Veolia Nuclear Solutions - Federal Services
Environmental Surveillance, Education, and Research Program
ISSN NUMBER 1089-5469

Idaho National Laboratory Site Offsite Environmental Surveillance Program Report: Third Quarter 2019

April 2020

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Program conducted for the U.S. Department of Energy, Idaho Operations Office
Under Contract DE-NE0008477

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Executive Summary

Some human-made radionuclides were detected in samples collected during the third quarter of 2019. None of the radionuclides detected in samples collected during the third quarter of 2019 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 third quarter of 2019 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, July 1 through September 30, 2019. All sample types (media) and the sampling schedule followed during 2019 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
- Milk
- Lettuce
- Grain

Table ES-1. Summary of Results for the Third Quarter of 2019.

Media	Sample Type	Analysis	Results
Air	Particulate Filters	Gross alpha, gross beta	There were no statistically significant differences in monthly and quarterly gross alpha and gross beta concentrations measured at Distant, Boundary, and INL Site sampling locations. No result exceeded results for the past ten years or the Derived Concentration Standard (DCS) for plutonium-239 (an alpha-emitting radionuclide) or strontium-90 (a beta-emitting radionuclide) in air.
	Particulate Filters Quarterly Composite	Gamma-emitting radionuclides, strontium-90, actinides (americium and plutonium)	No human-made gamma-emitting radionuclides were detected in any of the third quarter composite air samples. Americium-241and $^{239/240}$Pu, human-made alpha-emitting radionuclides, were detected in two composited air samples. Plutonium-238 was detected in one composited air sample. These results were within historical measurements and below the upper tolerance levels (UTLs) for these radionuclides. Strontium-90, a human-made beta-emitting radionuclide, was not measured in any composite collected during the third quarter.
	Charcoal Cartridge	Iodine-131	Iodine-131 was not detected in any of the 26 batches counted during the quarter.
Atmospheric Moisture	Liquid	Tritium	Eight of eight results showed tritium concentrations greater than the 3s uncertainty during the quarter. No sample result exceeded results for the past ten years or the DCS for tritium in air.
Precipitation	Liquid	Tritium	A total of eight samples were collected during the third quarter. Five of the tritium results were greater than the 3s uncertainty. All results were within the range previously measured in the past ten years and were consistent with those reported across the region by the Environmental Protection Agency.
Milk	Liquid	Iodine-131, other gamma-emitting radionuclides, strontium-90	Forty-one milk samples were collected at seven locations (including the offsite control sample from Colorado). No gamma emitting radionuclides of concern or tritium were detected.
Lettuce	Vegetation	Gamma-emitting radionuclides, strontium-90	No human-made gamma-emitting radionuclides were found in any of the ten samples (including a duplicate) collected this year. Strontium-90 was not detected in any of the samples analyzed.
Grain	Vegetation	Gamma-emitting radionuclides, strontium-90	No human-made gamma-emitting radionuclides or ^{90}Sr were detected in any of the twelve samples (including a duplicate) collected this year.

List of Abbreviations

AEC	Atomic Energy Commission
BLR	Big Lost River
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 2019, 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 third quarter of 2019 (July 1- September 30, 2019).

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 farms, grain (wheat and barley) from approximately 10 local producers, and lettuce from approximately nine 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 2009-2018) 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.

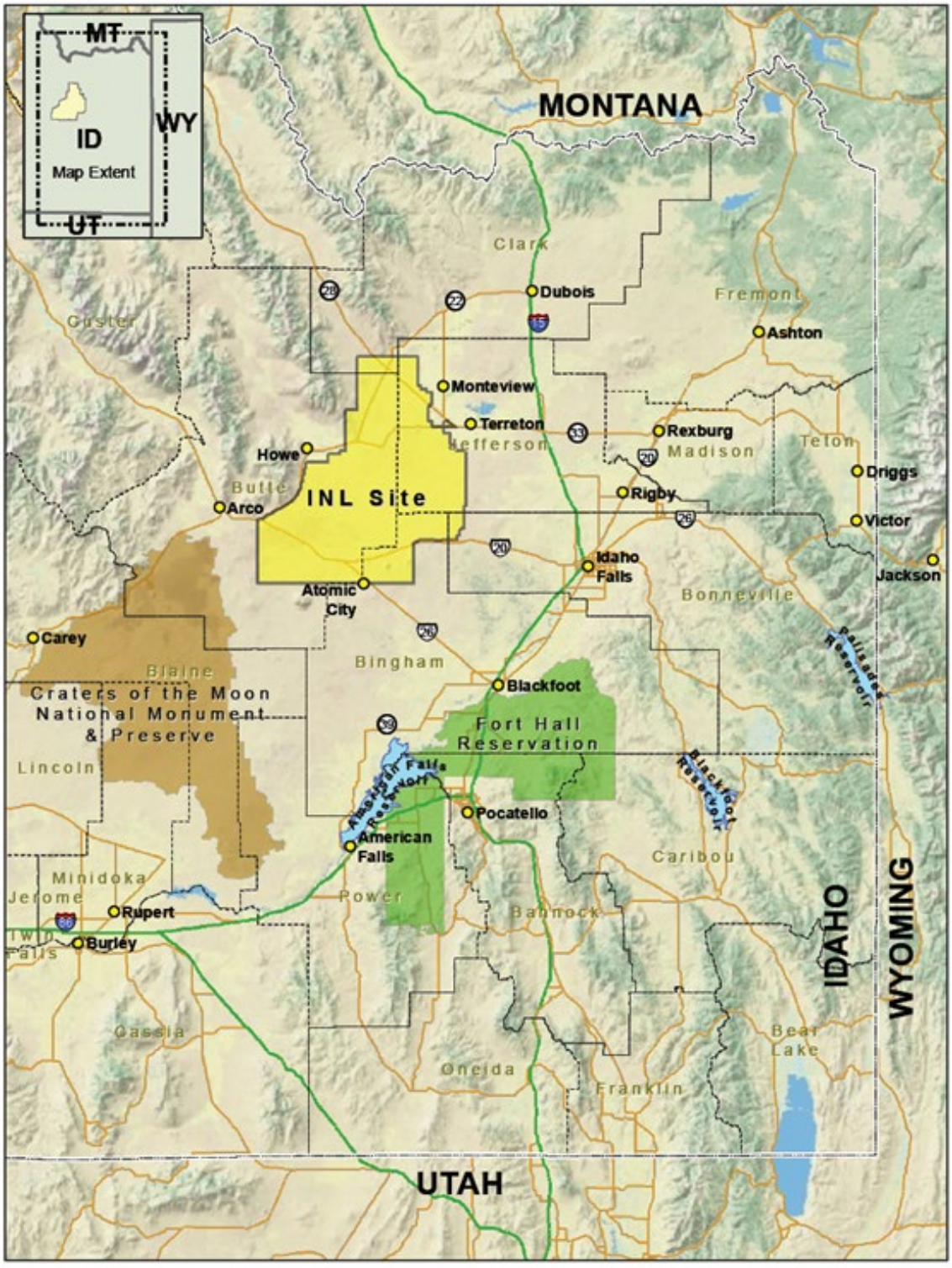

Figure 1. Location of the Idaho National Laboratory Site.

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 third quarter of 2019 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 third quarter of 2019 (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 2018, one replicate sampler was moved to Blue Dome (a Boundary location) and one was moved to Atomic City (also a Boundary location). An average of 20,297 ft^3 (575 m^3) of air was sampled at each location, each week, at an average flow rate of 2.04 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.

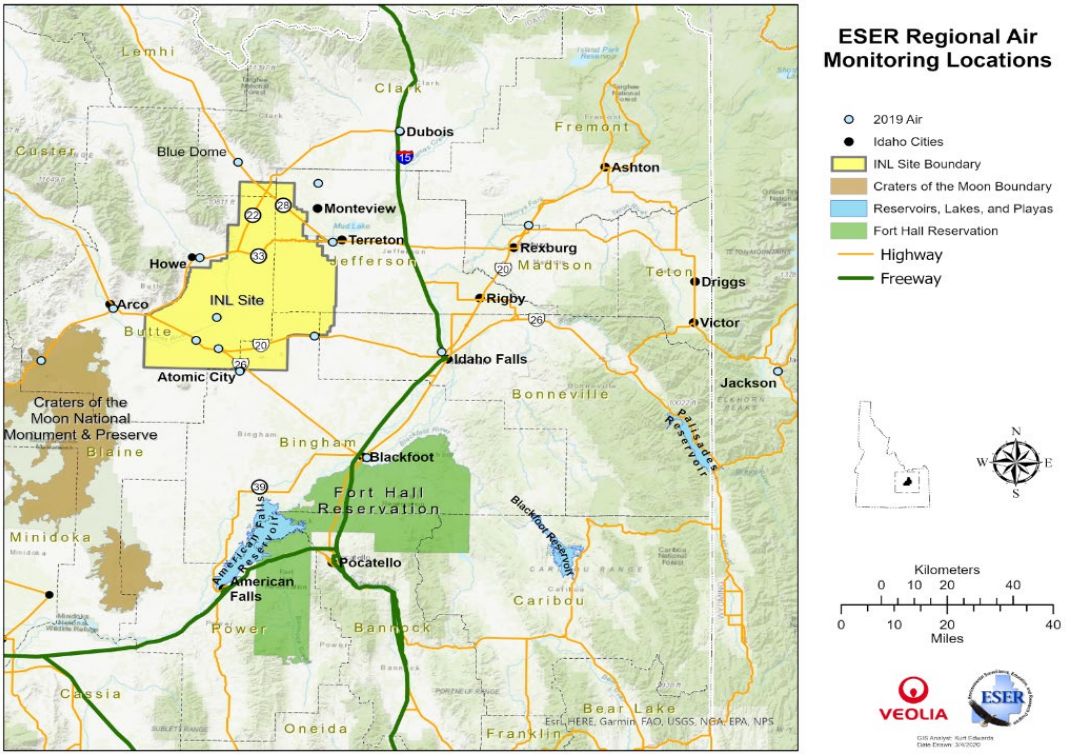

Figure 2. ESER air monitoring locations.

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 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 results are reported in Table C-1 and shown in Figures 3 through 6. Arco, EFS, Main Gate and Van Buren each had an invalid sample result due to a low total air volume (less than 7,000 ft^3). The low total air volume was the result of a power outage, faulty vacuum pump or lack of access due to a fire. Gross alpha concentrations measured in individual samples ranged from a low of $(6.8 \pm 2.1) \times 10^{-16}$ µCi/ml collected at Arco on September 25, 2019, to a high of $3.3 \times 10^{-15} \pm 2.7 \times 10^{-16}$ µCi/ml collected at the Main Gate on July 24, 2019. All results were less than the Derived Concentration Standard (DCS) of 3.4×10^{-14} µCi/ml for $^{239/240}Pu$ (see Table B-1 of Appendix B). In addition, the results were consistent with historical data, as represented by the 99%/95% upper tolerance limit (UTL) for gross alpha activity (4×10^{-15} µCi/ml). The UTL was determined using ten years of historical data (measured from 2009 through 2018) 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. None of the gross alpha measurements during the third quarter exceeded the UTL.

Gross alpha data have been tested for distribution (normally or lognormally distributed) and generally show no consistent discernible distribution. Because there is no discernible distribution of the data, a parametric test of significance cannot be used. The nonparametric Kruskal-Wallis analysis of variance by ranks test of multiple independent groups was used to determine statistical differences between INL Site, Boundary, and Distant locations. The test assesses the hypothesis that the different samples in the comparison were drawn from the same distribution or from distributions with the same median. In the computation of the Kruskal-Wallis test, each of the N observations is replaced by a rank. That is, all the results from all the locations are combined and ranked in a single series with the smallest result replaced by rank 1 and the largest result replaced by rank N (i.e., the total number of results). The sum of the ranks in each location group (i.e., INL Site, Boundary, and Distant) is found and then averaged for each group. If the samples are from the same populations, the average ranks should be about the same, whereas if the samples are from populations with different medians, the average ranks should differ. Statistically significant difference exists between data groups if the p-value (or probability value) is less than 0.05. Values greater than 0.05 translate into a 95 percent confidence that the medians are statistically the same. The p-value for each comparison is

shown in Table D-1. There was no statistically significant difference among groups for the quarter or for any specific month in the quarter.

To determine if there were any differences between stations and where the differences occur, the Kruskal-Wallis analysis of variance by ranks test was used again. Results measured at Idaho Falls differed statistically from all locations except for those measured at Howe, Monteview, and Sugar City during the third quarter (Table D-2). Idaho Falls was also different from the Main Gate during the month of May. The highest mean rank was calculated for Idaho Falls and the lowest mean rank was calculated for Main Gate. These differences may be visually observed in Figure D-1, where the Idaho Falls median and upper box values are higher than the other locations. The differences between locations may be due to variations in local meteorology, geology, or other natural factors. The Idaho Falls station is also located in a populated area increasing the probability of soil disturbance.

Gross beta results are presented in Table C-1 and displayed in Figures 7 through 10. 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). 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.

There were no statistically significant differences in the gross beta data between groups for the quarter or for any month, 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-3).

Iodine-131 was not detected in any of the 26 sets of charcoal cartridges measured during the second 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 was not detected in any sample. Plutonium-239/240 and ^{241}Am were detected in the sample collected from Monteview and the duplicate sample collected from Blue Dome (Table C-3). Plutonium-238 was detected in the composite sampled from Blue Dome. All results were within historical measurements made during the past ten years (2009-2018) and below the UTLs established for each radionuclide (i.e., 7.5×10^{-18} µCi/ml for ^{241}Am, 6.5×10^{-18} µCi/ml for ^{238}Pu, and 5.8×10^{-18} µCi/ml for $^{239/240}Pu$).

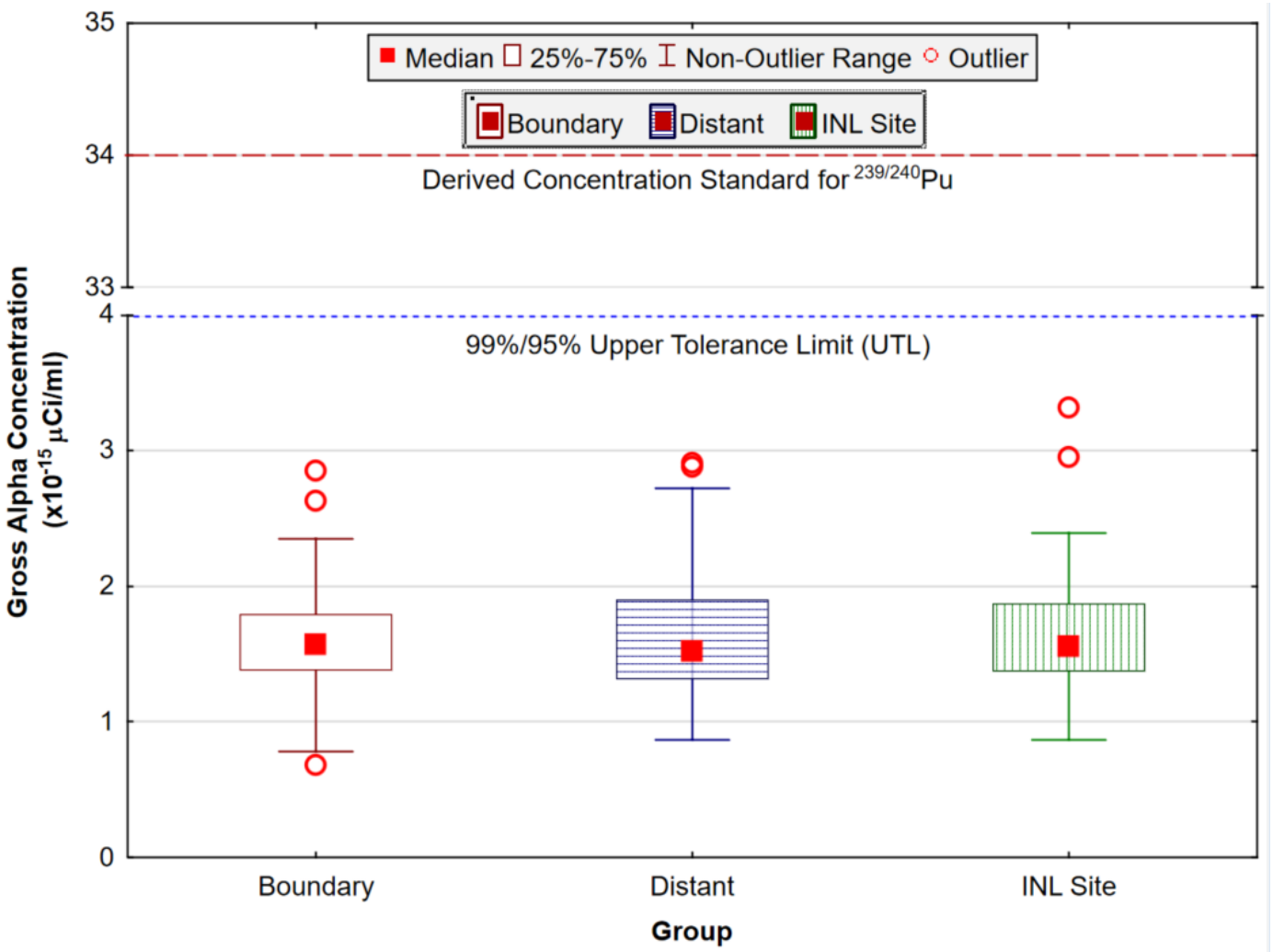

Figure 3. Gross alpha concentrations in air at ESER INL Site, Boundary, and Distant locations for the third quarter of 2019. The DOE Derived Concentration Standard (DCS) is the concentration of plutonium-239 ($^{239/240}$Pu) in air which, if inhaled for a year, would result in a dose of 100 mrem/yr. Because the measurements include naturally occurring radionuclides (such as ^{238}U, ^{234}U, ^{232}Th, ^{226}Ra and ^{210}Po) in uncertain proportions, a meaningful DCS cannot be constructed for gross alpha concentrations. The DCS for $^{239/240}$Pu is shown because it is the most restrictive human-made alpha emitter.

