Department of Environmental Quality
INL Oversight Program

ENVIRONMENTAL SURVEILLANCE PROGRAM QUARTERLY DATA REPORT

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Table of Contents

List of Tables

List of Figures

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 $1/1000^{th}$ 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 first 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 first quarter of 2011 for TSP filters are presented in **Table 3**. There are three gamma-emitting radionuclides above MDC, beryllium-7, a naturally occurring, cosmogenic radionuclide and manmade ^{134}Cs and ^{137}Cs produced by fission occurring in nuclear reactors. The ^{134}Cs and ^{137}Cs are presumably due to the March 11, 2011 nuclear reactor accident in Fukushima, Japan.

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 (**Table 6**)**.** Measurable quantities of these radionuclides are expected in the environment due to historic above ground testing of nuclear weapons. DEQ-INL's action levels of 190 for Americium-241, 1900 for Strontium-90, 210 for Plutonium-238, and 200 for Plutonium-239/240 (in

1 x 10^{-6} pCi/m^3) are 10 percent of the compliance values listed for the specific radionuclides in 40 CFR 61, Appendix E, Table 2. Field sample concentrations which exceed these amounts require further investigation. For the 2010 annual composites, one field sample exceeded the MDC for ^{90}Sr. Three samples exceeded the MDC for $^{239/240}$Pu. Two samples exceeded the MDC for ^{241}Am. Though minimally exceeding the MDC, the results are well under the specified regulatory limits and DEQ-INL OP's action levels. Results from the annual composite analyses are typically presented in the following year's first quarter report.

Radioactive iodine samples are collected weekly. Samples are collected by drawing air through a cartridge filled with activated charcoal using a low-volume air pump. The activated charcoal contained in the cartridge traps the radioiodine within its sponge-like pores. Each week, cartridges are collected from all eleven air monitoring stations and analyzed together as a composite. If Iodine-131 is detected in this composite, the cartridges are individually analyzed. ^{131}I was detected on the weekly composite for weeks 3/10-3/17, 3/17-3/24, and 3/24-3/31/11 (**Table 7**). Because of the ^{131}I detections, charcoal cartridges from each station were analyzed individually (**Table 8**). The results were well below the regulatory limit for ^{131}I shown in Table 8. The ^{131}I detections are presumably due to the nuclear reactor accident in Fukushima, Japan.

Atmospheric moisture was collected by drawing air through hygroscopic media at each of the 11 monitoring stations. This moisture was stripped from the hygroscopic media and analyzed to calculate the atmospheric tritium concentration. Reported values are the result of either a single sample or a weighted mean based upon the volume of air sampled when more than one atmospheric moisture sample was collected during the calendar quarter. Atmospheric tritium was not measured above the minimum detectable concentration (MDC) during the first quarter of 2011. Average atmospheric tritium concentrations are presented in **Table 4**.

Precipitation samples were collected at six monitoring locations during the first quarter of 2011. Precipitation samples were analyzed for tritium and gamma-emitting radionuclides. Tritium and gamma-emitting radionuclides, except ^{131}Iodine, were below minimum detectable concentration in precipitation collected during the first quarter of 2011. Tritium, Cesium-137, and Iodine-131 analysis results are presented in **Table 5**. The detection of ^{131}Iodine, which is not generally found above MDC in precipitation samples, is attributed to the nuclear reactor accident in Fukushima, Japan. While ^{131}I levels were elevated for a short period of time they do not pose a health risk due to the short 8 day half-life and the limited exposure. 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 Idaho Falls to perform gamma spectroscopy.

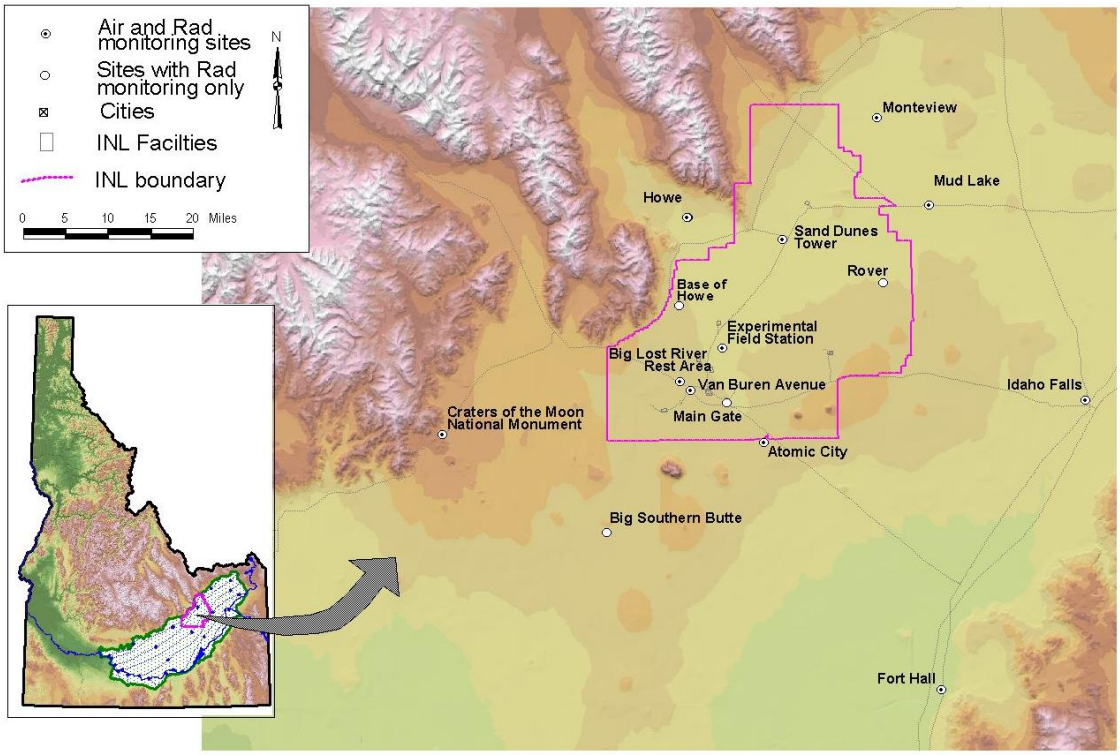

Figure 1. Air and radiation monitoring sites.

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, first quarter, 2011.

Station Location	Concentration					
	Gross Alpha			Gross Beta		
On-Site Locations						
Big Lost River Rest Area	0.4	-	2.2	20.3	-	95.1
Experimental Field Station	0.3	-	2.5	19.2	-	93.0
Sand Dunes Tower	0.3	-	2.3	17.3	-	102.5
Van Buren Avenue	0.3	-	2.1	19.1	-	94.6
Boundary Locations						
Atomic City	0.4	-	2.3	18.2	-	89.9
Howe	0.3	-	2.2	19.0	-	84.4
Monteview	0.4	-	3.3	21.7	-	133.1
Mud Lake	0.3	-	2.2	18.1	-	124.3
Distant Locations						
Craters of the Moon	0.2	-	1.4	15.5	-	68.2
Fort Hall[1]	0.3	-	1.8	17.0	-	98.2
Idaho Falls	0.4	-	3.0	21.6	-	119.3

[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, first quarter, 2011.

