VFS-ID-ESER-SURV-060

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 2018

April 2019

Contributors:
Marilyn Case, Racquel Clark, Russell Mitchell

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

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

Executive Summary

Some human-made radionuclides were detected in samples collected during the third quarter of 2018. None of the radionuclides detected in samples collected during the first quarter of 2018 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 2018 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, 2018. All sample types (media) and the sampling schedule followed during 2018 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
- Potatoes
- Grain
- Big game animals
- Soil

Table ES-1. Summary of Results for the Third Quarter of 2018.

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-241, ^{238}Pu and $^{239/240}$Pu, human-made alpha-emitting radionuclides, were not detected in any composited air sample. 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	Eleven of fifteen 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 six samples were collected during the third quarter. Three 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 nine samples (including a duplicate) collected this year. Strontium-90 was found in one of the samples analyzed. The value was within the range of measurements made in previous years.
Potatoes	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 eleven samples (including a duplicate) collected this year.

Large game animals	Tissue	Gamma-emitting radionuclides	No human-made gamma-emitting radionuclides were found in the muscle tissues or thyroid of an elk sampled in the third quarter.
Soil	Soil	Gamma-emitting radionuclides, strontium-90, actinides (americium and plutonium)	Cesium-137 was detected in all thirteen samples (including a duplicate) but has shown a decreasing trend over time consistent with its 30-year half-life. Strontium-90 was detected in one sample above 3σ and in three samples above 2σ. Although ^{90}Sr has approximately the same half-life as ^{137}Cs, it has decreased at a greater rate, possibly reflecting greater mobility in the environment. Plutonium-239/240 was detected in six samples and persists in the environment due to long half-lives. Plutonium-238 was detected in only one sample. Americium-241 was detected in two samples. The concentration appears to be increasing since the late 1970's as a result of the ingrowth from decay of ^{241}Pu.

List of Abbreviations

AEC	Atomic Energy Commission
BLR	Big Lost River
CFA	Central Facilities Area
DCS	Derived Concentration Standard
DOE	Department of Energy
DOE – ID	Department of Energy Idaho Operations Office
EAL	Environmental Assessment Laboratory
EFS	Experimental Field Station
EPA	Environmental Protection Agency
ERAMS	Environmental Radiation Ambient Monitoring System
ESER	Environmental Surveillance, Education, and Research
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 a number of 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 2018, environmental monitoring within the INL Site boundaries was primarily the responsibility of the INL and Idaho Cleanup Project (ICP) contractors.

At the beginning of the first quarter of 2018, ESER Program responsibilities were assumed by Veolia Nuclear Solutions-Federal Services (VNSFS), in conjunction with team members Idaho State University and Oak Ridge Associated Universities (ORAU). ORAU ceased operations in April 2018 and was replaced in May by GEL Laboratories.

This report contains monitoring results from the ESER Program for samples collected during the third quarter of 2018 (July 1- September 30, 2018).

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 through the use of 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 at least six 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 13 locations around the INL Site biennially
- environmental dosimeters from 17 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 have an effect on 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 laboratory 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 (i.e., the a posteriori measurement) 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 identify a potentially false positive result. 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). 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 particular 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.

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.

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

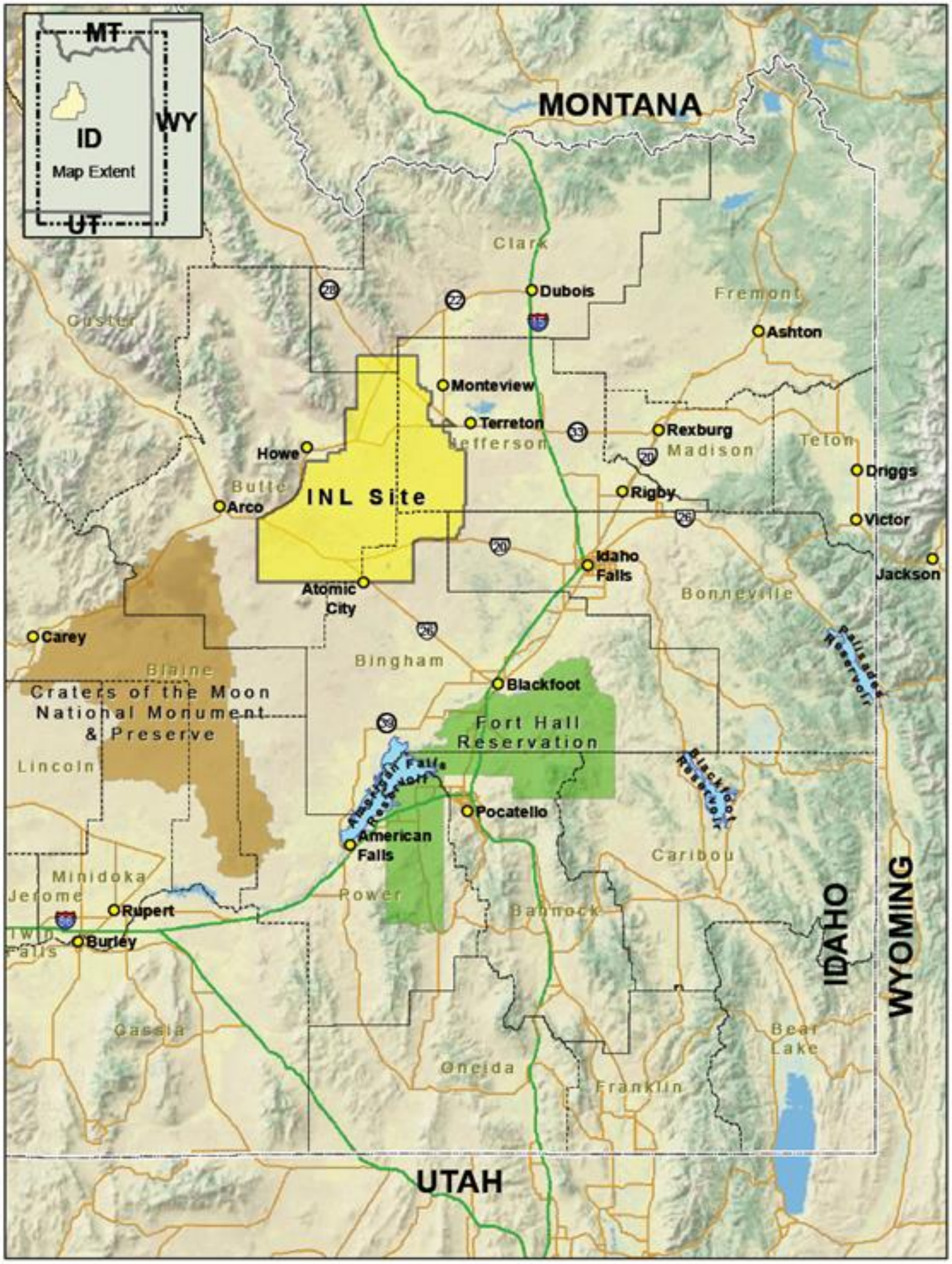

Figure 1. Location of the Idaho National Laboratory Site.

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 2018 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.

3.1 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 2018 (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 19,998 ft^3 (566 m^3) of air was sampled at each location, each week, at an average flow rate of 1.98 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.

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. Gross alpha data were tested for normality prior to statistical analyses, and generally showed no consistent discernible distribution. The data are graphically shown in Figures 3 through 6. Box and whiskers plots were used to present the non-parametric data. As shown in the figures all data were below were well below the DCS for $^{239/240}$Pu, the most conservative value for a human-made alpha-emitting radionuclide that might be detected at the INL Site. Nothing unusual was noted in the gross alpha data and all were well within measurements taken within the last ten years (2008-2017).

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.

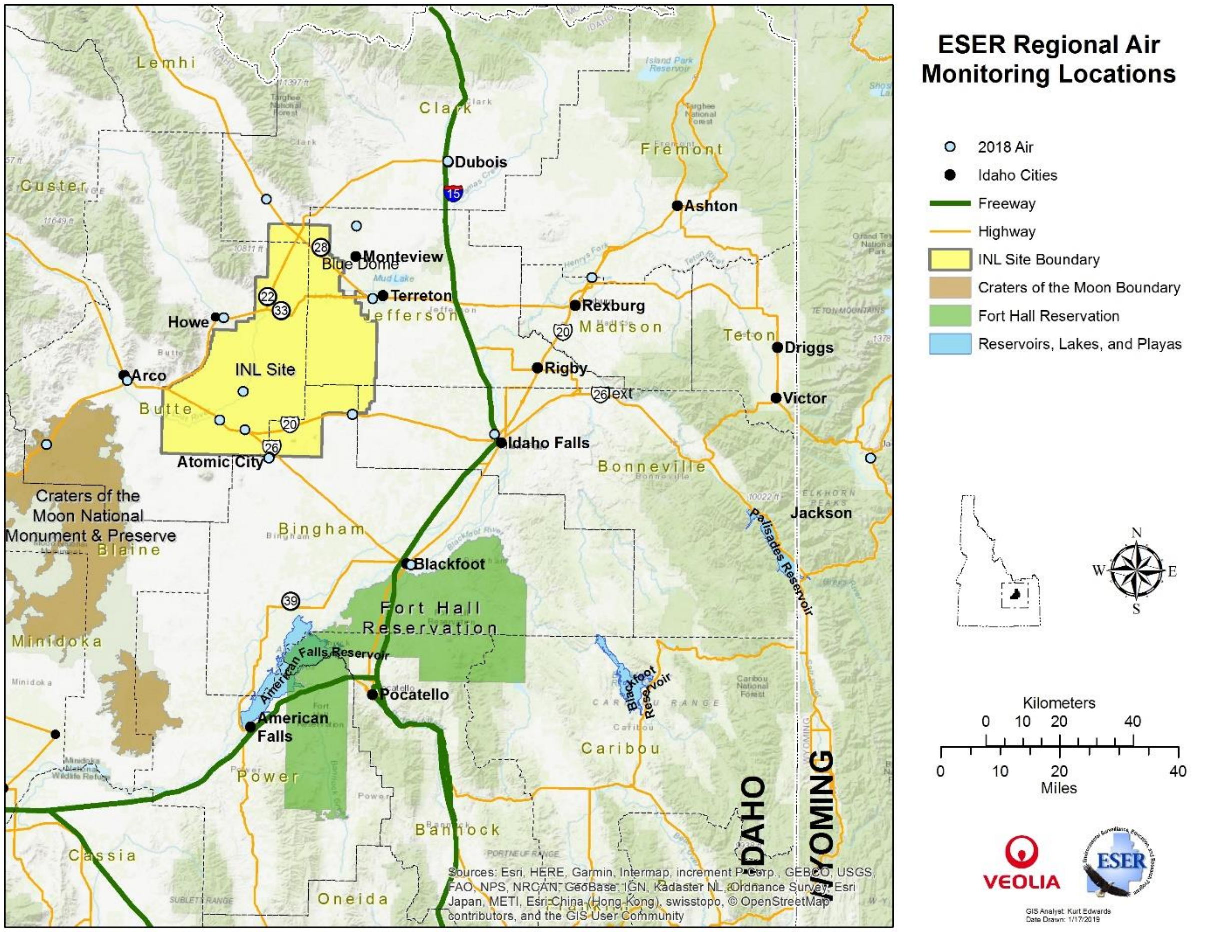

Figure 2. ESER air monitoring locations.

Because there is no discernible distribution of the data, the nonparametric Kruskal-Wallis test of multiple independent groups was used to test if there are statistical differences between INL Site, Boundary, and Distant locations. The use of nonparametric tests, such as Kruskal-Wallis, gives less weight to outlier and extreme values thus allowing a more appropriate comparison of data groups. A statistically significant difference exists between groups if the p-value is less than 0.05. Values greater than 0.05 translate into a 95 percent confidence that the groups are statistically the same. The p-value for each comparison is shown in Table D-1. The results show that there were no differences between location groups during the third quarter and during the months of July, August and September.

Gross beta results are presented in Table C-1 and displayed in Figures 7 through 10. The data are 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 was no statistically significant difference in the data between groups for the quarter as a whole using the Kruskal-Wallis analysis of variance by ranks test (Table D-1). There were also no statistical differences between location groups during any month of the quarter.

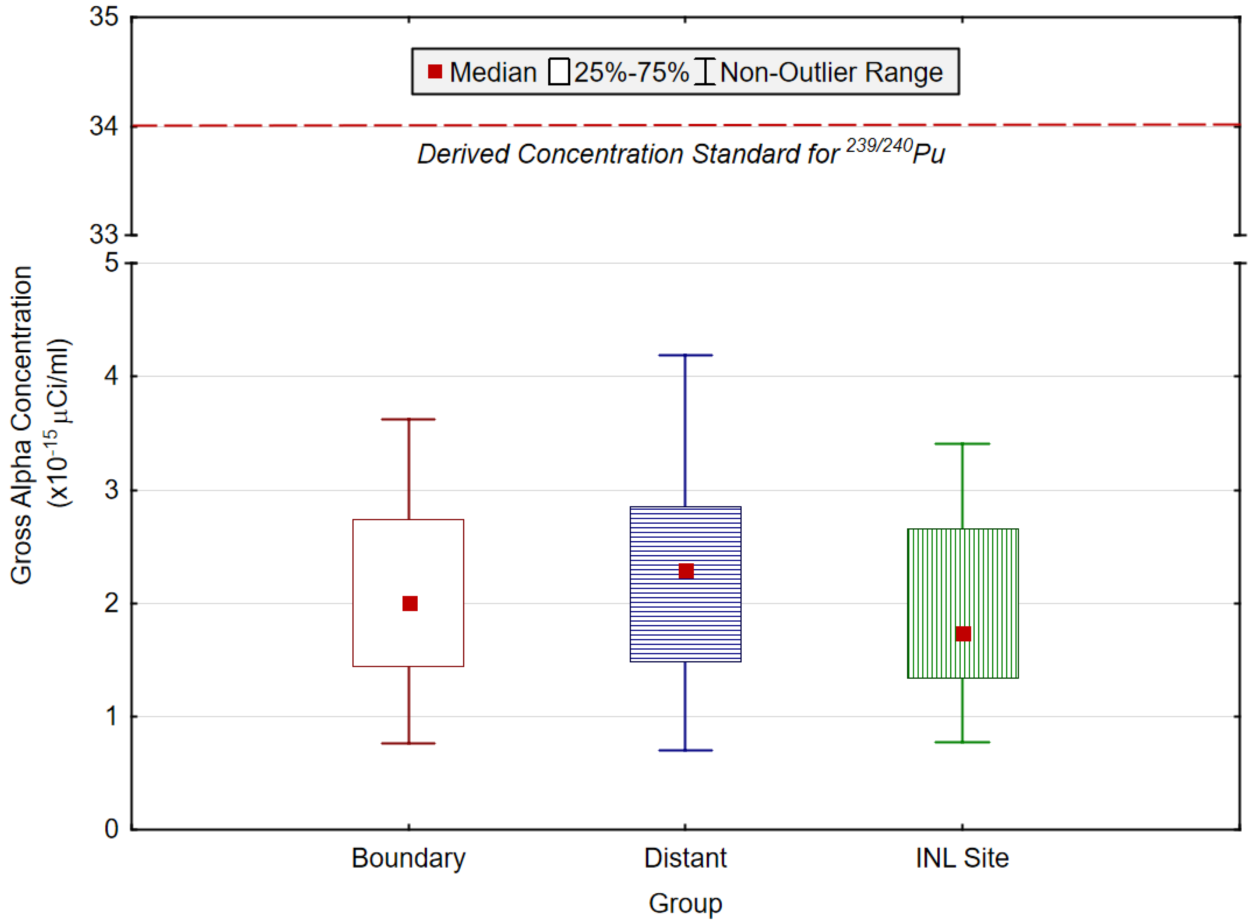

Figure 3. Gross alpha concentrations in air at ESER INL Site, Boundary, and Distant locations for the third quarter of 2018. The DOE Derived Concentration Standard (DCS) is the concentration of plutonium-239 ($^{239/240}Pu$) in air which, if inhaled for a year, would result in a dose of 100 mrem/yr. 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.

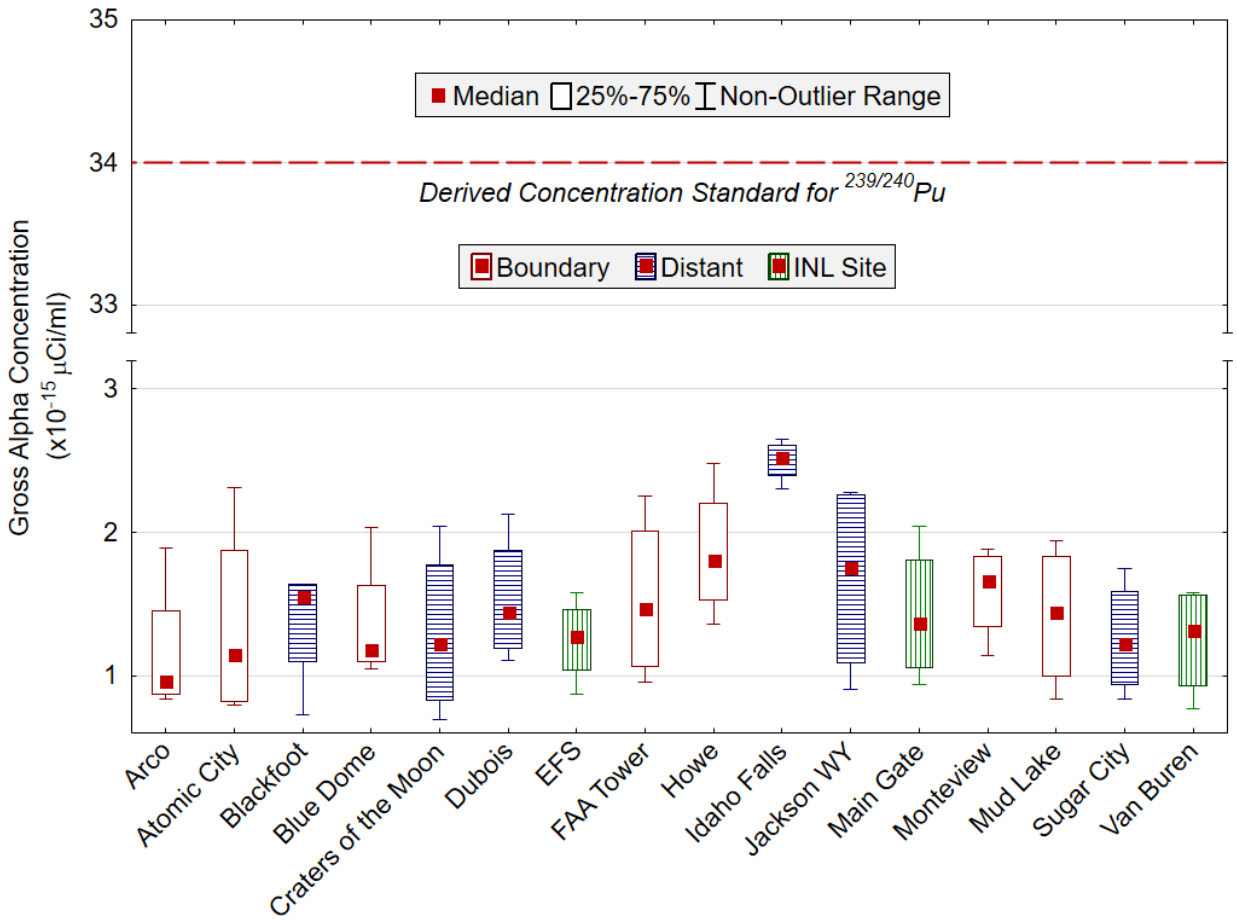

Figure 4. July gross alpha concentrations in air at ESER INL Site, Boundary, and Distant locations. Number of samples (N) = 4 at each location. The Derived Concentration Standard (DCS) is the concentration of plutonium-239/240 ($^{239/240}Pu$) in air which, if inhaled for a year, would result in a dose 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.

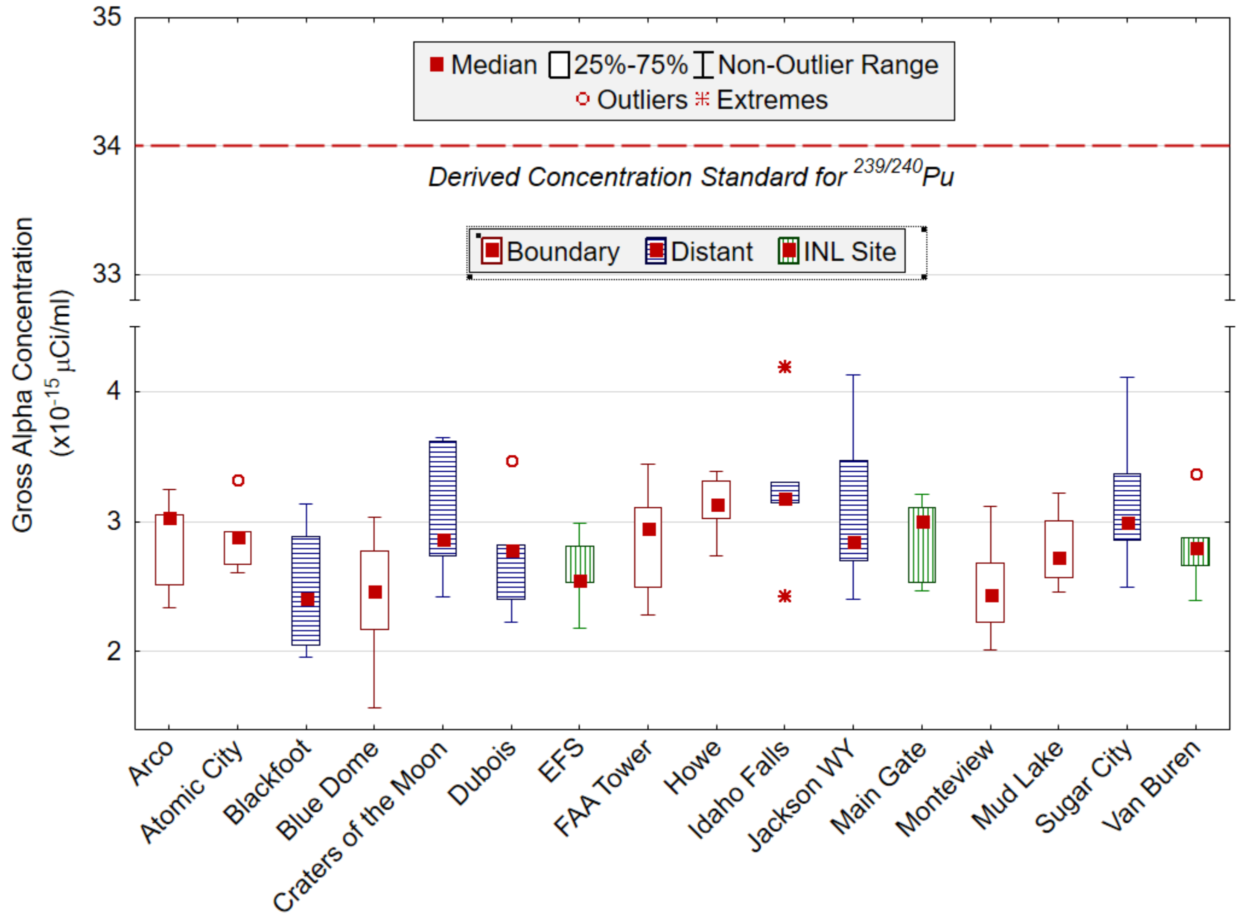

Figure 5. August gross alpha concentrations in air at ESER INL Site, Boundary, and Distant locations. Number of samples (N) = 5 at each location. The Derived Concentration Standard (DCS) is the concentration of plutonium-239/240 ($^{239/240}Pu$) in air which, if inhaled for a year, would result in a 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.