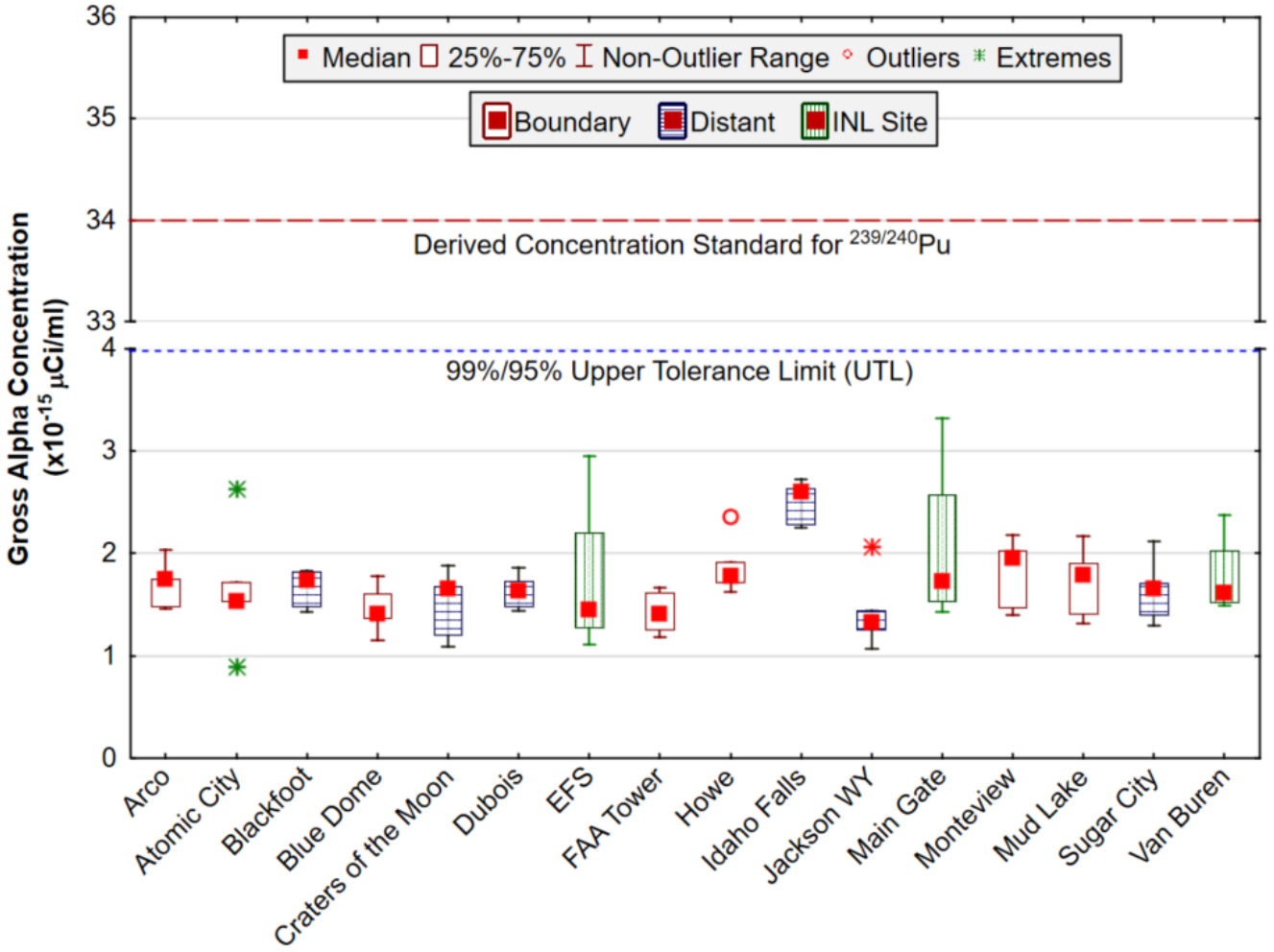

Figure 4. July gross alpha concentrations in air at ESER INL Site, Boundary, and Distant locations. Number of samples (N) = 5 at each location except EFS (N = 4), Main Gate (N = 4), and Van Buren (N = 4). The Derived Concentration Standard (DCS) is the concentration of plutonium-239/240 ($^{239/240}$Pu) 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 ^{238}U, ^{234}U, ^{232}Th, ^{226}Ra and ^{210}Po) in uncertain proportions, a meaningful DCS cannot be constructed for gross alpha concentrations. The DCS for $^{239/240}$Pu is shown because it is the most restrictive human-made alpha emitter.

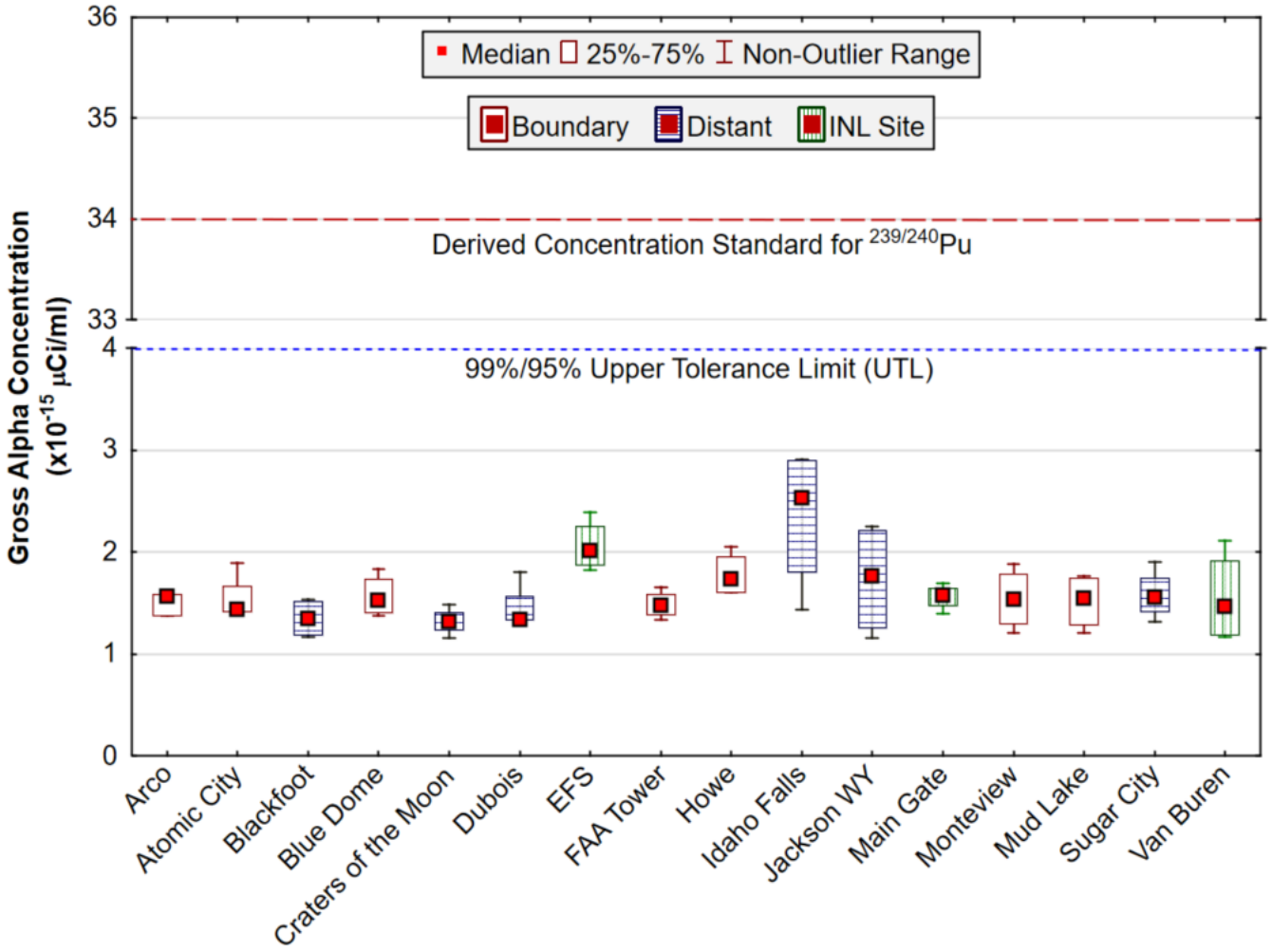

Figure 5. August gross alpha concentrations in air at ESER INL Site, Boundary, and Distant locations. Number of samples (N) = 4 at each location except Arco (N = 3). The Derived Concentration Standard (DCS) is the concentration of plutonium-239/240 ($^{239/240}$Pu) in air which, if inhaled for a year, would result in a dose of 100 mrem/yr. Because the measurements include naturally occurring radionuclides (such as ^{238}U, ^{234}U, ^{232}Th, ^{226}Ra and ^{210}Po) in uncertain proportions, a meaningful DCS cannot be constructed for gross alpha concentrations. The DCS for $^{239/240}$Pu is shown because it is the most restrictive human-made alpha emitter.

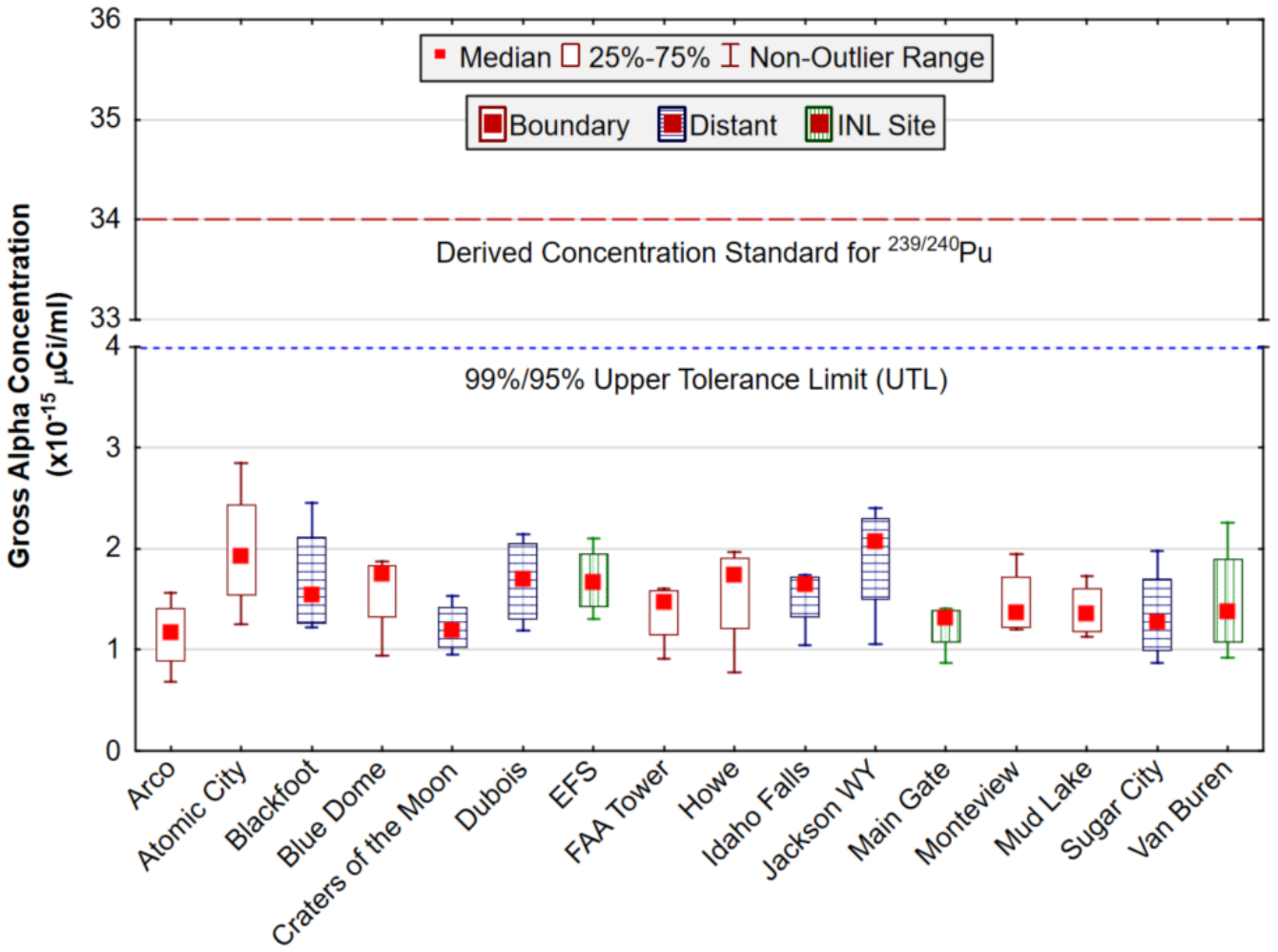

Figure 6. September gross alpha concentrations in air at ESER INL Site, Boundary, and Distant locations. Number of samples (N) = 4 at each location (except for Monteview and Van Buren, n=3). The Derived Concentration Standard (DCS) is the concentration of plutonium-239/240 ($^{239/240}$Pu) in air which, if inhaled for a year, would result in a dose of 100 mrem/yr. Because the measurements include naturally occurring radionuclides (such as ^{238}U, ^{234}U, ^{232}Th, ^{226}Ra and ^{210}Po) in uncertain proportions, a meaningful DCS cannot be constructed for gross alpha concentrations. The DCS for $^{239/240}$Pu is shown because it is the most restrictive human-made alpha emitter.

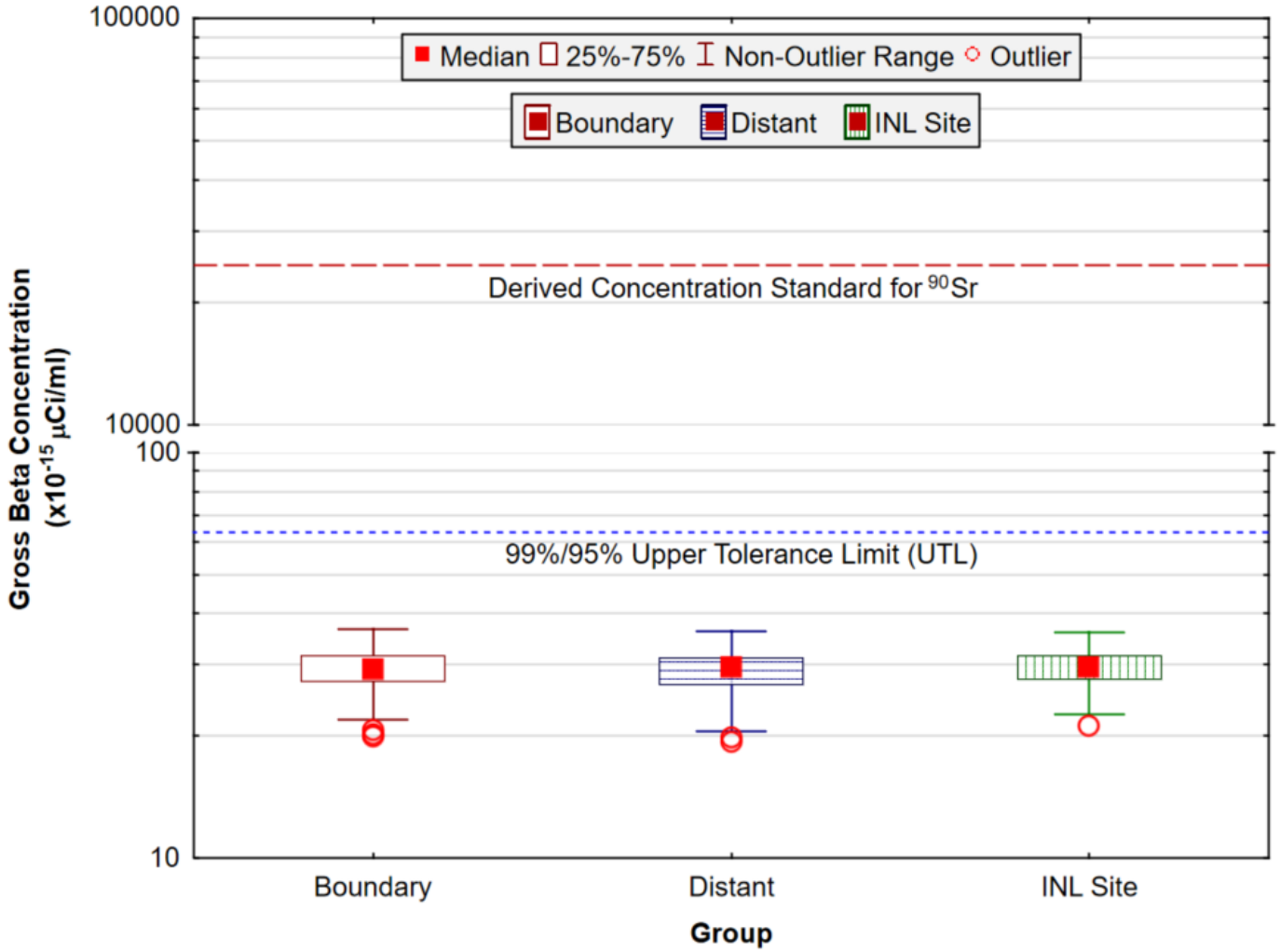

Figure 7. Gross beta concentrations in air at ESER INL Site, Boundary, and Distant locations for the third quarter of 2019. The Derived Concentration Standard (DCS) is the concentration of strontium-90 (^{90}Sr) in air which, if inhaled for a year, would result in a dose of 100 mrem/yr. Because the measurements include naturally occurring radionuclides (such as ^{40}K, ^{228}Ra, and ^{210}Pb) in uncertain proportions, a meaningful DCS cannot be constructed for gross beta concentrations. The DCS for ^{90}Sr is shown because it is the most restrictive human-made beta emitter.

