

Department of Environmental Quality
INL Oversight Program

**ENVIRONMENTAL SURVEILLANCE PROGRAM
QUARTERLY DATA REPORT**

October - December, 2008



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Table of Acronyms

aCi/L	-	attocuries per liter	RWMC	-	Radioactive Waste Management Complex
BEA	-	Battelle Energy Alliance, LLC	RTC	-	Reactor Technology Complex
CERCLA	-	Comprehensive Environmental Response, Compensation and Liability Act	SD	-	standard deviation
CFA	-	Central Facilities Area	SMCL	-	secondary maximum contaminant level
CWI	-	CH2M-WG Idaho, LLC	TAN	-	Test Area North
DEQ-INL OP	-	The State of Idaho, Department of Environmental Quality, Idaho National Laboratory Oversight Program	TCE	-	trichloroethene
DOE	-	U.S. Department of Energy	TDS	-	total dissolved solids
EIC	-	electret ionization chamber	TMI	-	Three Mile Island
EML	-	Environmental Monitoring Laboratory	TSP	-	total suspended particulate
EPA	-	Environmental Protection Agency	TSS	-	total suspended solids
ESER	-	Environmental Surveillance Education and Research Program (SM Stoller)	USGS	-	U.S. Geological Survey
ESP	-	Environmental Surveillance Program	VOC	-	volatile organic compound
ESRPA	-	Eastern Snake River Plain Aquifer	WLAP	-	Wastewater Land Application Permit
HPIC	-	high-pressure ion chamber			
LLD	-	lower limit of detection			
IBL	-	Idaho Bureau of Laboratories			
INL	-	Idaho National Laboratory			
INTEC	-	Idaho Nuclear Technology and Engineering Center			
LSC	-	liquid scintillation counting			
MFC	-	Materials and Fuels Complex			
µg/L	-	micrograms per liter			
mg/L	-	milligrams per liter			
mrem	-	millirem or 1/1000 th of a rem			
mR/hr	-	milliRoentgen per hour			
µR/hr	-	microRoentgen per hour			
MCL	-	maximum contaminant level			
MDA	-	minimum detectable activity			
MDC	-	minimum detectable concentration			
NIST	-	National Institute of Standards and Technology			
nCi/L	-	nanocuries per liter			
NOAA	-	National Oceanic and Atmospheric Administration			
NRF	-	Naval Reactors Facility			
pCi/g	-	picocuries per gram			
pCi/L	-	picocuries per liter			
pCi/m ³	-	picocuries per cubic meter			
PCE	-	perchloroethene			
QAPP	-	Quality Assurance Program Plan			
QA/QC	-	Quality Assurance/Quality Control			
RCRA	-	Resource Conservation and Recovery Act			
RPD	-	relative percent difference			

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 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 fourth 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 OP reports the Fort Hall station data as an additional distant site.

Airborne particulate matter was sampled using high-volume total suspended particulate (TSP) air samplers. Weekly gross alpha and gross beta particulate radioactivity results for filters from the TSP samplers are presented in **Appendix A** and summarized as a range of results in **Table 2**.

Composites of filters collected using TSP samplers during the course of a calendar quarter are analyzed using gamma spectroscopy. Typically, gamma spectroscopy results are only reported when exceeding a minimum detectable activity (MDA) or minimum detectable concentration (MDC). Gamma spectroscopy results for the fourth quarter of 2008 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/m³) are 10 percent of the compliance values listed for the specific radionuclides in 40 CFR 61, Appendix E, Table 2. Field sample concentrations which exceed these amounts require further investigation. Results from the annual 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 composite. If Iodine-131 is detected in this grouping, the canisters are individually analyzed. No radioactive isotopes of iodine, specifically Iodine-131, were detected on the weekly charcoal cartridges used to collect this nuclide during the fourth quarter.

Atmospheric moisture was collected by drawing air through hygroscopic media at each of the 11 monitoring stations. This moisture was stripped from the hygroscopic media and analyzed to calculate the atmospheric tritium concentration. Reported values are the result of either a single sample or a weighted mean based upon the volume of air sampled when more than one atmospheric moisture sample was collected during the calendar quarter. Atmospheric tritium was measured above the minimum detectable concentration for 1 of the 3 samples collected at the Experimental Field Station during the fourth quarter of 2008. This sample was less than 1 % of the DEQ-INL OP action level. Average atmospheric tritium concentrations are presented in **Table 4**.

Precipitation samples were collected at six monitoring locations during the fourth 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 fourth 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. One of the stations, Montevue, did not collect sufficient sample for gamma analysis.

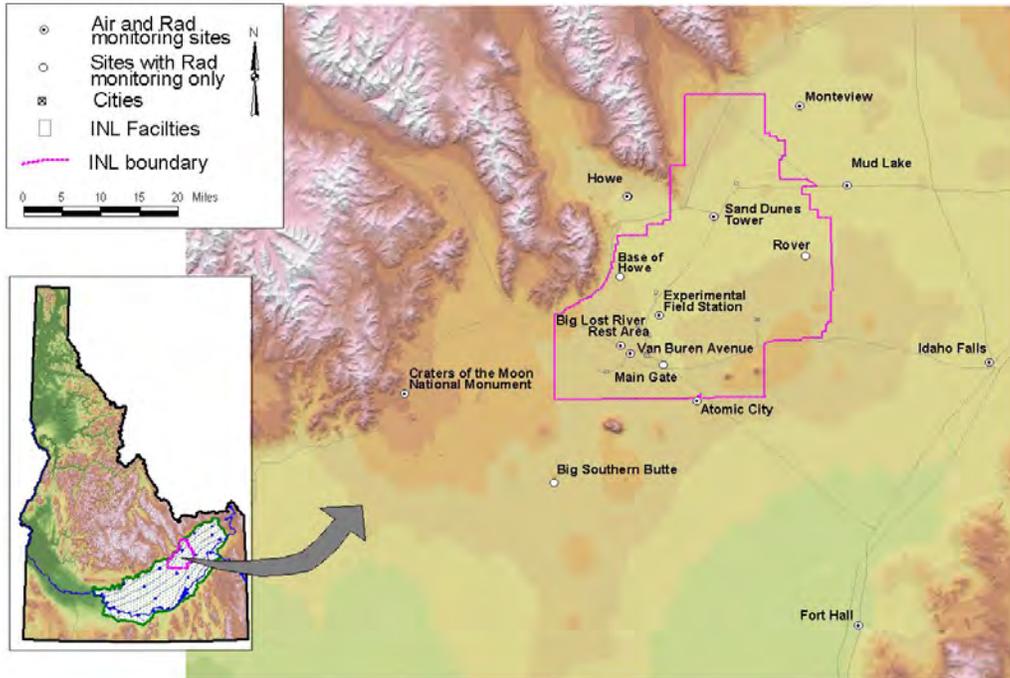


Figure 1. Air and radiation monitoring sites.

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

¹ Samples collected weekly; Samples collected quarterly.

² TSP and radioiodine samples collected by Shoshone-Bannock Tribes.

Table 2. Range of gross alpha and gross beta concentrations for TSP filters, fourth quarter, 2008. Concentrations are reported in 1×10^{-3} pCi/m³.

Station Location	Concentration			
	Gross Alpha		Gross Beta	
On-Site Locations				
Big Lost River Rest Area	0.3	- 2.0	14.7	- 63.3
Experimental Field Station	0.1	- 1.7	21.3	- 47.4
Sand Dunes Tower	0.3	- 1.5	23.3	- 51.8
Van Buren Avenue	0.2	- 1.7	21.2	- 55.5
Boundary Locations				
Atomic City	0.5	- 2.1	19.0	- 52.0
Howe	0.5	- 1.6	21.5	- 41.3
Monteview	0.0	- 1.2	9.0	- 42.9
Mud Lake	0.0	- 1.8	20.5	- 42.9
Distant Locations				
Craters of the Moon	0.0	- 1.3	13.8	- 40.5
Fort Hall ¹	0.0	- 1.5	11.0	- 33.8
Idaho Falls	0.1	- 3.0	20.6	- 74.6

¹ Operated by Shoshone-Bannock Tribes.

Table 3. Gamma spectroscopy analysis data for TSP filters, composite samples, fourth quarter, 2008. Concentrations are reported in 1×10^{-3} pCi/m³ with associated uncertainty (± 2 SD), minimum detectable concentration (MDC), and correspond to filter composites collected during the calendar quarter.

Station Location	Naturally Occurring Radionuclide Beryllium-7		Man-Made Gamma Emitting Radionuclides
	Concentration	± 2 SD	
On-site Locations			
Big Lost River Rest Area	103.7	5.4	<MDC
Experimental Field Station	65.3	3.6	<MDC
Sand Dunes Tower	62.5	3.4	<MDC
Van Buren Avenue	67.0	3.6	<MDC
Boundary Locations			
Atomic City	71.6	3.9	<MDC
Howe	63.3	3.4	<MDC
Monteview	41.8	2.5	<MDC
Mud Lake	61.6	3.5	<MDC
Distant Locations			
Craters of the Moon	67.3	3.6	<MDC
Fort Hall ¹	55.9	3.1	<MDC
Idaho Falls	90.0	4.7	<MDC

¹Operated by Shoshone-Bannock Tribes.

Table 4. Tritium concentrations in air from atmospheric moisture, fourth quarter, 2008. Concentrations are reported in pCi/m³ with associated uncertainty (± 2 SD) and minimum detectable concentration (MDC).

Station Location	Tritium		
	Concentration	± 2 SD	MDC
On-site Locations			
Big Lost River Rest Area	0.24	0.22	0.37
Experimental Field Station	0.40	0.27	0.43
Sand Dunes Tower	0.12	0.24	0.40
Van Buren Avenue	0.13	0.22	0.29
Boundary Locations			
Atomic City	0.08	0.21	0.18
Howe	0.11	0.26	0.43
Mud Lake	0.10	0.25	0.42
Monteview ²	0.00	0.06	0.11
Distant Locations			
Craters of the Moon	0.04	0.23	0.35
Fort Hall ¹	0.12	0.27	0.46
Idaho Falls	0.05	0.11	0.11

¹Operated by Shoshone-Bannock Tribes.

²Only one sample collected due to sampler failure.

Table 5. Tritium and Cesium-137 concentrations from precipitation, fourth 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	70	80	120	0.8	1.4	2.4
Boundary Locations						
Atomic City	90	80	120	0.0	1.4	2.5
Howe	40	70	120	0.5	1.7	2.8
Monteview	40	70	120	NS ¹	NS	NS
Mud Lake	110	80	120	2.1	1.9	3.1
Distant Locations						
Idaho Falls	50	80	130	0.6	1.4	2.4

¹ NS - Insufficient sample for gamma analysis.

