S.M. Stoller Corporation
Environmental Surveillance, Education, and Research Program
ISSN NUMBER 1089-5469

Idaho National Laboratory Site Offsite Environmental Surveillance Program Report: Fourth Quarter 2009

May 2010

Contributors:
Marilyn Case, Russ Mitchell

Program conducted for the U.S. Department of Energy, Idaho Operations Office
Under Contract DE-AC07-06ID14680

By the S.M. Stoller Corporation,
Environmental Surveillance, Education and Research Program
Douglas K. Halford, Program Manager
120 Technology Dr., Idaho Falls, Idaho 83402
www.stoller-eser.com

EXECUTIVE SUMMARY

Most of the radionuclides detected in samples collected during the fourth quarter of 2009 could be directly linked with INL Site activities. One exception was samples of waterfowl taken directly from wastewater ponds at the INL Site. Except for waterfowl, levels of detected radionuclides were no different than values measured at other locations across the United States or were consistent with levels measured historically at the INL Site. All detected radionuclide concentrations were well below guidelines 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 2009 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, 2009. All sample types (media) and the sampling schedule followed during 2009 are listed in Appendix A. Specifically, this report contains the results for the following:

- Air sampling, including particulate air filters, charcoal cartridges and atmospheric moisture
- Precipitation sampling
- Milk sampling
- Wheat sampling
- Potato sampling
- Large game animal sampling
- Waterfowl sampling
- Environmental radiation measurements

Table E-1 Summary of results for the Fourth Quarter of 2009.

Media	Sample Type	Analysis	Results
Air	Filters	Gross alpha, gross beta	There was a statistical difference in gross beta data in November but all data were within normal ranges. Gross alpha and gross beta concentrations were statistically higher at Distant locations than Boundary locations during one week in December. No result exceeded the DCG for gross alpha or gross beta activity in air.
		Gamma-emitting radionuclides, select actinides (^{241}Am, ^{238}Pu, and ^{239,240} Pu), ^{90}Sr	No man-made radionuclides were detected.
	Charcoal Cartridge	Iodine-131	No detections of ^{131}I were made during the fourth quarter.
Atmospheric Moisture	Liquid	Tritium	A total of ten samples were collected. One of these samples had a tritium result greater than the 3s uncertainty. No sample result exceeded the DCG for tritium in air.
Precipitation	Liquid	Tritium	Eleven samples were collected. Four of the results were greater than the 3s uncertainty. The concentration was consistent with those reported across the region by the Environmental Protection Agency and with previous results.
Milk	Liquid	Iodine-131, gamma-emitting radionuclides, ^{90}Sr, tritium	Twenty-eight samples, including two duplicates, were collected. No Iodine-131,other manmade gamma-emitting radionuclides or tritium were detected in any samples. Strontium-90 was detected in all three samples analyzed at levels consistent with previously reported values.
Wheat	Vegetation	Gamma-emitting radionuclides, ^{90}Sr	Thirteen wheat samples were collected. No manmade gamma-emitting radionuclides were found in any sample. Strontium-90 was detected in three samples at levels consistent with historical results.
Potatoes	Solid	Gamma-emitting radionuclides, ^{90}Sr	Nine samples were collected, including one duplicate. No man-made radionuclides were detected.
Large Game Animals	Tissue	Gamma-emitting radionuclides	One game animal was sampled. This pronghorn had Cesium-137 in the muscle tissue at a concentration just above the minimal detectable concentration and similar to the range found in background animals across the western United States.
Waterfowl	Tissue	Gamma-emitting radionuclides, select actinides (^{241}Am, ^{238}Pu, and ^{239,240} Pu), ^{90}Sr	Four radionuclides were found in tissues from ducks collected at the Advanced Test Reactor Complex, including edible tissue. Three were found in birds from the Materials and Fuels Complex but only one in edible tissues. Concentrations in edible tissues were generally similar to those found in the previous two years. The estimated dose from eating the entire edible mass of the duck with the highest concentrations

			was estimated at 0.006 mrem.
Environmental Radiation	TLDs	Ambient ionizing radiation	Values were consistent with expected exposures given the altitude and location of the TLDs. There were no statistical differences between Boundary and Distant location results.

LIST OF ABBREVIATIONS

AEC	Atomic Energy Commission
CFA	Central Facilities Area
DCG	Derived Concentration Guide
DOE	Department of Energy
DOE – ID	Department of Energy Idaho Operations Office
EAL	Environmental Assessment Laboratory
EFS	Experimental Field Station
EPA	Environmental Protection Agency
ERAMS	Environmental Radiation Ambient Monitoring System
ESER	Environmental Surveillance, Education, and Research
ICP	Idaho Cleanup Project
INL	Idaho National Laboratory
INEL	Idaho National Engineering Laboratory
INEEL	Idaho National Engineering and Environmental Laboratory
ISU	Idaho State University
MDC	minimum detectable concentration
NRTS	National Reactor Testing Station

LIST OF UNITS

Bq	becquerel
Ci	curie
g	gram
L	liter
µCi	microcurie
mL	milliliter
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 2003). During calendar year 2009, 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. The ESER Program is led by the S.M. Stoller Corporation in cooperation with its team members, including the University of Idaho, Idaho State University (ISU), the Wildlife Conservation Society and Teledyne Brown Engineering. This report contains monitoring results from the ESER Program for samples collected during the fourth quarter of 2009 (October 1-December 31, 2009).

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
- agricultural products, including milk at six dairies around the INL Site, potatoes from at least five local producers, wheat from approximately 10 local producers, and lettuce from approximately nine home-owned and portable gardens on and around the INL
- soil from 12 locations around the INL Site biennially
- environmental dosimeters from 15 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 Teledyne Brown Engineering, Inc. of Knoxville, Tennessee.

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, the EPA may request additional sampling be performed through RadNet [previously known as the Environmental Radiation Ambient Monitoring System (ERAMS) network] (EPA 2009). 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 (http://www.epa.gov/narel/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. The ESER has adopted guidelines developed by the United States Geological Survey (Bartholomay, et al. 2003), based on an extension of a method proposed by Currie (1984), to interpret analytical results and make decisions concerning detection. Most of the following discussion is taken from Bartholomay et al (2003).

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). Instrument signals for the target and blank vary randomly about the true signals and may overlap making it difficult to distinguish between radionuclide activities in blank and in environmental samples (Figure 1). That is, the variability around the sample result may substantially overlap the variability around a net activity of zero for samples with no radioactivity. 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.

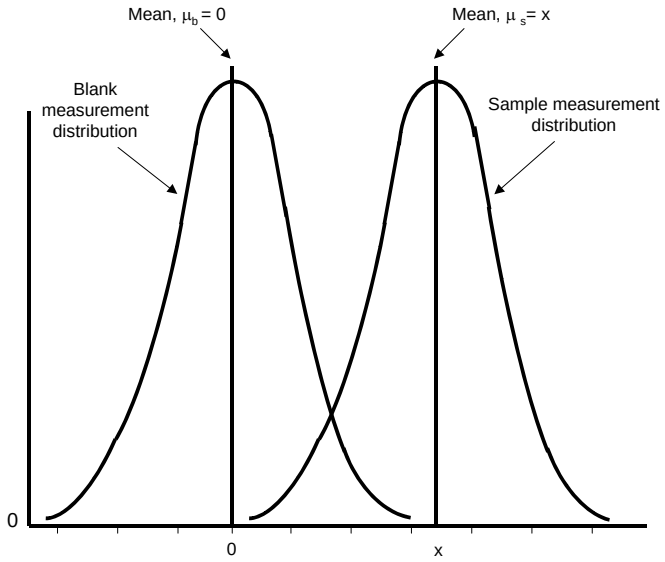

Figure 1. Example of overlap of blank and sample measurement distributions.

In the laboratory, instrument signals must exceed a critical level of 1.6s before the qualitative decision can be made as to whether the radionuclide was detected in a sample. At 1.6s there is about a 95-percent probability that the correct conclusion—not detected—will be made. Given a large number of samples, approximately 5 percent of the samples with measured concentrations greater than or equal to 1.6s, which were concluded as being detected, might not contain the radionuclide. These are referred to as false positives. For purposes of simplicity and consistency with past reporting, the ESER has rounded the 1.6s critical level estimate to 2s.

Once the critical level has been defined, the minimum detectable concentration may be determined. Concentrations that equal 3s represent a measurement at the detection level or minimum detectable concentration. For true concentrations of 3s or greater, there is a 95-percent probability that the radionuclide was detected in the target sample. In a large number of samples, the conclusion—not detected—will be made in 5 percent of the samples with true concentrations at the minimum detectable concentration of 3s. These measurements are known as false negatives. 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 detection may not be reliable.

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 typically 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 little 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 the S.M. Stoller Corporation at (208) 525-9358, or visit the Program's web page (http://www.stoller-eser.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 (2300 km^2) of the upper Snake River Plain in Southeastern Idaho. 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 cleanup operation, the 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 by 2012.

3. AIR SAMPLING

The primary pathway by which radionuclides can move off the INL Site is through the air and for this reason the air pathway is the primary focus of monitoring on and around the INL Site. Samples for particulates and iodine-131 (^{131}I) gas in air were collected weekly for the duration of the quarter at 16 locations using low-volume air samplers. Moisture in the atmosphere was sampled at four locations around the INL Site and analyzed for tritium. Air sampling activities and results for the fourth quarter of 2009 are discussed below. A summary of approximate minimum detectable concentrations (MDCs) for radiological analyses and DOE Derived Concentration Guide (DCG) (DOE 1993) values is provided in Appendix B.

LOW-VOLUME AIR SAMPLING

Radioactivity associated with airborne particulates was monitored continuously by 18 low-volume air samplers (two of which are used as replicate samplers) at 16 locations during the fourth quarter of 2009 (Figure 2). Three of these samplers are located on the INL Site, nine 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. During 2009, one replicate sampler was operating in Blue Dome (a Boundary location) and one was operating in Atomic City (also a Boundary location). An average of 16,513 ft^3 (467 m^3) of air was sampled at each location, each week, at an average flow rate of 1.64 ft^3/min (0.05 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.

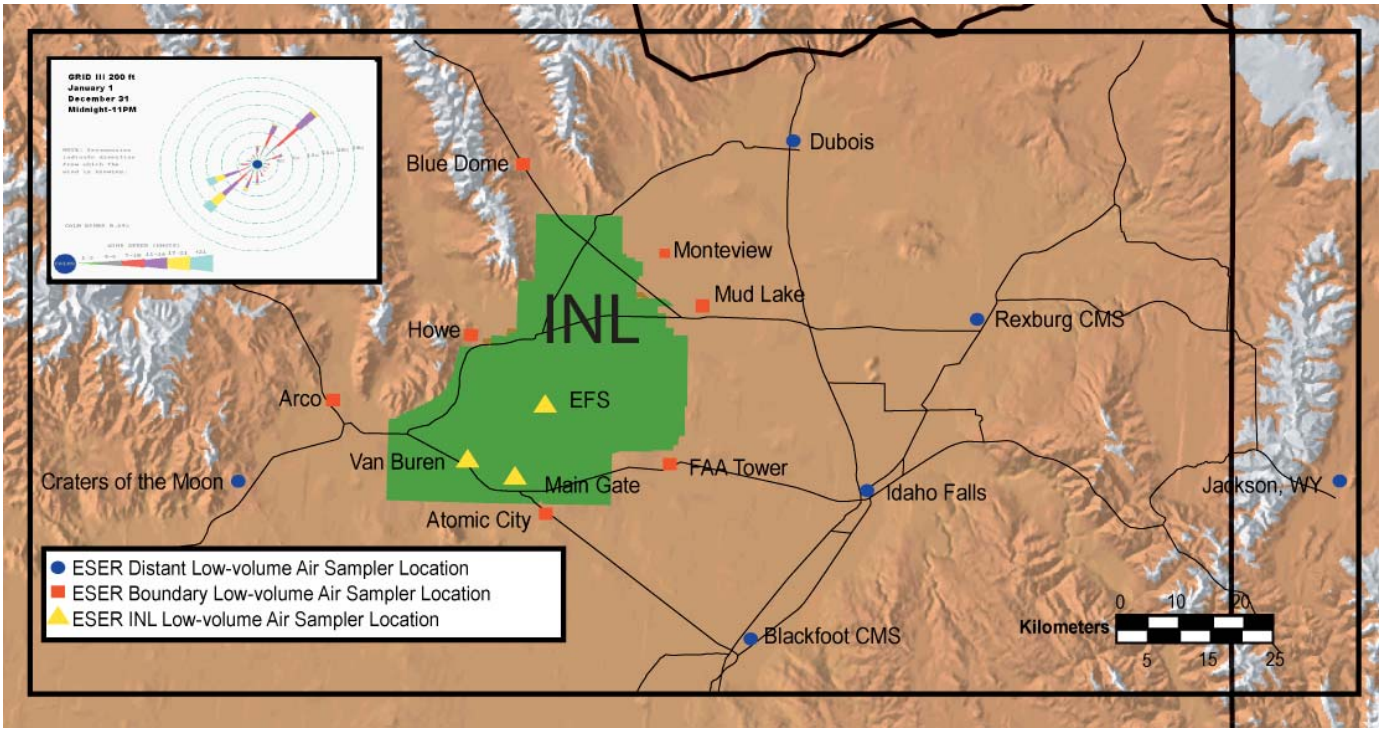

Figure 2. Low-volume air sampler locations.

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. Median gross alpha concentrations in air for INL Site, Boundary, and Distant locations for the fourth quarter of 2009 are shown in Figure 3. Gross alpha data are tested for normality prior to statistical analyses, and generally show no consistent discernable distribution. Box and whisker plots are commonly used when there is no assumed distribution. Each data group in Figure 3 is presented as a box and whisker plot, with a median (small red square), a box enclosing values between the 25th and 75th percentiles, and whiskers representing the non-outlier range. Outliers and extreme values are identified separately from the box and whiskers. Outliers and extreme values are atypical, infrequent data points that are far from the middle of the data distribution. For this report, outliers are defined as values that are greater than 1.5 times the height of the box, above or below the box. Extreme values are greater than 2 times the height of the box, above or below the box. Outliers and extreme values may reflect inherent variability, may be due to errors associated with transcription or measurement, or may be related to other anomalies. A careful review of the data collected during the third quarter indicates that the outlier values were not due to mistakes in collection, analysis, or reporting procedures, but rather reflect natural variability in the measurements. Thus, rather than dismissing the outliers, they were included in the subsequent statistical analyses.

Because there is no discernable 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. Figure 3 graphically shows that the gross alpha measurements made at INL Site, Boundary and Distant locations are similar for the third quarter. If the INL Site were a significant source of offsite contamination, concentrations of contaminants could be statistically greater at Boundary locations than at Distant locations.

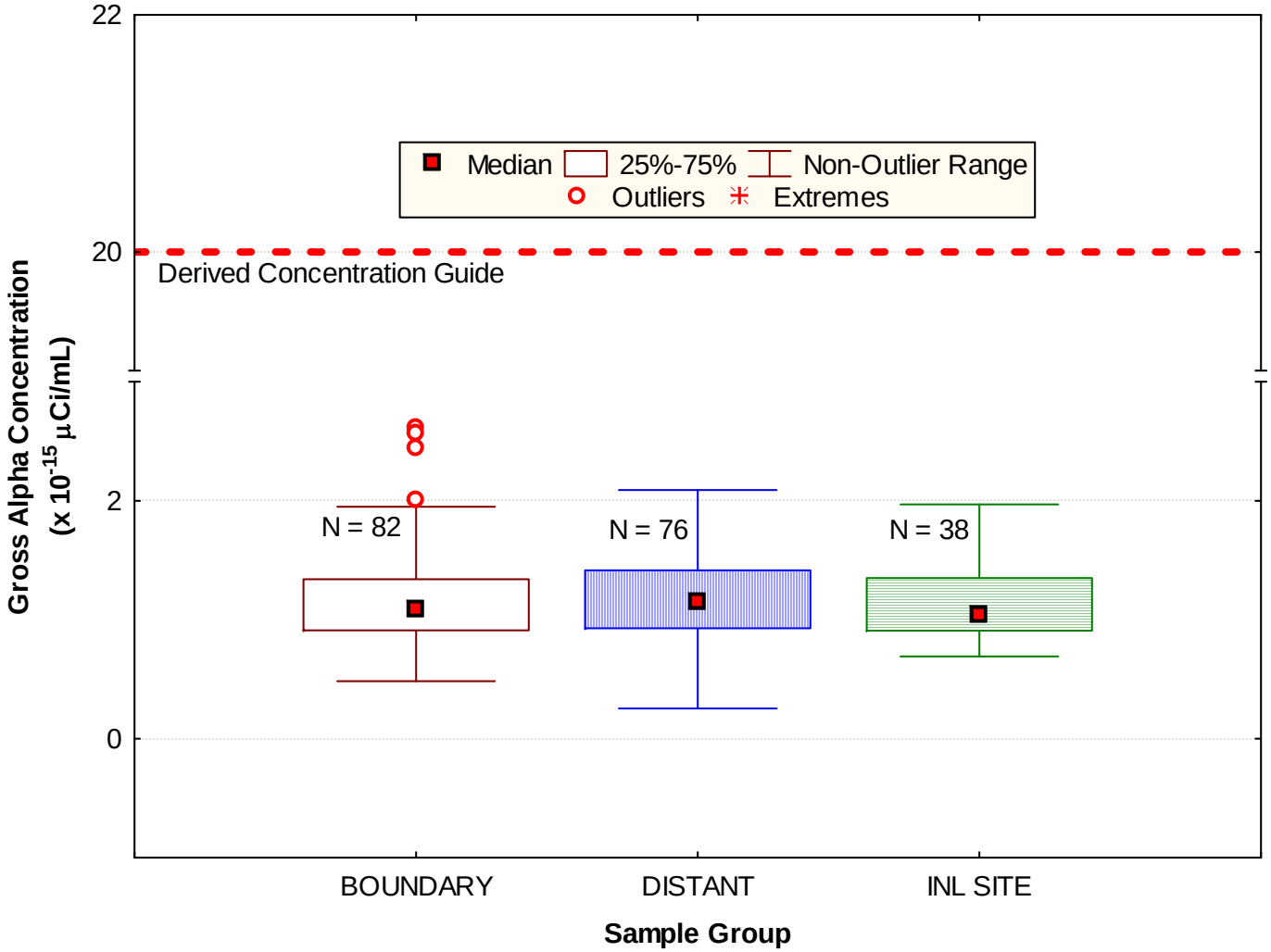

Figure 3. **Gross alpha concentrations in air at ESER INL Site, Boundary and Distant locations for the fourth quarter of 2009.**

