

Department of Environmental Quality
INL Oversight Program

**ENVIRONMENTAL SURVEILLANCE PROGRAM
QUARTERLY DATA REPORT**

January - March, 2008



**State of Idaho
INL Oversight Program**

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Table of Acronyms

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

Introduction

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

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

Results of the ESP are published using two distinct reporting formats: quarterly data reports and an annual ESP report. The annual ESP report is designed for a more broad audience and summarizes the results of the ESP for the previous four quarters. The annual report's primary emphasis is to focus on trends, ascertain the impacts of DOE operations on the environment, and confirm the validity of DOE monitoring programs. This quarterly report is designed to provide the mechanism to document the results of the ESP on a quarterly basis and provide detailed data to those who wish to "see the numbers." It is organized according to the media sampled and also provides a quality assurance assessment.

Air and Precipitation Monitoring Results

The ESP operated eight air monitoring stations on and near the INL as well as two monitoring stations distant from the INL during the first quarter, 2008 (**Figure 1**). These stations employed instrumentation for collecting airborne particulate matter, gaseous radioiodine, precipitation, and water vapor for tritium analysis (**Table 1**). The Shoshone-Bannock Tribes operated an air monitoring station located at Fort Hall. The Fort Hall station uses identical instrumentation and sampling protocol as the ten stations operated by the ESP. The DEQ-INL reports the Fort Hall station data as an additional distant site.

Adverse weather conditions prevented the collection of the Atomic City and Craters of the Moon sampling media on the collection day of 1/31/08 and several days thereafter. Therefore it was decided to leave them in place for an additional week and report their results as estimates.

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

Composites of filters collected using TSP samplers during the course of a calendar quarter were analyzed using gamma spectroscopy. Typically, gamma spectroscopy results were only reported when exceeding a minimum detectable activity (MDA) or minimum detectable concentration (MDC). Gamma spectroscopy results for the first quarter of 2008 for TSP filters are presented in **Table 3**. The only reported gamma-emitting radionuclide was beryllium-7, a naturally occurring, cosmogenic radionuclide.

Annual composites of filters collected using TSP samplers are also analyzed using radiochemical separation techniques. The samples are analyzed for strontium-90, plutonium-238, plutonium-239/240, and americium-241. The results of the 2007 analysis are included in this report. Only strontium-90 was detected at levels

above MDC. Therefore only strontium-90 data are displayed in **Table 4**. Initial analysis of the samples placed strontium-90 at all but one station. All samples capable of being reanalyzed were. Similar results were obtained in all but one reanalysis but Quality Control criterion restricted agreement to only seven of the eleven samples. Although measurable quantities of strontium-90 appear to be widespread in 2007, the activity concentrations are far below DEQ-INL's action level of 1900×10^{-6} pCi/m³ for this radionuclide. Measurable quantities of these radionuclides are expected in the environment due to historic above ground testing of nuclear weapons.

Radioactive iodine samples are collected weekly. Samples are collected by drawing air through a canister filled with activated charcoal using a low-volume air pump. The activated charcoal contained in the canister traps the radioiodine within its sponge-like pores. Each week, canisters are collected from all eleven air monitoring stations and analyzed together as a batch. If iodine-131 is detected in this grouping, the canisters are individually analyzed. No radioactive isotopes of iodine, specifically iodine-131, were detected on the weekly charcoal cartridges used to collect this nuclide during the first 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 at the Van Buren station in one of the two samples analyzed during the first quarter of 2008. The level was less than 1 % of the DEQ-INL action level. Average atmospheric tritium concentrations are presented in **Table 5**.

Precipitation samples were collected at six monitoring locations during the first quarter of 2008. Precipitation samples were analyzed for tritium and gamma-emitting radionuclides. Tritium and gamma-emitting radionuclides were below minimum detectable concentration in precipitation collected during the first quarter of 2008. Tritium and cesium-137 analysis results are presented in **Table 6**. 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.

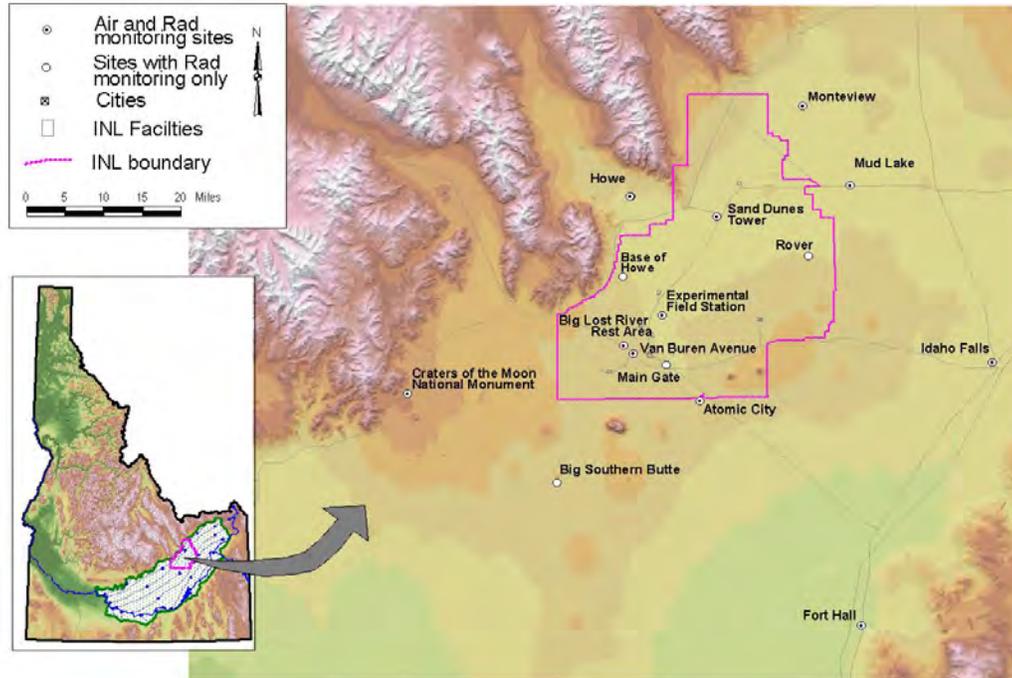


Figure 1. Air and radiation monitoring sites.

Table 1. Sampling locations and sample type.

Station Locations	Sample type ¹			
	TSP	Radioiodine	Water Vapor	Precipitation
On-site Locations				
Big Lost River Rest Area	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Experimental Field Station	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Sand Dunes Tower	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Van Buren Avenue	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Boundary Locations				
Atomic City	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Howe	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Monteview	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Mud Lake	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Distant Locations				
Craters of the Moon	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Fort Hall ²	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Idaho Falls	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

¹ Samples collected weekly; Samples collected quarterly.

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

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

Station Location	Concentration			
	Gross Alpha		Gross Beta	
On-Site Locations				
Big Lost River Rest Area	0.1	- 1.4	17.5	- 66.6
Experimental Field Station	0.1	- 0.8	9.7	- 52.3
Sand Dunes Tower	0.2	- 1.2	20.1	- 58.8
Van Buren Avenue	0.2	- 1.1	15.4	- 53.2
Boundary Locations				
Atomic City	0.0	- 1.1	15.1	- 59.6
Howe	0.1	- 0.8	16.0	- 58.6
Monteview	0.1	- 4.4	18.1	- 51.0
Mud Lake	0.0	- 1.0	17.9	- 51.6
Distant Locations				
Craters of the Moon	0.0	- 0.9	9.9	- 35.6
Fort Hall ¹	0.1	- 2.8	7.0	- 34.9
Idaho Falls	0.3	- 1.7	11.1	- 56.5

¹ Operated by Shoshone-Bannock Tribes.

