-EML
Soil	*in situ*	Gamma emitters	0	0	0	0	0	DEQ-INL OP
	Grab – "puck"	Gamma emitters	0	0	0	0	0	ISU-EML
Radiation								
Ambient	EICs	Gamma Radiation	67	0	0	9	0	DEQ-INL OP
	HPICs	Gamma Radiation	8	NA	NA	NA	0	DEQ-INL OP
Total analyses performed			**937**	**66**	**29**	**9**	**0**	
Total QC analyses performed (blanks, duplicates, and spikes)			**104**					
Ratio of total QC analyses to total sample analyses[3]			**11.1%**					
Percentage of data that are useable[4]			**100%**					

[1] Combined Laboratory and DEQ-INL OP rejection criteria (data was rejected for any reason).

[2] ISU-EML = Idaho State University – Environmental Monitoring Laboratory; ISU Sub = Subcontract laboratory to ISU-EML; IBL = Idaho Bureau of Laboratories, Boise; IBL Sub = Subcontract laboratory to IBL; DEQ-INL OP = Analyzed by INL Oversight Program, Idaho Department of Environmental Quality.

[3] DEQ-INL OP requires that the number of QC analyses performed be at least 10 percent of the number of sample analyses performed.

[4] Data usability is calculated as [total analyses – rejected data]/[total analyses]. DEQ-INL OP considers a data usability rate of 90 percent or higher to be acceptable.

Table 25. Blank analysis results for gross alpha and beta in particulate air (TSP), second quarter, 2019.

Collection Period		Corrected volume (m^3)[1]	Gross alpha		Gross beta	
Start	Stop		Value	Uncertainty (± 2 SD)	Value	Uncertainty (± 2 SD)
03/28/19	04/04/19	2042	-0.1	0.1	0.1	0.5
04/04/19	04/11/19	2042	0.0	0.1	-0.1	0.5
04/11/19	04/18/19	2042	0.0	0.1	-0.5	0.5
04/18/19	04/25/19	2042	0.0	0.1	-0.3	0.5
04/25/19	05/02/19	2042	0.0	0.1	0.1	0.5
05/02/19	05/09/19	2042	0.1	0.1	0.0	0.5
05/09/19	05/16/19	2042	0.0	0.1	0.0	0.5
05/16/19	05/23/19	2042	0.1	0.1	0.2	0.5
05/23/19	05/30/19	2042	0.1	0.1	0.0	0.5
05/30/19	06/06/19	2042	-0.1	0.1	0.1	0.5
06/06/19	06/13/19	2042	0.0	0.1	-0.2	0.5
06/13/19	06/20/19	2042	0.0	0.1	0.4	0.5
06/20/19	06/27/19	2042	0.0	0.1	0.1	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 26. Blank analysis results for gamma spectroscopy for TSP air filters, composite samples, second quarter, 2019.

Analysis Date	Beryllium-7			Ruthenium-106/Rhodium-106			Antimony-125		
	Concentration[1]	± 2 SD	MDC	Concentration	± 2 SD	MDC	Concentration	± 2 SD	MDC
07/17/2019	-17	46	79	-35	89	155	-5	13	22

Analysis Date	Cesium-134			Cesium-137		
	Concentration[1]	± 2 SD	MDC	Concentration	± 2 SD	MDC
07/17/2019	1	4	7	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 27. Blank analysis results for tritium in water vapor from air samples, second quarter, 2019.

Sample Number	Start Date	Collection Date	Analysis Date	Tritium		
				Concentration	± 2 SD	MDC
OP192ZTR01	07/01/19	07/09/19	07/22/19	0.12	0.09	0.14
OP192ZTR02	07/01/19	07/09/19	07/22/19	0.00	0.08	0.14
OP192ZTR03	07/01/19	07/10/19	07/22/19	0.05	0.08	0.14
OP192Fridge	05/06/19	07/11/19	07/22/19	0.00	0.08	0.14
OP192Sink	05/06/19	07/11/19	07/22/19	0.04	0.08	0.14

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

Table 28. Blank analysis results (pCi/L) for radiological constituents in water, second quarter, 2019.

