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Idaho National Laboratory Site Offsite Environmental Surveillance Program Report: Fourth Quarter 2015

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Contributors:
Russ Mitchell, Marilyn Case

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By Wastren Advantage Inc.
Environmental Surveillance, Education, and Research Program
Douglas K. Halford, Program Manager
120 Technology Dr., Idaho Falls, Idaho 83401
www.idahoeser.com

EXECUTIVE SUMMARY

None of the radionuclides detected in samples collected during the fourth quarter of 2015 could be directly linked with INL Site activities, with the exception of waterfowl collected from INL wastewater ponds. Levels of detected radionuclides were no different than values measured at other locations across the western United States. All detected radionuclide concentrations were well below standards set by the U.S. Department of Energy (DOE) and regulatory standards established by the U.S. Environmental Protection Agency (EPA) for protection of the public.

This report for the fourth quarter of 2015 contains results from the Environmental Surveillance, Education, and Research (ESER) Program's monitoring of the Department of Energy's Idaho National Laboratory (INL) Site's offsite environment, October 1 through December 31, 2015. All sample types (media) and the sampling schedule followed during 2015 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 and drinking/surface water
- Milk and potatoes
- Large game animals and waterfowl
- Environmental radiation measurements

Table E-1 Summary of results for the Fourth Quarter of 2015.

Media	Sample Type	Analysis	Results
Air	Filters	Gross alpha, gross beta	There were a few statistical differences in gross alpha or gross beta concentrations measured at Distant, Boundary, and INL Site sampling locations. These appeared to be normal variability in the data. No result exceeded the DCS for gross alpha or gross beta activity in air.
		Gamma-emitting radionuclides, ^{90}Sr, actinides (americium and plutonium)	No human- radionuclides were detected in any of the fourth quarter composites.
	Charcoal Cartridge	Iodine-131	Iodine-131 was detected in one of the 26 batches counted during the quarter. The result was just above the detection limit and was not confirmed by later recounts.
Atmospheric Moisture	Liquid	Tritium	Seven of the 12 sample results showed tritium concentrations greater than the 3s uncertainty during the quarter. No sample result exceeded the DCS for tritium in air.
Precipitation	Liquid	Tritium	Eleven samples were collected. Three of the results were greater than the 3s uncertainty. The concentrations were consistent with those reported across the region by the Environmental Protection Agency and with previous results.
Drinking and Surface Water	Liquid	Gross Alpha, Gross Beta, Tritium	Gross alpha activity was reported in two drinking water samples and one surface water sample. Gross beta was detected in six of the nine drinking water samples and in all of the surface water samples. Activities were consistent with natural levels of radioactivity in the aquifer. Tritium was detected in three drinking water samples, including a sample of bottled water, and in one of the surface water samples. The results were well below the DCS for tritium in drinking

			water.
Milk	Liquid	Iodine-131, other gamma-emitting radionuclides, ^{90}Sr, tritium	No Iodine-131 or other human-made gamma emitting radionuclides were detected. Strontium-90 was detected in all seven samples analyzed, including a control sample from out-of-state. All concentrations were well within the range of detections during the past few years. Tritium was detected in three of seven samples analyzed at a concentration similar to those found in other liquid media.
Potatoes	Vegetation	Gamma-emitting radionuclides, ^{90}Sr	No human-made gamma-emitting radionuclides or ^{90}Sr were found in any of the eight samples collected.
Large Game Animals	Tissue	Gamma-emitting radionuclides	No human-made gamma-emitting radionuclides were found in the muscle tissues, liver, or thyroid of any of the three game animals sampled in the fourth quarter.
Waterfowl	Tissue	Gamma emitting radionuclides, ^{90}Sr, ^{241}Am, and plutonium	Seven radionuclides were found in the three ducks from the Advanced Test Reactor complex. Six of these were also detected in the edible tissues of these ducks. These were likely to have originated from wastewater ponds at the facility. Concentrations were higher in 2015 than in the past several years, likely because dewatering of the ponds lowered the water levels and concentrated the radionuclides in the remaining water. Stontium-90 was detected in some portions of control ducks, but not in the edible tissues. A dose of 0.49 mrem was calculated from consumption of an entire duck with the maximum detected concentrations.
Environmental Dosimeters	Environmental radiation	External radioactivity	Measurements of environmental radiation were made using both thermoluminescent dosimeters (TLDs) and optically-stimulated luminescent dosimeters (OSLDs). Both dosimeter types showed a similar pattern with somewhat higher

		measurements at Distant locations than Boundary locations.

LIST OF ABBREVIATIONS

AEC	Atomic Energy Commission
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
GSS	Gonzales Stoller Surveillance, LLC
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
NRTS	National Reactor Testing Station
WAI	Wastren Advantage, Inc.

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 2015, environmental monitoring within the INL Site boundaries was primarily the responsibility of the INL and Idaho Cleanup Project (ICP) contractors, while monitoring outside the INL Site boundaries was conducted under the Environmental Surveillance, Education, and Research (ESER) Program. At the beginning of the first quarter of 2011, the ESER Program became led by a new partnership between S.M. Stoller and Jerome Gonzales Management Systems, Inc. with the support of the previous team members. This partnership is named Gonzales Stoller Surveillance, LLC (GSS).The ESER Program was led by GSS in cooperation with its team members, including the University of Idaho, Idaho State University (ISU), and ALS Environmental.

This report contains monitoring results from the ESER Program for samples collected during the fourth quarter of 2015 (October 1-December 31, 2015).

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 three locations on and around the INL Site
- drinking water from eight locations and surface water from three locations around the INL Site
- agricultural products, including milk at seven dairies around the INL Site, potatoes from at least six local producers, alfalfa from a local producer, grain (wheat and barley) from approximately 10 local producers, and lettuce from approximately nine home-owned and portable gardens on and around the INL
- soil from 13 locations around the INL Site biennially
- environmental dosimeters from 17 locations semi-annually
- various numbers of wildlife including big game (pronghorn, mule deer, and elk) and waterfowl sampled on and near 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 ALS Environmental of Fort Collins, Colorado.

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 [previously known as the Environmental Radiation Ambient Monitoring System (ERAMS) network] (EPA 2015). The EPA established the ERAMS network in 1973 with an emphasis on identifying trends in the accumulation of long-lived radionuclides in the environment. ERAMS was renamed RadNet in 2005 to reflect a new mission. RadNet is comprised of a nationwide network of sampling stations that provide air, precipitation, drinking water, and milk samples. 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 and for preparing quarterly reports on results from the environmental surveillance program. The quarterly reports are then consolidated into the INL Site Environmental Report for each calendar year. These annual reports also include 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 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. ESER currently defines a detection of radioactivity in an individual sample if the result exceeds the minimum detectable concentration (MDC) calculated by the laboratory after the analysis of a background sample (i.e., the *a posteriori* measurement) based on calculations derived by Curie (1968). The 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 WAI 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 multiprogram 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.

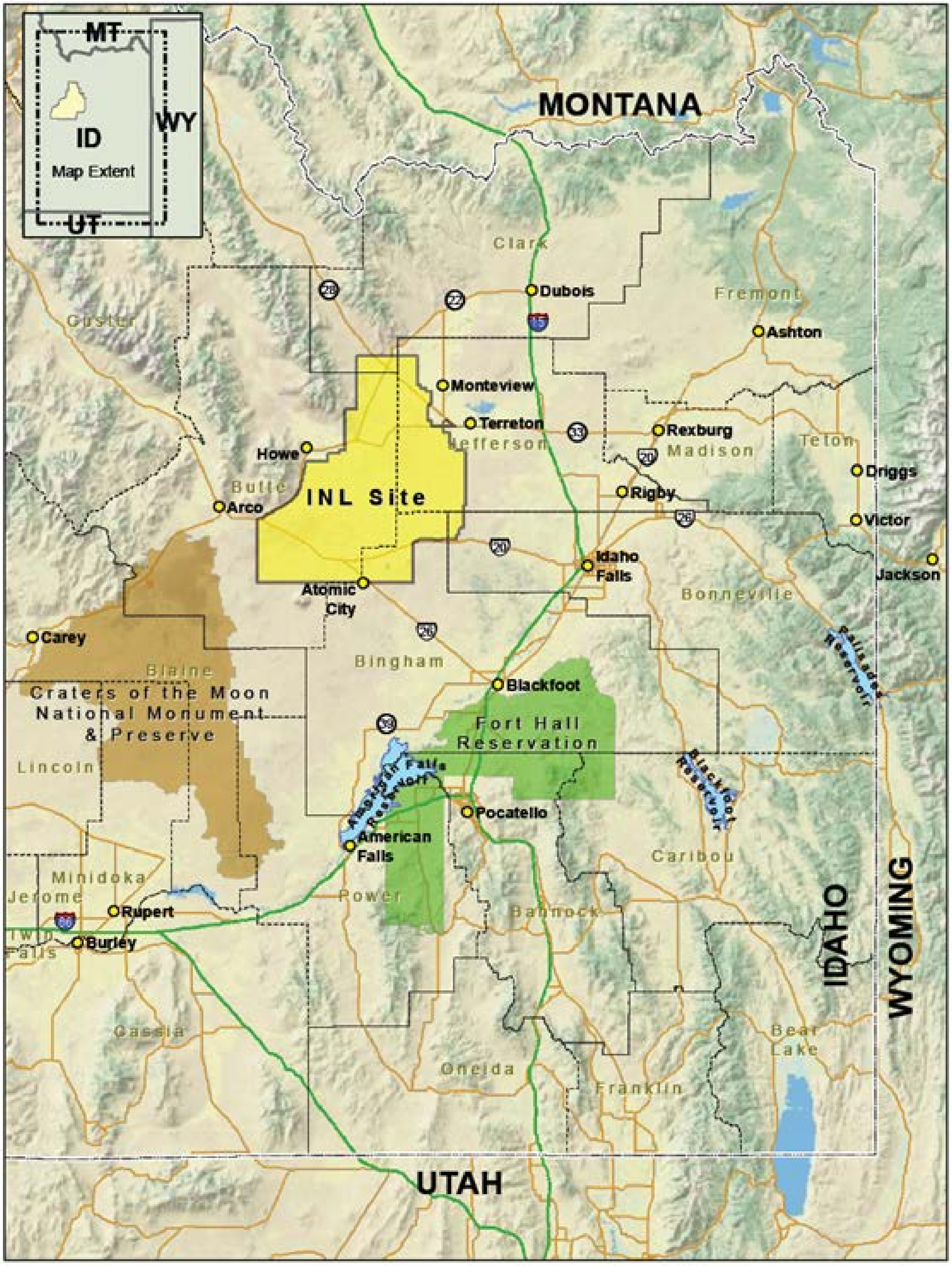

Figure 1-1. Location of the Idaho National Laboratory Site.

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 15 locations using low-volume air samplers. At the start of the fourth quarter the air sampler at Jackson was shut down. This was due to a safety concern regarding the ladder used for accessing the rooftop location. A more suitable location will be selected and the sampler will be restarted when it is complete. Moisture in the atmosphere was sampled at four locations around the INL Site and analyzed for tritium. Air sampling activities and results for the fourth quarter of 2015 are discussed below. A summary of approximate minimum detectable concentrations (MDCs) for radiological analyses and DOE Derived Concentration Standard (DCS) (DOE 2011b) values is provided in Appendix B.

LOW-VOLUME AIR SAMPLING

Radioactivity associated with airborne particulates was monitored continuously by 17 low-volume air samplers (two of which are used as replicate samplers) at 15 locations during the fourth quarter of 2015 (Figure 2). Four of these samplers are located on the INL Site, seven are situated off the INL Site near the boundary, and six 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. Throughout 2015, one replicate sampler was at Idaho Falls (a Distant location) and one was at Main Gate (an INL Site location). An average of 21,282 ft^3 (603 m^3) of air was sampled at each location, each week, at an average flow rate of 2.11 ft^3/min (0.06 m^3/min). Particulates in air were collected on membrane particulate filters (1.2-µm pore size). Gases passing through the filter were collected with an activated charcoal cartridge.

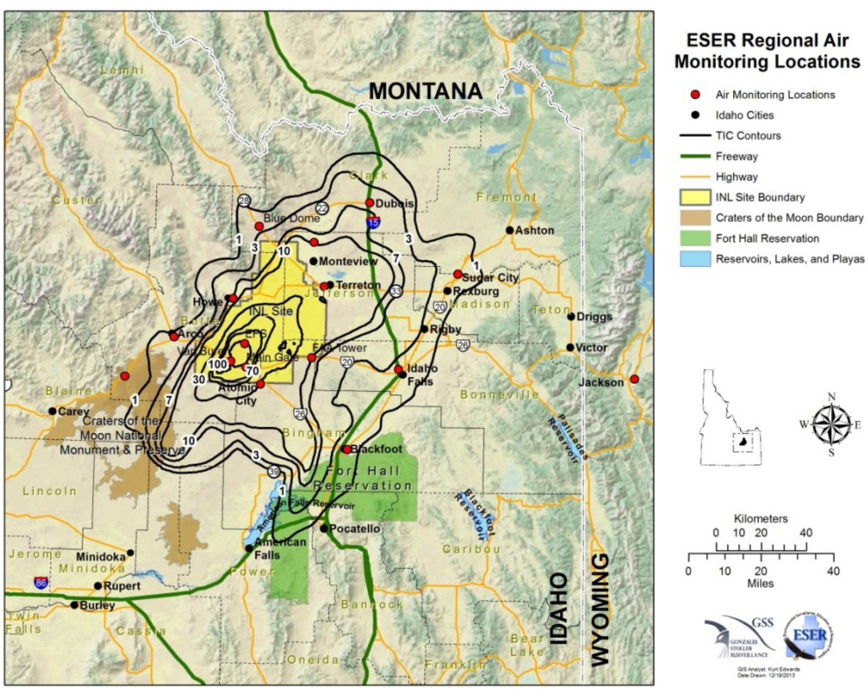

Figure 2. Low-volume air sampler locations.

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

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

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

Gross alpha results are reported in Table C-1 and shown in Figures 3 through 6. Gross alpha data are tested for normality prior to statistical analyses, and generally show no consistent discernible distribution. Because there is no discernible distribution of the data, the nonparametric Kruskal-Wallis test of multiple independent groups was used to test for 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 data groups if the (p) value is less than 0.05. Values greater than 0.05 translate into a 95 percent confidence that the medians are statistically the same. The p-value for each comparison is shown in Table D-1. For the quarter, there was no statistical difference noted in the data, as the p-value was above 0.05.

Comparisons of gross alpha concentrations were made for each month of the quarter. Again the Kruskal-Wallis test of multiple independent groups was used to determine if statistical differences exist between INL Site, Boundary, and Distant data groups. No statistical differences in gross alpha concentrations between groups were noted during any month of the quarter (Table D-1).

As an additional check, comparisons between gross alpha concentrations measured at Boundary and Distant locations were made on a weekly basis. The Mann-Whitney U test was used to compare the Boundary and Distant data because it is the most powerful nonparametric alternative to the t-test for independent samples. INL Site sample results were not included in this analysis because the onsite data, collected at only three locations, are not representative of the entire INL Site and would not aid in determining offsite impacts. There was one week, the week of November 18, where a statistical difference existed between the two sample groups (Table D-2). Most of the sampling locations during this week were fairly close to the median annual gross alpha concentration, with a slightly higher concentration noted at Mud Lake and a slightly lower concentration at Idaho Falls. This appears to be random variability in the data.

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 for presentation of the data. Outliers and extreme values were retained in subsequent statistical analyses because they are within the range of measurements made in the past five years, and because these values could not be attributed to mistakes in collection, analysis, or reporting procedures. A statistical difference was noted in the quarterly data and during the month of November using the Kruskal-Wallis test (Table D-1).

Comparison of weekly Boundary and Distant gross beta data sets, using the Mann Whitney U test, showed statistical differences between Boundary and Distant measurements during two weeks of the quarter (Table D-1). These were the weeks of December 9 and December 23. In both cases, the Distant group was higher than the Boundary group. For December 9, the difference was partially due to a somewhat lower concentration at Sugar City. No particular distribution was indicated during the December 23 week, when all concentrations were below the annual median gross beta concentration. As with the gross alpha data, there is always some random variability in the gross beta data.

Iodine-131 was detected in one of the 26 sets of charcoal cartridges measured during the fourth quarter. This result was confirmed upon recounting the set. The set was further divided into subsets and recounted. One of the subsets showed a detectable result. This was recounted and found to not contain detectable ^{131}I. It is not clear what could have been the source of ^{131}I reported initially but all the detections were just above the detection limit. Weekly ^{131}I results for each location are listed in Table C-2 of Appendix C.

No ^{137}Cs or other human-made gamma-emitting radionuclides were found in quarterly composites. As reported in the third quarter report, composites from the third quarter were originally reported with Plutonium-239/240 but were later invalidated because it appeared that interference from naturally-occurring Polonium-210 was affecting the results. Remaining composites from the third quarter were sent for analysis with instructions to chemically remove any Polonium-210. No Plutonium-239/240 was reported on this set of composites. This same methodology was followed for the fourth quarter composites and again no Plutonium-239/240 was found. There were also no detections for Americium-241, Plutonium-238, and Strontium-90.

All quarterly composite results are found in Appendix C, Table C-3.

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 12 atmospheric moisture samples collected during the fourth quarter of 2015. Seven of the 12 results exceeded the 3s uncertainty level for tritium, with similar results to those reported previously. Results also remain similar between the four sampling locations. All samples were significantly below the DOE DCS for tritium in air of 1.4×10^{-8} $\mu Ci/mL_{air}$ with a maximum reported value of 7.9×10^{-13} $\mu Ci/mL_{air}$ at Atomic City. Results are shown in Table C-4, Appendix C.

