Department of Environmental Quality
INL Oversight Program

ENVIRONMENTAL SURVEILLANCE PROGRAM QUARTERLY DATA REPORT

July – September, 2015

Boise Office
1410 N. Hilton
Boise, Idaho 83706
208-373-0428

Idaho Falls Office
900 N. Skyline, Suite B
Idaho Falls, Idaho 83402
208-528-2600

Table of Contents

List of Tables

List of Figures

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
CWI	-	CH2M-WG Idaho, LLC
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
ftbls	-	feet below land surface
GSS	-	Gonzales-Stoller Surveillance, LLC
HPIC	-	high-pressure ion chamber
LLD	-	lower limit of detection
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
LSC	-	liquid scintillation counting
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
MCL	-	maximum contaminant level
MDA	-	minimum detectable activity
MDC	-	minimum detectable concentration
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
RWMC	-	Radioactive Waste Management Complex
RTC	-	Reactor Technology Complex
SD	-	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 to those who wish to "see the numbers." It is organized according to the media sampled and also provides a quality assurance assessment.

Air and Precipitation Monitoring Results

The ESP operated eight air monitoring stations on and near the INL as well as two monitoring stations distant from the INL during the third quarter, 2015 (**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. Starting in the third quarter of 2013 a new sampler (HVP 4304) is operating side by side at Idaho Falls air station with the current sampler (HVP 3804). The new sampler (HVP 4304) is being operated to test dependability and durability under field conditions. 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). With the exception of experimental field station (EFS), the only reported gamma-emitting radionuclide was beryllium-7, a naturally occurring, cosmogenic radionuclide. Cesium-137 minimally exceeded MDC at EFS: 0.06 x 10^{-3} pCi/m^3 (MDC 0.05 x 10^{-3} pCi/m^3). Two recounts of this composite both produced results less than the MDC, indicating that the original result was probably a false positive. All results are well below the DEQ-INL OP action level for cesium-137 in air of 19 x 10^{-3} pCi/m^3 (40 CFR 61). Gamma spectroscopy results are presented in **Table 3**.

Radioactive iodine samples are collected weekly. Samples are collected by drawing air through a canister filled with activated charcoal using a low-volume air pump. The activated charcoal contained in the canister traps the radioiodine by adsorption onto its porous surface. Each week, canisters are collected from all eleven air monitoring stations and analyzed together as a composite. If Iodine-131 is detected in this grouping, the canisters are individually analyzed. No radioactive isotopes of iodine, specifically Iodine-131, were detected on the weekly charcoal cartridges used to collect this nuclide during the third quarter.

Atmospheric moisture was collected by drawing air through hygroscopic media at each of the 11 monitoring stations. This moisture was stripped from the hygroscopic media and analyzed to calculate the atmospheric tritium concentration. Reported values are the result of either a single sample or a weighted mean based upon the volume of air sampled when more than one atmospheric moisture sample was collected during the calendar quarter. There is one individual sample within the weighted mean that exceeded MDC located at the Experimental Field Station sampling site: 0.67 pCi/m^3 (MDC 0.62 pCi/m^3). Results are well below the DEQ-INL OP action level for atmospheric tritium of 150 pCi/m^3 (40 CFR 61). Average atmospheric tritium concentrations are presented in **Table 4**.

Precipitation samples were collected at six monitoring locations during the third quarter of 2015. Precipitation samples were analyzed for tritium and gamma-emitting radionuclides. Reported values were either the result of a single sample or a weighted mean when more than one precipitation sample was collected during the calendar quarter. Tritium and gamma-emitting radionuclides were below minimum detectable concentration in precipitation collected during the third quarter of 2015. Tritium and Cesium-137 analysis results are presented in **Table 5**.

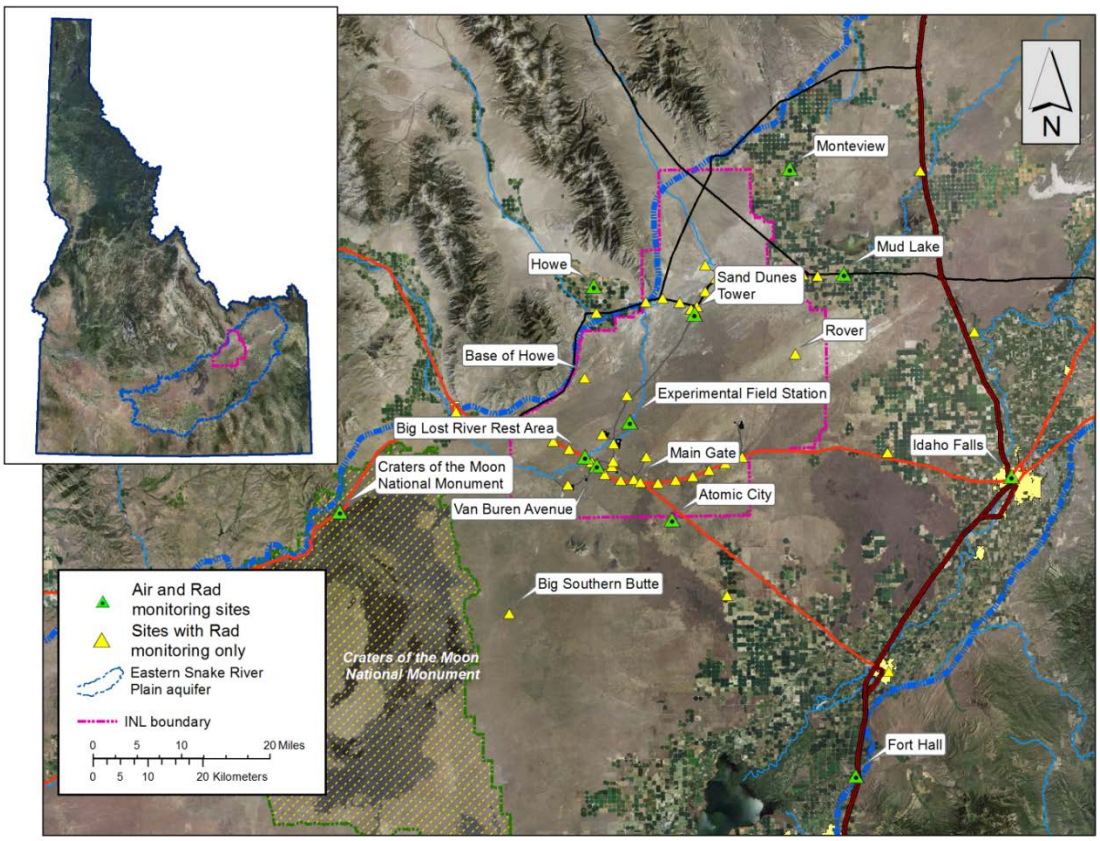

Figure 1. Air and radiation monitoring sites.

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, third quarter, 2015.

Station Location	Concentration					
	Gross Alpha			Gross Beta		
On-Site Locations						
Big Lost River Rest Area	1.1	-	3.2	28.4	-	51.5
Experimental Field Station	0.6	-	3.0	20.1	-	38.0
Sand Dunes Tower	0.6	-	2.7	16.4	-	29.0
Van Buren Avenue	0.5	-	3.0	18.7	-	35.4
Boundary Locations						
Atomic City	0.6	-	3.3	20.6	-	40.7
Howe	0.6	-	4.1	19.2	-	34.0
Monteview	0.8	-	5.8	19.9	-	41.3
Mud Lake	1.2	-	5.7	29.6	-	53.5
Distant Locations						
Craters of the Moon	0.4	-	2.6	17.3	-	29.5
Fort Hall[1]	0.6	-	2.8	16.3	-	31.1
Idaho Falls – HVP 3804	1.0	-	5.5	27.4	-	48.8
Idaho Falls – HVP 4304	0.8	-	5.0	21.3	-	46.8

[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, third quarter, 2015.

