Department of Environmental Quality
INL Oversight Program

ENVIRONMENTAL SURVEILLANCE PROGRAM QUARTERLY DATA REPORT

July – September, 2008

State of Idaho
INL Oversight Program

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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 - 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) 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'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 more 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, 2008 (**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 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 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 third quarter of 2008 for TSP filters are presented in **Table 3**. The only reported gamma-emitting radionuclide was beryllium-7, a naturally occurring, cosmogenic radionuclide.

Although there was a supply problem during the previous reporting periods with the Versapor® 1200 filters normally used to collect particulate matter from air, the problem has been resolved. All particulate air samples for this reporting period were collected on the normal Versapor® 1200 filters.

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'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/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 composites analysis 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 batch. 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 3 of the 4 samples collected at the Experimental Field Station and one at the Lost River Rest Area during the third quarter of 2008. All of these samples were less than 1 % of the DEQ-INL action level. Average atmospheric tritium concentrations are presented in **Table 4**.

Precipitation samples were collected at five monitoring locations during the third quarter of 2008. 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 2008. 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. Two of the stations, Mud Lake and Monteview, did not collect sufficient samples for gamma analysis.

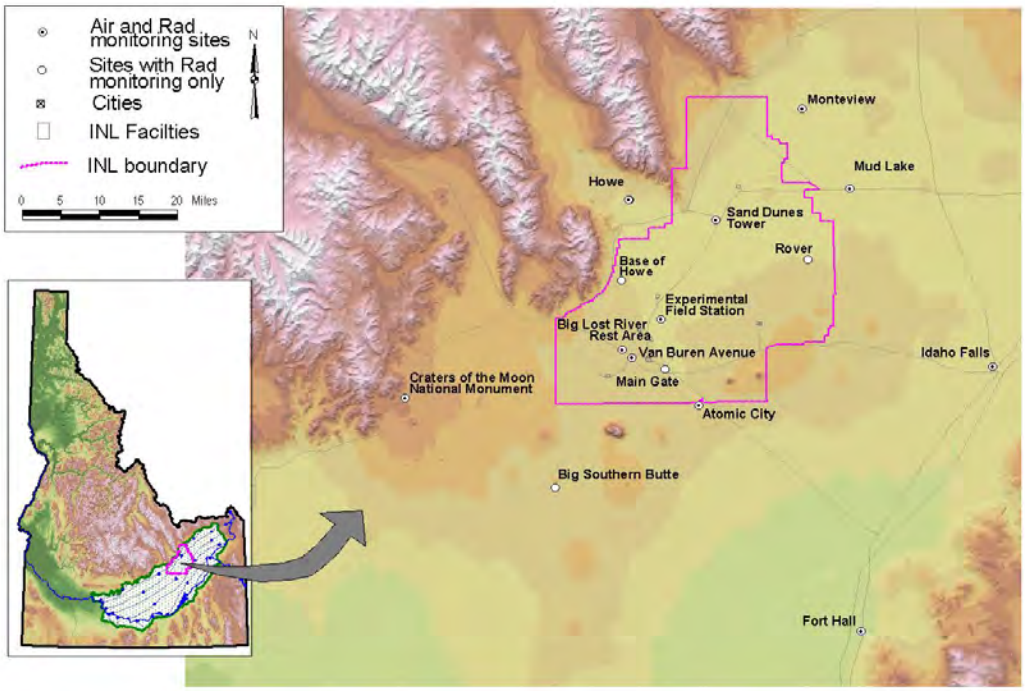

Figure 1. Air and radiation monitoring sites.

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	□	□	■	■[3]
Monteview	□	□	■	■[4]
Mud Lake	□	□	■	■[4]
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.
[3] No precipitation samples were collected.
[4] Insufficient samples for gamma analysis.

Table 2. Range of gross alpha and gross beta concentrations for TSP filters, third quarter, 2008. 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	1.1 - 3.4	31.9 - 88.4
Experimental Field Station	1.0 - 2.4	23.8 - 53.0
Sand Dunes Tower	0.7 - 2.2	23.6 - 49.9
Van Buren Avenue	1.0 - 3.0	28.5 - 57.4
Boundary Locations		
Atomic City	0.8 - 2.9	25.2 - 46.5
Howe	0.8 - 2.5	21.1 - 58.1
Monteview	0.8 - 2.4	17.4 - 54.2
Mud Lake	1.0 - 6.5	21.5 - 46.7
Distant Locations		
Craters of the Moon	0.3 - 2.5	19.3 - 42.6
Fort Hall[1]	1.0 - 3.5	17.5 - 36.0
Idaho Falls	1.1 - 3.5	22.8 - 48.5

[1] Operated by Shoshone-Bannock Tribes.

Table 3. Gamma spectroscopy analysis data for TSP filters, composite samples, third quarter, 2008. 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	160.1	8.2	<MDC
Experimental Field Station	115.3	6.2	<MDC
Sand Dunes Tower	117.1	6.1	<MDC
Van Buren Avenue	107.1	5.5	<MDC
Boundary Locations			
Atomic City	126.2	6.4	<MDC
Howe	106.3	5.5	<MDC
Monteview	103.7	5.4	<MDC
Mud Lake	105.9	5.5	<MDC
Distant Locations			
Craters of the Moon	109.4	5.8	<MDC
Fort Hall[1]	88.7	4.9	<MDC
Idaho Falls	135.4	7.2	<MDC

[1]Operated by Shoshone-Bannock Tribes.

Table 4. Tritium concentrations in air from atmospheric moisture, third quarter, 2008. 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	0.51	0.35	0.55
Experimental Field Station	0.85	0.36	0.55
Sand Dunes Tower	0.18	0.34	0.57
Van Buren Avenue	0.35	0.32	0.45
Boundary Locations			
Atomic City	0.19	0.32	0.56
Howe	0.10	0.34	0.56
Mud Lake	0.06	0.48	0.71
Monteview	0.20	0.63	1.07
Distant Locations			
Craters of the Moon	0.16	0.33	0.55
Fort Hall[1]	0.08	0.39	0.66
Idaho Falls	0.69	0.44	0.72

[1]Operated by Shoshone-Bannock Tribes..

Table 5. Tritium and cesium-137 concentrations from precipitation, third quarter, 2008. 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	80	130	0.2	1.5	2.6
Boundary Locations						
Atomic City	90	80	140	0.1	1.7	2.9
Monteview	60	80	140	NS[1]	NS	NS
Mud Lake	70	80	130	NS	NS	NS
Distant Locations						
Idaho Falls	10	80	130	0.5	1.4	2.4

[1] NS - Insufficient samples for gamma analysis.