Environmental Radiation Monitoring Results

The ESP operated 14 environmental radiation stations during the fourth 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 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 41 locations by DEQ-INL OP in a widespread network around the INL measuring external radiation. This information is tabulated in **Appendix B**.

These two systems are used by DEQ-INL OP to measure external gamma radiation for various radiological monitoring objectives. **Table 7** lists the average radiation exposure rates measured by the HPICs for fourth quarter 2008. **Table 8** lists the EIC monitoring results for fourth quarter 2008. Although somewhat higher than average readings were observed at MP 39, 41, and 43 on Hwy 33 (**Appendix B**) these readings were well below DEQ-INL OP's action level of 36 μ R/h which is $\frac{1}{2}$ of the EPA guideline level of 72 μ R/h. Overall exposure rates were within the expected historical range of values observed by DEQ-INL OP for background radiation.

Table 6. Summary of instrumentation at radiation monitoring stations.

Station Location	Instrument Type	
	HPIC	EIC
On-site Locations		
Base of Howe	■	■
Big Lost River Rest Area ¹		■
Experimental Field Station		■
Main Gate	■	■
Rover	■	■
Sand Dunes Tower	■	■
Van Buren Avenue		■
Boundary Locations		
Atomic City	■	■
Big Southern Butte	■	■
Howe	■	■
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 for fourth quarter, 2008, from HPIC network.

	Exposure Rate (µR/hr)	
	Quarterly Average	± 2 SD
On-site Locations		
Base of Howe	12.2	2.7
Big Lost River Rest Area ¹	NA	NA
Main Gate	14.3	2.1
Rover	14.4	1.9
Sand Dunes Tower	15.2	2.9
Boundary Locations		
Atomic City	13.4	2.7
Big Southern Butte	13.7	2.6
Howe	14.3	5.0
Monteview	12.6	1.5
Mud Lake	12.9	1.7
Distant Locations		
Fort Hall ²	14.0	2.3
Idaho Falls	11.5	1.7

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 fourth quarter, 2008.

Station Location	Exposure Rate ($\mu\text{R/hr}$)	
	Quarterly Average	$\pm 2 \text{ SD}$
On-site Locations		
Base of Howe ¹	7.9	0.4
Big Lost River Rest Area	13.5	1.0
Experimental Field Station	16.6	3.6
Main Gate	16.2	4.9
Rover ¹	13.6	3.9
Sand Dunes Tower	13.5	2.6
Van Buren Avenue	14.7	3.8
Boundary Locations		
Atomic City	16.3	6.8
Big Southern Butte ¹	13.9	4.1
Howe	10.8	0.7
Monteview	13.6	3.4
Mud Lake	10.9	0.3
Distant Locations		
Craters of the Moon	11.7	3.6
Fort Hall ²	11.4	4.8
Idaho Falls ³	NS (HPIC value 11.5)	NS (HPIC value 1.7)

¹ Left out for two quarters due to impassable roads. Reported value is the average of 4th quarter 2008 and 1st quarter 2009.

² Station operated by Shoshone-Bannock Tribes.

³ Sample was determined to be invalid due to operator error.

Water Monitoring

Water monitoring sites are sampled for the purposes of examining trends of INL contaminants and other general ground water quality indicators and for verifying DOE monitoring results. Sites sampled include ground water locations (wells and springs), surface water locations (streams), and selected wastewater sites. Sample sites have been selected to aid in identifying INL impacts on the Eastern Snake River Plain Aquifer (ESRPA), and are categorized as up-gradient, facility, boundary, distant, surface water, and waste water, (**Figure 2 and Figure 3**). Up-gradient locations are not impacted by INL operations and are considered representative of background ground water quality conditions. Facility sites are sample locations on the INL near facilities, in areas of known contamination, or wells selected to illustrate trends for specific INL contaminants or indicators of ground water quality. Boundary locations are on or near the perimeter of the INL and are down-gradient of potential sources of INL contamination. Distant locations are monitored to provide trends in water quality down-gradient of the INL and include wells and springs used for irrigation, public water supply, livestock, domestic, and industrial purposes. During the fourth quarter of 2008, 2 up-gradient, 14 facility, 3 boundary, 5 distant, and 1 surface water locations were sampled.

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

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

Gross alpha radioactivity was detected at 1 up-gradient, 6 facility, 2 boundary, 1 distant, and 1 surface water locations. Concentrations observed at facility locations were in areas of known contamination and consistent with historical trends. However, one sample result for TRA-07 was twice as high as historical concentrations. All other locations with detectable results were within the range of concentrations observed for naturally-occurring radioactivity. The EPA maximum contaminant level (MCL) for alpha particles is 15 pCi/L.

Gross beta radioactivity was detected in each of the 5 areas (up-gradient, facility, boundary, distant, and surface water) sampled. Concentrations observed at facility locations were consistent with historical trends. Concentrations for up-gradient, boundary, distant, and surface water locations were within the range of concentrations observed for naturally-occurring radioactivity. The MCL for beta and gamma radioactivity is 4 mrem/year, equivalent to 8 pCi/l if the source is strontium-90; 900 pCi/L if technetium-99; 20,000 pCi/L if tritium; or 200 pCi/L if cesium-137. Man-made, gamma emitting cesium-137 was detected at one facility location, USGS-047. This well has had historical detectable concentrations. Results for gross alpha; gross beta; and man-made, gamma emitting radioactivity are shown in **Table 9**.

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

Seven sites were sampled for isotopes of uranium; each had detectable results for uranium-234, and uranium-238. There were two detectable results for uranium-235 (**Table 11**). The ratios of results observed cannot be distinguished from background concentrations, which means the uranium found in the samples is likely to be naturally occurring. There were no detectable results for americium-241 (**Table 12**) or neptunium-237 (**Table 13**).

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

Using the standard analytical method, tritium was detected in eleven of fourteen facility samples (**Table 16**). Detections were consistent with historic concentrations for these sites. There were no detectable concentrations from other areas. Selected water samples with tritium concentrations not measurable using the standard method (typically a MDC of 130 pCi/L) were analyzed using an electrolytic enrichment method with a much lower MDC of 10 to 14 pCi/L (**Table 17**). One sample was analyzed this quarter from 3rd quarter sampling. There is currently a backlog of 19 samples from 2nd, 3rd, and 4th quarter, due to the large number of special samples from third 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 18**. Results for iron and zinc at TRA-07 were substantially higher than the previous year's results. All other results were within their

expected ranges. Common ion results are shown in **Table 19** and nutrient results are shown in **Table 20**. All results were consistent with historical values at those locations.

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

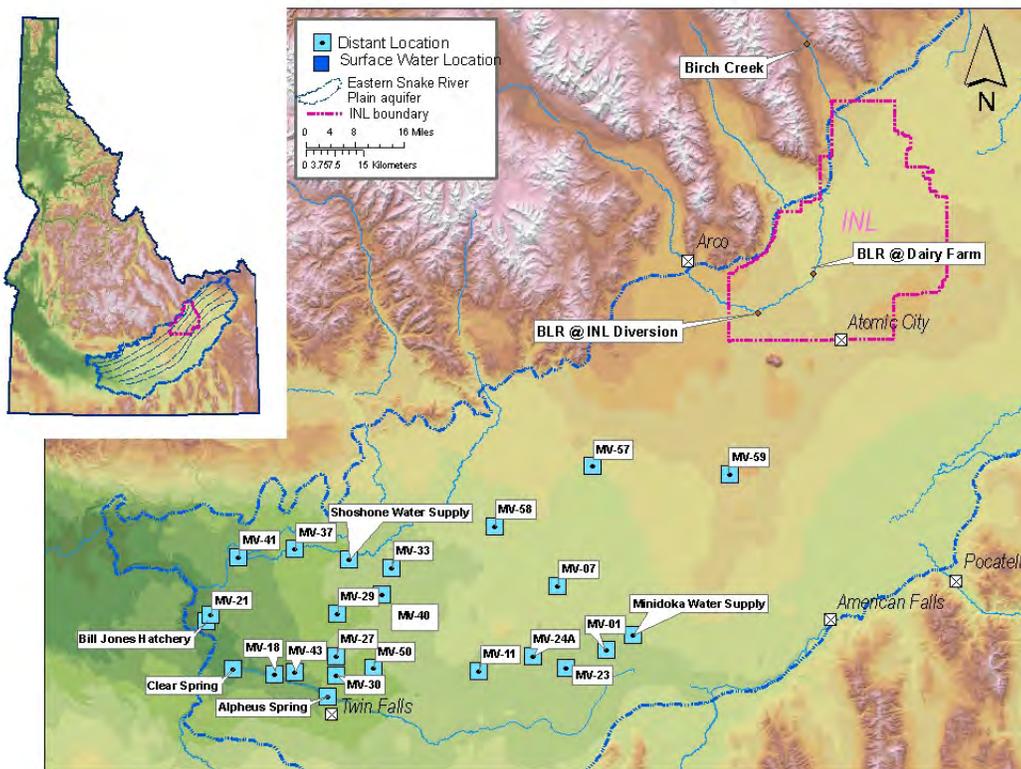


Figure 2. Distant sampling locations for fourth quarter, 2008.