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	106.7	5.4	<MDC[2]	
Experimental Field Station	73.1	3.9	^{137}Cs 0.06	0.05
Experimental Field Station recount	74.9	4.1	^{137}Cs 0.03	0.07
Experimental Field Station recount	71.2	3.9	^{137}Cs 0.03	0.05
Sand Dunes Tower	56.2	3.1	<MDC	
Van Buren Avenue	76.8	4.0	<MDC	
Boundary Locations				
Atomic City	72.7	3.8	<MDC	
Howe	66.3	3.7	<MDC	
Monteview	79.8	4.2	<MDC	
Mud Lake	100.5	5.4	<MDC	
Distant Locations				
Craters of the Moon	63.9	3.6	<MDC	
Fort Hall[1]	65.2	3.5	<MDC	
Idaho Falls – HVP 3804	94.4	4.9	<MDC	
Idaho Falls – HVP 4304	95.5	4.9	<MDC	

[1]Operated by Shoshone-Bannock Tribes.
[2]MDC for Cs-137 typically (0.05 – 0.1) 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, third quarter, 2015

Station Location	Tritium		
	Concentration	± 2 SD	MDC
On-site Locations			
Big Lost River Rest Area	0.06	0.49	0.82
Experimental Field Station	0.74	0.65	1.07
Sand Dunes Tower	0.20	0.53	0.90
Van Buren Avenue	0.48	0.55	0.92
Boundary Locations			
Atomic City	-0.18	0.56	0.94
Howe	-0.09	0.75	1.26
Mud Lake	0.25	0.62	1.05
Monteview	-0.18	0.69	1.17
Distant Locations			
Craters of the Moon	-0.03	0.50	0.84
Fort Hall[1]	0.05	0.56	0.95
Idaho Falls	0.11	0.57	0.98

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

Table 5. Tritium and Cesium-137 concentrations from precipitation, third quarter, 2015.

Station Location	Tritium			Cesium-137		
	Concentration	± 2 SD	MDC	Concentration	± 2 SD	MDC
On-site Locations						
Big Lost River Rest Area	40	80	140	0.8	1.4	2.3
Boundary Locations						
Atomic City	20	80	140	0.7	1.6	2.8
Howe	-50	80	140	0.3	1.7	2.7
Monteview	10	80	140	0.2	1.7	2.9
Mud Lake	-80	80	140	0.0	1.4	2.4
Distant Locations						
Idaho Falls	-10	80	140	1.0	1.5	2.5

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

Environmental Radiation Monitoring Results

The ESP operated 14 environmental radiation stations during the third quarter of 2015 (**Figure 1**). To detect gamma radiation, each station is instrumented with triplicate electret ionization chambers (EIC), and 11 of the stations also are equipped with a high-pressure ion chamber (HPIC) (**Table 6**).

The Shoshone-Bannock Tribes operate an additional environmental radiation monitoring station at Fort Hall equipped with EICs and an HPIC, both of which belong to the DEQ-INL OP. The DEQ-INL OP reports these results.

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 an additional 40 locations by DEQ-INL OP in a widespread network around the INL measuring external radiation. This information is tabulated in **Appendix B.**

These two systems are used by DEQ-INL OP to measure external gamma radiation for various radiological monitoring objectives. **Table 7** lists the average radiation exposure rates measured by the HPICs for third quarter 2015. **Table 8** lists the EIC monitoring results for third quarter 2015. 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		■
Main Gate	■	■
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[1]	■	■
Idaho Falls	■	■

[1]HPIC operated by Shoshone-Bannock Tribes with the EICs maintained by DEQ-INL OP.

Table 7. Average gamma exposure rates, third quarter 2015, from HPIC network.

Station Location	Exposure Rate (µR/hr)	
	Quarterly Average	± 2 SD
On-site Locations		
Base of Howe	15.7	1.1
Big Lost River Rest Area	15.3	0.7
Main Gate	14.8	0.7
Rover	16.1	1.4
Sand Dunes Tower	13.5	1.8
Boundary Locations		
Atomic City	13.2	0.7
Big Southern Butte	15.4	1.1
Howe Met Tower	12.9	1.0
Monteview	13.3	0.8
Mud Lake / Terreton	14.0	0.8
Distant Locations		
Fort Hall[1]	12.0	1.0
Idaho Falls	12.2	2.0

[1]Operated by Shoshone-Bannock Tribes.

Table 8. Electret ionization chamber (EIC) cumulative average exposure rates, third quarter, 2015.

Station Location	Exposure Rate (µR/hr)	
	Quarterly Average[1]	± 2 SD
On-site Locations		
Base of Howe	13.1	3.4
Big Lost River Rest Area	16.0	2.8
Experimental Field Station	16.4	2.5
Main Gate	17.2	1.9
Rover	14.2, 18.3	
Sand Dunes Tower	13.7	1.3
Van Buren Avenue	13.6, 16.0	
Boundary Locations		
Atomic City	12.8, 14.2	
Big Southern Butte	16.1	2.3
Howe Met Tower	14.4	1.1
Monteview	11.3, 12.3	
Mud Lake / Terreton	11.8	2.0
Distant Locations		
Craters of the Moon	14.1, 14.5	
Fort Hall[2]	10.0	1.3
Idaho Falls	7.5, 7.8	

[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.
[2]Station operated by Shoshone-Bannock Tribes.

Water Monitoring Results

Water monitoring sites are sampled for the purposes of examining trends of INL contaminants and other general ground water quality indicators and for verifying DOE monitoring results. Sites sampled include ground water locations (wells and springs), surface water locations (streams), and selected wastewater sites. Sample sites have been selected to aid in identifying INL impacts on the Eastern Snake River Plain Aquifer (ESRPA), and are categorized as up-gradient, facility, boundary, distant, surface water, and waste water, (**Figure 2 and Figure 3**). Up-gradient locations are not impacted by INL operations and are considered representative of background ground water quality conditions. Facility sites are sample locations on the INL near facilities, in areas of known contamination, or wells selected to illustrate trends for specific INL contaminants or indicators of ground water quality. Boundary locations are on or near the perimeter of the INL and are down-gradient of potential sources of INL contamination. Distant locations are monitored to provide trends in water quality down-gradient of the INL and include wells and springs used for irrigation, public water supply, livestock, domestic, and industrial purposes. During the third quarter of 2015, 1 up-gradient, 2 facility, and 8 distant locations were sampled. The two facility wells include TAN-2271 and TAN-2272 which were recently drilled near the TAN facility to evaluate and potentially treat existing contamination. Results of the ongoing in-situ bioremediation (ISB) rebound test at TAN indicate that elevated trichloroethene (TCE, trichloroethylene) concentrations found in and around monitoring well TAN-28 are coming from a residual untreated source in the aquifer. The purpose of the new wells is to locate the untreated source of

TCE and determine an ISB injection strategy to one or both wells and evaluate its impact on TCE concentrations at TAN-28 (DOE/ID-11444).

Most sites sampled by DEQ-INL OP are sampled with another agency or organization. Samples are collected at about the same time using the same collection equipment as the other agency or organization (co-sampled). DEQ-INL OP verifies work by these agencies monitoring on behalf of DOE by comparing results from co-sampled sites.

Gross alpha and gross beta analyses are conducted as a screening tool for alpha and beta emitting radionuclides potentially released from INL operations. Quantitative gamma analyses are conducted to identify and determine concentrations of gamma emitting radionuclides. Selected sites are sampled for the man-made, alpha emitting isotopes of plutonium, uranium, and americium; and beta emitting radionuclides technetium-99 and strontium-90, based on historic INL contamination. In the event of suspect or unexpected levels of gross radioactivity, additional samples may also be analyzed for other specific radionuclides.

Gross alpha radioactivity was detected at 1 facility and 2 distant locations. The facility location includes TAN-2272, a new well. The gross alpha concentration reported at TAN-2272 is consistent with historical trends associated with other wells at the TAN facility. All other locations with detectable results were within the range of concentrations observed for naturally-occurring radioactivity. The EPA maximum contaminant level (MCL) for alpha particles is 15 pCi/L.

Gross beta radioactivity was detected at all of the locations sampled during this quarter. Concentrations observed for all up-gradient, facility, and distant locations were consistent with the expected values at each monitoring site. The MCL for beta and gamma radioactivity is 4 mrem/year, equivalent to 8 pCi/L if the source is ^{90}Sr; 900 pCi/L if ^{99}Tc; 20,000 pCi/L if ^{3}H; or 200 pCi/L if ^{137}Cs. Man-made, gamma emitting ^{137}Cs was detected at one facility location, TAN-2272. A recount was conducted by the lab which agreed with the original result at 6.7 ± 2.0 pCi/L. TAN-2272 is a new well located in an area affected by historic INL waste disposal practices. Monitoring well TAN-37A (TAN-37 can be sampled from three different depths, denoted as level ‘A’ @ 240 feet below land surface [ftbls], level B @ 275 ftbls, and level C @ 375 ftbls), also sampled by DEQ-INL OP, is located near TAN-2272 and has shown detectable concentrations of ^{137}Cs in the past, most recently in April 2015. According to TAN-2272 well specifications, the primary groundwater sample pump intake depth is approximately 245 ftbls or similar to the sample depth at TAN-37A (DOE/ID-11444). Results for gross alpha, gross beta, and man-made, gamma emitting ^{137}Cs are shown in **Table 9**.