Environmental Radiation Monitoring Results

The ESP operated 14 environmental radiation stations during the third quarter of 2008 (**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 both an EIC and HPIC. The DEQ-INL 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 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 41 locations by DEQ-INL 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 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 2008. **Table 8** lists the EIC monitoring results for third quarter 2008. Exposure rates were within the expected historical range of values observed by DEQ-INL for background radiation. Base of Howe electret data was rejected due to large inconsistency with average HPIC Output at Base of Howe over this time period.

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	■	■
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.

Table 7. Average gamma exposure rates for third quarter, 2008, from HPIC network.

	Exposure Rate (µR/hr)	
	Quarterly Average	± 2 SD
On-site Locations		
Base of Howe	12.5	1.6
Big Lost River Rest Area[1]	NA	NA
Main Gate	14.2	0.6
Rover	14.1	0.7
Sand Dunes Tower	13.8	1.5
Boundary Locations		
Atomic City	13.4	1.5
Big Southern Butte	14.7	0.7
Howe	13.2	0.8
Monteview	12.9	0.8
Mud Lake	12.7	0.8
Distant Locations		
Fort Hall[2]	14.9	1.4
Idaho Falls	11.4	0.5

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

Table 8. Electret ionization chamber (EIC) cumulative average exposure rates for third quarter, 2008.

Station Location	Exposure Rate (µR/hr)	
	Quarterly Average	± 2 SD
On-site Locations		
Base of Howe[1]	NS	NS
Big Lost River Rest Area	13.8	4.4
Experimental Field Station	18.0	2.3
Main Gate	15.6	0.1
Rover	14.5	3.4
Sand Dunes Tower	17.1	5.2
Van Buren Avenue	16.2	3.3
Boundary Locations		
Atomic City	16.7	5.2
Big Southern Butte	12.9	2.3
Howe	9.5	2.3
Monteview	15.2	1.9
Mud Lake	18.5	3.1
Distant Locations		
Craters of the Moon	13.9	2.2
Fort Hall[2]	16.9	2.5
Idaho Falls	12.3	0.7

[1] Electret data reported as no sample (NS) due to large inconsistency with average HPIC Output at Base of Howe over this time period.
[2] Operated by Shoshone-Bannock Tribes.

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 2008, 1 up-gradient, 1 boundary, and 7 distant locations were sampled.

Most sites sampled by DEQ-INL 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 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. 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 not detected at any locations. 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. Gross beta radioactivity 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 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 at any locations. 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 at one boundary location USGS-103 (**Table 10**). Previously, tritium results from USGS-103 have been less than the detection level using the standard tritium analysis method, and at or near the detection level for the enriched tritium analysis method, consistent with expected SRPA background levels. In 2007, the USGS deepened this well to approximately 1290 feet and equipped it with a Westbay™ packer sampling system, designed to allow samples to be taken from seven isolated vertical zones within the well. This enables scientists to determine the vertical distribution of contaminants at that location. Following Westbay ™ installation in 2007, DEQ-INL co-sampled with the USGS at the zone closest to the original pump-depth (615 ft below land surface). The resulting tritium concentration (42 pCi/L) was greater than previous concentrations, but still within the general background range. This current quarter, the deepest zone was sampled, which is at 1269.4 ft bls (below land surface). The result (430 pCi/L) was an order of magnitude greater than the 2007 sample. These results indicate that at USGS-103, INL-related tritium contamination occurs at deeper levels within the aquifer. Results for gross alpha, beta and gamma emitting radioactivity at USGS-103 did not indicate the presence of other radionuclides. DEQ-INL will continue to co-sample this deepest zone on an annual basis. The USGS is planning to install three more Westbay ™ systems near the southern boundary this year. The DEQ-INL plans to sample these wells once they are completed.

All other sample locations with detections were consistent with historic concentrations for these sites. Selected water samples with tritium concentrations not measurable using the standard method (typically a MDC of 130 pCi/L) were analyzed using an electrolytic enrichment method with a much lower MDC of 10 to 14 pCi/L (**Table 11**). Nineteen samples were analyzed this quarter, all of which were from 2nd and 3rd quarter sampling. There is currently a backlog of two samples from 2nd quarter, due to the large number of samples for the quarter. All sample results were within the expected range of concentrations due to natural sources and levels remaining after the atomic bomb testing era.

Samples were also analyzed for metals and the results shown in **Table 12.** All metals 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.

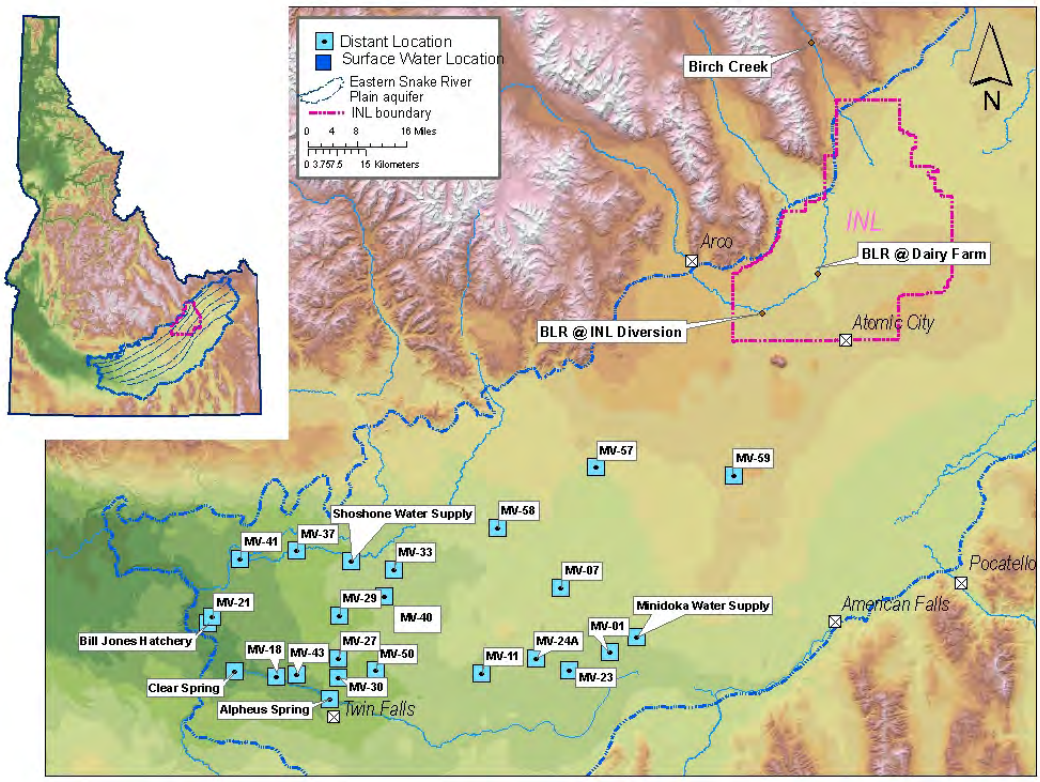

Figure 2. Distant sampling locations for third quarter, 2008.

