Department of Environmental Quality
INL Oversight Program

ENVIRONMENTAL SURVEILLANCE PROGRAM QUARTERLY DATA REPORT

July - September, 2011

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

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

Table of Contents

Table of Acronyms v
Introduction 1
Air and Precipitation Monitoring Results 1
Environmental Radiation Monitoring Results 6
Water Monitoring 8
Terrestrial Monitoring Results 17
Quality Assurance 18

List of Tables

Table 1. Sampling locations and sample type. 3
Table 2. Range of gross alpha and gross beta concentrations for TSP filters, third quarter, 2011. 3
Table 3. Gamma spectroscopy analysis data for TSP filters, composite samples, third quarter, 2011. 4
Table 4. Tritium concentrations in air from atmospheric moisture, third quarter, 2011 4
Table 5. Tritium and Cesium-137 concentrations from precipitation, third quarter, 2011 5
Table 6. Summary of instrumentation at radiation monitoring stations. 7
Table 7. Average gamma exposure rates, third quarter, 2011, from HPIC network. 7
Table 8. Electret ionization chamber (EIC) cumulative average exposure rates, third quarter, 2011. 8
Table 9. Alpha, beta, and gamma concentrations for water samples, third quarter, 2011. 12
Table 10. Tritium concentrations for water samples, third quarter, 2011. 12
Table 11. Enriched tritium concentrations for water samples from previous sampling quarters, 2010 and 2011. 13
Table 12. Reported metals concentrations in water samples, third quarter, 2011. 14
Table 13. Reported common ion concentrations in water samples, third quarter, 2011. 15
Table 14. Reported nutrient concentrations in water samples, third quarter, 2011. 16
Table 15. Gamma spectroscopy analysis data for milk samples, third quarter, 2011. 18
Table 16. Summary of the analytical performance and usability of the analyses performed for the DEQ-INL OP ESP, third quarter, 2011. 22
Table 17. Blank analysis results for gross alpha and beta in particulate air (TSP), third quarter, 2011. 23
Table 18. Blank analysis results for gamma spectroscopy for TSP particulate air filters, third quarter, 2011. 23
Table 19. Blank analysis results for tritium in water vapor from air samples, third quarter, 2011. 23
Table 20. Radiological blank analysis in ground and surface water for samples, third quarter, 2011. 24
Table 21. Blank analysis results (µg/L) for metals in ground and surface water for the third quarter, 2011. 25
Table 22. Blank analysis results (mg/L) for common ions and nutrients in ground and surface water for the third quarter, 2011. 25
Table 23. Electret ionization chamber irradiation results (categorized as spiked samples) for third quarter, 2011. 26
Table 24. Air sampling field equipment service reliability (percent operational), third quarter, 2011. 26
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, 2011 27
Table B-1. Results for all electret locations, third quarter, 2011. 31
Table C-1. List of volatile organic compounds (VOCs) analyzed for water samples. 33

List of Figures

Figure 1. Air and radiation monitoring sites. 2
Figure 2. Distant and surface water sampling locations, third quarter, 2011. 10
Figure 3. Up-gradient, facility, boundary and wastewater monitoring locations. third quarter, 2011. 11

Table of Acronyms

aCi/L	-	attocuries per liter
BEA	-	Battelle Energy Alliance, LLC
BLR		Big Lost River
CERCLA	-	Comprehensive Environmental Response, Compensation and Liability Act
CFA	-	Central Facilities Area
CWI	-	CH2M-WG Idaho, LLC
DEQ-INL OP	-	The State of Idaho, Department of Environmental Quality, Idaho National Laboratory Oversight Program
DOE	-	U.S. Department of Energy
EIC	-	electret ionization chamber
EML	-	Environmental Monitoring Laboratory
EPA	-	Environmental Protection Agency
ESER	-	Environmental Surveillance, Education and Research Program (Gonzales-Stoller Surveillance, LLC)
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	-	milliRoentgen
mR/hr	-	milliRoentgen per hour
µR/hr	-	microRoentgen per hour
MCL	-	maximum contaminant level
MDA	-	minimum detectable activity
MDC	-	minimum detectable concentration
NIST	-	National Institute of Standards and Technology
nCi/L	-	nanocuries per liter
NOAA	-	National Oceanic and Atmospheric Administration
NRF	-	Naval Reactors Facility
pCi/g	-	picocuries per gram
pCi/L	-	picocuries per liter
pCi/m^3	-	picocuries per cubic meter
PCE	-	perchloroethene
QAPP	-	Quality Assurance Program Plan
QA/QC	-	Quality Assurance/Quality Control
RCRA	-	Resource Conservation and Recovery Act
RPD	-	relative percent difference
RWMC	-	Radioactive Waste Management Complex
RTC	-	Reactor Technology Complex
SD	-	standard deviation
SMCL	-	secondary maximum contaminant level
TAN	-	Test Area North
TCE	-	trichloroethene
TDS	-	total dissolved solids
TMI	-	Three Mile Island
TSP	-	total suspended particulate
TSS	-	total suspended solids
USGS	-	U.S. Geological Survey
VOC	-	volatile organic compound
WLAP	-	Wastewater Land Application Permit

Introduction

The State of Idaho, Department of Environmental Quality, Idaho National Laboratory Oversight Program's (DEQ-INL OP) Environmental Surveillance Program (ESP) is conducted at locations on the INL, on the boundaries of the INL, and at distant locations to the INL in accordance with accepted monitoring procedures and management practices. This program is designed to provide the people of the state of Idaho with independently evaluated information about the impacts of the Department of Energy's (DOE) activities in Idaho.

The primary objective for DEQ-INL OP's ESP is to maintain an independent environmental monitoring and verification program designed to verify and supplement DOE's data and programs. This program is also used to provide the citizens of Idaho with information that has been independently evaluated to enable them to reach informed conclusions about DOE activities in Idaho and potential impacts to public health and the environment.

Results of the ESP are published using two distinct reporting formats: quarterly data reports and an annual ESP report. The annual ESP report is designed for a broad audience and summarizes the results of the ESP for the previous four quarters. The annual report's primary emphasis is to focus on trends, ascertain the impacts of DOE operations on the environment, and confirm the validity of DOE monitoring programs. This quarterly report is designed to 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, 2011 (**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 third quarter of 2011 for TSP filters are presented in **Table 3**. The only reported gamma-emitting radionuclide was beryllium-7, a naturally occurring, cosmogenic radionuclide.

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

specifically Iodine-131, were detected on the weekly charcoal cartridges used to collect this nuclide during the third quarter.

Atmospheric moisture was collected by drawing air through hygroscopic media at each of the 11 monitoring stations. This moisture was stripped from the hygroscopic media and analyzed to calculate the atmospheric tritium concentration. Reported values are the result of either a single sample or a weighted mean based upon the volume of air sampled when more than one atmospheric moisture sample was collected during the calendar quarter. Atmospheric tritium was measured above the minimum detectable concentration (MDC) at the Experimental Field Station, Van Buren, and Rest Area sampling sites during the third quarter of 2011. While results for this sampling site are above MDC they are still well below regulatory limits. Average atmospheric tritium concentrations are presented in **Table 4**.

Precipitation samples were collected at six monitoring locations during the third quarter of 2011. 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 2011. Tritium and Cesium-137 analysis results are presented in **Table 5**. Reported values were either the result of a single sample or a weighted mean when more than one precipitation sample was collected during the calendar quarter. There was insufficient sample at Monteview to perform gamma spectroscopy.

