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Idaho National Laboratory Site Offsite Environmental Surveillance Program Report: Fourth Quarter 2020

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Contributors:
Kevin Claver, Marilyn Case

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By
Veolia Nuclear Solutions - Federal Services
Environmental Surveillance, Education and Research Program
Bill Doering, Program Manager
120 Technology Dr., Idaho Falls, Idaho 83401
www.idahoeser.com

Executive Summary

Some human-made radionuclides were detected in samples collected during the fourth quarter of 2020. None of the radionuclides detected in samples collected during the fourth quarter of 2020 could be directly linked with INL Site activities. All detected radionuclide concentrations were well below standards set by the U.S. Department of Energy (DOE) and regulatory standards established by the U.S. Environmental Protection Agency (EPA) for protection of the public.

This report for the fourth quarter of 2020 contains results from the Environmental Surveillance, Education, and Research (ESER) Program's monitoring of the Department of Energy's Idaho National Laboratory (INL) Site's offsite environment, October 1 through December 31, 2020. All sample types (media) and the sampling schedule followed during 2020 are listed in Appendix A. This report contains results for the following sample types:

- Air, including particulate air filters, charcoal cartridges, and atmospheric moisture
- Precipitation
- Drinking and surface water
- Milk
- Potatoes
- Waterfowl
- OSLDs
- TLDs

Table ES-1. Summary of Results for the Fourth Quarter of 2020.

Media	Sample Type	Analysis	Results
Air	Particulate Filters	Gross alpha, gross beta	Most gross alpha results were declared invalid. Due to equipment failures, the laboratory was not able to count the samples for a long period of time after collection. This allowed for ingrowth of longer-lived radon-222 progeny. As a result, higher than expected measurements were observed. Gross beta activity did not appear to be affected by the longer period of time between collection and analysis so all results were considered to be valid. There were no statistically significant differences in monthly and quarterly gross beta concentrations measured at Distant, Boundary, and INL Site sampling locations. No result exceeded the Derived Concentration Standard (DCS) for gross alpha or gross beta activity in air. A few results exceeded the 99%/95% upper tolerance limit (UTL) but appear to be due to naturally higher concentrations during periods of temperature inversion.
	Quarterly Composite	Gamma-emitting radionuclides, strontium-90, actinides (americium and plutonium)	Strontium-90 (^{90}Sr) was detected in one quarterly composited sample collected from Arco, but was not detected in a duplicate sample. Plutonium-238 was detected in a sample collected from Howe. Both results were well below their associated DCSs, within historical measurements, and probably originate from historical nuclear weapons testing. Human-made gamma-emitting radionuclides (e.g., cesium-137), americium-241, and plutonium-239/240 were not detected in any of the fourth quarter composite air samples.
	Charcoal Cartridge	Iodine-131	Iodine-131 was not detected in any of the batches of charcoal cartridges counted during the quarter.

Media	Sample Type	Analysis	Results
Atmospheric Moisture	Liquid	Tritium	Six of ten results showed tritium concentrations greater than the 3s uncertainty during the quarter. Two of the reported values exceeded the UTL prompting further inspection of the results. The results are valid and within the range of measurements for the past ten years. No sample result exceeded the DCS for tritium in air.
Precipitation	Liquid	Tritium	A total of thirteen samples were collected during the fourth quarter. Six of the tritium results were greater than the 3s uncertainty. All results were below the 99%/95% UTL.
Drinking/Surface Water	Liquid	Gross alpha, gross beta, tritium	Gross alpha activity was detected in three of nine drinking water samples and in none of the four surface water samples. Gross beta activity was detected in eight of the nine drinking water and in all four surface water samples. All concentrations were generally similar to previous results. Tritium was detected in six drinking water and in one of the surface water samples. Results were similar to previous results and those in precipitation and well below the DCS for tritium in drinking water.
Milk	Liquid	Iodine-131, other gamma-emitting radionuclides, strontium-90, tritium	Forty-six milk samples were collected at seven locations (including the offsite control sample from Colorado and two duplicates). No gamma-emitting radionuclides or tritium were detected. Strontium-90 was detected in five of seven semiannual samples analyzed at concentrations consistent with historical measurements. Tritium was detected in seven of the eight samples analyzed. The results are consistent with tritium concentrations observed in previous years.
Potatoes	Vegetation	Gamma-emitting radionuclides, strontium-90	No human-made gamma-emitting radionuclides were found in any of the nine samples (including a

Media	Sample Type	Analysis	Results
			duplicate and a control) collected this year.
Waterfowl	Tissue	Gamma-emitting radionuclides, strontium-90, actinides (americium and plutonium)	Five human-made radionuclides were detected in some ducks at levels suggesting that they were ingested from ATR effluent ponds. The maximum dose from eating the edible tissue of a contaminated duck was estimated to be 0.078 mrem/year.
Environmental Dosimeters	Environmental radiation	External radioactivity	Measurements of environmental radiation made using optically stimulated luminescent dosimeters (OSLDs) show similar measurements at Distant locations and Boundary locations. The average of all measurements is about 61 mrem for the six-month period from May to November. The six-month average of all TLD measurements is approximately 58 mR.

List of Abbreviations

AEC	Atomic Energy Commission
ATR	Advanced Test Reactor
BLR	Big Lost River
CFA	Central Facilities Area
DCS	Derived Concentration Standard
DOE	Department of Energy
DOE – ID	Department of Energy Idaho Operations Office
EAL	Environmental Assessment Laboratory
EFS	Experimental Field Station
EPA	Environmental Protection Agency
ERAMS	Environmental Radiation Ambient Monitoring System
ESER	Environmental Surveillance, Education, and Research
FAA	Federal Aviation Administration
ICP	Idaho Cleanup Project
INL	Idaho National Laboratory
INEL	Idaho National Engineering Laboratory
INEEL	Idaho National Engineering and Environmental Laboratory
ISU	Idaho State University
MDC	minimum detectable concentration
NRF	Naval Reactors Facility
NRTS	National Reactor Testing Station
ORAU	Oak Ridge Associated Universities
OSLD	Optically Stimulated Luminescent Dosimeter
RWMC	Radioactive Waste Management Complex
VNSFS	Veolia Nuclear Solutions – Federal Services

List of Units

Bq	becquerel
Ci	curie
g	gram
L	liter
µCi	microcurie
ml	milliliter
mrem	millirem
mR	milliRoentgen
pCi	picocurie

1. ESER PROGRAM DESCRIPTION

Operations at the Idaho National Laboratory (INL) Site are conducted under requirements imposed by the U.S. Department of Energy (DOE) under authority of the Atomic Energy Act and the U.S. Environmental Protection Agency (EPA) under several acts (e.g. the Clean Air Act and Safe Drinking Water Act). The requirements imposed by DOE are specified in DOE Orders. These requirements include those to monitor the effects of DOE activities both inside and outside the boundaries of DOE facilities (DOE 2011a, DOE 2015a).

During calendar year 2020, environmental monitoring within the INL Site boundaries was primarily the responsibility of the INL and Idaho Cleanup Project (ICP) contractors. The ESER Program focuses on surveillance off the INL Site and is managed by Veolia Nuclear Solutions-Federal Services (VNSFS).

This report contains monitoring results from the ESER Program for samples collected during the fourth quarter of 2020 (October 1- December 31, 2020).

The surveillance portion of the ESER Program is designed to satisfy the following program objectives:

- Verify compliance with applicable environmental laws, regulations, and DOE Orders
- Characterize and define trends in the physical, chemical, and biological condition of environmental media on and around the INL Site
- Assess the potential radiation dose to members of the public from INL Site effluents
- Present program results clearly and concisely using reports, presentations, newsletter articles and press releases.

The goal of the surveillance program is to monitor different media at a number of potential exposure points within the various exposure pathways, including air, water, agricultural products, wildlife, and soil that could possibly contribute to the radiation dose received by the public.

Environmental samples collected include:

- air at 16 locations on and around the INL Site
- moisture in air at four locations around the INL Site
- precipitation from four locations (at the same sites where air moisture is sampled) on and around the INL Site
- drinking water from eight locations and surface water from three locations around the INL Site and five locations along the Big Lost River on the INL Site
- agricultural products, including milk at six dairies around the INL Site, potatoes from seven local producers, alfalfa from three locations off the INL Site, grain (wheat and barley) from approximately 9 local producers, and lettuce from approximately seven home-owned and portable gardens on and around the INL Site
- soil from 12 locations around the INL Site biennially
- environmental dosimeters from 16 locations semi-annually
- various numbers of wildlife including dead bats, road-killed big game (pronghorn, mule deer, and elk) and waterfowl sampled from the INL Site.

Table A-1 in Appendix A lists samples, sampling locations, and collection frequency for the ESER Program.

The ESER Program used two laboratories to perform analyses on routine environmental samples collected during the quarter reported here. The ISU Environmental Assessment Laboratory (EAL) performed routine gross alpha, gross beta, tritium, and gamma spectrometry analyses. Analyses requiring radiochemistry including strontium-90 (^{90}Sr), plutonium-238 (^{238}Pu), plutonium-239/240 ($^{239/240}$Pu), and americium-241 (^{241}Am) were performed by GEL Laboratories.

In the event of non-routine occurrences, such as suspected releases of radioactive material, the ESER Program may increase the frequency of sampling and/or the number of sampling locations based on the nature of the release and wind distribution patterns. Any data found to be outside historical norms in the ESER Program is thoroughly investigated to determine if an INL Site origin is likely. Investigation may include re-sampling and/or re-analysis of prior samples.

In the event of any suspected worldwide nuclear incidents, like the 1986 Chernobyl accident or the 2011 Fukushima accident, the EPA may request additional sampling be performed through RadNet. RadNet is a nationwide environmental radiation monitoring system that monitors the nation's air, precipitation, and drinking water for radiation. The ESER Program currently operates a high-volume air sampler and collects precipitation and drinking water in Idaho Falls for this national program and routinely sends samples to EPA's Eastern Environmental Radiation Facility for analyses. The RadNet data collected at Idaho Falls are not reported by the ESER Program but are available through the EPA RadNet website (https://www.epa.gov/radnet).

Once samples have been collected and analyzed, the ESER Program has the responsibility for quality control of the data, entry into the ESER database, and reporting in quarterly reports. The quarterly reports are then consolidated into the INL Site Environmental Report for each calendar year. The annual report also includes data collected by other INL Site contractors.

The results reported in the quarterly and annual reports are assessed in terms of data quality and statistical significance with respect to laboratory analytical uncertainties, sample locations, reported INL Site releases, meteorological data, and worldwide events that might conceivably affect the INL Site environment. First, field collection and laboratory information are reviewed to determine identifiable errors that would invalidate or limit use of the data. Examples of such limitations include insufficient sample volume, torn filters, evidence of laboratory cross-contamination or quality control issues. Data that pass initial screening are further evaluated using statistical methods. Statistical tools are necessary for data evaluation particularly since environmental measurements typically involve the determination of minute concentrations, which are difficult to detect and even more difficult to distinguish from other measurements.

Results are presented in this report with an analytical uncertainty term, s, where "s" is the estimated sample standard deviation (σ), assuming a Gaussian or normal distribution. All results are reported in this document, even those that do not necessarily represent detections. The term "detected", as used for the discussion of results in this report, does not imply any degree of risk to the public or environment, but rather indicates that the radionuclide was measured at a concentration sufficient for the analytical instrument to record a value that is statistically different from background. Laboratory measurements involve the analysis of a target sample and the analysis of a prepared laboratory blank (i.e., a sample which is identical to the sample collected in the environment, except that the radionuclide of interest is absent). In order to conclude that a radionuclide has been detected, it is essential to consider two fundamental aspects of the problem of detection: (1) the instrument signal for the sample must be greater than that observed for the blank before the decision can be made that the radionuclide has been

detected; and (2) an estimate must be made of the minimum radionuclide concentration that will yield a sufficiently large observed signal before the correct decision can be made for detection or non-detection. Each laboratory currently defines a detection of radioactivity in an individual sample if the result exceeds a detection level calculated by the laboratory after the analysis of a background sample, based on calculations derived by Curie (1984). The minimum detectable concentration (MDC) is defined as the concentration at which there is a 95 percent confidence that an analyte signal will be distinguishable from an analyte-free sample.

In addition, ESER uses a three standard deviation criterion to minimize the chance that a potentially false positive result is included in the data set. A false positive result is indicated when the range encompassing the result, plus or minus the total uncertainty at three standard deviations, includes zero (e.g., 2.5 +/- 1.0; range of -0.5 to 3.5). Statistically, the probability that a result can exceed the absolute value of its total uncertainty at three standard deviations by chance alone is less than 1 percent. A result that is greater than three times the total uncertainty of the measurement represents a statistically positive detection with over 99 percent confidence (DOE 2015b, NBS 1961). The ESER reports measured radionuclide concentrations greater than or equal to their respective 3s uncertainties as being detected with confidence.

Concentrations between 2s and 3s are reported as questionably detected. That is, the radionuclide may be present in the sample; however, the probability that a result can exceed the absolute value of its total uncertainty at two standard deviations by chance alone may be as high as 5 percent. Measurements made between 2s and 3s are examined further to determine if they are a part of a pattern (temporal or spatial) that might warrant further investigation or recounting. For example, if a radionuclide is routinely detected at > 3s at a specific location, a sample result between 2s and 3s might be considered detected.

If a result is less than or equal to 2s there is even less statistical confidence that the radionuclide is present in the sample. Analytical results in this report are presented as the result value ± one standard deviation (1s) for reporting consistency with the annual report. To obtain the 2s or 3s values simply multiply the uncertainty term by 2 or 3.

Data are also compared to historical measurements using the upper tolerance limit (UTL). The UTL is a value such that 99% of the population (in this case, all valid measurements made between 2010-2019) is less than the UTL with 95% confidence (EPA 2015). With a 99%/95% UTL it is expected that approximately 1% of the measurements will exceed the UTL if the concentration of a radionuclide is within the normal range. This means that if a concentration exceeds the UTL it does not necessarily indicate that the site is outside of the normal range. Rather, it indicates that the measurement should be closely examined to determine if it is unusually high.

For more information concerning the ESER Program, contact VNSFS at (208) 525-8250, or visit the Program’s web page (http://www.idahoeser.com).

2. The INL Site

The INL Site is a nuclear energy and homeland security research and environmental management facility. It is owned and administered by the U.S. Department of Energy, Idaho Operations Office (DOE-ID) and occupies about 890 mi^2 (2,300 km^2) of the upper Snake River Plain in Southeastern Idaho (Figure 1). The history of the INL Site began during World War II when the U.S. Naval Ordnance Station was located in Pocatello, Idaho. This station, one of two such installations in the U.S., retooled large guns from U.S. Navy warships. The retooled guns were tested on the nearby, uninhabited plain, known as the Naval Proving Ground. In the years following the war, as the nation worked to develop nuclear power, the Atomic Energy Commission (AEC), predecessor to the DOE, became interested in the Naval Proving Ground and made plans for a facility to build, test, and perfect nuclear power reactors.

The Naval Proving Ground became the National Reactor Testing Station (NRTS) in 1949, under the AEC. By the end of 1951, a reactor at the NRTS became the first to produce useful amounts of electricity. Over time the site has operated 52 various types of reactors, associated research centers, and waste handling areas. The NRTS was renamed the Idaho National Engineering Laboratory (INEL) in 1974, and the Idaho National Engineering and Environmental Laboratory (INEEL) in January 1997. With renewed interest in nuclear power the DOE announced in 2003 that Argonne National Laboratory and the INEEL would be the lead laboratories for development of the next generation of power reactors. On February 1, 2005, the INEEL and Argonne National Laboratory-West became the INL. The INL is committed to providing international nuclear leadership for the 21st Century, developing and demonstrating compelling national security technologies, and delivering excellence in science and technology as one of the Department of Energy's multi-program national laboratories. Battelle Energy Alliance, LLC, is responsible for the management and operations of the INL.

The Idaho Cleanup Project (ICP) Core is a separately managed effort. The ICP Core is charged with safely and cost-effectively completing the majority of cleanup work from past laboratory missions in an ongoing process. Fluor Idaho, LLC, is responsible for the ICP Core.

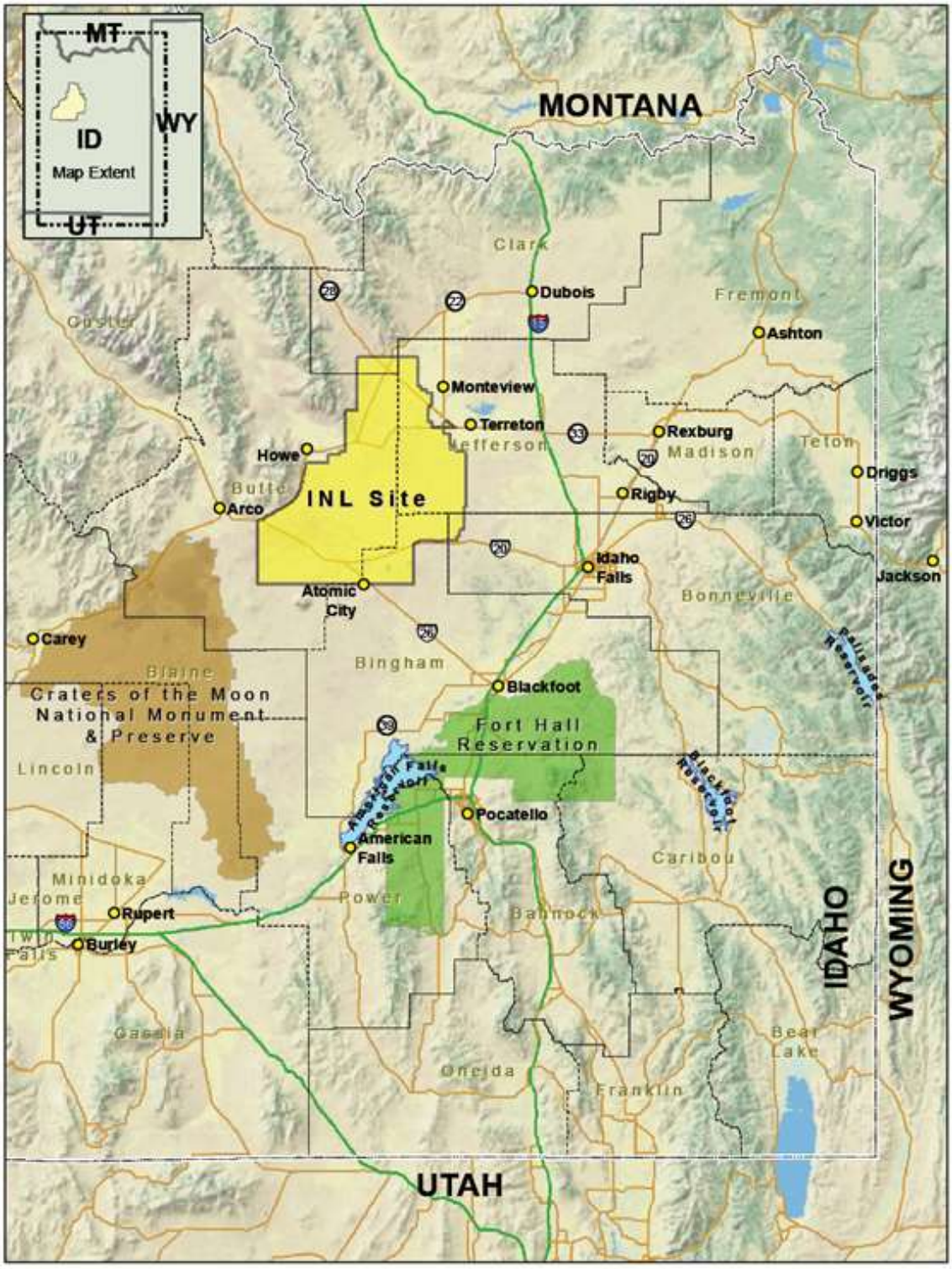


Figure 1. Location of the Idaho National Laboratory Site.

3. Air Sampling

The primary pathway by which radionuclides can move off the INL Site is through the air and for this reason the air pathway is the primary focus of monitoring on and around the INL Site. Samples for particulates and iodine-131 (^{131}I) gas in air were collected weekly for the duration of the quarter at 16 locations using low-volume air samplers. Moisture in the atmosphere was sampled at four locations around the INL Site and analyzed for tritium. Air sampling activities and results for the fourth quarter of 2020 are discussed below. A summary of approximate minimum detectable concentrations (MDCs) for radiological analyses and DOE Derived Concentration Standard (DCS) (DOE 2011b) values is provided in Appendix B.

Low-Volume Air Sampling

Radioactivity associated with airborne particulates was monitored continuously by 18 low-volume air samplers (two of which are used as replicate samplers) at 16 locations during the fourth quarter of 2020 (Figure 2). Three of these samplers are located on the INL Site, seven are situated off the INL Site near the boundary, and eight have been placed at locations distant to the INL Site. Samplers are divided into INL Site, Boundary, and Distant groups to determine if there is a gradient of radionuclide concentrations, increasing towards the INL Site. Each replicate sampler is relocated every other year to a new location. At the start of 2020, one replicate sampler was moved to Arco (a Boundary location) and one was moved to Mud Lake (also a Boundary location). An average of 19,661 ft^3 (557 m^3) of air was sampled at each location, each week, at an average flow rate of 1.96 ft^3/min (0.06 m^3/min). Particulates in air were collected on membrane particulate filters (1.2 µm pore size). Gases passing through the filter were collected with an activated charcoal cartridge.

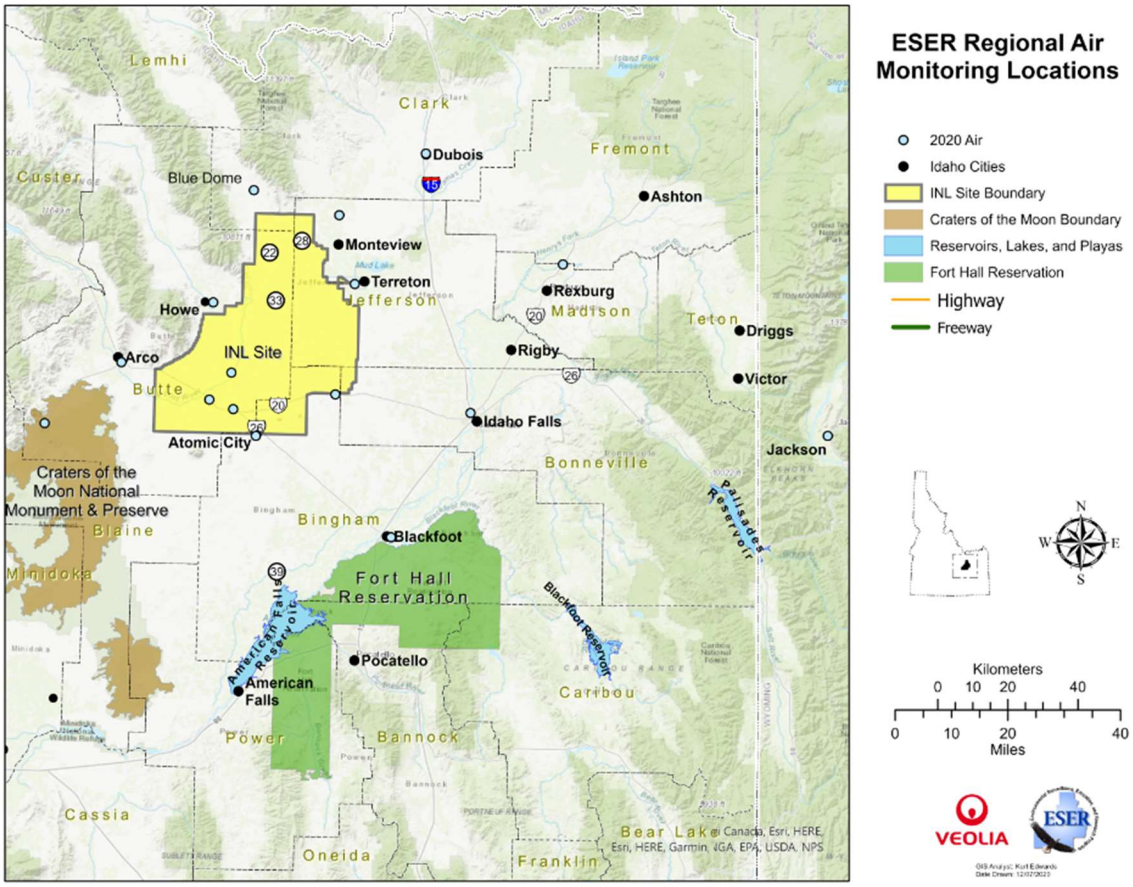


Figure 2. ESER air monitoring locations.

Filters and charcoal cartridges were changed weekly at each station during the quarter. Each particulate filter was analyzed for gross alpha and gross beta radioactivity using thin-window gas flow proportional counting systems after waiting about four days for shorter-lived naturally-occurring daughter products of radon and thorium to decay.

The weekly particulate filters collected during the quarter for each location were composited and analyzed for gamma-emitting radionuclides. Selected composites were also analyzed by location for ^{90}Sr, ^{238}Pu, $^{239/240}Pu$, and ^{241}Am as determined by a rotating quarterly schedule.

Charcoal cartridges were analyzed for gamma-emitting radionuclides, specifically for iodine-131 (^{131}I). Iodine-131 is of particular interest because it is produced in relatively large quantities by nuclear fission, is readily accumulated in human and animal thyroids, and has a half-life of eight days. This means that any elevated level of ^{131}I in the environment could be from a recent release of fission products.

