

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	
BEA	-	Battelle Energy Alliance, LLC	
CERCLA	-	Comprehensive Environmental Response, Compensation and Liability Act	
CFA	-	Central Facilities Area	
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	
EIC	-	electret ionization chamber	
EML	-	Environmental Monitoring Laboratory	
EPA	-	Environmental Protection Agency	
ESER	-	Environmental Surveillance, Education and Research Program (SM Stoller)	
ESP	-	Environmental Surveillance Program	
ESRPA	-	Eastern Snake River Plain Aquifer	
HPIC	-	high-pressure ion chamber	
LLD	-	lower limit of detection	
IBL	-	Idaho Bureau of Laboratories	
INL	-	Idaho National Laboratory	
INTEC	-	Idaho Nuclear Technology and Engineering Center	
LSC	-	liquid scintillation counting	
MFC	-	Materials and Fuels Complex	
µg/L	-	micrograms per liter	
mg/L	-	milligrams per liter	
mrem	-	millirem or 1/1000 th of a rem	
mR/hr	-	milliRoentgen per hour	
µR/hr	-	microRoentgen per hour	
MCL	-	maximum contaminant level	
MDA	-	minimum detectable activity	
MDC	-	minimum detectable concentration	
NIST	-	National Institute of Standards and Technology	
nCi/L	-	nanocuries per liter	
NOAA	-	National Oceanic and Atmospheric Administration	
NRF	-	Naval Reactors Facility	
pCi/g	-	picocuries per gram	
pCi/L	-	picocuries per liter	
pCi/m ³	-	picocuries per cubic meter	
PCE	-	perchloroethene	
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	
SMCL	-	secondary maximum contaminant level	
TAN	-	Test Area North	
TCE	-	trichloroethene	
TDS	-	total dissolved solids	
TMI	-	Three Mile Island	
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's (DEQ-INL OP) Environmental Surveillance Program (ESP) is conducted at locations on the INL, on 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 data and programs. This program is also used to provide the citizens of Idaho with information 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 provide the mechanism 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 fourth quarter, 2009 (**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. 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**.

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 fourth quarter of 2009 for TSP filters are presented in **Table 3**. The only reported gamma-emitting radionuclide was beryllium-7, a naturally occurring, cosmogenic radionuclide.

Annual composites of filters collected using TSP samplers are also analyzed using radiochemical separation techniques. The samples are analyzed for Strontium-90, Plutonium-238, Plutonium-239/240, and Americium-241. Measurable quantities of these radionuclides are expected in the environment due to historic above ground testing of nuclear weapons. DEQ-INL OP's action levels of 190 for Americium-241, 1900 for Strontium-90, 210 for Plutonium-238, and 200 for Plutonium-239/240

(in 1×10^{-6} pCi/m³) are 10 percent of the compliance values listed for the specific radionuclides in 40 CFR 61, Appendix E, Table 2. Field sample concentrations which exceed these amounts require further investigation. Results from the annual composite analyses are typically presented in the following year's first quarter report.

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 within its sponge-like pores. 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 fourth 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. Atmospheric tritium was not measured above the minimum detectable concentration during the fourth quarter of 2009. Average atmospheric tritium concentrations are presented in **Table 4**.

Precipitation samples were collected at five monitoring locations during the fourth quarter of 2009. Precipitation samples were analyzed for tritium and gamma-emitting radionuclides. Tritium and gamma-emitting radionuclides were below minimum detectable concentration in precipitation collected during the fourth quarter of 2009. Tritium and Cesium-137 analysis results for precipitation are presented in **Table 5**. 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.

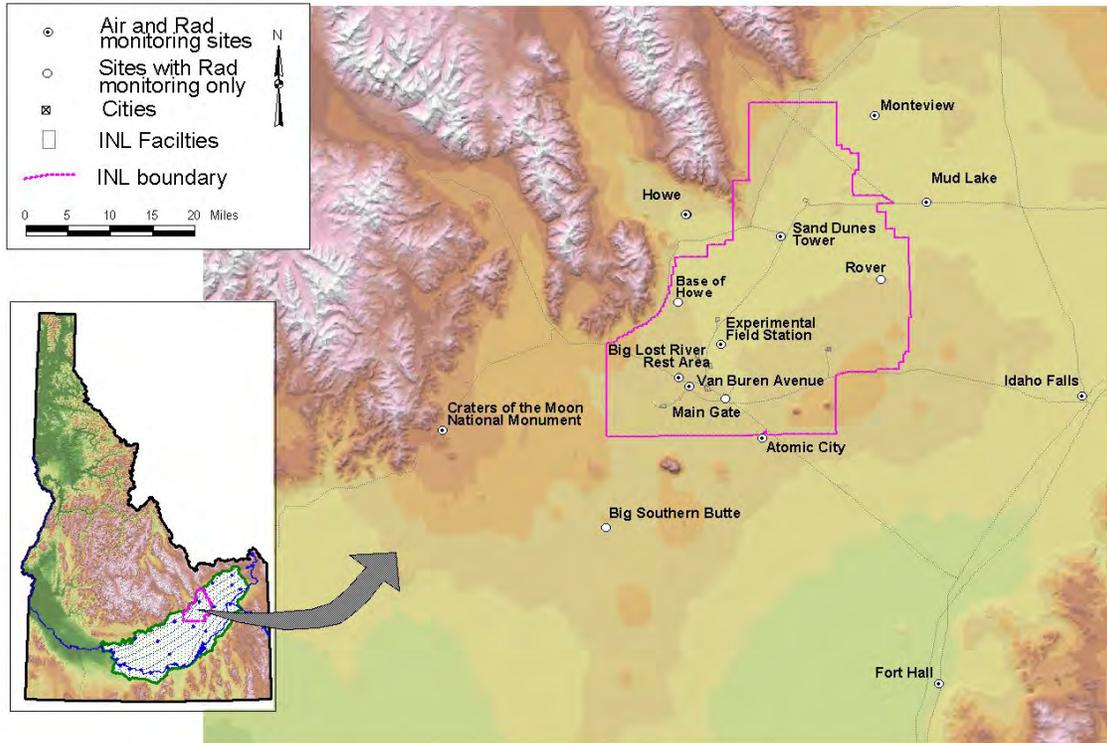


Figure 1. Air and radiation monitoring sites.

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	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Experimental Field Station	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Sand Dunes Tower	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Van Buren Avenue	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Boundary Locations				
Atomic City	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Howe	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Monteview	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Mud Lake	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Distant Locations				
Craters of the Moon	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Fort Hall ²	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Idaho Falls	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

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, fourth quarter, 2009. Concentrations are reported in 1×10^{-3} pCi/m³.

Station Location	Concentration			
	Gross Alpha		Gross Beta	
On-Site Locations				
Big Lost River Rest Area	0.3	- 1.4	19.9	- 51.1
Experimental Field Station	0.5	- 1.4	21.1	- 54.4
Sand Dunes Tower	0.3	- 1.5	17.2	- 54.4
Van Buren Avenue	0.5	- 1.7	22.8	- 64.5
Boundary Locations				
Atomic City	0.4	- 1.6	18.9	- 53.2
Howe	0.3	- 1.5	20.7	- 45.9
Monteview	0.7	- 1.6	22.4	- 63.6
Mud Lake	0.7	- 1.3	19.3	- 57.0
Distant Locations				
Craters of the Moon	0.1	- 1.2	13.5	- 42.0
Fort Hall ¹	0.4	- 1.1	13.0	- 50.9
Idaho Falls	0.6	- 1.6	22.8	- 61.3

¹ Operated by Shoshone-Bannock Tribes.

Table 3. Gamma spectroscopy analysis data for TSP filters, composite samples, fourth quarter, 2009. Concentrations are reported in 1×10^{-3} pCi/m³ with associated uncertainty (± 2 SD), minimum detectable concentration (MDC), and correspond to filter composites collected during the calendar quarter.

Station Location	Naturally Occurring Radionuclide Beryllium-7		Man-Made Gamma Emitting Radionuclides
	Concentration	± 2 SD	
On-site Locations			
Big Lost River Rest Area	59.4	3.5	<MDC ²
Experimental Field Station	62.3	3.6	<MDC
Sand Dunes Tower	56.2	3.3	<MDC
Van Buren Avenue	71.1	4.2	<MDC
Boundary Locations			
Atomic City	64.1	3.7	<MDC
Howe	58.9	3.5	<MDC
Monteview	75.7	4.3	<MDC
Mud Lake	50.1	3.0	<MDC
Distant Locations			
Craters of the Moon	55.4	3.3	<MDC
Fort Hall ¹	49.3	3.1	<MDC
Idaho Falls	82.3	4.7	<MDC

¹Operated by Shoshone-Bannock Tribes.

²MDC for Cs-137 typically $(5-10) \times 10^{-5}$ pCi/m³.

Table 4. Tritium concentrations in air from atmospheric moisture, fourth quarter, 2009. Concentrations are reported in pCi/m³ with associated uncertainty (± 2 SD) and minimum detectable concentration (MDC).

Station Location	Tritium		
	Concentration	± 2 SD	MDC
On-site Locations			
Big Lost River Rest Area	0.07	0.20	0.35
Experimental Field Station	0.16	0.25	0.41
Sand Dunes Tower	0.07	0.22	0.39
Van Buren Avenue	0.10	0.24	0.38
Boundary Locations			
Atomic City	0.11	0.23	0.39
Howe	0.00	0.24	0.42
Mud Lake	0.08	0.23	0.39
Monteview	0.04	0.22	0.38
Distant Locations			
Craters of the Moon	0.03	0.21	0.37
Fort Hall ¹	0.08	0.27	0.44
Idaho Falls	0.00	0.26	0.45

¹Operated by Shoshone-Bannock Tribes.

Table 5. Tritium and Cesium-137 concentrations from precipitation, fourth quarter, 2009. Concentrations are reported in pCi/L with associated uncertainty (± 2 SD) and minimum detectable concentration (MDC).