Station Location	Naturally Occurring Radionuclide Beryllium-7		^{134}Cs[3]		^{137}Cs[4]		Other Man-Made Gamma Emitting Radionuclides
	Concentration	± 2 SD	Concentration	± 2 SD	Concentration	± 2 SD	
On-site Locations							
Big Lost River Rest Area	74.5	4.1	0.80	0.06	1.01	0.10	<MDC
EFS[2]	65.6	3.7	0.93	0.12	1.04	0.11	<MDC
Sand Dunes Tower	60.3	3.4	0.95	0.10	1.00	0.10	<MDC
Van Buren Avenue	66.9	3.7	1.12	0.10	1.15	0.11	<MDC
Boundary Locations							
Atomic City	68.9	3.8	0.96	0.11	0.96	0.10	<MDC
Howe	61.8	3.5	0.67	0.09	0.72	0.09	<MDC
Monteview	83.2	4.6	1.00	0.13	1.04	0.12	<MDC
Mud Lake	52.2	3.1	0.87	0.12	1.05	0.11	<MDC
Distant Locations							
Craters of the Moon	64.1	3.7	0.70	0.06	0.82	0.10	<MDC
Fort Hall[1]	70.1	4.0	1.27	0.15	1.33	0.13	<MDC
Idaho Falls	75.9	4.2	1.10	0.10	1.20	0.11	<MDC

[1]Operated by Shoshone-Bannock Tribes.
[2]Experimental Field Station
[3]DCG = 200 pCi/L Cesium-134 for the public. The Derived Concentration Guide (DCG) from DOE 5400.5 is the concentration of a single radionuclide in air or water that, under conditions of continuous exposure for one year by one exposure mode (i.e., inhalation) would result in a committed effective dose equivalent of 100 mrem. The DCG applies to either inhalation or ingestion, not to a combination of both.
[4]DCG = 400 pCi/L (inhalation) Cesium-137 for the public.
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, first quarter, 2011.

Station Location	Tritium		
	Concentration	± 2 SD	MDC
On-site Locations			
Big Lost River Rest Area	0.21	0.16	0.27
Experimental Field Station	0.24	0.17	0.28
Sand Dunes Tower	0.08	0.14	0.25
Van Buren Avenue	0.12	0.17	0.28
Boundary Locations			
Atomic City	0.18	0.19	0.30
Howe	0.06	0.17	0.27
Mud Lake	0.08	0.20	0.32
Monteview	0.09	0.16	0.28
Distant Locations			
Craters of the Moon	0.12	0.20	0.33
Fort Hall[1]	0.17	0.23	0.38
Idaho Falls	0.14	0.20	0.33

[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, Cesium-137, and Iodine-131 concentrations from precipitation, first quarter, 2011.

Station Location	Tritium			Cesium-137[3]			Iodine-131[2]		
	Concentration	± 2 SD	MDC	Concentration	± 2 SD	MDC	Concentration	± 2 SD	MDC
On-site Locations									
Big Lost River Rest Area	0.0	100	170	0.7	1.7	2.8	43.1	6.1	8.2
Boundary Locations									
Atomic City	40	100	170	0.6	1.4	2.4	35.9	6.5	9.1
Howe	50	100	170	0.6	1.6	2.7	81.9	8.3	9.0
Monteview	0.0	100	170	0.1	1.3	2.3	69.5	7.7	8.3
Mud Lake	0.0	100	170	0.0	1.8	3.2	55.6	7.7	9.8
Distant Locations									
Idaho Falls	0.0	100	170	NS[1]	NS[1]	NS[1]	NS[1]	NS[1]	NS[1]

[1]Insufficient sample to perform gamma spectroscopy at Idaho Falls.
[2]DCG = 3000 pCi/L Iodine-131 for the public. The Derived Concentration Guide (DCG) from DOE 5400.5 is the concentration of a single radionuclide in air or water that, under conditions of continuous exposure for one year by one exposure mode (i.e., ingestion) would result in a committed effective dose equivalent of 100 mrem. The DCG applies to either inhalation or ingestion, not to a combination of both.
[3]DCG = 3000 pCi/L (ingestion) Cesium-137 for the public.
Note: Concentrations are reported in pCi/L with associated uncertainty (± 2 SD) and minimum detectable concentration (MDC).

Table 6. Annual radiochemical separation analysis data for TSP particulate filters collected during 2010.

Station Location	Sr^{90}			Pu^{238}			$Pu^{239/240}$			Am^{241}		
	Value[1]	± 2SD	MDC	Value[1]	± 2SD	MDC	Value[1]	± 2SD	MDC	Value[1]	± 2SD	MDC
On-Site Locations												
Rest Area	3.1	6.7	11.3	0.9	3.4	6.6	0.0	4.0	9.4	1.7	1.9	3.0
EFS[3]	1.0	5.4	9.2	1.2	2.9	5.5	3.9	5.2	8.7	0.6	1.4	2.5
Sand Dunes	0.0	6.3	10.9	0.0	3.2	6.4	0.1	1.1	1.1	1.2	1.8	3.1
Van Buren	2.0	6.1	10.2	0.0	3.3	7.3	1.1	2.7	5.2	1.8	1.9	3.0
Boundary Locations												
Atomic City	12.5	7.0	10.8	0.5	3.9	7.6	0.5	2.7	5.5	0.5	0.7	0.6
Howe	0.0	5.6	9.6	2.3	3.2	5.4	1.1	2.7	5.0	0.2	1.6	3.0
Monteview	4.1	6.1	10.2	0.0	4.2	8.1	0.0	3.5	7.8	2.6	2.1	3.1
Mud Lake	0.4	6.5	11.0	0.0	4.3	8.2	4.2	2.7	1.2	1.5	1.3	1.7
Distant Locations												
Craters of Moon	7.3	6.9	11.3	4.1	4.3	6.7	4.6	3.4	3.8	0.6	1.6	3.1
Fort Hall[2]	2.8	6.7	11.3	6.2	7.1	10.4	4.5	5.0	6.9	2.1	1.5	1.9
Idaho Falls	0.0	5.1	8.8	1.0	2.8	5.1	1.6	1.4	0.9	2.8	1.9	2.2

[1] Measurable quantities of these radionuclides are expected in the environment due to historic above-ground testing of nuclear weapons. DEQ-INL OP's action levels of 190 for americium-241, 1900 for strontium-90, 210 for plutonium-238, and 200 for plutonium-239/240 (in 1 x 10^{-6} pCi/m^3) are 10 percent of the compliance values listed for the specific radionuclide in 40 CFR 61, Appendix E, Table 2.
[2]Operated by Shoshone-Bannock Tribes.
[3]Experimental Field Station
Note: Concentrations are reported in 1 x 10^{-6} pCi/m^3 with associated uncertainty (± 2 SD), minimum detectable concentration (MDC), and correspond to filter composites collected during the calendar year.