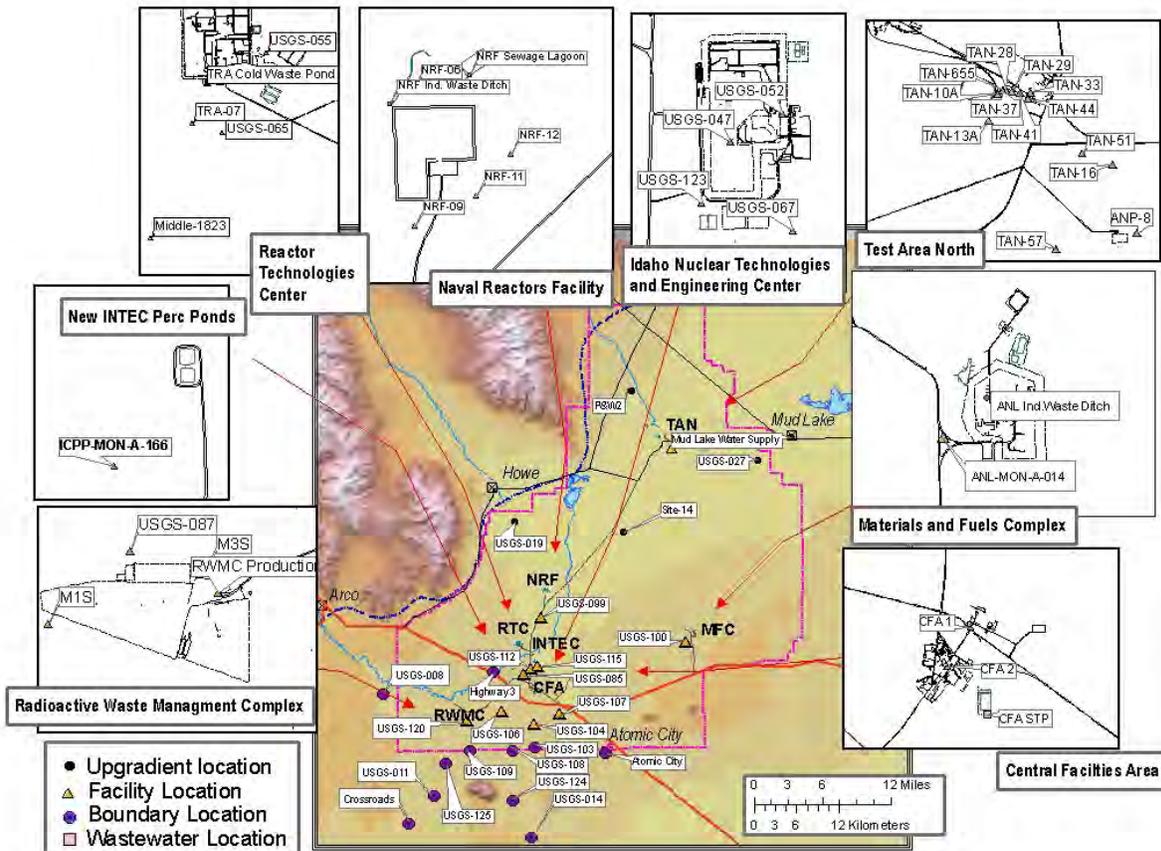


Figure 3. Up-gradient, facility, boundary and wastewater monitoring locations.

Table 9. Alpha, beta, and gamma concentrations for water samples, fourth 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	
<u>Up-gradient</u>								
Mud Lake Water Supply	11/19/2008	2.5	1.3	3.7	1.1	0.8	U	1.3
Site-14	10/23/2008	2.0 U	1.9	3.5	1.1	-1.0	U	2.2
<u>Facility</u>								
ANL-MON-A-014	11/5/2008	3.8	2.2	5.5	1.2	0.1	U	1.4
CFA 2	10/9/2008	5.2 U	4.8	9.2	2.8	0.7	U	1.9
M1S	11/4/2008	0.5 U	1.9	3.3	1.1	-0.4	U	1.3
M3S	11/4/2008	4.3	2.2	4.0	1.2	0.7	U	2.0
Middle-1823	10/16/2008	4.9	2.5	3.4	1.2	-0.3	U	1.5
RWMC Production	10/9/2008	2.4 U	2.1	3.6	1.1	1.1	U	1.5
TRA-07	10/16/2008	19.1	5.4	25.7	3.2	0.6	U	2.1
USGS-047	10/14/2008	1.3 U	2.4	80.2	2.4	4.3		2.0
USGS-052	10/15/2008	6.7	2.5	159.7	3.3	0.0	U	1.4
USGS-067	10/15/2008	3.2 U	2.9	95.5	2.7	-0.8	U	1.5
USGS-104	10/21/2008	2.7 U	2.4	2.7	1.2	-1.1	U	1.5
USGS-112	10/8/2008	3.8 U	2.6	29.1	1.7	1.0	U	1.5
USGS-115	10/8/2008	4.9	2.4	6.8	1.2	-0.3	U	1.6
USGS-120	10/9/2008	3.8 U	2.6	6.2	1.2	-0.1	U	1.3
<u>Boundary</u>								
Atomic City	11/19/2008	2.0 U	1.5	4.5	1.1	-1.2	U	1.6
USGS-014	10/21/2008	3.3	2.1	3.6	1.2	0.1	U	1.4
USGS-125	10/21/2008	4.2	2.1	3.1	1.1	0.7	U	1.4
<u>Distant</u>								
Alpheus Spring	11/18/2008	1.9 U	2.8	9.7	1.4	-0.7	U	1.6
Bill Jones Hatchery	11/18/2008	2.1 U	1.9	3.8	1.1	0.3	U	1.6
Clear Spring	11/18/2008	4.5	2.8	5.4	1.2	0.7	U	1.4
Minidoka Water Supply	11/18/2008	3.5 U	2.4	5.6	1.2	0.5	U	1.3
Shoshone Water Supply	11/18/2008	2.0 U	2.5	4.4	1.2	-1.2	U	1.9
<u>Surface water</u>								
Birch Creek	10/22/2008	3.8	2.2	2.5	1.1	0.1	U	1.4

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

² Concentrations expressed in pCi/L.

Table 10. Reported concentrations of plutonium isotopes in water samples, fourth quarter, 2008.

Sample Location	Sample Date	Plutonium-238			Plutonium-239/240			Plutonium-241		
		Concentration ^{1,2}	U	± 2SD	Concentration ^{1,2}	U	± 2SD	Concentration ^{1,2}	U	± 2SD
<u>Facility</u>										
M1S	11/4/2008	-0.002	U	0.022	0.004	U	0.022	-2.2	U	3.9
M3S	11/4/2008	0.001	U	0.021	0.004	U	0.021	-0.3	U	3.6
USGS-047	10/14/2008	0.009	U	0.024	0.003	U	0.024	3.6	U	4.2
USGS-052	10/15/2008	0.000	U	0.019	0.010	U	0.019	-0.3	U	3.4
USGS-067	10/15/2008	-0.004	U	0.025	-0.002	U	0.025	-0.6	U	4.1

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

² Concentrations expressed in pCi/L.

Table 11. Reported concentrations of uranium isotopes in water samples, fourth quarter, 2008.

Sample Location	Sample Date	Uranium-234		Uranium-235		Uranium-238		
		Concentration ^{1,2}	± 2SD	Concentration ^{1,2}	± 2SD	Concentration ^{1,2}	± 2SD	
<u>Facility</u>								
M1S	11/4/2008	0.89	0.27	0.051	U 0.069	0.38	0.16	
M3S	11/4/2008	1.40	0.33	0.060	U 0.058	0.57	0.18	
Middle-1823	10/16/2008	1.43	0.35	0.091	0.074	0.59	0.19	
TRA-07	10/16/2008	2.23	0.50	0.029	U 0.053	0.76	0.23	
USGS-047	10/14/2008	2.10	0.48	0.050	U 0.061	1.08	0.29	
USGS-052	10/15/2008	1.87	0.43	0.067	U 0.071	0.76	0.23	
USGS-067	10/15/2008	1.72	0.41	0.097	0.083	0.67	0.22	

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

² Concentrations expressed in pCi/L.

Table 12. Reported concentrations of americium-241 in water samples, fourth quarter, 2008.

Sample Location	Sample Date	Americium-241		
		Concentration ^{1,2}		± 2SD
<u>Facility</u>				
M1S	11/4/2008	0.011	U	0.039
M3S	11/4/2008	0.008	U	0.027
USGS-047	10/14/2008	0.001	U	0.027
USGS-052	10/15/2008	0.000	U	0.031
USGS-067	10/15/2008	-2.000	U	0.025

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

² Concentrations expressed in pCi/L.

Table 13. Reported concentrations of neptunium-237 in water samples, fourth quarter, 2008.

Sample Location	Sample Date	Neptunium-237		
		Concentration ^{1,2}		± 2SD
<u>Facility</u>				
M3S	11/4/2008	-0.010	U	0.038
USGS-047	10/14/2008	-0.010	U	0.040
USGS-052	10/15/2008	0	U	0.037
USGS-067	10/15/2008	-0.006	U	0.036

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

² Concentrations expressed in pCi/L.

Table 14. Reported concentrations of strontium-90 in water samples, fourth quarter, 2008.

Sample Location	Sample Date	Strontium-90	
		Concentration ^{1,2}	± 2SD
<u>Facility</u>			
CFA 2	10/9/2008	0.22 U	0.21
M1S	11/4/2008	0.17 U	0.21
M3S	11/4/2008	0.12 U	0.22
Middle-1823	10/16/2008	0.11 U	0.20
RWMC Production	10/9/2008	0.11 U	0.19
TRA-07	10/16/2008	3.83	0.98
USGS-047	10/14/2008	28.3	6.7
USGS-052	10/15/2008	4.0	1.0
USGS-067	10/15/2008	13.8	3.3
USGS-104	10/21/2008	0.12 U	0.19
USGS-112	10/08/2008	9.1	2.2
USGS-115	10/8/2008	0.05 U	0.20
USGS-120	10/9/2008	0.14 U	0.21

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

² Concentrations expressed in pCi/L.

Table 15. Reported concentrations of technetium-99 in water samples, fourth quarter, 2008.

Sample Location	Sample Date	Technetium-99	
		Concentration ^{1,2}	± 2SD
<u>Facility</u>			
ANL-MON-A-014	11/5/2008	0.7	0.3
CFA 2	10/9/2008	4.1	0.2
M1S	11/4/2008	0.8	0.2
M3S	11/4/2008	1.2	0.2
Middle-1823	10/16/2008	1.8	0.2
RWMC Production	10/9/2008	2.6	0.2
TRA-07	10/16/2008	2.1	0.2
USGS-047	10/14/2008	18.5	0.3
USGS-052	10/15/2008	314.9	1.1
USGS-067	10/15/2008	142.0	0.7
USGS-104	10/21/2008	1.9	0.2
USGS-112	10/8/2008	5.9	0.2
USGS-115	10/8/2008	3.2	0.2
USGS-120	10/9/2008	2.1	0.2

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

² Concentrations expressed in pCi/L.

Table 16. Tritium concentrations for water samples, fourth quarter, 2008.