Both TAN facility locations were analyzed for ^{90}Sr and had results above the drinking water MCL of 8 pCi/L (**Table 10**). These samples were collected in areas of known contamination at or near the TAN facility.

Using the standard analytical method, ^{3}H was detected at both new TAN facility wells (**Table 11**). The ^{3}H concentrations reported are consistent with historic INL waste disposal influences. Selected water samples with tritium concentrations not measurable using the standard method (typically a MDC of 130 pCi/L) are analyzed using an electrolytic enrichment method with a much lower MDC of 10 to 14 pCi/L. All seven sites that were analyzed using the enrichment method were collected during the previous quarter (Second Quarter, 2015) and are presented in **Table 12**. A backlog of 46 samples remains.

Samples were also analyzed for metals, common ions, and nutrients with results shown in **Tables 13, 14** and **15**. All results were within expected ranges at each location. Both TAN facility wells (TAN-2271, and TAN-2272) have elevated concentrations for certain analytes that are consistent with conditions

created from in-situ bioremediation (ISB) efforts as part of the clean-up actions for VOCs in ground water.

Volatile Organic Compounds (VOCs) were sampled at two locations at or near the TAN facility, with each location reporting detectable concentrations for multiple analytes. Results are shown in **Table 16.** The background concentrations for these VOCs should be non-detectable. The results discussed in this section only refer to detectable VOC concentrations; a complete list of analytes is shown in **Appendix C**.

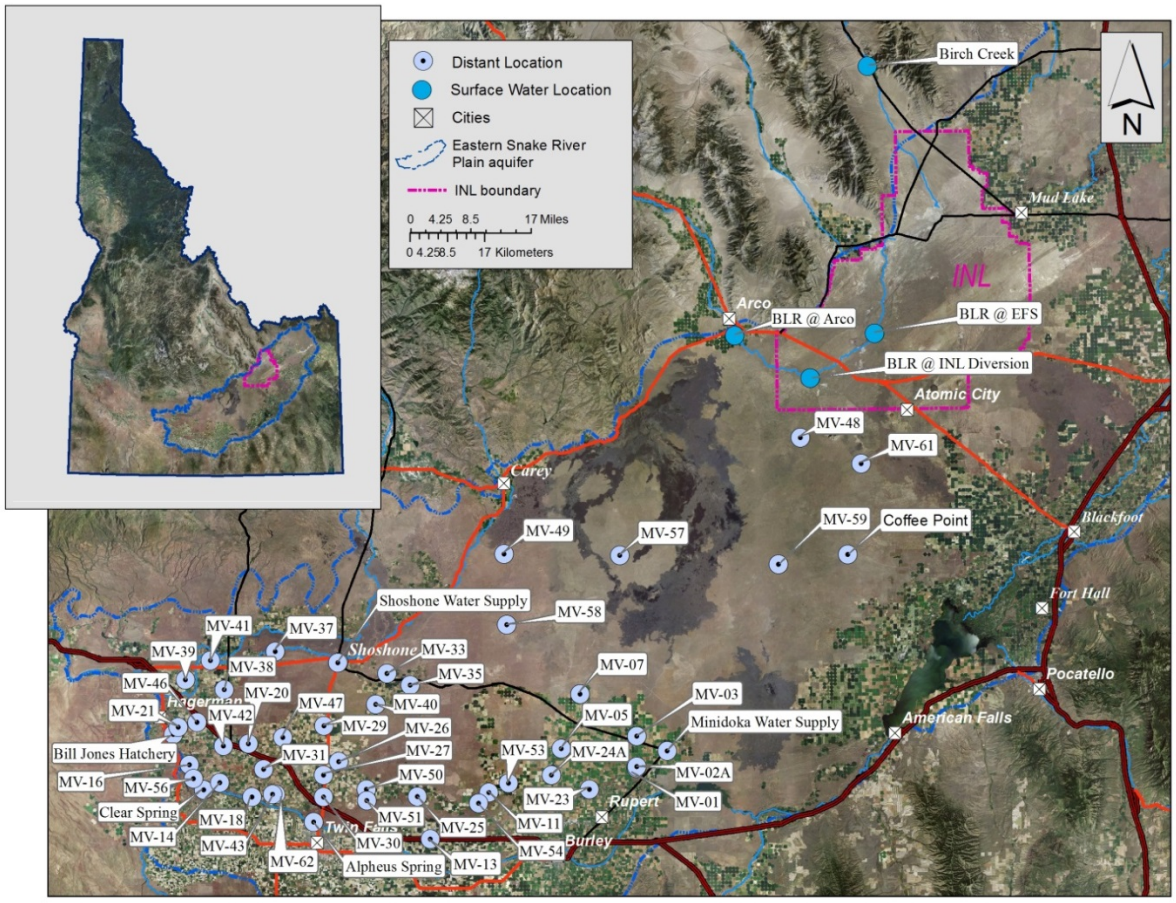

Figure 2. Distant and Surface Water monitoring locations.

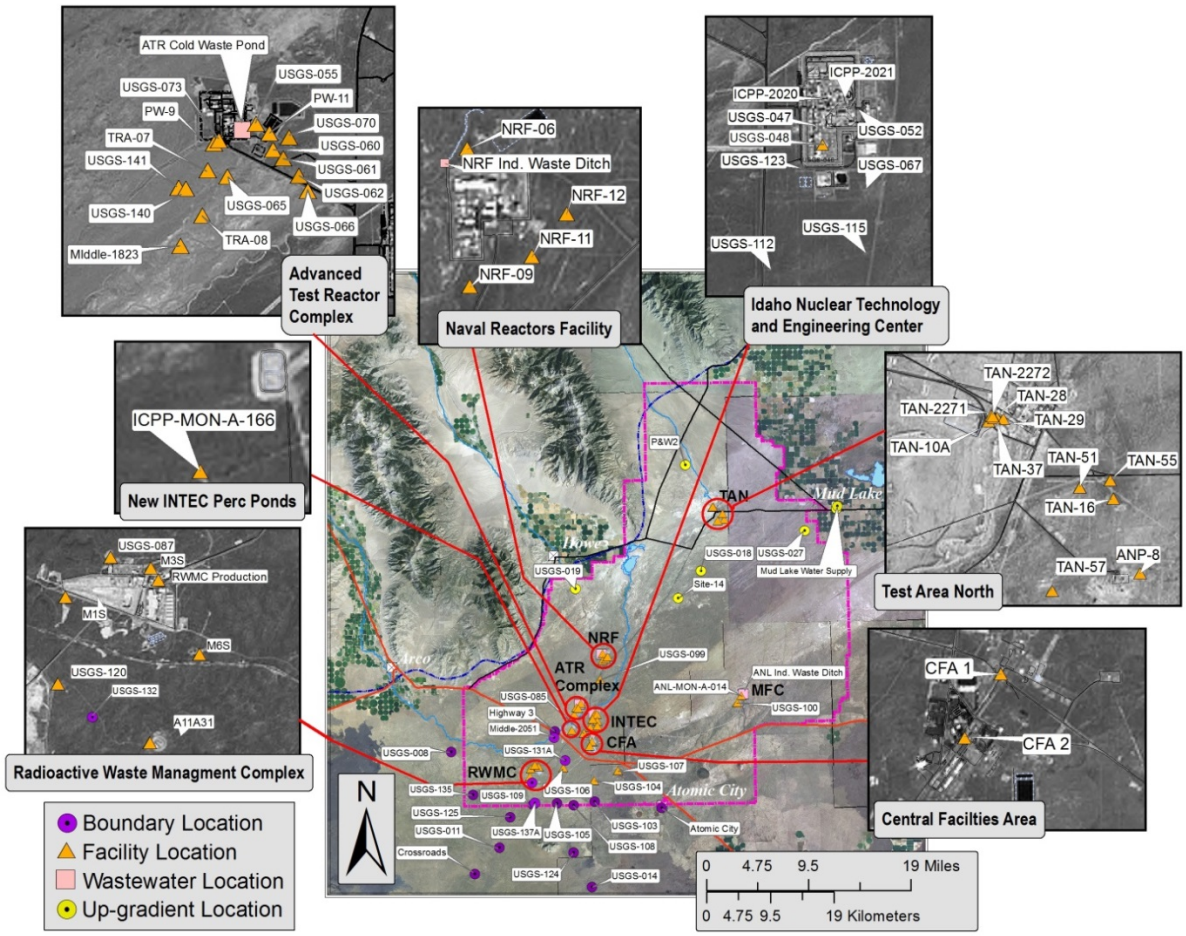

Figure 3. Upgradient, facility, boundary, and wastewater monitoring locations.