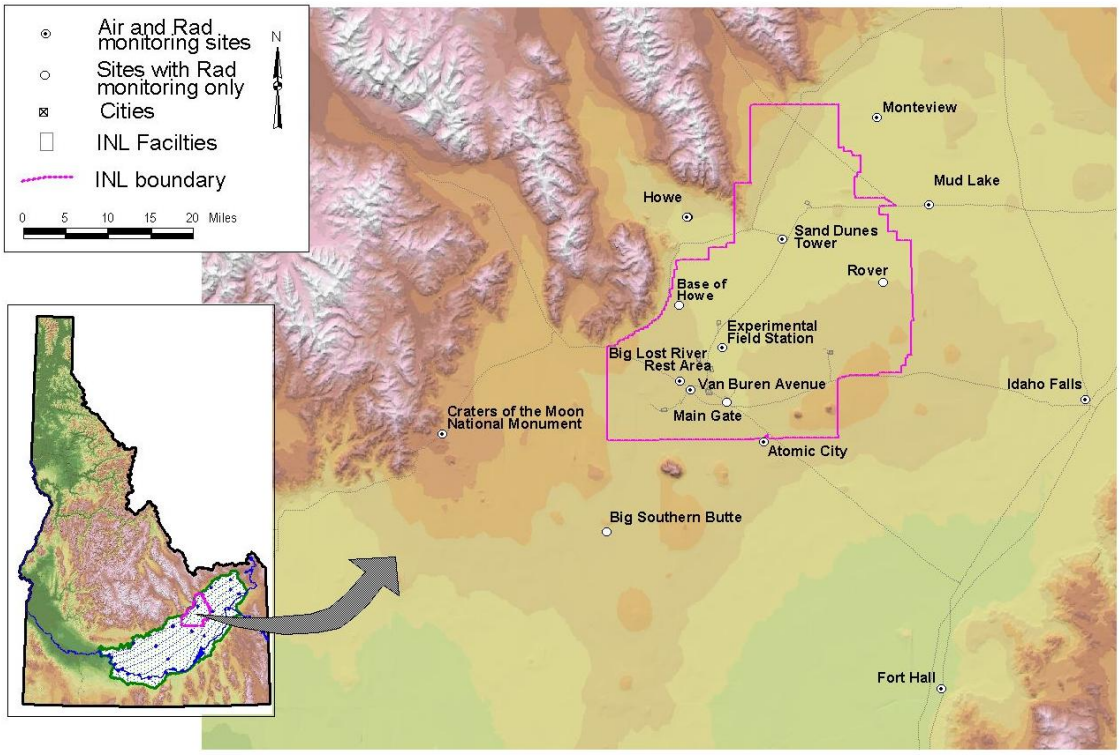

Figure 1. Air and radiation monitoring sites.

Table 1. Sampling locations and sample type.

Station Locations	Sample type[1]			
	TSP	Radioiodine	Water Vapor	Precipitation
On-site Locations				
Big Lost River Rest Area	□	□	■	■
Experimental Field Station	□	□	■	
Sand Dunes Tower	□	□	■	
Van Buren Avenue	□	□	■	
Boundary Locations				
Atomic City	□	□	■	■
Howe	□	□	■	■
Monteview	□	□	■	■
Mud Lake	□	□	■	■
Distant Locations				
Craters of the Moon	□	□	■	
Fort Hall[2]	□	□	■	
Idaho Falls	□	□	■	■

[1] □ Samples collected weekly; ■ Samples collected quarterly.
[2] TSP and radioiodine samples collected by Shoshone-Bannock Tribes.

Table 2. Range of gross alpha and gross beta concentrations for TSP filters, third quarter, 2011.

Station Location	Concentration					
	Gross Alpha			Gross Beta		
On-Site Locations						
Big Lost River Rest Area	1.2	-	3.1	42.4	-	69.2
Experimental Field Station	1.1	-	2.6	33.3	-	60.2
Sand Dunes Tower	0.8	-	2.4	29.9	-	55.8
Van Buren Avenue	0.9	-	3.1	33.2	-	62.0
Boundary Locations						
Atomic City	1.0	-	1.9	35.3	-	59.1
Howe	0.9	-	3.1	30.7	-	60.0
Monteview	1.2	-	2.7	38.7	-	62.2
Mud Lake	1.1	-	3.7	33.7	-	91.1
Distant Locations						
Craters of the Moon	0.7	-	2.0	27.2	-	53.6
Fort Hall[1]	1.0	-	2.3	27.3	-	42.5
Idaho Falls	1.1	-	2.9	35.7	-	65.2

[1]Operated by Shoshone-Bannock Tribes.
Note: Concentrations are expressed in 1 x 10^{-3} pCi/m^3.

Table 3. Gamma spectroscopy analysis data for TSP filters, composite samples, third quarter, 2011.

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	8.1	<MDC[2]
Experimental Field Station	119.6	6.2	<MDC
Sand Dunes Tower	104.3	5.5	<MDC
Van Buren Avenue	151.6	7.7	<MDC
Boundary Locations			
Atomic City	128.2	6.6	<MDC
Howe	115.5	6.0	<MDC
Monteview	134.6	6.9	<MDC
Mud Lake	115.3	6.1	<MDC
Distant Locations			
Craters of the Moon	136.5	7.0	<MDC
Fort Hall[1]	106.0	5.5	<MDC
Idaho Falls	149.2	7.7	<MDC

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

Table 4. Tritium concentrations in air from atmospheric moisture, third quarter, 2011

Station Location	Tritium		
	Concentration	± 2 SD	MDC
On-site Locations			
Big Lost River Rest Area	0.73	0.39	0.64
Experimental Field Station	1.09	0.41	0.70
Sand Dunes Tower	0.28	0.37	0.62
Van Buren Avenue	1.14	0.41	0.65
Boundary Locations			
Atomic City	0.77	0.48	0.78
Howe	0.70	0.53	0.89
Mud Lake	0.49	0.54	0.90
Monteview	0.43	0.44	0.72
Distant Locations			
Craters of the Moon	0.63	0.38	0.64
Fort Hall[1]	0.61	0.58	0.96
Idaho Falls	0.33	0.43	0.72

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

Table 5. Tritium and Cesium-137 concentrations from precipitation, third quarter, 2011.

Station Location	Tritium			Cesium-137		
	Concentration	± 2 SD	MDC	Concentration	± 2 SD	MDC
On-site Locations						
Big Lost River Rest Area	30	100	170	2.4	3.4	5.5
Boundary Locations						
Atomic City	0	100	170	0.8	1.8	3.1
Howe	0	100	170	0.6	2.2	3.7
Monteview	40	100	170	NS[1]	NS[1]	NS[1]
Mud Lake	90	100	170	0.5	3.2	5.4
Distant Locations						
Idaho Falls	10	100	170	1.6	2.0	3.2

[1]Insufficient sample to perform gamma spectroscopy at Monteview.

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

Environmental Radiation Monitoring Results

The ESP operated 14 environmental radiation stations during the third quarter of 2011 (**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/gamma-radiation-measurements.aspx

EICs are a passive-integrating system that provides a cumulative measure of environmental gamma radiation exposure in the field. EICs are deployed, collected, and analyzed quarterly. EICs offer an inexpensive methodology to measure gamma radiation over a wide area, particularly in regions which do not have a power source. EICs can also provide valuable gamma radiation data in the event of an emergency. For this reason EICs are deployed at an additional 40 locations by DEQ-INL OP in a widespread network around the INL measuring external radiation. This information is tabulated in **Appendix B.**

These two systems are used by DEQ-INL OP to measure external gamma radiation for various radiological monitoring objectives. **Table 7** lists the average radiation exposure rates measured by the HPICs for first quarter 2011. **Table 8** lists the EIC monitoring results for third quarter 2011. Overall exposure rates were within the expected historical range of values observed by DEQ-INL OP for background radiation.