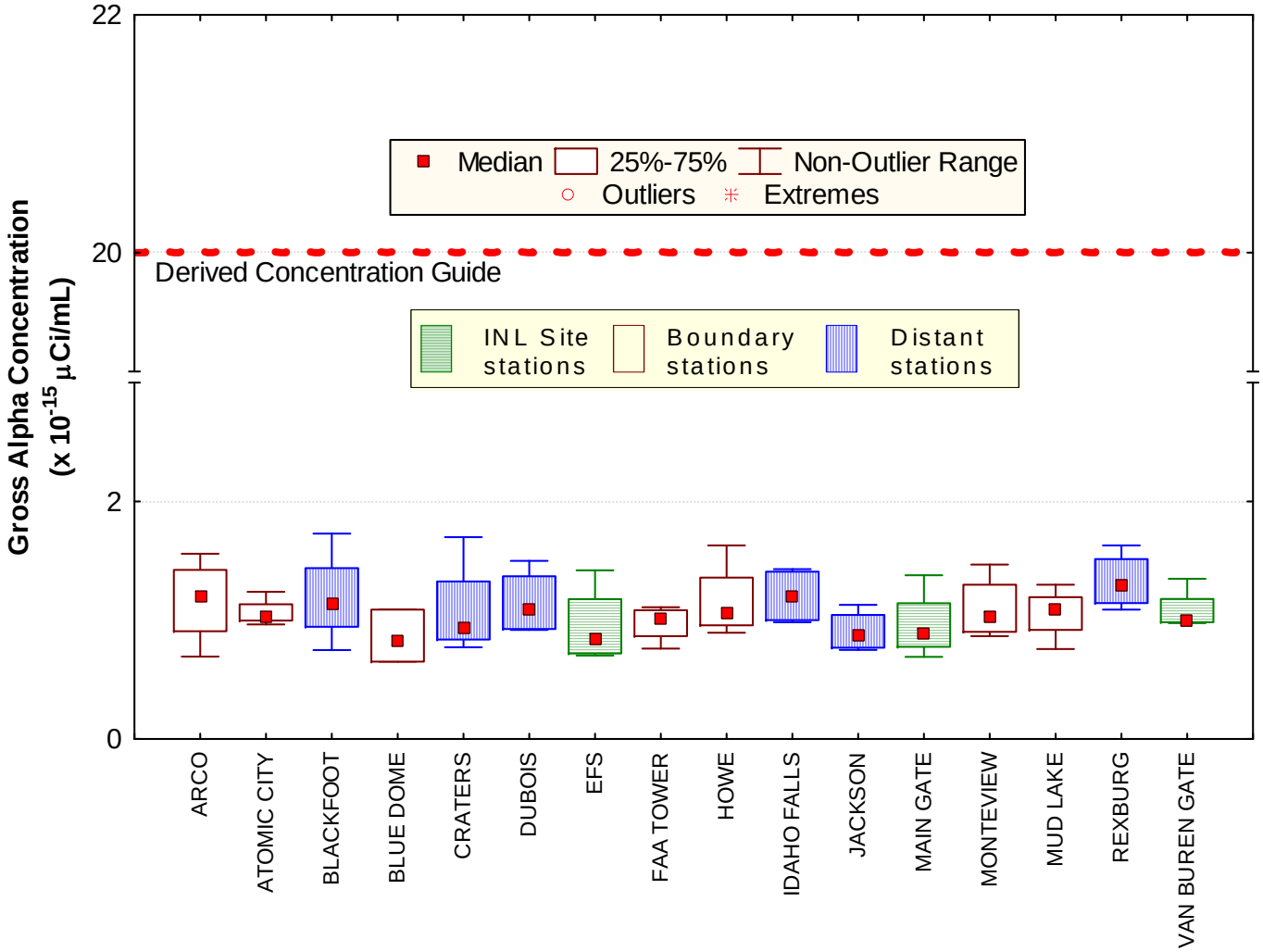

Figure 4. **October gross alpha concentrations in air at ESER INL Site, Boundary and Distant locations. Number of samples (N) = 4 at each location, except Blue Dome (N = 3).**

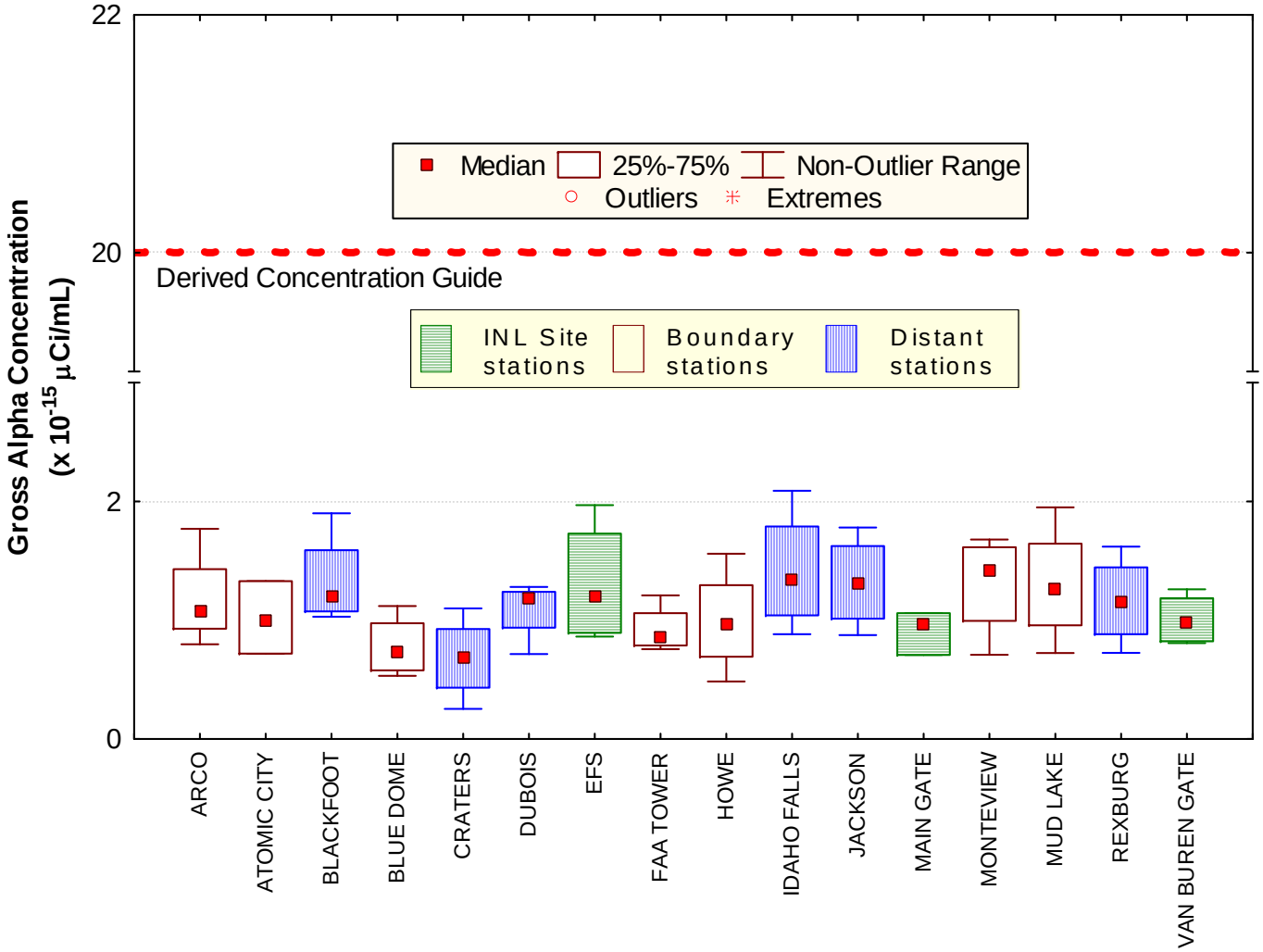

Figure 5. **November gross alpha concentrations in air at ESER INL Site, Boundary and Distant locations. Number of samples (N) = 4 at each location, except Atomic City, Jackson and Main Gate (N = 3).**

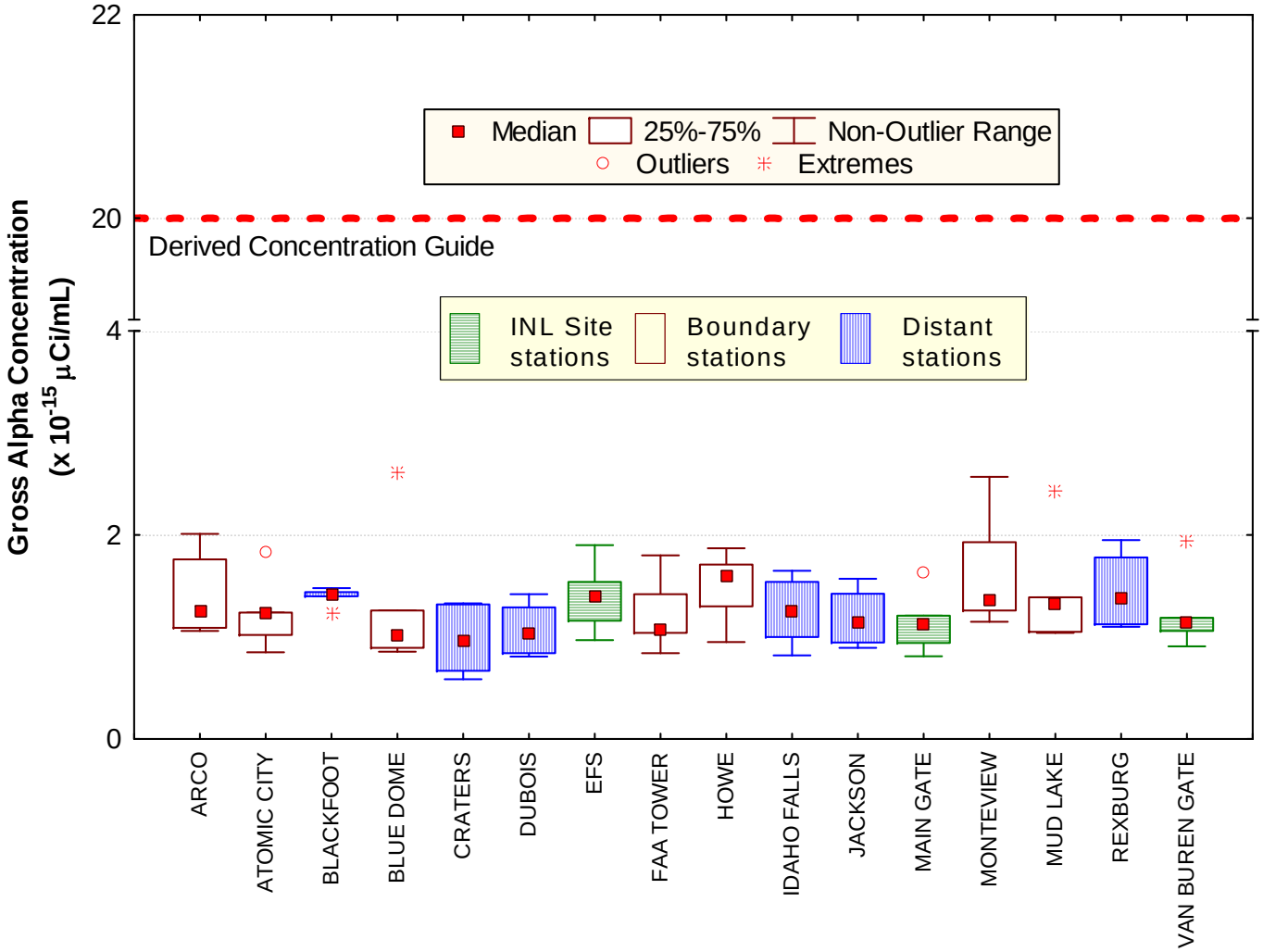

Figure 6. **December gross alpha concentrations in air at ESER INL Site, Boundary and Distant locations. Number of samples (N) = 5 at each location, except Rexburg (N = 4).**

Comparisons of gross alpha concentrations were made for each month of the quarter (Figures 4 – 6). 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. In the fourth quarter, there was one week (December 16) where a statistical difference existed between the two sample groups (Table D-2). In this case, the Boundary group was higher than the Distant group. Analysis of the weekly concentrations showed a typical weekly distribution with slightly higher concentrations at some of the northern plain stations (Blue Dome, Monteview and Mud Lake) with lower values at some valley locations (Blackfoot and Jackson).

Gross beta results are presented in Table C-1. Gross beta concentrations in air for INL Site, Boundary and Distant locations for the fourth quarter of 2009 are shown in Figure 7. The data were tested and 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. No statistical differences were noted in the quarterly data using the Kruskal-Wallace test (Table D-1).

Monthly median gross beta concentrations in air for each sampling group are shown in Figures 8 – 10. Statistical data are presented in Table D-1. During the month of November there was a statistical difference noted in gross beta between groups. As indicated by Figure 9, there was not a lot of variation between sampling locations and all gross beta concentrations were well within normal ranges.

Comparison of weekly Boundary and Distant gross beta data sets, using the Mann Whitney U test, showed a statistical difference between Boundary and Distant measurements during the week of December 16 (Table D-2). The same pattern noted in the gross alpha data discussion was seen in the gross beta values. The statistical test was influenced by a particular low concentration at the Jackson station during that week.

No ^{131}I was detected in any of the charcoal cartridge batches collected during the fourth quarter of 2009. Weekly ^{131}I results for each location are listed in Table C-2 of Appendix C. Gamma spectrographic analysis is also done with the ^{131}I analysis. Cesium-137 was not detected in any of the 28 measured batches of cartridges this quarter. The analytical laboratory considers occasional detections of this nuclide a result of the materials used in the charcoal filters.

Weekly filters for the fourth quarter of 2009 were composited by location. All samples were analyzed for gamma-emitting radionuclides, including ^{137}Cs (see Table C-3, Appendix C). No manmade gamma-emitting radionuclides were detected.

Selected composites were also analyzed for ^{90}Sr, ^{238}Pu, $^{239/240}$Pu and ^{241}Am (see Table C-3, Appendix C). None of these radionuclides were found on any fourth quarter composites.

ATMOSPHERIC MOISTURE SAMPLING

Ten atmospheric moisture samples were obtained during the fourth quarter of 2009 from Atomic City, Blackfoot, Idaho Falls and Rexburg. 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.

One of the ten samples exceeded the 3s uncertainty level for tritium, with a similar result to those reported previously. All samples were significantly below the DOE DCG for tritium in air of 1×10^{-7} $\mu Ci/mL_{air}$ with a maximum reported value of $(7.1 \pm 2.1) \times 10^{-13}$ $\mu Ci/mL_{air}$ at Blackfoot. All results are shown in Table C-4, Appendix C.

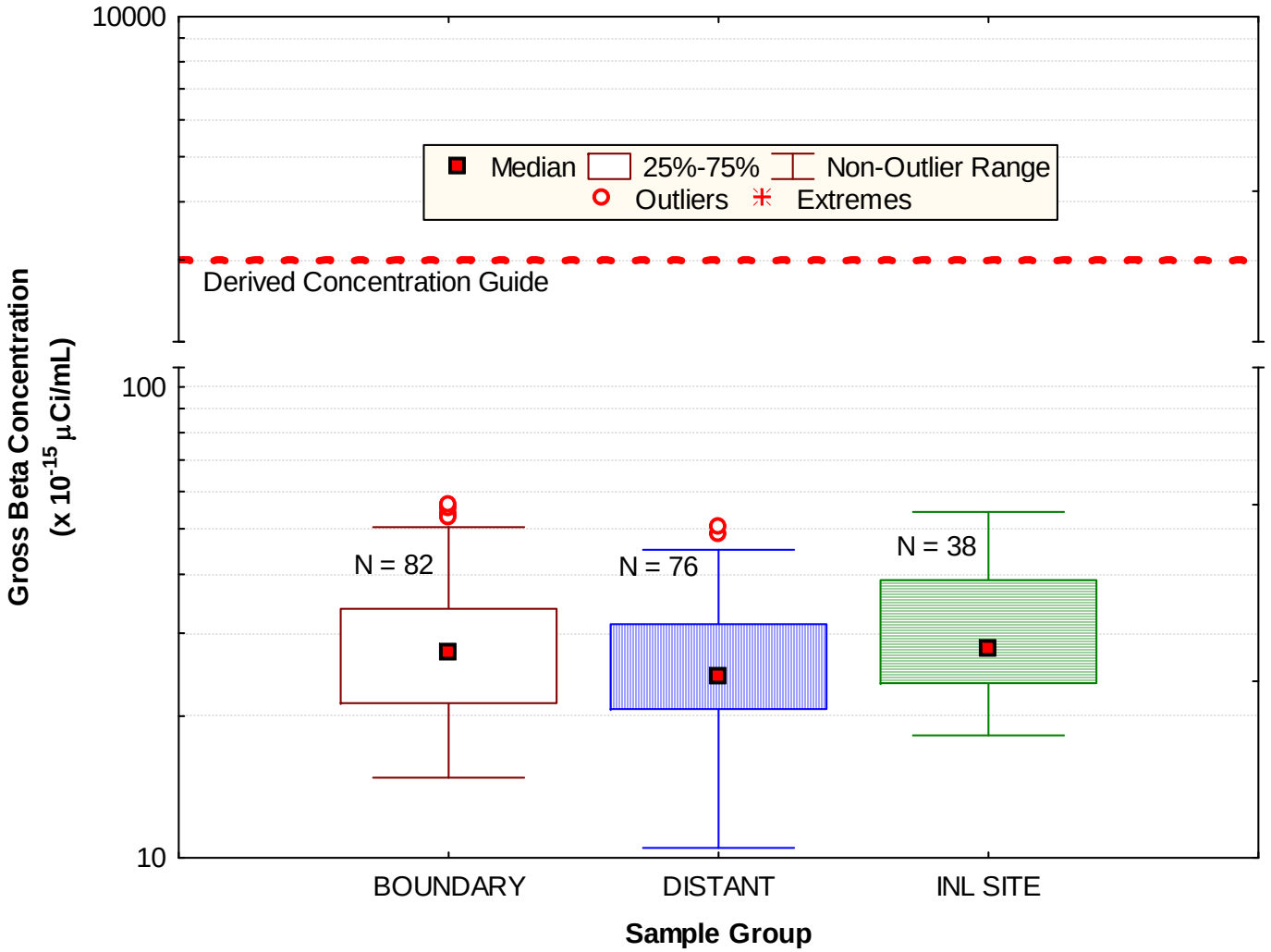

Figure 7. Gross beta concentrations in air at ESER INL Site, Boundary and Distant locations for the fourth quarter of 2009.