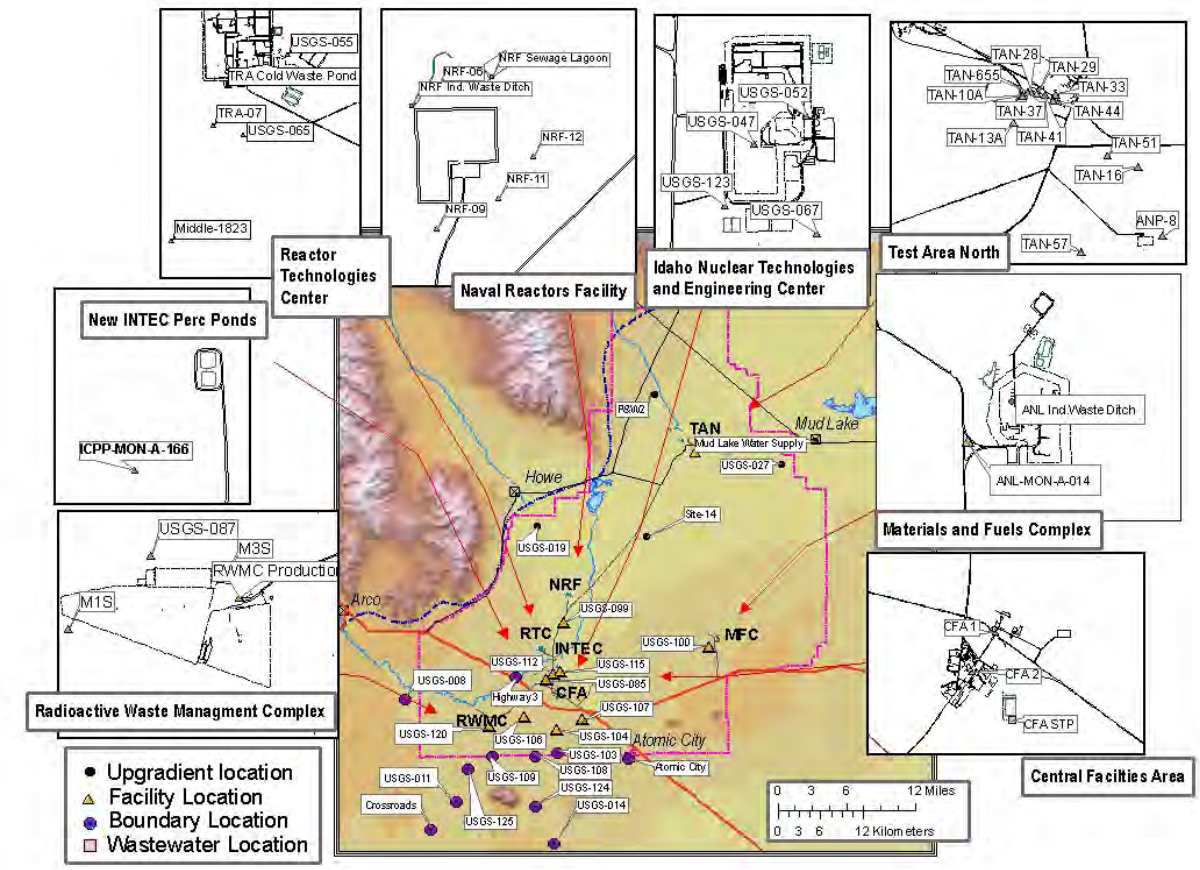

Figure 3. Up-gradient, facility, boundary and wastewater monitoring locations.

Table 9. Alpha, beta, and gamma concentrations for water samples, third quarter, 2008.

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	8/19/2008	-2.5	U	2.2	4.3		1.2	2.2	U	2.2
Boundary										
USGS-103	8/19/2008	3.8	U	2.6	1.9		1.2	0.3	U	1.3
Distant										
Bill Jones Hatchery	8/18/2008	0.5	U	2.4	4.1		1.2	0.6	U	1.4
Clear Spring	8/18/2008	2.9	U	3.1	3.6		1.3	-0.7	U	2.2
Minidoka Water Supply	8/18/2008	2.0	U	2.8	4.3		1.3	-1.0	U	1.4
MV-40	8/18/2008	-0.7	U	2.3	4.1		1.2	-0.2	U	1.4
MV-41	8/18/2008	4.1	U	4.7	7.8		2.8	0.6	U	1.6
MV-50	8/18/2008	0.2	U	3.5	6.2		1.4	0.3	U	1.5
Shoshone Water Supply	8/18/2008	-1.3	U	2.4	3.6		1.2	0.5	U	1.6

[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, 2008.

Sample Location	Sample Date	Tritium		
		Concentration[1,2]		± 2 SD
Up-gradient				
Mud Lake Water Supply	8/19/2008	-30	U	80
Boundary				
USGS-103	8/19/2008	430		100
Distant				
Bill Jones Hatchery	8/18/2008	20	U	80
Clear Spring	8/18/2008	40	U	80
Minidoka Water Supply	8/18/2008	0	U	80
MV-40	8/18/2008	10	U	80
MV-41	8/18/2008	60	U	80
MV-50	8/18/2008	40	U	80
Shoshone Water Supply	8/18/2008	20	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, 2008.

Sample Location	Sample Date	Enriched Tritium Concentration[1,2]		± 2 SD
Up-gradient				
Mud Lake Water Supply	8/19/2008	0	U	7
Facility				
USGS-107	6/9/2008	11	U	10
Boundary				
USGS-109	6/9/2008	78		10
Distant				
Alpheus Spring	6/17/2008	19		8
Bill Jones Hatchery	8/18/2008	3	U	7
Minidoka Water Supply	8/18/2008	11		7
MV-01	6/17/2008	40		9
MV-11	6/17/2008	23		8
MV-18	6/18/2008	22		6
MV-21	6/18/2008	7	U	6
MV-23	6/17/2008	25		7
MV-24A	6/17/2008	28		7
MV-29	6/17/2008	1	U	5
MV-30	6/17/2008	23		7
MV-37	6/18/2008	21		6
MV-40	8/18/2008	-1	U	8
MV-41	8/18/2008	13		8
MV-50	8/18/2008	17		8
Shoshone Water Supply	8/18/2008	16		7

[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, 2008.