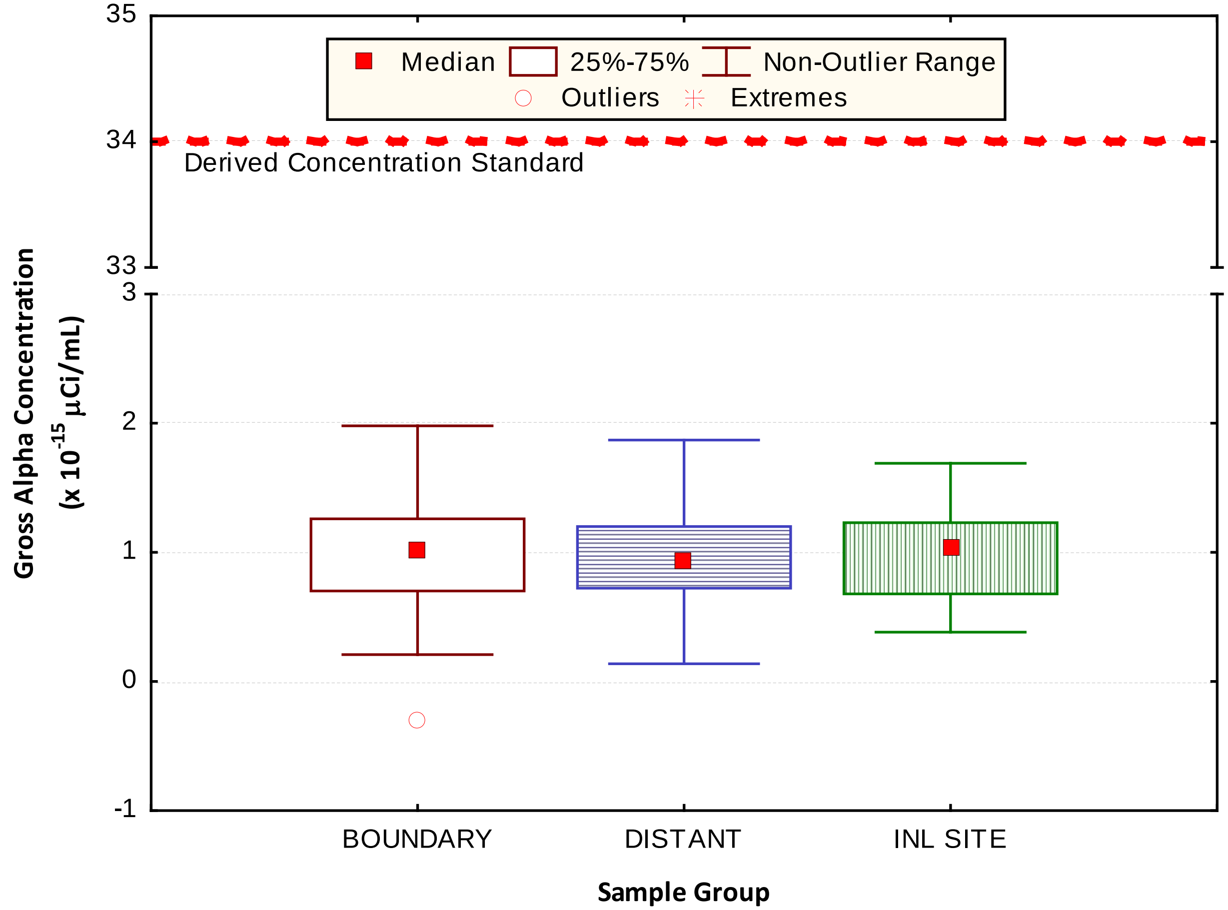

Figure 3. Gross alpha concentrations in air at ESER INL Site, Boundary, and Distant locations for the fourth quarter of 2015.

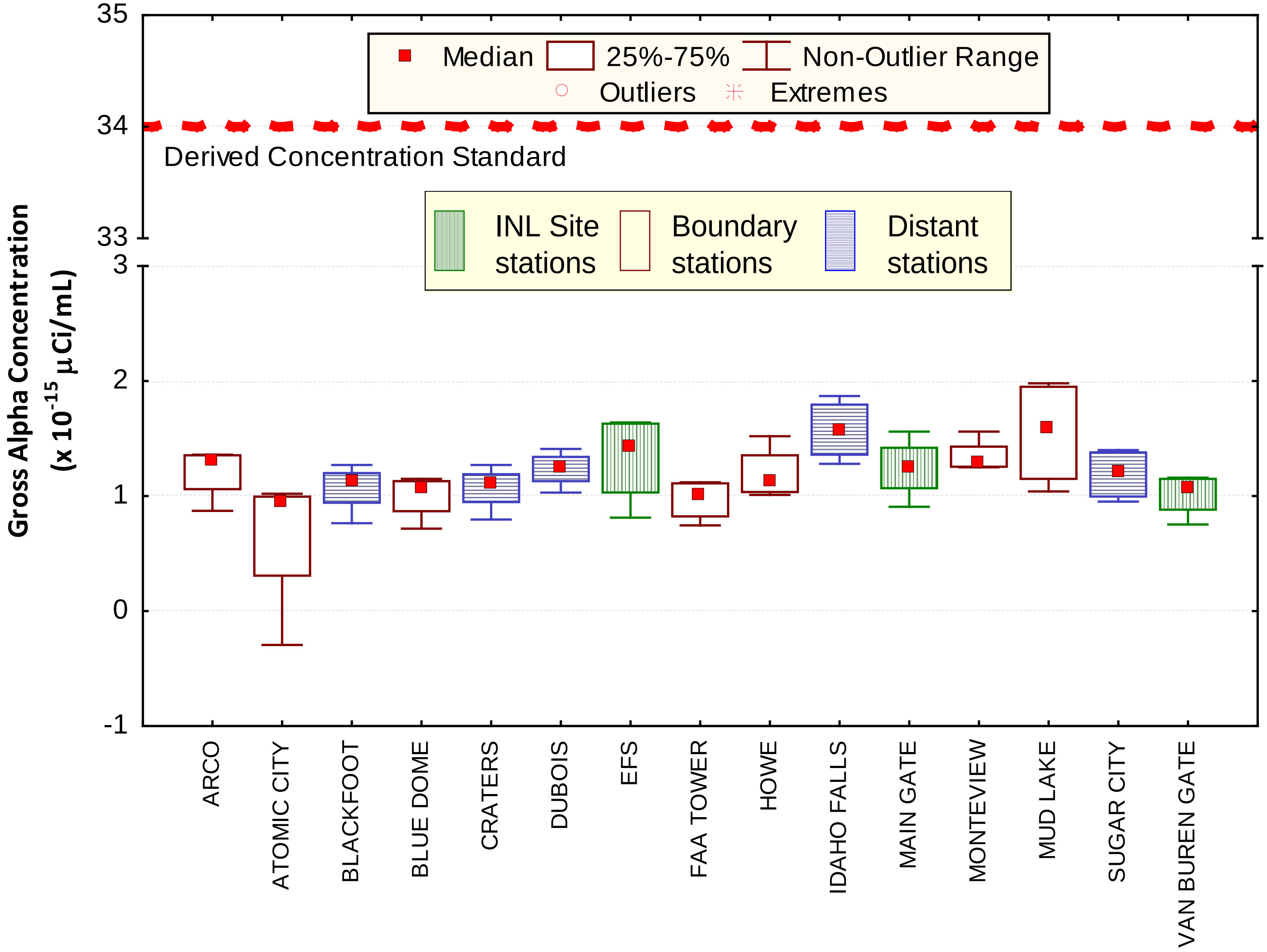

Figure 4. October gross alpha concentrations in air at ESER INL Site, Boundary, and Distant locations. Number of samples (N) = 4 at each location.

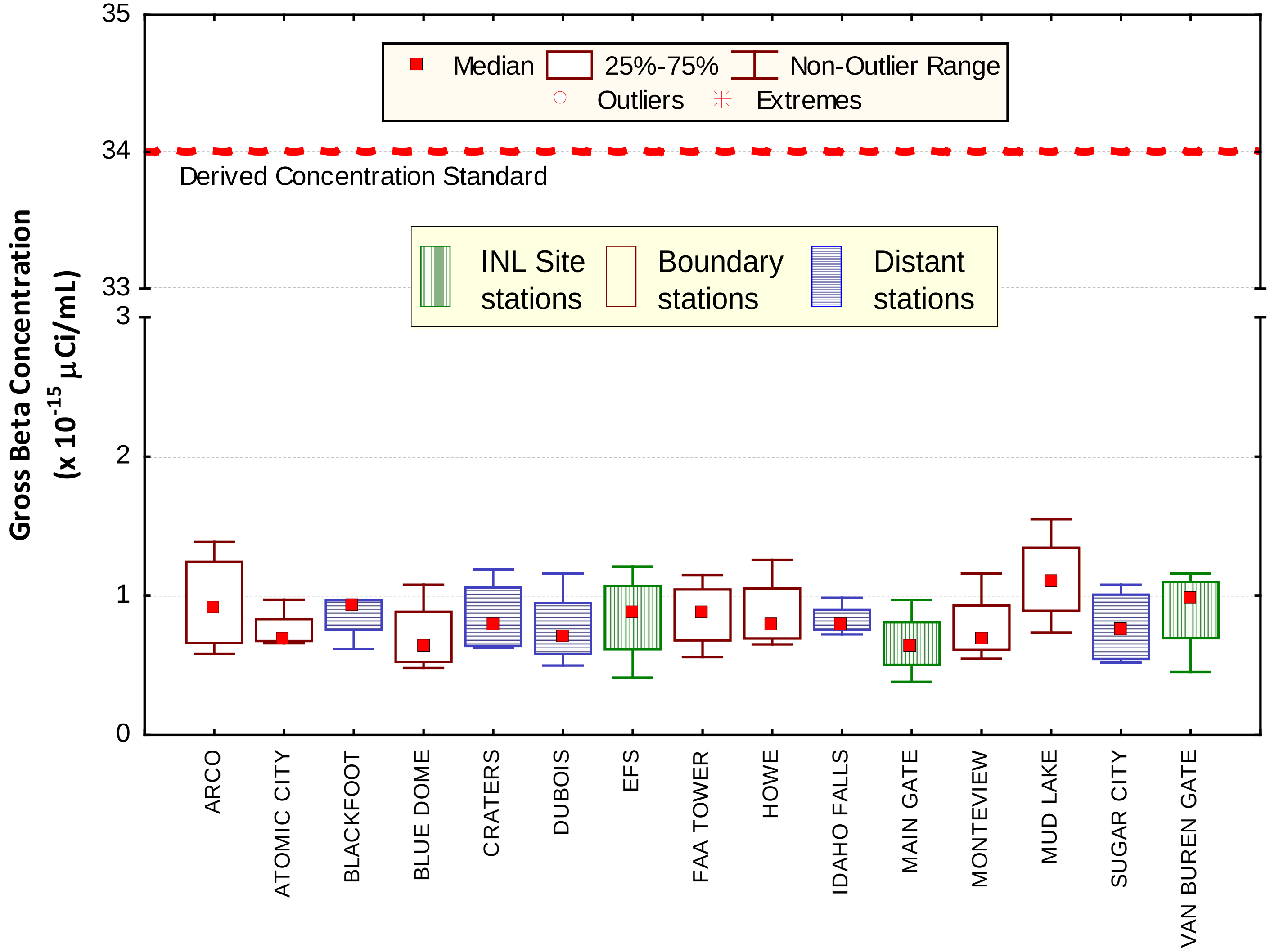

Figure 5. November gross alpha concentrations in air at ESER INL Site, Boundary, and Distant locations. Number of samples (N) = 4 at each location.

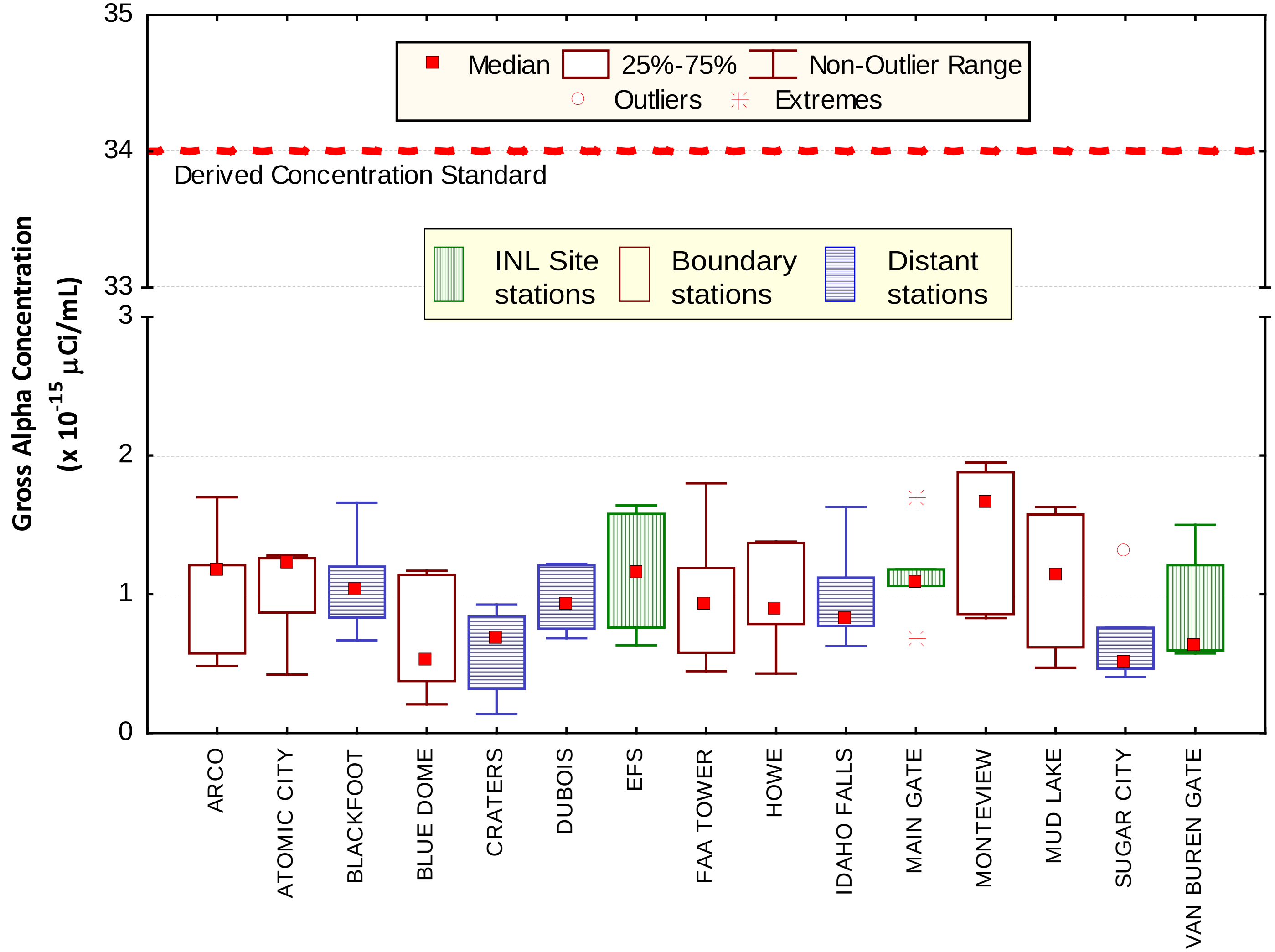

Figure 6. December gross alpha concentrations in air at ESER INL Site, Boundary, and Distant locations. Number of samples (N) = 5 at each location, except Mud Lake (N = 4).