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

Station Location	Naturally Occurring Radionuclide Beryllium-7		Man-Made Gamma Emitting Radionuclides
	Concentration	± 2 SD	
On-site Locations			
Big Lost River Rest Area	70.3	3.8	<MDC
Experimental Field Station	46.9	2.7	<MDC
Sand Dunes Tower	68.8	2.8	<MDC
Van Buren Avenue	55.6	3.0	<MDC
Boundary Locations			
Atomic City	54.8	3.1	<MDC
Howe	50.6	2.9	<MDC
Monteview	65.3	3.6	<MDC
Mud Lake	44.8	2.6	<MDC
Distant Locations			
Craters of the Moon	53.9	3.0	<MDC
Fort Hall ¹	45.9	2.7	<MDC
Idaho Falls	52.1	2.9	<MDC

¹ Operated by Shoshone-Bannock Tribes.

Table 4. Annual radiochemical separation analysis data for TSP particulate filters collected during 2007. Concentrations are reported in 1×10^{-3} pCi/m³ with associated uncertainty (± 2 SD), minimum detectable concentration (MDC), and correspond to filter composites collected during the calendar quarter.

Station Location	Strontium-90			Strontium-90 (reanalysis)		
	Concentration ¹	± 2 SD	MDC	Concentration ¹	± 2 SD	MDC
On-Site Locations						
Big Lost River Rest Area	-3.9	34.7	64.8	90.5	49.6	67.4
Experimental Field Station	57.5	15.2	14.6	20.7	11.3	15.7
Sand Dunes Tower	42.9	13.8	14.6	40.3	13.6	15.5
Van Buren Avenue	64.1	16.2	15.0	36.4	12.7	14.1
Boundary Locations						
Atomic City	61.5	15.4	14.2	NS ²	NS ²	NS ²
Howe	45.6	14.0	14.8	26.4	12.4	16.1
Monteview	62.6	17.2	17.0	47.8	15.4	16.3
Mud Lake	38.5	12.8	14.2	66.0	17.7	16.2
Distant Locations						
Craters of the Moon	60.1	14.9	13.1	22.0	10.6	14.1
Fort Hall ³	41.0	12.1	12.1	64.6	17.2	16.6
Idaho Falls	32.6	12.8	15.1	39.5	13.6	15.2

¹ Measurable quantities of these radionuclides are expected in the environment due to historic above-ground testing of nuclear weapons. DEQ-INL's action levels of 190 for americium-241, 1900 for strontium-90, 210 for plutonium-238, and 200 for plutonium-239/240 (in 1×10^{-6} pCi/m³) are 10 percent of the compliance values listed for the specific radionuclide in 40 CFR 61, Appendix E, Table 2. Field sample concentrations which exceed these amounts require further investigation.

² Insufficient sample for reanalysis.

³ Operated by Shoshone-Bannock Tribes.

Table 5. Tritium concentrations in air from atmospheric moisture, first quarter, 2008. Concentrations are reported in pCi/m³ with associated uncertainty (± 2 SD) and minimum detectable concentration (MDC).

Station Location	Tritium		
	Concentration	± 2 SD	MDC
On-site Locations			
Big Lost River Rest Area	0.17	0.14	0.24
Experimental Field Station	0.11	0.15	0.26
Sand Dunes Tower	0.09	0.10	0.17
Van Buren Avenue	0.21	0.14	0.24
Boundary Locations			
Atomic City	-0.01	0.02	0.04
Howe	0.09	0.15	0.24
Mud Lake	0.09	0.13	0.21
Monteview	-0.02	0.09	0.16
Distant Locations			
Craters of the Moon	-0.02	0.13	0.22
Fort Hall ¹	0.04	0.21	0.35
Idaho Falls	0.03	0.15	0.25

¹Operated by Shoshone-Bannock Tribes.

Table 6. Tritium and cesium-137 concentrations from precipitation, first quarter, 2008. Concentrations are reported in pCi/L with associated uncertainty (± 2 SD) and minimum detectable concentration (MDC).

Station Location	Tritium			Cesium-137		
	Concentration	± 2 SD	MDC	Concentration	± 2 SD	MDC
On-site Locations						
Big Lost River Rest Area	30	80	130	0.1	1.4	2.5
Boundary Locations						
Atomic City	10	80	130	-0.3	1.6	2.7
Howe	-10	80	130	-0.2	1.4	2.5
Monteview	-30	80	130	1.3	1.5	2.4
Mud Lake	10	80	130	-0.8	1.5	2.6
Distant Locations						
Idaho Falls	20	80	130	0.1	1.5	2.6

Environmental Radiation Monitoring Results

The ESP operated 14 environmental radiation stations during the first quarter of 2008 (**Figure 1**). To detect gamma radiation, each station is instrumented with an electret ionization chamber (EIC), and 11 of the stations also have high-pressure ion chambers (HPIC) (**Table 7**).

The Shoshone-Bannock Tribes operate an additional environmental radiation station at Fort Hall equipped with both an EIC and HPIC. The DEQ-INL reports these results.

HPICs are instruments capable of real-time measurements, and are sensitive enough to detect small changes in gamma radiation levels. The real-time gamma radiation measurements collected by the HPICs at each location are radioed to DEQ-INL and presented graphically via the worldwide web at http://www.deq.idaho.gov/inl_oversight/monitoring/piconline.cfm

EICs are a passive-integrating system that provides a cumulative measure of environmental gamma radiation exposure in the field. EICs are deployed, collected, and analyzed quarterly. EICs offer an inexpensive methodology to measure gamma radiation over a wide area, particularly in regions which do not have a power source. EICs can also provide valuable gamma radiation data in the event of an emergency. It is because of this reason that EICs are deployed at an additional 41 locations by DEQ-INL in a widespread network around the INL measuring external radiation. This information is tabulated in **Appendix B**.

These two systems are used by DEQ-INL to measure external gamma radiation for various radiological monitoring objectives. **Table 8** lists the average radiation exposure rates measured by the HPICs for first quarter 2008. **Table 9** lists the EIC monitoring results for first quarter 2008. Exposure rates were within the expected historical range of values observed by DEQ-INL for background radiation. The EIC's at remote located monitoring stations (Big Southern Butte, Rover, and Base of Howe) were inaccessible due to heavy snowfall at the end of the first quarter and thus were left out for two quarters (180 days). The reported values for these three EIC's will be the average $\mu\text{R/hr}$ over the whole period of time.

Table 7. Summary of instrumentation at radiation monitoring stations.

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

¹ Operated by Shoshone-Bannock Tribes.

² HPIC has not been re-deployed.

Table 8. Average gamma exposure rates for first quarter, 2008, from HPIC network.

