Department of Environmental Quality
INL Oversight Program

ENVIRONMENTAL SURVEILLANCE PROGRAM
QUARTERLY DATA REPORT

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

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

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Table of Acronyms

aCi/L	-	attocuries per liter
ATR	-	Advanced Test Reactor
BEA	-	Battelle Energy Alliance, LLC
BLR	-	Big Lost River
CERCLA	-	Comprehensive Environmental Response, Compensation and Liability Act
CFA	-	Central Facilities Area
CFR	-	Code of Federal Regulations
CITRC	-	Critical Infrastructure Test Range Complex
DEQ-INL OP	-	The State of Idaho, Department of Environmental Quality, Idaho National Laboratory Oversight Program
DOE	-	U.S. Department of Energy
EBR I & II	-	Experimental Breeder Reactors I & II
EFS	-	Experimental Field Station
EIC	-	electret ionization chamber
EML	-	Environmental Monitoring Laboratory
EPA	-	Environmental Protection Agency
ESER	-	Environmental Surveillance, Education and Research Program
ESP	-	Environmental Surveillance Program
ESRP	-	Eastern Snake River Plain
ESRPA	-	Eastern Snake River Plain Aquifer
Ft bls		feet below land surface
HPIC	-	high-pressure ion chamber
IBL	-	Idaho Bureau of Laboratories
ICPP	-	Idaho Chemical Processing Plant
ICP	-	Idaho Cleanup Project
ISB	-	In-situ bioremediation
IDL	-	instrument detection limit
INL	-	Idaho National Laboratory
INTEC	-	Idaho Nuclear Technology and Engineering Center
ISU	-	Idaho State University
LLD	-	lower limit of detection
LSC	-	liquid scintillation counting
MCL	-	maximum contaminant level
MDA	-	minimum detectable activity
MDC	-	minimum detectable concentration
MFC	-	Materials and Fuels Complex
µg/L	-	micrograms per liter
mg/L	-	milligrams per liter
MP	-	milepost
mrem	-	millirem or 1/1000th of a rem
mR	-	milliRoentgen
mR/hr	-	milliRoentgen per hour
µR/hr	-	microRoentgen per hour
MV	-	Magic Valley
NIST	-	National Institute of Standards and Technology
nCi/L	-	nanocuries per liter
NCRP	-	National Council on Radiation Protection and Measurements
NOAA	-	National Oceanic and Atmospheric Administration
NRF	-	Naval Reactors Facility
PBF	-	Power Burst Facility
pCi/g	-	picocuries per gram
pCi/L	-	picocuries per liter
pCi/m^3	-	picocuries per cubic meter
QAPP	-	Quality Assurance Program Plan
QA/QC	-	Quality Assurance/Quality Control
RCRA	-	Resource Conservation and Recovery Act
RPD	-	relative percent difference
RTC	-	Reactor Technology Complex
RWMC	-	Radioactive Waste Management Complex
SD	-	Sample standard deviation
SMC	-	Specific Manufacturing Capability
SMCL	-	secondary maximum contaminant level
TAN	-	Test Area North
TDS	-	total dissolved solids
TMI	-	Three Mile Island
TRA	-	Test Reactor Area
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 (DEQ-INL OP) conducts an Environmental Surveillance Program (ESP) at locations on the INL, near 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 environmental data and programs. This program also provides the citizens of Idaho with information on current and proposed DOE programs 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. 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 second quarter, 2022 (**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 both high-volume (8x10-inch filter) and low-volume (47-mm filter) total suspended particulate (TSP) air samplers. Many of these air samplers were found to be operating outside of their expected flow rate range in the second quarter, 2022. A calibrated flow rate gauge was taken into the field weekly to measure the sample start and stop flow rates of these samplers. The calibrated flow rate gauge measurements were used for the activity concentration calculations in the suspect measurements and have been footnoted as estimates. Weekly gross alpha and gross beta particulate radioactivity results for 47-mm filters from the low-volume TSP samplers are presented in **Appendix A** and summarized as a range of results in **Table 2**. Results are within the expected historical range.

Composites of 47-mm filters collected from low-volume TSP samplers during a calendar quarter are analyzed using gamma spectrometry. Composites of 8x10-inch filters collected from high-volume TSP samplers during each calendar month are also analyzed using gamma spectrometry. Typically, gamma spectrometry results are only reported when exceeding a minimum detectable concentration (MDC). Gamma spectrometry results for the second quarter of 2022 for 47-mm and 8x10-inch TSP filters are presented in **Tables 3** and **4**. For both filter sizes, the only reported gamma-emitting radionuclide

>MDC was beryllium-7 (Be-7), a naturally occurring, cosmogenic radionuclide. The MDC for cesium-137 (Cs-137) is also reported since Cs-137 is the most likely of the man-made gamma emitting radionuclides to be detected.

Beginning in first quarter 2022, quarterly composites of 8x10-inch filters collected using high-volume TSP samplers are analyzed using radiochemical separation techniques. Results from the quarterly 8x10-inch filter composite analyses are typically presented in the following quarter's report. The samples are analyzed for Strontium-90, Plutonium-238, Plutonium-239/240, and Americium-241. Measurable quantities of these radionuclides are expected in the environment due to historic above ground testing of nuclear weapons, and possibly from INL programs. DEQ-INL OP's action levels of 19 for Americium-241 (Am-241), 190 for Strontium-90 (Sr-90), 21 for Plutonium-238 (Pu-238), and 20 for Plutonium-239/240 (Pu-239/240) (in 1 x 10^{-5} 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.

Radiochemical separation analysis results for 8x10-inch TSP particulate filters collected during first quarter 2022 are presented in **Table 5.** Strontium-90 (Sr-90) results were greater than MDC at all locations except Fort Hall. Greater-than-MDC values range from 0.83 x 10^{-5} pCi/m^3 at Big Lost River Rest Area to 3.95 x 10^{-5} pCi/m^3 at Howe. Plutonium-238 (Pu-238) results were minimally greater than MDC at Atomic City, Fort Hall, and Idaho Falls, ranging from (0.02 to 0.04) x 10^{-5} pCi/m^3. Plutonium-239/240 (Pu-239/240) results were minimally greater than MDC at Sand Dunes, Fort Hall, and Idaho Falls Duplicate, ranging from (0.02 to 0.03) x 10^{-5} pCi/m^3. There are no greater-than-MDC results for Am-241.

Radioactive iodine samples are collected weekly. Samples are collected by drawing air through a canister filled with activated charcoal using a low-volume air pump. The activated charcoal contained in the canister traps the radioiodine by adsorption onto its porous surface. Each week, canisters are collected from all eleven air monitoring stations and analyzed together as a composite using gamma spectrometry (**Table 6**). 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 second quarter of 2022.

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. All results are below MDCs and well below the DEQ-INL OP action level of 150 pCi/m^3 (40 CFR 61). Atmospheric tritium concentrations and their weighted quarterly means are presented in **Table 7**.

Precipitation samples were collected at six monitoring locations during the second quarter of 2022. Precipitation samples were analyzed for tritium and man-made gamma emitting radionuclides. 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. Tritium and man-made gamma emitting radionuclides were below minimum detectable concentration in precipitation collected during the second quarter of 2022. Analysis results for Tritium (H-3) and Cesium-137, the most likely to be detected of man-made gamma emitting radionuclides, are presented in **Table 8**.

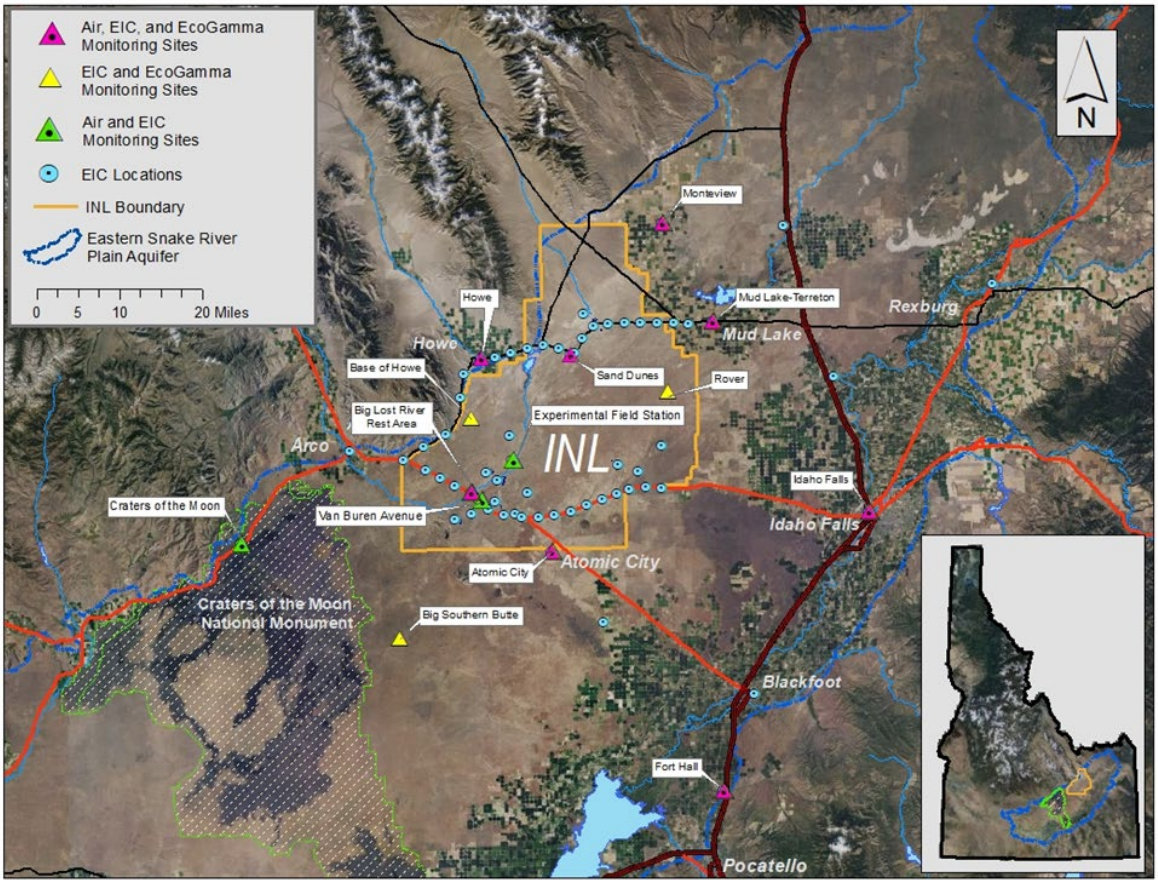

Figure 1. Air and radiation monitoring sites.

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 47-mm TSP filters, second quarter, 2022.

Station Location	Concentration					
	Gross Alpha			Gross Beta		
On-Site Locations						
Big Lost River Rest Area	0.1	-	0.8	8.1	-	25.4
Experimental Field Station	0.1	-	1.5	10.6	-	24.4
Sand Dunes Tower	0.0	-	0.8	7.9	-	24.0
Van Buren Avenue	0.3	-	1.2	12.1	-	23.9
Boundary Locations						
Atomic City	0.1	-	1.0	9.8	-	23.4
Howe	0.2 J[2]	-	1.2	9.1 J[2]	-	25.8 J[2]
Monteview	0.1	-	0.9	8.3	-	21.5
Mud Lake	-0.1	-	1.6	7.2	-	25.2
Distant Locations						
Craters of the Moon	-0.1	-	0.9	11.3	-	22.9
Fort Hall[1]	0.4 J[3]	-	1.5 J[3]	8.2 J[3]	-	23.4 J[3]
Idaho Falls	0.0 J[2]	-	1.0 J[2]	8.8 J[2]	-	22.7

[1]Operated by Shoshone-Bannock Tribes.
[2]Air volume was estimated. Results are J-flagged as estimates.
[3] Improper sampling orientation with the filter not fully exposed to the ambient air. Results are considered (usable) estimates.
Note: Concentrations are expressed in 1 x 10^{-3} pCi/m^3.

Table 3. Gamma spectroscopy analysis data for 47-mm TSP filters, composite samples, second quarter, 2022.

Station Location	Naturally Occurring Radionuclide Beryllium-7			Man-Made Gamma Emitting Radionuclides		
	Concentration	± 2 SD	MDC	Concentration	± 2 SD	MDC[2]
On-site Locations						
Big Lost River Rest Area	96.4	6.1	1.8	0.01	0.06	0.11
Experimental Field Station	114.0	6.8	1.8	0.03	0.07	0.12
Sand Dunes Tower	102.5 J[3]	6.5 J[3]	2.1 J[3]	-0.07 J[3]	0.07 J[3]	0.13 J[3]
Van Buren Avenue	111.7 J[3]	6.7 J[3]	1.8 J[3]	0.03 J[3]	0.08 J[3]	0.14 J[3]
Boundary Locations						
Atomic City	103.8 J[3]	6.5 J[3]	1.7 J[3]	-0.04 J[3]	0.11 J[3]	0.19 J[3]
Howe	85.8 J[3]	5.3 J[3]	1.7 J[3]	0.02 J[3]	0.07 J[3]	0.11 J[3]
Monteview	117.1 J[3]	7.1 J[3]	1.8 J[3]	-0.01 J[3]	0.09 J[3]	0.15 J[3]
Mud Lake	89.4 J[3]	5.5 J[3]	1.7 J[3]	0.05 J[3]	0.07 J[3]	0.12 J[3]
Distant Locations						
Craters of the Moon	105.7	6.7	2.0	0.03	0.09	0.15
Fort Hall[1]	99.0 J[4]	6.3 J[4]	1.8 J[4]	-0.01 J[4]	0.07 J[4]	0.12 J[4]
Idaho Falls	109.4 J[3]	7.0 J[3]	2.3 J[3]	-0.04 J[3]	0.07 J[3]	0.13 J[3]

[1]Operated by Shoshone-Bannock Tribes.
[2]MDC is for Cs-137. No man-made gamma emitting radionuclides were detected.
[3]Air volume was estimated in at least one weekly TSP sample for all locations. Results are J-flagged as estimates.
[4] Improper sampling orientation with the filter not fully exposed to the ambient air. Results are considered (usable) estimates.
Note: Concentrations are reported in 1 x 10^{-3} pCi/m^3 with associated uncertainty (± 2 SD) and minimum detectable concentration (MDC).

Table 4. Gamma spectrometry analysis data for 8x10-inch TSP filters, monthly composite samples, second quarter, 2022.

Station Location	Month[4]	Naturally Occurring Radionuclide Beryllium-7			Man-Made Gamma Emitting Radionuclides		
		Concentration	± 2 SD	MDC	Concentration	± 2 SD	MDC[2]
On-site Locations							
Big Lost River Rest Area	April	155.8	8.8	0.9	0.04	0.04	0.06
	May	147.4	8.3	0.6	0.00	0.03	0.04
	June	121.9	6.9	0.7	0.02	0.03	0.05
Experimental Field Station	April	167.3	9.4	1.1	0.01	0.04	0.06
	May	143.3	8.2	0.8	0.00	0.03	0.06
	June	132.6	7.5	0.6	0.04	0.03	0.05
Sand Dunes Tower	April	149.3	8.6	0.8	-0.01	0.05	0.08
	May	142.9	8.2	0.7	0.01	0.03	0.05
	June	121.8	6.9	0.7	0.01	0.04	0.06
Van Buren Avenue	April	137.4	7.8	0.8	0.02	0.03	0.05
	May	125.1	7.2	0.6	0.01	0.03	0.05
	June	145.8	8.3	0.9	0.04[5]	0.03	0.04[5]
Boundary Locations							
Atomic City	April	171.8	9.6	0.8	0.00	0.03	0.06
	May	173.9	9.8	0.7	0.03	0.04	0.06
	June	149.2	8.4	0.7	0.01	0.02	0.04
Howe	April	164.0	9.3	1.2	-0.03	0.06	0.09
	May	135.4	7.8	0.9	0.00	0.03	0.05
	June	107.6	6.2	0.6	0.03	0.03	0.06
Monteview	April	180.5	10.2	0.9	0.01	0.03	0.05
	May	165.1	9.3	0.7	0.03	0.04	0.06
	June	117.9	6.7	0.6	-0.01	0.04	0.06
Mud Lake	April	174.6	9.8	0.9	0.01	0.04	0.07
	May	155.2	8.8	0.6	0.04	0.03	0.06
	June	115.5	6.6	0.9	0.01	0.03	0.04
Distant Locations							
Craters of the Moon	April	170.1	9.6	0.9	-0.01	0.03	0.05
	May	170.2	9.6	0.7	0.00	0.03	0.05
	June	124.1	7.1	0.8	0.04	0.03	0.05
Fort Hall[1]	April	130.4	7.4	0.9	0.03	0.03	0.05
	May	107.2	6.2	0.7	0.02	0.03	0.05
	June	124.9	7.1	0.6	0.01	0.04	0.04
Idaho Falls	April	158.0	8.9	1.1	-0.02	0.03	0.05
	May	155.8	8.8	0.7	0.02	0.03	0.05
	June	145.2	8.2	0.7	0.00	0.02	0.03
Idaho Falls Duplicate[3]	April	166.2	9.4	0.9	-0.01	0.04	0.07
	May	157.6	8.9	0.7	0.03	0.03	0.05
	June	126.7	7.3	1.0	0.01	0.03	0.05

[1]Operated by Shoshone-Bannock Tribes.
[2]MDC is for Cs-137. No man-made gamma emitting radionuclides were detected.
[3] A duplicate 8x10-inch filter TSP sampler is currently being operated at the Idaho Falls location.
[4] Four filters /composite for April and May. Five filters/composite for June.
[5] Values are rounded. Unrounded concentration is less than unrounded MDC.
Note: Concentrations are reported in 1 x 10^{-3} pCi/m^3 with associated uncertainty (± 2 SD) and minimum detectable concentration (MDC).

Table 5. Radiochemical separation analysis results for 8x10-inch TSP particulate filter composites collected during first quarter 2022.

Station Location	^{90}Sr			^{238}Pu			$^{239/240}Pu$			^{241}Am		
	Value[1]	±2SD	MDC	Value[1]	± 2SD	MDC	Value[1]	±2SD	MDC	Value[1]	±2SD	MDC
On-Site Locations												
BLR[4] Rest Area	0.83	0.33	0.47	0.00	0.01	0.02	0.00	0.01	0.02	0.00	0.02	0.04
EFS[3]	2.62	0.72	0.57	0.02	0.02	0.03	0.02	0.02	0.03	0.00	0.02	0.05
Sand Dunes	1.31	0.42	0.47	-0.01	0.01	0.03	0.02	0.01	0.01	-0.02	0.02	0.05
Van Buren	3.82	0.94	0.41	0.01	0.01	0.01	0.02	0.02	0.02	-0.01	0.01	0.04
Boundary Locations												
Atomic City	3.43	0.87	0.48	0.03	0.02	0.02	0.02	0.01	0.02	0.00	0.02	0.04
Howe	3.95	1.05	0.74	0.01	0.02	0.03	0.02	0.02	0.03	0.01	0.03	0.05
Monteview	2.19	0.58	0.41	0.01	0.01	0.01	0.01	0.02	0.03	0.00	0.02	0.04
Mud Lake	1.70	0.53	0.56	0.02	0.02	0.03	-0.01	0.02	0.04	0.01	0.02	0.05
Distant Locations												
Craters of the Moon	0.82	0.35	0.51	0.02	0.02	0.02	0.02	0.02	0.02	0.00	0.02	0.04
Fort Hall[2]	0.21	0.53	0.97	0.04	0.03	0.02	0.03	0.03	0.02	0.04	0.06	0.09
Idaho Falls	1.24	0.40	0.46	0.02	0.02	0.01	0.01	0.02	0.02	0.00	0.02	0.05
Idaho Falls Dup[5]	1.92	0.70	0.95	0.01	0.03	0.01	0.03	0.03	0.01	-0.01	0.04	0.09

Note: Concentrations are reported in 1 x 10^{-5} pCi/m^3 with associated uncertainty (± 2 SD), minimum detectable concentration (MDC), and correspond to filter composites collected during the calendar quarter.

[1] Measurable quantities of these radionuclides are expected in the environment due to historic above-ground testing of nuclear weapons, and possibly from INL programs. DEQ-INL OP's action levels of 19 for americium-241, 190 for strontium-90, 21 for plutonium-238, and 20 for plutonium-239/240 (in 1 x 10^{-5} 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] EFS - Experimental Field Station.