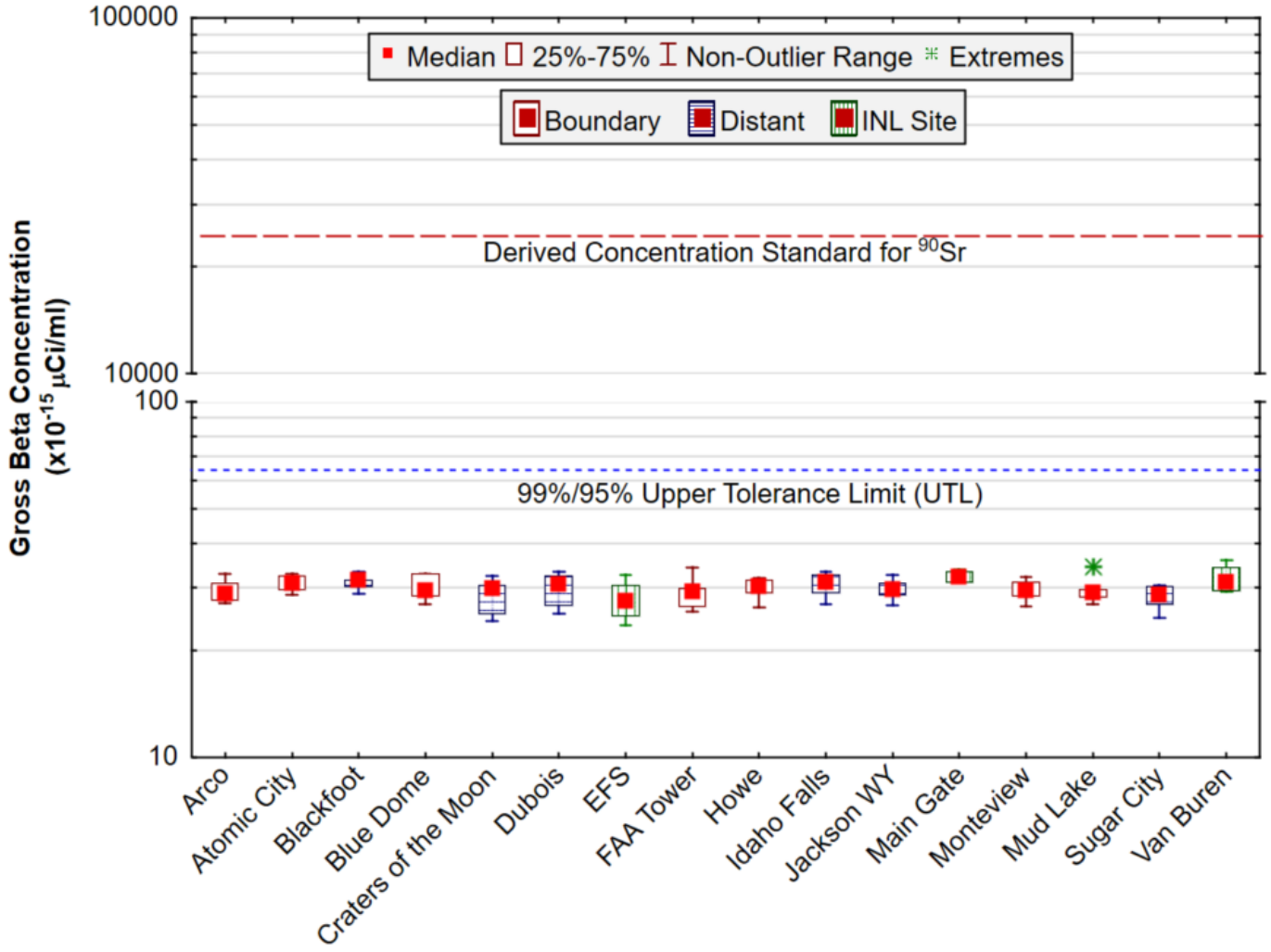

Figure 8. July gross beta concentrations in air at ESER INL Site, Boundary, and Distant locations. The Derived Concentration Standard (DCS) is the concentration of strontium-90 (^{90}Sr) in air which, if inhaled for a year, would result in a dose of 100 mrem/yr. Because the measurements include naturally occurring radionuclides (such as ^{40}K, ^{228}Ra, and ^{210}Pb) in uncertain proportions, a meaningful DCS cannot be constructed for gross beta concentrations. The DCS for ^{90}Sr is shown because it is the most restrictive human-made beta emitter.

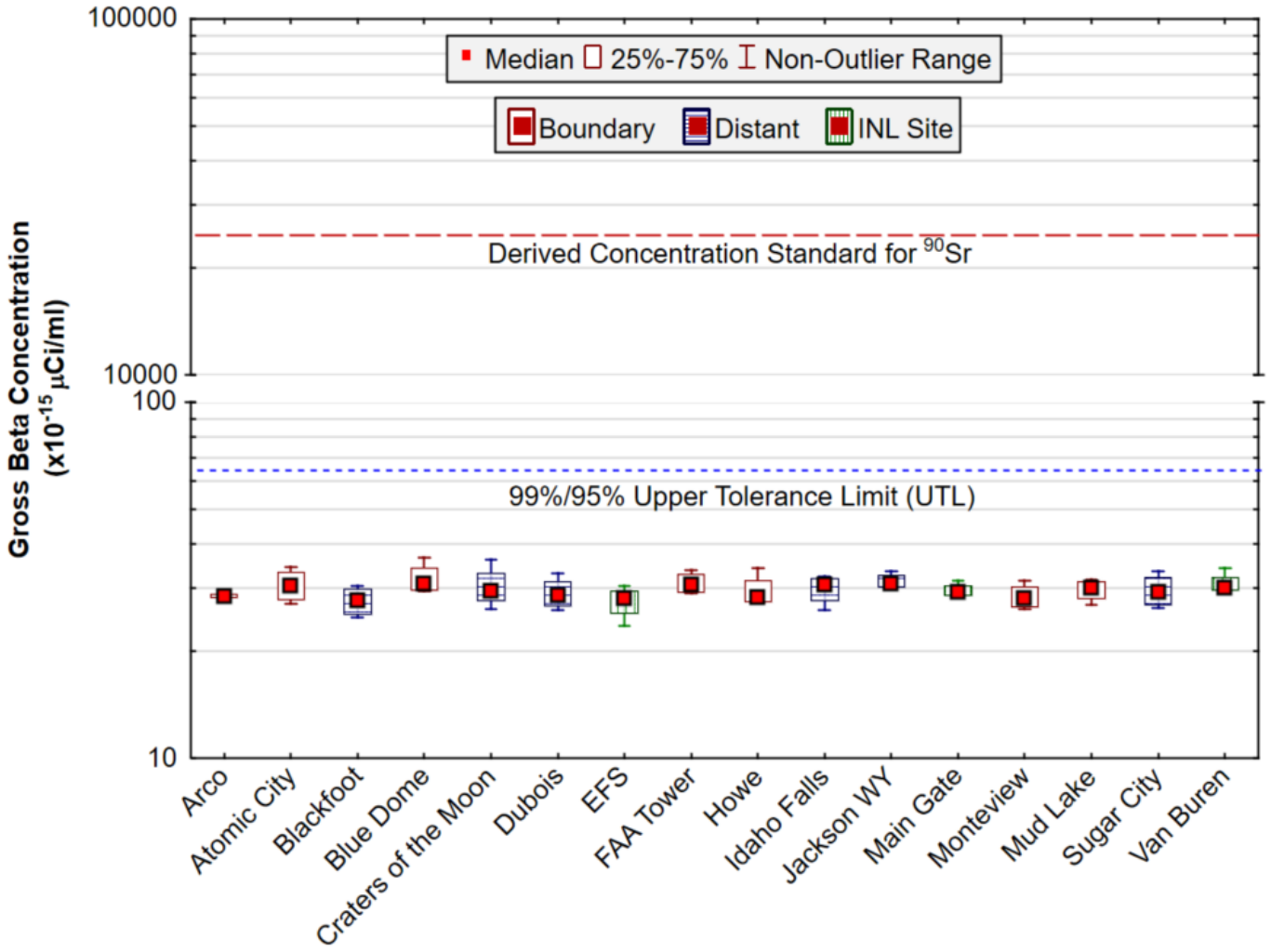

Figure 9. August gross beta concentrations in air at ESER INL Site, Boundary, and Distant locations. The Derived Concentration Standard (DCS) is the concentration of strontium-90 (^{90}Sr) in air which, if inhaled for a year, would result in a dose of 100 mrem/yr. Because the measurements include naturally occurring radionuclides (such as ^{40}K, ^{228}Ra, and ^{210}Pb) in uncertain proportions, a meaningful DCS cannot be constructed for gross beta concentrations. The DCS for ^{90}Sr is shown because it is the most restrictive human-made beta emitter.

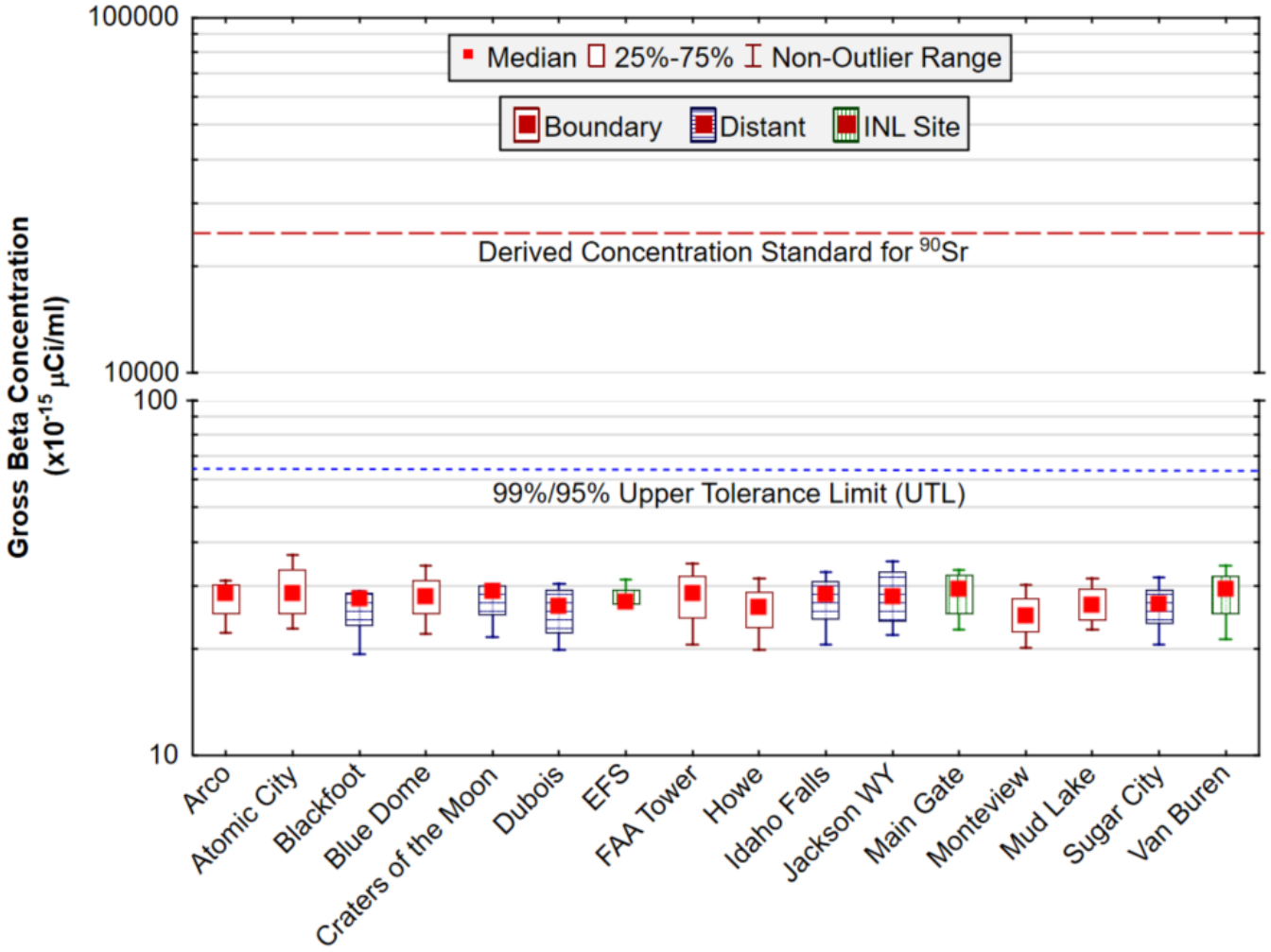

Figure 10. September gross beta concentrations in air at ESER INL Site, Boundary, and Distant locations. The Derived Concentration Standard (DCS) is the concentration of strontium-90 (^{90}Sr) in air which, if inhaled for a year, would result in a dose of 100 mrem/yr. Because the measurements include naturally occurring radionuclides (such as ^{40}K, ^{228}Ra, and ^{210}Pb) in uncertain proportions, a meaningful DCS cannot be constructed for gross beta concentrations. The DCS for ^{90}Sr 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 eight atmospheric moisture samples collected at the INL Site, Boundary, and Distant locations during the third quarter of 2019 (Figure 11). Eight of the results exceeded the 3s uncertainty level for tritium, with a maximum reported value of (14.7 ± 1.8) x 10^{-13} $\mu Ci/mL_{air}$ at EFS. The maximum result exceeded the 99%/95% UTL of 7.0 x 10^{-13} $\mu Ci/mL_{air}$ prompting a close inspection of the result. The result is valid and is within the range of values observed for the past ten years 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} $\mu Ci/mL_{air}$ with a maximum reported value of 14.7 x 10^{-13} $\mu Ci/mL_{air}$. Results are shown in Table C-4, Appendix C.

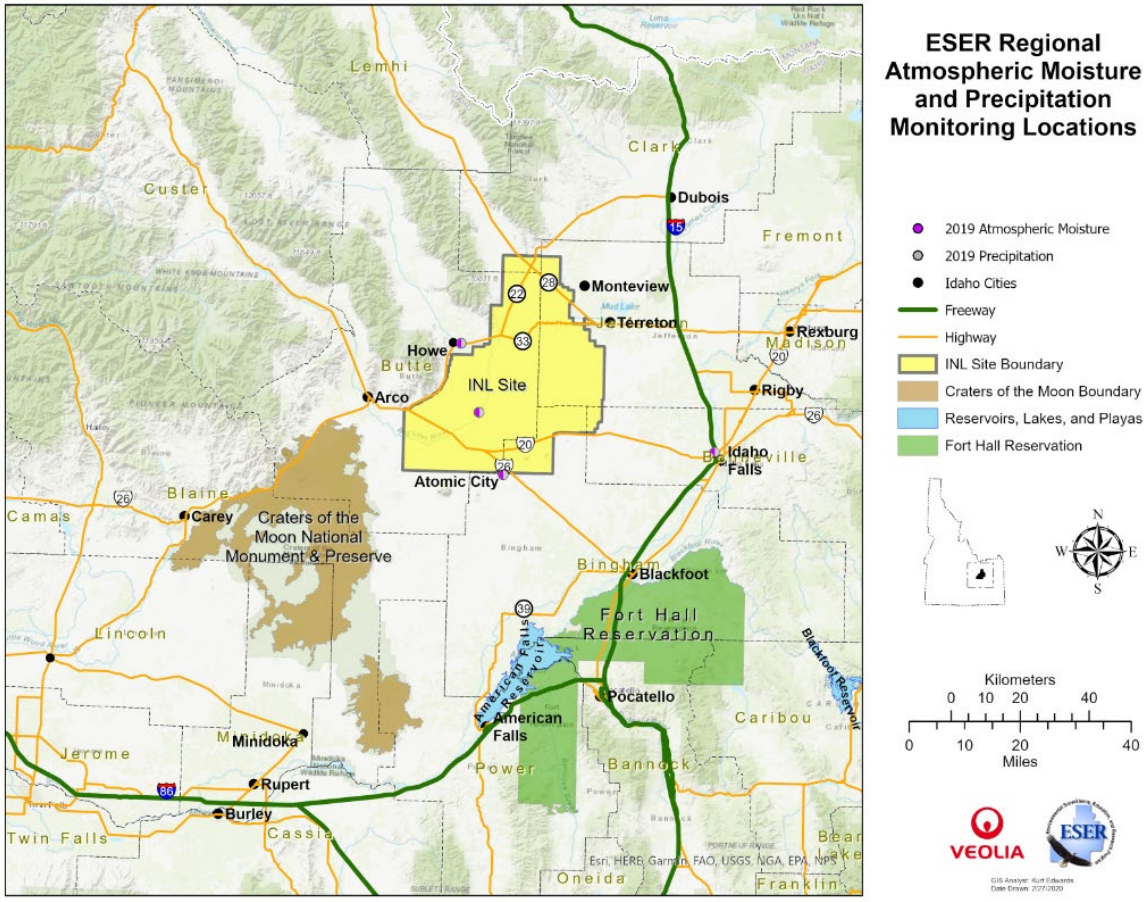

Figure 11. Atmospheric moisture and precipitation monitoring locations.

4. Precipitation and Water Sampling

Precipitation Sampling

Precipitation samples are gathered when enough precipitation occurs to allow for the collection of the minimum sample volume of approximately 50 mL (Figure 11). 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. These are the same locations where atmospheric moisture samples are collected. Precipitation samples are analyzed for tritium. Storm events in the third quarter of 2019 produced sufficient amounts of precipitation to yield eight samples.

Tritium was measured above the 3s values in five of the eight 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 INL Oversite Program presents tritium precipitation results for 2016 through 2019 (http://www.deq.idaho.gov/inl-oversight/monitoring/reports/) and the results range from -100 to 140 pCi/L. The maximum value in the third quarter was (146 ± 24) pCi/L in an EFS sample collected on September 11th. The result was below the UTL of 322 pCi/L.

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 third 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, lettuce, and grain samples available during the third quarter of 2019.

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 12) during the third quarter of 2019. 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 third quarter.

Neither ^{131}I nor ^{137}Cs was detected in any weekly or monthly samples during the third 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-6.

