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 1/1000th 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 third 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 second 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 x 10^{-6} pCi/m^3) 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 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. Atmospheric tritium was measured above the minimum detectable concentration for 4 of the samples collected at the Experimental Field Station and one at the Van Buren Avenue station during the third quarter of 2009. The weighted average for all samples at the Experimental Field Station exceeded the weighted MDC for the third quarter. All of these samples were less than 1 % of the DEQ-INL OP action level, which is 10 % of the 40CFR61, Appendix E, Table 2 emission limits. Average atmospheric tritium concentrations are presented in **Table 4**.

Precipitation samples were collected at six monitoring locations during the third 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 third quarter of 2009. Tritium and Cesium-137 analysis results 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. There were no analytical results for either radionuclide above the analytical MDC and well within regulatory limits.

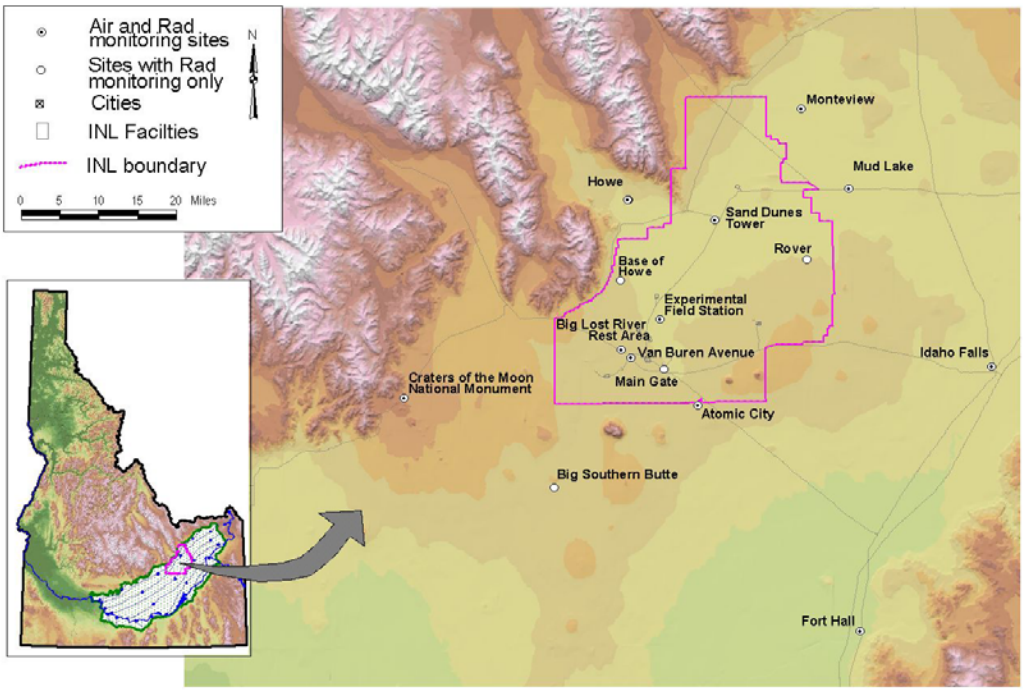

Figure 1. Air and radiation monitoring sites.

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, 2009. Concentrations are reported in 1x 10^{-3} pCi/m^3.

Station Location	Concentration	
	Gross Alpha	Gross Beta
On-Site Locations		
Big Lost River Rest Area	0.9 - 1.8	29.7 - 46.6
Experimental Field Station	0.9 - 1.6	29.2 - 44.7
Sand Dunes Tower	0.8 - 1.5	26.7 - 46.9
Van Buren Avenue	0.8 - 1.6	30.8 - 50.2
Boundary Locations		
Atomic City	0.9 - 1.4	29.5 - 43.0
Howe	0.8 - 1.5	23.9 - 43.3
Monteview	1.1 - 2.0	31.7 - 51.6
Mud Lake	0.8 - 1.6	25.6 - 42.7
Distant Locations		
Craters of the Moon	0.5 - 1.3	24.3 - 38.6
Fort Hall[1]	1.0 - 2.0	21.5 - 33.6
Idaho Falls	1.3 - 2.6	36.5 - 69.0

[1]Operated by Shoshone-Bannock Tribes.

Table 3. Gamma spectroscopy analysis data for TSP filters, composite samples, third quarter, 2009. Concentrations are reported in 1 x 10^{-3} pCi/m^3 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	115.9	6.0	<MDC[2]
Experimental Field Station	113.5	6.1	<MDC
Sand Dunes Tower	104.9	5.7	<MDC
Van Buren Avenue	120.1	6.2	<MDC
Boundary Locations			
Atomic City	113.9	6.1	<MDC
Howe	109.4	5.7	<MDC
Monteview	140.6	7.2	<MDC
Mud Lake	101.6	5.5	<MDC
Distant Locations			
Craters of the Moon	104.5	5.5	<MDC
Fort Hall[1]	85.4	4.6	<MDC
Idaho Falls	156.0	8.0	<MDC

[1]Operated by Shoshone-Bannock Tribes.
[2]MDC for Cs-137 typically (5-10)x10^{-5} pCi/m^3.

Table 4. Tritium concentrations in air from atmospheric moisture, third quarter, 2009. Concentrations are reported in pCi/m^3 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	0.52	0.44	0.73
Experimental Field Station	0.76	0.39	0.64
Sand Dunes Tower	0.19	0.42	0.70
Van Buren Avenue	0.50	0.39	0.65
Boundary Locations			
Atomic City	0.14	0.38	0.64
Howe	0.14	0.47	0.79
Mud Lake	0.23	0.55	0.87
Monteview	0.19	0.55	0.91
Distant Locations			
Craters of the Moon	0.04	0.24	0.41
Fort Hall[1]	0.11	0.51	0.85
Idaho Falls	0.08	0.49	0.81

[1]Operated by Shoshone-Bannock Tribes.

Table 5. Tritium and Cesium-137 concentrations from precipitation, third 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	0	110	190	0.4	1.4	2.4
Boundary Locations						
Atomic City	0	110	190	0.1	1.5	2.7
Howe	20	110	190	0.9	1.5	2.5
Monteview	0	110	190	1.9	2.0	3.3
Mud Lake	10	110	190	0.0	1.7	2.9
Distant Locations						
Idaho Falls	0	110	190	0.2	1.5	2.6

Environmental Radiation Monitoring Results

The ESP operated 14 environmental radiation stations during the third 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 third quarter 2009. **Table 8** lists the EIC monitoring results for third quarter 2009. Overall exposure rates were within the expected historical range of values observed by DEQ-INL OP for background radiation. The Howe Met Tower HPIC average gamma exposure rate, although less than half of INL-Oversight's action level, exhibited a higher than normal uncertainty level which was analyzed by Oversight staff and found to be the result of equipment malfunction.

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, third quarter, 2009, from HPIC network.