Sample Number	Sample Date	Blank Type	Concentration	± 2 SD	MDC	Within Blank Criteria?
Gross Alpha						
191W361	5/20/2019	Field	-0.2	0.3	0.6	Yes
191W067	4/16/2019	Field	0.2	0.2	0.3	Yes
191W211	4/23/2019	Field	0.1	0.2	0.4	Yes
191W409	6/24/2019	Field	0.0	0.2	0.4	Yes
Gross Beta						
191W361	5/20/2019	Field	1.3	0.6	1.0	No
191W067	4/16/2019	Field	0.2	0.6	1.0	Yes
191W211	4/23/2019	Field	0.2	0.6	1.0	Yes
191W409	6/24/2019	Field	-0.1	0.6	1.0	Yes
Cesium-137						
191W361	5/20/2019	Field	0.2	1.4	2.5	Yes
191W067	4/16/2019	Field	0.7	1.6	2.6	Yes
191W211	4/23/2019	Field	0.1	1.2	2.1	Yes
191W409	6/24/2019	Field	1.4	1.6	2.6	Yes
Tritium (standard method)						
191W362	5/20/2019	Field	-90	110	190	Yes
191W068	4/16/2019	Field	0	90	150	Yes
191W215	4/23/2019	Field	50	90	150	Yes
191W410	6/24/2019	Field	80	110	190	Yes
Tritium (low-level method)						
181W584	10/9/2018	Field	13	6	10	Yes*
Sr-90						
191W213	4/23/2019	Field	0.04	0.26	0.61	Yes
Tc-99						
191W214	4/23/2019	Field	-0.6	3.0	5.6	Yes
U-234						
191W216	4/23/2019	Field	0.039	0.045	0.072	Yes
U-235						
191W216	4/23/2019	Field	0	0.038	0.028	Yes
U-238						
191W216	4/23/2019	Field	0.008	0.032	0.065	Yes
Pu-238						
191W212	4/23/2019	Field	-0.014	0.024	0.059	Yes
Pu-239/240						
191W212	4/23/2019	Field	-0.001	0.024	0.046	Yes

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

Table 29. Blank analysis results (µg/L) for metals in groundwater and/or surface water, second quarter, 2019.

Sample Number	Sample Date	Blank Type	Arsenic	Barium	Chromium	Iron	Lead	Manganese	Selenium	Zinc
191W070	4/16/2019	Field	-	-	<1.0	-	<1.0	-	-	-
191W218	4/23/2019	Field	-	-	<1.0	-	-	-	-	-
191W412	6/24/2019	Field	-	-	<1.0	-	-	-	-	-

Table 30. Blank analysis results (mg/L) for common ions and nutrients in groundwater and/or surface water, second quarter, 2019.

Sample Number	Sample Date	Blank Type	Calcium	Magnesium	Sodium	Potassium	Fluoride	Chloride	Sulfate	Alkalinity†	NO_3+NO_2*	Total Phosphorus
191W070,069	4/16/2019	Field	<0.1	<0.1	<0.1	<0.1	-	<0.4	<0.8	<1.0	<0.01	<0.005
191W218,217	4/23/2019	Field	<0.1	<0.1	<0.1	<0.1	-	<0.4	<0.8	<1.0	<0.01	<0.005
191W412,411	6/24/2019	Field	<0.1	<0.1	<0.1	<0.1	-	<0.4	<0.8	1.0	<0.01	<0.005

† As $CaCO_3$.

* As N.

Table 31. Blank analysis results (µg/L) for VOCs in water, second quarter, 2019.

Sample Number	Sample Date	Blank Type	PCE	TCE	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	Vinyl Chloride	1,1-DCA	Carbon Tetrachloride	Methylene Chloride	Chloro-form	Chloro-methane	MEK
191W363	4/30/2019	Trip	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10

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

Table 32. Duplicate sample results (pCi/L) for radiological constituents in groundwater and/or surface water, second quarter, 2019.