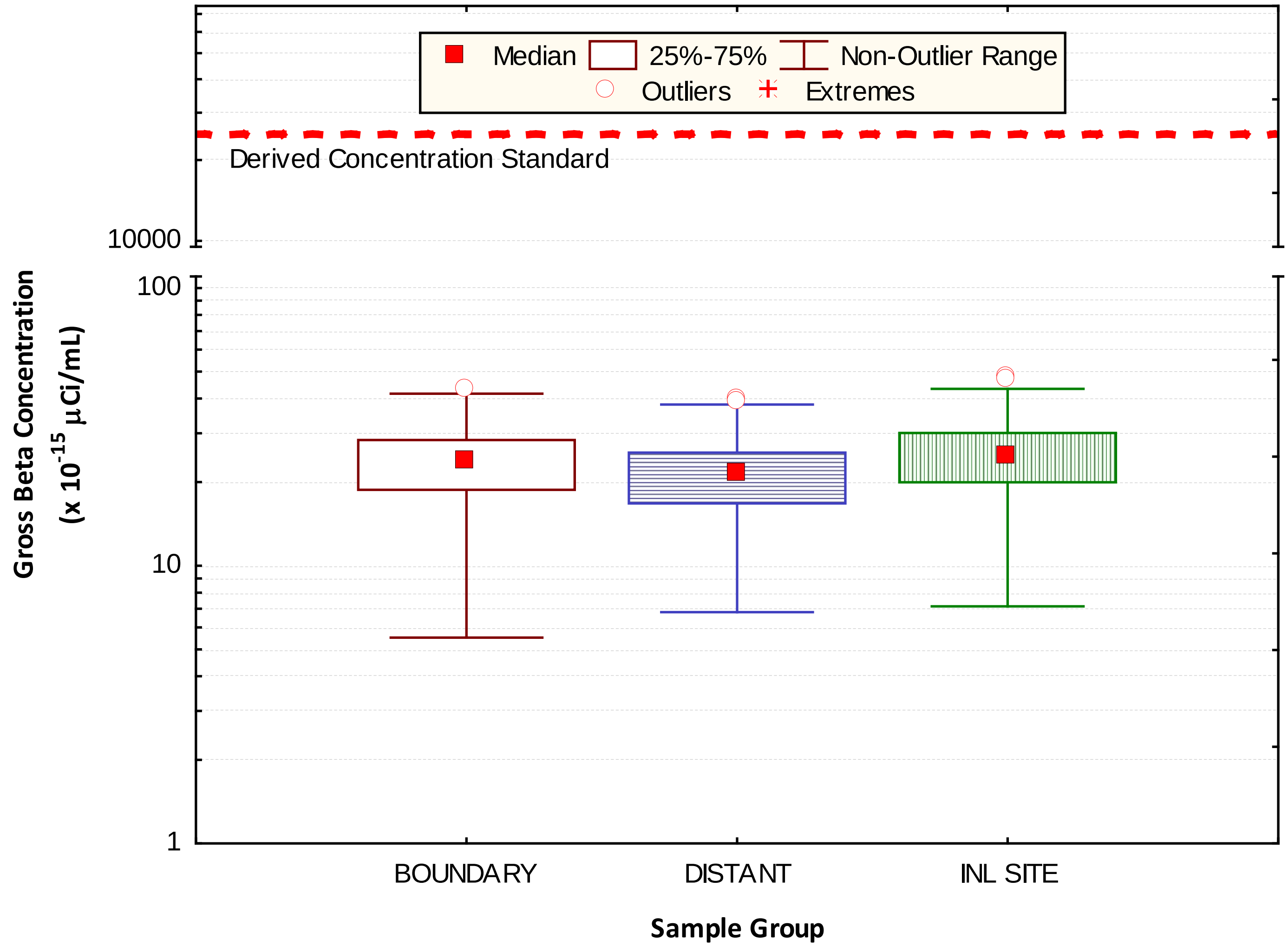

Figure 7. Gross beta concentrations in air at ESER INL Site, Boundary, and Distant locations for the fourth quarter of 2015.

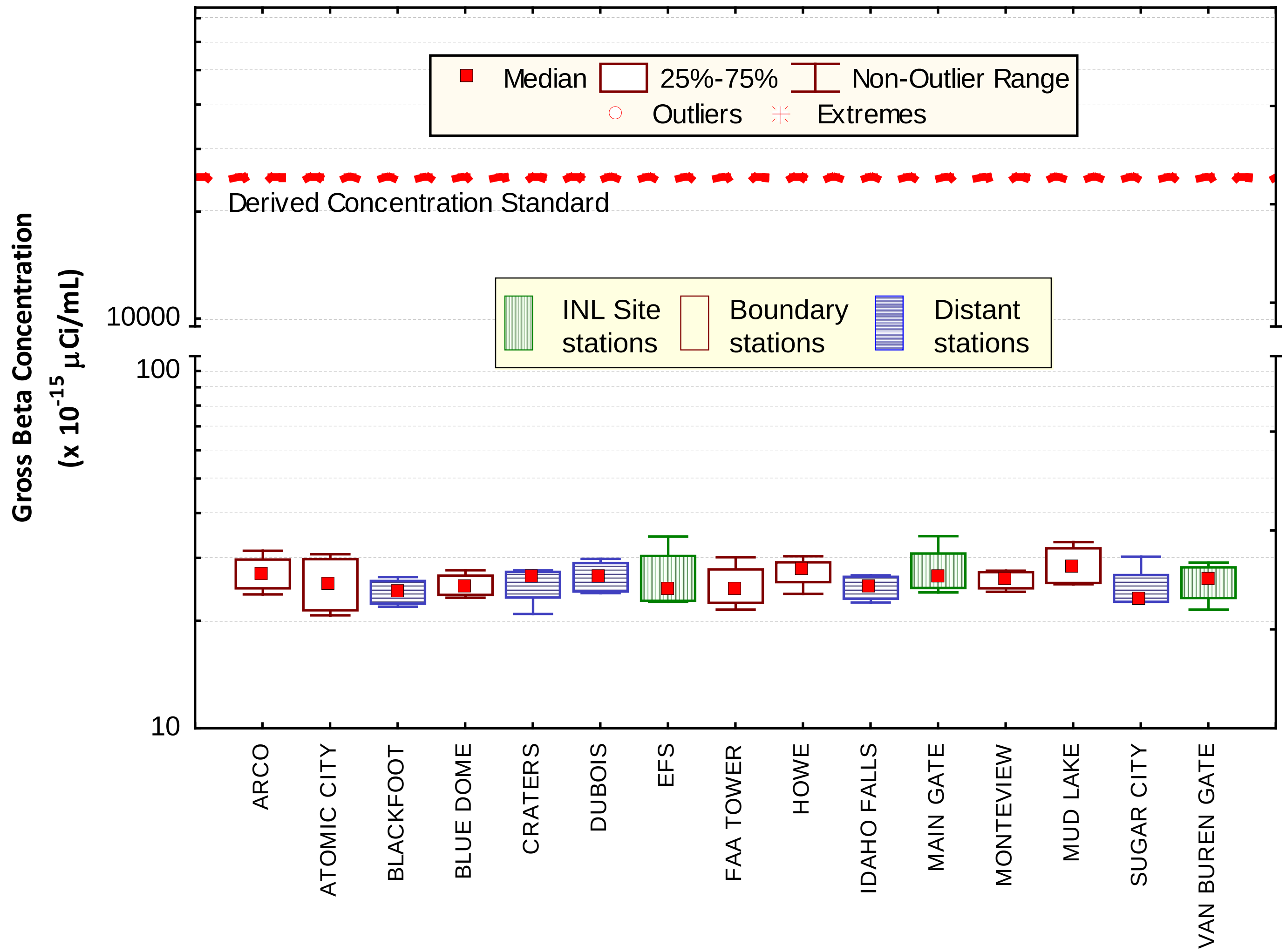

Figure 8. October gross beta concentrations in air at ESER INL Site, Boundary, and Distant locations. Number of samples (N) = 4 at each location.

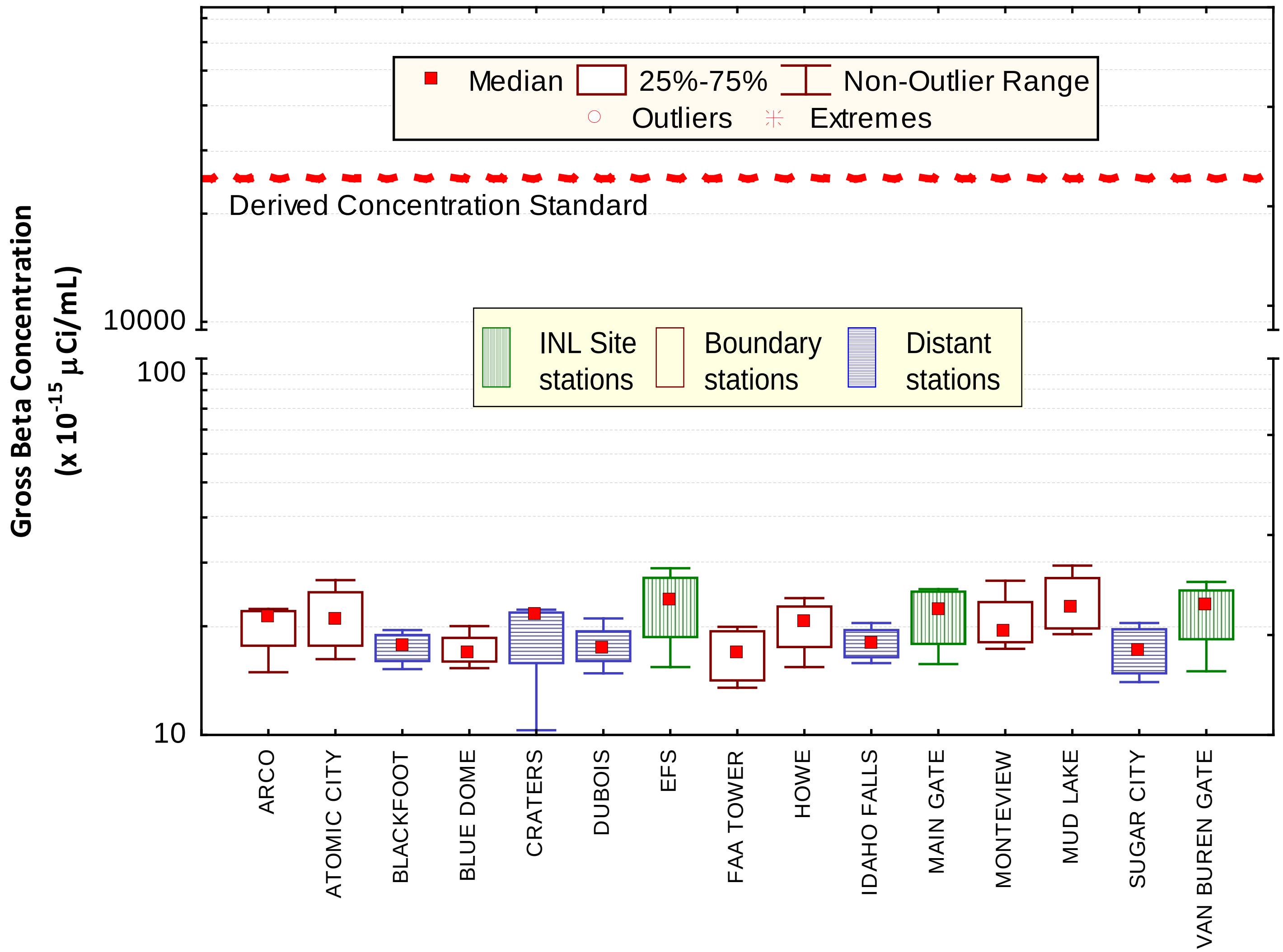

Figure 9. November gross beta concentrations in air at ESER INL Site, Boundary, and Distant locations. Number of samples (N) = 4 at each location.

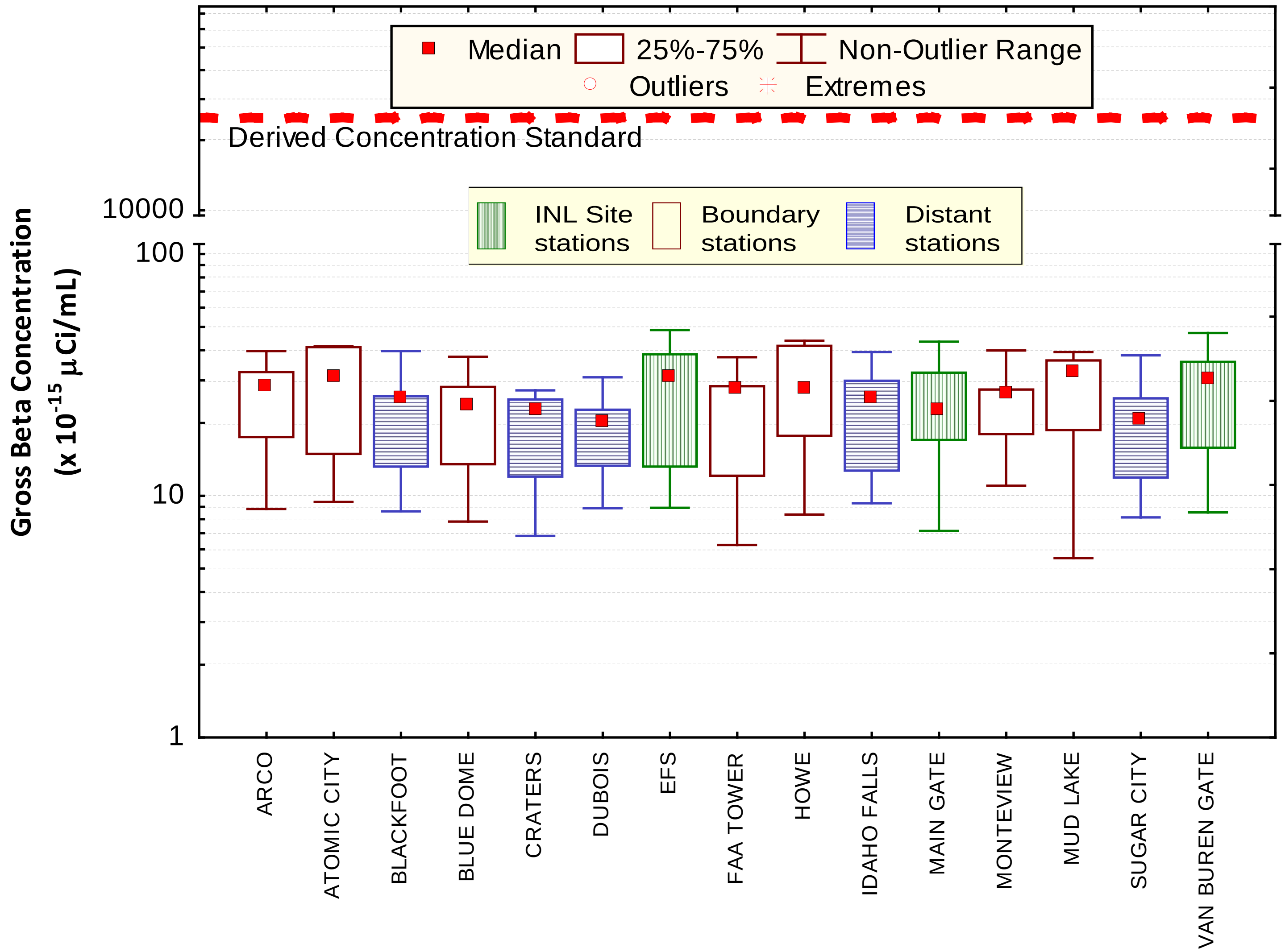

Figure 10. December gross beta concentrations in air at ESER INL Site, Boundary, and Distant locations. Number of samples (N) = 5 at each location, except Mud Lake (N = 4).

4. PRECIPITATION AND WATER SAMPLING

PRECIPITATION SAMPLING

Precipitation samples are gathered when sufficient precipitation occurs to allow for the collection of the minimum sample volume of approximately 50 mL. Samples are taken of monthly composites from Idaho Falls and CFA, and weekly from the EFS. Precipitation samples are analyzed for tritium. Storm events in the fourth quarter of 2015 produced sufficient precipitation to yield 11 samples.

Tritium was measured above the 3s values in 3 of the 11 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 and the remnants of fallout from nuclear 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 2015). 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 fourth quarter was 148 pCi/L in a late December EFS sample.

WATER SAMPLING

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

Gross alpha activity was detected in two of the drinking water samples (Atomic City and Craters of the Moon) and one of the surface water samples (Alpheus Spring near Twin Falls) at levels slightly above the minimum detectable concentration. Gross beta activity was detected in six of the nine drinking water samples (all except Idaho Falls, the Rest Area, and the control sample), and in all of the surface water samples. All concentrations were generally similar to previous results from drinking and surface water sampling. Natural levels of radioactive decay products of thorium and uranium exist in the Snake River Plain Aquifer and are the likely source of the measured concentrations.

Tritium was also detected in three of the drinking water samples (including the bottled water) and one of the four surface water samples. The concentrations were similar to those found in atmospheric moisture and precipitation samples and were consistent with previous results. The maximum value was 277 pCi/L at Clear Springs near Buhl. The results are well below the DCS of 1.9×10^6 pCi/L for tritium in drinking water.

5. AGRICULTURAL PRODUCT, WILDLIFE, AND SOIL SAMPLING

Another potential pathway for contaminants to reach humans is through the food chain. The ESER Program samples multiple agricultural products and game animals from around the INL Site and Southeast Idaho. Specifically, milk, alfalfa, grain, potatoes, lettuce, large game animals, and waterfowl are sampled. Milk is sampled throughout the year and large game animals are sampled whenever large game animals are killed onsite from vehicle collisions. Alfalfa is collected during the second quarter, lettuce and grain are sampled during the third quarter, while potatoes are collected during the 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 and agricultural products samples available during the fourth quarter of 2015.

MILK SAMPLING

Milk samples were collected weekly in Idaho Falls. Monthly samples were collected at six other locations around the INL Site (Figure 11) during the fourth quarter of 2015. In addition, 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 Iodine-131.

Iodine-131 was not detected in any weekly or monthly samples during the fourth quarter. No other human-made gamma-emitting radionuclides were found either. Data for ^{131}I and ^{137}Cs in milk samples are listed in Appendix C, Table C-7. During the summer of 2020, a review of Appendix C, Table C-7 determined the ^{131}I and ^{137}Cs activity concentration and uncertainty values for the Blackfoot milk sample collected on October 4, 2015 were incorrect. The incorrect values appear to be due to inadvertently copying the wrong values. The activity concentration and uncertainty values were updated with the correct values. Iodine-131 and ^{137}Cs was not detected in the Blackfoot milk sample collected on October 4, 2015.

Results for ^{90}Sr and tritium are listed in Appendix C, Table C-8. Strontium-90 was detected in all of the seven samples analyzed, including the control sample. The maximum concentration of 0.64 pCi/L from Idaho Falls and the average concentration of 0.42 pCi/L are near the midpoint of the range for these values over the past several years. The presence of ^{90}Sr at similar levels in samples from near the INL Site and distant from the INL Site (as well as the organic milk from Colorado), does not indicate an INL Site impact of the results. There is no DCS for ^{90}Sr in milk; however, for comparison the results were well below the drinking water DCS of 1.1 x 10^3 pCi/L.