Station Location	Exposure Rate (µR/hr)	
	Quarterly Average	± 2 SD
On-site Locations		
Base of Howe	11.3	1.1
Big Lost River Rest Area[1]	NS	NS
Main Gate	14.3	0.7
Rover	14.0	0.8
Sand Dunes Tower	14.7	2.4
Boundary Locations		
Atomic City	13.2	1.5
Big Southern Butte	14.3	1.1
Howe Met Tower[2]	13.2	7.4
Monteview	12.9	0.5
Mud Lake	12.5	1.2
Distant Locations		
Fort Hall[3]	14.7	1.5
Idaho Falls[4]	NS	NS

[1] Sampling at Big Lost River Rest Area was suspended due to construction and has not been re-deployed.
[2] 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.
[3] Operated by Shoshone-Bannock Tribes.
[3] Equipment failure prevented data collection.

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

Station Location	Exposure Rate (µR/hr)	
	Quarterly Average	± 2 SD
On-site Locations		
Base of Howe	10.9	1.6
Big Lost River Rest Area	12.5	0.9
Experimental Field Station	16.3	3.2
Main Gate	15.5	1.5
Rover	14.6	5.7
Sand Dunes Tower	15.2	3.0
Van Buren Avenue	17.3	2.1
Boundary Locations		
Atomic City	15.3	3.6
Big Southern Butte	13.5	3.6
Howe Met Tower[2]	10.6	2.4
Monteview	13.9	4.5
Mud Lake	14.5	4.6
Distant Locations		
Craters of the Moon	13.3	3.1
Fort Hall[1]	12.4	0.2
Idaho Falls	12.7	2.5

[1] Station operated by Shoshone-Bannock Tribes.
[2] The 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 third quarter of 2009, 1 up-gradient, 3 boundary, and 7 distant 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 distant location. The concentration observed at this location is 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 3 areas (up-gradient, boundary, and distant) sampled. Two of the boundary locations were equipped with the Westbay™ packer sampling system. The Westbay™ system is designed to allow samples to be taken from several isolated vertical zones within the wells. This enables scientists to determine the vertical distribution of contaminants at that location. DEQ-INL sampled the zone most likely to contain the highest concentrations of contamination. USGS-135 was sampled at a depth of 1111.8 feet and USGS- 105 was sampled at 1240.5 feet below land surface. Concentrations for up-gradient, boundary, and distant locations were within the range of concentrations observed for naturally-occurring radioactivity. The MCL for beta and gamma radioactivity is based on 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. Results for gross alpha; gross beta; and man-made, gamma emitting radioactivity are shown in **Table 9**.

Using the standard analytical method, tritium was detected in two of eleven samples (**Table 10**). Detections were consistent with historic concentrations for these sites. There were no detectable concentrations in the up-gradient or distant locations. 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. Twenty samples, from a backlog of 31samples, were analyzed using the enrichment method this quarter (**Table 11**). One of the twenty samples is a Quality Assurance (QA) sample. The backlog is due to technical difficulties. There is currently a backlog of 25 samples, including one QA sample.

Samples were also analyzed for metals and the results shown in **Table 12**. All results were within their expected ranges. Common ion results are shown in **Table 13** and nutrient results are shown in **Table 14**. All results were consistent with historical values at those locations.

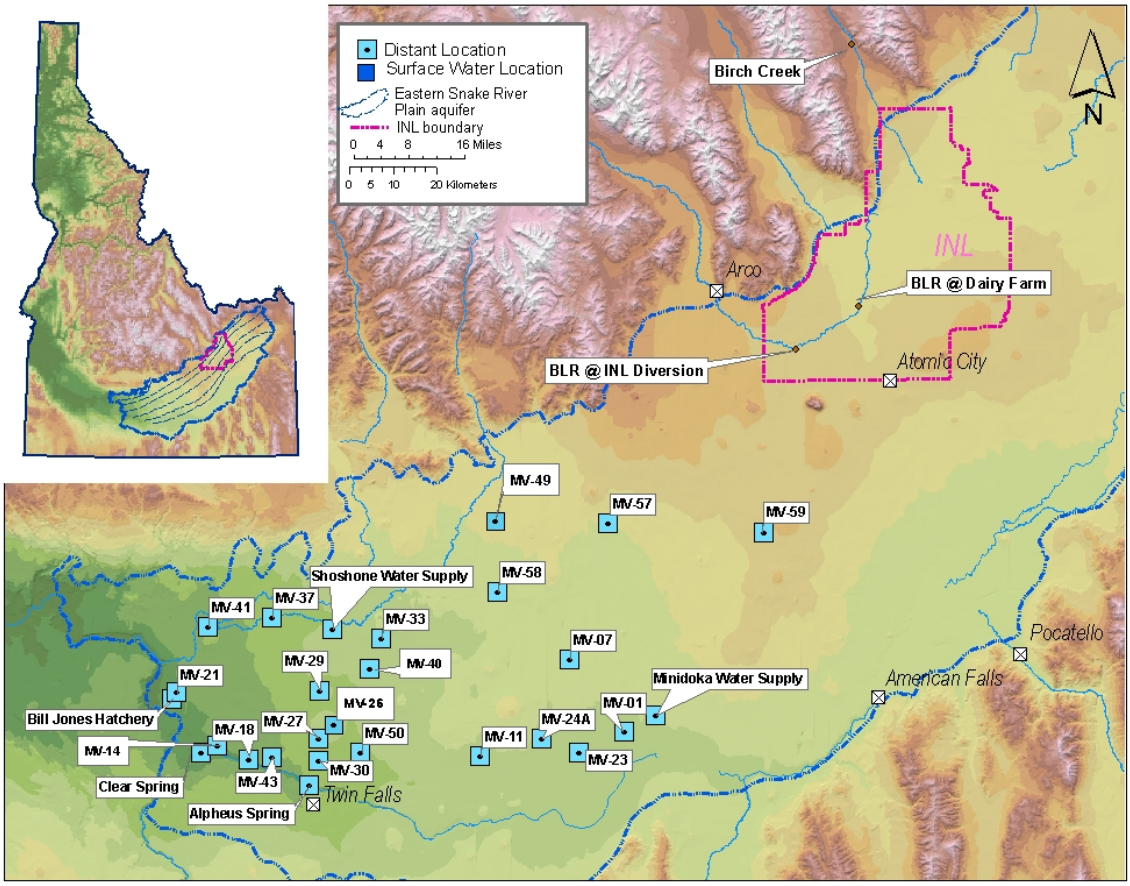

Figure 2. Distant sampling locations for third quarter, 2009.