Table 9. Gross alpha, gross beta, and gamma-emitting radionuclide concentrations for water samples, third quarter, 2015.

Sample Location	Sample Date	Gross Alpha			Gross Beta			Man-made gamma-emitting radionuclide Cesium-137		
		Concentration[1,2]		±2 SD	Concentration[1,2]		±2 SD	Concentration[1,2]		±2 SD
Up-gradient										
Mud Lake Water Supply	7/16/2015	-0.1	U	0.6	2.4		0.7	0.7	U	1.2
Facility										
TAN 2271	8/25/2015	5.4	U	3.8	1292.6		14.5	1.5	U	2.1
TAN 2272	8/27/2015	8.2		4.4	1105.1		14.7	5.5		2.1
Distant										
Alpheus Spring	7/13/2015	2.6		1.6	8.1		1.2	0.1	U	1.5
Bill Jones Hatchery	7/13/2015	1.0	U	0.8	2.6		0.9	0.8	U	1.4
Clear Spring	7/13/2015	1.3	U	1.2	4.9		1.0	0.7	U	1.4
Minidoka Water Supply	7/13/2015	0.7	U	1.1	3.9		0.9	1.0	U	1.6
MV-31	7/13/2015	0.8	U	0.9	4.4		1.0	0.2	U	1.8
MV-43	7/13/2015	5.3		2.7	5.7		2.4	-0.3	U	1.3
MV-62	7/13/2015	-0.6	U	1.7	6.6		2.0	0.3	U	1.2
Shoshone Water Supply	7/13/2015	1.7	U	1.1	2.6		0.9	-0.1	U	0.8

[1]Data qualifiers: U = non-detection, J = estimate, R = rejected.
[2]Concentrations with associated uncertainties (±2 SD) expressed in pCi/L.

Table 10. Reported concentrations of strontium-90 in water samples, third quarter, 2015.

Sample Location	Sample Date	Strontium-90		
		Concentration[1,2]		±2 SD
Facility				
TAN 2271	8/25/2015	490		110
TAN 2272	8/27/2015	411		97

[1]Data qualifiers: U = non-detection, J = estimate, R = rejected.
[2]Concentrations expressed in pCi/L.

Table 11. Tritium concentrations for water samples, third quarter, 2015.

Sample Location	Sample Date	Tritium		
		Concentration[1,2]		±2 SD
Up-gradient				
Mud Lake Water Supply	7/16/2015	-40	U	70
Facility				
TAN 2271	8/25/2015	540		110
TAN 2272	8/27/2015	660		110
Distant				
Alpheus Spring	7/13/2015	0	U	80
Bill Jones Hatchery	7/13/2015	-20	U	80
Clear Spring	7/13/2015	-20	U	80
Minidoka Water Supply	7/13/2015	10	U	90
MV-31	7/13/2015	-30	U	80
MV-43	7/13/2015	-10	U	80
MV-62	7/13/2015	30	U	80
Shoshone Water Supply	7/13/2015	-10	U	80

[1]Data qualifiers: U = non-detection, J = estimate, R = rejected.
[2]Concentrations with associated uncertainties (±2 SD) expressed in pCi/L.

Table 12. Enriched tritium concentrations for water samples from previous sampling quarters.

Sample Location	Sample Date	Enriched Tritium		
		Concentration[1,2]		±2 SD
Facility				
NRF-06	5/12/2015	25		5
USGS-100	4/16/2015	13		5
Boundary				
Middle-2051	6/10/2015	123		7
USGS-137A	6/22/2015	102		7
Distant				
Minidoka Water Supply	5/11/2015	5	U	3
MV-28	6/29/2015	8	U	5
MV-49	6/3/2015	38		6

[1]Data qualifiers: U = non-detection, J = estimate, R = rejected.
[2]Concentrations with associated uncertainties (±2 SD) expressed in pCi/L.

Table 13. Reported metals concentrations in water samples, third quarter, 2015.

Sample Location	Sample Date	Concentration[1,2]															
		Arsenic		Barium		Chromium		Iron		Lead		Manganese		Selenium		Zinc	
Up-gradient																	
Mud Lake Water Supply	7/16/2015	8.8		18		<5.0	U	<10	U	<5.0	U	35		<10	U	<5.0	U
Facility																	
TAN 2271	8/25/2015*	3.0		1000		<1.0	U	1400		<1.0	U	1500		<2.0	U	45	
TAN 2272	8/27/2015*	3.6		920		<1.0	U	800		<1.0	U	830		<2.0	U	28	
Distant																	
Alpheus Spring	7/13/2015	<5.0	U	82		<5.0	U	<10	U	<5.0	U	<2.0	U	<10	U	<5.0	U
Bill Jones Hatchery	7/13/2015	<5.0	U	21		<5.0	U	<10	U	<5.0	U	<2.0	U	<10	U	<5.0	U
Clear Spring	7/13/2015	<5.0	U	35		<5.0	U	<10	U	<5.0	U	<2.0	U	<10	U	<5.0	U
Minidoka Water Supply	7/13/2015	<5.0	U	36		<5.0	U	<10	U	<5.0	U	<2.0	U	<10	U	42	
MV-31	7/13/2015	<5.0	U	56		<5.0	U	<10	U	<5.0	U	<2.0	U	<10	U	<5.0	U
MV-43	7/13/2015	<5.0	U	160		<5.0	U	<10	U	<5.0	U	<2.0	U	<10	U	<5.0	U
MV-62	7/13/2015	<5.0	U	92		<5.0	U	<10	U	<5.0	U	<2.0	U	<10	U	76	U
Shoshone Water Supply	7/13/2015	<5.0	U	40		<5.0	U	<10	U	<5.0	U	<2.0	U	<10	U	11	

[1]Data qualifiers: U = non-detection, J = estimate, R = rejected, "<" = a result below the Minimum Detectable Concentration (MDC), NR = analysis not requested.
[2]Concentrations are expressed in µg/L. Samples are filtered unless otherwise indicated.
*Lower MDC's are a result of new lab equipment.

Table 14. Reported common ion concentrations in water samples, third quarter, 2015.

Sample Location	Sample Date	Concentration[1,2]																	
		Calcium		Magnesium		Sodium		Potassium		Fluoride		Chloride		Sulfate		Alkalinity[3]		Iodide	
Up-gradient																			
Mud Lake Water Supply*	7/16/2015	8.7		2.8		30		4.9		0.606		4.84		7.98		90		<0.05	U
Facility																			
TAN 2271*	8/25/2015	110		69		130		9.5		<0.200	U	128		46.3		651		NR	
TAN 2272*	8/27/2015	96		85		160		7.9		<0.200	U	132		46.4		746		NR	
Distant																			
Alpheus Spring*	7/13/2015	60		21		36		7.0		0.415		42.7		56.1		179		NR	
Bill Jones Hatchery*	7/13/2015	33		17		17		3.8		0.424		11.0		25.1		134		NR	
Clear Spring*	7/13/2015	46		19		26		4.3		0.565		33.4		45.3		145		NR	
Minidoka Water Supply*	7/13/2015	46		16		21		3.5		0.561		32.4		41.9		137		NR	
MV-31*	7/13/2015	49		16		41		5.4		0.646		25.5		53.9		173		NR	
MV-43*	7/13/2015	130		47		50		7.0		0.365		69.9		98.3		291		NR	
MV-62*	7/13/2015	74		30		43		6.8		0.383		56.9		74.4		215		NR	
Shoshone Water Supply*	7/13/2015	41		14		14		3.0		0.285		6.30		17.3		163		NR	

[1]Data qualifiers: U = non-detection, J = estimate, R = rejected. * = samples are filtered for calcium, magnesium, sodium and potassium. "<" = a result below the Minimum Detectable Concentration (MDC). NR = analysis not requested.