Station Location	Exposure Rate ($\mu\text{R/hr}$)	
	Quarterly Average	± 2 SD
On-site Locations		
Base of Howe	12.7	3.1
Big Lost River Rest Area	NS	NS
Main Gate	13.3	1.9
Rover	13.7	1.9
Sand Dunes Tower	13.9	4.4
Boundary Locations		
Atomic City	11.6	2.9
Big Southern Butte	12.7	4.6
Howe	14.0	7.4
Monteview	11.7	1.7
Mud Lake	11.9	1.8
Distant Locations		
Fort Hall ¹	13.8	1.8
Idaho Falls	10.2	3.0

¹ Operated by Shoshone-Bannock Tribes.

Table 9. Electret ionization chamber (EIC) cumulative average exposure rates for first quarter, 2008.

Station Location	Exposure Rate ($\mu\text{R/hr}$)	
	Quarterly Average	± 2 SD
On-site Locations		
Base of Howe ¹	15.3	9.7
Big Lost River Rest Area	11.4	4.5
Experimental Field Station	13.7	2.2
Main Gate	12.7	6.7
Rover ¹	12.9	1.8
Sand Dunes Tower	12.6	2.6
Van Buren Avenue	12.9	2.5
Boundary Locations		
Atomic City	11.4	3.1
Big Southern Butte ¹	10.2	2.0
Howe	9.8	1.1
Monteview	13.7	3.4
Mud Lake	13.2	0.4
Distant Locations		
Craters of the Moon	10.3	2.8
Fort Hall	11.4	4.2
Idaho Falls	10.0	2.0

¹ EIC's were left out for two quarters due to heavy snowfall. The reported average is for a 180 day period.

Water Monitoring

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

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

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

There were no detectable concentrations of gross alpha radioactivity in either of the two samples this quarter. The EPA maximum contaminant level (MCL) for alpha particles is 15 pCi/L.

Gross beta radioactivity was detected in the one facility sample and the one waste water sample. Both concentrations were within the range of concentrations 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 any sample locations. Results for gross alpha; gross beta; and man-made, gamma emitting radioactivity are shown in **Table 10**.

One site was sampled for plutonium isotopes (**Table 11**). There were no detectable results for plutonium isotopes this quarter.

One site was sampled for isotopes of uranium, and had detectable results for uranium-234 and uranium-238 but did not have a detectable result for uranium-235 (**Table 12**). 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 or neptunium-237 (**Table 13 and 14**).

One sample was analyzed for strontium-90 and did not have a detectable concentration (**Table 15**). One location was sampled for technetium-99 and had a detectable result, but was within the expected range of concentrations (**Table 16**) for this location.

Using the standard analytical method, tritium was detected in the one facility sample (**Table 17**). There was no detectable concentration in the waste water sample. 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 18**). Fifteen samples were analyzed this quarter, all of which were from 3rd and 4th quarter 2007. There had been a backlog of samples due to equipment problems, but all samples have now been analyzed. All sample results were within the expected range of concentrations due to natural sources and levels remaining after the atomic bomb testing era.

Samples were also analyzed for metals and the results shown in **Table 19**. All metals results were within their expected ranges. Common ion results are shown in **Table 20** and nutrient results are shown in **Table 21**. All results were consistent with historical values at those locations. However, a sample from the industrial waste ditch was improperly preserved in the field, so the results from that sample were qualified with a “J”.

One location, USGS-123, was sampled for Volatile Organic Compounds (VOCs) this quarter and had no detectable concentrations. A complete list of VOCs is shown in Appendix C. The background concentrations for VOCs should be zero.

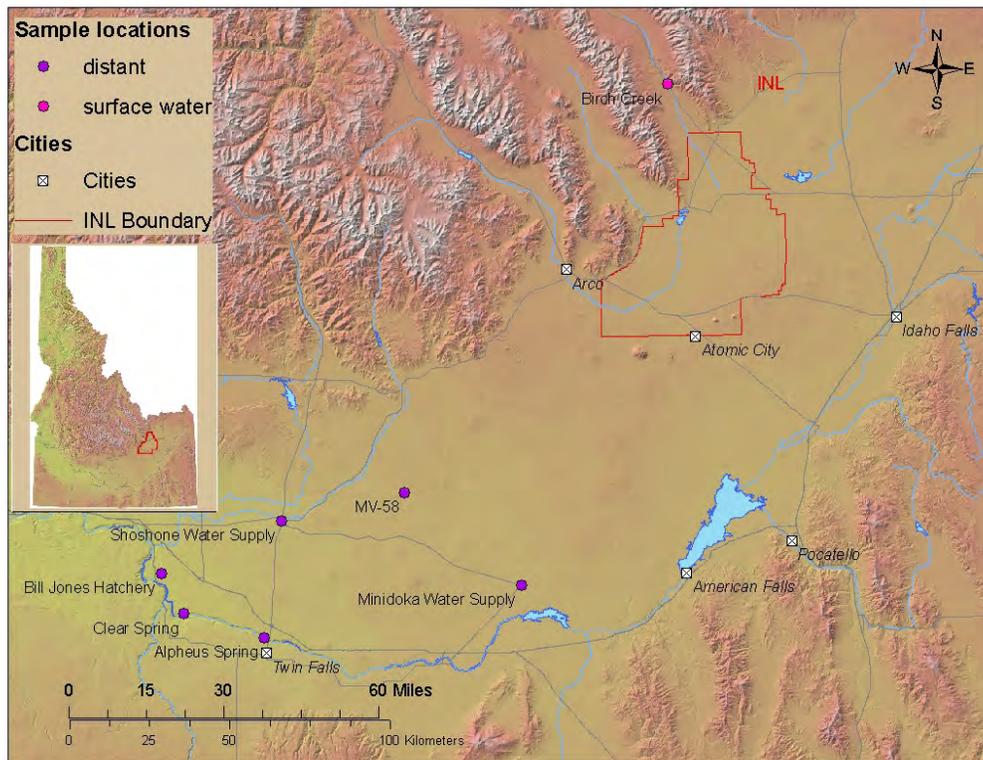


Figure 2. Distant sampling locations for first quarter, 2008.