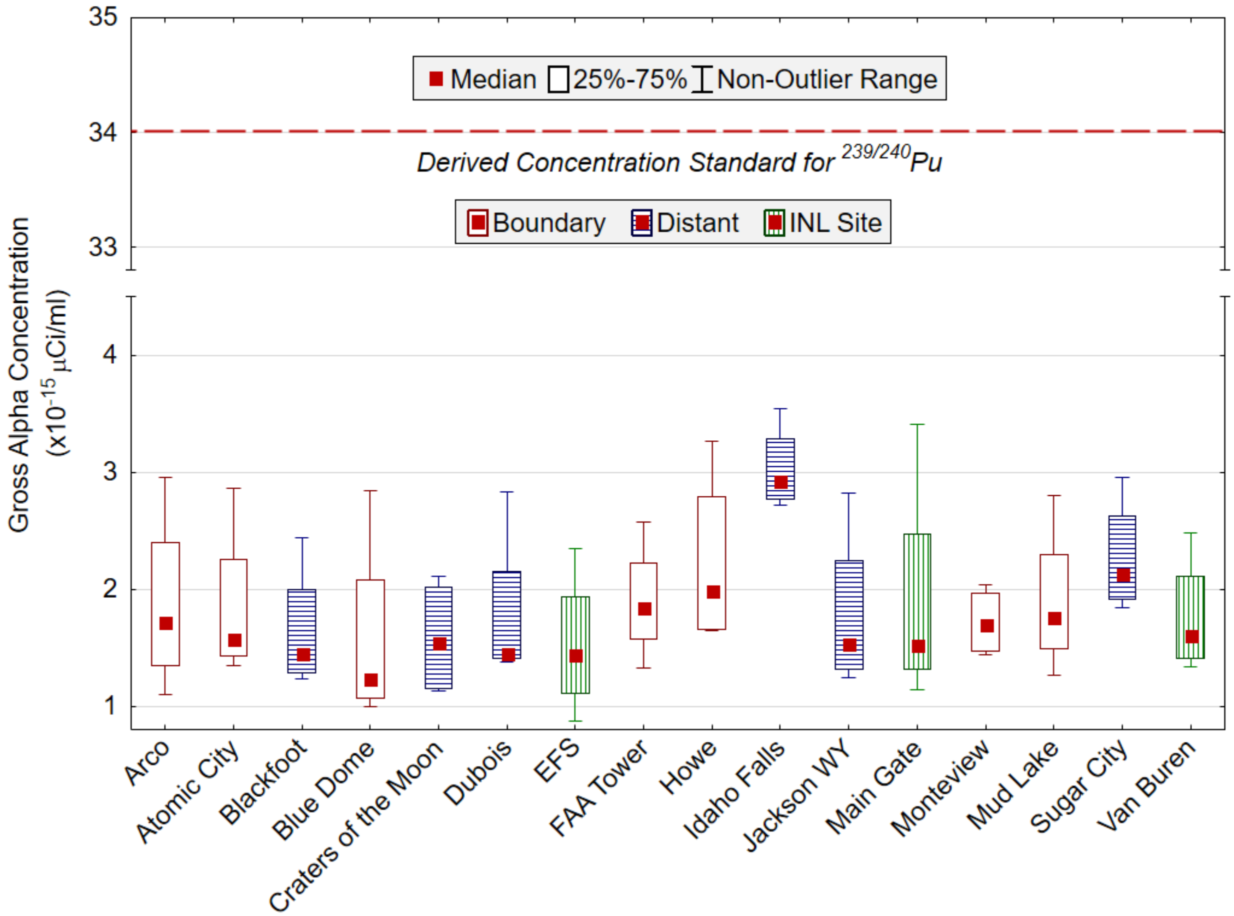

Figure 6. September gross alpha concentrations in air at ESER INL Site, Boundary, and Distant locations. Number of samples (N) = 4 at each location (except for Monteview and Van Buren, n=3). The Derived Concentration Standard (DCS) is the concentration of plutonium-239/240 ($^{239/240}Pu$) in air which, 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.

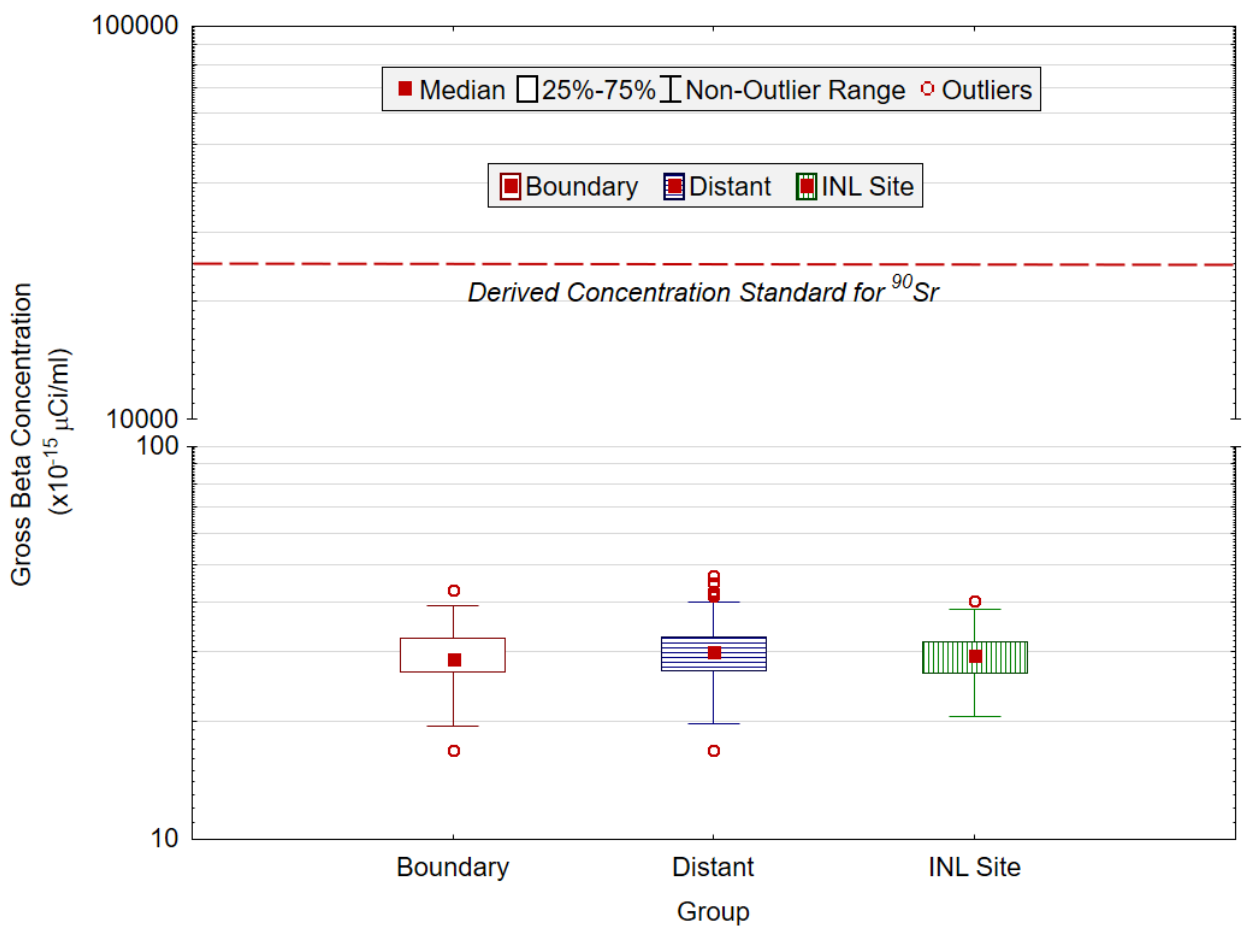

Figure 7. Gross beta concentrations in air at ESER INL Site, Boundary, and Distant locations for the third quarter of 2018. The Derived Concentration Standard (DCS) is the concentration of strontium-90 (^{90}Sr) in air which, if inhaled for a year, would result in a dose of 100 mrem/yr. Because the measurements 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.

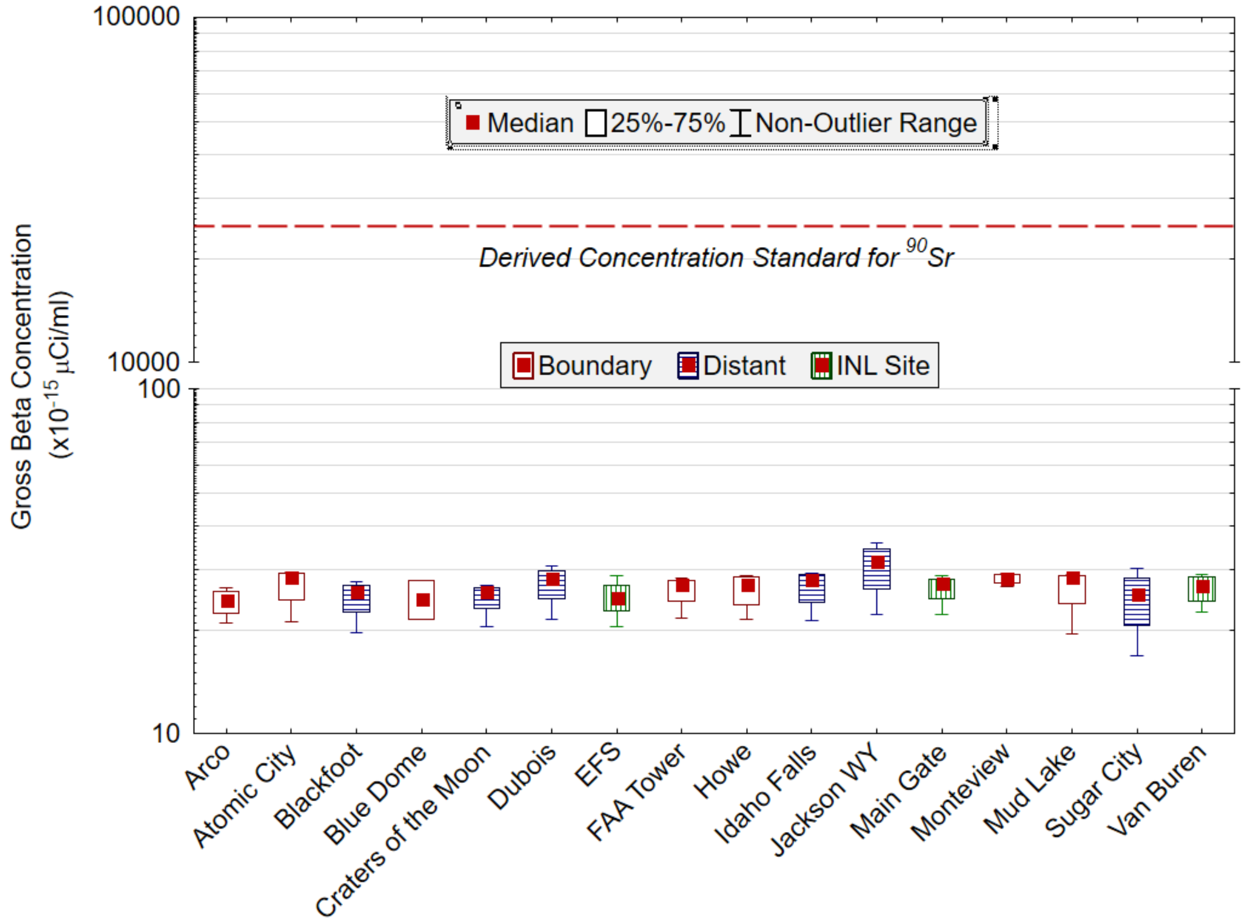

Figure 8. July gross beta concentrations in air at ESER INL Site, Boundary, and Distant locations. The Derived Concentration Standard (DCS) is the concentration of strontium-90 (^{90}Sr) in air which, if inhaled for a year, would result in a dose of 100 mrem/yr. Because the measurements include naturally 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.

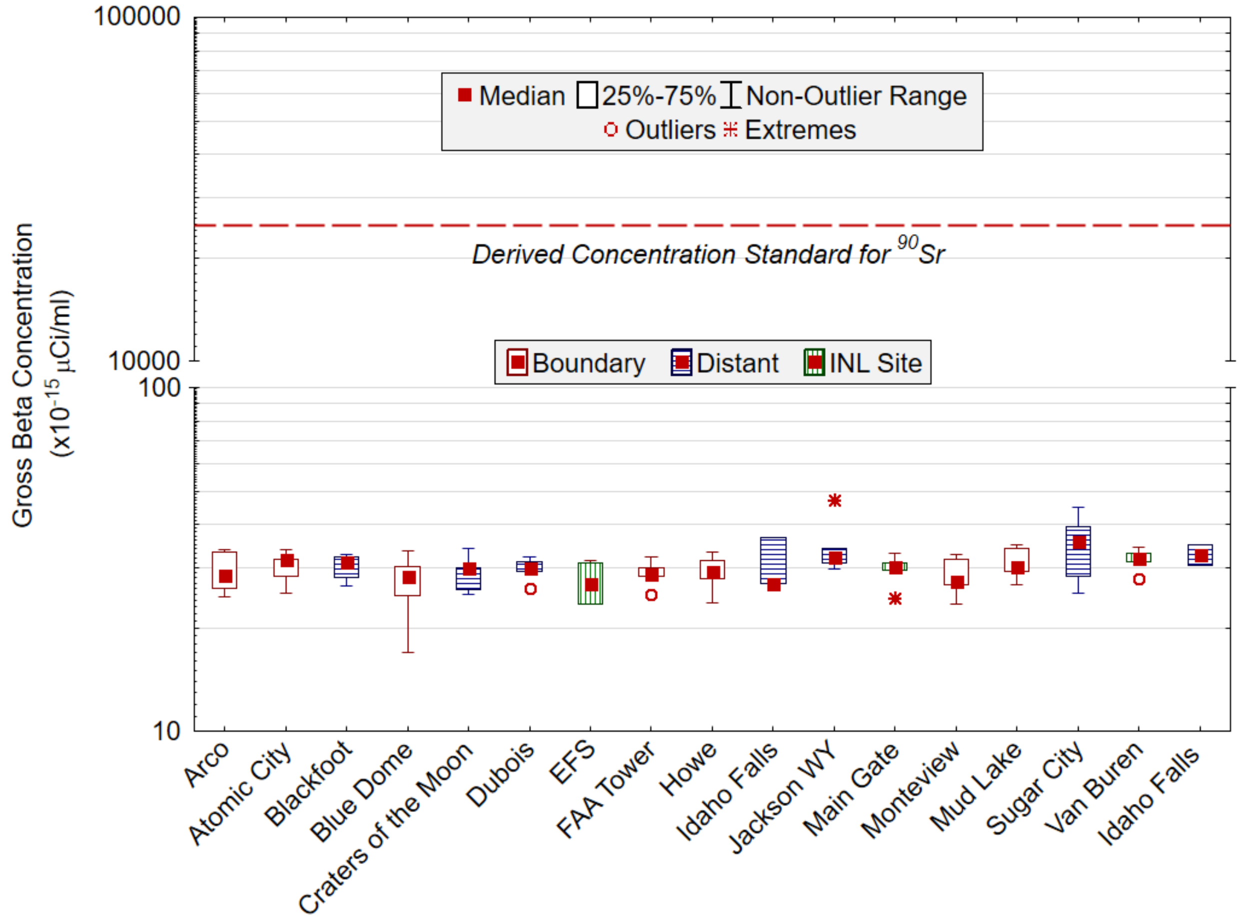

Figure 9. August gross beta concentrations in air at ESER INL Site, Boundary, and Distant locations. The Derived Concentration Standard (DCS) is the concentration of strontium-90 (^{90}Sr) in air which, if inhaled for a year, would result in a dose of 100 mrem/yr. Because the measurements include naturally 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.

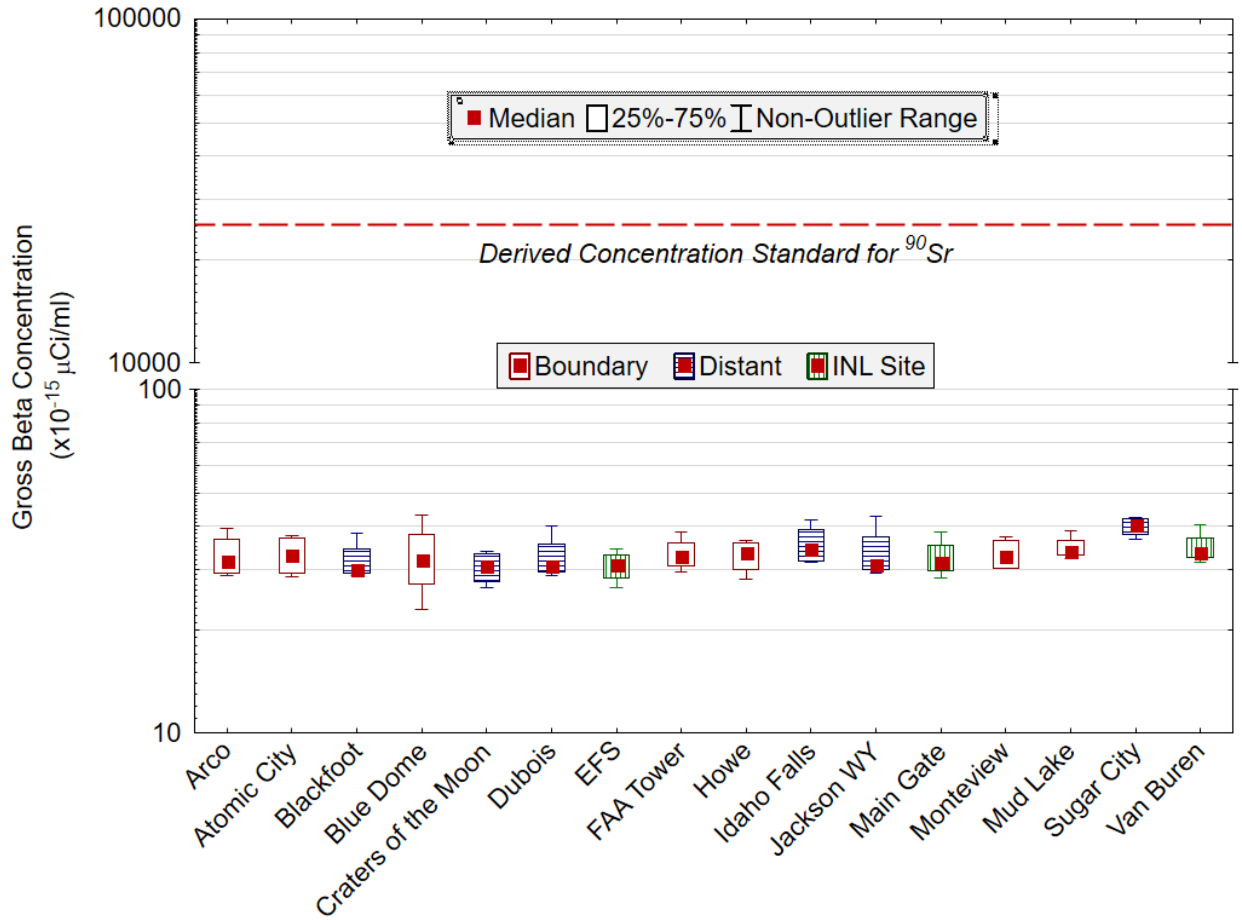

Figure 10. September gross beta concentrations in air at ESER INL Site, Boundary, and Distant locations. The Derived Concentration Standard (DCS) is the concentration of strontium-90 (^{90}Sr) in air which, if inhaled for a year, would result in a dose of 100 mrem/yr. Because the measurements include 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.

Iodine-131 was not detected in any of the 26 sets of charcoal cartridges measured during the third quarter. Weekly ^{131}I results for each location are listed in Table C-2 of Appendix C.

The results of analyses of quarterly composited filters are presented in Table C-3 of Appendix C. No ^{137}Cs or other human-made gamma-emitting radionuclides were found in quarterly composited filters. Srontium-90, a beta-emitting radionuclide, was not detected in any composite sample. Plutonium-238 and -239/240, alpha-emitting radionuclides, were also not detected in any composite sample.

3.2 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 fifteen atmospheric moisture samples collected at the INL Site, Boundary, and Distant locations during the third quarter of 2018 (Figure 11). Eleven of the results exceeded the 3s uncertainty level for tritium, with similar results to those reported during the past ten years (2008-2017). Results also remain similar between the four sampling locations. All samples were significantly below the DOE DCS for tritium in air of 1.4 x 10^{-8} µCi/mL_{air} with a maximum reported value of 17.5 x 10^{-13} µCi/mL_{air} at EFS. Results are shown in Table C-4, Appendix C.

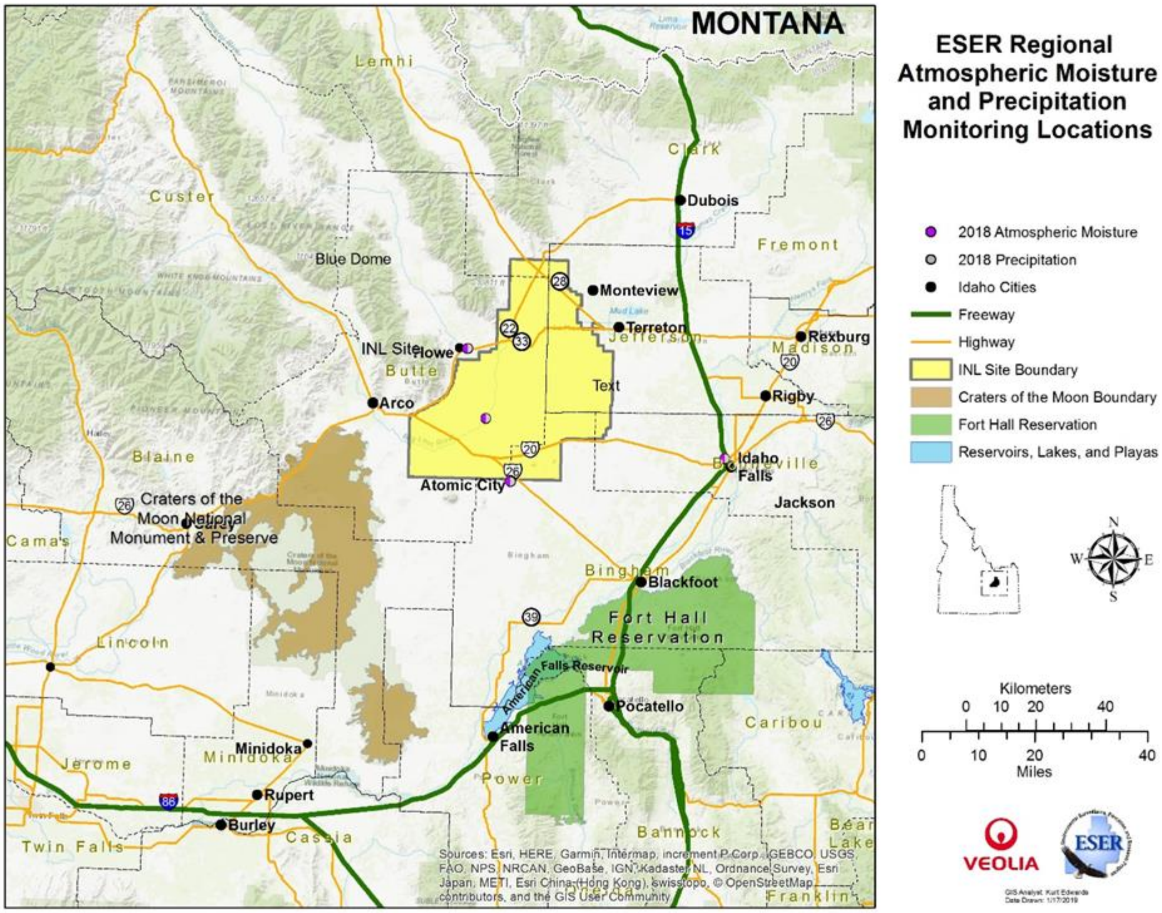

Figure 11. Moisture and precipitation monitoring locations.