Table 6. Summary of instrumentation at radiation monitoring stations.

Station Location	Instrument Type	
	HPIC	EIC
On-site Locations		
Base of Howe	■	■
Big Lost River Rest Area[1]		■
Experimental Field Station		■
Main Gate	■	■
Rover	■	■
Sand Dunes Tower	■	■
Van Buren Avenue		■
Boundary Locations		
Atomic City	■	■
Big Southern Butte	■	■
Howe Met Tower	■	■
Monteview	■	■
Mud Lake	■	■
Distant Locations		
Craters of the Moon		■
Fort Hall[2]	■	■
Idaho Falls	■	■

[1] HPIC Sampling at Big Lost River Rest Area was suspended due to construction and has not been re-deployed.
[2] HPIC operated by Shoshone-Bannock Tribes with the EIC maintained by DEQ-INL OP.

Table 7. Average gamma exposure rates, third quarter, 2011, from HPIC network.

Station Location	Exposure Rate (µR/hr)	
	Quarterly Average	± 2 SD
On-site Locations		
Base of Howe	11.9	0.7
Big Lost River Rest Area[1]	NS	NS
Main Gate[2]	NS	NS
Rover[3]	NS	NS
Sand Dunes Tower	14.1	2.7
Boundary Locations		
Atomic City	13.4	0.8
Big Southern Butte	14.7	2.0
Howe Met Tower	13.1	1.6
Monteview	14.1	0.7
Mud Lake/Terreton	13.3	0.8
Distant Locations		
Fort Hall[4]	14.3	0.5
Idaho Falls	13.3	1.4

[1] Sampling at Big Lost River Rest Area was suspended due to construction and has not been re-deployed.
[2] Main Gate HPIC experienced equipment irregularity and then total failure near the end of second quarter 2010 which could not be repaired and therefore is reported as No Sample (NS).
[3] The Rover HPIC was destroyed by a wildfire and is therefore reported as No Sample.
[4] Operated by Shoshone-Bannock Tribes.

Table 8. Electret ionization chamber (EIC) cumulative average exposure rates, third quarter, 2011.

Station Location	Exposure Rate (µR/hr)	
	Quarterly Average	± 2 SD
On-site Locations		
Base of Howe	12.8	0.8
Big Lost River Rest Area	15.1	3.0
Experimental Field Station	14.5	0.8
Main Gate	14.2	1.3
Rover	11.5	2.1
Sand Dunes Tower	13.5	1.6
Van Buren Avenue	12.4	2.8
Boundary Locations		
Atomic City	15.2	3.6
Big Southern Butte	12.4	3.1
Howe Met Tower	11.4	2.7
Monteview	14.6	3.4
Mud Lake / Terreton	14.0	1.8
Distant Locations		
Craters of the Moon	12.0	2.9
Fort Hall[1]	13.2	2.5
Idaho Falls	11.3	0.9

[1] Station 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 Site 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 2011, 1 up-gradient and 5 distant locations were sampled. No facility, waste water or surface water sample sites were visited during this quarter.

Throughout the year, most sites sampled by DEQ-INL OP are sampled with another agency or organization; however during this sample period all of the sites were sampled independent of the INL. For co-sampled sites, samples are collected at approximately 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 radioactivity was detected at two distant locations. The concentrations observed at these locations are 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 samples from both upgradient and distant sites. Concentrations for up-gradient 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 radionuclides were not detected in samples from any of the locations. Results for gross alpha; gross beta; and man-made, gamma emitting cesium-137 are shown in **Table 9**.

Tritium analyzed by the standard methodology was not detected in any of the samples collected (**Table 10**), consistent with historic analyses for these sites. Water samples with tritium concentrations not measurable using the standard method (typically a MDC of 130 pCi/L) are analyzed using an electrolytic enrichment method. This method provides a much lower MDC of 10 to 14 pCi/L. No samples were analyzed using the enrichment method for the current quarter; however samples from 15 sites collected during previous quarters were completed (**Table 11**). A backlog of 29 samples remains. All but two sample results were within the expected range of concentrations due to natural sources and levels remaining after the atomic bomb testing era. USGS-106 (Facility) and USGS-103 (Boundary) showed elevated levels of tritium; however both sites are within areas of known contamination and are consistent with historic concentrations.

Samples were also analyzed for metals and the results shown in **Table 12**. The previous metal sample results for Mud Lake Water Supply collected in the third quarter of 2010 (8/4/2010), consisted of high concentrations of both Manganese and Iron at 270 ug/L and 250 ug/L respectively. Both levels have returned to within historic concentration ranges at 40 ug/L and 11 ug/L. The Alpheus Spring result for Manganese showed the first detection at 2.1 ug/L since sampling began in 1994. The result is just above the detection limit of 2.0 ug/L and considerably below the secondary ground water standard of 50 ug/L. All other 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.

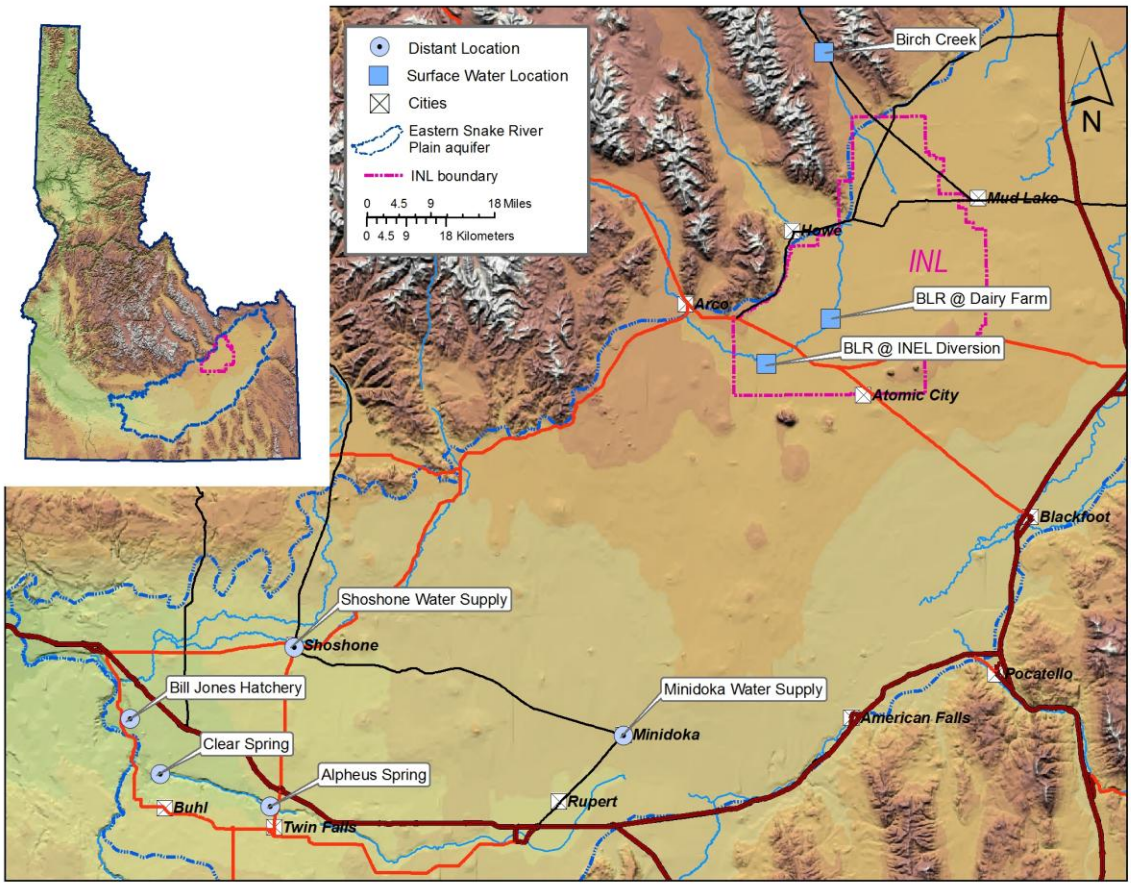

Figure 2. Distant and surface water sampling locations, third quarter, 2011.