Station Location	Tritium			Cesium-137		
	Concentration	± 2 SD	MDC	Concentration	± 2 SD	MDC
On-site Locations						
Big Lost River Rest Area	130	120	190	-0.9	1.5	2.6
Boundary Locations						
Atomic City	0	110	190	1.4	1.9	3.2
Howe	20	120	190	0.3	1.4	2.4
Montevieu ¹	NS	NS	NS	NS	NS	NS
Mud Lake	20	120	190	-0.4	2.1	3.5
Distant Locations						
Idaho Falls	50	120	190	-1.0	1.8	3.1

¹ Montevieu sampler hose became detached from the collection container

Environmental Radiation Monitoring Results

The ESP operated 14 environmental radiation stations during the fourth quarter of 2009 (**Figure 1**). To detect gamma radiation, each station is instrumented with an electret ionization chamber (EIC), and 10 of the stations also have high-pressure ion chambers (HPIC) (**Table 6**).

The Shoshone-Bannock Tribes operate an additional environmental radiation station at Fort Hall equipped with an EIC and 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/piconline.cfm

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 fourth quarter 2009. **Table 8** lists the EIC monitoring results for fourth quarter 2009. 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 ¹		■
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	■	■
Distant Locations		
Craters of the Moon		■
Fort Hall ²	■	■
Idaho Falls	■	■

¹ HPIC Sampling at Big Lost River Rest Area was suspended due to construction and has not been re-deployed.

² HPIC operated by Shoshone-Bannock Tribes with the EIC maintained by DEQ-INL OP.

Table 7. Average gamma exposure rates, fourth quarter, 2009, from HPIC network.

Station Location	Exposure Rate (µR/hr)	
	Quarterly Average	± 2 SD
On-site Locations		
Base of Howe	12.0	1.3
Big Lost River Rest Area ¹	NS	NS
Main Gate	17.8	8.5
Rover ²	NS	NS
Sand Dunes Tower	15.0	1.4
Boundary Locations		
Atomic City	15.4	1.3
Big Southern Butte	12.4	5.9
Howe Met Tower ³	14.0	1.3
Monteview	14.5	1.0
Mud Lake	13.7	1.3
Distant Locations		
Fort Hall ⁴	14.2	1.7
Idaho Falls	12.4	7.8

¹ Sampling at Big Lost River Rest Area was suspended due to construction and has not been re-deployed.

² The Rover HPIC experienced equipment failure which could not be repaired for the quarter and is therefore reported as No Sample.

³ The Howe HPIC has always been located at the Howe NOAA Met Tower, the name will be changed from Howe to Howe Met Tower in this and future reports to preserve location agreement with the EIC.

⁴ Operated by Shoshone-Bannock Tribes.

Table 8. Electret ionization chamber (EIC) cumulative average exposure rates, fourth quarter, 2009.

Station Location	Exposure Rate ($\mu\text{R/hr}$)	
	Quarterly Average	± 2 SD
On-site Locations		
Base of Howe	13.9	3.2
Big Lost River Rest Area	14.1	0.2
Experimental Field Station	18.8	3.3
Main Gate	18.2	1.8
Rover	15.1	1.2
Sand Dunes Tower	15.5	0.7
Van Buren Avenue	18.9	2.4
Boundary Locations		
Atomic City	12.8	0.2
Big Southern Butte	11.2	2.4
Howe Met Tower ²	14.9	2.8
Monteview	13.9	3.5
Mud Lake	15.0	2.5
Distant Locations		
Craters of the Moon	16.2	1.8
Fort Hall ¹	14.8	1.9
Idaho Falls	12.5	3.6

¹ Station operated by Shoshone-Bannock Tribes.

²The air monitoring station at Howe has been re-located to a more reliable location at the Howe NOAA Met Tower.

Water Monitoring

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 fourth quarter of 2009, 2 up-gradient, 16 facility, 3 boundary, 5 distant, and 1 surface water locations were sampled.

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, americium, and neptunium; 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 up-gradient, 4 facility, and 1 distant location. Concentrations observed at facility locations were in areas of known contamination and consistent with historical trends. 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 in each of the 5 areas (up-gradient, facility, boundary, distant, and surface water) sampled. Concentrations observed at facility locations were consistent with historical trends. Concentrations for up-gradient, boundary, distant, and surface water locations were within the range of concentrations observed for naturally-occurring radioactivity. The MCL for beta and gamma radioactivity is 4 mrem/year, equivalent to 8 pCi/l if the source is strontium-90; 900 pCi/L if technetium-99; 20,000 pCi/L if tritium; or 200 pCi/L if cesium-137. Man-made, gamma emitting cesium-137 was not detected this quarter. Results for gross alpha; gross beta; and man-made, gamma emitting radioactivity are shown in **Table 9**.

Five sites were sampled for plutonium isotopes (**Table 10**). There were no detectable results for plutonium isotopes this quarter.

Nine sites were sampled for isotopes of uranium. All nine sample sites had detectable results for uranium-234, 9 detectable results for uranium-238, and no detectable results for uranium-235 (**Table 11**). The ratios of results observed from most sites cannot be distinguished from background concentrations, which mean the uranium found in the samples is likely to be naturally occurring. One sample from TAN-10A may contain uranium above background concentrations, which is not surprising for this site. There were no detectable results for americium-241 (**Table 12**) or neptunium-237, (**Table 13**).

Five of fifteen samples analyzed for strontium-90 had detectable results this quarter (**Table 14**). All samples were from locations in areas of known contamination. All 13 locations sampled for technetium-99 had detectable results this quarter (**Table 15**). All results were within the expected ranges of concentrations.

Using the standard analytical method, tritium was detected in eleven of sixteen facility samples (**Table 16**). Detections were consistent with historic concentrations for these sites. There were no detectable concentrations from other areas. 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. Only thirteen samples were analyzed using the enrichment method this quarter (**Table 17**), due to technical difficulties. There is currently a backlog of 44 samples.

Samples were also analyzed for metals and the results shown in **Table 18**. All results were within their expected ranges. Common ion results are shown in **Table 19** and nutrient results are shown in **Table 20**. All results were consistent with historical values at those locations.

Six locations were sampled for Volatile Organic Compounds (VOCs) this quarter, four locations had detectable concentrations. All locations with detectable results are in areas of known contamination at RWMC. VOCs with detectable concentrations are shown in **Table 21** and a complete list of analyses is shown in **Appendix C**. The background concentrations for VOCs should be zero. The results discussed in this section only refer to detectable concentrations.

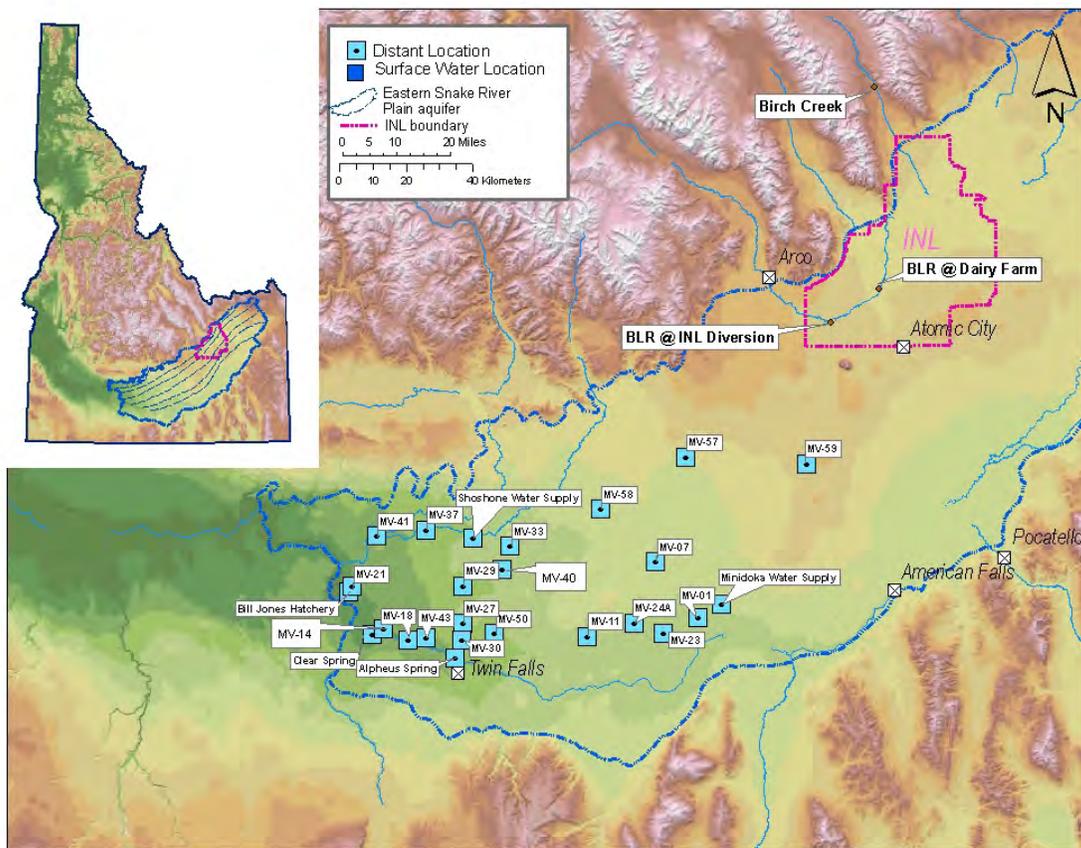


Figure 2. Distant sampling locations, fourth quarter, 2009.