4. Precipitation and Water Sampling

4.1 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 2018 produced sufficient amounts of precipitation to yield six samples.

Tritium was measured above the 3s values in three of the six 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 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 (EPA 2018). Most samples have values up to about 150 pCi/L, with occasional values ranging up to about 300-400 pCi/L. The maximum value in the third quarter was 221 pCi/L in an Idaho Falls sample collected on July 31.

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, potato, grain, wildlife, and soil samples available during the third quarter of 2018.

5.1 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 2018. 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 second 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.

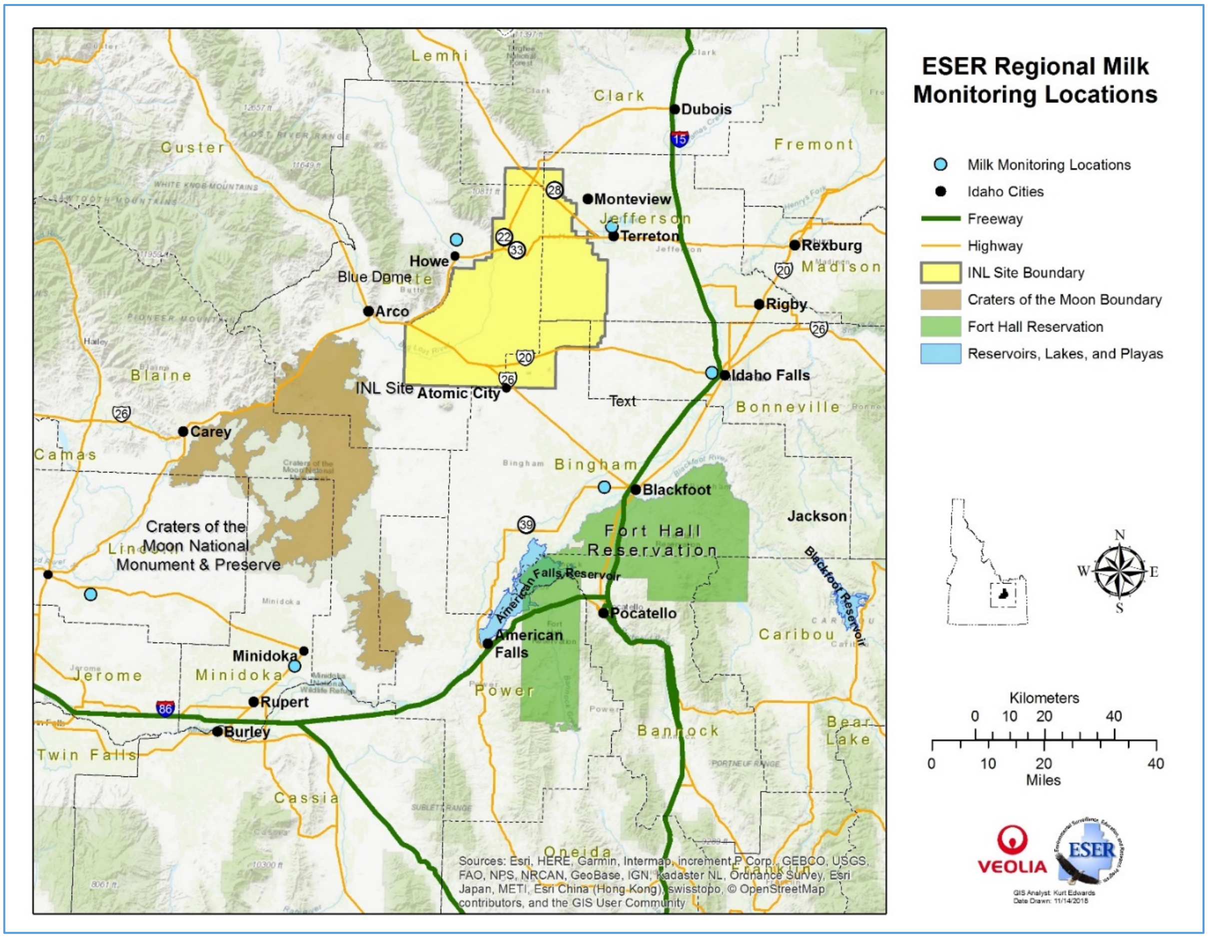

Figure 12. ESER milk monitoring locations.

5.2 Lettuce Sampling

Lettuce sampling was completed during the third quarter. A total of nine samples were collected, including a commercially-available sample from a grocery store and a duplicate sample at Idaho Falls (Figure 13). Seven lettuce samples were collected from portable planters at Atomic City, EFS, the Federal Aviation Administration (FAA) Tower, Howe, Idaho Falls (including a duplicate), 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.

No human-made gamma-emitting radionuclides were found in any of the samples. Strontium-90 was detected in one sample from EFS. Strontium-90 is present in the environment as a residual of fallout from aboveground nuclear weapons testing, which occurred between 1945 and 1980. This is the likely source for the measured result. Data for ^{137}Cs and ^{90}Sr in all lettuce samples taken during the third quarter are listed in Appendix C, Table C-7. During the summer of 2020, a review of Table C-7 determined the activity concentration values reported for the media were correct, however, the unit of concentration listed in the column headings were incorrect. Prior to 2010, concentrations were reported in either pCi/g or pCi/kg. In 2010, the concentration unit of pCi/kg was adopted for reporting radionuclide concentrations in soil and biota (vegetation and animals). The reasons for doing this include: 1) the use of one unit (pCi/kg) ensures consistency and comparability in reporting concentrations in various media, 2) the use of one unit (pCi/kg) minimizes mistakes (due to confusion about units) in data entry into the database, and 3) the unit of pCi/kg was selected because it is the unit associated with models that are used for dose calculations and the results tend to be whole numbers (e.g. 14 pCi/kg versus 0.014 pCi/g). The column headings have been updated to the correct units of concentration (pCi/kg and Bq/kg).

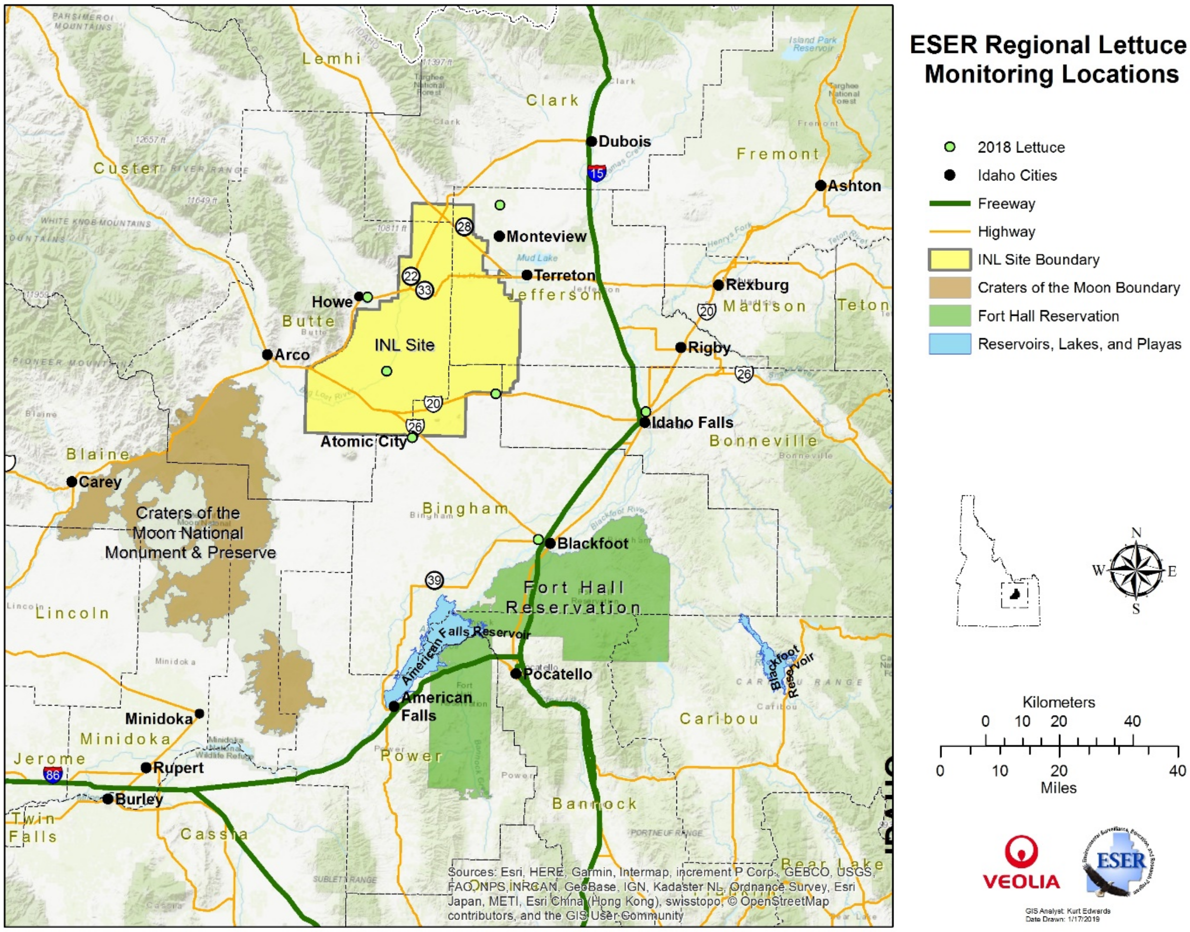

Figure 13. ESER lettuce monitoring locations.

5.3 Potato Sampling

Locally-grown potatoes from seven southeast Idaho locations (Figure 14) and one duplicate from Fort Hall were analyzed for gamma-emitting radionuclides like ^{137}Cs and for ^{90}Sr. A control sample from a local grocery store (grown in Washington state) was also analyzed. No human-made gamma-emitters were found in any sample. Strontium-90 was not reported in any sample. Data for potato samples are listed in Appendix C, Table C-8. During the summer of 2020, a review of Table C-8 determined the activity concentration values reported for the media were correct, however, the unit of concentration listed in the column headings were incorrect. Prior to 2010, concentrations were reported in either pCi/g or pCi/kg. In 2010, the concentration unit of pCi/kg was adopted for reporting radionuclide concentrations in soil and biota (vegetation and animals). The reasons for adopting the unit of concentration are discussed in Section 5.2 Lettuce Sampling. The column headings have been updated to the correct units of concentration (pCi/kg and Bq/kg).

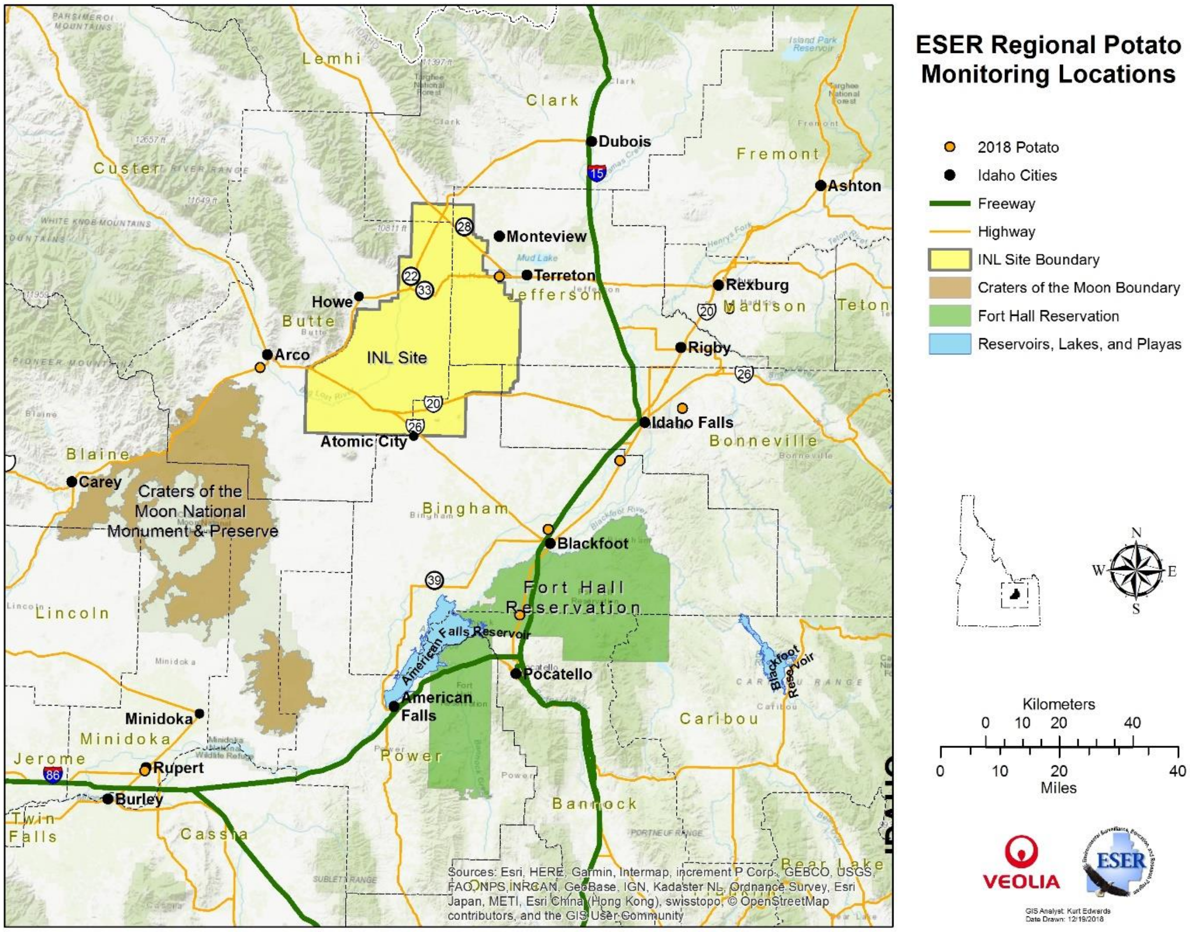

Figure 14. ESER potato monitoring locations.

5.4 Grain Sampling

Grain sampling (wheat and barley) was completed during the third quarter of 2018. A total of 10 grain samples (including one duplicate from Rupert) were collected from local grain growers (Figure 15). 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 11 grain samples collected in 2018 contained a detectable concentration of ^{90}Sr. Data for ^{137}Cs and ^{90}Sr in all grain samples taken during the third quarter are listed in Appendix C, Table C-9.

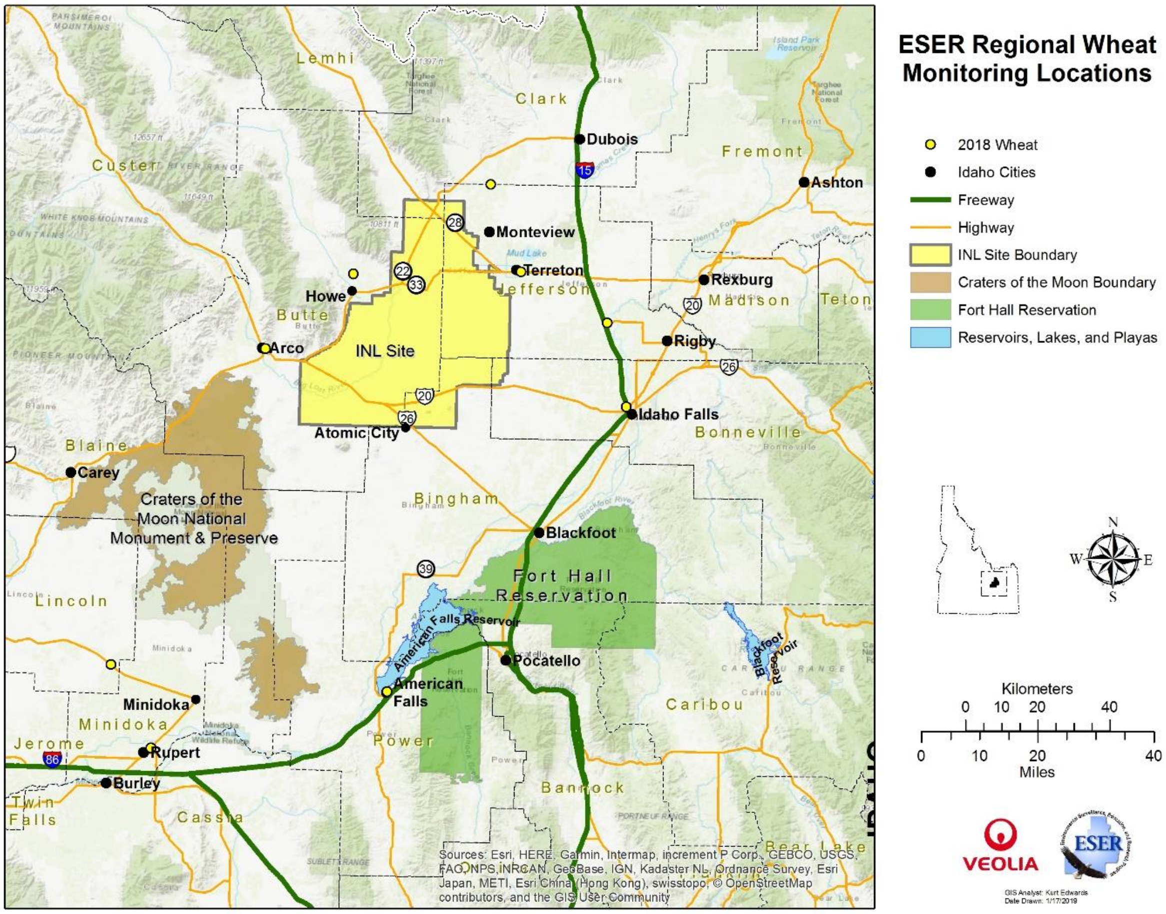

Figure 15. ESER grain monitoring locations.

5.5 Large Game Animal Sampling

Muscle and thyroid tissue were collected from an elk killed by a car. Liver tissue was also collected from two of the three game animals. No manmade gamma-emitting radionuclides were detected (Appendix C, Table C-10).

5.6 Soil Sampling

Soil samples were collected at twelve boundary and distant locations in the third quarter (Figure 16). Undisturbed locations sampled historically and representing areas of maximum potential airborne deposition as well as population centers and unaffected regions were selected for this purpose. All surface (0-5 cm) samples, including one duplicate sample collected at Atomic City, were analyzed for gamma-emitting radionuclides, ^{241}Am, ^{238}Pu, $^{239/240}$Pu, and ^{90}Sr. Results can be found in Appendix C, Table C-11. In addition, all subsurface (5-10 cm) samples were analyzed for gamma-emitting radionuclides.

Cesium-137 was detected in all soil samples (Figure 17) at concentrations consistent with historical measurements and is most likely present from fallout from past atmospheric nuclear weapons testing, which were carried out mainly in the 1960s. The majority of ^{137}Cs is present in surface soils at an average ratio of 2.5:1 (surface soil concentration to subsurface soil concentration). Analysis of the geometric mean of areal concentrations of ^{137}Cs in surface soil over time indicate that concentrations are decreasing at a rate consistent with the approximate 30-year half-life of this radionuclide (Figure 18).

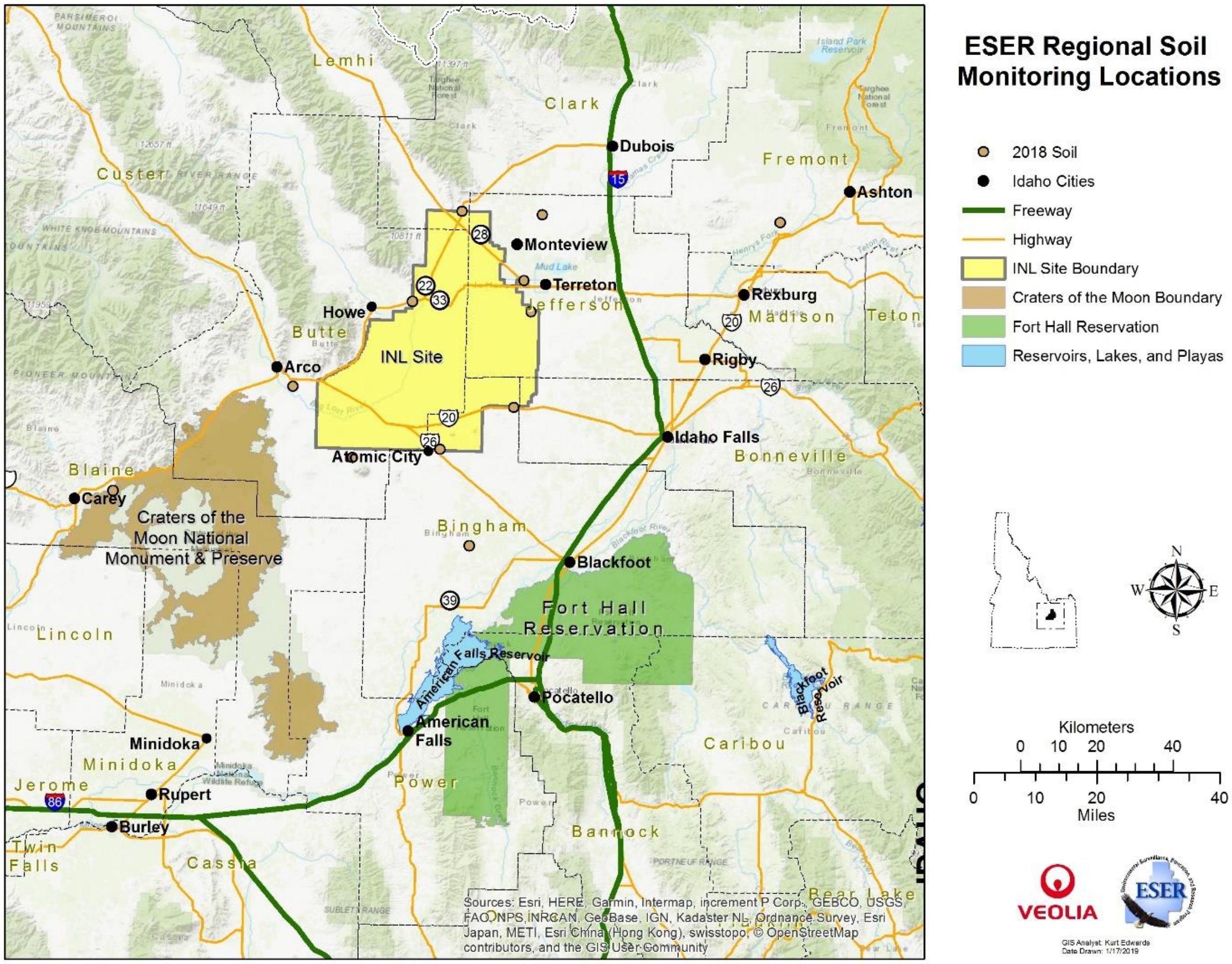

Figure 16. ESER soil monitoring locations.