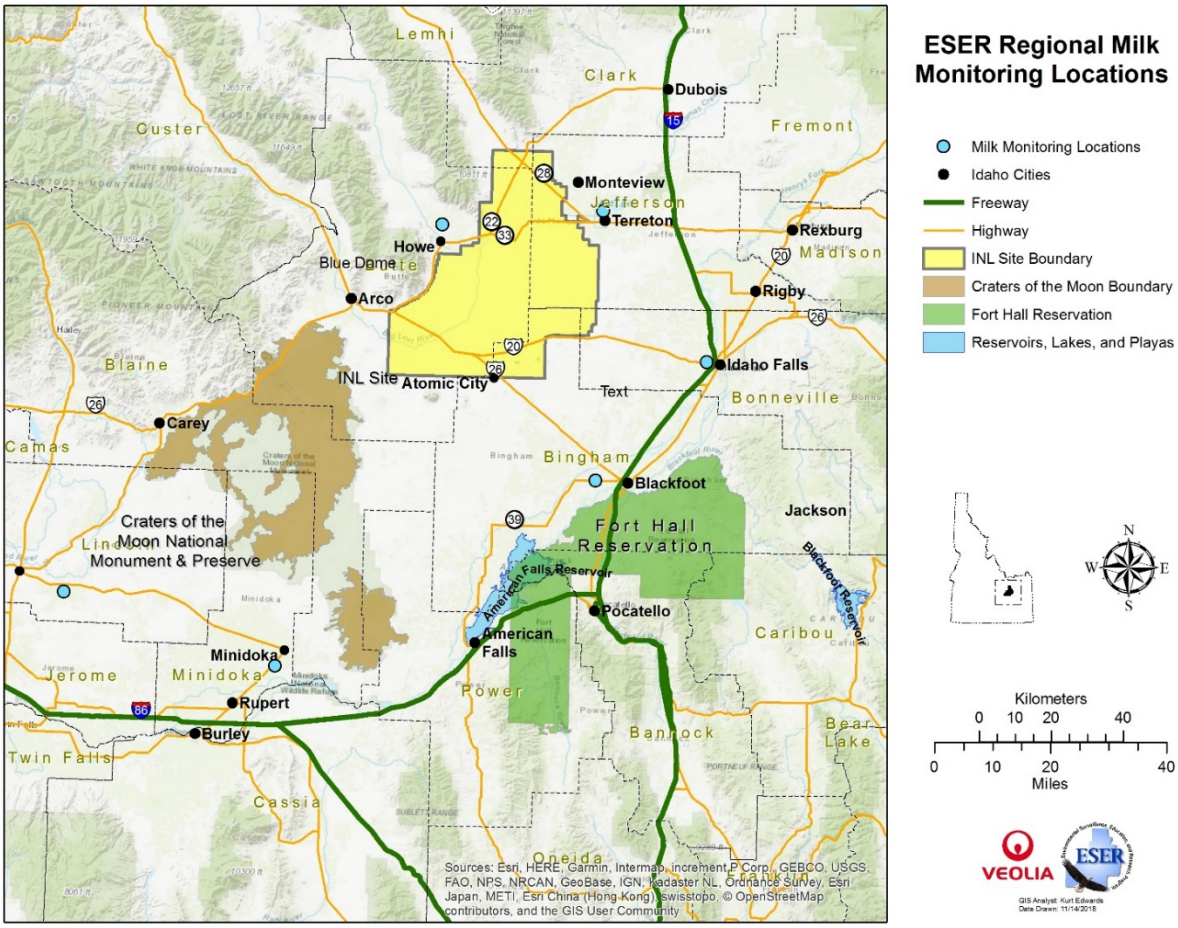

Figure 12. ESER milk monitoring locations.

Lettuce Sampling

Lettuce sampling was completed during the third quarter. A total of ten samples were collected, including a commercially-available sample from a grocery store and a duplicate sample at Tyhee (Figure 13). Seven lettuce samples were collected from portable planters at Atomic City, EFS, the Federal Aviation Administration (FAA) Tower, Howe, Idaho Falls, and Monteview. Soil from the vicinity of the sampling locations was used in the planters. This soil was amended with potting soil as a gardener in the region would typically do when they grow their lettuce. In addition to the portable samplers, a sample was obtained from a garden in Blackfoot and Tyhee (including a duplicate).

No human-made gamma-emitting radionuclides were found in any of the samples. Strontium-90 was not detected in any of the samples. Data for ^{137}Cs and ^{90}Sr in all lettuce samples taken during the third quarter are listed in Appendix C, Table C-7.

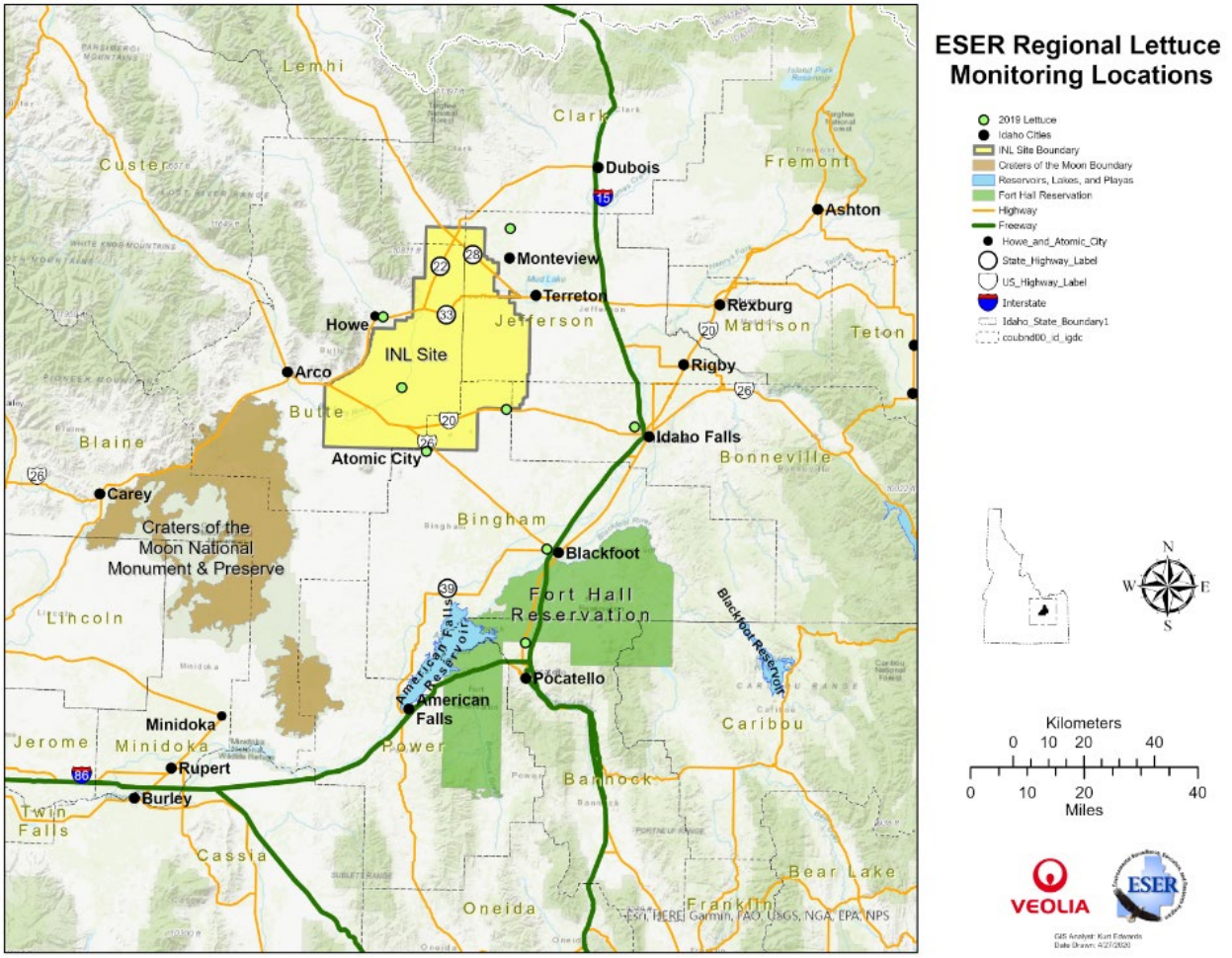

Figure 13. ESER lettuce monitoring locations.

Grain Sampling

Locally grown grain (wheat and barley) was collected from eleven Southeast Idaho locations and one duplicate from Howe (Figure 14). In addition, a commercially-available sample was obtained from outside the local area. All samples were analyzed for gamma-emitting radionuclides and ^{90}Sr.

No human-made gamma-emitting radionuclides were detected in any grain sample. None of the 12 grain samples collected in 2019 contained a detectable concentration of ^{90}Sr. Data for ^{137}Cs and ^{90}Sr in all grain samples taken during 2019 are listed in Appendix C, Table C-8.

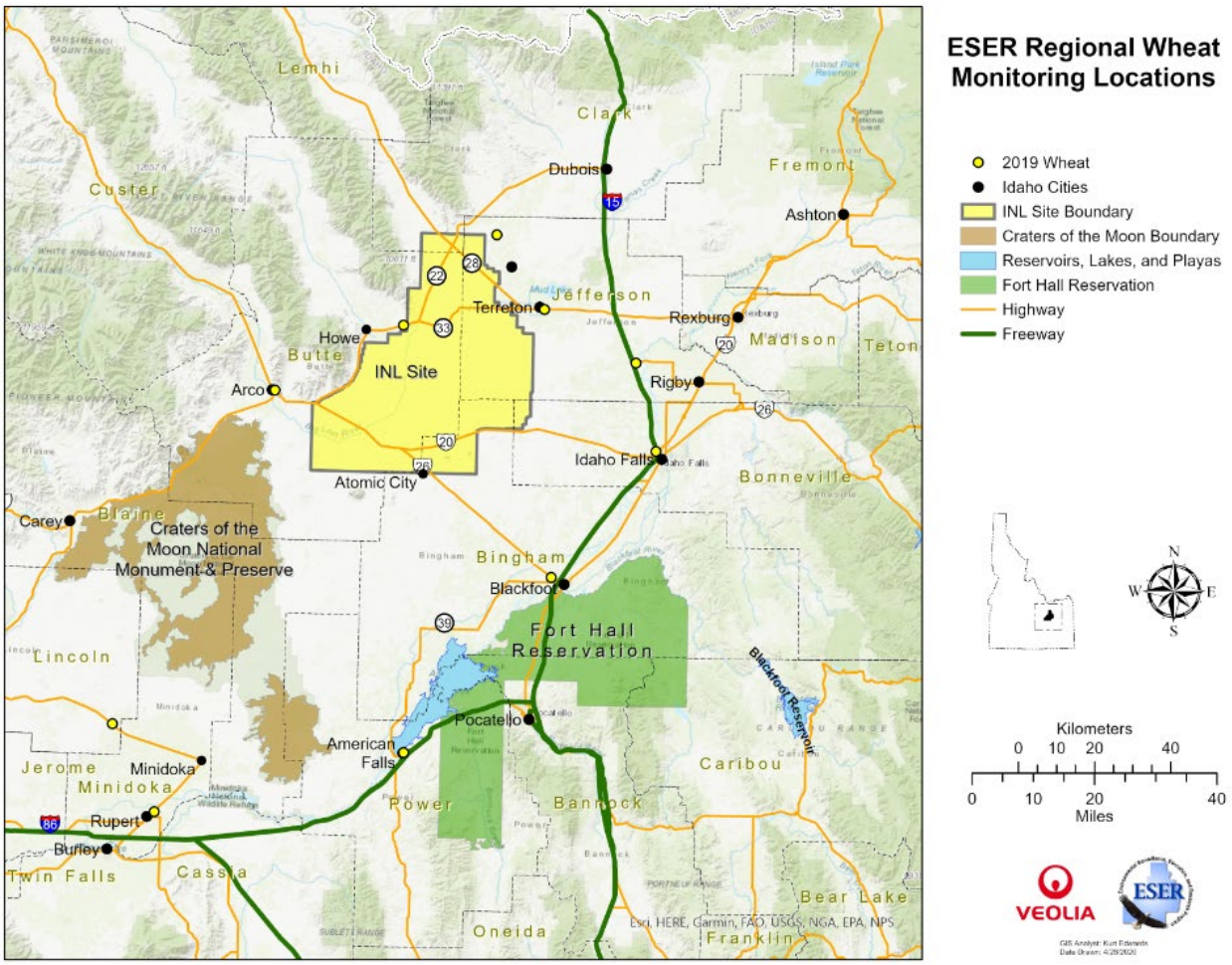

Figure 14. ESER grain monitoring locations.

Large Game Animal Sampling

No big game animals killed by vehicular collisions were available for sampling during the third quarter of 2019.

6. 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 Third Quarter of 2019 (VNSFS 2019).

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VNSFS, 2019, Environmental Quality Assurance Report for the 3rd Quarter 2019, 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				
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				
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 Third Quarter 2019

Sample Type	Analysis	Average Minimum Detectable Concentration[a] (MDC)	Derived Concentration Standard[b] (DCS)
Air (particulate filter)[e]	Gross alpha[c]	5.6×10^{-16} µCi/mL	3.4×10^{-14} µCi/mL
	Gross beta[d]	1.4×10^{-15} µCi/mL	2.5×10^{-11} µCi/mL
	^{137}Cs	7.4×10^{-17} µCi/mL	9.8×10^{-11} µCi/mL
	^{90}Sr	2.7×10^{-17} µCi/mL	2.5×10^{-11} µCi/mL
	^{241}Am	2.9×10^{-18} µCi/mL	4.1×10^{-14} µCi/mL
	^{238}Pu	2.1×10^{-18} µCi/mL	3.7×10^{-14} µCi/mL
	$^{239/240}$Pu	2.4×10^{-18} µCi/mL	3.4×10^{-14} µCi/mL
Air (charcoal cartridge)[e]	^{131}I	3.6×10^{-16} µCi/mL	4.1×10^{-10} µCi/mL
Air (atmospheric moisture)	^{3}H	87.5 pCi/L_{water} 6.5×10^{-13} µCi/mL_{air}	1.9×10^{6} pCi/L_{water} 2.1×10^{-7} µCi/mL_{air}
Air (precipitation)	^{3}H	88.9 pCi/L	1.9×10^{-6} pCi/L
Milk	^{131}I	0.6 pCi/L	[g]
	^{137}Cs	0.9 pCi/L	--
Lettuce	^{137}Cs	81.7 pCi/kg	--
	^{90}Sr	53.8 pCi/kg	--
Potatoes	^{137}Cs	1.2 pCi/kg	--
	^{90}Sr	44.5 pCi/kg	--
Grain	^{137}Cs	2.0 pCi/kg	--
	^{90}Sr	63.6 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. BLR = Big Lost River
g. – No appropriate DCS available