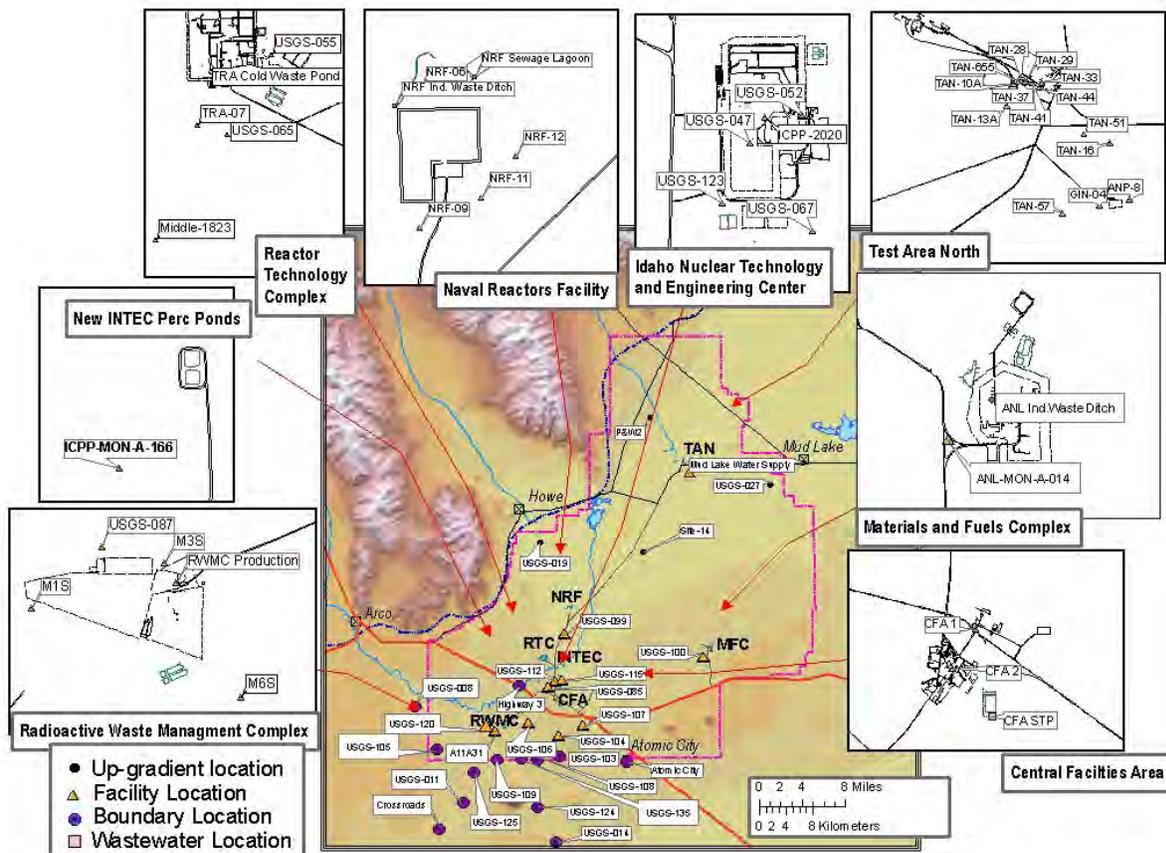


Figure 3. Up-gradient, facility, boundary and wastewater monitoring locations.

Table 9. Alpha, beta, and gamma concentrations for water samples, fourth quarter, 2009.

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	11/24/2009	0.3	U	1.2	3.4		0.9	0.4	U	1.4
Site-14	10/8/2009	4.6		2.8	1.4	U	1.1	0.0	U	1.3
Facility										
A11A31	11/4/2009	3.1	U	2.4	3.5		1.1	0.8	U	1.6
CFA 2	10/27/2009	-1.3	U	5.0	7.1		2.5	0.7	U	1.4
ICPP-MON-A-166	10/6/2009	1.6	U	1.9	3.4		1.0	0.0	U	1.4
M1S	11/2/2009	-1.2	U	2.0	2.3		1.0	-0.3	U	1.5
M3S	11/2/2009	1.7	U	2.6	7.5		1.2	0.6	U	2.0
M6S	11/3/2009	5.3		2.7	4.2		1.1	-0.4	U	1.6
Middle-1823	10/14/2009	6.3		2.4	2.2		1.0	0.2	U	2.0
RWMC Production	10/8/2009	1.7	U	2.8	2.1		1.1	-0.5	U	1.5
TAN-10A	10/13/2009	12.8		5.1	167.7		5.1	0.3	U	1.4
TRA-07	10/14/2009	5.0		2.8	5.0		1.1	0.2	U	1.9
USGS-055	10/14/2009	1.5	U	2.7	59.9		2.1	0.1	U	1.4
USGS-104	10/26/2009	-2.7	U	2.4	1.3	U	1.1	-0.7	U	1.4
USGS-112	10/7/2009	1.1	U	3.0	23.2		1.5	0.1	U	1.5
USGS-115	10/7/2009	0.7	U	2.7	5.3		1.2	-0.1	U	1.3
USGS-120	10/26/2009	-0.2	U	2.7	2.0		1.1	0.7	U	1.4
USGS-123	10/15/2009	2.8	U	2.0	2.9		1.0	-0.5	U	1.8
Boundary										
Highway 3	10/27/2009	2.0	U	2.4	3.5		1.0	-0.3	U	1.4
USGS-014	10/26/2009	-2.1	U	2.7	1.9		1.1	-0.4	U	1.4
USGS-125	10/26/2009	-1.6	U	2.7	3.8		1.1	0.1	U	1.4
Distant										
Alpheus Spring	11/16/2009	5.1		2.7	5.3		1.1	0.4	U	1.3
Bill Jones Hatchery	11/16/2009	1.9	U	2.2	4.2		1.0	-1.0	U	1.4
Clear Spring	11/16/2009	1.0	U	2.6	5.0		1.1	1.2	U	1.5
Minidoka Water Supply	11/16/2009	-1.6	U	1.9	3.0		1.0	1.0	U	1.6
Shoshone Water Supply	11/16/2009	1.2	U	2.3	3.0		1.0	0.3	U	1.3
Surface water										
Birch Creek	10/27/2009	1.5	U	2.3	5.6		1.1	0.0	U	1.8

¹ Data qualifiers: U = non-detection, J = estimate, R = rejected.

² Concentrations expressed in pCi/L.

Table 10. Reported concentrations of plutonium isotopes in water samples, fourth quarter, 2009.

Sample Location	Sample Date	Plutonium-238		Plutonium-239/240		Plutonium-241	
		Concentration ^{1,2}	± 2SD	Concentration ^{1,2}	± 2SD	Concentration ^{1,2}	± 2SD
Facility							
A11A31	11/4/2009	-0.002	U 0.022	0.04	U 0.03	1.8	U 2.8
M1S	11/2/2009	0.00	U 0.02	0.01	U 0.02	2.8	U 2.7
M3S	11/2/2009	0.00	U 0.02	0.01	U 0.02	1.3	U 2.6
M6S	11/3/2009	0.01	U 0.02	0.00	U 0.02	0.3	U 2.5
USGS-123	10/15/2009	0.00	U 0.02	-0.01	U 0.02	-0.4	U 4.1

¹ Data qualifiers: U = non-detection, J = estimate, R = rejected.

² Concentrations expressed in pCi/L.

Table 11. Reported concentrations of uranium isotopes in water samples, fourth quarter, 2009.

Sample Location	Sample Date	Uranium-234		Uranium-235		Uranium-238	
		Concentration ^{1,2}	± 2SD	Concentration ^{1,2}	± 2SD	Concentration ^{1,2}	± 2SD
Facility							
A11A31	11/4/2009	1.25	0.32	0.02	U 0.05	0.63	0.2
M1S	11/2/2009	0.86	0.25	0.01	U 0.05	0.34	0.15
M3S	11/2/2009	1.47	0.36	0.00	U 0.05	0.81	0.24
M6S	11/3/2009	1s.22	0.32	0.04	U 0.06	0.57	0.19
Middle-1823	10/14/2009	1.37	0.35	0.02	U 0.05	0.51	0.18
TAN-10A	10/13/2009	5.10	1.1	0.07	U 0.09	1.21	0.39
TRA-07	10/14/2009	2.45	0.55	0.07	U 0.07	1.26	0.33
USGS-055	10/14/2009	1.71	0.40	0.02	U 0.05	0.74	0.22
USGS-123	10/15/2009	1.38	0.34	0.06	U 0.06	0.61	0.19

¹ Data qualifiers: U = non-detection, J = estimate, R = rejected.

² Concentrations expressed in pCi/L.

Table 12. Reported concentrations of americium-241 in water samples, fourth quarter, 2009.

Sample Location	Sample Date	Americium-241	
		Concentration ^{1,2}	± 2SD
Facility			
A11A31	11/4/2009	0.02	U 0.02
M1S	11/2/2009	-0.01	U 0.03
M3S	11/2/2009	0.00	U 0.02
M6S	11/3/2009	0.01	U 0.02
USGS-123	10/15/2009	0.01	U 0.02

¹ Data qualifiers: U = non-detection, J = estimate, R = rejected.

² Concentrations expressed in pCi/L.

Table 13. Reported concentrations of neptunium-237 in water samples, fourth quarter, 2009.

Sample Location	Sample Date	Neptunium-237	
		Concentration ^{1,2}	± 2SD
USGS-123	10/15/2009	-0.043	U 0.072

¹ Data qualifiers: U = non-detection, J = estimate, R = rejected.

² Concentrations expressed in pCi/L.

Table 14. Reported concentrations of strontium-90 in water samples, fourth quarter, 2009.

Sample Location	Sample Date	Strontium-90		
		Concentration ^{1,2}		± 2SD
Facility				
A11A31	11/4/2009	0.07	U	0.16
CFA 2	10/27/2009	2.56		0.70
M1S	11/2/2009	0.04	U	0.17
M3S	11/2/2009	-0.03	U	0.16
M6S	11/3/2009	0.07	U	0.17
Middle-1823	10/14/2009	-0.07	U	0.26
RWMC Production	10/8/2009	0.30	U	0.24
TAN-10A	10/13/2009	85.00		20.00
TRA-07	10/14/2009	0.82		0.33
USGS-055	10/14/2009	27.50		6.50
USGS-104	10/26/2009	0.23	U	0.25
USGS-112	10/7/2009	9.40		2.30
USGS-115	10/7/2009	0.09	U	0.24
USGS-120	10/26/2009	0.29	U	0.28
USGS-123	10/15/2009	0.40	U	0.36

¹ Data qualifiers: U = non-detection, J = estimate, R = rejected.

² Concentrations expressed in pCi/L.

Table 15. Reported concentrations of technetium-99 in water samples, fourth quarter, 2009.