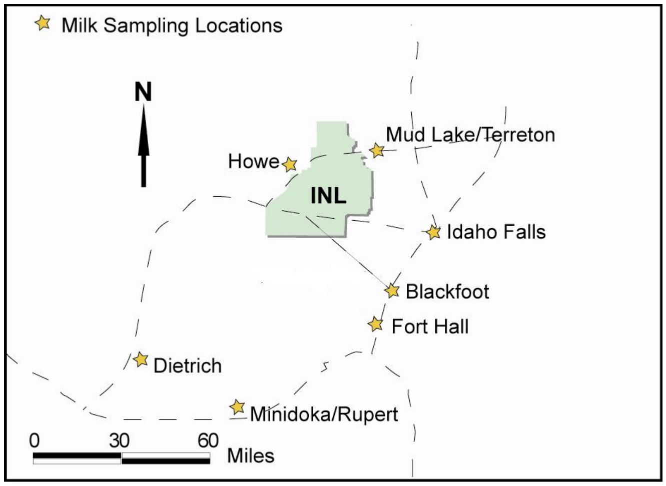

Figure 11. ESER milk sampling locations

Tritium was also detected in three of seven samples analyzed, with a maximum value of 98 pCi/L from Howe. All results were similar to those previously measured and similar to those found in other liquid media like precipitation. There is no DCS for tritium in milk, but the results were well below the DCS for tritium in drinking water (1.9 x 10^6 pCi/L).

POTATO SAMPLING

Locally-grown potatoes from six locations and one duplicate were analyzed for gamma-emitting radionuclides and ^{90}Sr. A control sample from a local grocery store was also analyzed. No human-made gamma-emitters or ^{90}Sr were found in any sample. Both ^{137}Cs and ^{90}Sr are present in the soil as a result of worldwide fallout from nuclear weapons testing, but they are only occasionally detected in potato samples. This is because potatoes are generally less efficient at removing radioactive elements from soil than leafy vegetables such as lettuce. Data for potato samples are listed in Appendix C, Table C-9. A review of Appendix C, Table C-9 in the summer of 2020, identified that the values listed for ^{90}Sr activity concentrations and uncertainties were correct, however, the values were not associated with their corresponding locations. The values appear to have been incorrectly sorted prior to incorporating the values into Table C-9. The ^{90}Sr values were assigned to the correct locations. Strontium-90 was not found in any of the samples collected.

LARGE GAME ANIMAL SAMPLING

Muscle samples were taken from three game animals during the fourth quarter; liver samples were taken from two animals and the thyroid of one animal was also collected. One animal was a mule deer and the two others were elk. No human-made gamma-emitting radionuclides were detected in any of the samples. Data for ^{137}Cs and ^{131}I in game samples are listed in Appendix C, Table C-10.

WATERFOWL SAMPLING

Waterfowl are collected each year at ponds on the INL Site and at a location off the INL Site. Three samples from wastewater ponds located at the ATR Complex plus two control samples collected near American Falls Reservoir were analyzed for gamma-emitting radionuclides, ^{90}Sr, and actinides (americium-241 [^{241}Am], plutonium-238 [^{238}Pu], and plutonium-239/240 [$^{239/240}$Pu]). These radionuclides were selected because they are often measured in liquid effluents from some INL Site facilities (Chapter 5). Each sample was divided into the following three sub-samples: 1) edible tissue (muscle, gizzard, heart, and liver), 2) external portion (feathers, feet, and head), and 3) all remaining tissue.

A total of seven human-made radionuclides were detected in the samples from at least one of the ducks collected at the ATR Complex ponds. These were cesium-134 (^{134}Cs), ^{137}Cs, chromium-51 (^{51}Cr), cobalt-58 (^{58}Co), cobalt-60 (^{60}Co), selenium-75 (^{75}Se), ^{90}Sr, and zinc-65 (^{65}Zn). All of these were also detected in the edible tissues of at least one duck, with the exception of ^{51}Cr. In the control ducks ^{90}Sr was detected in the external and remainder portions of the ducks, but it was not found in the edible tissues. Data for waterfowl samples are listed in Appendix C, Table C-11. During the summer of 2020, a review of Appendix C, Table C-11 determined the activity concentration values reported for the media were correct, however, the unit of concentration [(x10^{-5}) Bq/g] listed in one of the column headings was incorrect. The column heading has been updated to the correct unit of concentration [(x10^{-2}) Bq/kg].

Because more human-made radionuclides were found in ducks from ATR Complex than other locations and at higher levels, it is assumed that the evaporation pond associated with this facility is the source of these radionuclides. The ducks were not taken directly from the two-celled hypalon-lined radioactive wastewater evaporation pond, but rather from an adjacent sewage lagoon. However, the ducks probably also spent time at the evaporation pond. Concentrations of the detected radionuclides at the ATR Complex were higher in 2015 than in the past several sampling events. At the time of sample collection, the wastewater ponds were in the process of being dewatered to replace the hypalon liners. This likely resulted in a concentration of the radionuclides in the remaining pond water and an increased availability to the sediment on the liners.

The maximum potential dose from eating 225 g (8 oz) of duck meat collected in 2015 was calculated. Doses from consuming waterfowl are conservatively based on the assumption that ducks are eaten immediately after leaving the pond and no radioactive decay occurs. The maximum potential dose of 0.49 mrem from these waterfowl samples is much higher than the dose estimated for 2014 (0.032 mrem), but is below the 0.89 mrem (8.9 μSv) dose estimated from the most contaminated ducks taken from the evaporation ponds between 1993 and 1998 (Warren et al. 2001).

6. ENVIRONMENTAL RADIATION

An array of thermoluminescent dosimeters (TLDs) is distributed throughout the Eastern Snake River Plain to monitor for environmental radiation. In November 2011 the ESER Program also placed optically stimulated luminescent dosimeters (OSLDs) in the same locations as the TLDs to run a side-by-side comparison of the two dosimeter technologies. Two OSLDs are in place at each location. TLDs and OSLDs are changed out at the beginning of May and again at the beginning of November after six months in the field.

Results from the fourth quarter TLDs are presented in Appendix C, Table C-12. Similar to the low-volume air results the environmental dosimeter locations are also divided into Boundary and Distant groupings. For the Boundary group, six-month exposures ranged from 49.7 milliRotengens (mR) at Blue Dome to 60.7 mR at Mud Lake. The overall Boundary exposure was 55.5 mR. Distant exposures ranged from 50.2 mR at Dubois to 71.9 mR for the TLD at Sugar City. The average Distant exposure was 57.7 mR.

OSLD results from the fourth quarter followed a similar pattern to the TLDs (Appendix C, Table C-13). OSLDs are presented in dose units of millirem (mrem). Boundary OSLD values ranged from 48.40 mrem at Blue Dome to 65.05 mrem at Mud Lake, with an overall average of 53.76 mrem. Distant results varied from 44.20 mrem at Dubois to 76.10 mrem at Sugar City. The Distant average was 56.29 mrem.

7. QUALITY ASSURANCE

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

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

Sample results are compared to criteria described in the Quality Assurance Project Plan for the INL Site Offsite Environmental Surveillance Program (GSS 2012). Criteria established by DOE for Quality Assurance activities include:

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

Assessments of ESER data quality are achieved through analysis of spike, performance evaluation, and duplicate samples; through sample recounts; through analysis of blank samples; and through comparison of sample results to established method quality objectives. These assessments are documented in the ESER Quality Assurance for the Fourth Quarter of 2015 (GSS 2016).

8. REFERENCES

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.

EPA, 2015, RadNet—Tracking Environmental Radiation Nationwide, Web-page: http://www.epa.gov/narel/radnet/

GSS, 2012, Quality Assurance Project Plan for the INL Site Offsite Environmental Surveillance Program, Environmental Surveillance, Education and Research Program, April 2012.

GSS, 2016, *Environmental Quality Assurance Report 4th Quarter 2015*, Environmental Surveillance, Education, and Research Program, July 2016

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.

Warren, R. W., S. J. Majors, and R. C. Morris, 2001, *Waterfowl Uptake of Radionuclides from the TRA Evaporation Ponds and Potential Dose to Humans Consuming Them*, Stoller-ESER 01- 40, S.M. Stoller Corporation.

APPENDIX A

SUMMARY OF SAMPLING SCHEDULE

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

Sample Type Analysis	Collection Frequency	LOCATIONS		
		Distant	Boundary	INL Site
AIR SAMPLING				
LOW-VOLUME AIR				
Gross Alpha, Gross Beta, ^{131}I	weekly	Blackfoot, Craters of the Moon, Dubois, Idaho Falls, Jackson WY, Sugar City	Arco, Atomic City, FAA Tower, Howe, Monteview, Mud Lake, Blue Dome	Main Gate, EFS, Van Buren
Gamma Spec	quarterly	Blackfoot, Craters of the Moon, Dubois, Idaho Falls, Jackson WY, Sugar City	Arco, Atomic City, FAA Tower, Howe, Monteview, Mud Lake, Blue Dome	Main Gate, EFS, Van Buren
^{90}Sr, Transuranics	quarterly	Rotating schedule	Rotating schedule	Rotating schedule
ATMOSPHERIC MOISTURE				
Tritium	2 to 13 weeks	Blackfoot, Idaho Falls, Sugar City	Atomic City	None
PRECIPITATION				
Tritium	monthly	Idaho Falls	None	CFA
Tritium	weekly	None	None	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, Crystal Ice Caves (Aberdeen), Blackfoot, St. Anthony	Butte City, Monteview, Atomic City, FAA Tower, Howe, Mud Lake (2), Birch Creek, Frenchman's Cabin	None

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

Sample Type Analysis	Collection Frequency	LOCATIONS		
		Distant	Boundary	INL Site
FOODSTUFF SAMPLING				
MILK				
Gamma Spec (^{131}I)	weekly	Idaho Falls	None	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	Blackfoot, Idaho Falls, Rupert, Shelley, Hamer, occasional samples across the U.S.	Arco, Monteview, Mud Lake, Terreton	None
ALFALFA				
Gamma Spec, ^{90}Sr	annually	None	Mud Lake	None
GRAIN				
Gamma Spec, ^{90}Sr	annually	American Falls, Blackfoot, Carey, Idaho Falls, Minidoka, Roberts	Arco, Monteview, Mud Lake, Taber, Terreton	None
LETTUCE				
Gamma Spec, ^{90}Sr	annually	Blackfoot, Carey, Idaho Falls, Sugar City	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 Fourth Quarter 2015

Sample Type	Analysis	Approximate Minimum Detectable Concentration[a] (MDC)	Derived Concentration Standard[b] (DCS)
Air (particulate filter)[e]	Gross alpha[c]	4.16×10^{-16} µCi/mL	3.4×10^{-14} µCi/mL
	Gross beta[d]	9.14×10^{-16} µCi/mL	2.5×10^{-11} µCi/mL
	^{137}Cs	5.63×10^{-17} µCi/mL	3.9×10^{-10} µCi/mL
	^{90}Sr	1.79×10^{-17} µCi/mL	2.5×10^{-11} µCi/mL
	^{238}Pu	2.63×10^{-18} µCi/mL	3.7×10^{-14} µCi/mL
	$^{239/240}Pu$	2.40×10^{-18} µCi/mL	3.4×10^{-14} µCi/mL
	^{241}Am	3.46×10^{-18} µCi/mL	1.8×10^{-12} µCi/mL
Air (charcoal cartridge)[e]	^{131}I	3.32×10^{-16} µCi/mL	2.3×10^{-19} µCi/mL
Air (atmospheric moisture)	^{3}H	85.8 pCi/L_{water}	2.1×10^{-7} $µCi/mL_{air}$
Air (precipitation)	^{3}H	87.8 pCi/L	1.9×10^{-3} µCi/mL
Milk	^{131}I	0.56 pCi/L	--
	^{137}Cs	0.85 pCi/L	--
Potatoes	^{137}Cs	4.44 pCi/kg	--
	^{90}Sr	3.49 pCi/kg	--
Muscle Tissue	^{137}Cs	3.07 pCi/kg	--

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 is based on an average filtered air volume (pressure corrected) of 445 m^3/week.