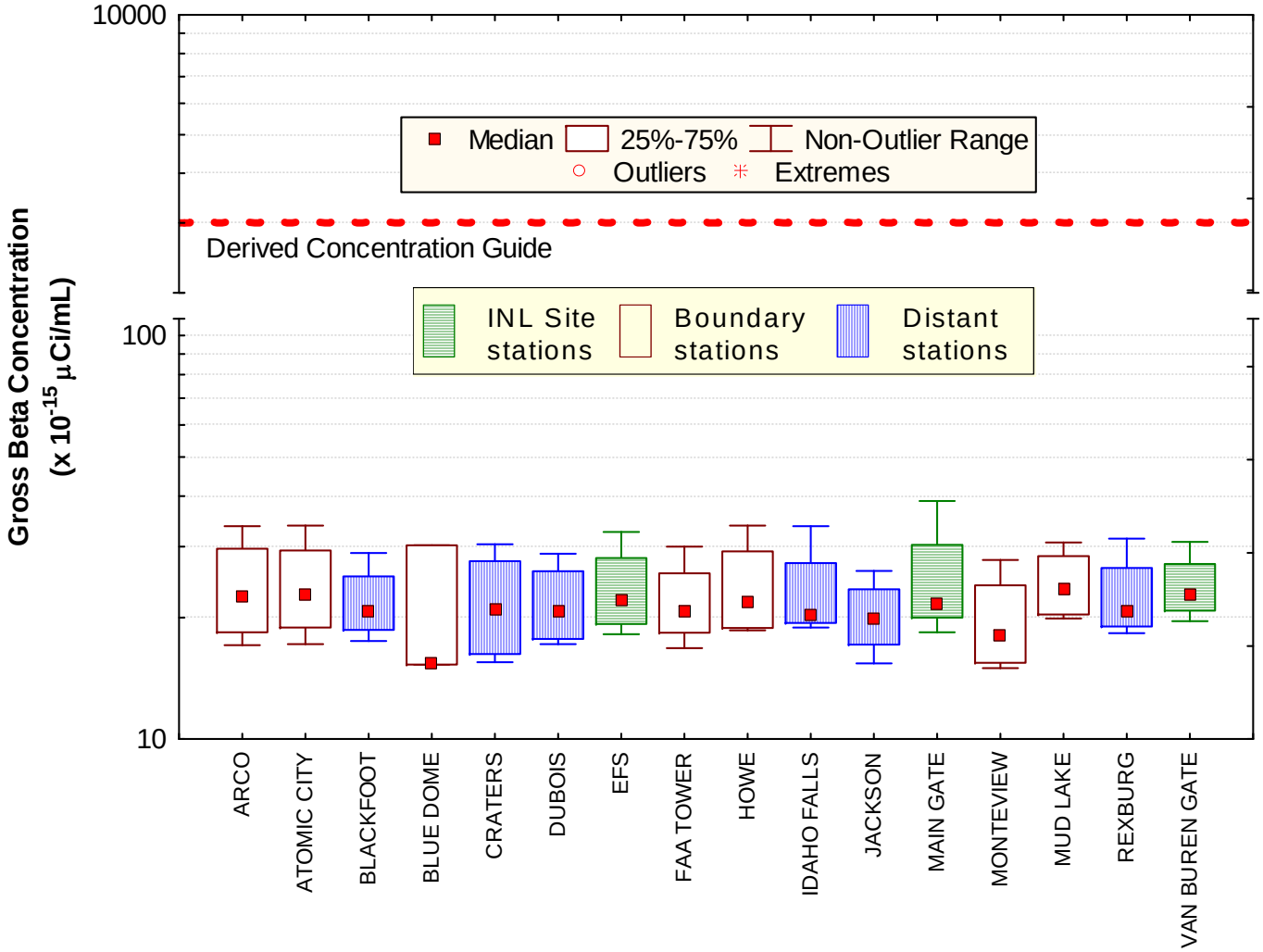

Figure 8. **October gross beta concentrations in air at ESER INL Site, Boundary and Distant locations. Number of samples (N) = 4 at each location, except Blue Dome (N = 3) .**

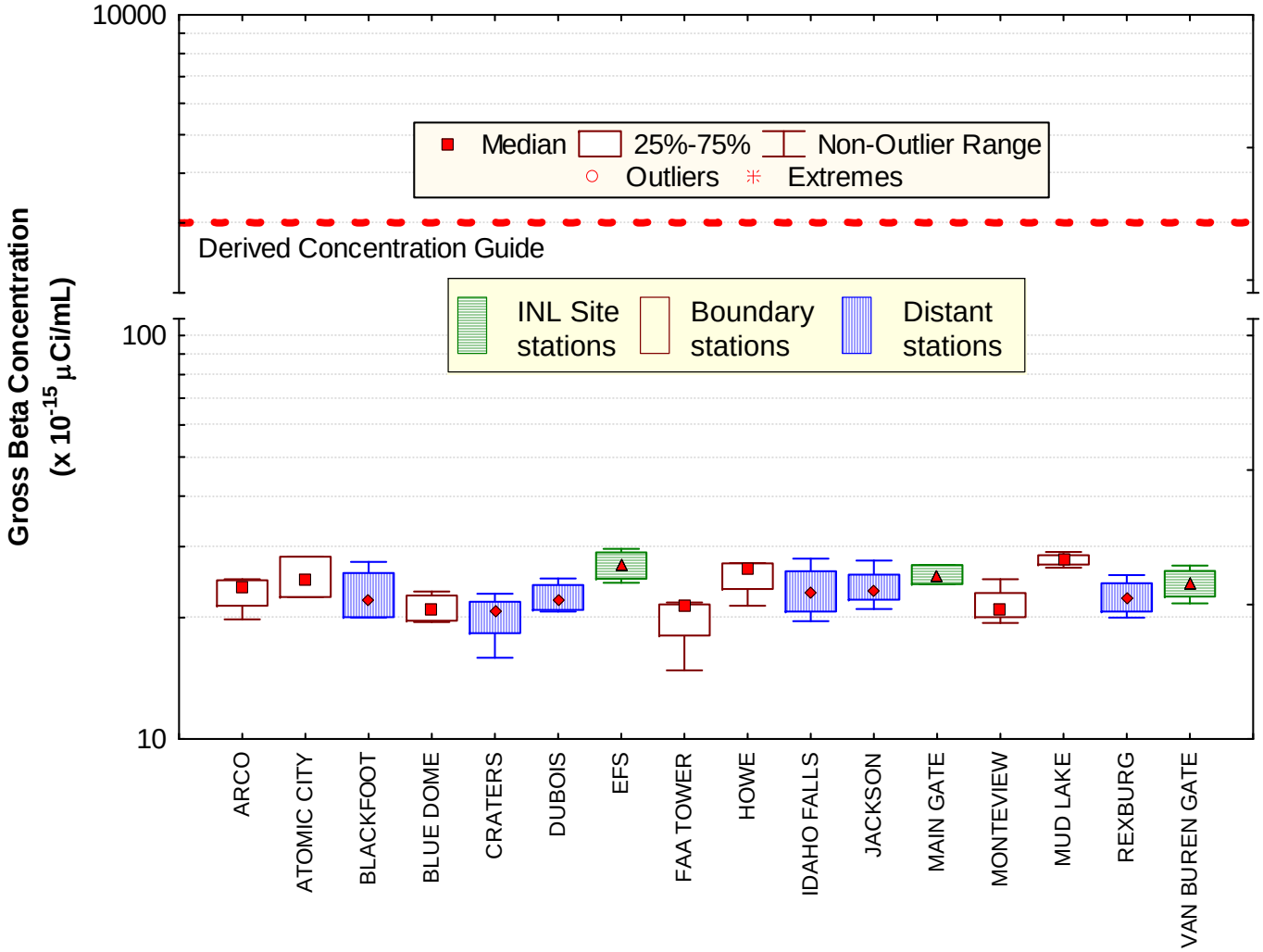

Figure 9. **November gross beta concentrations in air at ESER INL Site, Boundary and Distant locations. Number of samples (N) = 4 at each location, except Atomic City, Jackson and Main Gate (N = 3).**

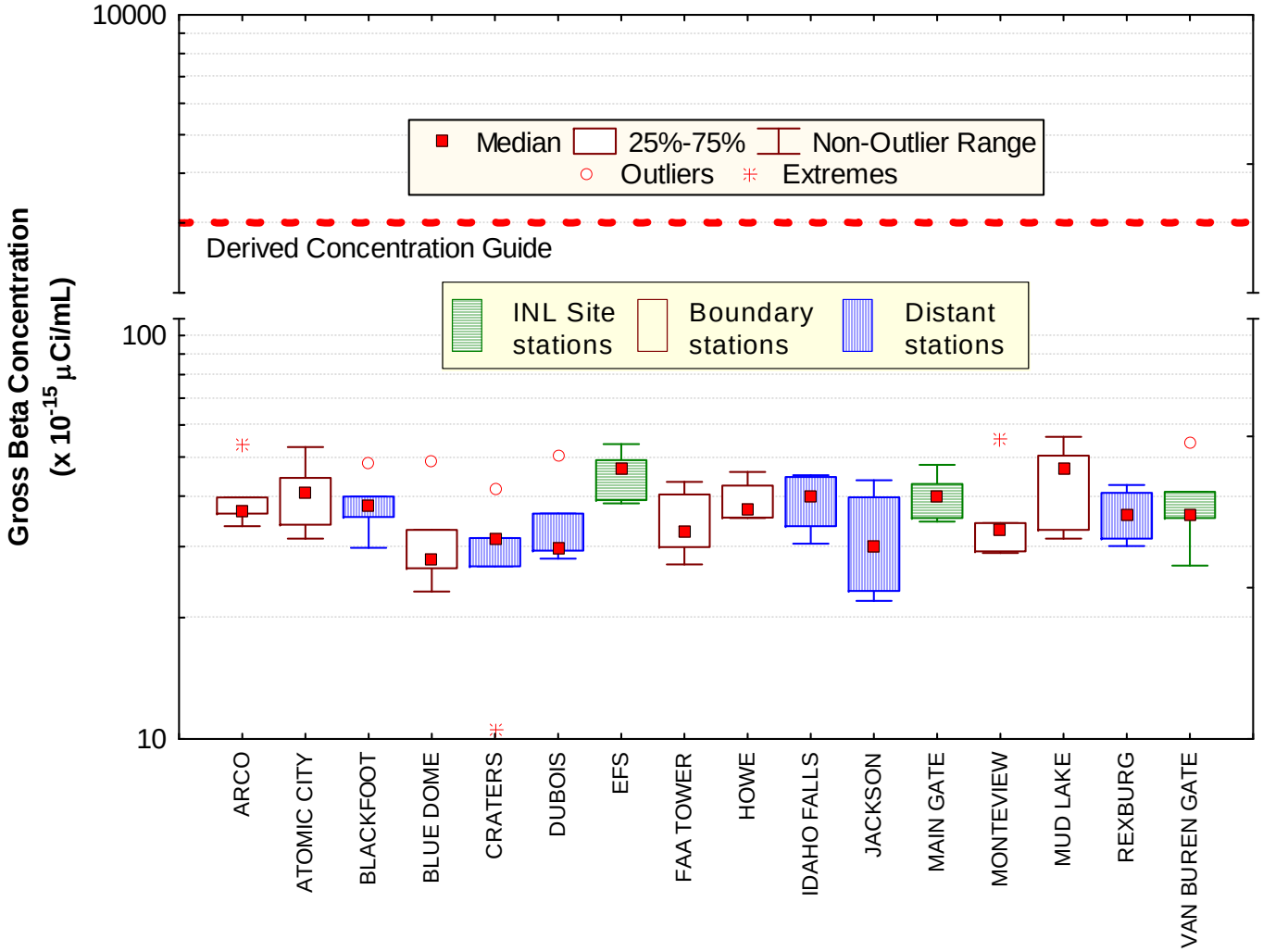

Figure 10. December gross beta concentrations in air at ESER INL Site, Boundary and Distant locations. Number of samples (N) = 5 at each location, except Rexburg (N = 4).

4. 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 2009 produced sufficient precipitation to yield 11 samples.

Tritium was measured above the 3s value in 4 of the 11 samples collected during the fourth quarter of 2009. 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. The EPA's RadNet program collects precipitation samples from across the United States. From 1980 to 2008, tritium measured in samples from Region 10 (which includes Idaho) averaged 117 pCi/L (EPA 2009). Data for all fourth quarter precipitation samples collected by the ESER Program were in the range of this value (averaging 102 pCi/L) and are listed in Table C-5 (Appendix C).

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, wheat, potatoes, garden 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. Lettuce and wheat 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 large game animals sampled during the fourth quarter of 2009.

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 2009. All samples were analyzed for gamma emitting radionuclides. No Iodine-131 or other gamma-emitting radionuclides were detected in any sample. Data for ^{131}I and ^{137}Cs in milk samples are listed in Appendix C, Table C-6.

Strontium-90 was detected in all three samples analyzed at levels within historical measurements, ranging from 0.28 to 0.44 pCi/L (Table C-7 in Appendix C). Tritium was not detected in either sample analyzed (Table C-7).

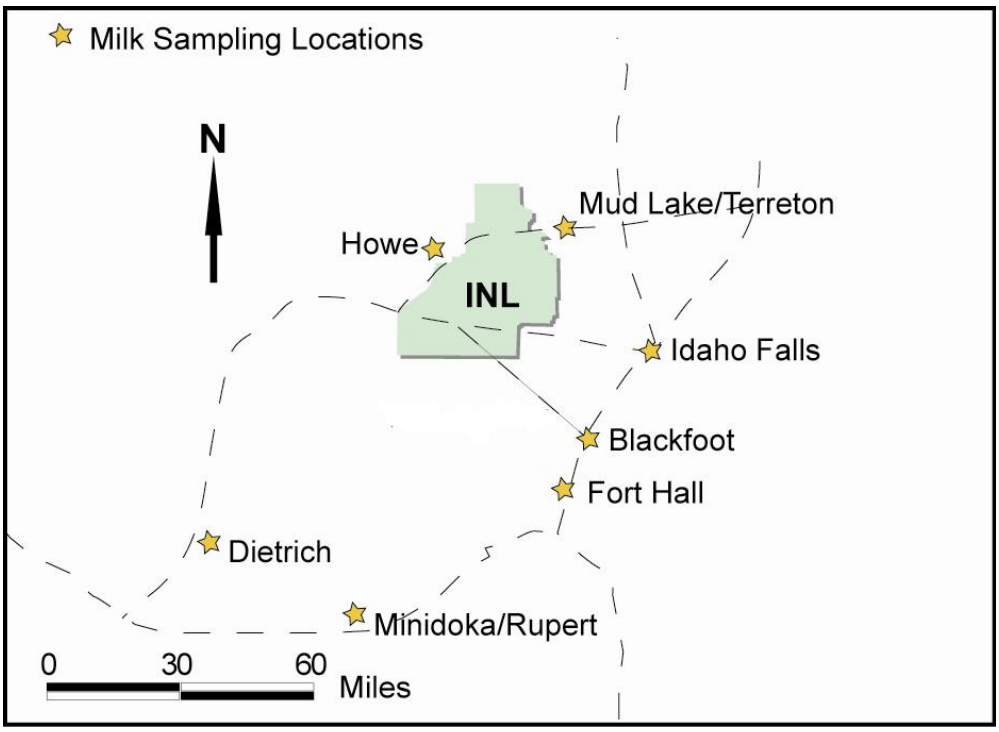

Figure 11. ESER milk sampling locations.

WHEAT SAMPLING

Wheat sampling extended into the fourth quarter of 2009. A total of 13 wheat samples (including one duplicate) were collected from local grain growers. All samples were analyzed for gamma-emitting radionuclides and ^{90}Sr. No manmade gamma-emitting radionuclides were detected in any wheat sample. Strontium-90 was detected in three of the samples, within the range of historical concentrations. Data for ^{137}Cs and ^{90}Sr in all wheat samples taken during the third and fourth quarters are listed in Appendix C, Table C-8.

POTATO SAMPLING

Nine potato samples were collected from area growers and from an out-of-state location (Colorado). All samples were analyzed for gamma emitting radionuclides and ^{90}Sr. No manmade radionuclides were detected in 2009 samples.

Data for ^{137}Cs and ^{90}Sr in all potato samples taken during the fourth quarter are listed in Table C -9 (Appendix C).

LARGE GAME ANIMAL SAMPLING

One large game animal (a pronghorn) was sampled on the INL Site during the fourth quarter of 2008. No manmade radionuclides were found in the thyroid muscle, but ^{137}Cs was reported just above the detection limit in the muscle. The reported value of 3.54 pCi/kg was below the range of concentrations of 5 to 15 pCi/kg found in a 1999 study on tissue samples from game animals across the western United States.

The data for ^{137}Cs and ^{131}I are listed in Appendix C, Table C-10.

WATERFOWL SAMPLING

Ten ducks were collected during 2009. Four each were collected from wastewater ponds located at the Advanced Test Reactor Complex (ATR Complex) and near the Materials and Fuels Complex (MFC), and two control samples were collected from near Roberts. Each sample was divided into the following three sub-samples: 1) edible tissue (muscle, gizzard, heart and liver), 2) external portion (feathers, feet and head), and 3) all remaining tissue. All were analyzed for gamma-emitting radionuclides, ^{90}Sr, plutonium-238 (^{238}Pu), plutonium-239,240 ($^{239/240}$Pu), and americium-241 (^{241}Am). Concentrations of radionuclides measured in the edible tissues of 2009 waterfowl are shown in Table C-11 (Appendix C).