[4] BLR – Big Lost River.

[5] Dup – Duplicate TSP sampler being run at the Idaho Falls location.

Table 6. Iodine-131 activity in weekly charcoal filter composites, second quarter, 2022.

Start Date	Collection Date	Iodine-131 activity (pCi/composite)		
		Activity	± 2 SD	MDA[1]
03/30/22	04/06/22	0.11	1.09	1.87
04/06/22	04/13/22	1.04	1.74	2.89
04/13/22	04/20/22	-0.36	1.49	2.56
04/20/22	04/27/22	0.27	1.63	2.76
04/27/22	05/04/22	0.06	1.28	2.18
05/04/22	05/11/22	-0.10	1.19	2.06
05/11/22	05/18/22	0.41	1.84	3.11
05/18/22	05/25/22	-0.08	1.48	2.55
05/25/22	06/01/22	1.06	1.84	3.06
06/01/22	06/08/22	-0.59	1.56	2.72
06/08/22	06/15/22	0.54	1.15	1.94
06/15/22	06/22/22	0.57	1.43	2.40
06/22/22	06/29/22	0.00	1.40	2.41

[1] The minimum detectable activity (MDA) is established for the least efficient counting position in the eleven-cartridge composite. Based on a typical 20,000 ft^3 (566 m^3) air volume per cartridge, the highest I-131 MDA of 3.11 pCi/composite is equivalent to a maximum MDC of 5 x10^{-4} pCi/m^3.

Table 7. Tritium concentrations in air from atmospheric moisture, second quarter, 2022.

Station Location	Start Date	Collection Date	Tritium		
			Concentration	± 2 SD	MDC
On-site Locations					
Big Lost River Rest Area	03/30/22	05/04/22	0.48	0.34	0.51
Big Lost River Rest Area	05/04/22	06/08/22	-0.18	0.41	0.78
Big Lost River Rest Area	06/08/22	06/29/22	0.10	0.47	0.78
Big Lost River Rest Area Mean	**03/30/22**	**06/29/22**	**0.13**	**0.40**	**0.68**
Experimental Field Station	03/30/22	05/04/22	0.43	0.33	0.50
Experimental Field Station	05/04/22	06/08/22	0.46	0.46	0.74
Experimental Field Station	06/08/22	06/29/22	0.67	0.56	0.95
Experimental Field Station Mean	**03/30/22**	**06/29/22**	**0.50**	**0.43**	**0.69**
Sand Dunes Tower	03/30/22	05/04/22	0.00	0.32	0.55
Sand Dunes Tower	05/04/22	06/01/22	0.49	0.44	0.71
Sand Dunes Tower	06/01/22	06/29/22	-0.05	0.53	0.90
Sand Dunes Tower Mean	**03/30/22**	**06/29/22**	**0.14**	**0.42**	**0.71**
Van Buren Avenue	03/30/22	05/04/22	0.20	0.31	0.51
Van Buren Avenue	05/04/22	06/08/22	0.31	0.44	0.70
Van Buren Avenue	06/08/22	06/29/22	-0.15	0.46	0.76
Van Buren Avenue Mean	**03/30/22**	**06/29/22**	**0.16**	**0.40**	**0.65**
Boundary Locations					
Atomic City	03/30/22	05/04/22	0.00	0.31	0.54
Atomic City	05/04/22	06/08/22	-0.23	0.42	0.74
Atomic City	06/08/22	06/29/22	0.32	0.48	0.79
Atomic City Mean	**03/30/22**	**06/29/22**	**-0.02**	**0.39**	**0.68**
Howe	03/30/22	05/04/22	0.53	0.35	0.53
Howe	05/04/22	06/01/22	0.28	0.47	0.75
Howe	06/01/22	06/29/22	0.12	0.56	0.93
Howe Mean	**03/30/22**	**06/29/22**	**0.32**	**0.46**	**0.73**
Mud Lake	03/30/22	05/04/22	0.32	0.36	0.57
Mud Lake	05/04/22	06/01/22	0.42	0.52	0.84
Mud Lake	06/01/22	06/29/22	0.36	0.54	0.89
Mud Lake Mean	**03/30/22**	**06/29/22**	**0.36**	**0.47**	**0.76**
Monteview	03/30/22	05/04/22	0.29	0.36	0.58
Monteview	05/04/22	06/01/22	0.66	0.51	0.81
Monteview	06/01/22	06/29/22	0.13	0.60	1.06
Monteview Mean	**03/30/22**	**06/29/22**	**0.36**	**0.48**	**0.80**
Distant Locations					
Craters of the Moon	03/30/22	05/04/22	0.27	0.27	0.46
Craters of the Moon	05/04/22	06/01/22	0.26	0.43	0.68
Craters of the Moon	06/01/22	06/29/22	-0.04	0.37	0.62
Craters of the Moon Mean	**03/30/22**	**06/29/22**	**0.16**	**0.35**	**0.58**
Fort Hall[1]	03/30/22	05/04/22	0.12	0.41	0.66
Fort Hall	05/04/22	06/08/22	0.06	0.57	0.90
Fort Hall	06/08/22	06/29/22	0.20	0.60	1.00
Fort Hall Mean	**03/30/22**	**06/29/22**	**0.11**	**0.51**	**0.82**

Idaho Falls	03/30/22	05/04/22	0.04	0.37	0.60
Idaho Falls	05/04/22	06/01/22	0.10	0.49	0.83
Idaho Falls	06/01/22	06/29/22	0.57	0.57	0.91
Idaho Falls Mean	**03/30/22**	**06/29/22**	**0.22**	**0.47**	**0.77**

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

Table 8. Tritium and gamma-emitting radionuclide concentrations from precipitation, second quarter, 2022.

Station Location	Start Date	Stop Date	Tritium			Cs-137		
			Concentration	± 2 SD	MDC	Concentration	± 2 SD	MDC
On-site Locations								
Big Lost River Rest Area	03/30/22	05/18/22	80	100	170	1.0	1.1	1.9
Big Lost River Rest Area	05/18/22	06/15/22	20	90	160	1.0	1.8	2.9
Big Lost River Rest Area	06/15/22	06/29/22	NS[1]	NS	NS	NS[1]	NS	NS
Big Lost River Rest Area Mean	**03/30/22**	**06/29/22**	**39**	**93**	**163**	**1.0**	**1.6**	**2.6**
Boundary Locations								
Atomic City	03/30/22	05/25/22	10	90	160	0.4	1.2	2.1
Atomic City	05/25/22	06/15/22	60	90	160	0.1	1.4	2.4
Atomic City	06/15/22	06/29/22	110	90	150	15.0[2]	46.1[2]	78.1[2]
Atomic City Mean	**03/30/22**	**06/29/22**	**39**	**90**	**160**	**0.3**	**1.4**	**2.5**
Howe	03/30/22	05/18/22	40	100	170	-0.3	1.0	1.8
Howe	05/18/22	06/14/22	-20	90	160	0.5	1.5	2.5
Howe	06/14/22	06/29/22	90	90	150	3.2[3]	7.5[3]	12.8[3]
Howe Mean	**03/30/22**	**06/29/22**	**-3**	**93**	**163**	**0.3**	**1.4**	**2.4**
Mud Lake	03/30/22	05/18/22	-10	90	150	0.5	1.1	1.9
Mud Lake	05/18/22	06/14/22	50	90	160	0.9	1.0	1.6
Mud Lake	06/14/22	06/29/22	NS[1]	NS	NS	NS[1]	NS	NS
Mud Lake Mean	**03/30/22**	**06/29/22**	**30**	**90**	**157**	**0.8**	**1.0**	**1.7**
Monteview	03/30/22	06/14/22	10	90	160	-0.1	1.1	2.0
Monteview	06/14/22	06/29/22	NS[1]	NS	NS	NS[1]	NS	NS
Monteview Mean	**03/30/22**	**06/29/22**	**10**	**90**	**160**	**-0.1**	**1.1**	**2.0**
Distant Locations								
Idaho Falls	03/30/22	05/10/22	60	90	150	1.2	1.0	1.6
Idaho Falls	05/10/22	06/14/22	10	90	160	0.9	1.2	1.9
Idaho Falls	06/14/22	06/29/22	NS[1]	NS	NS	NS[1]	NS	NS
Idaho Falls Mean	**03/30/22**	**06/29/22**	**37**	**90**	**155**	**1.1**	**1.1**	**1.7**

Note: Concentrations are reported in pCi/L with associated uncertainty (± 2 SD) and minimum detectable concentration (MDC).
[1] NS – No sample. No measurable precipitation was collected by the sampler for this time period.
[2] The 22 ml sample volume was insufficient volume for standard analysis. The sample was diluted to 250 ml and counted in a 250 ml Marinelli beaker. This resulted in high uncertainty (± 2 SD) and MDC, and apparent high Cs-137 concentration.
[3] The 97 ml sample volume was insufficient volume for standard analysis. The sample was diluted to 250 ml and counted in a 250 ml Marinelli beaker. This resulted in high uncertainty (± 2 SD) and MDC, and apparent high Cs-137 concentration.

Environmental Radiation Monitoring Results

The ESP operated 13 environmental radiation stations during the second quarter of 2022 (**Figure 1**). To detect gamma radiation, each station is instrumented with triplicate electret ionization chambers (EIC), and 10 of the stations also are equipped with an EcoGamma gamma radiation monitor with low and high range Geiger–Müller detectors. (**Table 9**).

The Shoshone-Bannock Tribes operate an air monitoring station at Fort Hall which is also equipped with EICs and an EcoGamma, both of which are owned and operated by the DEQ-INL OP. The DEQ-INL OP reports these results as a distant site.

EcoGammas 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 EcoGammas at each location are transmitted to DEQ-INL OP and presented graphically via the worldwide web at https://www.deq.idaho.gov/idaho-national-laboratory-oversight/inl-oversight-program/gamma-radiation-measurements. Historically, DEQ-INL OP has used high-pressure ion chambers (HPIC) for real-time gamma radiation measurements. We completed a change-over of removing the old HPICs and replacing them with EcoGammas at each of our monitoring stations in first quarter 2022. Slight differences between EcoGamma data and historical HPIC data are expected.

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 67 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 EcoGammas for second quarter 2022. **Table 11** lists the EIC monitoring results for second quarter 2022. 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	
	EcoGamma	EIC
On-site Locations		
Base of Howe	■	■
Big Lost River Rest Area	■	■
Experimental Field Station		■
Rover	■	■
Sand Dunes Tower	■	■
Van Buren Avenue		■
Boundary Locations		
Atomic City	■	■
Big Southern Butte	■	■
Howe Met Tower	■	■
Monteview	■	■
Mud Lake/Terreton	■	■
Distant Locations		
Craters of the Moon		■
Fort Hall	■	■
Idaho Falls	■	■

Table 10. Average gamma exposure rates, second quarter, 2022, from EcoGamma network.

Station Location	Exposure Rate (µR/hr)	
	Quarterly Average*	± 2 SD
On-site Locations		
Base of Howe	18.9	1.6
Big Lost River Rest Area	15.9	1.4
Rover	17.0	1.3
Sand Dunes Tower	16.0	1.3
Boundary Locations		
Atomic City	15.8	1.3
Big Southern Butte	19.6	1.7
Howe Met Tower	15.2	1.4
Monteview	13.6	1.2
Mud Lake / Terreton	15.0	1.3
Distant Locations		
Fort Hall	14.3	1.3
Idaho Falls	16.2	1.4

*The EcoGammas are sensitive electronic devices that can experience intermittent malfunctions and/or interference; this typically results in characteristic positive and/or negative data spikes. These aberrations are removed from the data set based on the judgement of the data analyst.

Table 11. Electret ionization chamber (EIC) cumulative average exposure rates, second quarter, 2022.

Station Location	Exposure Rate (µR/hr)	
	Quarterly Average[1]	± 2 SD
On-Site Locations		
Base of Howe	12.2	1.9
Big Lost River Rest Area	14.0	0.3
Experimental Field Station	19.5	1.7
Rover	14.4, 15.0	-
Sand Dunes Tower	13.7	1.6
Van Buren Avenue	15.9	3.4
Boundary Locations		
Atomic City	10.1, 14.1	-
Big Southern Butte	15.0	4.7
Howe Met Tower	NS[2]	NS[2]
Monteview	15.2	3.4
Mud Lake/Terreton	14.6	4.3
Distant Locations		
Craters of the Moon	15.1	2.6
Fort Hall	12.7	5.1
Idaho Falls	12.3	2.7

[1] Results are the average of triplicate exposure rate measurements with the associated sample variability (±2 SD), or the 2 measured exposure rates remaining after removal of an outlying value. One of the triplicate measurements is rejected if it is outside the average of the triplicate measurements ±2 SD of the historical population variability. Typically, the two most consistent measurements are reported, based on judgment of the data analyst.

[2] NS – No sample. Can holding the electrets was breached with condensed water inside.

Water Monitoring Results

DEQ-INL OP collects groundwater samples from wells and springs located within, upgradient of, and downgradient of the INL to evaluate the effects of INL contaminants on water quality in the eastern Snake River Plain (ESRP) aquifer and verify the results of DOE and USGS monitoring. Each year, DEQ-INL OP samples approximately 85-90 locations concurrently with a DOE contractor or the USGS and 15-20 locations independently. Co-sampled locations are primarily on or near the INL Site and are usually sampled during the second and fourth calendar quarters. DEQ-INL OP publishes a comparison of its own analytical results with those obtained by co-samplers in the DEQ-INL Oversight Program Annual Report. Locations sampled independently by DEQ-INL OP are mostly in the Magic Valley and are typically sampled during the third calendar quarter.

Most water samples are collected from wells drilled into the aquifer or springs formed by the intersection of the aquifer water table with the surface. Each aquifer well or spring is categorized as upgradient, facility, boundary, or distant based on its location (**Figure 2** and **Figure 3**):

- *Upgradient* sites are situated north or northeast of INL facilities in areas that have not been affected by INL operations. They are used to monitor background concentrations in the aquifer.

- *Facility* sites are located near facility complexes within the INL, including the Advanced Test Reactor complex (ATR), the Central Facilities Area (CFA), the Idaho Nuclear Technology and Engineering Center (INTEC), the Materials and Fuels Complex (MFC), the Naval Reactors Facility (NRF), the Radioactive Waste Management Complex (RWMC), and Test Area North

(TAN). Facility sites are located within or immediately downgradient of known areas of contamination and are sampled to monitor the concentrations and migration of specific contaminants.

- *Boundary* sites are located near the southern boundary of the INL, downgradient of potential sources of INL contamination. These include several wells equipped with Westbay Multilevel Groundwater Monitoring Systems ("Westbay wells"), which offer a look at the vertical distribution of constituents in the aquifer.

- *Distant* sites are located farther downgradient of the INL, primarily in the Magic Valley, and include wells and springs used for agricultural, municipal, domestic, and industrial purposes.

A small number of samples are also collected each year from streams, waste-pond effluent, and wells drilled into perched groundwater (groundwater that sits above the aquifer).

Samples collected from water-monitoring sites are analyzed for radiological and non-radiological constituents, many of which are present in the aquifer both naturally and as a result of INL operations. All locations are sampled for gross alpha and gross beta radioactivity, manmade gamma-emitting nuclides, tritium, chloride, sulfate, chromium, and nitrate-plus-nitrite.[1] Samples from locations at which tritium concentrations are too low to be detected by the standard method are re-analyzed for tritium using an electrolytic enrichment method (referred to as the low-level method), which has a minimum detectable concentration (MDC) about ten times lower than the standard method. Selected sites are also sampled for specific radionuclides—including uranium isotopes (^{234}U, ^{235}U, and ^{238}U), plutonium isotopes (^{238}Pu, $^{239/240}$Pu), americium-241 (^{241}Am), strontium-90 (^{90}Sr), iodine-129 (^{129}I) and technetium-99 (^{99}Tc)—selected trace metals, common ions, total phosphorous, and/or volatile organic compounds (VOCs) based on past and present INL operations or a history of elevated concentrations. If unexpected levels of radioactivity are detected in gross measurements, additional samples will be collected and analyzed for specific radionuclides.

During the second quarter of 2021, DEQ-INL OP sampled groundwater from the aquifer at 27 facility locations, 15 boundary locations, 5 distant locations, and 5 upgradient locations. DEQ-INL OP also sampled water from 4 perched well water locations. **Table 12** lists the sample date, co-sampler, well depth, and analyses requested for the locations sampled this quarter. Analytical results are reported in **Tables 14 through 24** and summarized below. The results of low-level tritium analyses for 17 samples collected in 2022 are reported in **Table 16** and discussed below.

Table 13 shows the range of background concentrations for each constituent in the ESRP aquifer and the EPA drinking water maximum contaminant level (MCL) or secondary maximum contaminant level (SMCL). Background concentrations depend on local geology, and the concentrations of constituents at sites not influenced by INL activities may on occasion be higher than the given background ranges due to local factors and natural variability.

Gross alpha and gross beta radioactivity

Gross alpha and gross beta analyses are used to screen for unexpectedly high levels of radioactivity in samples. DEQ-INL OP has determined from past sampling that background concentration ranges for gross alpha and gross beta radioactivity in the ESRP aquifer are approximately 0-5.6 pCi/L and 0-8.6

[1] Distant locations Alpheus Spring, Bill Jones Hatchery, Clear Spring, Minidoka Water Supply, and Shoshone Water Supply and upgradient location Mud Lake Water Supply are sampled for gross alpha and gross beta radioactivity, gamma-emitting radionuclides, and tritium during the second quarter. In the fourth quarter, common ions, metals, nitrate-plus-nitrate, and other constituents are collected along with gross alpha and gross beta radioactivity, gamma-emitting radionuclides, and tritium.

pCi/L, respectively. Occasional measurements of concentrations above these background ranges in uncontaminated samples are statistically probable due to uncertainties inherent in measuring low levels of radioactivity. Additionally, some samples will have levels of radioactivity slightly higher than background ranges due to higher-than-average concentrations of naturally occurring uranium, thorium, or potassium-40.

Gross alpha and beta radioactivity were detected at low levels in most samples (**Table 14**). Gross alpha radioactivity was measured at concentrations within the known background range at most locations, except for USGS-092, TAN-28, and TAN-29. USGS-092 is a perched well located at the RWMC facility that was added to the sampling schedule last year. Water levels in this well were very low and because the well must be manually bailed, an abundance of sediment was present in the samples. This may produce higher MDCs in the samples. Gross alpha concentration above background and MCL was detected at 56.9 ± 17 pCi/L (MDC = 17.3 pCi/L), whereas in 2021, the results were 5.3 ± 2.7 pCi/L (MDC = 3.7 pCi/L). Consistent with historical data, TAN-28 (7.6 ± 2.1 pCi/L, MDC = 2.2 pCi/L) and TAN-29 (6.1 ± 2.1 pCi/L, MCD = 1.3 pCi/L) displayed elevated above background levels of alpha radioactivity.

Elevated gross beta results were measured at TAN, RWMC, and ATR with a maximum of 1593 ± 51 pCi/L (MDC = 34 pCi/L) at TAN-2336. This result is similar to the Quarter 1, 2022 result of 1602 ± 49 pCi/L (MDC = 32). ATR perched water well USGS-055 had an elevated gross beta concentration of 58.0 ± 1.9 pCi/L (MDC = 1.3 pCi/L). USGS-092 also had an elevated gross beta concentration that measured 54.8 ± 17.3 pCi/L (MDC = 25.7 pCi/L), whereas in 2021, the results were 20.2 ± 2.3 pCi/L (MDC = 2.9 pCi/L). Due to the high gross alpha and beta results for USGS-092, it was requested that the lab re-analyze this sample. These results will be provided in a future quarterly report. All other results are consistent with previous data.

Manmade gamma-emitting radionuclides

TAN-2336 was the only location where cesium-137 (^{137}Cs) was detected. Results were 4.9 ± 1.8 pCi/L (MDC = 2.6 pCi/L). No manmade gamma-emitting radionuclides were detected at other locations sampled this quarter. Results for cesium-137 (^{137}Cs), the manmade gamma-emitter most likely to be detected in groundwater, are reported in **Table 14**.