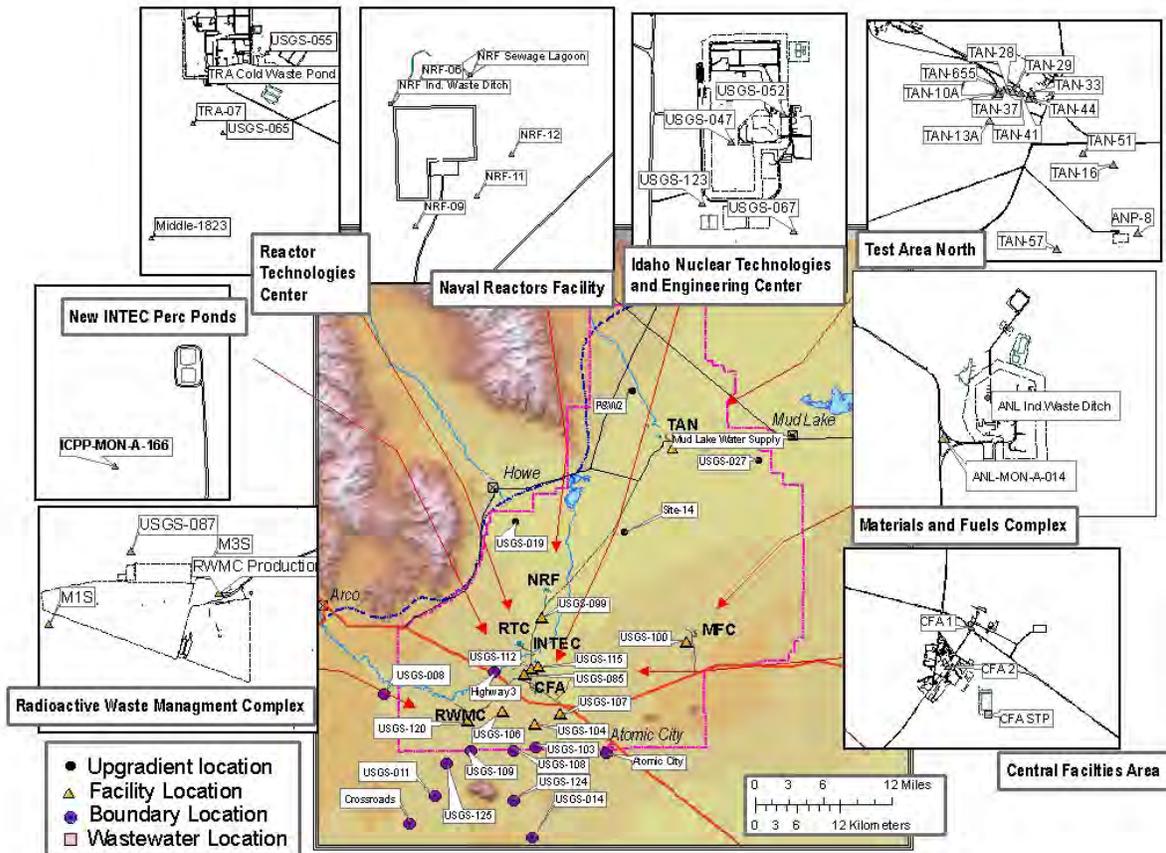


Figure 3. Up-gradient, facility, boundary and wastewater monitoring locations.

Table 10. Alpha, beta, and gamma concentrations for water samples, first quarter, 2008.

Sample Location	Sample Date	Gross Alpha		Gross Beta		Man-made gamma-emitting radionuclide Cesium-137		
		Concentration ^{1,2}	± 2 SD	Concentration ^{1,2}	± 2 SD	Concentration ^{1,2}	± 2 SD	
Facility								
USGS-123	3/4/2008	1.8 U	1.9	4.4	1.1	-0.2 U	1.6	
Waste water								
ANL Ind. Waste Ditch	3/18/2008	0.8 U	2.2	3.7	1.1	-0.6 U	1.5	

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

² Concentrations expressed in pCi/L.

Table 11. Reported concentrations of plutonium isotopes in water samples, first quarter, 2008.

Sample Location	Sample Date	Plutonium-238		Plutonium-239/240		Plutonium-241		
		Concentration ^{1,2}	± 2 SD	Concentration ^{1,2}	± 2 SD	Concentration ^{1,2}	± 2 SD	
Facility								
USGS-123	3/4/2008	-0.005 U	0.025	0.014 U	0.025	-0.8 U	4.2	

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

² Concentrations expressed in pCi/L.

Table 12. Reported concentrations of uranium isotopes in water samples, first quarter, 2008.

Sample Location	Sample Date	Uranium-234		Uranium-235		Uranium-238		
		Concentration ^{1,2}	± 2 SD	Concentration ^{1,2}	± 2 SD	Concentration ^{1,2}	± 2 SD	
Facility								
USGS-123	3/4/2008	1.71	0.39	0.069 U	0.065	0.70	0.21	

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

² Concentrations expressed in pCi/L.

Table 13. Reported concentrations of americium-241 in water samples, first quarter, 2008.

Sample Location	Sample Date	Americium-241	
		Concentration ^{1,2}	± 2SD
Facility			
USGS-123	3/4/2008	0.008 U	0.028

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

² Concentrations expressed in pCi/L.

Table 14. Reported concentrations of neptunium-237 in water samples, first quarter, 2008.

Sample Location	Sample Date	Americium-241	
		Concentration ^{1,2}	± 2SD
Facility			
USGS-123	3/4/2008	0.004 U	0.041

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

² Concentrations expressed in pCi/L.

Table 15. Reported concentrations of strontium-90 in water samples, first quarter, 2008.

Sample Location	Sample Date	Strontium-90	
		Concentration ^{1,2}	± 2SD
Facility			
USGS-123	3/4/2008	0.17 U	0.25

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

² Concentrations expressed in pCi/L.

Table 16. Reported concentrations of technetium-99 in water samples, first quarter, 2008.

Sample Location	Sample Date	Technetium-99	
		Concentration ^{1,2}	± 2 SD
Facility			
USGS-123 (dissolved)	3/4/2008	1.0	0.2

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

² Concentrations expressed in pCi/L.

Table 17. Tritium concentrations for water samples, first quarter, 2008.

Sample Location	Sample Date	Tritium	
		Concentration ^{1,2}	± 2 SD
Facility			
USGS-123	3/4/2008	3910	190
Waste water			
ANL Ind. Waste Ditch	3/18/2008	10 U	80

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

² Concentrations expressed in pCi/L.

Table 18. Enriched tritium concentrations for water samples, first quarter, 2008

Sample Location	Sample Date	Enriched Tritium	
		Concentration ^{1,2}	± 2 SD
Up-gradient			
Mud Lake Water Supply	11/16/2007	-7	7
Site-14	10/11/2007	1	5
Boundary			
Atomic City	11/26/2007	3	4
USGS-014	10/24/2007	7	7
USGS-103	10/2/2007	42	7
USGS-125	10/24/2007	45	9
Distant			
Alpheus Spring	8/8/2007	23	6
Alpheus Spring	11/15/2007	19	6
Bill Jones Hatchery	11/15/2007	5	6
Clear Spring	11/15/2007	8	6
Minidoka Water Supply	8/7/2007	-2	7
Minidoka Water Supply	11/15/2007	4	5
MV-58	11/26/2007	8	6
Shoshone Water Supply	11/15/2007	21	6
Surface water			
Birch Creek	10/30/2007	6	7

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

² Concentrations expressed in pCi/L.

Table 19. Reported metals concentrations in water samples, first quarter, 2008.

Location	Sample Date	Concentration ^{1,2}											
		Arsenic	Barium	Beryllium	Cadmium	Chromium	Iron	Lead	Manganese	Mercury	Selenium	Zinc	
Facility													
USGS-123	3/4/2008	<5 U	51	<1 U	<1 U	27	540	<5 U	14	<0.5 U	<10 U	<5 U	
Waste water													
ANL Ind.													
Waste Ditch	3/18/2008	<5 J	<1 J	<1 J	<1 J	<5 J	<20 J	<5 J	<2 J	<0.5 J	<10 J	<5 J	

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 20. Reported common ion concentrations in water samples first quarter, 2008.

Location	Sample Date	Concentration ^{1,2}											
		Calcium	Magnesium	Sodium	Potassium	Fluoride	Chloride	Sulfate	Silica	Alkalinity ³	TDS ⁴	TSS ⁵	
Facility													
USGS-123	3/4/2008	38	14	10.5	2.9	0.22	22.1	21.6	NR	133	NR	NR	
Waste water													
ANL Ind.													
Waste Ditch	3/18/2008	42 J	13 J	49 J	3.7 J	0.66	72.4	18.2	36	143	319	1	

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

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

³ As CaCO₃.