Several man-made radionuclides were detected in the samples from the ATR Complex ponds, including ^{137}Cs, cobalt-60 (^{60}Co), ^{90}Sr, and zinc-65 (^{65}Zn). All these radionuclides were also found in at least one edible tissue sample. Samples from MFC ponds contained ^{137}Cs, ^{90}Sr and one detection each of ^{238}Pu and $^{239/240}$Pu. Only ^{137}Cs was also found in edible tissue from MFC birds. No detections occurred in birds from the control location.

Because human-made radionuclides were found in ducks from the INL Site and not at control locations, it is assumed that the INL Site is the source of these radionuclides. Concentrations of the detected radionuclides from the Advanced Test Reactor Complex were slightly higher to those from 2006 through 2008 in some tissues, but ^{137}Cs concentrations were significantly lower than in 2005. In addition, concentrations were lower in 2009 than those of a 1994-1998 study (Warren et al. 2001). 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 used the evaporation pond.

Waterfowl hunting is not allowed on the INL Site, but a maximum potential exposure scenario to humans would be someone collecting a contaminated duck directly from the ponds and immediately consuming all muscle, liver, heart, and gizzard tissue. The maximum potential dose from eating 225 g (8 oz) of meat from the most contaminated waterfowl collected in 2009 was estimated to be 0.006 mrem. This dose is lower than dose estimates for some previous periods. The dose estimated for 2008 was 0.05 mrem, due in large part to Americium-241 (which was not detected in 2009). The maximum dose estimated for the period from 1993 through 1998 was 0.89 mrem and from 2000 through 2004 was 0.08 mrem. In the late 1970s, when the percolation ponds were still in use, the maximum dose estimated from eating a contaminated duck was estimated to be 54 mrem.

6. ENVIRONMENTAL RADIATION

An array of thermoluminescent dosimeters (TLDs) is distributed throughout the Eastern Snake River Plain to monitor for environmental radiation (Figure 12). TLDs are changed out in May and again in November after six months in the field. The results of the TLDs exposed from May to November 2009 are discussed below.

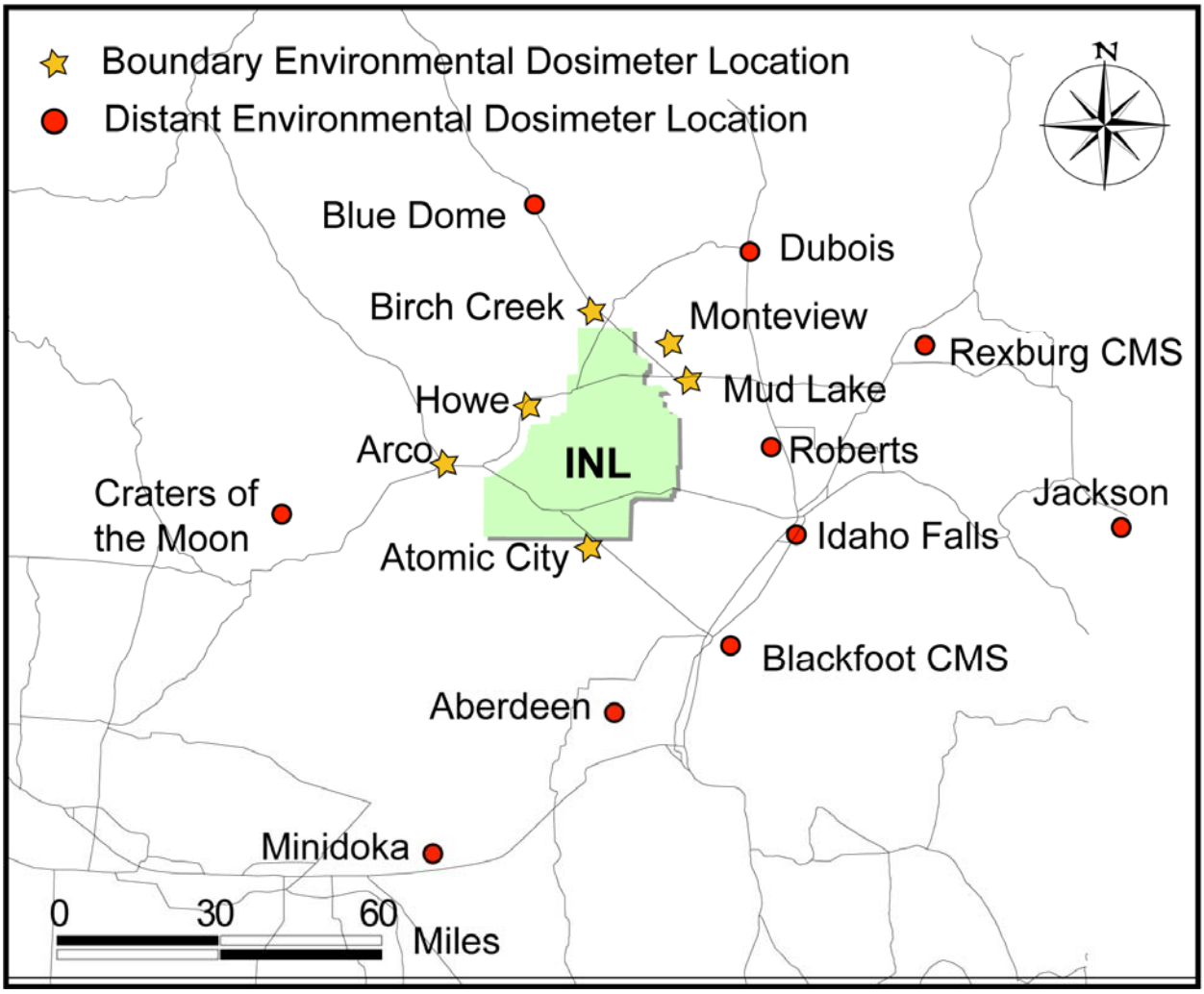

Figure 12. TLD locations.

Similar to the low-volume air results the environmental dosimeter locations are also divided into Boundary and Distant groupings. Boundary average exposure rates ranged from a low of 0.30 mR/day at Blue Dome to a high of 0.38 mR/day at Mud Lake. The overall Boundary average was 0.34 mR/day. The Distant group had a high of 0.40 mR/day at Rexburg and a low of 0.29 mR/day at the Dubois location. The overall average Distant value was 0.35 mR/day. There was no statistical difference between Boundary and Distant locations and all values are consistent with past readings. All results are listed in Appendix C, Table C-12.

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 (Stoller 2007). The following table summarizes the results of the quality assurance program for the fourth quarter of 2009.

QA Sample Type	Number of Sample Results	Number of Results Meeting Criteria	Percentage Meeting Criteria
Spikes/Laboratory Control Samples	197	195	99.0
Field Duplicates	69	68	98.6
Laboratory Splits	29	29	100.0
Recounts	156	156	100.0
Blanks	79	77	97.5
Method Uncertainty	1780	1662	99.0

8. REFERENCES

Bartholomay, R.C., Knobel, L.L., and Rousseau, J.P., 2003, *Field Methods and Quality Plan for Quality-of-Water Activities, U.S. Geological Survey, Idaho National Engineering and Environmental Laboratory, Idaho*, DOE/ID-22182, January 2003.

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, 2003, "Environmental Management System," U.S. Department of Energy Order 450.1, January 2003.

DOE, 1993, "Radiation Protection of the Public and the Environment," U.S. Department of Energy Order 5400.5, January 1993.

EPA, 2009, RadNet—Tracking Environmental Radiation Nationwide, Web-page: http://www.epa.gov/narel/radnet/

Stoller, 2007, *Quality Assurance Project Plan for the INL Site Offsite Environmental Surveillance Program*, Environmental Surveillance, Education and Research Program, February 2007.

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, Rexburg	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, Rexburg	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, Rexburg	Atomic City	None
PRECIPITATION				
Tritium	monthly	Idaho Falls	None	CFA
Tritium	weekly	None	None	EFS
ENVIRONMENTAL RADIATION SAMPLING				
TLDs				
Gamma Radiation	semiannual	Aberdeen, Blackfoot (2), Craters of the Moon, Dubois, Idaho Falls, Jackson WY, Minidoka, Rexburg, 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	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, Idaho Falls, Minidoka	Howe, Terreton	None
Tritium, ^{90}Sr	Semi-annually	Blackfoot, Dietrich, Idaho Falls, Minidoka	Howe, Terreton	None
POTATOES				
Gamma Spec, ^{90}Sr	annually	Aberdeen, Blackfoot, Fort Hall, Idaho Falls, Rupert, Taber, occasional samples across the U.S.	Arco, Monteview, Mud Lake, Terreton	None
WHEAT				
Gamma Spec, ^{90}Sr	annually	American Falls, Blackfoot, Dietrich, Idaho Falls, Minidoka, Carey	Arco, Monteview, Mud Lake, Taber, Terreton	None
LETTUCE				
Gamma Spec, ^{90}Sr	annually	Blackfoot, Carey, Idaho Falls	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	Wastewater disposal ponds

APPENDIX B

SUMMARY OF MDCs AND DCGs

Table B-1. Summary of Approximate Minimum Detectable Concentrations for Radiological Analyses Performed During Fourth Quarter 2009

Sample Type	Analysis	Approximate Minimum Detectable Concentration[a] (MDC)	Derived Concentration Guide[b] (DCG)
Air (particulate filter)[e]	Gross alpha[c]	4.33×10^{-16} µCi/mL	2×10^{-14} µCi/mL
	Gross beta[d]	1.38×10^{-15} µCi/mL	3×10^{-12} µCi/mL
	Specific gamma (^{137}Cs)	1.73×10^{-16} µCi/mL	4×10^{-10} µCi/mL
	^{238}Pu	3.36×10^{-18} µCi/mL	3×10^{-14} µCi/mL
	$^{239/240}$Pu	2.62×10^{-18} µCi/mL	2×10^{-14} µCi/mL
	^{241}Am	2.35×10^{-18} µCi/mL	2×10^{-14} µCi/mL
	^{90}Sr	6.44×10^{-17} µCi/mL	9×10^{-12} µCi/mL
Air (charcoal cartridge)[e]	^{131}I	9.60×10^{-16} µCi/mL	4×10^{-10} µCi/mL
Air (atmospheric moisture)	^{3}H	112.4 pCi/L_{water}	1×10^{-7} µCi/mL_{air}
Air (precipitation)	^{3}H	108.2 pCi/L	2×10^{-3} µCi/mL
Milk	^{131}I	0.56 pCi/L	--
	^{137}Cs	1.12 pCi/L	--
	^{3}H	107.9 pCi/L	--
	^{90}Sr	0.17 pCi/L	--
Wheat	^{137}Cs	1.90 pCi/kg	--
	^{90}Sr	4.65 pCi/kg	--
Potatoes	^{137}Cs	1.49 pCi/kg	--
	^{90}Sr	1.48 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 and precision of plus or minus 100 percent under a specified set of typical laboratory measurement conditions.

b DCGs, 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 The DCG for gross alpha is equivalent to the DCGs for ^{239,240}Pu and ^{241}Am.

d The DCG for gross beta is equivalent to the DCGs for ^{228}Ra

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

Sampling Group and Location	Sampling Date	GROSS ALPHA Result ± 1s Uncertainty ($\times 10^{-15}$ µCi/mL)			GROSS ALPHA Result ± 1s Uncertainty ($\times 10^{-11}$ Bq/mL)			Result > 3s	GROSS BETA Result ± 1s Uncertainty ($\times 10^{-15}$ µCi/mL)			GROSS BETA Result ± 1s Uncertainty ($\times 10^{-11}$ Bq/mL)			Result > 3s
BOUNDARY															
ARCO	10/7/2009	0.70	±	0.19	2.57	±	0.71	Y	17.10	±	0.77	63.27	±	2.86	Y
	10/14/2009	1.56	±	0.21	5.77	±	0.76	Y	33.70	±	0.80	124.69	±	2.95	Y
	10/21/2009	1.29	±	0.18	4.77	±	0.67	Y	19.70	±	0.64	72.89	±	2.38	Y
	10/28/2009	1.12	±	0.18	4.14	±	0.65	Y	25.60	±	0.69	94.72	±	2.56	Y
	11/4/2009	1.77	±	0.26	6.55	±	0.95	Y	24.60	±	0.83	91.02	±	3.09	Y
	11/11/2009	1.06	±	0.19	3.92	±	0.70	Y	19.80	±	0.57	73.26	±	2.09	Y
	11/18/2009	1.09	±	0.23	4.03	±	0.84	Y	24.90	±	0.83	92.13	±	3.09	Y
	11/25/2009	0.80	±	0.16	2.95	±	0.61	Y	23.00	±	0.68	85.10	±	2.52	Y
	12/2/2009	1.26	±	0.20	4.66	±	0.72	Y	36.20	±	0.81	133.94	±	3.00	Y
	12/9/2009	1.76	±	0.20	6.51	±	0.74	Y	33.70	±	0.76	124.69	±	2.82	Y
	12/16/2009	2.01	±	0.23	7.44	±	0.86	Y	53.90	±	0.98	199.43	±	3.61	Y
	12/23/2009	1.09	±	0.20	4.03	±	0.73	Y	36.90	±	0.87	136.53	±	3.21	Y
	12/30/2009	1.06	±	0.18	3.92	±	0.68	Y	39.70	±	0.84	146.89	±	3.09	Y
ATOMIC CITY	10/7/2009	0.97	±	0.23	3.57	±	0.84	Y	17.20	±	0.84	63.64	±	3.12	Y
	10/14/2009	1.24	±	0.19	4.59	±	0.71	Y	33.80	±	0.80	125.06	±	2.96	Y
	10/21/2009	1.03	±	0.18	3.81	±	0.66	Y	20.60	±	0.70	76.22	±	2.60	Y
	10/28/2009	1.03	±	0.17	3.81	±	0.61	Y	24.90	±	0.67	92.13	±	2.48	Y
a	11/4/2009	-4.12	±	3.85	-15.24	±	14.25		10.20	±	13.60	37.74	±	50.32	
	11/11/2009	1.33	±	0.21	4.92	±	0.79	Y	24.90	±	0.65	92.13	±	2.40	Y
	11/18/2009	0.99	±	0.24	3.67	±	0.90	Y	28.30	±	0.94	104.71	±	3.47	Y
	11/25/2009	0.72	±	0.15	2.66	±	0.56	Y	22.50	±	0.65	83.25	±	2.40	Y
	12/2/2009	1.24	±	0.21	4.59	±	0.76	Y	40.90	±	0.89	151.33	±	3.30	Y
	12/9/2009	1.24	±	0.18	4.59	±	0.66	Y	34.00	±	0.78	125.80	±	2.88	Y
	12/16/2009	1.83	±	0.22	6.77	±	0.82	Y	52.90	±	0.95	195.73	±	3.52	Y
	12/23/2009	0.85	±	0.17	3.15	±	0.63	Y	31.40	±	0.77	116.18	±	2.83	Y
	12/30/2009	1.02	±	0.18	3.77	±	0.67	Y	44.40	±	0.86	164.28	±	3.19	Y
QA-1 (ATOMIC CITY)	10/7/2009	0.50	±	0.18	1.86	±	0.67		18.00	±	0.79	66.60	±	2.92	Y
	10/14/2009	1.36	±	0.20	5.03	±	0.74	Y	33.70	±	0.81	124.69	±	3.00	Y
	10/21/2009	1.06	±	0.17	3.92	±	0.64	Y	21.10	±	0.68	78.07	±	2.51	Y
	10/28/2009	1.28	±	0.19	4.74	±	0.72	Y	24.70	±	0.72	91.39	±	2.68	Y
	11/4/2009	1.21	±	0.24	4.48	±	0.90	Y	24.10	±	0.87	89.17	±	3.23	Y
	11/11/2009	1.30	±	0.21	4.81	±	0.79	Y	24.20	±	0.65	89.54	±	2.40	Y
	11/18/2009	0.86	±	0.23	3.17	±	0.86	Y	26.90	±	0.91	99.53	±	3.37	Y
	11/25/2009	0.99	±	0.18	3.65	±	0.66	Y	23.10	±	0.70	85.47	±	2.57	Y
	12/2/2009	1.47	±	0.21	5.44	±	0.79	Y	42.50	±	0.89	157.25	±	3.30	Y
	12/9/2009	1.46	±	0.20	5.40	±	0.74	Y	36.60	±	0.84	135.42	±	3.12	Y
	12/16/2009	2.24	±	0.24	8.29	±	0.90	Y	50.50	±	0.96	186.85	±	3.54	Y
	12/23/2009	1.24	±	0.20	4.59	±	0.75	Y	29.60	±	0.80	109.52	±	2.95	Y
	12/30/2009	0.84	±	0.18	3.11	±	0.65	Y	43.90	±	0.89	162.43	±	3.28	Y
BLUE DOME	10/7/2009	0.65	±	0.18	2.41	±	0.66	Y	15.30	±	0.71	56.61	±	2.63	Y
	10/14/2009	1.09	±	0.16	4.03	±	0.60	Y	30.20	±	0.69	111.74	±	2.55	Y
	10/21/2009	0.83	±	0.14	3.05	±	0.52	Y	15.50	±	0.54	57.35	±	2.01	Y
a	10/28/2009	0.73	±	0.61	2.70	±	2.26		33.20	±	2.60	122.84	±	9.62	Y
	11/4/2009	0.63	±	0.19	2.31	±	0.69	Y	22.20	±	0.77	82.14	±	2.83	Y
	11/11/2009	1.12	±	0.18	4.14	±	0.65	Y	19.80	±	0.53	73.26	±	1.94	Y
	11/18/2009	0.83	±	0.19	3.07	±	0.72	Y	23.20	±	0.75	85.84	±	2.77	Y
	11/25/2009	0.53	±	0.13	1.97	±	0.48	Y	19.50	±	0.57	72.15	±	2.12	Y
	12/2/2009	1.26	±	0.18	4.66	±	0.65	Y	27.80	±	0.67	102.86	±	2.49	Y
	12/9/2009	0.89	±	0.14	3.31	±	0.51	Y	26.50	±	0.63	98.05	±	2.32	Y
	12/16/2009	2.62	±	0.26	9.69	±	0.97	Y	48.70	±	0.96	180.19	±	3.56	Y
	12/23/2009	0.86	±	0.16	3.17	±	0.58	Y	23.20	±	0.64	85.84	±	2.36	Y
	12/30/2009	1.01	±	0.17	3.74	±	0.64	Y	33.00	±	0.75	122.10	±	2.79	Y
QA-2	10/7/2009	0.78	±	0.22	2.88	±	0.81	Y	16.40	±	0.85	60.68	±	3.15	Y