Analysis/Sample Location	Original Sample Number	Concentration	± 2 SD	Duplicate Sample Number	Concentration	± 2 SD	RPD	$\lvert R_1-R_2 \rvert$	$3(S_1^2+S_2^2)^{1/2}$	Within Criteria?
Gross Alpha										
TAN-42	191W172	2.2	1.1	191W180	2.3	1.2	-4.4	0.1	2.4	Yes
MV-49	191W394	1.6	1.1	191W399	1.3	1.1	21	0.3	2.3	Yes
USGS-070	191W044	5.9	1.6	191W050	2.5	1.0	81	3.4	2.8	No
Gross Beta										
TAN-42	191W172	5.5	1.1	191W180	4.8	1.1	14	0.7	2.3	Yes
MV-49	191W394	3.3	1.0	191W399	2.7	1.0	20	0.6	2.1	Yes
USGS-070	191W044	44.6	1.8	191W050	46.0	1.8	-3.1	1.4	3.8	Yes
Cesium-137										
TAN-42	191W172	1.1	2.1	191W180	0.3	1.4	114	0.8	3.8	Yes
MV-49	191W394	-0.4	1.7	191W399	0.2	1.2	600	0.6	3.1	Yes
USGS-070	191W044	1.1	2.0	191W050	0.5	1.5	75	0.6	3.8	Yes
Tritium (standard method)										
A11A31	191W281	170	90	191W348	40	90	124	130	191	Yes
TAN-42	191W174	400	110	191W182	410	110	-2.5	10.0	233	Yes
USGS-070	191W046	260	100	191W052	280	100	-7.4	20.0	212	Yes
Sr-90										
TAN-42	191W173	-0.04	0.23	191W181	0.29	0.27	-264	0.3	0.5	Yes
USGS-070	191W045	14.3	3.5	191W051	14.6	3.6	-2.1	0.3	7.5	Yes
Tc-99										
A11A31	191W280	0.1	3.7	191W347	1.0	3.8	-164	0.9	8.0	Yes
U-234										
TAN-42	191W175	2.04	0.44	191W183	2.04	0.44	0	0.00	0.93	Yes
U-235										
TAN-42	191W175	0.054	0.053	191W183	0.135	0.084	-86	0.081	0.15	Yes
U-238										
TAN-42	191W175	1.06	0.27	191W183	0.98	0.26	7.8	0.08	0.56	Yes

Table 33. Duplicate sample results for metals (µg/L) in groundwater, second quarter, 2019.

Sample Location	Sample Number	Sample Date	Arsenic	Barium	Chromium	Iron	Lead	Manganese	Selenium	Zinc
TAN-42	191W177	4/17/2019	2.1	160	4.9	<10	<1.0	<1.0	-	-
TAN-42	191W185	4/17/2019	2.1	170	4.5	<10	<1.0	<1.0	-	-
RPD			**0**	**-6**	**8.5**	**0**	**0**	**0**	**-**	**-**
USGS-070	191W048	4/10/2019	8.8	-	7.4	-	-	-	-	-
USGS-070	191W054	4/10/2019	8.7	-	7.2	-	-	-	-	-
RPD			**1.1**	**-**	**2.7**	**-**	**-**	**-**	**-**	**-**
MV-49	191W397	6/20/2019	<2.0	-	1.7	-	-	-	-	-
MV-49	191W402	6/20/2019	<2.0	-	1.6	-	-	-	-	-
RPD			**0**	**-**	**6.1**	**-**	**-**	**-**	**-**	**-**

RPD = relative percent difference.

Table 34. Duplicate sample results for common ions and nutrients (mg/L) in groundwater, second quarter, 2019.

Sample Location	Sample Number	Sample Date	Calcium	Magnesium	Sodium	Potassium	Fluoride	Chloride	Sulfate	Total Alkalinity†	Total Nitrogen	Total Phosphorus
TAN-42*	191W177,176	4/17/2019	60	15	19	2.9	<0.20	42.3	32.9	162	1.3	0.040
TAN-42*	191W185,184	4/17/2019	61	16	19	2.9	0.20	42.3	33.1	162	1.3	0.040
RPD			**-2**	**-6**	**0**	**0**	**0**	**0**	**-1**	**0**	**0**	**0**
USGS-070*	191W048,047	4/10/2019	60	18	13	3.1	-	14.8	75.7	153	1.4	0.300
USGS-070*	191W054,053	4/10/2019	60	18	13	3.1	-	14.8	77.1	154	1.4	0.300
RPD			**0**	**0**	**0**	**0**	**-**	**0**	**-2**	**-1**	**0**	**0**
MV-49*	191W397,396	6/20/2019	51	15	7.6	2.1	-	4.55	19.6	183	2.0	0.044
MV-49*	191W402,401	6/20/2019	51	15	7.6	2.1	-	4.54	19.5	181	2.0	0.044
RPD			**0**	**0**	**0**	**0**	**-**	**0**	**1**	**1**	**0**	**0**

RPD = relative percent difference.
† As $CaCO_3$.
*Sample was filtered in the field.