Sample Location	Sample Date	Concentration[1,2]																	
		Arsenic		Barium	Beryllium	Cadmium		Chromium		Iron		Lead		Manganese	Mercury	Selenium		Zinc	
Up-gradient																			
Mud Lake Water Supply	8/19/2008	9.4		20	NR	<1	U	<5	U	40		<5	U	49	NR	<10	U	<5	U
Boundary																			
USGS-103	8/19/2008	NR		50	NR	NR		6.7		NR		<5	U	<2	U	NR		NR	9
Distant																			
Bill Jones Hatchery	8/18/2008	NR		22	NR	NR		<5	U	NR		<5	U	<2	U	NR		NR	<5	U
Clear Spring	8/18/2008	NR		37	NR	NR		<5	U	NR		<5	U	<2	U	NR		NR	<5	U
Minidoka Water Supply	8/18/2008	NR		35	NR	NR		<5	U	NR		<5	U	<2	U	NR		NR	19	
MV-40	8/18/2008	<5	U	17	NR	<1	U	<5	U	<10	U	<5	U	<2	U	NR		<10	U	<5	U
MV-41	8/18/2008	<5	U	77	NR	<1	U	<5	U	<10	U	<5	U	<2	U	NR		<10	U	<5	U
MV-50	8/18/2008	<5	U	64	NR	<1	U	<5	U	<10	U	<5	U	<2	U	NR		<10	U	10	
Shoshone Water Supply	8/18/2008	NR		41	NR	NR		<5	U	NR		<5	U	<2	U	NR		NR		<5	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 13. Reported common ion concentrations in water samples, third quarter, 2008.

Sample Location	Sample Date	Concentration[1,2]										
		Calcium	Magnesium	Sodium	Potassium	Fluoride	Chloride	Sulfate	Silica	Alkalinity[3]	TDS[4]	TSS[5]
Up-gradient												
Mud Lake Water Supply*	8/19/2008	8.8	2.7	32	5.0	0.57	4.8	8.5	NR	90	NR	NR
Boundary												
USGS-103*	8/19/2008	40	15	9.1	2.5	0.26	15	22	NR	139	NR	NR
Distant												
Bill Jones Hatchery*	8/18/2008	31	16	17	3.6	0.43	12	26	NR	140	NR	NR
Clear Spring*	8/18/2008	45	18	26	4.2	0.56	34	47	NR	150	NR	NR
Minidoka Water Supply*	8/18/2008	45	15	21	3.5	0.62	31	40	NR	138	NR	NR
MV-40*	8/18/2008	29	14	16	3.3	0.43	10	23	35	127	NR	NR
MV-41*	8/18/2008	66	29	43	4.4	0.40	30	64	43	260	NR	NR
MV-50*	8/18/2008	62	23	41	5.4	0.44	54	68	36	185	NR	NR
Shoshone Water Supply*	8/18/2008	42	14	15	3.0	0.27	6.5	17	NR	168	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 $CaCO_3$

[4] =Total Dissolved Solids,

[5] = Total Suspended Solids

Table 14. Reported nutrient concentrations in water samples, third quarter, 2008.

Sample Location	Sample Date	Concentration [1,2]		
		Nitrite + Nitrate	Phosphorus	Ammonia
Up-gradient				
Mud Lake Water Supply	8/19/2008	<0.01 U	0.036	NR
Boundary				
USGS-103	8/19/2008	0.82	0.015	NR
Distant				
Bill Jones Hatchery	8/18/2008	1.1	0.017	NR
Clear Spring	8/18/2008	1.6	0.026	NR
Minidoka Water Supply	8/18/2008	1.0	0.011	NR
MV-40	8/18/2008	0.79	0.021	0.011
MV-41	8/18/2008	2.4	0.070	0.012
MV-50	8/18/2008	1.7	0.026	<0.01 U
Shoshone Water Supply	8/18/2008	1.2	0.031	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 monitors milk for naturally occurring potassium-40 and man-made iodine-131. DEQ-INL 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.

DEQ-INL monitors long-term radiological conditions in the environment via soil sampling as well as field instrumentation capable of identifying and measuring quantities of gamma-emitting radionuclides. 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. Eight soil samples were collected and prepared in the field at four locations during the third calendar quarter of 2008. Gamma spectroscopic analysis results for ^{137}Cs concentrations are shown in **Table 16**. No man-made radionuclides other than ^{137}Cs were identified.

Table 15. Gamma spectroscopy analysis data for milk samples, third quarter, 2008.

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	06/30/08	1515	164	<MDC
	08/03/08	1528	116	<MDC
	09/02/08	1494	101	<MDC
Mud Lake/Nelson-Ricks Creamery	06/29/08	1547	104	<MDC
	08/03/08	1435	110	<MDC
	09/02/08	1408	97	<MDC
Gooding/Glanbia	07/01/08	1393	110	<MDC
	08/08/08	1483	101	<MDC
	09/03/08	1467	99	<MDC
Ft. Hall	07/08/08	1376	96	<MDC
	08/11/08	1339	105	<MDC
	09/09/08	1273	104	<MDC
Riverside	07/09/08	2022	125	<MDC
	08/11/08	1964	137	<MDC
	09/16/08	1988	138	<MDC

Table 15 continued. Gamma spectroscopy analysis data for milk samples, third quarter, 2008.

Sample Location/Dairy	Sample Date	Naturally occurring gamma-emitting radionuclide Potassium-40		Man-made gamma-emitting radionuclide Iodine-131[1]
		Concentration[3]	± 2 SD	
Verification Samples[2]				
Idaho Falls	07/01/08	1542	103	<MDC
Dietrich	07/01/08	1474	114	<MDC
Moreland	08/05/08	1495	102	<MDC
Howe	08/05/08	1609	106	<MDC
Moreland	09/02/08	1627	121	<MDC
Terreton	09/02/08	1499	113	<MDC

[1] <MDC – Less than Minimum Detectable Concentration (approximately 4 pCi/L for Iodine-131).
[2] DEQ-INL samples collected by the off-site INL environmental surveillance contractor.
[3] Concentrations are expressed in pCi/L.

Table 16. Gamma spectroscopy analysis data for soil samples, third quarter, 2008.

Location	Sample Type[1]	Sample Depth (cm)	Date Collected	Concentration[2]	± 2 SD	MDC
St. Anthony	Puck	0 to 5	8/18/08	0.59	0.06	0.08
St. Anthony	Puck	5 to 10	8/18/08	0.15	0.04	0.08
Reno Ranch	Puck	0 to 5	8/18/08	0.53	0.05	0.08
Reno Ranch	Puck	5 to 10	8/18/08	0.13	0.04	0.08
Carey	Puck	0 to 5	8/25/08	0.23	0.04	0.09
Carey	Puck	5 to 10	8/25/08	0.06	0.03	0.06
Butte City	Puck	0 to 5	8/25/08	0.32	0.05	0.08
Butte City	Puck	5 to 10	8/25/08	0.05	0.02	0.07

[1]Soil samples were collected in a "puck" (a cylindrical plastic container with a diameter of 6.5 cm and a height of 3.0 cm) and prepared in the field for gamma spectroscopic analysis at ISU.
[2]Concentrations reported in pCi/g.