Gross alpha and gross beta results are reported in Table C-1. Natural uranium is usually collected on air filters because it is present in local soils, which are the largest source of particulate matter collected on the filters. The primary source of natural radioactivity measured on the air particulate filters are particulate decay products from the radon-222 decay chain (Figure 3). The analytical procedure directs that air filters should be counted after five days so that shorter-lived radon progeny (polonium-214 and -218, lead-214 and Bi-214) decay away and

are not detected as gross alpha or gross beta radioactivity (Figure 4). Longer-lived radon-222 decay products are virtually always detected by gross alpha activity (polonium-210), gross beta activity (bismuth-210), and gamma spectroscopic analyses (lead-210). If the decay time between the end of sampling and the start of counting is long enough for the air-deposited activity to effectively vanish, then all the observed counts from that time will be from ingrowth, with none from the original air-deposited activity (Figure 5).

Due to multiple equipment failures that delayed sample analysis, the filters collected from October 7 through December 16 were analyzed 21 to 146 days, instead of five days, after collection. Most of the gross alpha results were subsequently determined to be invalid due to ingrowth of longer-lived radon-222 decay products. Figure 6 compares the ESER gross alpha results with those measured by the INL contractor and the state of Idaho Department of Environmental Quality INL Oversight Program (DEQIOP) at common sampling locations (https://www2.deq.idaho.gov/admin/LEIA/api/document/download/15978). The ESER measurements made during the period from October 7 through December 16 are above those made by the INL contractor and DEQIOP and the 99%/95% upper tolerance limit (UTL) for gross alpha activity (4×10^{-15} µCi/ml) indicating that they are atypically high. The UTL was determined using ten years of historical data (measured from 2010 through 2019) and the ProUCL statistical software (https://www.epa.gov/land-research/proucl-software).The 99%/95% UTL is a value such that 99% of the population (all possible air measurements) is less than the UTL with 95% confidence. With a 99% /95% UTL it is expected that approximately 1% of the measurements will exceed the UTL if the concentration of gross alpha is within the normal range. This means that if a concentration exceeds the UTL it does not necessarily indicate that the result is outside of the normal range. Rather, it indicates that the measurement should be closely examined to determine if it is unusually high.

Figure 7 shows that gross alpha activity increases as a function of time between collection and analysis, demonstrating longer-lived radon-222 daughter (polonium-210) ingrowth.

Only three weeks of data (from samples collected from December 16 to December 31) are considered valid. The results were consistent with historical data, as represented by the 99%/95% upper tolerance limit (UTL). None of the *valid* gross alpha measurements made during the fourth quarter exceeded the UTL.

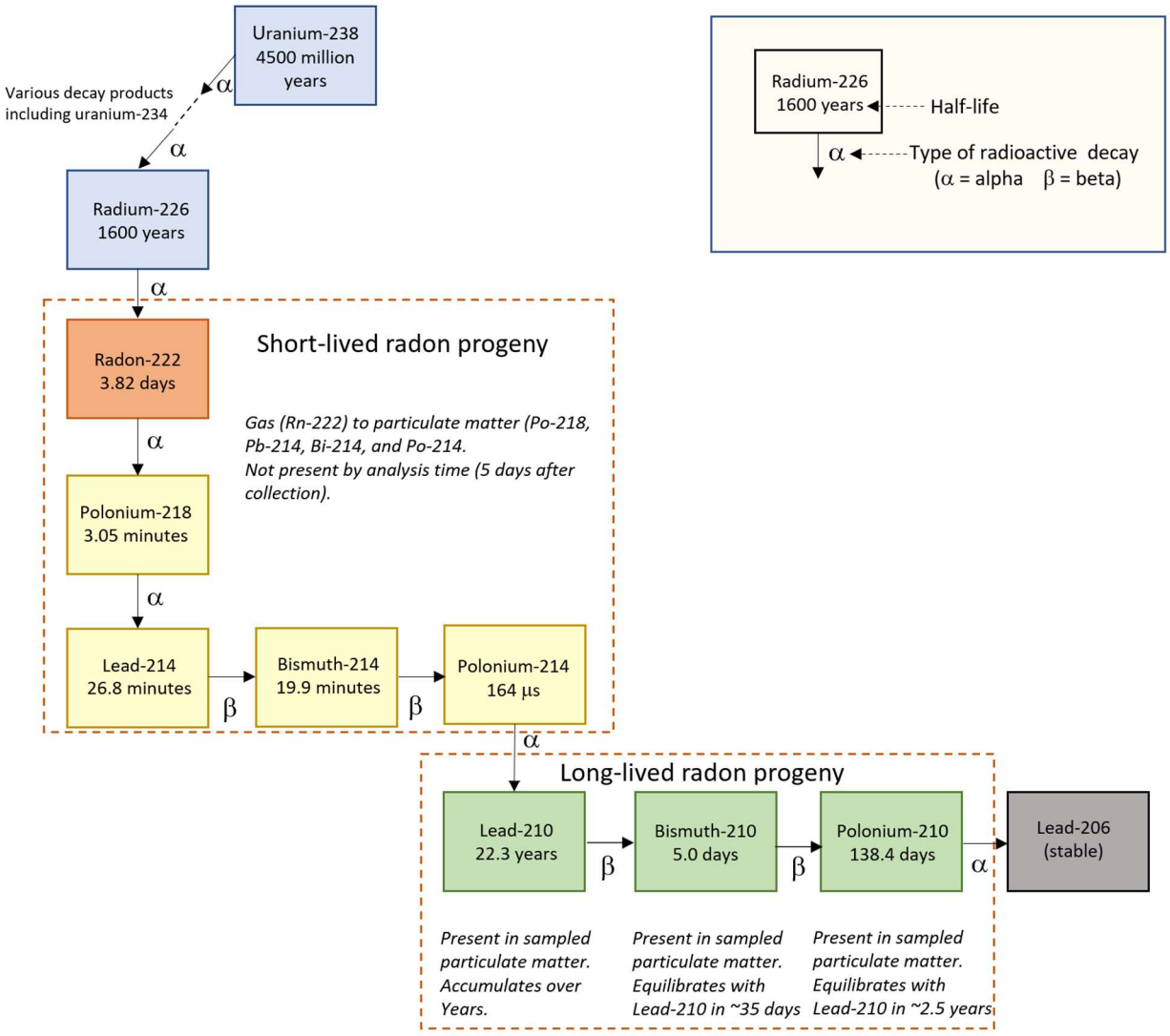


Figure 3. Uranium-238 decay series.

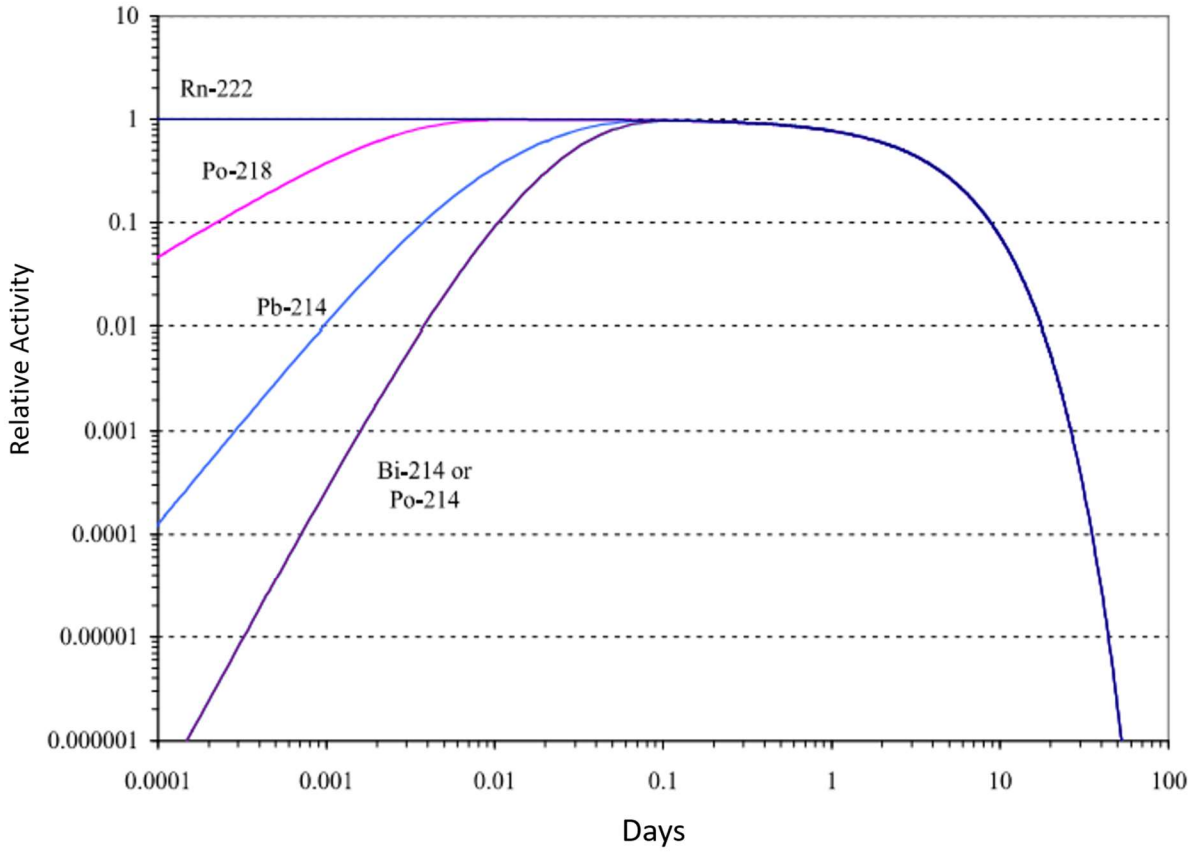


Figure 4. Shorter-lived radionuclides in radon-222 decay chain.

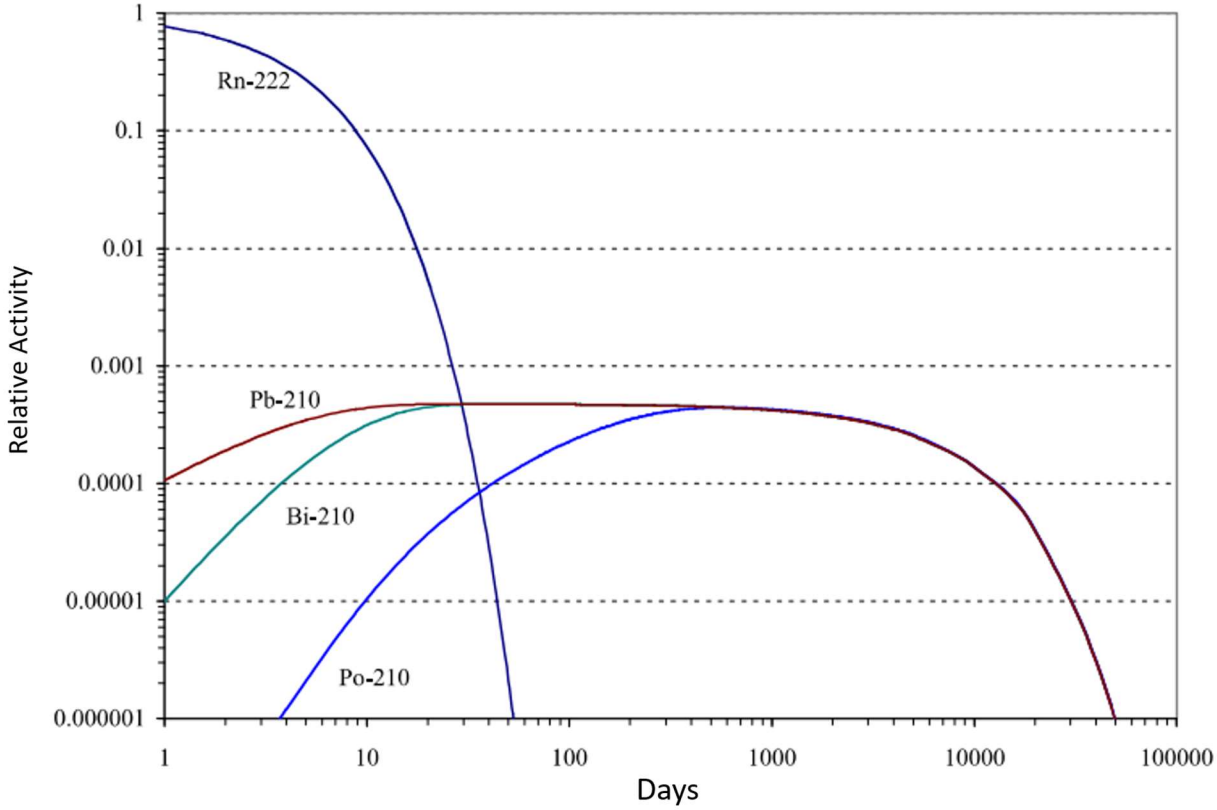


Figure 5. Longer-lived radionuclides in radon-222 decay chain.

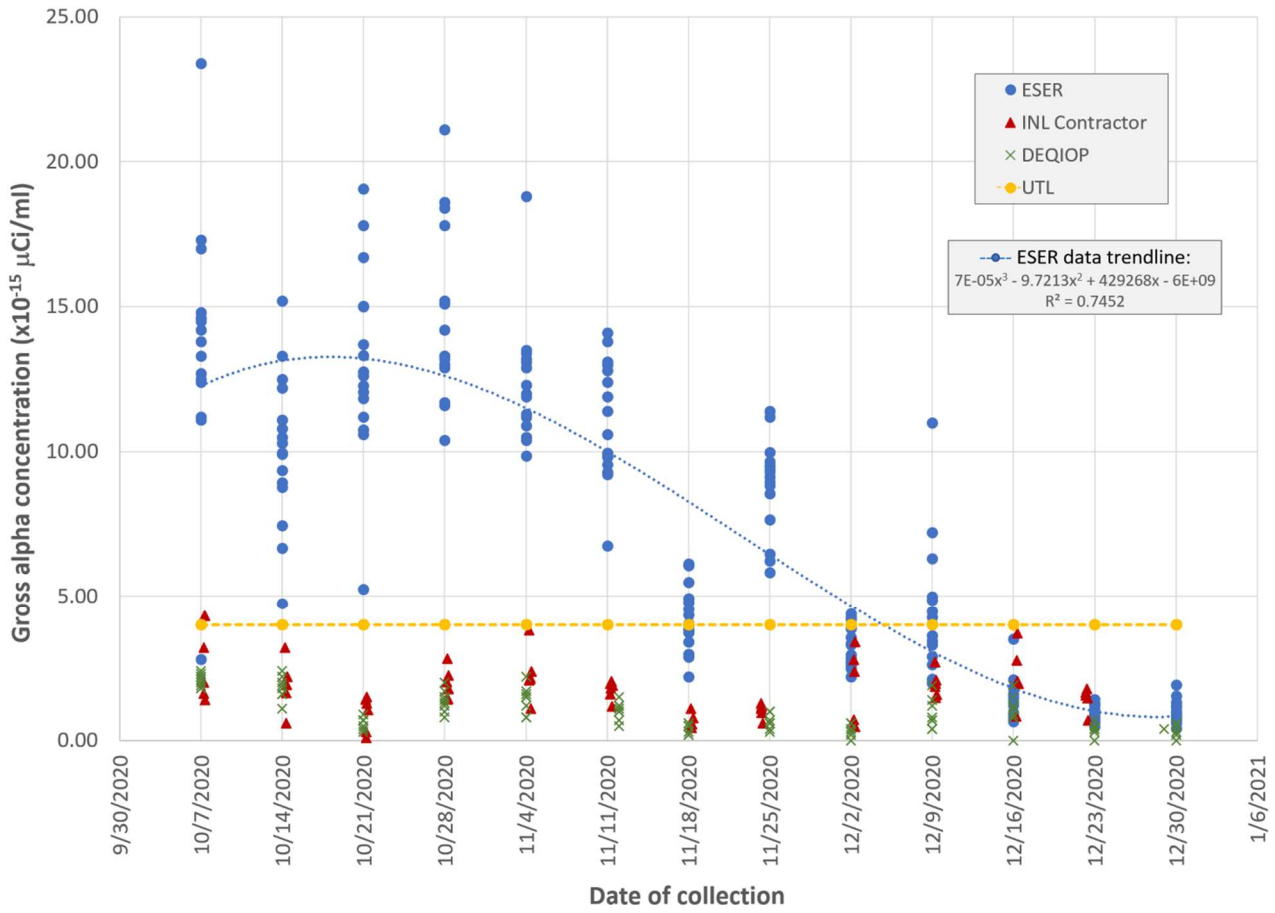


Figure 6. Comparison of gross alpha results collected by ESER, INL contractor and state of Idaho Department of Environmental Quality (DEQ) INL Oversight Program (IOP) at common locations. ESER filters were collected at Arco, Atomic City, Blackfoot, Blue Dome, Craters of the Moon, Dubois, Experimental Field Station, FAA Tower, Howe, Idaho Falls, Jackson WY, Main Gate, Monteview, Mud Lake, Sugar City, and Van Buren Gate. INL contractor filters were collected at Blackfoot, Craters of the Moon, Experimental Field Station, Howe, Sugar City, and Van Buren Gate. DEQ IOP filters were collected at Atomic City, Craters of the Moon, Experimental Field Station, Howe, Idaho Falls, Monteview, Mud Lake, and Van Buren Gate. Samples were not collected by the INL Contractor on December 30.

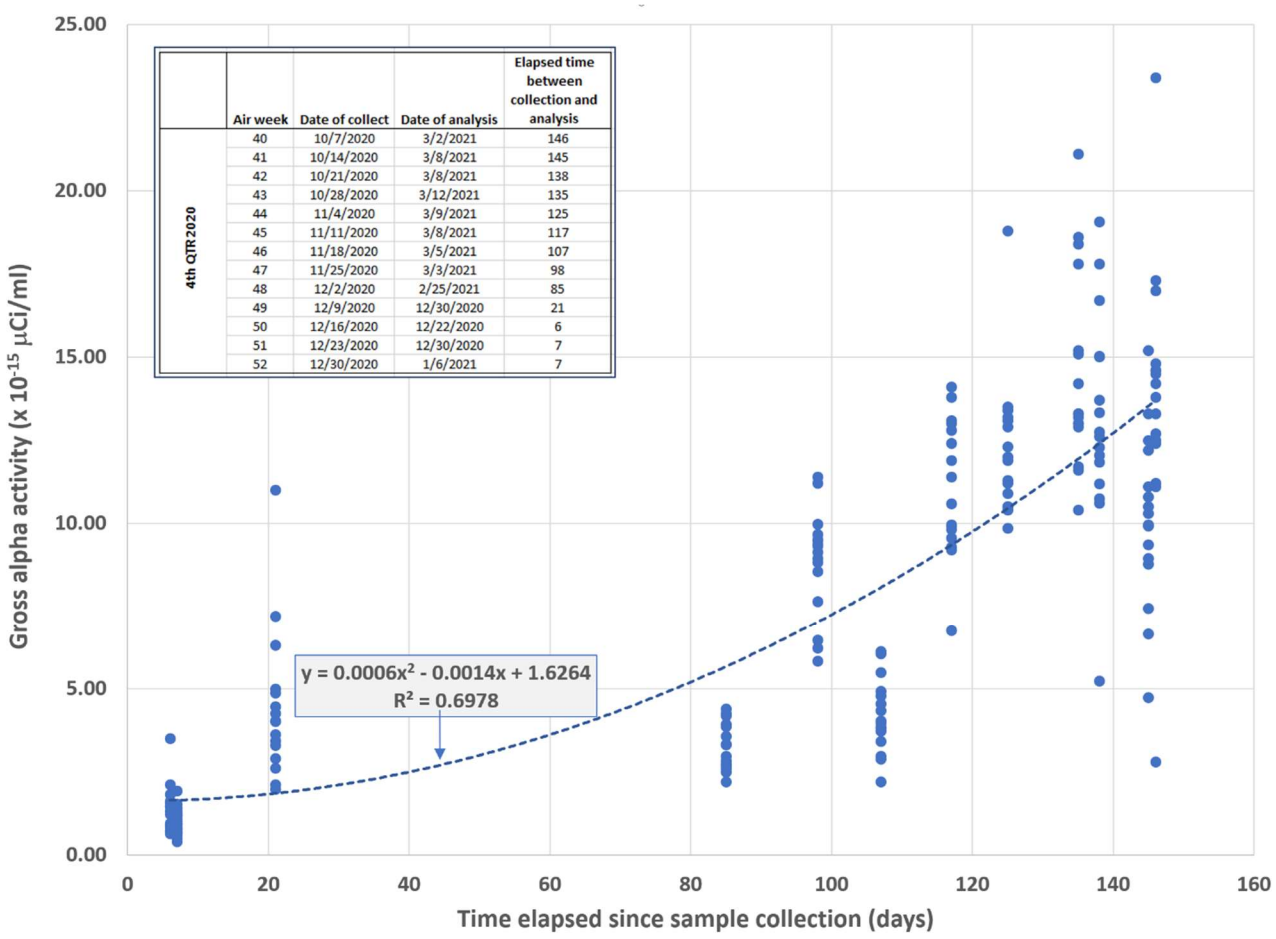


Figure 7. Gross alpha activity versus time elapsed between collection and analysis.

Gross beta results are presented in Table C-1. The results are graphed, along with those measured by the INL contractor and the INL DEQOP, in Figure 8. In general, the ESER data appear to track those reported by the DEQ INLOP and the INL contractor and are well below the DOE Derived Concentration Standard for strontium-90 (2.5×10^{-11} µCi/ml) (see Table B-1 of Appendix B). Some of the gross beta activity (December 9 and 16) reported by ESER exceeded the 99%/95% upper tolerance limit (UTL) for gross beta activity (64×10^{-15} µCi/ml) but are typical of temporal fluctuations in gross beta concentrations in air during winter months due to temperature inversions.

Figure 9 shows that gross beta activity does not necessarily depend on the time between collection and analysis. The filters analyzed for gross beta activity 21 days after collection (on December 9 and 21) appear to have much greater results than the remaining filters. However, results are comparable to the gross beta activity in filters sampled by the INL contractor and INL Oversight Program and probably reflect inversion conditions common during the winter months.

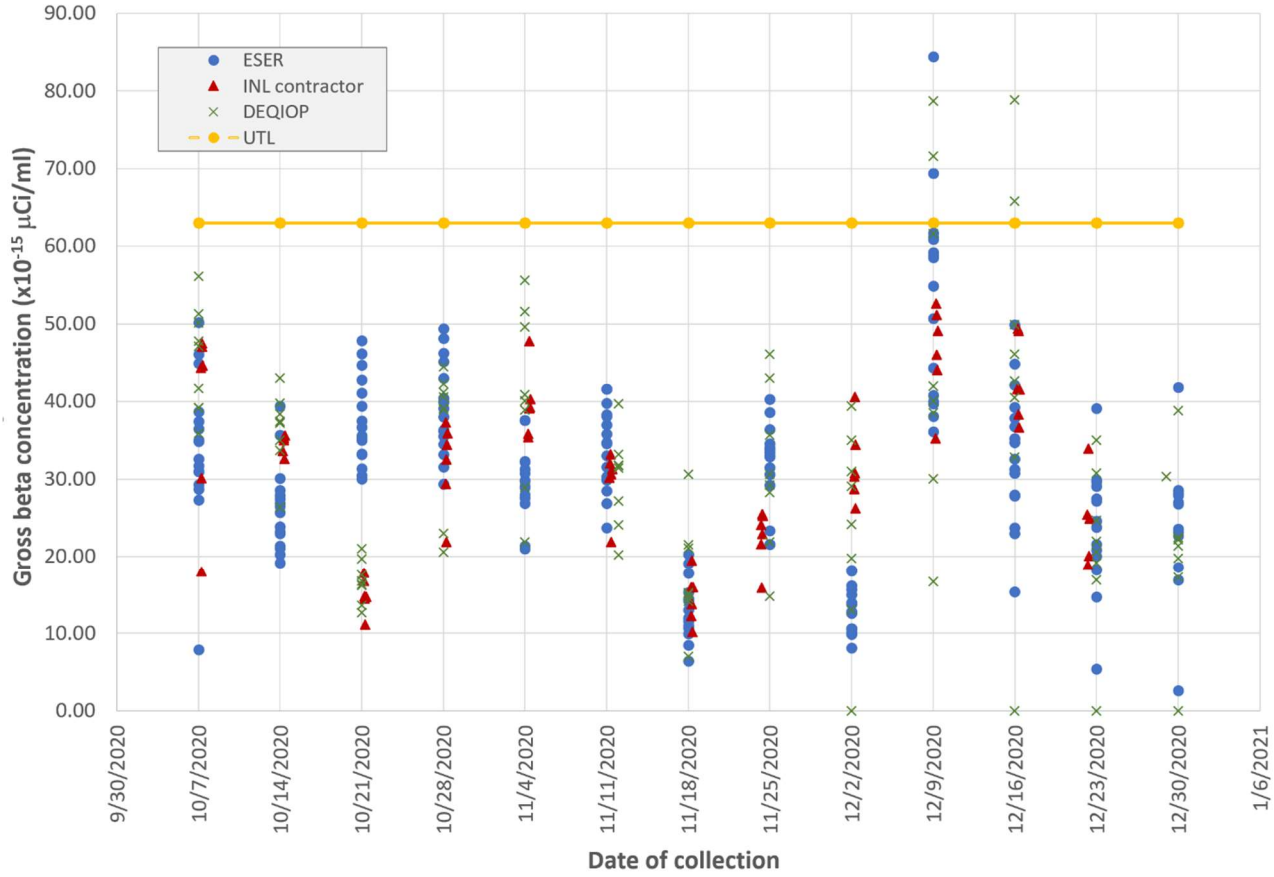
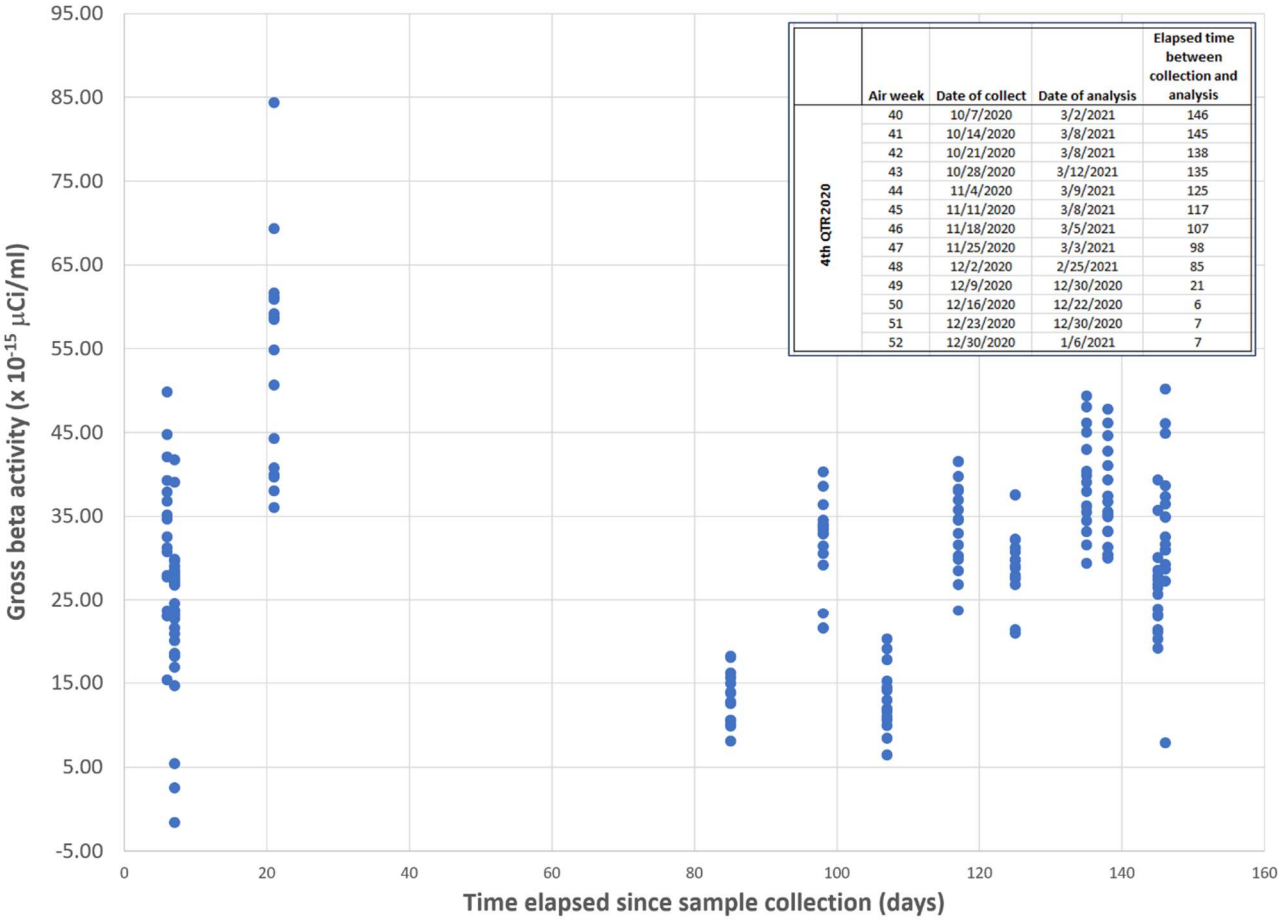