Sample Location	Sample Date	Technetium-99	
		Concentration ^{1,2}	± 2SD
A11A31	11/4/2009	0.6	0.2
CFA 2	10/27/2009	3.4	0.2
M1S	11/2/2009	0.7	0.1
M3S	11/2/2009	1.3	0.2
M6S	11/3/2009	0.8	0.2
Middle-1823	10/14/2009	0.2	0.1
TRA-07	10/14/2009	0.5	0.2
USGS-055	10/14/2009	1.8	0.2
USGS-104	10/26/2009	0.5	0.2
USGS-112	10/7/2009	5.9	0.3
USGS-115	10/7/2009	7.3	0.3
USGS-120	10/26/2009	1.2	0.2
USGS-123	10/15/2009	1.4	0.2

¹ Data qualifiers: U = non-detection, J = estimate, R = rejected

² Concentrations expressed in pCi/L.

Table 16. Tritium concentrations for water samples, fourth quarter, 2009.

Sample Location	Sample Date	Tritium		
		Concentration ^{1,2}		± 2 SD
<u>Up-gradient</u>				
Mud Lake Water Supply	11/24/2009	30	U	70
Site-14	10/8/2009	90	U	110
<u>Facility</u>				
A11A31	11/4/2009	190	U	120
CFA 2	10/27/2009	4600		210
ICPP-MON-A-166	10/6/2009	80	U	120
M1S	11/2/2009	30	U	120
M3S	11/2/2009	930		140
M6S	11/3/2009	70	U	110
Middle-1823	10/14/2009	1070		140
RWMC Production	10/8/2009	780		140
TAN-10A	10/13/2009	280		120
TRA-07	10/14/2009	10520		290
USGS-055	10/14/2009	2150		170
USGS-104	10/26/2009	760		130
USGS-112	10/7/2009	1380		150
USGS-115	10/7/2009	1380		150
USGS-120	10/26/2009	190	U	120
USGS-123	10/15/2009	3240		190
<u>Boundary</u>				
Highway 3	10/27/2009	140	U	110
USGS-014	10/26/2009	-20	U	110
USGS-125	10/26/2009	40	U	120
<u>Distant</u>				
Alpheus Spring	11/16/2009	20	U	70
Bill Jones Hatchery	11/16/2009	-20	U	70
Clear Spring	11/16/2009	-40	U	70
Minidoka Water Supply	11/16/2009	30	U	70
Shoshone Water Supply	11/16/2009	0	U	70
<u>Surface water</u>				
Birch Creek	10/27/2009	30	U	110

¹ Data qualifiers: U = non-detection, J = estimate, R = rejected

² Concentrations expressed in pCi/L.

Table 17. Enriched Tritium concentrations for water samples, fourth quarter, 2009.

Sample Location	Sample Date	Enriched Tritium		
		Concentration ^{1,2}		± 2 SD
<u>Distant</u> ³				
MV-02A	6/22/2009	9	U	7
MV-14	6/24/2009	5	U	8
MV-20	6/24/2009	-1	U	7
MV-28	6/24/2009	8	U	7
MV-31	6/24/2009	13		6
MV-33	6/22/2009	-3	U	7
MV-39	6/24/2009	11		7
MV-42	6/22/2009	11		6
MV-47	6/24/2009	-2	U	6
MV-51	6/22/2009	19		8
MV-54	6/22/2009	23		7
<u>Surface water</u>				
BLR @ Dairy Farm	6/23/2009	27		8
BLR @ INL Diversion	6/23/2009	26		9

¹ Data qualifiers: U = non-detection, J = estimate, R = rejected

² Concentrations expressed in pCi/L.

³ These second quarter 2009 sample locations are found in Figure 2 of the DEQ-INL OP Environmental Surveillance Program Quarterly Data Report, April – June 2009.

Table 18. Reported metals concentrations in water samples, fourth quarter, 2009.

Sample Location	Sample Date	Concentration ^{1,2}										
		Arsenic	Barium	Beryllium	Cadmium	Chromium	Iron	Lead	Manganese	Mercury	Selenium	Zinc
Up-gradient												
Site-14	10/8/2009	NR	64	NR	NR	5	NR	<1 U	<1 U	NR	NR	<2 U
Facility												
A11A31 (total)	11/4/2009	2	38	<1 U	<1 U	13	220	4.8	2.8	<0.5 U	<2 U	380
CFA 2	10/27/2009	NR	110	NR	NR	9.5	NR	<1 U	5.2	NR	NR	2.4
ICPP-MON-A-166 (total)	10/6/2009	<2 U	52	<1 U	<1 U	6.1	220	<1 U	32	<0.5 U	<2 U	3.0
M1S (total)	11/2/2009	2.7	24	<1 U	<1 U	33	58	<1 U	6.4	<0.5 U	2.4	8.2
M3S (total)	11/2/2009	<2 U	47	<1 U	<1 U	13	14	<1 U	<1 U	<0.5 U	<2 U	<2 U
M6S (total)	11/3/2009	<2 U	36	<1 U	<1 U	23	5200	<1 U	10	<0.5 U	2.2	2.8
Middle-1823 (total)	10/14/2009	<2 U	73	<1 U	<1 U	8.6	50	<1 U	4	<0.5 U	<2 U	<2 U
TAN-10A (total)	10/13/2009	<2 U	280	<1 U	<1 U	<1 U	1600	<1 U	910	<0.5 U	<2 U	5.2
TRA-07 (total)	10/14/2009	<2 U	81	<1 U	<1 U	96	500	<1 U	7.2	<0.5 U	<2 U	160
USGS-055 (total)	10/14/2009	8.2	100	<1 U	<1 U	14	530	1.7	7.6	<0.5 U	<2 U	13
USGS-104	10/26/2009	NR	34	NR	NR	8.5	NR	<1 U	<1 U	NR	NR	2.6
USGS-112	10/7/2009	NR	100	NR	NR	12	NR	<1 U	<1 U	NR	NR	<2 U
USGS-115	10/7/2009	NR	65	NR	NR	5.9	NR	<1 U	1	NR	NR	560
USGS-120	10/26/2009	NR	48	NR	NR	8.6	NR	<1 U	<1 U	NR	NR	<2 U
USGS-123 (total)	10/15/2009	<2 U	50	<1 U	<1 U	14	210	<1 U	3.9	<0.5 U	<2 U	3.4
Boundary												
Highway 3	10/27/2009	NR	58	NR	NR	2	NR	<1 U	<1 U	NR -	NR	56
USGS-014	10/26/2009	NR	24	NR	NR	4.1	NR	<1 U	<1 U	NR -	NR	3.1
USGS-105	9/16/2009	NR	43	NR	NR	7.4	NR	<1 U	<1 U	NR -	NR	3.7
USGS-125	10/26/2009	NR	42	NR	NR	2.9	NR	<1 U	18	NR -	NR	<2 U
USGS-135	9/14/2009	NR	59	NR	NR	2.2	NR	<1 U	6	NR -	NR	24
Surface water												
Birch Creek	10/27/2009	NR	71	NR	NR	<1 U	NR	<1 U	<1 U	NR	NR	<2 U

¹ Data qualifiers: U = non-detection, J = estimate, R = rejected, A "<" indicates a result below the Minimum Detectable Concentration. NR= analysis not requested.

² Concentrations are expressed in µg/L. Samples are filtered unless otherwise indicated.

Table 19. Reported common ion concentrations in water samples, fourth quarter, 2009.

Sample Location	Sample Date	Concentration ^{1,2}									
		Calcium	Magnesium	Sodium	Potassium	Fluoride	Chloride	Sulfate	Alkalinity ³	TDS ⁴	TSS ⁵
Up-gradient											
Site-14*	10/8/2009	33	13	14	2.9	0.490	9.69	24.8	132	NR	NR
Facility											
A11A31	11/4/2009	35	16	24	3.8	<0.2 U	21.7	44.2	135	NR	NR
CFA 2*	10/27/2009	81	27	34	4.5	<0.2 U	155	51.3	142	NR	NR
ICPP-MON-A-166	10/6/2009	34	12	9.5	2.6	0.279	8.04	17.7	127	180	8
M1S	11/2/2009	26	12	11	2.5	0.290	14.4	21.5	99	NR	NR
M3S	11/2/2009	43	14	8.2	2.6	0.220	14.7	26.1	143	NR	NR
M6S	11/3/2009	37	18	15	3.3	0.210	23	50	104	NR	NR
Middle-1823 RWMC	10/14/2009	53	18	11	1.8	<0.2 U	11.9	34.6	176	NR	NR
Production*	10/8/2009	NR	NR	NR	NR	0.220	23	28.7	140	NR	NR
TAN-10A	10/13/2009	88	25	48	3.7	<0.2 U	113	37.5	247	500	<5 U
TRA-07	10/14/2009	88	20	18	3.2	0.200	21.6	162	136	NR	NR
USGS-055	10/14/2009	83	24	15	3.2	0.228	17.6	147	150	NR	NR
USGS-104*	10/26/2009	34	13	8.6	2.4	<0.2 U	14.4	21.5	122	NR	NR
USGS-112*	10/7/2009	50	13	17	2.8	0.230	24.9	31.3	156	NR	NR
USGS-115*	10/7/2009	41	12	15	3.6	0.260	37.5	23.2	115	NR	NR
USGS-120*	10/26/2009	36	17	16	3.1	0.210	16.9	32.7	143	NR	NR
USGS-123	10/15/2009	40	15	10	2.9	0.230	23.7	22	126	NR	NR
Boundary											
Highway 3*	10/27/2009	44	11	5.9	2.3	0.260	6.43	21.4	148	NR	NR
USGS-014*	10/26/2009	36	15	16	2.7	0.900	23.1	22.5	139	NR	NR
USGS-105*	9/16/2009	39	14	11	2.7	0.229	11.3	23.9	141	NR	NR
USGS-125*	10/26/2009	37	14	11	2.7	0.200	12.8	24.5	141	NR	NR
USGS-135*	9/14/2009	39	13	6.6	1.8	0.229	7.35	20.4	136	NR	NR
Surface water											
Birch Creek*	10/27/2009	41	14	5	0.95	0.220	4.58	25.2	147	NR	NR

¹ Data qualifiers: U = non-detection, J = estimate, R = rejected. * = samples are filtered for calcium, magnesium, sodium and potassium. A "<" indicates a result below the Minimum Detectable Concentration. NR= analysis not requested. ² Concentrations expressed in mg/L. Samples are not filtered unless otherwise noted. ³ As CaCO₃. ⁴ =Total Dissolved Solids, ⁵ = Total Suspended Solids.