Sample Location	Sample Date	Tritium	
		Concentration ^{1,2}	± 2 SD
<u>Up-gradient</u>			
Mud Lake Water Supply	11/19/2008	-40 U	90
Site-14	10/23/2008	-50 U	80
<u>Facility</u>			
ANL-MON-A-014	11/5/2008	-20 U	90
CFA 2	10/9/2008	5250	210
M1S	11/4/2008	-40 U	90
M3S	11/4/2008	1000	110
Middle-1823	10/16/2008	1270	120
RWMC Production	10/9/2008	810	110
TRA-07	10/16/2008	4860	200
USGS-047	10/14/2008	1750	140
USGS-052	10/15/2008	1440	130
USGS-067	10/15/2008	4360	190
USGS-104	10/21/2008	770	110
USGS-112	10/8/2008	1560	130
USGS-115	10/8/2008	1140	130
USGS-120	10/9/2008	10 U	90
<u>Boundary</u>			
Atomic City	11/19/2008	10 U	90
USGS-014	10/21/2008	-90 U	80
USGS-125	10/21/2008	-30 U	90
<u>Distant</u>			
Alpheus Spring	11/18/2008	-20 U	90
Bill Jones Hatchery	11/18/2008	-30 U	90
Clear Spring	11/18/2008	-40 U	90
Minidoka Water Supply	11/18/2008	-60 U	90
Shoshone Water Supply	11/18/2008	-10 U	90
<u>Surface water</u>			
Birch Creek	10/22/2008	-20 U	90

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

² Concentrations expressed in pCi/L.

Table 17. Enriched tritium concentrations for water samples, fourth quarter, 2008.

Sample Location	Sample Date	Enriched Tritium	
		Concentration ^{1,2}	± 2 SD
<u>Distant</u>			
Clear Spring	8/18/2008	20	9

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

² Concentrations expressed in pCi/L.

Table 18. Reported metals concentrations in water samples, fourth quarter, 2008.

Sample Location	Sample Date	Concentration ^{1,2}											
		Arsenic	Barium	Beryllium	Cadmium	Chromium	Iron	Lead	Manganese	Mercury	Selenium	Zinc	
<u>Up-gradient</u>													
Site-14 *	10/23/2008	NR	61	NR	NR	5.4	NR	<5 U	<2 U	NR	NR	<5 U	
<u>Facility</u>													
ANL-MON-A-014	11/5/2008	<5 U	37	<1 U	<1 U	<5 U	34	<5 U	<2 U	<0.5 U	<10 U	<5 U	
CFA 2	10/9/2008	NR	100	NR	NR	8.5	NR	<5 U	5.5	NR	NR	5.7	
M1S	11/4/2008	<5 U	22	<1 U	<1 U	36	180	<5 U	3.8	<0.5 U	<10 U	<5 U	
M3S	11/4/2008	<5 U	43	<1 U	<1 U	14	14	<5 U	<2 U	<0.5 U	<10 U	<5 U	
Middle-1823	10/16/2008	<5 U	79	<1 U	<1 U	10	25	<5 U	<2 U	<0.5 U	<10 U	<5 U	
RWMC Production *	10/9/2008	NR	39	NR	NR	13	NR	<5 U	<2 U	NR	NR	<5 U	
TRA-07	10/16/2008	<5 U	120	<1 U	<1 U	110	3000	<5 U	51	<0.5 U	<10 U	830	
USGS-047	10/14/2008	<5 U	77	<1 U	<1 U	7.2	57	<5 U	2.0	<0.5 U	<10 U	6.5	
USGS-052	10/15/2008	<5 U	85	<1 U	<1 U	7.1	13	<5 U	<2 U	<0.5 U	<10 U	<5 U	
USGS-067	10/15/2008	<5 U	130	<1 U	<1 U	8.2	46	<5 U	<2 U	<0.5 U	<10 U	12	
USGS-104 *	10/21/2008	NR	32	NR	NR	8.4	NR	<5 U	<2 U	NR	NR	6.8	
USGS-112 *	10/8/2008	NR	100	NR	NR	13	NR	<5 U	<2 U	NR	NR	<5 U	
USGS-115 *	10/8/2008	NR	62	NR	NR	5.4	NR	<5 U	<2 U	NR	NR	620	
USGS-120 *	10/9/2008	NR	46	NR	NR	11	NR	<5 U	<2 U	NR	NR	<5 U	
<u>Boundary</u>													
USGS-014 *	10/21/2008	NR	22	NR	NR	<5 U	NR	<5 U	<2 U	NR	NR	<5 U	
USGS-125 *	10/21/2008	NR	42	NR	NR	<5 U	NR	<5 U	24	NR	NR	<5 U	
<u>Surface water</u>													
Birch Creek*	10/22/2008	NR	63	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 not filtered unless otherwise indicated. * denotes samples are filtered.

Table 19. Reported common ion concentrations in water samples, fourth quarter, 2008.

Sample Location	Sample Date	Concentration ^{1,2}										
		Calcium	Magnesium	Sodium	Potassium	Fluoride	Chloride	Sulfate	Silica	Alkalinity ³	TDS ⁴	TSS ⁵
<u>Up-gradient</u>												
Site-14*	10/23/2008	35	14	15	3.0	0.498	10	24.5	NR	128	NR	NR
<u>Facility</u>												
ANL-MON-A-014	11/5/2008	40	13	18	3.3	0.700	18	17.3	NR	136	NR	NR
CFA 2*	10/9/2008	82	28	35	4.5	0.160	137	53.3	NR	141	NR	NR
M1S	11/4/2008	28	12	11	2.6	0.290	14	21.5	NR	95	NR	NR
M3S	11/4/2008	46	16	8.3	2.6	0.242	15	25.8	NR	139	NR	NR
Middle-1823	10/16/2008	54	18	11	1.8	0.176	12	35.7	NR	172	NR	NR
<u>RWMC</u>												
Production*	10/9/2008	48	17	9.1	2.7	0.240	23	29.0	NR	135	NR	NR
TRA-07	10/16/2008	70	20	15	3.7	0.198	15	76.1	NR	159	NR	NR
USGS-047	10/14/2008	56	16	13	2.1	0.265	24	26.1	NR	154	NR	NR
USGS-052	10/15/2008	53	16	13	2.7	0.243	23	25.9	24	150	250	<5 U
USGS-067	10/15/2008	58	16	30	3.8	0.273	64	29.2	NR	133	NR	NR
USGS-104*	10/21/2008	36	14	8.8	2.5	0.250	14	21.0	NR	122	NR	NR
USGS-112*	10/8/2008	50	14	18	2.7	0.261	26	31.5	NR	150	NR	NR
USGS-115*	10/8/2008	42	13	18	3.8	0.287	48	25.3	NR	100	NR	NR
USGS-120*	10/9/2008	36	19	24	3.6	0.280	22	38.1	NR	140	NR	NR
<u>Boundary</u>												
USGS-014*	10/21/2008	37	16	17	2.7	1.01	22	22.4	NR	135	NR	NR
USGS-125*	10/21/2008	39	15	11	2.7	0.264	13	24.5	NR	140	NR	NR
<u>Surface water</u>												
Birch Creek*	10/22/2008	46	16	5.2	1.0	0.224	4.6	25.3	NR	145	NR	NR

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

² Concentrations expressed in mg/L. Samples are not filtered unless otherwise noted.

³ As CaCO₃

⁴ =Total Dissolved Solids,

⁵ = Total Suspended Solids

Table 20. Reported nutrient concentrations in water samples, fourth quarter, 2008.

Sample Location	Sample Date	Concentration ^{1,2}		
		Nitrite + Nitrate	Phosphorus	Total Kjeldahl Nitrogen
<u>Up-gradient</u>				
Site-14	10/23/2008	0.62	0.016	NR
<u>Facility</u>				
ANL-MON-A-014	11/5/2008	2	0.019	NR
CFA 2	10/9/2008	4	0.021	NR
M1S	11/4/2008	1	0.023	NR
M3S	11/4/2008	0.85	0.022	NR
Middle-1823	10/16/2008	1.1	0.026	NR
RWMC Production	10/9/2008	0.97	0.09	NR
TRA-07	10/16/2008	1.1	0.14	NR
USGS-047	10/14/2008	4.7	0.038	NR
USGS-052	10/15/2008	2.4	0.026	<0.1 U
USGS-067	10/15/2008	5.6	0.03	NR
USGS-104	10/21/2008	0.87	0.02	NR
USGS-112	10/8/2008	1.4	0.03	NR
USGS-115	10/8/2008	1.5	0.0096	NR
USGS-120	10/9/2008	0.92	0.019	NR
<u>Boundary</u>				
USGS-014	10/21/2008	1.2	0.013	NR
USGS-125	10/21/2008	0.61	0.016	NR
<u>Surface water</u>				
Birch Creek	10/22/2008	0.3	<0.005 U	NR

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

² Concentrations expressed in mg/L.

Table 21. Reported VOC concentrations in water samples, fourth quarter, 2008.

Analysis ¹	M3S	RWMC Production	Detection Limit	Units
	11/4/2008	10/9/2008		
Carbon tetrachloride	3.8	6.2	0.5	µg/L
Chloroform	<DL	1.5	0.5	µg/L
Trichloroethylene	1	2.8	0.5	µg/L

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

Terrestrial Monitoring Results

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

Milk

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 22**. Naturally occurring potassium-40 was detected in all samples within the expected range. Iodine-131 was not detected.

Table 22. Gamma spectroscopy analysis data for milk samples, fourth quarter, 2008.

Sample Location/Dairy	Sample Date	Naturally occurring gamma-emitting radionuclide Potassium-40		Man-made gamma-emitting radionuclide Iodine-131 ¹
		Concentration ²	± 2 SD	
Monitoring Samples				
Howe/Nelson-Ricks Creamery	10/06/2008	1409	109	<MDC
	11/03/2008	1383	106	<MDC
	12/01/2008	1438	113	<MDC
Mud Lake/Nelson-Ricks Creamery	10/06/2008	1373	96	<MDC
	11/04/2008	1520	103	<MDC
	12/01/2008	1423	107	<MDC
Gooding/Glanbia	10/07/2008	1427	112	<MDC
	11/04/2008	1426	111	<MDC
	12/18/2008	1377	105	<MDC
Riverside	10/15/2008	1850	117	<MDC
	11/13/2008	2063	140	<MDC
Fort Hall	10/06/2008	1299	107	<MDC
	11/09/2008	1061	90	<MDC
	12/08/2008	1175	99	<MDC
Verification Samples³				
Idaho Falls	10/08/2008	1441	99	<MDC
Rupert	10/07/2008	1532	118	<MDC
Terreton	11/03/2008	1703	125	<MDC
Dietrich	11/04/2008	1535	104	<MDC
Rupert	12/02/2008	1494	103	<MDC
Terreton	12/02/2008	1546	117	<MDC

¹ <MDC – Less than Minimum Detectable Concentration (approximately 4 pCi/L for Iodine-131).

² Concentrations are expressed in pCi/L

³ DEQ-INL OP samples collected by the off-site INL environmental surveillance contractor.