Figure 8. Comparison of gross beta results collected by ESER, INL contractor and state of Idaho Department of Environmental Quality (DEQ) INL Oversight Program (IOP) at common locations. ESER filters were collected at Arco, Atomic City, Blackfoot, Blue Dome, Craters of the Moon, Dubois, Experimental Field Station, FAA Tower, Howe, Idaho Falls, Jackson WY, Main Gate, Monteview, Mud Lake, Sugar City, and Van Buren Gate. INL contractor filters were collected at Blackfoot, Craters of the Moon, Experimental Field Station, Idaho Falls, Sugar City, and Van Buren Gate. DEQ IOP filters were collected at Atomic City, Craters of the Moon, Experimental Field Station, Howe, Idaho Falls, Monteview, Mud Lake, and Van Buren Gate. Samples were not collected by the INL Contractor on December 30. UTL = 99%/95% Upper Tolerance Limit.

Gross beta results are displayed as box plots in Figures 10 through 13. All results were less than the Derived Concentration Standard (DCS) of 2.5×10^{-11}µCi/ml for ^{90}Sr (see Table B-1 of Appendix B). The typical temporal fluctuations in gross beta concentrations in air were observed during the quarter because of temperature inversions. In addition, the results were consistent with historical data, as represented by the 99%/95% upper tolerance limit (UTL) for gross beta activity (6.4×10^{-14} µCi/ml). The data were tested quarterly and generally are found to be neither normally nor log-normally distributed. Box and whiskers plots were used to present the non-parametric data. Outliers and extreme values were retained in subsequent statistical analyses because they are within the range of measurements made in the past ten years, and because these values could not be attributed to mistakes in collection, analysis, or reporting procedures.



	Air week	Date of collect	Date of analysis	Elapsed time between collection and analysis
4th QTR 2020	40	10/7/2020	3/2/2021	146
	41	10/14/2020	3/8/2021	145
	42	10/21/2020	3/8/2021	138
	43	10/28/2020	3/12/2021	135
	44	11/4/2020	3/9/2021	125
	45	11/11/2020	3/8/2021	117
	46	11/18/2020	3/5/2021	107
	47	11/25/2020	3/3/2021	98
	48	12/2/2020	2/25/2021	85
	49	12/9/2020	12/30/2020	21
	50	12/16/2020	12/22/2020	6
	51	12/23/2020	12/30/2020	7
	52	12/30/2020	1/6/2021	7

Figure 9. Gross beta activity versus time elapsed between collection date and analysis.

There were no statistically significant differences in the gross beta data between groups for the quarter or for any month, except for the data measured during the month of November, using the Kruskal-Wallis analysis of variance by ranks test (Table D-1). To determine if there were any differences between stations and where the differences occur, multiple comparisons were also made using the Kruskal-Wallis analysis of variance by ranks test between gross beta concentrations measured at all locations. No differences were determined (Table D-2).

Iodine-131 was not detected in any of the 28 sets of charcoal cartridges measured during the fourth quarter. Weekly ^{131}I results for each location are listed in Table C-2.

No ^{137}Cs or other human-made gamma-emitting radionuclides were found in quarterly air composites. Strontium-90, a beta-emitting radionuclide associated with historic nuclear weapons testing fallout, was detected [(38.2 ± 12.6) × 10^{-18} µCi/ml] in one composite sample collected from Arco (Table C-3). However, Sr-90 was not detected in a duplicate sample collected at the same location. The result is well below the DCS for ^{90}Sr in air (2.5E-11 µCi/ml) and within historical measurements.

Americium-241 (^{241}Am) and plutonium 239/240 ($^{239/240}$Pu), alpha-emitting radionuclides, were not detected in any composite sample. However, Pu-238 was detected in one sample collected from Howe [(4.07 ± 1.29) × 10^{-18} µCi/ml], well below the DCS for ^{238}Pu in air (3.7 × 10^{-14} µCi/mL). Plutonium-238 has occasionally been detected in air samples in the past at similar levels. The source of this radionuclide is most likely global fallout.

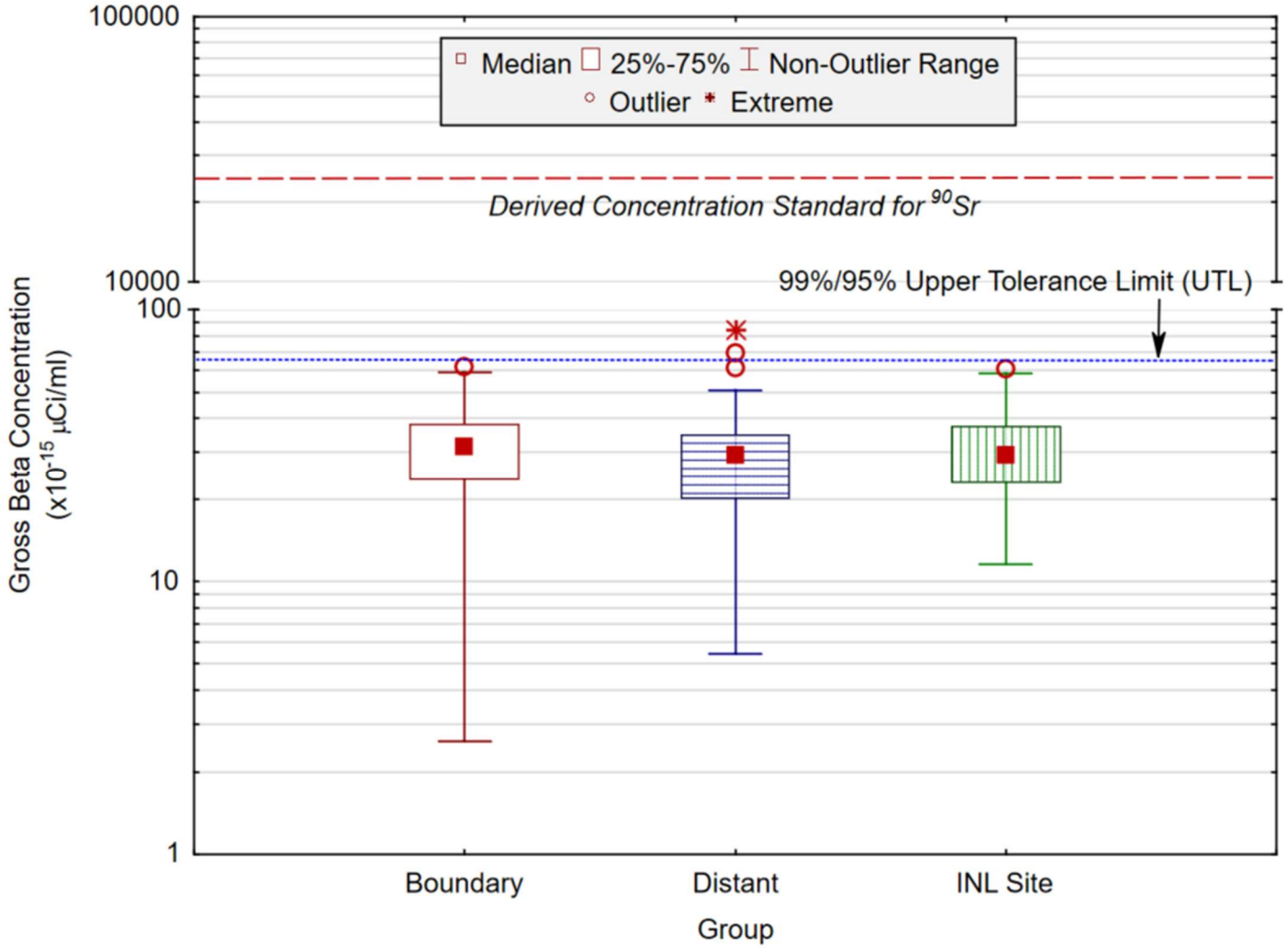


Figure 10. Gross beta concentrations in air at ESER INL Site, Boundary, and Distant locations for the fourth quarter of 2020. The Derived Concentration Standard (DCS) is the concentration of strontium-90 (90Sr) in air which, if inhaled for a year, would result in a dose of 100 mrem/yr. Because the measurements include naturally occurring radionuclides (such as 40K, 228Ra, and 210Pb) in uncertain proportions, a meaningful DCS cannot be constructed for gross beta concentrations. The DCS for 90Sr is shown because it is the most restrictive human-made beta emitter.

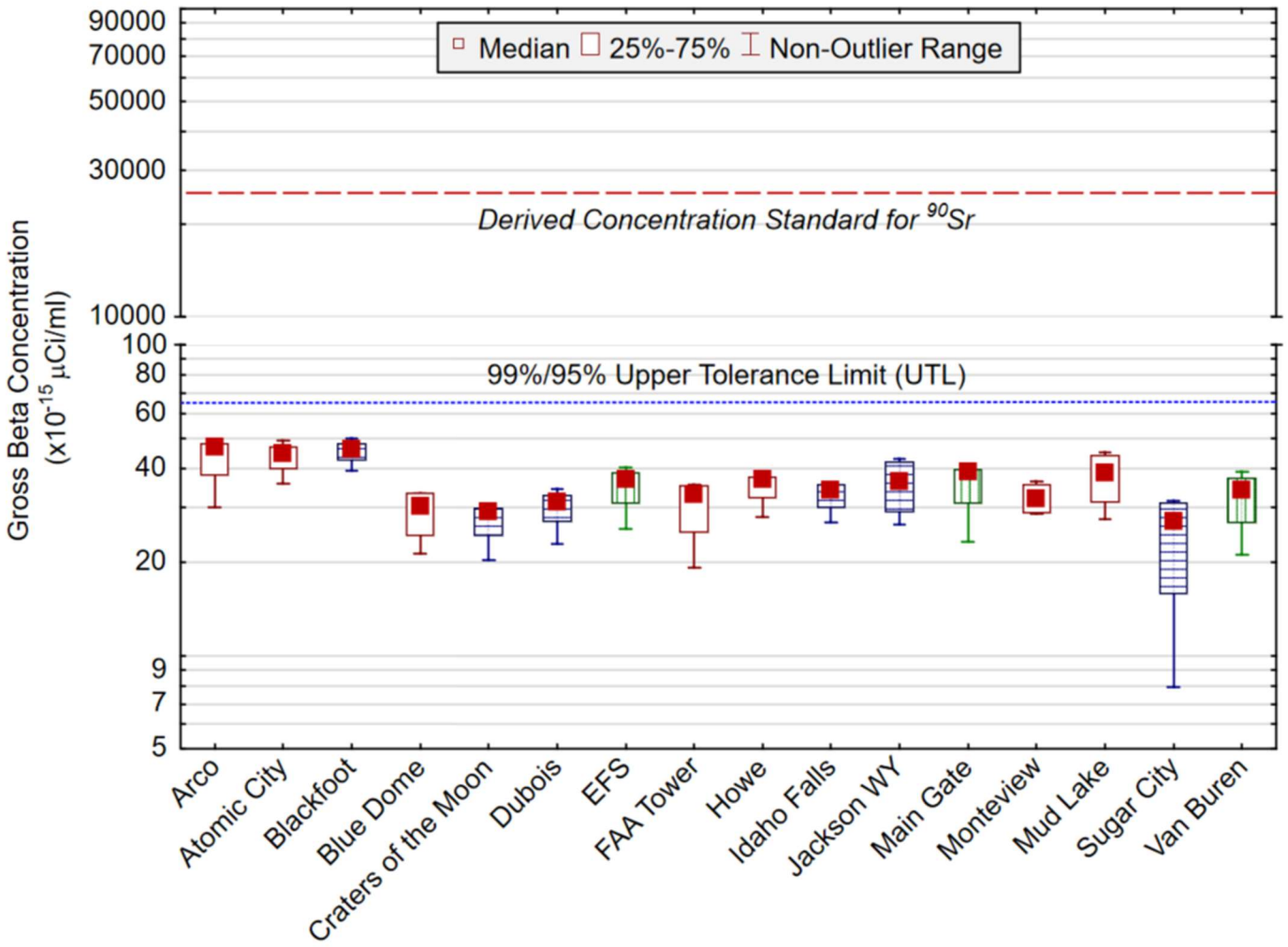


Figure 11. October gross beta concentrations in air at ESER INL Site, Boundary, and Distant locations. The Derived Concentration Standard (DCS) is the concentration of strontium-90 (90Sr) in air which, if inhaled for a year, would result in a dose of 100 mrem/yr. Because the measurements include naturally occurring radionuclides (such as 40K, 228Ra, and 210Pb) in uncertain proportions, a meaningful DCS cannot be constructed for gross beta concentrations. The DCS for 90Sr is shown because it is the most restrictive human-made beta emitter.

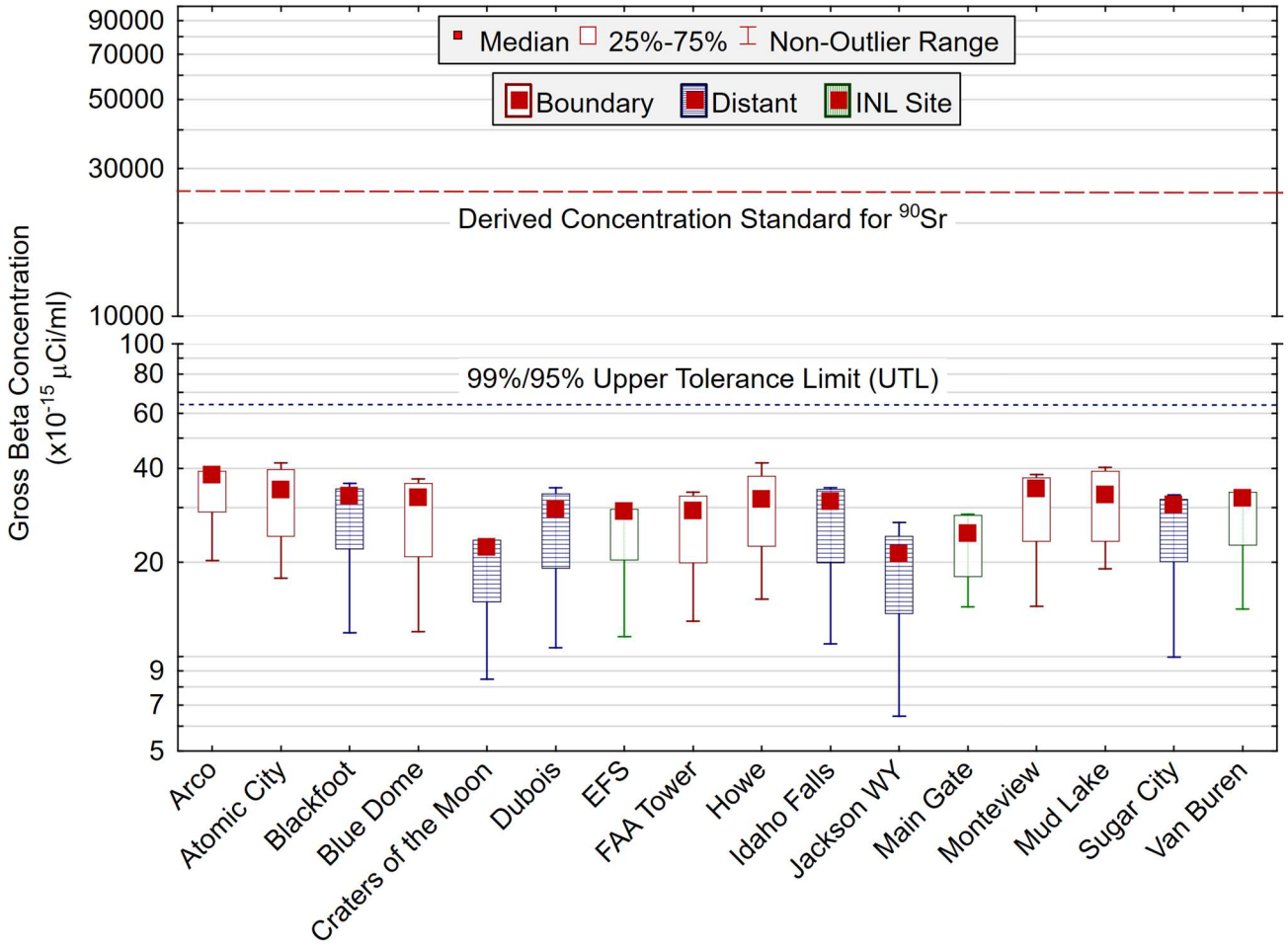


Figure 12. November gross beta concentrations in air at ESER INL Site, Boundary, and Distant locations. The Derived Concentration Standard (DCS) is the concentration of strontium-90 (90Sr) in air which, if inhaled for a year, would result in a dose of 100 mrem/yr. Because the measurements include naturally occurring radionuclides (such as 40K, 228Ra, and 210Pb) in uncertain proportions, a meaningful DCS cannot be constructed for gross beta concentrations. The DCS for 90Sr is shown because it is the most restrictive human-made beta emitter.

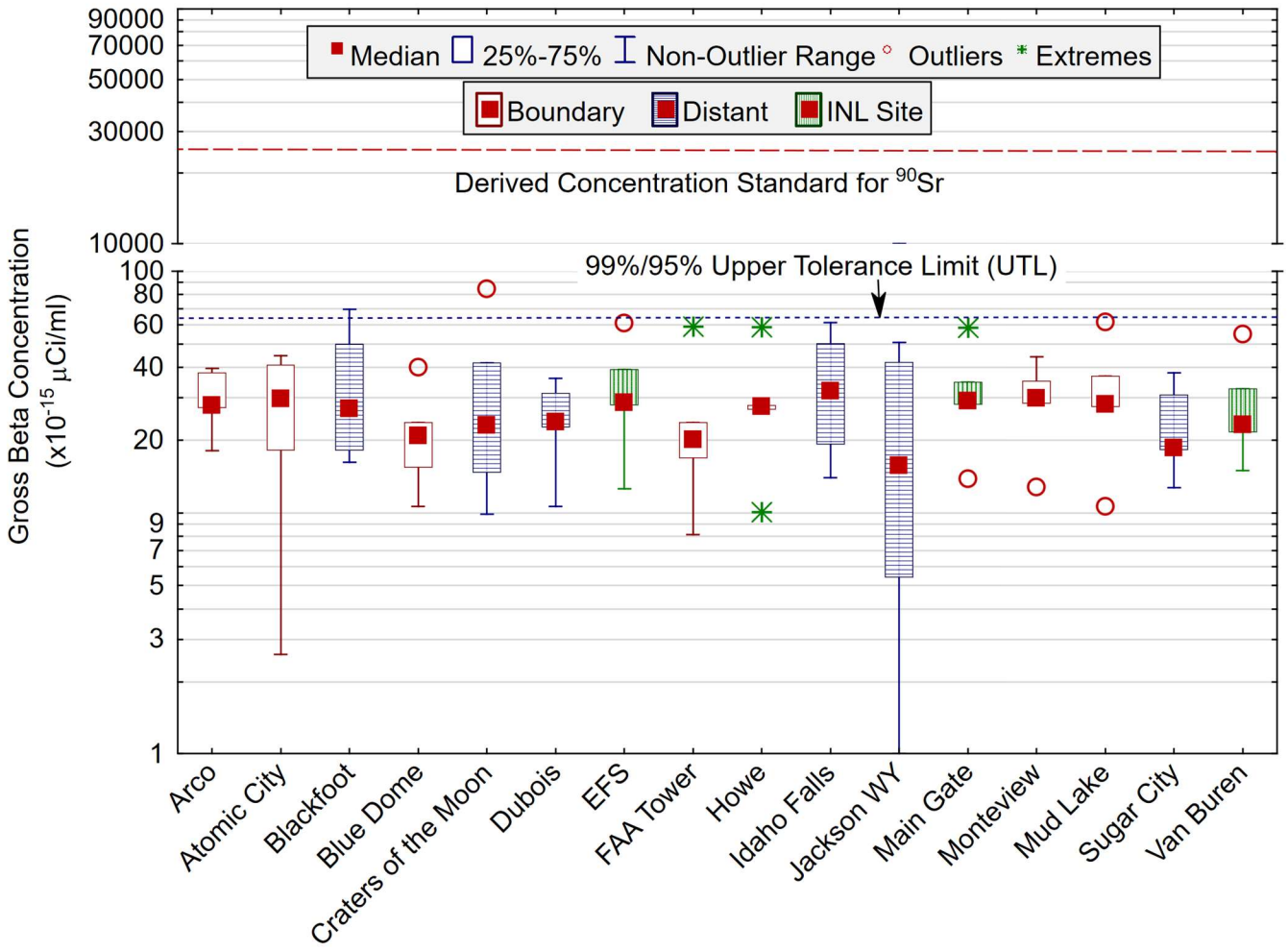


Figure 13. December gross beta concentrations in air at ESER INL Site, Boundary, and Distant locations. The Derived Concentration Standard (DCS) is the concentration of strontium-90 (90Sr) in air which, if inhaled for a year, would result in a dose of 100 mrem/yr. Because the measurements include naturally occurring radionuclides (such as 40K, 228Ra, and 210Pb) in uncertain proportions, a meaningful DCS cannot be constructed for gross beta concentrations. The DCS for 90Sr is shown because it is the most restrictive human-made beta emitter.

Atmospheric Moisture Sampling

Atmospheric moisture is collected by pulling air through a column of absorbent material (molecular sieve material) to absorb water vapor. The water is then extracted from the absorbent material by heat distillation. The resulting water samples are then analyzed for tritium using liquid scintillation.

Results were available for ten atmospheric moisture samples collected at the INL Site, Boundary, and Distant locations during the fourth quarter of 2020 (Figure 14). Six of the results exceeded the 3s uncertainty level for tritium, with a maximum reported value of (11.9 ± 3.3) x 10^{-13} $\mu Ci/mL_{air}$ at EFS. The highest two results exceeded the 99%/95% UTL of 7.0 x 10^{-13} $\mu Ci/mL_{air}$ prompting a close inspection of the data. The results are valid and within the range of values observed for the past ten years (-62.1 – 413 pCi/L) and thus appears to be consistent with ambient concentrations. Results also remain similar between the four sampling locations. All samples were significantly below the DOE DCS for tritium in air (as water vapor) of 2.1 x 10^{-7} $\mu Ci/mL_{air}$. Results are shown in Table C-4, Appendix C.