Table 20. Reported nutrient concentrations in water samples, fourth quarter, 2009.

Sample Location	Sample Date	Concentration ^{1,2}				
		Nitrite + Nitrate		Phosphorus	Total Kjeldahl Nitrogen	Ammonia
Up-gradient						
Site-14	10/8/2009	0.64	J	0.014	NR	NR
Facility						
A11A31	11/4/2009	0.87	J	0.024	NR	NR
CFA 2	10/27/2009	4.0	J	0.024	NR	NR
ICPP-MON-A-166	10/6/2009	0.25	J	0.037	<0.1 U	NR
M1S	11/2/2009	0.97	J	0.023	NR	NR
M3S	11/2/2009	0.84	J	0.022	NR	NR
M6S	11/3/2009	1.0	J	0.057	NR	NR
Middle-1823	10/14/2009	1.1	J	0.028	NR	NR
TAN-10A	10/13/2009	<0.01	U	0.075	0.12	0.02
TRA-07	10/14/2009	1.2	J	0.039	NR	NR
USGS-055	10/14/2009	1.6	J	0.280	NR	NR
USGS-104	10/26/2009	0.86	J	0.020	NR	NR
USGS-112	10/7/2009	1.4	J	0.031	NR	NR
USGS-115	10/7/2009	1.4	J	0.012	NR	NR
USGS-120	10/26/2009	0.88	J	0.021	NR	NR
USGS-123	10/15/2009	1.1	J	0.034	NR	NR
Boundary						
Highway 3	10/27/2009	0.44	J	0.025	NR	NR
USGS-014	10/26/2009	1.2	J	0.015	NR	NR
USGS-105	9/16/2009	0.67	J	0.021	NR	NR
USGS-125	10/26/2009	0.61	J	0.014	NR	NR
USGS-135	9/14/2009	0.75	J	0.023	NR	NR
Surface water						
Birch Creek	10/27/2009	0.27	J	<0.005 U	NR	NR

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

² Concentrations expressed in mg/L.

Table 21. Reported VOC concentrations in water samples, fourth quarter, 2009.

Sample Location	Sample Date	Concentrations ^{1,2}				
		Chloroform	Carbon tetrachloride		Trichloroethylene	
A11A31	11/4/2009	<DL	3.3	J	1.3	J
M3S	11/2/2009	<DL	5.7	J	1.5	J
M6S	11/3/2009	<DL	3.1	J	0.97	J
RWMC Production	10/8/2009	1.6	7.6	J	3.3	J

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

² Concentrations expressed in µg/L

Terrestrial Monitoring Results

The DEQ-INL OP conducts terrestrial (soil and milk) monitoring and verification to provide an indication as to the long-term deposition and migration of contaminants in the environment, and to provide independent verification of DOE's analytical measurement of terrestrial variables.

DEQ-INL OP monitors long-term radiological conditions via soil sampling as well as field instrumentation capable of identifying and measuring quantities of gamma-emitting radionuclides in soil. Monitoring concentrations of gamma-emitting radionuclides in surface soil provides some insight to transport, deposition, and accumulation of radioactive material in the environment as a result of INL operations as well as historical above ground testing of nuclear weapons. No soil sampling was performed during the fourth calendar quarter of 2009.

DEQ-INL OP monitors milk for naturally occurring potassium-40 and man-made iodine-131. DEQ-INL OP collects milk samples on a monthly basis. Results for analyses of milk samples are presented **Table 22**. Naturally occurring potassium-40 was detected in all samples within the expected range. Iodine-131 was not detected.

Table 22. Gamma spectroscopy analysis data for milk samples, fourth quarter, 2009.

Sample Location/Dairy	Sample Date	Naturally occurring gamma-emitting radionuclide Potassium-40		Man-made gamma-emitting radionuclide Iodine-131 ¹
		Concentration ³	± 2 SD	
Monitoring Samples				
Howe/Nelson-Ricks Creamery	10/05/2009	1443	111	<MDC
	11/02/2009	1371	110	<MDC
	12/01/2009	1296	102	<MDC
Mud Lake/Nelson-Ricks Creamery	10/05/2009	1409	106	<MDC
	11/03/2009	1343	104	<MDC
	12/03/2009	1448	100	<MDC
Gooding/Glanbia	10/06/2009	1369	105	<MDC
	11/03/2009	1434	99	<MDC
	12/03/2009	1430	107	<MDC
Riverside	10/07/2009	1844	127	<MDC
Verification Samples²				
Terreton	10/06/2009	1445	100	<MDC
Rupert	10/06/2009	1457	113	<MDC
Rupert	11/03/2009	1428	111	<MDC
Idaho Falls	11/03/2009	1432	111	<MDC
Terreton	12/01/2009	1401	106	<MDC
Rupert	12/01/2009	1592	119	<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 possibly identify and address errors or inaccuracies.

This section summarizes the results of the quality assurance (QA) assessment of the data collected for the fourth quarter of 2009 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 fourth quarter of 2009, the DEQ-INL OP submitted 94 QC samples for various radiological and non-radiological analyses (**Table 23**).

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 analyses will provide a "zero" result when no contaminant is expected to be present or an acceptable measure of "background," and therefore monitor any bias that may have been introduced during sample collection, storage, shipment, and analysis. Blank sample results submitted for gross alpha and gross beta screening in air for the fourth quarter of 2009 are presented in **Table 24**.

Blank sample results for select gamma emitters in air from composited air filters are presented in **Table 25**. Data for blank analyses used to assess data quality for tritium in water vapor in air are presented in **Table 26**. Blank analyses results for radiological and non-radiological analytes in ground and surface water are presented in **Table 27**, **Table 28**, and **Table 29**. One blank analyses for VOCs showed no detectable quantities and is not shown in the tables.

No anomalies were observed from the assessment of field blank samples as measured by the analytical laboratories used by DEQ-INL OP for the fourth quarter of 2009.

Duplicate Samples

Duplicate samples are collected in a manner such that the samples are thought to be essentially identical in composition and are used to assess analytical precision. The difference between the original sample and the duplicate sample is expressed as a relative percent difference (RPD), expressed as:

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

R_1 = first sample result

R_2 = second sample result

and is used to measure a laboratory's ability to reproduce consistent results. A relative percent difference is acceptable at ± 20 percent. For radiological analyses, the standard deviation of the differences can be

used as an indicator of the overall precision of the data set. Duplicate results for ground and surface water are presented in **Table 30, Table 31, Table 32, and Table 33** for radiological analyses, and non-radiological analyses. One gross-beta analysis failed the duplicate criteria. Since the other gross-beta analysis did pass the criteria, none of the sample results will be rejected or qualified as estimates. One fluoride comparison did not meet the duplicate criteria. Since the other fluoride comparison did pass the criteria none of the results will be qualified.

No other anomalies were observed, besides the ones previously mentioned, from the assessment of field duplicate samples as measured by the analytical laboratories used by DEQ-INL OP for the fourth quarter of 2009.

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 fourth quarter 2009, spiked samples were used to assess the influence of the sample media on laboratory performance. These non-radiological constituents were used to assess ground water analyte recovery rates and the results are presented in **Table 34, Table 35, and Table 36**. Five VOC comparisons did not meet the acceptable range for percent recovery. The sample results associated with these analytes will be qualified as estimates (J). One nitrogen analysis failed the estimate (J) criteria, so all nitrogen results will be flagged as estimates.

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 (EIC) to verify EIC response. Irradiations of EICs are conducted in a repeatable geometry to a known exposure of 30 mR and two additional 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 agrees within 25 percent of the known irradiated quantity. The irradiation results for fourth quarter 2009 are presented in **Table 37**. Real-time pressure correction is used to calculate the net exposure measured by these EIC control sets.

There were no other anomalies observed from the assessment of spiked samples as measured by DEQ-INL OP or the analytical laboratories used by DEQ-INL OP for the fourth quarter of 2009.

Analytical QA/QC Assessment

Other than those discussed above, no issues involving sample chain of custody, sample holding times, and the analysis of blank, duplicate, and spiked samples were observed during the fourth quarter of 2009, 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 fourth quarter of 2009.

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 fourth quarter of 2009 met the minimum criteria of the DEQ-INL OP ESP and is summarized in **Table 23**.

Preventative Maintenance and Equipment Reliability

All equipment was calibrated and checked according to pre-described periodicity. Service reliability for air sampling equipment for the fourth quarter of 2009 is summarized in **Table 38**.

Conclusion

All data collected for the fourth quarter of 2009, 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 23. Summary of the analytical performance and usability of the analyses performed for the DEQ-INL OP ESP, fourth quarter, 2009.

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	143	13	0	0	0	ISU-EML
		Gross beta	143	13	0	0	0	ISU-EML
		Gamma emitters	11	1	0	0	0	ISU-EML
		Radiochemical	0	0	0	0	0	ISU Sub
Water Vapor	Desiccant column	Tritium	32	2	0	0	0	ISU-EML
Gaseous	Charcoal filter	Iodine-131	13	0	0	0	0	ISU-EML
Precipitation	Poly bottle	Tritium	5	0	0	0	0	ISU-EML
		Gamma emitters	5	0	0	0	0	ISU-EML
WATER								
Groundwater & Surface Water	Grab or composite	Gross alpha	27	2	2	0	0	ISU-EML
		Gross beta	27	2	2	0	0	ISU-EML
		Gamma emitters	27	2	2	0	0	ISU-EML
		Tritium	27	2	2	0	0	ISU-EML
		Enriched tritium	13	0	0	0	0	ISU-EML
		Technetium-99	13	1	1	0	0	ISU-EML
		Radiochemical	63	8	8	0	0	ISU Sub
		Metals	22	2	2	2	0	IBL
		Common Ions	22	2	2	2	0	IBL
		Nutrients	22	2	2	2	0	IBL
Volatile Organics	6	1	1	2	0	IBL		
TERRESTRIAL								
Milk	Grab or composite	Gamma emitters	16	0	0	0	0	ISU-EML
Soil	<i>in situ</i>	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	10	NA	NA	NA	NA	DEQ-INL OP
Total Analyses			702	53	24	17		
Total of QC Analyses (blanks, duplicates, and spikes)			94					
Percentage of QC analyses of Total Test analyses³			13%					
Percentage of usable data⁴			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 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 24. Blank analysis results for gross alpha and beta in particulate air (TSP), fourth quarter, 2009.