⁴ =Total Dissolved Solids,

⁵ = Total Suspended Solids

Table 21. Reported nutrient concentrations in water samples, first quarter, 2008.

Location	Sample Date	Concentration ^{1,2}		
		Nitrite + Nitrate	Phosphorus	Total Kjeldahl Nitrogen
Facility				
USGS-123	3/4/2008	1.1	0.047	NR
Waste water				
ANL Ind. Waste Ditch	3/18/2008	2.1	0.484	0.36

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) surveillance and verification monitoring to provide an indication of long-term deposition trends and migration of contaminants in the environment, and to provide independent verification of DOE’s analytical measurement of terrestrial variables.

DEQ-INL monitors long-term radiological conditions in the environment via a combination of soil sampling and in the field detection instrumentation capable of identifying and measuring gamma-emitting radionuclides. Monitoring concentrations of gamma-emitting radionuclides in surface soil provides some insight to deposition, accumulation, and transport of radioactive material in the environment as a result of both INL operations and historical above ground testing of nuclear weapons. No in-situ gamma spectroscopy samples were collected in the first quarter of 2008. Soil analysis results from 4th quarter 2007 are still being assessed and will not be available for this report.

DEQ-INL monitors milk for naturally occurring potassium-40 and man-made iodine-131. DEQ-INL collects milk samples on a monthly basis. Results for analyses of milk samples are presented in **Table 22**. Naturally occurring potassium-40 was detected in all samples within the expected range. Iodine-131 was not detected.

Table 22. Gamma spectroscopy analysis data for milk samples, first quarter, 2008. Concentrations are expressed in pCi/L.

Sample Location/Dairy	Sample Date	Naturally occurring gamma-emitting radionuclide Potassium-40		Man-made gamma-emitting radionuclide Iodine-131
		Concentration	± 2 SD	
Monitoring Samples				
Howe/Nelson-Ricks Creamery	01/07/08	1563	118	<MDC
	02/05/08	1535	117	<MDC
	03/06/08	1333	95	<MDC
Mud Lake/Nelson-Ricks Creamery	01/08/08	1570	119	<MDC
	02/07/08	1445	113	<MDC
	03/08/08	1327	96	<MDC
Gooding/Glanbia	01/01/08	1465	111	<MDC
	02/06/08	1274	93	<MDC
	03/04/08	1504	115	<MDC
Blackfoot	03/12/08	1607	120	<MDC
Verification Samples¹				
Dietrich	03/04/08	1465	113	<MDC
Idaho Falls	03/04/08	1383	108	<MDC
Moreland	01/08/08	1417	110	<MDC
Rupert	02/05/08	1514	114	<MDC
Terreton	01/08/08	1633	121	<MDC
Terreton	02/05/08	1583	119	<MDC

¹ DEQ-INL samples collected by the off-site INL environmental surveillance contractor.

Quality Assurance

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

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

Analytical results for blanks, duplicates, and spikes are used to assess the precision, accuracy, and representativeness of results from analyzing laboratories. During the first quarter of 2008, the DEQ-INL submitted 66 QC samples for various radiological and non-radiological analyses (**Table 23**).

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 2008 are presented in **Table 24**.

Blank sample results for select gamma emitters in air from composited air filters are presented in **Table 25**. Blank sample results for 2007 TSP annual radiochemical composites are presented in **Table 26**. Data for blank analyses used to assess data quality for tritium in water vapor in air are presented in **Table 27**. Blank analyses results for radiological and non-radiological analytes in ground and surface water are presented in **Table 28**, **Table 29**, and **Table 30**.

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

Duplicate Samples

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

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

R₁ = first sample result

R₂ = 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. There were no duplicate samples this quarter. However, there is one duplicate enriched tritium result from fourth quarter, 2007 presented in **Table 31**.

No anomalies were observed from the assessment of the one field duplicate sample as measured by the analytical laboratory used by DEQ-INL.

Spiked Samples

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

During first quarter 2008, no field matrices were spiked to assess the influence of the sample media on laboratory performance. Neither was any laboratory spiked samples created using de-ionized water.

DEQ-INL also prepares additional “spike-like” quality control samples to assess ambient radiation measurement bias. Once per quarter, DEQ-INL irradiates a number of electret ionization chambers (EIC) to verify EIC response. Irradiations of EICs are conducted in a repeatable geometry to a known exposure of 30 mR and two additional exposures, ranging from 15 to 60 mR. EIC responses are compared directly with the exposure received from the NIST traceable cesium-137 source provided by ISU-EML. EIC response is considered acceptable if each measurement agrees within 25 percent of the known irradiated quantity. The irradiation results for first quarter 2008 are presented in **Table 32**. 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, the analysis of blank, and duplicate samples were observed during the first quarter of 2008, which significantly affected data quality. Methodologies and data reports issued by the contracting laboratories generally conformed to the requirements of DEQ-INL during the first quarter of 2008.

Data usability is the measure of data that is not rejected compared to the amount that was expected to be obtained. The overall data usability rate for the first quarter of 2008 met the minimum criteria of the DEQ-INL ESP and is summarized in **Table 23**.

Preventative Maintenance and Equipment Reliability

All equipment was calibrated and checked according to pre-described periodicity. Service reliability for air sampling equipment for the first quarter of 2008 is summarized in **Table 33**. All equipment performed well during this period. One TSP sample at Montevue was invalid due to insufficient collection volume resulting from a pump failure.

Conclusion

All data collected for the first quarter of 2008, have been assigned the applicable qualifiers to designate the appropriate use of the data. In addition, all data has been verified and deemed complete meeting the requirements and data quality objectives established by DEQ-INL.

Table 23. Summary of the analytical performance and usability of the analyses performed for the DEQ-INL ESP for first quarter, 2008.

Media Sampled	Collection Device	Analyte	Test Analyses	Blank Analyses	Duplicate Analyses	Spike Analyses	Data Rejected ¹	Analyzing Lab ²
AIR								
Particulate	4 inch filter	Gross alpha	138	13	0	0	0	ISU-EML
		Gross beta	138	13	0	0	0	ISU-EML
		Gamma emitters	11	1	0	0	0	ISU-EML
		Radiochemical	44	4	0	0	0	ISU Sub
Water Vapor	Desiccant column	Tritium	21	3	0	0	0	ISU-EML
Gaseous	Charcoal filter	Iodine-131	13	0	0	0	0	ISU-EML
Precipitation	Poly bottle	Tritium	6	0	0	0	0	ISU-EML
		Gamma emitters	6	0	0	0	0	ISU-EML
WATER								
Groundwater & Surface Water	Grab or composite	Gross alpha	2	1	0	0	0	ISU-EML
		Gross beta	2	1	0	0	0	ISU-EML
		Gamma emitters	2	1	0	0	0	ISU-EML
		Tritium	2	1	0	0	0	ISU-EML
		Enriched tritium	15	2	1	0	0	ISU-EML
		Technetium-99	1	1	0	0	0	ISU-EML
		Radiochemical	9	9	0	0	0	ISU Sub
		Metals	2	1	0	0	0	IBL
		Common Ions	2	1	0	0	0	IBL
		Nutrients	2	1	0	0	0	IBL
		Volatile Organics	1	0	0	0	0	IBL Sub
TERRESTRIAL								
Milk	Grab or composite	Gamma emitters	16	0	0	0	0	ISU-EML
Soil	<i>in situ</i>	Gamma emitters	0	0	0	0	0	DEQ-INL
	Grab – “puck”	Gamma emitters	0	0	0	0	0	ISU-EML
RADIATION								
Ambient	EICs	Gamma Radiation	56	0	0	12	0	DEQ-INL
	HPICs	Gamma Radiation	11	NA	NA	NA	NA	DEQ-INL
Total Test Analyses			500	53	1	12		
Total of QC Analyses (blanks, duplicates, and spikes)			66					
Percentage of QC analyses of total Test analyses³			13.2%					
Percentage of usable data⁴			100%					

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

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

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

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

Table 24. Blank analysis results for gross alpha and beta in particulate air (TSP) for the first quarter, 2008.