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

Sampling Group and Location	Sampling Date	GROSS ALPHA Result ± 1s Uncertainty ($\times 10^{-15}$ µCi/mL)	GROSS ALPHA Result ± 1s Uncertainty ($\times 10^{-11}$ Bq/mL)	GROSS ALPHA Result > 3s	GROSS BETA Result ± 1s Uncertainty ($\times 10^{-15}$ µCi/mL)	GROSS BETA Result ± 1s Uncertainty ($\times 10^{-11}$ Bq/mL)	GROSS BETA Result > 3s
(BLUE DOME)	10/14/2009	1.50 ± 0.21	5.55 ± 0.77	Y	31.90 ± 0.80	118.03 ± 2.95	Y
	10/21/2009	0.68 ± 0.14	2.50 ± 0.52	Y	17.00 ± 0.60	62.90 ± 2.23	Y
	10/28/2009	0.68 ± 0.15	2.52 ± 0.56	Y	20.50 ± 0.65	75.85 ± 2.39	Y
	11/4/2009	0.78 ± 0.21	2.89 ± 0.76	Y	21.70 ± 0.80	80.29 ± 2.95	Y
	11/11/2009	1.19 ± 0.20	4.40 ± 0.74	Y	19.80 ± 0.58	73.26 ± 2.15	Y
	11/18/2009	1.00 ± 0.23	3.70 ± 0.86	Y	23.70 ± 0.85	87.69 ± 3.15	Y
	11/25/2009	0.91 ± 0.17	3.36 ± 0.63	Y	20.90 ± 0.66	77.33 ± 2.45	Y
	12/2/2009	0.95 ± 0.16	3.53 ± 0.61	Y	28.90 ± 0.69	106.93 ± 2.55	Y
	12/9/2009	0.84 ± 0.15	3.09 ± 0.54	Y	27.90 ± 0.69	103.23 ± 2.55	Y
	12/16/2009	3.33 ± 0.26	12.32 ± 0.97	Y	48.90 ± 0.88	180.93 ± 3.25	Y
	12/23/2009	0.68 ± 0.16	2.53 ± 0.60	Y	26.80 ± 0.73	99.16 ± 2.70	Y
	12/30/2009	0.75 ± 0.17	2.78 ± 0.62	Y	34.90 ± 0.80	129.13 ± 2.94	Y
FAA TOWER	10/7/2009	0.97 ± 0.22	3.60 ± 0.81	Y	16.80 ± 0.81	62.16 ± 3.00	Y
	10/14/2009	1.11 ± 0.19	4.11 ± 0.70	Y	30.00 ± 0.78	111.00 ± 2.89	Y
	10/21/2009	0.76 ± 0.15	2.82 ± 0.57	Y	19.90 ± 0.66	73.63 ± 2.45	Y
	10/28/2009	1.06 ± 0.18	3.92 ± 0.65	Y	21.50 ± 0.67	79.55 ± 2.46	Y
	11/4/2009	0.76 ± 0.23	2.80 ± 0.84	Y	21.30 ± 0.87	78.81 ± 3.20	Y
	11/11/2009	1.21 ± 0.20	4.48 ± 0.75	Y	21.80 ± 0.61	80.66 ± 2.24	Y
	11/18/2009	0.82 ± 0.23	3.03 ± 0.84	Y	21.30 ± 0.84	78.81 ± 3.12	Y
	11/25/2009	0.91 ± 0.18	3.37 ± 0.67	Y	14.80 ± 0.62	54.76 ± 2.31	Y
	12/2/2009	0.84 ± 0.17	3.12 ± 0.64	Y	32.60 ± 0.78	120.62 ± 2.89	Y
	12/9/2009	1.42 ± 0.19	5.25 ± 0.71	Y	29.90 ± 0.77	110.63 ± 2.83	Y
	12/16/2009	1.80 ± 0.22	6.66 ± 0.81	Y	43.40 ± 0.88	160.58 ± 3.25	Y
	12/23/2009	1.07 ± 0.19	3.96 ± 0.72	Y	27.10 ± 0.77	100.27 ± 2.85	Y
	12/30/2009	1.04 ± 0.18	3.85 ± 0.67	Y	40.40 ± 0.84	149.48 ± 3.10	Y
HOWE	10/7/2009	0.90 ± 0.20	3.31 ± 0.75	Y	18.60 ± 0.79	68.82 ± 2.91	Y
	10/14/2009	1.63 ± 0.21	6.03 ± 0.78	Y	33.80 ± 0.81	125.06 ± 2.99	Y
	10/21/2009	1.09 ± 0.16	4.03 ± 0.58	Y	19.10 ± 0.59	70.67 ± 2.18	Y
	10/28/2009	1.02 ± 0.15	3.77 ± 0.55	Y	24.60 ± 0.61	91.02 ± 2.24	Y
	11/4/2009	0.48 ± 0.19	1.79 ± 0.68		27.30 ± 0.84	101.01 ± 3.10	Y
	11/11/2009	1.56 ± 0.21	5.77 ± 0.78	Y	21.40 ± 0.58	79.18 ± 2.15	Y
	11/18/2009	0.90 ± 0.21	3.34 ± 0.78	Y	25.70 ± 0.82	95.09 ± 3.03	Y
	11/25/2009	1.03 ± 0.17	3.81 ± 0.62	Y	27.20 ± 0.68	100.64 ± 2.53	Y
	12/2/2009	1.60 ± 0.21	5.92 ± 0.77	Y	37.00 ± 0.80	136.90 ± 2.97	Y
	12/9/2009	1.71 ± 0.18	6.33 ± 0.66	Y	35.40 ± 0.70	130.98 ± 2.59	Y
	12/16/2009	1.87 ± 0.20	6.92 ± 0.74	Y	45.90 ± 0.81	169.83 ± 3.00	Y
	12/23/2009	1.30 ± 0.18	4.81 ± 0.65	Y	35.30 ± 0.73	130.61 ± 2.69	Y
	12/30/2009	0.95 ± 0.18	3.52 ± 0.65	Y	42.50 ± 0.85	157.25 ± 3.14	Y
MONTEVIEW	10/7/2009	1.13 ± 0.19	4.18 ± 0.71	Y	15.00 ± 0.66	55.50 ± 2.44	Y
	10/14/2009	1.47 ± 0.18	5.44 ± 0.66	Y	27.80 ± 0.66	102.86 ± 2.43	Y
	10/21/2009	0.87 ± 0.15	3.21 ± 0.54	Y	15.90 ± 0.57	58.83 ± 2.09	Y
	10/28/2009	0.94 ± 0.15	3.48 ± 0.55	Y	20.30 ± 0.57	75.11 ± 2.12	Y
	11/4/2009	0.71 ± 0.18	2.63 ± 0.68	Y	21.10 ± 0.73	78.07 ± 2.68	Y
	11/11/2009	1.55 ± 0.19	5.74 ± 0.71	Y	19.40 ± 0.52	71.78 ± 1.91	Y
	11/18/2009	1.68 ± 0.24	6.22 ± 0.90	Y	24.90 ± 0.80	92.13 ± 2.96	Y
	11/25/2009	1.28 ± 0.18	4.74 ± 0.66	Y	20.70 ± 0.61	76.59 ± 2.27	Y
	12/2/2009	1.93 ± 0.23	7.14 ± 0.84	Y	33.00 ± 0.79	122.10 ± 2.93	Y
	12/9/2009	1.26 ± 0.16	4.66 ± 0.58	Y	29.20 ± 0.65	108.04 ± 2.40	Y
	12/16/2009	2.57 ± 0.25	9.51 ± 0.92	Y	55.20 ± 0.96	204.24 ± 3.56	Y
	12/23/2009	1.15 ± 0.18	4.26 ± 0.66	Y	28.90 ± 0.71	106.93 ± 2.63	Y
	12/30/2009	1.36 ± 0.19	5.03 ± 0.69	Y	34.30 ± 0.75	126.91 ± 2.77	Y
MUD LAKE	10/7/2009	0.76 ± 0.21	2.80 ± 0.78	Y	19.90 ± 0.86	73.63 ± 3.20	Y
	10/14/2009	1.30 ± 0.18	4.81 ± 0.65	Y	30.70 ± 0.70	113.59 ± 2.60	Y
	10/21/2009	1.09 ± 0.17	4.03 ± 0.61	Y	20.80 ± 0.64	76.96 ± 2.37	Y
	10/28/2009	1.08 ± 0.18	4.00 ± 0.65	Y	26.10 ± 0.71	96.57 ± 2.63	Y

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

Sampling Group and Location	Sampling Date	GROSS ALPHA Result ± 1s Uncertainty ($\times 10^{-15}$ µCi/mL)	GROSS ALPHA Result ± 1s Uncertainty ($\times 10^{-11}$ Bq/mL)	GROSS ALPHA Result > 3s	GROSS BETA Result ± 1s Uncertainty ($\times 10^{-15}$ µCi/mL)	GROSS BETA Result ± 1s Uncertainty ($\times 10^{-11}$ Bq/mL)	GROSS BETA Result > 3s
	11/4/2009	0.73 ± 0.23	2.68 ± 0.84	Y	29.10 ± 0.96	107.67 ± 3.54	Y
	11/11/2009	1.95 ± 0.24	7.22 ± 0.90	Y	26.60 ± 0.67	98.42 ± 2.49	Y
	11/18/2009	1.19 ± 0.25	4.40 ± 0.91	Y	27.50 ± 0.91	101.75 ± 3.35	Y
	11/25/2009	1.34 ± 0.18	4.96 ± 0.67	Y	28.00 ± 0.69	103.60 ± 2.56	Y
	12/2/2009	1.39 ± 0.21	5.14 ± 0.79	Y	50.40 ± 0.97	186.48 ± 3.58	Y
	12/9/2009	1.04 ± 0.16	3.85 ± 0.58	Y	31.40 ± 0.71	116.18 ± 2.62	Y
	12/16/2009	2.44 ± 0.26	9.03 ± 0.96	Y	56.10 ± 1.03	207.57 ± 3.81	Y
	12/23/2009	1.05 ± 0.18	3.89 ± 0.66	Y	33.00 ± 0.77	122.10 ± 2.85	Y
	12/30/2009	1.33 ± 0.22	4.92 ± 0.82	Y	46.90 ± 0.99	173.53 ± 3.67	Y
DISTANT							
BLACKFOOT CMS	10/7/2009	0.75 ± 0.17	2.77 ± 0.62	Y	17.50 ± 0.67	64.75 ± 2.48	Y
	10/14/2009	1.73 ± 0.19	6.40 ± 0.72	Y	28.90 ± 0.68	106.93 ± 2.53	Y
	10/21/2009	1.14 ± 0.16	4.22 ± 0.59	Y	19.80 ± 0.59	73.26 ± 2.20	Y
	10/28/2009	1.15 ± 0.16	4.26 ± 0.59	Y	21.70 ± 0.60	80.29 ± 2.20	Y
	11/4/2009	1.12 ± 0.20	4.14 ± 0.74	Y	20.10 ± 0.70	74.37 ± 2.60	Y
	11/11/2009	1.90 ± 0.21	7.03 ± 0.77	Y	24.10 ± 0.57	89.17 ± 2.11	Y
	11/18/2009	1.28 ± 0.22	4.74 ± 0.80	Y	27.50 ± 0.79	101.75 ± 2.93	Y
	11/25/2009	1.03 ± 0.16	3.81 ± 0.60	Y	20.00 ± 0.59	74.00 ± 2.19	Y
	12/2/2009	1.44 ± 0.19	5.33 ± 0.71	Y	38.00 ± 0.79	140.60 ± 2.91	Y
	12/9/2009	1.41 ± 0.18	5.22 ± 0.65	Y	35.50 ± 0.75	131.35 ± 2.78	Y
	12/16/2009	1.40 ± 0.19	5.18 ± 0.70	Y	39.90 ± 0.81	147.63 ± 2.99	Y
	12/23/2009	1.24 ± 0.17	4.59 ± 0.64	Y	29.80 ± 0.69	110.26 ± 2.55	Y
	12/30/2009	1.48 ± 0.19	5.48 ± 0.72	Y	48.50 ± 0.86	179.45 ± 3.17	Y
CRATERS OF	10/7/2009	0.77 ± 0.20	2.86 ± 0.75	Y	15.50 ± 0.78	57.35 ± 2.87	Y
THE MOON	10/14/2009	1.70 ± 0.21	6.29 ± 0.78	Y	30.40 ± 0.76	112.48 ± 2.80	Y
	10/21/2009	0.95 ± 0.16	3.53 ± 0.59	Y	17.00 ± 0.61	62.90 ± 2.25	Y
	10/28/2009	0.90 ± 0.16	3.34 ± 0.60	Y	24.80 ± 0.68	91.76 ± 2.52	Y
	11/4/2009	0.75 ± 0.22	2.79 ± 0.80	Y	20.90 ± 0.83	77.33 ± 3.05	Y
	11/11/2009	1.10 ± 0.20	4.07 ± 0.74	Y	20.70 ± 0.60	76.59 ± 2.21	Y
	11/18/2009	0.61 ± 0.19	2.26 ± 0.69	Y	22.90 ± 0.75	84.73 ± 2.79	Y
	11/25/2009	0.25 ± 0.13	0.94 ± 0.47		15.90 ± 0.60	58.83 ± 2.23	Y
	12/2/2009	0.59 ± 0.16	2.17 ± 0.60	Y	31.50 ± 0.78	116.55 ± 2.89	Y
	12/9/2009	1.33 ± 0.20	4.92 ± 0.72	Y	26.80 ± 0.77	99.16 ± 2.84	Y
	12/16/2009	1.32 ± 0.18	4.88 ± 0.67	Y	41.50 ± 0.80	153.55 ± 2.94	Y
	12/23/2009	0.67 ± 0.16	2.48 ± 0.60	Y	10.50 ± 0.55	38.85 ± 2.03	Y
	12/30/2009	0.97 ± 0.16	3.57 ± 0.61	Y	31.30 ± 0.71	115.81 ± 2.63	Y
DUBOIS	10/7/2009	0.94 ± 0.22	3.46 ± 0.81	Y	17.20 ± 0.83	63.64 ± 3.06	Y
	10/14/2009	1.50 ± 0.20	5.55 ± 0.73	Y	28.80 ± 0.73	106.56 ± 2.69	Y
	10/21/2009	1.24 ± 0.19	4.59 ± 0.68	Y	18.20 ± 0.65	67.34 ± 2.42	Y
	10/28/2009	0.92 ± 0.16	3.40 ± 0.60	Y	23.30 ± 0.66	86.21 ± 2.45	Y
	11/4/2009	0.72 ± 0.26	2.65 ± 0.96		23.20 ± 1.01	85.84 ± 3.74	Y
	11/11/2009	1.16 ± 0.19	4.29 ± 0.71	Y	21.10 ± 0.58	78.07 ± 2.14	Y
	11/18/2009	1.20 ± 0.27	4.44 ± 1.01	Y	25.00 ± 0.97	92.50 ± 3.57	Y
	11/25/2009	1.28 ± 0.19	4.74 ± 0.69	Y	20.70 ± 0.65	76.59 ± 2.40	Y
	12/2/2009	0.84 ± 0.18	3.12 ± 0.65	Y	28.00 ± 0.75	103.60 ± 2.78	Y
	12/9/2009	1.29 ± 0.17	4.77 ± 0.62	Y	29.30 ± 0.69	108.41 ± 2.54	Y
	12/16/2009	1.42 ± 0.23	5.25 ± 0.84	Y	50.60 ± 1.05	187.22 ± 3.89	Y
	12/23/2009	0.81 ± 0.17	2.99 ± 0.64	Y	29.60 ± 0.77	109.52 ± 2.83	Y
	12/30/2009	1.04 ± 0.20	3.85 ± 0.74	Y	36.20 ± 0.88	133.94 ± 3.24	Y
IDAHO FALLS	10/7/2009	0.98 ± 0.30	3.64 ± 1.12	Y	18.90 ± 1.15	69.93 ± 4.26	Y
	10/14/2009	1.39 ± 0.21	5.14 ± 0.76	Y	33.70 ± 0.83	124.69 ± 3.06	Y
	10/21/2009	1.43 ± 0.21	5.29 ± 0.78	Y	20.90 ± 0.74	77.33 ± 2.74	Y
	10/28/2009	1.02 ± 0.18	3.77 ± 0.65	Y	19.90 ± 0.66	73.63 ± 2.45	Y
	11/4/2009	0.88 ± 0.28	3.27 ± 1.02	Y	21.80 ± 1.02	80.66 ± 3.77	Y
	11/11/2009	2.09 ± 0.28	7.73 ± 1.05	Y	24.10 ± 0.74	89.17 ± 2.72	Y