Collection Period		Corrected volume (m ³) ¹	Gross alpha		Gross beta	
Start	Stop		Value	Uncertainty (± 2 SD)	Value	Uncertainty (± 2 SD)
10/01/09	10/08/09	1694	0.0	0.1	0.0	0.3
10/08/09	10/15/09	1694	-0.2	0.2	-0.1	0.3
10/15/09	10/22/09	1694	-0.1	0.2	-0.5	0.3
10/22/09	10/29/09	1694	-0.2	0.2	0.0	0.3
10/29/09	11/05/09	1694	0.0	0.1	0.0	0.3
11/05/09	11/12/09	1694	-0.2	0.2	-0.3	0.3
11/12/09	11/19/09	1694	-0.1	0.1	0.1	0.3
11/19/09	11/25/09	1694	-0.1	0.1	-0.4	0.3
11/25/09	12/03/09	1694	0.0	0.1	-0.2	0.3
12/03/09	12/10/09	1694	-0.1	0.1	-0.2	0.3
12/10/09	12/17/09	1694	-0.1	0.1	-0.2	0.3
12/17/09	12/24/09	1694	-0.1	0.1	0.0	0.3
12/24/09	12/31/09	1694	-0.5	0.2	-0.2	0.4

Note: Concentrations and associated uncertainties (±2 SD) are expressed in 1 x 10⁻³ pCi/m³.

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 25. Blank analysis results for gamma spectroscopy for TSP particulate air filters, fourth quarter, 2009.

Analysis Date	Beryllium-7			Ruthenium-106/ Rhodium-106			Antimony-125		
	Concentration ¹	± 2 SD	MDC	Concentration	± 2 SD	MDC	Concentration	± 2 SD	MDC
2/22/10	-32	68	118	19	33	54	-3	11	19
Analysis Date	Cesium-134			Cesium-137					
	Concentration ¹	± 2 SD	MDC	Concentration	± 2 SD	MDC			
2/22/10	2	4	6	2	4	7			

Note: Concentrations are expressed in 1 x 10⁻⁵ pCi/m³ 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 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 26. Blank analysis results for tritium in water vapor from air samples, fourth quarter, 2009.

Sample Number	Start Date	Collect Date	Analysis Date	Tritium		
				Concentration	± 2 SD	MDC
OP094ZTR01	11/03/09	11/04/09	3/04/10	-0.06	0.09	0.15
OP094ZTR02	12/18/09	12/21/09	3/04/10	-0.03	0.09	0.15

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

Table 27. Radiological blank analysis in ground and surface water for samples, fourth quarter, 2009.

Sample Number	Sample Date	Concentration	± 2 SD	MDC	Within Blank Criteria?
Gross Alpha					
091W571	11/2/2009	0.3	0.7	1.1	Yes
091W578	11/3/2009	0.5	0.7	1.1	Yes
Gross Beta					
091W571	11/2/2009	0.0	0.8	1.4	Yes
091W578	11/3/2009	-0.6	0.8	1.4	Yes
Cesium-137					
091W571	11/2/2009	0.1	1.4	2.4	Yes
091W578	11/3/2009	-0.6	1.4	2.5	Yes
Tritium					
091W573	11/2/2009	20	110	190	Yes
091W579	11/3/2009	20	120	200	Yes
Strontium-90					
091W574	11/2/2009	0.02	0.22	0.48	Yes
Technetium-99					
091W572	11/2/2009	-0.2	0.1	0.2	Yes
Plutonium-238					
091W574	11/2/2009	0.01	0.02	0.02	Yes
Plutonium-239/240					
091W574	11/2/2009	0.00	0.02	0.04	Yes
Plutonium-241					
091W574	11/2/2009	1.0	3.5	5.9	Yes
Americium-241					
091W574	11/2/2009	0.004	0.021	0.030	Yes
Uranium-234					
091W575	11/2/2009	-0.01	0.04	0.09	Yes
Uranium-235					
091W575	11/2/2009	0.01	0.05	0.09	Yes
Uranium-238					
091W575	11/2/2009	0.00	0.04	0.06	Yes

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

Table 28. Blank analysis results (µg/L) for metals in ground and surface water, fourth quarter, 2009.

Sample Number	Sample Date	Arsenic	Barium	Beryllium	Cadmium	Chromium	Iron	Lead	Manganese	Selenium	Zinc
091W577	11/2/2009	<2.0	<1.0	<1.0	<1.0	<1.0	<10	<1.0	<1.0	<2.0	<2.0
091W581	11/3/2009	<2.0	<1.0	NS*	<1.0	<1.0	<10	<1.0	<1.0	<2.0	<2.0

*Not Sampled

Table 29. Blank analysis results (mg/L) for common ions and nutrients in ground and surface water, fourth quarter, 2009.

Sample Number	Sample Date	Calcium	Magnesium	Sodium	Potassium	Fluoride	Chloride	Sulfate	Total Alkalinity	Total Nitrogen	Total Phosphorus
091W577,576,616	11/2/2009	<0.10	<0.10	<0.10	<0.10	<0.20	<0.40	<0.80	<1.0	<0.010	<0.0050
091W581,580,582	11/3/2009	<0.10	<0.10	<0.10	<0.10	<0.20	<0.40	<0.80	<1.0	<0.010	<0.0050

Table 30. Duplicate radiological analysis results in pCi/L for ground and surface water, fourth quarter, 2009.

Analysis/ Sample Location	Original Sample Number	Concentration	±2 SD	Duplicate Sample Number	Concentration	±2 SD	R ₁ -R ₂	3(s ₁ ² +s ₂ ²) ^{1/2}	Within Criteria? ¹
Gross Alpha									
M3S	091W439	1.7	2.6	091W552	-0.6	2.5	2.3	5.4	yes
USGS-125	091W517	-1.6	2.7	091W593	0.3	2.3	1.9	5.3	yes
Gross Beta									
M3S	091W439	7.5	1.2	091W552	3.6	1.1	3.9	2.4	no
USGS-125	091W517	3.8	1.1	091W593	3.0	1.0	0.8	2.2	yes
Gamma Spectroscopy Cesium-137									
M3S	091W439	0.6	2.0	091W552	0.6	1.4	0	3.7	yes
USGS-125	091W517	0.1	1.4	091W593	0.1	1.4	0	3.0	yes
Tritium									
M3S	091W441	930	140	091W555	1030	140	100	297	yes
USGS-125	091W518	40	120	091W594	-30	120	70	255	yes
Strontium-90									
M3S	091W442	-0.03	0.16	091W556	0.25	0.23	0.28	0.4	yes
Technetium-99									
M3S (dissolved)	091W440	1.3	0.2	091W554	1.3	0.2	0	0.4	yes
Plutonium-238									
M3S	091W442	0.00	0.02	091W556	0.00	0.02	0.024	0.042	yes
Plutonium-239/240									
M3S	091W442	0.01	0.02	091W556	0.01	0.02	0	0.042	yes
Plutonium-241									
M3S	091W442	1.3	2.6	091W556	1.2	4.1	0.1	7.3	yes
Uranium-234									
M3S	091W443	1.47	0.36	091W557	1.42	0.35	0.05	0.75	yes
Uranium-235									
M3S	091W443	0.00	0.05	091W557	0.05	0.06	0.05	0.117	yes
Uranium-238									
M3S	091W443	0.81	0.24	091W557	0.69	0.21	0.12	0.48	yes
Americium-241									
M3S	091W442	0.00	0.02	091W556	0.00	0.02	0.00	0.04	yes

¹ |R₁-R₂| ≤ 3(s₁²+s₂²)^{1/2}

Table 31. Duplicate results for metals (µg/L) in ground water and/or surface water, fourth quarter, 2009.

Sample Location	Sample Number	Sample Date	Arsenic	Barium	Cadmium	Chromium	Iron	Lead	Manganese	Selenium	Zinc
M3S (total)	091W445	11/2/2009	<2	47	<1	13	14	<1	<1	<2	<2
M3S (total)	091W559	11/2/2009	<2	47	<1	13	16	<1	<1	<2	<2
RPD			0	0	0	0	-13	0	0	0	0
USGS-125 (dissolved)	091W520	10/26/2009	-	42	-	2.9	-	<1	18	-	<2
USGS-125 (dissolved)	091W596	10/26/2009	-	42	-	3	-	<1	18	-	<2
RPD				0		-3		0	0		0

Relative Percent Difference = $(R1-R2) / ((R1+ R2)/2)*100$

Table 32. Duplicate results for common ions and nutrients (mg/L) in ground water and/or surface water, fourth quarter, 2009.

Sample Location	Sample Number	Sample Date	Calcium	Magnesium	Sodium	Potassium	Fluoride	Chloride	Sulfate	Total Alkalinity	Total Nitrogen	Total Phosphorus
M3S	091W445,444,446	11/2/2009	43	14	8.2	2.6	0.22	14.7	26.1	143	0.84	0.022
M3S	091W559,558,560	11/2/2009	43	14	8.2	2.6	0.20	14.8	26.2	143	0.84	0.022
RPD			0	0	0	0	10	-1	0	0	0	0
USGS-125	091W521	10/26/2009	37	14	11	2.7	0.20	12.8	24.5	141	0.61	0.014
USGS-125	091W597	10/26/2009	37	14	11	2.7	0.26	12.9	24.9	140	0.61	0.014
RPD			0	0	0	0	-26	-1	-2	1	0	0

Relative Percent Difference = $(R1-R2) / ((R1+ R2)/2)*100$

Table 33. Duplicate results for VOCs (µg/L) in ground water and/or surface water, fourth quarter, 2009.