Collection Period		Corrected volume (m ³) ¹	Gross alpha		Gross beta	
Start	Stop		Value	Uncertainty (± 2 SD)	Value	Uncertainty (± 2 SD)
12/27/07	1/3/08	1655	-0.1	0.2	-0.1	0.3
1/3/08	1/10/08	1655	-0.1	0.2	0.0	0.3
1/10/08	1/17/08	1655	-0.3	0.2	-0.4	0.4
1/17/08	1/24/08	1655	0.0	0.2	0.0	0.3
1/24/08	1/31/08	1655	-0.3	0.2	-0.2	0.4
1/31/08	2/7/08	1655	0.0	0.2	-0.1	0.3
2/7/08	2/14/08	1655	-0.2	0.2	-0.2	0.3
2/14/08	2/21/08	1655	-0.2	0.2	-0.2	0.3
2/21/08	2/28/08	1655	0.2	0.3	0.1	0.4
2/28/08	3/6/08	1655	-0.4	0.2	-0.1	0.3
3/6/08	3/13/08	1655	-0.2	0.2	-0.2	0.3
3/13/08	3/20/08	1655	0.1	0.2	0.1	0.3
3/20/08	3/27/08	1655	-0.3	0.2	-0.5	0.3

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

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

Table 25. Blank analysis results for gamma spectroscopy for TSP particulate air filters, for the first quarter, 2008.

Analysis Date	Beryllium-7			Ruthenium-106/ Rhodium-106			Antimony-125		
	Concentration ¹	± 2 SD	MDC	Concentration	± 2 SD	MDC	Concentration	± 2 SD	MDC
4/17/08	7	35	60	36	55	90	1	11	19
Analysis Date	Cesium-134			Cesium-137					
	Concentration ¹	± 2 SD	MDC	Concentration	± 2 SD	MDC			
4/17/08	4	5	8	2	5	9			

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

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

Table 26. Blank analysis results for 2007 annual radiochemical composites of air filters, first quarter, 2008.

Location	⁹⁰ Sr			⁹⁰ Sr re-analyses ²			²³⁸ Pu			²³⁹ Pu/ ²⁴⁰ Pu			²⁴¹ Am		
	Value ¹	2s	MDC	Value ¹	2s	MDC	Value ¹	2s	MDC	Value ¹	2s	MDC	Value ¹	2s	MDC
	Blank	0.30	0.80	1.39	0.62	1.05	1.76	0.03	0.09	0.20	-0.02	0.03	0.20	-0.01	0.03

¹ Values and uncertainties (2s) are expressed in 10⁻⁵ pCi/m³. The 2s uncertainty values are total propagated uncertainty (TPU), which includes counting and other analytical uncertainties. Initial analyses were performed from 3/24/2008 to 3/26/2008.

² Re-analyses for ⁹⁰Sr were performed on 4/3/2008.

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

Sample Number	Start Date	Collect Date	Analysis Date	Tritium		
				Concentration	± 2 SD	MDC
OP081ZTR01	3/6/08	3/7/08	4/9/08	-0.01	0.07	0.13
OP081ZTR02	3/6/08	3/31/08	4/9/08	0.04	0.08	0.13
OP081ZTR03	4/8/08	4/14/08	4/18/08	-0.03	0.08	0.14

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

Table 28. Radiological blank analysis in ground and surface water for samples for the first quarter, 2008. Concentrations are expressed in pCi/L with associated uncertainty (± 2 SD) and minimum detectable concentration (MDC).

Sample Number	Sample Date	Concentration	± 2 SD	MDC	Within Blank Criteria?
Gross Alpha					
081W010	3/18/2008	0.1	0.5	0.9	yes
Gross Beta					
081W010	3/18/2008	0.5	0.9	1.4	yes
Cesium-137					
081W010	3/18/2008	-0.1	1.5	2.6	yes
Tritium					
081W012	3/18/2008	-60	80	130	yes
Enriched Tritium					
071W500	7/26/2007	29	6	9	yes
071W573	10/16/2007	21	7	11	yes
Strontium-90					
081W013	3/18/2008	0.37	0.30	0.62	yes
Technetium-99					
081W011	3/18/2008	0.1	0.2	0.25	yes
Uranium-234					
081W014	3/18/2008	-0.011	0.041	0.105	yes
Uranium-235					
081W014	3/18/2008	0.005	0.048	0.086	yes
Uranium-238					
081W014	3/18/2008	0	0.041	0.083	yes
Plutonium-238					
081W013	3/18/2008	0	0.028	0.020	yes
Plutonium-239/240					
081W013	3/18/2008	0.020	0.028	0.041	yes
Plutonium-241					
081W013	3/18/2008	0.2	4.6	7.7	yes
Americium-241					
081W013	3/18/2008	0.035	0.035	0.041	yes
Neptunium-237					
081W013	3/18/2008	0.011	0.041	0.082	yes

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

Sample Number	Sample Date	Arsenic	Barium	Cadmium	Chromium	Iron	Lead	Manganese	Selenium	Zinc
081W016	3/18/2008	<5	<2	<1	<5	<10	<5	<2	<10	<5

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

Sample Number	Sample Date	Calcium	Magnesium	Sodium	Potassium	Fluoride	Chloride	Sulfate	Total Alkalinity	Total Nitrogen	Total Phosphorus
081W016	3/18/2008	<0.1	<0.1	<0.1	<0.1	<0.1	<1	<1	<1	<0.01	<0.005

Table 31. Duplicate radiological analysis results in pCi/L for ground and surface water, first quarter, 2008.

Analysis/ Sample Location	Original Sample Number	Concentration	±2 SD	Duplicate Sample Number	Concentration	±2 SD	R ₁ -R ₂	$3(s_1^2+s_2^2)^{1/2}$	Within Criteria? ¹
Enriched Tritium									
USGS-125	071W607	45	9	071W634	47	8	2	18	yes

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

Table 32. Electret ionization chamber irradiation results (categorized as spiked samples) for first quarter, 2008.

Electret #	Exposure Received		Net Measured Exposure ¹		%R
	(mR)	Uncertainty (mR)	(mR)	Uncertainty (mR)	
Spike 1	27.6	1.38	28.7	1.33	103.9%
Spike 1	27.6	1.38	28.0	1.37	101.4%
Spike 1	27.6	1.38	30.0	1.33	108.7%
Spike 2	33.1	1.66	34.4	1.28	103.9%
Spike 2	33.1	1.66	36.3	1.33	109.5%
Spike 2	33.1	1.66	35.1	1.28	106.0%
Spike 3	40.2	2.01	40.6	1.31	101.0%
Spike 3	40.2	2.01	41.9	1.35	104.3%
Spike 3	40.2	2.01	42.7	1.31	106.2%
Spike 4	27.6	1.38	23.3	1.25	84.5%
Spike 4	27.6	1.38	29.9	1.31	108.2%
Spike 4	27.6	1.38	29.2	1.31	108.2%

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

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

Table 33. Air sampling field equipment service reliability (percent operational) for first quarter, 2008.