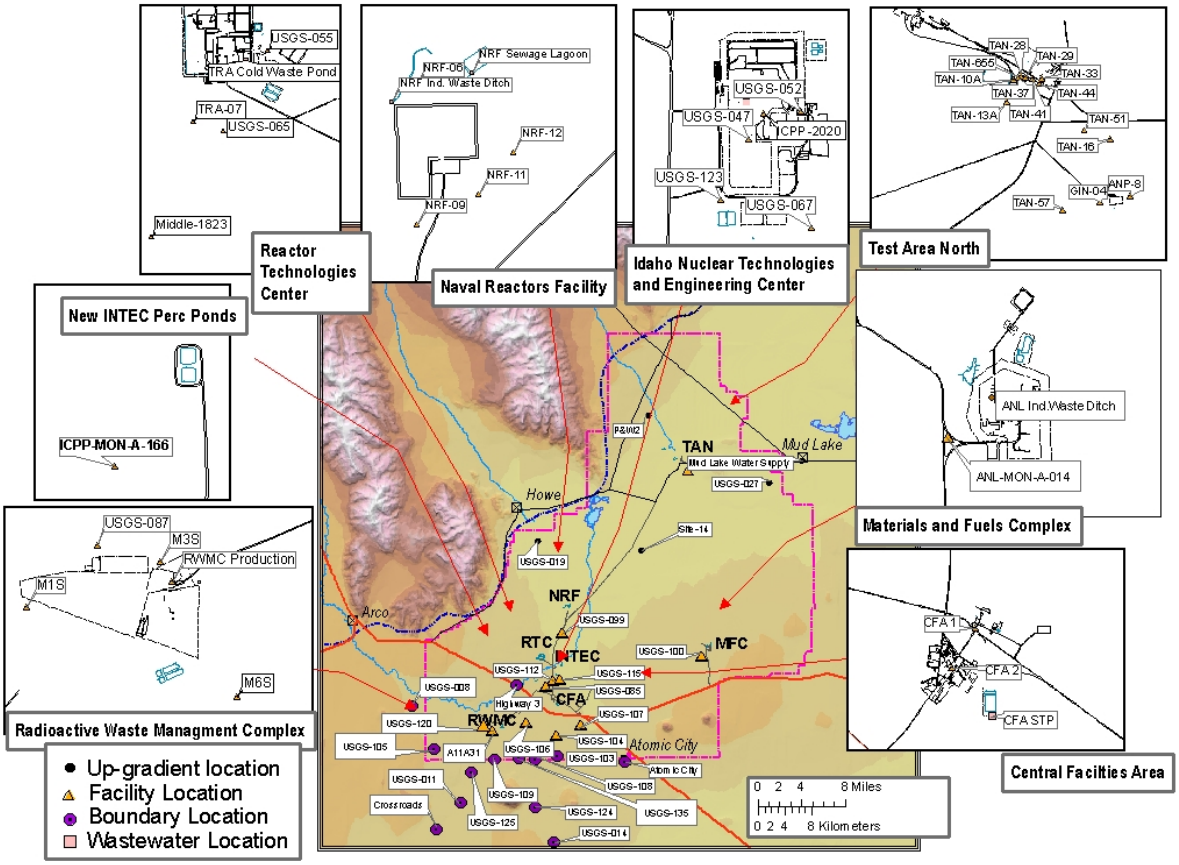

Figure 3. Up-gradient, facility, boundary and wastewater monitoring locations.

Table 9. Alpha, beta, and gamma concentrations for water samples, third 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	8/20/2009	-0.7	U	1.6	4.5		1.0	0.4	U	1.5
Boundary										
USGS-103	8/25/2009	1.7	U	2.5	3.3		1.0	-0.3	U	1.4
USGS-105	9/16/2009	3.0	U	2.5	4.2		1.0	0.0	U	1.4
USGS-135	9/14/2009	2.8	U	2.2	1.9		1.0	0.5	U	1.5
Distant										
Alpheus Spring	8/11/2009	1.8	U	2.9	8.3		1.2	-0.4		1.4
Bill Jones Hatchery	8/11/2009	3.1	U	2.3	3.7		1.0	-0.8	U	1.5
Minidoka Water Supply	8/11/2009	0.0	U	2.7	3.2		1.1	-0.3	U	1.3
MV-26	7/29/2009	3.4	U	2.3	4.5		1.0	1.1	U	1.4
MV-49	8/19/2009	6.7		2.8	3.7		1.1	0.3	U	1.4
MV-59	7/29/2009	0.6	U	1.7	4.2		1.0	-0.2	U	1.5
Shoshone Water Supply	8/11/2009	-1.7	U	2.4	2.1		1.0	0.5	U	1.5

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

Table 10. Tritium concentrations for water samples, third quarter, 2009.

Sample Location	Sample Date	Tritium		
		Concentration[1,2]		± 2 SD
Up-gradient				
Mud Lake Water Supply	8/20/2009	-40	U	80
Boundary				
USGS-103	8/25/2009	330		90
USGS-105	9/16/2009	190		90
USGS-135	9/14/2009	10	U	80
Distant				
Alpheus Spring	8/11/2009	-70	U	70
Bill Jones Hatchery	8/11/2009	-60	U	70
Minidoka Water Supply	8/11/2009	-50	U	80
MV-26	7/29/2009	-10	U	90
MV-49	8/19/2009	-10	U	80
MV-59	7/29/2009	10	U	90
Shoshone Water Supply	8/11/2009	70	U	80

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

Table 11. Enriched Tritium concentrations for water samples, third quarter, 2009.

Sample Location	Sample Date	Enriched Tritium		
		Concentration[1,2]		± 2 SD
Up-gradient				
Mud Lake Water Supply	5/20/2009	2	U	7
P&W-2	4/14/2009	1	U	8
USGS-019	4/14/2009	3	U	6
USGS-027	4/14/2009	13		7
Facility				
USGS-100	4/13/2009	-3	U	6
USGS-106	6/10/2009	567		19
USGS-107	6/10/2009	1	U	6
Boundary				
Atomic City	4/20/2009	-1	U	6
Crossroads	4/21/2009	8	U	8
USGS-008	4/15/2009	19		9
USGS-011	4/20/2009	15		9
USGS-109	6/10/2009	89		9
USGS-124	4/20/2009	54		10
Distant				
Alpheus Spring	5/18/2009	8	U	7
Bill Jones Hatchery	5/18/2009	2	U	6
Clear Spring	5/18/2009	3	U	7
Clear Spring	6/24/2009	5	U	7
Minidoka Water Supply	5/18/2009	1	U	6
Shoshone Water Supply	5/18/2009	33		8

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

Table 12. Reported metals concentrations in water samples, third quarter, 2009.

Sample Location	Sample Date	Concentration[1,2]								
		Arsenic	Barium	Cadmium	Chromium	Iron	Lead	Manganese	Selenium	Zinc
Up-gradient										
Mud Lake Water Supply	8/20/2009	8.8	20	<1.0 U	<1.0 U	31	<1.0 U	31	<2 U	<2.0 U
Boundary										
USGS-103	8/25/2009	NR	49	NR	6.0	NR	<1.0 U	<1.0 U	NR	9.6
USGS-105	9/16/2009	NR	43	NR	7.4	NR	<1.0 U	<1.0 U	NR	3.7
USGS-135	9/14/2009	NR	59	NR	2.2	NR	<1.0 U	6.0	NR	24
Distant										
Alpheus Spring	8/11/2009	NR	90	NR	1.2	NR	<1.0 U	<1.0 U	NR	<2.0 U
Bill Jones Hatchery	8/11/2009	NR	22	NR	2.8	NR	<1.0 U	<1.0 U	NR	<2.0 U
Minidoka Water Supply	8/11/2009	NR	38	NR	1.6	NR	<1.0 U	<1.0 U	NR	28
MV-26	7/29/2009	2.0	30	<1.0 U	1.9	<10 U	<1.0 U	<1.0 U	<2 U	<2.0 U
MV-49	8/19/2009	<2.0 U	68	<1.0 U	1.5	38	<1.0 U	1.7	<2 U	360
MV-59	7/29/2009	<2.0 U	12	<1.0 U	3.5	<10 U	1.4	<1.0 U	<2 U	120
Shoshone Water Supply	8/11/2009	NR	44	NR	1.7	NR	<1.0 U	<1.0 U	NR	3.1

[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 not filtered unless otherwise indicated.

