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Idaho National Engineering and Environmental Laboratory Offsite Environmental Surveillance Program Report: First Quarter 2003

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EXECUTIVE SUMMARY

None of the radionuclides detected in any of the samples collected during the first quarter of 2003 could be directly linked with INEEL activities. Levels of detected radionuclides were no different than values measured at other locations across the United States and/or were consistent with levels measured historically at the INEEL. 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. (See Table E-1.)

This report for the first quarter, 2003, contains results from the Environmental Surveillance, Education and Research (ESER) Program's monitoring of the Department of Energy's Idaho National Engineering and Environmental Laboratory's (INEEL) offsite environment, January 1 through March 31, 2003. All sample media and the sampling schedule followed during 2003 are listed in Appendix A. Specifically, this report contains the results for the following:

- Air sampling, including low-volume air sampling with air filters and charcoal cartridges, collection of atmospheric moisture, and sampling of particulate matter with an aerodynamic diameter less than or equal to 10 micrometers (PM_{10}) (Section 3);
- Precipitation sampling. (Section 4);
- Agricultural product sampling, including collection of milk and large game animals (Section 5);
- Quality assurance program (Section 6).

Results are presented in this report with an analytical uncertainty term, s, where "s" is an estimate of the population standard deviation (σ), assuming a normal (Guassian) distribution. The following guidelines, based on Currie (1984), are used to interpret the analytical results.

- Results greater than 3s are reported as "detected".
- Results less than 2s are reported as "undetected".
- Results between 2-3s are reported as "questionable" (i.e., the radionuclide might have been detected but such detection may not be considered reliable.)

Gross alpha and gross beta measurements are used as general indicators of the presence of radionuclides. Gross alpha and gross beta results were found to have no discernable statistical distribution during the first quarter of 2003. Because of this, these data were statistically analyzed using nonparametric methods, including the use of the median to represent central tendency. Neither quarterly nor monthly statistical analyses of gross alpha and gross beta concentrations during the first quarter showed any concentrations from Boundary locations to be statistically higher than corresponding data sets for Distant locations, as one would expect if the INEEL were a significant source of radionuclide contamination. Gross alpha concentrations were statistically different for the week ending April 2, 2003, with the Distant locations being higher than the Boundary locations. Gross beta concentrations measured at Boundary locations were greater than those measured at Distant locations during the weeks ending January 22, and February 12, 2003. The differences appear to be a function of higher sustained wind speeds and gusts at the boundary locations during these weeks.

During the first quarter, ^{131}I was not detected in any batch of charcoal cartridges.

Selected quarterly composite filter samples were analyzed for gamma emitting radionuclides, strontium-90 (^{90}Sr), plutonium-238 (^{238}Pu), plutonium-239/240 ($^{239/240}$Pu), and americium-241 (^{241}Am). Plutonium-239/240 was detected in one sample collected at Rexburg. The result was within the range of those measured in the past and is likely due to fallout from past nuclear weapons testing. In addition, the result was far less than DOE Derived Concentration Guide (DCG) value.

Ten atmospheric moisture samples were obtained during the first quarter of 2003; two and two duplicates from Blackfoot, two from Rexburg, and two and one duplicate from Idaho Falls, and one from Atomic City. Two sample results, one from Idaho Falls in January and one from Rexburg in March exceeded their respective 3s values. The maximum value of (5.54 ± 1.58) x 10^{-13} μCi/mL_{air} ([2.05 ± 0.58] x 10^{-8} Bq/mL_{air}) is well below the DCG for tritium in air of 1 x 10^{-7} μCi/mL (3.7 x 10^{-3} Bq/mL).

The ESER Program operates three PM_{10} samplers, one each at Rexburg, Blackfoot, and Atomic City. Sampling of PM_{10} is informational as no analyses are conducted for contaminants. PM_{10} concentrations were well below all health standard levels for all samples. The maximum 24-hour concentration was 37.9 µg/m^3 on January 8, 2003, in Rexburg.

Sufficient precipitation occurred to allow collection of two monthly composite samples from Idaho Falls, three monthly composite samples from the Central Facilities Area (CFA) on the INEEL, and eight weekly samples (five samples and three duplicates) from the Experimental Field Station (EFS) on the INEEL. Tritium was detected in seven samples: all three from CFA and four from the EFS. There is no DCG for tritium in precipitation, but in drinking water it is 2.0 x 10^6 pCi/L (74,074 Bq/L). The Safe Drinking Water Act sets a limit of 20,000 pCi/L (740 Bq/L) for tritium. The maximum level of tritium measured in first quarter precipitation samples ([184 ± 54.5] pCi/L or [6.81 ± 2.02] Bq/L) were well below the DCG value and the Safe Drinking Water Act Limit.

Milk samples were collected weekly in Idaho Falls and monthly at eight other locations around the INEEL. All samples were analyzed for gamma emitting radionuclides. Iodine-131 and ^{137}Cs concentrations were not detected in any milk sample.

One large game animal (a mule deer) was sampled during the first quarter of 2003. It was killed as a result of a vehicular collision. Thyroid, liver, and muscle tissue was sampled. Only the naturally occurring radionuclide potassium-40 was measured at concentrations greater than the associated 3s uncertainty values. No human-made radionuclides were detected.

Quality assurance samples submitted for analysis during the first quarter 2003 demonstrate that the results were reasonably complete, accurate, precise, and free of field contamination, as measured by criteria established in the ESER Quality Assurance Project Plan.

Table E-1 Summary of results for the first quarter of 2003.

Media	Sample Type	Analysis	Results
Air	Filters	Gross alpha, Gross beta	Statistical comparisons of all gross alpha and gross beta data collected during the first quarter indicate no differences between INEEL, Boundary, and Distant locations. Weekly statistical differences in gross alpha and gross beta results were observed twice between Boundary and Distant location groups. These differences can be attributed to natural variation in the data and to meteorological conditions (i.e.,temperature inversions). All gross alpha and gross beta results were within historical levels and were far less than applicable DOE DCGs.
		Gamma emitting radionuclides (including ^{137}Cs), select actinides (^{238}Pu, $^{239,240}Pu$, & ^{241}Am) and ^{90}Sr	Plutonium-239/240 was detected in one sample collected from Rexburg CMS. No ^{90}Sr, ^{238}Pu or ^{137}Cs was detected in any quarterly composite sample. The result was well below the DOE DCG and within historical measurements.
	Charcoal Cartridge	Iodine-131	None of the cartridges had measurable ^{131}I.
	PM10	Particulate matter	No regulatory limits were exceeded for atmospheric particulates.
Atmospheric Moisture	Liquid	Tritium	Two of 10 atmospheric moisture samples had tritium detected in them. No sample result exceeded the DCG for tritium in air.
Precipitation	Liquid	Tritium	Seven of 13 samples had measurable concentrations of tritium. All samples were well below regulatory limits for tritium in drinking water which is used for comparison only.
Milk	Liquid	Iodine-131, gamma emitting radionuclides (including ^{137}Cs)	Iodine-131 and ^{137}Cs were not reported above the 3s level in any sample collected during the first quarter of 2003.
Game Animals	Tissue	Iodine-131, gamma emitting radionuclides (including ^{137}Cs)	Iodine-131 and ^{137}Cs were not reported above the 3s level in any sample collected during the first quarter of 2003.

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LIST OF ABBREVIATIONS

AEC	Atomic Energy Commission
ANL-W	Argonne National Laboratory-West
CFA	Central Facilities Area
CMS	community monitoring station
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
INEL	Idaho National Engineering Laboratory
INEEL	Idaho National Engineering and Environmental Laboratory
INTEC	Idaho Nuclear Technology and Engineering Center
ISU	Idaho State University
MDC	minimum detectable concentration
M&O	Management and Operating
NRTS	National Reactor Testing Station
PM	particulate matter
PM_{10}	particulate matter less than 10 micrometers in diameter
SI	Systeme International d'Unites
TLDs	thermoluminescent dosimeters
TRA	Test Reactor Area
UI	University of Idaho
USGS	United States Geological Survey
WSU	Washington State University

LIST OF UNITS

Bq	becquerel
Ci	curie
g	gram
L	liter
μCi	microcurie
mL	milliliter
mR	milliroentgens
mrem	millirem
mSv	millisieverts
pCi	picocurie
R	Roentgen
μSv	microseiverts

1. ESER PROGRAM DESCRIPTION

Operations at the Idaho National Engineering and Environmental Laboratory (INEEL) 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 Clean Water Act). The requirements imposed by DOE are specified in DOE Orders. These requirements include the maintenance of an environmental management system that effectively monitors impacts of DOE activities on and off of DOE facilities (DOE 2003). During calendar year 2003, environmental monitoring within the INEEL boundaries was primarily the responsibility of the INEEL Management and Operating (M&O) contractor, while monitoring outside the INEEL 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 (UI) and Washington State University (WSU) for research, and MWH Global, Inc., and North Wind Environmental, Inc. for technical support. This report contains monitoring results from the ESER Program for samples collected during the first quarter of 2003 (January 1 – March 31, 2003).

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 spatial and temporal trends in radioactivity and radionuclide concentrations within environmental media on and around the INEEL;
- Assess the potential radiation dose to members of the public from INEEL effluents, and;
- 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 INEEL;
- moisture in air at four locations around the INEEL;
- precipitation at three locations on and around the INEEL;
- surface water at five locations on the Snake River;
- drinking water at 14 locations around the INEEL;
- agricultural products, including milk at 10 dairies around the INEEL, potatoes from at least five local producers, wheat from approximately 10 local producers, lettuce from approximately nine home-owned gardens around the INEEL, and sheep from two operators which graze their sheep on the INEEL;
- soil from 13 locations around the INEEL biennially;
- environmental dosimeters from 16 locations semi-annually; and

- various numbers of wildlife including big game (pronghorn, mule deer, and elk), waterfowl, doves, and marmots sampled on and near the INEEL. Fish are also sampled as available (i.e., when there is flow in the Big Lost River).