[2]Concentrations are expressed in mg/L.

[3]As $CaCO_3$

Table 15. Reported nutrient concentrations in water samples, third quarter, 2015.

Sample Location	Sample Date	Concentration[1,2]			
		Nitrite + Nitrate		Phosphorus	
Up-gradient					
Mud Lake Water Supply	7/16/2015	<0.01	U	0.038	
Facility					
TAN 2271	8/25/2015	0.042		0.220	
TAN 2272	8/27/2015	0.037		0.120	
Distant					
Alpheus Spring	7/13/2015	2.0		0.023	
Bill Jones Hatchery	7/13/2015	1.1		0.021	
Clear Spring	7/13/2015	1.7		0.027	
Minidoka Water Supply	7/13/2015	1.1		0.017	
MV-31	7/13/2015	0.027		0.420	
MV-43	7/13/2015	30		0.028	
MV-62	7/13/2015	7.6		0.025	
Shoshone Water Supply	7/13/2015	1.2		0.031	

[1]Data qualifiers: U = non-detection, J = estimate, R = rejected, NR = analysis not requested.

[2]Concentrations expressed in mg/L. Samples are filtered unless otherwise noted.

Table 16. Reported VOC concentrations in water samples, third quarter, 2015.

Sample Location	Sample Date	Concentrations[1,2]						
		1,1-Dicholoroethene	Carbon tetrachloride	Cis-1,2-Dichloroethene	Trans-1,2-Dichlorethene	Tetrachloroethylene (PERC)	Trichloroethylene (TCE)	Vinyl Chloride
TAN-2271	6/2/2015	<0.5	<0.5	2.4	25	<0.5	14.0	<0.5
TAN-2272	6/2/2015	<0.5	<0.5	13.8	44	<0.5	40.8	2.8

[1]Data qualifiers: J = estimate, R = rejected, "<" = less than detection limit.

[2]Concentrations expressed in µg/L.

Terrestrial Monitoring Results

The DEQ-INL OP conducts terrestrial (soil and milk) monitoring to characterize deposition and migration of contaminants, and provide independent verification of DOE's terrestrial monitoring programs. Physical soil sampling and *in-situ* gamma spectrometry are used to characterize actual deposition and accumulation of radioactive contaminants in soils. Milk samples are collected to evaluate the potential for ingestion of radioactivity by the population around the INL. No *in-situ* gamma spectroscopic measurements were performed, nor were any soil samples physically collected during the third calendar quarter of 2015.

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 17**. ^{40}K was detected in all samples within the expected range of concentrations. ^{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 17. Gamma spectroscopy analysis data for milk samples, third quarter, 2015.

Sample Location/Dairy	Sample Date	Naturally occurring Potassium-40		Man-made Iodine-131[1]
		Concentration[3]	± 2 SD	
Monitoring Samples				
Ft. Hall	7/06/2015	1458	117	<MDC
	8/02/2015	1209	94	<MDC
Gooding/Glanbia	8/06/2015	1496	107	<MDC
	9/24/2015	1450	73	<MDC
Riverside	7/05/2015	1664	122	<MDC
	8/02/2015	2162	141	<MDC
	9/21/2015	2034	139	<MDC
Verification Samples[2]				
Howe	7/07/2015	1393	115	<MDC
Dietrich	7/07/2015	1509	104	<MDC
Rupert	8/04/2015	1738	121	<MDC
Terreton	8/04/2015	1756	107	<MDC
Dietrich	9/01/2015	1656	102	<MDC
Idaho Falls	9/01/2015	1543	116	<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 are expressed in pCi/L.

Quality Assurance

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

This section summarizes the results of the quality assurance (QA) assessment of the data collected for the third quarter of 2015 for the DEQ-INL OP's ESP. It also summarizes the quality control (QC) samples (spikes, blanks, and duplicates) submitted to the Idaho Bureau of Laboratories-Boise (IBL) for non-radiological analyses and to Idaho State University's Environmental Monitoring Laboratory (ISU-EML) for radiological analyses during the quarter. All analyses and QC measures at the analytical laboratories used by the ESP are performed in accordance with approved written procedures maintained by each respective analytical laboratory. Sample collection is performed in accordance with written procedures maintained by the DEQ-INL OP.

Analytical results for blanks, duplicates, and spikes are used to assess the precision, accuracy, and representativeness of results from analyzing laboratories. During the third quarter of 2015, the DEQ-INL OP submitted 53 QC samples for various radiological and non-radiological analyses (**Table 18**).

Blank Samples

Blank samples consist of matrices that have negligible, acceptably low, or immeasurable amounts of the analyte(s) of interest in them. They are designed to determine if an analysis will yield a "zero" result when no contaminant is present, or a sufficiently low result to serve as an acceptable measure of "background." Blank samples are used to monitor for bias introduced during sample collection, storage, shipment, and analysis. Blank sample results submitted for gross alpha and gross beta screening in air for the third quarter of 2015 are presented in **Table 19**.

Blank sample results for select gamma emitters in air from composited air filters are presented in **Table 20**. Data for blank analyses used to assess data quality for tritium in water vapor in air are presented in **Table 21**. Blank analyses results for radiological and non-radiological analytes in ground and surface water are presented in **Table 22**, **Table 23**, **Table 24**, and **Table 25**.

No anomalies were observed from the assessment of field blank samples as measured by the analytical laboratories used by DEQ-INL OP for the third quarter of 2015.

Duplicate Samples

A laboratory's analytical precision capability, i.e., its ability to reproduce results, is assessed by comparing duplicate sample results. Duplicate samples are samples collected from the same location at approximately the same time and are considered to be essentially identical in composition. The difference between duplicate sample results is expressed as the relative percent difference (RPD), calculated from the following equation:

$RPD = (R_1 - R_2)/((R_1 + R_2)/2)*100$

Where:

R_1 = First sample result.

R_2 = Second sample result.

A relative percent difference of up to ± 20 percent is acceptable. For non-radiological analysis, the RPD is used to compare each set of duplicate samples in which both of the results exceed five times the detection level. If one or both of the duplicate sample results are less than five times the detection level, the absolute difference between the two results is acceptable if it is less than or equal to the method detection limit.

For radiological analysis, the RPD is calculated (using the above equation) to compare duplicate samples if both duplicate results are greater than the sample-specific minimum detectable concentration (MDC). DEQ-INL OP also considers duplicate sample results with an absolute difference of no more than three times the pooled error (or "3 sigma") to be in acceptable agreement. This is accomplished using the following equation:

$$|R_1 - R_2| \leq 3(S_1^2 + S_2^2)^{1/2}$$

Where:

R_1 = First sample result.

R_2 = Second sample result.

S_1 = Uncertainty (one standard deviation) associated with the laboratory measurement of the first sample.

S_2 = Uncertainty (one standard deviation) associated with the laboratory measurement of the second sample.

No field duplicate samples were collected during the third quarter of 2015.

Spiked Samples

Spiked samples are samples to which known concentrations of specific analytes have been added in order to assess the bias a laboratory may have in accurately measuring these analytes. To determine agreement after laboratory analysis, DEQ-INL OP calculates the ratio of the spike concentration determined from the laboratory measurement to the known spike concentration in the sample. This result is known as percent recovery (%R) and the acceptable range used by DEQ-INL OP is 100 ± 25 percent. Additionally, all results were qualified as "estimates (J)" if the associated quality control spike sample had a recovery of 50 – 74% or 126 – 150%, provided that each result was greater than the instrument detection limit (IDL). All results were qualified as "rejected (R)" if the associated quality control spike sample had a recovery of < 50% or > 150%, provided each result was also greater than the IDL.

During third quarter 2015, no field matrices were spiked to assess the influence of the sample media on laboratory performance, and there were no spiked de-ionized water samples submitted to laboratories to assess ground water analyte recovery rates.

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 the average triplicate measurement has a percent recovery of 100±25% when compared to the known irradiated quantity. The irradiation results for third quarter 2015 are presented in **Table 26**. 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.

Analytical QA/QC Assessment

No issues involving sample chain of custody, sample holding times, and the analysis of blank, duplicate, and spiked samples were observed during the third quarter of 2015, which significantly affected data quality. Methodologies and data reports issued by the contracting laboratories generally conformed to the requirements of DEQ-INL OP during the third quarter of 2015.