Soil

DEQ-INL OP monitors long-term radiological conditions via soil sampling and as well as field instrumentation capable of identifying and measuring quantities of gamma-emitting radionuclides in soil. Monitoring concentrations of gamma-emitting radionuclides in surface soil provides some insight into 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 34 locations (see **Figure 4**) including onsite, boundary, and distant monitoring locations during the fourth calendar quarter of 2008. No soil samples were physically collected during the fourth calendar quarter of 2008. Gamma spectroscopic analysis results for ^{137}Cs concentrations are shown in **Table 23**. No man-made radionuclides other than ^{137}Cs were identified. The ^{137}Cs concentrations in soil were within historical range of results.

Table 23. In-Situ Gamma spectroscopy analysis data for soil samples, fourth quarter, 2008.

Location	Date Acquired	Concentration ³	± 2 SD	MDA
Boundary sampling locations				
Atomic City	11/13/2008	0.16	0.03	0.009
Monteview	11/14/2008	0.03	0.01	0.004
Mud Lake/Terreton	11/14/2008	0.02	0.01	0.003
Howe	11/17/2008	0.10	0.01	0.003
Howe Met Tower	11/17/2008	0.06	0.01	0.004
Reno Ranch	11/18/2008	0.11	0.01	0.004
Butte City	11/18/2008	0.08	0.02	0.006
Large Grid 12-4	11/19/2008	0.26	0.03	0.009
Large Grid 12-5	11/19/2008	0.22	0.03	0.009
Big Southern Butte	11/19/2008	0.20	0.04	0.010
Large Grid 18-4	11/19/2008	0.18	0.04	0.012
Distant sampling locations				
Roberts	11/14/2008	0.06	0.01	0.003
Idaho Falls ¹	11/14/2008	0.04	0.01	0.004
Idaho Falls CMS ²	11/14/2008	0.02	0.01	0.003
St. Anthony	11/18/2008	0.11	0.02	0.005
Carey	11/18/2008	0.06	0.02	0.005
On site sampling locations				
Big Lost Rest Area	11/13/2008	0.15	0.04	0.011
Van Buren	11/13/2008	0.32	0.04	0.011
Experimental Field Station	11/13/2008	0.26	0.03	0.009
INL Main Gate	11/13/2008	0.20	0.02	0.007
Rover	11/17/2008	0.16	0.05	0.009
Base of Howe	11/17/2008	0.21	0.03	0.008
Sand Dunes	11/21/2008	0.17	0.03	0.009
Large Grid 6-3	11/21/2008	0.24	0.04	0.010
Large Grid 18-1	11/21/2008	0.19	0.03	0.010
Large Grid 24-9	12/10/2008	0.24	0.04	0.011
Large Grid 24-8	12/10/2008	0.27	0.02	0.007
Large Grid 18-7	12/10/2008	0.18	0.03	0.008
Large Grid 30-1	12/10/2008	0.23	0.03	0.008
Large Grid 18-8	12/11/2008	0.25	0.04	0.010
Large Grid 24-2	12/11/2008	0.31	0.04	0.009
Large Grid 24-7	12/11/2008	0.26	0.03	0.010
Large Grid 18-3	12/11/2008	0.17	0.03	0.010

¹ DEQ-INL OP HPIC/Air monitoring station near Idaho Falls, Idaho² DEQ-INL OP HPIC Community Monitoring Station (CMS) near John's Hole Bridge Idaho Falls, Idaho³ Concentrations reported in pCi/g assumes an exponential distribution over the top 20 cm of soil.

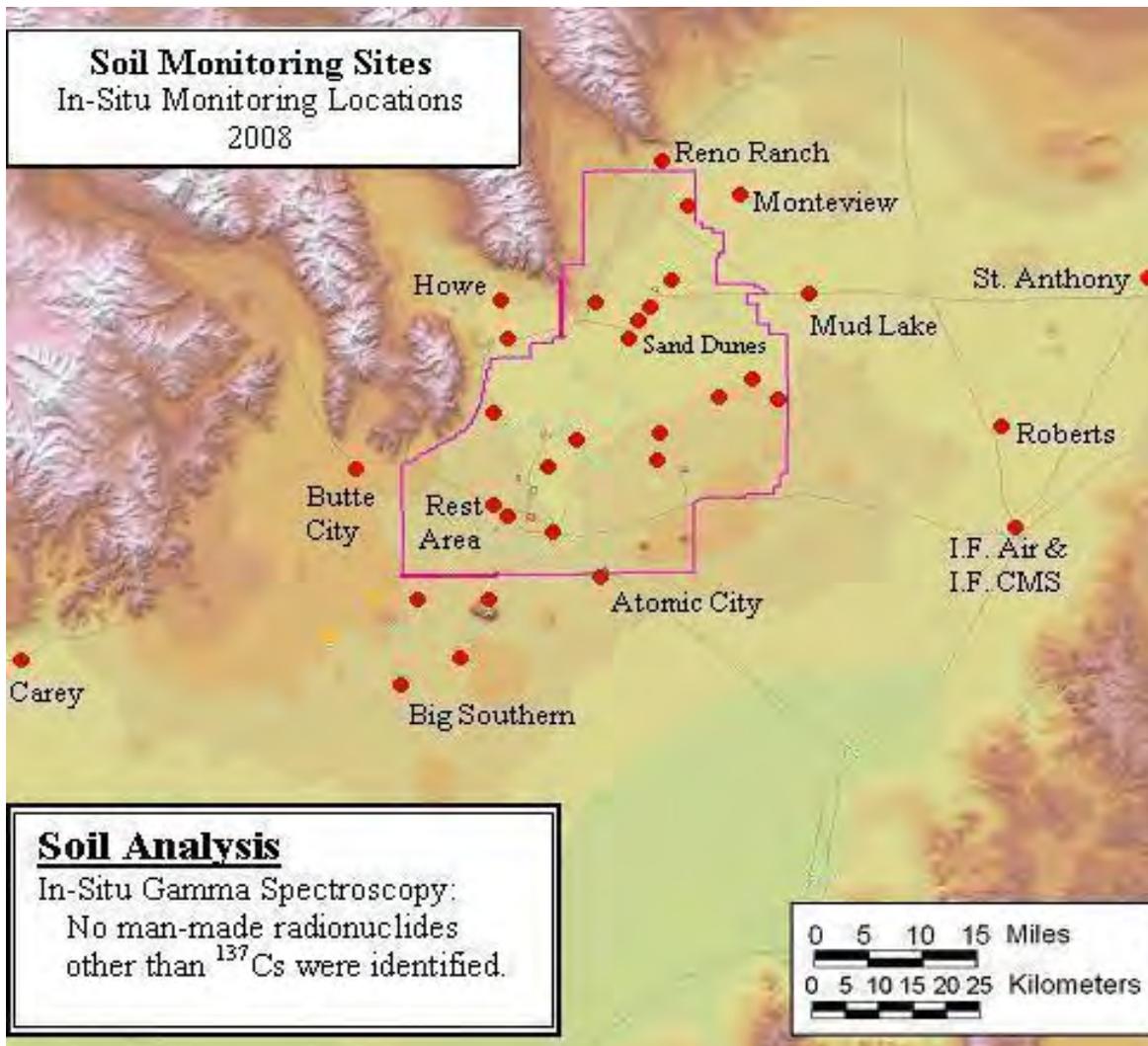


Figure 4. In-situ soil monitoring sites indicated by red dot, fourth quarter 2008.

Quality Assurance

The measurement of any physical quantity is subject to inaccuracy from errors that may be introduced during sample collection, measurement, calibration, and the reading and reporting of results. While all of these inaccuracies cannot be quantified with certainty for each analytical result, a quality assurance program can evaluate the overall quality of a data set and possibly identify and address errors or inaccuracies.

This section summarizes the results of the quality assurance (QA) assessment of the data collected for the fourth quarter of 2008 for the DEQ-INL OP's ESP. It also summarizes the quality control (QC) samples (spikes, blanks, and duplicates) submitted to the Idaho Bureau of Laboratories-Boise (IBL) for non-radiological analyses and to Idaho State University's Environmental Monitoring Laboratory (ISU-EML) for radiological analyses during the quarter. All analyses and QC measures at the analytical laboratories used by the ESP are performed in accordance with approved written procedures maintained by each respective analytical laboratory. Sample collection is performed in accordance with written procedures maintained by the DEQ-INL OP.

Analytical results for blanks, duplicates, and spikes are used to assess the precision, accuracy, and representativeness of results from analyzing laboratories. During the fourth quarter of 2008, the DEQ-INL OP submitted 101 QC samples for various radiological and non-radiological analyses (**Table 24**).

Blank Samples

Blank samples consist of matrices that have negligible, acceptably low, or immeasurable amounts of the analyte(s) of interest in them. They are designed to determine if analyses will provide a "zero" result when no contaminant is expected to be present or an acceptable measure of "background," and therefore monitor any bias that may have been introduced during sample collection, storage, shipment, and analysis. Blank sample results submitted for gross alpha and gross beta screening in air for the fourth quarter of 2008 are presented in **Table 25**.

Blank sample results for select gamma emitters in air from composited air filters are presented in **Table 26**. Data for blank analyses used to assess data quality for tritium in water vapor in air are presented in **Table 27**. Blank analyses results for radiological and non-radiological analytes in ground and surface water are presented in **Table 28**, **Table 29**, and **Table 30**.

No anomalies were observed from the assessment of field blank samples as measured by the analytical laboratories used by DEQ-INL OP for the fourth quarter of 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 31**, **Table 32**, and **Table 33** for radiological analyses, and non-radiological

analyses. One duplicate analysis for tritium failed duplicate criteria. No results will be qualified since two other tritium duplicates passed the criteria. Duplicate results for Cs-137 in soil are presented in **Table 34**.

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 fourth 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 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 second quarter 2008, no field matrices were spiked to assess the influence of the sample media on laboratory performance. However, several spiked samples were created using de-ionized water and submitted to analytical laboratories for analyses. These non-radiological constituents were used to assess ground water analyte recovery rates and the results are presented in **Table 35**, **Table 36**, and **Table 37**. The vinyl chloride analyses failed the spike criteria; however, there were no detectable concentrations in any samples so the data does not need to be qualified.

DEQ-INL OP also prepares additional “spike-like” quality control samples to assess ambient radiation measurement bias. Once per quarter, DEQ-INL OP irradiates a number of electret ionization chambers (EIC) to verify EIC response. Irradiations of EICs are conducted in a repeatable geometry to a known exposure of 30 mR and two additional exposures, ranging from 15 to 60 mR. EIC responses are compared directly with the exposure received from the NIST traceable cesium-137 source provided by ISU-EML. EIC response is considered acceptable if each measurement agrees within 25 percent of the known irradiated quantity. The irradiation results for fourth quarter 2008 are presented in **Table 39**. Real-time pressure correction is used to calculate the net exposure measured by these EIC control sets.