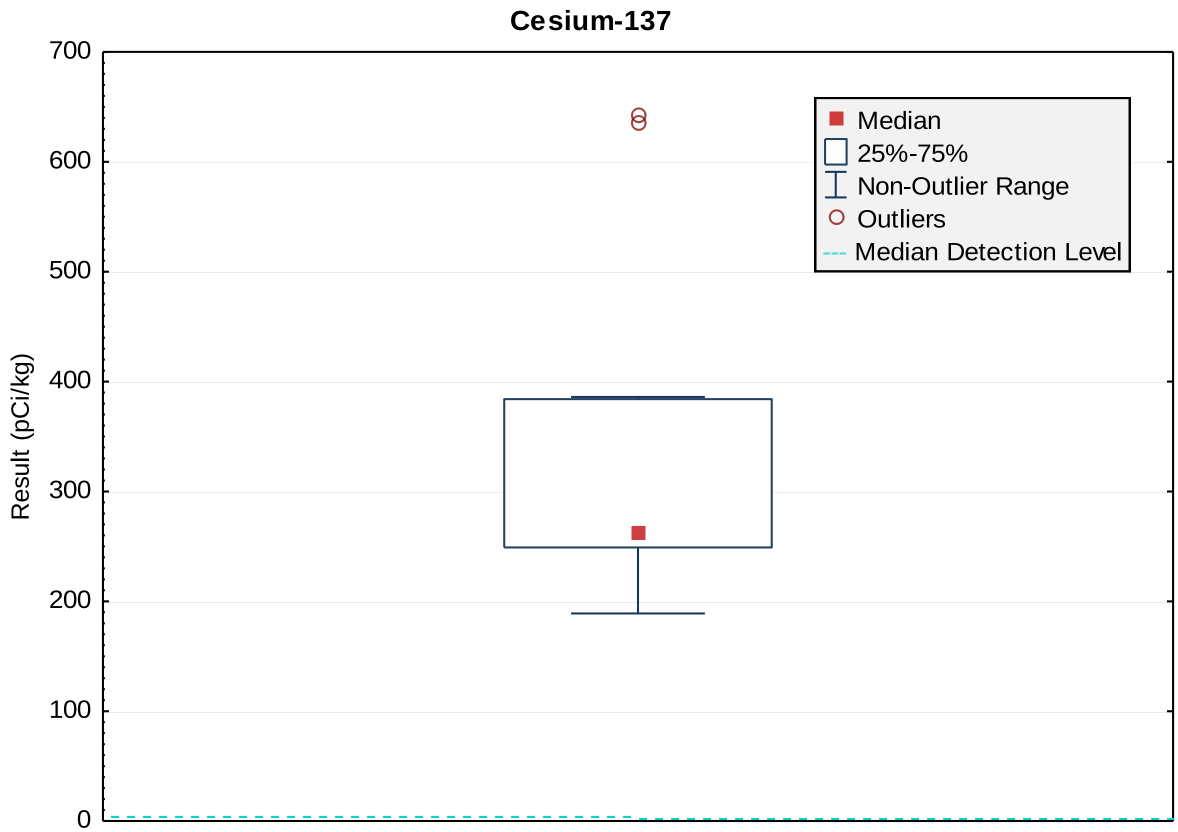

Figure 17. Cesium-137 concentrations in surface soil (0-5 cm). Number of samples = 13 (including duplicate sample.)

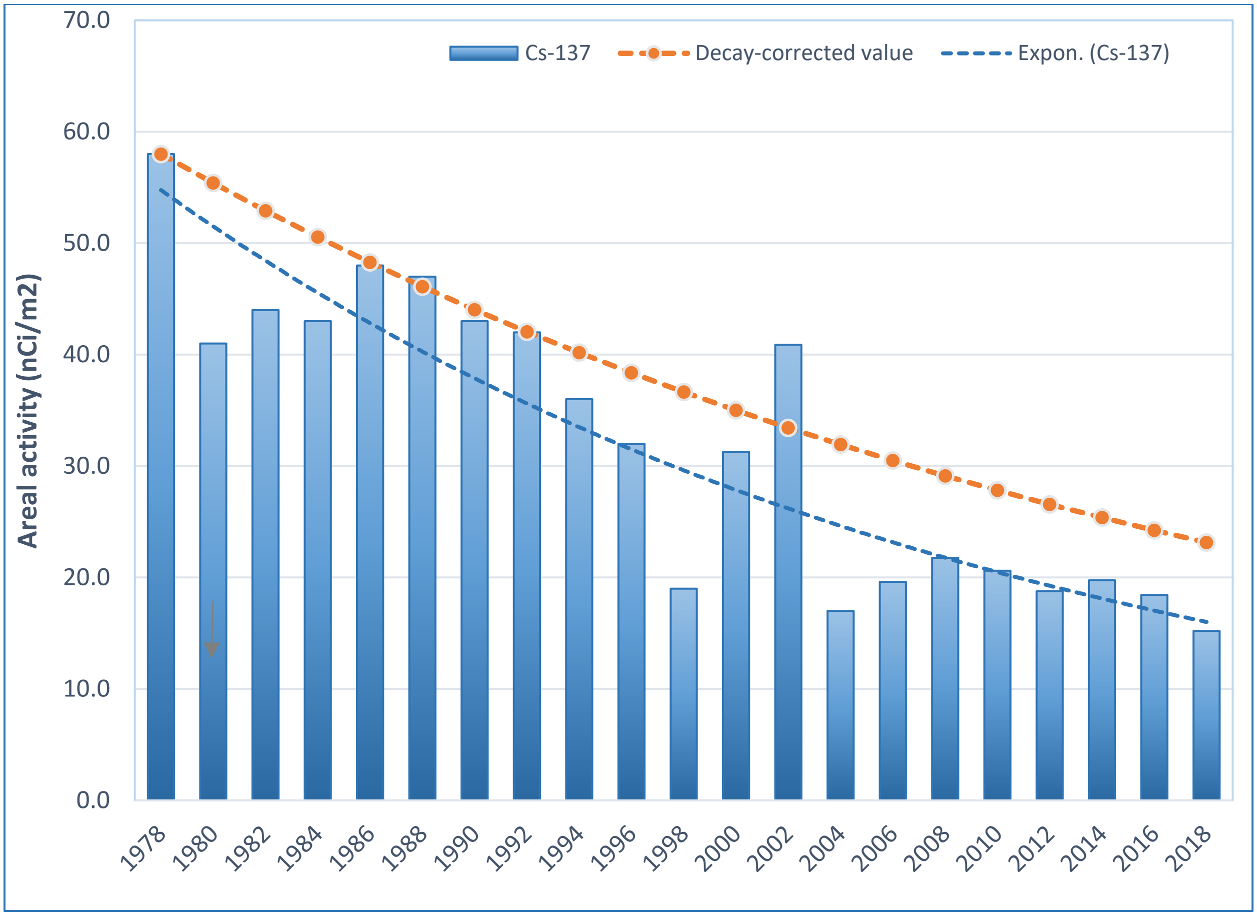

Figure 18. Mean (geometric) areal activities of ^{137}Cs in surface (0–5 cm [0–2.5 in.]) soils off the INL Site (1978–2018). Decay-corrected values assume an initial mean areal activity measured in 1978 and a half-life of 30.17 years. The decreasing trend in the mean activity in soil samples is best represented by an exponential function (R^2=0.79).

Strontium-90, another fallout radionuclide, was detected above 3s in one surface soil sample and above 2s in three other samples at levels within historical measurements (Figure 19). Current results are typically below detection levels and it is thus apparent that ^{90}Sr is becoming more undetectable in surface soil. Mean annual (geometric) concentrations of ^{90}Sr in surface over time appear to decrease at a rate which exceeds that projected for radioactive decay (Figure 20). Strontium-90 is more mobile than ^{137}Cs in alkaline soils and the accelerated decrease may be due to other processes in the soil, such as movement into lower depths or uptake by plants.

No accumulation of either ^{137}Cs or ^{90}Sr on surface soil is indicated as a result of operations at the INL Site.

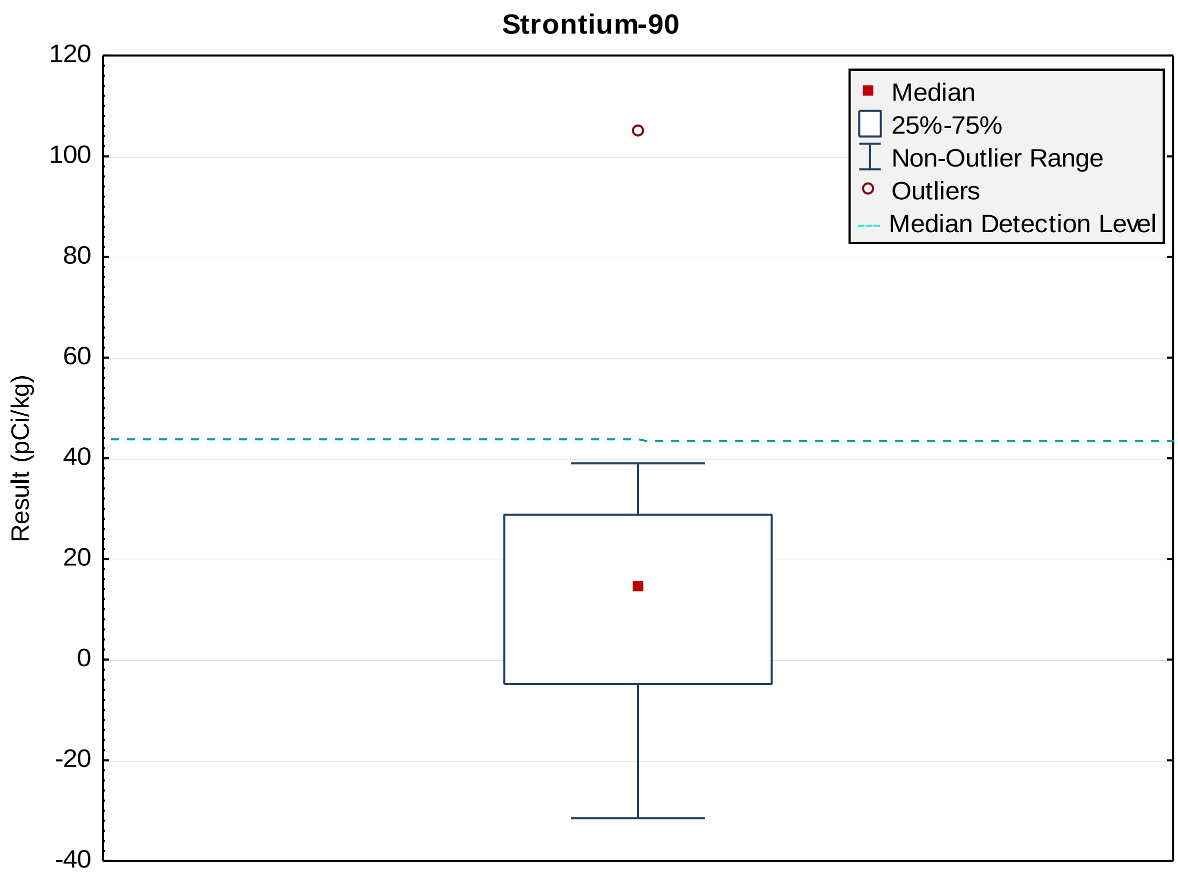

Figure 19. Strontium-90 concentrations in surface soil (0-5 cm). Number of samples = 13 (includes duplicate sample).

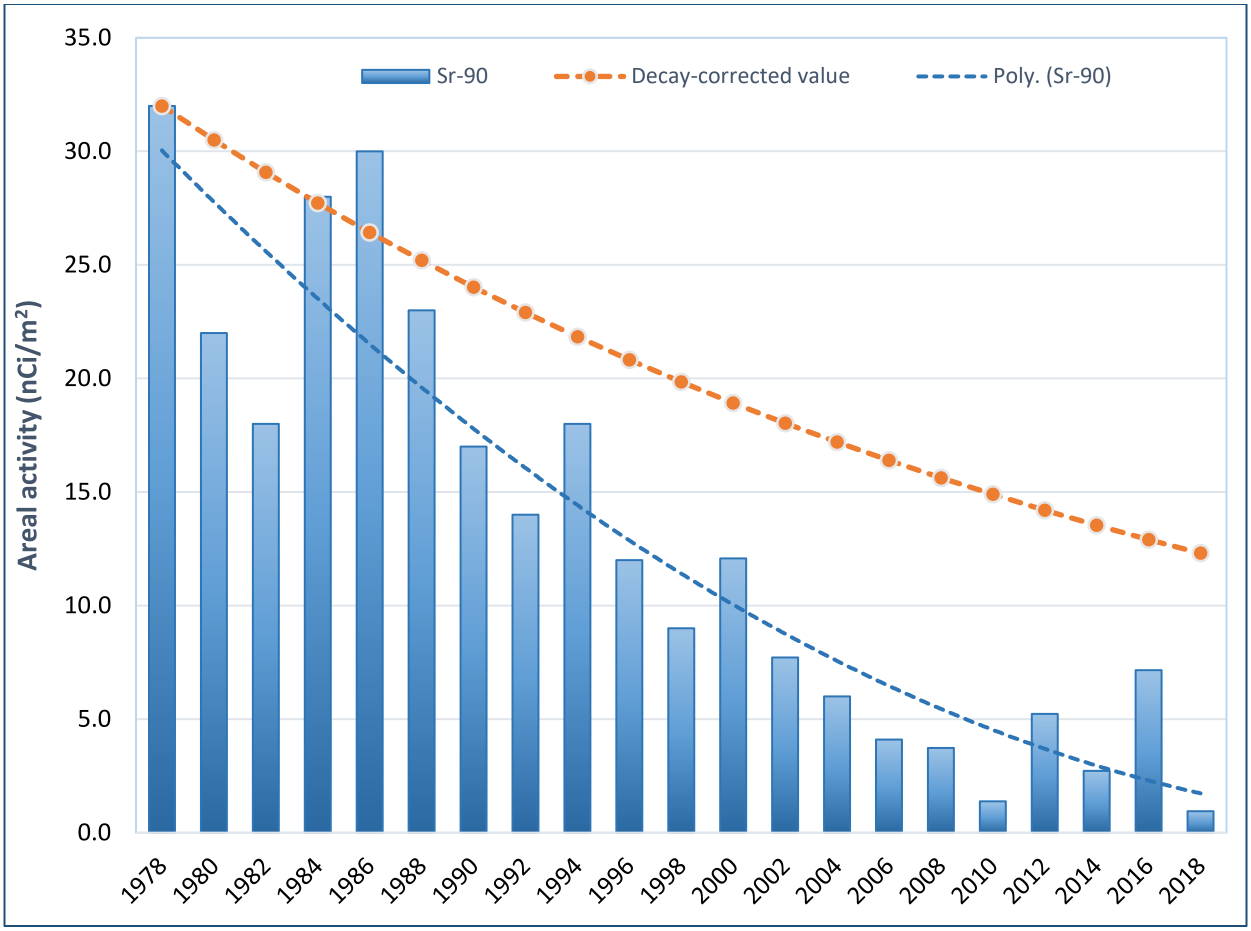

Figure 20. Mean (geometric) areal activities of ^{90}Sr in surface (0–5 cm [0–2.5 in.]) soils off the INL Site (1978–2018). All results above zero were included in the calculation of the geometric mean. Decay-corrected values assume an initial mean areal activity measured in 1978 and a half-life of 28.8 years. The decreasing trend in the mean activity in soil samples is best represented by a second order polynomial (R^2=0.85).

Transuranic radionuclides (including isotopes of plutonium) are present in our environment as a result of global fallout from above-ground nuclear weapon tests. Until 1979 the integrated deposition in the north temperate zone (40-50° latitude) was estimated for ^{238}Pu (1.5 Bq/m^2 [0.04 nCi/m^2]); $^{239/240}$Pu (58 Bq/m^2 [1.6 nCi/m^2]); ^{241}Pu (730 Bq/m^2 [19.73 nCi/m^2]) and ^{241}Am (25 Bq/m^2 [0.68 nCi/m^2]) (Bunzl et al 1987). Measurements of ^{238}Pu, $^{239/240}$Pu, and ^{241}Am made by the DOE Radiological and Environmental Sciences Laboratory (RESL) during the same time period are shown in Table 1. The estimated fallout lies within the 95% confidence intervals reported for ^{238}Pu (both years) and $^{239/240}$Pu (1978). The concentrations of ^{241}Am measured in surface soils in 1978 and 1980 are about half of the fallout concentrations estimated for 1979.

Based on the estimated fallout presented in Table 1, ^{238}Pu would not be expected to be detected very often in the environment. Not surprisingly, no particular trend in ^{238}Pu has been observed over time by the ESER program because it is infrequently detected (about 10% of the time since 2008). In addition, the half-life of ^{238}Pu is 87.7 years so about 25% of the original activity has decayed. Plutonium-238 was detected above 3s in only one ESER sample, collected at Mud Lake South (Table C-11), (9.49 ± 2.74 pCi/kg or 0.61 nCi/m^2) and above 2s in two other samples (maximum of 10.9 ± 4.38 pCi/kg or 0.48 nCi/m^2) 2018 (Figure 21).

Table 1. Radionuclides in offsite surface soils[a] (1978 and 1980)

		Geometric Average[b]			Detection Limit		Estimated Fallout (1979)[c] (nCi/m^2)
Radionuclide	**Year**	pCi/kg	nCi/m^2	**No. of samples**	pCi/kg	nCi/m^2	
Pu-238	1978	1.0 ×/÷ 1.9	0.06 ×/÷ 1.9	10	2	0.2	0.04
	1980	0.7 ×/÷ 1.3	0.05 ×/÷ 1.3	10	2	0.2	
Pu-239/240	1978	18.0 ×/÷ 1.4	1.09 ×/÷ 1.7	10	4	0.3	1.16
	1980	10.0 ×/÷ 1.7	0.63 ×/÷ 1.3	10	4	0.3	
Am-241	1978	6.2 ×/÷ 1.4	0.38 ×/÷ 1.3	10	4	0.3	0.68
	1980	3.0 ×/÷ 1.3	0.20 ×/÷ 1.4	10	4	0.3	

a. Soil samples collected to a depth of 5 cm.
b. Geometric average ×/÷ 2 standard geometric deviations of the mean. This represents the 95% confidence interval for the mean. From DOE-ID 1981.
c. From Bunzl et al. 1987.

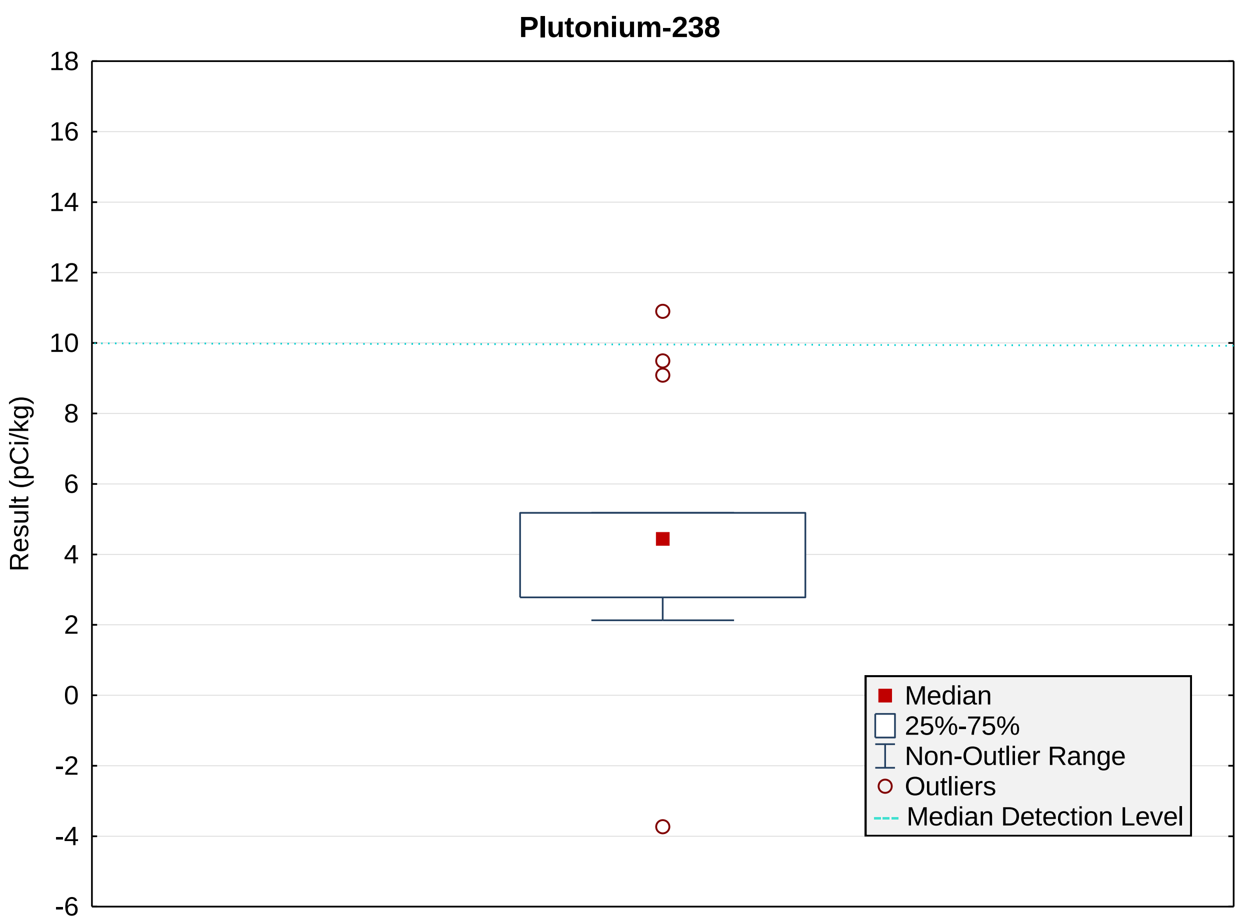

Figure 21. Plutonium-238 concentrations in surface soil (0-5 cm). Number of samples = 13 (includes duplicate sample).

Plutonium-239 and -240 have long half-lives (24,100 years and 6,561 years, respectively) and thus these fallout radionuclides persist in the environment (Figure 22). Six of the 13 samples analyzed in 2018 had detectable concentrations (greater than 3s) of ^{239,240}Pu (Table C-11). Three more samples had ^{239,240}Pu concentrations greater than 2s, which could be considered detected. The highest result (46.40 ± 7.50 pCi/kg or 1.54 nCi/m^2) is slightly higher than would be expected from estimated fallout (1.16 nCi/m^2), as shown in Table 1, but well within historical measurements (Figure 23).

No statistical trend is discernible, most likely because of several factors. These include:

- the heterogeneous nature of soils (variation of particle size and soil chemistry) and consequently of radionuclide concentrations across the area sampled
- nonuniform redistribution of contaminated soil via deposition and resuspension resulting from differences in wind, vegetation cover and topography
- the use of multiple laboratories, which have different procedures and detection limits, over the past four decades
- the small subsample analyzed. Radiochemical analyses of soil samples involve the consumption of a small subsample (typically only 5 g) which represents about 0.25% of the original sample weight. Although the sample is dried and sieved (< 35 mesh or 0.5 mm), the subsample is not homogeneous and not necessarily representative of the entire sample collected. [Note: Gamma analyses, on the other hand, can be performed on a much large sample size (~500 g)].