APPENDIX C

SAMPLE ANALYSIS RESULTS

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

Sampling Group and Location	Sampling Date	GROSS ALPHA Result ± 1s Uncertainty ($\times 10^{-15}$ µCi/mL)	GROSS ALPHA Result ± 1s Uncertainty ($\times 10^{-11}$ Bq/mL)	GROSS ALPHA Result > 3s	GROSS BETA Result ± 1s Uncertainty ($\times 10^{-15}$ µCi/mL)	GROSS BETA Result ± 1s Uncertainty ($\times 10^{-11}$ Bq/mL)	GROSS BETA Result > 3s
BOUNDARY							
ARCO	07/03/19	2.04 ± 0.21	7.55 ± 0.78	Yes	32.80 ± 0.73	121.36 ± 2.69	Yes
	07/10/19	1.48 ± 0.18	5.48 ± 0.68	Yes	28.80 ± 0.68	106.56 ± 2.52	Yes
	07/17/19	1.46 ± 0.18	5.40 ± 0.68	Yes	27.70 ± 0.67	102.49 ± 2.49	Yes
	07/24/19	1.75 ± 0.19	6.48 ± 0.71	Yes	27.20 ± 0.66	100.64 ± 2.45	Yes
	07/31/19	1.75 ± 0.20	6.48 ± 0.73	Yes	30.90 ± 0.69	114.33 ± 2.54	Yes
a	08/07/19	±	±	No	±	±	No
	08/14/19	1.37 ± 0.26	5.07 ± 0.97	Yes	28.90 ± 0.75	106.93 ± 2.76	Yes
	08/21/19	1.56 ± 0.19	5.77 ± 0.69	Yes	28.40 ± 0.67	105.08 ± 2.49	Yes
	08/28/19	1.58 ± 0.19	5.85 ± 0.69	Yes	28.30 ± 0.67	104.71 ± 2.48	Yes
	09/04/19	1.09 ± 0.23	4.03 ± 0.85	Yes	31.10 ± 0.71	115.07 ± 2.62	Yes
	09/11/19	1.56 ± 0.26	5.77 ± 0.94	Yes	27.90 ± 0.70	103.23 ± 2.58	Yes
	09/18/19	1.25 ± 0.25	4.63 ± 0.91	Yes	29.40 ± 0.73	108.78 ± 2.70	Yes
	09/25/19	0.68 ± 0.21	2.53 ± 0.77	Yes	22.20 ± 0.66	82.14 ± 2.43	Yes
ATOMIC CITY	07/03/19	1.53 ± 0.19	5.66 ± 0.71	Yes	32.80 ± 0.73	121.36 ± 2.69	Yes
	07/10/19	1.53 ± 0.19	5.66 ± 0.70	Yes	32.30 ± 0.72	119.51 ± 2.66	Yes
	07/17/19	0.90 ± 0.16	3.32 ± 0.57	Yes	28.60 ± 0.67	105.82 ± 2.48	Yes
	07/24/19	2.63 ± 0.23	9.73 ± 0.83	Yes	29.70 ± 0.69	109.89 ± 2.53	Yes
	07/31/19	1.72 ± 0.19	6.36 ± 0.72	Yes	30.90 ± 0.69	114.33 ± 2.53	Yes
	08/07/19	1.89 ± 0.28	6.99 ± 1.04	Yes	34.50 ± 0.77	127.65 ± 2.85	Yes
	08/14/19	1.40 ± 0.25	5.18 ± 0.91	Yes	28.70 ± 0.70	106.19 ± 2.60	Yes
	08/21/19	1.43 ± 0.18	5.29 ± 0.67	Yes	32.10 ± 0.70	118.77 ± 2.60	Yes
	08/28/19	1.43 ± 0.18	5.29 ± 0.65	Yes	27.10 ± 0.65	100.27 ± 2.40	Yes
	09/04/19	2.85 ± 0.30	10.55 ± 1.11	Yes	36.70 ± 0.78	135.79 ± 2.88	Yes
	09/11/19	2.02 ± 0.27	7.47 ± 0.98	Yes	27.40 ± 0.68	101.38 ± 2.52	Yes
	09/18/19	1.84 ± 0.27	6.81 ± 1.01	Yes	29.80 ± 0.74	110.26 ± 2.75	Yes
	09/25/19	1.25 ± 0.23	4.63 ± 0.85	Yes	22.80 ± 0.66	84.36 ± 2.43	Yes
QA-1	07/03/19	1.50 ± 0.19	5.55 ± 0.69	Yes	30.70 ± 0.70	113.59 ± 2.60	Yes
(ATOMIC CITY)	07/10/19	1.44 ± 0.18	5.33 ± 0.66	Yes	29.90 ± 0.67	110.63 ± 2.49	Yes
	07/17/19	1.56 ± 0.18	5.77 ± 0.68	Yes	27.00 ± 0.65	99.90 ± 2.42	Yes
	07/24/19	2.24 ± 0.21	8.29 ± 0.77	Yes	28.20 ± 0.66	104.34 ± 2.44	Yes
	07/31/19	1.15 ± 0.17	4.26 ± 0.62	Yes	25.50 ± 0.63	94.35 ± 2.34	Yes
	08/07/19	1.34 ± 0.25	4.96 ± 0.94	Yes	32.70 ± 0.73	120.99 ± 2.71	Yes
	08/14/19	1.21 ± 0.24	4.48 ± 0.87	Yes	26.40 ± 0.68	97.68 ± 2.51	Yes
	08/21/19	1.55 ± 0.18	5.74 ± 0.67	Yes	31.10 ± 0.68	115.07 ± 2.51	Yes
	08/28/19	1.65 ± 0.19	6.11 ± 0.69	Yes	25.50 ± 0.64	94.35 ± 2.37	Yes
	09/04/19	2.35 ± 0.27	8.70 ± 1.01	Yes	31.00 ± 0.71	114.70 ± 2.61	Yes
	09/11/19	1.87 ± 0.26	6.92 ± 0.96	Yes	26.70 ± 0.67	98.79 ± 2.48	Yes
	09/18/19	2.19 ± 0.29	8.10 ± 1.06	Yes	28.30 ± 0.73	104.71 ± 2.71	Yes
	09/25/19	1.07 ± 0.23	3.96 ± 0.85	Yes	20.50 ± 0.65	75.85 ± 2.42	Yes
BLUE DOME	07/03/19	1.60 ± 0.19	5.92 ± 0.69	Yes	32.80 ± 0.71	121.36 ± 2.61	Yes
	07/10/19	1.78 ± 0.20	6.59 ± 0.73	Yes	32.90 ± 0.72	121.73 ± 2.67	Yes
	07/17/19	1.15 ± 0.17	4.26 ± 0.63	Yes	28.40 ± 0.68	105.08 ± 2.51	Yes
	07/24/19	1.41 ± 0.18	5.22 ± 0.65	Yes	27.00 ± 0.66	99.90 ± 2.43	Yes
	07/31/19	1.37 ± 0.18	5.07 ± 0.65	Yes	29.50 ± 0.66	109.15 ± 2.44	Yes
	08/07/19	1.63 ± 0.28	6.03 ± 1.02	Yes	36.50 ± 0.79	135.05 ± 2.92	Yes
	08/14/19	1.83 ± 0.26	6.77 ± 0.96	Yes	29.90 ± 0.71	110.63 ± 2.63	Yes
	08/21/19	1.38 ± 0.18	5.11 ± 0.67	Yes	32.00 ± 0.71	118.40 ± 2.62	Yes
	08/28/19	1.42 ± 0.17	5.25 ± 0.64	Yes	29.40 ± 0.66	108.78 ± 2.45	Yes
	09/04/19	1.79 ± 0.27	6.62 ± 0.98	Yes	34.20 ± 0.76	126.54 ± 2.80	Yes
	09/11/19	1.88 ± 0.26	6.96 ± 0.97	Yes	28.10 ± 0.69	103.97 ± 2.55	Yes
	09/18/19	1.72 ± 0.25	6.36 ± 0.91	Yes	28.10 ± 0.68	103.97 ± 2.50	Yes
	09/25/19	0.94 ± 0.22	3.48 ± 0.81	Yes	22.00 ± 0.65	81.40 ± 2.42	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	Result ± 1s Uncertainty ($\times 10^{-15}$ µCi/mL)			Result ± 1s Uncertainty ($\times 10^{-11}$ Bq/mL)			Result > 3s
QA-2	07/03/19	1.51	±	0.18	5.59	±	0.68	Yes	31.80	±	0.70	117.66	±	2.59	Yes
(BLUE DOME)	07/10/19	1.10	±	0.17	4.07	±	0.63	Yes	29.60	±	0.69	109.52	±	2.57	Yes
	07/17/19	0.98	±	0.16	3.61	±	0.60	Yes	26.40	±	0.66	97.68	±	2.44	Yes
	07/24/19	1.39	±	0.18	5.14	±	0.67	Yes	28.50	±	0.69	105.45	±	2.55	Yes
	07/31/19	1.25	±	0.18	4.63	±	0.67	Yes	31.10	±	0.71	115.07	±	2.61	Yes
	08/07/19	1.01	±	0.26	3.74	±	0.95	Yes	37.30	±	0.80	138.01	±	2.97	Yes
	08/14/19	1.49	±	0.25	5.51	±	0.93	Yes	31.00	±	0.73	114.70	±	2.70	Yes
	08/21/19	1.38	±	0.19	5.11	±	0.68	Yes	33.30	±	0.73	123.21	±	2.71	Yes
	08/28/19	1.21	±	0.17	4.48	±	0.63	Yes	29.10	±	0.68	107.67	±	2.50	Yes
	09/04/19	1.14	±	0.25	4.22	±	0.93	Yes	34.30	±	0.78	126.91	±	2.87	Yes
	09/11/19	0.98	±	0.24	3.61	±	0.87	Yes	27.80	±	0.70	102.86	±	2.60	Yes
	09/18/19	1.24	±	0.24	4.59	±	0.88	Yes	31.70	±	0.73	117.29	±	2.70	Yes
	09/25/19	0.95	±	0.22	3.52	±	0.80	Yes	21.80	±	0.64	80.66	±	2.36	Yes
FAA TOWER	07/03/19	1.67	±	0.20	6.18	±	0.72	Yes	34.10	±	0.73	126.17	±	2.71	Yes
	07/10/19	1.25	±	0.18	4.63	±	0.67	Yes	29.80	±	0.71	110.26	±	2.63	Yes
	07/17/19	1.18	±	0.17	4.37	±	0.62	Yes	26.60	±	0.65	98.42	±	2.42	Yes
	07/24/19	1.61	±	0.18	5.96	±	0.67	Yes	25.70	±	0.64	95.09	±	2.35	Yes
	07/31/19	1.41	±	0.18	5.22	±	0.67	Yes	29.30	±	0.67	108.41	±	2.48	Yes
	08/07/19	1.44	±	0.28	5.33	±	1.04	Yes	33.80	±	0.80	125.06	±	2.95	Yes
	08/14/19	1.33	±	0.25	4.92	±	0.92	Yes	29.40	±	0.73	108.78	±	2.69	Yes
	08/21/19	1.51	±	0.19	5.59	±	0.70	Yes	31.90	±	0.71	118.03	±	2.64	Yes
	08/28/19	1.65	±	0.19	6.11	±	0.70	Yes	29.10	±	0.67	107.67	±	2.49	Yes
	09/04/19	1.55	±	0.27	5.74	±	0.99	Yes	34.80	±	0.79	128.76	±	2.91	Yes
	09/11/19	0.91	±	0.24	3.36	±	0.87	Yes	28.30	±	0.71	104.71	±	2.63	Yes
	09/18/19	1.61	±	0.26	5.96	±	0.95	Yes	29.10	±	0.72	107.67	±	2.67	Yes
	09/25/19	1.40	±	0.23	5.18	±	0.86	Yes	20.60	±	0.63	76.22	±	2.32	Yes
HOWE	07/03/19	1.72	±	0.20	6.36	±	0.73	Yes	31.90	±	0.71	118.03	±	2.63	Yes
	07/10/19	1.62	±	0.19	5.99	±	0.71	Yes	30.30	±	0.70	112.11	±	2.59	Yes
	07/17/19	1.78	±	0.20	6.59	±	0.74	Yes	29.10	±	0.70	107.67	±	2.58	Yes
	07/24/19	1.91	±	0.20	7.07	±	0.72	Yes	26.40	±	0.65	97.68	±	2.39	Yes
	07/31/19	2.35	±	0.22	8.70	±	0.80	Yes	31.50	±	0.68	116.55	±	2.53	Yes
	08/07/19	1.60	±	0.29	5.92	±	1.07	Yes	34.10	±	0.80	126.17	±	2.96	Yes
	08/14/19	2.05	±	0.28	7.59	±	1.04	Yes	27.60	±	0.72	102.12	±	2.67	Yes
	08/21/19	1.86	±	0.21	6.88	±	0.76	Yes	28.80	±	0.70	106.56	±	2.58	Yes
	08/28/19	1.60	±	0.19	5.92	±	0.70	Yes	27.30	±	0.67	101.01	±	2.46	Yes
	09/04/19	1.97	±	0.29	7.29	±	1.05	Yes	31.50	±	0.76	116.55	±	2.83	Yes
	09/11/19	1.84	±	0.27	6.81	±	1.01	Yes	26.00	±	0.69	96.20	±	2.57	Yes
	09/18/19	1.65	±	0.25	6.11	±	0.94	Yes	26.30	±	0.68	97.31	±	2.53	Yes
	09/25/19	0.78	±	0.21	2.88	±	0.77	Yes	19.90	±	0.63	73.63	±	2.31	Yes
MONTEVIEW	07/03/19	1.47	±	0.18	5.44	±	0.67	Yes	31.00	±	0.69	114.70	±	2.54	Yes
	07/10/19	2.03	±	0.21	7.51	±	0.77	Yes	32.20	±	0.72	119.14	±	2.66	Yes
	07/17/19	2.18	±	0.21	8.07	±	0.78	Yes	28.40	±	0.67	105.08	±	2.49	Yes
	07/24/19	1.95	±	0.20	7.22	±	0.74	Yes	26.50	±	0.66	98.05	±	2.44	Yes
	07/31/19	1.40	±	0.18	5.18	±	0.65	Yes	29.40	±	0.66	108.78	±	2.43	Yes
	08/07/19	1.21	±	0.26	4.48	±	0.96	Yes	31.60	±	0.75	116.92	±	2.77	Yes
	08/14/19	1.88	±	0.26	6.96	±	0.95	Yes	27.20	±	0.68	100.64	±	2.51	Yes
	08/21/19	1.69	±	0.19	6.25	±	0.70	Yes	28.90	±	0.67	106.93	±	2.47	Yes
	08/28/19	1.38	±	0.17	5.11	±	0.63	Yes	26.20	±	0.62	96.94	±	2.30	Yes
	09/04/19	1.95	±	0.28	7.22	±	1.02	Yes	30.30	±	0.74	112.11	±	2.73	Yes
	09/11/19	1.20	±	0.24	4.44	±	0.90	Yes	25.00	±	0.67	92.50	±	2.49	Yes
	09/18/19	1.50	±	0.25	5.55	±	0.92	Yes	24.60	±	0.67	91.02	±	2.48	Yes
	09/25/19	1.24	±	0.23	4.59	±	0.86	Yes	20.10	±	0.64	74.37	±	2.35	Yes