Tritium

Tritium was analyzed for all locations sampled this quarter (**Table 15**). Using the standard analytical method, which typically has an MDC of 110 to 190 pCi/L, tritium was detected at 13 facility wells, five boundary wells, and one perched water well. The detected tritium concentrations at the facility wells ranged from 303 ± 110 pCi/L (MDC = 160 pCi/L) at TAN-2271, down from to 400 ± 100 pCi/L (MDC = 150 pCi/L) in 2021 to 1906 ± 170 pCi/L (MDC = 160 pCi/L) at CFA 1, down from 2260 ± 170 pCi/L (MDC = 150) in 2021. Tritium concentrations detected in the boundary wells ranged from 157 ± 100 pCi/L (MDC = 150 pCi/L) at USGS-137A to 706 ± 140 pCi/L (MDC = 170 pCi/L) at USGS-131A (812 ft bgs). ATR perched water well (USGS-055) had a detection of 1494 ± 150 pCi/L (MDC = 160 pCi/L).

Samples from 15 aquifer and two perched water well locations requiring low-level tritium analysis were analyzed this quarter and the results are reported in **Table 16**. Twelve samples were from facility wells, three were from boundary wells, and two were from upgradient wells. All concentrations from upgradient sites were within the background range (0-33 pCi/L). Concentrations were detected at ten facility locations, ranging from 13 ± 7 pCi/L (MDC = 11 pCi/L) at NRF-09 to 58 ± 10 pCi/L (MDC = 12 pCi/L) at A11A31, two perched water locations with 55 ± 10 pCi/L (MDC = 12 pCi/L) at USGS-068 and 19 ± 8 pCi/L (MDC = 12 pCi/L) at USGS-062, and two boundary locations, ranging from 43 ± 9

pCi/L (MDC = 12 pCi/L) at USGS-124 to 126 ± 12 pCi/L (MDC = 11 pCi/L) at USGS-103 (1258 ft bgs). A backlog of 11 samples to be analyzed for low-level tritium, remains.

All tritium concentrations were consistent with historical data, were measured in areas of known contamination related to INL waste disposal practices, and were all well below the drinking water MCL of 20,000 pCi/L.

Strontium-90

Fourteen aquifer locations and three perched groundwater locations were sampled for ^{90}Sr this quarter (**Table 17**). Detectable concentrations were found in five aquifer samples at TAN and CFA, with a maximum concentration of 620 ± 150 pCi/L (MDC = 0) at TAN-2336. Detectable concentrations were also found in three ATR perched groundwater samples, with a maximum of 21.1 ± 5.0 (MDC = 0.3 pCi/L) at USGS-055. ATR perched well USGS-068 at 1.51 ± 0.41 pCi/L (MDC = 0.34 pCi/L) saw a decrease from 6.7 ± 1.6 pCi/L (MDC = 0.4 pCi/L) in 2021. Five locations had ^{90}Sr concentrations that exceeded the MCL of 8 pCi/L. All elevated concentrations were measured in samples from areas of known contamination and are consistent with historical trends.

Technetium-99

Eight aquifer facility locations at RWMC, INTEC, TAN, CFA, two boundary locations (USGS-131A, 812 ft bgs and USGS-131A, 616 ft bgs) and one upgradient location (USGS-027) were sampled for ^{99}Tc (**Table 18**). All samples for ^{99}Tc were non-detections and consistent with historical data and trends.

Plutonium Isotopes

TAN-47 was sampled for plutonium isotopes (^{238}Pu and $^{239/240}Pu$) this quarter (**Table 19**). These samples had no detectable concentrations for ^{238}Pu and $^{239/240}Pu$.

Uranium Isotopes

Five TAN facility wells were sampled for uranium isotopes this quarter (**Table 20**). All locations yielded detectable results for ^{234}U. The highest concentrations were from TAN-28 at 9.0 ± 1.7 pCi/L (MDC = 0.1 pCi/L) and from TAN-29 at 4.6 ± 0.8 pCi/L (MDC = 0.07 pCi/L). TAN-28 concentration levels in 2021 were 1.95 ± 0.44 pCi/L (MDC = 0.09 pCi/L); however, in 2019, they were 8.8 ± 1.5 pCi/L (MDC = 0.1 pCi/L). There were three detections of ^{235}U with a maximum of 0.36 ± 0.17 pCi/L (MDC = 0.04) at TAN-28. All five locations had detections for ^{238}U. The maximum concentration for ^{238}U was 1.34 ± 0.35 pCi/L (MDC = 0.09 pCi/L) at TAN-28. The elevated $^{234}U/^{238}U$ activity ratios at TAN-28 and TAN-29 are greater than naturally occurring $^{234}U/^{238}U$ ratios of about 1.5-3.1, and therefore indicate an anthropogenic source. All detections were consistent with historical data and trends.

Common ions, trace metals, and nutrients

Select locations were sampled for common ions (calcium, magnesium, sodium, potassium, chloride, sulfate, and alkalinity), trace metals, (arsenic, barium, chromium, iron, lead, manganese, and selenium) and dissolved nutrients (nitrate-plus-nitrite, phosphorous) (**Tables 21, 22, and 23**).

Levels of barium, iron, manganese, sodium, chloride, alkalinity, potassium, and phosphorous in samples from TAN were elevated above background due to in-situ bioremediation (ISB) conditions, with TAN-2336 measuring the highest concentrations. Chloride was measured at 372 mg/L at NRF-06, exceeding the EPA's secondary MCL of 250 mg/L, however, this elevated concentration is consistent with

historical data. TAN-28, TAN-29, TAN-2271 and TAN-2336 exceeded background levels of chloride, with the highest at TAN-2336 (162 mg/L). Two perched water wells had elevated above background levels of chloride: USGS-068 at 129 mg/L and USGS-092 at 104 mg/L.

TAN-2336 had the highest chromium value this quarter, at 440 µg/L. This co-sampled value is consistent with the contractor's value of 434 µg/L. The elevated result, up from 130 µg/L in Quarter 1, 2022, is likely due to a greater number of bioremediation injections that occurred between January and April 2022, than prior to January 2022. The highest chromium value for perched water wells was 54 µg/L at USGS-068 located at ATR. Another ATR well, USGS-062, measured at 29 µg/L. This is not consistent with historical data, where the range has been between 6.8 µg/L to 11 µg/L. A re-analysis was requested of the lab, producing the same result of 29 µg/L. UGSS-062 is scheduled to be sampled again in the Spring of 2023 and the results will be reviewed carefully. RWMC well M15S has been experiencing slight increases in chromium values since 2019. This quarter, M15S measured a chromium value of 59 µg/L, which is an increase from 48 µg/L in 2021. Values for 2020 were 32 µg/L and 25 µg/L in 2019. Although there has been an increase in concentrations, they are below the MCL of 100 µg/L. Most boundary wells sampled this quarter measured chromium values slightly greater than the background range, with the highest value of 11µg/L at USGS-131A (616 ft bgs).

An arsenic level of 10 µg/L, which is also the MCL, was measured at ATR perched groundwater well USGS-062. This is a slight increase from 9.7 µg/L in 2021, but consistent with past data. All other concentrations were consistent with past observations and trends with most within natural background ranges.

All nutrient results were consistent with past results and within background levels with two exceptions. Two perched groundwater well locations had elevated nitrate + nitrite concentrations above MCL of 14.9 mg/L at USGS-092 (RWMC) and 18 mg/L at USGS-068 (ATR). In 2021, results at USGS-092 were 16 mg/L and 9.3 mg/L at USGS-068. One TAN location had elevated levels of phosphorus with 34 mg/L at TAN-2336. All other concentrations were consistent with past observations and trends with most within natural background ranges.

Volatile organic compounds (VOCs)

VOCs were measured at ten aquifer wells located at TAN and seven aquifer wells located at RWMC (**Table 24**). All had detectable concentrations of at least one VOC, except for M1S, TAN-56, and TAN-2312. Carbon tetrachloride, trichloroethene (TCE), and chloroform continue to be detected at RWMC wells at levels consistent with previous observations. TAN-2336 had a measured methyl ethyl ketone concentration of 439 µg/L. The value most likely represents a side reaction in the in-situ bioremediation process with a reported environmental half-life ranging from 13-128 days (Aaronson and Howard, 1997). Due to its short-lived nature, there is no immediate threat to human health and the environment. Concentrations of 2-hexanone at 2.68 µg/L and toluene at 1.79 µg/L were also observed at TAN-2336. 2-hexanone has not been detected in the past, although toluene has been detected irregularly at RWMC and other TAN wells. Concentrations for these analytes are low, with toluene concentrations well below the drinking water MCL (100 µg/L). 2-hexanone is currently not regulated by the EPA. Tetrachloroethene (PCE), trichloroethene (TCE), trans-1, 2-dichloroethene (trans-1, 2-DCE) and cis-1,2-dichloroethene (cis-1, 2-DCE) continue to be detected at TAN wells; however, notable MCL exceedances and/or changes from previous measurements include:

- TAN-2336 methyl ethyl ketone (MEK) = 439 µg/L, down from 1140 µg/L in January 2022 (no MCL)
- TAN-2271 trans-1, 2-DCE = 2.49 µg/L, down from 80.4 µg/L in 2021 (MCL is 100 µg/L)

- TAN-28 vinyl chloride = 21.9 µg/L, up from 11.9 in 2021 (MCL is 2 µg/L)
- TAN-28 cis-1, 2-DCE = 25.7 µg/L, up from 13.2 µg/L in 2021 (MCL is 70 µg/L)
- TAN-28 TCE = 4.21 µg/L, up from 1.75 µg/L in 2021 (MCL is 5 µg/L)
- TAN-51 TCE = 164 µg/L, up from 120 µg/L in 2021 (MCL is 5 µg/L)
- TAN-42 TCE = 69.2 µg/L, up from 33.3 µg/L in 2021 (MCL is 5 µg/L)
- TAN-29 cis-1, 2-DCE = 39.5 µg/L, down from 49.9 µg/L in 2021 (MCL is 70 µg/L)
- TAN-29 trans-1, 2-DCE = 8.46 µg/L, down from 13.9 µg/L in 2021 (MCL is 100 µg/L)
- TAN-42 PCE = 6.90 µg/L, up from 3.92 µg/L in 2021 (MCL is 5 µg/L)

All other VOC detections were consistent with historical data and were measured in areas of known contamination.

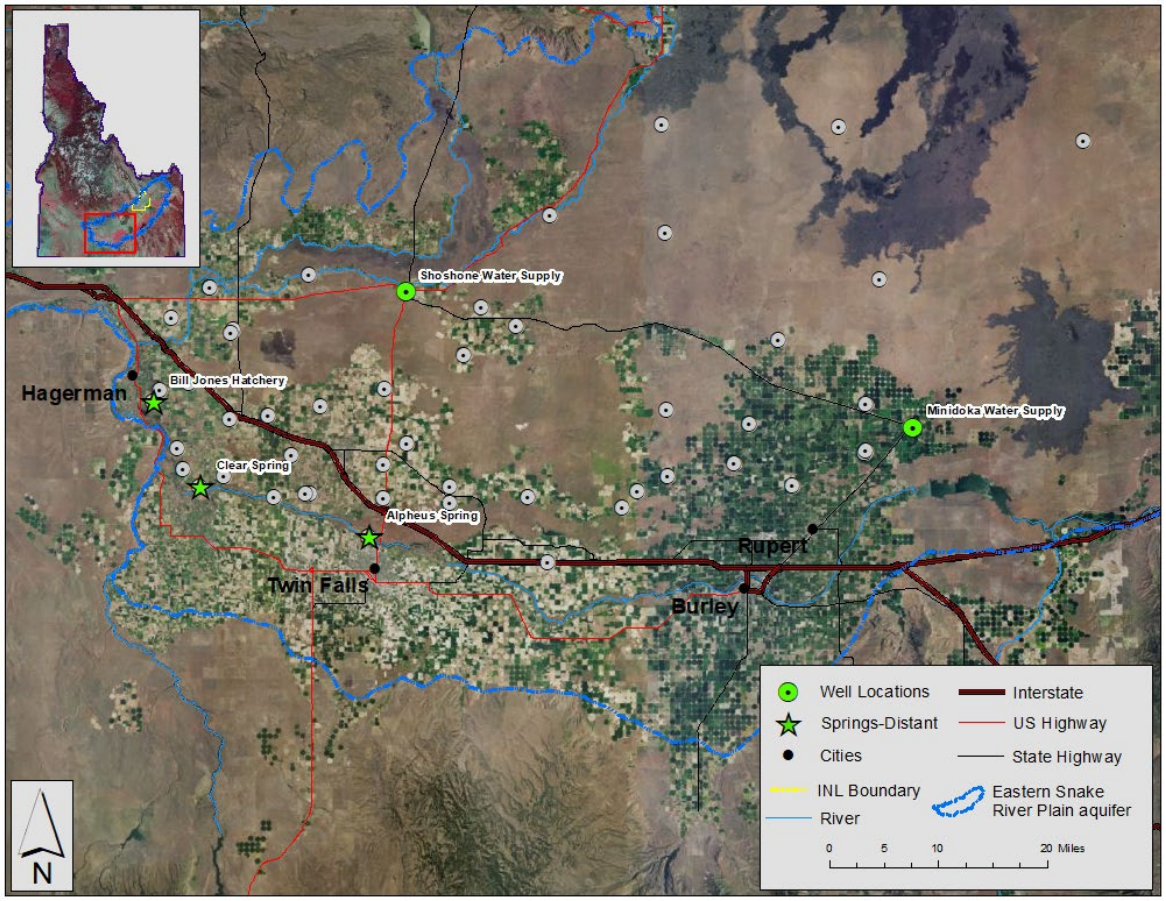

Figure 2. Distant water monitoring locations.

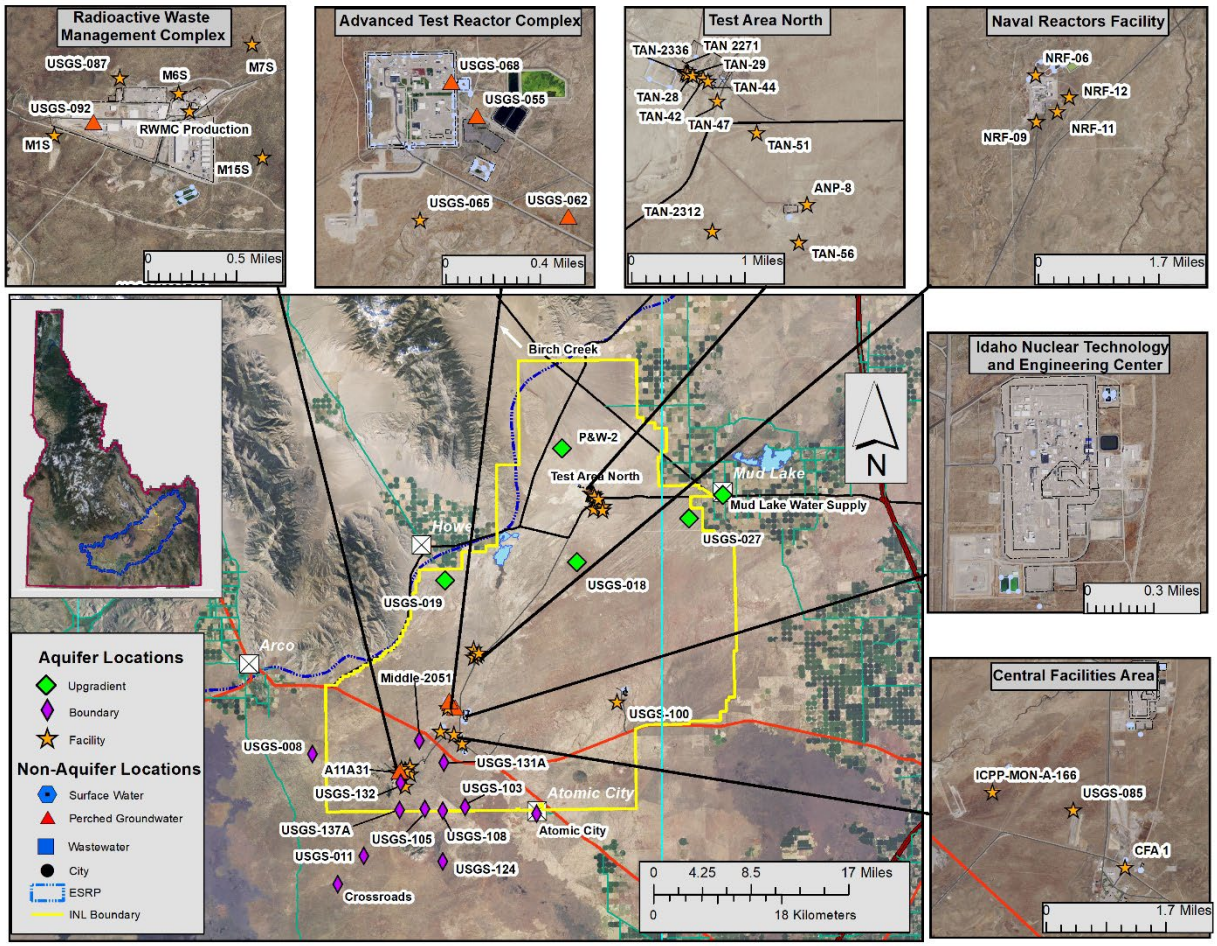

Figure 3. Upgradient, facility, boundary, perched groundwater (GW), surface water and wastewater monitoring locations.

Table 12. Locations sampled in water, second quarter, 2022.