Table 35. Duplicate sample results (µg/L) for VOCs in water, second quarter, 2019.

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	Chloro-form	MEK
TAN-42	191W179	4/17/2019	10.4	76.7	<2.13*	3.24	<2.13*	<2.13*	<2.13*	<2.13*	<2.13*	<2.13*	<2.13*	<42.6*
TAN-42	191W187	4/17/2019	9.09	74.8	<2.13*	2.94	<2.13*	<2.13*	<2.13*	<2.13*	<2.13*	<2.13*	<2.13*	<42.7*
RPD			**13**	**3**	**0**	**10**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

RPD = relative percent difference.
Abbreviations: PCE = tetrachloroethene; TCE = trichloroethene; 1,1-DCE = 1,1-dichloroethene; cis-1,2-DCE = cis-1,2-dichloroethene; trans-1,2-DCE = trans-1,2-dichloroethene; 1,1-DCA = 1,1-dichloroethane; MEK = Methyl Ethyl Ketone.
*Sample diluted prior to analysis.

Table 36. Electret ionization chamber (EIC) irradiation results (categorized as spiked samples), second quarter, 2019.

Electret #	Exposure Received		Net Measured Exposure[1]		%R	Within Spec?
	(mR)	Uncertainty (±1 SD, mR)	(mR)	Uncertainty (±1 SD, mR)		
SJE153	40.0	2.0	36.5	1.4	91.2%	Y
SJE076	40.0	2.0	36.1	1.4	90.3%	Y
SJE987	40.0	2.0	36.4	1.4	90.9%	Y
				Triplicate AVG:	**90.8%**	**Y**
SJW993	30.0	1.5	26.6	1.4	88.6%	Y
SJE093	30.0	1.5	25.7	1.4	85.6%	Y
SJE007	30.0	1.5	27.0	1.3	90.0%	Y
				Triplicate AVG:	**88.1%**	**Y**
SJE107	20.0	1.0	17.2	1.4	85.9%	Y
SIR681	20.0	1.0	17.6	1.3	88.0%	Y
SJX082	20.0	1.0	16.7	1.4	83.5%	Y
				Triplicate AVG:	**85.8%**	**Y**

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

Table 37. Air sampling field equipment service reliability (percent operational), second quarter, 2019.

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	92%	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, second quarter, 2019.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	±2 SD	Concentration	±2 SD
On-Site Locations						
Big Lost River Rest Area	03/28/19	04/04/19	0.4	0.2	24.2	1.1
	04/04/19	04/11/19	0.5	0.2	15.6	0.9
	04/11/19	04/18/19	0.5	0.2	16.8	1.0
	04/18/19	04/25/19	0.8	0.2	25.2	1.1
	04/25/19	05/02/19	1.0	0.2	34.1	1.3
	05/02/19	05/09/19	1.0	0.2	35.4	1.3
	05/09/19	05/16/19	1.3	0.3	41.8	1.4
	05/16/19	05/23/19	0.5	0.2	13.8	0.9
	05/23/19	05/30/19	0.7	0.2	24.4	1.1
	05/30/19	06/06/19	1.1	0.3	37.5	1.3
	06/06/19	06/13/19	0.9	0.2	22.2	1.1
	06/13/19	06/20/19	1.2	0.3	35.4	1.3
	06/20/19	06/27/19	1.0	0.3	28.9	1.2
Experimental Field Station	03/28/19	04/04/19	0.2	0.2	16.3	1.0
	04/04/19	04/11/19	0.3	0.2	10.8	0.9
	04/11/19	04/18/19	0.3	0.2	11.3	0.9
	04/18/19	04/25/19	0.5	0.2	19.9	1.1
	04/25/19	05/02/19	0.9	0.2	24.1	1.1
	05/02/19	05/09/19	1.0	0.3	24.8	1.2
	05/09/19	05/16/19	1.1	0.3	31.3	1.3
	05/16/19	05/23/19	0.3	0.2	10.4	1.0
	05/23/19	05/30/19	0.6	0.2	17.5	1.0
	05/30/19	06/06/19	0.7	0.2	26.7	1.2
	06/06/19	06/13/19	0.8	0.2	16.7	1.0
	06/13/19	06/20/19	0.9	0.3	26.8	1.2
	06/20/19	06/27/19	1.1	0.3	22.4	1.1
Sand Dunes Tower	03/28/19	04/04/19	0.3	0.2	14.4	0.9
	04/04/19	04/11/19	0.3	0.1	8.4	0.7
	04/11/19	04/18/19	0.2	0.2	8.4	0.7
	04/18/19	04/25/19	0.4	0.2	14.2	0.9
	04/25/19	05/02/19	0.6	0.2	18.0	0.9
	05/02/19	05/09/19	0.5	0.2	17.8	0.9
	05/09/19	05/16/19	0.3	0.2	24.9	1.1
	05/16/19	05/23/19	0.1	0.1	7.5	0.7
	05/23/19	05/30/19	0.3	0.2	13.2	0.8
	05/30/19	06/06/19	0.5	0.2	22.6	1.0
	06/06/19	06/13/19	0.5	0.2	11.5	0.8
	06/13/19	06/20/19	0.5	0.2	19.3	1.0
	06/20/19	06/27/19	0.6	0.2	15.0	0.9