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

Sampling Group and Location	Sampling Date	GROSS ALPHA Result ± 1s Uncertainty ($\times 10^{-15}$ µCi/mL)	GROSS ALPHA Result ± 1s Uncertainty ($\times 10^{-11}$ Bq/mL)	GROSS ALPHA Result > 3s	GROSS BETA Result ± 1s Uncertainty ($\times 10^{-15}$ µCi/mL)	GROSS BETA Result ± 1s Uncertainty ($\times 10^{-11}$ Bq/mL)	GROSS BETA Result > 3s
MUD LAKE	07/03/19	1.90 ± 0.20	7.03 ± 0.75	Yes	34.50 ± 0.73	127.65 ± 2.71	Yes
	07/10/19	1.32 ± 0.18	4.88 ± 0.65	Yes	29.60 ± 0.68	109.52 ± 2.51	Yes
	07/17/19	1.41 ± 0.18	5.22 ± 0.68	Yes	29.00 ± 0.69	107.30 ± 2.56	Yes
	07/24/19	2.17 ± 0.21	8.03 ± 0.77	Yes	27.00 ± 0.66	99.90 ± 2.45	Yes
	07/31/19	1.79 ± 0.20	6.62 ± 0.73	Yes	28.30 ± 0.67	104.71 ± 2.47	Yes
	08/07/19	1.21 ± 0.26	4.48 ± 0.95	Yes	31.70 ± 0.74	117.29 ± 2.74	Yes
	08/14/19	1.76 ± 0.27	6.51 ± 0.98	Yes	27.00 ± 0.70	99.90 ± 2.60	Yes
	08/21/19	1.73 ± 0.20	6.40 ± 0.73	Yes	29.30 ± 0.70	108.41 ± 2.58	Yes
	08/28/19	1.36 ± 0.18	5.03 ± 0.68	Yes	30.80 ± 0.71	113.96 ± 2.64	Yes
	09/04/19	1.73 ± 0.27	6.40 ± 1.00	Yes	31.50 ± 0.75	116.55 ± 2.76	Yes
	09/11/19	1.24 ± 0.26	4.59 ± 0.95	Yes	27.50 ± 0.72	101.75 ± 2.68	Yes
	09/18/19	1.13 ± 0.23	4.18 ± 0.86	Yes	25.50 ± 0.68	94.35 ± 2.50	Yes
	09/25/19	1.48 ± 0.24	5.48 ± 0.88	Yes	22.70 ± 0.65	83.99 ± 2.41	Yes
DISTANT							
BLACKFOOT	07/03/19	1.82 ± 0.20	6.73 ± 0.75	Yes	31.50 ± 0.71	116.55 ± 2.64	Yes
	07/10/19	1.43 ± 0.19	5.29 ± 0.70	Yes	31.40 ± 0.73	116.18 ± 2.69	Yes
	07/17/19	1.74 ± 0.19	6.44 ± 0.70	Yes	28.80 ± 0.66	106.56 ± 2.46	Yes
	07/24/19	1.83 ± 0.21	6.77 ± 0.76	Yes	33.30 ± 0.75	123.21 ± 2.78	Yes
	07/31/19	1.48 ± 0.19	5.48 ± 0.69	Yes	30.20 ± 0.69	111.74 ± 2.54	Yes
	08/07/19	1.17 ± 0.24	4.33 ± 0.90	Yes	30.40 ± 0.71	112.48 ± 2.61	Yes
	08/14/19	1.53 ± 0.25	5.66 ± 0.93	Yes	24.80 ± 0.67	91.76 ± 2.47	Yes
	08/21/19	1.50 ± 0.18	5.55 ± 0.67	Yes	29.30 ± 0.66	108.41 ± 2.45	Yes
	08/28/19	1.20 ± 0.16	4.44 ± 0.60	Yes	26.10 ± 0.63	96.57 ± 2.32	Yes
	09/04/19	1.31 ± 0.23	4.85 ± 0.85	Yes	28.00 ± 0.66	103.60 ± 2.44	Yes
	09/11/19	1.78 ± 0.25	6.59 ± 0.93	Yes	27.30 ± 0.66	101.01 ± 2.45	Yes
	09/18/19	2.45 ± 0.29	9.07 ± 1.09	Yes	29.10 ± 0.74	107.67 ± 2.73	Yes
	09/25/19	1.22 ± 0.22	4.51 ± 0.80	Yes	19.30 ± 0.59	71.41 ± 2.20	Yes
CRATERS OF THE MOON	07/03/19	1.88 ± 0.21	6.96 ± 0.77	Yes	32.40 ± 0.74	119.88 ± 2.73	Yes
	07/10/19	1.09 ± 0.17	4.03 ± 0.63	Yes	29.80 ± 0.71	110.26 ± 2.62	Yes
	07/17/19	1.20 ± 0.16	4.44 ± 0.60	Yes	25.30 ± 0.61	93.61 ± 2.26	Yes
	07/24/19	1.68 ± 0.18	6.22 ± 0.68	Yes	24.20 ± 0.61	89.54 ± 2.27	Yes
	07/31/19	1.65 ± 0.19	6.11 ± 0.71	Yes	30.40 ± 0.68	112.48 ± 2.51	Yes
	08/07/19	1.48 ± 0.27	5.48 ± 0.98	Yes	36.10 ± 0.78	133.57 ± 2.87	Yes
	08/14/19	1.32 ± 0.24	4.88 ± 0.90	Yes	26.30 ± 0.68	97.31 ± 2.52	Yes
	08/21/19	1.16 ± 0.17	4.29 ± 0.61	Yes	29.10 ± 0.67	107.67 ± 2.46	Yes
	08/28/19	1.32 ± 0.18	4.88 ± 0.65	Yes	30.00 ± 0.68	111.00 ± 2.52	Yes
	09/04/19	1.53 ± 0.25	5.66 ± 0.93	Yes	30.30 ± 0.71	112.11 ± 2.63	Yes
	09/11/19	1.30 ± 0.24	4.81 ± 0.90	Yes	28.30 ± 0.69	104.71 ± 2.57	Yes
	09/18/19	0.95 ± 0.23	3.53 ± 0.85	Yes	29.90 ± 0.73	110.63 ± 2.68	Yes
	09/25/19	1.09 ± 0.22	4.03 ± 0.81	Yes	21.50 ± 0.64	79.55 ± 2.35	Yes
DUBOIS	07/03/19	1.48 ± 0.18	5.48 ± 0.68	Yes	25.30 ± 0.65	93.61 ± 2.40	Yes
	07/10/19	1.73 ± 0.19	6.40 ± 0.72	Yes	30.60 ± 0.70	113.22 ± 2.58	Yes
	07/17/19	1.44 ± 0.20	5.33 ± 0.73	Yes	33.20 ± 0.77	122.84 ± 2.86	Yes
	07/24/19	1.63 ± 0.20	6.03 ± 0.72	Yes	26.70 ± 0.69	98.79 ± 2.53	Yes
	07/31/19	1.86 ± 0.21	6.88 ± 0.76	Yes	32.40 ± 0.72	119.88 ± 2.65	Yes
	08/07/19	1.33 ± 0.26	4.92 ± 0.96	Yes	33.00 ± 0.75	122.10 ± 2.76	Yes
	08/14/19	1.80 ± 0.26	6.66 ± 0.95	Yes	26.10 ± 0.67	96.57 ± 2.49	Yes
	08/21/19	1.33 ± 0.18	4.92 ± 0.66	Yes	29.60 ± 0.69	109.52 ± 2.54	Yes
	08/28/19	1.33 ± 0.17	4.92 ± 0.64	Yes	27.60 ± 0.65	102.12 ± 2.42	Yes
	09/04/19	1.97 ± 0.27	7.29 ± 1.01	Yes	30.50 ± 0.73	112.85 ± 2.71	Yes
	09/11/19	2.14 ± 0.28	7.92 ± 1.05	Yes	28.10 ± 0.72	103.97 ± 2.65	Yes
	09/18/19	1.42 ± 0.24	5.25 ± 0.88	Yes	24.60 ± 0.65	91.02 ± 2.41	Yes
	09/25/19	1.19 ± 0.23	4.40 ± 0.85	Yes	19.80 ± 0.63	73.26 ± 2.33	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	Result ± 1s Uncertainty ($\times 10^{-15}$ µCi/mL)			Result ± 1s Uncertainty ($\times 10^{-11}$ Bq/mL)			Result > 3s
IDAHO FALLS	07/03/19	2.25	±	0.22	8.33	±	0.81	Yes	33.30	±	0.74	123.21	±	2.73	Yes
	07/10/19	2.60	±	0.23	9.62	±	0.85	Yes	32.60	±	0.73	120.62	±	2.68	Yes
	07/17/19	2.63	±	0.23	9.73	±	0.86	Yes	26.90	±	0.68	99.53	±	2.51	Yes
	07/24/19	2.72	±	0.23	10.06	±	0.86	Yes	29.10	±	0.70	107.67	±	2.57	Yes
	07/31/19	2.28	±	0.22	8.44	±	0.80	Yes	31.10	±	0.70	115.07	±	2.58	Yes
	08/07/19	2.18	±	0.30	8.07	±	1.12	Yes	32.30	±	0.78	119.51	±	2.87	Yes
	08/14/19	1.43	±	0.26	5.29	±	0.96	Yes	26.00	±	0.71	96.20	±	2.63	Yes
	08/21/19	2.91	±	0.25	10.77	±	0.91	Yes	31.70	±	0.73	117.29	±	2.71	Yes
	08/28/19	2.88	±	0.25	10.66	±	0.91	Yes	29.50	±	0.72	109.15	±	2.65	Yes
	09/04/19	1.70	±	0.28	6.29	±	1.04	Yes	32.90	±	0.79	121.73	±	2.93	Yes
	09/11/19	1.74	±	0.27	6.44	±	1.01	Yes	28.80	±	0.73	106.56	±	2.69	Yes
	09/18/19	1.60	±	0.25	5.92	±	0.94	Yes	28.00	±	0.70	103.60	±	2.60	Yes
	09/25/19	1.05	±	0.22	3.89	±	0.82	Yes	20.50	±	0.63	75.85	±	2.34	Yes
JACKSON	07/03/19	2.07	±	0.22	7.66	±	0.82	Yes	32.50	±	0.76	120.25	±	2.79	Yes
	07/10/19	1.33	±	0.19	4.92	±	0.69	Yes	28.60	±	0.71	105.82	±	2.62	Yes
	07/17/19	1.07	±	0.17	3.96	±	0.64	Yes	26.70	±	0.69	98.79	±	2.56	Yes
	07/24/19	1.25	±	0.18	4.63	±	0.67	Yes	30.80	±	0.74	113.96	±	2.72	Yes
	07/31/19	1.44	±	0.20	5.33	±	0.73	Yes	29.70	±	0.72	109.89	±	2.67	Yes
	08/07/19	2.25	±	0.32	8.33	±	1.18	Yes	33.60	±	0.82	124.32	±	3.02	Yes
	08/14/19	2.18	±	0.30	8.07	±	1.12	Yes	30.30	±	0.79	112.11	±	2.91	Yes
	08/21/19	1.35	±	0.19	5.00	±	0.70	Yes	30.30	±	0.73	112.11	±	2.72	Yes
	08/28/19	1.16	±	0.18	4.29	±	0.66	Yes	31.50	±	0.74	116.55	±	2.73	Yes
	09/04/19	2.40	±	0.31	8.88	±	1.15	Yes	35.30	±	0.82	130.61	±	3.05	Yes
	09/11/19	2.19	±	0.31	8.10	±	1.14	Yes	30.20	±	0.78	111.74	±	2.89	Yes
	09/18/19	1.95	±	0.28	7.22	±	1.02	Yes	26.00	±	0.71	96.20	±	2.62	Yes
	09/25/19	1.06	±	0.24	3.92	±	0.88	Yes	21.80	±	0.68	80.66	±	2.53	Yes
SUGAR CITY	07/03/19	1.40	±	0.17	5.18	±	0.64	Yes	30.50	±	0.67	112.85	±	2.48	Yes
	07/10/19	1.29	±	0.17	4.77	±	0.64	Yes	30.30	±	0.69	112.11	±	2.54	Yes
	07/17/19	1.71	±	0.19	6.33	±	0.70	Yes	24.70	±	0.63	91.39	±	2.34	Yes
	07/24/19	2.12	±	0.21	7.84	±	0.76	Yes	26.90	±	0.66	99.53	±	2.42	Yes
	07/31/19	1.65	±	0.19	6.11	±	0.71	Yes	28.70	±	0.67	106.19	±	2.49	Yes
	08/07/19	1.32	±	0.27	4.88	±	0.98	Yes	33.50	±	0.77	123.95	±	2.83	Yes
	08/14/19	1.90	±	0.27	7.03	±	1.00	Yes	27.40	±	0.71	101.38	±	2.61	Yes
	08/21/19	1.59	±	0.19	5.88	±	0.70	Yes	30.90	±	0.69	114.33	±	2.57	Yes
	08/28/19	1.51	±	0.18	5.59	±	0.67	Yes	26.40	±	0.64	97.68	±	2.38	Yes
	09/04/19	1.98	±	0.27	7.33	±	1.01	Yes	31.70	±	0.73	117.29	±	2.72	Yes
	09/11/19	1.42	±	0.25	5.25	±	0.94	Yes	26.80	±	0.70	99.16	±	2.57	Yes
	09/18/19	0.87	±	0.22	3.22	±	0.82	Yes	26.60	±	0.68	98.42	±	2.53	Yes
	09/25/19	1.13	±	0.22	4.18	±	0.83	Yes	20.60	±	0.63	76.22	±	2.33	Yes
INL SITE															
EFS	07/03/19	1.11	±	0.17	4.11	±	0.62	Yes	32.60	±	0.71	120.62	±	2.62	Yes
	07/10/19	1.43	±	0.18	5.29	±	0.68	Yes	28.40	±	0.68	105.08	±	2.52	Yes
	07/17/19	1.46	±	0.18	5.40	±	0.68	Yes	26.50	±	0.66	98.05	±	2.44	Yes
a	07/24/19		±			±		No		±			±		No
	07/31/19	2.95	±	0.22	10.92	±	0.81	Yes	23.50	±	0.57	86.95	±	2.09	Yes
	08/07/19	2.39	±	0.29	8.84	±	1.07	Yes	30.50	±	0.71	112.85	±	2.64	Yes
	08/14/19	2.11	±	0.27	7.81	±	0.99	Yes	23.50	±	0.65	86.95	±	2.41	Yes
	08/21/19	1.92	±	0.19	7.10	±	0.71	Yes	27.60	±	0.64	102.12	±	2.36	Yes
	08/28/19	1.82	±	0.20	6.73	±	0.74	Yes	28.40	±	0.68	105.08	±	2.53	Yes
	09/04/19	2.10	±	0.27	7.77	±	1.00	Yes	31.30	±	0.72	115.81	±	2.66	Yes
	09/11/19	1.54	±	0.26	5.70	±	0.94	Yes	27.30	±	0.69	101.01	±	2.56	Yes
	09/18/19	1.80	±	0.26	6.66	±	0.98	Yes	26.50	±	0.70	98.05	±	2.58	Yes
	09/25/19	1.31	±	0.29	4.85	±	1.06	Yes	27.00	±	0.83	99.90	±	3.06	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	Result ± 1s Uncertainty ($\times 10^{-15}$ µCi/mL)			Result ± 1s Uncertainty ($\times 10^{-11}$ Bq/mL)			Result > 3s
MAIN GATE	07/03/19	1.64	±	0.19	6.07	±	0.71	Yes	33.80	±	0.72	125.06	±	2.68	Yes
	07/10/19	1.82	±	0.21	6.73	±	0.78	Yes	32.90	±	0.77	121.73	±	2.83	Yes
a	07/17/19		±			±		No		±			±		No
	07/24/19	3.32	±	0.27	12.28	±	0.99	Yes	31.00	±	0.76	114.70	±	2.80	Yes
	07/31/19	1.43	±	0.18	5.29	±	0.68	Yes	31.20	±	0.69	115.44	±	2.55	Yes
	08/07/19	1.69	±	0.27	6.25	±	0.98	Yes	31.60	±	0.72	116.92	±	2.67	Yes
	08/14/19	1.39	±	0.24	5.14	±	0.90	Yes	29.50	±	0.71	109.15	±	2.62	Yes
	08/21/19	1.55	±	0.18	5.74	±	0.65	Yes	28.80	±	0.64	106.56	±	2.37	Yes
	08/28/19	1.59	±	0.18	5.88	±	0.67	Yes	28.60	±	0.65	105.82	±	2.41	Yes
	09/04/19	1.36	±	0.24	5.03	±	0.87	Yes	33.20	±	0.71	122.84	±	2.64	Yes
	09/11/19	0.87	±	0.23	3.22	±	0.83	Yes	27.60	±	0.68	102.12	±	2.53	Yes
	09/18/19	1.41	±	0.25	5.22	±	0.93	Yes	31.20	±	0.74	115.44	±	2.75	Yes
	09/25/19	1.28	±	0.24	4.74	±	0.88	Yes	22.60	±	0.67	83.62	±	2.46	Yes
VAN BUREN GATE	07/03/19	1.66	±	0.20	6.14	±	0.72	Yes	35.90	±	0.75	132.83	±	2.77	Yes
	07/10/19	1.56	±	0.19	5.77	±	0.69	Yes	29.50	±	0.69	109.15	±	2.54	Yes
a	07/17/19		±			±		No		±			±		No
	07/24/19	2.38	±	0.21	8.81	±	0.79	Yes	29.20	±	0.67	108.04	±	2.48	Yes
	07/31/19	1.49	±	0.18	5.51	±	0.67	Yes	32.60	±	0.69	120.62	±	2.55	Yes
	08/07/19	1.72	±	0.27	6.36	±	1.00	Yes	34.10	±	0.75	126.17	±	2.77	Yes
	08/14/19	2.11	±	0.27	7.81	±	1.00	Yes	29.60	±	0.71	109.52	±	2.62	Yes
	08/21/19	1.17	±	0.17	4.33	±	0.61	Yes	30.40	±	0.67	112.48	±	2.49	Yes
	08/28/19	1.21	±	0.17	4.48	±	0.61	Yes	29.70	±	0.66	109.89	±	2.45	Yes
	09/04/19	1.53	±	0.25	5.66	±	0.93	Yes	34.30	±	0.74	126.91	±	2.75	Yes
	09/11/19	1.23	±	0.24	4.55	±	0.87	Yes	29.00	±	0.69	107.30	±	2.55	Yes
	09/18/19	2.26	±	0.28	8.36	±	1.04	Yes	29.80	±	0.73	110.26	±	2.69	Yes
	09/25/19	0.92	±	0.21	3.40	±	0.79	Yes	21.20	±	0.63	78.44	±	2.34	Yes

a. Invalid sample result shown in red.