Table 13. Reported common ion concentrations in water samples, third quarter, 2009.

Sample Location	Sample Date	Concentration[1,2]							
		Calcium	Magnesium	Sodium	Potassium	Fluoride	Chloride	Sulfate	Alkalinity[3]
Up-gradient									
Mud Lake Water Supply*	8/20/2009	8.6	2.7	31	4.9	0.680	4.83	8.22	90
Boundary									
USGS-103*	8/25/2009	39	15	8.8	2.4	0.217	14.3	21.9	142
USGS-105*	9/16/2009	39	14	11	2.7	0.229	11.3	23.9	141
USGS-135*	9/14/2009	39	13	6.6	1.8	0.229	7.35	20.4	136
Distant									
Alpheus Spring*	8/11/2009	58	20	35	6.5	0.520	53.0	68.7	181
Bill Jones Hatchery*	8/11/2009	30	16	16	3.5	0.458	12.0	26.9	134
Minidoka Water Supply*	8/11/2009	45	15	21	3.4	0.761	35.2	44.4	138
MV-26*	7/29/2009	41	16	23	3.8	0.573	29.9	41	137
MV-49*	8/19/2009	49	15	8	2.1	0.207	3.57	18	181
MV-59*	7/29/2009	26	13	17	3.2	0.436	13.6	19.2	113
Shoshone Water Supply*	8/11/2009	42	14	15	3.0	0.312	6.99	18.6	168

[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 $CaCO_3$

Table 14. Reported nutrient concentrations in water samples, third quarter, 2009.

Sample Location	Sample Date	Concentration [1,2]					
		Nitrite + Nitrate		Phosphorus	Ammonia		
Up-gradient							
Mud Lake Water Supply	8/20/2009	<0.01	U	0.038	NR		
Boundary							
USGS-103	8/25/2009	0.82		0.022	NR		
USGS-105	9/16/2009	0.67		0.021	NR		
USGS-135	9/14/2009	0.75		0.023	NR		
Distant							
Alpheus Spring	8/11/2009	2.1		0.030	NR		
Bill Jones Hatchery	8/11/2009	1.2		0.019	NR		
Minidoka Water Supply	8/11/2009	1.1		0.016	NR		
MV-26	7/29/2009	1.0		0.018	<0.010	U	
MV-49	8/19/2009	1.7		0.048	<0.010	U	
MV-59	7/29/2009	0.82		0.015	0.015		
Shoshone Water Supply	8/11/2009	1.3		0.032	NR		

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

[2] Concentrations expressed in mg/L.

Terrestrial Monitoring Results

The ESP 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 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 in **Table 15**. Naturally occurring potassium-40 was detected in all samples within the expected range. Iodine-131 was not detected.

Table 15. Gamma spectroscopy analysis data for milk samples, third 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	07/06/2009	1614	124	<MDC
	08/02/2009	1488	115	<MDC
	08/31/2009	1405	107	<MDC
Mud Lake/Nelson-Ricks Creamery	07/06/2009	1453	108	<MDC
	08/02/2009	1490	110	<MDC
	08/31/2009	1394	111	<MDC
Gooding/Glanbia	07/08/2009	1404	110	<MDC
	08/04/2009	1466	126	<MDC
	09/02/2009	1703	125	<MDC
Riverside	07/09/2009	1701	111	<MDC
	08/13/2009	1959	135	<MDC
	09/09/2009	1703	125	<MDC
Verification Samples[2]				
Rupert	07/07/2009	1479	110	<MDC
Howe	07/07/2009	1473	114	<MDC
Terreton	08/04/2009	1513	114	<MDC
Rupert	08/04/2009	1515	104	<MDC
Dietrich	09/01/2009	1383	97	<MDC
Idaho Falls	09/01/2009	1433	112	<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.

DEQ-INL OP monitors long-term radiological conditions via physical soil sampling as well as field instrumentation capable of identifying and measuring in-situ concentrations of gamma-emitting radionuclides in soil. Monitoring concentrations of gamma-emitting radionuclides in surface soil provides some insight to transport, deposition, and accumulation of radioactive material in the environment as a result of INL operations as well as historical above ground testing of nuclear weapons.

In-Situ gamma spectroscopic measurements were performed at 30 locations (**Figure 4**) including onsite, boundary, and distant monitoring locations during the third calendar quarter of 2009. No man-made radionuclides other than ^{137}Cs were identified. Gamma spectroscopic analysis results for ^{137}Cs concentrations are shown in **Table 16**.

Table 16. **Gamma In-Situ gamma spectroscopic analysis results for (^{137}Cs) soil monitoring, third quarter, 2009 by DEQ-INL OP.**

Location	Date Acquired	Concentration[1]	± 2 SD	MDA
Boundary Sampling Locations				
Mud Lake/Terreton	7/29/2009	0.113	0.004	0.002
Monteview	7/29/2009	0.076	0.002	0.001
Howe	8/10/2009	0.081	0.002	0.001
Howe Met Tower	8/10/2009	0.074	0.004	0.002
Atomic City	8/12/2009	0.073	0.004	0.002
Reno Ranch	8/12/2009	0.129	0.004	0.002
Large Grid 18-4	8/21/2009	0.210	0.009	0.004
Large Grid 12-5	8/21/2009	0.413	0.006	0.003
Large Grid 12-4	8/21/2009	0.211	0.011	0.005
Big Southern Butte	8/21/2009	0.087	0.004	0.002
Distant Sampling Locations				
Roberts	8/12/2009	0.094	0.003	0.002
Idaho Falls CMS[2]	8/14/2009	0.030	0.002	0.001
Idaho Falls[3]	8/26/2009	0.114	0.004	0.002
On site Sampling Locations				
Experimental Field Station	8/7/2009	0.190	0.012	0.004
Van Buren	8/7/2009	0.137	0.004	0.002
Sand Dunes	8/7/2009	0.045	0.004	0.003
Big Lost Rest Area	8/7/2009	0.144	0.007	0.003
Large Grid 18-1	8/7/2009	0.200	0.009	0.004
Large Grid 18-7	8/10/2009	0.199	0.008	0.004
Base of Howe	8/10/2009	0.143	0.004	0.002
Large Grid 18-3	8/11/2009	0.217	0.009	0.005
Large Grid 18-8	8/11/2009	0.230	0.012	0.007
Large Grid 24-2	8/11/2009	0.374	0.012	0.006
Large Grid 24-7	8/11/2009	0.308	0.010	0.005
Rover	8/11/2009	0.096	0.005	0.003
INL Main Gate	8/12/2009	0.098	0.004	0.002
Large Grid 30-1	8/12/2009	0.193	0.010	0.005
Large Grid 24-9	8/14/2009	0.208	0.011	0.005
Large Grid 24-8	8/14/2009	0.313	0.009	0.004
Large Grid 6-3	8/14/2009	0.230	0.010	0.005

[1]Concentrations are reported in pCi/g
[2]DEQ-INL OP HPIC Community Monitoring Station (CMS) near John's Hole Bridge, Idaho Falls, ID
[3]DEQ-INL OP HPIC air monitoring station near Idaho Falls, ID

The average Cesium-137 value was 0.168 picocuries per gram (pCi/g) with a minimum value of 0.030 pCi/g and a maximum of 0.413 pCi/g, well below the DEQ-INL OP action level of 6.4 pCi/g and the recommended federal screening limit for surface soil of 6.8 pCi/g. Based upon terrestrial radiological measurements of soil and milk, there were no discernable impacts to the environment from INL operations. Long-term accumulation of radionuclides observed by soil monitoring was consistent with historical measurements and was in the range of concentrations expected as a result of historic above-ground testing of nuclear weapons.