Station Locations	Sample Type ¹			
	TSP	Radioiodine	Atmospheric Moisture	Precipitation
Onsite Locations				
Big Lost River Rest Area	100 %	100 %	100 %	100 %
Experimental Field Station	100 %	100 %	100 %	NC
Sand Dunes Tower	100 %	100 %	100 %	NC
Van Buren Avenue	100 %	100 %	100 %	NC
Boundary Locations				
Atomic City	100 %	100 %	100 %	100 %
Howe	100 %	100 %	100 %	100 %
Monteview	92 %	100 %	100 %	100 %
Mud Lake	100 %	100 %	100 %	100 %
Distant Locations				
Craters of the Moon	100 %	100 %	100 %	NC
Idaho Falls	100 %	100 %	100 %	100 %

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

¹ NC = sample not collected at this location

Appendix A

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

Sample location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	± 2 SD	Concentration	± 2 SD
Rest Area	12/27/07	01/03/08	0.7	0.3	35.7	1.3
	01/03/08	01/10/08	0.6	0.3	28.6	1.2
	01/10/08	01/17/08	0.6	0.3	29.3	1.2
	01/17/08	01/24/08	1.0	0.3	60.4	1.7
	01/24/08	01/31/08	0.2	0.3	23.4	1.1
	01/31/08	02/07/08	0.1	0.2	17.5	1.0
	02/07/08	02/14/08	0.2	0.3	20.9	1.1
	02/14/08	02/21/08	0.6	0.3	46.9	1.5
	02/21/08	02/28/08	0.9	0.3	50.5	1.6
	02/28/08	03/06/08	0.6	0.3	34.8	1.3
	03/06/08	03/13/08	1.4	0.3	66.6	1.8
	03/13/08	03/20/08	0.5	0.2	19.9	1.0
	03/20/08	03/27/08	0.5	0.3	24.5	1.1
Experimental Field Station	12/27/07	01/03/08	0.6	0.3	26.6	1.2
	01/03/08	01/10/08	0.3	0.3	24.1	1.2
	01/10/08	01/17/08	0.2	0.3	21.7	1.1
	01/17/08	01/24/08	0.8	0.3	52.3	1.6
	01/24/08	01/31/08	0.3	0.3	28.6	1.2
	01/31/08	02/07/08	0.1	0.2	9.7	0.8
	02/07/08	02/14/08	0.5	0.3	15.5	0.9
	02/14/08	02/21/08	0.6	0.3	43.0	1.5
	02/21/08	02/28/08	0.7	0.3	40.9	1.5
	02/28/08	03/06/08	0.4	0.3	26.4	1.2
	03/06/08	03/13/08	0.7	0.3	46.5	1.5
	03/13/08	03/20/08	0.5	0.2	15.6	0.9
	03/20/08	03/27/08	0.3	0.3	20.4	1.1

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

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	± 2 SD	Concentration	± 2 SD
Sand Dunes	12/27/07	01/03/08	0.7	0.3	31.1	1.3
	01/03/08	01/10/08	0.4	0.3	27.2	1.2
	01/10/08	01/17/08	0.4	0.3	20.1	1.1
	01/17/08	01/24/08	1.2	0.3	57.0	1.7
	01/24/08	01/31/08	0.7	0.3	43.1	1.5
	01/31/08	02/07/08	0.5	0.3	21.5	1.1
	02/07/08	02/14/08	0.2	0.3	20.9	1.1
	02/14/08	02/21/08	0.5	0.3	54.0	1.6
	02/21/08	02/28/08	0.6	0.3	46.9	1.5
	02/28/08	03/06/08	0.5	0.3	31.6	1.3
	03/06/08	03/13/08	0.8	0.3	58.8	1.7
	03/13/08	03/20/08	0.5	0.2	21.5	1.1
	03/20/08	03/27/08	0.5	0.3	22.5	1.1
Van Buren	12/27/07	01/03/08	0.5	0.2	27.4	1.2
	01/03/08	01/10/08	0.4	0.2	24.0	1.1
	01/10/08	01/17/08	0.2	0.3	20.1	1.0
	01/17/08	01/24/08	1.1	0.3	53.2	1.6
	01/24/08	01/31/08	0.2	0.3	22.8	1.1
	01/31/08	02/07/08	0.4	0.2	15.4	0.9
	02/07/08	02/14/08	0.3	0.3	16.8	0.9
	02/14/08	02/21/08	0.8	0.3	42.4	1.4
	02/21/08	02/28/08	1.0	0.3	43.5	1.4
	02/28/08	03/06/08	0.4	0.3	26.2	1.1
	03/06/08	03/13/08	0.8	0.3	50.0	1.5
	03/13/08	03/20/08	0.5	0.2	16.6	0.9
	03/20/08	03/27/08	0.5	0.3	21.8	1.1
Atomic City	12/27/07	01/03/08	0.3	0.2	20.6	1.0
	01/03/08	01/10/08	1.0	0.3	26.2	1.2
	01/10/08	01/17/08	0.0	0.3	21.3	1.1
	01/17/08	01/24/08	1.1	0.3	59.6	1.7
	01/24/08	01/31/08	0.0	0.2	16.0	0.9
	01/31/08	02/14/08	0.5 ¹	0.2 ¹	18.1 ¹	0.7 ¹
	02/14/08	02/21/08	0.5	0.3	42.6	1.4
	02/21/08	02/28/08	0.7	0.3	47.7	1.5
	02/28/08	03/06/08	0.4	0.3	26.4	1.2
	03/06/08	03/13/08	0.9	0.3	53.4	1.6
	03/13/08	03/20/08	0.5	0.2	15.1	0.9
	03/20/08	03/27/08	0.3	0.3	22.9	1.1

¹ Due to the inability to collect the filters at Atomic City and Craters on 2/7/08, the composite sample collected on 2/14/08 was analyzed and is reported here as an estimate for the two week period.