Table 7. Results of screening measurements for Iodine-131.

Collection Date		Iodine-131 Activity (pCi/composite)		
Start	Stop	Value	± 2SD	MDA
12/30/10	1/06/11	0.00	1.50	2.59
1/06/11	1/13/11	0.00	0.94	1.63
1/13/11	1/20/11	0.51	0.97	1.62
1/20/11	1/27/11	0.00	0.80	1.42
1/27/11	2/03/11	1.44	1.65	2.71
2/03/11	2/10/11	0.00	1.33	2.30
2/10/11	2/17/11	0.00	0.84	1.45
2/17/11	2/24/11	0.20	2.03	3.38
2/24/11	3/03/11	1.98	1.72	2.79
3/03/11	3/10/11	0.69	1.27	2.11
3/10/11	3/17/11	17.5	2.6	3.6
3/17/11	3/24/11	1852	78	11
3/24/11	3/31/11	1121	44	4

Note: Charcoal cartridges from all air stations are counted in one composite for each collection period (normally a week). These screening results are not decay corrected to time of sample collection.

Table 8. Concentration of Iodine-131 in air on charcoal cartridges for individual stations. Results decay corrected to time of sample collection.

Sample Location	Collection Date		Iodine-131 Activity (pCi/m^3)		
	Start	Stop	Value[3]	Uncertainty (2s)	MDC
On-Site Locations					
Rest Area	3/10/11	3/17/11	0.0012	0.0018	0.0029
	3/17/11	3/24/11	0.3110	0.0222	0.0067
	3/24/11	3/31/11	0.1767	0.0265	0.0189
EFS[2]	3/10/11	3/17/11	0.0011	0.0013	0.0021
	3/17/11	3/24/11	0.2898	0.0196	0.0091
	3/24/11	3/31/11	0.1875	0.0236	0.0098
Sand Dunes	3/10/11	3/17/11	0.0019	0.0014	0.0023
	3/17/11	3/24/11	0.3207	0.0215	0.0096
	3/24/11	3/31/11	0.1500	0.0211	0.0096
Van Buren	3/10/11	3/17/11	0.0022	0.0011	0.0018
	3/17/11	3/24/11	0.2578	0.0457	0.0060
	3/24/11	3/31/11	0.2200	0.0278	0.0147
Boundary Locations					
Atomic City	3/10/11	3/17/11	0.0035	0.0015	0.0023
	3/17/11	3/24/11	0.3129	0.0242	0.0036
	3/24/11	3/31/11	0.2076	0.0302	0.0185
Howe	3/10/11	3/17/11	0.0021	0.0015	0.0025
	3/17/11	3/24/11	0.2136	0.0199	0.0028
	3/24/11	3/31/11	0.1206	0.0195	0.0153
Monteview	3/10/11	3/17/11	0.0021	0.0010	0.0014
	3/17/11	3/24/11	0.3697	0.0786	0.0109
	3/24/11	3/31/11	0.1876	0.0262	0.0173
Mud Lake	3/10/11	3/17/11	0.0006	0.0089	0.0018
	3/17/11	3/24/11	0.2951	0.0132	0.0031
	3/24/11	3/31/11	0.1858	0.0266	0.0081
Distant Locations					
Craters of the Moon	3/10/11	3/17/11	0.0028	0.0017	0.0027
	3/17/11	3/24/11	0.3270	0.0215	0.0028
	3/24/11	3/31/11	0.2329	0.0316	0.0202
Fort Hall[1]	3/10/11	3/17/11	0.0107	0.0020	0.0028
	3/17/11	3/24/11	0.2988	0.0655	0.0137
	3/24/11	3/31/11	0.1940	0.0294	0.0138
Idaho Falls	3/10/11	3/17/11	0.0030	0.0013	0.0021
	3/17/11	3/24/11	0.3465	0.0704	0.0102
	3/24/11	3/31/11	0.1338	0.0220	0.0124

[1]Operated by Shoshone-Bannock Tribes.
[2]Experimental Field Station
[3]DCG = 400 pCi/m^3 Iodine-131 for the public. The Derived Concentration Guide (DCG) from DOE 5400.5 is the concentration of a single radionuclide in air or water that, under conditions of continuous exposure for one year by one exposure mode (i.e., inhalation) would result in a committed effective dose equivalent of 100 mrem. The DCG applies to either inhalation or ingestion, not to a combination of both.

Environmental Radiation Monitoring Results

The ESP operated 14 environmental radiation stations during the first 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 9**).

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 10** lists the average radiation exposure rates measured by the HPICs for first quarter 2011. **Table 11** lists the EIC monitoring results for first quarter 2011. Overall exposure rates were within the expected historical range of values observed by DEQ-INL OP for background radiation.

Table 9. 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 10. Average gamma exposure rates, first quarter, 2011, from HPIC network.

Station Location	Exposure Rate (µR/hr)	
	Quarterly Average	± 2 SD
On-site Locations		
Base of Howe	10.4	1.4
Big Lost River Rest Area[1]	NS	NS
Main Gate[2]	NS	NS
Rover[3]	NS	NS
Sand Dunes Tower	13.7	1.0
Boundary Locations		
Atomic City	11.5	1.4
Big Southern Butte	10.0	1.0
Howe Met Tower	13.0	1.7
Monteview	12.0	1.9
Mud Lake/Terreton	11.4	1.6
Distant Locations		
Fort Hall[4]	12.6	3.7
Idaho Falls	11.5	1.1

[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 the quarter which could not be repaired and therefore is reported as No Sample.
[3] The Rover HPIC was destroyed by a wildfire and is therefore reported as No Sample.
[4] Operated by Shoshone-Bannock Tribes.

Table 11. Electret ionization chamber (EIC) cumulative average exposure rates, first quarter, 2011.

Station Location	Exposure Rate (µR/hr)	
	Quarterly Average	± 2 SD
On-site Locations		
Base of Howe	11.7[2]	1.4[2]
Big Lost River Rest Area	12.6	2.0
Experimental Field Station	15.4	3.4
Main Gate	13.9	2.8
Rover[1]	12.0[2]	3.3[2]
Sand Dunes Tower	11.0	1.8
Van Buren Avenue	15.1	2.2
Boundary Locations		
Atomic City	12.3	3.8
Big Southern Butte[1]	9.8[2]	1.1[2]
Howe Met Tower	10.5	2.8
Monteview	11.5	3.1
Mud Lake / Terreton	11.5	1.9
Distant Locations		
Craters of the Moon	10.4	0.3
Fort Hall[1]	10.4	0.1
Idaho Falls	12.3	1.6

[1] Station operated by Shoshone-Bannock Tribes.
[2]These values are also used for the 4th quarter 2010 data for these stations since they are the averages over the 2 quarters due to impassable roads, which prevented EIC collection at the end of 2010.