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 Idaho State University (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 Severn-Trent, Inc.

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 INEEL 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 the Environmental Radiation Ambient Monitoring System (ERAMS) network (EPA 2002). 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 is comprised of a nationwide network of sampling stations that provide air, precipitation, surface water, drinking water, and milk samples. The ESER Program currently operates a high-volume air sampler and precipitation sampling equipment in Idaho Falls for this national program and routinely sends samples to EPA's Eastern Environmental Radiation Facility for analyses. The ERAMS data collected at Idaho Falls are not reported by the ESER Program but are available through the EPA ERAMS website (http://www.epa.gov/enviro/html/erams/).

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 INEEL Annual Site Environmental Report for each calendar year. Annual reports also include data collected by other INEEL 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 INEEL releases, meteorological data, and worldwide events that might conceivably have an effect on the INEEL environment. First, field collection and laboratory information are reviewed to determine identifiable errors that would invalidate or limit use of the data. Examples of these 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 an estimated sample standard deviation (σ), assuming a Guassian 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 detected 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 (USGS 2000), 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 USGS (2000).

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.

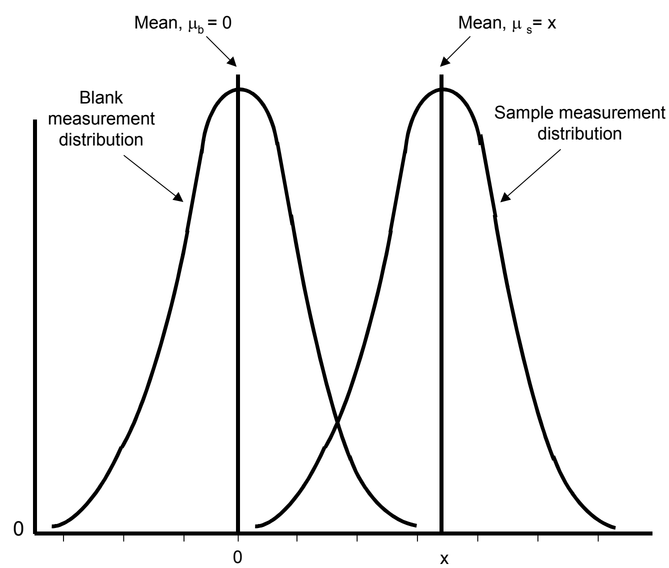

Figure 1. Example overlap of blank and sample measurement distributions.

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 estimation 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 usually 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. A more detailed discussion about confidence in detections may be found in Confidence in Detections under Helpful Information.

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 INEEL

The INEEL is a nuclear energy 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. The history of the INEEL 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 evolved into an assembly of 52 reactors, associated research centers, and waste handling areas. The NRTS was renamed the Idaho National Engineering Laboratory (INEL) in 1974 and the INEEL in January 1997. With renewed interest in nuclear power the DOE announced in 2002 that Argonne National Laboratory and the INEEL will be the lead laboratories for development of the next generation of power reactors. Other activities at the INEEL include environmental cleanup, subsurface research, and technology development.

3. AIR SAMPLING

The primary pathway by which radionuclides can move off the INEEL is through the air and for this reason the air pathway is the primary focus of monitoring on and around the INEEL. Samples for particulates and iodine-131 (^{131}I) gas in air were collected weekly at 16 locations using low-volume air samplers for the duration of the quarter. Moisture in the atmosphere was sampled at four locations around the INEEL and analyzed for tritium. Concentrations of airborne particulates less than 10 micrometers in diameter (PM_{10}) were measured for comparison with EPA standards at three locations. Air sampling activities and results for the first quarter, 2003 are discussed below. A summary of approximate minimum detectable concentrations (MDCs) for radiological analyses and DOE Derived Concentration Guide (DCG) values (DOE 1993) 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 first quarter of 2003 (Figure 2). Three of these samplers are located on the INEEL, nine (7 samplers plus two replicates) are situated off the INEEL near the boundary, and six have been placed at locations distant to the INEEL. Samplers are divided into INEEL, Boundary, and Distant groups to determine if there is a gradient of radionuclide concentrations, increasing towards the INEEL. Each replicate sampler is relocated every year to a new location. One replicate sampler was placed at Blackfoot (Distant location) and one at Mud Lake (Boundary location) during 2003. An average volume of 16,877 ft^3 (478 m^3) of air was sampled at each location, each week, at an average flow rate of approximately1.3 ft^3/min (0.04 m^3/min). Particulates in air were collected on glass fiber particulate filters (1.2-μm pore size). Gases passing through the filter were collected with an activated charcoal cartridge.

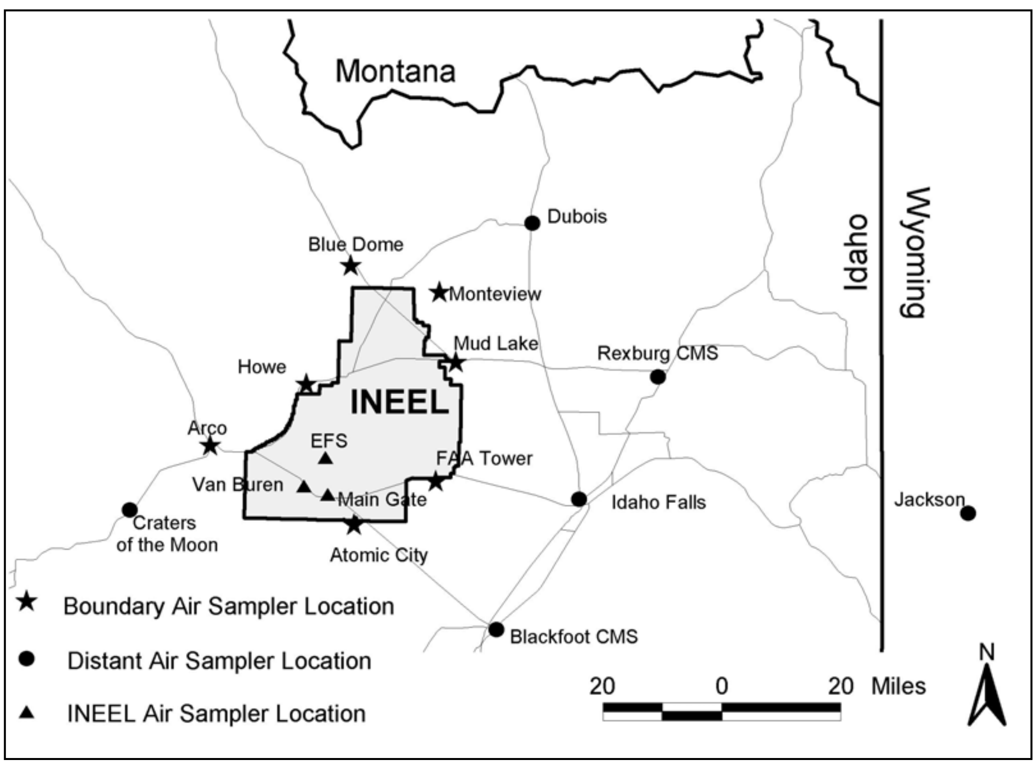

Figure 2. Low-volume air sampler locations.

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. More information concerning gross alpha and beta radioactivity can be found in Gross versus Specific Analyses under Helpful Information.

The weekly particulate filters collected during the quarter for each location were composited and analyzed for gamma-emitting radionuclides. Composites were also analyzed by location for ^{90}Sr, or ^{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 INEEL, Boundary, and Distant locations for the first quarter of 2003 are shown in Figure 3. The data were tested for normality prior to statistical analyses. For the most part the data showed no 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 value, 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 first quarter indicates that the outliers and extreme values were not due to mistakes in collection, analysis, or reporting procedures, but rather reflect natural variability in the measurements. The outlier values shown in Figure 3 lie within the range of measurements made within the past five years. Thus, rather than dismissing the outliers, they were included in the subsequent statistical analyses. Further discussion of box plots may be found in Determining Statistical Differences under Helpful Information.

Figure 3 graphically shows that the gross alpha measurements made at INEEL, Boundary, and Distant locations are similar for the first quarter. If the INEEL was a significant source of offsite contamination, concentrations of contaminants should be statistically greater at Boundary locations than at Distant locations. 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 INEEL, Boundary, and Distant locations. The use of nonparametric tests, such as Kruskal-Wallis, gives less weight to outliers 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. There were no statistical differences in gross alpha concentrations between groups for the first quarter.