Data usability is the measure of data that is not rejected compared to the amount that was expected to be obtained. The overall data usability rate for the third quarter of 2015 met the minimum criteria of the DEQ-INL OP ESP and is summarized in **Table 18**.

Preventative Maintenance and Equipment Reliability

All equipment was calibrated and checked according to prescribed periodicity. During the third quarter of 2015 the radioiodine pump was replaced at the Rest Area and Craters of the Moon sampling stations. The TSP blower was replaced at Experimental Field Station, Atomic City, and Idaho Falls sampling stations. Service reliability for air sampling equipment for the third quarter of 2015 is summarized in **Table 27**.

Conclusion

All data collected for the third quarter of 2015 have been assigned the applicable qualifiers to designate the appropriate use of the data. In addition, all data has been verified and deemed complete meeting the requirements and data quality objectives established by DEQ-INL OP.

Table 18. Summary of the analytical performance and usability of the analyses performed for the DEQ-INL OP ESP, third quarter, 2015.

Media Sampled	Collection Device	Analyte	Test Analyses	Blank Analyses	Duplicate Analyses	Spike Analyses	Data Rejected[1]	Analyzing Lab[2]
Air								
Particulate	4-inch filter	Gross alpha	156	13	0	0	2	ISU-EML
		Gross beta	156	13	0	0	2	ISU-EML
		Gamma emitters	12	1	0	0	0	ISU-EML
		Radiochemical	0	0	0	0	0	ISU Sub
Water Vapor	Desiccant column	Tritium	50	2	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	11	2	0	0	0	ISU-EML
		Gross beta	11	2	0	0	0	ISU-EML
		Gamma emitters	11	2	0	0	0	ISU-EML
		Tritium	11	2	0	0	0	ISU-EML
		Enriched tritium	7	0	0	0	0	ISU-EML
		Technetium-99	0	0	0	0	0	ISU-EML
		Radiochemical	2	0	0	0	0	ISU Sub
		Metals	11	2	0	0	0	IBL
		Common Ions	11	2	0	0	0	IBL
		Nutrients	11	2	0	0	0	IBL
		Volatile Organics	2	1	0	0	0	IBL
Terrestrial								
Milk	Grab or composite	Gamma emitters	13	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	55	0	0	9	0	DEQ-INL OP
	HPICs	Gamma Radiation	12	NA	NA	NA	0	DEQ-INL OP
Total Analyses			**560**	**44**	**0**	**9**	**4**	
Total of QC Analyses (blanks, duplicates, and spikes)			**53**					
Percentage of QC analyses of total Test analyses[3]			**9.5%**					
Percentage of usable data[4]			**99.3%**					

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

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

[3] Analyzing quality control samples at a rate of approximately 5 to 10 percent of the total number of test analyses performed for the year is deemed appropriate for the DEQ-INL OP ESP.

[4] Data usability rate [total analyses – rejected data]/[total analyses] of 90 percent or higher is acceptable for the DEQ-INL OP ESP.

Table 19. Blank analysis results for gross alpha and beta in total suspended particulate (TSP) air filters, third quarter, 2015.

Collection Period		Corrected volume (m^3)[1]	Gross alpha		Gross beta	
Start	Stop		Value	Uncertainty (± 2 SD)	Value	Uncertainty (± 2 SD)
07/02/15	07/09/15	2011	0.0	0.1	0.2	0.4
07/09/15	07/16/15	2011	0.0	0.1	-0.3	0.5
07/16/15	07/23/15	2011	0.0	0.1	0.1	0.4
07/23/15	07/30/15	2011	0.1	0.1	-0.2	0.5
07/30/15	08/06/15	2011	0.0	0.1	-0.5	0.4
08/06/15	08/13/15	2011	0.0	0.1	0.3	0.5
08/13/15	08/20/15	2011	0.0	0.1	-0.1	0.5
08/20/15	08/27/15	2011	0.0	0.1	-0.1	0.5
08/27/15	09/03/15	2011	0.0	0.1	0.1	0.4
09/03/15	09/10/15	2011	0.0	0.1	0.1	0.5
09/10/15	09/16/15	2011	0.0	0.1	0.5	0.5
09/16/15	09/24/15	2011	0.1	0.1	-0.1	0.5
09/24/15	10/01/15	2011	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 20. Blank analysis results for gamma spectroscopy for TSP air filters, composite samples, third quarter, 2015.

Analysis Date	Beryllium-7			Ruthenium-106/Rhodium-106			Antimony-125		
	Concentration[1]	± 2 SD	MDC	Concentration	± 2 SD	MDC	Concentration	± 2 SD	MDC
10/28/15	-20	30	52	2	62	106	0	9	15

Analysis Date	Cesium-134			Cesium-137		
	Concentration[1]	± 2 SD	MDC	Concentration	± 2 SD	MDC
10/28/15	2	2	7	0	3	5

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 21. Blank analysis results for tritium in water vapor from air samples, third quarter, 2015.

Sample Number	Start Date	Collection Date	Analysis Date	Tritium		
				Concentration	± 2 SD	MDC
OP153ZTR01	10/20/15	10/21/15	10/28/15	-0.01	0.08	0.13
OP153ZTR02	10/20/15	10/21/15	10/28/15	-0.03	0.08	0.13

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

Table 22. Radiological blank analysis results in groundwater and/or surface water, third quarter, 2015.

Sample Number	Sample Date	Concentration[1]	± 2 SD	MDC	Within Blank Criteria?
Gross Alpha					
151W001	8/27/2015	-0.1	0.2	0.4	Yes
151W542	7/13/2015	0	0.2	0.4	Yes
Gross Beta					
151W001	8/27/2015	0	0.6	1.0	Yes
151W542	7/13/2015	-0.5	0.6	1.0	Yes
Cesium-137					
151W001	8/27/2015	0.8	1.4	2.3	Yes
151W542	7/13/2015	0.2	1.3	2.3	Yes
Tritium					
151W002	8/27/2015	-70	80	150	Yes
151W544	7/13/2015	20	90	150	Yes

[1] Concentrations are expressed in pCi/L with associated uncertainty (± 2 SD) and minimum detectable concentration (MDC).

Table 23. Blank analysis results (µg/L) for metals in groundwater and/or surface water, third quarter, 2015.

Sample Number	Sample Date	Arsenic	Barium	Chromium	Iron	Lead	Manganese	Selenium	Zinc
151W004*	8/27/2015	<2.0	<1.0	<1.0	<10	<1.0	<1.0	<2.0	<10
151W546	7/13/2015	<5.0	<2.0	<5.0	<10	<5.0	<2.0	<10	<5.0

*The differences in MDC's are a result of new lab equipment.

Table 24. Blank analysis results (mg/L) for common ions and nutrients in groundwater and/or surface water, third quarter, 2015.

Sample Number	Sample Date	Calcium	Magnesium	Sodium	Potassium	Fluoride	Chloride	Sulfate	Total Alkalinity	Total Nitrogen	Total Phosphorus
151W005,004,003	8/27/2015	<0.1	<0.1	<0.1	<0.1	<0.2	<0.4	<0.8	<1.0	<0.01	<0.005
151W547,546,545	7/13/2015	<0.1	<0.1	<0.1	<0.1	<0.2	<0.4	<0.8	<1.0	<0.01	<0.005

Table 25. Blank analysis results (µg/L) for VOCs in groundwater and/or surface water, third quarter 2015.

Sample Number	Sample Date	1,1-Dichloroethene	Carbon tetrachloride	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	Tetrachloroethylene (PERC)	Trichloroethylene (TCE)	Vinyl chloride
151W006	8/27/2015	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

Table 26. Electret ionization chamber irradiation results (categorized as spiked samples), third quarter, 2015.

Electret #	Exposure Received		Net Measured Exposure[1]		%R
	(mR)	Uncertainty (±1 SD, mR)	(mR)	Uncertainty (±1 SD, mR)	
SGP633	42	2.1	37.5	1.3	89
SHD958	42	2.1	38.7	1.4	92
SHD973	42	2.1	43.4	1.3	103
SHD926	30	1.5	31.8	1.4	106
SHD900	30	1.5	26.7	1.4	89
SGP547	30	1.5	26.6	1.3	89
SHD884	22	1.1	20.6	1.4	94
SGO639	22	1.1	19.1	1.3	87
SGO635	22	1.1	20.1	1.3	92

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

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

Table 27. Air sampling field equipment service reliability (percent operational), third quarter, 2015.