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. 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 first quarter of 2011 one facility location, USGS-123, was sampled. Results are reported in this section, along with backlogged enriched tritium analyses.

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

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

There were no detectable concentrations of gross alpha radioactivity this quarter. The EPA maximum contaminant level (MCL) for alpha particles is 15 pCi/L. Gross beta radioactivity was detected in the facility sample, however, the concentration was within the range observed for naturally-occurring radioactivity. The derived MCL for beta radioactivity is 8 pCi/L if the source of the radioactivity is strontium-90; 900 pCi/L if technetium-99; or 20,000 pCi/L if tritium. Man-made, gamma emitting cesium-137 was not detected at the sample location. Results for gross alpha, gross beta, and man-made gamma emitting radioactivity are shown in **Table 12**.

The facility site was sampled for plutonium isotopes (**Table13**). There were no detectable results for plutonium isotopes this quarter.

Isotopes of uranium were also sampled at the facility site. There were detectable results for uranium-234 and uranium-238, however, the result for uranium-235 was non-detectable (**Table 14**). The ratio of results observed cannot be distinguished from background concentrations, which means the uranium found in the sample is likely to be naturally occurring. There were no detectable results for americium-241 (**Table 15**).

The facility sample was analyzed for strontium-90 and had a detectable result, but was within the expected range of concentrations for this location (**Table 16**). One location was sampled for technetium-99 and had a detectable result, but was within the expected range of concentrations (**Table 17**) for this location.

Using the standard analytical method, tritium was detected in the facility sample (**Table 18**). 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 19**). Fourteen samples were analyzed this quarter, all of which were from 3rd and 4th quarter 2010. All sample results were within the expected range of concentrations due to natural sources and levels remaining after the atomic bomb testing era.

The facility sample was also analyzed for metals, common ions, nutrients, and volatile organic compounds (VOCs). Results for metals, common ions, and nutrients are displayed in **Tables 20, 21, and 22** respectively. All results were consistent with historical values found at the facility location. There were no detectable concentrations for VOCs found this quarter. A complete list of the VOCs monitored are shown in Appendix C. The background concentrations for VOCs should be zero.

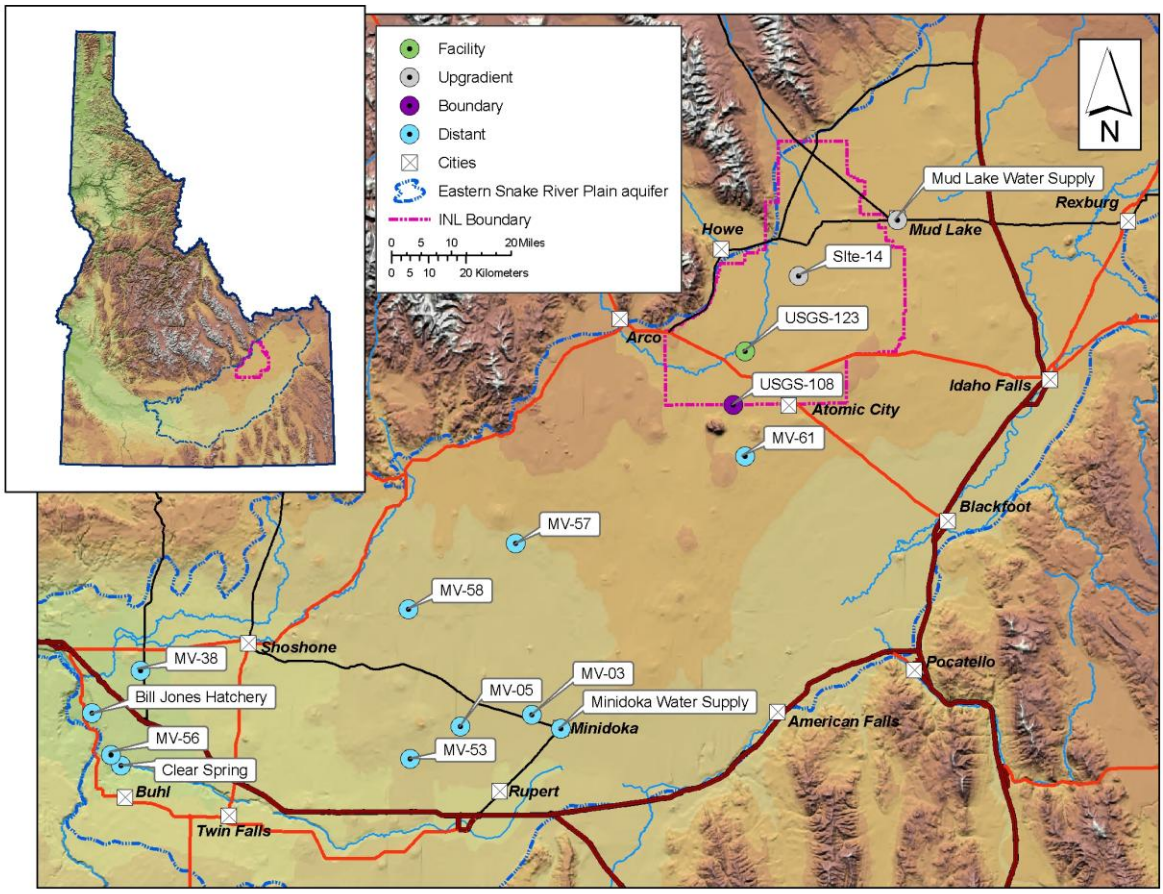

Figure 2. Upgradient, facility, boundary, and distant sampling locations, first quarter, 2011.

Table 12. Alpha, beta, and gamma concentrations for water samples, first quarter, 2011.

Sample Location	Sample Date	Gross Alpha			Gross Beta			Man-made gamma-emitting radionuclide Cesium-137		
		Concentration[1,2]		± 2 SD	Concentration		± 2 SD	Concentration		± 2 SD
Facility										
USGS-123	3/7/2011	-0.3	U	1.4	4.2		0.8	0.0	U	1.6

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

[2] Concentrations expressed in pCi/L

Table 13. Reported concentrations of plutonium isotopes in water samples, first quarter, 2011.

Sample Location	Sample Date	Plutonium-238			Plutonium-239/240		
		Concentration[1,2]		± 2SD	Concentration		± 2SD
Facility							
USGS-123	3/7/2011	0.007	U	0.026	0.007	U	0.026

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

[2] Concentrations expressed in pCi/L

Table 14. Reported concentrations of uranium isotopes in water samples, first quarter, 2011.