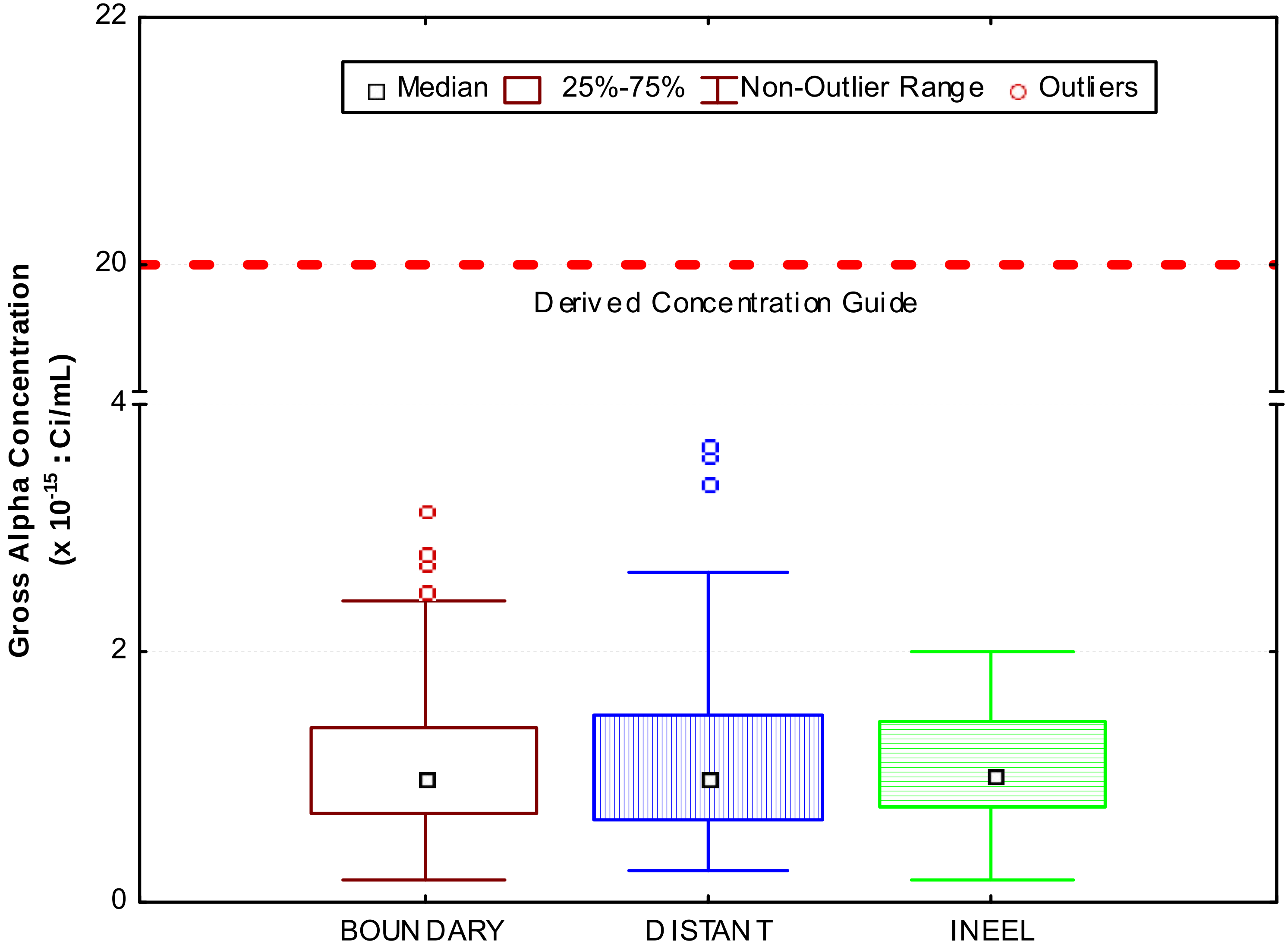

Figure 3. **Gross alpha concentrations in air at ESER Program Boundary, Distant, and INEEL sample group locations for the first quarter of 2003.**

Comparisons of gross alpha concentrations were made for each month of the quarter (Figures 4 – 6). The Kruskal-Wallis test of multiple independent groups was used to determine if statistical differences exist between INEEL, Boundary, and Distant data groups. There were no statistical differences in gross alpha between groups for any month (Table D-1).

As a further 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. INEEL sample results were not included in this analysis because the onsite data, collected at only three locations, are not representative of the entire INEEL and would not aid in determining offsite impacts. The gross alpha concentrations measured at Distant locations were statistically greater than those measured at Boundary locations for only the week ending April 2, 2003 (Table D-2). In general, this appeared to be a function of filter loading (i.e., there tended to be higher concentrations of particulate matter on filters collected at distant locations). More detail on the statistical tests used can be found in Determining Statistical Differences under Helpful Information.

Gross beta results are presented in Table C-1. Gross beta concentrations in air for Boundary, Distant, and INEEL locations for the first quarter of 2003 are shown in Figure 7. The data showed no discernable distribution. 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. As in the case of alpha activity, the quarterly data for each group appear to be similar and were determined using the Kruskal-Wallace test to be statistically the same (Figure 6 and 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. There was no statistical difference, using the Kruskal-Wallace test, between monthly median gross beta concentrations of the different groups for any month during the quarter.

Comparison of weekly Boundary and Distant data sets, using the Mann Whitney U test, indicated a statistical difference between the two location groups for the weeks ending January 22, and February 12, 2003 (Table D-2). The Boundary group was statistically greater than the Distant group for both weeks. The results were all well within historical measurements made at the INEEL for all locations. They are also within recent historical measurements made by EPA in EPA Region 10 (Alaska, Idaho, Oregon, and Washington). The EPA's ERAMS program collects air samples from across the United States. From 1996 through 2002, tritium measured in Region 10 samples ranged from $(0.06 \pm .01) \times 10^{-14}$ to $(10.7 \pm .08) \times 10^{-14}$ pCi/mL (from $[0.2 \pm 0.7] \times 10^{-10}$ to $[39.6 \pm 2.8] \times 10^{-10}$ Bq/mL) (EPA 2004). The INEEL results thus do not implicate any release from the INEEL.

Iodine-131 was not detected (at a level greater than the associated 3s value) in any batch of charcoal cartridges. Each batch contained eight charcoal cartridges. Weekly ^{131}I results for each location are listed in Table C-2 of Appendix C.

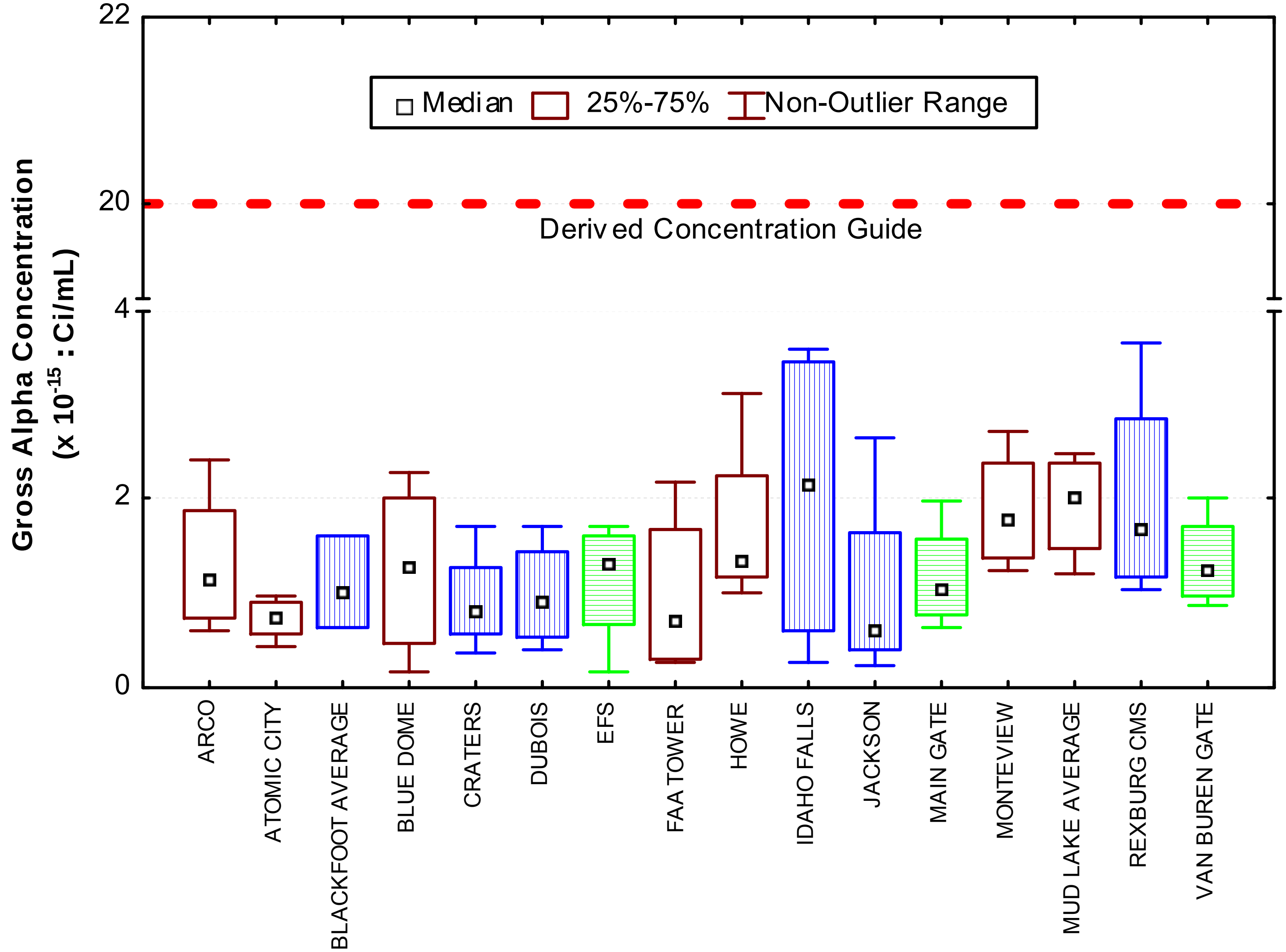

Figure 4. **January gross alpha concentrations in air at ESER Program stations**. Stations belonging to INEEL, Boundary, or Distant locations are represented by boxes that are patterned with vertical green stripes, no fill, or horizontal blue stripes, respectively. [Number of samples (N) = 4 for each location except for Blackfoot CMS and Blackfoot Q/A-1, where N = 3.]