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

Sampling Group and Location	Sampling Date	GROSS ALPHA Result ± 1s Uncertainty ($\times 10^{-15}$ µCi/mL)	GROSS ALPHA Result ± 1s Uncertainty ($\times 10^{-11}$ Bq/mL)	GROSS ALPHA Result > 3s	GROSS BETA Result ± 1s Uncertainty ($\times 10^{-15}$ µCi/mL)	GROSS BETA Result ± 1s Uncertainty ($\times 10^{-11}$ Bq/mL)	GROSS BETA Result > 3s
	11/18/2009	1.49 ± 0.29	5.51 ± 1.07	Y	28.00 ± 1.00	103.60 ± 3.70	Y
	11/25/2009	1.20 ± 0.21	4.44 ± 0.79	Y	19.60 ± 0.74	72.52 ± 2.75	Y
	12/2/2009	1.65 ± 0.24	6.11 ± 0.88	Y	40.10 ± 0.94	148.37 ± 3.46	Y
	12/9/2009	1.00 ± 0.17	3.70 ± 0.64	Y	33.70 ± 0.82	124.69 ± 3.04	Y
	12/16/2009	1.54 ± 0.25	5.70 ± 0.93	Y	44.60 ± 1.08	165.02 ± 4.00	Y
	12/23/2009	0.82 ± 0.21	3.03 ± 0.76	Y	30.50 ± 0.90	112.85 ± 3.34	Y
	12/30/2009	1.25 ± 0.23	4.63 ± 0.84	Y	45.10 ± 1.02	166.87 ± 3.77	Y
JACKSON	10/7/2009	0.79 ± 0.20	2.92 ± 0.73	Y	15.40 ± 0.75	56.98 ± 2.79	Y
	10/14/2009	1.13 ± 0.19	4.18 ± 0.72	Y	26.10 ± 0.76	96.57 ± 2.82	Y
	10/21/2009	0.75 ± 0.15	2.78 ± 0.56	Y	18.90 ± 0.65	69.93 ± 2.41	Y
	10/28/2009	0.96 ± 0.18	3.56 ± 0.65	Y	20.90 ± 0.69	77.33 ± 2.54	Y
	11/4/2009	0.88 ± 0.23	3.24 ± 0.85	Y	21.00 ± 0.86	77.70 ± 3.17	Y
	11/11/2009	1.47 ± 0.22	5.44 ± 0.83	Y	23.40 ± 0.64	86.58 ± 2.38	Y
	11/18/2009	1.15 ± 0.25	4.26 ± 0.94	Y	27.70 ± 0.94	102.49 ± 3.46	Y
	11/25/2009	1.78 ± 0.23	6.59 ± 0.84	Y	23.30 ± 0.73	86.21 ± 2.70	Y
a	11/27/2009	1.42 ± 0.50	5.25 ± 1.83		48.80 ± 2.02	180.56 ± 7.47	Y
	12/9/2009	1.57 ± 0.16	5.81 ± 0.58	Y	35.70 ± 0.63	132.09 ± 2.34	Y
	12/16/2009	1.00 ± 0.18	3.69 ± 0.67	Y	24.60 ± 0.73	91.02 ± 2.71	Y
	12/22/2009	0.89 ± 0.20	3.31 ± 0.74	Y	22.00 ± 0.78	81.40 ± 2.89	Y
	12/29/2009	1.28 ± 0.21	4.74 ± 0.77	Y	43.80 ± 0.93	162.06 ± 3.42	Y
REXBURG CMS	10/7/2009	1.09 ± 0.20	4.03 ± 0.73	Y	18.30 ± 0.72	67.71 ± 2.66	Y
	10/14/2009	1.63 ± 0.21	6.03 ± 0.78	Y	31.40 ± 0.78	116.18 ± 2.88	Y
	10/21/2009	1.40 ± 0.19	5.18 ± 0.71	Y	19.70 ± 0.66	72.89 ± 2.46	Y
	10/28/2009	1.20 ± 0.18	4.44 ± 0.68	Y	21.70 ± 0.67	80.29 ± 2.48	Y
	11/4/2009	1.27 ± 0.21	4.70 ± 0.79	Y	21.40 ± 0.74	79.18 ± 2.73	Y
	11/11/2009	1.62 ± 0.21	5.99 ± 0.77	Y	23.20 ± 0.59	85.84 ± 2.17	Y
	11/18/2009	0.73 ± 0.21	2.69 ± 0.79	Y	25.50 ± 0.85	94.35 ± 3.16	Y
	11/25/2009	1.04 ± 0.17	3.85 ± 0.64	Y	20.00 ± 0.63	74.00 ± 2.33	Y
a	12/2/2009	-14.10 ± 23.90	-52.17 ± 88.43		-105.00 ± 80.60	-388.50 ± 298.22	
	12/9/2009	1.95 ± 0.21	7.22 ± 0.77	Y	32.70 ± 0.76	120.99 ± 2.80	Y
	12/16/2009	1.61 ± 0.21	5.96 ± 0.78	Y	38.90 ± 0.85	143.93 ± 3.15	Y
	12/23/2009	1.10 ± 0.20	4.07 ± 0.74	Y	30.10 ± 0.82	111.37 ± 3.02	Y
	12/30/2009	1.15 ± 0.19	4.26 ± 0.72	Y	42.60 ± 0.88	157.62 ± 3.26	Y
INL SITE							
EFS	10/7/2009	0.94 ± 0.19	3.47 ± 0.70	Y	18.20 ± 0.72	67.34 ± 2.68	Y
	10/14/2009	1.42 ± 0.21	5.25 ± 0.76	Y	32.60 ± 0.81	120.62 ± 3.00	Y
	10/21/2009	0.74 ± 0.15	2.73 ± 0.56	Y	20.40 ± 0.67	75.48 ± 2.48	Y
	10/28/2009	0.70 ± 0.16	2.60 ± 0.58	Y	23.60 ± 0.71	87.32 ± 2.61	Y
	11/4/2009	1.97 ± 0.28	7.29 ± 1.05	Y	28.40 ± 0.93	105.08 ± 3.46	Y
	11/11/2009	1.49 ± 0.23	5.51 ± 0.86	Y	24.40 ± 0.68	90.28 ± 2.50	Y
	11/18/2009	0.92 ± 0.26	3.42 ± 0.95	Y	29.60 ± 1.01	109.52 ± 3.74	Y
	11/25/2009	0.86 ± 0.18	3.19 ± 0.65	Y	25.50 ± 0.74	94.35 ± 2.73	Y
	12/2/2009	1.54 ± 0.21	5.70 ± 0.79	Y	49.10 ± 0.93	181.67 ± 3.44	Y
	12/9/2009	1.40 ± 0.19	5.18 ± 0.70	Y	39.10 ± 0.83	144.67 ± 3.06	Y
	12/16/2009	1.90 ± 0.23	7.03 ± 0.86	Y	53.80 ± 1.00	199.06 ± 3.68	Y
	12/23/2009	1.16 ± 0.19	4.29 ± 0.71	Y	38.40 ± 0.84	142.08 ± 3.11	Y
	12/30/2009	0.97 ± 0.18	3.59 ± 0.65	Y	46.60 ± 0.87	172.42 ± 3.21	Y
MAIN GATE	10/7/2009	0.69 ± 0.17	2.56 ± 0.64	Y	18.40 ± 0.72	68.08 ± 2.66	Y
	10/14/2009	1.38 ± 0.29	5.11 ± 1.07	Y	38.90 ± 1.20	143.93 ± 4.44	Y
	10/21/2009	0.86 ± 0.15	3.19 ± 0.56	Y	21.60 ± 0.64	79.92 ± 2.37	Y
	10/28/2009	0.91 ± 0.16	3.36 ± 0.58	Y	21.70 ± 0.63	80.29 ± 2.32	Y
	11/4/2009	1.06 ± 0.21	3.92 ± 0.79	Y	24.20 ± 0.80	89.54 ± 2.94	Y
a	11/11/2009	±	±		±	±	
	11/18/2009	0.97 ± 0.24	3.58 ± 0.88	Y	27.00 ± 0.91	99.90 ± 3.36	Y
	11/25/2009	0.71 ± 0.16	2.62 ± 0.58	Y	25.30 ± 0.69	93.61 ± 2.56	Y

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

Sampling Group and Location	Sampling Date	GROSS ALPHA Result ± 1s Uncertainty ($\times 10^{-15}$ µCi/mL)	GROSS ALPHA Result ± 1s Uncertainty ($\times 10^{-11}$ Bq/mL)	GROSS ALPHA Result > 3s	GROSS BETA Result ± 1s Uncertainty ($\times 10^{-15}$ µCi/mL)	GROSS BETA Result ± 1s Uncertainty ($\times 10^{-11}$ Bq/mL)	GROSS BETA Result > 3s
	12/2/2009	0.94 ± 0.18	3.49 ± 0.67	Y	42.90 ± 0.87	158.73 ± 3.22	Y
	12/9/2009	0.81 ± 0.14	3.00 ± 0.53	Y	34.60 ± 0.74	128.02 ± 2.72	Y
	12/16/2009	1.63 ± 0.21	6.03 ± 0.76	Y	47.80 ± 0.89	176.86 ± 3.30	Y
	12/23/2009	1.21 ± 0.19	4.48 ± 0.69	Y	35.30 ± 0.78	130.61 ± 2.90	Y
	12/30/2009	1.12 ± 0.19	4.14 ± 0.70	Y	40.10 ± 0.85	148.37 ± 3.15	Y
VAN BUREN GATE	10/7/2009	1.01 ± 0.21	3.74 ± 0.77	Y	19.60 ± 0.79	72.52 ± 2.92	Y
	10/14/2009	1.35 ± 0.19	5.00 ± 0.68	Y	30.80 ± 0.73	113.96 ± 2.71	Y
	10/21/2009	0.99 ± 0.19	3.67 ± 0.68	Y	22.00 ± 0.76	81.40 ± 2.80	Y
	10/28/2009	0.98 ± 0.17	3.61 ± 0.61	Y	23.50 ± 0.67	86.95 ± 2.46	Y
	11/4/2009	0.84 ± 0.21	3.10 ± 0.78	Y	25.30 ± 0.84	93.61 ± 3.10	Y
	11/11/2009	1.26 ± 0.20	4.66 ± 0.74	Y	23.40 ± 0.61	86.58 ± 2.24	Y
	11/18/2009	0.81 ± 0.23	2.99 ± 0.84	Y	26.90 ± 0.90	99.53 ± 3.32	Y
	11/25/2009	1.11 ± 0.17	4.11 ± 0.64	Y	21.70 ± 0.64	80.29 ± 2.35	Y
	12/2/2009	1.14 ± 0.19	4.22 ± 0.69	Y	41.00 ± 0.84	151.70 ± 3.10	Y
	12/9/2009	1.19 ± 0.18	4.40 ± 0.66	Y	35.90 ± 0.81	132.83 ± 3.01	Y
	12/16/2009	1.95 ± 0.23	7.22 ± 0.84	Y	54.30 ± 0.96	200.91 ± 3.57	Y
	12/23/2009	1.06 ± 0.18	3.92 ± 0.67	Y	26.90 ± 0.72	99.53 ± 2.67	Y
	12/30/2009	0.91 ± 0.17	3.36 ± 0.61	Y	35.30 ± 0.76	130.61 ± 2.79	Y

a. Invalid Sample Result

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

Sampling Group and Location	Sampling Date	Result ± 1s Uncertainty ($\times 10^{-15}$ µCi/mL)			Result ± 1s Uncertainty ($\times 10^{-11}$ Bq/mL)			Result > 3s
BOUNDARY								
ARCO	10/07/2009	-0.56	±	1.40	-2.07	±	5.18	
	10/14/2009	-0.69	±	1.35	-2.55	±	5.00	
	10/21/2009	1.03	±	1.53	3.81	±	5.66	
	10/28/2009	1.54	±	1.34	5.69	±	4.95	
	11/04/2009	-0.19	±	1.37	-0.71	±	5.08	
	11/11/2009	-1.94	±	1.62	-7.18	±	6.00	
	11/18/2009	2.55	±	1.43	9.42	±	5.30	
	11/25/2009	-1.47	±	1.53	-5.44	±	5.67	
	12/02/2009	0.68	±	1.41	2.51	±	5.21	
	12/09/2009	-1.79	±	1.34	-6.61	±	4.97	
	12/16/2009	0.22	±	1.34	0.81	±	4.96	
	12/23/2009	1.89	±	1.38	7.00	±	5.12	
	12/30/2009	2.49	±	1.40	9.21	±	5.17	
ATOMIC CITY	10/07/2009	-0.63	±	1.58	-2.34	±	5.85	
	10/14/2009	-0.70	±	1.36	-2.57	±	5.04	
	10/21/2009	1.16	±	1.72	4.28	±	6.37	
	10/28/2009	1.48	±	1.29	5.48	±	4.77	
a	11/04/2009	-5.43	±	39.10	-20.07	±	144.68	
	11/11/2009	-2.08	±	1.74	-7.68	±	6.42	
	11/18/2009	2.86	±	1.61	10.58	±	5.95	
	11/25/2009	-1.37	±	1.43	-5.08	±	5.30	
	12/02/2009	0.73	±	1.52	2.71	±	5.62	
	12/09/2009	-1.85	±	1.39	-6.83	±	5.13	
	12/16/2009	0.21	±	1.30	0.79	±	4.81	
	12/23/2009	1.71	±	1.25	6.32	±	4.62	
	12/30/2009	2.42	±	1.36	8.95	±	5.02	
QA-1	10/07/2009	-0.57	±	1.41	-2.09	±	5.22	
	10/14/2009	-0.71	±	1.39	-2.63	±	5.15	
	10/21/2009	1.08	±	1.60	3.98	±	5.91	
	10/28/2009	1.69	±	1.48	6.27	±	5.46	
	11/04/2009	-0.21	±	1.49	-0.76	±	5.51	
	11/11/2009	-2.12	±	1.77	-7.84	±	6.55	
	11/18/2009	2.80	±	1.58	10.37	±	5.83	
	11/25/2009	-1.51	±	1.58	-5.59	±	5.84	
	12/02/2009	0.71	±	1.48	2.64	±	5.47	
	12/09/2009	-2.01	±	1.51	-7.44	±	5.59	
	12/16/2009	0.22	±	1.37	0.83	±	5.05	
	12/23/2009	1.90	±	1.39	7.04	±	5.15	
	12/30/2009	2.57	±	1.44	9.50	±	5.33	
BLUE DOME	10/07/2009	-0.32	±	1.24	-1.17	±	4.59	
	10/14/2009	-0.76	±	1.04	-2.81	±	3.84	
	10/21/2009	-0.24	±	1.13	-0.87	±	4.17	
a	10/28/2009	-8.95	±	9.15	-33.13	±	33.87	
	11/04/2009	0.53	±	1.16	1.96	±	4.31	
	11/11/2009	0.21	±	1.13	0.79	±	4.19	
	11/18/2009	0.37	±	1.15	1.38	±	4.24	
	11/25/2009	1.25	±	1.12	4.61	±	4.13	
	12/02/2009	1.25	±	1.16	4.63	±	4.29	
	12/09/2009	1.73	±	1.09	6.39	±	4.05	
	12/16/2009	1.26	±	1.30	4.67	±	4.82	

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

Sampling Group and Location	Sampling Date	Result ± 1s Uncertainty ($\times 10^{-15}$ µCi/mL)			Result ± 1s Uncertainty ($\times 10^{-11}$ Bq/mL)			Result > 3s
BOUNDARY								
	12/23/2009	0.27	±	1.01	0.98	±	3.75	
	12/30/2009	0.96	±	1.23	3.55	±	4.54	
QA-2	10/07/2009	-0.40	±	1.55	-1.47	±	5.75	
	10/14/2009	-0.94	±	1.28	-3.47	±	4.74	
	10/21/2009	-0.26	±	1.26	-0.98	±	4.67	
	10/28/2009	-1.45	±	1.48	-5.36	±	5.48	
	11/04/2009	0.57	±	1.26	2.11	±	4.65	
	11/11/2009	0.25	±	1.35	0.94	±	4.98	
	11/18/2009	0.45	±	1.38	1.66	±	5.10	
	11/25/2009	1.52	±	1.36	5.61	±	5.03	
	12/02/2009	1.27	±	1.17	4.69	±	4.34	
	12/09/2009	1.96	±	1.24	7.24	±	4.59	
	12/16/2009	1.07	±	1.10	3.94	±	4.08	
	12/23/2009	0.30	±	1.16	1.12	±	4.28	
	12/30/2009	1.01	±	1.29	3.75	±	4.79	
FAA TOWER	10/07/2009	-0.37	±	1.44	-1.36	±	5.34	
	10/14/2009	-0.95	±	1.30	-3.52	±	4.81	
	10/21/2009	-0.28	±	1.33	-1.03	±	4.93	
	10/28/2009	-1.47	±	1.51	-5.45	±	5.57	
	11/04/2009	0.65	±	1.43	2.40	±	5.28	
	11/11/2009	0.26	±	1.36	0.95	±	5.02	
	11/18/2009	0.46	±	1.43	1.72	±	5.28	
	11/25/2009	1.68	±	1.50	6.20	±	5.56	
	12/02/2009	1.44	±	1.34	5.33	±	4.94	
	12/09/2009	2.23	±	1.41	8.25	±	5.22	
	12/16/2009	1.18	±	1.22	4.36	±	4.51	
	12/23/2009	0.33	±	1.25	1.22	±	4.62	
	12/30/2009	0.99	±	1.27	3.68	±	4.71	
HOWE	10/07/2009	-0.34	±	1.32	-1.25	±	4.90	
	10/14/2009	-0.92	±	1.26	-3.40	±	4.65	
	10/21/2009	-0.23	±	1.12	-0.87	±	4.15	
	10/28/2009	-1.14	±	1.17	-4.23	±	4.32	
	11/04/2009	0.55	±	1.20	2.02	±	4.44	
	11/11/2009	0.24	±	1.27	0.89	±	4.70	
	11/18/2009	0.41	±	1.25	1.51	±	4.63	
	11/25/2009	1.34	±	1.20	4.95	±	4.44	
	12/02/2009	1.38	±	1.28	5.11	±	4.74	
	12/09/2009	1.68	±	1.06	6.20	±	3.93	
	12/16/2009	0.97	±	1.01	3.60	±	3.72	
	12/23/2009	0.25	±	0.94	0.92	±	3.48	
	12/30/2009	0.98	±	1.25	3.62	±	4.63	
MONTEVIEW	10/07/2009	-0.29	±	1.13	-1.06	±	4.16	
	10/14/2009	-0.74	±	1.01	-2.73	±	3.74	
	10/21/2009	-0.25	±	1.18	-0.91	±	4.37	
	10/28/2009	-1.20	±	1.22	-4.42	±	4.52	
	11/04/2009	0.50	±	1.10	1.85	±	4.08	
	11/11/2009	0.21	±	1.11	0.78	±	4.12	
	11/18/2009	0.40	±	1.22	1.47	±	4.51	
	11/25/2009	1.34	±	1.20	4.96	±	4.45	
	12/02/2009	1.47	±	1.36	5.42	±	5.02	