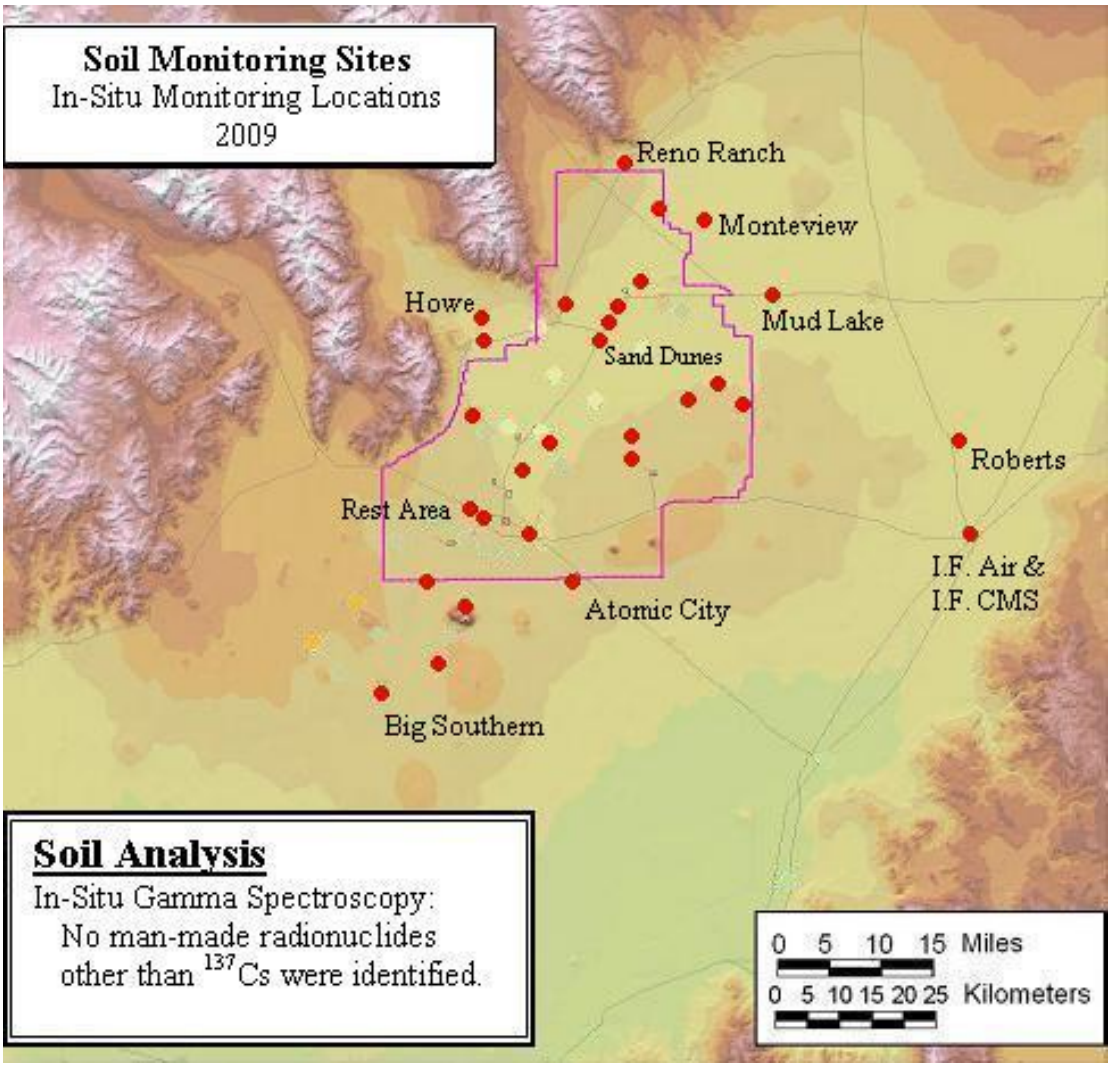

Figure 4. Third quarter 2009 In-situ soil monitoring sites indicated by red dot.

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 third 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 third quarter of 2009, the DEQ-INL OP submitted 47 QC samples for various radiological and non-radiological analyses (**Table 17**).

Blank Samples

Blank samples consist of matrices that have negligible, acceptably low, or immeasurable amounts of the analyte(s) of interest in them. They are 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 third quarter of 2009 are presented in **Table 18**.

Blank sample results for select gamma emitters in air from composited air filters are presented in **Table 19**. There were no blank analyses submitted to assess data quality for tritium in water vapor in air during the third quarter 2009. Blank analyses results for radiological and non-radiological analytes in ground and surface water are presented in **Table 20, Table 21, and Table 22**.

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 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):

$RPD = (R_1-R_2)/((R_1+R_2)/2)*100$
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. One duplicate result for ground water is presented in **Table 23** for enriched tritium analysis. Duplicate QA measurements (taken on different dates) of in-situ soil were compared for two gamma-emitting radionuclides, K-40, and Cs-137. The K-40 comparisons were all in agreement. The Cs-137 comparisons only agreed in 33% of the samples. The Cs-137 results were typically two to three orders of magnitude lower than the K-40 results and are well below the DEQ-INL OP screening limits. The disagreement in these results will be investigated. Analyses of field duplicate gamma-emitting radionuclides in soil are presented in **Table 24.**

With the exception of in-situ soil, no other anomalies were observed from the assessment of field duplicate samples as measured by the analytical laboratories used by DEQ-INL OP for the third 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 third quarter 2009, no field matrices were spiked to assess the influence of the sample media on laboratory performance.

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 third quarter 2009 are presented in **Table 25**. Real-time pressure correction is used to calculate the net exposure measured by these EIC control sets.

There were no 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 third quarter of 2009.

Analytical QA/QC Assessment

Other than the one previously mentioned, no issues involving sample chain of custody, sample holding times, the analysis of blank, spike, and duplicate samples were observed during the third 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 third 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 third quarter of 2009 met the minimum criteria of the DEQ-INL OP ESP and is summarized in **Table 17**.

Preventative Maintenance and Equipment Reliability

All equipment was calibrated and checked according to pre-described periodicity. Service reliability for air sampling equipment for the third quarter of 2009 is summarized in **Table 26**. All equipment performed well during this period.