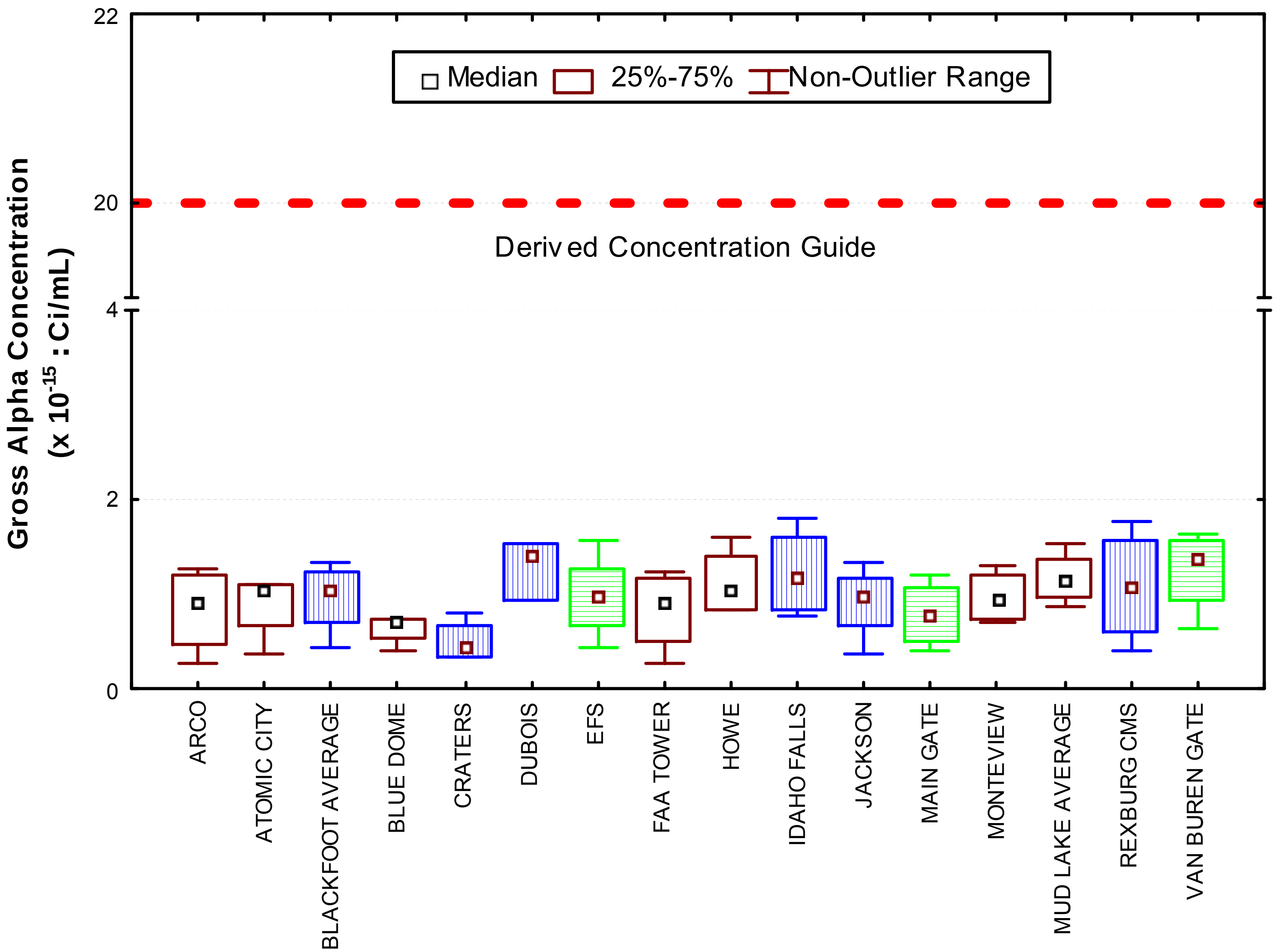

Figure 5. **February gross alpha concentrations in air at ESER Program INEEL, Boundary, and Distant locations.** Stations belonging to INEEL, Boundary, or Distant locations are represented by boxes that are patterned with vertical green stripes, no fill, or horizontal blue stripes, respectively. [Number of samples (N) = 4 at each location, except Dubois where N = 3.]

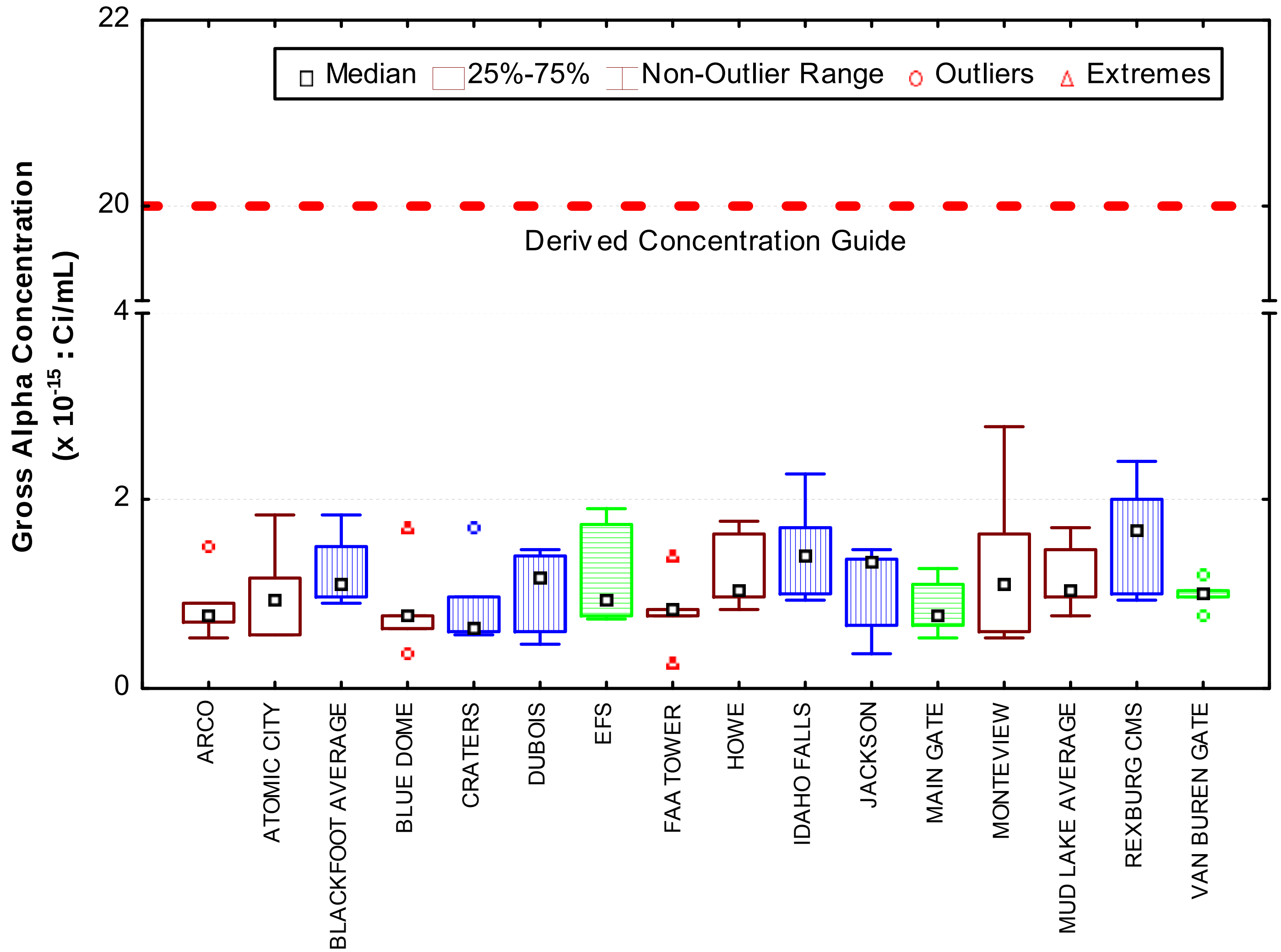

Figure 6. March gross alpha concentrations in air at ESER Program INEEL, Boundary, and Distant locations. Stations belonging to INEEL, Boundary, or Distant locations are represented by boxes that are patterned with vertical green stripes, no fill, or horizontal blue stripes, respectively. [Number of samples (N) = 5 at each location except for Blackfoot Q/A-1, where N=4.]