Sample Location	Sample Date	Uranium-234			Uranium-235			Uranium-238		
		Concentration[1,2]		± 2SD	Concentration		± 2SD	Concentration		± 2SD
Facility										
USGS-123	3/7/2011	1.40		0.31	0.035	U	0.041	0.62		0.18

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

[2] Concentrations expressed in pCi/L

Table 15. Reported concentrations of americium-241 in water samples, first quarter, 2011.

Sample Location	Sample Date	Americium-241		
		Concentration[1,2]		± 2SD
Facility				
USGS-123	3/7/2011	0.010	U	0.022

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

[2] Concentrations expressed in pCi/L

Table 16. Reported concentrations of strontium-90 in water samples, first quarter, 2011.

Sample Location	Sample Date	Strontium-90		
		Concentration[1,2]		± 2SD
Facility				
USGS-123	3/7/2011	0.171		0.093

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

[2] Concentrations expressed in pCi/L

Table 17. Reported concentrations of technetium-99 in water samples, first quarter, 2011.

Sample Location	Sample Date	Technetium-99		
		Concentration[1,2]		± 2SD
Facility				
USGS-123 (dissolved)	3/7/2011	2.0		0.2

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

[2] Concentrations expressed in pCi/L

Table 18. Tritium concentrations for water samples, first quarter, 2011.

Sample Location	Sample Date	Tritium		
		Concentration[1,2]		± 2 SD
Facility				
USGS-123	3/7/2011	2940		170

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

Table 19. Enriched tritium concentrations for water samples from previous sampling quarters, 2010.

Sample Location	Sample Date	Enriched Tritium		
		Concentration[1,2]		± 2 SD
Upgradient				
Mud Lake Water Supply	8/4/2010	3	U	6
Site-14	10/14/2010	2	U	5
Boundary				
USGS-108	9/20/2010	79		8
Distant				
Bill Jones Hatchery	8/3/2010	6	U	7
Clear Spring	8/3/2010	7	U	5
Minidoka Water Supply	8/3/2010	8		4
MV-03	8/2/2010	2	U	5
MV-05	8/2/2010	3	U	6
MV-38	8/3/2010	17		6
MV-53	8/3/2010	21		6
MV-56	8/3/2010	2	U	5
MV-57	7/8/2010	1	U	5
MV-58	8/2/2010	5	U	5
MV-61	10/13/2010	5	U	6

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

Table 20. Reported metals concentrations in water samples, first quarter, 2011.

Sample Location	Sample Date	Concentration[1,2]																					
		Arsenic		Barium		Beryllium		Cadmium		Chromium		Iron		Lead		Manganese		Mercury		Selenium		Zinc	
Facility																							
USGS-123 (total)	3/7/2011	<2.0	U	50		<1.0	U	<1.0	U	18		530		<1.0	U	11		<0.50	U	<2.0	U	5.3	

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

[2] Concentrations are expressed in µg/L. Samples are not filtered unless otherwise indicated.

Table 21. Reported common ion concentrations in water samples, first quarter, 2011.

Sample Location	Sample Date	Concentration[1,2]																					
		Calcium		Magnesium		Sodium		Potassium		Fluoride		Chloride		Sulfate		Silica		Alkalinity[3]		TDS[4]		TSS[5]	
Facility																							
USGS-123	3/7/2011	41		16		10		3.0		<0.20	U	23.4		21.6		30		127		NR		NR	

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

[3] As $CaCO_3$

[4] =Total Dissolved Solids

[5] = Total Suspended Solids

Table 22. Reported nutrient concentrations in water samples, first quarter, 2011.

Sample Location	Sample Date	Concentration[1,2]					
		Nitrite + Nitrate		Phosphorus		Total Kjeldahl Nitrogen	
Facility							
USGS-123	3/7/2011	1.0		0.039		NR	

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

[2] Concentrations expressed in mg/L.

Terrestrial Monitoring Results

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

DEQ-INL OP monitors long-term radiological conditions via soil sampling as well as field instrumentation capable of identifying and measuring quantities of gamma-emitting radionuclides in soil. Monitoring concentrations of gamma-emitting radionuclides in surface soil provides some insight to transport, deposition, and accumulation of radioactive material in the environment as a result of INL operations as well as historical above ground testing of nuclear weapons. No in-situ gamma spectroscopic measurements were performed, nor were any soil samples physically collected during the first 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. Riverside is a small operation that needed to suspend sampling for the month of February. They were able to resume milk sampling in March. Results for analyses of milk samples are presented in **Table 23**. Naturally occurring potassium-40 was detected in all samples within the expected range. Iodine-131 was not detected.

Table 23. Gamma spectroscopy analysis data for milk samples, first 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	
Monitoring Samples				
Howe/Nelson-Ricks Creamery	01/04/2011	1323	102	<MDC
	02/01/2011	1380	105	<MDC
	03/01/2011	1394	99	<MDC
Mud Lake/Nelson-Ricks Creamery	01/04/2011	1468	103	<MDC
	02/01/2011	1466	99	<MDC
	03/01/2011	1478	110	<MDC
Gooding/Glanbia	01/05/2011	1440	107	<MDC
	02/01/2011	1353	111	<MDC
	03/01/2011	1348	97	<MDC
Fort Hall	01/05/2011	1416	111	<MDC
	02/02/2011	1292	95	<MDC
	03/02/2011	1525	119	<MDC
Riverside	01/13/2011	1605	116	<MDC
	03/01/2011	1565	122	<MDC
Verification Samples[2]				
Idaho Falls	01/04/2011	1428	108	<MDC
Minidoka	01/04/2011	1474	116	<MDC
Howe	02/01/2011	1456	114	<MDC
Dietrich	02/01/2011	1293	101	<MDC
Minidoka	03/01/2011	1456	109	<MDC
Terreton	03/01/2011	1475	117	<MDC

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

[2] DEQ-INL OP samples collected by the off-site INL environmental surveillance contractor.

[3] Concentrations are expressed in pCi/L.

Quality Assurance

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

This section summarizes the results of the quality assurance (QA) assessment of the data collected for the first 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 first quarter of 2011, the DEQ-INL OP submitted 44 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 first quarter of 2011 are presented in **Table 25**.

Blank sample results for select gamma emitters in air from composited air filters are presented in **Table 26**. Blank analysis results for radiochemical separation analyses for TSP particulate filters collected during 2010 are presented in **Table 27**. Data for blank analyses used to assess data quality for tritium in water vapor in air are presented in **Table 28**. Blank analyses results for enriched tritium in ground and surface water are presented in **Table 29**.

No anomalies were observed from the assessment of field blank samples as measured by the analytical laboratories used by DEQ-INL OP for the first quarter of 2011.

Duplicate Samples

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

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

and is used to measure a laboratory's ability to reproduce consistent results. A relative percent difference is acceptable at ± 20 percent. For radiological analyses, the standard deviation of the differences can be used as an indicator of the overall precision of the data set. Duplicate results for ground and surface water are presented in **Table 30**, for enriched tritium analyses of samples from 2010. No duplicate samples for surface water and ground water were analyzed for the first quarter of 2011.