Sample Location	Date Sampled	Co-sampler	Well Depth (ft bgs)	Analyses*
Aquifer Samples				
Facility				
Advanced Test Reactor Complex				
USGS-065	04/12/22	USGS	498	α, β, γ, ^{3}H, ^{90}Sr, Cl-, SO_4^{2}, Cr, NO3+NO2
Idaho Nuclear Technology and Engineering Center				
ICPP-MON-A-166	04/13/22	IEC	527	α, β, γ, ^{3}H, ^{90}Sr, Cl-, SO_4^{2-}, Cr, NO_3+NO_2
Radioactive Waste Management Complex				
RWMC Production	04/14/22	USGS	685	α, β, γ, ^{3}H, ^{90}Sr, ^{99}Tc, ^{129}I, Cl-, SO_4^{2-}, Cr, NO_3+NO_2, VOCs
USGS-087	04/20/22	USGS	673	α, β, γ, ^{3}H, ^{90}Sr, ^{99}Tc, ^{129}I, Cl-, SO_4^{2-}, Cr, NO_3+NO_2, VOCs
M15S	05/02/22	IEC	620	α, β, γ, ^{3}H, Cl-, SO_4^{2-}, Cr, NO_3+NO_2, VOCs
M1S	05/03/22	IEC	678	α, β, γ, ^{3}H, ^{90}Sr, ^{99}Tc, ^{129}I, Cl-, SO_4^{2-}, Cr, NO_3+NO_2, VOCs
M6S	05/02/22	IEC	697	α, β, γ, ^{3}H, ^{90}Sr, ^{99}Tc, ^{129}I, Cl-, SO_4^{2-}, Cr, NO_3+NO_2, VOCs
A11A31	05/02/22	IEC	678	α, β, γ, ^{3}H, Cl-, SO_4^{2-}, Cr, NO_3+NO_2, VOCs
M7S	05/03/22	IEC	638	α, β, γ, ^{3}H, Cl-, SO_4^{2-}, Cr, NO_3+NO_2, VOCs
Test Area North				
TAN-2336	04/05/22	IEC	255	α, β, γ, ^{3}H, ^{90}Sr, U iso, com. ions, trace metals, NO_3+NO_2, P, VOCs
TAN-2271	04/05/22	IEC	289	α, β, γ, ^{3}H, ^{90}Sr, com. ions, trace metals, NO_3+NO_2, VOCs
TAN-28	04/05/22	IEC	262	α, β, γ, ^{3}H, ^{90}Sr, U iso, com. ions, trace metals, NO_3+NO_2, VOCs
TAN-29	04/0522	IEC	253	α, β, γ, ^{3}H, ^{90}Sr, U iso, com. ions, trace metals, NO_3+NO_2, VOCs
TAN-42	04/05/22	IEC	440	α, β, γ, ^{3}H, ^{90}Sr, U iso, com. Ions, trace metals, NO_3+NO_2, P, VOCs
TAN-44	04/05/22	IEC	442	α, β, γ, ^{3}H, ^{90}Sr, com. ions, trace metals, NO_3+NO_2, VOCs
TAN-47	06/13/22	IEC	n/a	α, β, γ, ^{3}H, ^{90}Sr, ^{99}Tc, U iso, P iso, com. ions, Cr, NO_3+NO_2, VOCs
ANP-8	06/13/22	IEC	309	α, β, γ, ^{3}H, com. ions, trace metals, NO_3+NO_2, VOCs
TAN-2312	06/13/21	IEC	522	α, β, γ, ^{3}H, Cl-, SO_4^{2-}, Cr, NO_3+NO_2, VOCs
TAN-51	06/13/22	IEC	470	α, β, γ, ^{3}H, Cl-, SO_4^{2-}, com. ions, trace metals, NO_3+NO_2, VOCs
TAN-56	06/14/22	IEC	460	α, β, γ, ^{3}H, Cl-, SO_4^{2-}, Cr, NO_3+NO_2, VOCs
Central Facilities Area				
USGS-085	04/4/22	USGS	637	α, β, γ, ^{3}H, ^{90}Sr, ^{99}Tc, Cl-, SO_4^{2-}, Cr, NO_3+NO_2
CFA 1	04/18/22	USGS	639	α, β, γ, ^{3}H, ^{90}Sr, ^{99}Tc, Cl-, SO_4^{2-}, Cr, NO_3+NO_2
Materials and Fuels Complex				
USGS-100	04/14/22	USGS	750	α, β, γ, ^{3}H, Cl-, SO_4^{2-}, Cr, NO_3+NO_2
Naval Reactors Facility				
NRF-06	05/17/22	USGS	417	α, β, γ, ^{3}H, Cl-, SO_4^{2-}, Cr, NO_3+NO_2
NRF-09	05/17/22	USGS	422	α, β, γ, ^{3}H, Cl-, SO_4^{2-}, Cr, NO_3+NO_2
NRF-11	05/17/22	USGS	417	α, β, γ, ^{3}H, Cl-, SO_4^{2-}, Cr, NO_3+NO_2
NRF-12	05/17/22	USGS	425	α, β, γ, ^{3}H, Cl-, SO_4^{2-}, Cr, NO_3+NO_2
Boundary				
Crossroads	04/20/22	USGS	796	α, β, γ, ^{3}H, Cl-, SO_4^{2-}, Cr, NO_3+NO_2
USGS-008	04/20/22	USGS	812	α, β, γ, ^{3}H, Cl-, SO_4^{2-}, Cr, NO_3+NO_2
USGS-011	04/19/22	USGS	704	α, β, γ, ^{3}H, Cl-, SO_4^{2-}, Cr, NO_3+NO_2
USGS-124	04/19/22	USGS	800	α, β, γ, ^{3}H, Cl-, SO_4^{2-}, Cr, NO_3+NO_2
Middle-2051 (749 ft bgs)	06/15/22	USGS	749	α, β, γ, ^{3}H, Cl- SO_4^{2-}, Cr, NO_3+NO_2
Middle-2051 (1091 ft bgs)	06/15/22	USGS	1091	α, β, γ, ^{3}H, Cl-, SO_4^{2-}, Cr, NO_3+NO_2
Atomic City	06/06/22	USGS	639	α, β, γ, ^{3}H, Cl-, SO_4^{2-}, Cr, NO_3+NO_2
USGS-137A (747 ft bgs)	06/22/22	USGS	747	α, β, γ, ^{3}H, Cl-, SO_4^{2-}, Cr, NO_3+NO_2
USGS-132 (765 ft bgs)	06/21/22	USGS	765	α, β, γ, ^{3}H, Cl-, SO_4^{2-}, Cr, NO_3+NO_2
USGS-103 (1258 ft bgs)	06/16/22	USGS	1258	α, β, γ, ^{3}H, Cl-, SO_4^{2-}, Cr, NO_3+NO_2
USGS-131A (616 ft bgs)	06/29/22	USGS	616	α, β, γ, ^{3}H, ^{99}Tc, Cl-, SO_4^{2-}, Cr, NO_3+NO_2

USGS-131A (812 ft bgs)	06/29/22	USGS	812	α, β, γ, ^{3}H, ^{99}Tc, Cl-, SO_4^{2-}, Cr, NO_3+NO_2
USGS-105 (952 ft bgs)	06/27/22	USGS	952	α, β, γ, ^{3}H, Cl-, SO_4^{2-},Cr, NO_3+NO_2
USGS-105 (1072 ft bgs)	06/27/22	USGS	1072	α, β, γ, ^{3}H, Cl-, SO_4^{2-},Cr, NO_3+NO_2
USGS-108 (1172 ft bgs)	06/28/22	USGS	1172	α, β, γ, ^{3}H, Cl-, SO_4^{2-},Cr, NO_3+NO_2
Upgradient				
P&W-2	04/12/22	USGS	386	α, β, γ, ^{3}H, Cl-, SO_4^{2-},Cr, NO_3+NO_2
USGS-018	04/12/22	USGS	329	α, β, γ, ^{3}H, Cl-, SO_4^{2-},Cr, NO_3+NO_2
USGS-019	04/12/22	USGS	405	α, β, γ, ^{3}H, Cl-, SO_4^{2-},Cr, NO_3+NO_2
USGS-027	04/11/22	USGS	312	α, β, γ, ^{3}H, ^{99}Tc, Cl-, SO_4^{2-},Cr, NO_3+NO_2
Mud Lake Water Supply	05/10/22	None	330	α, β, γ, ^{3}H
Distant				
Alpheus Spring	05/09/22	None	n/a	α, β, γ, ^{3}H
Bill Jones Hatchery	05/09/22	None	n/a	α, β, γ, ^{3}H
Clear Spring	05/09/22	None	n/a	α, β, γ, ^{3}H
Minidoka Water Supply	05/09/22	None	282	α, β, γ, ^{3}H
Shoshone Water Supply	05/09/22	None	715	α, β, γ, ^{3}H
Other Samples				
Perched Groundwater				
Advanced Test Reactor & Radioactive Waste Management Complexes:				
USGS-055	04/13/22	USGS	81	α, β, γ, ^{3}H, ^{90}Sr, com. ions, trace metals, NO_3+NO_2
USGS-062	04/13/22	USGS	165	α, β, γ, ^{3}H, ^{90}Sr, com. ions, trace metals, NO_3+NO_2
USGS-068	04/13/22	USGS	128	α, β, γ, ^{3}H, ^{90}Sr, Cl-, SO_4^{2-}, As, Cr, NO_3+NO_2
USGS-092	04/18/22	USGS	n/a	α, β, γ, ^{3}H, Cl-, SO_4^{2}, Cr, NO_3+NO_2

ft bgs = feet below ground surface.
*α = gross alpha radioactivity; β = gross beta radioactivity; γ = manmade gamma-emitting radionuclides; ^{3}H = tritium; ^{90}Sr = Strontium-90, ^{99}Tc = Technetium-99, Pu iso. = plutonium isotopes ^{238}Pu, $^{239/240}$ Pu, Pu; U iso. = uranium isotopes ^{234}U, ^{235}U, ^{238}U; Cl = chloride; Cr = chromium; com. ions = Ca^{2+}, Mg^{2+}, Na^{+}, K^{+}, Cl^{-}, SO_4^{2-}, alkalinity; trace metals (metals) = arsenic (As), barium (Ba), chromium (Cr), iron (Fe), manganese (Mn), lead (Pb), selenium (Se); NO_3+NO_2 = nitrate plus nitrite; P = phosphorus; and VOCs (volatile organic compounds).
n/a = well depth not available.

Table 13. Constituent background concentration ranges and EPA drinking water standards.

Constituent	Background[1]	MCL or SMCL[2]
Radiological Constituents (pCi/L)		
Gross alpha	0-5.6[a]	15
Gross beta	0-8.6[a]	4 mrem/yr
Cesium-137	0	200
Tritium	0-33[a]	20,000
Strontium-90	0	8
Technetium-99	0	900
Uranium-234	0.043-1.9[b]	30 µg/L (total U)
Uranium-235	0-0.048[b]	
Uranium-238	0.021-0.719[b]	
Plutonium-238	0	---
Plutonium-239/240	0	---
Americium-241	0	---
Non-radiological Constituents		
Common Ions (mg/L)		
Alkalinity (as $CaCO_3$)	91-261[a]	---
Calcium	23 – 71[a]	---
Chloride	4.9 – 66.6[a]	250*
Fluoride	0.1 – 1.50[a]	4
Magnesium	10.1 – 27.4[a]	---
Potassium	1.2 – 5.8[a]	---
Sodium	2.6 – 27.0[a]	---
Sulfate	9.6 – 40.4[a]	250*
Trace Metals (µg/L)		
Arsenic	2 – 3[c]	10
Barium	50 – 70[c]	2000
Chromium	<1.0 – 5.2[a]	100
Iron	4 – 16[d]	300*
Lead	<5[c]	15
Manganese	<1 – 4[a]	50*
Selenium	<1[c]	50
Zinc	<3 – 10.5[d]	5000*
Nutrients (mg/L)		
Nitrate plus nitrite	<0.04 – 3.59[b]	10 for NO_3^-, 1 for NO_2^-
Phosphorous	<0.01 – 0.02[d]	---
Volatile Organic Compounds (µg/L)		
Tetrachloroethene (PCE)	0	5
Trichloroethene (TCE)	0	5
1,1-Dichloroethene	0	7
cis-1,2-dichloroethene	0	70
trans-1,2-dichloroethene	0	100
Vinyl chloride	0	2
Carbon tetrachloride	0	5
Chloroform	0	80[e]
Chloromethane	0	---
Methylene Chloride	0	5
Methyl Ethyl Ketone	0	---
1,1-Dichloroethane	0	---

[1] Sources for background ranges are: [a] DEQ data compiled from distant, boundary, and surface water sites from 1993-2018.
[b] Bartholomay and Hall, 2016 (DOE/ID-22237); [c] Knobel and others, 1992; [d] Knobel and others, 1999 (DOE/ID-22164).
[2] Maximum Contaminant Levels (MCLs) are the highest levels of contaminants legally allowed in public drinking water systems in Idaho. Most wells sampled by DEQ-INL OP are not used for drinking water. A * designates a Secondary MCL (SMCL), which is a guideline recommended by the EPA for constituents that may affect the taste, color, or odor of drinking water. [e] MCL is for total trihalomethanes.

Table 14. Gross alpha, gross beta, and man-made gamma-emitting radionuclide concentrations (pCi/L) in water samples, second quarter, 2022.

Sample Location	Sample Date	Gross Alpha			Gross Beta			Cesium-137*		
		Concentration		2 SD	Concentration		2 SD	Concentration		2 SD
Aquifer Samples										
Facility										
Advanced Test Reactor Complex										
USGS-065	04/12/22	1.8		1.0	5.3		1.0	1.0	U	1.4
Radioactive Waste Management Complex										
RWMC Production	04/14/22	1.6		1.0	5.8		0.9	0.2	U	0.9
USGS-087	04/20/22	1.7		0.8	3.9		0.8	0.0	U	1.1
M1S	05/03/22	1.6		0.7	2.0		0.7	-0.7	U	1.8
M6S	05/02/22	2.8		0.9	3.1		0.9	0.9	U	1.2
M15S	05/02/22	1.3		0.8	3.3		0.9	0.3	U	1.1
A11A31	05/02/22	1.4		0.8	4.1		0.9	0.3	U	1.1
M7S	05/03/22	2.1		0.9	3.4		0.8	0.1	U	1.5
Test Area North										
TAN 2271	04/05/22	1.5	U	1.4	715.8		8.3	1.1	U	1.2
TAN-28	04/05/22	7.6		2.1	348.6		5.9	0.8	U	1.2
TAN-2336	04/05/22	1.6	U	20.4	1593		51	4.9		1.8
TAN-29	04/05/22	6.1		1.5	51.7		2.0	0.2	U	1.2
TAN-42	04/05/22	2.4		0.9	5.6		0.9	0.0	U	1.1
TAN-44	04/05/22	1.4		0.8	6.1		1.0	0.0	U	1.2
TAN-47	06/13/22	1.2	J#	0.8	3.3		0.8	1.7	U	2.1
TAN-51	06/13/22	2.5		1.0	6.3		1.0	0.1	U	1.5
TAN-2312	06/13/22	2.3		0.8	4.6		0.8	1.9	U	1.3
ANP-8	06/13/22	1.7		0.8	4.2		0.8	0.4	U	1.0
TAN-56	06/14/22	1.8		0.9	4.1		0.9	-1.7	U	1.6
Central Facilities Area										
USGS-085	04/04/22	1.3		0.7	6.4		0.9	-0.2	U	1.0
CFA 1	04/18/22	1.5		1.0	7.1		1.0	0.4	U	1.3
Idaho Nuclear Technology and Engineering Center										
ICPP-MON-A-166	04/13/22	1.6		0.9	3.6		0.8	0.0	U	1.0
Materials and Fuels Complex										
USGS-100	04/14/22	1.4		0.9	3.1		0.8	1.3	U	1.2
Naval Reactors Facility										
NRF-06	05/17/22	1.7	U	2.0	7.9		2.0	-0.5	U	2.0
NRF-09	05/17/22	1.1	U	0.9	4.5		1.0	0.9	U	1.2
NRF-11	05/17/22	1.1	U	0.8	3.4		0.9	1.0	U	1.4
NRF-12	05/17/22	1.2		0.8	1.7		0.9	0.3	U	1.1
Boundary										
USGS-011	04/19/22	1.0	U	0.8	2.1		0.8	0.1	U	1.3
USGS-124	04/19/22	1.4		0.8	3.3		0.9	-0.5	U	1.1
USGS-008	04/20/22	2.0		0.9	1.9		0.8	0.0	U	1.0
Crossroads	04/20/22	1.5		0.8	2.1		0.8	1.1	U	1.1
Atomic City	06/06/22	2.4		0.9	3.4		0.9	-0.3	U	1.5
Middle-2051 (1091 ft bgs)	06/15/22	1.9		0.8	2.4		0.8	0.4	U	1.0
Middle-2051 (749 ft bgs)	06/15/22	1.3		0.7	2.1		0.8	0.3	U	1.0
USGS-103 (1258 ft bgs)	06/16/22	2.2		0.8	4.8		0.9	-0.2	U	1.0
USGS-132 (765 ft bgs)	06/21/22	1.5		0.9	2.9		0.8	0.6	U	1.1
USGS-137A (747 ft bgs)	06/22/22	1.9		0.9	3.1		0.9	-0.3	U	1.3
USGS-105 (1072 ft bgs)	06/27/22	1.8		0.9	1.9		0.8	0.6	U	1.0
USGS-105 (952 ft bgs)	06/27/22	1.4		0.8	3.3		0.8	-0.1	U	1.1
USGS-108 (1172 ft bgs)	06/28/22	1.5		0.9	3.0		0.8	0.2	U	1.2
USGS-131A (812 ft bgs)	06/29/22	0.7	U	0.8	4.5		0.9	-0.7	U	1.6
USGS-131A (616 ft bgs)	06/29/22	1.4		0.8	3.9		0.9	-0.6	U	1.1
Upgradient										
USGS-027	04/11/22	4.0		1.1	7.2		1.0	1.0	U	1.1
P&W-2	04/12/22	1.6		0.9	2.6		0.8	-0.3	U	1.6
USGS-019	04/12/22	0.5	U	1.4	1.0	U	1.5	-1.0	U	1.3

USGS-018	04/12/22	1.3		0.8	2.5		0.8	0.9	U	1.0
Mud Lake Water Supply	05/10/22	0.4	U	0.5	3.7		0.7	1.4	U	1.3
Distant										
Alpheus Spring	05/09/22	1.1	U	0.9	7.8		1.0	-0.4	U	1.1
Clear Spring	05/09/22	0.7	U	0.7	4.2		0.9	0.5	U	1.0
Bill Jones Hatchery	05/09/022	1.5		0.8	3.7		0.8	1.3	U	1.4
Shoshone Water Supply	05/09/22	1.0	U	0.7	2.2		0.8	1.3	U	1.5
Minidoka Water Supply	05/09/22	1.3		0.8	3.7		0.9	0.8	U	1.9
Other Samples										
Perched Groundwater										
Advanced Test Reactor & Radioactive Waste Materials Complexes										
USGS-055	04/13/22	1.7		1.1	58.0		1.9	1.0	U	1.3
USGS-068	04/13/22	1.6	U	1.6	6.6		1.7	0.6	U	1.0
USGS-062	04/13/22	1.6		0.9	4.9		0.9	-0.2	U	1.0
USGS-092	04/18/22	56.9		17.0	54.8		17.3	3.1	U	4.0

Data qualifiers: U = undetected, J = estimate, R = rejected, "+" or "-" after a J means that the estimated result is biased high or low, respectively.
**Result is >MDC but <2SD and is therefore considered a non-detection.
#Result is >MDC and >2SD but <3SD and is therefore considered questionable and J-flagged as an estimate.
Typical MDC range (gross alpha) 0.3 – 3.2 pCi/L. MDC range (gross beta) 0.9 – 2.6 pCi/L. MDC range (Cs-137) 1.6 – 3.5 pCi/L. MDCs (and 2 SD) for USGS-092 and TAN-2336 are higher due to smaller sample aliquants used in the analyses because of high dissolved solids.
*ISU-EML analyzes water samples for all common manmade gamma-emitting radionuclides. If none are detected, only the results for ^{137}Cs, the manmade gamma-emitter most likely to be detected in groundwater, are reported in this table.
ft bgs = feet below ground surface.

Table 15. Tritium concentrations (pCi/L) in water samples, second quarter, 2022.

Sample Location	Sample Date	Tritium		
		Concentration		2 SD
Aquifer Samples				
Facility				
Advanced Test Reactor Complex				
USGS-065	04/12/22	1097		140
Idaho Nuclear Technology and Engineering Center				
ICPP-MON-A-166	04/13/22	62	U	100
Radioactive Waste Management Complex				
RWMC Production	04/14/22	388		110
USGS-087	04/20/22	313		110
M15S	05/02/22	36	U	100
M1S	05/03/22	23	U	100
M6S	05/02/22	-26	U	90
A11A31	05/02/22	64	U	100
M7S	05/03/22	406		110
Test Area North				
TAN-2336	04/05/22	319		110
TAN-2271	04/05/22	303		110
TAN-28	04/05/22	831		130
TAN-29	04/0522	795		130
TAN-42	04/05/22	381		110
TAN-44	04/05/22	471		110
TAN-47	06/13/22	-13	U	90
ANP-8	06/13/22	61	U	90
TAN-2312	06/13/21	32	U	90
TAN-51	06/13/22	378		110
TAN-56	06/14/22	16	U	90
Central Facilities Area				
USGS-085	04/4/22	523		120
CFA 1	04/18/22	1906		170
Materials and Fuels Complex				
USGS-100	04/14/22	-16	U	90
Naval Reactors Facility				
NRF-06	05/17/22	54	U	100
NRF-09	05/17/22	-35	U	90
NRF-11	05/17/22	-47	U	90
NRF-12	05/17/22	0	U	90
Boundary				
Crossroads	04/20/22	-23	U	90
USGS-008	04/20/22	6	U	90
USGS-011	04/19/22	-36	U	90
USGS-124	04/19/22	16	U	100
Middle-2051 (749 ft bgs)	06/15/22	212		100
Middle-2051 (1091 ft bgs)	06/15/22	99	U	90
Atomic City	06/06/22	61	U	90
USGS-137A (747 ft bgs)	06/22/22	157		100
USGS-132 (765 ft bgs)	06/21/22	119	U	90
USGS-103 (1258 ft bgs)	06/16/22	93	U	90
USGS-131A (616 ft bgs)	06/29/22	622		120
USGS-131A (812 ft bgs)	06/29/22	706		140
USGS-105 (952 ft bgs)	06/27/22	129	U	90
USGS-105 (1075 ft bgs)	06/27/22	226		100
USGS-108 (1172 ft bgs)	06/28/22	93	U	90
Upgradient				
P&W-2	04/12/22	-68	U	90
USGS-018	04/12/22	13	U	100
USGS-019	04/12/22	-24	U	90

USGS-027	04/11/22	-32	U	100
Mud Lake Water Supply	05/10/22	-33	U	90
Distant				
Alpheus Spring	05/09/22	-27	U	90
Bill Jones Hatchery	05/09/22	53	U	90
Clear Spring	05/09/22	-55	U	90
Minidoka Water Supply	05/09/22	-4	U	90
Shoshone Water Supply	05/09/22	-23	U	90
Other Samples				
Perched Groundwater				
Advanced Test Reactor & Radioactive Waste Management Complexes				
USGS-055	04/13/22	1494		150
USGS-062	04/13/22	26	U	100
USGS-068	04/13/22	-52	U	100
USGS-092	04/18/22	16	U	100

Data qualifiers: U = undetected, J = estimate, R = rejected, "+" or "-" after a J means that the estimated result is biased high or low, respectively. ft bgs = feet below ground surface.
MDC range 150 - 170 pCi/L.