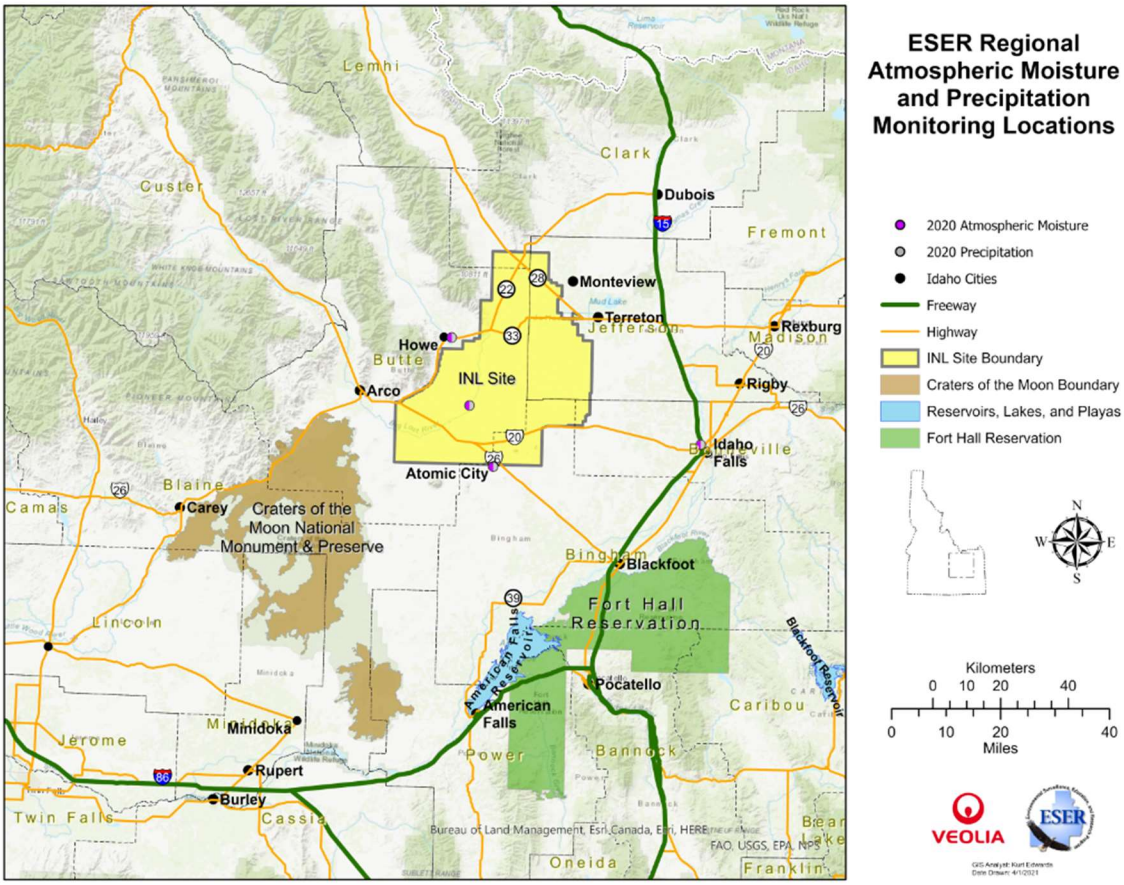


Figure 14. Moisture and precipitation monitoring locations.

4. Precipitation and Water

Precipitation Sampling

Precipitation samples are gathered when enough precipitation occurs to allow for the collection of the minimum sample volume of approximately 50 mL. Samples are taken of monthly composites from Idaho Falls, and weekly (when available) from the EFS on the INL Site and Atomic City and Howe on the INL Site boundary (Figure 14). These are the same locations where atmospheric moisture samples are collected. Precipitation samples are analyzed for tritium. Storm events in the fourth quarter of 2020 produced sufficient amounts of precipitation to yield thirteen samples.

Tritium was measured above the 3s values in six of the thirteen samples. These results are listed in Table C-5 (Appendix C). Low levels of tritium exist in the environment at all times as a result of cosmic ray reactions with water molecules in the upper atmosphere. Long-term data collected around the globe since 1961 by the International Atomic Energy Agency suggest that tritium levels have steadily decreased since the Nuclear Test Ban Treaty in 1963 and are close to their pre-nuclear test values (Cauquoin et al. 2015) and that there are no longer remnants of fallout from weapons testing. When detected, tritium values have remained well within the historical range and the range measured across the country by the EPA Radnet program and INL Oversight Program. The EPA Radnet database lists tritium results for precipitation collected in Idaho. The last sample for which results are available was collected on December 15, 2011. A search of the RadNet database (https://enviro.epa.gov/enviro/erams_query_v2.simple_query) for tritium in precipitation collected in Idaho from 2007 through 2011 shows a range of -84 to 123 pCi/L. The maximum value in the fourth quarter was (149 ± 25.4) pCi/L in an EFS sample collected on November 18th. The result was below the 99%/95% UTL of 322 pCi/L.

Water Sampling

Drinking water samples were collected at eight locations. A control sample of bottled water was also prepared. Surface water samples were collected at three Thousand Springs locations (plus a duplicate). All samples were analyzed for gross alpha, gross beta, and tritium. Results are listed in Table C-6 of Appendix C.

Gross alpha activity was detected in three of the nine drinking water samples (Atomic City, Craters of the Moon, and Shoshone samples) and in none of the four surface water samples. The highest reported gross alpha value was (7.4 ± 0.99) pCi/L in the drinking water sample from Atomic City. Gross beta activity was detected in eight of the nine drinking water samples (all except the control), and in all four of the surface water samples. All concentrations were similar to previous results from drinking and surface water sampling. Natural levels of radioactive decay products of thorium and uranium exist in the Snake River Plain Aquifer and are the likely source of the measured concentrations. The highest reported gross beta value was (4.6 ± 0.54) pCi/L in the surface water sample collected from Alpheus Spring near Twin Falls. This location has historically shown the highest levels of natural activity.

Tritium was also detected in six of the nine drinking water samples (all except Craters of the Moon, Minidoka, and Mud Lake) and one of the surface water samples (Clear Springs duplicate sample). The concentrations were similar to those found in atmospheric moisture and precipitation samples and were consistent with previous results. The maximum value was (121 ± 25) pCi/L in drinking water at Atomic CIty. The results are well below the DCS of 1.9 x 10^6 pCi/L for tritium in drinking water.

5. Agricultural Product, Wildlife, and Soil Sampling

Another potential pathway for contaminants to reach humans is through the food chain. The ESER Program samples multiple agricultural products and game animals from around the INL Site and Southeast Idaho. Specifically, milk, alfalfa, grain, potatoes, lettuce, large game animals, and waterfowl are sampled. Milk is sampled throughout the year and large game animals are sampled whenever large game animals are killed onsite from vehicle collisions. Alfalfa is collected during the second quarter, lettuce and grain are sampled during the fourth quarter, while potatoes are collected during the third or fourth quarter. Waterfowl are collected in either the third or fourth quarter. See Table A-1, Appendix A, for more details on agricultural product and wildlife sampling. This section discusses results from milk, potato, and wildlife samples available during the fourth quarter of 2020.

Milk Sampling

Milk samples were collected weekly at Idaho Falls and Terreton. Monthly samples were collected at five other locations around the INL Site (Figure 15) during the fourth quarter of 2020. In addition to the local locations, commercially-available organic milk (from Colorado) was purchased as a control sample each month. All samples were analyzed for gamma emitting radionuclides, with particular emphasis on ^{131}I. Semi-annual samples were collected and analyzed for ^{90}Sr and tritium during the fourth quarter.

Neither ^{131}I nor ^{137}Cs was detected in any weekly or monthly samples during the fourth quarter. No other human-made gamma-emitting radionuclides were found either. Data for ^{131}I and ^{137}Cs in milk samples are listed in Appendix C, Table C-7.

Results for ^{90}Sr and tritium are listed in Appendix C, Table C-8. Strontium-90 was detected in five of the seven semiannual samples. The maximum result (0.45 ± 0.05) pCi/L was detected in a sample collected at Terreton. The result is consistent with ^{90}Sr concentrations observed in previous years. There is no DCS for ^{90}Sr in milk; however, for comparison the result was well below the drinking water DCS of 1.1×10^3 pCi/L.

Tritium was detected in seven of the eight milk samples analyzed this quarter. The maximum concentration (214 ± 25) pCi/L was measured in a sample collected from Monteview on November 2. These concentrations are similar to those of previous years and are consistent with those found in atmospheric moisture and precipitation samples. The DCS for tritium in water is 1,900,000 pCi/L. The maximum observed value in milk samples is approximately 0.01 percent of the DCS.

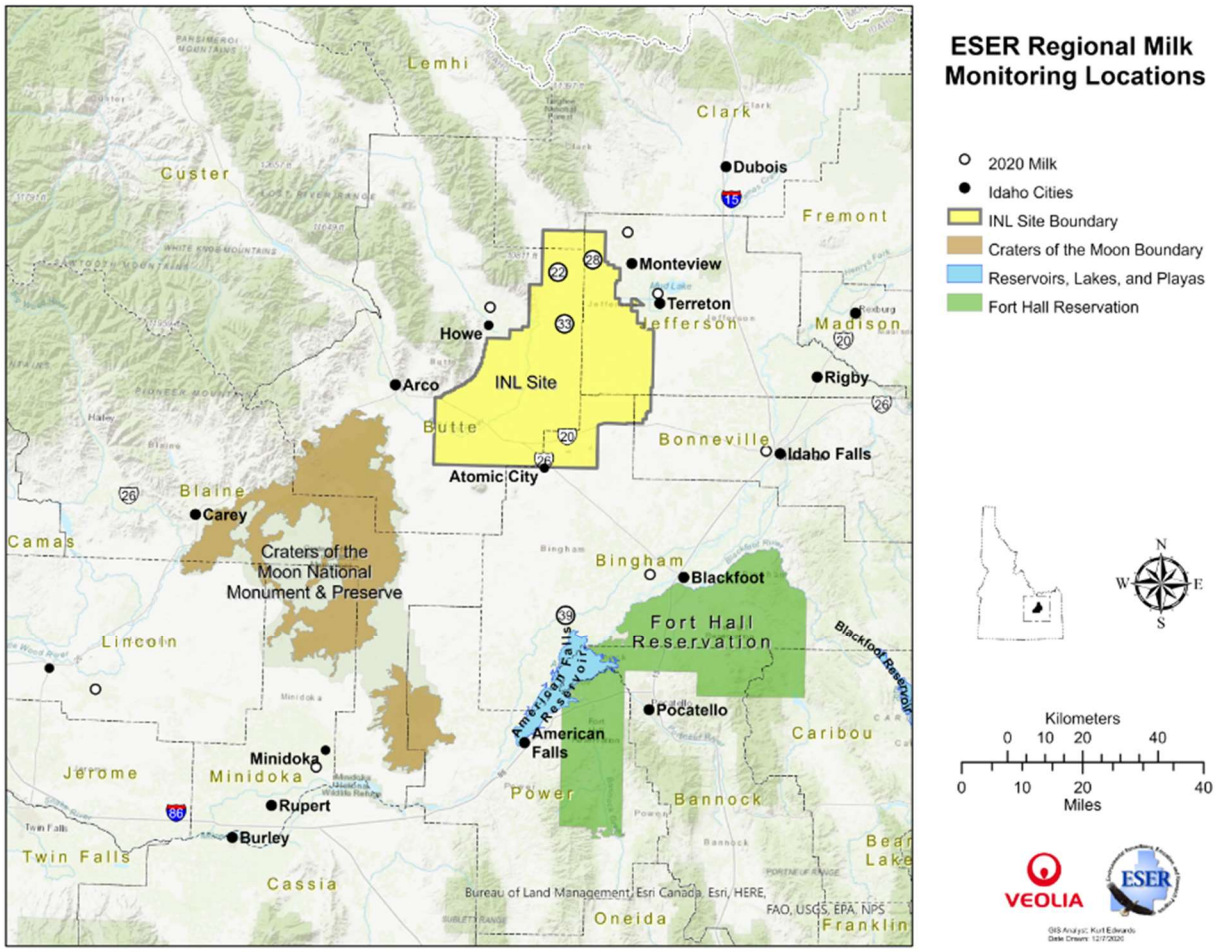


Figure 15. ESER milk monitoring locations.

Potato Sampling

Locally-grown potatoes from seven southeast Idaho locations (Figure 16) and one duplicate from Shelley were analyzed for gamma-emitting radionuclides like ^{137}Cs and for ^{90}Sr. A control sample from a local grocery store (grown in Oregon state) was also analyzed. No human-made gamma-emitters were found in any sample. Strontium-90 was not reported in any sample. Data for potato samples are listed in Appendix C, Table C-9.

Large Game Animal Sampling

No big game animals killed by vehicular collisions were available for sampling during the fourth quarter of 2020.

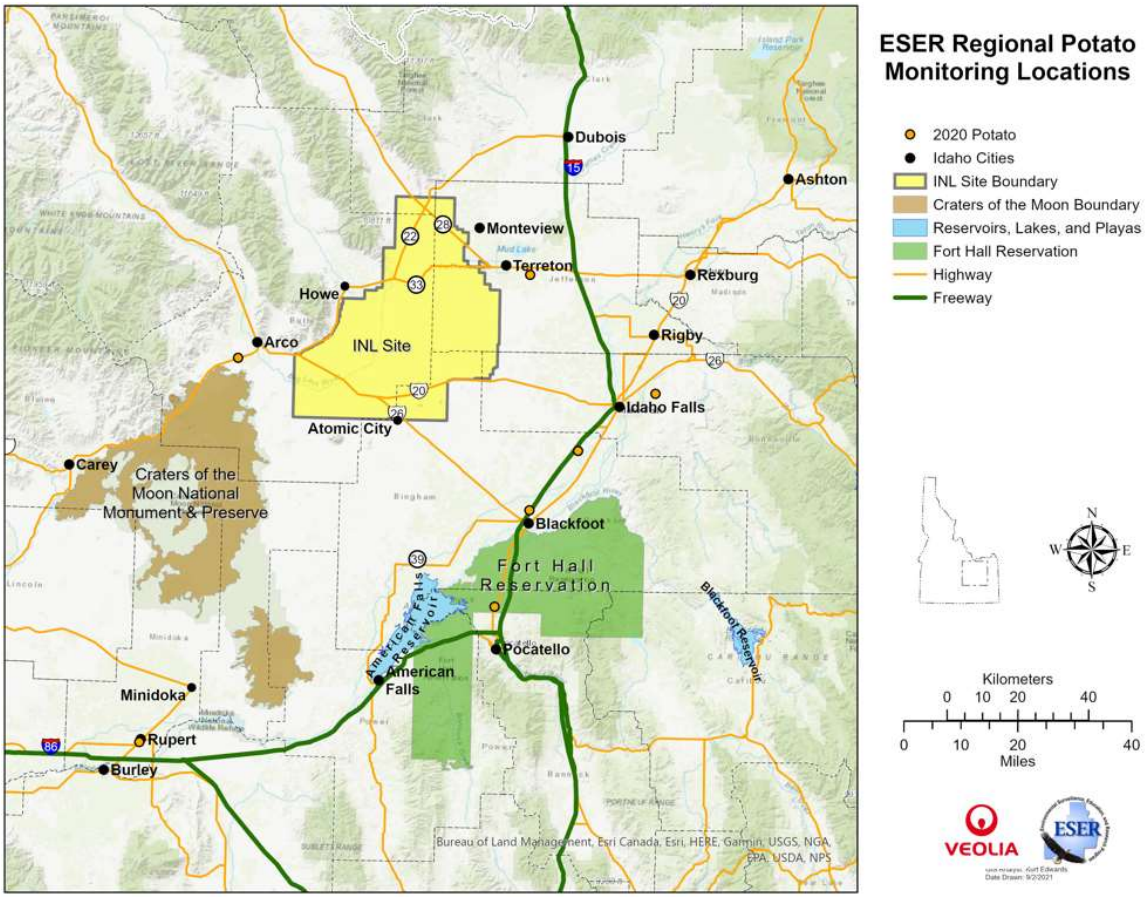


Figure 16. ESER potato monitoring locations.

Waterfowl

Waterfowl are collected each year by the ESER contractor at a wastewater pond on the INL Site and at a location off the INL Site. Three waterfowl were collected from a pond located at the Advanced Test Reactor (ATR) Complex. Two control waterfowl were collected from the South Fork of the Snake River. Each sample was divided into the following three sub-samples: 1) edible tissue (muscle, gizzard, heart, and liver), 2) external portion (feathers, feet, and head), and 3) all remaining tissue. All samples were analyzed for gamma-emitting radionuclides, ^{90}Sr, and actinides (americium-241 [^{241}Am], plutonium-238 [^{238}Pu], and plutonium-239/240 [$^{239/240}$Pu]). These radionuclides were selected because they have historically been measured in liquid effluents from some INL Site facilities.

A total of five human-made radionuclides were detected in edible, exterior, and remainder sub-samples from ducks collected at the ATR Complex ponds (Table 1). These were chromium-51 (^{51}Cr), cobalt-60 (^{60}Co), zinc-65 (^{65}Zn), ^{90}Sr, and ^{137}Cs. All of these radionuclides were found in the edible tissues (Appendix C, Table C-10). One radionuclide (^{90}Sr) was detected in the control ducks.

The maximum potential dose from eating 225 g (8 oz) of duck meat collected in 2020 was calculated. Doses from consuming waterfowl are conservatively based on the assumption that ducks are eaten immediately after leaving the pond and no radioactive decay occurs. The

maximum potential dose of 0.078 mrem estimated from these waterfowl sample results is higher than the dose estimated for 2019 (0.004 mrem).

Table 1. Radionuclide Concentrations Detected in Waterfowl Collected in 2020.

Radionuclides Detected in Waterfowl Tissue (pCi/kg dry weight)				
Location	**Species**	**Portion**	**Radionuclide**	**Concentration**
ATR Complex Ponds	Green-winged Teal	Edible	^{60}Co	3,320 ± 37
			^{90}Sr	46 ± 3
			^{65}Zn	4,950 ± 90
			^{137}Cs	4,570 ± 58
		Exterior	^{60}Co	4,280 ± 53
			^{65}Zn	2,740 ± 110
			^{137}Cs	2,820 ± 50
			^{90}Sr	2,810 ± 18
		Remainder	^{60}Co	5,040 ± 41
			^{65}Zn	6,550 ± 104
			^{90}Sr	2,430 ± 17
			^{137}Cs	5,640 ± 8
	Northern Pintail	Edible	^{137}Cs	20 ± 4
		Exterior	^{90}Sr	44 ± 4
		Remainder	^{90}Sr	30 ± 3
			^{137}Cs	9 ± 2
	Northern Shoveler	Edible	^{51}Cr	382 ± 58
		Exterior	^{60}Co	22 ± 3
			^{90}Sr	48 ± 3
		Remainder	^{90}Sr	19 ± 3
Control (South Fork)	Mallard	Exterior	^{90}Sr	11 ± 3
		Remainder	^{90}Sr	11 ± 3
	Mallard	Exterior	^{90}Sr	10 ± 3

6. Environmental Radiation

An array of optically stimulated luminescent dosimeters (OSLDs) and thermoluminescent dosimeter (TLD) is distributed throughout the Eastern Snake River Plain to monitor for environmental radiation. Beginning in November 2011, two OSLDs were placed in the same locations (Figure 17) as the TLDs to run a side-by-side comparison of the two dosimeter technologies. OSLDs and TLDs are changed out at the beginning of May and again at the beginning of November after six months in the field.

OSLD results from dosimeters collected during the fourth quarter are displayed in Appendix C, Table C-11. Results are presented in dose units of millirem (mrem). Similar to the low-volume air results the environmental dosimeter locations are also divided into Boundary and Distant groupings. The Boundary OSLD values ranged from 50.85 mrem at Blue Dome to 70.70 mrem at Mud Lake, with an overall average of 61.73 mrem. This equates to an average daily

dose of 0.34 mrem. Distant results varied from 50.65 mrem at Dubois to 75.40 mrem at Sugar City. The Distant average was 61.21 mrem, which also equates to 0.34 mrem per day. Results vary between sampling locations based on the geologic composition of the soils in the vicinity of the OSLD and the elevation of the station.

TLD results from fourth quarter are presented in Appendix C, Table C-12. The results for TLDs are provided in exposure units of milliroentgen (mR). The TLD results from second quarter were still being evaluated at the time the quarterly report was being published. This was the result of ISU reviewing a quality assurance measurement performed to verify the calibration of the internal strontium-90 source for the TLD reader. The review concluded that the measured ^{90}Sr source rate met the criteria of being within ±5% of the current calibration source rate displayed by the TLD reader. The fourth quarter Boundary values ranged from 49.0 mR at Blue Dome to 64.4 mR at Atomic City, with an overall average of 57.4 mR. This results in an average daily exposure rate of 0.32 mR per day. The Distant results for fourth quarter ranged from 50.6 mR at Blackfoot (Mountain View Middle School) to 77.1 mR at Sugar City. The overall Distant exposure was 59.3 mR with an average daily exposure rate of 0.33 mR day.

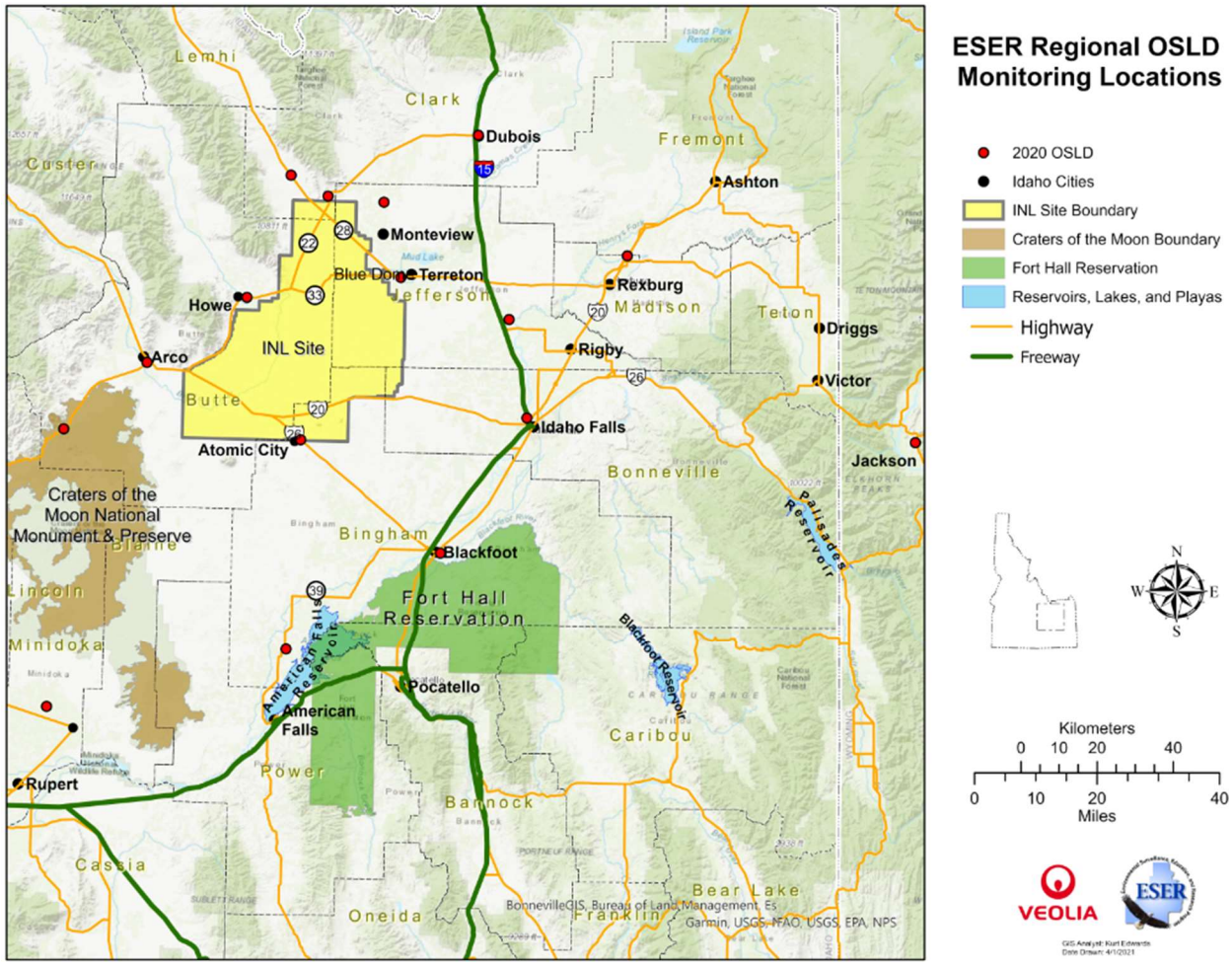


Figure 17. ESER optically stimulated luminescent dosimeter (OSLD) locations.

7. Quality Assurance

The ESER Quality Assurance Program consists of five ongoing tasks which measure:

1. method uncertainty
2. data completeness
3. data accuracy, using spike, performance evaluation and laboratory control samples
4. data precision, using split samples, duplicate samples and recounts
5. presence of contamination in samples, using blanks.

Sample results are compared to criteria described in the Quality Assurance Project Plan for the INL Site Offsite Environmental Surveillance Program (VNSFS 2018). Criteria established by DOE for Quality Assurance activities include:

- Quality assurance program
- Personnel training and qualification
- Quality improvement process
- Documents and records
- Established work processes
- Established standards for design and verification
- Established procurement requirements
- Inspection and acceptance testing
- Management assessment
- Independent assessment

Assessments of ESER data quality are achieved through analysis of spike, performance evaluation, and duplicate samples; through sample recounts; through analysis of blank samples; and through comparison of sample results to established method quality objectives. These assessments are documented in the ESER Quality Assurance for the Fourth Quarter of 2020 (VNSFS 2021).

8. References

K. Bunzl, K. Henrichs and W. Kracke, 1987, "Fallout ^{241}Am in Human Livers from the Federal Republic of Germany", *Health Physics* Vol. 51, No.5.

Cauquoin, A., P. Jean-Baptiste, C. Risia, É. Fourré, B. Stenni, and A. Landais, 2015, "The global distribution of natural tritium in precipitation simulated with an Atmospheric General Circulation Model and comparison with observations", Earth and Planetary Science Letters 427 (2015) 160–170. http://www.lmd.jussieu.fr/~acauquoin/Mes_Publications/Cauquoin%20et%20al.%202015%20-%20EPSL.pdf.