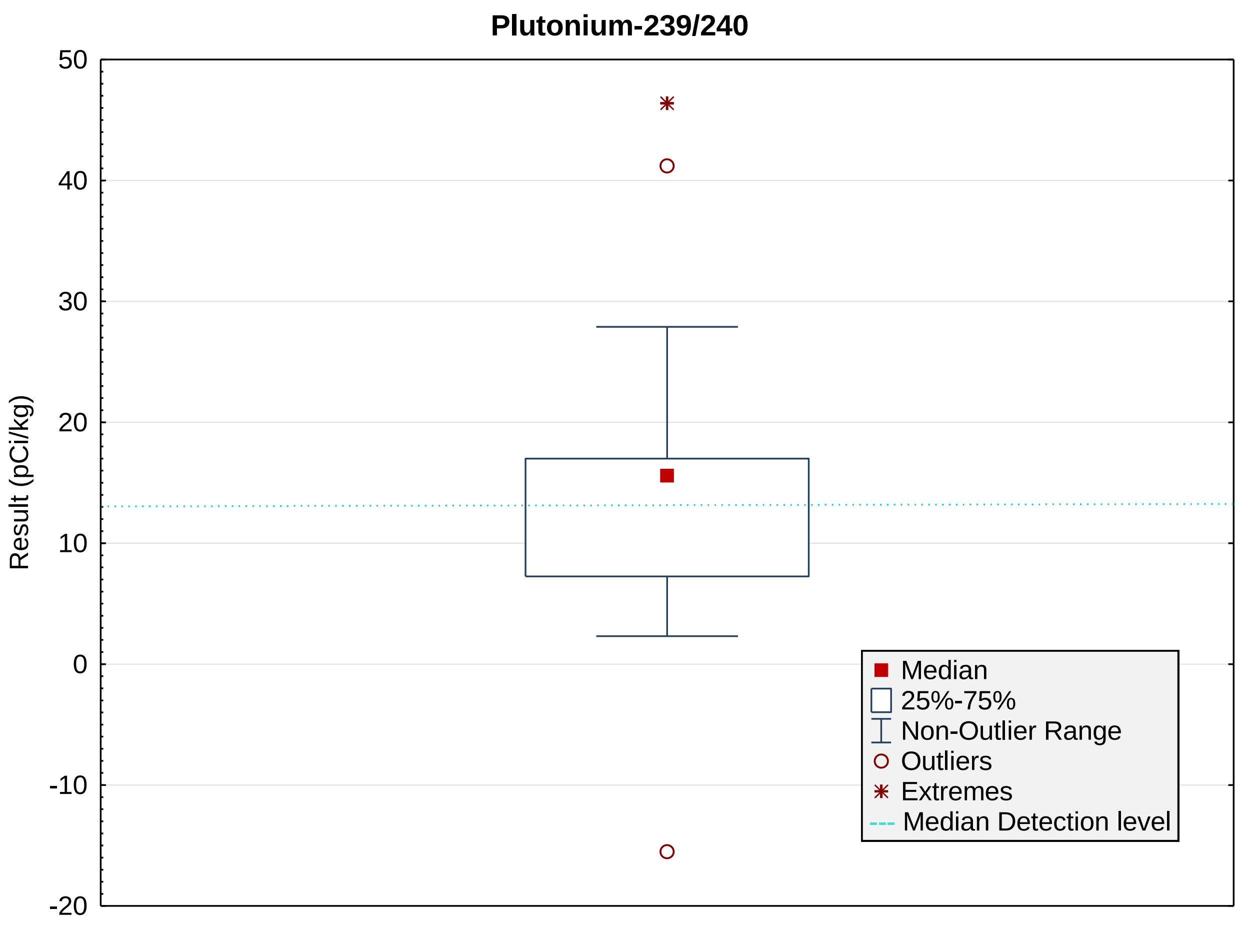

Figure 22. Plutonium-239/240 concentrations in surface soil (0-5 cm). Number of samples = 13 (includes duplicate sample).

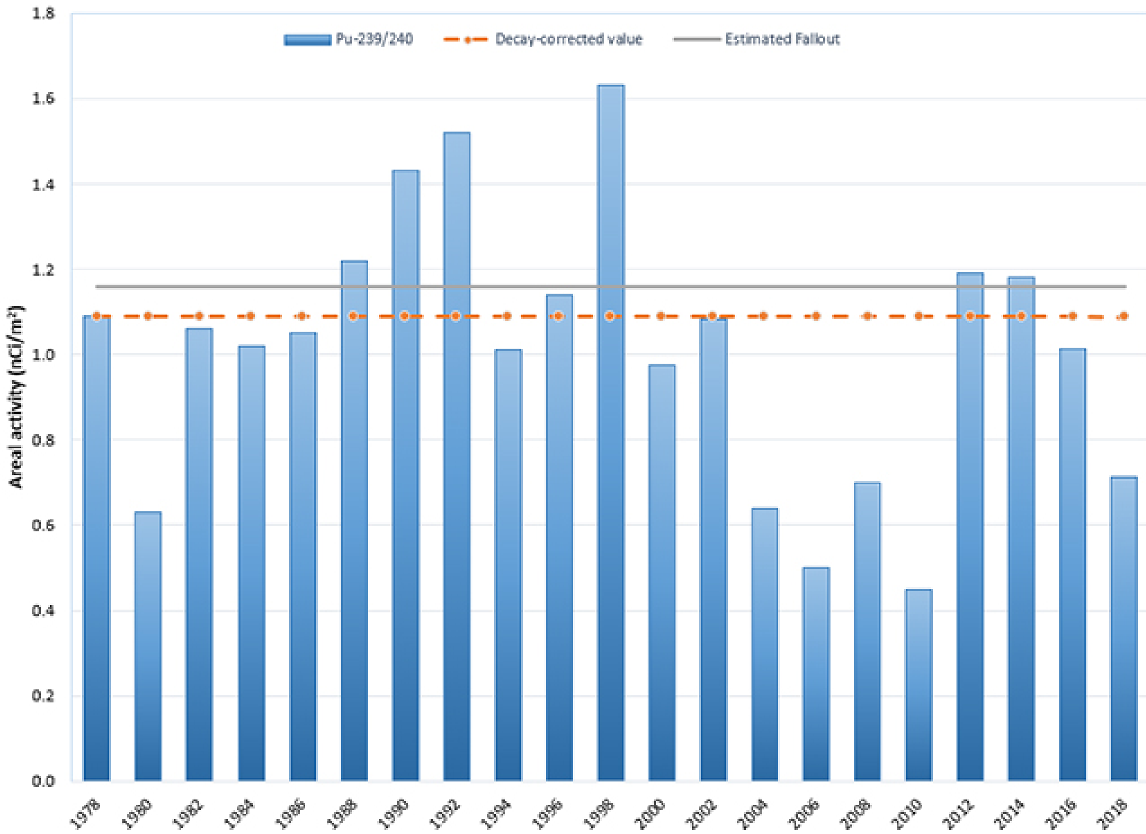

Figure 23. Mean (geometric) areal activities of $^{239/240}$Pu in surface (0–5 cm [0–2.5 in.]) soils off the INL Site (1978–2018). All results above zero were included in the calculation of the geometric mean. No statistically significant trend in the mean activity in soil samples could be determined. The fallout concentration was estimated from Bunzl et al. 1987.

Americium-241 is not produced directly in nuclear explosions but is the decay product of the fallout alpha-emitter ^{241}Pu (half-life 14.4 y). For this reason, the ^{241}Am activity in the environment is expected to increase as ^{241}Pu decays. Americium-241 was detected (>3σ) in only three of the 13 samples collected in 2018 (Table C-11). The highest result (34.10 ± 8.61 pCi/kg or 2.25 nCi/m^2), collected from Mud Lake, is about 93% higher than expected from that projected from estimated fallout (Figure 24). Soil concentrations in samples collected by ESER appear to show an increasing trend with time, although no statistically significant trend was evident.

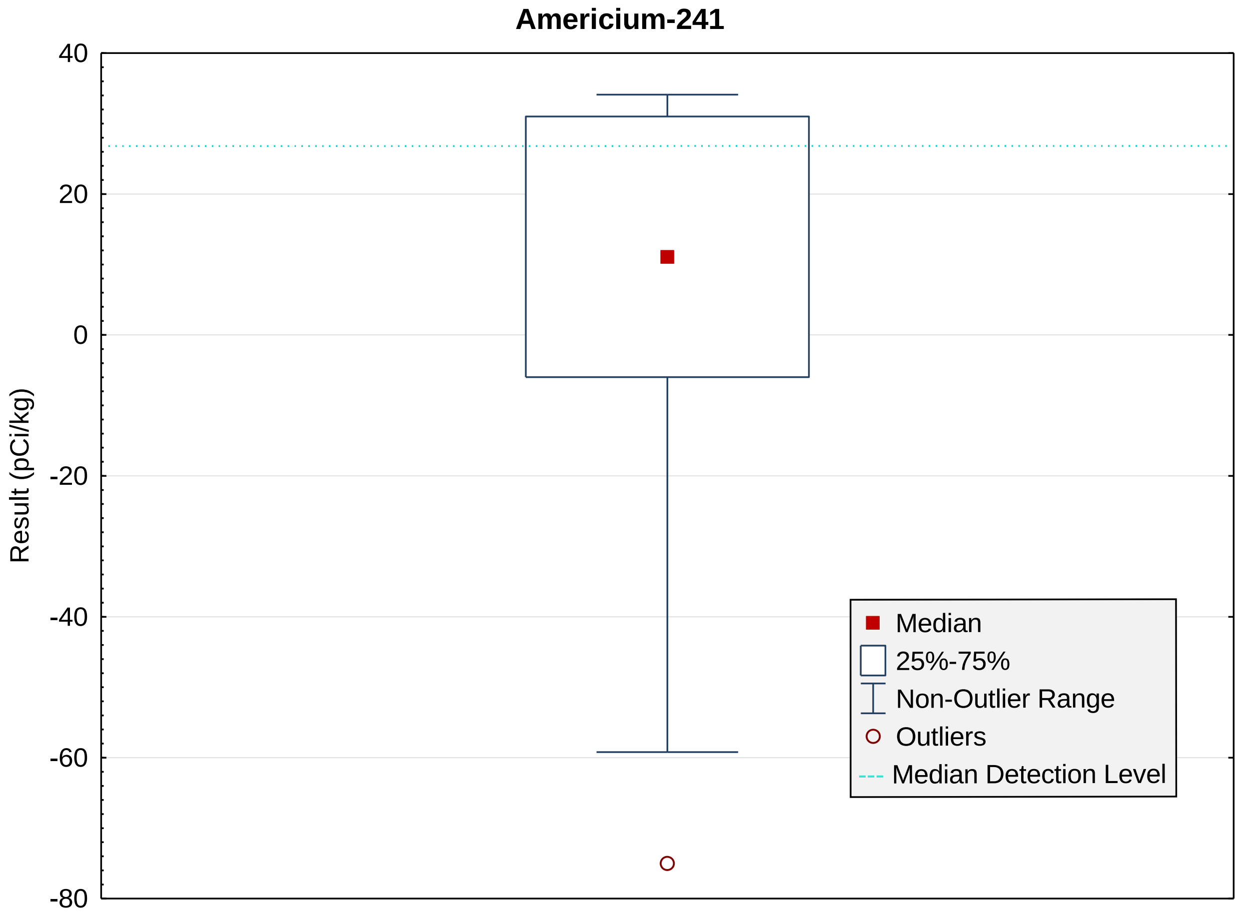

Figure 24. Am-241 concentrations in surface soil (0-5 cm). Number of samples = 13 (includes duplicate sample).

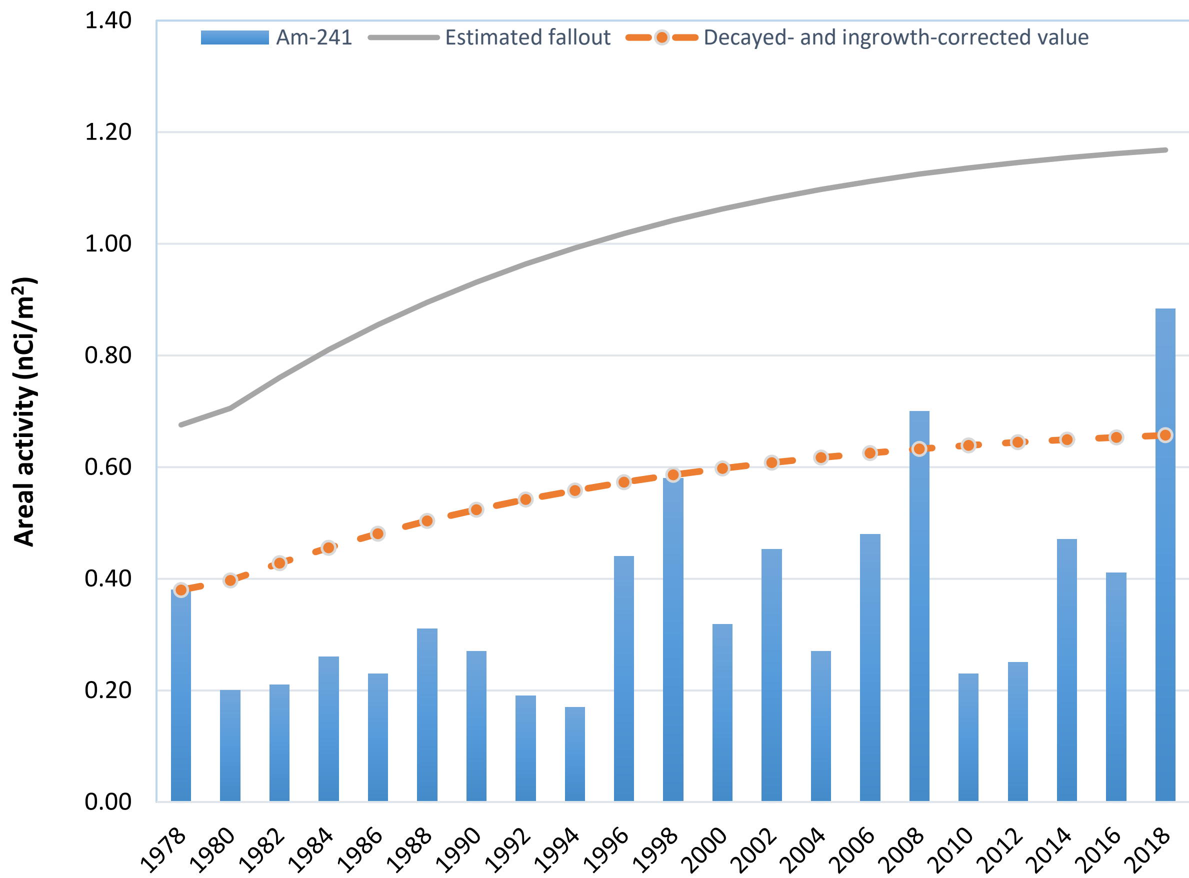

Figure 25. Mean (geometric) areal activities of ^{241}Am in surface (0–5 cm [0–2.5 in.]) soils off the INL Site (1978–2018). The projected concentration assumes the initial fallout areal concentration reported in Bunzl et al (1987) plus the decay of Pu-241 to Am-241. Results above zero were included in the calculation of the geometric mean. Decay-corrected values assume an initial mean areal activity measured in 1978 and a half-life of 432.2 years for Am-241 and 14.4 years for Pu-241. No statistically significant trend in the mean activity in soil samples could be determined. The fallout concentration was estimated using Bunzl et al. 1987.

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 2018a). 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 2018 (VNSFS 2018b).

7. References

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

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

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

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

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

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

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

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

EPA, 2018, RadNet—Tracking Environmental Radiation Nationwide, Web page: http://www.epa.gov/narel/radnet/

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

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

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

VNSFS, 2018b, Environmental Quality Assurance Report for the 3rd Quarter 2018, 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 and 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
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
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 2018

Sample Type	Analysis	Average Minimum Detectable Concentration[a] (MDC)	Derived Concentration Standard[b] (DCS)
Air (particulate filter)[e]	Gross alpha[c]	5.0×10^{-16} µCi/mL	3.4×10^{-14} µCi/mL
	Gross beta[d]	1.3×10^{-15} µCi/mL	2.5×10^{-11} µCi/mL
	^{137}Cs	7.8×10^{-17} µCi/mL	9.8×10^{-11} µCi/mL
	^{90}Sr	3.5×10^{-17} µCi/mL	2.5×10^{-11} µCi/mL
	^{241}Am	6.8×10^{-18} µCi/mL	4.1×10^{-14} µCi/mL
	^{238}Pu	1.5×10^{-17} µCi/mL	3.7×10^{-14} µCi/mL
	$^{239/240}Pu$	1.7×10^{-17} µCi/mL	3.4×10^{-14} µCi/mL
Air (charcoal cartridge)[e]	^{131}I	5.0×10^{-16} µCi/mL	2.3×10^{-19} µCi/mL
Air (atmospheric moisture)	^{3}H	87.0 pCi/L_{water} 4.7×10^{-13} µCi/mL_{air}	2.1×10^{-7} µCi/mL_{air}
Air (precipitation)	^{3}H	88.3 pCi/L	1.9×10^{-3} µCi/mL
Milk	^{131}I	0.6 pCi/L	--
	^{137}Cs	1.0 pCi/L	--
Lettuce	^{137}Cs	44.5 pCi/kg	--
	^{90}Sr	62.2 pCi/kg	--
Potatoes	^{137}Cs	1.9 pCi/kg	--
	^{90}Sr	62.1 pCi/kg	--
Grain	^{137}Cs	2.4 pCi/kg	--
	^{90}Sr	63.6 pCi/kg	--
Soil	^{137}Cs	0.8 pCi/kg	--
	^{90}Sr	48.9 pCi/kg	--
	^{241}Am	38.9 pCi/kg	--
	^{238}Pu	15.9 pCi/kg	--
	$^{239/240}Pu$	16.6 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