No anomalies were observed from the assessment of field duplicate samples as measured by the analytical laboratories used by DEQ-INL OP for the first 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 first quarter 2011, no field matrices were spiked to assess the influence of the sample media on laboratory performance. Neither were any spiked samples created using de-ionized water.

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 approximately 30 mR and two additional exposures, ranging from 20 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 first quarter 2011 are presented in **Table 31**. Real-time pressure correction is used to calculate the net exposure measured by these EIC control sets.

Analytical QA/QC Assessment

No issues involving sample chain of custody, sample holding times, and the analysis of blank, duplicate, and spiked samples were observed during the first 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 first 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 first quarter of 2011 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. The TSP sampler at Craters was unplugged upon arrival which resulted in an invalid sample. After the sampler was plugged in, it started and operated normally. The TSP sampler at EFS was not restarted after the filter change resulting in a non-sample "NS" for one week. Service reliability for air sampling equipment for the first quarter of 2011 is summarized in **Table 32**.

Conclusion

All data collected for the first 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 24. Summary of the analytical performance and usability of the analyses performed for the DEQ-INL OP ESP, first 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	141	13	0	0	0	ISU-EML
		Gross beta	141	13	0	0	0	ISU-EML
		Gamma emitters	13	1	0	0	0	ISU-EML
		Radiochemical	44	4	0	0	0	ISU Sub
Water Vapor	Desiccant column	Tritium	22	2	0	0	0	ISU-EML
Gaseous	Charcoal filter	Iodine-131	46	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	1	0	0	0	0	ISU-EML
		Gross beta	1	0	0	0	0	ISU-EML
		Gamma emitters	1	0	0	0	0	ISU-EML
		Tritium	1	0	0	0	0	ISU-EML
		Enriched tritium	14	1	1	0	0	ISU-EML
		Technetium-99	1	0	0	0	0	ISU-EML
		Radiochemical	1	0	0	0	0	ISU Sub
		Metals	1	0	0	0	0	IBL
		Common Ions	1	0	0	0	0	IBL
		Nutrients	1	0	0	0	0	IBL
		Volatile Organics	1	0	0	0	0	IBL
TERRESTRIAL								
Milk	Grab or composite	Gamma emitters	20	0	0	0	0	ISU-EML
Soil	*in situ*	Gamma emitters	0	0	0	0	0	DEQ-INL OP
	Grab – "puck"	Gamma emitters	0	0	0	0	0	ISU-EML
RADIATION								
Ambient	EICs	Gamma Radiation	55	0	0	9	0	DEQ-INL OP
	HPICs	Gamma Radiation	9	NA	NA	NA	0	DEQ-INL OP
Total Analyses			**526**	34	1	9	0	
Total of QC Analyses (blanks, duplicates, and spikes)			**44**					
Percentage of QC analyses of Total Test analyses[3]			**8.4**					
Percentage of usable data[4]			**100%**					

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

Table 25. Blank analysis results for gross alpha and beta in particulate air (TSP), first quarter, 2011.

Collection Period		Corrected volume (m^3) [1]	Gross alpha		Gross beta	
Start	Stop		Value	Uncertainty (± 2 SD)	Value	Uncertainty (± 2 SD)
12/30/10	1/06/11	1400	-0.1	0.1	-0.6	0.6
1/06/11	1/13/11	1400	0.2	0.1	0.1	0.6
1/13/11	1/20/11	1400	0.0	0.1	0.1	0.6
1/20/11	1/27/11	1400	0.0	0.1	0.2	0.6
1/27/11	2/03/11	1400	0.1	0.1	0.0	0.6
2/03/11	2/10/11	1400	0.0	0.1	0.5	0.6
2/10/11	2/17/11	1400	0.1	0.1	0.3	0.6
2/17/11	2/24/11	1400	0.0	0.1	0.4	0.6
2/24/11	3/03/11	1400	0.0	0.1	0.3	0.6
3/03/11	3/10/11	1400	0.0	0.1	-0.2	0.6
3/10/11	3/17/11	1400	0.1	0.1	-0.7	0.6
3/17/11	3/24/11	1400	0.1	0.1	0.0	0.6

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 26. Blank analysis results for gamma spectroscopy for TSP particulate air filters, first 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
4/20/11	57	156	94	9	62	104	-6	10	17

Analysis Date	Cesium-134			Cesium-137		
	Concentration[1]	± 2 SD	MDC	Concentration	± 2 SD	MDC
4/20/11	5	8	8	2	5	8

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 27. Blank analysis results for 2010 TSP annual radiochemical composites of air filters.

Location	^{90}Sr			^{238}Pu			$^{239}Pu/^{240}Pu$			^{241}Am		
	Value[1]	± 2 SD	MDC	Value[1]	± 2 SD	MDC	Value[1]	± 2 SD	MDC	Value[1]	± 2 SD	MDC
Blank	-0.40	0.62	1.10	0.18	0.18	0.22	0.14	0.27	0.45	0.20	0.21	0.31

[1]Concentrations values reported in 1 x 10^{-5} pCi/m^3 with associated uncertainty (±2 SD) and minimum detectable concentration (MDC).

Table 28. Blank analysis results for tritium in water vapor from air samples, first quarter, 2011.

Sample Number	Start Date	Collect Date	Analysis Date	Tritium		
				Concentration	± 2 SD	MDC
OP111ZTR01	02/11/11	02/15/11	04/27/11	0.09	0.10	0.16
OP111ZTR02	04/12/11	04/13/11	04/20/11	0.09	0.07	0.12

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

Table 29. Radiological blank analysis in ground and surface water for samples, first quarter, 2011.

Sample Number	Sample Date	Concentration	± 2 SD	MDC	Within Blank Criteria?
Enriched Tritium					
101W391	8/3/2010	24	5	7	Yes

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

Table 30. Duplicate radiological analysis results in pCi/L for ground and surface water, first quarter, 2011.

Analysis/ Sample Location	Original Sample Number	Concentration	±2 SD	Duplicate Sample Number	Concentration	±2 SD	$/R_1-R_2/$	$3(s_1^2+s_2^2)^{1/2}$	Within Criteria?[1]
Enriched Tritium									
MV-05	101W331	3	6	101W361	8	6	5	13	yes

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

Table 31. Electret ionization chamber irradiation results (categorized as spiked samples), first quarter, 2011.

Electret #	Exposure Received		Net Measured Exposure[1]		%R
	(mR)	Uncertainty (mR)	(mR)	Uncertainty (mR)	
Spike 1	51.1	2.6	47.6	1.4	93.1%
Spike 1	51.1	2.6	52.4	1.4	102.4%
Spike 1	51.1	2.6	50.6	1.3	99.0%
Spike 2	30.3	1.5	28.2	1.4	93.1%
Spike 2	30.3	1.5	30.3	1.4	100.2%
Spike 2	30.3	1.5	29.3	1.3	96.9%
Spike 3	24.0	1.2	22.0	1.4	91.6%
Spike 3	24.0	1.2	25.3	1.4	105.3%
Spike 3	24.0	1.2	22.9	1.4	95.4%

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

Table 32. Air sampling field equipment service reliability (percent operational), first 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	92 %	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	100 %	100 %	100 %	100 %
Mud Lake	100 %	100 %	100 %	100 %
Distant Locations				
Craters of the Moon	92 %	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.
[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, first quarter, 2011.