Conclusion

All data collected for the third 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 17. Summary of the analytical performance and usability of the analyses performed for the DEQ-INL OP ESP, third 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	141	13	0	0	0	ISU-EML
		Gross beta	141	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	75	0	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	1	0	0	0	ISU-EML
		Gross beta	11	1	0	0	0	ISU-EML
		Gamma emitters	11	1	0	0	0	ISU-EML
		Tritium	11	1	0	0	0	ISU-EML
		Enriched tritium	19	0	1	0	0	ISU-EML
		Technetium-99	0	0	0	0	0	ISU-EML
		Radiochemical	0	0	0	0	0	ISU Sub
		Metals	11	1	0	0	0	IBL
		Common Ions	11	1	0	0	0	IBL
		Nutrients	11	1	0	0	0	IBL
		Volatile Organics	0	0	0	0	0	IBL
TERRESTRIAL								
Milk	Grab or composite	Gamma emitters	18	0	0	0	0	ISU-EML
Soil	*in situ*	Gamma emitters	30	0	3	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 Test Analyses			**602**	**34**	**4**	**9**	**0**	
Total of QC Analyses (blanks, duplicates, and spikes)			**47**					
Percentage of QC analyses of Total Test analyses[3]			**7.8%**					
Percentage of usable data[4]			**100%**					

1 Combined Laboratory and DEQ-INL OP rejection criteria (data was rejected for any reason).
2 ISU-EML = Idaho State University – Environmental Monitoring Laboratory; ISU Sub = Subcontract laboratory to ISU-EML; IBL = Idaho Bureau of Laboratories, Boise; IBL Sub = Subcontract laboratory to IBL; DEQ-INL OP = Analyzed by INL Oversight Program, Idaho Department of Environmental Quality.
3 Analyzing quality control samples at a rate of approximately 5 to 10 percent of the total number of test analyses performed for the year is deemed appropriate for the DEQ-INL OP ESP.
4 Data usability rate [total analyses – rejected data]/[total analyses] of 90 percent or higher is acceptable for the DEQ-INL OP ESP.

Table 18. Blank analysis results for gross alpha and beta in particulate air (TSP), third quarter, 2009.

Collection Period		Corrected volume (m^3) [1]	Gross alpha		Gross beta	
Start	Stop		Value	Uncertainty (± 2 SD)	Value	Uncertainty (± 2 SD)
7/2/09	7/9/09	1659	0.0	0.1	0.1	0.5
7/9/09	7/16/09	1659	-0.1	0.1	-0.6	0.5
7/16/09	7/23/09	1659	-0.1	0.1	0.0	0.5
7/23/09	7/30/09	1659	-0.2	0.1	0.0	0.5
7/30/09	8/6/09	1659	0.1	0.2	0.4	0.5
8/6/09	8/13/09	1659	-0.1	0.1	-0.4	0.5
8/13/09	8/20/09	1659	-0.1	0.1	-0.4	0.5
8/20/09	8/27/09	1659	0.0	0.1	-0.1	0.5
8/27/09	9/3/09	1659	0.0	0.1	-0.3	0.5
9/3/09	9/10/09	1659	0.0	0.1	-0.4	0.5
9/10/09	9/17/09	1659	-0.1	0.1	-0.5	0.5
9/17/09	9/24/09	1659	0.0	0.1	0.1	0.5
9/24/09	10/1/09	1659	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 19. Blank analysis results for gamma spectroscopy for TSP particulate air filters, third 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
10/31/09	-3	41	70	5	5	82	1	9	15

Analysis Date	Cesium-134			Cesium-137		
	Concentration[1]	± 2 SD	MDC	Concentration	± 2 SD	MDC
10/31/09	-2	4	7	-2	5	9

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 average volumes collected through each valid field filter was used to compute "air concentrations" for the blank for meaningful comparison to sample results. No air was actually passed through the blank filters.

Table 20. Radiological blank analysis in ground and surface water for samples, third quarter, 2009.

Sample Number	Sample Date	Concentration	± 2 SD	MDC	Within Blank Criteria?
Gross Alpha					
MV-34	7/29/2009	-0.1	0.6	1.0	Yes
Gross Beta					
MV-34	7/29/2009	0.1	0.8	1.5	Yes
Cesium-137					
MV-34	7/29/2009	0.6	1.7	2.8	Yes
Tritium					
MV-34	7/29/2009	-60	90	150	Yes

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

Table 21. Blank analysis results (µg/L) for metals in ground and surface water, third quarter, 2009.

Sample Number	Sample Date	Arsenic	Barium	Beryllium	Cadmium	Chromium	Iron	Lead	Manganese	Selenium	Zinc
091W334	7/29/2009	<2.0	<1.0	<1.0	<1.0	<1.0	<10	<1.0	<1.0	<2.0	<2.0

Table 22. Blank analysis results (mg/L) for common ions and nutrients in ground and surface water, third quarter, 2009.

Sample Number	Sample Date	Calcium	Magnesium	Sodium	Potassium	Fluoride	Chloride	Sulfate	Total Alkalinity	Total Nitrogen	Total Phosphorus
091W334,332, 335	7/29/2009	<0.10	<0.10	<0.10	<0.10	<0.20	<0.40	<0.80	<1.0	<0.010	<0.0050

Table 23. Duplicate radiological analysis results in pCi/L for ground and surface water, third 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]
Enriched Tritium									
USGS-124	091W046	54	10	091W112	54	9	0	20	yes

[1] $/R_1-R_2/ \leq 3(s_1^2+s_2^2)^{1/2}$

Table 24. Duplicate in-situ analyses of gamma-emitting radionuclides in soil, third quarter, 2009.

Sample Location	Original Sample Date	QA Sample Date	Original K-40 Result (pCi/g)	QA K-40 Result (pCi/g)	K-40 RPD %	K-40 Within Criteria?	Original Cs-137 Result (pCi/g)	QA Cs-137 Result (pCi/g)	Cs-137 RPD %	Cs-137 Within Criteria?
Mud Lake Air Station	7/29/09	8/26/09	11.87± 0.12	11.50± 0.14	3.17	Yes	0.1126± 0.004	0.0301± 0.003	115.72	No
Big Lost Air Station	8/07/09	8/26/09	12.61± 0.19	11.57± 0.14	8.60	Yes	0.1435± 0.007	0.1673± 0.004	15.32	Yes
Atomic City Air Station	8/12/09	8/26/09	10.72± 0.14	9.96± 0.20	7.31	Yes	0.0732± 0.004	0.0503± 0.003	37.11	No

Table 25. Electret ionization chamber irradiation results (categorized as spiked samples), third quarter, 2009.