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

Sampling Group and Location	Sampling Date	Result ± 1s Uncertainty ($\times 10^{-15}$ µCi/mL)			Result ± 1s Uncertainty ($\times 10^{-11}$ Bq/mL)			Result > 3s
BOUNDARY								
	12/09/2009	1.70	±	1.08	6.30	±	3.99	
	12/16/2009	1.14	±	1.18	4.22	±	4.37	
	12/23/2009	0.28	±	1.05	1.02	±	3.88	
	12/30/2009	0.92	±	1.18	3.41	±	4.36	
MUD LAKE	10/07/2009	-0.37	±	1.47	-1.39	±	5.43	
	10/14/2009	-0.77	±	1.06	-2.87	±	3.92	
	10/21/2009	-0.26	±	1.22	-0.95	±	4.52	
	10/28/2009	-1.44	±	1.47	-5.34	±	5.45	
	11/04/2009	0.65	±	1.42	2.39	±	5.27	
	11/11/2009	0.27	±	1.40	0.98	±	5.19	
	11/18/2009	0.46	±	1.40	1.69	±	5.18	
	11/25/2009	1.33	±	1.19	4.92	±	4.42	
	12/02/2009	1.52	±	1.41	5.62	±	5.21	
	12/09/2009	1.88	±	1.19	6.96	±	4.41	
	12/16/2009	1.28	±	1.33	4.75	±	4.91	
	12/23/2009	0.29	±	1.09	1.06	±	4.04	
	12/30/2009	1.19	±	1.53	4.41	±	5.64	
DISTANT								
BLACKFOOT CMS	10/07/2009	-0.45	±	1.13	-1.67	±	4.18	
	10/14/2009	-0.59	±	1.15	-2.18	±	4.26	
	10/21/2009	0.90	±	1.33	3.32	±	4.93	
	10/28/2009	1.33	±	1.16	4.92	±	4.29	
	11/04/2009	-0.16	±	1.17	-0.60	±	4.35	
	11/11/2009	-1.69	±	1.41	-6.25	±	5.22	
	11/18/2009	2.23	±	1.25	8.25	±	4.64	
	11/25/2009	-1.27	±	1.33	-4.70	±	4.90	
	12/02/2009	0.62	±	1.28	2.29	±	4.75	
	12/09/2009	-1.67	±	1.26	-6.18	±	4.65	
	12/16/2009	0.20	±	1.21	0.73	±	4.49	
	12/23/2009	1.48	±	1.08	5.48	±	4.01	
	12/30/2009	2.23	±	1.25	8.25	±	4.63	
CRATERS	10/07/2009	-0.59	±	1.47	-2.18	±	5.44	
	10/14/2009	-0.68	±	1.33	-2.51	±	4.91	
	10/21/2009	1.02	±	1.52	3.79	±	5.63	
	10/28/2009	1.53	±	1.33	5.67	±	4.94	
	11/04/2009	-0.20	±	1.47	-0.75	±	5.42	
	11/11/2009	-2.07	±	1.73	-7.65	±	6.39	
	11/18/2009	2.29	±	1.29	8.47	±	4.76	
	11/25/2009	-1.51	±	1.58	-5.60	±	5.85	
	12/02/2009	0.70	±	1.46	2.60	±	5.39	
	12/09/2009	-2.13	±	1.60	-7.89	±	5.93	
	12/16/2009	0.19	±	1.14	0.69	±	4.24	
	12/23/2009	1.87	±	1.37	6.93	±	5.06	
	12/30/2009	2.24	±	1.26	8.28	±	4.65	
DUBOIS	10/07/2009	-0.37	±	1.47	-1.38	±	5.42	
	10/14/2009	-0.86	±	1.17	-3.18	±	4.34	
	10/21/2009	-0.29	±	1.37	-1.06	±	5.07	
	10/28/2009	-1.38	±	1.41	-5.10	±	5.22	
	11/04/2009	0.78	±	1.72	2.90	±	6.37	
	11/11/2009	0.24	±	1.28	0.90	±	4.74	

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

Sampling Group and Location	Sampling Date	Result ± 1s Uncertainty ($\times 10^{-15}$ µCi/mL)			Result ± 1s Uncertainty ($\times 10^{-11}$ Bq/mL)			Result > 3s
BOUNDARY								
	11/18/2009	0.53	±	1.62	1.95	±	6.00	
	11/25/2009	1.46	±	1.31	5.42	±	4.86	
	12/02/2009	1.50	±	1.39	5.57	±	5.16	
	12/09/2009	1.88	±	1.19	6.95	±	4.40	
	12/16/2009	1.43	±	1.48	5.28	±	5.46	
	12/23/2009	0.31	±	1.17	1.13	±	4.32	
	12/30/2009	1.16	±	1.49	4.31	±	5.51	
IDAHO FALLS	10/07/2009	-0.57	±	2.21	-2.09	±	8.19	
	10/14/2009	-0.96	±	1.31	-3.55	±	4.86	
	10/21/2009	-0.32	±	1.54	-1.19	±	5.69	
	10/28/2009	-1.54	±	1.57	-5.68	±	5.81	
	11/04/2009	0.81	±	1.78	2.99	±	6.58	
	11/11/2009	0.33	±	1.75	1.22	±	6.47	
	11/18/2009	0.53	±	1.63	1.96	±	6.02	
	11/25/2009	1.89	±	1.69	6.98	±	6.26	
	12/02/2009	1.70	±	1.57	6.27	±	5.82	
	12/09/2009	2.31	±	1.47	8.56	±	5.42	
	12/16/2009	1.64	±	1.70	6.08	±	6.28	
	12/23/2009	0.40	±	1.50	1.46	±	5.57	
	12/30/2009	1.28	±	1.64	4.75	±	6.08	
JACKSON	10/07/2009	-0.57	±	1.41	-2.09	±	5.23	
	10/14/2009	-0.76	±	1.49	-2.82	±	5.52	
	10/21/2009	1.08	±	1.60	3.98	±	5.92	
	10/28/2009	1.73	±	1.51	6.42	±	5.59	
	11/04/2009	-0.21	±	1.54	-0.79	±	5.71	
	11/11/2009	-2.15	±	1.80	-7.96	±	6.65	
	11/18/2009	2.87	±	1.62	10.63	±	5.98	
	11/25/2009	-1.17	±	7.55	-4.33	±	27.93	
a	11/27/2009	2.47	±	5.11	9.12	±	18.91	
	12/09/2009	-1.22	±	0.92	-4.52	±	3.40	
	12/16/2009	0.24	±	1.45	0.87	±	5.35	
	12/22/2009	2.21	±	1.62	8.19	±	5.99	
	12/29/2009	2.76	±	1.55	10.22	±	5.73	
REXBURG CMS	10/07/2009	-0.30	±	1.17	-1.10	±	4.32	
	10/14/2009	-0.91	±	1.24	-3.37	±	4.60	
	10/21/2009	-0.28	±	1.34	-1.04	±	4.96	
	10/28/2009	-1.48	±	1.51	-5.47	±	5.59	
	11/04/2009	0.51	±	1.12	1.89	±	4.15	
	11/11/2009	0.23	±	1.22	0.85	±	4.50	
	11/18/2009	0.43	±	1.34	1.61	±	4.94	
	11/25/2009	1.43	±	1.28	5.28	±	4.74	
a	12/02/2009	372.94	±	345.66	1379.89	±	1278.93	
	12/09/2009	2.04	±	1.30	7.57	±	4.79	
	12/16/2009	1.21	±	1.25	4.47	±	4.62	
	12/23/2009	0.34	±	1.29	1.25	±	4.75	
	12/30/2009	1.04	±	1.33	3.85	±	4.93	
INL SITE								
EFS	10/07/2009	-0.50	±	1.24	-1.84	±	4.59	
	10/14/2009	-0.73	±	1.42	-2.69	±	5.26	
	10/21/2009	1.07	±	1.60	3.97	±	5.90	

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

Sampling Group and Location	Sampling Date	Result ± 1s Uncertainty ($\times 10^{-15}$ µCi/mL)			Result ± 1s Uncertainty ($\times 10^{-11}$ Bq/mL)			Result > 3s
BOUNDARY								
	10/28/2009	1.68	±	1.46	6.21	±	5.41	
	11/04/2009	-0.21	±	1.51	-0.78	±	5.60	
	11/11/2009	-2.26	±	1.89	-8.36	±	6.99	
	11/18/2009	3.11	±	1.75	11.51	±	6.47	
	11/25/2009	-1.56	±	1.63	-5.79	±	6.04	
	12/02/2009	0.68	±	1.42	2.53	±	5.25	
	12/09/2009	-1.84	±	1.38	-6.80	±	5.11	
	12/16/2009	0.23	±	1.39	0.84	±	5.15	
	12/23/2009	1.74	±	1.27	6.43	±	4.70	
	12/30/2009	2.35	±	1.32	8.71	±	4.89	
MAIN GATE	10/07/2009	-0.49	±	1.23	-1.82	±	4.54	
	10/14/2009	-1.24	±	2.43	-4.60	±	9.01	
	10/21/2009	0.96	±	1.43	3.57	±	5.30	
	10/28/2009	1.46	±	1.27	5.40	±	4.71	
	11/04/2009	-0.18	±	1.29	-0.66	±	4.77	
	11/11/2009	-1.62	±	1.36	-6.01	±	5.02	
	11/18/2009	2.78	±	1.56	10.28	±	5.78	
	11/25/2009	-1.42	±	1.48	-5.24	±	5.47	
	12/02/2009	0.68	±	1.40	2.50	±	5.18	
	12/09/2009	-1.65	±	1.24	-6.11	±	4.59	
	12/16/2009	0.21	±	1.26	0.76	±	4.65	
	12/23/2009	1.64	±	1.20	6.05	±	4.43	
	12/30/2009	2.55	±	1.43	9.43	±	5.29	
VAN BUREN GATE	10/07/2009	-0.54	±	1.36	-2.02	±	5.04	
	10/14/2009	-0.63	±	1.24	-2.35	±	4.59	
	10/21/2009	1.25	±	1.86	4.63	±	6.88	
	10/28/2009	1.52	±	1.33	5.63	±	4.90	
	11/04/2009	-0.19	±	1.37	-0.70	±	5.05	
	11/11/2009	-1.93	±	1.61	-7.15	±	5.98	
	11/18/2009	2.74	±	1.54	10.13	±	5.70	
	11/25/2009	-1.35	±	1.41	-5.01	±	5.23	
	12/02/2009	0.66	±	1.36	2.43	±	5.03	
	12/09/2009	-1.92	±	1.44	-7.09	±	5.33	
	12/16/2009	0.21	±	1.31	0.79	±	4.83	
	12/23/2009	1.72	±	1.26	6.35	±	4.64	
	12/30/2009	2.28	±	1.28	8.44	±	4.73	

a. Invalid Sample Result

TABLE C-3. Quarterly Americium-241, Cesium-137, Plutonium-238, Plutonium-239/240, and Strontium-90 Concentrations in Composite Air Filters.

Sampling Group and Location	Sampling Date	Analyte	Result ± 1s Uncertainty ($\times 10^{-18}$ µCi/mL)			Result ± 1s Uncertainty ($\times 10^{-13}$ Bq/mL)			Result > 3s
BOUNDARY									
ARCO	12/30/2009	CESIUM-137	-65.90	±	114.00	-243.83	±	421.80	
ATOMIC CITY	12/30/2009	CESIUM-137	-53.30	±	166.00	-197.21	±	614.20	
		STRONTIUM-90	-41.90	±	25.80	-155.03	±	95.46	
ATOMIC CITY (QA-1)	12/30/2009	CESIUM-137	47.10	±	121.00	174.27	±	447.70	
		STRONTIUM-90	-18.20	±	14.30	-67.34	±	52.91	
BLUE DOME	12/30/2009	AMERICIUM-241	0.00	±	0.00	0.00	±	0.00	
		CESIUM-137	-25.40	±	119.00	-93.98	±	440.30	
		PLUTONIUM-238	-0.44	±	0.32	-1.62	±	1.18	
		PLUTONIUM-239/40	0.00	±	0.14	0.00	±	0.53	
BLUE DOME (QA-2)	12/30/2009	AMERICIUM-241	0.40	±	0.89	1.46	±	3.27	
		CESIUM-137	155.00	±	139.00	573.50	±	514.30	
		PLUTONIUM-238	0.00	±	0.14	0.00	±	0.50	
		PLUTONIUM-239/40	1.54	±	2.18	5.70	±	8.07	
FAA TOWER	12/30/2009	AMERICIUM-241	1.09	±	1.10	4.03	±	4.07	
		CESIUM-137	39.20	±	120.00	145.04	±	444.00	
		PLUTONIUM-238	0.00	±	0.14	0.00	±	0.53	
		PLUTONIUM-239/40	-0.60	±	0.60	-2.20	±	2.20	
HOWE	12/30/2009	CESIUM-137	-232.00	±	120.00	-858.40	±	444.00	
MONTEVIEW	12/30/2009	CESIUM-137	-303.00	±	120.00	-1121.10	±	444.00	
		STRONTIUM-90	-32.40	±	21.20	-119.88	±	78.44	
MUD LAKE	12/30/2009	CESIUM-137	-71.80	±	116.00	-265.66	±	429.20	

TABLE C-3. Quarterly Americium-241, Cesium-137, Plutonium-238, Plutonium-239/240, and Strontium-90 Concentrations in Composite Air Filters.

Sampling Group and Location	Sampling Date	Analyte	Result ± 1s Uncertainty ($\times 10^{-18}$ µCi/mL)			Result ± 1s Uncertainty ($\times 10^{-13}$ Bq/mL)			Result > 3s
DISTANT									
BLACKFOOT	12/30/2009	CESIUM-137	118.00	±	123.00	436.60	±	455.10	
		STRONTIUM-90	-25.30	±	11.90	-93.61	±	44.03	
CRATERS	12/30/2009	CESIUM-137	-539.00	±	137.00	-1994.30	±	506.90	
DUBOIS	12/30/2009	CESIUM-137	-538.00	±	143.00	-1990.60	±	529.10	
IDAHO FALLS	12/30/2009	AMERICIUM-241	0.00	±	0.00	0.00	±	0.00	
		CESIUM-137	63.40	±	149.00	234.58	±	551.30	
		PLUTONIUM-238	1.89	±	1.50	6.99	±	5.55	
		PLUTONIUM-239/40	0.47	±	0.82	1.75	±	3.03	
JACKSON	12/30/2009	CESIUM-137	-169.00	±	162.00	-625.30	±	599.40	
REXBURG CMS	12/30/2009	CESIUM-137	70.90	±	126.00	262.33	±	466.20	
		STRONTIUM-90	-20.60	±	16.70	-76.22	±	61.79	
INL SITE									
EFS	12/30/2009	CESIUM-137	-131.00	±	155.00	-484.70	±	573.50	
		STRONTIUM-90	-29.40	±	21.00	-108.78	±	77.70	
MAIN GATE	12/30/2009	AMERICIUM-241	0.54	±	0.54	1.99	±	2.00	
		CESIUM-137	-593.00	±	143.00	-2194.10	±	529.10	
		PLUTONIUM-238	1.73	±	1.15	6.40	±	4.26	
		PLUTONIUM-239/40	1.73	±	0.92	6.40	±	3.40	
VAN BUREN GATE	12/30/2009	AMERICIUM-241	2.62	±	1.32	9.69	±	4.88	
		CESIUM-137	39.00	±	142.00	144.30	±	525.40	
		PLUTONIUM-238	0.00	±	0.14	0.00	±	0.50	
		PLUTONIUM-239/40	1.10	±	1.90	4.07	±	7.03	

TABLE C-4. Tritium Concentrations in Atmospheric Moisture.

Sampling Group and Location	Start Date	Sampling Date	Result ± 1s Uncertainty ($\times 10^{-13}$ $\mu Ci/mL_{air}$)			Result ± 1s Uncertainty ($\times 10^{-9}$ Bq/mL_{air})			Collection Medium	Result > 3s
BOUNDARY										
ATOMIC CITY	09/23/2009	10/21/2009	-3.49	±	1.79	-12.90	±	6.62	Molecular Sieve	
ATOMIC CITY	10/21/2009	11/25/2009	0.22	±	1.38	0.83	±	5.12	Molecular Sieve	
DISTANT										
BLACKFOOT	09/30/2009	10/21/2009	7.09	±	2.11	26.23	±	7.81	Molecular Sieve	Y
BLACKFOOT	10/21/2009	11/12/2009	5.21	±	1.75	19.29	±	6.47	Molecular Sieve	
BLACKFOOT	11/12/2009	12/23/2009	3.02	±	1.09	11.17	±	4.05	Molecular Sieve	
IDAHO FALLS	09/22/2009	10/14/2009	-1.37	±	1.83	-5.06	±	6.76	Molecular Sieve	
IDAHO FALLS	10/14/2009	11/05/2009	0.13	±	1.53	0.48	±	5.66	Molecular Sieve	
IDAHO FALLS	11/05/2009	12/09/2009	2.55	±	1.14	9.44	±	4.23	Molecular Sieve	
REXBURG	09/23/2009	10/21/2009	5.81	±	2.26	21.49	±	8.36	Molecular Sieve	
REXBURG	10/21/2009	11/18/2009	1.10	±	2.09	4.06	±	7.75	Molecular Sieve	

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	9/30/2009	11/3/2009	333.00	±	38.20	12.32	±	1.41	Y
	11/3/2009	12/1/2009	91.80	±	34.60	3.40	±	1.28	
CFA	9/1/2009	10/1/2009	34.30	±	32.30	1.27	±	1.20	
	10/1/2009	11/2/2009	-22.20	±	32.90	-0.82	±	1.22	
	11/2/2009	11/30/2009	72.10	±	33.10	2.67	±	1.22	
EFS	9/30/2009	10/7/2009	86.80	±	34.00	3.21	±	1.26	
	10/7/2009	10/14/2009	114.00	±	33.30	4.22	±	1.23	Y
	10/14/2009	10/21/2009	13.60	±	33.50	0.50	±	1.24	
	11/18/2009	11/25/2009	153.00	±	34.70	5.66	±	1.28	Y
	12/16/2009	12/23/2009	155.00	±	35.30	5.74	±	1.31	Y
	12/23/2009	12/30/2009	94.20	±	34.00	3.49	±	1.26	