Station Locations	Sample Type			
	TSP	Radioiodine	Atmospheric Moisture	Precipitation
Onsite Locations				
Big Lost River Rest Area	100%	92%	100%	100%
Experimental Field Station	92%	100%	100%	NC[1]
Sand Dunes Tower	100%	100%	100%	NC[1]
Van Buren Avenue	100%	100%	100%	NC[1]
Boundary Locations				
Atomic City	92%	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%	92%	100%	NC[1]
Idaho Falls	92%	100%	100%	100%

Note: The values in this table were calculated by dividing the number of weeks the equipment was in operation by the number of weeks in the quarter.

[1] NC = Sample not collected at this location.

Appendix A

Table A-1. Weekly concentrations (in 1 x 10^{-3} pCi/m^3) for gross alpha and gross beta analyses for TSP filters for all locations, third quarter, 2015.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	±2 SD	Concentration	±2 SD
On-Site Locations						
Big Lost River Rest Area	07/02/15	07/09/15	1.5	0.3	36.2	1.3
	07/09/15	07/16/15	1.2	0.3	32.2	1.2
	07/16/15	07/23/15	1.1	0.2	28.4	1.2
	07/23/15	07/30/15	1.1	0.2	28.8	1.2
	07/30/15	08/06/15	1.5	0.3	38.4	1.3
	08/06/15	08/13/15	1.2	0.3	30.2	1.2
	08/13/15	08/20/15	3.0	0.4	30.8	1.3
	08/20/15	08/27/15	3.2	0.4	33.3	1.5
	08/31/15	09/03/15	1.8	0.3	35.6	1.3
	09/03/15	09/10/15	1.3	0.3	28.6	1.2
	09/10/15	09/16/15	1.8	0.3	44.7	1.6
	09/16/15	09/24/15	1.1	0.2	31.5	1.1
	09/24/15	10/01/15	1.5	0.3	51.5	1.5
Experimental Field Station	07/02/15	07/09/15	1.0	0.2	25.5	1.1
	07/09/15	07/16/15	0.8	0.2	22.7	1.1
	07/16/15	07/23/15	0.6	0.2	21.3	1.1
	07/23/15	07/30/15	0.8	0.2	20.1	1.1
	07/30/15	08/06/15	1.1	0.2	27.8	1.2
	08/06/15	08/13/15	0.7	0.2	23.6	1.1
	08/13/15	08/20/15	NS[1]	NS[1]	NS[1]	NS[1]
	08/20/15	08/27/15	3.0	0.4	23.5	1.1
	08/27/15	09/03/15	2.5	0.4	28.6	1.3
	09/08/15	09/10/15	2.4	0.8	32.4	2.8
	09/10/15	09/16/15	2.6	0.4	32.5	1.4
	09/16/15	09/24/15	1.5	0.3	24.3	1.1
	09/24/15	10/01/15	2.5	0.4	38.0	1.4
Sand Dunes Tower	07/02/15	07/09/15	0.7	0.2	22.7	1.0
	07/09/15	07/16/15	0.8	0.2	18.3	1.0
	07/16/15	07/23/15	0.7	0.3	16.4	1.2
	07/23/15	07/30/15	0.8	0.2	17.3	1.0
	07/30/15	08/06/15	0.8	0.2	21.2	1.0
	08/06/15	08/13/15	0.7	0.2	18.0	0.9
	08/13/15	08/20/15	1.7	0.3	18.9	1.0
	08/20/15	08/27/15	2.7	0.3	19.0	1.0
	08/27/15	09/03/15	1.1	0.2	21.0	1.0
	09/03/15	09/10/15	0.8	0.2	17.7	0.9
	09/10/15	09/16/15	0.9	0.2	22.7	1.1
	09/16/15	09/24/15	0.6	0.2	18.8	0.9
	09/24/15	10/01/15	1.0	0.2	29.0	1.1

[1] NS – No sample for this week due to a low sample volume caused by a scheduled power outage.

Table A-1 continued. Weekly concentrations (in 1 x 10^{-3} pCi/m^3) for gross alpha and gross beta analyses for TSP filters for all locations, third quarter, 2015.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	±2 SD	Concentration	±2 SD
Van Buren Avenue	07/02/15	07/09/15	1.2	0.2	26.1	1.1
	07/09/15	07/16/15	0.7	0.2	22.7	1.1
	07/16/15	07/23/15	0.5	0.2	18.7	1.0
	07/23/15	07/30/15	0.8	0.2	19.1	1.0
	07/30/15	08/06/15	1.0	0.2	25.3	1.1
	08/06/15	08/13/15	0.9	0.2	21.6	1.0
	08/13/15	08/20/15	2.4	0.3	23.6	1.1
	08/20/15	08/27/15	3.0	0.4	26.1	1.2
	08/27/15	09/03/15	1.2	0.3	28.2	1.2
	09/03/15	09/10/15	1.1	0.2	22.4	1.1
	09/10/15	09/16/15	0.8	0.2	31.4	1.3
	09/16/15	09/24/15	0.7	0.2	21.7	1.0
	09/24/15	10/01/15	1.0	0.2	35.4	1.3
Boundary Locations						
Atomic City	07/02/15	07/09/15	1.0	0.2	29.3	1.2
	07/09/15	07/16/15	0.7	0.2	23.8	1.1
	07/16/15	07/23/15	0.6	0.2	21.2	1.0
	07/23/15	07/30/15	1.1	0.2	20.6	1.0
	07/30/15	08/06/15	1.4	0.3	28.8	1.2
	08/06/15	08/13/15	0.9	0.2	24.0	1.1
	08/13/15	08/20/15	2.5	0.3	24.5	1.1
	08/20/15	08/27/15	3.3	0.4	25.8	1.2
	08/27/15	09/03/15	1.6	0.5	28.2	1.9
	09/03/15	09/10/15	1.0	0.2	22.2	1.0
	09/10/15	09/16/15	1.2	0.3	32.6	1.3
	09/16/15	09/24/15	0.7	0.2	26.0	1.0
	09/24/15	10/01/15	1.4	0.3	40.7	1.3
Howe	07/02/15	07/09/15	1.0	0.2	26.5	1.2
	07/09/15	07/16/15	0.7	0.2	22.3	1.1
	07/16/15	07/23/15	0.6	0.2	19.2	1.0
	07/23/15	07/30/15	1.0	0.2	20.2	1.1
	07/30/15	08/06/15	0.9	0.2	25.7	1.2
	08/06/15	08/13/15	0.9	0.2	19.3	1.0
	08/13/15	08/20/15	2.3	0.3	22.6	1.1
	08/20/15	08/27/15	4.1	0.6	24.0	1.6
	08/27/15	09/03/15	1.2	0.3	24.4	1.1
	09/03/15	09/10/15	0.9	0.2	20.4	1.1
	09/10/15	09/16/15	1.1	0.3	28.1	1.3
	09/16/15	09/24/15	0.7	0.2	20.1	1.0
	09/24/15	10/01/15	1.1	0.3	34.0	1.3