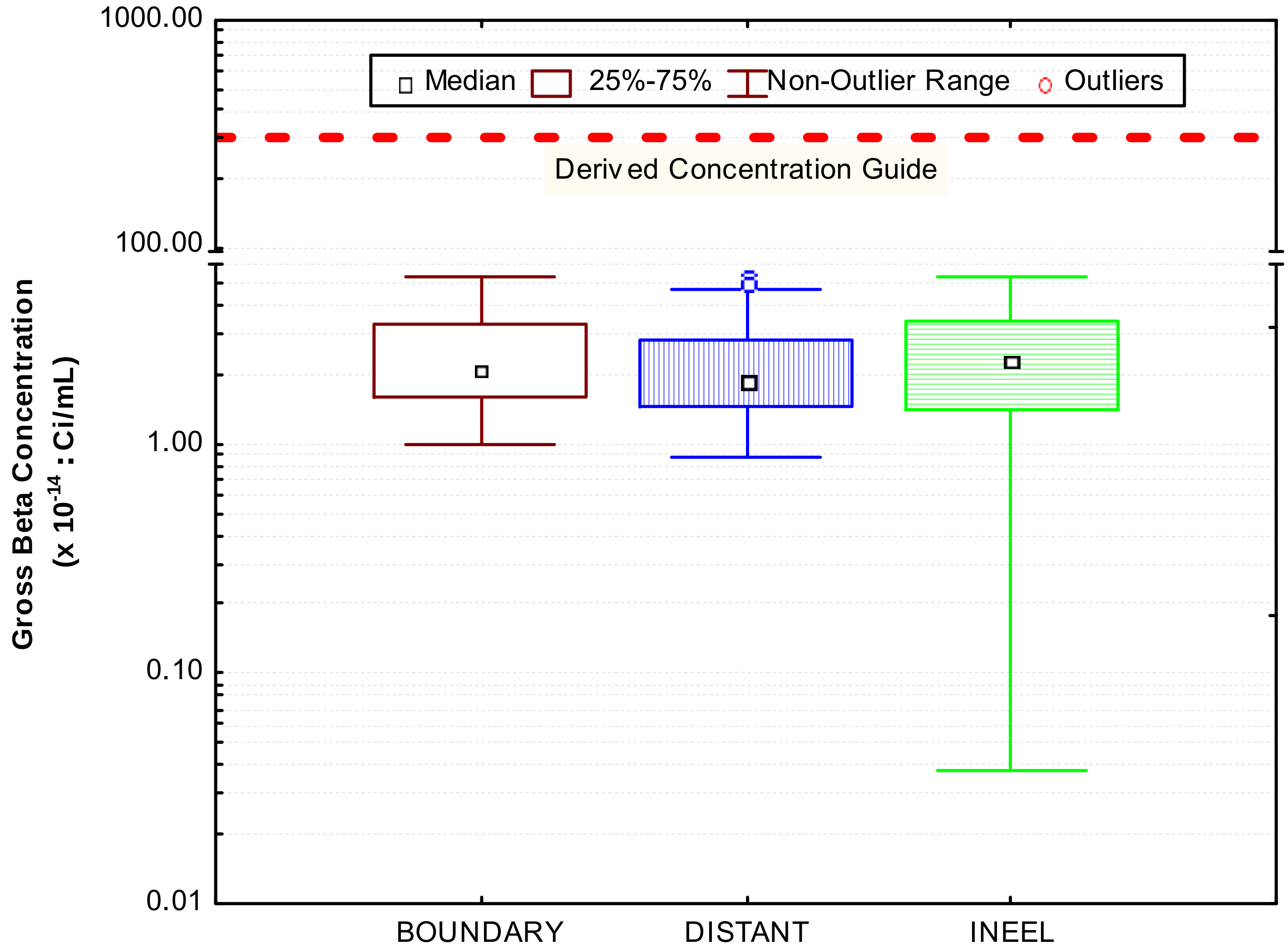

Figure 7. **Gross beta concentrations in air at ESER Program Boundary, Distant, and INEEL sample group locations for the first quarter 2003.**

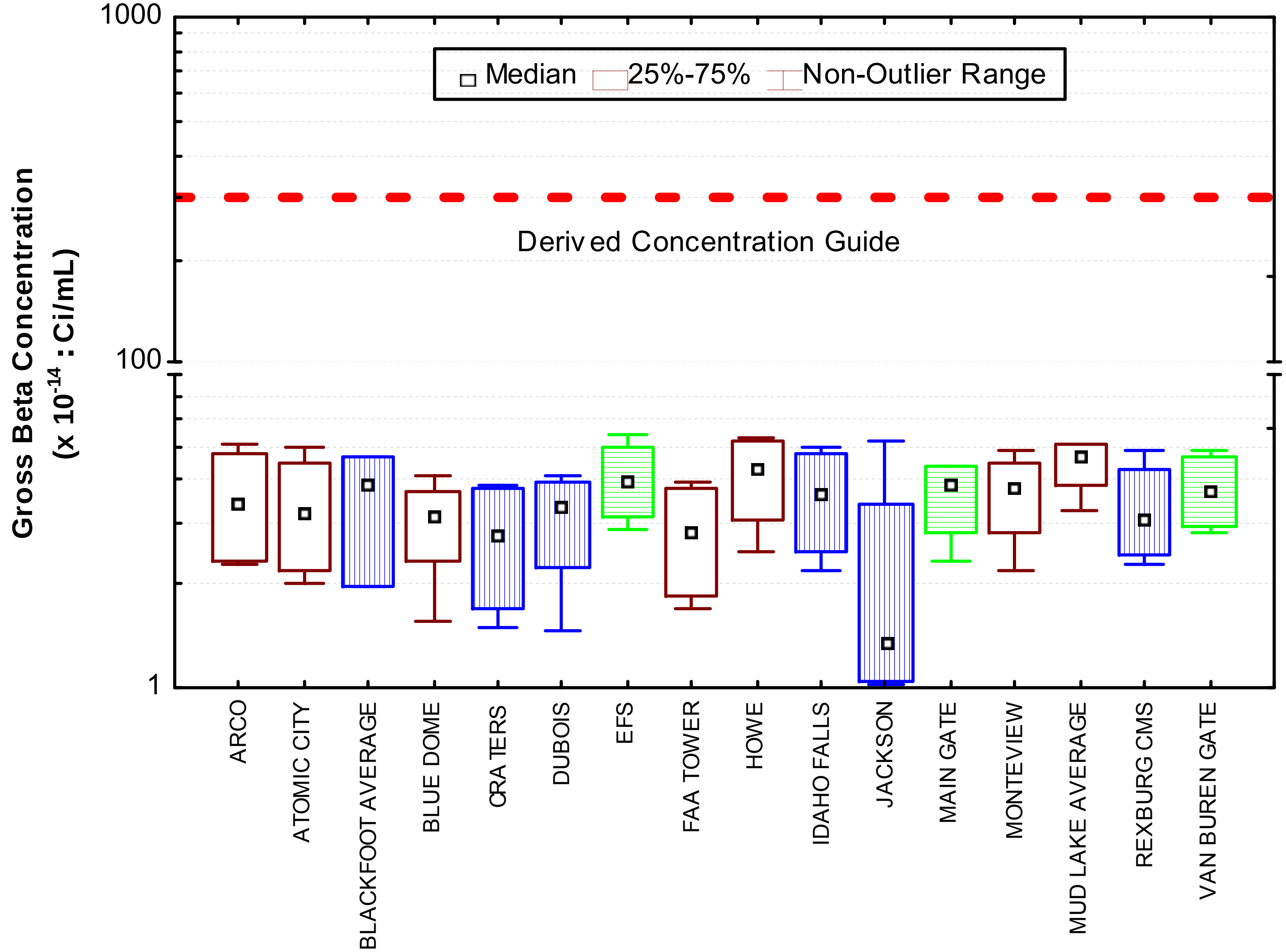

Figure 8. **January gross beta concentrations in air at ESER Program INEEL, Boundary, and Distant locations.** Distant locations are represented by boxes that are patterned with vertical green stripes, no fill, or horizontal blue stripes, respectively. [Number of samples (N) = 5 for each location except for Rexburg CMS, where N = 4.]**)**

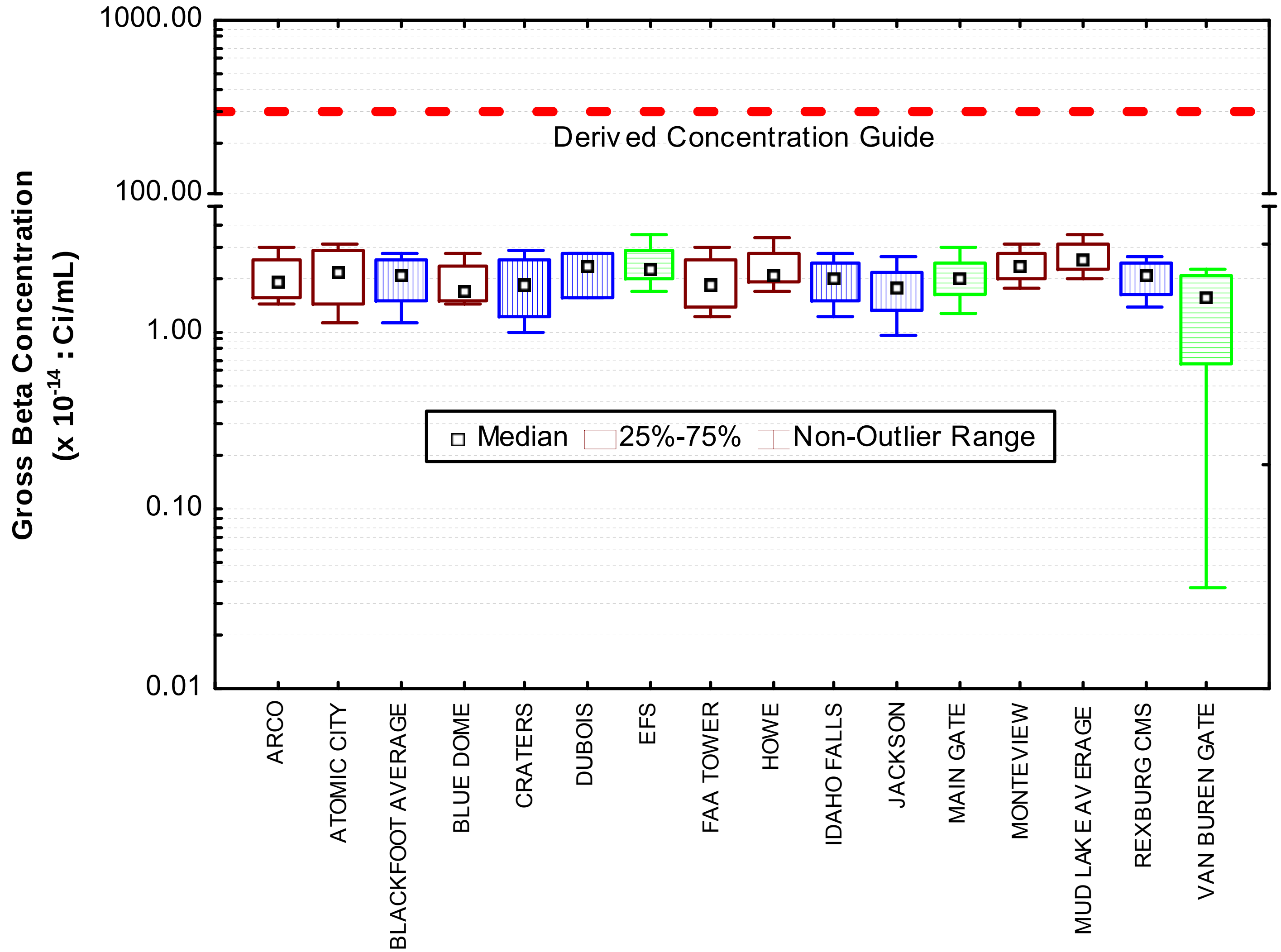

Figure 9. **February gross beta concentrations in air at ESER Program INEEL, Boundary, and Distant locations.** Stations belonging to INEEL, Boundary, or Distant locations are represented by boxes that are patterned with vertical green stripes, no fill, or horizontal blue stripes, respectively. [Number of samples (N) = 4 at each location.]