There were no other anomalies observed from the assessment of spiked samples as measured by DEQ-INL OP or the analytical laboratories used by DEQ-INL OP for the fourth quarter of 2008.

Analytical QA/QC Assessment

Other than the two previously mentioned, no issues involving sample chain of custody, sample holding times, and the analysis of blank, duplicate, and spiked samples were observed during the fourth quarter of 2008, which significantly affected data quality. Methodologies and data reports issued by the contracting laboratories generally conformed to the requirements of DEQ-INL OP during the fourth quarter of 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 fourth quarter of 2008 met the minimum criteria of the DEQ-INL OP ESP and is summarized in **Table 24**.

Preventative Maintenance and Equipment Reliability

All equipment was calibrated and checked according to pre-described periodicity. Service reliability for air sampling equipment for the fourth quarter of 2008 is summarized in **Table 39**. The low volume pump at Montevue, which runs both the Radio Iodine and atmospheric Tritium samples, seized up. No samples were obtained for a three week period while a new pump was obtained. The blower motor on the TSP sampler at Montevue was also replaced due to failure.

Conclusion

All data collected for the fourth 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 OP.

Table 24. Summary of the analytical performance and usability of the analyses performed for the DEQ-INL OP ESP for fourth 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	142	13	0	0	0	ISU-EML
		Gross beta	142	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	35	3	0	0	ISU-EML	
Gaseous	Charcoal filter	Iodine-131	13	0	0	0	ISU-EML	
Precipitation	Poly bottle	Tritium	6	0	0	0	0	ISU-EML
		Gamma emitters	5	0	0	0	0	ISU-EML
WATER								
Groundwater & Surface Water	Grab or composite	Gross alpha	25	2	3	0	0	ISU-EML
		Gross beta	25	2	3	0	0	ISU-EML
		Gamma emitters	25	2	3	0	0	ISU-EML
		Tritium	25	2	3	0	0	ISU-EML
		Enriched tritium	1	0	0	0	0	ISU-EML
		Technetium-99	14	1	1	0	0	ISU-EML
		Radiochemical	59	9	8	0	0	ISU Sub
		Metals	18	2	3	2	0	IBL
		Common Ions	18	2	3	2	0	IBL
		Nutrients	18	2	3	2	0	IBL
Volatile Organics	3	0	0	1	0	IBL		
TERRESTRIAL								
Milk	Grab or composite	Gamma emitters	20	0	0	0	0	ISU-EML
Soil	<i>in situ</i>	Gamma emitters	33	0	1	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	11	NA	NA	NA	NA	DEQ-INL OP
Total Test Analyses			704	54	31	16		
Total of QC Analyses (blanks, duplicates, and spikes)			101					
Percentage of QC analyses of total Test analyses³			14%					
Percentage of usable data⁴			100%					

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

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

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

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

Table 25. Blank analysis results for gross alpha and beta in particulate air (TSP) for the fourth quarter, 2008.

Collection Period		Corrected volume (m ³) ¹	Gross alpha		Gross beta	
Start	Stop		Value	Uncertainty (± 2 SD)	Value	Uncertainty (± 2 SD)
10/02/08	10/09/08	1667	0.0	0.2	0.0	0.4
10/09/08	10/16/08	1667	0.1	0.2	0.0	0.4
10/16/08	10/23/08	1667	0.1	0.2	-0.2	0.3
10/23/08	10/30/08	1667	-0.1	0.2	0.5	0.3
10/30/08	11/06/08	1667	0.3	0.2	-0.2	0.3
11/06/08	11/13/08	1667	0.0	0.2	0.0	0.3
11/13/08	11/20/08	1667	0.0	0.2	-0.6	0.3
11/20/08	11/27/08	1667	-0.1	0.2	-0.2	0.3
11/27/08	12/04/08	1667	0.0	0.2	-0.1	0.4
12/04/08	12/11/08	1667	0.1	0.2	-0.3	0.3
12/11/08	12/18/08	1667	-0.1	0.2	-0.7	0.4
12/18/08	12/24/08	1667	0.0	0.2	0.3	0.3
12/24/08	12/31/08	1667	-0.2	0.2	-0.1	0.3

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

¹ A volume equal to the average of the volumes collected through each valid field filter was used to compute “concentrations” for the blank for meaningful comparison to sample results. No air was passed through the blank filters.

Table 26 Blank analysis results for gamma spectroscopy for TSP particulate air filters for the fourth 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
01/20/09	2	26	45	2	30	51	3	7	12
Analysis Date	Cesium-134			Cesium-137					
	Concentration ¹	± 2 SD	MDC	Concentration	± 2 SD	MDC			
01/20/09	-1	3	6	0	3	5			

Note: Concentrations are expressed in 1 x 10⁻⁵ pCi/m³ with associated uncertainty (± 2 SD) and minimum detectable concentration (MDC).

¹ These concentrations are from blank filters collected weekly, composited, and analyzed for the calendar quarter. A composite volume equal to the sum of the average volumes collected through each valid field filter was used to compute “air concentrations” for the blank for meaningful comparison to sample results. No air was actually passed through the blank filters.

Table 27. Blank analysis results for tritium in water vapor from air samples for the fourth quarter, 2008.

Sample Number	Start Date	Collect Date	Analysis Date	Tritium		
				Concentration	± 2 SD	MDC
OP084ZTR01	10/21/08	10/22/08	1/15/09	0.07	0.08	0.13
OP084ZTR02	11/4/08	11/7/08	1/15/09	0.07	0.08	0.14
OP084ZTR03	11/24/08	11/25/08	1/15/09	0.02	0.09	0.15

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

Table 28. Radiological blank analysis in ground and surface water for samples for the fourth quarter, 2008.

Sample Number	Sample Date	Concentration	± 2 SD	MDC	Within Blank Criteria?
Gross Alpha					
081W467	10/22/2008	-0.1	0.6	1.0	Yes
081W475	10/22/2008	0.5	0.6	1.0	Yes
Gross Beta					
081W467	10/22/2008	0.3	0.9	1.4	Yes
081W475	10/22/2008	1.3	0.9	1.4	Yes
Cesium-137					
081W467	10/22/2008	-0.3	2.0	3.5	Yes
081W475	10/22/2008	-1.1	1.4	2.5	Yes
Tritium					
081W469	10/22/2008	-20	80	140	Yes
081W476	10/22/2008	10	80	140	Yes
Strontium-90					
081W470	10/22/2008	0.01	0.21	0.49	Yes
Technetium-99					
081W468	10/22/2008	-0.16	0.2	0.30	Yes
Plutonium-238					
081W470	10/22/2008	-0.006	0.023	0.046	Yes
Plutonium-239/240					
081W470	10/22/2008	0.009	0.023	0.04	Yes
Plutonium-241					
081W470	10/22/2008	0.1	4.2	7.2	Yes
Americium-241					
081W470	10/22/2008	-0.001	0.026	0.050	Yes
Neptunium-237					
081W470	10/22/2008	0.008	0.036	0.048	Yes
Uranium-234					
081W470	10/22/2008	0.099	0.072	0.034	Yes
Uranium-235					
081W470	10/22/2008	0.015	0.053	0.039	Yes
Uranium-238					
081W470	10/22/2008	0.010	0.045	0.097	Yes

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

Table 29. Blank analysis results (µg/L) for metals in ground and surface water for the fourth quarter, 2008.

Sample Number	Sample Date	Arsenic	Barium	Cadmium	Chromium	Iron	Lead	Manganese	Selenium	Zinc
081W473	10/22/2008	<5	<2	<1	<5	<10	<5	<2	<10	<5
081W478	10/22/2008	<5	<2	<1	<5	<10	<5	<2	<10	<5

Table 30. Blank analysis results (mg/L) for common ions and nutrients in ground and surface water for the fourth quarter, 2008.

Sample Number	Sample Date	Calcium	Magnesium	Sodium	Potassium	Fluoride	Chloride	Sulfate	Total Alkalinity	Total Nitrogen	Total Phosphorus
081W472,473,474,	10/22/2008	<0.1	<0.1	<0.1	<0.1	<0.1	<1	<1	<1	<0.01	<0.0050
081W478,477,608	10/22/2008	<0.1	<0.1	<0.1	<0.1	<0.1	<1	<1	<1	<0.01	<0.0050

Table 31. Duplicate radiological analysis results in pCi/L for ground and surface water, fourth 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									
USGS-014	081W508	3.3	2.1	081W610	3.6	2.3	0.3	4.7	yes
USGS-104	081W513	2.7	2.4	081W590	5.2	2.0	2.5	4.7	yes
M3S	081W626	4.3	2.2	081W642	1.5	2.2	2.8	4.7	yes
Gross Beta									
USGS-014	081W508	3.6	1.2	081W610	4.3	1.2	0.7	2.5	yes
USGS-104	081W513	2.7	1.2	081W590	4.9	1.1	2.2	2.4	yes
M3S	081W626	4.0	1.2	081W642	3.8	1.2	0.2	2.5	yes
Gamma Spectroscopy Cesium-137									
USGS-014	081W508	0.1	1.4	081W610	0.8	1.7	0.7	3.3	yes
USGS-104	081W513	-1.1	1.5	081W590	-0.2	1.5	0.9	2.3	yes
M3S	081W626	0.7	2	081W642	0.9	1.5	0.2	3.1	yes
Tritium									
USGS-014	081W509	-90	80	081W611	-30	90	60	181	yes
USGS-104	081W516	770	110	081W593	880	120	110	244	yes
M3S	081W628	1000	110	081W644	720	110	280	233	No
Strontium-90									
M3S	081W629	0.12	0.22	081W645	0.09	0.19	0.03	0.4	yes
Technetium-99									
M3S (dissolved)	081W627	1.2	0.2	081W643	1.3	0.2	0.1	0.4	yes
Plutonium-238									
M3S	081W629	0.001	0.021	081W645	0.004	0.02	0.003	0.044	yes
Plutonium-239/240									
M3S	081W629	0.004	0.021	081W645	-0.008	0.02	0.012	0.044	yes
Plutonium-241									
M3S	081W629	-0.3	3.6	081W645	1.1	3.6	1.4	7.6	yes
Uranium-234									
M3S	081W630	1.40	0.33	081W646	1.50	0.036	0.10	0.50	yes
Uranium-235									
M3S	081W630	0.060	0.058	081W646	0.057	0.065	0.003	0.131	yes
Uranium-238									
M3S	081W630	0.57	0.18	081W646	0.75	0.23	0.18	0.44	yes
Americium-241									
M3S	081W629	0.008	0.027	081W645	0.004	0.023	0.004	0.05	yes

¹/R₁-R₂/ ≤ 3(s₁²+s₂²)^{1/2}

Table 32. Duplicate results for metals (µg/L) in ground water and/or surface water for the fourth quarter, 2008.