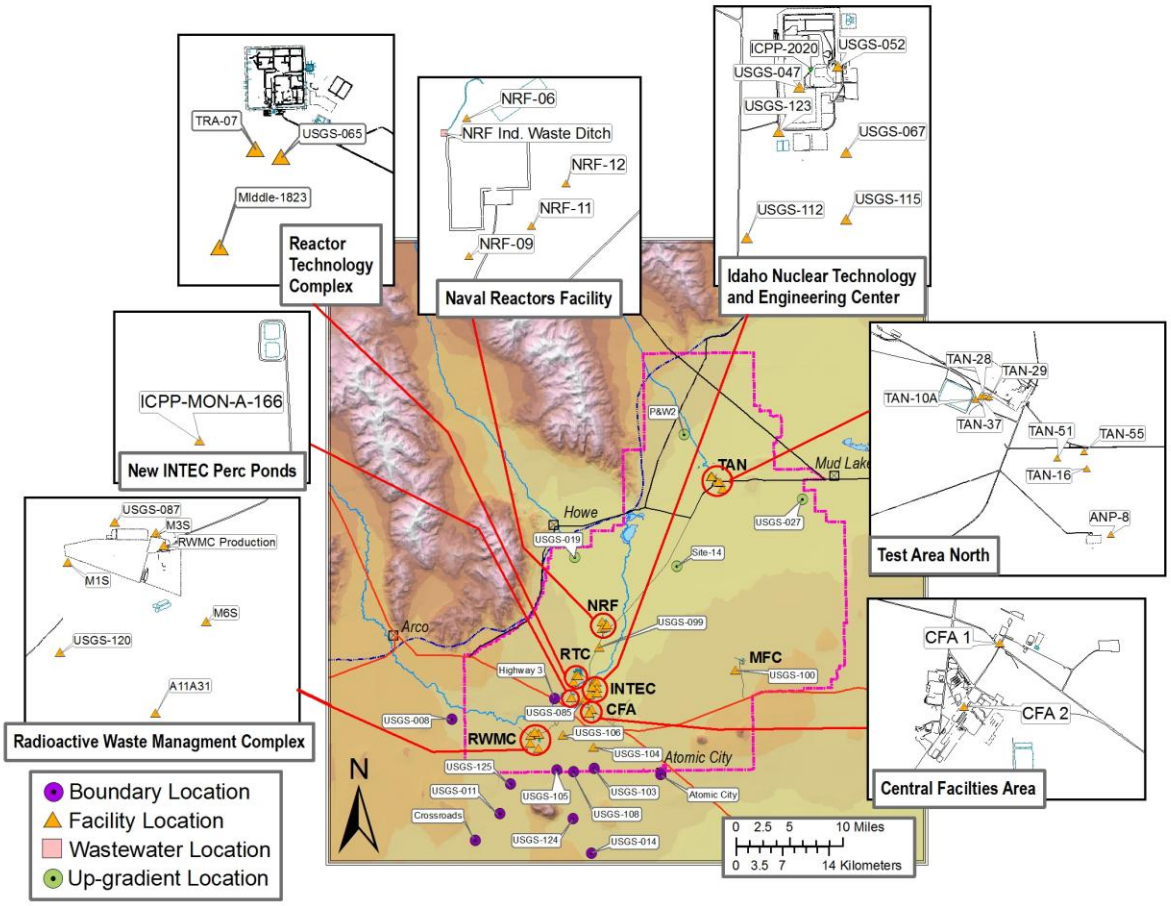

Figure 3. Up-gradient, facility, boundary and wastewater monitoring locations. third quarter, 2011.

Table 9. Alpha, beta, and gamma concentrations for water samples, third quarter, 2011.

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	9/19/2011	0.1	U	0.6	4.4		0.8	-0.1	U	2.2
Distant										
Alpheus Spring	8/17/2011	3.9		1.6	9.0		1.1	1.0	U	2.6
Bill Jones Hatchery	8/17/2011	0.7	U	0.9	3.4		0.8	-2.0	U	2.0
Clear Spring	8/17/2011	0.6	U	1.0	5.6		1.0	0.5	U	1.9
Minidoka Water Supply	8/17/2011	0.7	U	1.0	4.3		0.9	-1.1	U	2.5
Shoshone Water Supply	8/17/2011	1.5		1.0	3.2		0.9	-0.2	U	1.8

[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, 2011.

Sample Location	Sample Date	Tritium		
		Concentration[1,2]		± 2 SD
Up-gradient				
Mud Lake Water Supply	9/19/2011	30	U	100
Distant				
Alpheus Spring	8/17/2011	-10	U	100
Bill Jones Hatchery	8/17/2011	-10	U	100
Clear Spring	8/17/2011	-10	U	100
Minidoka Water Supply	8/17/2011	30	U	100
Shoshone Water Supply	8/17/2011	130	U	100

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

[2] Concentrations expressed in pCi/L.

Table 11. Enriched tritium concentrations for water samples from previous sampling quarters, 2010 and 2011.

Sample Location	Sample Date	Enriched Tritium		
		Concentration[1,2]		± 2 SD
Upgradient				
USGS-019	4/20/2011	3	U	6
USGS-027	4/19/2011	-1	U	6
Facility				
M1S	5/17/2011	-1	U	6
USGS-100	4/21/2011	10		6
USGS-106	6/8/2011	427		17
Boundary				
Crossroads	4/28/2011	10		6
USGS-011	4/26/2011	10		6
USGS-103	6/24/2010	324		12
Distant				
Alpheus Spring	5/23/2011	15		6
Bill Jones Hatchery	5/23/2011	8	U	6
Clear Spring	5/23/2011	5	U	6
Minidoka Water Supply	5/23/2011	3	U	6
Shoshone Water Supply	11/9/2010	28		5
Surface Water				
BLR @ Dairy Farm	6/28/2011	46		8
BLR @ INEL Diversion	4/28/2011	28		8

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

[2] Concentrations expressed in pCi/L.

Table 12. Reported metals concentrations in water samples, third quarter, 2011.

Sample Location	Sample Date	Concentration[1,2]																					
		Arsenic		Barium		Beryllium		Cadmium		Chromium		Iron		Lead		Manganese		Mercury		Selenium		Zinc	
Up-gradient																							
Mud Lake Water Supply	9/19/2011	NR	-	20		NR	-	NR	-	<5	U	11		<5	U	40		NR	-	NR	-	<5	U
Distant																							
Alpheus Spring	8/17/2011	NR	-	89	J	NR	-	NR	-	<5	U	<10	U	<5	U	2.1	J	NR	-	NR	-	<5	U
Bill Jones Hatchery	8/17/2011	NR	-	22	J	NR	-	NR	-	<5	U	<10	U	<5	U	<2	U	NR	-	NR	-	<5	U
Clear Spring	8/17/2011	NR	-	37	J	NR	-	NR	-	<5	U	<10	U	<5	U	<2	U	NR	-	NR	-	<5	U
Minidoka Water Supply	8/17/2011	NR	-	36	J	NR	-	NR	-	<5	U	<10	U	<5	U	<2	U	NR	-	NR	-	16	
Shoshone Water Supply	8/17/2011	NR	-	42	J	NR	-	NR	-	<5	U	<10	U	<5	U	<2	U	NR	-	NR	-	6	

[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, 2011.