Currie, L.A., 1984, Lower Limit of Detection: Definition and Elaboration of a Proposed Position for Radiological Effluent and Environmental Measurements, NUREG/CR-4007, U.S. Nuclear Regulatory Commission, Washington, D.C., September 1984.

DOE, 2011a, "Radiation Protection of the Public and the Environment," U.S. Department of Energy O 458.1, Administrative Change 3, February 11, 2011.

DOE, 2011b, "Derived Concentration Technical Standard", Department of Energy Standard 1196-2011, April 2011.

DOE, 2015a, "Environmental Radiological Effluent Monitoring and Environmental Surveillance", DOE-HDBK-1216-2015, March 2015.

DOE, 2015b, Handbook for the Department of Energy's Mixed Analyte Performance Evaluation Program (MAPEP), January 2015. Available at: http://www.id.energy.gov/resl/mapep/handbookv15.pdf.

DOE-ID, 1981, "1980 Environmental Monitoring Program Report for Idaho National Engineering Laboratory Site", IDO-12082 (80), May 1981.

EPA, 2015, "ProUCL Version 5.1 Technical Guide", EPA/600/R-07/041 October 2015.EPA, 2018, RadNet—Tracking Environmental Radiation Nationwide, Web page: http://www.epa.gov/narel/radnet/

ICRP, 2009, ICRP Publication 114: Environmental Protection: Transfer Parameters for Reference Animals and Plants, Annals of the International Commission on Radiological Protection (ICRP), December 2009.

Pinder, J. E. III, K. W. McLeod, D. C. Adriano, J. C. Corey, and L. Boni, 1990, "Atmospheric Deposition, Resuspension and Root Uptake of Pu in Corn and Other Grain-Producing Agroecosystems Near a Nuclear Fuel Facility," Health Physics, Vol. 59, pp. 853-867.

VNSFS, 2018, Quality Assurance Project Plan for the INL Site Offsite Environmental Surveillance Program, Environmental Surveillance, Education and Research Program.

VNSFS, 2021, Environmental Quality Assurance Report for the 3rd Quarter 2020, Environmental Surveillance, Education, and Research Program.

APPENDIX A

SUMMARY OF SAMPLING SCHEDULE

Table A-1. Summary of the ESER Program's Sampling Schedule.

Sample Type Analysis	Collection Frequency	LOCATIONS		
		Distant	Boundary	INL Site
AIR SAMPLING				
LOW-VOLUME AIR				
Gross Alpha, Gross Beta, ^{131}I	weekly	Blackfoot, Craters of the Moon, Dubois, Idaho Falls, Jackson WY, Sugar City	Arco, Atomic City, FAA Tower, Howe, Monteview, Mud Lake, Blue Dome	Main Gate, EFS, Van Buren
Gamma Spec	quarterly	Blackfoot, Craters of the Moon, Dubois, Idaho Falls, Jackson WY, Sugar City	Arco, Atomic City, FAA Tower, Howe, Monteview, Mud Lake, Blue Dome	Main Gate, EFS, Van Buren
^{90}Sr, Transuranics	quarterly	Rotating schedule	Rotating schedule	Rotating schedule
ATMOSPHERIC MOISTURE				
Tritium	2 to 13 weeks	Idaho Falls	Atomic City, Howe	EFS
PRECIPITATION				
Tritium	monthly	Idaho Falls	None	None
Tritium	weekly	None	Atomic City, Howe	EFS
WATER SAMPLING				
DRINKING WATER				
Gross Alpha, Gross Beta, Tritium	Semiannually	Craters of the Moon, Idaho Falls, Minidoka, Shoshone	Atomic City, Howe, Mud Lake, Rest Area	None
SURFACE WATER				
Gross Alpha, Gross Beta, Tritium	Semiannually	Buhl, Hagerman, Twin Falls	None	Big Lost River (when flowing)
ENVIRONMENTAL RADIATION SAMPLING				
TLDs/OSLDs				
Gamma Radiation	semiannual	Aberdeen, Blackfoot (2), Craters of the Moon, Dubois, Idaho Falls, Jackson WY, Minidoka, Sugar City, Roberts	Arco, Atomic City, Birch Creek, Blue Dome, Howe, Monteview, Mud Lake	None
SOIL SAMPLING				
SOIL				

Sample Type Analysis	Collection Frequency	LOCATIONS		
		Distant	Boundary	INL Site
Gamma Spec, ^{90}Sr, Transuranics	biennially	Carey, Blackfoot, St. Anthony	Butte City, Monteview, Atomic City, FAA Tower, Howe, Mud Lake (2), Birch Creek, Frenchman's Cabin	None
FOODSTUFF SAMPLING				
MILK				
Gamma Spec (^{131}I)	weekly	Idaho Falls	Terreton	None
Gamma Spec (^{131}I)	monthly	Blackfoot, Dietrich, Fort Hall, Idaho Falls, Minidoka	Howe, Terreton	None
Tritium, ^{90}Sr	Semi-annually	Blackfoot, Dietrich, Fort Hall, Idaho Falls, Minidoka	Howe, Terreton	None
POTATOES				
Gamma Spec, ^{90}Sr	annually	Varies among Blackfoot, Idaho Falls, Rupert, Shelley, Hamer, Driggs, occasional samples across the U.S.	Varies among Arco, Monteview, Mud Lake, Terreton	None
ALFALFA				
Gamma Spec, ^{90}Sr	annually	Idaho Falls	Howe, Mud Lake	None
GRAIN				
Gamma Spec, ^{90}Sr	annually	Varies among American Falls, Blackfoot, Carey, Idaho Falls, Rupert/Minidoka, Roberts	Varies among Arco, Monteview, Mud Lake, Taber, Terreton	None
LETTUCE				
Gamma Spec, ^{90}Sr	annually	Varies among Blackfoot, Carey, Idaho Falls, Rigby, Sugar City	Varies among Arco, Atomic City, FAA Tower, Howe, Monteview	EFS
WILDLIFE SAMPLING				
BIG GAME				
Gamma Spec	varies	Occasional samples across the U.S.	Public Highways	INL Site roads
WATERFOWL				

Sample Type Analysis	Collection Frequency	LOCATIONS		
		Distant	Boundary	INL Site
Gamma Spec, ^{90}Sr, Transuranics	annually	Varies among: Heise, Firth, Fort Hall, Mud Lake, Market Lake, and American Falls	None	INL Site wastewater disposal ponds

APPENDIX B

SUMMARY OF MDCs AND DCSs

Table B-1. Summary of Approximate Minimum Detectable Concentrations for Radiological Analyses Performed during Fourth Quarter 2020

Sample Type	Analysis	Average Minimum Detectable Concentration[a] (MDC)	Derived Concentration Standard[b] (DCS)
Air (particulate filter)[e]	Gross alpha	4.9×10^{-16} µCi/mL	3.4×10^{-14} µCi/ml[c]
	Gross beta	3.2×10^{-15} µCi/mL	2.5×10^{-11} µCi/ml[d]
	^{137}Cs	9.1×10^{-17} µCi/mL	9.8×10^{-11} µCi/ml
	^{90}Sr	4.3×10^{-17} µCi/mL	2.5×10^{-11} µCi/ml
	^{241}Am	3.8×10^{-18} µCi/mL	4.1×10^{-14} µCi/ml
	^{238}Pu	3.3×10^{-18} µCi/mL	3.7×10^{-14} µCi/ml
	$^{239/240}$Pu	4.4×10^{-18} µCi/mL	3.4×10^{-14} µCi/ml
Air (charcoal cartridge)[e]	^{131}I	9.3×10^{-16} µCi/mL	4.1×10^{-10} µCi/ml
Air (atmospheric moisture)	^{3}H	90 pCi/L_{water} 3.6×10^{-13} $\mu Ci/mL_{air}$	1.9×10^{6} pCi/L_{water} 2.1×10^{-7} $\mu Ci/ml_{air}$
Air (precipitation)	^{3}H	90 pCi/L	1.9×10^{-6} pCi/L
Milk	^{131}I	0.55 pCi/L	1,300 pCi/L[f]
	^{137}Cs	1.1 pCi/L	3,000 pCi/L[f]
	^{90}Sr	0.17 pCi/L	1,100 pCi/L[f]
	^{3}H	90 pCi/L	1.9×10^{6} pCi/L[f]
Drinking Water/Surface Water	Gross alpha	1.7 pCi/L	140 pCi/L[c]
	Gross beta	1.5 pCi/L	1,100 pCi/L[d]
	^{3}H	89 pCi/L	1.9×10^{6} pCi/L
Waterfowl	^{137}Cs	4.2 pCi/kg	--[g]
	^{90}Sr	9.2 pCi/kg	--
	^{241}Am	6.6 pCi/kg	--
	^{238}Pu	8.5 pCi/kg	--
	$^{239/240}$Pu	9.3 pCi/kg	--

Sample Type	Analysis	Average Minimum Detectable Concentration[a] (MDC)	Derived Concentration Standard[b] (DCS)

a. The MDC is an estimate of the concentration of radioactivity in a given sample type that can be identified with a 95 percent level of confidence. MDCs are calculated and reported by the laboratories based on actual ESER sample results following analysis.
b. DCSs, set by the DOE, represent reference values for radiation exposure. They are based on a radiation dose of 100 mrem/yr for exposure through a particular exposure mode such as direct exposure, inhalation, or ingestion of water.
c. Based on the most restrictive human-made alpha emitter (^{239}Pu).
d. Based on the most restrictive human-made beta emitter (^{90}Sr).
e. The approximate MDC for air is based on an average filtered air volume (pressure corrected) of 445 m^3/week. The MDCs for lettuce, potatoes, grain and soil are per dry weight.
f. There is no DCS established for radionuclides in milk. However, The DCS shown is for the radionuclide ingested in water.
g. – No appropriate DCS available

APPENDIX C

SAMPLE ANALYSIS RESULTS

Table C-1. Weekly Gross Alpha and Gross Beta Concentrations in Air

		GROSS ALPHA								GROSS BETA							
Sampling Group and Location	Sampling Date	Result ± 1s Uncertainty ($\times 10^{-15}$ µCi/mL)			Result ± 1s Uncertainty ($\times 10^{-11}$ Bq/mL)			Result > 3s	Comment	Result ± 1s Uncertainty ($\times 10^{-15}$ µCi/mL)			Result ± 1s Uncertainty ($\times 10^{-11}$ Bq/mL)			Result > 3s	Comment
BOUNDARY																	
ARCO	10/7/2020	17.30	±	1.19	64.01	±	4.40		Invalid[a]	46.10	±	1.86	170.57	±	6.88	Yes	
	10/14/2020	12.20	±	0.98	45.14	±	3.62		Invalid[a]	30.10	±	1.49	111.37	±	5.51	Yes	
	10/21/2020	5.24	±	0.54	19.39	±	2.00		Invalid[a]	11.90	±	0.83	44.03	±	3.07	Yes	
	10/28/2020	18.60	±	1.08	68.82	±	4.00		Invalid[a]	47.80	±	1.61	176.86	±	5.96	Yes	
	11/4/2020	13.50	±	0.69	49.95	±	2.55		Invalid[a]	37.60	±	2.41	139.12	±	8.92	Yes	
	11/11/2020	13.10	±	0.70	48.47	±	2.57		Invalid[a]	39.80	±	1.15	147.26	±	4.26	Yes	
	11/18/2020	6.13	±	0.47	22.68	±	1.75		Invalid[a]	20.30	±	1.30	75.11	±	4.81	Yes	
	11/25/2020	11.20	±	0.65	41.44	±	2.41		Invalid[a]	38.60	±	1.13	142.82	±	4.18	Yes	
	12/2/2020	4.39	±	0.26	16.24	±	0.94		Invalid[a]	18.10	±	0.48	66.97	±	1.77	Yes	
	12/9/2020	2.62	±	0.23	9.69	±	0.86		Invalid[a]	39.70	±	1.32	146.89	±	4.88	Yes	
	12/16/2020	1.54	±	0.22	5.70	±	0.82	Yes		37.90	±	1.67	140.23	±	6.18	Yes	
	12/23/2020	1.21	±	0.21	4.48	±	0.77	Yes		27.20	±	1.72	100.64	±	6.36	Yes	
	12/30/2020	1.92	±	0.24	7.10	±	0.89	Yes		27.90	±	1.58	103.23	±	5.85	Yes	
QA-1	10/7/2020	13.20	±	0.89	48.84	±	3.30		Invalid[a]	35.10	±	1.40	129.87	±	5.18	Yes	
(ARCO)	10/14/2020	8.80	±	0.69	32.56	±	2.56		Invalid[a]	21.00	±	1.04	77.70	±	3.85	Yes	
	10/21/2020	4.58	±	0.56	16.95	±	2.07		Invalid[a]	32.66	±	1.21	120.86	±	4.48	Yes	
	10/28/2020	11.60	±	0.78	42.92	±	2.89		Invalid[a]	36.90	±	1.37	136.53	±	5.07	Yes	
	11/4/2020	11.30	±	0.61	41.81	±	2.26		Invalid[a]	29.70	±	2.16	109.89	±	7.99	Yes	
	11/11/2020	10.70	±	0.60	39.59	±	2.21		Invalid[a]	28.40	±	0.94	105.08	±	3.49	Yes	
	11/18/2020	5.15	±	0.42	19.06	±	1.55		Invalid[a]	14.30	±	1.10	52.91	±	4.07	Yes	
	11/25/2020	10.20	±	0.56	37.74	±	2.08		Invalid[a]	30.50	±	0.92	112.85	±	3.41	Yes	
	12/2/2020	3.22	±	0.21	11.91	±	0.77		Invalid[a]	13.50	±	0.40	49.95	±	1.47	Yes	
	12/9/2020	3.49	±	0.30	12.91	±	1.10		Invalid[a]	42.60	±	1.61	157.62	±	5.96	Yes	
	12/16/2020	1.14	±	0.18	4.22	±	0.67	Yes		26.80	±	1.36	99.16	±	5.03	Yes	
	12/23/2020	1.08	±	0.19	4.00	±	0.69	Yes		24.30	±	1.56	89.91	±	5.77	Yes	
	12/30/2020	1.30	±	0.27	4.81	±	0.98	Yes		23.30	±	2.10	86.21	±	7.77	Yes	
ATOMIC CITY	10/7/2020	23.40	±	1.34	86.58	±	4.96		Invalid[a]	44.90	±	1.84	166.13	±	6.81	Yes	
	10/14/2020	15.20	±	1.10	56.24	±	4.07		Invalid[a]	35.70	±	1.63	132.09	±	6.03	Yes	
	10/21/2020	19.06	±	1.06	70.53	±	3.92		Invalid[a]	44.65	±	1.51	165.21	±	5.59	Yes	
	10/28/2020	21.10	±	1.17	78.07	±	4.33		Invalid[a]	49.40	±	1.67	182.78	±	6.18	Yes	
	11/4/2020	18.80	±	0.81	69.56	±	3.00		Invalid[a]	37.60	±	2.52	139.12	±	9.32	Yes	
	11/11/2020	14.10	±	0.71	52.17	±	2.63		Invalid[a]	41.60	±	1.16	153.92	±	4.29	Yes	
	11/18/2020	6.06	±	0.45	22.42	±	1.68		Invalid[a]	17.80	±	1.20	65.86	±	4.44	Yes	
	11/25/2020	8.56	±	0.53	31.67	±	1.95		Invalid[a]	30.60	±	0.94	113.22	±	3.48	Yes	
	12/2/2020	4.25	±	0.24	15.73	±	0.88		Invalid[a]	18.20	±	0.45	67.34	±	1.68	Yes	
	12/9/2020	3.44	±	0.31	12.73	±	1.15		Invalid[a]	40.80	±	1.68	150.96	±	6.22	Yes	
	12/16/2020	1.59	±	0.23	5.88	±	0.84	Yes		44.80	±	1.76	165.76	±	6.51	Yes	
	12/23/2020	1.00	±	0.18	3.70	±	0.65	Yes		29.70	±	1.57	109.89	±	5.81	Yes	
	12/30/2020	-0.02	±	0.09	-0.08	±	0.33	No		2.60	±	1.10	9.62	±	4.07	No	
BLUE DOME	10/7/2020	12.70	±	0.90	46.99	±	3.31		Invalid[a]	27.30	±	1.31	101.01	±	4.85	Yes	
	10/14/2020	10.50	±	0.77	38.85	±	2.84		Invalid[a]	21.40	±	1.08	79.18	±	4.00	Yes	
	10/21/2020	13.33	±	0.87	49.31	±	3.20		Invalid[a]	33.28	±	1.28	123.15	±	4.74	Yes	
	10/28/2020	13.30	±	0.86	49.21	±	3.20		Invalid[a]	33.20	±	1.28	122.84	±	4.74	Yes	
	11/4/2020	11.20	±	0.59	41.44	±	2.19		Invalid[a]	29.80	±	2.07	110.26	±	7.66	Yes	
	11/11/2020	13.80	±	0.68	51.06	±	2.50		Invalid[a]	37.00	±	1.06	136.90	±	3.92	Yes	
	11/18/2020	4.04	±	0.39	14.95	±	1.43		Invalid[a]	12.00	±	1.06	44.40	±	3.92	Yes	
	11/25/2020	9.37	±	0.56	34.67	±	2.06		Invalid[a]	34.60	±	1.00	128.02	±	3.70	Yes	
	12/2/2020	2.84	±	0.20	10.51	±	0.73		Invalid[a]	10.60	±	0.36	39.22	±	1.33	Yes	
	12/9/2020	2.90	±	0.29	10.73	±	1.08		Invalid[a]	40.00	±	1.65	148.00	±	6.11	Yes	
	12/16/2020	0.74	±	0.17	2.74	±	0.61	Yes		15.40	±	1.32	56.98	±	4.88	Yes	
	12/23/2020	0.80	±	0.17	2.94	±	0.62	Yes		20.90	±	1.51	77.33	±	5.59	Yes	
	12/30/2020	1.02	±	0.18	3.77	±	0.68	Yes		23.60	±	1.46	87.32	±	5.40	Yes	
FAA TOWER	10/7/2020	13.80	±	0.90	51.06	±	3.33		Invalid[a]	31.00	±	1.33	114.70	±	4.92	Yes	

Table C-1. Weekly Gross Alpha and Gross Beta Concentrations in Air

		GROSS ALPHA								GROSS BETA							
Sampling Group and Location	Sampling Date	Result ± 1s Uncertainty ($\times 10^{-15}$ µCi/mL)			Result ± 1s Uncertainty ($\times 10^{-11}$ Bq/mL)			Result > 3s	Comment	Result ± 1s Uncertainty ($\times 10^{-15}$ µCi/mL)			Result ± 1s Uncertainty ($\times 10^{-11}$ Bq/mL)			Result > 3s	Comment
	10/14/2020	10.80	±	0.76	39.96	±	2.81		Invalid[a]	19.20	±	1.02	71.04	±	3.77	Yes	
	10/21/2020	15.01	±	0.94	55.52	±	3.47		Invalid[a]	35.27	±	1.35	130.49	±	5.00	Yes	
	10/28/2020	15.10	±	0.95	55.87	±	3.50		Invalid[a]	35.50	±	1.36	131.35	±	5.03	Yes	
	11/4/2020	10.50	±	0.59	38.85	±	2.19		Invalid[a]	26.90	±	2.12	99.53	±	7.84	Yes	
	11/11/2020	9.93	±	0.58	36.74	±	2.14		Invalid[a]	31.60	±	0.98	116.92	±	3.63	Yes	
	11/18/2020	3.73	±	0.37	13.80	±	1.35		Invalid[a]	13.00	±	1.05	48.10	±	3.89	Yes	
	11/25/2020	9.49	±	0.56	35.11	±	2.09		Invalid[a]	33.50	±	1.00	123.95	±	3.69	Yes	
	12/2/2020	2.20	±	0.17	8.14	±	0.64		Invalid[a]	8.12	±	0.32	30.04	±	1.18	Yes	
	12/9/2020	4.99	±	0.36	18.46	±	1.35		Invalid[a]	59.20	±	1.89	219.04	±	6.99	Yes	
	12/16/2020	0.90	±	0.18	3.31	±	0.66	Yes		23.70	±	1.44	87.69	±	5.33	Yes	
	12/23/2020	0.77	±	0.16	2.83	±	0.61	Yes		20.10	±	1.49	74.37	±	5.51	Yes	
	12/30/2020	0.59	±	0.15	2.19	±	0.56	Yes		16.90	±	1.33	62.53	±	4.92	Yes	
HOWE	10/7/2020	14.50	±	1.00	53.65	±	3.68		Invalida	37.40	±	1.54	138.38	±	5.70	Yes	
	10/14/2020	4.74	±	0.57	17.54	±	2.09		Invalida	27.90	±	1.24	103.23	±	4.59	Yes	
	10/21/2020	13.70	±	0.89	50.71	±	3.29		Invalida	36.73	±	1.35	135.91	±	5.00	Yes	
	10/28/2020	14.20	±	0.92	52.54	±	3.40		Invalida	38.00	±	1.40	140.60	±	5.18	Yes	
	11/4/2020	10.40	±	0.59	38.48	±	2.19		Invalida	29.80	±	2.16	110.26	±	7.99	Yes	
	11/11/2020	12.40	±	0.66	45.88	±	2.43		Invalida	41.60	±	1.13	153.92	±	4.18	Yes	
	11/18/2020	4.92	±	0.44	18.20	±	1.63		Invalida	15.30	±	1.21	56.61	±	4.48	Yes	
	11/25/2020	9.98	±	0.57	36.93	±	2.11		Invalida	34.00	±	0.99	125.80	±	3.66	Yes	
	12/2/2020	2.71	±	0.19	10.03	±	0.71		Invalida	10.10	±	0.35	37.37	±	1.29	Yes	
	12/9/2020	3.30	±	0.31	12.21	±	1.13		Invalida	58.80	±	1.81	217.56	±	6.70	Yes	
	12/16/2020	1.62	±	0.21	5.99	±	0.79	Yes		27.80	±	1.45	102.86	±	5.37	Yes	
	12/23/2020	0.93	±	0.19	3.43	±	0.68	Yes		27.50	±	1.70	101.75	±	6.29	Yes	
	12/30/2020	0.89	±	0.18	3.29	±	0.68	Yes		26.80	±	1.57	99.16	±	5.81	Yes	
MONTEVIEW	10/7/2020	11.10	±	0.84	41.07	±	3.10		Invalid[a]	29.30	±	1.33	108.41	±	4.92	Yes	
	10/14/2020	9.96	±	0.77	36.85	±	2.84		Invalid[a]	28.60	±	1.23	105.82	±	4.55	Yes	
	10/21/2020	12.76	±	0.88	47.20	±	3.26		Invalid[a]	34.99	±	1.35	129.45	±	5.01	Yes	
	10/28/2020	13.20	±	0.91	48.84	±	3.37		Invalid[a]	36.30	±	1.40	134.31	±	5.18	Yes	
	11/4/2020	13.20	±	0.68	48.84	±	2.50		Invalid[a]	32.20	±	2.31	119.14	±	8.55	Yes	
	11/11/2020	13.00	±	0.68	48.10	±	2.53		Invalid[a]	38.30	±	1.12	141.71	±	4.14	Yes	
	11/18/2020	4.55	±	0.42	16.84	±	1.54		Invalid[a]	14.50	±	1.15	53.65	±	4.26	Yes	
	11/25/2020	8.83	±	0.55	32.67	±	2.03		Invalid[a]	36.40	±	1.04	134.68	±	3.85	Yes	
	12/2/2020	3.34	±	0.21	12.36	±	0.79		Invalid[a]	12.80	±	0.39	47.36	±	1.44	Yes	
	12/9/2020	3.63	±	0.32	13.43	±	1.17		Invalid[a]	44.30	±	1.70	163.91	±	6.29	Yes	
	12/16/2020	1.82	±	0.23	6.73	±	0.84	Yes		35.20	±	1.56	130.24	±	5.77	Yes	
	12/23/2020	1.28	±	0.20	4.74	±	0.74	Yes		29.90	±	1.64	110.63	±	6.07	Yes	
	12/30/2020	1.18	±	0.18	4.37	±	0.67	Yes		28.40	±	1.39	105.08	±	5.14	Yes	
MUD LAKE	10/7/2020	12.50	±	0.90	46.25	±	3.32		Invalid[a]	35.00	±	1.44	129.50	±	5.33	Yes	
	10/14/2020	9.92	±	0.75	36.70	±	2.76		Invalid[a]	27.50	±	1.18	101.75	±	4.37	Yes	
	10/21/2020	12.62	±	0.85	46.70	±	3.13		Invalid[a]	42.81	±	1.41	158.39	±	5.22	Yes	
	10/28/2020	13.30	±	0.89	49.21	±	3.30		Invalid[a]	45.10	±	1.49	166.87	±	5.51	Yes	
	11/4/2020	12.00	±	0.63	44.40	±	2.32		Invalid[a]	27.70	±	2.15	102.49	±	7.96	Yes	
	11/11/2020	11.90	±	0.63	44.03	±	2.33		Invalid[a]	38.10	±	1.07	140.97	±	3.96	Yes	
	11/18/2020	4.79	±	0.42	17.72	±	1.56		Invalid[a]	19.10	±	1.24	70.67	±	4.59	Yes	
	11/25/2020	11.40	±	0.65	42.18	±	2.40		Invalid[a]	40.30	±	1.14	149.11	±	4.22	Yes	
	12/2/2020	2.59	±	0.19	9.58	±	0.70		Invalid[a]	10.60	±	0.36	39.22	±	1.33	Yes	
	12/9/2020	4.47	±	0.34	16.54	±	1.27		Invalid[a]	61.70	±	1.87	228.29	±	6.92	Yes	
	12/16/2020	1.46	±	0.22	5.40	±	0.82	Yes		36.80	±	1.69	136.16	±	6.25	Yes	
	12/23/2020	1.08	±	0.19	4.00	±	0.68	Yes		27.50	±	1.58	101.75	±	5.85	Yes	
	12/30/2020	0.95	±	0.18	3.52	±	0.68	Yes		28.20	±	1.55	104.34	±	5.74	Yes	