Table 16. Low-level tritium concentrations (pCi/L) in water samples collected during 2022 and analyzed using the electrolytic enrichment method, second quarter, 2022.

Sample Location	Sample Date	Tritium		
		Concentration		2 SD
Aquifer Samples				
Facility				
Radioactive Waste Management Complex				
M15S	05/02/22	53		10
A11A31	05/02/22	58		10
Test Area North				
TAN-2312	06/13/22	3	U	7
ANP-8	06/13/22	58		9
Idaho Nuclear Technology and Engineering Center				
ICPP-MON-A-166	04/13/22	41		9
Materials and Fuels Complex				
USGS-100	4/14/22	8	U	7
Naval Reactors Facility				
NRF-06	05/17/22	15		8
NRF-09	05/17/22	13		7
NRF-11	05/17/22	15		8
NRF-12	05/17/22	19		8
Boundary				
USGS-124	04/19/22	43		9
Atomic City	06/06/22	2	U	6
USGS-103 (1258 ft bgs)	06/16/22	126		12
Upgradient				
USGS-018	04/12/22	7	U	7
P&W-2	04/12/22	1	U	7
Other Samples				
Perched Groundwater				
Advanced Test Reactor & Radioactive Waste Management Complexes				
USGS-068	04/13/22	55		10
USGS-062	04/13/22	19		8

Data qualifiers: U = undetected, J = estimate, R = rejected, "+" or "-" after a J means that the estimated result is biased high or low, respectively. ft bgs = feet below ground surface.
MDC range 11 - 13 pCi/L.

Table 17. Strontium-90 concentrations (pCi/L) in water samples, second quarter, 2022.

Sample Location	Sample Date	Strontium-90		
		Concentration		2 SD
Aquifer Samples				
Facility				
Advanced Test Reactor				
USGS-065	04/12/22	0.13	U	0.25
Test Area North				
TAN-2271	04/05/22	294		69
TAN-2336	04/05/22	620		150
TAN-28	04/05/22	125		30
TAN-29	04/05/22	14.5		3.5
TAN-42	04/05/22	0.21	U	0.26
TAN-44	04/05/22	0.29	U	0.28
TAN-47	06/13/22	-0.05	U	0.12
Central Facilities Area				
USGS-085	04/04/22	1.74		0.53
CFA 1	04/18/22	-0.23	U	0.18
Radioactive Waste Management Complex				
RWMC Production	04/14/22	-0.01	U	0.17
USGS-087	04/20/22	-0.07	U	0.18
M6S	05/02/22	-0.19	U	0.19
M1S	05/03/22	0.08	U	0.16
Other Samples				
Perched Groundwater				
Advanced Test Reactor Complex				
USGS-068	04/13/22	1.51		0.41
USGS-062	04/13/22	0.61		0.31
USGS-055	04/13/22	21.1		5.0

Data qualifiers: U = undetected, J = estimate, R = rejected, "+" or "-" after a J means that the estimated result is biased high or low, respectively.
MDC range 0 – 0.57 pCi/L.

Table 18. Technetium-99 concentrations (pCi/L) in water samples, second quarter, 2022.

Sample Location	Sample Date	Technetium-99		
		Concentration		2 SD
Aquifer Samples				
Facility				
Central Facilities Area				
USGS-085	04/04/22	3.7	U	4.2
CFA 1	04/18/22	4.1	U	4.3
Idaho Nuclear Technology and Engineering Center				
ICPP-MON-A-166	04/13/22	2.3	U	4.8
Radioactive Waste Management Complex				
RWMC Production	04/14/22	2.8	U	4.1
USGS-087	04/20/22	1.5	U	4.4
M6S	05/02/22	6.3	U	4.9
M1S	05/03/22	0.2	U	4.2
Test Area North				
TAN-47	06/13/22	-5	U	3.4
Boundary				
USGS-131A (812 ft bgs)	06/29/22	-1.5	U	3.3
USGS-131A (616 ft bgs)	06/29/22	0.4	U	3.3
Upgradient				
USGS-027	04/11/22	-2.5	U	3.8

Data qualifiers: U = undetected, J = estimate, R = rejected, "+" or "-" after a J means that the estimated result is biased high or low, respectively.
MDC range 5.8 – 8.1 pCi/L.

Table 19. Plutonium isotope concentrations (pCi/L) in water samples, second quarter, 2022.

Sample Location	Sample Date	Plutonium-238			Plutonium-239/240		
		Concentration		2 SD	Concentration		2 SD
Aquifer Samples							
Facility							
Test Area North							
TAN-47	06/13/22	0.0	U	0.014	0.026	U	0.023

Data qualifiers: U = undetected, J = estimate, R = rejected, "+" or "-" after a J means that the estimated result is biased high or low, respectively.
MDC range (Pu-238) 0.031 pCi/l. MDC range (Pu-239/240) 0.031 pCi/L.

Table 20. Uranium isotope concentrations (pCi/L) in water samples, second quarter, 2022.

Sample Location	Sample Date	Uranium-234			Uranium-235			Uranium-238		
		Concentration		2 SD	Concentration		2 SD	Concentration		2 SD
Aquifer Samples										
Facility										
Test Area North										
TAN-28	04/05/22	9.0		1.7	0.36		0.17	1.34		0.35
TAN-2336	04/05/22	0.79		0.28	0.02	U	0.097	0.32		0.16
TAN-29	04/05/22	4.6		0.8	0.163		0.088	0.98		0.24
TAN-42	04/05/22	1.64		0.38	0.064	U	0.067	0.68		0.21
TAN-47	06/13/22	0.95		0.22	0.064	J[#]	0.045	0.65		0.16

Data qualifiers: U = undetected, J = estimate, R = rejected, "+" or "-" after a J means that the estimated result is biased high or low, respectively.
*Result is >MDC but <2SD and is therefore considered a non-detection.
[#]Result is >MDC and >2SD but <3SD and is therefore considered questionable and J-flagged as an estimate.
MDC range (U-234) 0.05 – 0.18 pCi/L. MDC range (U-235) 0.04 – 0.145 pCi/L. MDC range (U-238) 0.04 – 0.12 pCi/L.

Table 21. Common ion concentrations (mg/L) in water samples, second quarter, 2022.

Sample Location	Sample Date	Calcium*		Magnesium*		Sodium*		Potassium*		Chloride		Sulfate		Alkalinity†	
Aquifer Samples															
Facility															
Idaho Nuclear Technology and Engineering Center															
ICPP-MON-A-166	04/13/22	-		-	-	-	-	-	-	18.5		19.3-		122	
Advanced Test Reactor															
USGS-065	04/12/22	-		-	-	-	-	-	-	19.8		136[3]		130	
Test Area North															
TAN-2336	04/05/22	160[1]		100[1]		6700[5]		21[1]		162[2]		40.9[2]		7270	
TAN-2271	040/5/22	59		49		110		8.3		104[3]		34.2		463	
TAN-28	040/5/22	97		38		75		6.5		93.1[3]		26.9		451	
TAN-29	04/0522	64		18		49		5.0		75.2[3]		35.9		215	
TAN-42	04/05/22	56		15		17		2.9		46.8[4]		32.5		157	
TAN-44	04/05/22	61		16		22		3.2		66.6[3]		34.0		157	
TAN-47	06/13/22	32		13		5.9		2.9		13.0		20.0		114	
ANP-8	06/13/22	41		15		7.1		3.0		16.1		31.3		133	
TAN-2312	06/13/21	-		-						8.65		25.4		126	
TAN-51	06/13/22	51		15		7.1		3.0		34.0		30.4		135	
TAN-56	06/14/22	-	-	-		-		-		11.4		29.3		137	
Central Facilities Area															
USGS-085	04/04/22	-		-	-	-	-	-	-	12.1		40.6		159	
CFA 1	04/18/22	-		-	-	-	-	-	-	70.3[3]		33.2		130	
Naval Reactors Facility															
NRF-06	05/17/22	-		-	-	-	-	-	-	372[2]		71.8[2]		172	
NRF-09	05/17/22	-		-	-	-	-	-	-	40.9[4]		41.0		196	
NRF-11	05/17/22	-		-	-	-	-	-	-	41.1[4]		37.6		197	
NRF-12	05/17/22	-		-	-	-	-	-	-	34.2		36.6		193	
Radioactive Waste Management Complex															
USGS-087	04/20/22	-		-	-	-	-	-	-	34		28.2-		112	
M1S	05/03/22	-		-	-	-	-	-	-	13.8		22.3		94.9	
M6S	05/02/22	-		-	-	-	-	-	-	29.2		61.9		98.9	
M15S	05/02/22	-		-	-	-	-	-	-	75.8[3]		43.8		93.8	
A11A31	05/02/22	-		-	-	-	-	-	-	35.6[4]		58.5		137	
M7S	05/03/22	-		-	-	-	-	-	-	15.0		25.6		141	
RWMC Production	04/14/22	-		-	-	-	-	-	-	27.2		31.0		142	
Materials and Fuels Complex															
USGS-100	04/14/21	-		-	-	-	-	-	-	16.3	-	18.2		135	
Boundary															
Crossroads	04/20/22	-		-	-	-	-	-	-	10.5		8.23		122	
USGS-008	04/20/22	-		-	-	-	-	-	-	7.64		22.4		153	
USGS-011	04/19/22	-		-	-	-	-	-	-	9.11		22.6		142	
USGS-124	04/19/22	-		-	-	-	-	-	-	16.3		23.9		141	
Middle-2051 (749 ft bgs)	06/15/22	-		-	-	-	-	-	-	11.1		25.7		153	
Middle-2051 (1091 ft bgs)	06/15/22	-		-	-	-	-	-	-	11.9		23.4		146	
Atomic City	06/06/22	-		-	-	-	-	-	-	16.4		17.4		137	
USGS-137A (747 ft bgs)	06/22/22									12.5		25.8		145	
USGS-132 (765 ft bgs)	06/21/22	-		-	-	-	-	-	-	11.3		25.9		152	
USGS-103 (1258 ft bgs)	06/16/22	-		-	-	-	-	-	-	14.9		23.3		140	
USGS-131A (616 ft bgs)	06/29/22	-		-	-	-	-	-	-	19.4		25.4		141	
USGS-131A (812 ft bgs)	06/29/22	-		-	-	-	-	-	-	24.4		28.7		153	
USGS-105 (952 ft bgs)	06/27/22	-		-	-	-	-	-	-	13.7		25.8		142	

USGS-105 (1075 ft bgs)	06/27/22	-		-	-	-	-	-	-	13.8		26.6		140	
USGS-108 (1172 ft bgs)	06/28/22	-		-	-	-	-	-	-	18.6		26.6		153	
Upgradient															
P&W-2	04/12/22	-		-	-	-	-	-	-	7.13		27.5		146	
USGS-018	04/12/22	-		-	-	-	-	-	-	12		27.4		134	
USGS-019	04/12/22	-		-	-	-	-	-	-	12.1		23.6		160	
USGS-027	04/11/22	-		-	-	-	-	-	-	46.2[4]		39.8		161	
Other Samples															
Perched Groundwater															
Advanced Test Reactor & Radioactive Waste Management Complexes															
USGS-055	04/13/22	50		16		11		2.7		12.9		48.4		161	
USGS-062	04/13/22	52		17		13		2.9		13.3		66.3		155	
USGS-068	04/13/22	-		-	-	-	-	-	-	129[1]		476[1]		195	
USGS-092	04/18/22	-		-	-	-	-	-	-	104[3]		58		212	

Data qualifiers: U = undetected, J = estimate, R = rejected, "<" = less than detection limit, "+" or "-" after a J means that the estimated result is biased high or low, respectively.
† As $CaCO_3$.
"-" = not analyzed.
Note 1. Lab indicated that a 10:1 dilution of this sample was required for this analyte. Note 2. Lab indicated that a 20:1 dilution of this sample was required for this analyte. Note 3. Lab indicated that a 5:1 dilution of this sample was required for this analyte. Note 4. Lab indicated that a 2:1 dilution of this sample was required for this analyte. Note 5. Lab indicated that a 50:1 dilution of this sample was required for this analyte.

Table 22. Dissolved metals concentrations (µg/L) in water samples, second quarter, 2022.

Sample Location	Sample Date	Arsenic		Barium		Chromium		Iron		Lead		Manganese	
Aquifer Samples													
Facility													
Advanced Test Reactor													
USGS-065	04/12/22	-	-	-	-	72		-	-	-	-	-	-
Idaho Nuclear Technology and Engineering Center													
ICPP-MON-A-166	04/13/21	-	-	-	-	4.3	-	-	-	-	-	-	-
Radioactive Waste Management Complex													
USGS-087	04/20/22	-	-	-	-	6.9	-	-	-	-	-	-	-
M1S	05/03/22	-	-	-	-	36	-	-	-	-	-	-	-
M6S	05/02/22	-	-	-	-	36	-	-	-	-	-	-	-
M15S	05/02/22	-	-	-	-	59	-	-	-	-	-	-	-
A11A31	05/02/22	-	-	-	-	15	-	-	-	-	-	-	-
M7S	05/03/22	-	-	-	-	11	-	-	-	-	-	-	-
RWMC Production	04/14/22	-	-	-	-	12	-	-	-	-	-	-	-
Test Area North													
TAN-2336	04/05/22	12[1]	UJ	2400[2]	-	440[2]	-	38000[2]	-	<62[1]	U	2200[2]	-
TAN-2271	04/05/22	1.3	UJ	600	-	1.0	-	2100	-	<1.0	U	980	-
TAN-28	04/05/22	1.2	UJ	390	-	1.2	-	2400	-	<1.0	U	1500	-
TAN-29	04/0522	1.8	UJ	200	-	0.65	UJ	5.6	U J	<1.0	U	110	-
TAN-42	04/05/22	2.0	-	150	-	8.4	-	30	-	<1.0	U	1.2	-
TAN-44	04/05/22	2.0	J	170	-	3.8	-	<10	U	<1.0	U	0.41	UJ
TAN-47	06/13/22	-	-	-	-	4.9	-		-			-	-
ANP-8	06/13/22	1.4	UJ	82	-	3.2	-	150	-	<1.0	U	16	-
TAN-2312	06/13/21	-	-	-	-	6.4	-	-	-	-	-	-	-
TAN-51	06/13/22	1.9	UJ	92	-	4.5	-	<10	U	0.12	UJ	<1.0	U
TAN-56	06/14/22	-	-	-	-	3.1	-	-	-	-	-	-	-
Central Facilities Area													
USGS-085	04/04/22	-	-	-	-	18	-	-	-	-	-	-	-
CFA 1	04/18/22	-	-	-	-	14	-	-	-	-	-	-	-
Materials and Fuels Complex													
USGS-100	04/14/22	-	-	-	-	2.9	-	-	-	-	-	-	-
Naval Reactors Facility													

NRF-06	05/17/22	-	-	-	-	66	-	-	-	-	-	-	-
NRF-09	05/17/22	-	-	-	-	13	-	-	-	-	-	-	-
NRF-11	05/17/22	-	-	-	-	13	-	-	-	-	-	-	-
NRF-12	05/17/22	-	-	-	-	9.5	-	-	-	-	-	-	-
Boundary													
Crossroads	04/20/22	-	-	-	-	0.24	UJ	-	-	-	-	-	-
USGS-008	04/20/22	-	-	-	-	3.0	-	-	-	-	-	-	-
USGS-011	04/19/22	-	-	-	-	4.0	-	-	-	-	-	-	-
USGS-124	04/19/22	-	-	-	-	5.7	-	-	-	-	-	-	-
Middle-2051 (749 ft bgs)	06/15/22	-	-	-	-	6.7	-	-	-	-	-	-	-
Middle-2051 (1091 ft bgs)	06/15/22	-	-	-	-	7.0	-	-	-	-	-	-	-
Atomic City	06/06/22	-	-	-	-	2.7	-	-	-	-	-	-	-
USGS-137A (747 ft bgs)	06/22/22	-	-	-	-	7.1	-	-	-	-		-	-
USGS-132 (765 ft bgs)	06/21/22	-	-	-	-	7.5	-	-	-	-	-	-	-
USGS-103 (1258 ft bgs)	06/16/22	-	-	-	-	5.9	-	-	-	-	-	-	-
USGS-131A (616 ft bgs)	06/29/22	-	-	-	-	11	-	-	-	-	-	-	-
USGS-131A (812 ft bgs)	06/29/22	-	-	-	-	10	-	-	-	-	-	-	-
USGS-105 (952 ft bgs)	06/27/22	-	-	-	-	9.5	-	-	-	-	-	-	-
USGS-105 (1075 ft bgs)	06/27/22	-	-	-	-	9.1	-	-	-	-	-	-	-
USGS-108 (1172 ft bgs)	06/28/22	-	-	-	-	6.5	-	-	-	-	-	-	-
Upgradient													
P&W-2	04/12/22	-	-	-	-	1.8		-	-	-	-	-	-
USGS-018	04/12/22	-	-	-	-	2.8		-	-	-	-	-	-
USGS-019	04/12/22	-	-	-	-	1.6		-	-	-	-	-	-
USGS-027	04/11/22	-	-	-	-	5.1		-	-	-	-	-	-
Other Samples													
Perched Groundwater													
Advanced Test Reactor & Radioactive Waste Management Complexes													
USGS-068	04/13/22	-	-	-	-	54	-	-	-	-	-	-	-
USGS-062	04/13/22	10	-	-	-	29	-	-	-	-	-	-	-
USGS-055	04/13/22	7.6	-	-		32	-	-	-	-	-	-	-
USGS-092	04/18/22	-	-	-	-	6.2	-	-	-	-	-	-	-

Table 23. Dissolved nutrient concentrations (mg/L) in water samples, second quarter, 2022.

Sample Location	Sample Date	Nitrate + Nitrite*		Total Phosphorus	
Aquifer Samples					
Facility					
Advanced Test Reactor Complex					
USGS-065	04/12/22	1.4	-	-	-
Idaho Nuclear Technology and Engineering Center					
ICPP-MON-A-166	04/13/22	0.31	-	-	-
Radioactive Waste Management Complex					
RWMC Production	04/14/22	1.0	-		
USGS-087	04/20/22	0.67	-	-	-
M1S	05/03/22	1.1	-	-	-
M6S	05/02/22	2.0	-	-	-
M15S	05/02/22	1.5	-	-	-
A11A31	05/02/22	1.0	-	-	-
M7S	05/03/22	0.82	-	-	-
Test Area North					
TAN-2336	04/05/22	0.46[2]	-	34[3]	-
TAN-2271	04/05/22	<0.010	U	-	-
TAN-28	04/05/22	<0.010	U	-	-
TAN-29	04/0522	2.3[4]	-		
TAN-42	04/05/22	1.4	-	0.039	-
TAN-44	04/05/22	2.0	-	-	-
TAN-47	06/13/22	0.70	-	-	-
ANP-8	06/13/22	0.89	-	-	-

TAN-2312	06/13/21	0.73	-		
TAN-51	06/13/22	1.2	-		
TAN-56	06/14/22	0.76	-		
Central Facilities Area					
USGS-085	04/04/22	0.97	-	-	-
CFA 1	04/18/22	2.5[2]	-	-	-
Materials and Fuels Complex					
USGS-100	04/14/22	2.4[2]	-	-	-
Naval Reactors Facility					
NRF-06	05/17/22	2.1[4]	-	-	-
NRF-09	05/17/22	3.0[2]	-	-	-
NRF-11	05/17/22	2.3[2]	-	-	-
NRF-12	05/17/22	2.2[2]	-	-	-
Boundary					
Crossroads	04/20/22	0.01	UJ	-	-
USGS-008	04/20/22	0.99	-	-	-
USGS-011	04/19/22	0.75	-	-	-
USGS-124	04/19/22	0.87	-	-	-
Middle-2051 (749 ft bgs)	06/15/22	0.85	-	-	-
Middle-2051 (1091 ft bgs)	06/15/22	0.92	-	-	-
Atomic City	06/06/22	1.7	-	-	-
USGS-137A (747 ft bgs)	06/22/22	0.71	-	-	-
USGS-132 (765 ft bgs)	06/21/22	0.77	-	-	-
USGS-103 (1258 ft bgs)	06/16/22	0.82	-	-	-
USGS-131A (616 ft bgs)	06/29/22	0.96	-	-	-
USGS-131A (812 ft bgs)	06/29/22	1.2	-	-	-
USGS-105 (952 ft bgs)	06/27/22	0.78	-	-	-
USGS-105 (1075 ft bgs)	06/27/22	0.74	-	-	-
USGS-108 (1172 ft bgs)	06/28/22	1.0	-	-	-
Upgradient					
USGS-027	04/11/22	2.5[2]	-	-	-
P&W-2	04/12/22	2.6[2]	-	-	-
USGS-019	04/12/22	0.95	-	-	-
USGS-018	04/11/22	0.64	-	-	-
Other Samples					
Perched Groundwater					
Advanced Test Reactor & Radioactive Waste Management Complexes					
USGS-055	04/13422	1.2	-	-	-
USGS-068	04/13/22	18[1]	-	-	-
USGS-062	04/13/22	1.1	-	-	-
USGS-092	04/18/22	14.9	-	-	-

Samples were filtered in the field unless otherwise noted.
Data qualifiers: U = undetected, J = estimate, R = rejected, "<" = less than detection limit, "+" or "-" after a J means that the estimated result is biased high or low, respectively. ft bgs = feet below ground surface.
* As N.
"-" = not analyzed.
Note 1. Lab indicated that a 20:1 dilution of this sample was required for this analyte. Note 2. Lab indicated that a 2:1 dilution of this sample was required for this analyte. Note 3. Lab indicated that a 200:1 dilution of this sample was required for this analyte. Note 4. Lab indicated that a 4:1 dilution of this sample was required for this analyte.