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 (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
BOUNDARY															
ARCO	10/7/2015	0.87	±	0.15	3.22	±	0.57	Yes	27.90	±	0.62	103.23	±	2.29	Yes
	10/14/2015	1.35	±	0.17	5.00	±	0.63	Yes	23.70	±	0.58	87.69	±	2.16	Yes
	10/21/2015	1.25	±	0.16	4.63	±	0.60	Yes	25.60	±	0.59	94.72	±	2.19	Yes
	10/28/2015	1.36	±	0.18	5.03	±	0.65	Yes	31.40	±	0.65	116.18	±	2.41	Yes
	11/4/2015	0.59	±	0.13	2.16	±	0.49	Yes	14.90	±	0.48	55.13	±	1.77	Yes
	11/11/2015	1.39	±	0.17	5.14	±	0.64	Yes	22.30	±	0.56	82.51	±	2.08	Yes
	11/18/2015	1.10	±	0.17	4.07	±	0.64	Yes	21.70	±	0.58	80.29	±	2.16	Yes
	11/25/2015	0.74	±	0.19	2.72	±	0.69	Yes	20.40	±	0.54	75.48	±	2.01	Yes
	12/2/2015	1.70	±	0.18	6.29	±	0.68	Yes	39.70	±	0.70	146.89	±	2.60	Yes
	12/9/2015	1.18	±	0.17	4.37	±	0.64	Yes	28.50	±	0.65	105.45	±	2.40	Yes
	12/16/2015	0.48	±	0.13	1.79	±	0.47	Yes	8.82	±	0.42	32.63	±	1.55	Yes
	12/23/2015	0.58	±	0.15	2.13	±	0.54	Yes	17.50	±	0.53	64.75	±	1.95	Yes
	12/30/2015	1.21	±	0.18	4.48	±	0.68	Yes	32.50	±	0.71	120.25	±	2.64	Yes
ATOMIC CITY	10/7/2015	0.97	±	0.16	3.59	±	0.60	Yes	28.80	±	0.64	106.56	±	2.37	Yes
	10/14/2015	-0.29	±	0.07	-1.09	±	0.28	No	20.70	±	0.57	76.59	±	2.12	Yes
	10/21/2015	1.02	±	0.15	3.77	±	0.57	Yes	22.10	±	0.58	81.77	±	2.13	Yes
	10/28/2015	0.91	±	0.15	3.37	±	0.57	Yes	30.70	±	0.64	113.59	±	2.36	Yes
	11/4/2015	0.66	±	0.14	2.44	±	0.51	Yes	16.20	±	0.49	59.94	±	1.83	Yes
	11/11/2015	0.69	±	0.14	2.56	±	0.53	Yes	19.10	±	0.54	70.67	±	1.99	Yes
	11/18/2015	0.97	±	0.17	3.60	±	0.63	Yes	26.80	±	0.64	99.16	±	2.37	Yes
	11/25/2015	0.69	±	0.19	2.56	±	0.68	Yes	22.80	±	0.57	84.36	±	2.10	Yes
	12/2/2015	1.22	±	0.18	4.51	±	0.65	Yes	41.20	±	0.75	152.44	±	2.78	Yes
	12/9/2015	1.26	±	0.18	4.66	±	0.65	Yes	31.10	±	0.68	115.07	±	2.50	Yes
	12/16/2015	0.42	±	0.13	1.56	±	0.49	Yes	9.43	±	0.45	34.89	±	1.66	Yes
	12/23/2015	0.87	±	0.17	3.22	±	0.63	Yes	14.90	±	0.53	55.13	±	1.94	Yes
	12/30/2015	1.28	±	0.20	4.74	±	0.74	Yes	41.50	±	0.83	153.55	±	3.08	Yes
BLUE DOME	10/7/2015	1.02	±	0.16	3.77	±	0.60	Yes	27.70	±	0.62	102.49	±	2.30	Yes
	10/14/2015	1.11	±	0.16	4.11	±	0.59	Yes	23.20	±	0.58	85.84	±	2.13	Yes
	10/21/2015	1.15	±	0.16	4.26	±	0.59	Yes	24.10	±	0.59	89.17	±	2.19	Yes
	10/28/2015	0.72	±	0.15	2.65	±	0.55	Yes	25.80	±	0.61	95.46	±	2.27	Yes
	11/4/2015	0.48	±	0.13	1.78	±	0.49	Yes	15.30	±	0.50	56.61	±	1.84	Yes
	11/11/2015	0.57	±	0.13	2.11	±	0.48	Yes	16.60	±	0.50	61.42	±	1.84	Yes
	11/18/2015	1.08	±	0.17	4.00	±	0.62	Yes	20.00	±	0.56	74.00	±	2.05	Yes
	11/25/2015	0.69	±	0.18	2.56	±	0.65	Yes	17.10	±	0.49	63.27	±	1.81	Yes
	12/2/2015	1.17	±	0.17	4.33	±	0.64	Yes	37.60	±	0.72	139.12	±	2.68	Yes
	12/9/2015	1.14	±	0.18	4.22	±	0.66	Yes	28.20	±	0.67	104.34	±	2.49	Yes
	12/16/2015	0.38	±	0.13	1.39	±	0.48	No	7.82	±	0.43	28.93	±	1.59	Yes
	12/23/2015	0.21	±	0.14	0.77	±	0.51	No	13.50	±	0.52	49.95	±	1.92	Yes
	12/30/2015	0.53	±	0.15	1.96	±	0.54	Yes	23.80	±	0.62	88.06	±	2.29	Yes
FAA TOWER	10/7/2015	0.75	±	0.16	2.76	±	0.57	Yes	25.60	±	0.62	94.72	±	2.31	Yes
	10/14/2015	0.90	±	0.15	3.33	±	0.55	Yes	21.50	±	0.56	79.55	±	2.06	Yes
	10/21/2015	1.10	±	0.15	4.07	±	0.57	Yes	23.40	±	0.57	86.58	±	2.10	Yes
	10/28/2015	1.12	±	0.17	4.14	±	0.63	Yes	30.10	±	0.66	111.37	±	2.42	Yes
	11/4/2015	0.80	±	0.15	2.96	±	0.56	Yes	14.80	±	0.50	54.76	±	1.85	Yes
	11/11/2015	1.15	±	0.16	4.26	±	0.60	Yes	13.50	±	0.48	49.95	±	1.76	Yes
	11/18/2015	0.94	±	0.16	3.49	±	0.59	Yes	19.90	±	0.54	73.63	±	2.01	Yes
	11/25/2015	0.56	±	0.17	2.07	±	0.63	Yes	18.80	±	0.51	69.56	±	1.87	Yes
	12/2/2015	1.80	±	0.18	6.66	±	0.68	Yes	37.40	±	0.67	138.38	±	2.48	Yes
	12/9/2015	1.19	±	0.18	4.40	±	0.67	Yes	28.40	±	0.68	105.08	±	2.50	Yes
	12/16/2015	0.93	±	0.17	3.43	±	0.63	Yes	6.26	±	0.43	23.16	±	1.59	Yes
	12/23/2015	0.45	±	0.16	1.65	±	0.58	No	12.10	±	0.52	44.77	±	1.91	Yes
	12/30/2015	0.58	±	0.17	2.15	±	0.62	Yes	27.90	±	0.72	103.23	±	2.68	Yes
HOWE	10/7/2015	1.01	±	0.17	3.74	±	0.61	Yes	28.00	±	0.64	103.60	±	2.36	Yes
	10/14/2015	1.19	±	0.17	4.40	±	0.62	Yes	23.80	±	0.60	88.06	±	2.21	Yes
	10/21/2015	1.52	±	0.18	5.62	±	0.68	Yes	27.50	±	0.65	101.75	±	2.41	Yes
	10/28/2015	1.06	±	0.17	3.92	±	0.62	Yes	30.30	±	0.66	112.11	±	2.45	Yes
	11/4/2015	0.65	±	0.14	2.41	±	0.52	Yes	15.40	±	0.50	56.98	±	1.84	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
	11/11/2015	0.74	±	0.14	2.72	±	0.53	Yes	19.60	±	0.55	72.52	±	2.02	Yes
	11/18/2015	1.26	±	0.18	4.66	±	0.66	Yes	23.90	±	0.60	88.43	±	2.21	Yes
	11/25/2015	0.85	±	0.19	3.13	±	0.68	Yes	21.40	±	0.54	79.18	±	1.99	Yes
	12/2/2015	1.38	±	0.18	5.11	±	0.67	Yes	41.70	±	0.75	154.29	±	2.76	Yes
	12/9/2015	1.37	±	0.18	5.07	±	0.66	Yes	27.90	±	0.64	103.23	±	2.35	Yes
	12/16/2015	0.43	±	0.13	1.59	±	0.46	Yes	8.36	±	0.41	30.93	±	1.53	Yes
	12/23/2015	0.79	±	0.16	2.91	±	0.58	Yes	17.70	±	0.53	65.49	±	1.96	Yes
	12/30/2015	0.90	±	0.17	3.32	±	0.61	Yes	43.80	±	0.78	162.06	±	2.89	Yes
MONTEVIEW	10/7/2015	1.26	±	0.18	4.66	±	0.67	Yes	25.20	±	0.63	93.24	±	2.33	Yes
	10/14/2015	1.56	±	0.19	5.77	±	0.69	Yes	24.10	±	0.61	89.17	±	2.25	Yes
	10/21/2015	1.30	±	0.18	4.81	±	0.66	Yes	27.10	±	0.66	100.27	±	2.43	Yes
	10/28/2015	1.25	±	0.18	4.63	±	0.65	Yes	27.60	±	0.64	102.12	±	2.36	Yes
	11/4/2015	0.68	±	0.15	2.50	±	0.55	Yes	17.30	±	0.54	64.01	±	2.01	Yes
	11/11/2015	0.55	±	0.14	2.03	±	0.51	Yes	19.90	±	0.56	73.63	±	2.06	Yes
	11/18/2015	1.16	±	0.18	4.29	±	0.67	Yes	26.70	±	0.64	98.79	±	2.38	Yes
	11/25/2015	0.70	±	0.18	2.59	±	0.67	Yes	18.80	±	0.52	69.56	±	1.93	Yes
	12/2/2015	1.88	±	0.21	6.96	±	0.76	Yes	39.90	±	0.75	147.63	±	2.78	Yes
	12/9/2015	1.66	±	0.19	6.14	±	0.70	Yes	26.50	±	0.62	98.05	±	2.31	Yes
	12/16/2015	1.95	±	0.20	7.22	±	0.75	Yes	11.00	±	0.46	40.70	±	1.72	Yes
	12/23/2015	0.86	±	0.16	3.17	±	0.61	Yes	18.00	±	0.55	66.60	±	2.02	Yes
	12/30/2015	0.83	±	0.17	3.07	±	0.62	Yes	27.50	±	0.67	101.75	±	2.49	Yes
MUD LAKE	10/7/2015	1.04	±	0.16	3.85	±	0.61	Yes	25.70	±	0.61	95.09	±	2.25	Yes
	10/14/2015	1.92	±	0.21	7.10	±	0.77	Yes	30.60	±	0.69	113.22	±	2.55	Yes
	10/21/2015	1.26	±	0.16	4.66	±	0.61	Yes	25.30	±	0.60	93.61	±	2.22	Yes
	10/28/2015	1.98	±	0.21	7.33	±	0.79	Yes	33.20	±	0.71	122.84	±	2.64	Yes
	11/4/2015	0.74	±	0.15	2.72	±	0.56	Yes	19.00	±	0.55	70.30	±	2.05	Yes
	11/11/2015	1.05	±	0.17	3.89	±	0.61	Yes	20.40	±	0.57	75.48	±	2.11	Yes
	11/18/2015	1.55	±	0.19	5.74	±	0.70	Yes	29.40	±	0.65	108.78	±	2.39	Yes
	11/25/2015	1.14	±	0.21	4.22	±	0.76	Yes	24.90	±	0.59	92.13	±	2.18	Yes
	12/2/2015	1.63	±	0.19	6.03	±	0.69	Yes	39.30	±	0.71	145.41	±	2.64	Yes
	12/9/2015	1.52	±	0.19	5.62	±	0.71	Yes	31.90	±	0.70	118.03	±	2.59	Yes
	12/16/2015	0.47	±	0.12	1.75	±	0.45	Yes	5.52	±	0.36	20.42	±	1.32	Yes
a	12/23/2015		±			±		No		±			±		No
	12/30/2015	0.77	±	0.14	2.83	±	0.52	Yes	33.30	±	0.64	123.21	±	2.35	Yes
DISTANT															
BLACKFOOT	10/7/2015	1.27	±	0.17	4.70	±	0.63	Yes	26.50	±	0.60	98.05	±	2.21	Yes
	10/14/2015	1.13	±	0.15	4.18	±	0.57	Yes	21.90	±	0.54	81.03	±	2.01	Yes
	10/21/2015	1.12	±	0.15	4.14	±	0.56	Yes	22.80	±	0.56	84.36	±	2.06	Yes
	10/28/2015	0.76	±	0.14	2.83	±	0.52	Yes	25.20	±	0.57	93.24	±	2.11	Yes
	11/4/2015	0.97	±	0.16	3.58	±	0.57	Yes	15.20	±	0.49	56.24	±	1.82	Yes
	11/11/2015	0.62	±	0.13	2.29	±	0.47	Yes	18.30	±	0.50	67.71	±	1.84	Yes
	11/18/2015	0.89	±	0.16	3.31	±	0.58	Yes	16.80	±	0.51	62.16	±	1.89	Yes
	11/25/2015	0.97	±	0.20	3.59	±	0.73	Yes	19.50	±	0.54	72.15	±	1.98	Yes
	12/2/2015	1.66	±	0.19	6.14	±	0.71	Yes	39.70	±	0.73	146.89	±	2.72	Yes
	12/9/2015	1.20	±	0.17	4.44	±	0.61	Yes	25.80	±	0.60	95.46	±	2.22	Yes
	12/16/2015	0.83	±	0.14	3.08	±	0.53	Yes	8.62	±	0.41	31.89	±	1.51	Yes
	12/23/2015	0.67	±	0.16	2.48	±	0.58	Yes	13.20	±	0.50	48.84	±	1.83	Yes
	12/30/2015	1.04	±	0.17	3.85	±	0.64	Yes	25.60	±	0.64	94.72	±	2.38	Yes
CRATERS OF THE MOON	10/7/2015	1.10	±	0.17	4.07	±	0.61	Yes	27.10	±	0.62	100.27	±	2.28	Yes
	10/14/2015	1.11	±	0.16	4.11	±	0.60	Yes	20.90	±	0.57	77.33	±	2.09	Yes
	10/21/2015	1.27	±	0.17	4.70	±	0.61	Yes	25.60	±	0.60	94.72	±	2.22	Yes
	10/28/2015	0.80	±	0.15	2.95	±	0.55	Yes	27.70	±	0.62	102.49	±	2.28	Yes
	11/4/2015	0.63	±	0.13	2.32	±	0.49	Yes	10.30	±	0.42	38.11	±	1.54	Yes
	11/11/2015	1.19	±	0.17	4.40	±	0.62	Yes	22.20	±	0.58	82.14	±	2.13	Yes
	11/18/2015	0.93	±	0.16	3.44	±	0.60	Yes	21.40	±	0.56	79.18	±	2.09	Yes
	11/25/2015	0.66	±	0.19	2.42	±	0.70	Yes	21.30	±	0.56	78.81	±	2.08	Yes
	12/2/2015	0.84	±	0.20	3.12	±	0.75	Yes	22.60	±	0.74	83.62	±	2.72	Yes
	12/9/2015	0.93	±	0.16	3.43	±	0.60	Yes	25.00	±	0.62	92.50	±	2.30	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**
	12/16/2015	0.14 ± 0.11	0.51 ± 0.40	No	6.82 ± 0.40	25.23 ± 1.46	Yes
	12/23/2015	0.32 ± 0.13	1.18 ± 0.50	No	12.00 ± 0.47	44.40 ± 1.74	Yes
	12/30/2015	0.68 ± 0.15	2.51 ± 0.56	Yes	27.30 ± 0.64	101.01 ± 2.37	Yes
DUBOIS	10/7/2015	1.03 ± 0.17	3.81 ± 0.64	Yes	28.20 ± 0.66	104.34 ± 2.43	Yes
	10/14/2015	1.27 ± 0.17	4.70 ± 0.64	Yes	24.40 ± 0.61	90.28 ± 2.24	Yes
	10/21/2015	1.41 ± 0.18	5.22 ± 0.65	Yes	23.90 ± 0.61	88.43 ± 2.25	Yes
	10/28/2015	1.23 ± 0.18	4.55 ± 0.65	Yes	29.80 ± 0.66	110.26 ± 2.43	Yes
	11/4/2015	0.50 ± 0.13	1.85 ± 0.48	Yes	14.80 ± 0.48	54.76 ± 1.79	Yes
	11/11/2015	0.74 ± 0.14	2.73 ± 0.51	Yes	17.70 ± 0.51	65.49 ± 1.88	Yes
	11/18/2015	1.16 ± 0.18	4.29 ± 0.65	Yes	21.00 ± 0.57	77.70 ± 2.12	Yes
	11/25/2015	0.67 ± 0.19	2.47 ± 0.70	Yes	17.20 ± 0.52	63.64 ± 1.92	Yes
	12/2/2015	1.21 ± 0.18	4.48 ± 0.65	Yes	30.90 ± 0.67	114.33 ± 2.48	Yes
	12/9/2015	1.22 ± 0.18	4.51 ± 0.67	Yes	22.70 ± 0.62	83.99 ± 2.28	Yes
	12/16/2015	0.94 ± 0.16	3.46 ± 0.58	Yes	8.88 ± 0.43	32.86 ± 1.61	Yes
	12/23/2015	0.68 ± 0.16	2.53 ± 0.57	Yes	13.30 ± 0.49	49.21 ± 1.81	Yes
	12/30/2015	0.75 ± 0.15	2.78 ± 0.56	Yes	20.30 ± 0.57	75.11 ± 2.09	Yes
IDAHO FALLS	10/7/2015	1.44 ± 0.18	5.33 ± 0.66	Yes	26.80 ± 0.61	99.16 ± 2.26	Yes
	10/14/2015	1.28 ± 0.16	4.74 ± 0.61	Yes	22.50 ± 0.56	83.25 ± 2.08	Yes
	10/21/2015	1.87 ± 0.18	6.92 ± 0.68	Yes	23.60 ± 0.57	87.32 ± 2.11	Yes
	10/28/2015	1.72 ± 0.19	6.36 ± 0.68	Yes	26.30 ± 0.60	97.31 ± 2.21	Yes
	11/4/2015	0.72 ± 0.15	2.68 ± 0.56	Yes	15.80 ± 0.53	58.46 ± 1.94	Yes
	11/11/2015	0.99 ± 0.16	3.65 ± 0.59	Yes	20.40 ± 0.56	75.48 ± 2.07	Yes
	11/18/2015	0.81 ± 0.16	3.00 ± 0.57	Yes	18.60 ± 0.54	68.82 ± 1.98	Yes
	11/25/2015	0.78 ± 0.19	2.90 ± 0.71	Yes	17.00 ± 0.51	62.90 ± 1.90	Yes
	12/2/2015	1.63 ± 0.19	6.03 ± 0.70	Yes	39.30 ± 0.72	145.41 ± 2.67	Yes
	12/9/2015	0.82 ± 0.15	3.03 ± 0.56	Yes	25.30 ± 0.61	93.61 ± 2.25	Yes
	12/16/2015	0.77 ± 0.15	2.86 ± 0.54	Yes	9.31 ± 0.43	34.45 ± 1.60	Yes
	12/23/2015	0.63 ± 0.15	2.32 ± 0.56	Yes	12.70 ± 0.48	46.99 ± 1.78	Yes
	12/30/2015	1.12 ± 0.17	4.14 ± 0.64	Yes	29.90 ± 0.67	110.63 ± 2.48	Yes
QA-2	10/7/2015	1.23 ± 0.18	4.55 ± 0.65	Yes	27.60 ± 0.64	102.12 ± 2.36	Yes
(IDAHO FALLS)	10/14/2015	1.51 ± 0.18	5.59 ± 0.67	Yes	22.90 ± 0.59	84.73 ± 2.18	Yes
	10/21/2015	1.62 ± 0.18	5.99 ± 0.66	Yes	25.00 ± 0.60	92.50 ± 2.21	Yes
	10/28/2015	1.25 ± 0.17	4.63 ± 0.63	Yes	30.00 ± 0.64	111.00 ± 2.37	Yes
	11/4/2015	0.79 ± 0.16	2.93 ± 0.58	Yes	17.40 ± 0.55	64.38 ± 2.02	Yes
	11/11/2015	0.75 ± 0.15	2.78 ± 0.54	Yes	20.40 ± 0.56	75.48 ± 2.05	Yes
	11/18/2015	1.14 ± 0.17	4.22 ± 0.63	Yes	20.90 ± 0.56	77.33 ± 2.08	Yes
	11/25/2015	0.81 ± 0.20	3.01 ± 0.72	Yes	16.40 ± 0.51	60.68 ± 1.90	Yes
	12/2/2015	1.79 ± 0.20	6.62 ± 0.72	Yes	46.40 ± 0.77	171.68 ± 2.86	Yes
	12/9/2015	0.97 ± 0.16	3.60 ± 0.60	Yes	27.80 ± 0.64	102.86 ± 2.35	Yes
	12/16/2015	0.55 ± 0.13	2.04 ± 0.50	Yes	10.60 ± 0.45	39.22 ± 1.65	Yes
	12/23/2015	0.55 ± 0.14	2.03 ± 0.52	Yes	13.70 ± 0.48	50.69 ± 1.76	Yes
	12/30/2015	0.94 ± 0.18	3.46 ± 0.66	Yes	39.40 ± 0.79	145.78 ± 2.93	Yes
SUGAR CITY	10/7/2015	0.95 ± 0.15	3.52 ± 0.56	Yes	22.60 ± 0.55	83.62 ± 2.04	Yes
	10/14/2015	1.36 ± 0.16	5.03 ± 0.60	Yes	22.60 ± 0.55	83.62 ± 2.03	Yes
	10/21/2015	1.04 ± 0.15	3.85 ± 0.55	Yes	23.50 ± 0.56	86.95 ± 2.09	Yes
	10/28/2015	1.40 ± 0.18	5.18 ± 0.68	Yes	30.20 ± 0.67	111.74 ± 2.47	Yes
	11/4/2015	0.52 ± 0.13	1.93 ± 0.48	Yes	14.00 ± 0.47	51.80 ± 1.73	Yes
	11/11/2015	1.08 ± 0.16	4.00 ± 0.60	Yes	18.80 ± 0.54	69.56 ± 2.01	Yes
	11/18/2015	0.94 ± 0.16	3.47 ± 0.60	Yes	20.40 ± 0.55	75.48 ± 2.05	Yes
	11/25/2015	0.57 ± 0.17	2.12 ± 0.64	Yes	15.60 ± 0.48	57.72 ± 1.76	Yes
	12/2/2015	1.32 ± 0.17	4.88 ± 0.63	Yes	38.10 ± 0.70	140.97 ± 2.58	Yes
	12/9/2015	0.76 ± 0.14	2.81 ± 0.51	Yes	20.80 ± 0.54	76.96 ± 1.98	Yes
	12/16/2015	0.40 ± 0.12	1.49 ± 0.44	Yes	8.14 ± 0.40	30.12 ± 1.46	Yes
	12/23/2015	0.47 ± 0.14	1.72 ± 0.50	Yes	11.90 ± 0.45	44.03 ± 1.66	Yes
	12/30/2015	0.50 ± 0.14	1.86 ± 0.50	Yes	25.30 ± 0.60	93.61 ± 2.23	Yes
INL SITE							
EFS	10/7/2015	0.81 ± 0.15	3.00 ± 0.56	Yes	22.90 ± 0.57	84.73 ± 2.11	Yes
	10/14/2015	1.25 ± 0.17	4.63 ± 0.63	Yes	22.60 ± 0.58	83.62 ± 2.16	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
	10/21/2015	1.62	±	0.18	5.99	±	0.68	Yes	26.30	±	0.62	97.31	±	2.30	Yes
	10/28/2015	1.64	±	0.20	6.07	±	0.75	Yes	34.40	±	0.74	127.28	±	2.72	Yes
	11/4/2015	0.41	±	0.14	1.52	±	0.50	Yes	15.40	±	0.52	56.98	±	1.93	Yes
	11/11/2015	0.93	±	0.16	3.46	±	0.60	Yes	21.90	±	0.59	81.03	±	2.19	Yes
	11/18/2015	1.21	±	0.19	4.48	±	0.70	Yes	28.90	±	0.68	106.93	±	2.51	Yes
	11/25/2015	0.82	±	0.20	3.03	±	0.73	Yes	25.50	±	0.61	94.35	±	2.25	Yes
	12/2/2015	1.64	±	0.20	6.07	±	0.74	Yes	48.50	±	0.83	179.45	±	3.07	Yes
	12/9/2015	1.16	±	0.18	4.29	±	0.67	Yes	31.30	±	0.70	115.81	±	2.59	Yes
	12/16/2015	0.76	±	0.15	2.81	±	0.55	Yes	8.92	±	0.43	33.00	±	1.60	Yes
	12/23/2015	0.63	±	0.16	2.34	±	0.59	Yes	13.20	±	0.51	48.84	±	1.88	Yes
	12/30/2015	1.58	±	0.21	5.85	±	0.78	Yes	38.50	±	0.80	142.45	±	2.96	Yes
MAIN GATE	10/7/2015	0.91	±	0.16	3.36	±	0.58	Yes	27.20	±	0.62	100.64	±	2.28	Yes
	10/14/2015	1.23	±	0.17	4.55	±	0.61	Yes	24.00	±	0.58	88.80	±	2.16	Yes
	10/21/2015	1.28	±	0.16	4.74	±	0.60	Yes	25.40	±	0.59	93.98	±	2.17	Yes
	10/28/2015	1.56	±	0.19	5.77	±	0.70	Yes	34.50	±	0.70	127.65	±	2.58	Yes
	11/4/2015	0.38	±	0.12	1.41	±	0.45	Yes	15.70	±	0.49	58.09	±	1.81	Yes
	11/11/2015	0.65	±	0.14	2.41	±	0.52	Yes	20.00	±	0.55	74.00	±	2.04	Yes
	11/18/2015	0.97	±	0.16	3.59	±	0.60	Yes	25.30	±	0.60	93.61	±	2.20	Yes
	11/25/2015	0.63	±	0.18	2.32	±	0.67	Yes	24.50	±	0.58	90.65	±	2.13	Yes
	12/2/2015	1.69	±	0.19	6.25	±	0.69	Yes	43.40	±	0.74	160.58	±	2.73	Yes
	12/9/2015	1.18	±	0.18	4.37	±	0.67	Yes	32.30	±	0.71	119.51	±	2.63	Yes
	12/16/2015	1.06	±	0.17	3.92	±	0.61	Yes	7.15	±	0.41	26.46	±	1.52	Yes
	12/23/2015	0.68	±	0.16	2.51	±	0.60	Yes	17.00	±	0.55	62.90	±	2.04	Yes
	12/30/2015	1.08	±	0.18	4.00	±	0.67	Yes	22.60	±	0.63	83.62	±	2.35	Yes
QA-1	10/7/2015	0.73	±	0.15	2.72	±	0.54	Yes	26.50	±	0.60	98.05	±	2.23	Yes
(MAIN GATE)	10/14/2015	1.14	±	0.16	4.22	±	0.58	Yes	22.90	±	0.56	84.73	±	2.06	Yes
	10/21/2015	1.33	±	0.16	4.92	±	0.60	Yes	26.60	±	0.59	98.42	±	2.18	Yes
	10/28/2015	0.99	±	0.15	3.65	±	0.57	Yes	31.70	±	0.64	117.29	±	2.35	Yes
	11/4/2015	0.79	±	0.15	2.94	±	0.57	Yes	16.40	±	0.53	60.68	±	1.95	Yes
	11/11/2015	1.03	±	0.17	3.81	±	0.61	Yes	22.80	±	0.60	84.36	±	2.21	Yes
	11/18/2015	0.80	±	0.16	2.96	±	0.61	Yes	26.20	±	0.64	96.94	±	2.36	Yes
	11/25/2015	0.78	±	0.19	2.88	±	0.68	Yes	24.00	±	0.57	88.80	±	2.11	Yes
	12/2/2015	1.11	±	0.18	4.11	±	0.65	Yes	44.00	±	0.78	162.80	±	2.90	Yes
	12/9/2015	1.42	±	0.18	5.25	±	0.68	Yes	31.40	±	0.68	116.18	±	2.50	Yes
	12/16/2015	1.42	±	0.18	5.25	±	0.67	Yes	7.70	±	0.42	28.49	±	1.57	Yes
	12/23/2015	0.60	±	0.16	2.22	±	0.58	Yes	16.60	±	0.55	61.42	±	2.02	Yes
	12/30/2015	1.08	±	0.18	4.00	±	0.67	Yes	23.70	±	0.65	87.69	±	2.39	Yes
VAN BUREN GATE	10/7/2015	0.75	±	0.15	2.79	±	0.56	Yes	27.30	±	0.63	101.01	±	2.31	Yes
	10/14/2015	1.14	±	0.16	4.22	±	0.58	Yes	21.50	±	0.55	79.55	±	2.04	Yes
	10/21/2015	1.16	±	0.15	4.29	±	0.57	Yes	24.80	±	0.57	91.76	±	2.11	Yes
	10/28/2015	1.01	±	0.15	3.74	±	0.57	Yes	29.10	±	0.61	107.67	±	2.26	Yes
	11/4/2015	0.45	±	0.13	1.68	±	0.47	Yes	15.00	±	0.49	55.50	±	1.80	Yes
	11/11/2015	1.16	±	0.17	4.29	±	0.64	Yes	21.80	±	0.59	80.66	±	2.20	Yes
	11/18/2015	1.04	±	0.19	3.85	±	0.69	Yes	26.50	±	0.67	98.05	±	2.49	Yes
	11/25/2015	0.94	±	0.20	3.47	±	0.73	Yes	23.70	±	0.58	87.69	±	2.15	Yes
	12/2/2015	1.50	±	0.20	5.55	±	0.73	Yes	47.10	±	0.82	174.27	±	3.04	Yes
	12/9/2015	1.21	±	0.18	4.48	±	0.67	Yes	30.10	±	0.69	111.37	±	2.56	Yes
	12/16/2015	0.62	±	0.15	2.31	±	0.54	Yes	8.53	±	0.44	31.56	±	1.64	Yes
	12/23/2015	0.58	±	0.15	2.13	±	0.57	Yes	15.80	±	0.53	58.46	±	1.96	Yes
	12/30/2015	0.60	±	0.16	2.21	±	0.59	Yes	35.80	±	0.76	132.46	±	2.79	Yes