Quality Assurance

The measurement of any physical quantity is subject to uncertainty from errors that may be introduced during sample collection, measurement, calibration, and the reading and reporting of results. While the sum of these inaccuracies cannot be quantified 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 2008 for the DEQ-INL'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.

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 2008, the DEQ-INL submitted 58 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 2008 are presented in **Table 18**.

Blank sample results for select gamma emitters in air from composited air filters are presented in **Table 19**. Data for blank analyses used to assess data quality for tritium in water vapor in air are presented in **Table 20**. Blank analyses results for radiological and non-radiological analytes in ground and surface water are presented in **Table 21**, **Table 22,** and **Table 23**. The one blank sample for total nitrogen came back with a result of 0.012 mg/L, just above the detection level (0.010 mg/L). Since duplicate pair results for total nitrogen passed the duplicate criteria and the sample results were within historical concentrations, none of the data has been rejected or qualified based on this blank result.

No anomalies were observed from the assessment of field blank samples as measured by the analytical laboratories used by DEQ-INL for the third quarter of 2008.

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:

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

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 24, Table 25,** and **Table 26** for radiological analyses and non-radiological analyses. Duplicate results for soil are presented in **Table 27**.

No anomalies were observed from the assessment of field duplicate samples as measured by the analytical laboratories used by DEQ-INL for the third quarter of 2008.

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 calculates the difference between the known concentration in the sample and the measured concentration by the laboratory. This result is known as percent recovery (%R) and the acceptable range used by DEQ-INL 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 2008, no field matrices were spiked to assess the influence of the sample media on laboratory performance.

DEQ-INL also prepares additional "spike-like" quality control samples to assess ambient radiation measurement bias. Once per quarter, DEQ-INL 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 2008 are presented in **Table 28**. 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 or the analytical laboratories used by DEQ-INL for the third quarter of 2008.

Analytical QA/QC Assessment

Other than the one previously mentioned, no issues involving sample chain of custody, sample holding times, the analysis of blank, spiked, and duplicate samples were observed during the third quarter of 2008, which significantly affected data quality. Methodologies and data reports issued by the contracting laboratories generally conformed to the requirements of DEQ-INL during the third quarter of 2008.

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 2008 met the minimum criteria of the DEQ-INL 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 2008 is summarized in **Table 29**. All equipment performed well during this period.

Conclusion

All data collected for the third quarter of 2008, 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.

Table 17. Summary of the analytical performance and usability of the analyses performed for the DEQ-INL ESP for third quarter, 2008.

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	150	14	0	0	0	ISU-EML
		Gross beta	150	14	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	56	2	0	0	0	ISU-EML
Gaseous	Charcoal filter	Iodine-131	14	0	0	0	0	ISU-EML
Precipitation	Poly bottle	Tritium	5	0	0	0	0	ISU-EML
		Gamma emitters	3	0	0	0	0	ISU-EML
WATER								
Groundwater & Surface Water	Grab or composite	Gross alpha	9	1	1	0	0	ISU-EML
		Gross beta	9	1	1	0	0	ISU-EML
		Gamma emitters	9	1	1	0	0	ISU-EML
		Tritium	9	1	1	0	0	ISU-EML
		Enriched tritium	19	1	1	0	0	ISU-EML
		Technetium-99	0	0	0	0	0	ISU-EML
		Radiochemical	0	0	0	0	0	ISU Sub
		Metals	9	1	1	0	0	IBL
		Common Ions	9	1	1	0	0	IBL
		Nutrients	9	1	1	0	0	IBL
		Volatile Organics	0	0	0	0	0	IBL
TERRESTRIAL								
Milk	Grab or composite	Gamma emitters	21	0	0	0	0	ISU-EML
Soil	*in situ*	Gamma emitters	0	0	0	0	0	DEQ-INL
	Grab – "puck"	Gamma emitters	8	0	2	0	0	ISU-EML
RADIATION								
Ambient	EICs	Gamma Radiation	56	0	0	9	0	DEQ-INL
	HPICs	Gamma Radiation	11	NA	NA	NA	NA	DEQ-INL
Total Test Analyses			**567**	39	10	9	0	
Total of QC Analyses (blanks, duplicates, and spikes)			**58**					
Percentage of QC analyses of total Test analyses[3]			**10.2%**					
Percentage of usable data[4]			**100**					

[1] Combined Laboratory and DEQ-INL 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 = 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 ESP.

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

Table 18. Blank analysis results for gross alpha and beta in particulate air (TSP) for the third quarter, 2008.

Collection Period		Corrected volume (m^3) [1]	Gross alpha		Gross beta	
Start	Stop		Value	Uncertainty (± 2 SD)	Value	Uncertainty (± 2 SD)
6/26/08	7/3/08	1710	0.0	0.2	0.2	0.3
7/3/08	7/10/08	1710	0.0	0.2	0.2	0.4
7/10/08	7/17/08	1710	-0.3	0.2	0.0	0.3
7/17/08	7/24/08	1710	-0.1	0.2	-0.2	0.3
7/24/08	7/31/08	1710	0.0	0.2	0.2	0.3
7/31/08	8/7/08	1710	-0.2	0.2	-0.1	0.3
8/7/08	8/14/08	1710	-0.1	0.2	-0.4	0.3
8/14/08	8/21/08	1710	0.1	0.2	0.5	0.3
8/21/08	8/28/08	1710	-0.2	0.2	-0.3	0.3
8/28/08	9/4/08	1710	0.1	0.2	-0.1	0.3
9/4/08	9/11/08	1710	-0.1	0.2	0.0	0.3
9/11/08	9/18/08	1710	0.0	0.2	-0.1	0.3
9/18/08	9/25/08	1710	-0.2	0.2	-0.1	0.3
9/25/08	10/2/08	1710	0.1	0.2	-0.3	0.3

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 for the third quarter, 2008.

Analysis Date	Beryllium-7			Ruthenium-106/ Rhodium-106			Antimony-125		
	Concentration[1]	± 2 SD	MDC	Concentration	± 2 SD	MDC	Concentration	± 2 SD	MDC
11/04/08	47	29	50	-20	27	49	3	27	49

Analysis Date	Cesium-134			Cesium-137		
	Concentration[1]	± 2 SD	MDC	Concentration	± 2 SD	MDC
11/04/08	0	3	5	-1	3	5

Note: Concentrations are expressed in 1 x 10^{-5} pCi/m^3 with associated uncertainty (± 2 SD) and minimum detectable concentration (MDC).
[1] These concentrations are from blank filters collected weekly, composited, and analyzed for the calendar quarter. A composite volume equal to the sum of the 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. Blank analysis results for tritium in water vapor from air samples for the third quarter, 2008.