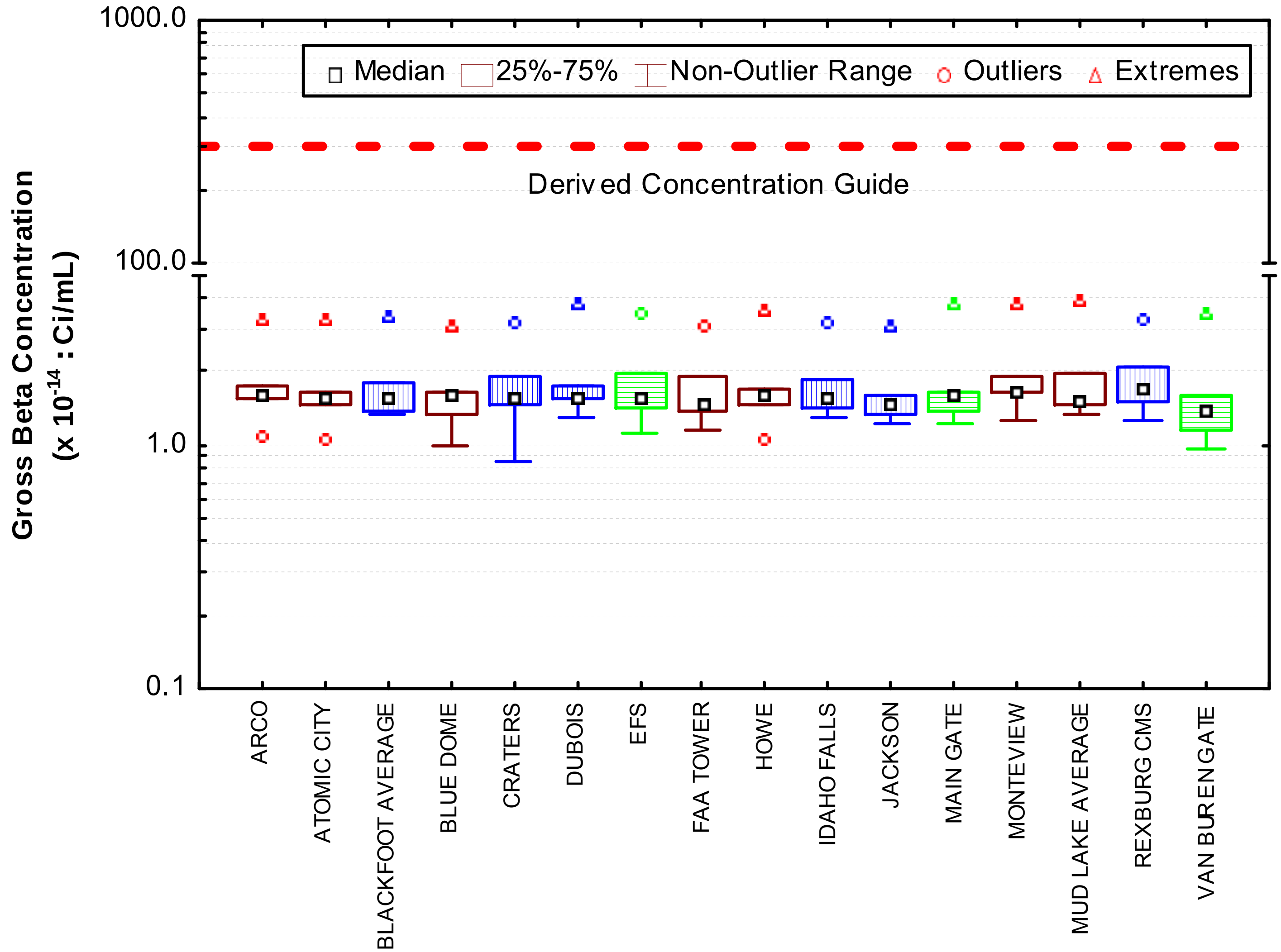

Figure 10. March gross beta concentrations in air at ESER Program INEEL, Boundary, and Distant locations. Stations belonging to INEEL, Boundary, or Distant locations are represented by boxes that are patterned with vertical green stripes, no fill, or horizontal blue stripes, respectively. [Number of samples (N) = 4 at each location except for Blue Dome, where N=2, and Idaho Falls, where N=3.]

Weekly filters for the first quarter of 2003 were composited by location and analyzed for gamma-emitting radionuclides, including ^{137}Cs. Composites were also analyzed for ^{90}Sr, ^{238}Pu, $^{239/240}Pu$, and ^{241}Am. Plutonium-239/240 was detected in one of the quarterly composites, at a concentration of $(8.3 \pm 1.8) \times 10^{-18}$ μCi/mL ([3.1 ± 0.7] x 10^{-13} Bq/mL) collected at Rexburg CMS. Strontium-90, cesium-137, and ^{238}Pu were not detected in any sample. Occasional detection of human-made radionuclides is not unusual and represents natural variations in concentrations of radionuclides introduced by historical nuclear weapons testing. The $^{239/240}$ Pu concentration measured during this quarter is consistent with those recorded in the past and is far less than the DCG (2 x 10^{-14} μCI/mL). All results for composite filter samples are shown in Table C-3, Appendix C.

ATMOSPHERIC MOISTURE SAMPLING

Seven atmospheric moisture samples and three duplicate samples were obtained during the first quarter of 2003: two samples and two duplicate samples from Blackfoot, two samples and a duplicate sample from Idaho Falls, two samples from Rexburg, and one sample from Atomic City. Atmospheric moisture is collected by pulling air through a column of absorbent material (i.e., silica gel) 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

Two samples, one collected at Idaho Falls in January and one collected at Rexburg in March, exceeded their respective 3s values. All seven sample results were well below the DOE DCG for tritium in air of 1×10^{-7} μCi/mL (3.7×10^{-3} Bq/mL). The maximum value (collected at Rexburg in March) was $(5.5 \pm 1.6) \times 10^{-13}$ μCi/mL of air ([2.1 ± 0.6] $\times 10^{-8}$ Bq/mL of air). (Table C-4, Appendix C)

PM_{10} AIR SAMPLING

The EPA began using a standard for concentrations of airborne particulate matter (PM) less than 10 micrometers in diameter (PM_{10}) in 1987 (40 CFR 50.6, 1996). Particles of this size can be inhaled deep into the lungs and are considered to be responsible for most of the adverse health effects associated with airborne particulate pollution. The air quality standards for these particulates are an annual average of 50 μg/m^3, with a maximum 24-hour concentration of 150 μg/m^3.

The ESER Program operates three PM_{10} samplers, one each at the Rexburg CMS and Blackfoot CMS, and one in Atomic City. Sampling of PM_{10} is informational only as no chemical analyses are conducted for contaminants. A twenty-four hour sampling period is scheduled to run once every six days. Measurement problems nullified only two of samples from Atomic City during the quarter. The maximum 24-hour concentration was 37.9 μg/m^3 on January 8, 2003, at Rexburg. The average, maximum, and minimum results of the 24-hour samples are summarized in Table 1. None of the results exceeds the maximum 24-hour air quality standard established by EPA. Results for all PM_{10} samples are listed in Table C-5, Appendix C. Appendix C.

Table 1. Summary of 24-hour PM_{10} values.

	Concentration[a]		
Location	**Minimum**	**Maximum**	**Average**
Atomic City	0.0[b]	6.9	1.7
Blackfoot, CMS	1.3	13.1	5.6
Rexburg, CMS	0.4	37.9	10.8

a. All concentrations are in (mg/m^3).
b. Result less than 0.

4. WATER SAMPLING

The ESER program samples precipitation, surface water, and drinking water. Monthly composite precipitation samples are collected from Idaho Falls and the Central Facilities Area (CFA) on the INEEL. Weekly precipitation samples are collected from the Experimental Field Station (EFS) on the INEEL. Surface and/or drinking water are sampled twice each year at 19 locations around the INEEL. This occurs during the second and fourth quarters and is therefore not reported here. 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.

PRECIPITATION SAMPLING

Precipitation samples are gathered when sufficient precipitation occurs to allow for the collection of the minimum sample volume of approximately 20 mL. Samples are taken of a monthly composite from Idaho Falls and CFA, and weekly from the EFS. Precipitation samples are analyzed for tritium. Storm events in the first quarter of 2003 produced enough precipitation for a total of 13 samples – two from Idaho Falls, three from CFA, and five and three duplicates from the EFS.

Tritium was measured above the sample's 3s value in seven samples: the three from CFA and four from the EFS collected in February and March. While there is no regulatory limit for tritium in precipitation, the DOE DCG and maximum contaminant level set by EPA for tritium in drinking water can be used as a measure. The highest tritium concentration, 184.0 ± 109.0 pCi/L (3.5 ± 2.3 Bq/L), was measured in a sample collected from the EFS on March 19. This value is many times lower than the DCG value (2×10^6 pCi/L) and the Safe Drinking Water Act limit (20,000 pCi/L) for tritium in drinking water.

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. Tritium measured in first quarter ESER samples were within the range of values measured elsewhere. The EPA's ERAMS program collects precipitation samples from across the United States. From 1996 through 2002, tritium measured in Region 10 (Alaska, Idaho, Oregon, and Washington) samples ranged from 0 to 1953 ± 71pCi/L (72.53 ± 2.63 Bq/L) (EPA 2004). Data for all first quarter 2003 precipitation samples collected by the ESER Program are listed in Table C-6 (Appendix C).

5. AGRICULTURAL PRODUCTS AND WILDLIFE 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 INEEL and Southeast Idaho. Specifically, milk, wheat, potatoes, garden lettuce, sheep, big game, waterfowl, and marmots are sampled. Milk is sampled throughout the year. Sheep are sampled during the second quarter. Lettuce and wheat are sampled during the third quarter, while potatoes and waterfowl are collected during the 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 sampled during the first quarter of 2003. A summary of approximate minimum detectable concentrations (MDCs) for radiological analyses is provided in Appendix B. There no regulatory standards for radionuclide concentrations in agricultural products and wildlife tissues.