Sample Location	Sample Date	Sample Number	Concentrations	
			Carbon tetrachloride	Trichloroethylene
M3S	11/2/2009	091W447	5.7	1.5
M3S	11/2/2009	091W561	5.8	1.5
RPD			-2	0

Relative Percent Difference = $(R1-R2) / ((R1+ R2)/2)*100$

Table 34. De-ionized water spike results (in µg/L) and percent recovery for metals in ground and surface water, fourth quarter, 2009.

Spike Sample Number	Sample Date	Barium			Chromium			Lead			Manganese			Zinc		
		spike	result	%R ¹	spike	result	%R	spike	result	%R	spike	result	%R	spike	result	%R
091W564	10/15/2009	52.9	56	106	61.1	59	97	6.78	7.2	106	6.33	6.2	98	167	140	84
091W568	11/4/2009	73.7	80	109	85.1	84	99	6.02	6.60	110	8.81	8.9	101	233	200	86

¹A percent recovery of 100 ± 25 is considered acceptable and is recorded as %R.

Table 35. De-ionized water spike results (in mg/L) and percent recovery for common ions and nutrients in ground and surface water, fourth quarter, 2009.

Spike Sample Number	Sample Date	Calcium			Magnesium			Sodium			Potassium			Fluoride		
		spike	result	%R ¹	spike	result	%R	spike	result	%R	spike	result	%R	spike	result	%R
091W563, 564	10/15/2009	15.5	15	97	7.94	7.7	97	15.5	15	97	2.98	2.9	97	1.15	1.11	97
091W567, 568	11/4/2009	21.5	21	98	11.1	11	99	21.7	21	97	4.15	4.0	96	1.10	1.03	94

¹A percent recovery of 100 ± 25 is considered acceptable and is recorded as %R.

Table 35. continued. De-ionized water spike results (in mg/L) and percent recovery for common ions and nutrients in ground and surface water, fourth quarter, 2009.

Spike Sample Number	Sample Date	Chloride			Sulfate			Total Alkalinity as CaCO ₃			Total Nitrogen			Total Phosphorus		
		spike	result	%R ¹	spike	result	%R	spike	result	%R	spike	result	%R	spike	result	%R
091W563, 565	10/15/2009	18.7	19.4	104	18.5	18.1	98	51.0	51.0	100	1.04	1.50	144	0.0274	0.026	95
091W567, 569	11/4/2009	45.7	37.1	81	17.3	16.6	96	48.3	47.0	97	2.7	2.7	100	0.0179	0.019	106

¹A percent recovery of 100 ± 25 is considered acceptable and is recorded as %R.

Table 36. De-ionized water spike results (in µg/L) and percent recovery for VOCs in ground and surface water, fourth quarter, 2009.

Spike Sample Number	Sample Date	cis-1,2-Dichloroethylene			trans-1,2-Dichloroethylene			Toluene			Trichloroethylene			Vinyl Chloride		
		spike	result	%R	spike	result	%R	spike	result	%R	spike	result	%R	spike	result	%R
091W566	10/15/2009	17.1	21.0	123	13.6	18.0	132	10.2	13.0	127	13.4	17.0	127	8.18	13.0	159
Spike Sample Number	Sample Date	Carbon tetrachloride			Styrene			Tetrachloroethylene			Trichloroethylene			Vinyl Chloride		
		spike	result	%R	spike	result	%R	spike	result	%R	spike	result	%R	spike	result	%R
091W570	11/4/2009	17.0	22.0	129	18.5	17.0	92	10.2	9.40	92	14.8	17.0	115	18.7	23.0	123

¹A percent recovery of 100 ± 25 is considered acceptable and is recorded as %R.

Table 37. Electret ionization chamber irradiation results (categorized as spiked samples), fourth quarter, 2009.

Electret #	Exposure Received		Net Measured Exposure ¹		%R
	(mR)	Uncertainty (mR)	(mR)	Uncertainty (mR)	
Spike 1	35	1.8	38.7	1.3	110.5%
Spike 1	35	1.8	34.1	1.4	97.4%
Spike 1	35	1.8	34.5	1.3	98.5%
Spike 2	30	1.5	30.6	1.3	101.8%
Spike 2	30	1.5	28.8	1.3	96.1%
Spike 2	30	1.5	28.7	1.3	95.8%
Spike 3	25	1.3	23.2	1.3	92.7%
Spike 3	25	1.3	23.4	1.4	93.5%
Spike 3	25	1.3	23.5	1.3	94.1%

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

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

Table 38. Air sampling field equipment service reliability (percent operational), fourth quarter, 2009.

Station Locations	Sample Type			
	TSP	Radioiodine	Atmospheric Moisture	Precipitation
Onsite Locations				
Big Lost River Rest Area	100 %	100 %	100 %	100 %
Experimental Field Station	100 %	100 %	100 %	NC ¹
Sand Dunes Tower	100 %	100 %	100 %	NC ¹
Van Buren Avenue	100 %	100 %	100 %	NC ¹
Boundary Locations				
Atomic City	100 %	100 %	100 %	100 %
Howe	100 %	100 %	100 %	100 %
Montevue ²	100 %	100 %	100 %	0 %
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.

¹NC = sample not collected at this location

²Montevue precipitation sampler hose became detached from the collection container

Appendix A

Table A-1. Weekly concentrations (in 1×10^{-3} pCi/m³) for gross alpha and gross beta analyses for TSP filters for all locations, fourth quarter, 2009.

Sample location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	± 2 SD	Concentration	± 2 SD
Rest Area	10/01/09	10/08/09	0.4	0.2	22.0	1.0
	10/08/09	10/15/09	0.9	0.3	33.9	1.3
	10/15/09	10/22/09	0.7	0.2	23.1	1.1
	10/22/09	10/29/09	0.6	0.3	19.9	1.0
	10/29/09	11/05/09	1.4	0.3	32.3	1.3
	11/05/09	11/12/09	0.7	0.3	25.7	1.2
	11/12/09	11/19/09	1.0	0.3	29.9	1.2
	11/19/09	11/25/09	0.3	0.2	22.5	1.2
	11/25/09	12/03/09	1.0	0.2	40.8	1.3
	12/03/09	12/10/09	1.0	0.3	48.8	1.6
	12/10/09	12/17/09	1.1	0.3	51.1	1.6
	12/17/09	12/24/09	1.0	0.3	40.4	1.4
	12/24/09	12/31/09	0.3	0.3	46.8	1.5
Experimental Field Station	10/01/09	10/08/09	0.5	0.2	21.3	1.0
	10/08/09	10/15/09	0.8	0.3	30.6	1.2
	10/15/09	10/22/09	0.8	0.3	20.4	1.0
	10/22/09	10/29/09	0.6	0.3	21.1	1.0
	10/29/09	11/05/09	1.3	0.3	30.7	1.2
	11/05/09	11/12/09	0.9	0.3	31.9	1.3
	11/12/09	11/19/09	0.7	0.2	28.2	1.2
	11/19/09	11/25/09	0.7	0.3	21.4	1.1
	11/25/09	12/03/09	1.2	0.3	54.4	1.5
	12/03/09	12/10/09	1.0	0.3	43.5	1.5
	12/10/09	12/17/09	1.3	0.3	54.0	1.6
	12/17/09	12/24/09	1.4	0.3	43.0	1.5
	12/24/09	12/31/09	0.5	0.3	54.3	1.6

Table A-1 continued. Weekly concentrations (in 1×10^{-3} pCi/m³) for gross alpha and gross beta analyses for TSP filters for all locations, fourth quarter, 2009.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	± 2 SD	Concentration	± 2 SD
Sand Dunes	10/01/09	10/08/09	0.3	0.2	18.0	1.0
	10/08/09	10/15/09	0.5	0.2	29.9	1.2
	10/15/09	10/22/09	0.6	0.2	17.2	1.0
	10/22/09	10/29/09	0.4	0.2	18.3	1.0
	10/29/09	11/05/09	1.0	0.3	30.6	1.2
	11/05/09	11/12/09	0.7	0.3	24.7	1.1
	11/12/09	11/19/09	1.0	0.3	30.3	1.2
	11/19/09	11/25/09	0.5	0.3	23.5	1.2
	11/25/09	12/03/09	0.8	0.2	37.4	1.3
	12/03/09	12/10/09	0.7	0.2	38.5	1.4
	12/10/09	12/17/09	1.2	0.3	54.4	1.6
	12/17/09	12/24/09	1.5	0.3	40.7	1.4
12/24/09	12/31/09	0.5	0.3	40.8	1.4	
Van Buren	10/01/09	10/08/09	0.7	0.2	26.1	1.1
	10/08/09	10/15/09	0.6	0.2	36.1	1.3
	10/15/09	10/22/09	0.8	0.3	27.8	1.2
	10/22/09	10/29/09	0.5	0.3	22.8	1.1
	10/29/09	11/05/09	1.2	0.3	37.2	1.4
	11/05/09	11/12/09	0.6	0.2	31.4	1.3
	11/12/09	11/19/09	0.9	0.3	32.9	1.3
	11/19/09	11/25/09	0.5	0.3	24.4	1.2
	11/25/09	12/03/09	1.7	0.3	46.5	1.4
	12/03/09	12/10/09	1.1	0.3	55.8	1.7
	12/10/09	12/17/09	1.4	0.3	64.5	1.8
	12/17/09	12/24/09	1.5	0.3	48.1	1.6
12/24/09	12/31/09	0.5	0.3	53.5	1.6	
Atomic City	10/01/09	10/08/09	0.6	0.2	22.0	1.1
	10/08/09	10/15/09	0.8	0.3	33.5	1.3
	10/15/09	10/22/09	0.8	0.3	22.9	1.1
	10/22/09	10/29/09	0.6	0.3	18.9	1.0
	10/29/09	11/05/09	0.8	0.2	32.5	1.3
	11/05/09	11/12/09	0.5	0.2	29.9	1.3
	11/12/09	11/19/09	1.1	0.3	30.0	1.2
	11/19/09	11/25/09	0.4	0.3	22.7	1.2
	11/25/09	12/03/09	0.8	0.2	45.1	1.4
	12/03/09	12/10/09	0.6	0.2	39.3	1.4
	12/10/09	12/17/09	1.0	0.3	50.3	1.6
	12/17/09	12/24/09	1.6	0.3	42.3	1.5
12/24/09	12/31/09	0.4	0.3	53.2	1.6	