Table A-1 continued. Weekly concentrations (in 1 x 10^{-3} pCi/m^3) for gross alpha and gross beta analyses for TSP filters for all locations, second quarter, 2019.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	±2 SD	Concentration	±2 SD
Van Buren Avenue	03/28/19	04/04/19	0.2	0.2	13.1	0.9
	04/04/19	04/11/19	0.2	0.2	8.0	0.8
	04/11/19	04/18/19	0.3	0.2	8.9	0.8
	04/18/19	04/25/19	0.6	0.2	15.3	0.9
	04/25/19	05/02/19	0.8	0.2	18.9	1.0
	05/02/19	05/09/19	0.8	0.2	18.2	1.0
	05/09/19	05/16/19	0.9	0.2	24.3	1.1
	05/16/19	05/23/19	0.3	0.2	6.9	0.7
	05/23/19	05/30/19	0.5	0.2	13.1	0.9
	05/30/19	06/06/19	0.5	0.2	21.9	1.0
	06/06/19	06/13/19	1.0	0.3	16.9	1.0
	06/13/19	06/20/19	0.6	0.3	22.8	1.3
	06/20/19	06/27/19	NS[1]	NS[1]	NS[1]	NS[1]
Boundary Locations						
Atomic City	03/28/19	04/04/19	0.4	0.2	25.7	1.1
	04/04/19	04/11/19	0.6	0.2	15.7	0.9
	04/11/19	04/18/19	0.6	0.2	16.4	1.0
	04/18/19	04/25/19	0.8	0.2	26.3	1.2
	04/25/19	05/02/19	1.2	0.3	34.3	1.3
	05/02/19	05/09/19	1.3	0.3	37.5	1.3
	05/09/19	05/16/19	1.2	0.3	40.1	1.4
	05/16/19	05/23/19	0.5	0.2	14.1	0.9
	05/23/19	05/30/19	0.8	0.2	25.6	1.1
	05/30/19	06/06/19	1.3	0.3	37.9	1.3
	06/06/19	06/13/19	0.9	0.2	21.4	1.1
	06/13/19	06/20/19	1.1	0.3	37.3	1.3
	06/20/19	06/27/19	1.0	0.3	25.5	1.1
Howe	03/28/19	04/04/19	0.3	0.2	12.6	0.9
	04/04/19	04/11/19	0.3	0.2	8.1	0.8
	04/11/19	04/18/19	0.2	0.2	8.8	0.8
	04/18/19	04/25/19	0.5	0.2	15.5	1.0
	04/25/19	05/02/19	1.0	0.2	18.4	1.0
	05/02/19	05/09/19	0.5	0.2	16.9	1.0
	05/09/19	05/16/19	0.6	0.2	25.2	1.2
	05/16/19	05/23/19	0.2	0.2	7.1	0.7
	05/23/19	05/30/19	0.5	0.2	13.9	0.9
	05/30/19	06/06/19	0.5	0.2	21.2	1.1
	06/06/19	06/13/19	0.5	0.2	13.0	0.9
	06/13/19	06/20/19	0.6	0.2	19.9	1.1
	06/20/19	06/27/19	0.7	0.2	14.7	0.9

[1]NS – No sample - failed TSP sampler replaced on 06/27/2019.