a. Invalid sample result shown in red

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

Sampling Group and Location	Sampling Date	Result ± 1s Uncertainty (x 10^{-15} µCi/mL)			Result ± 1s Uncertainty (x 10^{-11} Bq/mL)			Result > 3s
BOUNDARY								
ARCO	10/07/2015	0.13	±	1.06	0.50	±	3.90	No
	10/14/2015	1.82	±	1.29	6.75	±	4.79	No
	10/21/2015	2.82	±	1.15	10.45	±	4.25	No
	10/28/2015	0.65	±	1.12	2.40	±	4.16	No
	11/04/2015	0.66	±	1.03	2.46	±	3.81	No
	11/11/2015	-1.79	±	1.10	-6.63	±	4.07	No
	11/18/2015	-1.25	±	1.13	-4.62	±	4.19	No
	11/25/2015	-1.96	±	1.15	-7.27	±	4.27	No
	12/02/2015	0.52	±	1.12	1.91	±	4.14	No
	12/09/2015	-0.48	±	1.10	-1.79	±	4.07	No
	12/16/2015	-0.56	±	1.12	-2.06	±	4.14	No
	12/23/2015	-1.14	±	1.44	-4.22	±	5.34	No
	12/30/2015	-1.17	±	1.40	-4.34	±	5.17	No
ATOMIC CITY	10/07/2015	0.14	±	1.10	0.52	±	4.07	No
	10/14/2015	1.96	±	1.39	7.25	±	5.14	No
	10/21/2015	2.98	±	1.21	11.02	±	4.48	No
	10/28/2015	0.64	±	1.11	2.37	±	4.11	No
	11/04/2015	0.66	±	1.03	2.46	±	3.80	No
	11/11/2015	-1.85	±	1.13	-6.84	±	4.20	No
	11/18/2015	-1.27	±	1.15	-4.71	±	4.27	No
	11/25/2015	-1.95	±	1.15	-7.22	±	4.24	No
	12/02/2015	0.57	±	1.23	2.10	±	4.55	No
	12/09/2015	-0.49	±	1.10	-1.80	±	4.09	No
	12/16/2015	-0.60	±	1.20	-2.21	±	4.46	No
	12/23/2015	-1.25	±	1.58	-4.61	±	5.84	No
	12/30/2015	-1.28	±	1.53	-4.74	±	5.64	No
BLUE DOME	10/07/2015	5.09	±	1.22	18.84	±	4.52	**Yes**
	10/14/2015	-0.68	±	1.10	-2.52	±	4.07	No
	10/21/2015	0.68	±	1.02	2.53	±	3.77	No
	10/28/2015	1.00	±	1.09	3.70	±	4.05	No
	11/04/2015	-0.61	±	0.98	-2.25	±	3.61	No
	11/11/2015	-2.55	±	1.00	-9.42	±	3.70	No
	11/18/2015	-0.25	±	1.00	-0.94	±	3.68	No
	11/25/2015	-1.46	±	0.99	-5.40	±	3.67	No
	12/02/2015	-0.65	±	1.12	-2.40	±	4.14	No
	12/09/2015	1.26	±	1.11	4.66	±	4.10	No
	12/16/2015	0.42	±	1.11	1.55	±	4.11	No
	12/23/2015	-1.23	±	1.51	-4.57	±	5.58	No
	12/30/2015	2.03	±	1.38	7.51	±	5.10	No
FAA TOWER	10/07/2015	5.41	±	1.30	20.01	±	4.80	**Yes**
	10/14/2015	-0.68	±	1.10	-2.51	±	4.07	No
	10/21/2015	0.65	±	0.97	2.41	±	3.58	No
	10/28/2015	1.00	±	1.09	3.70	±	4.05	No
	11/04/2015	-0.62	±	1.00	-2.30	±	3.68	No
	11/11/2015	-2.66	±	1.05	-9.85	±	3.87	No
	11/18/2015	-0.25	±	0.97	-0.91	±	3.58	No
	11/25/2015	-1.46	±	0.99	-5.40	±	3.68	No
	12/02/2015	-0.57	±	0.98	-2.11	±	3.63	No
	12/09/2015	1.26	±	1.11	4.66	±	4.11	No
	12/16/2015	0.45	±	1.20	1.67	±	4.44	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
	12/23/2015	-1.30	±	1.59	-4.80	±	5.86	No
	12/30/2015	2.37	±	1.61	8.76	±	5.95	No
HOWE	10/07/2015	5.29	±	1.27	19.56	±	4.69	**Yes**
	10/14/2015	-0.71	±	1.15	-2.63	±	4.26	No
	10/21/2015	0.73	±	1.08	2.70	±	4.01	No
	10/28/2015	1.01	±	1.11	3.75	±	4.11	No
	11/04/2015	-0.60	±	0.97	-2.23	±	3.58	No
	11/11/2015	-2.65	±	1.04	-9.81	±	3.86	No
	11/18/2015	-0.25	±	1.00	-0.94	±	3.69	No
	11/25/2015	-1.48	±	1.01	-5.47	±	3.72	No
	12/02/2015	-0.63	±	1.09	-2.34	±	4.03	No
	12/09/2015	1.15	±	1.01	4.24	±	3.74	No
	12/16/2015	0.39	±	1.02	1.43	±	3.79	No
	12/23/2015	-1.10	±	1.34	-4.05	±	4.95	No
	12/30/2015	1.93	±	1.31	7.14	±	4.85	No
MONTEVIEW	10/07/2015	5.54	±	1.33	20.51	±	4.92	**Yes**
	10/14/2015	-0.73	±	1.18	-2.69	±	4.35	No
	10/21/2015	0.75	±	1.12	2.78	±	4.14	No
	10/28/2015	1.02	±	1.11	3.77	±	4.12	No
	11/04/2015	-0.65	±	1.04	-2.39	±	3.83	No
	11/11/2015	-2.73	±	1.07	-10.10	±	3.97	No
	11/18/2015	-0.27	±	1.05	-0.99	±	3.87	No
	11/25/2015	-1.53	±	1.04	-5.64	±	3.84	No
	12/02/2015	-0.66	±	1.14	-2.45	±	4.22	No
	12/09/2015	1.15	±	1.01	4.25	±	3.75	No
	12/16/2015	0.40	±	1.05	1.46	±	3.89	No
	12/23/2015	-1.13	±	1.38	-4.18	±	5.11	No
	12/30/2015	2.11	±	1.43	7.81	±	5.31	No
MUD LAKE	10/07/2015	5.16	±	1.24	19.09	±	4.58	**Yes**
	10/14/2015	-0.76	±	1.23	-2.80	±	4.53	No
	10/21/2015	0.67	±	1.00	2.49	±	3.70	No
	10/28/2015	1.07	±	1.17	3.96	±	4.34	No
	11/04/2015	-0.63	±	1.01	-2.33	±	3.74	No
	11/11/2015	-2.77	±	1.09	-10.26	±	4.04	No
	11/18/2015	-0.25	±	0.99	-0.93	±	3.65	No
	11/25/2015	-1.55	±	1.06	-5.75	±	3.92	No
	12/02/2015	-0.61	±	1.06	-2.27	±	3.90	No
	12/09/2015	1.22	±	1.08	4.53	±	3.99	No
	12/16/2015	0.37	±	0.98	1.36	±	3.62	No
a	12/23/2015		±			±		No
	12/30/2015	1.66	±	1.13	6.15	±	4.18	No
DISTANT								
BLACKFOOT	10/07/2015	0.13	±	1.03	0.48	±	3.81	No
	10/14/2015	1.71	±	1.21	6.31	±	4.48	No
	10/21/2015	2.76	±	1.12	10.21	±	4.15	No
	10/28/2015	0.61	±	1.06	2.26	±	3.91	No
	11/04/2015	0.68	±	1.06	2.53	±	3.92	No
	11/11/2015	-1.67	±	1.03	-6.19	±	3.80	No
	11/18/2015	-1.18	±	1.07	-4.37	±	3.97	No
	11/25/2015	-1.97	±	1.16	-7.28	±	4.28	No
	12/02/2015	0.56	±	1.21	2.07	±	4.49	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
	12/09/2015	-0.45	±	1.04	-1.68	±	3.83	No
	12/16/2015	-0.54	±	1.08	-1.99	±	4.00	No
	12/23/2015	-1.22	±	1.54	-4.50	±	5.71	No
	12/30/2015	-1.16	±	1.39	-4.30	±	5.13	No
CRATERS	10/07/2015	0.14	±	1.07	0.51	±	3.97	No
	10/14/2015	1.89	±	1.34	7.00	±	4.97	No
	10/21/2015	2.89	±	1.18	10.71	±	4.35	No
	10/28/2015	0.65	±	1.13	2.41	±	4.18	No
	11/04/2015	0.66	±	1.02	2.43	±	3.76	No
	11/11/2015	-1.87	±	1.15	-6.91	±	4.24	No
	11/18/2015	-1.20	±	1.09	-4.43	±	4.02	No
	11/25/2015	-2.02	±	1.19	-7.46	±	4.39	No
	12/02/2015	0.83	±	1.81	3.09	±	6.70	No
	12/09/2015	-0.49	±	1.12	-1.83	±	4.16	No
	12/16/2015	-0.57	±	1.15	-2.12	±	4.27	No
	12/23/2015	-1.19	±	1.51	-4.40	±	5.58	No
	12/30/2015	-1.11	±	1.32	-4.09	±	4.88	No
DUBOIS	10/07/2015	5.55	±	1.33	20.52	±	4.92	**Yes**
	10/14/2015	-0.71	±	1.16	-2.64	±	4.28	No
	10/21/2015	0.72	±	1.07	2.65	±	3.94	No
	10/28/2015	1.01	±	1.11	3.74	±	4.10	No
	11/04/2015	-0.59	±	0.95	-2.20	±	3.52	No
	11/11/2015	-2.53	±	0.99	-9.36	±	3.68	No
	11/18/2015	-0.26	±	1.02	-0.96	±	3.77	No
	11/25/2015	-1.61	±	1.10	-5.97	±	4.07	No
	12/02/2015	-0.66	±	1.14	-2.45	±	4.22	No
	12/09/2015	1.25	±	1.10	4.63	±	4.08	No
	12/16/2015	0.40	±	1.06	1.48	±	3.92	No
	12/23/2015	-1.14	±	1.39	-4.22	±	5.16	No
	12/30/2015	1.94	±	1.32	7.18	±	4.88	No
IDAHO FALLS	10/07/2015	5.04	±	1.21	18.66	±	4.48	**Yes**
	10/14/2015	-0.66	±	1.07	-2.46	±	3.98	No
	10/21/2015	0.65	±	0.96	2.40	±	3.57	No
	10/28/2015	0.94	±	1.02	3.46	±	3.79	No
	11/04/2015	-0.65	±	1.04	-2.40	±	3.85	No
	11/11/2015	-2.70	±	1.06	-10.01	±	3.94	No
	11/18/2015	-0.25	±	0.99	-0.93	±	3.65	No
	11/25/2015	-1.59	±	1.08	-5.87	±	3.99	No
	12/02/2015	-0.62	±	1.08	-2.31	±	3.98	No
	12/09/2015	1.14	±	1.01	4.23	±	3.73	No
	12/16/2015	0.39	±	1.04	1.45	±	3.84	No
	12/23/2015	-1.14	±	1.39	-4.22	±	5.16	No
	12/30/2015	1.97	±	1.34	7.29	±	4.96	No
QA-2	10/07/2015	5.33	±	1.28	19.73	±	4.74	**Yes**
(IDAHO FALLS)	10/14/2015	-0.71	±	1.15	-2.64	±	4.27	No
	10/21/2015	0.67	±	1.00	2.49	±	3.70	No
	10/28/2015	0.97	±	1.06	3.57	±	3.91	No
	11/04/2015	-0.65	±	1.04	-2.41	±	3.86	No
	11/11/2015	-2.67	±	1.05	-9.87	±	3.88	No
	11/18/2015	-0.25	±	0.98	-0.93	±	3.63	No
	11/25/2015	-1.62	±	1.11	-6.01	±	4.09	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
	12/02/2015	-0.62	±	1.07	-2.30	±	3.96	No
	12/09/2015	1.15	±	1.02	4.27	±	3.76	No
	12/16/2015	0.39	±	1.02	1.43	±	3.79	No
	12/23/2015	-1.08	±	1.32	-3.98	±	4.87	No
	12/30/2015	2.15	±	1.46	7.97	±	5.42	No
SUGAR CITY	10/07/2015	4.81	±	1.15	17.79	±	4.27	**Yes**
	10/14/2015	-0.64	±	1.03	-2.36	±	3.82	No
	10/21/2015	0.64	±	0.95	2.37	±	3.53	No
	10/28/2015	1.03	±	1.12	3.80	±	4.16	No
	11/04/2015	-0.58	±	0.93	-2.15	±	3.45	No
	11/11/2015	-2.69	±	1.06	-9.95	±	3.91	No
	11/18/2015	-0.25	±	0.98	-0.93	±	3.63	No
	11/25/2015	-1.49	±	1.01	-5.51	±	3.75	No
	12/02/2015	-0.60	±	1.04	-2.22	±	3.83	No
	12/09/2015	1.05	±	0.93	3.89	±	3.43	No
	12/16/2015	0.36	±	0.97	1.35	±	3.58	No
	12/23/2015	-1.06	±	1.29	-3.92	±	4.79	No
	12/30/2015	1.85	±	1.26	6.86	±	4.66	No
INL SITE								
EFS	10/07/2015	0.13	±	1.06	0.50	±	3.91	No
	10/14/2015	1.88	±	1.33	6.96	±	4.94	No
	10/21/2015	2.99	±	1.22	11.08	±	4.50	No
	10/28/2015	0.75	±	1.30	2.77	±	4.81	No
	11/04/2015	0.75	±	1.15	2.76	±	4.27	No
	11/11/2015	-1.98	±	1.21	-7.32	±	4.49	No
	11/18/2015	-1.33	±	1.21	-4.92	±	4.47	No
	11/25/2015	-2.03	±	1.19	-7.51	±	4.41	No
	12/02/2015	0.59	±	1.29	2.20	±	4.77	No
	12/09/2015	-0.52	±	1.18	-1.91	±	4.35	No
	12/16/2015	-0.58	±	1.17	-2.15	±	4.32	No
	12/23/2015	-1.27	±	1.61	-4.69	±	5.94	No
	12/30/2015	-1.26	±	1.51	-4.68	±	5.57	No
MAIN GATE	10/07/2015	0.14	±	1.07	0.50	±	3.96	No
	10/14/2015	1.81	±	1.28	6.69	±	4.75	No
	10/21/2015	2.79	±	1.13	10.32	±	4.20	No
	10/28/2015	0.68	±	1.18	2.53	±	4.38	No
	11/04/2015	0.67	±	1.03	2.47	±	3.82	No
	11/11/2015	-1.87	±	1.15	-6.90	±	4.24	No
	11/18/2015	-1.16	±	1.06	-4.31	±	3.91	No
	11/25/2015	-1.91	±	1.12	-7.08	±	4.16	No
	12/02/2015	0.52	±	1.14	1.94	±	4.21	No
	12/09/2015	-0.52	±	1.18	-1.91	±	4.35	No
	12/16/2015	-0.59	±	1.19	-2.19	±	4.40	No
	12/23/2015	-1.25	±	1.58	-4.62	±	5.86	No
	12/30/2015	-1.23	±	1.47	-4.56	±	5.44	No
QA-1	10/07/2015	0.13	±	1.05	0.49	±	3.89	No
(MAIN GATE)	10/14/2015	1.73	±	1.23	6.39	±	4.54	No
	10/21/2015	2.72	±	1.11	10.07	±	4.10	No
	10/28/2015	0.62	±	1.07	2.29	±	3.97	No
	11/04/2015	0.73	±	1.13	2.69	±	4.17	No
	11/11/2015	-1.96	±	1.21	-7.26	±	4.46	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
	11/18/2015	-1.29	±	1.17	-4.76	±	4.32	No
	11/25/2015	-1.90	±	1.11	-7.01	±	4.12	No
	12/02/2015	0.58	±	1.26	2.15	±	4.66	No
	12/09/2015	-0.48	±	1.10	-1.78	±	4.06	No
	12/16/2015	-0.59	±	1.19	-2.20	±	4.42	No
	12/23/2015	-1.25	±	1.58	-4.62	±	5.86	No
	12/30/2015	-1.24	±	1.47	-4.57	±	5.45	No
VAN BUREN GATE	10/07/2015	0.14	±	1.10	0.52	±	4.05	No
	10/14/2015	1.76	±	1.25	6.52	±	4.63	No
	10/21/2015	2.70	±	1.10	10.00	±	4.07	No
	10/28/2015	0.62	±	1.07	2.28	±	3.95	No
	11/04/2015	0.68	±	1.05	2.51	±	3.88	No
	11/11/2015	-1.99	±	1.22	-7.37	±	4.53	No
	11/18/2015	-1.40	±	1.27	-5.16	±	4.69	No
	11/25/2015	-1.98	±	1.16	-7.32	±	4.30	No
	12/02/2015	0.60	±	1.29	2.21	±	4.79	No
	12/09/2015	-0.52	±	1.18	-1.92	±	4.38	No
	12/16/2015	-0.61	±	1.23	-2.27	±	4.56	No
	12/23/2015	-1.23	±	1.55	-4.53	±	5.75	No
	12/30/2015	-1.21	±	1.44	-4.46	±	5.32	No