Sample Number	Start Date	Collect Date	Analysis Date	Tritium		
				Concentration	± 2 SD	MDC
OP083ZTR01	8/1/08	8/8/08	12/24/08	-0.01	0.09	0.15
OP083ZTR02	8/1/08	9/2/08	10/8/08	0.02	0.09	0.15

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

Table 21. Radiological blank analysis in ground and surface water for samples for the third quarter, 2008. Concentrations are expressed in pCi/L with associated uncertainty (± 2SD) and minimum detectable concentration (MDC).

Sample Number	Sample Date	Concentration	± 2 SD	MDC	Within Blank Criteria?
Gross Alpha					
081W462	8/19/2008	0.3	0.6	1.0	yes
Gross Beta					
081W462	8/19/2008	1.5	0.9	1.5	yes
Cesium-137					
081W462	8/19/2008	0.3	1.5	2.5	yes
Tritium					
081W463	8/19/2008	10	80	130	yes
Enriched Tritium					
081W463	8/19/2008	22	7	11	yes

Table 22. Blank analysis results (µg/L) for metals in ground and surface water for the third quarter, 2008.

Sample Number	Sample Date	Arsenic	Barium	Cadmium	Chromium	Iron	Lead	Manganese	Selenium	Zinc
081W465	8/19/2008	<5	<2	<1	<5	<10	<5	<2	<10	<5

Table 23. Blank analysis results (mg/L) for common ions and nutrients in ground and surface water for the third quarter, 2008.

Sample Number	Sample Date	Calcium	Magnesium	Sodium	Potassium	Fluoride	Chloride	Sulfate	Total Alkalinity	Total Nitrogen	Total Phosphorus
081W465,464,466	8/19/2008	<0.1	<0.1	<0.1	<0.1	<0.1	<1	<1	<1	0.012	<0.0050

Table 24. Duplicate radiological analysis results in pCi/L for ground and surface water, third quarter, 2008.

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									
Mud Lake Water Supply	081W323	-2.5	2.2	081W447	0	1.6	2.5	4	yes
Gross Beta									
Mud Lake Water Supply	081W323	4.3	1.2	081W447	5.1	1.2	2.7	8	yes
Gamma Spectroscopy Cesium-137									
Mud Lake Water Supply	081W323	2.2	2.2	081W447	-1.5	1.6	3.7	4	yes
Tritium									
Mud Lake Water Supply	081W325	-30	80	081W448	-20	80	10	170	yes
Enriched Tritium									
MV-37	081W391	21	6	081W343	26	8	5	15	yes

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

Table 25. Duplicate results for metals (µg/L) in ground water and/or surface water for the third quarter, 2008.

Sample Location	Sample Number	Sample Date	Arsenic	Barium	Cadmium	Chromium	Iron	Lead	Manganese	Selenium	Zinc
Mud Lake Water Supply	081W327	8/19/2008	9.4	20	<1	<5	40	<5	49	<10	<5
Duplicate	081W450	8/19/2008	8.8	19	<1	<5	45	<5	50	<10	<5
RPD			7	5	0	0	-12	0	-2	0	0

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

Table 26. Duplicate results for common ions and nutrients (mg/L) in ground water and/or surface water for third quarter, 2008.

Sample Location	Sample Number	Sample Date	Calcium	Magnesium	Sodium	Potassium	Fluoride	Chloride	Sulfate	Total Alkalinity	Total Nitrogen	Total Phosphorus
Mud Lake Water Supply	081W327,326,328	8/19/2008	8.8	2.7	32	5	0.57	4.8	8.5	90	<0.01	0.036
Duplicate	081W450,449,451	8/19/2008	8.7	2.7	32	5	0.57	4.8	8.5	90	<0.01	0.037
RPD			1	0	0	0	0	0	0	0	0	-3

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

Table 27. Duplicate results for Cs-137 in soil for third quarter, 2008.

Sample Location	Original Sample Number	Cs-137 Concentration (pCi/g)	± 2 s	Duplicate Sample Number	Cs-137 Concentration (pCi/g)	± 2 s	Within Criteria?[1]
Butte City	OP083BCSR01	0.32	0.05	OP083BCSR03	0.28	0.05	Yes
Butte City	OP083BCSR02	0.05	0.02	OP083BCSR04	0.02	0.03	Yes

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

Table 28. Electret ionization chamber irradiation results (categorized as spiked samples) for third quarter, 2008.

Electret #	Exposure Received		Net Measured Exposure[1]		%R
	(mR)	Uncertainty (mR)	(mR)	Uncertainty (mR)	
Spike 1	25	1.25	20.2	1.39	80.9
Spike 1	25	1.25	22.4	1.40	89.7
Spike 1	25	1.25	21.2	1.40	84.9
Spike 2	30	1.50	27.1	1.40	90.3
Spike 2	30	1.50	27.2	1.40	90.6
Spike 2	30	1.50	27.3	1.39	91.0
Spike 3	35	1.75	33.1	1.39	94.7
Spike 3	35	1.75	29.0	1.39	82.9
Spike 3	35	1.75	29.4	1.38	83.9

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

Table 29. Air sampling field equipment service reliability (percent operational) for third quarter, 2008.

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[2]	100 %	100 %	100 %	0 %
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
[2] Precipitation sampling at Howe was suspended due to irrigation water entering the sample

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, 2008.

Sample location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	± 2 SD	Concentration	± 2 SD
Rest Area	06/26/08	07/03/08	1.7	0.3	41.6	1.4
	07/03/08	07/10/08	2.0	0.4	36.1	1.4
	07/10/08	07/17/08	1.1	0.3	31.9	1.3
	07/17/08	07/24/08	1.5	0.3	41.4	1.4
	07/24/08	07/31/08	2.8	0.4	47.1	1.5
	07/31/08	08/07/08	1.5	0.4	42.9	1.5
	08/07/08	08/14/08	1.6	0.4	46.3	1.6
	08/14/08	08/21/08	2.8	0.4	38.5	1.5
	08/21/08	08/28/08	2.9	0.5	40.3	1.6
	08/28/08	09/04/08	3.0	0.5	40.5	1.6
	09/04/08	09/11/08	2.4	0.4	45.9	1.6
	09/11/08	09/18/08	3.1	0.5	61.6	1.9
	09/18/08	09/25/08	3.4	0.5	63.6	1.9
	09/25/08	10/02/08	2.8	0.4	88.4	2.3
Experimental Field Station	06/26/08	07/03/08	1.3	0.3	27.1	1.2
	07/03/08	07/10/08	1.7	0.4	30.5	1.5
	07/10/08	07/17/08	1.0	0.3	27.5	1.2
	07/17/08	07/24/08	1.9	0.4	43.2	1.5
	07/24/08	07/31/08	2.1	0.4	38.1	1.4
	07/31/08	08/07/08	1.5	0.4	30.9	1.3
	08/07/08	08/14/08	NS[1]	NS	NS	NS
	08/14/08	08/21/08	NS	NS	NS	NS
	08/21/08	08/28/08	2.2	0.4	23.8	1.2
	08/28/08	09/04/08	1.9	0.4	25.5	1.2
	09/04/08	09/11/08	2.2	0.4	31.9	1.3
	09/11/08	09/18/08	2.4	0.4	43.0	1.5
	09/18/08	09/25/08	2.3	0.4	40.8	1.4
	09/25/08	10/02/08	1.6	0.3	53.0	1.6

[1] NS - Insufficient sample collected due to electrical outages, planned or unplanned.