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*	9/19/2011	8.9		2.8		31		5.0		0.571		5.31		8.22		38		91		NR	-	NR	-
Distant																							
Alpheus Spring*	8/17/2011	59		21		34		6.5		0.382		43.1		58.8		40		178		NR	-	NR	-
Bill Jones Hatchery*	8/17/2011	31		16		17		3.5		0.463		11.7		26.9		34		135		NR	-	NR	-
Clear Spring*	8/17/2011	45		20		25		4.1		0.530		34.0		47.6		34		145		NR	-	NR	-
Minidoka Water Supply*	8/17/2011	47		16		21		3.5		0.627		31.4		42.0		31		136		NR	-	NR	-
Shoshone Water Supply*	8/17/2011	43		15		15		3.0		0.282		6.72		18.0		30		171		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 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, 2011.

Sample Location	Sample Date	Concentration [1,2]									
		Nitrite + Nitrate		Phosphorus		Nitrite		Total Kjeldahl Nitrogen		Ammonia	
Up-gradient											
Mud Lake Water Supply	9/19/2011	<0.01	U	0.043		NR	-	NR	-	NR	-
Distant											
Alpheus Spring	8/17/2011	2.1		0.026		NR	-	NR	-	NR	-
Bill Jones Hatchery	8/17/2011	1.3		0.021		NR	-	NR	-	NR	-
Clear Spring	8/17/2011	1.8		0.034		NR	-	NR	-	NR	-
Minidoka Water Supply	8/17/2011	1.1		0.018		NR	-	NR	-	NR	-
Shoshone Water Supply - MV-36	8/17/2011	1.4		0.034		NR	-	NR	-	NR	-

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

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

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.

Soil

DEQ-INL OP monitors long-term radiological conditions via soil sampling as well as field instrumentation capable of identifying and measuring quantities of gamma-emitting radionuclides in soil. Monitoring concentrations of gamma-emitting radionuclides in surface soil provides insight to transport, deposition, and accumulation of radioactive material in the environment as a result of INL operations as well as historical above ground testing of nuclear weapons. No in-situ gamma spectroscopic measurements were performed, nor were any soil samples physically collected during the third calendar quarter of 2011.

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

Table 15. Gamma spectroscopy analysis data for milk samples, third quarter, 2011.

Sample Location/Dairy	Sample Date	Naturally occurring gamma-emitting radionuclide Potassium-40		Man-made gamma-emitting radionuclide Iodine-131[1]	
		Concentration[3]	± 2 SD	Concentration[3]	± 2 SD
Monitoring Samples					
Howe/Nelson-Ricks Creamery	07/05/2011	1489	108	<MDC	
	07/30/2011	1466	124	<MDC	
	09/06/2011	1441	122	<MDC	
Mud Lake/Nelson-Ricks Creamery	07/05/2011	1467	108	<MDC	
	08/02/2011	1407	104	<MDC	
	09/06/2011	1559	110	<MDC	
Gooding/Glanbia	07/08/2011	1639	116	<MDC	
	08/04/2011	1460	103	<MDC	
	09/06/2011	1530	109	<MDC	
Fort Hall	07/06/2011	1459	106	<MDC	
	08/03/2011	1448	123	<MDC	
	09/07/2011	850	95	<MDC	
Riverside[4]	07/14/2011	2080	134	<MDC	
Verification Samples[2]					
Minidoka	07/05/2011	1565	111	<MDC	
Idaho Falls	07/04/2011	1474	123	<MDC	
Dietrich	08/02/2011	1407	104	<MDC	
Howe	08/02/2011	1504	126	<MDC	
Rupert	09/06/2011	1487	122	<MDC	
Idaho Falls	09/06/2011	1450	107	<MDC	

[1] <MDC – Less than Minimum Detectable Concentration (approximately 4 pCi/L for Iodine-131).
[2] DEQ-INL OP samples collected by the off-site INL environmental surveillance contractor.
[3] Concentrations are expressed in pCi/L.
[4] Riverside is a small operation that needed to suspend sampling for the months of August and September.

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 to ensure precise, accurate, representative, and reliable results, and to maximize data usability.

This section summarizes the results of the quality assurance (QA) assessment of the data collected for the third quarter of 2011 for the DEQ-INL OP's ESP. It also summarizes the quality control (QC) samples (spikes, blanks, and duplicates) submitted to the Idaho Bureau of Laboratories-Boise (IBL) for non-radiological analyses and to Idaho State University's Environmental Monitoring Laboratory (ISU-EML) for radiological analyses during the quarter. All analyses and QC measures at the analytical laboratories used by the ESP are performed in accordance with approved written procedures maintained by each respective analytical laboratory. Sample collection is performed in accordance with written procedures maintained by the DEQ-INL OP.

Analytical results for blanks, duplicates, and spikes are used to assess the precision, accuracy, and representativeness of results from analyzing laboratories. During the third quarter of 2011, the DEQ-INL OP submitted 50 QC samples for various radiological and non-radiological analyses (**Table 16**).

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 2011 are presented in **Table 17**.

Blank sample results for select gamma emitters in air from composited air filters are presented in **Table 18**. Data for blank analyses used to assess data quality for tritium in water vapor in air are presented in **Table 19**. Blank analyses results for radiological and non-radiological analytes in ground and surface water are presented in **Table 20**, **Table 21**, and **Table 22**.

There were two anomalies observed from the assessment of field blank samples as measured by the analytical laboratories used by DEQ-INL OP for the third quarter of 2011. The first includes a detection of Manganese at 18 ug/L. There were five samples analyzed on the same day as the blank sample (10/25/2011). Four of the five samples were non-detects and therefore will not be flagged; however, the lone sample showing detection will be flagged with a "J" and qualified as an estimate. The other anomaly includes a detection of Barium at 9 ug/L. Again there were five samples analyzed on the same day as the blank sample (10/25/2011). Barium concentrations at all five sites agree with historic values, however, all five samples will be flagged with a "J" and qualified as estimates.

Duplicate Samples

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

$RPD = (R_1-R_2)/((R_1+R_2)/2)*100$
R_1 = first sample result
R_2 = second sample result

and is used to measure a laboratory's ability to reproduce consistent results. A relative percent difference is acceptable at ± 20 percent.

DEQ-INL OP also uses standard radiological counting error (expressed as one standard deviation) to compare results for radiological analyses. Comparison tests that have an absolute difference in the two sample results of no more than three times the pooled error (or "3 sigma") for these measurements are considered acceptable. This is accomplished using the following equation:

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

Where:

R_1 = First sample value.

R_2 = Second sample value.

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

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

No field duplicate samples were collected by DEQ-INL OP for the third quarter of 2011.

Spiked Samples

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

During third quarter 2011, no field matrices were spiked to assess the influence of the sample media on laboratory performance.

DEQ-INL OP also prepares additional "spike-like" quality control samples to assess ambient radiation measurement bias. Once per quarter, DEQ-INL OP irradiates a number of electret ionization chambers (EIC) to verify EIC response. Irradiations of EICs are conducted in a repeatable geometry to a known exposure of 30 mR and two additional exposures, ranging from 15 to 60 mR. EIC responses are compared directly with the exposure received from the NIST traceable cesium-137 source provided by ISU-EML. EIC response is considered acceptable if each measurement agrees within 25 percent of the known irradiated quantity. The irradiation results for third quarter 2011 are presented in **Table 23**. Real-time pressure correction is used to calculate the net exposure measured by these EIC control sets.