Table C-6. 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)			Result > 3s	Cesium-137 Result ± 1s Uncertainty (pCi/L)			Cesium-137 Result ± 1s Uncertainty (Bq/L)			Result > 3s
BLACKFOOT															
	10/06/09	-1.37	±	1.81	-0.051	±	0.067		0.07	±	0.92	0.003	±	0.034	
DIETRICH															
	10/06/09	0.74	±	0.84	0.027	±	0.031		0.97	±	0.76	0.036	±	0.028	
	11/03/09	0.38	±	1.47	0.014	±	0.054		0.51	±	1.37	0.019	±	0.051	
	12/01/09	1.14	±	1.73	0.042	±	0.064		-0.22	±	1.42	-0.008	±	0.053	
Duplicate	12/01/09	0.88	±	1.67	0.033	±	0.062		-3.21	±	1.53	-0.119	±	0.057	
HOWE															
	10/06/09	0.81	±	1.22	0.030	±	0.045		-2.15	±	0.90	-0.080	±	0.033	
	11/03/09	-0.13	±	0.90	-0.005	±	0.033		0.58	±	0.75	0.021	±	0.028	
	12/01/09	-0.86	±	0.97	-0.032	±	0.036		0.63	±	0.82	0.023	±	0.030	
IDAHO FALLS															
	10/06/09	-0.47	±	0.89	-0.017	±	0.033		0.71	±	0.76	0.026	±	0.028	
	10/13/09	0.19	±	0.80	0.007	±	0.030		-0.01	±	0.71	0.000	±	0.026	
	10/20/09	1.24	±	0.70	0.046	±	0.026		0.65	±	0.74	0.024	±	0.027	
	10/27/09	0.97	±	1.50	0.036	±	0.056		-1.06	±	1.47	-0.039	±	0.054	
	11/03/09	-0.60	±	0.80	-0.022	±	0.030		1.25	±	0.76	0.046	±	0.028	
	11/10/09	0.44	±	0.84	0.016	±	0.031		-0.42	±	0.76	-0.016	±	0.028	
	11/17/09	-4.82	±	1.66	-0.179	±	0.061		1.83	±	1.34	0.068	±	0.050	
	11/24/09	-1.26	±	1.53	-0.047	±	0.057		-0.66	±	1.38	-0.025	±	0.051	
	12/01/09	0.51	±	0.81	0.019	±	0.030		-0.40	±	0.76	-0.015	±	0.028	
Duplicate	12/01/09	2.36	±	1.10	0.087	±	0.041		-0.41	±	0.91	-0.015	±	0.034	
	12/08/09	-0.79	±	0.84	-0.029	±	0.031		1.86	±	0.78	0.069	±	0.029	
	12/15/09	0.50	±	0.83	0.018	±	0.031		0.67	±	0.77	0.025	±	0.028	
	12/22/09	0.21	±	0.78	0.008	±	0.029		0.45	±	0.77	0.017	±	0.028	
	12/29/09	-1.50	±	0.87	-0.056	±	0.032		0.92	±	0.77	0.034	±	0.029	
RUPERT															
	10/06/09	0.74	±	1.11	0.027	±	0.041		-0.31	±	0.96	-0.012	±	0.035	
	11/03/09	-0.56	±	1.09	-0.021	±	0.040		-1.13	±	0.89	-0.042	±	0.033	
	12/01/09	0.40	±	1.21	0.015	±	0.045		-1.63	±	0.92	-0.060	±	0.034	
TERRETON															
	10/06/09	-0.01	±	1.94	0.000	±	0.072		0.12	±	1.47	0.004	±	0.054	
	11/03/09	-1.23	±	1.69	-0.046	±	0.063		2.11	±	1.22	0.078	±	0.045	
	12/01/09	1.77	±	1.81	0.066	±	0.067		0.32	±	1.38	0.012	±	0.051	

Table C-7. Strontium-90 and Tritium Concentrations in Milk

Strontium-90								
Location	Sampling Date	Result ± 1s Uncertainty (pCi/L)			Result ± 1s Uncertainty (Bq/L)			Result > 3s
DIETRICH	11/03/2009	0.28	±	0.05	0.010	±	0.002	Y
RUPERT	11/03/2009	0.44	±	0.06	0.016	±	0.002	Y
TERRETON	11/03/2009	0.34	±	0.06	0.013	±	0.002	Y
Tritium								
		Concentration ± 1s			Concentration ± 1s			Result > 3s
HOWE	11/03/2009	-65.70	±	31.00	-2.433	±	1.148	
IDAHO FALLS	11/03/2009	34.90	±	31.70	1.293	±	1.174	

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

Location	Sampling Date	Cesium-137 Result ± 1s Uncertainty pCi/kg			Cesium-137 Result ± 1s Uncertainty bq/kg			Result > 3s
AMERICAN FALLS	09/01/09	0.12	±	1.35	0.00	±	0.05	
ARCO	09/30/09	-1.66	±	7.70	-0.06	±	0.29	
BLACKFOOT	08/20/09	0.53	±	1.87	0.02	±	0.07	
CAREY	09/17/09	0.79	±	1.97	0.03	±	0.07	
DIETRICH	10/07/09	-0.51	±	1.24	-0.02	±	0.05	
HOWE	09/10/09	1.57	±	1.28	0.06	±	0.05	
IDAHO FALLS	08/19/09	-3.69	±	1.69	-0.14	±	0.06	
MINIDOKA	09/17/09	3.59	±	1.31	0.13	±	0.05	
MONTEVIEW	08/21/09	-1.83	±	2.38	-0.07	±	0.09	
MUD LAKE	09/10/09	-0.84	±	1.37	-0.03	±	0.05	
TABER	08/20/09	-0.10	±	1.09	0.00	±	0.04	
TERRETON	09/10/09	-0.01	±	1.49	0.00	±	0.06	
TERRETON (DUPLICATE)	09/10/09	2.38	±	1.19	0.09	±	0.04	
		Strontium-90						
		Result ± 1s Uncertainty pCi/kg			**Result ± 1s Uncertainty bq/kg**			**Result > 3s**
AMERICAN FALLS	09/01/09	4.55	±	1.66	0.17	±	0.06	
ARCO	09/30/09	1.87	±	1.05	0.07	±	0.04	
BLACKFOOT	08/20/09	4.56	±	1.55	0.17	±	0.06	
CAREY	09/17/09	7.57	±	1.73	0.28	±	0.06	Y
DIETRICH	10/07/09	2.65	±	1.94	0.10	±	0.07	
HOWE	09/10/09	3.23	±	1.43	0.12	±	0.05	
IDAHO FALLS	08/19/09	16.80	±	1.94	0.62	±	0.07	Y
MINIDOKA	09/17/09	1.71	±	1.42	0.06	±	0.05	
MONTEVIEW	08/21/09	1.19	±	1.35	0.04	±	0.05	
MUD LAKE	09/10/09	3.30	±	1.15	0.12	±	0.04	
TABER	08/20/09	3.54	±	1.91	0.13	±	0.07	
TERRETON	09/10/09	2.66	±	1.05	0.10	±	0.04	
TERRETON (DUPLICATE)	09/10/09	3.78	±	1.19	0.14	±	0.04	Y

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

		Cesium-137						
		Result ± 1s Uncertainty pCi/kg			Result ± 1s Uncertainty bq/kg			
Location	Sampling Date							Result > 3s
BLACKFOOT	10/29/2009	0.73	±	2.83	0.03	±	0.10	
BLACKFOOT NORTH	10/28/2009	-0.07	±	0.51	0.00	±	0.02	
BUTTE CITY	10/21/2009	1.03	±	0.68	0.04	±	0.03	
COLORADO	10/27/2009	-0.58	±	2.54	-0.02	±	0.09	
IF	10/7/2009	0.29	±	0.44	0.01	±	0.02	
MONTEVIEW	10/21/2009	0.53	±	0.51	0.02	±	0.02	
RUPERT	10/6/2009	-0.33	±	0.52	-0.01	±	0.02	
RUPERT (DUPLICATE)	10/6/2009	0.04	±	0.75	0.00	±	0.03	
TERRETON	10/21/2009	-0.27	±	0.45	-0.01	±	0.02	
		Strontium-90						
		Result ± 1s Uncertainty pCi/kg			Result ± 1s Uncertainty bq/kg			
								Result > 3s
BLACKFOOT	10/29/2009	0.73	±	0.57	0.03	±	0.02	
BLACKFOOT NORTH	10/28/2009	0.05	±	0.70	0.00	±	0.03	
BUTTE CITY	10/21/2009	0.22	±	0.47	0.01	±	0.02	
COLORADO	10/27/2009	-0.76	±	0.35	-0.03	±	0.01	
IF	10/7/2009	0.62	±	0.39	0.02	±	0.01	
MONTEVIEW	10/21/2009	0.43	±	0.34	0.02	±	0.01	
RUPERT	10/6/2009	0.25	±	0.41	0.01	±	0.02	
RUPERT (DUPLICATE)	10/6/2009	0.01	±	0.41	0.00	±	0.02	
TERRETON	10/21/2009	0.09	±	0.43	0.00	±	0.02	

Table C-10. Cesium-137 and Iodine-131 Concentrations 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
PRONGHORN	11/23/2009	Muscle	^{131}I	0.06	±	1.15	0.24	±	4.26	
			^{137}Cs	3.54	±	0.99	13.10	±	3.68	Y
PRONGHORN	11/23/2009	Thyroid	^{131}I	-716.00	±	426.00	-2649.20	±	1576.20	
			^{137}Cs	158.00	±	412.00	584.60	±	1524.40	

Table C-11. Gamma-emitting Radionuclides.
Strontium-90 and Actinides in Waterfowl

Location	Sampling		Result ± Uncertainty(1s)			Result ± Uncertainty(1s)			
Species	Date	Analyte	(x 10^{-3}) pCi/g			(x 10^{-5}) Bq/g			Result > 3s
ATR Complex	9/19/2009								
Mallard		AMERICIUM-241	0.11	±	0.17	0.42	±	0.64	
		CESIUM-137	217.00	±	6.62	803.70	±	24.52	Y
		CHROMIUM-51	-215.00	±	152.00	-796.30	±	562.96	
		COBALT-60	21.20	±	2.21	78.52	±	8.19	Y
		PLUTONIUM-238	0.05	±	0.04	0.20	±	0.15	
		PLUTONIUM-239/240	0.04	±	0.04	0.16	±	0.14	
		STRONTIUM-90	3.12	±	1.24	11.56	±	4.59	
		ZINC-65	423.00	±	15.50	1566.67	±	57.41	Y
ATR Complex	9/19/2009								
Mallard		AMERICIUM-241	-0.03	±	0.11	-0.09	±	0.41	
		CESIUM-137	176.00	±	5.93	651.85	±	21.96	Y
		CHROMIUM-51	207.00	±	185.00	766.67	±	685.19	
		COBALT-60	24.50	±	2.28	90.74	±	8.44	Y
		PLUTONIUM-238	-0.10	±	0.06	-0.39	±	0.23	
		PLUTONIUM-239/240	0.06	±	0.05	0.22	±	0.17	
		STRONTIUM-90	26.70	±	1.57	98.89	±	5.81	Y
		ZINC-65	477.00	±	17.30	1766.67	±	64.07	Y
ATR Complex	9/19/2009								
Green-winged		AMERICIUM-241	0.25	±	0.43	0.93	±	1.60	
Teal		CESIUM-137	17.70	±	7.58	65.56	±	28.07	
		CHROMIUM-51	563.00	±	778.00	2085.19	±	2881.48	
		COBALT-60	9.18	±	5.48	34.00	±	20.30	
		PLUTONIUM-238	0.00	±	0.00	0.00	±	0.00	
		PLUTONIUM-239/240	-0.04	±	0.04	-0.14	±	0.14	
		STRONTIUM-90	73.90	±	4.86	273.70	±	18.00	Y
		ZINC-65	-3.75	±	19.50	-13.89	±	72.22	
ATR Complex	9/19/2009								
Green-winged		AMERICIUM-241	0.00	±	0.00	0.00	±	0.00	
Teal		CESIUM-137	9.72	±	8.61	36.00	±	31.89	
		CHROMIUM-51	-102.00	±	699.00	-377.78	±	2588.89	
		COBALT-60	7.15	±	6.37	26.48	±	23.59	
		PLUTONIUM-238	0.17	±	0.08	0.62	±	0.31	
		PLUTONIUM-239/240	0.04	±	0.07	0.15	±	0.27	
		STRONTIUM-90	8.22	±	5.25	30.44	±	19.44	
		ZINC-65	-30.00	±	22.50	-111.11	±	83.33	
MFC	9/19/2009								
Green-winged		AMERICIUM-241	-0.14	±	0.10	-0.53	±	0.37	
Teal		CESIUM-137	187.00	±	10.60	692.59	±	39.26	Y
		CHROMIUM-51	64.50	±	559.00	238.89	±	2070.37	
		COBALT-60	0.81	±	4.91	2.99	±	18.19	
		PLUTONIUM-238	0.06	±	0.15	0.23	±	0.55	
		PLUTONIUM-239/240	0.03	±	0.08	0.12	±	0.31	
		STRONTIUM-90	-1.26	±	4.47	-4.67	±	16.56	
		ZINC-65	-23.30	±	17.70	-86.30	±	65.56	
MFC	9/19/2009								
Green-winged		AMERICIUM-241	0.45	±	0.28	1.66	±	1.02	
Teal		CESIUM-137	193.00	±	11.60	714.81	±	42.96	Y
		CHROMIUM-51	143.00	±	690.00	529.63	±	2555.56	
		COBALT-60	4.94	±	5.63	18.30	±	20.85	
		PLUTONIUM-238	0.12	±	0.21	0.43	±	0.79	
		PLUTONIUM-239/240	0.12	±	0.18	0.43	±	0.67	
		STRONTIUM-90	-2.31	±	4.82	-8.56	±	17.85	
		ZINC-65	2.13	±	20.40	7.89	±	75.56	
MFC	10/3/2009								
Ruddy Duck		AMERICIUM-241	0.54	±	0.23	2.00	±	0.83	
		CESIUM-137	3.75	±	4.02	13.89	±	14.89	
		CHROMIUM-51	-137.00	±	266.00	-507.41	±	985.19	
		COBALT-60	2.49	±	3.23	9.22	±	11.96	
		PLUTONIUM-238	0.08	±	0.17	0.31	±	0.62	
		PLUTONIUM-239/240	0.17	±	0.15	0.62	±	0.54	

Table C-11. Gamma-emitting Radionuclides.
Strontium-90 and Actinides in Waterfowl

		STRONTIUM-90	3.24	±	1.87	12.00	±	6.93
		ZINC-65	0.58	±	11.50	2.13	±	42.59
MFC	10/3/2009							
Ruddy Duck		AMERICIUM-241	0.05	±	0.08	0.18	±	0.28
		CESIUM-137	0.00	±	3.08	0.00	±	11.41
		CHROMIUM-51	61.00	±	203.00	225.93	±	751.85
		COBALT-60	1.78	±	2.44	6.59	±	9.04
		PLUTONIUM-238	0.07	±	0.08	0.25	±	0.29
		PLUTONIUM-239/240	0.02	±	0.06	0.06	±	0.22
		STRONTIUM-90	1.61	±	0.78	5.96	±	2.89
		ZINC-65	-10.60	±	9.22	-39.26	±	34.15
CONTROL	11/13/2009							
Green-winged		AMERICIUM-241	-0.02	±	0.06	-0.08	±	0.22
Teal		CESIUM-137	-0.85	±	4.74	-3.16	±	17.56
		CHROMIUM-51	113.00	±	117.00	418.52	±	433.33
		COBALT-60	-0.09	±	3.66	-0.32	±	13.56
		PLUTONIUM-238	0.12	±	0.11	0.45	±	0.42
		PLUTONIUM-239/240	0.10	±	0.08	0.38	±	0.31
		STRONTIUM-90	1.89	±	0.89	7.00	±	3.30
		ZINC-65	-3.79	±	11.50	-14.04	±	42.59
CONTROL	11/13/2009							
American		AMERICIUM-241	0.47	±	0.24	1.74	±	0.89
Wigeon		CESIUM-137	4.67	±	3.02	17.30	±	11.19
		CHROMIUM-51	85.90	±	117.00	318.15	±	433.33
		COBALT-60	6.64	±	2.33	24.59	±	8.63
		PLUTONIUM-238	-0.01	±	0.04	-0.04	±	0.16
		PLUTONIUM-239/240	0.02	±	0.02	0.08	±	0.08
		STRONTIUM-90	-1.26	±	0.94	-4.67	±	3.46
		ZINC-65	0.92	±	7.68	3.39	±	28.44

Table C-12. Environmental Radiation Results

Location	Start Date	End Date	Radiation Measurement ± 2s Uncertainty mR	Exposure mR/day
BOUNDARY				
ARCO	5/6/2009	11/4/2009	65.0 ± 12.7	0.36
ATOMIC CITY	5/6/2009	11/4/2009	65.2 ± 12.8	0.36
BIRCH CREEK	5/6/2009	11/4/2009	58.6 ± 11.5	0.32
BLUE DOME	5/6/2009	11/4/2009	54.4 ± 10.7	0.30
HOWE	5/6/2009	11/4/2009	58.9 ± 11.5	0.32
MONTEVIEW	5/6/2009	11/4/2009	61.5 ± 12.1	0.34
MUD LAKE	5/6/2009	11/4/2009	70.0 ± 13.7	0.38
			Boundary Average	**0.34**
DISTANT				
ABERDEEN	5/5/2009	11/3/2009	68.4 ± 13.4	0.38
BLACKFOOT	5/6/2009	11/4/2009	65.3 ± 12.8	0.36
BLACKFOOT CMS	5/6/2009	11/4/2009	56.2 ± 11.0	0.31
CRATERS	5/6/2009	11/4/2009	65.3 ± 12.8	0.36
DUBOIS	5/6/2009	11/4/2009	53.5 ± 10.5	0.29
IDAHO FALLS	5/4/2009	11/5/2009	64.2 ± 12.6	0.35
MINIDOKA	5/5/2009	11/3/2009	58.0 ± 11.4	0.32
REXBURG	5/6/2009	11/4/2009	73.6 ± 14.4	0.40
ROBERTS	5/5/2009	11/3/2009	69.0 ± 13.5	0.38
			Distant Average	**0.35**
OUT-OF-STATE				
JACKSON	5/11/2009	11/2/2009	52.5 ± 10.3	0.30

APPENDIX D

STATISTICAL ANALYSIS RESULTS

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

Parameter	P[a]
Gross Alpha	
Quarter	0.55
October	0.26
November	0.57
December	0.49
Gross Beta	
Quarter	0.06
October	0.49
November	0.02
December	0.07

a. A 'p' value greater than 0.05 signifies no statistical difference between data groups.

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	0.67
	October 14	0.13
	October 21	0.25
	October 28	0.58
	November 4	0.15
	November 11	0.48
	November 18	0.78
	November 25	0.39
	December 2	0.71
	December 9	0.57
	December 16	0.00
	December 23	0.29
	December 30	0.52
Gross Beta		
	October 7	0.62
	October 14	0.28
	October 21	0.94
	October 28	0.20
	November 4	0.08
	November 11	0.48
	November 18	0.43
	November 25	0.35
	December 2	0.71
	December 9	0.52
	December 16	0.02
	December 23	0.37
	December 30	0.68

a. A 'p' value greater than 0.05 signifies no statistical difference between data groups.