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	07/03/19	0.88	±	0.92	3.25	±	3.41	No
	07/10/19	-0.86	±	1.62	-3.17	±	5.99	No
	07/17/19	-1.23	±	2.02	-4.55	±	7.47	No
	07/24/19	-0.52	±	1.94	-1.91	±	7.18	No
	07/31/19	-0.64	±	1.00	-2.37	±	3.69	No
a	08/07/19		±			±		No
	08/14/19	-1.60	±	2.10	-5.92	±	7.77	No
	08/21/19	-1.31	±	1.01	-4.85	±	3.74	No
	08/28/19	1.58	±	2.02	5.85	±	7.47	No
	09/04/19	0.10	±	0.99	0.36	±	3.66	No
	09/11/19	1.30	±	0.94	4.81	±	3.49	No
	09/18/19	-2.59	±	2.07	-9.58	±	7.66	No
	09/25/19	-0.79	±	1.03	-2.93	±	3.81	No
ATOMIC CITY	07/03/19	0.89	±	0.93	3.27	±	3.44	No
	07/10/19	-0.87	±	1.64	-3.20	±	6.07	No
	07/17/19	-1.20	±	1.97	-4.44	±	7.29	No
	07/24/19	-0.51	±	1.93	-1.89	±	7.14	No
	07/31/19	-0.64	±	0.99	-2.35	±	3.67	No
	08/07/19	-0.31	±	1.03	-1.14	±	3.81	No
	08/14/19	-1.46	±	1.92	-5.40	±	7.10	No
	08/21/19	-1.30	±	1.00	-4.81	±	3.70	No
	08/28/19	1.54	±	1.96	5.70	±	7.25	No
	09/04/19	0.10	±	1.02	0.37	±	3.77	No
	09/11/19	1.26	±	0.92	4.66	±	3.39	No
	09/18/19	-2.64	±	2.10	-9.77	±	7.77	No
	09/25/19	-0.78	±	1.02	-2.88	±	3.77	No
QA-1	07/03/19	0.87	±	0.91	3.22	±	3.38	No
(ATOMIC CITY)	07/10/19	-0.82	±	1.55	-3.03	±	5.74	No
	07/17/19	-1.19	±	1.95	-4.40	±	7.22	No
	07/24/19	-0.50	±	1.88	-1.85	±	6.96	No
	07/31/19	-0.64	±	0.99	-2.36	±	3.68	No
	08/07/19	-0.30	±	0.99	-1.10	±	3.66	No
	08/14/19	-1.45	±	1.91	-5.37	±	7.07	No
	08/21/19	-1.25	±	0.96	-4.63	±	3.56	No
	08/28/19	1.57	±	2.00	5.81	±	7.40	No
	09/04/19	0.10	±	0.98	0.36	±	3.61	No
	09/11/19	1.25	±	0.91	4.63	±	3.36	No
	09/18/19	-2.66	±	2.12	-9.84	±	7.84	No
	09/25/19	-0.82	±	1.07	-3.03	±	3.96	No
BLUE DOME	07/03/19	-0.20	±	0.76	-0.74	±	2.80	No
	07/10/19	0.64	±	0.82	2.35	±	3.03	No
	07/17/19	1.18	±	1.86	4.37	±	6.88	No
	07/24/19	-3.14	±	1.94	-11.62	±	7.18	No
	07/31/19	0.25	±	1.70	0.93	±	6.29	No
	08/07/19	-0.01	±	0.95	-0.04	±	3.52	No
	08/14/19	-1.19	±	1.01	-4.40	±	3.74	No
	08/21/19	2.25	±	1.96	8.33	±	7.25	No
	08/28/19	0.29	±	0.96	1.05	±	3.55	No
	09/04/19	1.57	±	1.04	5.81	±	3.85	No
	09/11/19	0.97	±	1.69	3.58	±	6.25	No
	09/18/19	0.10	±	0.88	0.35	±	3.24	No
	09/25/19	-0.38	±	1.86	-1.40	±	6.88	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
QA-2	07/03/19	-0.20	±	0.76	-0.74	±	2.83	No
(BLUE DOME)	07/10/19	0.64	±	0.83	2.38	±	3.07	No
	07/17/19	1.18	±	1.86	4.37	±	6.88	No
	07/24/19	-3.28	±	2.02	-12.14	±	7.47	No
	07/31/19	0.27	±	1.84	1.00	±	6.81	No
	08/07/19	-0.01	±	0.97	-0.04	±	3.59	No
	08/14/19	-1.21	±	1.03	-4.48	±	3.81	No
	08/21/19	2.32	±	2.02	8.58	±	7.47	No
	08/28/19	0.30	±	1.01	1.11	±	3.74	No
	09/04/19	1.64	±	1.09	6.07	±	4.03	No
	09/11/19	1.01	±	1.77	3.74	±	6.55	No
	09/18/19	0.10	±	0.93	0.37	±	3.43	No
	09/25/19	-0.37	±	1.81	-1.37	±	6.70	No
FAA TOWER	07/03/19	-0.21	±	0.79	-0.76	±	2.90	No
	07/10/19	0.67	±	0.86	2.47	±	3.19	No
	07/17/19	1.15	±	1.82	4.26	±	6.73	No
	07/24/19	-3.06	±	1.89	-11.32	±	6.99	No
	07/31/19	0.26	±	1.76	0.96	±	6.51	No
	08/07/19	-0.01	±	1.02	-0.04	±	3.77	No
	08/14/19	-1.25	±	1.06	-4.63	±	3.92	No
	08/21/19	2.28	±	1.98	8.44	±	7.33	No
	08/28/19	0.30	±	1.00	1.10	±	3.69	No
	09/04/19	1.66	±	1.10	6.14	±	4.07	No
	09/11/19	1.02	±	1.79	3.77	±	6.62	No
	09/18/19	0.10	±	0.96	0.38	±	3.55	No
	09/25/19	-0.37	±	1.80	-1.36	±	6.66	No
HOWE	07/03/19	-0.21	±	0.79	-0.76	±	2.90	No
	07/10/19	0.64	±	0.83	2.38	±	3.06	No
	07/17/19	1.20	±	1.90	4.44	±	7.03	No
	07/24/19	-3.09	±	1.90	-11.43	±	7.03	No
	07/31/19	0.25	±	1.71	0.93	±	6.33	No
	08/07/19	-0.01	±	1.02	-0.04	±	3.77	No
	08/14/19	-1.28	±	1.09	-4.74	±	4.03	No
	08/21/19	2.35	±	2.04	8.70	±	7.55	No
	08/28/19	0.30	±	1.02	1.12	±	3.77	No
	09/04/19	1.69	±	1.12	6.25	±	4.14	No
	09/11/19	1.03	±	1.80	3.81	±	6.66	No
	09/18/19	0.10	±	0.94	0.38	±	3.46	No
	09/25/19	-0.38	±	1.84	-1.39	±	6.81	No
MONTEVIEW	07/03/19	-0.20	±	0.76	-0.74	±	2.80	No
	07/10/19	0.64	±	0.83	2.38	±	3.06	No
	07/17/19	1.16	±	1.83	4.29	±	6.77	No
	07/24/19	-3.20	±	1.97	-11.84	±	7.29	No
	07/31/19	0.25	±	1.69	0.92	±	6.25	No
	08/07/19	-0.01	±	0.96	-0.04	±	3.56	No
	08/14/19	-1.17	±	0.99	-4.33	±	3.68	No
	08/21/19	2.19	±	1.90	8.10	±	7.03	No
	08/28/19	0.28	±	0.94	1.03	±	3.47	No
	09/04/19	1.63	±	1.09	6.03	±	4.03	No
	09/11/19	1.01	±	1.77	3.74	±	6.55	No
	09/18/19	0.10	±	0.95	0.38	±	3.50	No
	09/25/19	-0.38	±	1.87	-1.42	±	6.92	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
MUD LAKE	07/03/19	-0.21	±	0.78	-0.76	±	2.89	No
	07/10/19	0.62	±	0.80	2.29	±	2.95	No
	07/17/19	1.20	±	1.89	4.44	±	6.99	No
	07/24/19	-3.16	±	1.95	-11.69	±	7.22	No
	07/31/19	0.26	±	1.78	0.97	±	6.59	No
	08/07/19	-0.01	±	0.94	-0.04	±	3.49	No
	08/14/19	-1.25	±	1.06	-4.63	±	3.92	No
	08/21/19	2.32	±	2.02	8.58	±	7.47	No
	08/28/19	0.32	±	1.06	1.17	±	3.92	No
	09/04/19	1.63	±	1.08	6.03	±	4.00	No
	09/11/19	1.07	±	1.87	3.96	±	6.92	No
	09/18/19	0.10	±	0.94	0.38	±	3.48	No
	09/25/19	-0.37	±	1.81	-1.37	±	6.70	No
DISTANT								
BLACKFOOT	07/03/19	0.88	±	0.92	3.26	±	3.42	No
	07/10/19	-0.90	±	1.71	-3.33	±	6.33	No
	07/17/19	-1.17	±	1.92	-4.33	±	7.10	No
	07/24/19	-0.56	±	2.09	-2.05	±	7.73	No
	07/31/19	-0.65	±	1.01	-2.41	±	3.74	No
	08/07/19	-0.29	±	0.98	-1.08	±	3.61	No
	08/14/19	-1.47	±	1.93	-5.44	±	7.14	No
	08/21/19	-1.25	±	0.97	-4.63	±	3.57	No
	08/28/19	1.50	±	1.91	5.55	±	7.07	No
	09/04/19	0.09	±	0.94	0.34	±	3.47	No
	09/11/19	1.21	±	0.88	4.48	±	3.25	No
	09/18/19	-2.64	±	2.11	-9.77	±	7.81	No
	09/25/19	-0.73	±	0.95	-2.69	±	3.52	No
CRATERS	07/03/19	0.92	±	0.96	3.39	±	3.56	No
	07/10/19	-0.90	±	1.70	-3.32	±	6.29	No
	07/17/19	-1.11	±	1.82	-4.11	±	6.73	No
	07/24/19	-0.49	±	1.85	-1.81	±	6.85	No
	07/31/19	-0.64	±	0.99	-2.35	±	3.66	No
	08/07/19	-0.30	±	1.02	-1.12	±	3.77	No
	08/14/19	-1.47	±	1.93	-5.44	±	7.14	No
	08/21/19	-1.27	±	0.98	-4.70	±	3.63	No
	08/28/19	1.56	±	1.99	5.77	±	7.36	No
	09/04/19	0.10	±	1.01	0.37	±	3.74	No
	09/11/19	1.28	±	0.93	4.74	±	3.44	No
	09/18/19	-2.54	±	2.03	-9.40	±	7.51	No
	09/25/19	-0.76	±	1.00	-2.83	±	3.70	No
DUBOIS	07/03/19	-0.21	±	0.79	-0.77	±	2.93	No
	07/10/19	0.63	±	0.81	2.33	±	3.01	No
	07/17/19	1.31	±	2.07	4.85	±	7.66	No
	07/24/19	-3.39	±	2.09	-12.54	±	7.73	No
	07/31/19	0.27	±	1.82	0.99	±	6.73	No
	08/07/19	-0.01	±	0.93	-0.03	±	3.44	No
	08/14/19	-1.19	±	1.01	-4.40	±	3.74	No
	08/21/19	2.25	±	1.96	8.33	±	7.25	No
	08/28/19	0.29	±	0.99	1.08	±	3.65	No
	09/04/19	1.61	±	1.07	5.96	±	3.96	No
	09/11/19	1.03	±	1.81	3.81	±	6.70	No
	09/18/19	0.10	±	0.90	0.36	±	3.34	No
	09/25/19	-0.38	±	1.86	-1.41	±	6.88	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
IDAHO FALLS	07/03/19	-0.21	±	0.81	-0.78	±	2.99	No
	07/10/19	0.64	±	0.83	2.38	±	3.07	No
	07/17/19	1.21	±	1.91	4.48	±	7.07	No
	07/24/19	-3.26	±	2.01	-12.06	±	7.44	No
	07/31/19	0.26	±	1.78	0.97	±	6.59	No
	08/07/19	-0.01	±	1.00	-0.04	±	3.70	No
	08/14/19	-1.31	±	1.11	-4.85	±	4.11	No
	08/21/19	2.38	±	2.07	8.81	±	7.66	No
	08/28/19	0.33	±	1.09	1.20	±	4.03	No
	09/04/19	1.74	±	1.16	6.44	±	4.29	No
	09/11/19	1.05	±	1.83	3.89	±	6.77	No
	09/18/19	0.10	±	0.94	0.38	±	3.48	No
	09/25/19	-0.38	±	1.84	-1.39	±	6.81	No
JACKSON	07/03/19	0.95	±	0.99	3.50	±	3.67	No
	07/10/19	-0.92	±	1.75	-3.42	±	6.48	No
	07/17/19	-1.32	±	2.17	-4.88	±	8.03	No
	07/24/19	-0.57	±	2.13	-2.09	±	7.88	No
	07/31/19	-0.72	±	1.12	-2.66	±	4.14	No
	08/07/19	-0.35	±	1.16	-1.28	±	4.29	No
	08/14/19	-1.69	±	2.22	-6.25	±	8.21	No
	08/21/19	-1.45	±	1.12	-5.37	±	4.14	No
	08/28/19	1.73	±	2.20	6.40	±	8.14	No
	09/04/19	0.11	±	1.16	0.42	±	4.29	No
	09/11/19	1.49	±	1.08	5.51	±	4.00	No
	09/18/19	-2.66	±	2.12	-9.84	±	7.84	No
	09/25/19	-0.85	±	1.11	-3.15	±	4.11	No
SUGAR CITY	07/03/19	-0.19	±	0.73	-0.71	±	2.70	No
	07/10/19	0.62	±	0.80	2.29	±	2.96	No
	07/17/19	1.14	±	1.80	4.22	±	6.66	No
	07/24/19	-3.12	±	1.92	-11.54	±	7.10	No
	07/31/19	0.27	±	1.80	0.98	±	6.66	No
	08/07/19	-0.01	±	0.96	-0.04	±	3.54	No
	08/14/19	-1.24	±	1.05	-4.59	±	3.89	No
	08/21/19	2.23	±	1.93	8.25	±	7.14	No
	08/28/19	0.29	±	0.99	1.09	±	3.67	No
	09/04/19	1.57	±	1.05	5.81	±	3.89	No
	09/11/19	1.02	±	1.78	3.77	±	6.59	No
	09/18/19	0.10	±	0.93	0.37	±	3.45	No
	09/25/19	-0.37	±	1.82	-1.38	±	6.73	No
INL SITE								
EFS	07/03/19	0.85	±	0.89	3.13	±	3.29	No
	07/10/19	-0.87	±	1.65	-3.22	±	6.11	No
	07/17/19	-1.23	±	2.01	-4.55	±	7.44	No
a	07/24/19		±			±		No
	07/31/19	-0.55	±	0.86	-2.05	±	3.19	No
	08/07/19	-0.29	±	0.98	-1.09	±	3.64	No
	08/14/19	-1.45	±	1.91	-5.37	±	7.07	No
	08/21/19	-1.22	±	0.94	-4.51	±	3.47	No
	08/28/19	1.63	±	2.07	6.03	±	7.66	No
	09/04/19	0.10	±	1.00	0.36	±	3.70	No
	09/11/19	1.30	±	0.94	4.81	±	3.49	No
	09/18/19	-2.56	±	2.04	-9.47	±	7.55	No
	09/25/19	-1.02	±	1.33	-3.77	±	4.92	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
MAIN GATE	07/03/19	0.85	±	0.90	3.16	±	3.32	No
	07/10/19	-0.95	±	1.80	-3.52	±	6.66	No
a	07/17/19		±			±		No
	07/24/19	-0.59	±	2.21	-2.16	±	8.18	No
	07/31/19	-0.64	±	1.00	-2.37	±	3.70	No
	08/07/19	-0.30	±	0.98	-1.09	±	3.64	No
	08/14/19	-1.45	±	1.90	-5.37	±	7.03	No
	08/21/19	-1.19	±	0.92	-4.40	±	3.41	No
	08/28/19	1.49	±	1.90	5.51	±	7.03	No
	09/04/19	0.09	±	0.96	0.35	±	3.53	No
	09/11/19	1.27	±	0.92	4.70	±	3.41	No
	09/18/19	-2.57	±	2.05	-9.51	±	7.59	No
	09/25/19	-0.80	±	1.05	-2.96	±	3.89	No
VAN BUREN GATE	07/03/19	0.87	±	0.91	3.22	±	3.37	No
	07/10/19	-0.85	±	1.62	-3.15	±	5.99	No
a	07/17/19		±			±		No
	07/24/19	-0.50	±	1.87	-1.84	±	6.92	No
	07/31/19	-0.62	±	0.96	-2.29	±	3.56	No
	08/07/19	-0.30	±	1.00	-1.10	±	3.69	No
	08/14/19	-1.44	±	1.90	-5.33	±	7.03	No
	08/21/19	-1.25	±	0.97	-4.63	±	3.57	No
	08/28/19	1.50	±	1.91	5.55	±	7.07	No
	09/04/19	0.10	±	1.00	0.36	±	3.70	No
	09/11/19	1.24	±	0.90	4.59	±	3.34	No
	09/18/19	-2.55	±	2.03	-9.44	±	7.51	No
	09/25/19	-0.77	±	1.00	-2.83	±	3.70	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	09/30/19	AMERICIUM-241	1.90	±	1.05	7.03	±	3.89	No
		CESIUM-137	-241.00	±	91.40	-891.70	±	338.18	No
		PLUTONIUM-238	0.12	±	0.65	0.44	±	2.42	No
		PLUTONIUM-239/240	1.41	±	1.09	5.22	±	4.03	No
ATOMIC CITY	09/30/19	CESIUM-137	65.90	±	106.00	243.83	±	392.20	No
		STRONTIUM-90	-6.07	±	8.34	0.00	±	0.00	No
QA-1 (ATOMIC CITY)	09/30/19	CESIUM-137	-84.80	±	101.00	-313.76	±	373.70	No
		STRONTIUM-90	-5.33	±	9.01	-19.72	±	33.34	No
BLUE DOME	09/30/19	AMERICIUM-241	2.04	±	1.00	7.55	±	3.70	No
		CESIUM-137	34.00	±	74.60	125.80	±	276.02	No
		PLUTONIUM-238	3.13	±	0.90	11.58	±	3.34	**Yes**
		PLUTONIUM-239/240	1.24	±	0.87	4.59	±	3.21	No
QA-2 (BLUE DOME)	09/30/19	AMERICIUM-241	2.78	±	0.84	10.29	±	3.12	**Yes**
		CESIUM-137	-82.60	±	78.50	-305.62	±	290.45	No
		PLUTONIUM-238	1.01	±	0.54	3.74	±	2.01	No
		PLUTONIUM-239/240	2.61	±	0.79	9.35	±	2.91	**Yes**
FAA TOWER	09/30/19	CESIUM-137	89.50	±	82.80	331.15	±	306.36	No
		STRONTIUM-90	8.96	±	7.82	33.15	±	28.93	No
HOWE	09/30/19	CESIUM-137	-84.40	±	102.00	-312.28	±	377.40	No
MONTEVIEW	09/30/19	AMERICIUM-241	3.23	±	0.99	11.95	±	3.65	**Yes**
		CESIUM-137	64.60	±	97.70	239.02	±	361.49	No
		PLUTONIUM-238	2.42	±	0.85	8.95	±	3.15	No
		PLUTONIUM-239/240	3.72	±	1.00	13.76	±	3.70	**Yes**
MUD LAKE	09/30/19	CESIUM-137	99.00	±	81.50	366.30	±	301.55	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	09/30/19	CESIUM-137	-109.00	±	103.00	-403.30	±	381.10	No
CRATERS	09/30/19	CESIUM-137	-88.10	±	83.10	-325.97	±	307.47	No
		STRONTIUM-90	-10.30	±	7.58	-38.11	±	28.05	No
DUBOIS	09/30/19	CESIUM-137	-44.20	±	75.80	-163.54	±	280.46	No
IDAHO FALLS	09/30/19	CESIUM-137	-185.00	±	106.00	-684.50	±	392.20	No
JACKSON	09/30/19	AMERICIUM-241	3.38	±	1.40	12.51	±	5.18	No
		CESIUM-137	-108.00	±	89.60	-399.60	±	331.52	No
		PLUTONIUM-238	1.30	±	0.94	4.81	±	3.46	No
		PLUTONIUM-239/240	1.81	±	0.86	6.70	±	3.18	No
SUGAR CITY	09/30/19	AMERICIUM-241	2.13	±	0.90	7.88	±	3.34	No
		CESIUM-137	-135.00	±	102.00	-499.50	±	377.40	No
		PLUTONIUM-238	0.80	±	0.80	2.95	±	2.97	No
		PLUTONIUM-239/240	2.14	±	0.85	7.92	±	3.14	No
INL SITE									
EFS	09/30/19	CESIUM-137	-132.00	±	113.00	-488.40	±	418.10	No
		STRONTIUM-90	17.60	±	7.03	65.12	±	26.01	No
MAIN GATE	09/30/19	CESIUM-137	-231.00	±	119.00	-854.70	±	440.30	No
		STRONTIUM-90	-112.00	±	9.31	-414.40	±	34.45	No
VAN BUREN GATE	09/30/19	CESIUM-137	-17.40	±	101.00	-64.38	±	373.70	No
		STRONTIUM-90	-2.03	±	6.20	-7.51	±	22.94	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	06/19/19	07/10/19	9.40	±	1.68	34.78	±	6.22	**Yes**
ATOMIC CITY	07/10/19	07/31/19	6.19	±	1.76	22.90	±	6.51	**Yes**
HOWE	06/12/19	07/03/19	6.43	±	1.72	23.79	±	6.36	**Yes**
HOWE	07/03/19	07/17/19	10.00	±	2.13	37.00	±	7.88	**Yes**
DISTANT									
IDAHO FALLS	06/26/19	07/10/19	7.11	±	2.01	26.31	±	7.44	**Yes**
IDAHO FALLS	07/10/19	07/24/19	8.42	±	2.00	31.15	±	7.40	**Yes**
INL SITE									
EFS	06/19/19	07/10/19	10.80	±	1.36	39.96	±	5.03	**Yes**
EFS	07/10/19	07/31/19	14.70	±	1.77	54.39	±	6.55	**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	07/10/19	07/17/19	87.30	±	25.60	3.23	±	0.95	**Yes**
ATOMIC CITY	09/04/19	09/11/19	76.10	±	24.00	2.82	±	0.89	**Yes**
HOWE	07/10/19	07/17/19	35.10	±	24.20	1.30	±	0.90	No
DISTANT									
IDAHO FALLS	06/30/19	07/31/19	127.00	±	24.50	4.70	±	0.91	**Yes**
IDAHO FALLS	07/31/19	08/31/19	67.20	±	24.30	2.49	±	0.90	No
IDAHO FALLS	08/31/19	09/30/19	25.70	±	23.30	0.95	±	0.86	No
INL SITE									
EFS	09/04/19	09/11/19	146.00	±	24.10	5.40	±	0.89	**Yes**
EFS	09/18/19	09/25/19	136.00	±	24.80	5.03	±	0.92	**Yes**