Table 24. Volatile organic compound concentrations (µg/L) in water samples, second quarter, 2022. Only VOCs detected this quarter or in the recent past are shown.

Sample Location	Sample Date	PCE		TCE		1,1-DCE		cis-1,2-DCE		trans-1,2-DCE		Vinyl Chloride		1,1,1 TCA		2-Hexanone	
Aquifer Samples																	
Facility																	
Radioactive Waste Management Complex																	
USGS-087	04/20/22	<0.5	U	0.74	-	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U
M1S	05/03/22	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U
M6S	05/02/22	<0.5	U	1.14	-	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U
M15S	05/02/22	0.5	-	3.93	-	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U
A11A31	05/02/22	<0.5	U	2.22	-	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U
M7S	05/03/22	<0.5	U	2.31	-	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U
RWMC Production	04/14/22	<0.5	U	3.03	-	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U
Test Area North																	
TAN-2336	04/05/22	<0.5	U	0.70	-	<0.5	U	<0.5	U	1.83	-	<0.5	U	<0.5	U	2.68	-
TAN-2271	04/05/22	<0.5	U	<0.5	U	<0.5	U	<0.5	U	2.49	-	<0.5	U	<0.5	U	<0.5	U
TAN-28	04/05/22	<0.5	U	4.21	-	<0.5	U	25.7	-	87.7[3]	-	21.9	-	<0.5	U	<0.5	U
TAN-29	04/05/22	16.5	-	458[1]	-	0.70	-	39.5	-	8.46	-	<0.5	U	<0.5	U	<0.5	U
TAN-42	04/14/21	6.90	-	69.2[2]	-	<0.5	U	2.23	-	0.50	-	<0.5	U	<0.5	U	<0.5	U
TAN-44	04/05/22	3.43	-	30.8	-	<0.5	U	1.06	-	<0.5	U	<0.5	U	<0.5	U	<0.5	U
TAN-51	06/13/22	26.7	-	164[1]	-	0.61		3.60	-	1.32	-	<0.5	U	<0.5	U	<0.5	U
TAN-56	06/14/22	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U
TAN-2312	06/13/22	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U
ANP-8	06/13/22	2.49	-	14.2	-	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U

Table 24 cont. Volatile organic compound concentrations (µg/L) in water samples, second quarter, 2022. Only VOCs detected this quarter or in the recent past are shown.

Sample Location	Sample Date	Carbon Tetrachloride		Chloroform		Chloro-ethane		1,1-DCA		Carbon Disulfide		Methyl Ethyl Ketone	
USGS-087	04/20/22	3.29	-	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<10	U
M1S	05/03/22	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<10	U
M6S	05/02/22	3.65	-	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<10	U
M15S	05/02/22	6.93	-	2.19	-	<0.5	U	<0.5	U	<0.5	U	<10	U
A11A31	05/02/22	4.97	-	0.93	-	<0.5	U	<0.5	U	<0.5	U	<10	U
M7S	05/03/22	4.79	-	0.99	-	<0.5	U	<0.5	U	<0.5	U	<10	U
RWMC Production	04/14/22	5.67	-	1.81	-	<0.5	U	<0.5	U	<0.5	U	<10	U
TAN-2336	04/05/22	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U	439[2]	-
TAN-2271	04/05/22	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<10	U
TAN-28	04/05/22	<0.5	U	<0.5	U	0.91	-	<0.5	U	<0.5		<10	U
TAN-29	04/05/22	<0.5	U	<0.5	U	<0.5	U	0.67	-	<0.5	U	<10	U
TAN-42	04/05/22	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<10	U
TAN-44	04/05/22	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<10	U
TAN-51	06/13/22	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<10	U
TAN-56	06/14/22	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<10	U
TAN-2312	06/13/22	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<10	U
ANP-8	06/13/22	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<10	U

Abbreviations: PCE = tetrachloroethene; TCE = trichloroethene; 1,1-DCE = 1,1-dichloroethene; cis-1,2-DCE = cis-1,2-dichloroethene; trans-1,2-DCE = trans-1,2-dichloroethene; 1,1-DCA = 1,1-dichloroethane; 1,1,1 TCA = 1,1,1-trichloroethane

Data qualifiers: U = undetected, J = estimate, R = rejected, "<" = less than detection limit, "+" or "-" after a J means that the estimated result is biased high or low, respectively.

Note 1. Lab indicated that a 10:1 dilution of this sample was required for this analyte. Note 2. Lab indicated that a 2:1 dilution of this sample was required for this analyte. Note 3. Lab indicated that a 5:1 dilution of this sample was required for this analyte.

Terrestrial Monitoring Results

The DEQ-INL OP conducts terrestrial (soil and milk) monitoring to characterize deposition and migration of contaminants and provide independent verification of DOE's terrestrial monitoring programs. Physical soil sampling and *in-situ* gamma spectrometry are used to characterize actual deposition and accumulation of radioactive contaminants in soils. Milk samples are collected to evaluate the potential for ingestion of radioactivity by the population around the INL. No *in-situ* gamma spectroscopic measurements were performed, nor were any soil samples physically collected during the second calendar quarter of 2022.

Milk

DEQ-INL OP monitors milk for the naturally occurring radionuclide potassium-40 (^{40}K) and man-made iodine-131 (^{131}I). Milk samples are collected on a monthly basis. Results for gamma spectrometric analyses of milk samples are presented in **Table 25**. ^{40}K was detected in all samples within the expected range of concentration. ^{131}I was not detected. Based on measurements of radionuclides in milk, there were no discernable impacts to the off-site environment from INL operations.

Table 25. Gamma spectrometry analysis data for milk samples, second quarter, 2022.

Sample Location/Dairy	Sample Date	Naturally occurring Potassium-40		Man-made Iodine-131		
		Concentration[2]	± 2 SD	Concentration[2]	± 2 SD	MDC
Monitoring Samples						
Gooding	04/20/22	1617	117	-1.0	2.5	4.1
	05/23/22	1492	111	0.5	1.6	2.7
	06/21/22	1671	113	0.8	1.7	2.8
Verification Samples[1]						
Dietrich	04/05/22	1328	101	-1.3	2.0	3.4
Terreton	04/05/22	1477	109	-0.3	1.2	2.0
Minidoka	05/03/22	1710	122	0.8	1.5	2.5
Howe	06/06/22	1494	112	0.1	1.2	2.2

[1] DEQ-INL OP samples collected by the off-site INL environmental surveillance contractor.
[2] Concentrations with associated uncertainties (± 2 SD) and minimum detectable concentrations (MDC) are expressed in pCi/L.

Quality Assurance

Measurements of constituent concentrations in environmental media are subject to inaccuracy from errors that may be introduced during the collection, transportation, and analysis of samples, calibration of equipment, and recording and reporting of results. While it is impossible to quantify every error that may affect a result, a quality assurance (QA) program can evaluate the overall quality of a dataset and, in many cases, identify and address errors or inaccuracies. DEQ-INL OP's QA program is designed to (1) ensure sample integrity, (2) evaluate the precision and accuracy of analytical results, and (3) ensure that the environmental data are representative and complete.

This section summarizes the quality assurance assessment of the data collected by DEQ-INL OP in the second quarter of 2022. Included are the results of quality control (QC) samples (blanks, duplicates, and spikes) that DEQ-INL OP submitted to Idaho State University's Environmental Monitoring Laboratory (ISU-EML) for radiological analyses and to the Idaho Bureau of Laboratories-Boise (IBL) for non-radiological analyses during the quarter. The analytical results of QC samples are used to assess the precision, accuracy, and representativeness of the environmental data presented in this report. During the second quarter of 2022, DEQ-INL OP submitted 137 QC samples for various radiological and non-radiological analyses (**Table 26**).

All samples referenced in this report were collected in accordance with written procedures maintained by the DEQ-INL OP. Analytical methods and QC procedures used by the laboratories were performed in accordance with approved written procedures maintained by each lab. QC samples analyzed by the labs as part of each lab's internal QA program are not discussed in this report.

Blank Samples

Blank samples consist of matrices that contain immeasurable or acceptably low concentrations of the analyte(s) of interest. They are used to monitor for contamination introduced during sample collection, storage, shipment, and analysis. For water matrices, a blank sample consists of 18-megaohm deionized water from the DEQ-Idaho Falls Regional office and is categorized as a field blank, equipment blank, or trip blank depending on how the blank is handled. A field blank is used to monitor for contamination introduced from the environment during sample collection, an equipment blank is used to monitor for contamination introduced by contaminated equipment, and a trip blank is used to monitor for contamination introduced during transportation of samples (trip blanks are typically only used for VOCs). Most water blank samples submitted to laboratories by DEQ-INL OP are field blanks.

For all analyses except low-level tritium in water, a blank sample result is considered acceptable if it is less than or equal to the minimum detectable concentration (MDC). For low-level tritium analyses in water samples, a blank sample result is acceptable if it is less than or equal to 33 pCi/L.[2] If a blank result exceeds acceptance criteria, above-MDC results in other samples collected, transported, or analyzed together with the failed blank may be qualified as biased high (J+) or rejected (R), or may remain unqualified, depending on the relative sizes of the blank detection and other sample results.

Sample results for blank TSP filters submitted for gross alpha and gross beta screening in air for the second quarter of 2022 are presented in **Table 27**. Blank sample results for select gamma emitters in air from 47-mm TSP filter quarterly composites and 8x10-inch monthly composites are presented in **Table 28**. Blank sample results for radiochemical analysis of 8x10-inch TSP filter quarterly composites from first quarter 2022 are presented in **Table 29.** Data for blank analyses used to assess data quality for tritium in water vapor in air are presented in **Table 30**. Blank sample results for radiological analytes in

[2] The water used by DEQ-INL OP to create blank samples contains measurable concentrations of tritium produced cosmogenically and by above-ground testing of nuclear weapons during the twentieth century. The highest tritium concentration that DEQ considers acceptable in a blank is calculated as the mean tritium concentration in DEQ blanks from 2013 to 2017 plus two standard deviations (33 pCi/L).

groundwater are presented in **Table 31**. Blank sample results for metals, common ions and nutrients, and VOCs are presented in **Tables 32, 33, and 34.**

All blank sample results passed acceptance criteria in the second quarter of 2022.

Duplicate Samples

A duplicate sample is one that is collected at the same location and approximately the same time as another sample (referred to as the "original" sample). Duplicate sample results are compared to the original sample's results to evaluate reproducibility. Significant differences between the two could indicate poor analytical precision or a non-uniform sample matrix.

The difference between the results of an original and duplicate sample (referred to below as a "duplicate-sample pair") is evaluated differently for radiological and non-radiological analyses. For radiological analyses, the results of a duplicate-sample pair are considered to be in agreement if their absolute difference is less than or equal to three times the pooled error of the results:

$$|R_1 - R_2| \leq 3\sqrt{S_1^2 + S_2^2}$$

R_1 = Original sample result
R_2 = Duplicate sample result
S_1 = Analytical uncertainty (1 SD) of the original result
S_2 = Analytical uncertainty (1 SD) of the duplicate result

Radiological results are also considered to be in agreement if their relative percent difference (RPD) is no more than ±20 percent. RPD is calculated as:

$$RPD = \frac{R_1 - R_2}{(R_1 + R_2)/2} \times 100$$

For non-radiological analyses, the RPD is used to evaluate duplicate sample pairs in which both results exceed five times the MDC. An RPD of up to ±20 percent is acceptable. If one or both sample results is less than five times the MDC, the results agree if their absolute difference is less than or equal to the MDC.

Duplicate results for radiological analyses in groundwater and surface water are presented in **Table 35**. Duplicate results for metals, common ions and nutrients, and VOCs in groundwater are presented in **Tables 36, 37,** and **38.** All duplicate results passed acceptance criteria in the second quarter of 2022**.**

Spiked Samples

Spiked samples are samples to which known concentrations of specific analytes have been added. They are used to assess a laboratory's analytical accuracy. The percent recovery (%R) of each spiked-sample analysis is calculated as the ratio of the spike concentration determined by the lab to the known spike concentration. DEQ-INL OP considers the lab's result to be in control if the percent recovery is 100 ± 25%. If the percent recovery of a spiked sample is 50-74%, above-MDC results of samples analyzed in the same batch as the spiked sample may be qualified as low-biased estimates (J-), and below-MDC results may be qualified as undetected estimates (UJ). If the percent recovery of a spiked sample is 126-150%, above-MDC results of associated samples may be qualified as high-biased estimates (J+), and below-MDC results may be qualified as undetected (U). If the percent recovery of a spiked sample is <50% or >150%, the results of all associated samples may be qualified as rejected (R), except for sample results below MDC associated with a spiked-sample analysis having a percent recovery >150%, in which case the sample result remains qualified as undetected (U).

Spiked sample results for metals, common ions and nutrients, and VOCs in groundwater are presented in **Tables 39, 40,** and **41**. All spiked sample results passed acceptance criteria in the second quarter of 2022**.**

DEQ-INL OP also prepares additional "spike-like" quality control samples to assess ambient radiation measurement bias. Once per quarter, DEQ-INL OP irradiates several electret ionization chambers (EICs) at ISU to verify EIC response. Irradiations of EICs are conducted in a repeatable geometry to a known exposure of near 30 mR and two additional higher and lower 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 has a percent recovery of 100 ± 25% when compared to the known irradiated quantity. Overall response for each control set is considered acceptable if the average of the three individual results for the set has a percent recovery of 100 ± 25%. Real-time pressure correction is used to calculate the net exposure measured by these EIC control sets. The ISU irradiation results for second quarter 2022 are presented in **Table 42**. Although one individual EIC reading did not pass the acceptance criterion, all EIC averages passed the DEQ-INL OP acceptance criterion.

Historical EIC irradiations results from ISU have generally been biased low (percent recovery <100%) but within DEQ-INL OP acceptance criteria. As part of an ongoing investigation of this low bias, DEQ-INL OP irradiated three sets of EICs at the Qal-Tek Idaho Falls Facility this quarter. Results are presented in **Table** 43. All individual results and averages passed the acceptance criterion, with values generally higher than the ISU values but still <100% recovery. DEQ-INL OP will continue to investigate the cause(s) of this low bias in irradiated EIC percent recoveries.

Laboratory QC Issues

There were no laboratory QC issues in the second quarter of 2022.

DEQ-INL OP Equipment QC Issue

A calibrated flow rate gauge was taken into the field weekly to measure the sample start and stop flow rates of the 47-mm filter TSP air samplers. For several of these samplers, the rotameter-indicated stop flow rate was greater than the ± 10% error tolerance when compared with the calibrated flow rate gauge in the second quarter, 2022. The calibrated flow rate gauge measurements were used for the activity concentration calculations in the suspect measurements, and results are considered (usable) estimates.

Qualification of Low-Level Sample Results

Sample results >MDC are generally considered detections, with the following exceptions[3] that apply primarily to radionuclide concentrations in water samples:

1. Results >MDC but ≤ 2SD are considered non-detections and U-flagged as undetected, where SD is the sample standard deviation.
2. Results >MDC and >2SD but <3SD are considered questionable and J-flagged as estimates.

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 second quarter of 2022 which significantly affected data quality. The ratio of total QC analyses to total field sample analyses of 16.2% is acceptable and above the DEQ-INL OP minimum requirement of 10%. Methodologies and data reports issued by the contracting laboratories generally conformed to the requirements of DEQ-INL OP during the second quarter of 2022.

[3] Monitoring and Surveillance Committee, Consistency in Reporting Results Subcommittee Meeting Summary, 2/5/04 and 4/1/04.

Data usability is the measure of field sample results that are not rejected divided by the total number of field sample results obtained. The overall data usability (non-rejected results divided by the total number of field sample results reported) of 99.7% for the second quarter of 2022 is excellent and well above the acceptable value of 90% for the DEQ-INL OP ESP and is summarized in **Table 26**. The overall data completeness (usable results divided by the total number of field sample results expected) of 99.6% is also well above the acceptable value of 90%.

Preventative Maintenance and Equipment Reliability

All equipment was calibrated and checked according to prescribed periodicity. Service reliability for air sampling equipment for the second quarter of 2022 is summarized in **Table 44**.

Conclusion

All data collected for the second quarter of 2022 have been assigned the applicable qualifiers to designate the appropriate use of the data. The overall data usability of 99.7% and data completeness of 99.6% are well above the acceptable value of 90% for the quarter, with the data meeting the requirements and data quality objectives established by DEQ-INL OP.

Table 26. Summary of the analyses performed, second quarter, 2022.

Media Sampled	Collection Device	Analyte	Sample Analyses	Blank Analyses	Duplicate Analyses	Spike Analyses	Data Rejected[1]	Analyzing Lab[2]
Air								
Particulate	47-mm filters	Gross alpha	143	13	0	0	1	ISU-EML
		Gross beta	143	13	0	0	1	ISU-EML
	47-mm and 8x10" filters	Gamma emitters	47	4	0	0	0	ISU-EML
	8x10" filters	Radiochemical	12	1	0	0	0	ISU Sub
Water Vapor	Desiccant column	Tritium	33	6	0	0	0	ISU-EML
Gaseous	Charcoal filter	Iodine-131	13	0	0	0	0	ISU-EML
Precipitation	Poly bottle	Tritium	10	0	0	0	0	ISU-EML
		Gamma emitters	13	0	0	0	0	ISU-EML
Water								
Groundwater & Surface Water	Grab or composite	Gross alpha	56	5	7	0	0	ISU-EML
		Gross beta	56	5	7	0	0	ISU-EML
		Gamma emitters	56	5	7	0	0	ISU-EML
		Tritium	56	5	7	0	0	ISU-EML
		Low-level tritium	17	1	5	0	0	ISU-EML
		Radiochemical[6]	34	1	2	0	0	ISU Sub
		Metals	50	5	6	1	0	IBL
		Common Ions	50	5	6	1	0	IBL
		Nutrients	50	5	6	1	0	IBL
		Volatile Organics	17	1	2	1	0	IBL
Terrestrial								
Milk	Grab or composite	Gamma emitters	7	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	66	0	0	18	1	DEQ-INL OP
	EcoGamma	Gamma Radiation	11	NA	NA	NA	0	DEQ-INL OP
Total analyses performed			**940**	**75**	**55**	**22**	**3**	
Total QC analyses performed. (blanks, duplicates, and spikes)			**152**					
Ratio of total QC analyses to total sample analyses[3]			**16.2%**					
Data usability[4], percent			**99.7%**					
Data completeness[5], percent			**99.6%**					

[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] DEQ-INL OP requires that the number of QC analyses performed be at least 10 percent of the number of sample analyses performed.

[4] Data usability is calculated as [total analyses – rejected data]/[total analyses]. DEQ-INL OP considers a data usability rate of 90 percent or higher to be acceptable.