Table C-1. Weekly Gross Alpha and Gross Beta Concentrations in Air

		GROSS ALPHA								GROSS BETA							
Sampling Group and Location	Sampling Date	Result ± 1s Uncertainty ($\times 10^{-15}$ µCi/mL)			Result ± 1s Uncertainty ($\times 10^{-11}$ Bq/mL)			Result > 3s	Comment	Result ± 1s Uncertainty ($\times 10^{-15}$ µCi/mL)			Result ± 1s Uncertainty ($\times 10^{-11}$ Bq/mL)			Result > 3s	Comment
QA-2 (MUD LAKE)	10/7/2020	9.74	±	0.78	36.04	±	2.88		Invalid[a]	27.10	±	1.27	100.27	±	4.70	Yes	
	10/14/2020	10.50	±	0.77	38.85	±	2.85		Invalid[a]	31.70	±	1.25	117.29	±	4.63	Yes	
	10/21/2020	15.56	±	0.91	57.58	±	3.37		Invalid[a]	45.77	±	1.42	169.34	±	5.26	Yes	
	10/28/2020	15.60	±	0.92	57.72	±	3.39		Invalid[a]	46.00	±	1.43	170.20	±	5.29	Yes	
	11/4/2020	12.50	±	0.60	46.25	±	2.23		Invalid[a]	31.60	±	2.04	116.92	±	7.55	Yes	
	11/11/2020	13.00	±	0.67	48.10	±	2.48		Invalid[a]	42.50	±	1.14	157.25	±	4.22	Yes	
	11/18/2020	6.65	±	0.49	24.61	±	1.82		Invalid[a]	18.80	±	1.29	69.56	±	4.77	Yes	
	11/25/2020	12.40	±	0.67	45.88	±	2.49		Invalid[a]	47.90	±	1.23	177.23	±	4.55	Yes	
	12/2/2020	4.19	±	0.24	15.50	±	0.90		Invalid[a]	17.40	±	0.46	64.38	±	1.68	Yes	
	12/9/2020	5.28	±	0.37	19.54	±	1.35		Invalid[a]	83.10	±	1.97	307.47	±	7.29	Yes	
	12/16/2020	1.19	±	0.19	4.40	±	0.72	Yes		36.00	±	1.56	133.20	±	5.77	Yes	
	12/23/2020	1.00	±	0.19	3.69	±	0.71	Yes		30.80	±	1.77	113.96	±	6.55	Yes	
	12/30/2020	0.84	±	0.18	3.10	±	0.68	Yes		33.30	±	1.70	123.21	±	6.29	Yes	
DISTANT																	
BLACKFOOT	10/7/2020	13.30	±	1.01	49.21	±	3.74		Invalid[a]	50.20	±	1.81	185.74	±	6.70	Yes	
	10/14/2020	10.30	±	0.94	38.11	±	3.46		Invalid[a]	39.40	±	1.70	145.78	±	6.29	Yes	
	10/21/2020	17.80	±	1.08	65.85	±	3.99		Invalid[a]	46.15	±	1.61	170.76	±	5.95	Yes	
	10/28/2020	17.80	±	1.08	65.86	±	4.00		Invalid[a]	46.20	±	1.61	170.94	±	5.96	Yes	
	11/4/2020	13.10	±	0.69	48.47	±	2.55		Invalid[a]	32.30	±	2.39	119.51	±	8.84	Yes	
	11/11/2020	12.80	±	0.70	47.36	±	2.58		Invalid[a]	35.80	±	1.11	132.46	±	4.11	Yes	
	11/18/2020	3.83	±	0.35	14.17	±	1.31		Invalid[a]	11.90	±	0.98	44.03	±	3.61	Yes	
	11/25/2020	9.66	±	0.55	35.74	±	2.02		Invalid[a]	33.00	±	0.95	122.10	±	3.51	Yes	
	12/2/2020	4.19	±	0.23	15.50	±	0.85		Invalid[a]	16.20	±	0.42	59.94	±	1.54	Yes	
	12/9/2020	6.31	±	0.41	23.35	±	1.50		Invalid[a]	69.40	±	2.02	256.78	±	7.47	Yes	
	12/16/2020	2.11	±	0.27	7.81	±	0.98	Yes		49.90	±	1.92	184.63	±	7.10	Yes	
	12/23/2020	0.88	±	0.18	3.24	±	0.66	Yes		18.20	±	1.56	67.34	±	5.77	Yes	
	12/30/2020	1.32	±	0.21	4.88	±	0.79	Yes		27.00	±	1.62	99.90	±	5.99	Yes	
CRATERS OF THE MOON	10/7/2020	14.60	±	0.90	54.02	±	3.33		Invalid[a]	28.70	±	1.26	106.19	±	4.66	Yes	
	10/14/2020	8.94	±	0.68	33.08	±	2.52		Invalid[a]	20.30	±	1.00	75.11	±	3.70	Yes	
	10/21/2020	10.60	±	0.78	39.22	±	2.88		Invalid[a]	30.04	±	1.22	111.16	±	4.50	Yes	
	10/28/2020	10.40	±	0.76	38.48	±	2.82		Invalid[a]	29.40	±	1.19	108.78	±	4.40	Yes	
	11/4/2020	9.86	±	0.55	36.48	±	2.05		Invalid[a]	21.40	±	1.94	79.18	±	7.18	Yes	
	11/11/2020	6.75	±	0.46	24.98	±	1.70		Invalid[a]	23.70	±	0.83	87.69	±	3.06	Yes	
	11/18/2020	2.21	±	0.27	8.18	±	1.01		Invalid[a]	8.47	±	0.84	31.34	±	3.09	Yes	
	11/25/2020	5.83	±	0.43	21.57	±	1.60		Invalid[a]	23.40	±	0.82	86.58	±	3.04	Yes	
	12/2/2020	2.49	±	0.18	9.21	±	0.67		Invalid[a]	9.89	±	0.34	36.59	±	1.25	Yes	
	12/9/2020	7.20	±	0.42	26.64	±	1.54		Invalid[a]	84.40	±	2.08	312.28	±	7.70	Yes	
	12/16/2020	0.72	±	0.16	2.65	±	0.59	Yes		23.00	±	1.37	85.10	±	5.07	Yes	
	12/23/2020	0.65	±	0.15	2.39	±	0.55	Yes		14.70	±	1.37	54.39	±	5.07	Yes	
	12/30/2020	1.54	±	0.25	5.70	±	0.93	Yes		41.80	±	2.03	154.66	±	7.51	Yes	
DUBOIS	10/7/2020	12.40	±	0.87	45.88	±	3.22		Invalid[a]	31.00	±	1.34	114.70	±	4.96	Yes	
	10/14/2020	9.36	±	0.77	34.63	±	2.85		Invalid[a]	23.00	±	1.18	85.10	±	4.37	Yes	
	10/21/2020	11.84	±	0.80	43.79	±	2.96		Invalid[a]	31.33	±	1.21	115.93	±	4.49	Yes	
	10/28/2020	13.00	±	0.88	48.10	±	3.26		Invalid[a]	34.50	±	1.34	127.65	±	4.96	Yes	
	11/4/2020	10.50	±	0.59	38.85	±	2.19		Invalid[a]	27.60	±	2.13	102.12	±	7.88	Yes	
	11/11/2020	11.40	±	0.61	42.18	±	2.26		Invalid[a]	34.70	±	1.01	128.39	±	3.74	Yes	
	11/18/2020	3.97	±	0.39	14.69	±	1.43		Invalid[a]	10.70	±	1.04	39.59	±	3.85	Yes	
	11/25/2020	9.52	±	0.56	35.22	±	2.09		Invalid[a]	31.50	±	0.97	116.55	±	3.59	Yes	
	12/2/2020	2.68	±	0.19	9.92	±	0.71		Invalid[a]	10.60	±	0.36	39.22	±	1.33	Yes	
	12/9/2020	2.12	±	0.27	7.84	±	0.98		Invalid[a]	36.10	±	1.63	133.57	±	6.03	Yes	
	12/16/2020	0.65	±	0.16	2.41	±	0.60	Yes		31.30	±	1.53	115.81	±	5.66	Yes	
	12/23/2020	0.63	±	0.15	2.34	±	0.57	Yes		23.80	±	1.53	88.06	±	5.66	Yes	
	12/30/2020	0.41	±	0.14	1.51	±	0.51	No		22.70	±	1.42	83.99	±	5.25	Yes	
IDAHO FALLS	10/7/2020	11.20	±	0.81	41.44	±	2.99		Invalid[a]	34.90	±	1.35	129.13	±	5.00	Yes	

Table C-1. Weekly Gross Alpha and Gross Beta Concentrations in Air

		GROSS ALPHA								GROSS BETA							
Sampling Group and Location	Sampling Date	Result ± 1s Uncertainty ($\times 10^{-15}$ µCi/mL)			Result ± 1s Uncertainty ($\times 10^{-11}$ Bq/mL)			Result > 3s	Comment	Result ± 1s Uncertainty ($\times 10^{-15}$ µCi/mL)			Result ± 1s Uncertainty ($\times 10^{-11}$ Bq/mL)			Result > 3s	Comment
	10/14/2020	6.66	±	0.60	24.64	±	2.22		Invalid[a]	26.90	±	1.11	99.53	±	4.11	Yes	
	10/21/2020	10.75	±	0.81	39.78	±	2.98		Invalid[a]	33.20	±	1.31	122.82	±	4.84	Yes	
	10/28/2020	11.70	±	0.88	43.29	±	3.26		Invalid[a]	36.20	±	1.43	133.94	±	5.29	Yes	
	11/4/2020	10.90	±	0.64	40.33	±	2.35		Invalid[a]	28.90	±	2.32	106.93	±	8.58	Yes	
	11/11/2020	9.21	±	0.59	34.08	±	2.17		Invalid[a]	34.60	±	1.08	128.02	±	4.00	Yes	
	11/18/2020	4.34	±	0.40	16.06	±	1.47		Invalid[a]	11.00	±	1.04	40.70	±	3.85	Yes	
	11/25/2020	9.32	±	0.56	34.48	±	2.08		Invalid[a]	33.80	±	1.01	125.06	±	3.74	Yes	
	12/2/2020	2.97	±	0.21	10.99	±	0.77		Invalid[a]	14.00	±	0.42	51.80	±	1.55	Yes	
	12/9/2020	11.00	±	0.49	40.70	±	1.81		Invalid[a]	61.20	±	1.92	226.44	±	7.10	Yes	
	12/16/2020	3.50	±	0.30	12.95	±	1.09	Yes		39.30	±	1.61	145.41	±	5.96	Yes	
	12/23/2020	1.42	±	0.21	5.25	±	0.77	Yes		24.60	±	1.57	91.02	±	5.81	Yes	
	12/30/2020		±			±			Invalid[u]		±			±			Invalid[u]
JACKSON	10/7/2020	14.80	±	1.01	54.76	±	3.74		Invalid[a]	31.70	±	1.48	117.29	±	5.48	Yes	
	10/14/2020	13.30	±	1.03	49.21	±	3.81		Invalid[a]	26.50	±	1.45	98.05	±	5.37	Yes	
	10/21/2020	12.28	±	0.86	45.45	±	3.16		Invalid[a]	41.07	±	1.42	151.96	±	5.26	Yes	
	10/28/2020	12.90	±	0.90	47.73	±	3.32		Invalid[a]	43.00	±	1.49	159.10	±	5.51	Yes	
	11/4/2020	12.30	±	0.65	45.51	±	2.39		Invalid[a]	21.00	±	2.14	77.70	±	7.92	Yes	
	11/11/2020	9.29	±	0.58	34.37	±	2.15		Invalid[a]	26.90	±	0.96	99.53	±	3.54	Yes	
	11/18/2020	2.88	±	0.33	10.66	±	1.21		Invalid[a]	6.47	±	0.88	23.94	±	3.24	Yes	
	11/25/2020	6.47	±	0.46	23.94	±	1.71		Invalid[a]	21.60	±	0.81	79.92	±	3.00	Yes	
	12/2/2020	3.87	±	0.23	14.32	±	0.87		Invalid[a]	15.70	±	0.44	58.09	±	1.61	Yes	
	12/9/2020	4.03	±	0.36	14.91	±	1.32		Invalid[a]	50.70	±	1.94	187.59	±	7.18	Yes	
	12/16/2020	1.47	±	0.23	5.44	±	0.84	Yes		42.10	±	1.78	155.77	±	6.59	Yes	
	12/23/2020	0.48	±	0.15	1.79	±	0.54	Yes		5.43	±	1.37	20.09	±	5.07	Yes	
	12/30/2020	-0.09	±	0.09	-0.34	±	0.33	No		-1.53	±	1.15	-5.66	±	4.26	No	
SUGAR CITY	10/7/2020	2.80	±	0.43	10.36	±	1.58		Invalid[a]	7.93	±	0.80	29.34	±	2.97	Yes	
	10/14/2020	8.77	±	0.69	32.45	±	2.57		Invalid[a]	23.90	±	1.09	88.43	±	4.03	Yes	
	10/21/2020	11.19	±	0.80	41.39	±	2.94		Invalid[a]	30.48	±	1.22	112.76	±	4.53	Yes	
	10/28/2020	11.60	±	0.82	42.92	±	3.05		Invalid[a]	31.60	±	1.27	116.92	±	4.70	Yes	
	11/4/2020	12.90	±	0.64	47.73	±	2.38		Invalid[a]	30.80	±	2.17	113.96	±	8.03	Yes	
	11/11/2020	9.96	±	0.57	36.85	±	2.11		Invalid[a]	30.30	±	0.95	112.11	±	3.52	Yes	
	11/18/2020	2.98	±	0.32	11.03	±	1.17		Invalid[a]	9.98	±	0.91	36.93	±	3.36	Yes	
	11/25/2020	8.95	±	0.54	33.12	±	1.99		Invalid[a]	32.90	±	0.97	121.73	±	3.58	Yes	
	12/2/2020	2.73	±	0.19	10.10	±	0.70		Invalid[a]	12.70	±	0.38	46.99	±	1.39	Yes	
	12/9/2020	1.98	±	0.24	7.33	±	0.90		Invalid[a]	38.10	±	1.52	140.97	±	5.62	Yes	
	12/16/2020	0.84	±	0.17	3.12	±	0.63	Yes		30.80	±	1.48	113.96	±	5.48	Yes	
	12/23/2020	0.72	±	0.15	2.66	±	0.57	Yes		18.30	±	1.40	67.71	±	5.18	Yes	
	12/30/2020	0.69	±	0.15	2.56	±	0.56	Yes		18.60	±	1.30	68.82	±	4.81	Yes	
INL SITE																	
EFS	10/7/2020	14.60	±	1.03	54.02	±	3.81		Invalid[a]	36.50	±	1.60	135.05	±	5.92	Yes	
	10/14/2020	7.44	±	0.68	27.53	±	2.50		Invalid[a]	25.70	±	1.18	95.09	±	4.37	Yes	
	10/21/2020	12.05	±	0.83	44.59	±	3.08		Invalid[a]	37.48	±	1.34	138.67	±	4.97	Yes	
	10/28/2020	13.00	±	0.90	48.10	±	3.32		Invalid[a]	40.40	±	1.45	149.48	±	5.37	Yes	
	11/4/2020	11.30	±	0.63	41.81	±	2.31		Invalid[a]	29.10	±	2.22	107.67	±	8.21	Yes	
	11/11/2020	10.60	±	0.60	39.22	±	2.22		Invalid[a]	29.90	±	0.97	110.63	±	3.59	Yes	
	11/18/2020	5.49	±	0.44	20.31	±	1.62		Invalid[a]	11.60	±	1.08	42.92	±	4.00	Yes	
	11/25/2020	7.65	±	0.51	28.31	±	1.87		Invalid[a]	29.20	±	0.93	108.04	±	3.44	Yes	
	12/2/2020	3.31	±	0.21	12.25	±	0.79		Invalid[a]	12.60	±	0.39	46.62	±	1.44	Yes	
	12/9/2020	4.87	±	0.36	18.02	±	1.34		Invalid[a]	60.90	±	1.91	225.33	±	7.07	Yes	
	12/16/2020	1.22	±	0.20	4.51	±	0.73	Yes		28.00	±	1.49	103.60	±	5.51	Yes	
	12/23/2020	0.95	±	0.21	3.50	±	0.77	Yes		39.10	±	2.06	144.67	±	7.62	Yes	
	12/30/2020	0.79	±	0.17	2.94	±	0.63	Yes		28.60	±	1.54	105.82	±	5.70	Yes	
MAIN GATE	10/7/2020	17.00	±	0.98	62.90	±	3.63		Invalid[a]	38.70	±	1.43	143.19	±	5.29	Yes	
	10/14/2020	12.50	±	0.87	46.25	±	3.23		Invalid[a]	23.20	±	1.18	85.84	±	4.37	Yes	

Table C-1. Weekly Gross Alpha and Gross Beta Concentrations in Air

		GROSS ALPHA								GROSS BETA							
Sampling Group and Location	Sampling Date	Result ± 1s Uncertainty ($\times 10^{-15}$ µCi/mL)			Result ± 1s Uncertainty ($\times 10^{-11}$ Bq/mL)			Result > 3s	Comment	Result ± 1s Uncertainty ($\times 10^{-15}$ µCi/mL)			Result ± 1s Uncertainty ($\times 10^{-11}$ Bq/mL)			Result > 3s	Comment
	10/21/2020	15.03	±	0.96	55.60	±	3.56		Invalid[a]	39.38	±	1.45	145.71	±	5.35	Yes	
	10/28/2020	15.20	±	0.97	56.24	±	3.60		Invalid[a]	39.90	±	1.46	147.63	±	5.40	Yes	
	11/4/2020	11.90	±	0.64	44.03	±	2.38		Invalid[a]	28.00	±	2.23	103.60	±	8.25	Yes	
	11/11/2020	9.56	±	0.58	35.37	±	2.13		Invalid[a]	28.50	±	0.96	105.45	±	3.54	Yes	
	11/18/2020	3.41	±	0.36	12.62	±	1.32		Invalid[a]	14.40	±	1.09	53.28	±	4.03	Yes	
	11/25/2020	6.22	±	0.46	23.01	±	1.69		Invalid[a]	21.60	±	0.82	79.92	±	3.03	Yes	
	12/2/2020	3.93	±	0.24	14.54	±	0.87		Invalid[a]	13.80	±	0.42	51.06	±	1.54	Yes	
	12/9/2020	4.02	±	0.33	14.87	±	1.21		Invalid[a]	58.50	±	1.82	216.45	±	6.73	Yes	
	12/16/2020	1.32	±	0.21	4.88	±	0.78	Yes		34.70	±	1.64	128.39	±	6.07	Yes	
	12/23/2020	1.26	±	0.21	4.66	±	0.76	Yes		29.10	±	1.69	107.67	±	6.25	Yes	
	12/30/2020	1.17	±	0.21	4.33	±	0.78	Yes		28.10	±	1.68	103.97	±	6.22	Yes	
GATE	10/7/2020	14.20	±	0.90	52.54	±	3.33		Invalid[a]	32.60	±	1.33	120.62	±	4.92	Yes	
	10/14/2020	11.10	±	0.78	41.07	±	2.87		Invalid[a]	21.10	±	1.06	78.07	±	3.92	Yes	
	10/21/2020	16.71	±	0.96	61.81	±	3.55		Invalid[a]	35.62	±	1.32	131.78	±	4.89	Yes	
	10/28/2020	18.40	±	1.05	68.08	±	3.89		Invalid[a]	39.10	±	1.45	144.67	±	5.37	Yes	
	11/4/2020	13.40	±	0.67	49.58	±	2.47		Invalid[a]	31.30	±	2.25	115.81	±	8.33	Yes	
	11/11/2020	9.82	±	0.59	36.33	±	2.16		Invalid[a]	33.00	±	1.02	122.10	±	3.77	Yes	
	11/18/2020	3.83	±	0.38	14.17	±	1.40		Invalid[a]	14.20	±	1.10	52.54	±	4.07	Yes	
	11/25/2020	9.13	±	0.56	33.78	±	2.06		Invalid[a]	34.00	±	1.01	125.80	±	3.74	Yes	
	12/2/2020	3.57	±	0.22	13.21	±	0.82		Invalid[a]	15.00	±	0.42	55.50	±	1.56	Yes	
	12/9/2020	4.26	±	0.34	15.76	±	1.25		Invalid[a]	54.90	±	1.81	203.13	±	6.70	Yes	
	12/16/2020	0.95	±	0.18	3.52	±	0.66	Yes		32.60	±	1.52	120.62	±	5.62	Yes	
	12/23/2020	0.67	±	0.16	2.48	±	0.60	Yes		21.60	±	1.56	79.92	±	5.77	Yes	
	12/30/2020	0.82	±	0.17	3.04	±	0.63	Yes		23.20	±	1.43	85.84	±	5.29	Yes	

Invalid sample result shown in red

a. Sample result invalid because the sample was counted 20 days or more after collection. Results were atypically high due to long-lived beta-emitting radon daughter radionuclides.

b. Sample result invalid due to loss of sample.

Table C-2. Weekly Iodine-131 Activity in Air.

Sampling Group and Location	Sampling Date	Result ± 1s Uncertainty ($\times 10^{-15}$ µCi/mL)			Result ± 1s Uncertainty ($\times 10^{-11}$ Bq/mL)			Result > 3s
BOUNDARY								
ARCO	10/07/20	0.54	±	2.03	1.99	±	7.51	No
	10/14/20	1.28	±	1.98	4.74	±	7.33	No
	10/21/20	1.26	±	1.21	4.66	±	4.48	No
	10/28/20	2.27	±	1.70	8.40	±	6.29	No
	11/04/20	0.07	±	1.68	0.26	±	6.22	No
	11/11/20	-0.34	±	1.33	-1.24	±	4.92	No
	11/18/20	0.78	±	1.24	2.88	±	4.59	No
	11/25/20	0.62	±	1.57	2.28	±	5.81	No
	12/02/20	-1.17	±	1.50	-4.33	±	5.55	No
	12/09/20	1.77	±	2.08	6.55	±	7.70	No
	12/16/20	-1.04	±	2.11	-3.85	±	7.81	No
	12/23/20	-0.73	±	1.54	-2.69	±	5.70	No
	12/30/20	1.94	±	2.43	7.18	±	8.99	No
QA-1	10/07/20	0.40	±	1.50	1.48	±	5.55	No
(ARCO)	10/14/20	0.89	±	1.38	3.29	±	5.11	No
	10/21/20	1.54	±	1.48	5.70	±	5.48	No
	10/28/20	1.88	±	1.41	6.96	±	5.22	No
	11/04/20	0.06	±	1.56	0.24	±	5.77	No
	11/11/20	-0.30	±	1.21	-1.12	±	4.48	No
	11/18/20	0.72	±	1.15	2.66	±	4.26	No
	11/25/20	0.51	±	1.29	1.88	±	4.77	No
	12/02/20	-1.07	±	1.37	-3.96	±	5.07	No
	12/09/20	2.24	±	2.64	8.29	±	9.77	No
	12/16/20	-0.89	±	1.81	-3.29	±	6.70	No
	12/23/20	-0.66	±	1.40	-2.44	±	5.18	No
	12/30/20	2.92	±	3.66	10.80	±	13.54	No
ATOMIC CITY	10/07/20	0.52	±	1.95	1.91	±	7.22	No
	10/14/20	1.31	±	2.03	4.85	±	7.51	No
	10/21/20	1.53	±	1.46	5.66	±	5.40	No
	10/28/20	2.12	±	1.59	7.84	±	5.88	No
	11/04/20	0.07	±	1.72	0.27	±	6.36	No
	11/11/20	-0.33	±	1.29	-1.21	±	4.77	No
	11/18/20	0.72	±	1.16	2.68	±	4.29	No
	11/25/20	0.53	±	1.35	1.96	±	5.00	No
	12/02/20	-1.06	±	1.36	-3.92	±	5.03	No
	12/09/20	2.42	±	2.85	8.95	±	10.55	No
	12/16/20	-1.05	±	2.13	-3.89	±	7.88	No
	12/23/20	-0.63	±	1.34	-2.34	±	4.96	No
	12/30/20	1.81	±	2.27	6.70	±	8.40	No
BLUE DOME	10/07/20	3.17	±	1.55	11.73	±	5.74	No
	10/14/20	0.25	±	1.18	0.91	±	4.37	No
	10/21/20	-0.31	±	1.19	-1.15	±	4.40	No
	10/28/20	-1.83	±	2.11	-6.77	±	7.81	No
	11/04/20	-1.15	±	1.46	-4.26	±	5.40	No
	11/11/20	-0.53	±	1.95	-1.96	±	7.22	No
	11/18/20	-1.19	±	1.94	-4.40	±	7.18	No
	11/25/20	-0.88	±	1.18	-3.25	±	4.37	No
	12/02/20	-0.12	±	1.20	-0.44	±	4.44	No
	12/09/20	0.38	±	1.40	1.42	±	5.18	No
	12/16/20	-2.28	±	1.23	-8.44	±	4.55	No

Table C-2. Weekly Iodine-131 Activity in Air.