There were no anomalies observed from the assessment of spiked samples as measured by DEQ-INL OP or the analytical laboratories used by DEQ-INL OP for the third quarter of 2011.

Analytical QA/QC Assessment

Aside from the field blank water samples, no other issues involving sample chain of custody, sample holding times, analysis of blank, duplicate, and spiked samples were observed during the third quarter of 2011, which significantly affected data quality. Methodologies and data reports issued by the contracting laboratories generally conformed to the requirements of DEQ-INL OP during the third quarter of 2011.

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 2011 met the minimum criteria of the DEQ-INL OP ESP and is summarized in **Table 16**.

Three weekly TSP air filters from Idaho Falls and one from Mud Lake were rejected because they did not meet the minimum air volume requirement to be considered a valid sample.

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 2011 is summarized in **Table 24**.

During the third quarter of 2011, the radioiodine pump at EFS and the TSP blower at Idaho Falls were replaced.

Conclusion

All data collected for the third quarter of 2011, 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 16. Summary of the analytical performance and usability of the analyses performed for the DEQ-INL OP ESP, third quarter, 2011.

Media Sampled	Collection Device	Analyte	Test Analyses	Blank Analyses	Duplicate Analyses	Spike Analyses	Data Rejected[1]	Analyzing Lab[2]
AIR								
Particulate	4 inch filter	Gross alpha	143	13	0	0	4	ISU-EML
		Gross beta	143	13	0	0	4	ISU-EML
		Gamma emitters	11	1	0	0	0	ISU-EML
		Radiochemical	0	0	0	0	0	ISU Sub
Water Vapor	Desiccant column	Tritium	51	5	0	0	0	ISU-EML
Gaseous	Charcoal filter	Iodine-131	13	0	0	0	0	ISU-EML
Precipitation	Poly bottle	Tritium	6	0	0	0	0	ISU-EML
		Gamma emitters	5	0	0	0	0	ISU-EML
WATER								
Groundwater & Surface Water	Grab or composite	Gross alpha	6	1	0	0	0	ISU-EML
		Gross beta	6	1	0	0	0	ISU-EML
		Gamma emitters	6	1	0	0	0	ISU-EML
		Tritium	6	1	0	0	0	ISU-EML
		Enriched tritium	15	2	0	0	0	ISU-EML
		Technetium-99	0	0	0	0	0	ISU-EML
		Radiochemical	0	0	0	0	0	ISU Sub
		Metals	6	1	0	0	0	IBL
		Common Ions	6	1	0	0	0	IBL
		Nutrients	6	1	0	0	0	IBL
		Volatile Organics	0	0	0	0	0	IBL
TERRESTRIAL								
Milk	Grab or composite	Gamma emitters	19	1	0	0	0	ISU-EML
Soil	*in situ*	Gamma emitters	0	1	0	0	0	ISU-EML
	Grab – "puck"	Gamma emitters	0	1	0	0	0	ISU-EML
RADIATION								
Ambient	EICs	Gamma Radiation	55	0	0	9	0	DEQ-INL OP
	HPICs	Gamma Radiation	9	NA	NA	NA	NA	DEQ-INL OP
Total Analyses			**512**	**41**	**0**	**9**	**8**	
Total of QC Analyses (blanks, duplicates, and spikes)			**50**					
Percentage of QC analyses of Total Test analyses[3]			**9.8%**					
Percentage of usable data[4]			**98.4%**					

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 17. Blank analysis results for gross alpha and beta in particulate air (TSP), third quarter, 2011.

Collection Period		Corrected volume (m^3) [1]	Gross alpha		Gross beta	
Start	Stop		Value	Uncertainty (± 2 SD)	Value	Uncertainty (± 2 SD)
06/30/2011	07/07/2011	1387	0.0	0.1	0.0	0.6
07/07/2011	07/14/2011	1387	-0.1	0.1	-0.4	0.6
07/14/2011	07/21/2011	1387	-0.1	0.1	0.1	0.6
07/21/2011	07/28/2011	1387	0.0	0.1	0.8	0.6
07/28/2011	08/04/2011	1387	0.2	0.2	-0.1	0.7
08/04/2011	08/11/2011	1387	-0.2	0.2	0.7	0.7
08/11/2011	08/18/2011	1387	-0.1	0.3	-1.8	0.8
08/18/2011	08/25/2011	1387	-0.1	0.2	-2.2	0.8
08/25/2011	09/01/2011	1387	0.0	0.1	0.1	0.6
09/01/2011	09/08/2011	1387	0.0	0.2	0.2	0.6
09/08/2011	09/15/2011	1387	0.0	0.1	0.7	0.6
09/15/2011	09/22/2011	1387	-0.2	0.2	-1.1	0.8
09/22/2011	09/29/2011	1387	0.0	0.2	-0.1	0.9

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 18. Blank analysis results for gamma spectroscopy for TSP particulate air filters, third quarter, 2011.

Analysis Date	Beryllium-7			Ruthenium-106/ Rhodium-106			Antimony-125		
	Concentration[1]	± 2 SD	MDC	Concentration	± 2 SD	MDC	Concentration	± 2 SD	MDC
10/27/2011	-6	67	113	-23	53	91	-1	15	25

Analysis Date	Cesium-134			Cesium-137		
	Concentration[1]	± 2 SD	MDC	Concentration	± 2 SD	MDC
10/27/2011	6	6	8	2	7	12

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 19. Blank analysis results for tritium in water vapor from air samples, third quarter, 2011.

Sample Number	Start Date	Collect Date	Analysis Date	Tritium		
				Concentration	± 2 SD	MDC
OP113ZTR01	07/18/2011	07/20/2011	10/05/2011	0.09	0.10	0.16
OP113ZTR02	08/12/2011	08/15/2011	10/05/2011	0.02	0.10	0.16
OP113ZTR03	09/15/2011	09/19/2011	10/27/2011	0.05	0.10	0.16
OP113ZTR04	10/12/2011	10/12/2011	10/27/2011	0.05	0.10	0.16
OP113ZTR05	10/12/2011	10/12/2011	10/27/2011	0.09	0.10	0.16

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

Table 20. Radiological blank analysis in ground and surface water for samples, third quarter, 2011.

Sample Number	Sample Date	Concentration	± 2 SD	MDC	Within Blank Criteria?
Gross Alpha					
111W386	8/17/2011	0.0	0.2	0.4	Yes
Gross Beta					
111W386	8/17/2011	-0.3	0.6	1.0	Yes
Cesium-137					
111W386	8/17/2011	0.1	2.0	3.4	Yes
Tritium					
111W387	8/17/2011	70	100	160	Yes
Enriched Tritium					
111W216	4/19/2011	23	6	9	Yes
111W206	4/26/2011	23	7	10	Yes

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

Table 21. Blank analysis results (µg/L) for metals in ground and surface water for the third quarter, 2011.

Sample Number	Sample Date	Arsenic	Barium	Beryllium	Cadmium	Chromium	Iron	Lead	Manganese	Selenium	Zinc
111W389	8/17/2011	NR	9	NR	NR	<5	<10	<5	18	NR	<5
NR: No result reported.											

Table 22. Blank analysis results (mg/L) for common ions and nutrients in ground and surface water for the third quarter, 2011.

Sample Number	Sample Date	Calcium	Magnesium	Sodium	Potassium	Fluoride	Chloride	Sulfate	Total Alkalinity	Total Nitrogen	Total Phosphorus
101W388,389,390	8/17/2011	<0.1	<0.1	<0.1	<0.1	<0.2	<0.4	<0.8	1	<0.01	<0.005

Table 23. Electret ionization chamber irradiation results (categorized as spiked samples) for third quarter, 2011.