Sample Location	Sample Number	Sample Date	Arsenic	Barium	Cadmium	Chromium	Iron	Lead	Manganese	Selenium	Zinc
Site-14 (dissolved)	081W506	10/23/2008	NR	61	NR	5.4	NR	<5	<2	NR	<5
Site-14 (dissolved)	081W595	10/23/2008	NR	62	NR	5.4	NR	<5	<2	NR	<5
RPD				-2		0		0	0	0	0
M3S (total)	081W632	11/4/2008	<5	43	<1	<1	14	<5	<5	<5	<5
M3S (total)	081W648	11/4/2008	<5	43	<1	<1	14	<5	<5	<5	<5
RPD			0	0	0	0	0	0	0	0	0
USGS-014 (dissolved)	081W511	10/21/2008	NR	22	NR	<5	NR	<5	<2	NR	<5
USGS-014 (dissolved)	081W613	10/21/2008	NR	22	NR	<5	NR	<5	<2	NR	<5
RPD				0		0		0	0		0

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

NR = Analysis not requested

Table 33. Duplicate results for common ions and nutrients (mg/L) in ground water and/or surface water for fourth quarter, 2008.

Sample Location	Sample Number	Sample Date	Calcium	Magnesium	Sodium	Potassium	Fluoride	Chloride	Sulfate	Total Alkalinity	Total Nitrogen	Total Phosphorus
Site-14	081W506,505	10/23/2008	35	14	15	3	0.498	10.2	24.5	128	0.62	0.016
Site-14	081W595,594	10/23/2008	36	14	15	3	0.499	9.97	24.5	128	0.62	0.015
RPD			-3	0	0	0	0	2	0	0	0	6
M3S (total)	081W632,631	11/4/2008	46	16	8.3	2.6	0.242	14	25.8	139	1.2	0.013
M3S (total)	081W648,647	11/4/2008	46	16	8.3	2.6	0.245	14	25.8	140	1.2	0.014
RPD			0	0	0	0	-1	0	0	-1	0	-7
USGS-014*	081W511,510	10/21/2008	37	16	17	2.7	1.01	22.2	22.4	135	0.85	0.022
USGS-014*	081W613,612	10/21/2008	39	16	17	2.8	1.01	22.2	22.5	136	0.85	0.022
RPD			-5	0	0	-4	0	0	0	-1	0	0

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

Table 34. Duplicate results for Cs-137 in soil for fourth quarter, 2008.

Sample Location	Original Sample Number	Cs-137 Concentration (pCi/g)	± 2 SD	Duplicate Sample Number	Cs-137 Concentration (pCi/g)	± 2 SD	Within Criteria? ¹
Big Lost Rest Area Air Station	RAAIR08	0.15	0.04	RAQA08	0.19	0.02	Yes

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

Table 35. De-ionized water spike results (in µg/L) and percent recovery for metals in ground and surface water for the fourth quarter, 2008.

Spike Sample Number	Sample Date	Barium			Chromium			Lead			Manganese			Zinc		
		spike	result	%R ¹	spike	result	%R	spike	result	%R	spike	result	%R	spike	result	%R
081W598	10/22/2008	94.5	97	103	109	110	101	7.43	7.5	101	11.3	12	106	299	300	100
081W601	10/22/2008	68.0	69	101	78.5	82	104	6.58	6.5	99	8.14	8.7	107	215	210	98

Table 36. De-ionized water spike results (in mg/L) and percent recovery for common ions and nutrients in ground and surface water for the fourth quarter, 2008.

Spike Sample Number	Sample Date	Calcium			Magnesium			Sodium			Potassium			Fluoride		
		spike	result	%R ¹	spike	result	%R	spike	result	%R	spike	result	%R	spike	result	%R
081W598,597	10/22/2008	27.6	28	101	14.2	14	99	27.8	27	97	5.32	5.2	98	0.835	0.876	105
081W601, 602	10/22/2008	19.9	19	95	10.2	10	98	20	19	95	3.83	3.7	97	0.33	0.35	106

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

Table 36. continued. De-ionized water spike results (in mg/L) and percent recovery for common ions and nutrients in ground and surface water for the second quarter, 2008.

Spike Sample Number	Sample Date	Chloride			Sulfate			Total Alkalinity as CaCO3			Total Nitrogen			Total Phosphorus		
		spike	result	%R	spike	result	%R	spike	result	%R	spike	result	%R	spike	result	%R
081W599,597	10/22/2008	54.5	54.5	100	12.3	12.5	102	20.2	20	99	3.08	3.1	101	0.0186	0.017	91
081W600, 602	10/22/2008	8.18	8.54	104	4.03	3.9	97	5.49	5	91	2.55	2.6	102	0.0251	0.022	88

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

Table 37. De-ionized water spike results (in µg/L) and percent recovery for VOCs in ground and surface water for the fourth quarter, 2008.

Spike Sample Number	Sample Date	cis- 1, 2- Dichloroethylene			trans-1, 2- Dichloroethylene			Toluene			Trichloroethylene			Vinyl Chloride		
		spike	result	%R	spike	result	%R	spike	result	%R	spike	result	%R	spike	result	%R
081W615	10/22/2008	14.7	15	102	11.7	14	120	8.73	9.6	110	11.4	12	105	7.01	10	143

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

Table 38. Electret ionization chamber irradiation results (categorized as spiked samples) for fourth quarter, 2008.

Electret #	Exposure Received		Net Measured Exposure ¹		%R
	(mR)	Uncertainty (mR)	(mR)	Uncertainty (mR)	
Spike 1	40	2.00	42.0	1.4	104.9
Spike 1	40	2.00	41.3	1.4	103.4
Spike 1	40	2.00	40.1	1.3	100.2
Spike 2	30	1.50	30.6	1.4	101.9
Spike 2	30	1.50	28.0	1.4	93.2
Spike 2	30	1.50	29.5	1.4	98.4
Spike 3	25	1.25	22.7	1.4	90.8
Spike 3	25	1.25	27.0	1.3	108.0
Spike 3	25	1.25	25.1	1.4	100.6

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

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

Table 39. Air sampling field equipment service reliability (percent operational) for fourth 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 ¹
Van Buren Avenue	100 %	100 %	100 %	NC ¹
Boundary Locations				
Atomic City	100 %	100 %	100 %	100 %
Howe	100 %	100 %	100 %	100 %
Monteview	92 %	77 %	77 %	100 %
Mud Lake	100 %	100 %	100 %	100 %
Distant Locations				
Craters of the Moon	100 %	100 %	100 %	NC ¹
Idaho Falls	100 %	100 %	100 %	100 %

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

¹NC = sample not collected at this location

Appendix A

Table A-1. Weekly concentrations (in 1×10^{-3} pCi/m³) for gross alpha and gross beta analyses for TSP filters for all locations, fourth quarter, 2008.

Sample location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	± 2 SD	Concentration	± 2 SD
Rest Area	10/02/08	10/09/08	1.2	0.3	34.9	1.3
	10/09/08	10/16/08	1.0	0.3	14.7	1.0
	10/16/08	10/23/08	2.0	0.4	62.0	1.8
	10/23/08	10/30/08	0.4	0.2	23.7	1.0
	10/30/08	11/06/08	1.4	0.3	39.1	1.5
	11/06/08	11/13/08	0.9	0.3	39.6	1.5
	11/13/08	11/20/08	1.6	0.4	63.3	2.1
	11/20/08	11/27/08	1.1	0.4	54.9	1.9
	11/27/08	12/04/08	1.5	0.3	61.2	1.6
	12/04/08	12/11/08	1.5	0.3	59.5	1.7
	12/11/08	12/18/08	1.2	0.3	60.5	1.8
	12/18/08	12/24/08	0.9	0.3	33.8	1.4
	12/24/08	12/31/08	0.3	0.3	33.5	1.4
Experimental Field Station	10/02/08	10/09/08	0.9	0.3	25.5	1.2
	10/09/08	10/16/08	0.9	0.3	32.5	1.3
	10/16/08	10/23/08	1.4	0.3	39.6	1.4
	10/23/08	10/30/08	1.5	0.3	43.2	1.5
	10/30/08	11/06/08	0.7	0.2	25.0	1.1
	11/06/08	11/13/08	0.6	0.2	27.3	1.2
	11/13/08	11/20/08	0.6	0.3	33.0	1.3
	11/20/08	11/27/08	1.7	0.4	42.2	1.6
	11/27/08	12/04/08	1.1	0.3	41.1	1.3
	12/04/08	12/11/08	0.9	0.3	46.1	1.5
	12/11/08	12/18/08	0.9	0.3	47.4	1.5
	12/18/08	12/24/08	0.4	0.3	22.1	1.2
	12/24/08	12/31/08	0.1	0.2	21.3	1.0