Sampling Group and Location	Sampling Date	Result ± 1s Uncertainty ($\times 10^{-15}$ µCi/mL)			Result ± 1s Uncertainty ($\times 10^{-11}$ Bq/mL)			Result > 3s
	12/23/20	0.47	±	1.20	1.75	±	4.44	No
	12/30/20	1.36	±	1.21	5.03	±	4.48	No
FAA TOWER	10/07/20	2.98	±	1.46	11.03	±	5.40	No
	10/14/20	0.24	±	1.13	0.87	±	4.18	No
	10/21/20	-0.31	±	1.19	-1.15	±	4.40	No
	10/28/20	-1.91	±	2.21	-7.07	±	8.18	No
	11/04/20	-1.21	±	1.54	-4.48	±	5.70	No
	11/11/20	-0.53	±	1.97	-1.98	±	7.29	No
	11/18/20	-1.15	±	1.87	-4.26	±	6.92	No
	11/25/20	-0.89	±	1.19	-3.29	±	4.40	No
	12/02/20	-0.12	±	1.19	-0.44	±	4.40	No
	12/09/20	0.39	±	1.43	1.45	±	5.29	No
	12/16/20	-2.29	±	1.24	-8.47	±	4.59	No
	12/23/20	0.47	±	1.19	1.74	±	4.40	No
	12/30/20	1.31	±	1.17	4.85	±	4.33	No
HOWE	10/07/20	3.43	±	1.68	12.69	±	6.22	No
	10/14/20	0.28	±	1.35	1.04	±	5.00	No
	10/21/20	-0.33	±	1.25	-1.21	±	4.63	No
	10/28/20	-1.88	±	2.17	-6.96	±	8.03	No
	11/04/20	-1.22	±	1.55	-4.51	±	5.74	No
	11/11/20	-0.55	±	2.03	-2.04	±	7.51	No
	11/18/20	-1.27	±	2.08	-4.70	±	7.70	No
	11/25/20	-0.87	±	1.16	-3.20	±	4.29	No
	12/02/20	-0.12	±	1.18	-0.43	±	4.37	No
	12/09/20	0.38	±	1.37	1.39	±	5.07	No
	12/16/20	-2.18	±	1.18	-8.07	±	4.37	No
	12/23/20	0.51	±	1.30	1.89	±	4.81	No
	12/30/20	1.44	±	1.29	5.33	±	4.77	No
MONTEVIEW	10/07/20	3.17	±	1.55	11.73	±	5.74	No
	10/14/20	0.26	±	1.23	0.95	±	4.55	No
	10/21/20	-0.33	±	1.25	-1.21	±	4.63	No
	10/28/20	-1.97	±	2.27	-7.29	±	8.40	No
	11/04/20	-1.28	±	1.63	-4.74	±	6.03	No
	11/11/20	-0.57	±	2.11	-2.12	±	7.81	No
	11/18/20	-1.23	±	2.00	-4.55	±	7.40	No
	11/25/20	-0.90	±	1.21	-3.34	±	4.48	No
	12/02/20	-0.12	±	1.19	-0.44	±	4.40	No
	12/09/20	0.38	±	1.39	1.41	±	5.14	No
	12/16/20	-2.22	±	1.20	-8.21	±	4.44	No
	12/23/20	0.48	±	1.21	1.76	±	4.48	No
	12/30/20	1.20	±	1.07	4.44	±	3.96	No
MUD LAKE	10/07/20	3.23	±	1.58	11.95	±	5.85	No
	10/14/20	0.24	±	1.17	0.90	±	4.33	No
	10/21/20	-0.34	±	1.29	-1.25	±	4.77	No
	10/28/20	-1.83	±	2.12	-6.77	±	7.84	No
	11/04/20	-1.21	±	1.54	-4.48	±	5.70	No
	11/11/20	-0.54	±	1.97	-1.98	±	7.29	No
	11/18/20	-1.21	±	1.97	-4.48	±	7.29	No
	11/25/20	-0.99	±	1.32	-3.64	±	4.88	No
	12/02/20	-0.12	±	1.20	-0.44	±	4.44	No
	12/09/20	0.38	±	1.39	1.41	±	5.14	No

Table C-2. Weekly Iodine-131 Activity in Air.

Sampling Group and Location	Sampling Date	Result ± 1s Uncertainty ($\times 10^{-15}$ µCi/mL)			Result ± 1s Uncertainty ($\times 10^{-11}$ Bq/mL)			Result > 3s
	12/16/20	-2.45	±	1.33	-9.07	±	4.92	No
	12/23/20	0.46	±	1.18	1.72	±	4.37	No
	12/30/20	1.39	±	1.24	5.14	±	4.59	No
QA-2	10/07/20	3.08	±	1.51	11.40	±	5.59	No
(MUD LAKE)	10/14/20	0.24	±	1.17	0.90	±	4.33	No
	10/21/20	-0.34	±	1.28	-1.24	±	4.74	No
	10/28/20	-1.73	±	2.00	-6.40	±	7.40	No
	11/04/20	-1.09	±	1.39	-4.03	±	5.14	No
	11/11/20	-0.55	±	2.02	-2.03	±	7.47	No
	11/18/20	-1.20	±	1.95	-4.44	±	7.22	No
	11/25/20	-0.97	±	1.31	-3.60	±	4.85	No
	12/02/20	-0.12	±	1.23	-0.46	±	4.55	No
	12/09/20	0.37	±	1.35	1.37	±	5.00	No
	12/16/20	-2.23	±	1.21	-8.25	±	4.48	No
	12/23/20	0.52	±	1.32	1.93	±	4.88	No
	12/30/20	1.50	±	1.34	5.55	±	4.96	No
DISTANT								
BLACKFOOT	10/07/20	0.50	±	1.88	1.84	±	6.96	No
	10/14/20	1.38	±	2.13	5.11	±	7.88	No
	10/21/20	1.58	±	1.51	5.85	±	5.59	No
	10/28/20	2.34	±	1.75	8.66	±	6.48	No
	11/04/20	0.07	±	1.72	0.27	±	6.36	No
	11/11/20	-0.34	±	1.36	-1.27	±	5.03	No
	11/18/20	0.68	±	1.09	2.53	±	4.03	No
	11/25/20	0.51	±	1.29	1.87	±	4.77	No
	12/02/20	-1.00	±	1.28	-3.70	±	4.74	No
	12/09/20	2.51	±	2.96	9.29	±	10.95	No
	12/16/20	-1.13	±	2.29	-4.18	±	8.47	No
	12/23/20	-0.70	±	1.49	-2.60	±	5.51	No
	12/30/20	2.04	±	2.55	7.55	±	9.44	No
CRATERS	10/07/20	0.37	±	1.41	1.38	±	5.22	No
OF THE MOON	10/14/20	0.85	±	1.32	3.16	±	4.88	No
	10/21/20	1.27	±	1.22	4.70	±	4.51	No
	10/28/20	2.03	±	1.52	7.51	±	5.62	No
	11/04/20	0.06	±	1.46	0.23	±	5.40	No
	11/11/20	-0.28	±	1.12	-1.04	±	4.14	No
	11/18/20	0.68	±	1.09	2.53	±	4.03	No
	11/25/20	0.52	±	1.31	1.91	±	4.85	No
	12/02/20	-1.02	±	1.31	-3.77	±	4.85	No
	12/09/20	2.37	±	2.79	8.77	±	10.32	No
	12/16/20	-0.95	±	1.92	-3.50	±	7.10	No
	12/23/20	-0.63	±	1.33	-2.32	±	4.92	No
	12/30/20	2.40	±	3.01	8.88	±	11.14	No
DUBOIS	10/07/20	3.07	±	1.50	11.36	±	5.55	No
	10/14/20	0.27	±	1.32	1.01	±	4.88	No
	10/21/20	-0.30	±	1.14	-1.10	±	4.22	No
	10/28/20	-1.75	±	2.02	-6.48	±	7.47	No
	11/04/20	-1.21	±	1.54	-4.48	±	5.70	No
	11/11/20	-0.52	±	1.91	-1.92	±	7.07	No
	11/18/20	-1.21	±	1.97	-4.48	±	7.29	No
	11/25/20	-0.89	±	1.19	-3.28	±	4.40	No

Table C-2. Weekly Iodine-131 Activity in Air.

Sampling Group and Location	Sampling Date	Result ± 1s Uncertainty ($\times 10^{-15}$ µCi/mL)			Result ± 1s Uncertainty ($\times 10^{-11}$ Bq/mL)			Result > 3s
	12/02/20	-0.12	±	1.21	-0.44	±	4.48	No
	12/09/20	0.39	±	1.43	1.45	±	5.29	No
	12/16/20	-2.29	±	1.24	-8.47	±	4.59	No
	12/23/20	0.47	±	1.18	1.72	±	4.37	No
	12/30/20	1.34	±	1.19	4.96	±	4.40	No
IDAHO FALLS	10/07/20	2.92	±	1.43	10.80	±	5.29	No
	10/14/20	0.23	±	1.11	0.86	±	4.11	No
	10/21/20	-0.33	±	1.27	-1.23	±	4.70	No
	10/28/20	-1.95	±	2.25	-7.22	±	8.33	No
	11/04/20	-1.34	±	1.70	-4.96	±	6.29	No
	11/11/20	-0.59	±	2.18	-2.19	±	8.07	No
	11/18/20	-1.18	±	1.92	-4.37	±	7.10	No
	11/25/20	-0.90	±	1.21	-3.34	±	4.48	No
	12/02/20	-0.13	±	1.28	-0.47	±	4.74	No
	12/09/20	0.38	±	1.38	1.40	±	5.11	No
	12/16/20	-2.16	±	1.17	-7.99	±	4.33	No
	12/23/20	0.47	±	1.20	1.75	±	4.44	No
a	12/30/20		±			±		No
JACKSON	10/07/20	0.46	±	1.74	1.71	±	6.44	No
	10/14/20	1.31	±	2.02	4.85	±	7.47	No
	10/21/20	1.38	±	1.32	5.11	±	4.88	No
	10/28/20	2.12	±	1.59	7.84	±	5.88	No
	11/04/20	0.07	±	1.63	0.25	±	6.03	No
	11/11/20	-0.33	±	1.30	-1.21	±	4.81	No
	11/18/20	0.76	±	1.22	2.82	±	4.51	No
	11/25/20	0.53	±	1.35	1.97	±	5.00	No
	12/02/20	-1.11	±	1.42	-4.11	±	5.25	No
	12/09/20	2.73	±	3.21	10.10	±	11.88	No
	12/16/20	-1.09	±	2.22	-4.03	±	8.21	No
	12/23/20	-0.71	±	1.50	-2.61	±	5.55	No
	12/30/20	2.01	±	2.52	7.44	±	9.32	No
SUGAR CITY	10/07/20	2.88	±	1.41	10.66	±	5.22	No
	10/14/20	0.24	±	1.14	0.88	±	4.22	No
	10/21/20	-0.29	±	1.12	-1.08	±	4.14	No
	10/28/20	-1.83	±	2.12	-6.77	±	7.84	No
	11/04/20	-1.19	±	1.51	-4.40	±	5.59	No
	11/11/20	-0.52	±	1.91	-1.92	±	7.07	No
	11/18/20	-1.07	±	1.74	-3.96	±	6.44	No
	11/25/20	-0.86	±	1.15	-3.18	±	4.26	No
	12/02/20	-0.11	±	1.14	-0.42	±	4.22	No
	12/09/20	0.35	±	1.27	1.29	±	4.70	No
	12/16/20	-2.19	±	1.19	-8.10	±	4.40	No
	12/23/20	0.44	±	1.12	1.63	±	4.14	No
	12/30/20	1.25	±	1.12	4.63	±	4.14	No
INL SITE								
EFS	10/07/20	0.48	±	1.82	1.79	±	6.73	No
	10/14/20	1.00	±	1.54	3.69	±	5.70	No
	10/21/20	1.66	±	1.59	6.14	±	5.88	No
	10/28/20	2.04	±	1.53	7.55	±	5.66	No
	11/04/20	0.07	±	1.62	0.25	±	5.99	No
	11/11/20	-0.31	±	1.22	-1.14	±	4.51	No

Table C-2. Weekly Iodine-131 Activity in Air.

Sampling Group and Location	Sampling Date	Result ± 1s Uncertainty ($\times 10^{-15}$ µCi/mL)			Result ± 1s Uncertainty ($\times 10^{-11}$ Bq/mL)			Result > 3s
	11/18/20	0.74	±	1.19	2.74	±	4.40	No
	11/25/20	0.54	±	1.37	2.00	±	5.07	No
	12/02/20	-1.08	±	1.39	-4.00	±	5.14	No
	12/09/20	2.46	±	2.89	9.10	±	10.69	No
	12/16/20	-0.99	±	2.00	-3.64	±	7.40	No
	12/23/20	-0.83	±	1.77	-3.07	±	6.55	No
	12/30/20	1.89	±	2.37	6.99	±	8.77	No
MAIN GATE	10/07/20	0.38	±	1.43	1.40	±	5.29	No
	10/14/20	1.01	±	1.55	3.74	±	5.74	No
	10/21/20	1.45	±	1.39	5.37	±	5.14	No
	10/28/20	2.20	±	1.65	8.14	±	6.11	No
	11/04/20	0.07	±	1.64	0.25	±	6.07	No
	11/11/20	-0.31	±	1.24	-1.16	±	4.59	No
	11/18/20	0.77	±	1.23	2.85	±	4.55	No
	11/25/20	0.54	±	1.37	2.00	±	5.07	No
	12/02/20	-1.12	±	1.44	-4.14	±	5.33	No
	12/09/20	2.36	±	2.78	8.73	±	10.29	No
	12/16/20	-1.05	±	2.13	-3.89	±	7.88	No
	12/23/20	-0.70	±	1.48	-2.58	±	5.48	No
	12/30/20	2.13	±	2.67	7.88	±	9.88	No
VAN BUREN GATE	10/07/20	0.38	±	1.43	1.41	±	5.29	No
	10/14/20	0.90	±	1.38	3.31	±	5.11	No
	10/21/20	1.32	±	1.26	4.88	±	4.66	No
	10/28/20	1.98	±	1.48	7.33	±	5.48	No
	11/04/20	0.07	±	1.60	0.25	±	5.92	No
	11/11/20	-0.32	±	1.25	-1.17	±	4.63	No
	11/18/20	0.78	±	1.24	2.87	±	4.59	No
	11/25/20	0.56	±	1.41	2.06	±	5.22	No
	12/02/20	-1.09	±	1.40	-4.03	±	5.18	No
	12/09/20	2.39	±	2.82	8.84	±	10.43	No
	12/16/20	-0.97	±	1.98	-3.60	±	7.33	No
	12/23/20	-0.68	±	1.45	-2.53	±	5.37	No
	12/30/20	1.83	±	2.30	6.77	±	8.51	No

a. Invalid sample result shown in red

Table C-3. Quarterly Cesium-137, Strontium-90, and Actinide Concentrations in Composite Air Filters.

Sampling Group and Location	Sampling Date	Analyte	Result ± 1s Uncertainty ($\times 10^{-18}$ µCi/mL)			Result ± 1s Uncertainty ($\times 10^{-14}$ Bq/mL)			Result > 3s
BOUNDARY									
ARCO	12/30/20	CESIUM-137	33.70	±	137.00	124.69	±	506.90	No
		STRONTIUM-90	38.20	±	12.60	141.34	±	46.62	**Yes**
QA-1 (ARCO)	12/30/20	CESIUM-137	1.83	±	110.00	6.77	±	407.00	No
		STRONTIUM-90	3.35	±	10.30	12.40	±	38.11	No
ATOMIC CITY	12/30/20	CESIUM-137	-8.21	±	114.00	-30.38	±	421.80	No
BLUE DOME	12/30/20	CESIUM-137	-46.10	±	126.00	-170.57	±	466.20	No
FAA TOWER	12/30/20	CESIUM-137	-172.00	±	177.00	-636.40	±	654.90	No
		STRONTIUM-90	22.60	±	15.30	83.62	±	56.61	No
HOWE	12/30/20	AMERICIUM-241	1.11	±	1.22	4.11	±	4.51	No
		CESIUM-137	-205.00	±	159.00	-758.50	±	588.30	No
		PLUTONIUM-238	4.07	±	1.29	15.06	±	4.77	**Yes**
		PLUTONIUM-239/240	2.51	±	1.06	9.29	±	3.92	No
MONTEVIEW	12/30/20	AMERICIUM-241	0.00	±	0.87	0.00	±	3.23	No
		CESIUM-137	-175.00	±	179.00	-647.50	±	662.30	No
		PLUTONIUM-238	0.76	±	1.10	2.82	±	4.07	No
		PLUTONIUM-239/240	0.57	±	1.42	2.11	±	5.25	No
MUD LAKE	12/30/20	CESIUM-137	-133.00	±	156.00	-492.10	±	577.20	No
		STRONTIUM-90	-15.70	±	9.01	-58.09	±	33.34	No
QA-2 (MUD LAKE)	12/30/20	CESIUM-137	-113.00	±	150.00	-418.10	±	555.00	No
		STRONTIUM-90	-8.22	±	15.60	-30.41	±	57.72	No

Table C-3. Quarterly Cesium-137, Strontium-90, and Actinide Concentrations in Composite Air Filters.

Sampling Group and Location	Sampling Date	Analyte	Result ± 1s Uncertainty ($\times 10^{-18}$ µCi/mL)			Result ± 1s Uncertainty ($\times 10^{-14}$ Bq/mL)			Result > 3s
DISTANT									
BLACKFOOT		CESIUM-137	-62.40	±	162.00	-230.88	±	599.40	No
CRATERS		AMERICIUM-241	1.89	±	1.36	6.99	±	5.03	No
		CESIUM-137	80.40	±	143.00	297.48	±	529.10	No
		PLUTONIUM-238	0.78	±	0.89	2.87	±	3.29	No
		PLUTONIUM-239/240	-0.19	±	1.22	-0.72	±	4.51	No
DUBOIS		CESIUM-137	-24.40	±	174.00	-90.28	±	643.80	No
IDAHO FALLS		CESIUM-137	-233.00	±	170.00	-862.10	±	629.00	No
		STRONTIUM-90	13.20	±	13.20	48.84	±	48.84	No
JACKSON		AMERICIUM-241	2.27	±	1.42	8.40	±	5.25	No
		CESIUM-137	-366.00	±	207.00	-1354.20	±	765.90	No
		PLUTONIUM-238	1.11	±	1.09	4.11	±	4.03	No
		PLUTONIUM-239/240	2.39	±	1.01	8.84	±	3.74	No
SUGAR CITY		CESIUM-137	-71.50	±	104.00	-264.55	±	384.80	No
INL SITE									
EFS	12/30/20	CESIUM-137	72.60	±	150.00	268.62	±	555.00	No
		STRONTIUM-90	-9.46	±	14.10	-35.00	±	52.17	No
MAIN GATE	12/30/20	AMERICIUM-241	1.03	±	1.03	3.81	±	3.81	No
		CESIUM-137	-39.30	±	130.00	-145.41	±	481.00	No
		PLUTONIUM-238	0.22	±	0.76	0.81	±	2.82	No
		PLUTONIUM-239/240	-1.75	±	1.56	-6.48	±	5.77	No
VAN BUREN GATE	12/30/20	AMERICIUM-241	-0.74	±	1.04	-2.72	±	3.85	No
		CESIUM-137	-24.60	±	172.00	-91.02	±	636.40	No
		PLUTONIUM-238	0.72	±	1.21	2.66	±	4.48	No
		PLUTONIUM-239/240	-1.26	±	1.56	-4.66	±	5.77	No

Table C-4. Tritium Concentrations in Atmospheric Moisture

Sampling Group and Location	Start Date	Sampling Date	Result ± 1s Uncertainty ($\times 10^{-13}$ µCi/mL$_{air}$)			Result ± 1s Uncertainty ($\times 10^{-9}$ Bq/mL$_{air}$)			Result > 3s
BOUNDARY									
ATOMIC CITY	9/2/2020	10/7/2020	2.02	±	1.14	7.47	±	4.22	No
ATOMIC CITY	10/7/2020	11/11/2020	0.49	±	0.86	1.79	±	3.19	No
ATOMIC CITY	11/11/2020	12/30/2020	5.96	±	0.94	22.05	±	3.47	**Yes**
HOWE	9/23/2020	10/21/2020	2.67	±	1.36	9.88	±	5.03	No
HOWE	10/21/2020	12/9/2020	7.67	±	1.00	28.38	±	3.70	**Yes**
DISTANT									
IDAHO FALLS	9/16/2020	10/14/2020	0.44	±	1.31	1.61	±	4.85	No
IDAHO FALLS	10/14/2020	11/18/2020	4.75	±	1.14	17.58	±	4.22	**Yes**
IDAHO FALLS	11/18/2020	12/23/2020	5.44	±	1.09	20.13	±	4.03	**Yes**
INL SITE									
EFS	9/30/2020	11/4/2020	11.90	±	3.28	44.03	±	12.14	**Yes**
EFS	11/4/2020	12/9/2020	9.16	±	1.29	33.87	±	4.79	**Yes**

Table C-5. Monthly and Weekly Tritium Concentrations in Precipitation

Location	Start Date	End Date	Result ± 1s Uncertainty (pCi/L)			Result ± 1s Uncertainty (Bq/L)			Result > 3s
BOUNDARY									
ATOMIC CITY	11/4/2020	11/11/2020	108.00	±	25.30	4.00	±	0.94	**Yes**
ATOMIC CITY	11/11/2020	11/18/2020	26.30	±	24.30	0.97	±	0.90	No
ATOMIC CITY	12/9/2020	12/16/2020	-6.73	±	30.70	-0.25	±	1.14	No
ATOMIC CITY	12/16/2020	12/23/2020	103.00	±	31.30	3.81	±	1.16	**Yes**
HOWE	11/4/2020	11/11/2020	41.10	±	24.50	1.52	±	0.91	No
HOWE	12/9/2020	12/16/2020	114.00	±	31.70	4.22	±	1.17	**Yes**
DISTANT									
IDAHO FALLS	9/30/2020	10/30/2020	23.10	±	23.10	0.85	±	0.85	No
IDAHO FALLS	10/30/2020	11/30/2020	42.60	±	24.50	1.58	±	0.91	No
IDAHO FALLS	11/30/2020	12/31/2020	52.72	±	31.36	1.95	±	1.16	No
INL SITE									
EFS	11/4/2020	11/11/2020	35.30	±	24.00	1.31	±	0.89	No
EFS	11/11/2020	11/18/2020	149.00	±	25.40	5.51	±	0.94	**Yes**
EFS	12/9/2020	12/16/2020	136.00	±	31.90	5.03	±	1.18	**Yes**
EFS	12/23/2020	12/30/2020	133.00	±	31.90	4.92	±	1.18	**Yes**

Table C-6. Gross Alpha, Gross Beta, and Tritium Concentrations in Surface and Drinking Water

Location	Sampling Date	Analyte	Result ± 1s Uncertainty (pCi/L)			Result ± 1s Uncertainty (Bq/L)			Result > 3s
SURFACE WATER									
Alpheus Spring	11/9/2020	GROSS ALPHA	1.39	±	0.70	0.05	±	0.03	No
		GROSS BETA	4.56	±	0.54	0.17	±	0.02	**Yes**
		TRITIUM	45.48	±	24.01	1.68	±	0.89	No
Bill Jones, Jr. Trout Farm	11/9/2020	GROSS ALPHA	1.06	±	0.50	0.04	±	0.02	No
		GROSS BETA	1.90	±	0.46	0.07	±	0.02	**Yes**
		TRITIUM	-1.10	±	22.78	-0.04	±	0.84	No
Clear Springs	11/9/2020	GROSS ALPHA	1.13	±	0.62	0.04	±	0.02	No
		GROSS BETA	4.55	±	0.53	0.17	±	0.02	**Yes**
		TRITIUM	71.50	±	24.34	2.65	±	0.90	No
Clear Springs (Duplicate)	11/9/2020	GROSS ALPHA	0.55	±	0.61	0.02	±	0.02	No
		GROSS BETA	4.27	±	0.53	0.16	±	0.02	**Yes**
		TRITIUM	108.97	±	25.24	4.04	±	0.93	**Yes**
DRINKING WATER									
Atomic City	11/11/2020	GROSS ALPHA	7.36	±	0.99	0.27	±	0.04	**Yes**
		GROSS BETA	4.40	±	0.53	0.16	±	0.02	**Yes**
		TRITIUM	120.77	±	24.60	4.47	±	0.91	**Yes**
Control	11/10/2020	GROSS ALPHA	-0.36	±	0.54	-0.01	±	0.02	No
		GROSS BETA	0.42	±	0.47	0.02	±	0.02	No
		TRITIUM	86.70	±	24.24	3.21	±	0.90	**Yes**
Craters of the Moon	11/11/2020	GROSS ALPHA	2.31	±	0.64	0.09	±	0.02	**Yes**
		GROSS BETA	1.51	±	0.47	0.06	±	0.02	**Yes**
		TRITIUM	69.18	±	23.92	2.56	±	0.89	No
Howe	11/11/2020	GROSS ALPHA	0.76	±	0.54	0.03	±	0.02	No
		GROSS BETA	1.52	±	0.47	0.06	±	0.02	**Yes**
		TRITIUM	85.50	±	24.13	3.17	±	0.89	**Yes**
Idaho Falls	11/10/2020	GROSS ALPHA	1.77	±	0.70	0.07	±	0.03	No
		GROSS BETA	2.34	±	0.50	0.09	±	0.02	**Yes**
		TRITIUM	71.68	±	23.48	2.65	±	0.87	**Yes**
Minidoka	11/9/2020	GROSS ALPHA	1.19	±	0.63	0.04	±	0.02	No
		GROSS BETA	3.90	±	0.52	0.14	±	0.02	**Yes**
		TRITIUM	1.35	±	22.67	0.05	±	0.84	No
Mud Lake	11/10/2020	GROSS ALPHA	0.03	±	0.58	0.00	±	0.02	No
		GROSS BETA	2.93	±	0.51	0.11	±	0.02	**Yes**
		TRITIUM	28.44	±	22.89	1.05	±	0.85	No
Rest Area	11/11/2020	GROSS ALPHA	1.19	±	0.58	0.04	±	0.02	No
		GROSS BETA	3.08	±	0.50	0.11	±	0.02	**Yes**
		TRITIUM	74.26	±	24.08	2.75	±	0.89	**Yes**

Table C-6. Gross Alpha, Gross Beta, and Tritium Concentrations in Surface and Drinking Water