Electret #	Exposure Received		Net Measured Exposure[1]		%R
	(mR)	Uncertainty (mR)	(mR)	Uncertainty (mR)	
Spike 1	43.0	2.2	43.2	1.4	100.4%
Spike 1	43.0	2.2	43.7	1.3	101.6%
Spike 1	43.0	2.2	43.9	1.4	102.2%
Spike 2	30.4	1.5	31.7	1.4	104.2%
Spike 2	30.4	1.5	31.9	1.3	104.8%
Spike 2	30.4	1.5	29.9	1.4	98.4%
Spike 3	23.0	1.2	22.4	1.3	97.5%
Spike 3	23.0	1.2	23.7	1.3	103.1%
Spike 3	23.0	1.2	24.1	1.4	104.7%

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

Table 24. Air sampling field equipment service reliability (percent operational), third quarter, 2011.

Station Locations	Sample Type			
	TSP	Radioiodine	Atmospheric Moisture	Precipitation
Onsite Locations				
Big Lost River Rest Area	100 %	100 %	100 %	100 %
Experimental Field Station	100 %	92 %	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	100 %	100 %	100 %	100 %
Mud Lake	100 %	100 %	100 %	100 %
Distant Locations				
Craters of the Moon	100 %	100 %	100 %	NC[1]
Idaho Falls	92 %	100 %	100 %	100 %

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

Appendix A

Table A-1. Weekly concentrations (in 1 x 10^{-3} pCi/m^3) for gross alpha and gross beta analyses for TSP filters for all locations, third quarter, 2011.

Sample location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	± 2 SD	Concentration	± 2 SD
On-site Locations						
Rest Area	6/30/11	7/07/11	1.8	0.3	48.2	1.7
	7/07/11	7/14/11	1.2	0.3	43.1	1.7
	7/14/11	7/21/11	1.5	0.3	46.0	1.7
	7/21/11	7/28/11	1.5	0.3	42.4	1.6
	7/28/11	8/04/11	1.7	0.4	44.6	1.7
	8/04/11	8/11/11	1.2	0.3	50.1	1.8
	8/11/11	8/18/11	1.7	0.4	48.2	1.8
	8/18/11	8/25/11	1.6	0.4	58.4	1.9
	8/25/11	9/01/11	3.1	0.5	59.0	2.1
	9/01/11	9/08/11	2.1	0.4	53.4	1.9
	9/08/11	9/15/11	2.3	0.4	69.2	2.1
	9/15/11	9/22/11	2.1	0.4	52.4	1.8
	9/22/11	9/29/11	2.0	0.4	58.1	2.0
Experimental Field Station	6/30/11	7/07/11	1.5	0.3	39.1	1.6
	7/07/11	7/14/11	1.6	0.3	36.4	1.6
	7/14/11	7/21/11	1.4	0.3	36.2	1.6
	7/21/11	7/28/11	1.1	0.3	33.3	1.5
	7/28/11	8/04/11	1.2	0.5	45.7	2.4
	8/04/11	8/11/11	1.7	0.8	53.8	3.2
	8/11/11	8/18/11	1.6	0.4	43.7	1.8
	8/18/11	8/25/11	1.1	0.4	45.7	2.2
	8/25/11	9/01/11	2.3	0.7	51.3	3.0
	9/01/11	9/08/11	1.8	0.4	44.8	1.8
	9/08/11	9/15/11	2.6	0.4	60.2	2.0
	9/15/11	9/22/11	1.6	0.4	46.2	1.8
	9/22/11	9/29/11	1.6	0.4	47.4	1.8

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, 2011.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	± 2 SD	Concentration	± 2 SD
Sand Dunes	6/30/11	7/07/11	1.5	0.3	32.9	1.4
	7/07/11	7/14/11	0.8	0.2	29.9	1.4
	7/14/11	7/21/11	0.8	0.2	31.7	1.4
	7/21/11	7/28/11	0.9	0.3	31.8	1.4
	7/28/11	8/04/11	1.2	0.3	32.5	1.4
	8/04/11	8/11/11	1.0	0.3	38.2	1.5
	8/11/11	8/18/11	1.3	0.3	37.1	1.5
	8/18/11	8/25/11	1.2	0.3	43.9	1.6
	8/25/11	9/01/11	2.1	0.4	44.2	1.8
	9/01/11	9/08/11	1.6	0.3	44.5	1.6
	9/08/11	9/15/11	2.4	0.4	55.8	1.8
	9/15/11	9/22/11	1.8	0.4	42.3	1.6
	9/22/11	9/29/11	1.5	0.3	47.2	1.7
Van Buren	6/30/11	7/07/11	1.6	0.3	35.9	1.5
	7/07/11	7/14/11	0.9	0.3	33.2	1.5
	7/14/11	7/21/11	1.3	0.3	38.0	1.6
	7/21/11	7/28/11	1.1	0.3	35.8	1.5
	7/28/11	8/04/11	1.3	0.3	38.5	1.6
	8/04/11	8/11/11	1.2	0.3	45.9	1.7
	8/11/11	8/18/11	1.5	0.3	38.5	1.6
	8/18/11	8/25/11	1.6	0.3	45.1	1.7
	8/25/11	9/01/11	3.1	0.5	48.0	1.8
	9/01/11	9/08/11	1.8	0.4	47.1	1.7
	9/08/11	9/15/11	2.1	0.4	62.0	2.0
	9/15/11	9/22/11	1.3	0.3	46.5	1.7
	9/22/11	9/29/11	2.1	0.4	50.5	1.8
Boundary Locations						
Atomic City	6/30/11	7/07/11	1.4	0.3	37.0	1.6
	7/07/11	7/14/11	1.3	0.3	35.3	1.5
	7/14/11	7/21/11	1.3	0.3	35.3	1.5
	7/21/11	7/28/11	1.0	0.3	35.5	1.5
	7/28/11	8/04/11	1.6	0.4	40.2	1.6
	8/04/11	8/11/11	1.0	0.3	42.0	1.7
	8/11/11	8/18/11	1.7	0.4	40.1	1.6
	8/18/11	8/25/11	1.4	0.3	44.9	1.7
	8/25/11	9/01/11	1.9	0.4	48.5	1.8
	9/01/11	9/08/11	1.6	0.3	45.2	1.7
	9/08/11	9/15/11	1.9	0.4	59.1	1.9
	9/15/11	9/22/11	1.4	0.3	46.9	1.6
	9/22/11	9/29/11	1.7	0.3	49.8	1.7