Sample location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	± 2 SD	Concentration	± 2 SD
On-site Locations						
Rest Area	12/30/10	1/06/11	2.2	0.4	83.4	2.3
	1/06/11	1/13/11	1.6	0.3	85.8	2.3
	1/13/11	1/20/11	0.8	0.2	35.8	1.5
	1/20/11	1/27/11	0.7	0.2	31.7	1.4
	1/27/11	2/03/11	1.0	0.3	46.1	1.7
	2/03/11	2/10/11	1.0	0.3	32.5	1.5
	2/10/11	2/17/11	1.4	0.3	49.0	1.8
	2/17/11	2/24/11	0.5	0.2	23.6	1.3
	2/24/11	3/03/11	0.8	0.2	40.7	1.6
	3/03/11	3/10/11	0.5	0.2	24.1	1.3
	3/10/11	3/17/11	0.5	0.2	20.3	1.2
	3/17/11	3/24/11	0.8	0.2	95.1	2.4
	3/24/11	3/31/11	0.4	0.2	59.0	1.9
Experimental Field Station	12/30/10	1/06/11	2.5	0.4	93.0	2.5
	1/06/11	1/13/11	1.5	0.3	90.5	2.4
	1/13/11	1/20/11	0.7	0.2	35.4	1.6
	1/20/11	1/27/11	0.5	0.2	38.2	1.6
	1/27/11	2/03/11	0.9	0.2	39.9	1.6
	2/03/11	2/10/11	0.9	0.3	47.5	1.8
	2/10/11	2/17/11	1.0	0.3	49.0	1.8
	2/17/11	2/24/11	0.3	0.2	24.8	1.3
	2/24/11	3/03/11	0.6	0.2	36.3	1.6
	3/03/11	3/10/11	NS[1]	NS[1]	NS[1]	NS[1]
	3/10/11	3/17/11	0.5	0.2	19.2	1.2
	3/17/11	3/24/11	1.0	0.3	78.0	2.2
	3/24/11	3/31/11	0.4	0.2	54.3	1.9

[1]NS – Sampler not started from previous week.

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, first quarter, 2011.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	± 2 SD	Concentration	± 2 SD
Sand Dunes	12/30/10	1/06/11	2.2	0.4	85.1	2.2
	1/06/11	1/13/11	2.3	0.4	102.5	2.4
	1/13/11	1/20/11	0.8	0.2	37.4	1.5
	1/20/11	1/27/11	0.6	0.2	35.7	1.5
	1/27/11	2/03/11	0.9	0.2	44.0	1.6
	2/03/11	2/10/11	1.1	0.3	53.8	1.7
	2/10/11	2/17/11	1.2	0.3	54.0	1.8
	2/17/11	2/24/11	0.5	0.2	25.6	1.3
	2/24/11	3/03/11	0.6	0.2	37.1	1.5
	3/03/11	3/10/11	0.4	0.2	26.9	1.3
	3/10/11	3/17/11	0.6	0.2	17.3	1.1
	3/17/11	3/24/11	0.6	0.2	76.6	2.1
	3/24/11	3/31/11	0.3	0.2	55.2	1.7
Van Buren	12/30/10	1/06/11	2.1	0.4	86.0	2.3
	1/06/11	1/13/11	1.6	0.3	76.7	2.2
	1/13/11	1/20/11	1.0	0.3	35.8	1.5
	1/20/11	1/27/11	0.6	0.2	31.4	1.4
	1/27/11	2/03/11	0.9	0.2	41.7	1.6
	2/03/11	2/10/11	0.9	0.3	29.1	1.4
	2/10/11	2/17/11	1.1	0.3	45.7	1.7
	2/17/11	2/24/11	0.7	0.2	21.7	1.2
	2/24/11	3/03/11	0.8	0.2	36.4	1.5
	3/03/11	3/10/11	0.6	0.2	24.7	1.3
	3/10/11	3/17/11	0.6	0.2	19.1	1.2
	3/17/11	3/24/11	0.7	0.2	94.6	2.4
	3/24/11	3/31/11	0.3	0.2	59.1	1.9
Boundary Locations						
Atomic City	12/30/10	1/06/11	2.3	0.4	82.9	2.3
	1/06/11	1/13/11	1.9	0.3	89.5	2.3
	1/13/11	1/20/11	0.7	0.2	32.5	1.5
	1/20/11	1/27/11	0.4	0.2	28.8	1.4
	1/27/11	2/03/11	0.7	0.2	43.3	1.6
	2/03/11	2/10/11	1.0	0.3	48.7	1.7
	2/10/11	2/17/11	1.5	0.3	47.5	1.7
	2/17/11	2/24/11	0.5	0.2	22.4	1.2
	2/24/11	3/03/11	0.5	0.2	35.0	1.5
	3/03/11	3/10/11	0.6	0.2	22.6	1.3
	3/10/11	3/17/11	0.4	0.2	18.2	1.2
	3/17/11	3/24/11	0.8	0.2	89.9	2.3
	3/24/11	3/31/11	0.5	0.2	57.7	1.9