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, 2019.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	±2 SD	Concentration	±2 SD
Monteview	03/28/19	04/04/19	0.4	0.2	16.3	1.0
	04/04/19	04/11/19	0.5	0.2	10.4	0.8
	04/11/19	04/18/19	0.6	0.2	12.2	0.9
	04/18/19	04/25/19	0.7	0.2	17.1	1.0
	04/25/19	05/02/19	1.0	0.2	20.4	1.0
	05/02/19	05/09/19	0.9	0.2	21.2	1.1
	05/09/19	05/16/19	1.2	0.3	32.2	1.3
	05/16/19	05/23/19	0.4	0.2	12.3	1.0
	05/23/19	05/30/19	0.6	0.2	15.5	0.9
	05/30/19	06/06/19	0.9	0.3	25.3	1.1
	06/06/19	06/13/19	0.7	0.2	16.0	0.9
	06/13/19	06/20/19	0.7	0.2	23.5	1.1
	06/20/19	06/27/19	0.8	0.2	17.6	1.0
Mud Lake	03/28/19	04/04/19	0.6	0.2	22.3	1.1
	04/04/19	04/11/19	0.6	0.2	13.5	0.9
	04/11/19	04/18/19	0.6	0.2	13.9	0.9
	04/18/19	04/25/19	1.0	0.2	25.4	1.1
	04/25/19	05/02/19	1.2	0.3	26.2	1.2
	05/02/19	05/09/19	1.1	0.2	28.8	1.2
	05/09/19	05/16/19	1.1	0.3	39.5	1.3
	05/16/19	05/23/19	0.3	0.2	11.0	0.8
	05/23/19	05/30/19	0.6	0.2	20.3	1.0
	05/30/19	06/06/19	0.7	0.2	34.0	1.3
	06/06/19	06/13/19	0.8	0.2	19.3	1.0
	06/13/19	06/20/19	1.0	0.3	32.7	1.3
	06/20/19	06/27/19	1.0	0.2	25.5	1.1
Distant Locations						
Craters of the Moon	03/28/19	04/04/19	0.2	0.2	11.5	0.8
	04/04/19	04/11/19	0.1	0.1	7.7	0.7
	04/11/19	04/18/19	0.2	0.2	8.1	0.8
	04/18/19	04/25/19	0.7	0.2	15.9	0.9
	04/25/19	05/02/19	0.7	0.2	19.6	1.0
	05/02/19	05/09/19	0.6	0.2	20.9	1.0
	05/09/19	05/16/19	1.1	0.2	31.8	1.2
	05/16/19	05/23/19	0.3	0.2	7.2	0.7
	05/23/19	05/30/19	0.3	0.2	14.8	0.9
	05/30/19	06/06/19	0.5	0.2	24.9	1.1
	06/06/19	06/13/19	0.5	0.2	12.8	0.9
	06/13/19	06/20/19	0.8	0.2	25.8	1.1
	06/20/19	06/27/19	0.6	0.2	18.9	1.0

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, 2019.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	±2 SD	Concentration	±2 SD
Fort Hall[1]	03/28/19	04/04/19	0.7	0.2	23.7	1.1
	04/04/19	04/11/19	0.8	0.2	18.7	1.0
	04/11/19	04/18/19	0.5	0.2	14.9	0.9
	04/18/19	04/25/19	1.3	0.3	22.7	1.1
	04/25/19	05/02/19	1.5	0.3	33.0	1.3
	05/02/19	05/09/19	1.7	0.3	29.7	1.2
	05/09/19	05/16/19	1.6	0.3	42.8	1.4
	05/16/19	05/23/19	0.5	0.2	12.5	0.8
	05/23/19	05/30/19	0.6	0.2	21.9	1.0
	05/30/19	06/06/19	1.4	0.3	40.4	1.4
	06/06/19	06/13/19	0.9	0.2	19.7	1.0
	06/13/19	06/20/19	1.5	0.3	36.6	1.3
	06/20/19	06/27/19	1.1	0.3	25.8	1.1
Idaho Falls - HVP 4304	03/28/19	04/04/19	0.7	0.2	29.5	1.2
	04/04/19	04/11/19	0.7	0.2	15.5	0.9
	04/11/19	04/18/19	0.4	0.2	14.1	0.9
	04/18/19	04/25/19	1.2	0.3	22.6	1.1
	04/25/19	05/02/19	1.7	0.3	31.6	1.2
	05/02/19	05/09/19	2.6	0.5	49.7	2.0
	05/09/19	05/16/19	1.3	0.3	35.4	1.3
	05/16/19	05/23/19	0.5	0.2	13.1	0.9
	05/23/19	05/30/19	0.7	0.2	19.2	1.0
	05/30/19	06/06/19	1.2	0.3	39.6	1.4
	06/06/19	06/13/19	0.8	0.2	20.7	1.0
	06/13/19	06/20/19	1.0	0.3	36.8	1.3
	06/20/19	06/27/19	0.9	0.3	24.3	1.2