		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**
BOUNDARY							
ARCO	07/03/18	1.02 ± 0.18	3.77 ± 0.65	Yes	20.90 ± 0.65	77.33 ± 2.39	Yes
	07/11/18	1.89 ± 0.19	6.99 ± 0.72	Yes	26.50 ± 0.65	98.05 ± 2.39	Yes
	07/18/18	0.84 ± 0.14	3.10 ± 0.52	Yes	25.00 ± 0.59	92.50 ± 2.16	Yes
	07/25/18	0.91 ± 0.24	3.35 ± 0.88	Yes	23.80 ± 0.68	88.06 ± 2.53	Yes
	08/01/18	3.25 ± 0.32	12.03 ± 1.18	Yes	28.50 ± 0.74	105.45 ± 2.72	Yes
	08/08/18	3.03 ± 0.37	11.21 ± 1.37	Yes	24.60 ± 0.82	91.02 ± 3.05	Yes
	08/15/18	2.51 ± 0.23	9.29 ± 0.86	Yes	33.30 ± 0.77	123.21 ± 2.85	Yes
	08/22/18	2.34 ± 0.23	8.66 ± 0.86	Yes	33.90 ± 0.79	125.43 ± 2.91	Yes
	08/29/18	3.05 ± 0.32	11.29 ± 1.18	Yes	26.10 ± 0.89	96.57 ± 3.28	Yes
	09/05/18	1.84 ± 0.20	6.81 ± 0.74	Yes	29.60 ± 0.69	109.52 ± 2.57	Yes
	09/12/18	2.96 ± 0.25	10.95 ± 0.93	Yes	39.30 ± 0.80	145.41 ± 2.96	Yes
	09/19/18	1.10 ± 0.19	4.07 ± 0.70	Yes	33.70 ± 0.73	124.69 ± 2.70	Yes
	09/26/18	1.60 ± 0.19	5.92 ± 0.70	Yes	28.70 ± 0.67	106.19 ± 2.46	Yes
ATOMIC CITY	07/03/18	0.79 ± 0.16	2.93 ± 0.60	Yes	21.10 ± 0.64	78.07 ± 2.38	Yes
	07/11/18	2.31 ± 0.20	8.55 ± 0.75	Yes	29.00 ± 0.65	107.30 ± 2.42	Yes
	07/18/18	0.85 ± 0.16	3.16 ± 0.59	Yes	27.90 ± 0.68	103.23 ± 2.51	Yes
	07/25/18	1.44 ± 0.24	5.33 ± 0.90	Yes	29.40 ± 0.69	108.78 ± 2.57	Yes
	08/01/18	3.32 ± 0.32	12.28 ± 1.19	Yes	31.70 ± 0.77	117.29 ± 2.83	Yes
	08/08/18	2.92 ± 0.32	10.80 ± 1.18	Yes	28.20 ± 0.76	104.34 ± 2.80	Yes
	08/15/18	2.67 ± 0.24	9.88 ± 0.90	Yes	31.70 ± 0.77	117.29 ± 2.83	Yes
	08/22/18	2.61 ± 0.23	9.66 ± 0.87	Yes	33.80 ± 0.76	125.06 ± 2.80	Yes
	08/29/18	2.89 ± 0.27	10.69 ± 1.00	Yes	25.20 ± 0.75	93.24 ± 2.78	Yes
	09/05/18	1.64 ± 0.18	6.07 ± 0.67	Yes	30.00 ± 0.66	111.00 ± 2.43	Yes
	09/12/18	2.86 ± 0.26	10.58 ± 0.94	Yes	37.60 ± 0.81	139.12 ± 3.00	Yes
	09/19/18	1.35 ± 0.20	5.00 ± 0.73	Yes	36.00 ± 0.74	133.20 ± 2.73	Yes
	09/26/18	1.50 ± 0.18	5.55 ± 0.68	Yes	28.40 ± 0.66	105.08 ± 2.44	Yes
QA-1	07/03/18	0.77 ± 0.16	2.83 ± 0.58	Yes	20.80 ± 0.63	76.96 ± 2.32	Yes
(ATOMIC CITY)	07/11/18	1.62 ± 0.18	5.99 ± 0.65	Yes	27.10 ± 0.63	100.27 ± 2.33	Yes
	07/18/18	1.06 ± 0.17	3.92 ± 0.62	Yes	27.60 ± 0.67	102.12 ± 2.47	Yes
	07/25/18	1.66 ± 0.26	6.14 ± 0.96	Yes	26.50 ± 0.69	98.05 ± 2.55	Yes
	08/01/18	3.14 ± 0.34	11.62 ± 1.24	Yes	30.50 ± 0.80	112.85 ± 2.95	Yes
	08/08/18	3.62 ± 0.35	13.39 ± 1.30	Yes	28.80 ± 0.79	106.56 ± 2.91	Yes
	08/15/18	2.45 ± 0.24	9.07 ± 0.90	Yes	32.00 ± 0.80	118.40 ± 2.97	Yes
	08/22/18	2.90 ± 0.25	10.73 ± 0.93	Yes	31.80 ± 0.76	117.66 ± 2.82	Yes
	08/29/18	2.25 ± 0.25	8.33 ± 0.93	Yes	24.80 ± 0.76	91.76 ± 2.81	Yes
	09/05/18	1.57 ± 0.18	5.81 ± 0.66	Yes	30.10 ± 0.66	111.37 ± 2.45	Yes
	09/12/18	2.69 ± 0.25	9.95 ± 0.91	Yes	37.10 ± 0.80	137.27 ± 2.97	Yes
	09/19/18	1.28 ± 0.19	4.74 ± 0.71	Yes	32.80 ± 0.71	121.36 ± 2.63	Yes
	09/26/18	1.40 ± 0.18	5.18 ± 0.68	Yes	32.60 ± 0.70	120.62 ± 2.60	Yes
BLUE DOME	07/03/18	1.14 ± 0.19	4.22 ± 0.68	Yes	21.40 ± 0.67	79.18 ± 2.46	Yes
	07/11/18	2.03 ± 0.20	7.51 ± 0.72	Yes	27.90 ± 0.65	103.23 ± 2.39	Yes
	07/18/18	1.05 ± 0.16	3.89 ± 0.60	Yes	27.60 ± 0.65	102.12 ± 2.40	Yes
	07/25/18	1.23 ± 0.22	4.55 ± 0.81	Yes	21.60 ± 0.59	79.92 ± 2.18	Yes
	08/01/18	2.17 ± 0.27	8.03 ± 1.01	Yes	28.20 ± 0.71	104.34 ± 2.64	Yes
	08/08/18	3.03 ± 0.30	11.21 ± 1.11	Yes	24.80 ± 0.68	91.76 ± 2.50	Yes
	08/15/18	2.47 ± 0.23	9.14 ± 0.87	Yes	30.20 ± 0.75	111.74 ± 2.77	Yes
	08/22/18	2.77 ± 0.28	10.25 ± 1.03	Yes	33.50 ± 0.88	123.95 ± 3.27	Yes
	08/29/18	1.57 ± 0.18	5.81 ± 0.66	Yes	16.90 ± 0.54	62.53 ± 1.99	Yes
	09/05/18	1.32 ± 0.19	4.88 ± 0.70	Yes	31.50 ± 0.75	116.55 ± 2.76	Yes
	09/12/18	2.84 ± 0.28	10.51 ± 1.04	Yes	43.00 ± 0.94	159.10 ± 3.47	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 (x 10^{-15} µCi/mL)			Result ± 1s Uncertainty (x 10^{-11} Bq/mL)			Result > 3s	Result ± 1s Uncertainty (x 10^{-15} µCi/mL)			Result ± 1s Uncertainty (x 10^{-11} Bq/mL)			Result > 3s
	09/19/18	1.00	±	0.17	3.68	±	0.63	Yes	32.50	±	0.67	120.25	±	2.49	Yes
	09/26/18	1.15	±	0.16	4.26	±	0.60	Yes	22.90	±	0.59	84.73	±	2.16	Yes
QA-2	07/03/18	0.87	±	0.17	3.22	±	0.62	Yes	19.80	±	0.64	73.26	±	2.36	Yes
(BLUE DOME)	07/11/18	2.03	±	0.19	7.51	±	0.71	Yes	27.70	±	0.64	102.49	±	2.36	Yes
	07/18/18	0.94	±	0.16	3.47	±	0.59	Yes	27.50	±	0.66	101.75	±	2.45	Yes
	07/25/18	1.72	±	0.27	6.36	±	1.00	Yes	28.80	±	0.73	106.56	±	2.69	Yes
	08/01/18	2.10	±	0.28	7.77	±	1.04	Yes	31.20	±	0.76	115.44	±	2.82	Yes
	08/08/18	3.33	±	0.34	12.32	±	1.24	Yes	29.50	±	0.78	109.15	±	2.87	Yes
	08/15/18	2.85	±	0.25	10.55	±	0.94	Yes	31.30	±	0.78	115.81	±	2.88	Yes
	08/22/18	2.56	±	0.27	9.47	±	1.01	Yes	32.90	±	0.88	121.73	±	3.26	Yes
	08/29/18	2.64	±	0.27	9.77	±	0.99	Yes	23.60	±	0.75	87.32	±	2.77	Yes
	09/05/18	1.76	±	0.19	6.51	±	0.70	Yes	29.20	±	0.67	108.04	±	2.46	Yes
	09/12/18	3.03	±	0.25	11.21	±	0.94	Yes	36.50	±	0.78	135.05	±	2.89	Yes
	09/19/18	1.29	±	0.20	4.77	±	0.73	Yes	31.90	±	0.72	118.03	±	2.67	Yes
	09/26/18	1.37	±	0.18	5.07	±	0.67	Yes	28.00	±	0.66	103.60	±	2.43	Yes
FAA TOWER	07/03/18	0.96	±	0.17	3.54	±	0.63	Yes	21.60	±	0.65	79.92	±	2.41	Yes
	07/11/18	2.25	±	0.20	8.33	±	0.74	Yes	27.30	±	0.64	101.01	±	2.35	Yes
	07/18/18	1.17	±	0.18	4.33	±	0.66	Yes	26.80	±	0.68	99.16	±	2.53	Yes
	07/25/18	1.76	±	0.27	6.51	±	0.99	Yes	28.20	±	0.71	104.34	±	2.63	Yes
	08/01/18	3.44	±	0.37	12.73	±	1.36	Yes	28.60	±	0.83	105.82	±	3.06	Yes
	08/08/18	3.11	±	0.32	11.51	±	1.19	Yes	28.30	±	0.75	104.71	±	2.79	Yes
	08/15/18	2.28	±	0.23	8.44	±	0.84	Yes	29.90	±	0.75	110.63	±	2.76	Yes
	08/22/18	2.50	±	0.24	9.25	±	0.87	Yes	32.30	±	0.76	119.51	±	2.83	Yes
	08/29/18	2.95	±	0.27	10.92	±	1.01	Yes	25.00	±	0.75	92.50	±	2.76	Yes
	09/05/18	1.88	±	0.20	6.96	±	0.74	Yes	29.50	±	0.68	109.15	±	2.53	Yes
	09/12/18	2.57	±	0.24	9.51	±	0.89	Yes	38.30	±	0.80	141.71	±	2.97	Yes
	09/19/18	1.33	±	0.19	4.92	±	0.72	Yes	33.40	±	0.72	123.58	±	2.65	Yes
	09/26/18	1.81	±	0.20	6.70	±	0.75	Yes	31.90	±	0.72	118.03	±	2.65	Yes
HOWE	07/03/18	1.93	±	0.22	7.14	±	0.81	Yes	21.40	±	0.66	79.18	±	2.43	Yes
	07/11/18	2.48	±	0.22	9.18	±	0.81	Yes	28.70	±	0.68	106.19	±	2.52	Yes
	07/18/18	1.69	±	0.20	6.25	±	0.75	Yes	28.40	±	0.71	105.08	±	2.63	Yes
	07/25/18	1.36	±	0.25	5.03	±	0.91	Yes	25.90	±	0.68	95.83	±	2.52	Yes
	08/01/18	2.74	±	0.31	10.14	±	1.14	Yes	29.30	±	0.75	108.41	±	2.79	Yes
	08/08/18	3.14	±	0.32	11.62	±	1.20	Yes	27.90	±	0.75	103.23	±	2.77	Yes
	08/15/18	3.39	±	0.28	12.54	±	1.04	Yes	31.50	±	0.81	116.55	±	3.00	Yes
	08/22/18	3.31	±	0.28	12.25	±	1.03	Yes	33.10	±	0.82	122.47	±	3.03	Yes
	08/29/18	3.02	±	0.33	11.17	±	1.24	Yes	23.60	±	0.90	87.32	±	3.34	Yes
	09/05/18	2.31	±	0.21	8.55	±	0.79	Yes	31.90	±	0.70	118.03	±	2.58	Yes
	09/12/18	3.27	±	0.27	12.10	±	0.98	Yes	36.20	±	0.79	133.94	±	2.93	Yes
	09/19/18	1.65	±	0.21	6.11	±	0.77	Yes	35.30	±	0.73	130.61	±	2.72	Yes
	09/26/18	1.66	±	0.19	6.14	±	0.70	Yes	28.10	±	0.66	103.97	±	2.42	Yes
MONTEVIEW	07/03/18	1.79	±	0.37	6.62	±	1.37	Yes	26.60	±	1.24	98.42	±	4.59	Yes
	07/11/18	1.54	±	0.17	5.70	±	0.64	Yes	28.30	±	0.64	104.71	±	2.36	Yes
	07/18/18	1.14	±	0.20	4.22	±	0.73	Yes	29.30	±	0.78	108.41	±	2.89	Yes
	07/25/18	1.88	±	0.27	6.96	±	1.00	Yes	28.40	±	0.71	105.08	±	2.62	Yes
	08/01/18	2.23	±	0.28	8.25	±	1.04	Yes	26.70	±	0.71	98.79	±	2.62	Yes
	08/08/18	3.12	±	0.32	11.54	±	1.18	Yes	27.30	±	0.74	101.01	±	2.73	Yes
	08/15/18	2.44	±	0.23	9.03	±	0.83	Yes	31.70	±	0.74	117.29	±	2.73	Yes
	08/22/18	2.68	±	0.23	9.92	±	0.87	Yes	32.80	±	0.74	121.36	±	2.74	Yes
	08/29/18	2.01	±	0.28	7.44	±	1.03	Yes	23.40	±	0.86	86.58	±	3.17	Yes
	09/05/18	1.50	±	0.18	5.55	±	0.67	Yes	30.10	±	0.68	111.37	±	2.52	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 (x 10^{-15} μCi/mL)**	**Result ± 1s Uncertainty (x 10^{-11} Bq/mL)**	**Result > 3s**	**Result ± 1s Uncertainty (x 10^{-15} μCi/mL)**	**Result ± 1s Uncertainty (x 10^{-11} Bq/mL)**	**Result > 3s**
	09/12/18	2.04 ± 0.22	7.55 ± 0.80	Yes	37.30 ± 0.78	138.01 ± 2.87	Yes
	09/19/18	1.44 ± 0.20	5.33 ± 0.73	Yes	35.30 ± 0.73	130.61 ± 2.70	Yes
	09/26/18	1.89 ± 0.20	6.99 ± 0.74	Yes	30.20 ± 0.68	111.74 ± 2.50	Yes
MUD LAKE	07/03/18	0.83 ± 0.16	3.09 ± 0.60	Yes	19.40 ± 0.63	71.78 ± 2.32	Yes
	07/11/18	1.72 ± 0.18	6.36 ± 0.68	Yes	28.40 ± 0.65	105.08 ± 2.41	Yes
	07/18/18	1.16 ± 0.17	4.29 ± 0.64	Yes	28.90 ± 0.69	106.93 ± 2.55	Yes
	07/25/18	1.94 ± 0.28	7.18 ± 1.04	Yes	28.40 ± 0.73	105.08 ± 2.71	Yes
	08/01/18	2.73 ± 0.31	10.10 ± 1.16	Yes	30.20 ± 0.78	111.74 ± 2.87	Yes
	08/08/18	3.22 ± 0.34	11.91 ± 1.27	Yes	29.10 ± 0.80	107.67 ± 2.96	Yes
	08/15/18	2.57 ± 0.24	9.51 ± 0.87	Yes	34.80 ± 0.79	128.76 ± 2.91	Yes
	08/22/18	3.01 ± 0.27	11.14 ± 1.01	Yes	34.00 ± 0.84	125.80 ± 3.10	Yes
	08/29/18	2.46 ± 0.30	9.10 ± 1.11	Yes	26.60 ± 0.90	98.42 ± 3.32	Yes
	09/05/18	1.72 ± 0.21	6.36 ± 0.76	Yes	32.30 ± 0.75	119.51 ± 2.79	Yes
	09/12/18	2.80 ± 0.25	10.36 ± 0.92	Yes	38.80 ± 0.81	143.56 ± 2.99	Yes
	09/19/18	1.26 ± 0.20	4.66 ± 0.74	Yes	34.10 ± 0.75	126.17 ± 2.76	Yes
	09/26/18	1.79 ± 0.20	6.62 ± 0.73	Yes	33.50 ± 0.71	123.95 ± 2.62	Yes
DISTANT							
BLACKFOOT	07/03/18	0.73 ± 0.16	2.69 ± 0.58	Yes	19.70 ± 0.62	72.89 ± 2.30	Yes
	07/11/18	1.64 ± 0.18	6.07 ± 0.65	Yes	26.40 ± 0.62	97.68 ± 2.31	Yes
	07/18/18	1.47 ± 0.18	5.44 ± 0.67	Yes	25.50 ± 0.64	94.35 ± 2.37	Yes
	07/25/18	1.63 ± 0.24	6.03 ± 0.88	Yes	27.50 ± 0.65	101.75 ± 2.42	Yes
	08/01/18	3.14 ± 0.30	11.62 ± 1.11	Yes	31.10 ± 0.73	115.07 ± 2.69	Yes
	08/08/18	2.41 ± 0.30	8.92 ± 1.11	Yes	28.00 ± 0.76	103.60 ± 2.80	Yes
	08/15/18	1.96 ± 0.20	7.25 ± 0.74	Yes	32.20 ± 0.72	119.14 ± 2.65	Yes
	08/22/18	2.05 ± 0.21	7.59 ± 0.77	Yes	32.70 ± 0.73	120.99 ± 2.68	Yes
	08/29/18	2.89 ± 0.32	10.69 ± 1.20	Yes	26.50 ± 0.92	98.05 ± 3.42	Yes
	09/05/18	1.35 ± 0.17	5.00 ± 0.64	Yes	28.70 ± 0.66	106.19 ± 2.43	Yes
	09/12/18	2.44 ± 0.24	9.03 ± 0.88	Yes	38.20 ± 0.81	141.34 ± 2.98	Yes
	09/19/18	1.23 ± 0.19	4.55 ± 0.70	Yes	30.50 ± 0.69	112.85 ± 2.56	Yes
	09/26/18	1.55 ± 0.19	5.74 ± 0.68	Yes	29.50 ± 0.67	109.15 ± 2.46	Yes
CRATERS OF	07/03/18	0.70 ± 0.16	2.58 ± 0.58	Yes	20.50 ± 0.65	75.85 ± 2.39	Yes
THE MOON	07/11/18	2.04 ± 0.20	7.55 ± 0.74	Yes	26.20 ± 0.65	96.94 ± 2.39	Yes
	07/18/18	0.96 ± 0.16	3.54 ± 0.61	Yes	25.70 ± 0.66	95.09 ± 2.43	Yes
	07/25/18	1.50 ± 0.25	5.55 ± 0.94	Yes	26.90 ± 0.69	99.53 ± 2.56	Yes
	08/01/18	3.65 ± 0.33	13.51 ± 1.20	Yes	25.80 ± 0.69	95.46 ± 2.57	Yes
	08/08/18	3.62 ± 0.35	13.39 ± 1.30	Yes	29.80 ± 0.79	110.26 ± 2.94	Yes
	08/15/18	2.74 ± 0.26	10.14 ± 0.96	Yes	29.80 ± 0.80	110.26 ± 2.94	Yes
	08/22/18	2.87 ± 0.25	10.62 ± 0.94	Yes	34.10 ± 0.80	126.17 ± 2.94	Yes
	08/29/18	2.42 ± 0.25	8.95 ± 0.93	Yes	25.00 ± 0.74	92.50 ± 2.75	Yes
	09/05/18	1.92 ± 0.20	7.10 ± 0.74	Yes	28.70 ± 0.67	106.19 ± 2.49	Yes
	09/12/18	2.11 ± 0.23	7.81 ± 0.84	Yes	33.90 ± 0.77	125.43 ± 2.86	Yes
	09/19/18	1.13 ± 0.29	4.18 ± 1.06	Yes	32.70 ± 1.01	120.99 ± 3.74	Yes
	09/26/18	1.17 ± 0.17	4.33 ± 0.64	Yes	26.40 ± 0.64	97.68 ± 2.38	Yes
DUBOIS	07/03/18	1.27 ± 0.19	4.70 ± 0.71	Yes	21.50 ± 0.67	79.55 ± 2.48	Yes
	07/11/18	1.62 ± 0.19	5.99 ± 0.71	Yes	28.80 ± 0.70	106.56 ± 2.60	Yes
	07/18/18	1.11 ± 0.18	4.11 ± 0.66	Yes	30.60 ± 0.72	113.22 ± 2.68	Yes
	07/25/18	2.13 ± 0.30	7.88 ± 1.10	Yes	27.90 ± 0.75	103.23 ± 2.76	Yes
	08/01/18	2.40 ± 0.30	8.88 ± 1.11	Yes	31.10 ± 0.79	115.07 ± 2.90	Yes
	08/08/18	3.47 ± 0.36	12.84 ± 1.34	Yes	29.30 ± 0.82	108.41 ± 3.04	Yes
	08/15/18	2.78 ± 0.24	10.29 ± 0.90	Yes	30.00 ± 0.74	111.00 ± 2.75	Yes
	08/22/18	2.82 ± 0.28	10.43 ± 1.02	Yes	32.20 ± 0.85	119.14 ± 3.15	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 (x 10^{-15} µCi/mL)	Result ± 1s Uncertainty (x 10^{-11} Bq/mL)	Result > 3s	Result ± 1s Uncertainty (x 10^{-15} µCi/mL)	Result ± 1s Uncertainty (x 10^{-11} Bq/mL)	Result > 3s
	08/29/18	2.23 ± 0.24	8.25 ± 0.90	Yes	26.00 ± 0.75	96.20 ± 2.78	Yes
	09/05/18	1.38 ± 0.18	5.11 ± 0.67	Yes	28.60 ± 0.69	105.82 ± 2.55	Yes
	09/12/18	2.83 ± 0.25	10.47 ± 0.91	Yes	40.10 ± 0.80	148.37 ± 2.97	Yes
	09/19/18	1.48 ± 0.20	5.48 ± 0.75	Yes	31.00 ± 0.71	114.70 ± 2.61	Yes
	09/26/18	1.43 ± 0.19	5.29 ± 0.70	Yes	30.30 ± 0.70	112.11 ± 2.58	Yes
IDAHO FALLS	07/03/18	2.30 ± 0.24	8.51 ± 0.88	Yes	21.20 ± 0.67	78.44 ± 2.48	Yes
	07/11/18	2.56 ± 0.22	9.47 ± 0.81	Yes	27.00 ± 0.66	99.90 ± 2.43	Yes
	07/18/18	2.49 ± 0.23	9.21 ± 0.87	Yes	28.90 ± 0.72	106.93 ± 2.65	Yes
	07/25/18	2.65 ± 0.31	9.81 ± 1.15	Yes	29.10 ± 0.75	107.67 ± 2.78	Yes
	08/01/18	2.43 ± 0.30	8.99 ± 1.11	Yes	27.00 ± 0.74	99.90 ± 2.74	Yes
	08/08/18	3.15 ± 0.33	11.66 ± 1.21	Yes	30.50 ± 0.78	112.85 ± 2.89	Yes
	08/15/18	3.18 ± 0.26	11.77 ± 0.98	Yes	36.50 ± 0.82	135.05 ± 3.04	Yes
	08/22/18	3.30 ± 0.27	12.21 ± 1.00	Yes	34.80 ± 0.81	128.76 ± 3.00	Yes
	08/29/18	4.19 ± 0.34	15.50 ± 1.24	Yes	26.90 ± 0.83	99.53 ± 3.06	Yes
	09/05/18	2.72 ± 0.24	10.06 ± 0.87	Yes	31.50 ± 0.72	116.55 ± 2.66	Yes
	09/12/18	3.54 ± 0.29	13.10 ± 1.05	Yes	41.70 ± 0.87	154.29 ± 3.23	Yes
	09/19/18	2.82 ± 0.26	10.43 ± 0.95	Yes	36.50 ± 0.78	135.05 ± 2.87	Yes
	09/26/18	3.03 ± 0.25	11.21 ± 0.94	Yes	32.00 ± 0.74	118.40 ± 2.74	Yes
JACKSON	07/03/18	0.91 ± 0.14	3.35 ± 0.53	Yes	22.10 ± 0.57	81.77 ± 2.09	Yes
	07/11/18	2.24 ± 0.25	8.29 ± 0.91	Yes	35.70 ± 0.86	132.09 ± 3.18	Yes
	07/18/18	1.27 ± 0.18	4.70 ± 0.67	Yes	30.30 ± 0.71	112.11 ± 2.62	Yes
	07/25/18	2.28 ± 0.30	8.44 ± 1.10	Yes	32.80 ± 0.78	121.36 ± 2.89	Yes
	08/01/18	3.47 ± 0.36	12.84 ± 1.32	Yes	31.00 ± 0.83	114.70 ± 3.06	Yes
	08/08/18	4.13 ± 0.39	15.28 ± 1.44	Yes	32.10 ± 0.87	118.77 ± 3.20	Yes
	08/15/18	2.70 ± 0.30	9.99 ± 1.12	Yes	46.90 ± 1.11	173.53 ± 4.11	Yes
	08/22/18	2.85 ± 0.27	10.55 ± 1.00	Yes	34.10 ± 0.85	126.17 ± 3.16	Yes
	08/29/18	2.40 ± 0.30	8.88 ± 1.11	Yes	29.60 ± 0.95	109.52 ± 3.50	Yes
	09/05/18	1.67 ± 0.19	6.18 ± 0.71	Yes	31.50 ± 0.70	116.55 ± 2.60	Yes
	09/12/18	2.82 ± 0.25	10.43 ± 0.93	Yes	42.90 ± 0.85	158.73 ± 3.14	Yes
	09/19/18	1.24 ± 0.18	4.59 ± 0.65	Yes	29.30 ± 0.64	108.41 ± 2.35	Yes
	09/26/18	1.39 ± 0.19	5.14 ± 0.70	Yes	30.50 ± 0.71	112.85 ± 2.61	Yes
SUGAR CITY	07/03/18	0.84 ± 0.15	3.10 ± 0.57	Yes	16.80 ± 0.56	62.16 ± 2.08	Yes
	07/11/18	1.75 ± 0.17	6.48 ± 0.64	Yes	30.10 ± 0.63	111.37 ± 2.32	Yes
	07/18/18	1.03 ± 0.16	3.81 ± 0.58	Yes	26.60 ± 0.63	98.42 ± 2.32	Yes
	07/25/18	1.42 ± 0.23	5.25 ± 0.86	Yes	24.30 ± 0.63	89.91 ± 2.32	Yes
	08/01/18	2.86 ± 0.29	10.58 ± 1.08	Yes	28.30 ± 0.70	104.71 ± 2.60	Yes
	08/08/18	3.37 ± 0.32	12.47 ± 1.17	Yes	25.20 ± 0.69	93.24 ± 2.55	Yes
	08/15/18	2.50 ± 0.24	9.25 ± 0.88	Yes	39.40 ± 0.84	145.78 ± 3.11	Yes
	08/22/18	3.00 ± 0.29	11.10 ± 1.08	Yes	44.80 ± 1.00	165.76 ± 3.68	Yes
	08/29/18	4.11 ± 0.40	15.21 ± 1.48	Yes	35.80 ± 1.11	132.46 ± 4.11	Yes
	09/05/18	1.84 ± 0.21	6.81 ± 0.78	Yes	36.50 ± 0.79	135.05 ± 2.93	Yes
	09/12/18	2.96 ± 0.27	10.95 ± 1.00	Yes	42.50 ± 0.89	157.25 ± 3.31	Yes
	09/19/18	1.98 ± 0.26	7.33 ± 0.96	Yes	41.80 ± 0.91	154.66 ± 3.36	Yes
	09/26/18	2.29 ± 0.25	8.47 ± 0.93	Yes	39.10 ± 0.87	144.67 ± 3.23	Yes
INL SITE							
EFS	07/03/18	0.87 ± 0.17	3.21 ± 0.63	Yes	20.50 ± 0.66	75.85 ± 2.42	Yes
	07/11/18	1.58 ± 0.17	5.85 ± 0.64	Yes	25.00 ± 0.61	92.50 ± 2.24	Yes
	07/18/18	1.21 ± 0.18	4.48 ± 0.66	Yes	28.80 ± 0.69	106.56 ± 2.56	Yes
	07/25/18	1.34 ± 0.24	4.96 ± 0.89	Yes	24.80 ± 0.66	91.76 ± 2.42	Yes
	08/01/18	2.99 ± 0.31	11.06 ± 1.16	Yes	30.80 ± 0.77	113.96 ± 2.83	Yes
	08/08/18	2.55 ± 0.31	9.44 ± 1.14	Yes	23.50 ± 0.72	86.95 ± 2.65	Yes