Table A-1 continued. Weekly concentrations (in 1 x 10^{-3} pCi/m^3) for gross alpha and gross beta analyses for TSP filters for all locations, third quarter, 2015.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	±2 SD	Concentration	±2 SD
Monteview	07/02/15	07/09/15	1.2	0.2	29.5	1.2
	07/09/15	07/16/15	0.8	0.2	24.4	1.2
	07/16/15	07/23/15	0.8	0.2	22.8	1.1
	07/23/15	07/30/15	1.0	0.2	19.9	1.0
	07/30/15	08/06/15	1.1	0.2	29.7	1.2
	08/06/15	08/13/15	1.0	0.2	25.7	1.1
	08/13/15	08/20/15	2.0	0.3	27.4	1.3
	08/20/15	08/27/15	5.8	0.8	32.4	2.1
	08/27/15	09/03/15	1.6	0.3	30.0	1.2
	09/03/15	09/10/15	1.0	0.2	20.4	1.0
	09/10/15	09/16/15	1.8	0.3	31.3	1.4
	09/16/15	09/24/15	1.2	0.2	26.6	1.1
	09/24/15	10/01/15	1.5	0.3	41.3	1.4
Mud Lake	07/02/15	07/09/15	1.7	0.3	37.8	1.3
	07/09/15	07/16/15	1.3	0.3	30.0	1.3
	07/16/15	07/23/15	1.2	0.3	31.4	1.2
	07/23/15	07/30/15	1.3	0.3	29.6	1.2
	07/30/15	08/06/15	1.5	0.3	43.2	1.4
	08/06/15	08/13/15	1.8	0.3	33.3	1.3
	08/13/15	08/20/15	2.8	0.5	39.5	1.9
	08/20/15	08/27/15	5.7	1.0	44.5	3.0
	08/27/15	09/03/15	1.8	0.3	36.7	1.3
	09/03/15	09/10/15	1.7	0.3	29.7	1.2
	09/10/15	09/16/15	2.0	0.3	42.6	1.5
	09/16/15	09/24/15	1.3	0.2	31.8	1.1
	09/24/15	10/01/15	2.1	0.3	53.5	1.6
Distant Locations						
Craters of the Moon	07/02/15	07/09/15	0.7	0.2	22.5	1.1
	07/09/15	07/16/15	NS[1]	NS[1]	NS[1]	NS[1]
	07/16/15	07/23/15	0.4	0.2	18.2	1.0
	07/23/15	07/30/15	0.6	0.2	17.7	1.0
	07/30/15	08/06/15	0.8	0.2	24.4	1.1
	08/06/15	08/13/15	0.6	0.2	19.8	1.0
	08/13/15	08/20/15	1.9	0.3	19.6	1.1
	08/20/15	08/27/15	2.6	0.4	20.8	1.1
	08/27/15	09/03/15	0.8	0.2	22.2	1.1
	09/03/15	09/10/15	0.7	0.2	17.3	1.0
	09/10/15	09/16/15	1.0	0.3	24.9	1.3
	09/16/15	09/24/15	0.6	0.2	17.8	0.9
	09/24/15	10/01/15	1.0	0.2	29.5	1.2

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

Table A-1 continued. Weekly concentrations (in 1 x 10^{-3} pCi/m^3) for gross alpha and gross beta analyses for TSP filters for all locations, third quarter, 2015.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	±2 SD	Concentration	±2 SD
Fort Hall[1]	07/02/15	07/09/15	0.8	0.2	24.4	1.1
	07/09/15	07/16/15	0.7	0.2	19.5	1.0
	07/16/15	07/23/15	0.8	0.2	20.1	1.0
	07/23/15	07/30/15	0.6	0.2	16.3	0.9
	07/30/15	08/06/15	1.3	0.3	24.8	1.1
	08/06/15	08/13/15	0.8	0.2	19.8	1.0
	08/13/15	08/20/15	2.4	0.3	24.8	1.1
	08/20/15	08/27/15	2.8	0.4	24.6	1.2
	08/27/15	09/03/15	1.1	0.2	22.1	1.0
	09/03/15	09/10/15	0.9	0.2	16.6	1.0
	09/10/15	09/16/15	1.4	0.3	27.5	1.3
	09/16/15	09/24/15	0.9	0.2	19.5	0.9
	09/24/15	10/01/15	1.2	0.3	31.1	1.2
Idaho Falls - HVP 3804	07/02/15	07/09/15	1.5	0.3	36.6	1.4
	07/09/15	07/16/15	1.0	0.3	30.5	1.3
	07/16/15	07/23/15	1.0	0.3	28.8	1.3
	07/23/15	07/30/15	1.0	0.2	27.4	1.2
	07/30/15	08/06/15	1.3	0.3	43.1	1.7
	08/06/15	08/13/15	1.2	0.3	30.9	1.3
	08/13/15	08/20/15	2.9	0.4	32.3	1.4
	08/20/15	08/27/15	5.5	0.7	34.6	1.9
	08/27/15	09/03/15	1.4	0.3	31.4	1.3
	09/03/15	09/10/15	1.2	0.3	27.7	1.2
	09/10/15	09/16/15	1.8	0.3	38.6	1.5
	09/16/15	09/24/15	1.3	0.2	30.3	1.2
	09/24/15	10/01/15	1.7	0.3	48.8	1.5
Idaho Falls - HVP 4304[2]	07/02/15	07/09/15	1.3	0.3	32.4	1.2
	07/09/15	07/16/15	1.0	0.2	29.6	1.2
	07/16/15	07/23/15	1.1	0.2	24.9	1.1
	07/23/15	07/30/15	0.9	0.2	21.3	1.0
	07/30/15	08/06/15	1.3	0.3	33.3	1.5
	08/06/15	08/13/15	0.9	0.2	27.8	1.2
	08/13/15	08/20/15	2.5	0.4	31.3	1.3
	08/20/15	08/27/15	5.0	0.7	33.2	2.0
	08/27/15	09/03/15	1.3	0.3	28.6	1.2
	09/03/15	09/10/15	0.8	0.2	24.5	1.1
	09/10/15	09/16/15	1.7	0.3	36.6	1.4
	09/16/15	09/24/15	1.1	0.2	28.2	1.1
	09/24/15	10/01/15	1.9	0.3	46.8	1.5

[1] Operated by Shoshone Bannock-Tribes.
[2] HVP 4304 – This is a new sampler model being operated side by side with sampler HVP 3804 to test the dependability and durability in field conditions.

Appendix B

Table B-1. Results for all electret locations, third quarter, 2015.

Sample Location	Net Corrected Exposure Rate (µR/hr)[1]	± 2 SD (µR/hr)
Arco	11.5	3.0
Craters of the Moon	14.1, 14.5	
Big Lost River Rest Area	16.0	2.9
Van Buren Avenue	13.6, 16.0	
Experimental Field Station	16.4	2.5
Main Gate	17.2	1.9
Atomic City	12.8, 14.2	
Taber	11.5	2.4
Blackfoot	10.5	3.4
Ft. Hall[2]	10.0	1.3
Idaho Falls	7.5, 7.8	
Mud Lake/ Terreton	11.8	2.0
Monteview	11.3, 12.3	
Sand Dunes Tower	13.7	1.3
Howe Met. Tower	14.4	1.1
MP276 -20	15.4, 17.9	
MP274 -20	8.6, 9.1	
MP272 -20	8.8, 10.0	
MP270 -20	12.2	2.7
MP268 -20	11.8, 12.1	
MP266 -20	11.5, 14.5	
MP264 -20	12.1	0.8
MP270 -20/26	13.7	2.4
MP268 -20/26	12.3	0.6
MP266 -20/26	12.8	1.0
MP263 -20/26	11.5, 11.9	
MP261 -20/26	11.1	2.5
MP259 -20/26	11.1	0.7
MFC (EBR II)	11.9	2.0
EBR I	9.6, 11.9	
RWMC	11.7	2.7
CFA	12.0	0.7
CITRC (PBF)	14.8	2.5
INTEC	17.0	0.8
ATR (TRA)	12.5, 13.2	
NRF	15.9	2.9
TAN/SMC	9.2, 11.5	
Mud Lake Bank of Commerce	12.7	2.3
MP43-33	13.6	2.9
MP41-33	13.4	2.4
MP39-33	12.7	3.0
MP 37-33	8.0	1.6
MP35-33	10.7	3.0
MP33-33	13.6	1.4
MP31-33	10.2, 13.5	
MP29-33	10.3	2.5
MP27-33	16.3	1.4
MP25-33	11.3	0.5
MP23-33	13.7, 14.1	
Base of Howe	13.1	3.4

Table B-1 continued. Results for all electret locations, third quarter, 2015.

Sample Location	Net Corrected Exposure Rate (µR/hr)[1]	± 2 SD (µR/hr)
Rover	14.2, 18.3	
Hamer	13.7, 14.1	
Sugar City	17.4	2.9
Roberts	13.5, 14.3	
Big Southern Butte	16.1	2.3

[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.

[2]Station operated by Shoshone-Bannock Tribes.

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
Tetrachloroethylene (PERC)	0.5
Toluene	0.5
1,2,4-Trichlorobenzene	0.5
1,1,1-Trichloroethane	0.5
1,1,2-Trichloroethane	0.5
Trichloroethylene	0.5
Vinyl chloride	0.5
Xylenes (total)	0.5
Bromodichloromethane	0.5
Dibromochloromethane	0.5
Bromoform	0.5
Chloroform	0.5
Bromobenzene	0.5
Bromochloromethane	0.5
Bromomethane	0.5
n-Butylbenzene	0.5
sec-Butylbenzene	1.0
tert-Butylbenzene	0.5
Chloroethane	0.5
Chloromethane	0.5
2-Chlorotoluene	0.5

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

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