Table A-1 continued. Weekly concentrations (in 1×10^{-3} pCi/m³) for gross alpha and gross beta analyses for TSP filters for all locations, fourth quarter, 2009.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	± 2 SD	Concentration	± 2 SD
Howe	10/01/09	10/08/09	0.5	0.2	20.7	1.0
	10/08/09	10/15/09	0.7	0.3	29.3	1.2
	10/15/09	10/22/09	0.6	0.2	21.7	1.1
	10/22/09	10/29/09	0.6	0.3	21.5	1.1
	10/29/09	11/05/09	1.0	0.3	33.4	1.3
	11/05/09	11/12/09	0.5	0.2	24.6	1.1
	11/12/09	11/19/09	0.9	0.3	26.7	1.2
	11/19/09	11/25/09	0.8	0.3	22.3	1.2
	11/25/09	12/03/09	0.9	0.2	40.6	1.3
	12/03/09	12/10/09	1.2	0.3	41.3	1.5
	12/10/09	12/17/09	0.9	0.3	45.9	1.5
	12/17/09	12/24/09	1.5	0.3	45.2	1.5
	12/24/09	12/31/09	0.3	0.3	36.5	1.4
Montevieu	10/01/09	10/08/09	0.8	0.2	24.8	1.1
	10/08/09	10/15/09	1.0	0.3	40.5	1.4
	10/15/09	10/22/09	1.0	0.3	25.0	1.1
	10/22/09	10/29/09	0.8	0.3	26.9	1.2
	10/29/09	11/05/09	1.6	0.3	44.6	1.5
	11/05/09	11/12/09	1.4	0.3	36.5	1.4
	11/12/09	11/19/09	1.5	0.3	37.2	1.3
	11/19/09	11/25/09	0.7	0.3	22.4	1.2
	11/25/09	12/03/09	1.3	0.3	50.8	1.5
	12/03/09	12/10/09	1.3	0.3	55.2	1.7
	12/10/09	12/17/09	1.6	0.3	63.6	1.8
	12/17/09	12/24/09	1.4	0.3	43.7	1.5
	12/24/09	12/31/09	1.0	0.4	50.9	1.6
Mud Lake	10/01/09	10/08/09	0.7	0.2	20.2	1.0
	10/08/09	10/15/09	1.1	0.3	29.4	1.2
	10/15/09	10/22/09	0.7	0.3	19.3	1.0
	10/22/09	10/29/09	0.8	0.3	21.3	1.1
	10/29/09	11/05/09	1.3	0.3	31.6	1.3
	11/05/09	11/12/09	0.7	0.3	29.3	1.2
	11/12/09	11/19/09	1.0	0.3	28.7	1.2
	11/19/09	11/25/09	0.9	0.3	22.7	1.2
	11/25/09	12/03/09	1.0	0.2	34.7	1.2
	12/03/09	12/10/09	1.1	0.3	32.8	1.3
	12/10/09	12/17/09	0.9	0.3	48.2	1.5
	12/17/09	12/24/09	1.3	0.3	37.8	1.4
	12/24/09	12/31/09	0.8	0.3	57.0	1.7

Table A-1 continued. Weekly concentrations (in 1×10^{-3} pCi/m³) for gross alpha and gross beta analyses for TSP filters for all locations, fourth quarter, 2009.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	± 2 SD	Concentration	± 2 SD
Distant Locations						
Craters						
	10/01/09	10/08/09	0.3	0.2	17.0	0.9
	10/08/09	10/15/09	0.3	0.2	24.1	1.1
	10/15/09	10/22/09	0.3	0.2	16.5	0.9
	10/22/09	10/29/09	0.4	0.2	15.4	0.9
	10/29/09	11/05/09	0.7	0.2	25.1	1.1
	11/05/09	11/12/09	0.4	0.2	20.2	1.0
	11/12/09	11/19/09	0.8	0.2	21.1	1.0
	11/19/09	11/25/09	0.2	0.2	13.5	0.9
	11/25/09	12/03/09	0.5	0.2	27.2	1.1
	12/03/09	12/10/09	0.8	0.3	42.0	1.5
	12/10/09	12/17/09	0.6	0.2	37.3	1.4
	12/17/09	12/24/09	1.2	0.3	31.9	1.3
	12/24/09	12/31/09	0.1	0.3	38.4	1.4
Fort Hall'						
	10/01/09	10/08/09	0.4	0.2	16.5	0.9
	10/08/09	10/15/09	0.6	0.2	22.4	1.1
	10/15/09	10/22/09	0.5	0.2	18.1	1.0
	10/22/09	10/29/09	1.0	0.3	14.3	0.9
	10/29/09	11/05/09	1.0	0.3	18.1	1.0
	11/05/09	11/12/09	1.0	0.3	24.6	1.1
	11/12/09	11/19/09	0.9	0.3	16.9	1.0
	11/19/09	11/25/09	0.5	0.3	13.0	0.9
	11/25/09	12/03/09	0.8	0.2	28.2	1.1
	12/03/09	12/10/09	0.7	0.2	26.5	1.2
	12/10/09	12/17/09	0.6	0.2	28.6	1.2
	12/17/09	12/24/09	1.1	0.3	25.7	1.1
	12/24/09	12/31/09	0.4	0.3	50.9	1.6
Idaho Falls						
	10/01/09	10/08/09	0.7	0.2	25.8	1.1
	10/08/09	10/15/09	0.9	0.3	38.7	1.4
	10/15/09	10/22/09	0.9	0.3	31.1	1.3
	10/22/09	10/29/09	0.8	0.3	25.2	1.1
	10/29/09	11/05/09	1.6	0.3	37.5	1.4
	11/05/09	11/12/09	1.6	0.5	61.3	2.4
	11/12/09	11/19/09	1.6	0.3	36.4	1.3
	11/19/09	11/25/09	1.0	0.3	22.8	1.2
	11/25/09	12/03/09	1.3	0.3	46.2	1.4
	12/03/09	12/10/09	1.0	0.3	38.9	1.4
	12/10/09	12/17/09	0.9	0.3	42.3	1.4
	12/17/09	12/24/09	1.4	0.3	38.9	1.4
	12/24/09	12/31/09	0.6	0.3	57.8	1.7

Operated by Shoshone-Bannock Tribe

Appendix B

Table B-1. Results for all electret locations, fourth quarter, 2009.

Sample Location	Net Corrected Exposure Rate ($\mu\text{R/h}$)	± 2 SD ($\mu\text{R/h}$)
Arco	15.6	3.9
Craters	16.2	1.8
Rest Area	14.1	0.2
Van Buren	18.9	2.4
EFS	18.8	3.3
Main Gate	18.2	1.8
Atomic City	12.8	0.2
Taber	15.5	1.9
Blackfoot	12.0	1.2
Ft. Hall	14.8	1.9
Idaho Falls	12.5	3.6
Mud Lake/ Terretton	15.0	2.5
Monteview	13.9	3.5
Sand Dunes	15.5	0.7
Howe ¹	² NS	² NS
Howe Met Tower	14.9	2.8
MP276 -20	10.0	0.8
MP274 -20	10.9	2.2
MP272 -20	12.1	1.9
MP270 -20	14.8	2.5
MP268 -20	16.4	1.9
MP266 -20	13.5	2.3
MP264 -20	12.6	2.7
MP270 -20/26	16.4	2.3
MP268 -20/26	13.7	3.1
MP266 -20/26	14.6	2.7
MP263 -20/26	12.7	2.0
MP261 -20/26	14.1	3.7
MP259 -20/26	13.4	3.7
MFC (EBR II)	16.8	2.0
EBR I	13.4	0.6
RWMC	17.3	2.9
CFA	16.0	1.8
CITRC (PBF)	14.2	3.5

¹ The air monitoring station at Howe has been re-located to a more reliable location at the Howe NOAA Met Tower which already contains an EIC, therefore the Howe EIC will be dropped and will not appear in future reports.

²NS = No sample collected at this location

Table B-1 continued. Results for all electret locations, fourth quarter, 2009.

Sample Location	Net Corrected Exposure Rate ($\mu\text{R/h}$)	± 2 SD ($\mu\text{R/h}$)
INTEC (ICPPI)	13.2	1.2
ATR (TRA)	16.4	2.7
NRF	17.5	1.7
TAN	13.7	3.5
Mud Lake Bank of Commerce	17.1	2.5
MP43-33	20.2	1.2
MP41-33	17.4	3.3
MP39-33	17.0	2.4
MP37-33	13.1	1.2
MP35-33	13.8	3.5
MP33-33	14.8	2.9
MP31-33	15.8	3.9
MP29-33	14.2	0.0
MP27-33	20.0	0.9
MP25-33	17.0	4.0
MP23-33	15.6	0.4
Base of Howe	13.9	3.2
Rover	15.1	1.2
Hamer	15.0	2.0
Sugar City	19.6	0.2
Roberts	14.2	3.6
Big Southern Butte	11.2	2.4

Appendix C

Table C-1. List of volatile organic compounds (VOCs) analyzed for water samples. Minimum detectable concentrations (MDC) are expressed in µg/L.

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	0.5
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. Minimum detectable concentrations (MDC) are expressed in µg/L.

Analyte	Minimum detectable concentrations (MDC) (expressed in µg/L)
4-Chlorotoluene	0.5
1,2-Dibromo-3-chloropropane (DBCP)	1.0
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	0.5
Hexachlorobutadiene	0.5
Isopropylbenzene	0.5
p-Isopropyltoluene	0.5
Methyl Tert Butyl Ether (MTBE)	1.0
Naphthalene	1.0
n-Propylbenzene	0.5
1,1,1,2-Tetrachloroethane	0.5
1,1,2,2-Tetrachloroethane	0.5
1,2,3-Trichlorobenzene	1.25
Trichlorofluoromethane	0.5
1,2,3-Trichloropropane	0.5
1,2,4-Trimethylbenzene	0.5
1,3,5-Trimethylbenzene	0.5