MILK SAMPLING

Milk samples were collected weekly in Idaho Falls and monthly at eight other locations around the INEEL (Figure 11) during the first quarter of 2003. All samples were analyzed for gamma emitting radionuclides. Samples are analyzed for ^{90}Sr during the second and fourth quarters. Data for ^{131}I and ^{137}Cs in milk samples are listed in Table C-7. Neither ^{131}I nor ^{137}Cs was detected (at a level greater than its 3s uncertainty) in any milk sample during this quarter. ESER Program milk sampling locations.

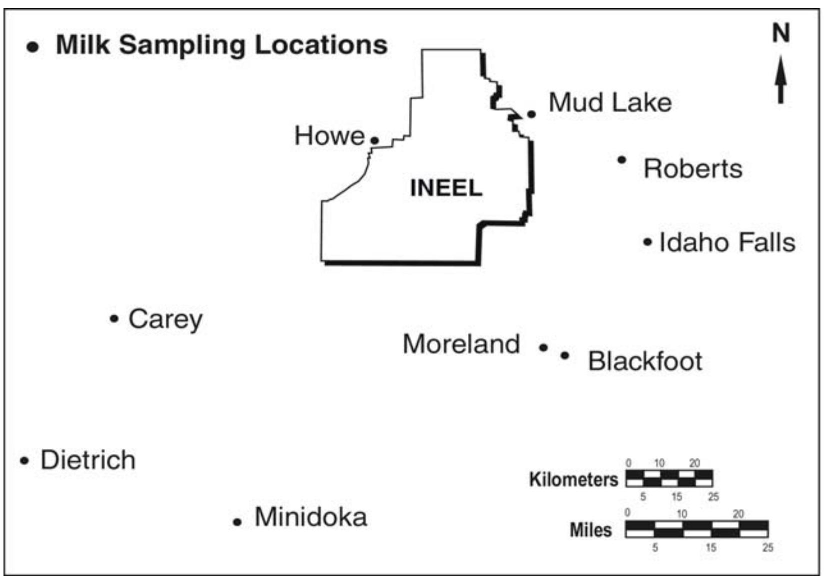

Figure 11. Milk sampling locations.

LARGE GAME ANIMAL SAMPLING

One game animal, a mule deer, was sampled during the first quarter of 2003. The deer was killed as a result of vehicular collision. Samples of thyroid, liver, and muscle tissue were collected. Cesium-137 and ^{131}I data for big game samples are listed in Appendix C, Table C-8. Each sample collected was analyzed for gamma-emitting radionuclides. Liver and muscle tissue of this animal had detectable concentrations of naturally occurring potassium-40. No man-made radionuclides were measured in samples from this mule deer.

6. QUALITY ASSURANCE

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

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

The following discussion summarizes the results of the quality assurance program for the period from January 1 to March 31, 2003.

DATA COMPLETENESS

The Quality Assurance Project Plan (QAPP) specifies a 98 percent completeness goal for all regularly scheduled sample types (Stoller 2004). Data completeness was 100 percent during the first quarter for all sample types with the following exceptions: an air filter from Mountain View CMS on January 8 was reported lost and three other samples were invalid due to insufficient volume collected because of equipment failure (Blackfoot QA-1 on January 8, Dubois on February 19, and Blackfoot QA-1 on March 12).

DATA ACCURACY

During the first quarter of 2003, spikes of the following types were submitted for analyses by ESER:

- Air filter composite spike analyzed for gamma-emitting radionuclides by the EAL;
- Charcoal cartridge spike analyzed for ^{131}I by the EAL; and
- Precipitation sample spike analyzed for tritium by the EAL.

The QAPP specifies a required accuracy of ±10 percent for gamma-emitting radionuclides and ^{131}I in air and ± 10 percent for tritium in precipitation. The EAL was within the accuracy criteria for all radionuclides except for chromium-51 and cobalt-60 in LV air filters and for ^{131}I in the charcoal cartridge spike. The gamma-emitting constituents, ^{51}Cr and ^{60}Co, are not typically measured in ambient air and thus do not represent a major concern. However, we will continue to track the issue. The ^{131}I problem was determined by the EAL to be related to how the spike was prepared. The company which prepares the spikes (Analytics) appears to have spiked the wrong side of the charcoal cartridge. When the EAL reversed the cartridge, the result was accurate within the specified criterion.

The EAL also prepares internal laboratory spikes. During the first quarter of 2003, ten analyses were conducted on NIST-traceable standards for gamma-emitting radionuclides. Geometries included low-volume air filter composites and charcoal cartridges. A total of 40 analytical results were generated. All of the results within the ±20 percent range, with the exception of one result for ^{57}Co. However, this result was within the three sigma criterion (see *Data Precision* section). Water samples spiked with NIST tritium standards were well within the ± 20 percent criterion, and in fact were within 5 percent of the known value. In addition, a gross beta water spike received two analyses and both were within about 10 percent of the known value.

Severn-Trent analyzes a laboratory control sample (LCS) with each batch of samples submitted by the ESER. During the first quarter these consisted only of ^{90}Sr and actinides in air. The QAPP specifies accuracies of ± 10 percent for these analyses. All LCS results were within parameters: ^{90}Sr was +7.6 percent, $^{239/240}Pu$ was +0.5 percent, and ^{241}Am was -1.8 percent.

DATA PRECISION

Data precision is measured using duplicate samples, split samples, and recounts. The QAPP specifies that sample results should agree within ±20 percent or 3σ, whichever is greater. For environmental samples at levels that are within the normal range found by the ESER, the 3σ criterion is the one that applies in nearly all cases. Mathematically, the 3σ criterion is expressed as:

$$|X-Y| < 3 \times (\mathrm{sqrt}(\sigma_x^2 + \sigma_y^2)),$$

where:

X is the result of the regular sample

Y is the result of the duplicate sample

σ_x is the uncertainty of the regular sample

σ_y is the uncertainty of the duplicate sample

Another measure of duplicate sample results is the relative percent difference. This value is the difference in the two results divided by the mean of the two results.

Field duplicate samples

Duplicate milk samples were collected during the first quarter and were analyzed for gamma-emitting radionuclides. They were found to be within the 3s criterion for ^{131}I and ^{137}Cs.

Duplicate air samplers are operated at two locations adjacent to regular air samplers. In the first quarter of 2003 these samplers, designated as QA-1 and QA-2, were in operation at Mountain View and Mud Lake, respectively. Particulate filters were analyzed for gross alpha and gross beta activity. All valid QA-1 samples met the 3s criterion for gross alpha during the first quarter. Eight of 11 valid QA-1 samples met the 3s criterion for gross beta activity during the same period. Three did not meet this criterion and had relative percent differences of 25 percent, 30 percent, and 69 percent. Twelve of thirteen valid QA-2 samples met the 3s criterion for gross alpha activity and for gross beta activity during the first quarter. The relative percent difference for the ones that did not meet the criterion was 94 percent for gross alpha and 19 percent for gross beta.

Composite air samples from the two QA samplers were submitted for analysis at the end of the first quarter for gamma spectrometry at the EAL and for ^{90}Sr at Severn-Trent. All results were within the 3s criterion.

A comparison of duplicate results can also show bias in the sampling system. For example, if one set of results is consistently lower or higher than the other one might suspect that this bias was due to a leak in the system or variations in the calibration of the flow meter. Figures 12 through 15 show the ratio of results (QA duplicate sampler/main sampler) over time. A ratio of one means that the results of both samplers are exactly the same. The figure show that the bias is small (<2) and not consistent, indicating that there is no obvious bias in the duplicate sampling systems. The average bias ratios during the first quarter are 1.0, 1.0, 1.2, and 1.0 for Mountain View gross alpha, Mud Lake gross alpha, Mountain View gross beta, and Mud Lake gross beta, respectively.

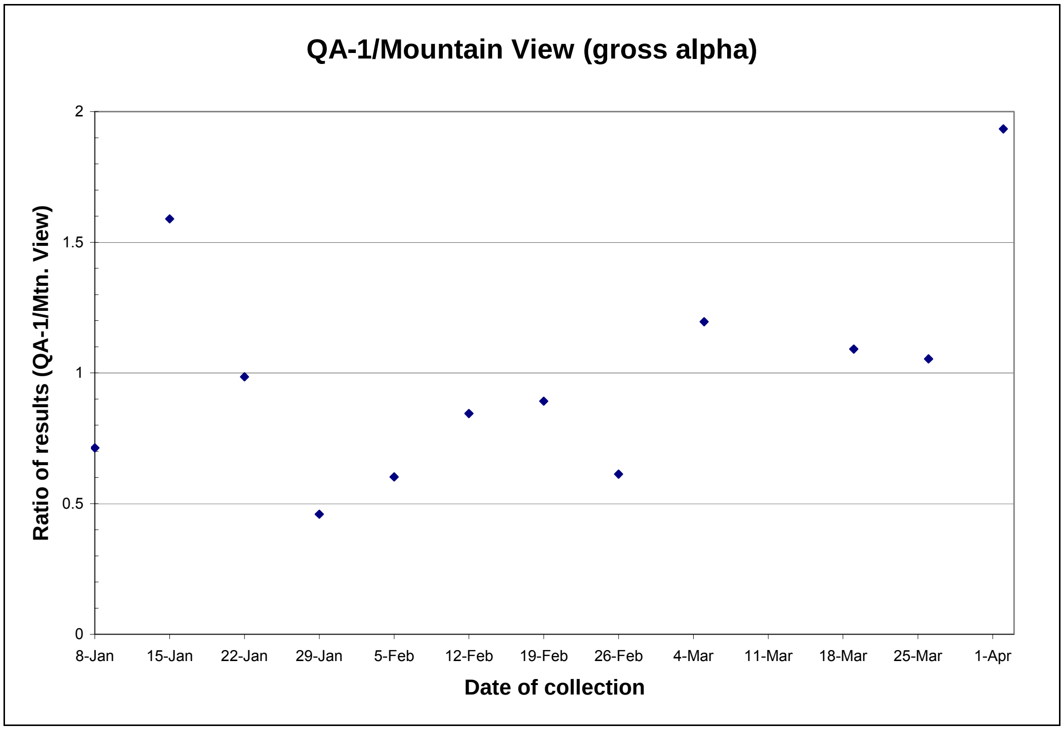

Figure 12. Ratio of QA-1/Mountain View gross alpha activities.