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, 2008.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	± 2 SD	Concentration	± 2 SD
Sand Dunes	06/26/08	07/03/08	1.2	0.3	27.0	1.2
	07/03/08	07/10/08	1.7	0.4	32.8	1.3
	07/10/08	07/17/08	1.2	0.3	29.6	1.2
	07/17/08	07/24/08	1.4	0.3	35.2	1.4
	07/24/08	07/31/08	2.2	0.4	36.0	1.4
	07/31/08	08/07/08	1.3	0.4	32.5	1.3
	08/07/08	08/14/08	0.7	0.3	29.5	1.3
	08/14/08	08/21/08	2.0	0.3	28.9	1.2
	08/21/08	08/28/08	1.8	0.4	23.7	1.2
	08/28/08	09/04/08	1.8	0.4	23.6	1.1
	09/04/08	09/11/08	1.8	0.4	33.3	1.3
	09/11/08	09/18/08	2.0	0.4	39.1	1.4
	09/18/08	09/25/08	2.0	0.4	41.9	1.5
	09/25/08	10/02/08	1.5	0.3	49.9	1.6
Van Buren	06/26/08	07/03/08	1.3	0.3	32.6	1.2
	07/03/08	07/10/08	2.0	0.4	36.9	1.3
	07/10/08	07/17/08	1.4	0.3	33.4	1.3
	07/17/08	07/24/08	1.8	0.3	40.3	1.4
	07/24/08	07/31/08	2.9	0.4	41.9	1.4
	07/31/08	08/07/08	1.0	0.3	41.3	1.4
	08/07/08	08/14/08	1.5	0.3	34.1	1.3
	08/14/08	08/21/08	3.0	0.4	31.1	1.3
	08/21/08	08/28/08	2.2	0.4	30.9	1.3
	08/28/08	09/04/08	2.1	0.4	28.5	1.2
	09/04/08	09/11/08	2.4	0.4	38.7	1.4
	09/11/08	09/18/08	2.3	0.4	41.2	1.4
	09/18/08	09/25/08	2.6	0.4	45.4	1.5
	09/25/08	10/02/08	1.7	0.4	57.4	2.2
Atomic City	06/26/08	07/03/08	1.4	0.3	28.8	1.2
	07/03/08	07/10/08	1.9	0.4	32.6	1.6
	07/10/08	07/17/08	2.0	0.4	34.4	1.3
	07/17/08	07/24/08	2.5	0.4	42.7	1.5
	07/24/08	07/31/08	2.0	0.4	41.2	1.4
	07/31/08	08/07/08	1.7	0.4	36.7	1.4
	08/07/08	08/14/08	1.0	0.3	30.6	1.2
	08/14/08	08/21/08	2.9	0.4	27.1	1.1
	08/21/08	08/28/08	2.0	0.4	25.2	1.1
	08/28/08	09/04/08	2.7	0.4	27.4	1.2
	09/04/08	09/11/08	1.9	0.4	31.7	1.2
	09/11/08	09/18/08	2.3	0.4	44.7	1.4
	09/18/08	09/25/08	2.5	0.4	46.5	1.5
	09/25/08	10/02/08	0.8	0.2	38.7	1.3

Table A-1 continued. Weekly concentrations (in 1 x 10^{-3} pCi/m^3) for gross alpha and gross beta analyses for TSP filters for all locations, third quarter, 2008.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	± 2 SD	Concentration	± 2 SD
Howe	06/26/08	07/03/08	1.1	0.3	24.8	1.1
	07/03/08	07/10/08	2.1	0.4	29.2	1.2
	07/10/08	07/17/08	NS[1]	NS	NS	NS
	07/17/08	07/24/08	1.5	0.3	30.7	1.2
	07/24/08	07/31/08	1.7	0.3	30.4	1.2
	07/31/08	08/07/08	1.0	0.3	29.1	1.2
	08/07/08	08/14/08	0.8	0.3	27.0	1.1
	08/14/08	08/21/08	2.3	0.4	26.4	1.1
	08/21/08	08/28/08	1.5	0.3	21.7	1.1
	08/28/08	09/04/08	1.7	0.3	21.1	1.0
	09/04/08	09/11/08	1.3	0.3	25.5	1.1
	09/11/08	09/18/08	1.5	0.3	32.9	1.3
	09/18/08	09/25/08	2.5	0.4	38.5	1.4
	09/25/08	10/02/08	1.7	0.3	58.1	1.6
Monteview	06/26/08	07/03/08	1.0	0.3	22.4	1.1
	07/03/08	07/10/08	1.0	0.3	22.2	1.1
	07/10/08	07/17/08	0.8	0.3	19.9	1.0
	07/17/08	07/24/08	1.0	0.3	20.1	1.0
	07/24/08	07/31/08	1.6	0.3	24.9	1.0
	07/31/08	08/07/08	1.1	0.3	23.8	1.0
	08/07/08	08/14/08	0.8	0.3	24.3	1.0
	08/14/08	08/21/08	1.9	0.3	20.7	1.0
	08/21/08	08/28/08	1.6	0.3	18.6	0.9
	08/28/08	09/04/08	1.4	0.3	17.4	0.9
	09/04/08	09/11/08	1.3	0.4	26.1	1.3
	09/11/08	09/18/08	1.8	0.3	33.0	1.2
	09/18/08	09/25/08	2.4	0.4	38.4	1.3
	09/25/08	10/02/08	1.8	0.3	54.2	1.5
Mud Lake	06/26/08	07/03/08	1.5	0.3	27.3	1.2
	07/03/08	07/10/08	1.8	0.4	29.5	1.3
	07/10/08	07/17/08	1.4	0.4	28.5	1.3
	07/17/08	07/24/08	1.8	0.4	33.6	1.4
	07/24/08	07/31/08	2.0	0.4	35.1	1.4
	07/31/08	08/07/08	6.5	0.6	32.7	1.4
	08/07/08	08/14/08	1.0	0.3	25.8	1.2
	08/14/08	08/21/08	2.6	0.4	24.1	1.2
	08/21/08	08/28/08	2.0	0.4	22.2	1.1
	08/28/08	09/04/08	1.8	0.4	21.5	1.1
	09/04/08	09/11/08	1.4	0.4	28.0	1.2
	09/11/08	09/18/08	1.8	0.4	35.1	1.4
	09/18/08	09/25/08	2.5	0.4	38.4	1.4
	09/25/08	10/02/08	1.7	0.3	46.7	1.6