[1] Operated by Shoshone Bannock-Tribes.

Appendix B

Table B-1. Results for all electret ionization chamber (EIC) locations, second quarter, 2019.

Sample Location	Net Corrected Exposure Rate (µR/hr)[1]	± 2 SD (µR/hr)
Arco	11.9, 11.4	-
Craters of the Moon	10.3	1.4
Rest Area	11.1	3.4
Van Buren Avenue	12.5	0.9
Experimental Field Station	16.3, 14.7	-
Main Gate	13.5	3.9
Atomic City	11.3	3.2
Taber	12.1	0.3
Blackfoot	10.1, 8.7	-
Ft. Hall	13.2, 14.3	-
Idaho Falls	9.7	1.2
Mud Lake/ Terreton	11.5	2.3
Monteview	9.5	1.8
Sand Dunes	11.7	2.3
Howe Met. Tower	10.7	3.4
MP282 -20	11.4	2.9
MP280 -20	10.2, 10.8	-
MP278 -20	14.7, 15.6	-
MP276 -20	11.0	2.3
MP274 -20	11.0, 11.8	-
MP272 -20	11.0	2.5
MP270 -20	11.4	3.2
MP268 -20	9.9, 14.3	-
MP266 -20	12.7	3.4
MP264 -20	10.2	1.6
MP270 -20/26	12.9	3.5
MP268 -20/26	13.4	2.0
MP266 -20/26	14.9	1.9
MP263 -20/26	10.3	1.9
MP261 -20/26	11.3	2.8
MP259 -20/26	11.0	2.6
MP256 -20/26	10.5	0.7
MFC (EBR II)	14.8, 15.0	-
EBR I	11.5	1.7
RWMC	11.6, 13.4	-
CFA	13.1	1.8
CITRC (PBF)	12.2	1.1
INTEC	18.8	1.4
ATR (TRA)	13.5	1.4
NRF	13.7, 14.7	-
TAN/SMC	12.2, 13.4	-
Mud Lake Bank of Commerce	12.0	2.0
MP43-33	12.5	2.3
MP41-33	15.0, 16.0	-
MP39-33	12.2	1.2
MP37-33	11.3	0.6
MP35-33	10.3	1.0
MP33-33	13.2	1.9
MP31-33	10.2	1.4
MP29-33	12.4	1.7
MP27-33	14.9	2.8

Table B-1. continued. Results for all electret ionization chamber (EIC) locations, second quarter, 2019.

Sample Location	Net Corrected Exposure Rate (µR/hr)[1]	± 2 SD (µR/hr)
MP25-33	11.9	3.0
MP23-33	9.5, 9.6	-
MP21-33	11.1	3.3
MP19-33	10.5	1.5
MP14-33	9.4	3.4
MP11-33	12.4	3.6
MP06-33	11.5	0.7
MP03-33	13.2	3.7
Base of Howe	9.4	0.7
Rover	12.7, 15.7	-
Hamer	14.3	3.3
Sugar City	13.4	1.7
Roberts	15.5	2.4
Big Southern Butte	6.6	3.4
T4 North	13.8	1.8
T4 South	10.6, 11.7	-

[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 Ethyl Ketone (MEK)	10
Methyl Tert Butyl Ether (MTBE)	0.5
Naphthalene	0.5
n-Propylbenzene	0.5
1,1,1,2-Tetrachloroethane	0.5
1,1,2,2-Tetrachloroethane	0.5
1,2,3-Trichlorobenzene	0.5
Trichlorofluoromethane	0.5
1,2,3-Trichloropropane	0.5
1,2,4-Trimethylbenzene	1.0
1,3,5-Trimethylbenzene	0.5