Table C-6. Weekly and Monthly Iodine-131 and Cesium-137 Concentrations in Milk

		Iodine-131							Cesium-137						
Location	Sampling Date	Result ± 1s Uncertainty (pCi†/L)			Result ± 1s Uncertainty (Bq‡/L)			Result > 3s	Result ± 1s Uncertainty (pCi/L)			Result ± 1s Uncertainty (Bq/L)			Result > 3s
BLACKFOOT	07/08/19	0.11	±	2.32	0.00	±	0.09	No	-2.16	±	1.97	-0.08	±	0.07	No
	08/05/19	-1.72	±	2.34	-0.06	±	0.09	No	-3.03	±	1.98	-0.11	±	0.07	No
CONTROL	07/02/19	-3.79	±	2.41	-0.14	±	0.09	No	-2.57	±	1.91	-0.10	±	0.07	No
	08/06/19	1.82	±	1.41	0.07	±	0.05	No	-0.08	±	0.99	0.00	±	0.04	No
	09/03/19	-1.78	±	1.40	-0.07	±	0.05	No	1.09	±	1.04	0.04	±	0.04	No
DIETRICH	07/02/19	1.39	±	2.13	0.05	±	0.08	No	-0.41	±	1.82	-0.02	±	0.07	No
	08/06/19	2.02	±	2.03	0.07	±	0.08	No	0.88	±	1.51	0.03	±	0.06	No
	09/03/19	-0.65	±	0.92	-0.02	±	0.03	No	-0.89	±	0.86	-0.03	±	0.03	No
HOWE	07/02/19	3.25	±	1.78	0.12	±	0.07	No	0.58	±	1.33	0.02	±	0.05	No
	08/06/19	1.15	±	1.03	0.04	±	0.04	No	-0.07	±	0.84	0.00	±	0.03	No
	09/03/19	-0.71	±	1.29	-0.03	±	0.05	No	0.64	±	1.00	0.02	±	0.04	No
IDAHO FALLS	07/02/19	-1.03	±	0.84	-0.04	±	0.03	No	2.38	±	0.91	0.09	±	0.03	No
	07/09/19	0.82	±	0.88	0.03	±	0.03	No	0.18	±	0.86	0.01	±	0.03	No
	07/16/19	-1.17	±	1.65	-0.04	±	0.06	No	-1.18	±	1.52	-0.04	±	0.06	No
	07/23/19	0.65	±	1.59	0.02	±	0.06	No	-1.74	±	1.51	-0.06	±	0.06	No
	07/30/19	1.61	±	1.60	0.06	±	0.06	No	0.77	±	1.48	0.03	±	0.05	No
	08/06/19	0.95	±	0.89	0.04	±	0.03	No	1.12	±	0.86	0.04	±	0.03	No
DUPLICATE	08/06/19	-1.59	±	1.34	-0.06	±	0.05	No	1.04	±	0.96	0.04	±	0.04	No
	08/13/19	-0.99	±	1.56	-0.04	±	0.06	No	-1.49	±	1.52	-0.06	±	0.06	No
	08/20/19	2.59	±	1.60	0.10	±	0.06	No	0.90	±	1.41	0.03	±	0.05	No
	08/27/19	0.69	±	2.31	0.03	±	0.09	No	-5.80	±	2.06	-0.21	±	0.08	No
	09/04/19	1.51	±	1.48	0.06	±	0.05	No	2.02	±	1.42	0.07	±	0.05	No
	09/10/19	1.51	±	1.51	0.06	±	0.06	No	-0.87	±	1.45	-0.03	±	0.05	No
	09/17/19	2.28	±	1.67	0.08	±	0.06	No	-0.85	±	1.42	-0.03	±	0.05	No
	09/24/19	-0.18	±	1.65	-0.01	±	0.06	No	-0.85	±	1.50	-0.03	±	0.06	No
MINIDOKA	07/02/19	-0.31	±	0.91	-0.01	±	0.03	No	2.38	±	0.95	0.09	±	0.04	No
	08/06/19	1.17	±	2.36	0.04	±	0.09	No	0.16	±	1.85	0.01	±	0.07	No
	09/03/19	-1.06	±	1.74	-0.04	±	0.06	No	0.26	±	1.39	0.01	±	0.05	No
TERRETON	07/02/19	3.07	±	1.56	0.11	±	0.06	No	-2.90	±	1.57	-0.11	±	0.06	No
	07/10/19	0.63	±	1.07	0.02	±	0.04	No	0.17	±	0.96	0.01	±	0.04	No
	07/17/19	0.83	±	1.07	0.03	±	0.04	No	0.49	±	1.02	0.02	±	0.04	No
	07/24/19	-0.85	±	1.09	-0.03	±	0.04	No	-0.12	±	0.96	0.00	±	0.04	No
	07/31/19	1.57	±	2.01	0.06	±	0.07	No	1.13	±	1.88	0.04	±	0.07	No
	08/06/19	0.61	±	1.15	0.02	±	0.04	No	-0.60	±	0.97	-0.02	±	0.04	No
	08/14/19	0.94	±	1.09	0.03	±	0.04	No	2.22	±	1.06	0.08	±	0.04	No
	08/21/19	-0.14	±	1.05	-0.01	±	0.04	No	1.36	±	1.01	0.05	±	0.04	No
	08/28/19	-0.41	±	1.08	-0.02	±	0.04	No	-0.97	±	1.03	-0.04	±	0.04	No
	09/03/19	0.89	±	1.17	0.03	±	0.04	No	-1.24	±	1.02	-0.05	±	0.04	No
	09/11/19	1.29	±	1.11	0.05	±	0.04	No	-0.31	±	0.98	-0.01	±	0.04	No
	09/19/19	-1.80	±	1.87	-0.07	±	0.07	No	1.78	±	1.93	0.07	±	0.07	No
	09/25/19	0.66	±	1.11	0.02	±	0.04	No	1.36	±	1.04	0.05	±	0.04	No

Tabel C-7. Cesium-137 and Strontium-90 Concentrations in Lettuce

		Cesium-137						
		Result ± 1s Uncertainty			Result ± 1s Uncertainty			
Location	Sampling Date	pCi/kg			(x 10^{-2} Bq/kg)			Result > 3s
ATOMIC CITY	07/17/19	-51.30	±	119.00	-190.00	±	440.74	No
BLACKFOOT	07/20/19	159.00	±	118.00	588.89	±	437.04	No
CONTROL	07/22/19	-8.95	±	99.40	-33.15	±	368.15	No
EFS	07/17/19	-11.10	±	115.00	-41.11	±	425.93	No
FAA TOWER	07/17/19	-195.00	±	115.00	-722.22	±	425.93	No
HOWE	07/10/19	13.50	±	99.60	50.00	±	368.89	No
IDAHO FALLS	07/17/19	-18.00	±	65.00	-66.67	±	240.74	No
MONTEVIEW	07/10/19	82.80	±	113.00	306.67	±	418.52	No
TYHEE	07/20/19	-10.40	±	82.70	-38.52	±	306.30	No
TYHEE (DUPLICATE)	07/20/19	-5.58	±	95.50	-20.67	±	353.70	No
		Strontium-90						
		Result ± 1s Uncertainty			Result ± 1s Uncertainty			
		pCi/kg			(x 10^{-2} Bq/kg)			Result > 3s
ATOMIC CITY	07/17/19	27.20	±	18.80	100.74	±	69.63	No
BLACKFOOT	07/20/19	15.60	±	18.40	57.78	±	68.15	No
CONTROL	07/22/19	-26.00	±	10.70	-96.30	±	39.63	No
EFS	07/17/19	44.60	±	19.70	165.19	±	72.96	No
FAA TOWER	07/17/19	-20.00	±	12.10	-74.07	±	44.81	No
HOWE	07/10/19	41.10	±	20.30	152.22	±	75.19	No
IDAHO FALLS	07/17/19	-5.14	±	17.40	-19.04	±	64.44	No
MONTEVIEW	07/10/19	12.00	±	17.90	44.44	±	66.30	No
TYHEE	07/20/19	32.00	±	11.60	118.52	±	42.96	No
TYHEE (DUPLICATE)	07/20/19	20.50	±	11.50	75.93	±	42.59	No

Table C-8. Cesium-137 and Strontium-90 Concentrations in Grain

		Cesium-137						
		Result ± 1s Uncertainty			Result ± 1s Uncertainty			
Location	Sampling Date	pCi/kg			Bq/kg			Result > 3s
AMERICAN FALLS	09/03/19	1.58	±	1.22	0.06	±	0.05	No
ARCO	10/02/19	0.58	±	1.54	0.02	±	0.06	No
BLACKFOOT	08/14/19	1.23	±	1.39	0.05	±	0.05	No
CONTROL	09/10/19	-0.50	±	1.72	-0.02	±	0.06	No
HOWE	09/04/19	-2.83	±	1.66	-0.10	±	0.06	No
HOWE(DUPLICATE)	09/04/19	-3.01	±	1.61	-0.11	±	0.06	No
IDAHO FALLS	09/03/19	1.16	±	1.81	0.04	±	0.07	No
KIMAMA	09/03/19	-0.32	±	1.25	-0.01	±	0.05	No
MONTEVIEW	09/03/19	0.88	±	1.88	0.03	±	0.07	No
ROBERTS	09/03/19	-0.21	±	1.34	-0.01	±	0.05	No
RUPERT	09/03/19	0.55	±	1.91	0.02	±	0.07	No
TERRETON	09/03/19	1.47	±	1.29	0.05	±	0.05	No
		Strontium-90						
		Result ± 1s Uncertainty			Result ± 1s Uncertainty			
		pCi/kg			Bq/kg			Result > 3s
AMERICAN FALLS	9/3/2019	-22.10	±	17.20	-0.82	±	0.64	No
ARCO	10/2/2019	10.70	±	18.30	0.40	±	0.68	No
BLACKFOOT	8/14/2019	33.20	±	19.60	1.23	±	0.73	No
CONTROL	9/10/2019	-3.64	±	16.00	-0.13	±	0.59	No
HOWE	9/4/2019	-5.21	±	17.00	-0.19	±	0.63	No
HOWE(DUPLICATE)	9/4/2019	-18.30	±	17.20	-0.68	±	0.64	No
IDAHO FALLS	9/3/2019	-36.40	±	12.70	-1.35	±	0.47	No
KIMAMA	9/3/2019	-9.80	±	16.90	-0.36	±	0.63	No
MONTEVIEW	9/3/2019	-16.20	±	16.00	-0.60	±	0.59	No
ROBERTS	9/3/2019	-20.10	±	16.00	-0.74	±	0.59	No
RUPERT	9/3/2019	-8.98	±	17.00	-0.33	±	0.63	No
TERRETON	9/3/2019	45.80	±	19.80	1.70	±	0.73	No

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 Alpha					
Quarter	Valid N	Sum of ranks	Mean rank	H[a]	*p*[b]
Boundary	90	9100.500	101.1167		
Distant	78	7969.500	102.1731	0.2311905	0.8908
INL Site	36	3840.000	106.6667		
July	Valid N	Sum of ranks	Mean rank	H	*p*
Boundary	35	1326.000	37.88571		
Distant	30	1188.000	39.60000	0.1818874	0.9131
INL Site	12	489.000	40.75000		
August	Valid N	Sum of ranks	Mean rank	H	*p*
Boundary	27	871.5000	32.27778		
Distant	24	681.0000	28.37500	2.514209	0.2845
INL Site	12	463.5000	38.62500		
September	Valid N	Sum of ranks	Mean rank	H	*p*
Boundary	28	899.0000	32.10714		
Distant	24	811.0000	33.79167	0.2241756	0.8940
INL Site	12	370.0000	30.83333		
Gross Beta					
Quarter	Valid N	Sum of ranks	Mean rank	H	*p*
Boundary	90	9156.000	101.7333		
Distant	78	7770.500	99.6218	0.8873796	0.6417
INL Site	36	3983.500	110.6528		
July	Valid N	Sum of ranks	Mean rank	H	*p*
Boundary	35	1319.500	37.70000		
Distant	30	1135.500	37.85000	1.263552	0.5316
INL Site	12	548.000	45.66667		
August	Valid N	Sum of ranks	Mean rank	H	*p*
Boundary	27	882.5000	32.68519		
Distant	24	762.0000	31.75000	0.0809777	0.9603
INL Site	12	371.5000	30.95833		
September	Valid N	Sum of ranks	Mean rank	H	*p*
Boundary	28	893.5000	31.91071		
Distant	24	744.5000	31.02083	0.8297860	0.6604
INL Site	12	442.0000	36.83333		

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 alpha results between locations during the third 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 (3rd-Qtr-19-LVf in 3rd-Qtr-19-LVf)
Independent (grouping) variable: GeographicName
Kruskal-Wallis test: H (15, N= 204) =27.34436 p =.0261
Include condition: v8="Gross alpha"

Depend.: coded result	**Arco R:87.208**	Atomic City R:112.88	Blackfoot R:96.462	Blue Dome R:95.462	Craters of the Moon R:62.154	Dubois R:101.69	EFS R:127.63	FAA Tower R:76.615	Howe R:134.12	Idaho Falls R:155.27	Jackson WY R:104.65	Main Gate R:92.583	Monteview R:105.12	Mud Lake R:95.346	Sugar City R:92.808	Van Buren R:99.792
Arco		1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.477249	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	0.671871	1.000000	0.226168	0.006943	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	0.671871	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	0.081802	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000
Howe	1.000000	1.000000	1.000000	1.000000	0.226168	1.000000	1.000000	1.000000		1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000
Idaho Falls	0.477249	1.000000	1.000000	1.000000	0.006943	1.000000	1.000000	0.081802	1.000000		1.000000	0.958685	1.000000	1.000000	0.838246	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	0.958685	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	0.838246	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	

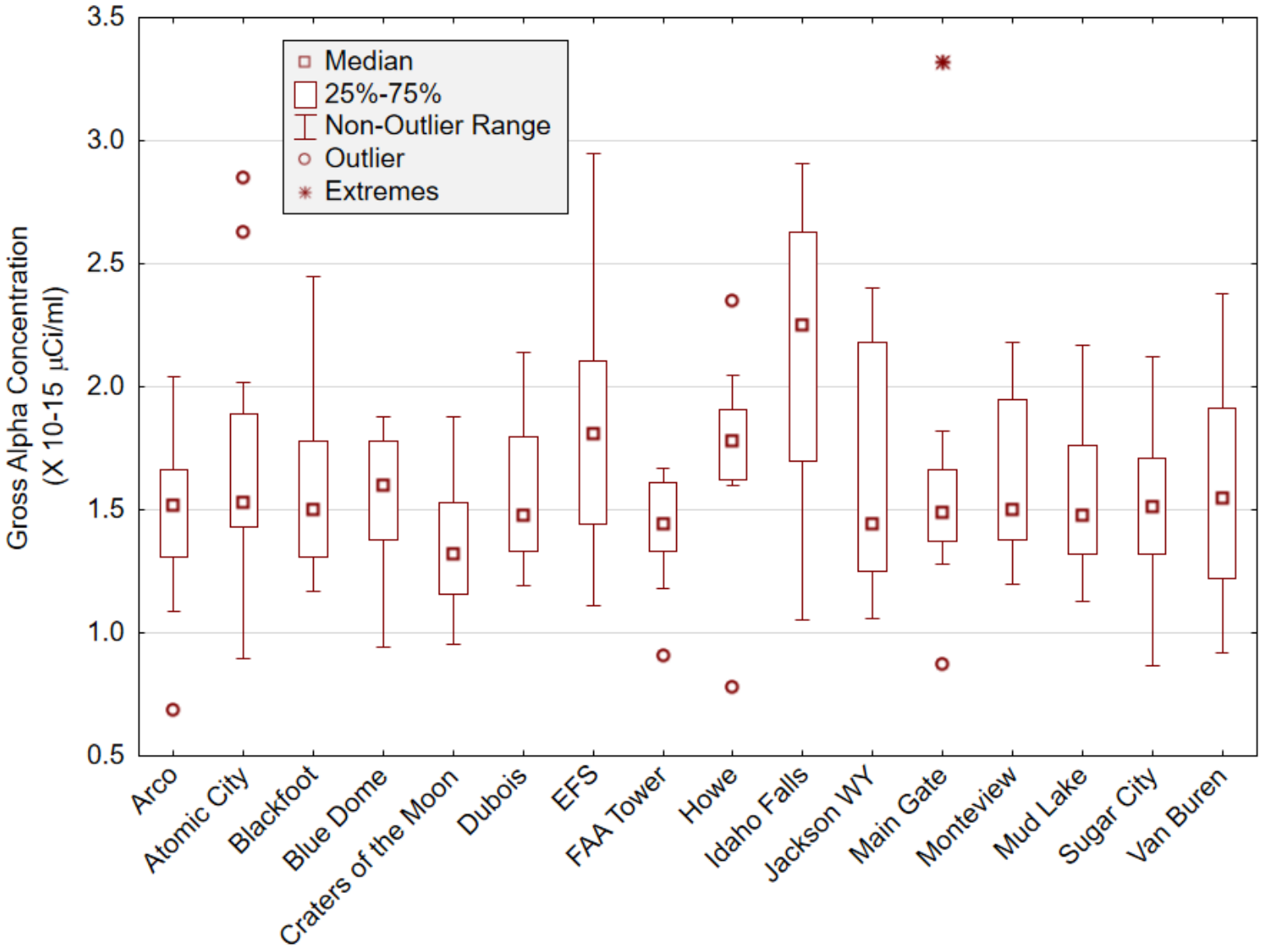

Figure D-1. Third quarter gross alpha concentrations in air at all sampling locations. Number of samples (N) = 13 at each location.

Table D-3. Results of multiple comparisons of gross beta results between locations during the third 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 (3rd-Qtr-19-LVf in 3rd-Qtr-19-LVf)
Independent (grouping) variable: GeographicName
Kruskal-Wallis test: H (15, N= 204) =15.77927 p =.3969
Include condition: v8="Gross beta"

Depend.: coded result	Arco R:92.042	Atomic City R:122.27	Blackfoot R:94.115	Blue Dome R:118.62	Craters of the Moon R:97.308	Dubois R:91.115	EFS R:75.000	FAA Tower R:109.27	Howe R:92.846	Idaho Falls R:112.81	Jackson WY R:117.58	Main Gate R:126.58	Monteview R:80.962	Mud Lake R:95.385	Sugar City R:84.808	**Van Buren R:130.38**
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	