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, 2008.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	± 2 SD	Concentration	± 2 SD
Distant Locations						
Craters	06/26/08	07/03/08	0.8	0.3	26.2	1.1
	07/03/08	07/10/08	1.0	0.3	19.3	1.0
	07/10/08	07/17/08	1.7	0.4	26.8	1.2
	07/17/08	07/24/08	1.5	0.3	36.5	1.4
	07/24/08	07/31/08	2.3	0.4	35.8	1.3
	07/31/08	08/07/08	1.3	0.3	33.6	1.3
	08/07/08	08/14/08	0.3	0.3	28.2	1.5
	08/14/08	08/21/08	2.5	0.4	25.2	1.1
	08/21/08	08/28/08	2.0	0.4	22.6	1.1
	08/28/08	09/04/08	1.8	0.4	22.7	1.1
	09/04/08	09/11/08	1.4	0.3	28.0	1.2
	09/11/08	09/18/08	1.9	0.4	35.3	1.4
	09/18/08	09/25/08	2.0	0.4	35.1	1.4
	09/25/08	10/02/08	1.3	0.3	42.6	1.4
Fort Hall[1]	06/26/08	07/03/08	1.9	0.3	21.8	1.1
	07/03/08	07/10/08	2.3	0.4	25.3	1.2
	07/10/08	07/17/08	1.4	0.3	23.0	1.1
	07/17/08	07/24/08	1.7	0.3	29.2	1.2
	07/24/08	07/31/08	2.0	0.4	27.6	1.2
	07/31/08	08/07/08	1.0	0.3	20.0	1.0
	08/07/08	08/14/08	1.5	0.3	21.2	1.1
	08/14/08	08/21/08	3.5	0.4	21.4	1.1
	08/21/08	08/28/08	2.0	0.4	17.5	1.0
	08/28/08	09/04/08	NS[2]	NS	NS	NS
	09/04/08	09/11/08	1.9	0.4	22.6	1.1
	09/11/08	09/18/08	2.4	0.4	28.8	1.2
	09/18/08	09/25/08	2.0	0.4	31.2	1.3
	09/25/08	10/02/08	2.1	0.3	36.0	1.3
Idaho Falls	06/26/08	07/03/08	1.6	0.3	22.8	1.1
	07/03/08	07/10/08	2.3	0.4	36.9	1.4
	07/10/08	07/17/08	1.6	0.4	36.6	1.4
	07/17/08	07/24/08	2.4	0.4	48.5	1.6
	07/24/08	07/31/08	3.1	0.6	47.1	2.1
	07/31/08	08/07/08	1.7	0.4	43.9	1.5
	08/07/08	08/14/08	1.1	0.3	31.3	1.3
	08/14/08	08/21/08	3.5	0.4	36.2	1.4
	08/21/08	08/28/08	2.2	0.4	28.4	1.3
	08/28/08	09/04/08	2.0	0.4	26.8	1.2
	09/04/08	09/11/08	2.1	0.4	36.4	1.4
	09/11/08	09/18/08	2.2	0.4	40.6	1.4
	09/18/08	09/25/08	2.4	0.4	41.7	1.5
	09/25/08	10/02/08	2.1	0.4	46.8	1.6

[1] Operated by Shosone-Bannack Tribe
[2] Sample pump was not re-started from previous week

Appendix B

Table B-1. Results for all electret locations, third quarter, 2008.

Sample Location	**Net Corrected Exposure Rate** (µR/h)	**± 2 SD** (µR/h)
Arco	16.6	7.1
Craters	13.9	2.2
Rest Area	13.8	4.4
Van Buren	16.2	3.3
EFS	18.0	2.3
Main Gate	15.6	0.1
Atomic City	16.7	5.2
Taber	19.8	6.3
Blackfoot	20.8	4.0
Ft. Hall	16.9	2.5
Idaho Falls	12.3	0.7
Mud Lake/ Terreton	18.5	3.0
Monteview	15.2	1.9
Sand Dunes	17.1	5.1
Howe	9.5	2.3
Howe Met. Tower	17.2	3.2
MP276 -20	15.1	4.8
MP274 -20	9.9	4.8
MP272 -20	14.9	4.8
MP270 -20	15.5	4.8
MP268 -20	15.1	4.8
MP266 -20	17.4	4.8
MP264 -20[1]	NS	NS
MP270 -20/26	18.4	4.8
MP268 -20/26	15.9	4.8
MP266 -20/26	16.7	4.8
MP263 -20/26	16.2	4.8
MP261 -20/26	12.0	4.8
MP259 -20/26	12.6	4.8
MFC (EBR II)	14.3	3.6
EBR I	14.7	3.4
RWMC	17.5	3.2
CFA	18.1	1.2
CITRC (PBF)	16.6	2.4

Table B-1 continued. Results for all electret locations, third quarter, 2008.

Sample Location	**Net Corrected Exposure Rate** (µR/h)	**± 2 SD** (µR/h)
INTEC (ICPPI)	16.6	6.3
ATR (TRA)	17.3	6.2
NRF	15.7	5.4
TAN	15.8	3.8
Mud Lake Bank of Commerce	18.4	4.9
MP43-33	17.9	4.1
MP41-33	16.0	4.1
MP39-33	14.7	4.1
MP37-33	16.1	4.1
MP35-33	11.1	4.1
MP33-33	16.2	4.1
MP31-33	14.3	4.1
MP29-33	16.6	4.1
MP27-33	16.5	4.1
MP25-33	13.4	4.1
MP23-33	12.5	4.1
Base of Howe[2]	NS	NS
Rover	14.5	3.4
Hamer	17.0	7.6
Sugar City	20.2	1.0
Roberts	16.6	1.7
Big Southern Butte	12.9	2.3

[1] Sample was determined to be an outlier since the data was greater than 3 standard deviations with respect to accompanying Highway 20 readings. Therefore the data was specified as no sample (NS).

[2] Electret data reported as no sample (NS) due to large inconsistency with average HPIC Output at Base of Howe over this time period and also nearly double the readings from neighboring electrets.

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