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

Sampling Group and Location	Sampling Date	GROSS ALPHA Result ± 1s Uncertainty (x 10^{-15} µCi/mL)			Result ± 1s Uncertainty (x 10^{-11} Bq/mL)			Result > 3s	GROSS BETA Result ± 1s Uncertainty (x 10^{-15} µCi/mL)			Result ± 1s Uncertainty (x 10^{-11} Bq/mL)			Result > 3s
	08/15/18	2.81	±	0.25	10.40	±	0.93	Yes	31.50	±	0.78	116.55	±	2.87	Yes
	08/22/18	2.18	±	0.21	8.07	±	0.77	Yes	26.80	±	0.66	99.16	±	2.43	Yes
	08/29/18	2.53	±	0.28	9.36	±	1.02	Yes	23.40	±	0.78	86.58	±	2.89	Yes
	09/05/18	1.52	±	0.18	5.62	±	0.65	Yes	26.40	±	0.63	97.68	±	2.32	Yes
	09/12/18	2.35	±	0.23	8.70	±	0.85	Yes	34.40	±	0.76	127.28	±	2.81	Yes
	09/19/18	0.87	±	0.17	3.23	±	0.64	Yes	31.50	±	0.69	116.55	±	2.55	Yes
	09/26/18	1.35	±	0.18	5.00	±	0.66	Yes	30.10	±	0.67	111.37	±	2.49	Yes
MAIN GATE	07/03/18	1.17	±	0.18	4.33	±	0.67	Yes	22.10	±	0.65	81.77	±	2.42	Yes
	07/11/18	2.04	±	0.19	7.55	±	0.71	Yes	27.30	±	0.63	101.01	±	2.33	Yes
	07/18/18	0.93	±	0.16	3.46	±	0.60	Yes	27.20	±	0.67	100.64	±	2.48	Yes
	07/25/18	1.57	±	0.26	5.81	±	0.95	Yes	28.60	±	0.71	105.82	±	2.62	Yes
	08/01/18	3.21	±	0.32	11.88	±	1.19	Yes	30.90	±	0.77	114.33	±	2.84	Yes
	08/08/18	3.01	±	0.34	11.14	±	1.24	Yes	30.20	±	0.81	111.74	±	2.99	Yes
	08/15/18	3.11	±	0.25	11.51	±	0.91	Yes	32.90	±	0.74	121.73	±	2.74	Yes
	08/22/18	2.47	±	0.25	9.14	±	0.91	Yes	29.50	±	0.77	109.15	±	2.86	Yes
	08/29/18	2.53	±	0.26	9.36	±	0.97	Yes	24.40	±	0.76	90.28	±	2.80	Yes
	09/05/18	1.50	±	0.18	5.55	±	0.67	Yes	28.30	±	0.67	104.71	±	2.46	Yes
	09/12/18	3.41	±	0.26	12.62	±	0.95	Yes	38.40	±	0.77	142.08	±	2.85	Yes
	09/19/18	1.14	±	0.19	4.22	±	0.69	Yes	31.70	±	0.70	117.29	±	2.59	Yes
	09/26/18	1.54	±	0.20	5.70	±	0.72	Yes	30.90	±	0.71	114.33	±	2.64	Yes
VAN BUREN GATE	07/03/18	0.77	±	0.17	2.86	±	0.64	Yes	22.50	±	0.70	83.25	±	2.60	Yes
	07/11/18	1.58	±	0.18	5.85	±	0.65	Yes	25.80	±	0.62	95.46	±	2.30	Yes
	07/18/18	1.08	±	0.17	4.00	±	0.63	Yes	29.00	±	0.68	107.30	±	2.52	Yes
	07/25/18	1.55	±	0.25	5.74	±	0.94	Yes	28.10	±	0.70	103.97	±	2.59	Yes
	08/01/18	2.88	±	0.31	10.66	±	1.15	Yes	32.90	±	0.78	121.73	±	2.89	Yes
	08/08/18	3.37	±	0.35	12.47	±	1.30	Yes	31.10	±	0.82	115.07	±	3.05	Yes
	08/15/18	2.80	±	0.25	10.36	±	0.93	Yes	34.40	±	0.81	127.28	±	2.99	Yes
	08/22/18	2.39	±	0.24	8.84	±	0.90	Yes	31.90	±	0.79	118.03	±	2.93	Yes
	08/29/18	2.66	±	0.28	9.84	±	1.03	Yes	27.80	±	0.83	102.86	±	3.06	Yes
	09/05/18	1.74	±	0.19	6.44	±	0.71	Yes	31.50	±	0.69	116.55	±	2.56	Yes
	09/12/18	2.48	±	0.24	9.18	±	0.88	Yes	40.40	±	0.83	149.48	±	3.05	Yes
	09/19/18	1.34	±	0.19	4.96	±	0.72	Yes	33.60	±	0.72	124.32	±	2.65	Yes
	09/26/18	1.47	±	0.19	5.44	±	0.70	Yes	33.40	±	0.72	123.58	±	2.66	Yes

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

Sampling Group and Location	Sampling Date	Result ± 1s Uncertainty ($x 10^{-15}$ μCi/mL)			Result ± 1s Uncertainty ($x 10^{-11}$ Bq/mL)			Result > 3s
BOUNDARY								
ARCO	07/03/18	1.86	±	1.27	6.88	±	4.70	No
	07/11/18	-0.87	±	1.42	-3.22	±	5.25	No
	07/18/18	0.37	±	0.77	1.37	±	2.84	No
	07/25/18	0.20	±	1.50	0.73	±	5.55	No
	08/01/18	-0.91	±	0.98	-3.37	±	3.64	No
	08/08/18	1.39	±	1.44	5.14	±	5.33	No
	08/15/18	0.04	±	1.06	0.15	±	3.92	No
	08/22/18	-1.04	±	1.14	-3.85	±	4.22	No
	08/29/18	-0.15	±	1.55	-0.54	±	5.74	No
	09/05/18	-0.39	±	0.99	-1.43	±	3.66	No
	09/12/18	-2.19	±	1.65	-8.10	±	6.11	No
	09/19/18	2.01	±	1.74	7.44	±	6.44	No
	09/26/18	0.58	±	1.02	2.13	±	3.77	No
ATOMIC CITY	07/03/18	1.83	±	1.26	6.77	±	4.66	No
	07/11/18	-0.83	±	1.36	-3.07	±	5.03	No
	07/18/18	0.44	±	0.91	1.63	±	3.37	No
	07/25/18	0.18	±	1.34	0.65	±	4.96	No
	08/01/18	-0.91	±	0.98	-3.36	±	3.63	No
	08/08/18	1.12	±	1.16	4.14	±	4.29	No
	08/15/18	0.04	±	1.09	0.15	±	4.03	No
	08/22/18	-0.97	±	1.07	-3.60	±	3.96	No
	08/29/18	-0.12	±	1.22	-0.43	±	4.51	No
	09/05/18	-0.35	±	0.90	-1.30	±	3.32	No
	09/12/18	-2.31	±	1.74	-8.55	±	6.44	No
	09/19/18	1.96	±	1.70	7.25	±	6.29	No
	09/26/18	0.57	±	1.01	2.12	±	3.74	No
QA-2 (ATOMIC CITY)	07/03/18	1.77	±	1.22	6.55	±	4.51	No
	07/11/18	-0.82	±	1.34	-3.04	±	4.96	No
	07/18/18	0.43	±	0.89	1.60	±	3.30	No
	07/25/18	0.18	±	1.41	0.68	±	5.22	No
	08/01/18	-1.00	±	1.08	-3.70	±	4.00	No
	08/08/18	1.17	±	1.21	4.33	±	4.48	No
	08/15/18	0.05	±	1.17	0.17	±	4.33	No
	08/22/18	-1.02	±	1.13	-3.77	±	4.18	No
	08/29/18	-0.12	±	1.26	-0.44	±	4.66	No
	09/05/18	-0.35	±	0.90	-1.30	±	3.34	No
	09/12/18	-2.29	±	1.72	-8.47	±	6.36	No
	09/19/18	1.97	±	1.70	7.29	±	6.29	No

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

Sampling Group and Location	Sampling Date	Result ± 1s Uncertainty (x 10^{-15} µCi/mL)			Result ± 1s Uncertainty (x 10^{-11} Bq/mL)			Result > 3s
	09/26/18	0.58	±	1.02	2.13	±	3.77	No
BLUE DOME	07/03/18	-1.40	±	1.09	-5.18	±	4.03	No
	07/11/18	0.15	±	0.81	0.57	±	2.99	No
	07/18/18	-0.28	±	1.29	-1.02	±	4.77	No
	07/25/18	1.55	±	0.86	5.74	±	3.18	No
	08/01/18	-2.12	±	1.51	-7.84	±	5.59	No
	08/08/18	-0.98	±	0.94	-3.61	±	3.49	No
	08/15/18	0.77	±	1.04	2.86	±	3.85	No
	08/22/18	0.79	±	1.94	2.93	±	7.18	No
	08/29/18	-0.25	±	1.30	-0.91	±	4.81	No
	09/05/18	0.47	±	1.00	1.74	±	3.68	No
	09/12/18	0.71	±	1.20	2.62	±	4.44	No
	09/19/18	1.37	±	0.89	5.07	±	3.29	No
	09/26/18	0.74	±	0.91	2.75	±	3.36	No
QA-1	07/03/18	-1.37	±	1.07	-5.07	±	3.96	No
(BLUE DOME)	07/11/18	0.15	±	0.80	0.56	±	2.96	No
	07/18/18	-0.29	±	1.34	-1.06	±	4.96	No
	07/25/18	1.82	±	1.01	6.73	±	3.74	No
	08/01/18	-2.21	±	1.58	-8.18	±	5.85	No
	08/08/18	-1.09	±	1.06	-4.03	±	3.92	No
	08/15/18	0.80	±	1.08	2.96	±	4.00	No
	08/22/18	0.80	±	1.95	2.96	±	7.22	No
	08/29/18	-0.34	±	1.81	-1.27	±	6.70	No
	09/05/18	0.41	±	0.86	1.50	±	3.18	No
	09/12/18	0.58	±	0.98	2.14	±	3.62	No
	09/19/18	1.56	±	1.01	5.77	±	3.74	No
	09/26/18	0.79	±	0.97	2.92	±	3.57	No
FAA TOWER	07/03/18	-1.34	±	1.04	-4.96	±	3.85	No
	07/11/18	0.15	±	0.80	0.57	±	2.96	No
	07/18/18	-0.31	±	1.44	-1.14	±	5.33	No
	07/25/18	1.78	±	0.99	6.59	±	3.65	No
	08/01/18	-2.67	±	1.91	-9.88	±	7.07	No
	08/08/18	-1.07	±	1.03	-3.96	±	3.81	No
	08/15/18	0.77	±	1.04	2.86	±	3.85	No
	08/22/18	0.64	±	1.56	2.35	±	5.77	No
	08/29/18	-0.33	±	1.74	-1.22	±	6.44	No
	09/05/18	0.42	±	0.90	1.57	±	3.31	No
	09/12/18	0.59	±	0.99	2.17	±	3.66	No
	09/19/18	1.49	±	0.97	5.51	±	3.57	No

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

Sampling Group and Location	Sampling Date	Result ± 1s Uncertainty ($x 10^{-15}$ µCi/mL)			Result ± 1s Uncertainty ($x 10^{-11}$ Bq/mL)			Result > 3s
	09/26/18	0.83	±	1.02	3.07	±	3.77	No
HOWE	07/03/18	-1.36	±	1.06	-5.03	±	3.92	No
	07/11/18	0.17	±	0.86	0.61	±	3.20	No
	07/18/18	-0.31	±	1.47	-1.16	±	5.44	No
	07/25/18	1.74	±	0.97	6.44	±	3.58	No
	08/01/18	-2.26	±	1.61	-8.36	±	5.96	No
	08/08/18	-1.07	±	1.03	-3.96	±	3.81	No
	08/15/18	0.86	±	1.15	3.17	±	4.26	No
	08/22/18	0.70	±	1.72	2.60	±	6.36	No
	08/29/18	-0.46	±	2.41	-1.69	±	8.92	No
	09/05/18	0.41	±	0.88	1.53	±	3.24	No
	09/12/18	0.59	±	1.00	2.20	±	3.70	No
	09/19/18	1.49	±	0.97	5.51	±	3.58	No
	09/26/18	0.78	±	0.96	2.89	±	3.54	No
MONTEVIEW	07/03/18	-3.22	±	2.51	-11.91	±	9.29	No
	07/11/18	0.15	±	0.79	0.56	±	2.92	No
	07/18/18	-0.36	±	1.69	-1.34	±	6.25	No
	07/25/18	1.75	±	0.97	6.48	±	3.60	No
	08/01/18	-2.17	±	1.55	-8.03	±	5.74	No
	08/08/18	-1.06	±	1.02	-3.92	±	3.77	No
	08/15/18	0.73	±	0.98	2.70	±	3.63	No
	08/22/18	0.60	±	1.46	2.21	±	5.40	No
	08/29/18	-0.43	±	2.25	-1.58	±	8.33	No
	09/05/18	0.42	±	0.88	1.54	±	3.26	No
	09/12/18	0.57	±	0.96	2.09	±	3.53	No
	09/19/18	1.48	±	0.96	5.48	±	3.54	No
	09/26/18	0.78	±	0.96	2.90	±	3.54	No
MUD LAKE	07/03/18	-1.34	±	1.05	-4.96	±	3.89	No
	07/11/18	0.16	±	0.81	0.57	±	3.01	No
	07/18/18	-0.30	±	1.39	-1.10	±	5.14	No
	07/25/18	1.85	±	1.03	6.85	±	3.81	No
	08/01/18	-2.32	±	1.66	-8.58	±	6.14	No
	08/08/18	-1.16	±	1.12	-4.29	±	4.14	No
	08/15/18	0.76	±	1.02	2.81	±	3.77	No
	08/22/18	0.72	±	1.76	2.65	±	6.51	No
	08/29/18	-0.43	±	2.26	-1.58	±	8.36	No
	09/05/18	0.47	±	0.99	1.74	±	3.67	No
	09/12/18	0.59	±	0.99	2.18	±	3.68	No
	09/19/18	1.58	±	1.02	5.85	±	3.77	No

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

Sampling Group and Location	Sampling Date	Result ± 1s Uncertainty ($x 10^{-15}$ µCi/mL)			Result ± 1s Uncertainty ($x 10^{-11}$ Bq/mL)			Result > 3s
	09/26/18	0.79	±	0.96	2.91	±	3.56	No
DISTANT								
BLACKFOOT	07/03/18	1.81	±	1.25	6.70	±	4.63	No
	07/11/18	-0.82	±	1.34	-3.03	±	4.96	No
	07/18/18	0.43	±	0.88	1.58	±	3.26	No
	07/25/18	0.17	±	1.26	0.61	±	4.66	No
	08/01/18	-0.84	±	0.91	-3.11	±	3.36	No
	08/08/18	1.12	±	1.17	4.14	±	4.33	No
	08/15/18	0.04	±	0.97	0.14	±	3.57	No
	08/22/18	-0.92	±	1.02	-3.42	±	3.77	No
	08/29/18	-0.16	±	1.64	-0.57	±	6.07	No
	09/05/18	-0.36	±	0.92	-1.34	±	3.42	No
	09/12/18	-2.26	±	1.70	-8.36	±	6.29	No
	09/19/18	1.97	±	1.71	7.29	±	6.33	No
	09/26/18	0.57	±	1.00	2.09	±	3.70	No
CRATERS	07/03/18	1.87	±	1.29	6.92	±	4.77	No
	07/11/18	-0.87	±	1.43	-3.23	±	5.29	No
	07/18/18	0.44	±	0.92	1.64	±	3.39	No
	07/25/18	0.18	±	1.41	0.68	±	5.22	No
	08/01/18	-0.88	±	0.95	-3.27	±	3.53	No
	08/08/18	1.16	±	1.20	4.29	±	4.44	No
	08/15/18	0.05	±	1.21	0.17	±	4.48	No
	08/22/18	-1.05	±	1.16	-3.89	±	4.29	No
	08/29/18	-0.11	±	1.21	-0.42	±	4.48	No
	09/05/18	-0.37	±	0.96	-1.38	±	3.54	No
	09/12/18	-2.29	±	1.73	-8.47	±	6.40	No
	09/19/18	3.52	±	3.05	13.02	±	11.29	No
	09/26/18	0.58	±	1.03	2.15	±	3.81	No
DUBOIS	07/03/18	-1.40	±	1.09	-5.18	±	4.03	No
	07/11/18	0.18	±	0.92	0.65	±	3.39	No
	07/18/18	-0.31	±	1.45	-1.15	±	5.37	No
	07/25/18	1.93	±	1.07	7.14	±	3.96	No
	08/01/18	-2.32	±	1.66	-8.58	±	6.14	No
	08/08/18	-1.21	±	1.17	-4.48	±	4.33	No
	08/15/18	0.77	±	1.03	2.83	±	3.81	No
	08/22/18	0.77	±	1.87	2.83	±	6.92	No
	08/29/18	-0.33	±	1.72	-1.20	±	6.36	No
	09/05/18	0.44	±	0.93	1.62	±	3.42	No
	09/12/18	0.57	±	0.96	2.10	±	3.55	No

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

Sampling Group and Location	Sampling Date	Result ± 1s Uncertainty ($x 10^{-15}$ µCi/mL)			Result ± 1s Uncertainty ($x 10^{-11}$ Bq/mL)			Result > 3s
	09/19/18	1.53	±	0.99	5.66	±	3.67	No
	09/26/18	0.83	±	1.01	3.06	±	3.74	No
IDAHO FALLS	07/03/18	-1.40	±	1.10	-5.18	±	4.07	No
	07/11/18	0.16	±	0.85	0.60	±	3.16	No
	07/18/18	-0.31	±	1.47	-1.16	±	5.44	No
	07/25/18	1.89	±	1.05	6.99	±	3.89	No
	08/01/18	-2.31	±	1.65	-8.55	±	6.11	No
	08/08/18	-1.08	±	1.04	-4.00	±	3.85	No
	08/15/18	0.79	±	1.06	2.92	±	3.92	No
	08/22/18	0.67	±	1.63	2.47	±	6.03	No
	08/29/18	-0.37	±	1.95	-1.37	±	7.22	No
	09/05/18	0.44	±	0.93	1.63	±	3.44	No
	09/12/18	0.63	±	1.07	2.35	±	3.96	No
	09/19/18	1.60	±	1.04	5.92	±	3.85	No
	09/26/18	0.87	±	1.07	3.23	±	3.96	No
JACKSON	07/03/18	-0.24	±	1.03	-0.89	±	3.81	No
	07/11/18	-1.14	±	1.87	-4.22	±	6.92	No
	07/18/18	0.45	±	0.92	1.65	±	3.42	No
	07/25/18	0.20	±	1.50	0.73	±	5.55	No
	08/01/18	-1.05	±	1.14	-3.89	±	4.22	No
	08/08/18	1.27	±	1.32	4.70	±	4.88	No
	08/15/18	0.06	±	1.55	0.22	±	5.74	No
	08/22/18	4.36	±	1.98	16.13	±	7.33	No
	08/29/18	-0.15	±	1.61	-0.56	±	5.96	No
	09/05/18	-0.38	±	0.97	-1.40	±	3.59	No
	09/12/18	-2.27	±	1.71	-8.40	±	6.33	No
	09/19/18	1.76	±	1.52	6.51	±	5.62	No
	09/26/18	0.61	±	1.08	2.26	±	4.00	No
SUGAR CITY	07/03/18	-1.23	±	0.96	-4.55	±	3.55	No
	07/11/18	0.14	±	0.73	0.51	±	2.70	No
	07/18/18	-0.27	±	1.26	-0.99	±	4.66	No
	07/25/18	1.59	±	0.88	5.88	±	3.27	No
	08/01/18	-2.05	±	1.46	-7.59	±	5.40	No
	08/08/18	-0.99	±	0.96	-3.67	±	3.55	No
	08/15/18	0.78	±	1.05	2.88	±	3.89	No
	08/22/18	0.79	±	1.94	2.94	±	7.18	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 (x 10^{-18} µCi/mL)			Result ± 1s Uncertainty (x 10^{-14} Bq/mL)			Result > 3s
BOUNDARY									
ARCO	09/26/18	CESIUM-137	65.9	±	106.00	243.83	±	392.20	No
	09/26/18	STRONTIUM-90	0.65	±	8.94	2.39	±	33.08	No
ATOMIC CITY	09/26/18	AMERICIUM-241	3.48	±	1.71	12.88	±	6.33	No
	09/26/18	CESIUM-137	-50.60	±	68.20	-187.22	±	252.34	No
	09/26/18	PLUTONIUM-238	0.00	±	2.26	0.00	±	8.36	No
	09/26/18	PLUTONIUM-239/240	3.28	±	2.34	0.00	±	0.00	No
QA-1 (ATOMIC CITY)	09/26/18	AMERICIUM-241	2.73	±	86.90	10.10	±	321.53	No
	09/26/18	CESIUM-137	-38.90	±	86.90	-143.93	±	321.53	No
	09/26/18	PLUTONIUM-238	2.16	±	2.14	7.99	±	7.92	No
	09/26/18	PLUTONIUM-239/240	3.08	±	2.44	11.40	±	9.03	No
BLUE DOME	09/26/18	CESIUM-137	-39.70	±	84.90	-146.89	±	314.13	No
	09/26/18	STRONTIUM-90	-12.80	±	8.53	-47.36	±	31.56	No
QA-2 (BLUE DOME)	09/26/18	CESIUM-137	106.00	±	74.50	392.20	±	275.65	No
	09/26/18	STRONTIUM-90	-12.80	±	8.53	9.35	±	31.56	No
FAA TOWER	09/26/18	AMERICIUM-241	1.26	±	1.64	4.66	±	6.07	No
	09/26/18	CESIUM-137	69.20	±	103.00	256.04	±	381.10	No
	09/26/18	PLUTONIUM-238	-3.74	±	4.06	-13.84	±	15.02	No
	09/26/18	PLUTONIUM-239/240	0.53	±	3.91	1.97	±	14.47	No
HOWE	09/26/18	CESIUM-137	-142.00	±	91.30	-525.40	±	337.81	No
MONTEVIEW	09/26/18	CESIUM-137	135.00	±	108.00	499.50	±	399.60	No
	09/26/18	STRONTIUM-90	-11.90	±	8.77	-44.03	±	32.45	No
MUD LAKE	09/26/18	CESIUM-137	-134.00	±	108.00	-495.80	±	399.60	No
DISTANT									
BLACKFOOT	09/26/18	CESIUM-137	27.30	±	81.70	101.01	±	302.29	No
CRATERS	09/26/18	AMERICIUM-241	4.94	±	2.38	18.28	±	8.81	No
	09/26/18	CESIUM-137	-4.12	±	91.60	-15.24	±	338.92	No
	09/26/18	PLUTONIUM-238	0.00	±	4.79	0.00	±	17.72	No
	09/26/18	PLUTONIUM-239/240	-2.45	±	4.64	-9.07	±	17.17	No
DUBOIS	09/26/18	CESIUM-137	-26.10	±	84.90	-96.57	±	314.13	No
IDAHO FALLS	09/26/18	CESIUM-137	-35.60	±	92.20	-131.72	±	341.14	No
JACKSON	09/26/18	AMERICIUM-241	4.70	±	2.20	17.39	±	8.14	No
	09/26/18	CESIUM-137	68.60	±	74.90	253.82	±	277.13	No