[5] Data completeness is calculated as usable results divided by the total number of field sample results expected. DEQ-INL OP considers a data completeness rate of 90 percent or higher to be acceptable.

[6] Radiochemical includes Strontium-90, Technetium-99, Uranium 234, 235, and 238, Plutonium-238, 239/240, and Americium-241.

Table 27. Blank analysis results for gross alpha and beta in 47-mm particulate air (TSP), second quarter, 2022.

Collection Period		Corrected volume (m^3)[1]	Gross alpha			Gross beta		
Start	Stop		Value	± 2 SD	MDC	Value	±2 SD	MDC
03/30/22	04/06/22	562	-0.3	0.3	0.6	0.0	0.7	1.2
04/06/22	04/13/22	562	0.0	0.2	0.5	-0.4	0.7	1.2
04/13/22	04/20/22	562	-0.3	0.3	0.6	-0.2	0.6	1.0
04/20/22	04/27/22	562	-0.2	0.3	0.6	-0.4	0.7	1.2
04/27/22	05/04/22	562	0.0	0.3	0.6	0.4	0.5	0.9
05/04/22	05/10/22	562	-0.1	0.3	0.6	-0.3	0.6	1.0
05/10/22	05/18/22	562	-0.3	0.2	0.6	0.6	0.6	1.1
05/18/22	05/25/22	562	0.0	0.3	0.6	0.0	0.7	1.2
05/25/22	06/01/22	562	-0.3	0.3	0.6	0.5	0.6	1.1
06/01/22	06/08/22	562	0.3	0.3	0.4	-0.6	0.7	1.2
06/08/22	06/14/22	562	0.0	0.3	0.6	-0.7	0.7	1.2
06/14/22	06/22/22	562	0.2	0.4	0.7	0.3	0.7	1.1
06/22/22	06/29/22	562	-0.4	0.3	0.7	0.3	0.6	1.1

Note: Concentrations, associated uncertainties (± 2 SD), and minimum detectable concentrations (MDC) are expressed in 1 x 10^{-3} pCi/m^3.
[1] A volume equal to the average of the weekly 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 28. Blank analysis results for gamma spectroscopy for 47-mm TSP air filters, composite samples, second quarter, 2022.

Analysis Date	Beryllium-7			Ruthenium-106/Rhodium-106			Antimony-125		
	Concentration[1]	± 2 SD	MDC	Concentration	± 2 SD	MDC	Concentration	± 2 SD	MDC
07/27/2022	-6	96	163	16	142	243	3	27	44
Analysis Date	**Cesium-134**			**Cesium-137**		
	Concentration[1]	**± 2 SD**	**MDC**	**Concentration**	**± 2 SD**	**MDC**
07/27/2022	1	7	11	9	9	16

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 weekly 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 passed through the blank filters.

Table 28 (continued). Blank analysis results for gamma spectrometry for 8x10-inch TSP air filters, monthly composite samples, second quarter, 2022.

Month	Beryllium-7			Ruthenium-106/Rhodium-106			Antimony-125		
	Concentration[1]	± 2 SD	MDC	Concentration	± 2 SD	MDC	Concentration	± 2 SD	MDC
April 2022	17	25	41	15	77	131	2	5	8
May 2022	19	36	60	5	51	88	1	9	15
June 2022	17	26	44	-18	45	81	-6	6	11

Month	Cesium-134			Cesium-137		
	Concentration[1]	± 2 SD	MDC	Concentration	± 2 SD	MDC
April 2022	-1	3	6	1	5	8
May 2022	-2	3	5	0	3	4
June 2022	0	3	4	2	4	7

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 month. A composite volume equal to the sum of the weekly 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 passed through the blank filters.

Table 29. Blank results for radiochemical analysis of 8x10-inch TSP air filters, quarterly composite samples, first quarter, 2022

Sample Description	^{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	-0.41	0.28	0.53	0.00	0.01	0.02	0.00	0.01	0.02	0.00	0.02	0.05

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 weekly 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 passed through the blank filters.

Table 30. Blank analysis results for tritium in water vapor from air samples, second quarter, 2022.

Sample Number	Start Date	Collection Date	Analysis Date	Tritium		
				Concentration	± 2 SD	MDC
OP222ZTR01	05/16/2022	05/25/2022	06/02/2022	0.01	0.09	0.16
OP222ZTR02	05/16/2022	05/25/2022	06/02/2022	0.10	0.10	0.16
OP222ZTR03	06/30/2022	07/12/2022	07/25/2022	0.01	0.09	0.16
OP222ZTR04	06/30/2022	07/14/2022	07/25/2022	0.03	0.09	0.15
OP222 FRIDGE	05/06/2022	07/14/2022	07/25/2022	0.01	0.09	0.15
OP222 SINK	05/06/2022	07/14/2022	07/25/2022	0.02	0.09	0.15

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

Table 31. Blank analysis results (pCi/L) for radiological constituents in water, second quarter, 2022.

Sample Number	Sample Date	Blank Type	Concentration	± 2 SD	MDC	Within Blank Criteria?
Gross Alpha						
221W070	4/05/2022	Field	0.2	0.2	0.3	Yes
221W370	5/17/2022	Field	-0.1	0.2	0.4	Yes
221W441	6/21/2022	Field	0.3	0.3	0.4	Yes
221W446	6/15/2022	Field	0.2	0.2	0.3	Yes
221W486	6/28/2022	Field	0.1	0.2	0.3	Yes
Gross Beta						
221W070	4/05/2022	Field	0.2	0.5	0.9	Yes
221W370	5/17/2022	Field	0.5	0.6	0.9	Yes
221W441	6/21/2022	Field	0.0	0.5	0.9	Yes
221W446	6/15/2022	Field	0.7	0.6	0.9	Yes
221W486	6/28/2022	Field	0.5	0.5	0.9	Yes
Cesium-137						
221W070	4/05/2022	Field	-0.5	1.4	2.5	Yes
221W370	5/17/2022	Field	0.1	1.3	2.2	Yes
221W441	6/21/2022	Field	0.4	1.5	2.6	Yes
221W446	6/15/2022	Field	-0.2	2.1	3.5	Yes
221W486	6/28/2022	Field	-1.3	1.5	2.7	Yes
Tritium (standard method)						
221W072	4/05/2022	Field	0	90	160	Yes
221W371	5/17/2022	Field	-20	100	170	Yes
221W442	6/21/2022	Field	20	90	150	Yes
221W447	6/15/2022	Field	10	90	150	Yes
221W487	6/28/2022	Field	-50	90	160	Yes
Tritium (low-level method)						
221W371	5/17/2022	Field	-1	6	11	Yes
Strontium-90						
221W071	4/05/2022	Field	0.12	0.25	0.55	Yes

MDC = minimum detectable concentration.

Table 32. Blank analysis results (µg/L) for metals in water, second quarter, 2022.

Sample Number	Sample Date	Blank Type	Arsenic	Barium	Chromium	Iron	Lead	Manganese	Selenium	Zinc
221W074	4/05/2022	Field	<2.0	<1.0	<1.0	<10	<1.0	<1.0	-	-
221W373	5/17/2022	Field	-	-	<1.0	-	-	-	-	-
221W444	6/21/2022	Field	-	-	<1.0	-	-	-	-	-
221W449	6/15/2022	Field	-	-	<1.0	-	-	-	-	-
221W489	6/28/2022	Field	-	-	<1.0	-	-	-	-	-

Table 33. Blank analysis results (mg/L) for common ions and nutrients in water, second quarter, 2022.

Sample Number	Sample Date	Blank Type	Calcium	Magnesium	Sodium	Potassium	Fluoride	Chloride	Sulfate	Alkalinity†	NO_3+NO_2*	Total Phosphorus
221W073,074, 075	4/05/2022	Field	<0.10	<0.10	<0.10	<0.10	-	<0.4	<0.8	<1.0	<0.01	-
221W372, 374	05/17/2022	Field	-	-	-	-	-	<0.4	<0.8	<1.0	<0.01	-
221W443, 445	06/21/2022	Field	-	-	-	-	-	<0.4	<0.8	<1.0	<0.01	-
221W448, 450	06/15/2022	Field	-	-	-	-	-	<0.4	<0.8	<1.0	<0.01	-
221W488, 490	06/28/2022	Field	-	-	-	-	-	<0.4	<0.8	<1.0	<0.01	-

† As $CaCO_3$.
* As N.

Table 34. Blank analysis results (µg/L) for VOCs in water, second quarter, 2022.

Sample Number	Sample Date	Blank Type	PCE	TCE	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	Vinyl Chloride	1,1-DCA	Carbon Tetrachloride	Methylene Chloride	Chloro-form	Chloro-methane	MEK
221W076	4/05/2022	Field	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10

Abbreviations: PCE = tetrachloroethene; TCE = trichloroethene; 1,1-DCE = 1,1-dichloroethene; cis-1,2-DCE = cis-1,2-dichloroethene; trans-1,2-DCE = trans-1,2-dichloroethene; 1,1-DCA = 1,1-dichloroethane
MEK = Methyl Ethyl Ketone

Table 35. Duplicate sample results (pCi/L) for radiological constituents in groundwater and/or surface water, second quarter, 2022.

Analysis/Sample Location	Original Sample Number	Concentration	± 2 SD	Duplicate Sample Number	Concentration	± 2 SD	RPD	$\lvert R_1-R_2 \rvert$	$3(S_1^2+S_2^2)^{1/2}$	Within Criteria?
Gross Alpha										
USGS-018	221W188	1.3	0.8	221W256	2.4	0.9	-59	1.1	1.8	Yes
USGS-100	221W237	1.4	0.9	221W261	1.4	0.8	0	0	1.8	Yes
CFA-1	221W248	1.5	1.0	221W283	2.4	1.2	-46	0.9	2.3	Yes
M15S	221W308	1.3	0.8	221W342	1.1	0.8	17	0.2	1.7	Yes
Clear Spring	221W294	0.7	0.7	221W348	0.9	0.9	-25	0.2	1.7	Yes
Atomic City	221W375	2.4	0.9	221W380	1.1	0.7	74	1.3	1.7	Yes
ANP-8	221W390	1.7	0.8	221W433	1.6	0.9	6	0.1	1.8	Yes
Gross Beta										
USGS-018	221W188	2.5	0.8	221W256	3.6	0.8	-36	1.1	1.7	Yes
USGS-100	221W237	3.1	0.8	221W261	3.5	0.8	-12	0.4	1.7	Yes
CFA-1	221W248	7.1	1.0	221W283	8.2	1.0	-14	1.1	2.1	Yes
M15S	221W308	3.3	0.9	221W342	3.8	0.9	-14	0.5	1.9	Yes
Clear Spring	221W294	4.2	0.9	221W348	3.0	0.9	33	1.2	1.9	Yes
Atomic City	221W375	3.4	0.9	221W380	3.2	0.8	6	0.2	1.8	Yes
ANP-8	221W390	4.2	0.8	221W433	4.0	0.9	5	0.2	1.8	Yes
Cesium-137										
USGS-018	221W188	0.9	1.0	221W256	-0.1	1.3	250	1.0	2.5	Yes
USGS-100	221W237	1.3	1.2	221W261	1.1	1.2	17	0.2	2.6	Yes
CFA-1	221W248	0.4	1.3	221W283	0.6	1.1	-40	0.2	2.6	Yes
M15S	221W308	0.3	1.1	221W342	1.3	1.6	-125	1.0	2.9	Yes
Clear Spring	221W294	0.5	1.0	221W348	1.0	1.1	-67	0.5	2.2	Yes
Atomic City	221W375	-0.3	1.5	221W380	-0.4	1.5	29	0.1	3.2	Yes
ANP-8	221W390	0.4	1.0	221W433	0.4	1.5	0	0.0	2.7	Yes
Tritium (standard method)										
USGS-018	221W189	13	100	221W257	-30	90	-400	40	202	Yes
USGS-100	221W238	-16	90	221W262	-10	90	67	10	191	Yes
CFA-1	221W251	1906	170	221W286	1977	170	-4	71	361	Yes
M15S	221W309	36	170	221W343	-35	160	142	80	202	Yes
Clear Spring	221W295	-55	90	221W349	21	90	447	76	191	Yes
Atomic City	221W376	61	90	221W381	-16	90	400	80	191	Yes
ANP-8	221W391	61	90	221W434	22	90	100	40	191	Yes
Tritium (low level method)										
USGS-018	221W189	7	7	221W257	3	7	80	4	15	Yes
USGS-100	221W238	8	7	221W262	11	8	-32	3	16	Yes
M15S	221W309	53	10	221W343	61	10	-14	8	21	Yes
Atomic City	221W376	2	6	221W381	9	6	236	7	13	Yes

ANP-8	221W391	58	9	221W434	50	10	15	8	20	Yes
Strontium-90										
CFA-1	221W249	-0.23	0.18	221W284	-0.14	0.17	-49	0.09	0.37	Yes
Technetium-99										
CFA-1	221W250	4.1	4.3	221W285	3.8	4.2	8	0.3	6.3	Yes

[1]RPD calculation results in division by zero. Absolute difference in the duplicate sample results meets the ≤3(pooled error) criterion.

Table 36. Duplicate sample results for metals (µg/L) in groundwater, second quarter, 2022.

Sample Location	Sample Number	Sample Date	Arsenic	Barium	Chromium	Iron	Lead	Manganese	Selenium	Zinc
USGS-018	221W191	4/12/2022	-	-	2.8	-	-	-	-	-
USGS-018	221W259	4/12/2022	-	-	2.9	-	-	-	-	-
RPD			**-**	**-**	**-3.5**	**-**	**-**	**-**	**-**	**-**
USGS-100	221W241	4/14/2022	-	-	2.9	-	-	-	-	-
USGS-100	221W264	4/14/2022	-	-	2.8	-	-	-	-	-
RPD			**-**	**-**	**3.5**	**-**	**-**	**-**	**-**	**-**
CFA-1	221W254	4/18/2022	-	-	14	-	-	-	-	-
CFA-1	221W188	4/18/2022	-	-	14	-	-	-	-	-
RPD			**-**	**-**	**0**	**-**	**-**	**-**	**-**	**-**
M15S	221W311	5/02/2022	-	-	59	-	-	-	-	-
M15S	221W345	5/02/2022	-	-	58	-	-	-	-	-
RPD					**1.7**					
Atomic City	221W378	06/06/2022	-	-	2.7	-	-	-	-	-
Atomic City	221W383	06/06/2022	-	-	2.7	-	-	-	-	-
RPD					**0**					
ANP-8	221W393	06/13/2022	<2.0	82	3.2	170	0	16	-	-
ANP-8	221W438	06/13/2022	<2.0	82	3.2	150	0	16	-	-
RPD			**0**	**0**	**0**	**13**	**0**	**0**	**-**	**-**

RPD = relative percent difference.
Data qualifier: J = estimate.

Table 37. Duplicate sample results for common ions and nutrients (mg/L) in groundwater, second quarter, 2022.

Sample Location	Sample Number	Sample Date	Calcium	Magnesium	Sodium	Potassium	Fluoride	Chloride	Sulfate	Total Alkalinity†	Total Nitrogen	Total Phosphorus
USGS-018	221W190, 192	4/12/2022	-	-	-	-	-	12.0	27.4	134	0.64	-
USGS-018	221W258, 260	4/12/2022	-	-	-	-	-	12.1	27.6	134	0.65	-
RPD			**-**	**-**	**-**	**-**	**-**	**-0.8**	**-0.7**	**0.0**	**-1.6**	**-**
USGS-100	221W239, 242	4/14/2022	-	-	-	-	-	16.0	18.1	133	2.3	-
USGS-100	221W263, 265	4/14/2022	-	-	-	-	-	16.3	18.2	135	2.4	-
RPD			**-**	**-**	**-**	**-**	**-**	**-1.9**	**-0.6**	**-1.5**	**-4.3**	**-**
CFA-1	221W252, 255	4/18/2022	-	-	-	-	-	70.3	33.2	130	2.5	-
CFA-1	221W287, 289	4/18/2022	-	-	-	-	-	70.0	32.8	130	2.5	-
RPD			**-**	**-**	**-**	**-**	**-**	**0.4**	**1.2**	**0**	**0**	**-**
M15S	221W310, 312	5/02/2022	-	-	-	-	-	75.8	43.8	93.8	1.5	-
M15S	221W344, 346	5/02/2022	-	-	-	-	-	76.8	44.1	93.8	1.4	-
RPD								**-1.3**	**-0.7**	**0**	**6.9**	**-**
Atomic City	221W377, 379	6/06/2022	-	-	-	-	-	16.4	17.4	137	1.7	-
Atomic City	221W382, 384	6/06/2022	-	-	-	-	-	16.4	17.4	136	1.7	-
RPD			-	-	-	-	-	**0**	**0**	**0.7**	**0**	**-**
ANP-8	221W392, 393, 394	6/13/2022	41	15	7.1	3	-	16.1	31.3	133	0.89	-
ANP-8	221W436, 438, 439	6/13/2022	41	15	7.1	3	-	16.0	31.3	133	0.89	-
RPD			**0**	**0**	**0**	**0**	**-**	**0.6**	**-0.0**	**0**	**0**	**-**

RPD = relative percent difference.

† As $CaCO_3$.

Table 38. Duplicate sample results (µg/L) for VOCs in water, second quarter, 2022.

Location	Sample Number	Sample Date	PCE	TCE	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	Vinyl Chloride	1,1-DCA	Carbon Tetrachloride	Methylene Chloride	Chloro-methane	Styrene	Chloro-form	MEK
M15S	221W313	5/02/22	<0.5	3.93	<0.5	<0.5	<0.5	<0.5	<0.5	6.93	<0.5	<0.5	<0.5	2.19	<10
M15S	221W347	5/02/22	0.5	3.84	<0.5	<0.5	<0.5	<0.5	<0.5	7.05	<0.5	<0.5	<0.5	2.15	<10
RPD			**0**	**2.3**	**0**	**0**	**0**	**0**	**0**	**-1.7**	**0**	**0**	**0**	**1.8**	**0**
ANP-8	221W395	6/13/22	2.49	14.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10
ANP-8	221W440	6/13/22	2.43	14.3	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10
RPD			**2.4**	**-0.7**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

RPD = relative percent difference.

Abbreviations: PCE = tetrachloroethene; TCE = trichloroethene; 1,1-DCE = 1,1-dichloroethene; cis-1,2-DCE = cis-1,2-dichloroethene; trans-1,2-DCE = trans-1,2-dichloroethene; 1,1-DCA = 1,1-dichloroethane, MEK = Methyl Ethyl Ketone (2-Butanone).

Table 39. Spiked sample results (µg/L) for metals in water, second quarter, 2022.

Sample Number	Sample Date	Barium			Chromium			Lead			Manganese			Zinc		
		Spike	Result	%R	Spike	Result	%R	Spike	Result	%R	Spike	Result	%R	Spike	Result	%R
221W339	5/3/2022	83.6	86	103	67.2	67	100	6.1	6.3	103	7.62	8.2	108	53.8	53	99

Table 40. Spiked sample results (mg/L) for common ions and nutrients in water, second quarter, 2022.

Sample Number	Sample Date	Calcium			Magnesium			Sodium			Potassium			Fluoride		
		Spike	Result	%R	Spike	Result	%R	Spike	Result	%R	Spike	Result	%R	Spike	Result	%R
221W338	5/03/2022	10.6	9.9	93	9.75	9.5	97	11.5	12	104	2.76	2.7	98	-	-	-

Table 40. (Continued). Spiked sample results (mg/L) for common ions and nutrients in water, second quarter, 2022.

Sample Number	Sample Date	Chloride			Sulfate			Total Alkalinity as $CaCO_3$			Total Nitrogen			Total Phosphorus		
		Spike	Result	%R	Spike	Result	%R	Spike	Result	%R	Spike	Result	%R	Spike	Result	%R
221W338, 340	5/03/2022	87.9	93.1	106	12.5	12.8	102	41.4	41.8	101	3.22	3.3	102	0.0151	0.014	93

Table 41. Spiked sample results (µg/L) for VOCs in water, second quarter, 2022.

Sample Number	Sample Date	Carbon Tetrachloride			Styrene			Tetrachloroethene			Trichloroethene			Vinyl Chloride		
		Spike	Result	%R	Spike	Result	%R	Spike	Result	%R	Spike	Result	%R	Spike	Result	%R
221W341	5/03/2022	4.56	4.68	103	12.3	11.7	95	16.4	18.1	110	6.32	7.42	117	6.00	7.10	118

Table 42. ISU-EML electret ionization chamber (EIC) irradiation results (categorized as spiked samples), second quarter, 2022.