Electret #	Exposure Received		Net Measured Exposure[1]		%R
	(mR)	Uncertainty (mR)	(mR)	Uncertainty (mR)	
Spike 1	40	2.0	37.4	1.3	93.4%
Spike 1	40	2.0	41.0	1.3	102.6%
Spike 1	40	2.0	35.0	1.4	87.4%
Spike 2	30	1.5	30.2	1.3	100.6%
Spike 2	30	1.5	29.2	1.4	97.4%
Spike 2	30	1.5	27.3	1.3	91.1%
Spike 3	23.5	1.2	21.8	1.3	92.7%
Spike 3	23.5	1.2	23.6	1.4	100.5%
Spike 3	23.5	1.2	22.6	1.3	96.0%

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

Table 26. Air sampling field equipment service reliability (percent operational), third 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
Van Buren Avenue	100 %	100 %	100 %	NC
Boundary Locations				
Atomic City	100 %	100 %	100 %	100 %
Howe	100 %	100 %	100 %	100 %
Monteview	100 %	100 %	100 %	100 %
Mud Lake	100 %	100 %	100 %	100 %
Distant Locations				
Craters of the Moon	100 %	100 %	100 %	NC
Idaho Falls	100 %	100 %	100 %	100 %

Note: The values in this table were calculated by dividing the number of weeks the equipment was in operation by the number of weeks in the quarter.
[1]NC = sample not collected at this location

Appendix A

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

Sample location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	± 2 SD	Concentration	± 2 SD
Rest Area	07/02/09	07/09/09	1.2	0.3	34.5	1.4
	07/09/09	07/16/09	1.2	0.3	33.4	1.4
	07/16/09	07/23/09	1.5	0.3	43.1	1.5
	07/23/09	07/30/09	0.9	0.3	34.3	1.4
	07/30/09	08/06/09	1.3	0.3	37.1	1.4
	08/06/09	08/13/09	1.7	0.3	36.5	1.4
	08/13/09	08/20/09	1.0	0.3	29.7	1.3
	08/20/09	08/27/09	1.8	0.3	46.6	1.6
	08/27/09	09/03/09	1.5	0.3	44.2	1.5
	09/03/09	09/10/09	1.3	0.3	42.0	1.5
	09/10/09	09/17/09	1.4	0.3	39.0	1.5
	09/17/09	09/24/09	1.3	0.3	37.3	1.6
	09/24/09	10/01/09	1.3	0.3	40.0	1.5
Experimental Field Station	07/02/09	07/09/09	NS[1]	NS[1]	NS[1]	NS[1]
	07/09/09	07/16/09	1.2	0.3	33.4	1.4
	07/16/09	07/23/09	1.1	0.3	37.5	1.4
	07/23/09	07/30/09	0.9	0.3	33.2	1.3
	07/30/09	08/06/09	0.9	0.2	34.4	1.4
	08/06/09	08/13/09	1.5	0.3	36.6	1.4
	08/13/09	08/20/09	0.9	0.2	29.2	1.3
	08/20/09	08/27/09	1.3	0.3	44.7	1.5
	08/27/09	09/03/09	1.2	0.3	34.1	1.4
	09/03/09	09/10/09	1.4	0.3	42.3	1.5
	09/10/09	09/17/09	1.6	0.3	33.5	1.4
	09/17/09	09/24/09	1.6	0.3	32.2	1.3
	09/24/09	10/01/09	1.1	0.3	37.3	1.4

[1] Insufficient sample volume due to planned 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, 2009.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	± 2 SD	Concentration	± 2 SD
Sand Dunes	07/02/09	07/09/09	1.3	0.3	33.2	1.4
	07/09/09	07/16/09	1.1	0.3	32.9	1.4
	07/16/09	07/23/09	1.2	0.3	42.2	1.5
	07/23/09	07/30/09	0.8	0.3	33.3	1.4
	07/30/09	08/06/09	1.3	0.3	36.0	1.4
	08/06/09	08/13/09	1.3	0.3	34.4	1.4
	08/13/09	08/20/09	1.0	0.3	26.7	1.3
	08/20/09	08/27/09	1.5	0.3	46.9	1.6
	08/27/09	09/03/09	1.4	0.3	39.0	1.5
	09/03/09	09/10/09	1.2	0.3	38.7	1.5
	09/10/09	09/17/09	1.1	0.3	30.4	1.3
	09/17/09	09/24/09	NS[1]	NS[1]	NS[1]	NS[1]
	09/24/09	10/01/09	0.9	0.3	32.2	1.3
Van Buren	07/02/09	07/09/09	1.4	0.3	34.5	1.4
	07/09/09	07/16/09	1.4	0.3	39.5	1.5
	07/16/09	07/23/09	1.1	0.3	40.8	1.5
	07/23/09	07/30/09	0.8	0.3	34.9	1.4
	07/30/09	08/06/09	1.2	0.3	36.6	1.4
	08/06/09	08/13/09	1.5	0.3	41.1	1.5
	08/13/09	08/20/09	1.0	0.3	30.8	1.3
	08/20/09	08/27/09	1.4	0.3	50.2	1.7
	08/27/09	09/03/09	1.4	0.3	45.6	1.6
	09/03/09	09/10/09	1.5	0.3	45.3	1.6
	09/10/09	09/17/09	1.6	0.3	43.2	1.6
	09/17/09	09/24/09	1.5	0.3	38.0	1.4
	09/24/09	10/01/09	1.4	0.3	42.1	1.5
Atomic City	07/02/09	07/09/09	1.2	0.3	35.4	1.4
	07/09/09	07/16/09	1.4	0.3	37.7	1.4
	07/16/09	07/23/09	1.4	0.3	37.1	1.4
	07/23/09	07/30/09	0.9	0.3	32.6	1.3
	07/30/09	08/06/09	1.9	0.4	37.5	1.6
	08/06/09	08/13/09	1.2	0.3	34.3	1.4
	08/13/09	08/20/09	0.9	0.2	29.5	1.3
	08/20/09	08/27/09	1.3	0.3	43.0	1.6
	08/27/09	09/03/09	1.4	0.3	40.8	1.5
	09/03/09	09/10/09	1.2	0.3	37.6	1.4
	09/10/09	09/17/09	1.4	0.3	38.0	1.5
	09/17/09	09/24/09	1.2	0.3	34.2	1.4
	09/24/09	10/01/09	1.2	0.3	40.3	1.5

[1] Sample lost in high wind during retrieval.