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

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	± 2 SD	Concentration	± 2 SD
Howe	12/27/07	01/03/08	0.5	0.3	25.9	1.2
	01/03/08	01/10/08	0.1	0.2	20.2	1.0
	01/10/08	01/17/08	0.1	0.3	17.5	1.0
	01/17/08	01/24/08	0.8	0.3	41.5	1.4
	01/24/08	01/31/08	0.3	0.5	41.7	2.0
	01/31/08	02/07/08	0.5	0.3	16.0	0.9
	02/07/08	02/14/08	NS ²	NS ²	NS ²	NS ²
	02/14/08	02/21/08	0.4	0.3	58.6	1.7
	02/21/08	02/28/08	0.5	0.3	37.1	1.4
	02/28/08	03/06/08	0.2	0.3	20.1	1.0
	03/06/08	03/13/08	0.8	0.3	48.8	1.6
	03/13/08	03/20/08	0.4	0.2	18.1	1.0
	03/20/08	03/27/08	0.4	0.3	21.4	1.1
Montevieu	12/27/07	01/03/08	0.7	0.3	23.9	1.1
	01/03/08	01/10/08	0.4	0.3	21.2	1.0
	01/10/08	01/17/08	0.1	0.3	18.1	1.0
	01/17/08	01/24/08	1.2	0.3	46.5	1.5
	01/24/08	01/31/08	4.4	0.6	31.7	1.5
	01/31/08	02/07/08	NS ²	NS ²	NS ²	NS ²
	02/07/08	02/14/08	0.3	0.3	32.1	1.3
	02/14/08	02/21/08	0.7	0.3	49.7	1.6
	02/21/08	02/28/08	0.7	0.3	44.3	1.4
	02/28/08	03/06/08	0.2	0.3	29.9	1.2
	03/06/08	03/13/08	1.3	0.3	51.0	1.5
	03/13/08	03/20/08	0.7	0.2	31.0	1.1
	03/20/08	03/27/08	0.7	0.3	28.2	1.2
Mud Lake	12/27/07	01/03/08	0.7	0.3	32.2	1.3
	01/03/08	01/10/08	0.5	0.3	25.7	1.2
	01/10/08	01/17/08	0.0	0.3	17.9	1.0
	01/17/08	01/24/08	1.0	0.3	51.6	1.6
	01/24/08	01/31/08	0.3	0.3	35.6	1.4
	01/31/08	02/07/08	0.8	0.3	21.0	1.1
	02/07/08	02/14/08	0.3	0.3	27.3	1.2
	02/14/08	02/21/08	0.5	0.3	45.3	1.5
	02/21/08	02/28/08	0.8	0.3	40.7	1.5
	02/28/08	03/06/08	0.3	0.3	28.4	1.2
	03/06/08	03/13/08	1.0	0.3	49.6	1.6
	03/13/08	03/20/08	0.7	0.3	22.3	1.1
	03/20/08	03/27/08	1.0	0.4	21.2	1.3

² Pump ran for insufficient time to collect a valid sample, therefore reported as no sample (NS).

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

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	± 2 SD	Concentration	± 2 SD
Distant Locations						
Craters	12/27/07	01/03/08	0.2	0.2	11.0	0.8
	01/03/08	01/10/08	0.4	0.3	15.5	0.9
	01/10/08	01/17/08	0.0	0.3	10.2	0.8
	01/17/08	01/24/08	0.3	0.2	35.6	1.3
	01/24/08	01/31/08	0.1	0.3	9.9	0.8
	01/31/08	02/14/08	0.2 ¹	0.1 ¹	9.9 ¹	0.5 ¹
	02/14/08	02/21/08	0.3	0.2	24.6	1.1
	02/21/08	02/28/08	0.9	0.3	28.1	1.2
	02/28/08	03/06/08	0.2	0.3	16.7	0.9
	03/06/08	03/13/08	0.7	0.3	29.1	1.2
	03/13/08	03/20/08	0.3	0.2	10.1	0.7
	03/20/08	03/27/08	0.5	0.3	17.5	1.0
	Fort Hall³	12/27/07	01/03/08	0.4	0.2	12.4
01/03/08		01/10/08	0.1	0.2	15.8	0.9
01/10/08		01/17/08	0.3	0.3	11.8	0.8
01/17/08		01/24/08	1.0	0.3	34.9	1.3
01/24/08		01/31/08	0.4	0.3	10.6	0.8
01/31/08		02/07/08	0.2	0.2	7.0	0.6
02/07/08		02/14/08	0.3	0.3	13.2	0.9
02/14/08		02/21/08	1.8	0.4	25.6	1.1
02/21/08		02/28/08	1.4	0.3	28.1	1.2
02/28/08		03/06/08	0.9	0.3	14.9	0.9
03/06/08		03/13/08	2.8	0.5	26.1	1.3
03/13/08		03/20/08	NS ²	NS ²	NS ²	NS ²
03/20/08		03/27/08	0.7	0.3	17.1	1.0
Idaho Falls	12/27/07	01/03/08	0.4	0.2	19.2	1.0
	01/03/08	01/10/08	0.4	0.3	21.7	1.1
	01/10/08	01/17/08	1.7	0.4	21.5	1.1
	01/17/08	01/24/08	1.2	0.3	56.5	1.7
	01/24/08	01/31/08	0.4	0.3	25.7	1.2
	01/31/08	02/07/08	0.3	0.2	11.1	0.8
	02/07/08	02/14/08	0.4	0.3	17.4	1.0
	02/14/08	02/21/08	1.0	0.3	38.9	1.4
	02/21/08	02/28/08	0.5	0.3	39.0	1.4
	02/28/08	03/06/08	0.3	0.3	21.7	1.1
	03/06/08	03/13/08	0.7	0.3	36.7	1.4
	03/13/08	03/20/08	0.5	0.2	14.8	0.9
	03/20/08	03/27/08	0.5	0.3	18.4	1.0

² Pump ran for insufficient time to collect a valid sample, therefore reported as no sample (NS).³ Operated by Shoshone-Bannock Tribes.

Appendix B

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

Sample Location	Net Corrected Exposure ($\mu\text{R/h}$)	± 2 SD ($\mu\text{R/h}$)
Arco	9.35	4.0
Craters	10.3	2.8
Rest Area	11.4	4.5
Van Buren	12.9	2.5
EFS	13.7	2.2
Main Gate	12.7	6.7
Atomic City	11.4	3.1
Taber	9.6	2.6
Blackfoot	11.5	2.6
Ft. Hall	11.4	4.2
Idaho Falls	10.0	2.0
Mud Lake/ Terretton	13.2	0.4
Monteview	13.7	3.4
Sand Dunes	12.6	2.6
Howe	9.8	1.1
Howe Met. Tower	12.6	4.8
MP276 -20	11.1	3.0
MP274 -20	11.4	3.0
MP272 -20	9.4	3.0
MP270 -20	9.2	3.0
MP268 -20	12.6	3.0
MP266 -20	11.9	3.0
MP264 -20	14.8	3.0
MP270 -20/26	13.0	3.0
MP268 -20/26	12.1	3.0
MP266 -20/26	11.0	3.0
MP263 -20/26	10.2	3.0
MP261 -20/26	11.5	3.0
MP259 -20/26	10.4	3.0
MFC (EBR II)	8.8	5.8
EBR I	12.3	0.7
RWMC	12.1	6.4
CFA	14.4	6.8
CITRC (PBF)	13.8	3.2

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

Sample Location	Net Corrected Exposure ($\mu\text{R/h}$)	± 2 SD ($\mu\text{R/h}$)
INTEC (ICPPI)	12.9	1.6
ATR (TRA)	13.4	5.6
NRF	13.1	2.0
TAN	14.9	3.1
Mud Lake Bank of Commerce	15.0	2.4
MP43-33	18.5	6.9
MP41-33	18.2	6.9
MP39-33	12.0	6.9
MP37-33	12.1	6.9
MP35-33	14.3	6.9
MP33-33	18.0	6.9
MP31-33	11.9	6.9
MP29-33	11.6	6.9
MP27-33	11.4	6.9
MP25-33	15.6	6.9
MP23-33	7.7	6.9
Base of Howe	15.3	9.7
Rover	12.9	1.8
Hamer	11.6	0.4
Sugar City	11.9	2.9
Roberts	11.2	7.9
Big Southern Butte	10.2	2.0

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