a. Invalid sample result shown in red

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

Sampling Group and Location	Sampling Date	Analyte	Result ± 1s Uncertainty (x 10^{-18} µCi/mL)			Result ± 1s Uncertainty (x 10^{-14} Bq/mL)			Result > 3s
BOUNDARY									
ARCO	12/30/2015	CESIUM-137	16.39	±	91.66	60.65	±	339.14	No
ATOMIC CITY	12/30/2015	CESIUM-137	-9.45	±	108.23	-34.95	±	400.46	No
		STRONTIUM-90	1.80	±	5.36	6.66	±	19.83	No
BLUE DOME	12/30/2015	CESIUM-137	-37.46	±	104.31	-138.59	±	385.94	No
FAA TOWER	12/30/2015	CESIUM-137	-64.62	±	85.82	-239.09	±	317.55	No
		STRONTIUM-90	-2.36	±	5.07	-8.73	±	18.76	No
HOWE	12/30/2015	AMERICIUM-241	-1.33	±	0.73	-4.92	±	2.71	No
		CESIUM-137	-81.36	±	114.24	-301.05	±	422.70	No
		PLUTONIUM-238	1.13	±	0.82	4.18	±	3.03	No
		PLUTONIUM-239/240	1.80	±	0.85	6.66	±	3.16	No
MONTEVIEW	12/30/2015	AMERICIUM-241	-1.37	±	0.70	-5.07	±	2.59	No
		CESIUM-137	-27.99	±	112.66	-103.58	±	416.83	No
		PLUTONIUM-238	2.34	±	0.88	8.66	±	3.26	No
		PLUTONIUM-239/240	2.33	±	1.02	8.62	±	3.77	No
MUD LAKE	12/30/2015	AMERICIUM-241	0.42	±	0.87	1.55	±	3.22	No
		CESIUM-137	-18.90	±	118.76	-69.92	±	439.41	No
		PLUTONIUM-238	1.32	±	1.08	4.88	±	4.00	No
		PLUTONIUM-239/240	0.44	±	1.08	1.62	±	4.00	No
DISTANT									
BLACKFOOT	12/30/2015	CESIUM-137	-84.11	±	83.51	-311.22	±	309.00	No
CRATERS	12/30/2015	CESIUM-137	-3.08	±	88.80	-11.40	±	328.58	No
DUBOIS	12/30/2015	AMERICIUM-241	-1.35	±	0.79	-5.00	±	2.93	No
		CESIUM-137	-47.57	±	124.52	-176.02	±	460.71	No
		PLUTONIUM-238	0.55	±	0.78	2.04	±	2.89	No
		PLUTONIUM-239/240	1.10	±	0.68	4.07	±	2.51	No
IDAHO FALLS	12/30/2015	CESIUM-137	-126.87	±	118.36	-469.42	±	437.93	No
		STRONTIUM-90	14.40	±	6.29	53.28	±	23.27	No
QA-2 (IDAHO FALLS)	12/30/2015	CESIUM-137	61.85	±	94.81	228.83	±	350.78	No
		STRONTIUM-90	-1.38	±	5.20	-5.11	±	19.24	No
SUGAR CITY	12/30/2015	CESIUM-137	106.09	±	90.41	392.54	±	334.50	No
INL SITE									
EFS	12/30/2015	AMERICIUM-241	-0.14	±	0.80	-0.52	±	2.96	No
		CESIUM-137	-88.36	±	100.23	-326.92	±	370.87	No
		PLUTONIUM-238	1.70	±	1.21	6.29	±	4.48	No
		PLUTONIUM-239/240	4.23	±	1.51	15.65	±	5.59	No
MAIN GATE	12/30/2015	CESIUM-137	-58.18	±	119.47	-215.25	±	442.05	No
		STRONTIUM-90	1.52	±	5.34	5.62	±	19.76	No
QA-1 (MAIN GATE)	12/30/2015	CESIUM-137	-22.40	±	90.11	-82.89	±	333.40	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
		STRONTIUM-90	1.55	±	4.80	5.74	±	17.76	No
VAN BUREN GATE	12/30/2015	AMERICIUM-241	-0.57	±	0.91	-2.12	±	3.35	No
		CESIUM-137	160.43	±	118.43	593.60	±	438.18	No
		PLUTONIUM-238	-0.95	±	0.75	-3.50	±	2.78	No
		PLUTONIUM-239/240	0.94	±	0.58	3.49	±	2.16	No

TABLE C-4. Tritium Concentrations in Atmospheric Moisture

Sampling Group and Location	Start Date	Sampling Date	Result ± 1s Uncertainty (x 10^{-13} µCi/mL_{air})			Result ± 1s Uncertainty (x 10^{-9} Bq/mL_{air})			Result > 3s
BOUNDARY									
ATOMIC CITY	09/16/15	10/14/15	7.89	±	0.64	29.19	±	2.36	**Yes**
ATOMIC CITY	10/14/15	11/04/15	4.35	±	0.76	16.11	±	2.80	**Yes**
ATOMIC CITY	11/04/15	12/23/15	0.38	±	0.35	1.42	±	1.31	No
DISTANT									
BLACKFOOT	09/30/15	10/21/15	2.81	±	1.20	10.39	±	4.44	No
BLACKFOOT	10/21/15	11/11/15	6.48	±	1.47	23.99	±	5.45	**Yes**
BLACKFOOT	11/11/15	12/30/15	1.71	±	0.84	6.34	±	3.09	No
IDAHO FALLS	09/22/15	10/12/15	3.60	±	1.10	13.33	±	4.07	**Yes**
IDAHO FALLS	10/12/15	10/30/15	7.73	±	1.37	28.61	±	5.08	**Yes**
IDAHO FALLS	10/30/15	11/30/15	-4.66	±	0.82	-17.26	±	3.05	No
SUGAR CITY	09/23/15	10/14/15	6.93	±	1.94	25.64	±	7.17	**Yes**
SUGAR CITY	10/14/15	11/04/15	4.04	±	1.65	14.95	±	6.10	No
SUGAR CITY	11/04/15	12/16/15	3.46	±	0.85	12.82	±	3.16	**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
IDAHO FALLS	09/30/15	10/30/15	-34.20	±	24.50	-1.27	±	0.91	No
	10/30/15	11/30/15	-62.10	±	25.60	-2.30	±	0.95	No
	11/30/15	12/31/15	-8.61	±	27.10	-0.32	±	1.00	No
CFA	09/28/15	11/02/15	16.00	±	24.40	0.59	±	0.90	No
	11/02/15	11/30/15	15.60	±	24.60	0.58	±	0.91	No
EFS	09/30/15	10/07/15	113.00	±	23.80	4.18	±	0.88	**Yes**
	10/14/15	10/21/15	-46.80	±	24.30	-1.73	±	0.90	No
	10/28/15	11/04/15	9.29	±	24.30	0.34	±	0.90	No
	12/09/15	12/16/15	-110.00	±	26.00	-4.07	±	0.96	No
	12/16/15	12/23/15	94.30	±	24.40	3.49	±	0.90	**Yes**
	12/23/15	12/30/15	147.79	±	25.00	5.47	±	0.93	**Yes**

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

Location	Sampling Date	Analyte	Result ± 1s Uncertainty (pCi/L)			Result ± 1s Uncertainty (Bq/L)			Result > 3s
SURFACE WATER									
Alpheus Spring	11/5/2015	GROSS ALPHA	3.20	±	0.80	0.12	±	0.03	**Yes**
		GROSS BETA	4.30	±	0.60	0.16	±	0.02	**Yes**
		TRITIUM	-9.10	±	23.10	-0.34	±	0.86	No
Bill Jones Fish Farm	11/5/2015	GROSS ALPHA	1.92	±	0.66	0.07	±	0.02	No
		GROSS BETA	3.95	±	0.56	0.15	±	0.02	**Yes**
		TRITIUM	8.30	±	23.30	0.31	±	0.86	No
Bill Jones Fish Farm (Duplicate)	11/5/2015	GROSS ALPHA	0.50	±	0.62	0.02	±	0.02	No
		GROSS BETA	3.83	±	0.56	0.14	±	0.02	**Yes**
		TRITIUM	4.80	±	23.30	0.18	±	0.86	No
Clear Springs	11/5/2015	GROSS ALPHA	1.92	±	0.82	0.07	±	0.03	No
		GROSS BETA	5.29	±	0.62	0.20	±	0.02	**Yes**
		TRITIUM	276.70	±	26.50	10.25	±	0.98	**Yes**
DRINKING WATER									
Atomic City	11/4/2015	GROSS ALPHA	2.23	±	0.70	0.08	±	0.03	**Yes**
		GROSS BETA	1.91	±	0.59	0.07	±	0.02	**Yes**
		TRITIUM	-27.40	±	24.00	-1.01	±	0.89	No
Control	11/9/2015	GROSS ALPHA	0.19	±	0.23	0.01	±	0.01	No
		GROSS BETA	-0.38	±	0.48	-0.01	±	0.02	No
		TRITIUM	181.00	±	27.60	6.70	±	1.02	**Yes**
Craters of the Moon	11/4/2015	GROSS ALPHA	2.15	±	0.66	0.08	±	0.02	**Yes**
		GROSS BETA	2.60	±	0.59	0.10	±	0.02	**Yes**
		TRITIUM	137.00	±	25.50	5.07	±	0.94	**Yes**
Howe	11/2/2015	GROSS ALPHA	1.59	±	0.70	0.06	±	0.03	No
		GROSS BETA	2.50	±	0.56	0.09	±	0.02	**Yes**
		TRITIUM	56.50	±	24.50	2.09	±	0.91	No
Idaho Falls	11/9/2015	GROSS ALPHA	1.38	±	0.68	0.05	±	0.03	No
		GROSS BETA	0.39	±	0.57	0.01	±	0.02	No
		TRITIUM	117.00	±	25.30	4.33	±	0.94	**Yes**
Minidoka	11/5/2015	GROSS ALPHA	0.73	±	0.66	0.03	±	0.02	No
		GROSS BETA	2.40	±	0.55	0.09	±	0.02	**Yes**
		TRITIUM	27.50	±	24.20	1.02	±	0.90	No
Mud Lake	11/9/2015	GROSS ALPHA	0.20	±	0.51	0.01	±	0.02	No
		GROSS BETA	4.63	±	0.60	0.17	±	0.02	**Yes**
		TRITIUM	-72.30	±	24.60	-2.68	±	0.91	No
Rest Area	11/4/2015	GROSS ALPHA	0.73	±	0.64	0.03	±	0.02	No
		GROSS BETA	1.69	±	0.59	0.06	±	0.02	No
		TRITIUM	-84.20	±	24.60	-3.12	±	0.91	No
Shoshone	11/5/2015	GROSS ALPHA	1.26	±	0.64	0.05	±	0.02	No
		GROSS BETA	2.52	±	0.55	0.09	±	0.02	**Yes**
		TRITIUM	-22.40	±	25.40	-0.83	±	0.94	No