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, 2011.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	± 2 SD	Concentration	± 2 SD
Howe	6/30/11	7/07/11	1.5	0.3	34.9	1.6
	7/07/11	7/14/11	1.1	0.3	30.7	1.5
	7/14/11	7/21/11	1.2	0.3	35.0	1.5
	7/21/11	7/28/11	0.9	0.3	31.6	1.5
	7/28/11	8/04/11	1.1	0.3	34.6	1.6
	8/04/11	8/11/11	1.4	0.4	42.4	1.7
	8/11/11	8/18/11	1.4	0.3	33.1	1.5
	8/18/11	8/25/11	1.3	0.3	39.5	1.7
	8/25/11	9/01/11	3.1	0.5	47.2	1.8
	9/01/11	9/08/11	2.3	0.4	43.0	1.7
	9/08/11	9/15/11	1.8	0.4	60.0	2.0
	9/15/11	9/22/11	1.5	0.4	41.1	1.7
	9/22/11	9/29/11	1.7	0.4	41.4	1.7
Monteview	6/30/11	7/07/11	1.7	0.3	42.7	1.7
	7/07/11	7/14/11	1.2	0.3	38.7	1.6
	7/14/11	7/21/11	1.5	0.3	44.2	1.7
	7/21/11	7/28/11	1.2	0.3	40.1	1.6
	7/28/11	8/04/11	1.7	0.4	47.6	1.8
	8/04/11	8/11/11	1.4	0.4	48.5	1.8
	8/11/11	8/18/11	1.7	0.4	45.1	1.7
	8/18/11	8/25/11	1.9	0.4	54.5	1.9
	8/25/11	9/01/11	2.7	0.4	55.0	1.9
	9/01/11	9/08/11	2.4	0.4	49.8	1.8
	9/08/11	9/15/11	2.2	0.4	62.2	2.0
	9/15/11	9/22/11	1.9	0.4	47.9	1.8
	9/22/11	9/29/11	2.6	0.4	53.0	1.9
Mud Lake	6/30/11	7/07/11	1.9	0.4	39.5	1.7
	7/07/11	7/14/11	1.3	0.3	33.7	1.6
	7/14/11	7/21/11	1.1	0.3	36.1	1.6
	7/21/11	7/28/11	1.2	0.3	34.6	1.6
	7/28/11	8/04/11	1.4	0.4	38.0	1.7
	8/04/11	8/11/11	1.5	0.4	40.7	1.7
	8/11/11	8/18/11	2.3	0.4	42.7	1.8
	8/18/11	8/25/11	2.0	0.4	56.8	2.0
	8/25/11	9/01/11	3.0	0.5	54.3	1.9
	9/01/11	9/08/11	2.6	0.5	57.4	2.0
	9/08/11	9/15/11	3.7	0.6	91.1	2.8
	9/15/11	9/22/11	2.4	0.4	64.7	2.2
	9/22/11	9/29/11	R[1]	R[1]	R[1]	R[1]

[1]R – Results rejected due to insufficient sample volume.

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, 2011.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	± 2 SD	Concentration	± 2 SD
Distant Locations						
Craters	6/30/11	7/07/11	1.3	0.3	32.0	1.5
	7/07/11	7/14/11	1.1	0.3	30.6	1.5
	7/14/11	7/21/11	0.9	0.3	30.0	1.5
	7/21/11	7/28/11	0.8	0.3	27.2	1.4
	7/28/11	8/04/11	1.0	0.3	31.2	1.6
	8/04/11	8/11/11	0.9	0.3	41.2	1.7
	8/11/11	8/18/11	1.6	0.4	33.2	1.6
	8/18/11	8/25/11	0.7	0.3	37.2	1.7
	8/25/11	9/01/11	1.7	0.4	43.0	1.8
	9/01/11	9/08/11	1.7	0.4	39.5	1.7
	9/08/11	9/15/11	2.0	0.4	53.6	1.9
	9/15/11	9/22/11	0.9	0.3	36.3	1.6
	9/22/11	9/29/11	1.2	0.3	38.2	1.7
Fort Hall[1]	6/30/11	7/07/11	1.3	0.3	32.5	1.5
	7/07/11	7/14/11	1.0	0.3	28.8	1.4
	7/14/11	7/21/11	1.2	0.3	31.4	1.4
	7/21/11	7/28/11	1.1	0.3	27.3	1.3
	7/28/11	8/04/11	1.4	0.3	30.5	1.5
	8/04/11	8/11/11	1.4	0.4	34.1	1.5
	8/11/11	8/18/11	2.3	0.4	29.8	1.5
	8/18/11	8/25/11	1.6	0.4	35.5	1.6
	8/25/11	9/01/11	1.8	0.4	35.4	1.5
	9/01/11	9/08/11	1.6	0.4	30.8	1.5
	9/08/11	9/15/11	2.1	0.4	42.5	1.6
	9/15/11	9/22/11	1.9	0.4	36.0	1.6
	9/22/11	9/29/11	1.6	0.3	36.7	1.5
Idaho Falls	6/30/11	7/07/11	1.9	0.4	43.3	1.7
	7/07/11	7/14/11	1.6	0.3	37.7	1.6
	7/14/11	7/21/11	1.1	0.3	35.7	1.5
	7/21/11	7/28/11	1.3	0.3	36.3	1.5
	7/28/11	8/04/11	1.9	0.4	47.3	1.8
	8/04/11	8/11/11	1.3	0.3	47.5	1.8
	8/11/11	8/18/11	2.8	0.5	41.9	1.7
	8/18/11	8/25/11	2.3	0.7	52.3	3.0
	8/25/11	9/01/11	R[2]	R[2]	R[2]	R[2]
	9/01/11	9/08/11	R[2]	R[2]	R[2]	R[2]
	9/08/11	9/15/11	R[2]	R[2]	R[2]	R[2]
	9/15/11	9/22/11	2.9	0.4	63.4	2.0
	9/22/11	9/29/11	2.9	0.7	65.2	3.4

[1] Operated by Shosone-Bannock Tribes
[2] R – Results rejected due to insufficient sample volume.

Appendix B

Table B-1. Results for all electret locations, third quarter, 2011.

Sample Location	Net Corrected Exposure Rate (µR/h)	± 2 SD (µR/h)
Arco	13.0	2.4
Craters	12.0	2.9
Rest Area	15.1	3.0
Van Buren	12.4	2.8
EFS	14.5	0.8
Main Gate	14.2	1.3
Atomic City	15.2	3.6
Taber	13.4	2.5
Blackfoot	11.3	0.8
Ft. Hall[1]	13.2	2.5
Idaho Falls	11.3	0.9
Mud Lake/Terreton	14.0	1.8
Monteview	14.6	3.4
Sand Dunes	13.5	1.6
Howe Met. Tower	11.4	2.7
MP276 -20	10.9	0.4
MP274 -20	10.1	0.4
MP272 -20[2]	13.0 (J)	6.9 (J)
MP270 -20	14.1	2.1
MP268 -20	14.0	0.1
MP266 -20	14.2	1.7
MP264 -20	13.3	1.9
MP270 -20/26	15.2	3.8
MP268 -20/26	12.0	1.2
MP266 -20/26	12.1	0.5
MP263 -20/26	11.5	1.4
MP261 -20/26	12.0	3.8
MP259 -20/26	13.5	3.4
MFC (EBR II)	13.1	1.7
EBR I	10.4	0.2
RWMC	13.8	0.6
CFA	16.0	1.8
CITRC (PBF)	12.6	3.8

[1]Station operated by Shoshone-Bannock Tribes.
[2] The reported result is the mean of the results from three individual electrets placed at each location. The "J" qualifier (estimate) indicates that the individual results did not meet DEQ-INL OP agreement criteria.

Table B-1 continued. Results for all electret locations, third quarter, 2011.

Sample Location	Net Corrected Exposure Rate (µR/h)	± 2 SD (µR/h)
INTEC (ICPPI)	15.4	3.7
ATR (TRA)[2]	21.6 (J)	4.3 (J)
NRF	11.0	0.2
TAN	10.0	1.0
Mud Lake Bank of Commerce	14.7	0.4
MP43-33	12.3	2.9
MP41-33	15.8	0.1
MP39-33	14.8	0.7
MP37-33	10.9	3.4
MP35-33	10.0	0.2
MP33-33	14.6	0.5
MP31-33	14.1	3.0
MP29-33	14.1	3.2
MP27-33	18.1	0.9
MP25-33	15.4	1.4
MP23-33	10.4	1.1
Base of Howe	12.8	0.8
Rover	11.5	2.1
Hamer	12.6	2.0
Sugar City	17.1	3.6
Roberts	13.6	2.4
Big Southern Butte	12.4	3.1

[2]The reported result is the mean of the results from three individual electrets placed at each location. The "J" qualifier (estimate) indicates that the individual results did not meet DEQ-INL OP agreement criteria.

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