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

	09/26/18	PLUTONIUM-238	-16.80	±	6.79	-62.16	±	25.12	No
	09/26/18	PLUTONIUM-239/240	-15.40	±	9.29	-56.98	±	34.37	No
SUGAR CITY	09/26/18	CESIUM-137	-54.70	±	92.10	-202.39	±	340.77	No
	09/26/18	STRONTIUM-90	-7.94	±	10.70	-29.38	±	39.59	No
INL SITE									
EFS	09/26/18	CESIUM-137	114.00	±	71.60	421.80	±	264.92	No
	09/26/18	STRONTIUM-90	-27.80	±	8.61	-102.86	±	31.86	No
MAIN GATE	09/26/18	AMERICIUM-241	-6.71	±	2.90	-24.83	±	10.73	No
	09/26/18	CESIUM-137	-42.60	±	89.80	-157.62	±	332.26	No
	09/26/18	PLUTONIUM-238	2.80	±	2.76	10.36	±	10.21	No
	09/26/18	PLUTONIUM-239/240	2.79	±	4.09	10.32	±	15.13	No
VAN BUREN GATE	09/26/18	CESIUM-137	-109.00	±	92.60	-403.30	±	342.62	No
	09/26/18	STRONTIUM-90	9.74	±	5.41	36.04	±	20.02	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	06/20/18	07/11/18	4.09	±	2.15	15.13	±	7.96	No
ATOMIC CITY	07/11/18	08/01/18	9.60	±	1.60	35.52	±	5.92	**Yes**
ATOMIC CITY	08/01/18	08/29/18	17.40	±	1.52	64.38	±	5.62	**Yes**
HOWE	06/20/18	07/11/18	3.57	±	2.69	13.21	±	9.95	No
HOWE	07/11/18	08/01/18	13.60	±	2.43	50.32	±	8.99	**Yes**
HOWE	08/01/18	08/29/18	14.20	±	2.04	52.54	±	7.55	**Yes**
HOWE	08/29/18	09/26/18	4.06	±	1.34	15.02	±	4.96	**Yes**
DISTANT									
IDAHO FALLS	06/27/18	07/11/18	5.24	±	2.78	19.39	±	10.29	No
IDAHO FALLS	07/11/18	07/25/18	7.57	±	2.95	28.01	±	10.92	No
IDAHO FALLS	07/25/18	08/08/18	9.77	±	1.87	36.15	±	6.92	**Yes**
IDAHO FALLS	08/08/18	08/22/18	11.10	±	1.95	41.07	±	7.22	**Yes**
IDAHO FALLS	08/22/18	09/12/18	9.67	±	1.52	35.78	±	5.62	**Yes**
INL SITE									
EFS	06/27/18	07/18/18	9.69	±	1.94	35.85	±	7.18	**Yes**
EFS	07/18/18	08/08/18	17.50	±	1.56	64.75	±	5.77	**Yes**
EFS	08/08/18	09/12/18	15.20	±	1.15	56.24	±	4.26	**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	08/22/18	08/29/18	148.00	±	24.30	5.48	±	0.90	**Yes**
HOWE	07/11/18	07/18/18	160.00	±	24.50	5.92	±	0.91	**Yes**
HOWE	08/22/18	08/29/18	46.10	±	24.00	1.71	±	0.89	No
DISTANT									
IDAHO FALLS	06/30/18	07/31/18	221.00	±	25.30	8.18	±	0.94	**Yes**
IDAHO FALLS	07/31/18	08/31/18	46.70	±	24.00	1.73	±	0.89	No
INL SITE									
EFS	08/22/18	08/29/18	186.00	±	25.80	6.88	±	0.95	**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	07/08/18	-0.75	±	2.18	-0.03	±	0.08	No	-1.27	±	1.36	-0.05	±	0.05	No
	08/05/18	-2.63	±	2.22	-0.10	±	0.08	No	2.24	±	1.41	0.08	±	0.05	No
CONTROL	07/02/18	0.83	±	1.12	0.03	±	0.04	No	-0.47	±	0.78	-0.02	±	0.03	No
	08/07/18	-1.94	±	2.21	-0.07	±	0.08	No	1.75	±	1.44	0.06	±	0.05	No
	09/04/18	1.22	±	1.85	0.05	±	0.07	No	-0.17	±	1.33	-0.01	±	0.05	No
DIETRICH	07/02/18	-0.63	±	1.06	-0.02	±	0.04	No	-0.81	±	0.98	-0.03	±	0.04	No
	08/07/18	0.34	±	1.04	0.01	±	0.04	No	-0.15	±	0.82	-0.01	±	0.03	No
	09/04/18	-0.62	±	1.98	-0.02	±	0.07	No	-1.53	±	1.33	-0.06	±	0.05	No
HOWE	07/02/18	-2.23	±	1.94	-0.08	±	0.07	No	0.55	±	1.36	0.02	±	0.05	No
DUPLICATE	07/02/18	-1.87	±	2.07	-0.07	±	0.08	No	-0.20	±	1.28	-0.01	±	0.05	No
	08/07/18	-2.55	±	2.10	-0.09	±	0.08	No	0.07	±	1.30	0.00	±	0.05	No
IDAHO FALLS	07/03/18	-0.99	±	0.99	-0.04	±	0.04	No	-1.07	±	0.83	-0.04	±	0.03	No
	07/10/18	-2.63	±	1.72	-0.10	±	0.06	No	0.06	±	1.53	0.00	±	0.06	No
	07/17/18	0.25	±	1.54	0.01	±	0.06	No	0.97	±	1.41	0.04	±	0.05	No
	07/25/18	0.28	±	1.41	0.01	±	0.05	No	0.77	±	1.48	0.03	±	0.05	No
	07/31/18	2.95	±	1.64	0.11	±	0.06	No	1.52	±	1.39	0.06	±	0.05	No
	08/07/18	0.98	±	0.99	0.04	±	0.04	No	0.01	±	0.82	0.00	±	0.03	No
	08/14/18	-0.30	±	1.00	-0.01	±	0.04	No	-1.51	±	0.87	-0.06	±	0.03	No
	08/21/18	0.18	±	1.60	0.01	±	0.06	No	-1.67	±	1.58	-0.06	±	0.06	No
	08/28/18	-0.61	±	1.60	-0.02	±	0.06	No	-2.78	±	1.64	-0.10	±	0.06	No
	09/04/18	0.01	±	1.06	0.00	±	0.04	No	-0.08	±	0.81	0.00	±	0.03	No
	09/11/18	-2.36	±	1.73	-0.09	±	0.06	No	0.39	±	1.54	0.01	±	0.06	No
	09/18/18	-1.35	±	1.68	-0.05	±	0.06	No	0.26	±	1.39	0.01	±	0.05	No
	09/25/18	1.39	±	1.62	0.05	±	0.06	No	0.29	±	1.43	0.01	±	0.05	No
MINIDOKA	07/02/18	-1.50	±	1.90	-0.06	±	0.07	No	-0.77	±	1.31	-0.03	±	0.05	No
	08/07/18	-2.60	±	1.83	-0.10	±	0.07	No	-0.44	±	1.46	-0.02	±	0.05	No
	09/04/18	-0.08	±	1.14	0.00	±	0.04	No	0.20	±	0.83	0.01	±	0.03	No
TERRETON	07/02/18	-0.01	±	0.97	0.00	±	0.04	No	2.24	±	0.90	0.08	±	0.03	No
	07/11/18	0.98	±	0.90	0.04	±	0.03	No	0.72	±	0.85	0.03	±	0.03	No
	07/18/18	-0.52	±	1.70	-0.02	±	0.06	No	-0.83	±	1.35	-0.03	±	0.05	No
	07/25/18	1.05	±	0.99	0.04	±	0.04	No	0.32	±	0.92	0.01	±	0.03	No
	08/01/18	0.28	±	0.95	0.01	±	0.04	No	0.26	±	0.93	0.01	±	0.03	No
	08/07/18	1.49	±	1.65	0.06	±	0.06	No	0.51	±	1.41	0.02	±	0.05	No
	08/15/18	-2.27	±	1.74	-0.08	±	0.06	No	-0.66	±	1.36	-0.02	±	0.05	No
	08/22/18	0.99	±	1.70	0.04	±	0.06	No	-0.08	±	1.34	0.00	±	0.05	No
	08/29/18	-1.91	±	1.69	-0.07	±	0.06	No	0.20	±	1.32	0.01	±	0.05	No
	09/04/18	0.53	±	1.67	0.02	±	0.06	No	0.82	±	1.43	0.03	±	0.05	No
DUPLICATE	9/4/2018[a]	-1.57	±	1.04	-0.06	±	0.04	No	-0.07	±	0.81	0.00	±	0.03	No
	09/12/18	1.53	±	1.73	0.06	±	0.06	No	-0.74	±	1.37	-0.03	±	0.05	No
	09/19/18	0.42	±	0.97	0.02	±	0.04	No	-0.84	±	0.95	-0.03	±	0.04	No
	09/26/18	-1.05	±	1.00	-0.04	±	0.04	No	-0.39	±	0.95	-0.01	±	0.04	No

[a] A review of the table performed in the summer of 2020, determined the activity concentration values reported for the media were correct, however, the collection date for the duplicate milk sample collected from Terreton was incorrect. The collection date was inadvertently listed as July 2, 2018 when the sample was actually collected on September 4, 2018. The collection date was updated with the correct value.

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

Location	Sampling Date	Cesium-137 Result ± 1s Uncertainty pCi/kg[a]			Result ± 1s Uncertainty ($x 10^{-2}$ Bq/kg)[a]			Result > 3s
ATOMIC CITY	07/18/18	60.80	±	69.00	225.19	±	255.56	No
BLACKFOOT	06/30/18	31.60	±	84.80	117.04	±	314.07	No
CONTROL	08/29/18	-118.00	±	86.50	-437.04	±	320.37	No
EFS	07/18/18	33.20	±	73.20	122.96	±	271.11	No
FAA TOWER	07/28/18	109.00	±	84.70	403.70	±	313.70	No
HOWE	07/18/18	14.60	±	90.70	54.07	±	335.93	No
IDAHO FALLS	07/27/18	57.80	±	82.20	214.07	±	304.44	No
IDAHO FALLS (DUPLICATE)	07/27/18	-39.30	±	60.80	-145.56	±	225.19	No
MONTEVIEW	07/18/18	82.70	±	86.70	306.30	±	321.11	No
		Strontium-90						
		Result ± 1s Uncertainty pCi/kg[a]			**Result ± 1s Uncertainty ($x 10^{-2}$ Bq/kg)[a]**			**Result > 3s**
ATOMIC CITY	07/18/18	33.30	±	19.40	123.33	±	71.85	No
BLACKFOOT	06/30/18	54.30	±	84.80	201.11	±	314.07	No
CONTROL	08/29/18	-37.60	±	14.90	-139.26	±	55.19	No
EFS	07/18/18	154.00	±	23.50	570.37	±	87.04	**Yes**
FAA TOWER	07/28/18	44.70	±	20.00	165.56	±	74.07	No
HOWE	07/18/18	30.90	±	19.40	114.44	±	71.85	No
IDAHO FALLS	07/27/18	55.60	±	20.00	205.93	±	74.07	No
IDAHO FALLS (DUPLICATE)	07/27/18	43.40	±	19.40	160.74	±	71.85	No
MONTEVIEW	07/18/18	0.89	±	17.50	3.30	±	64.81	No

[a] During the summer of 2020, a review of the table determined the activity concentration values reported for the media were correct, however, the unit of concentration listed in the column headings were incorrect. The column headings have been updated to the correct units of concentration (pCi/kg and Bq/kg). For further discussion see Section 5.2 Lettuce Sampling.

Tabel C-8. Cesium-137 and Strontium-90 Concentrations in Potatoes

		Cesium-137						
		Result ± 1s Uncertainty pCi/kg[a]			Result ± 1s Uncertainty (x 10^{-2} Bq/kg)[a]			
Location	Sampling Date							Result > 3s
ARCO	09/26/18	1.97	±	1.72	7.30	±	6.37	No
BLACKFOOT	10/06/18	-0.37	±	1.15	-1.35	±	4.26	No
CONTROL	10/15/18	-0.48	±	1.05	-1.78	±	3.89	No
IDAHO FALLS	09/29/18	-1.35	±	1.73	-5.00	±	6.41	No
MUD LAKE	09/26/18	-0.63	±	1.03	-2.33	±	3.81	No
FORT HALL	10/20/18	-0.06	±	1.58	-0.22	±	5.85	No
FORT HALL (DUPLICATE)	10/20/18	-1.06	±	1.14	-3.93	±	4.22	No
REXBURG	10/15/18	0.87	±	2.00	3.22	±	7.41	No
RUPERT	10/02/18	1.09	±	1.71	4.04	±	6.33	No
SHELLEY	09/27/18	-0.43	±	0.97	-1.60	±	3.59	No
		Strontium-90						
		Result ± 1s Uncertainty pCi/kg[a]			Result ± 1s Uncertainty (x 10^{-2} Bq/kg)[a]			Result > 3s
ARCO	09/26/18	-3.56	±	14.80	-13.19	±	54.81	No
BLACKFOOT	10/06/18	7.26	±	17.60	26.89	±	65.19	No
CONTROL	10/15/18	-0.01	±	17.40	-0.05	±	64.44	No
IDAHO FALLS	09/29/18	13.70	±	17.80	50.74	±	65.93	No
MUD LAKE	09/26/18	-5.84	±	16.00	-21.63	±	59.26	No
FORT HALL	10/20/18	27.50	±	18.60	101.85	±	68.89	No
FORT HALL (DUPLICATE)	10/20/18	52.70	±	20.60	195.19	±	76.30	No
REXBURG	10/15/18	-23.10	±	14.80	-85.56	±	54.81	No
RUPERT	10/02/18	-34.40	±	13.70	-127.41	±	50.74	No
SHELLEY	09/27/18	-10.20	±	16.70	-37.78	±	61.85	No

[a] During the summer of 2020, a review of the table determined the activity concentration values reported for the media were correct, however, the unit of concentration listed in the column headings were incorrect. The column headings have been updated to the correct units of concentration (pCi/kg and Bq/kg). For further discussion see Section 5.3 Potato Sampling.

Table C-9. Cesium-137 and Strontium-90 Concentrations in Grain

Location	Sampling Date	Cesium-137 Result ± 1s Uncertainty pCi/kg			Result ± 1s Uncertainty Bq/kg			Result > 3s
AMERICAN FALLS	09/04/18	-0.39	±	1.14	-0.01	±	0.04	No
ARCO	09/04/18	0.12	±	1.28	0.00	±	0.05	No
CONTROL	09/04/18	-0.99	±	1.27	-0.04	±	0.05	No
HOWE	09/04/18	-1.08	±	1.97	-0.04	±	0.07	No
IDAHO FALLS	09/04/18	-2.97	±	2.07	-0.11	±	0.08	No
KIMAMA	08/29/18	-3.29	±	2.00	-0.12	±	0.07	No
MONTEVIEW	09/07/18	1.56	±	1.97	0.06	±	0.07	No
ROBERTS	09/04/18	-0.35	±	1.36	-0.01	±	0.05	No
RUPERT	09/04/18	0.63	±	2.08	0.02	±	0.08	No
RUPERT (DUPLICATE)	09/04/18	-0.87	±	1.97	-0.03	±	0.07	No
TERRETON	08/15/18	-0.12	±	1.76	0.00	±	0.07	No
		Strontium-90						
		Result ± 1s Uncertainty pCi/kg			**Result ± 1s Uncertainty Bq/kg**			**Result > 3s**
AMERICAN FALLS	09/04/18	13.50	±	17.90	0.50	±	0.66	No
ARCO	09/04/18	-29.80	±	13.80	-1.10	±	0.51	No
CONTROL	09/04/18	-7.30	±	18.20	-0.27	±	0.67	No
HOWE	09/04/18	-8.63	±	16.10	-0.32	±	0.60	No
IDAHO FALLS	09/04/18	-2.05	±	17.20	-0.08	±	0.64	No
KIMAMA	08/29/18	9.10	±	18.10	0.34	±	0.67	No
MONTEVIEW	09/07/18	-0.85	±	16.80	-0.03	±	0.62	No
ROBERTS	09/04/18	53.90	±	19.90	2.00	±	0.74	No
RUPERT	09/04/18	11.40	±	17.70	0.42	±	0.66	No
RUPERT (DUPLICATE)	09/04/18	-6.19	±	18.00	-0.23	±	0.67	No
TERRETON	08/15/18	-33.20	±	15.30	-1.23	±	0.57	No

Table C-10. Gamma-emitting Radionuclides in Large Game Animals

Species	Collection Date	Tissue	Analyte	Result ± 1s Uncertainty (pCi/kg wet weight)			Result ± 1s Uncertainty ($x 10^{-2}$ Bq/kg wet weight)			Result > 3s
ELK	09/25/18	Muscle	^{131}I	-2.20	±	2.59	-8.14	±	9.58	No
	09/25/18		^{137}Cs	1.46	±	1.36	5.40	±	5.03	No
ELK	09/25/18	Thyroid	^{131}I	2.77	±	113.00	10.25	±	418.10	No
	09/25/18		^{137}Cs	-59.50	±	99.80	-220.15	±	369.26	No

Table C-11. Actinides, Cesium-137, and Strontium-90 Concentrations in Soil

Location	Sampling Date	Americium-241 Concentration ± 1s (pCi/Kg)			Concentration ± 1s (Bq/Kg)			Result > 3s
BOUNDARY								
ATOMIC CITY	07/24/18	8.57	±	8.45	0.32	±	0.31	No
ATOMIC CITY (DUPLICATE)	07/24/18	31.80	±	8.75	1.18	±	0.32	Yes
BUTTE CITY	07/24/18	9.89	±	5.39	0.37	±	0.20	No
FAA TOWER	07/24/18	-59.20	±	17.10	-2.19	±	0.63	No
FRENCHMAN'S CABIN	07/24/18	33.70	±	20.00	1.25	±	0.74	No
HOWE	07/23/18	-9.92	±	16.80	-0.37	±	0.62	No
MONTEVIEW	07/23/18	11.10	±	8.65	0.41	±	0.32	No
MUD LAKE #1	07/23/18	34.10	±	8.61	1.26	±	0.32	Yes
MUD LAKE #2	07/23/18	-5.99	±	11.70	-0.22	±	0.43	No
RENO RANCH	07/23/18	15.30	±	11.30	0.57	±	0.42	No
DISTANT								
BLACKFOOT	07/24/18	-75.00	±	20.30	-2.78	±	0.75	No
CAREY	07/24/18	16.70	±	8.23	0.62	±	0.30	No
ST. ANTHONY	07/23/18	31.00	±	9.09	1.15	±	0.34	Yes

Location	Sampling Date	Cesium-137 Concentration ± 1s (pCi/Kg)			Concentration ± 1s (Bq/Kg)			Result > 3s
BOUNDARY								
ATOMIC CITY	07/24/18	277.98	±	16.76	10.30	±	0.62	Yes
ATOMIC CITY (DUPLICATE)	07/24/18	267.00	±	15.50	9.89	±	0.57	Yes
BUTTE CITY	07/24/18	261.88	±	15.17	9.70	±	0.56	Yes
FAA TOWER	07/24/18	383.96	±	21.86	14.22	±	0.81	Yes
FRENCHMAN'S CABIN	07/24/18	262.08	±	15.07	9.71	±	0.56	Yes
HOWE	07/23/18	192.13	±	11.29	7.12	±	0.42	Yes
MONTEVIEW	07/23/18	248.59	±	14.96	9.21	±	0.55	Yes
MUD LAKE #1	07/23/18	188.52	±	11.62	6.98	±	0.43	Yes
MUD LAKE #2	07/23/18	257.28	±	15.43	9.53	±	0.57	Yes
RENO RANCH	07/23/18	386.26	±	22.10	14.31	±	0.82	Yes
DISTANT								
BLACKFOOT	07/24/18	207.68	±	12.20	7.69	±	0.45	Yes
CAREY	07/24/18	642.10	±	36.21	23.78	±	1.34	Yes

Table C-11. Actinide, Cesium-137, and Strontium-90 Concentrations in Soil

ST. ANTHONY	07/23/18	634.73	±	36.61	23.51	±	1.36	Yes

Location	Sampling Date	Plutonium-238 Concentration ± 1s (pCi/Kg)			Concentration ± 1s (Bq/Kg)			Result > 3s
BOUNDARY								
ATOMIC CITY	07/24/18	2.61	±	3.19	0.10	±	0.12	No
ATOMIC CITY (DUPLICATE)	07/24/18	5.18	±	5.53	0.19	±	0.20	No
BUTTE CITY	07/24/18	2.13	±	3.01	0.08	±	0.11	No
FAA TOWER	07/24/18	-3.73	±	4.46	-0.14	±	0.17	No
FRENCHMAN'S CABIN	07/24/18	9.09	±	27.00	0.34	±	1.00	No
HOWE	07/23/18	4.99	±	3.48	0.18	±	0.13	No
MONTEVIEW	07/23/18	4.05	±	1.62	0.15	±	0.06	No
MUD LAKE #1	07/23/18	4.19	±	2.87	0.16	±	0.11	No
MUD LAKE #2	07/23/18	9.49	±	2.74	0.35	±	0.10	Yes
RENO RANCH	07/23/18	4.82	±	2.55	0.18	±	0.09	No
DISTANT								
BLACKFOOT	07/24/18	2.78	±	4.37	0.10	±	0.16	No
CAREY	07/24/18	10.90	±	4.38	0.40	±	0.16	No
ST. ANTHONY	07/23/18	4.44	±	2.72	0.16	±	0.10	No

Location	Sampling Date	Plutonium-239/240 Concentration ± 1s (pCi/kg) (pCi/Kg)			Concentration ± 1s (Bq/Kg)			Result > 3s
BOUNDARY								
ATOMIC CITY	07/24/18	15.60	±	5.20	0.58	±	0.19	No
ATOMIC CITY (DUPLICATE)	07/24/18	-15.50	±	8.77	-0.57	±	0.32	No
BUTTE CITY	07/24/18	15.90	±	5.52	0.59	±	0.20	No
FAA TOWER	07/24/18	17.00	±	4.90	0.63	±	0.18	Yes
FRENCHMAN'S CABIN	07/24/18	7.25	±	17.50	0.27	±	0.65	No
HOWE	07/23/18	8.71	±	4.35	0.32	±	0.16	No
MONTEVIEW	07/23/18	13.80	±	2.69	0.51	±	0.10	Yes
MUD LAKE #1	07/23/18	6.95	±	3.65	0.26	±	0.14	No
MUD LAKE #2	07/23/18	16.90	±	3.76	0.63	±	0.14	Yes
RENO RANCH	07/23/18	27.90	±	5.35	1.03	±	0.20	Yes
DISTANT								
BLACKFOOT	07/24/18	2.31	±	5.95	0.09	±	0.22	No

Table C-11. Actinide, Cesium-137, and Strontium-90 Concentrations in Soil

CAREY	07/24/18	41.20	±	8.04	1.53	±	0.30	Yes
ST. ANTHONY	07/23/18	46.40	±	7.50	1.72	±	0.28	Yes

Location	Sampling Date	Strontium-90 Concentration ± 1s (pCi/Kg)			Concentration ± 1s (Bq/Kg)			Result > 3s
BOUNDARY								
ATOMIC CITY	07/24/18	5.49	±	11.70	0.20	±	0.43	No
ATOMIC CITY (DUPLICATE)	07/24/18	32.40	±	11.60	1.20	±	0.43	No
BUTTE CITY	07/24/18	17.70	±	9.53	0.66	±	0.35	No
FAA TOWER	07/24/18	5.04	±	14.00	0.19	±	0.52	No
FRENCHMAN'S CABIN	07/24/18	28.80	±	13.50	1.07	±	0.50	No
HOWE	07/23/18	-31.50	±	15.70	-1.17	±	0.58	No
MONTEVIEW	07/23/18	14.40	±	16.70	0.53	±	0.62	No
MUD LAKE #1	07/23/18	-9.01	±	16.10	-0.33	±	0.60	No
MUD LAKE #2	07/23/18	-15.20	±	11.90	-0.56	±	0.44	No
RENO RANCH	07/23/18	39.00	±	19.20	1.44	±	0.71	No
DISTANT								
BLACKFOOT	07/24/18	14.40	±	9.38	0.53	±	0.35	No
CAREY	07/24/18	-4.82	±	12.50	-0.18	±	0.46	No
ST. ANTHONY	07/23/18	105.00	±	25.60	3.89	±	0.95	Yes

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.

Parameter	P[a]
Gross Alpha	
Quarter	0.2871
July	0.3596
August	0.4781
September	0.4878
Gross Beta	
Quarter	0.3995
July	0.9174
August	0.2936
September	0.8620

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