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, 2009.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	± 2 SD	Concentration	± 2 SD
Howe	07/02/09	07/09/09	1.0	0.3	31.1	1.3
	07/09/09	07/16/09	1.1	0.3	36.3	1.4
	07/16/09	07/23/09	1.2	0.3	33.7	1.3
	07/23/09	07/30/09	0.8	0.3	26.3	1.2
	07/30/09	08/06/09	1.1	0.3	31.6	1.3
	08/06/09	08/13/09	1.3	0.3	30.1	1.3
	08/13/09	08/20/09	1.0	0.2	23.9	1.2
	08/20/09	08/27/09	1.5	0.3	43.3	1.5
	08/27/09	09/03/09	1.2	0.3	39.5	1.4
	09/03/09	09/10/09	1.1	0.3	34.6	1.4
	09/10/09	09/17/09	1.3	0.3	30.9	1.3
	09/17/09	09/24/09	1.3	0.3	28.3	1.3
	09/24/09	10/01/09	1.4	0.3	30.0	1.3
Monteview						
	07/02/09	07/09/09	1.1	0.3	43.4	1.5
	07/09/09	07/16/09	1.6	0.3	41.1	1.5
	07/16/09	07/23/09	1.5	0.3	44.9	1.5
	07/23/09	07/30/09	1.1	0.3	39.2	1.4
	07/30/09	08/06/09	1.4	0.3	40.8	1.5
	08/06/09	08/13/09	1.6	0.3	39.9	1.5
	08/13/09	08/20/09	1.2	0.3	31.7	1.3
	08/20/09	08/27/09	2.0	0.3	51.6	1.6
	08/27/09	09/03/09	1.6	0.3	45.8	1.6
	09/03/09	09/10/09	1.9	0.3	47.9	1.6
	09/10/09	09/17/09	1.5	0.3	41.2	1.5
	09/17/09	09/24/09	1.4	0.3	35.4	1.4
	09/24/09	10/01/09	1.5	0.3	45.4	1.5
Mud Lake	07/02/09	07/09/09	1.4	0.3	32.7	1.4
	07/09/09	07/16/09	1.0	0.3	29.7	1.4
	07/16/09	07/23/09	1.2	0.3	38.0	1.5
	07/23/09	07/30/09	0.8	0.3	28.4	1.3
	07/30/09	08/06/09	1.1	0.3	31.1	1.4
	08/06/09	08/13/09	1.4	0.3	31.5	1.4
	08/13/09	08/20/09	1.1	0.3	25.6	1.3
	08/20/09	08/27/09	1.5	0.3	42.7	1.6
	08/27/09	09/03/09	1.2	0.3	36.2	1.5
	09/03/09	09/10/09	1.6	0.3	34.1	1.4
	09/10/09	09/17/09	1.4	0.3	31.8	1.4
	09/17/09	09/24/09	1.3	0.3	35.0	1.4
	09/24/09	10/01/09	1.5	0.3	36.3	1.4

[1] NS - Insufficient sample collected due to sampler failure.

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, 2009.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	± 2 SD	Concentration	± 2 SD
Distant Locations						
Craters	07/02/09	07/09/09	0.8	0.2	29.3	1.3
	07/09/09	07/16/09	0.9	0.2	33.6	1.4
	07/16/09	07/23/09	0.9	0.3	35.1	1.4
	07/23/09	07/30/09	0.5	0.2	27.8	1.3
	07/30/09	08/06/09	1.0	0.3	31.6	1.4
	08/06/09	08/13/09	0.8	0.3	30.5	1.3
	08/13/09	08/20/09	0.7	0.2	24.3	1.2
	08/20/09	08/27/09	1.3	0.3	38.6	1.5
	08/27/09	09/03/09	1.3	0.3	34.6	1.4
	09/03/09	09/10/09	1.0	0.3	32.5	1.3
	09/10/09	09/17/09	0.9	0.3	29.4	1.3
	09/17/09	09/24/09	0.8	0.2	27.8	1.3
	09/24/09	10/01/09	1.0	0.3	32.7	1.4
Fort Hall[1]	07/02/09	07/09/09	1.0	0.3	26.2	1.2
	07/09/09	07/16/09	1.7	0.3	26.6	1.2
	07/16/09	07/23/09	1.8	0.3	29.6	1.3
	07/23/09	07/30/09	1.9	0.4	24.5	1.3
	07/30/09	08/06/09	2.0	0.3	27.3	1.3
	08/06/09	08/13/09	1.3	0.3	24.9	1.2
	08/13/09	08/20/09	1.4	0.3	22.6	1.2
	08/20/09	08/27/09	1.6	0.3	33.6	1.4
	08/27/09	09/03/09	1.6	0.3	30.8	1.3
	09/03/09	09/10/09	1.2	0.3	30.8	1.3
	09/10/09	09/17/09	1.7	0.3	29.6	1.3
	09/17/09	09/24/09	1.3	0.3	21.5	1.2
	09/24/09	10/01/09	1.4	0.3	30.0	1.3
Idaho Falls	07/02/09	07/09/09	1.7	0.3	47.0	1.5
	07/09/09	07/16/09	1.7	0.3	42.1	1.5
	07/16/09	07/23/09	2.1	0.4	59.7	2.2
	07/23/09	07/30/09	1.5	0.4	50.8	1.9
	07/30/09	08/06/09	1.7	0.4	53.9	1.9
	08/06/09	08/13/09	2.1	0.4	46.3	1.8
	08/13/09	08/20/09	1.3	0.3	36.5	1.4
	08/20/09	08/27/09	2.6	0.4	69.0	2.2
	08/27/09	09/03/09	2.0	0.4	59.9	1.8
	09/03/09	09/10/09	2.3	0.4	60.4	2.1
	09/10/09	09/17/09	2.1	0.4	52.5	1.9
	09/17/09	09/24/09	2.1	0.4	50.6	1.9
	09/24/09	10/01/09	1.6	0.3	39.6	1.5

[1] Operated by Shosone-Bannack Tribe
[2] Insufficient Sample Volume collected

Appendix B

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

Sample Location	Net Corrected Exposure Rate (μR/h)	± 2 SD (μR/h)
Arco	14.0	5.4
Craters	13.3	3.1
Rest Area	12.4	0.9
Van Buren	17.3	2.1
EFS	16.3	3.2
Main Gate	15.6	1.6
Atomic City	15.3	3.6
Taber	24.1	25.5
Blackfoot	16.2	1.8
Ft. Hall	12.4	0.2
Idaho Falls	12.7	2.5
Mud Lake/ Terreton	14.5	4.6
Monteview	13.9	4.5
Sand Dunes	15.2	3.0
Howe[1]	NS	NS
Howe Met Tower	10.6	2.4
MP276 -20	12.8	1.3
MP274 -20	11.7	4.6
MP272 -20	12.3	2.5
MP270 -20	13.8	1.0
MP268 -20	13.2	2.5
MP266 -20	12.7	3.9
MP264 -20	13.4	5.5
MP270 -20/26	13.3	1.5
MP268 -20/26	19.1	0.9
MP266 -20/26	15.2	1.7
MP263 -20/26	13.4	3.5
MP261 -20/26	12.4	3.4
MP259 -20/26[1]	14.8	2.9
MFC (EBR II)	13.3	2.9
EBR I	13.0	3.1
RWMC	16.6	3.5
CFA	17.3	4.4
CITRC (PBF)	15.2	2.0

[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.

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

Sample Location	Net Corrected Exposure Rate (μR/h)	± 2 SD (μR/h)
INTEC (ICPPI)	23.2	0.7
ATR (TRA)	18.4	3.5
NRF	17.2	5.1
TAN	14.2	2.4
Mud Lake Bank of Commerce	14.7	3.2
MP43-33	16.2	1.9
MP41-33	16.8	6.1
MP39-33	22.5	9.4
MP37-33[2]	13.6	2.4
MP35-33	12.6	3.5
MP33-33	15.1	2.8
MP31-33	18.6	2.5
MP29-33	13.6	2.2
MP27-33	15.3	0.5
MP25-33	14.5	6.5
MP23-33	10.0	2.0
Base of Howe	10.9	1.6
Rover	14.6	5.7
Hamer	15.9	2.9
Sugar City	17.7	4.7
Roberts	14.5	5.1
Big Southern Butte	13.5	3.6

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