Electret #	Exposure Received		Net Measured Exposure[1]		%R	Within Spec?
	(mR)	Uncertainty (±1 SD, mR)	(mR)	Uncertainty (±1 SD, mR)		
SKR521	45.0	2.3	37.8	1.3	84.0%	Yes
SKR527	45.0	2.3	37.6	1.3	83.6%	Yes
SKR463	45.0	2.3	37.4	1.3	83.1%	Yes
				Triplicate AVG:	**83.6%**	**Yes**
SKR529	30.0	1.5	28.3	1.3	94.3%	Yes
SKR537	30.0	1.5	29.6	1.3	98.7%	Yes
SKR438	30.0	1.5	28.8	1.3	96.0%	Yes
				Triplicate AVG:	**96.3%**	**Yes**
SKR441	20.0	1.0	16.9	1.3	84.5%	Yes
SKR566	20.0	1.0	14.8	1.3	74.0%	No
SKR532	20.0	1.0	16.1	1.3	80.5%	Yes
				Triplicate AVG:	**79.7%**	**Yes**

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

Table 43. Qal-Tek electret ionization chamber (EIC) irradiation results (categorized as spiked samples), second quarter, 2022.

Electret #	Exposure Received		Net Measured Exposure[1]		%R	Within Spec?
	(mR)	Uncertainty (±1 SD, mR)	(mR)	Uncertainty (±1 SD, mR)		
SKR502	40.0	1.4	37.9	1.3	94.8%	Yes
SMD331	40.0	1.4	35.9	1.4	89.8%	Yes
SMD628	40.0	1.4	39.3	1.4	98.2%	Yes
				Triplicate AVG:	**94.3%**	**Yes**
SMD508	30.0	1.1	28.5	1.4	95.0%	Yes
SKR554	30.0	1.1	26.9	1.3	89.7%	Yes
SMD519	30.0	1.1	27.9	1.3	93.0%	Yes
				Triplicate AVG:	**92.6%**	**Yes**
SKR315	20.0	0.7	18.7	1.3	93.5%	Yes
SMD582	20.0	0.7	18.7	1.3	93.5%	Yes
SKR577	20.0	0.7	20.2	1.3	101.0%	Yes
				Triplicate AVG:	**96.0%**	**Yes**

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

Table 44. Air sampling field equipment service reliability (percent operational), second quarter, 2022.

Station Locations	Sample Type				
	47-mm TSP	8x10-inch TSP	Radioiodine	Atmospheric Moisture	Precipitation
Onsite Locations					
Big Lost River Rest Area	100%	100%	100%	100%	100%
Experimental Field Station	100%	100%	100%	100%	NC[1]
Sand Dunes Tower	100%	100%	100%	100%	NC[1]
Van Buren Avenue	100%	100%	100%	100%	NC[1]
Boundary Locations					
Atomic City	100%	100%	100%	100%	100%
Howe	100%	100%	100%	100%	100%
Monteview	100%	100%	100%	100%	100%
Mud Lake	100%	100%	100%	100%	100%
Distant Locations[2]					
Craters of the Moon	100%	100%	100%	100%	NC[1]
Idaho Falls	100%	100%	100%	100%	100%
Idaho Falls Duplicate[3]	NC[1]	100%	-	-	-

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

[1] NC = Sample not collected at this location.

[2] The Fort Hall Station, operated by the Shoshone-Bannock Tribes, is not included here.

[3] A duplicate 8x10-inch filter TSP sampler is currently installed at the Idaho Falls location.

Appendix A

Table A-1. Weekly concentrations (in 1 x 10^{-3} pCi/m^3) for gross alpha and gross beta analyses of 47-mm TSP filters for all locations, second quarter, 2022.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	±2 SD	Concentration	±2 SD
On-Site Locations						
Big Lost River Rest Area	03/30/22	04/06/22	0.2	0.4	14.3	1.3
	04/06/22	04/13/22	0.7	0.4	14.7	1.2
	04/13/22	04/20/22	0.4	0.4	13.4	1.1
	04/20/22	04/27/22	0.6	0.4	15.6	1.2
	04/27/22	05/04/22	0.6	0.4	9.3	1.0
	05/04/22	05/10/22	0.3	0.4	8.1	1.1
	05/10/22	05/18/22	0.5	0.3	18.8	1.2
	05/18/22	05/25/22	0.6	0.5	16.8	1.3
	05/25/22	06/01/22	0.1	0.4	10.0	1.1
	06/01/22	06/08/22	0.5	0.3	16.8	1.3
	06/08/22	06/14/22	0.6	0.5	14.7	1.3
	06/14/22	06/22/22	0.8	0.4	17.3	1.2
	06/22/22	06/29/22	0.6	0.4	25.4	1.4
Experimental Field Station	03/30/22	04/06/22	0.5	0.4	15.1	1.2
	04/06/22	04/13/22	0.8	0.4	18.5	1.3
	04/13/22	04/20/22	0.8	0.4	22.6	1.4
	04/20/22	04/27/22	1.3	0.5	16.9	1.3
	04/27/22	05/04/22	0.7	0.4	10.6	1.0
	05/04/22	05/10/22	0.2	0.4	13.2	1.2
	05/10/22	05/18/22	1.0	0.4	19.9	1.2
	05/18/22	05/25/22	0.5	0.4	16.6	1.2
	05/25/22	06/01/22	0.1	0.4	11.1	1.1
	06/01/22	06/08/22	1.5	0.4	18.1	1.3
	06/08/22	06/14/22	0.4	0.4	16.0	1.4
	06/14/22	06/22/22	0.9	0.4	17.4	1.2
	06/22/22	06/29/22	0.9	0.5	24.4	1.4
Sand Dunes Tower	03/30/22	04/06/22	0.4	0.4	16.4	1.2
	04/06/22	04/13/22	0.6	0.3	16.9	1.3
	04/13/22	04/20/22	0.4	0.4	13.6	1.1
	04/20/22	04/27/22	0.6	0.4	17.4	1.3
	04/27/22	05/04/22	0.1	0.3	11.1	1.0
	05/04/22	05/10/22	0.1	0.4	7.9	1.0
	05/10/22	05/18/22	0.8	0.4	20.3	1.2
	05/18/22	05/25/22	0.7	0.4	17.7	1.3
	05/25/22	06/01/22	0.0	0.3	11.5	1.1
	06/01/22	06/08/22	0.5	0.3	17.9	1.3
	06/08/22	06/14/22	0.5	0.4	15.6	1.4
	06/14/22	06/22/22[1]	0.4	0.4	16.4	1.2
	06/22/22	06/29/22	0.7	0.5	24.0	1.4

Table A-1 continued. Weekly concentrations (in 1 x 10^{-3} pCi/m^3) for gross alpha and gross beta analyses of 47-mm TSP filters for all locations, second quarter, 2022.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	±2 SD	Concentration	±2 SD
Van Buren Avenue	03/30/22	04/06/22	0.7	0.4	16.3	1.3
	04/06/22	04/13/22	1.0	0.4	15.3	1.2
	04/13/22	04/20/22[1]	0.4	0.4	18.9	1.3
	04/20/22	04/27/22[1]	0.7	0.4	17.1	1.3
	04/27/22	05/04/22	0.4	0.4	17.8	1.2
	05/04/22	05/10/22	0.3	0.4	14.0	1.2
	05/10/22	05/18/22	0.7	0.4	19.8	1.2
	05/18/22	05/25/22	0.7	0.4	16.9	1.3
	05/25/22	06/01/22	0.3	0.4	12.1	1.1
	06/01/22	06/08/22	1.2	0.4	17.6	1.3
	06/08/22	06/14/22	0.5	0.4	14.7	1.3
	06/14/22	06/22/22	0.8	0.4	18.6	1.2
	06/22/22	06/29/22	0.5	0.4	23.9	1.4
Boundary Locations						
Atomic City	03/30/22	04/06/22	0.3	0.4	15.3	1.2
	04/06/22	04/13/22	1.0	0.4	15.2	1.3
	04/13/22	04/20/22	0.5	0.4	20.2	1.3
	04/20/22	04/27/22	0.6	0.4	17.8	1.4
	04/27/22	05/04/22	0.8	0.4	17.3	1.2
	05/04/22	05/10/22	0.3	0.4	13.7	1.2
	05/10/22	05/18/22	1.0	0.4	19.0	1.2
	05/18/22	05/25/22[1]	0.2	0.4	16.6	1.4
	05/25/22	06/01/22	0.1	0.4	9.8	1.0
	06/01/22	06/08/22	0.8	0.4	16.9	1.3
	06/08/22	06/14/22	0.5	0.4	16.5	1.4
	06/14/22	06/22/22	0.5	0.4	18.1	1.2
	06/22/22	06/29/22	0.6	0.4	23.4	1.4
Howe	03/30/22	04/06/22	1.2	0.5	17.6	1.4
	04/06/22	04/13/22[6]	R	R	R	R
	04/13/22	04/20/22	1.0	0.5	17.2	1.4
	04/20/22	04/27/22[1]	1.0	0.5	16.6	1.3
	04/27/22	05/04/22[1]	0.5	0.4	17.2	1.2
	05/04/22	05/10/22[1]	0.4	0.5	9.1	1.1
	05/10/22	05/18/22[1]	0.5	0.3	20.2	1.2
	05/18/22	05/25/22[1,2]	0.5	0.7	13.5	1.8
	05/25/22	06/01/22[1]	0.2	0.4	11.2	1.0
	06/01/22	06/08/22[1]	0.7	0.3	18.4	1.3
	06/08/22	06/14/22[1]	0.7	0.5	15.4	1.4
	06/14/22	06/22/22[1]	0.5	0.4	17.7	1.2
	06/22/22	06/29/22[1]	0.3	0.4	25.8	1.5

Table A-1 continued. Weekly concentrations (in 1 x 10^{-3} pCi/m^3) for gross alpha and gross beta analyses of 47-mm TSP filters for all locations, second quarter, 2022.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	±2 SD	Concentration	±2 SD
Monteview	03/30/22	04/06/22	0.6	0.4	15.4	1.2
	04/06/22	04/13/22	0.7	0.4	16.0	1.2
	04/13/22	04/20/22	0.6	0.4	12.8	1.1
	04/20/22	04/27/22[1]	0.6	0.4	17.9	1.4
	04/27/22	05/04/22	0.1	0.3	11.6	1.0
	05/04/22	05/10/22	0.1	0.4	8.3	1.0
	05/10/22	05/18/22	0.9	0.4	18.8	1.1
	05/18/22	05/25/22	0.4	0.4	16.6	1.2
	05/25/22	06/01/22	0.2	0.3	12.6	1.0
	06/01/22	06/08/22	0.7	0.3	15.8	1.2
	06/08/22	06/14/22[1]	0.4	0.4	16.8	1.4
	06/14/22	06/22/22	0.5	0.4	14.4	1.1
	06/22/22	06/29/22	0.6	0.5	21.5	1.4
Mud Lake	03/30/22	04/06/22	1.6	0.5	16.8	1.3
	04/06/22	04/13/22	0.9	0.4	17.2	1.3
	04/13/22	04/20/22	0.6	0.4	7.2	0.9
	04/20/22	04/27/22	1.1	0.4	17.8	1.3
	04/27/22	05/04/22	0.7	0.4	12.0	1.0
	05/04/22	05/10/22	0.2	0.4	9.0	1.1
	05/10/22	05/18/22	0.7	0.4	18.5	1.2
	05/18/22	05/25/22	0.6	0.4	15.1	1.2
	05/25/22	06/01/22	-0.1	0.3	12.3	1.1
	06/01/22	06/08/22	0.6	0.3	17.7	1.3
	06/08/22	06/14/22[1]	0.5	0.4	19.1	1.5
	06/14/22	06/22/22	0.4	0.4	18.3	1.2
	06/22/22	06/29/22	0.4	0.5	25.2	1.5
Distant Locations						
Craters of the Moon	03/30/22	04/06/22	0.5	0.4	14.6	1.3
	04/06/22	04/13/22	0.9	0.4	16.9	1.4
	04/13/22	04/20/22	0.6	0.5	19.9	1.4
	04/20/22	04/27/22	0.5	0.4	14.7	1.3
	04/27/22	05/04/22	0.5	0.4	12.6	1.1
	05/04/22	05/10/22	-0.1	0.4	11.5	1.3
	05/10/22	05/18/22	0.6	0.4	18.3	1.3
	05/18/22	05/25/22	0.2	0.4	18.0	1.4
	05/25/22	06/01/22	0.1	0.4	11.3	1.1
	06/01/22	06/08/22	0.5	0.3	16.7	1.4
	06/08/22	06/14/22	0.5	0.5	13.8	1.4
	06/14/22	06/22/22	0.8	0.5	19.4	1.3
	06/22/22	06/29/22	0.5	0.5	22.9	1.5

Table A-1 continued. Weekly concentrations (in 1 x 10^{-3} pCi/m^3) for gross alpha and gross beta analyses of 47-mm TSP filters for all locations, second quarter, 2022.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	±2 SD	Concentration	±2 SD
Fort Hall[4]	03/30/22	04/06/22[3]	0.8	0.4	13.4	1.1
	04/06/22	04/13/22[3]	0.9	0.4	13.2	1.1
	04/13/22	04/20/22[3]	1.5	0.5	12.0	1.1
	04/20/22	04/27/22[3]	0.9	0.4	15.6	1.2
	04/27/22	05/04/22[3]	0.7	0.4	10.7	1.0
	05/04/22	05/10/22[3]	0.4	0.4	8.2	1.0
	05/10/22	05/18/22[3]	0.7	0.3	17.3	1.1
	05/18/22	05/25/22[3]	0.8	0.4	17.7	1.2
	05/25/22	06/01/22[3]	0.5	0.4	10.2	1.0
	06/01/22	06/08/22[3]	0.7	0.3	16.1	1.2
	06/08/22	06/14/22[3]	0.5	0.4	16.0	1.4
	06/14/22	06/22/22[3]	0.7	0.4	17.4	1.2
	06/22/22	06/29/22[3]	0.8	0.5	23.4	1.4
Idaho Falls	03/30/22	04/06/22[1]	0.6	0.4	15.4	1.2
	04/06/22	04/13/22[1]	1.0	0.4	12.8	1.1
	04/13/22	04/20/22[1]	0.8	0.4	13.0	1.1
	04/20/22	04/27/22[1]	0.7	0.4	17.8	1.2
	04/27/22	05/04/22[1]	0.6	0.4	18.9	1.2
	05/04/22	05/10/22[1]	0.4	0.5	8.8	1.1
	05/10/22	05/18/22[1]	0.9	0.4	19.4	1.2
	05/18/22	05/25/22[1]	0.9	0.4	14.9	1.2
	05/25/22	06/01/22[1]	0.1	0.4	12.7	1.1
	06/01/22	06/08/22[1]	0.5	0.3	17.4	1.3
	06/08/22	06/14/22[5]	0.0	0.6	21.5	2.0
	06/14/22	06/22/22	0.7	0.4	15.4	1.1
	06/22/22	06/29/22	0.8	0.5	22.7	1.4

Note: MDCs typically range from (0.4 to 0.8) x 10^{-3} pCi/m^3 for gross alpha and from (0.9 to 1.5) x 10^{-3} pCi/m^3 for gross beta.

[1] Faulty rotameter indicated flow rate. Rotameter stop flow rate was > ± 10% error tolerance when compared with a field calibrator. Total volume is an estimate based on elapsed time multiplied by the average of the air flow rate measurements from the air flow calibrator. Results are considered (usable) estimates.
[2] Partial sample. Power off at filter stop time.
[3] Improper sampling orientation with the filter not fully exposed to the ambient air. Results are considered (usable) estimates.
[4] Operated by Shoshone-Bannock Tribes.
[5] Partial sample due to motor replacement. Volume is estimated. Results are considered (usable) estimates.
[6] R - Results rejected. Insufficient sample volume for a valid analysis.

Appendix B

Table B-1. Results for all electret ionization chamber (EIC) locations, second quarter, 2022.

Sample Location	Net Corrected Exposure Rate (µR/hr)[1]	± 2 SD (µR/hr)
Arco	13.3	2.8
Craters of the Moon	15.1	2.6
Rest Area	14.0	0.3
Van Buren Avenue	15.9	3.4
Experimental Field Station	19.5	1.7
Main Gate	14.6	3.7
Atomic City	10.1, 14.1	-
Taber	14.3	3.1
Blackfoot	12.8	4.1
Ft. Hall	12.7	5.1
Idaho Falls	12.3	2.7
Mud Lake/ Terreton	14.6	4.3
Monteview	15.2	3.4
Sand Dunes	13.7	1.6
Howe Met. Tower	NS[3]	NS[3]
MP282 -20	13.5	5.1
MP280 -20	12.6	5.0
MP278 -20	11.6	2.5
MP276 -20	12.8	2.4
MP274 -20	10.2	2.6
MP272 -20	11.4	3.1
MP270 -20	14.5	4.1
MP268 -20	11.8	2.6
MP266 -20	11.7	1.9
MP264 -20	12.8	1.7
MP270 -20/26	R[2]	R[2]
MP268 -20/26	15.6	2.7
MP266 -20/26	15.0	2.4
MP263 -20/26	15.2	3.9
MP261 -20/26	10.3	1.5
MP259 -20/26	14.7, 15.7	-
MP256 -20/26	8.8	1.8
MFC (EBR II)	14.5	4.1
EBR I	13.5	2.1
RWMC	15.7	3.3
CFA	15.3	3.0
CITRC (PBF)	13.4	3.7
INTEC	16.2	5.1
ATR (TRA)	15.2	2.9
NRF	15.1	3.9
TAN/SMC	13.2	2.4
Mud Lake Bank of Commerce	15.2	1.2
MP43-33	11.9	1.2
MP41-33	14.4	2.0
MP39-33	12.5	4.0
MP37-33	14.0	3.0
MP35-33	12.8	3.4
MP33-33	14.1	0.0
MP31-33	12.9	3.9
MP29-33	12.5	4.4
MP27-33	13.1	3.2

Table B-1. continued. Results for all electret ionization chamber (EIC) locations, second quarter, 2022.

Sample Location	Net Corrected Exposure Rate (µR/hr)[1]	± 2 SD (µR/hr)
MP25-33	14.6	1.5
MP23-33	14.7	4.0
MP21-33	13.5	1.4
MP19-33	14.0	2.2
MP14-33	12.9	1.6
MP11-33	13.7	1.6
MP06-33	13.0	4.9
MP03-33	12.0	0.9
Base of Howe	12.2	1.9
Rover	14.4, 15.0	-
Hamer	14.9	2.8
Sugar City	17.6	2.3
Roberts	14.7	5.3
Big Southern Butte	15.0	4.7
T4 North	14.1	2.1
T4 South	10.6	1.5

[1]Results are the average of triplicate exposure rate measurements with the associated sample variability (±2 SD), or the 2 measured exposure rates remaining after removal of an outlying value. One of the triplicate measurements is rejected if it is outside the average of the triplicate measurements ±2 SD of the historical population variability. Typically, the two most consistent measurements are reported, based on judgment of the data analyst.
[2] Wide variation among triplicate exposure rate measurements, with no consistency between pairs of measurements. All results for this location were rejected (R).
[3] NS – No sample. Can holding the electrets was breached with condensed water inside.

Appendix C

Table C-1. List of volatile organic compounds (VOCs) analyzed for water samples.

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
Tetrachloroethene (PCE)	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	1.0
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.

Analyte	Minimum detectable concentrations (MDC) (expressed in µg/L)
4-Chlorotoluene	0.5
1,2-Dibromo-3-chloropropane (DBCP)	0.5
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	1.0
Hexachlorobutadiene	0.5
Isopropylbenzene	0.5
p-Isopropyltoluene	0.5
Methyl Ethyl Ketone (MEK)	10
Methyl Tert Butyl Ether (MTBE)	0.5
Naphthalene	0.5
n-Propylbenzene	0.5
1,1,1,2-Tetrachloroethane	0.5
1,1,2,2-Tetrachloroethane	0.5
1,2,3-Trichlorobenzene	0.5
Trichlorofluoromethane	0.5
1,2,3-Trichloropropane	0.5
1,2,4-Trimethylbenzene	1.0
1,3,5-Trimethylbenzene	0.5