Table A-1 continued. Weekly concentrations (in 1×10^{-3} pCi/m³) for gross alpha and gross beta analyses for TSP filters for all locations, fourth quarter, 2008.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	± 2 SD	Concentration	± 2 SD
Sand Dunes	10/02/08	10/09/08	0.7	0.3	23.8	1.1
	10/09/08	10/16/08	0.9	0.3	29.3	1.2
	10/16/08	10/23/08	1.5	0.3	38.5	1.4
	10/23/08	10/30/08	1.3	0.3	51.8	1.6
	10/30/08	11/06/08	1.1	0.3	26.4	1.2
	11/06/08	11/13/08	0.6	0.2	25.3	1.1
	11/13/08	11/20/08	1.0	0.3	49.5	1.9
	11/20/08	11/27/08	0.9	0.3	38.8	1.5
	11/27/08	12/04/08	1.0	0.3	39.2	1.3
	12/04/08	12/11/08	1.4	0.3	49.3	1.6
	12/11/08	12/18/08	1.0	0.3	41.6	1.5
	12/18/08	12/24/08	0.3	0.3	25.9	1.3
	12/24/08	12/31/08	0.3	0.3	23.3	1.1
Van Buren	10/02/08	10/09/08	1.0	0.3	28.7	1.2
	10/09/08	10/16/08	1.0	0.3	33.2	1.3
	10/16/08	10/23/08	1.7	0.3	41.0	1.4
	10/23/08	10/30/08	1.5	0.3	55.5	1.6
	10/30/08	11/06/08	0.9	0.2	27.4	1.1
	11/06/08	11/13/08	0.8	0.2	26.9	1.1
	11/13/08	11/20/08	0.8	0.3	48.9	1.5
	11/20/08	11/27/08	1.3	0.3	38.2	1.5
	11/27/08	12/04/08	1.3	0.3	52.0	1.5
	12/04/08	12/11/08	0.9	0.3	40.2	1.4
	12/11/08	12/18/08	0.8	0.3	39.3	1.4
	12/18/08	12/24/08	0.4	0.3	21.2	1.1
	12/24/08	12/31/08	0.2	0.2	22.1	1.0
Atomic City	10/02/08	10/09/08	0.6	0.3	27.4	1.1
	10/09/08	10/16/08	1.0	0.3	33.3	1.2
	10/16/08	10/23/08	1.5	0.3	35.8	1.3
	10/23/08	10/30/08	1.7	0.4	46.8	1.5
	10/30/08	11/06/08	0.9	0.3	28.9	1.2
	11/06/08	11/13/08	0.6	0.2	25.2	1.1
	11/13/08	11/20/08	1.0	0.3	52.0	1.6
	11/20/08	11/27/08	2.1	0.4	45.4	1.6
	11/27/08	12/04/08	1.6	0.3	50.1	1.5
	12/04/08	12/11/08	1.5	0.3	45.6	1.5
	12/11/08	12/18/08	1.1	0.3	49.1	1.6
	12/18/08	12/24/08	0.5	0.3	19.0	1.1
	12/24/08	12/31/08	0.8	0.3	21.5	1.1

Table A-1 continued. Weekly concentrations (in 1×10^{-3} pCi/m³) for gross alpha and gross beta analyses for TSP filters for all locations, fourth quarter, 2008.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	± 2 SD	Concentration	± 2 SD
Howe	10/02/08	10/09/08	0.7	0.3	21.5	1.0
	10/09/08	10/16/08	1.1	0.3	30.8	1.2
	10/16/08	10/23/08	1.0	0.3	28.6	1.2
	10/23/08	10/30/08	0.9	0.3	39.4	1.3
	10/30/08	11/06/08	0.9	0.2	22.7	1.0
	11/06/08	11/13/08	0.5	0.2	27.0	1.1
	11/13/08	11/20/08	0.6	0.2	28.3	1.2
	11/20/08	11/27/08	1.5	0.3	28.1	1.3
	11/27/08	12/04/08	0.6	0.2	28.5	1.1
	12/04/08	12/11/08	0.9	0.3	41.3	1.4
	12/11/08	12/18/08	0.9	0.3	33.9	1.3
	12/18/08	12/24/08	0.6	0.3	24.6	1.2
	12/24/08	12/31/08	1.6	0.4	21.5	1.1
Montevieu	10/02/08	10/09/08	1.0	0.3	25.2	1.1
	10/09/08	10/16/08	0.8	0.2	24.4	1.1
	10/16/08	10/23/08	1.2	0.3	25.1	1.1
	10/23/08	10/30/08	1.2	0.3	42.9	1.4
	10/30/08	11/06/08	0.3	0.2	13.7	0.8
	11/06/08	11/13/08	0.7	0.2	16.0	0.9
	11/13/08	11/20/08	0.6	0.2	20.5	1.0
	11/20/08	11/27/08	0.5	0.3	16.1	1.0
	11/27/08	12/04/08	0.6	0.2	26.5	1.1
	12/04/08	12/11/08	0.5	0.2	22.5	1.0
	12/11/08	12/18/08	NS ¹	NS	NS	NS
	12/18/08	12/24/08	0.1	0.2	9.0	0.8
	12/24/08	12/31/08	0.0	0.2	9.2	0.7
Mud Lake	10/02/08	10/09/08	1.1	0.3	24.2	1.2
	10/09/08	10/16/08	1.0	0.3	27.0	1.3
	10/16/08	10/23/08	1.8	0.4	38.7	1.4
	10/23/08	10/30/08	1.5	0.4	39.1	1.4
	10/30/08	11/06/08	0.9	0.3	23.9	1.1
	11/06/08	11/13/08	0.4	0.2	22.9	1.1
	11/13/08	11/20/08	1.1	0.4	41.8	1.8
	11/20/08	11/27/08	1.2	0.3	31.9	1.4
	11/27/08	12/04/08	1.2	0.3	42.9	1.4
	12/04/08	12/11/08	1.5	0.3	42.8	1.5
	12/11/08	12/18/08	0.9	0.3	39.5	1.5
	12/18/08	12/24/08	0.9	0.3	21.3	1.2
	12/24/08	12/31/08	0.0	0.3	20.5	1.1

¹ NS - Insufficient sample collected due to sampler failure.

Table A-1 continued. Weekly concentrations (in 1×10^{-3} pCi/m³) for gross alpha and gross beta analyses for TSP filters for all locations, fourth quarter, 2008.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	± 2 SD	Concentration	± 2 SD
Distant Locations						
Craters						
	10/02/08	10/09/08	0.7	0.3	22.1	1.1
	10/09/08	10/16/08	0.9	0.3	24.4	1.1
	10/16/08	10/23/08	1.0	0.3	29.5	1.2
	10/23/08	10/30/08	1.0	0.3	32.1	1.3
	10/30/08	11/06/08	0.7	0.2	21.7	1.1
	11/06/08	11/13/08	0.7	0.2	21.7	1.1
	11/13/08	11/20/08	0.7	0.3	38.2	1.4
	11/20/08	11/27/08	1.3	0.3	29.7	1.3
	11/27/08	12/04/08	1.0	0.3	40.5	1.3
	12/04/08	12/11/08	0.5	0.2	34.1	1.3
	12/11/08	12/18/08	0.8	0.3	30.4	1.2
	12/18/08	12/24/08	0.3	0.2	14.3	1.0
	12/24/08	12/31/08	0.0	0.2	13.8	0.9
Fort Hall'						
	10/02/08	10/09/08	1.3	0.3	19.6	1.0
	10/09/08	10/16/08	1.2	0.3	20.8	1.1
	10/16/08	10/23/08	1.5	0.3	25.4	1.1
	10/23/08	10/30/08	0.8	0.3	31.6	1.2
	10/30/08	11/06/08	0.8	0.3	17.8	1.0
	11/06/08	11/13/08	0.9	0.3	15.7	0.9
	11/13/08	11/20/08	1.5	0.3	30.5	1.2
	11/20/08	11/27/08	1.4	0.3	28.4	1.3
	11/27/08	12/04/08	1.2	0.3	33.8	1.2
	12/04/08	12/11/08	0.9	0.3	27.2	1.2
	12/11/08	12/18/08	0.6	0.2	27.9	1.2
	12/18/08	12/24/08	0.3	0.2	11.0	0.8
	12/24/08	12/31/08	0.2	0.2	11.2	0.8
Idaho Falls						
	10/02/08	10/09/08	1.7	0.4	26.9	1.2
	10/09/08	10/16/08	0.8	0.3	34.5	1.3
	10/16/08	10/23/08	1.8	0.3	41.4	1.4
	10/23/08	10/30/08	1.4	0.4	40.8	1.7
	10/30/08	11/06/08	1.3	0.3	45.1	1.5
	11/06/08	11/13/08	1.0	0.3	39.0	1.4
	11/13/08	11/20/08	2.0	0.4	74.6	1.9
	11/20/08	11/27/08	3.0	0.5	56.2	1.8
	11/27/08	12/04/08	2.2	0.4	70.4	2.0
	12/04/08	12/11/08	1.2	0.3	51.7	1.7
	12/11/08	12/18/08	1.4	0.3	49.4	1.7
	12/18/08	12/24/08	0.4	0.3	21.6	1.2
	12/24/08	12/31/08	0.1	0.3	20.6	1.1

Operated by Shosone-Bannack Tribe

Appendix B

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

Sample Location	Net Corrected Exposure Rate ($\mu\text{R}/\text{h}$)	± 2 SD ($\mu\text{R}/\text{h}$)
Arco	13.0	3.9
Craters	11.7	3.6
Rest Area	13.5	1.0
Van Buren	14.7	3.8
EFS	16.6	3.6
Main Gate	16.2	4.9
Atomic City	16.3	6.8
Taber	11.3	2.6
Blackfoot	9.8	1.2
Ft. Hall	11.4	4.7
Idaho Falls ¹	NS	NS
Mud Lake/ Terreton	10.8	0.3
Monteview	13.6	3.4
Sand Dunes	13.5	2.6
Howe	10.8	0.6
Howe Met. Tower	11.3	0.7
MP276 -20	14.5	5.5
MP274 -20	20.9	5.5
MP272 -20	12.3	5.5
MP270 -20	16.1	5.5
MP268 -20	11.1	5.5
MP266 -20	16.5	5.5
MP264 -20	18.7	5.5
MP270 -20/26	16.0	5.5
MP268 -20/26	12.9	5.5
MP266 -20/26	17.8	5.5
MP263 -20/26	17.9	5.5
MP261 -20/26	17.0	5.5
MP259 -20/26	16.2	5.5
MFC (EBR II)	14.4	5.2
EBR I	11.9	3.7
RWMC	14.0	1.7
CFA	15.9	5.4
CITRC (PBF)	13.5	3.2

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

Sample Location	Net Corrected Exposure Rate ($\mu\text{R}/\text{h}$)	$\pm 2 \text{ SD}$ ($\mu\text{R}/\text{h}$)
INTEC (ICPPI)	10.9	2.9
ATR (TRA)	16.2	1.6
NRF	16.7	3.2
TAN	11.2	4.1
Mud Lake Bank of Commerce	18.9	2.7
MP43-33	20.0	8.6
MP41-33	23.0	8.6
MP39-33	26.4	8.6
MP37-33	13.4	8.6
MP35-33	14.9	8.6
MP33-33	16.9	8.6
MP31-33	17.0	8.6
MP29-33	13.9	8.6
MP27-33	13.6	8.6
MP25-33	14.7	8.6
MP23-33	14.5	8.6
Base of Howe ²	7.9	0.4
Rover ²	13.5	3.9
Hamer	15.8	1.9
Sugar City	19.1	2.0
Roberts	14.1	2.7
Big Southern Butte ²	13.9	4.1

¹ Sample was determined to be invalid due to operator error

² Left out for two quarters due to impassable roads. Reported value is the average of 4th quarter 2008 and 1st quarter 2009.

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 $\mu\text{g/L}$.

Analyte	Minimum detectable concentrations (MDC) (expressed in $\mu\text{g/L}$)
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