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, first quarter, 2011.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	± 2 SD	Concentration	± 2 SD
Howe	12/30/10	1/06/11	2.2	0.4	84.4	2.3
	1/06/11	1/13/11	1.6	0.3	83.5	2.3
	1/13/11	1/20/11	0.8	0.2	36.2	1.6
	1/20/11	1/27/11	0.4	0.2	33.0	1.5
	1/27/11	2/03/11	0.7	0.2	37.9	1.6
	2/03/11	2/10/11	0.9	0.3	43.3	1.7
	2/10/11	2/17/11	0.8	0.2	53.3	1.9
	2/17/11	2/24/11	0.7	0.2	27.8	1.4
	2/24/11	3/03/11	0.6	0.2	37.2	1.6
	3/03/11	3/10/11	0.5	0.2	19.0	1.2
	3/10/11	3/17/11	0.6	0.2	19.1	1.2
	3/17/11	3/24/11	1.0	0.3	81.7	2.3
	3/24/11	3/31/11	0.3	0.2	45.3	1.7
Monteview	12/30/10	1/06/11	3.3	0.5	123.4	2.8
	1/06/11	1/13/11	2.6	0.4	133.1	2.8
	1/13/11	1/20/11	1.0	0.3	41.3	1.6
	1/20/11	1/27/11	0.8	0.3	48.1	1.8
	1/27/11	2/03/11	1.3	0.3	67.7	2.1
	2/03/11	2/10/11	1.4	0.3	81.7	2.2
	2/10/11	2/17/11	1.8	0.3	69.0	2.0
	2/17/11	2/24/11	1.0	0.3	39.0	1.6
	2/24/11	3/03/11	0.7	0.2	43.9	1.7
	3/03/11	3/10/11	0.7	0.2	31.5	1.5
	3/10/11	3/17/11	0.6	0.2	21.7	1.3
	3/17/11	3/24/11	1.0	0.3	114.3	2.6
	3/24/11	3/31/11	0.4	0.2	68.8	2.0
Mud Lake	12/30/10	1/06/11	2.2	0.4	124.3	2.8
	1/06/11	1/13/11	2.0	0.4	107.3	2.6
	1/13/11	1/20/11	0.9	0.3	37.3	1.6
	1/20/11	1/27/11	0.6	0.2	35.4	1.6
	1/27/11	2/03/11	0.8	0.2	40.0	1.7
	2/03/11	2/10/11	1.0	0.3	53.8	1.9
	2/10/11	2/17/11	1.2	0.3	53.2	1.9
	2/17/11	2/24/11	0.7	0.2	27.5	1.4
	2/24/11	3/03/11	0.8	0.2	37.5	1.6
	3/03/11	3/10/11	0.5	0.2	25.5	1.4
	3/10/11	3/17/11	0.5	0.2	18.1	1.2
	3/17/11	3/24/11	0.8	0.2	97.8	2.5
	3/24/11	3/31/11	0.3	0.2	56.9	1.9

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, first quarter, 2011.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	± 2 SD	Concentration	± 2 SD
Distant Locations						
Craters	12/30/10	1/06/11	1.4	0.3	55.8	2.0
	1/06/11	1/13/11	NS[2]	NS[2]	NS[2]	NS[2]
	1/13/11	1/20/11	0.4	0.2	19.7	1.3
	1/20/11	1/27/11	0.4	0.2	22.3	1.3
	1/27/11	2/03/11	0.7	0.2	37.9	1.6
	2/03/11	2/10/11	0.7	0.3	33.8	1.6
	2/10/11	2/17/11	0.9	0.3	27.3	1.4
	2/17/11	2/24/11	0.3	0.2	17.4	1.2
	2/24/11	3/03/11	0.7	0.2	27.7	1.4
	3/03/11	3/10/11	0.3	0.2	17.8	1.2
	3/10/11	3/17/11	0.7	0.2	15.5	1.2
	3/17/11	3/24/11	0.5	0.2	68.2	2.1
	3/24/11	3/31/11	0.2	0.2	43.7	1.8
Fort Hall[1]	12/30/10	1/06/11	1.8	0.3	53.3	1.8
	1/06/11	1/13/11	1.0	0.3	48.2	1.8
	1/13/11	1/20/11	0.5	0.2	17.0	1.1
	1/20/11	1/27/11	0.5	0.2	23.6	1.3
	1/27/11	2/03/11	1.6	0.3	33.2	1.5
	2/03/11	2/10/11	1.5	0.3	35.8	1.5
	2/10/11	2/17/11	1.4	0.3	35.0	1.5
	2/17/11	2/24/11	0.5	0.2	18.6	1.1
	2/24/11	3/03/11	1.0	0.4	45.4	2.5
	3/03/11	3/10/11	1.2	0.6	57.7	3.5
	3/10/11	3/17/11	1.0	0.2	18.1	1.2
	3/17/11	3/24/11	1.0	0.3	98.2	2.4
	3/24/11	3/31/11	0.3	0.2	61.1	1.9
Idaho Falls	12/30/10	1/06/11	3.0	0.4	94.7	2.4
	1/06/11	1/13/11	1.8	0.3	78.7	2.2
	1/13/11	1/20/11	0.7	0.2	33.7	1.5
	1/20/11	1/27/11	0.7	0.2	39.2	1.6
	1/27/11	2/03/11	1.0	0.3	49.9	1.8
	2/03/11	2/10/11	2.1	0.4	67.6	2.0
	2/10/11	2/17/11	2.1	0.4	87.3	2.8
	2/17/11	2/24/11	0.5	0.2	24.0	1.3
	2/24/11	3/03/11	0.7	0.2	27.0	1.4
	3/03/11	3/10/11	0.7	0.3	24.9	1.3
	3/10/11	3/17/11	0.7	0.2	21.6	1.3
	3/17/11	3/24/11	1.1	0.3	119.3	2.7
	3/24/11	3/31/11	0.4	0.2	67.5	2.0

[1] Operated by Shosone-Bannock Tribes
[2] NS – Sampler unplugged

Appendix B

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

Sample Location	Net Corrected Exposure Rate (µR/h)	± 2 SD (µR/h)
Arco	11.8	0.0
Craters	10.4	0.3
Rest Area	12.6	2.0
Van Buren	15.1	2.2
EFS	15.4	3.4
Main Gate	13.9	2.8
Atomic City	12.3	3.8
Taber	11.2	3.4
Blackfoot	9.5	2.1
Ft. Hall[1]	10.4	0.1
Idaho Falls	12.3	1.6
Mud Lake/ Terreton	11.5	1.9
Monteview	11.5	3.1
Sand Dunes	11.0	1.8
Howe Met. Tower	10.5	2.8
MP276 -20	8.3	1.4
MP274 -20	8.9	3.1
MP272 -20	8.8	2.9
MP270 -20	8.3	2.1
MP268 -20	10.5	2.8
MP266 -20	11.9	3.8
MP264 -20	10.9	2.7
MP270 -20/26	9.6	2.1
MP268 -20/26	12.0	3.0
MP266 -20/26	13.2	2.3
MP263 -20/26	11.9	1.3
MP261 -20/26	10.7	3.8
MP259 -20/26	9.6	3.3
MFC (EBR II)	12.5	3.3
EBR I	14.3	1.7
RWMC	10.5	0.8
CFA	13.3	1.8
CITRC (PBF)	12.0	1.6

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

Sample Location	Net Corrected Exposure Rate (µR/h)	± 2 SD (µR/h)
INTEC (ICPPI)	12.9	0.3
ATR (TRA)	21.6	2.4
NRF	13.0	0.2
TAN	11.2	0.5
Mud Lake Bank of Commerce	14.0	2.9
MP43-33	11.4	2.6
MP41-33	10.2	1.0
MP39-33	12.8	1.0
MP37-33	11.9	2.5
MP35-33	12.1	2.3
MP33-33	16.6	1.8
MP31-33	10.0	3.2
MP29-33	13.4	0.9
MP27-33	14.8	1.5
MP25-33	11.7	0.1
MP23-33	10.5	3.6
Base of Howe	11.7	1.4
Rover	12.0	3.3
Hamer	12.1	3.2
Sugar City	14.0	2.8
Roberts	10.5	1.3
Big Southern Butte	9.8	1.1

[1] Operated by Shosone-Bannock Tribes.

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