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

Location	Sampling Date	Iodine-131 Result ± 1s Uncertainty (pCi/L)			Iodine-131 Result ± 1s Uncertainty (Bq/L)			Iodine-131 Result > 3s	Cesium-137 Result ± 1s Uncertainty (pCi/L)			Cesium-137 Result ± 1s Uncertainty (Bq/L)			Cesium-137 Result > 3s
BLACKFOOT	10/4/2015[a]	-2.15	±	2.58	-0.080	±	0.096	No	-0.85	±	1.98	-0.031	±	0.073	No
	10/31/15	-3.26	±	1.58	-0.121	±	0.059	No	0.92	±	0.80	0.034	±	0.030	No
	12/06/15	0.71	±	2.81	0.026	±	0.104	No	0.75	±	0.93	0.028	±	0.034	No
CONTROL	10/06/15	-3.25	±	2.30	-0.120	±	0.085	No	-0.09	±	1.25	-0.003	±	0.046	No
	11/03/15	-0.85	±	1.54	-0.031	±	0.057	No	-0.96	±	0.89	-0.036	±	0.033	No
	12/01/15	-2.67	±	2.22	-0.099	±	0.082	No	-0.48	±	1.31	-0.018	±	0.049	No
DIETRICH	10/06/15	0.87	±	1.87	0.032	±	0.069	No	-2.12	±	1.32	-0.079	±	0.049	No
	11/03/15	-1.33	±	2.01	-0.049	±	0.074	No	2.03	±	1.93	0.075	±	0.071	No
	12/01/15	-2.24	±	2.08	-0.083	±	0.077	No	0.73	±	2.02	0.027	±	0.075	No
Duplicate	12/01/15	0.70	±	1.87	0.026	±	0.069	No	1.08	±	1.31	0.040	±	0.049	No
HOWE	10/06/15	-1.12	±	1.43	-0.041	±	0.053	No	0.84	±	0.90	0.031	±	0.033	No
	11/03/15	0.24	±	2.25	0.009	±	0.083	No	-0.51	±	1.96	-0.019	±	0.073	No
	12/01/15	-2.38	±	2.25	-0.088	±	0.083	No	1.98	±	1.97	0.073	±	0.073	No
IDAHO FALLS	10/06/15	0.32	±	1.09	0.012	±	0.040	No	1.43	±	0.80	0.053	±	0.030	No
Duplicate	10/06/15	0.43	±	1.28	0.016	±	0.047	No	-1.39	±	0.92	-0.051	±	0.034	No
	10/13/15	0.26	±	1.28	0.010	±	0.047	No	1.28	±	0.90	0.047	±	0.033	No
	10/20/15	-1.91	±	1.16	-0.071	±	0.043	No	0.38	±	0.79	0.014	±	0.029	No
	10/27/15	0.21	±	1.08	0.008	±	0.040	No	0.10	±	0.77	0.004	±	0.029	No
	11/03/15	0.10	±	1.07	0.004	±	0.040	No	0.03	±	0.78	0.001	±	0.029	No
	11/10/15	0.57	±	1.08	0.021	±	0.040	No	0.44	±	0.81	0.016	±	0.030	No
	11/17/15	0.95	±	1.09	0.035	±	0.040	No	0.13	±	0.78	0.005	±	0.029	No
	11/24/15	0.72	±	1.11	0.027	±	0.041	No	1.05	±	0.83	0.039	±	0.031	No
	12/01/15	-0.59	±	1.09	-0.022	±	0.040	No	0.67	±	0.81	0.025	±	0.030	No
	12/08/15	0.55	±	1.95	0.020	±	0.072	No	0.04	±	1.95	0.001	±	0.072	No
	12/15/15	0.41	±	1.97	0.015	±	0.073	No	4.51	±	2.04	0.167	±	0.076	No
	12/22/15	-0.65	±	1.30	-0.024	±	0.048	No	-0.51	±	1.55	-0.019	±	0.057	No
	12/29/15	-0.56	±	1.27	-0.021	±	0.047	No	-2.09	±	1.63	-0.077	±	0.060	No
RUPERT	10/06/15	-0.58	±	1.15	-0.021	±	0.043	No	0.00	±	0.75	0.000	±	0.028	No
	11/03/15	0.31	±	1.24	0.012	±	0.046	No	0.42	±	0.88	0.016	±	0.032	No
	12/01/15	-0.93	±	1.21	-0.034	±	0.045	No	0.98	±	0.83	0.036	±	0.031	No
TERRETON	10/06/15	0.40	±	1.97	0.015	±	0.073	No	0.43	±	1.29	0.016	±	0.048	No
	11/03/15	0.41	±	2.16	0.015	±	0.080	No	0.16	±	1.27	0.006	±	0.047	No
	12/01/15	1.33	±	1.44	0.049	±	0.053	No	1.21	±	0.89	0.045	±	0.033	No

[a] During the summer of 2020, a review of the table determined the Iodine-131 and Cesium-137 activity concentration and uncertainty values for the Blackfoot milk sample collected on October 4, 2015 were incorrect. The activity concentration and uncertainty values were updated with the correct values. For further discussion, see Milk Sampling in Section 5.

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

Location	Sampling Date	Strontium-90 Result ± 1s Uncertainty (pCi/L)			Strontium-90 Result ± 1s Uncertainty (Bq/L)			Result > 3s
BLACKFOOT	10/31/15	0.39	±	0.08	0.014	±	0.003	Yes
CONTROL	11/03/15	0.42	±	0.08	0.016	±	0.003	Yes
DIETRICH	11/03/15	0.32	±	0.07	0.012	±	0.003	Yes
HOWE	11/03/15	0.25	±	0.07	0.009	±	0.003	Yes
IDAHO FALLS	11/03/15	0.64	±	0.10	0.024	±	0.004	Yes
RUPERT	11/03/15	0.35	±	0.07	0.013	±	0.003	Yes
TERRETON	11/03/15	0.57	±	0.10	0.021	±	0.004	Yes

Location	Sampling Date	Tritium Concentration ± 1s (pCi/L)			Tritium Concentration ± 1s (Bq/L)			Result > 3s
BLACKFOOT	10/31/15	66.70	±	25.20	2.470	±	0.933	No
CONTROL	11/03/15	18.50	±	23.10	0.685	±	0.856	No
DIETRICH	11/03/15	76.30	±	24.00	2.826	±	0.889	Yes
HOWE	11/03/15	98.20	±	25.60	3.637	±	0.948	Yes
IDAHO FALLS	11/03/15	38.40	±	24.90	1.422	±	0.922	No
RUPERT	11/03/15	96.40	±	25.50	3.570	±	0.944	Yes
TERRETON	11/03/15	37.50	±	24.80	1.389	±	0.919	No

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

Location	Sampling Date	Cesium-137 Result ± 1s Uncertainty pCi/kg			Result ± 1s Uncertainty Bq/kg			Result > 3s
ARCO	10/7/2015	0.86	±	1.15	0.03	±	0.04	No
BLACKFOOT	10/10/2015	-0.02	±	1.63	0.00	±	0.06	No
BLACKFOOT (Duplicate)	10/10/2015	0.38	±	1.87	0.01	±	0.07	No
CONTROL	10/12/2015	0.54	±	1.93	0.02	±	0.07	No
IDAHO FALLS	9/29/2015	0.97	±	1.28	0.04	±	0.05	No
MONTEVIEW	9/30/2015	-0.04	±	1.71	0.00	±	0.06	No
SHELLEY	9/28/2015	-0.15	±	1.65	-0.01	±	0.06	No
TERRETON	10/2/2015	-0.77	±	1.93	-0.03	±	0.07	No
		Strontium-90[a] Result ± 1s Uncertainty pCi/kg			Result ± 1s Uncertainty Bq/kg			Result > 3s
ARCO	10/7/2015	1.47	±	0.90	0.05	±	0.03	No
BLACKFOOT	10/10/2015	0.10	±	0.94	0.00	±	0.03	No
BLACKFOOT (Duplicate)	10/10/2015	0.73	±	1.03	0.03	±	0.04	No
CONTROL	10/12/2015	0.05	±	1.04	0.00	±	0.04	No
IDAHO FALLS	9/29/2015	1.08	±	1.15	0.04	±	0.04	No
MONTEVIEW	9/30/2015	-0.60	±	1.06	-0.02	±	0.04	No
SHELLEY	9/28/2015	2.47	±	1.13	0.09	±	0.04	No
TERRETON	10/2/2015	-0.29	±	1.22	-0.01	±	0.05	No

[a] A review of the table, performed in the summer of 2020, identified that the values listed for the Strontium-90 results and uncertainties were incorrect. The Strontium-90 result and uncertainty values were updated with the correct values. For further discussion, see Potato Sampling in Section 5.

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
MULE DEER	10/22/2015	Liver	^{131}I	2.63	±	17.60	9.73	±	65.12	No
			^{137}Cs	10.30	±	11.80	38.11	±	43.66	No
MULE DEER	10/22/2015	Muscle	^{131}I	73.70	±	59.50	272.69	±	220.15	No
			^{137}Cs	4.01	±	48.60	14.84	±	179.82	No
MULE DEER	10/22/2015	Thyroid	^{131}I	-688.00	±	465.00	-2545.60	±	1720.50	No
			^{137}Cs	-37.20	±	281.00	-137.64	±	1039.70	No
ELK	11/13/2015	Muscle	^{131}I	-0.41	±	1.73	-1.53	±	6.40	No
			^{137}Cs	1.20	±	1.02	4.44	±	3.77	No
ELK	11/16/2015	Liver	^{131}I	0.32	±	3.90	1.18	±	14.43	No
			^{137}Cs	0.68	±	3.02	2.52	±	11.17	No
ELK	11/16/2015	Muscle	^{131}I	-0.45	±	3.25	-1.66	±	12.03	No
			^{137}Cs	0.99	±	2.54	3.67	±	9.40	No

Table C-11. Actinide, Gamma-emitting Radionuclide, and Strontium-90 Concentrations in Edible Tissues of Waterfowl

Location	Sampling Date	Analyte	Result pCi/kg	±	Uncertainty(1s) pCi/kg	Result (x 10^{-2}) Bq/kg[a]	±	Uncertainty(1s) (x 10^{-2}) Bq/kg[a]	Result > 3s
ATR Complex	9/19/2015								
		AMERICIUM-241	-0.08	±	0.49	-0.30	±	1.81	No
		CESIUM-134	28.80	±	4.39	106.67	±	16.26	Yes
		CESIUM-137	12900.00	±	716.00	47777.78	±	2651.85	Yes
		COBALT-58	45.00	±	11.10	166.67	±	41.11	Yes
		COBALT-60	14200.00	±	707.00	52592.59	±	2618.52	Yes
		MANGANESE-54	26.40	±	9.31	97.78	±	34.48	No
		PLUTONIUM-238	0.96	±	0.46	3.56	±	1.71	No
		PLUTONIUM-239/240	0.68	±	0.50	2.53	±	1.83	No
		SELENIUM-75	14.40	±	4.81	53.33	±	17.81	No
		STRONTIUM-90	3120.00	±	368.00	11555.56	±	1362.96	Yes
		ZINC-65	1830.00	±	122.00	6777.78	±	451.85	Yes
ATR Complex	9/19/2015								
		AMERICIUM-241	-1.06	±	0.43	-3.93	±	1.59	No
		CESIUM-134	63.40	±	11.90	234.81	±	44.07	Yes
		CESIUM-137	26600.00	±	1470.00	98518.52	±	5444.44	Yes
		CHROMIUM-51	188.00	±	86.30	696.30	±	319.63	No
		COBALT-58	85.50	±	17.30	316.67	±	64.07	Yes
		COBALT-60	27000.00	±	1340.00	100000.00	±	4962.96	Yes
		PLUTONIUM-238	0.60	±	0.60	2.21	±	2.22	No
		PLUTONIUM-239/240	0.20	±	0.49	0.73	±	1.80	No
		SELENIUM-75	50.60	±	8.16	187.41	±	30.22	Yes
		STRONTIUM-90	4350.00	±	512.00	16111.11	±	1896.30	Yes
		ZINC-65	4330.00	±	256.00	16037.04	±	948.15	Yes
ATR Complex	9/19/2015								
		AMERICIUM-241	-0.47	±	0.43	-1.74	±	1.59	No
		CESIUM-137	33.80	±	11.70	125.19	±	43.33	No
		COBALT-60	90.10	±	15.70	333.70	±	58.15	Yes
		PLUTONIUM-238	0.58	±	0.50	2.13	±	1.85	No
		PLUTONIUM-239/240	0.86	±	0.41	3.18	±	1.52	No
		STRONTIUM-90	25.10	±	5.93	92.96	±	21.96	Yes
Control	1/9/2016								
		AMERICIUM-241	-0.95	±	0.42	-3.51	±	1.56	No
		PLUTONIUM-238	0.00	±	0.33	0.00	±	1.23	No
		PLUTONIUM-239/240	0.68	±	0.34	2.51	±	1.24	No
		STRONTIUM-90	4.25	±	5.51	15.74	±	20.41	No
Control	1/9/2016								
		AMERICIUM-241	-0.01	±	0.45	-0.02	±	1.66	No
		PLUTONIUM-238	0.38	±	0.34	1.40	±	1.24	No
		PLUTONIUM-239/240	0.88	±	0.52	3.26	±	1.94	No
		STRONTIUM-90	3.61	±	4.90	13.37	±	18.15	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 ($x10^{-5}$) Bq/g unit of concentration listed in the column heading was incorrect. The column heading has been updated to the correct unit of concentration ($x10^{-2}$) Bq/kg. For further discussion see Waterfowl Sampling in Section 5.

Table C-12. Environmental Radiation Measurements Using TLDs

Location	Start Date	End Date	Radiation Measurement ± 2s Uncertainty mR			Exposure mR/day
BOUNDARY						
ARCO	5/6/2015	10/26/2015	56.60	±	5.55	0.33
ATOMIC CITY	5/6/2015	10/26/2015	58.60	±	5.74	0.34
BIRCH CREEK	5/6/2015	10/26/2015	49.70	±	4.87	0.29
BLUE DOME	5/6/2015	10/26/2015	50.40	±	4.94	0.29
HOWE	5/6/2015	10/26/2015	53.30	±	5.23	0.31
MONTEVIEW	5/6/2015	10/26/2015	59.00	±	5.79	0.34
MUD LAKE	5/6/2015	10/26/2015	60.70	±	5.96	0.35
					Boundary Average	**0.32**
DISTANT						
ABERDEEN	5/5/2015	10/26/2015	58.80	±	5.77	0.34
BLACKFOOT	5/6/2015	10/26/2015	54.90	±	5.38	0.32
CRATERS	5/6/2015	10/26/2015	57.70	±	5.66	0.33
DUBOIS	5/6/2015	10/23/2015	50.20	±	4.92	0.30
IDAHO FALLS	5/6/2015	10/26/2015	56.80	±	5.57	0.33
MINIDOKA	5/5/2015	10/26/2015	51.90	±	5.09	0.30
MOUNTAIN VIEW	5/6/2015	10/23/2015	56.70	±	5.56	0.33
ROBERTS	5/5/2015	10/23/2015	60.50	±	5.93	0.35
SUGAR CITY	5/6/2015	10/26/2015	71.90	±	7.05	0.42
					Distant Average	**0.33**

APPENDIX D

STATISTICAL ANALYSIS RESULTS

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

Parameter	P[a]
Gross Alpha	
Quarter	0.68
October	0.52
November	0.83
December	0.34
Gross Beta	
Quarter	0.03
October	0.31
November	0.03
December	0.22

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

Table D-2. Statistical difference in weekly gross alpha and gross beta concentrations measured at Boundary and Distant locations.

		Mann-Whitney U test
Parameter	**Week**	**P[a]**
Gross Alpha		
	October 7	0.12
	October 14	0.87
	October 21	0.60
	October 28	0.94
	November 4	0.81
	November 11	0.60
	November 18	0.03
	November 25	0.60
	December 2	0.26
	December 9	0.06
	December 16	0.94
	December 23	0.58
	December 30	0.57
Gross Beta		
	October 7	0.68
	October 14	0.46
	October 21	0.33
	October 28	0.12
	November 4	0.07
	November 11	1.00
	November 18	0.06
	November 25	0.12
	December 2	0.12
	December 9	0.00
	December 16	0.81
	December 23	0.02
	December 30	0.06

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