Shoshone	11/9/2020	GROSS ALPHA	2.35	±	0.67	0.09	±	0.02	**Yes**
		GROSS BETA	2.06	±	0.49	0.08	±	0.02	**Yes**
		TRITIUM	109.91	±	24.54	4.07	±	0.91	**Yes**

Table C-7. Weekly and Monthly Iodine-131 and Cesium-137 Concentrations in Milk

Location	Sampling Date	Iodine-131 Result ± 1s Uncertainty (pCi/L)	Iodine-131 Result ± 1s Uncertainty (Bq/L)	Iodine-131 Result > 3s	Cesium-137 Result ± 1s Uncertainty (pCi/L)	Cesium-137 Result ± 1s Uncertainty (Bq/L)	Cesium-137 Result > 3s
BLACKFOOT	10/04/20	-2.72 ± 3.53	-0.10 ± 0.13	No	0.15 ± 1.32	0.01 ± 0.05	No
	11/01/20	-0.48 ± 2.38	-0.02 ± 0.09	No	-1.53 ± 1.56	-0.06 ± 0.06	No
	12/06/20	-3.01 ± 1.55	-0.11 ± 0.06	No	-0.67 ± 1.03	-0.02 ± 0.04	No
CONTROL	10/06/20	0.55 ± 2.31	0.02 ± 0.09	No	-1.72 ± 1.36	-0.06 ± 0.05	No
	11/03/20	-0.54 ± 1.10	-0.02 ± 0.04	No	0.25 ± 0.67	0.01 ± 0.02	No
	12/01/20	-3.69 ± 1.41	-0.14 ± 0.05	No	0.09 ± 1.35	0.00 ± 0.05	No
DIETRICH	10/06/20	-0.15 ± 1.67	-0.01 ± 0.06	No	-0.06 ± 1.38	0.00 ± 0.05	No
	11/02/20	1.52 ± 1.10	0.06 ± 0.04	No	0.11 ± 0.63	0.00 ± 0.02	No
	12/01/20	0.13 ± 1.17	0.00 ± 0.04	No	-0.57 ± 1.01	-0.02 ± 0.04	No
Duplicate	12/01/20	2.64 ± 1.88	0.10 ± 0.07	No	-1.42 ± 1.33	-0.05 ± 0.05	No
HOWE	10/06/20	-3.11 ± 1.74	-0.12 ± 0.06	No	-1.86 ± 1.37	-0.07 ± 0.05	No
	11/03/20	-0.04 ± 1.31	0.00 ± 0.05	No	-1.22 ± 1.07	-0.05 ± 0.04	No
	12/01/20	1.12 ± 1.20	0.04 ± 0.04	No	-2.12 ± 1.59	-0.08 ± 0.06	No
IDAHO FALLS	10/06/20	-1.42 ± 1.36	-0.05 ± 0.05	No	-0.28 ± 1.05	-0.01 ± 0.04	No
	10/13/20	1.00 ± 1.20	0.04 ± 0.04	No	-1.05 ± 1.44	-0.04 ± 0.05	No
	10/20/20	-1.03 ± 1.58	-0.04 ± 0.06	No	1.26 ± 1.05	0.05 ± 0.04	No
	10/27/20	1.36 ± 1.11	0.05 ± 0.04	No	2.34 ± 1.51	0.09 ± 0.06	No
	11/03/20	1.20 ± 0.94	0.04 ± 0.03	No	-0.33 ± 0.64	-0.01 ± 0.02	No
	11/11/20	-0.27 ± 0.89	-0.01 ± 0.03	No	0.86 ± 0.66	0.03 ± 0.02	No
	11/17/20	1.14 ± 1.07	0.04 ± 0.04	No	1.50 ± 1.41	0.06 ± 0.05	No
	11/24/20	0.73 ± 0.80	0.03 ± 0.03	No	1.32 ± 0.67	0.05 ± 0.02	No
	12/01/20	0.36 ± 0.87	0.01 ± 0.03	No	0.77 ± 0.65	0.03 ± 0.02	No
	12/08/20	0.70 ± 0.93	0.03 ± 0.03	No	-0.21 ± 0.63	-0.01 ± 0.02	No
	12/15/20	1.92 ± 1.05	0.07 ± 0.04	No	-1.96 ± 1.62	-0.07 ± 0.06	No
	12/22/20	0.58 ± 0.93	0.02 ± 0.03	No	0.03 ± 1.42	0.00 ± 0.05	No
	12/29/20	0.48 ± 0.98	0.02 ± 0.04	No	0.70 ± 1.48	0.03 ± 0.05	No
MINIDOKA	10/06/20	-1.91 ± 1.50	-0.07 ± 0.06	No	-0.21 ± 1.41	-0.01 ± 0.05	No
	11/02/20	1.90 ± 2.52	0.07 ± 0.09	No	1.43 ± 1.32	0.05 ± 0.05	No
	12/01/20	-0.98 ± 1.68	-0.04 ± 0.06	No	1.76 ± 1.33	0.07 ± 0.05	No
MONTEVIEW	10/06/20	0.48 ± 2.53	0.02 ± 0.09	No	0.70 ± 1.39	0.03 ± 0.05	No
	11/01/20	-2.28 ± 2.18	-0.08 ± 0.08	No	0.93 ± 1.35	0.03 ± 0.05	No
	12/01/20	-1.46 ± 1.11	-0.05 ± 0.04	No	-0.49 ± 0.65	-0.02 ± 0.02	No
TERRETON	10/06/20	-0.47 ± 1.23	-0.02 ± 0.05	No	0.59 ± 0.99	0.02 ± 0.04	No
Duplicate	10/06/20	-1.97 ± 1.36	-0.07 ± 0.05	No	-1.35 ± 1.44	-0.05 ± 0.05	No
	10/14/20	2.13 ± 1.26	0.08 ± 0.05	No	-1.04 ± 1.06	-0.04 ± 0.04	No
	10/20/20	1.27 ± 1.33	0.05 ± 0.05	No	0.34 ± 0.90	0.01 ± 0.03	No
	10/28/20	3.19 ± 1.18	0.12 ± 0.04	No	1.00 ± 1.03	0.04 ± 0.04	No
	11/03/20	0.83 ± 1.25	0.03 ± 0.05	No	0.49 ± 1.04	0.02 ± 0.04	No
	11/11/20	-0.22 ± 1.52	-0.01 ± 0.06	No	2.20 ± 1.39	0.08 ± 0.05	No
	11/17/20	-1.13 ± 1.70	-0.04 ± 0.06	No	1.21 ± 1.32	0.04 ± 0.05	No
	11/25/20	0.20 ± 0.86	0.01 ± 0.03	No	-0.41 ± 1.42	-0.02 ± 0.05	No
	12/01/20	0.90 ± 1.08	0.03 ± 0.04	No	-0.62 ± 1.38	-0.02 ± 0.05	No

Table C-7. Weekly and Monthly Iodine-131 and Cesium-137 Concentrations in Milk

Location	Sampling Date	Iodine-131 Result ± 1s Uncertainty (pCi/L)	Iodine-131 Result ± 1s Uncertainty (Bq/L)	Iodine-131 Result > 3s	Cesium-137 Result ± 1s Uncertainty (pCi/L)	Cesium-137 Result ± 1s Uncertainty (Bq/L)	Cesium-137 Result > 3s
	12/09/20	0.45 ± 0.98	0.02 ± 0.04	No	0.88 ± 1.43	0.03 ± 0.05	No
	12/15/20	-1.59 ± 1.22	-0.06 ± 0.05	No	0.39 ± 1.00	0.01 ± 0.04	No
	12/23/20	0.32 ± 1.02	0.01 ± 0.04	No	1.02 ± 1.07	0.04 ± 0.04	No
	12/30/20	-0.21 ± 0.80	-0.01 ± 0.03	No	0.16 ± 0.67	0.01 ± 0.02	No

Table C-8. Strontium-90 and Tritium Concentrations in Milk

Location	Sampling Date	Strontium-90 Result ± 1s Uncertainty (pCi/L)			Strontium-90 Result ± 1s Uncertainty (Bq/L)			Result > 3s
BLACKFOOT	11/01/20	NS[b]						
CONTROL	11/03/20	0.42	±	0.05	0.02	±	0.00	**Yes**
DIETRICH	11/02/20	0.22	±	0.05	0.01	±	0.00	**Yes**
HOWE	11/03/20	-0.25	±	0.09	-0.01	±	0.00	No
IDAHO FALLS	11/03/20	0.37	±	0.05	0.01	±	0.00	**Yes**
MINIDOKA	11/02/20	0.14	±	0.05	0.01	±	0.00	No
MONTEVIEW	11/01/20	0.27	±	0.05	0.01	±	0.00	**Yes**
TERRETON	11/03/20	0.45	±	0.05	0.02	±	0.00	**Yes**
		Tritium						
		Result ± 1s Uncertainty			**Result ± 1s Uncertainty**			**Result > 3s**
BLACKFOOT	11/01/20	161.53	±	24.47	5.98	±	0.91	**Yes**
CONTROL	11/03/20	101.85	±	24.05	3.77	±	0.89	**Yes**
DIETRICH	11/02/20	145.29	±	24.64	5.38	±	0.91	**Yes**
HOWE	11/03/20	111.98	±	24.14	4.15	±	0.89	**Yes**
IDAHO FALLS	11/03/20	22.39	±	30.89	0.83	±	1.14	No
MINIDOKA	11/02/20	139.09	±	24.59	5.15	±	0.91	**Yes**
MONTEVIEW	11/01/20	214.03	±	24.97	7.93	±	0.92	**Yes**
TERRETON	11/03/20	75.01	±	24.06	2.78	±	0.89	**Yes**

[a] NS = no sample. The Blackfoot sample is collected from a small goat farm. There was insufficient sample collected in November 2020 for radiochemical analysis.

Tabel C-9. Cesium-137 and Strontium-90 Concentrations in Potatoes

Location	Sampling Date	Cesium-137 Result ± 1s Uncertainty pCi/kg			Cesium-137 Result ± 1s Uncertainty (x 10^{-2} Bq/kg)			Result > 3s
ARCO	10/6/2020	0.60	±	0.94	2.24	±	3.46	No
BLACKFOOT	9/24/2020	0.32	±	0.98	1.19	±	3.64	No
CONTROL	10/1/2020	-0.52	±	0.92	-1.92	±	3.41	No
IDAHO FALLS	9/24/2020	2.14	±	1.29	7.93	±	4.78	No
POCATELLO	8/29/2020	-0.08	±	0.95	-0.29	±	3.53	No
RUPERT	10/6/2020	-0.48	±	1.12	-1.79	±	4.15	No
SHELLEY	9/24/2020	0.07	±	1.96	0.28	±	7.26	No
SHELLEY (DUPLICATE)	9/24/2020	0.06	±	0.89	0.21	±	3.31	No
TERRETON	10/5/2020	2.16	±	1.97	8.00	±	7.30	No
		Strontium-90						
		Result ± 1s Uncertainty pCi/kg			**Result ± 1s Uncertainty (x 10^{-2} Bq/kg)**			**Result > 3s**
ARCO	10/6/2020	-30.60	±	10.50	-113.33	±	38.89	No
BLACKFOOT	9/24/2020	-9.91	±	11.50	-36.70	±	42.59	No
CONTROL	10/1/2020	33.20	±	14.90	122.96	±	55.19	No
IDAHO FALLS	9/24/2020	15.80	±	13.80	58.52	±	51.11	No
POCATELLO	8/29/2020	8.22	±	16.20	30.44	±	60.00	No
RUPERT	10/6/2020	-6.40	±	11.90	-23.70	±	44.07	No
SHELLEY	9/24/2020	18.50	±	15.20	68.52	±	56.30	No
SHELLEY (DUPLICATE)	9/24/2020	17.20	±	16.70	63.70	±	61.85	No
TERRETON	10/5/2020	19.40	±	14.60	71.85	±	54.07	No

Table C-10. Actinides, Gamma-emitting Radionuclide, and Strontium-90 Concentrations in Edible Tissues of Waterfowl

Location	Sampling Date	Analyte	Result ± Uncertainty(1s) pCi/kg			Result ± Uncertainty(1s) (x 10^{-2}) Bq/kg			Result > 3s
ATR Complex	9/26/2020								
		AMERICIUM-241	0.57	±	1.27	2.10	±	4.70	No
		CESIUM-137	4570	±	57.9	16926	±	214	**Yes**
		CHROMIUM-51	3840	±	3720	14222	±	13778	No
		COBALT-60	3320	±	36.70	12296	±	136	**Yes**
		PLUTONIUM-238	2.71	±	4.04	10.0	±	15.0	No
		PLUTONIUM-239/240	0.90	±	5.40	3.33	±	20.0	No
		STRONTIUM-90	45.5	±	3.49	168.5	±	12.9	**Yes**
		ZINC-65	4950	±	89.7	18333	±	332	**Yes**
ATR Complex	9/26/2020								
		AMERICIUM-241	-2.33	±	1.84	-8.63	±	6.81	No
		CESIUM-137	19.5	±	3.90	72.2	±	14.4	**Yes**
		CHROMIUM-51	121	±	1080	448	±	4000	No
		COBALT-60	1.34	±	2.17	4.96	±	8.04	No
		PLUTONIUM-238	0.00	±	1.74	0.00	±	6.44	No
		PLUTONIUM-239/240	2.50	±	2.40	9.26	±	8.89	No
		STRONTIUM-90	1.05	±	2.68	3.89	±	9.93	No
		ZINC-65	-21.0	±	9.38	-77.8	±	34.7	No
ATR Complex	10/16/2020								
		AMERICIUM-241	1.62	±	1.79	6.00	±	6.63	No
		CESIUM-137	3.35	±	2.96	12.4	±	11.0	No
		CHROMIUM-51	382	±	58.3	1415	±	216	**Yes**
		COBALT-60	4.11	±	2.12	15.2	±	7.85	No
		PLUTONIUM-238	0.00	±	1.78	0.00	±	6.59	No
		PLUTONIUM-239/240	-0.66	±	2.05	-2.43	±	7.59	No
		STRONTIUM-90	-3.22	±	2.29	-11.9	±	8.48	No
		ZINC-65	-20.9	±	8.49	-77.4	±	31.4	No
Control	12/26/2020								
		AMERICIUM-241	1.13	±	1.59	4.19	±	5.89	No
		CESIUM-137	2.74	±	1.57	10.1	±	5.81	No
		CHROMIUM-51	22.2	±	58.2	82.2	±	216	No
		COBALT-60	1.73	±	1.17	6.41	±	4.33	No
		PLUTONIUM-238	-1.20	±	1.47	-4.44	±	5.44	No
		PLUTONIUM-239/240	-0.60	±	2.31	-2.21	±	8.56	No
		STRONTIUM-90	8.97	±	3.11	33.2	±	11.5	No
		ZINC-65	-5.81	±	3.96	-21.5	±	14.7	No
Control	12/26/2020								
		AMERICIUM-241	-1.25	±	1.53	-4.63	±	5.67	No
		CESIUM-137	0.07	±	1.23	0.25	±	4.56	No
		CHROMIUM-51	-146000	±	102000	-540741	±	377778	No
		COBALT-60	2.18	±	1.15	8.07	±	4.26	No
		PLUTONIUM-238	-0.52	±	2.16	-1.94	±	8.00	No
		PLUTONIUM-239/240	2.09	±	2.66	7.74	±	9.85	No
		STRONTIUM-90	5.18	±	2.48	19.2	±	9.19	No
		ZINC-65	4.06	±	8.34	15.0	±	30.9	No

Table C-11. Environmental Radiation Measurements Using OSLDs

Location	Start Date	End Date	Radiation Measurement ± 1s Uncertainty mrem	Dose mrem/day
BOUNDARY				
ARCO	05/05/20	11/04/20	65.55 ± 3.28	0.36
ATOMIC CITY	05/05/20	11/04/20	66.50 ± 3.33	0.36
BIRCH CREEK	05/06/20	11/03/20	53.70 ± 2.68	0.30
BLUE DOME	05/06/20	11/04/20	50.85 ± 2.54	0.28
HOWE	05/06/20	11/04/20	59.70 ± 2.99	0.33
MONTEVIEW	05/06/20	11/04/20	65.10 ± 3.26	0.36
MUD LAKE	05/06/20	11/04/20	70.70 ± 3.54	0.39
Boundary Average			**61.73**	**0.34**
DISTANT				
ABERDEEN	05/07/20	11/02/20	64.35 ± 3.22	0.36
CRATERS	05/05/20	11/04/20	63.80 ± 3.19	0.35
DUBOIS	05/06/20	11/04/20	50.65 ± 2.54	0.28
IDAHO FALLS	05/06/20	11/04/20	59.25 ± 2.96	0.33
JACKSON	05/07/20	11/05/20	55.70 ± 2.79	0.31
MINIDOKA	05/05/20	11/02/20	56.40 ± 2.82	0.31
MOUNTAIN VIEW	05/05/20	11/04/20	58.15 ± 2.91	0.32
ROBERTS	05/05/20	11/03/20	67.15 ± 3.36	0.37
SUGAR CITY	05/06/20	11/04/20	75.40 ± 3.77	0.41
Distant Average			**61.21**	**0.34**

Table C-12. Environmental Radiation Measurements Using TLDs

Location	Start Date	End Date	Radiation Measurement ± 1s Uncertainty mR	Exposure mR/day
BOUNDARY				
ARCO	05/05/20	11/04/20	58.10 ± 5.69	0.32
ATOMIC CITY	05/05/20	11/04/20	64.40 ± 6.31	0.35
BIRCH CREEK	05/06/20	11/03/20	51.00 ± 5.00	0.28
BLUE DOME	05/06/20	11/04/20	49.00 ± 4.80	0.27
HOWE	05/06/20	11/04/20	56.30 ± 5.52	0.31
MONTEVIEW	05/06/20	11/04/20	59.20 ± 5.80	0.33
MUD LAKE	05/06/20	11/04/20	63.70 ± 6.25	0.35
Boundary Average			**57.39**	**0.32**
DISTANT				
ABERDEEN	05/07/20	11/02/20	58.40 ± 5.72	0.33
CRATERS	05/05/20	11/04/20	59.80 ± 5.86	0.33
DUBOIS	05/06/20	11/04/20	51.20 ± 5.02	0.28
IDAHO FALLS	05/06/20	11/04/20	60.20 ± 5.90	0.33
JACKSON	05/07/20	11/05/20	57.00 ± 5.59	0.31
MINIDOKA	05/05/20	11/02/20	56.90 ± 5.58	0.31
MOUNTAIN VIEW	05/05/20	11/04/20	50.60 ± 4.96	0.28
ROBERTS	05/05/20	11/03/20	62.80 ± 6.15	0.35
SUGAR CITY	05/06/20	11/04/20	77.10 ± 7.55	0.42
Distant Average			**59.33**	**0.33**

APPENDIX D

STATISTICAL ANALYSIS RESULTS

Table D-1. Results of the Kruskal-Wallis statistical test between INL Site, Boundary, and Distant sample groups by quarter and by month.

Gross Beta					
Quarter	**Valid N**	**Sum of ranks**	**Mean rank**	**H[a]**	***p*[b]**
Boundary	91	10131	111.3297		
Distant	77	7296	94.7532	3.212048	0.2007
INL Site	39	4101	105.1538		
October	**Valid N**	**Sum of ranks**	**Mean rank**	**H**	***P***
Boundary	28	999	35.35714		
Distant	24	679	28.29167	1.991523	0.3694
INL Site	12	411	34.25000		
November	**Valid N**	**Sum of ranks**	**Mean rank**	**H**	***P***
Boundary	28	1112.5	39.73214		
Distant	24	640	26.66667	7.520694	0.0233
INL Site	12	327.5	27.29167		
December	**Valid N**	**Sum of ranks**	**Mean rank**	**H**	***P***
Boundary	35	1382.5	39.50000		
Distant	29	1112.5	38.36207	0.6991999	0.7050
INL Site	15	665	44.33333		

a. H = Kruskal Wallis test statistic calculated using mean ranks. This test assumes H is approximately distributed as χ^2

b. A p-value (probability value) greater than 0.05 signifies no statistical difference between data groups. Any values below 0.05 are indicated in red.

Table D-2. Results of multiple comparisons of gross beta results between locations during the fourth quarter. A 'p' value greater than 0.05 signifies no statistical difference between data groups. Any values below 0.05 are indicated in red. R represents the average rank for each location.

	Multiple Comparisons p values (2-tailed); Coded Result (4th_Qtr-2020-LVf in 4th-Qtr-2020-LVF_KTC) Independent (grouping) variable: GeographicName Kruskal-Wallis test: H (15, N= 207) =19.72582 p =.1827 Include condition: v8='gross beta'															
Depend.: Coded Result	Arco R:133.81	Atomic City R:130.35	Blackfoot R:130.92	Blue Dome R:85.192	Craters of the Moon R:76.308	Dubois R:88.077	EFS R:108.96	FAA Tower R:86.269	Howe R:109.54	Idaho Falls R:109.54	Jackson WY R:87.385	Main Gate R:104.00	Monteview R:112.92	Mud Lake R:121.27	Sugar City R:77.385	**Van Buren R:102.50**
Arco		1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000
Atomic City	1.000000		1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000
Blackfoot	1.000000	1.000000		1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000
Blue Dome	1.000000	1.000000	1.000000		1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000
Craters of the Moon	1.000000	1.000000	1.000000	1.000000		1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000
Dubois	1.000000	1.000000	1.000000	1.000000	1.000000		1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000
EFS	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000		1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000
FAA Tower	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000		1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000
Howe	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000		1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000
Idaho Falls	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000		1.000000	1.000000	1.000000	1.000000	1.000000	1.000000
Jackson WY	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000		1.000000	1.000000	1.000000	1.000000	1.000000
Main Gate	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000		1.000000	1.000000	1.000000	1.000000
Monteview	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000		1.000000	1.000000	1.000000
Mud Lake	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000		1.000000	1.000000
Sugar City	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000		1.000000
Van Buren	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	

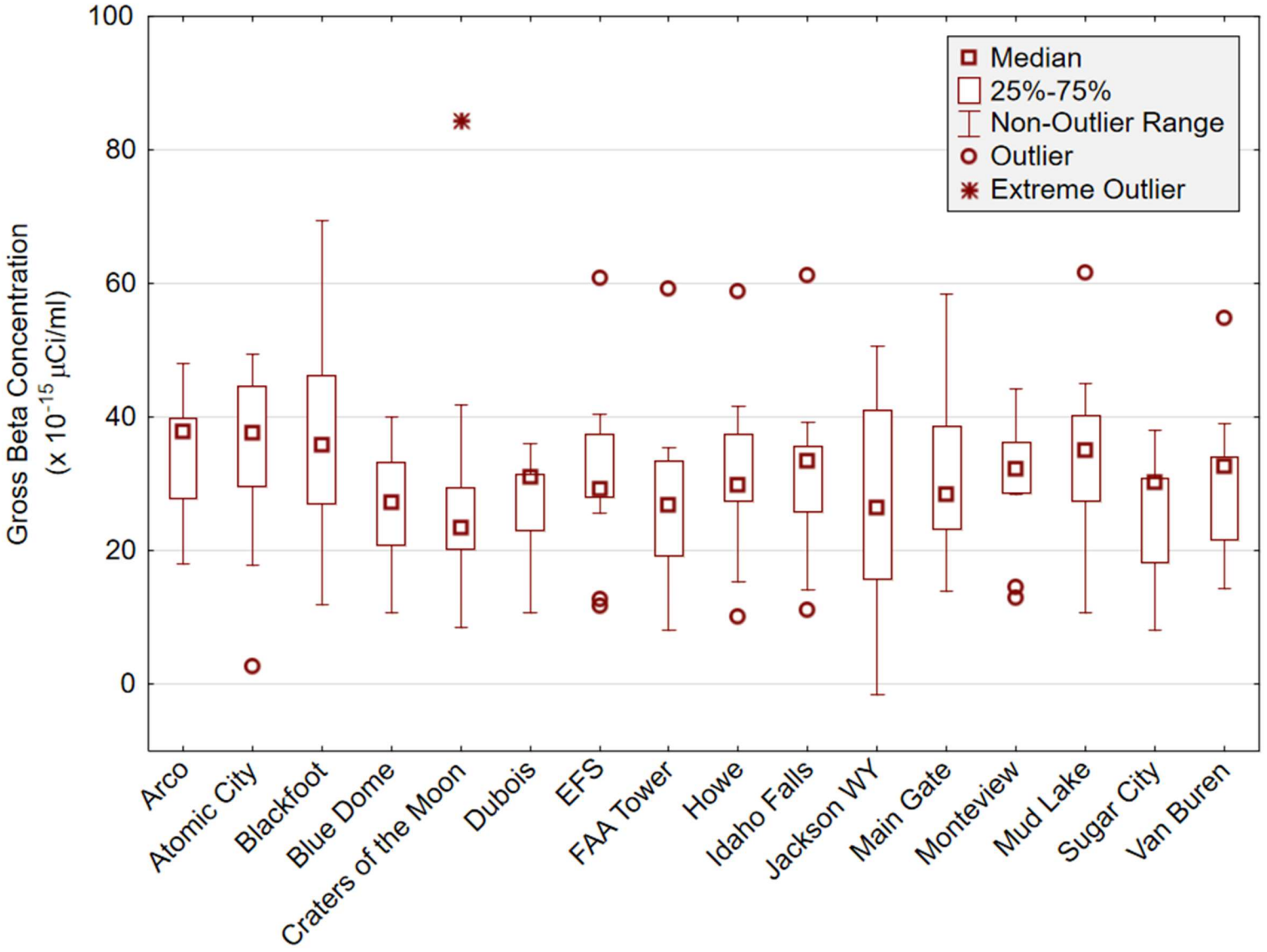


Figure D-1. Fourth quarter gross beta concentrations in air at all sampling locations. Number of samples (N) = 13 at each location except Idaho Falls (n=12).