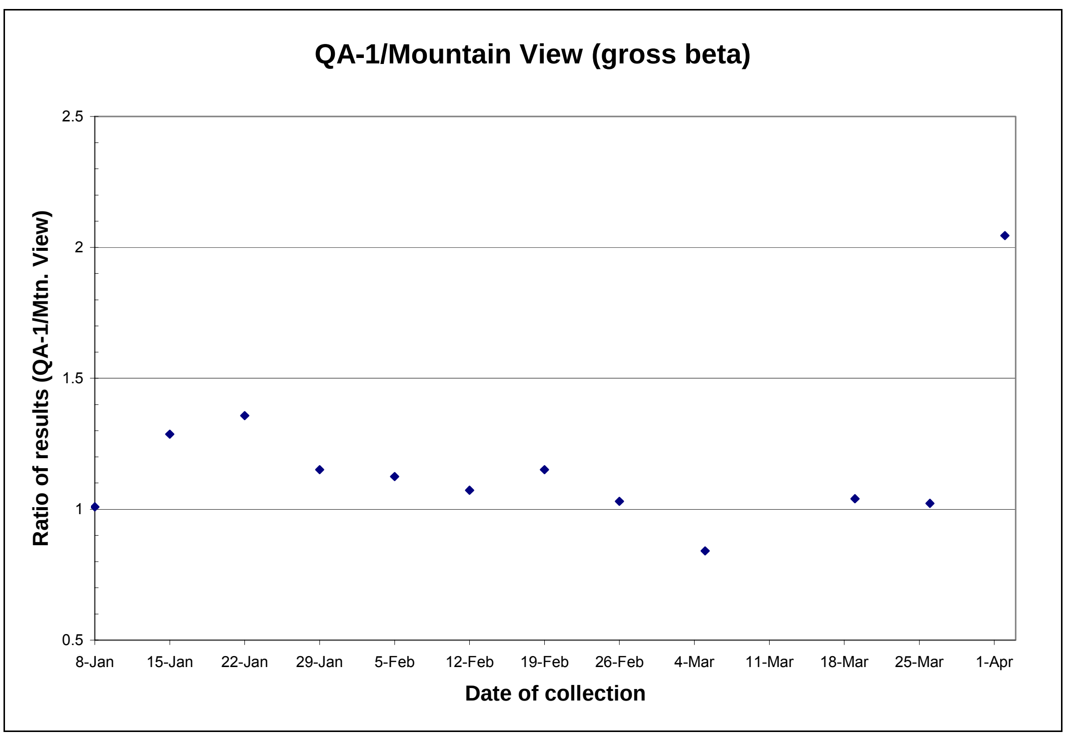

Figure 13. Ratio of QA-1/Mountain View gross beta activities.

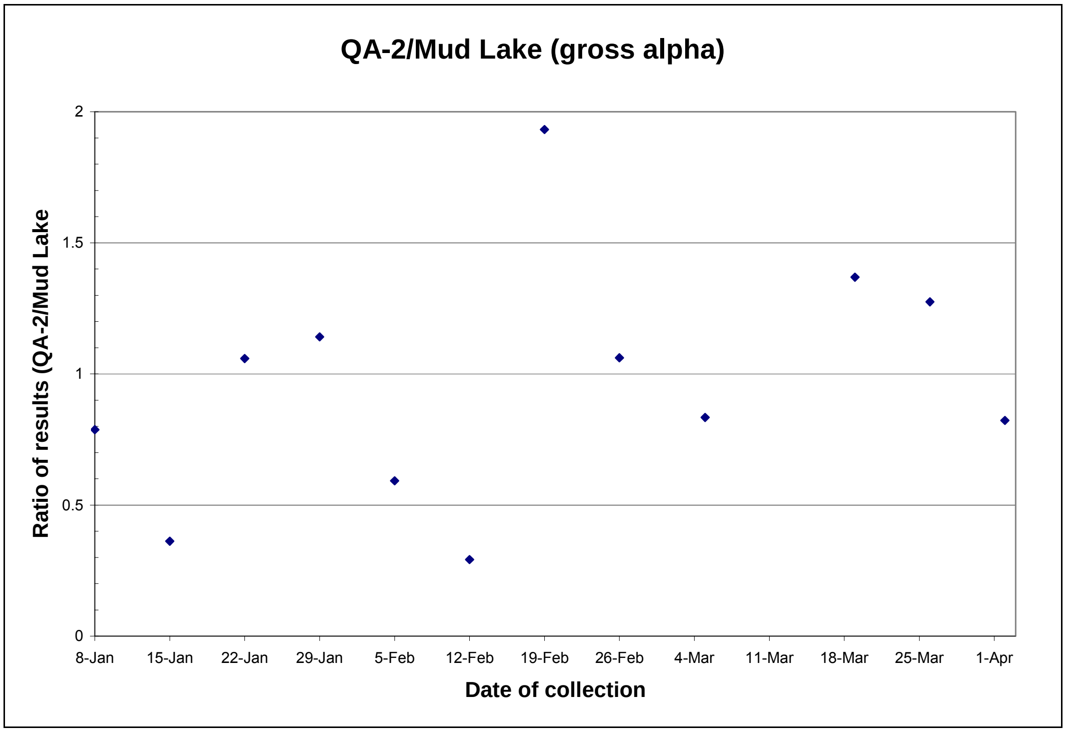

Figure 14. Ratio of QA-2/Mud Lake gross alpha activities.

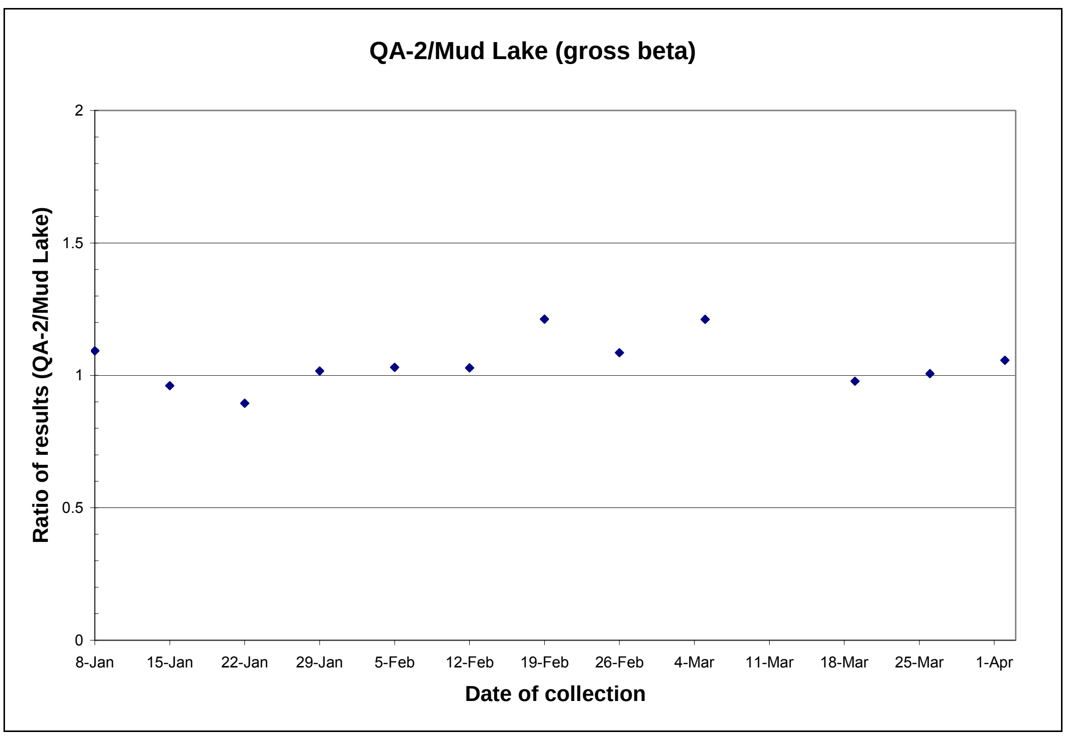

Figure 15. Ratio of QA-2/Mud Lake gross beta activities.

Lab split samples

The EAL splits and analyzes a number of milk, precipitation, and atmospheric moisture samples each quarter. The laboratory tests each result using both the ±20 percent criterion and the 3σ criterion, although it considers the former test meaningless for analyses producing fewer than 15 total counts and questionable even where counts are on the order of 100. The latter criterion is applied in nearly all cases at the levels seen in environmental samples analyzed for the ESER program. Results of the EAL split sample analyses met the criteria for acceptance during the first quarter 2003.

The EAL also recounts a number of samples of each media type. The lab tests each recount using both 20 percent criterion and the 3σ criterion, subject to the limitations described in the previous paragraph. All first quarter 2003 results were within the criteria for acceptance.

BLANKS

The ESER Program submits field blanks along with the regular samples to test for the introduction of contamination during the process of field collection, laboratory preparation, and laboratory analysis. The current program includes the use of two field blanks, designated as Blank A and Blank B, that each accompanies one of the air filter routes. Quarterly composites of the blanks are also submitted. After gamma spectrometry analysis, one of the blanks is analyzed for ^{90}Sr and the other for transuranics.

The QAPP also specifies that one milk sample blank will be submitted per year (although this is now being done monthly).

The QAPP does not specify requirements for blank performance, but ideally the result should be within ±3σ of zero on most analyses. The 2003 blanks submitted for analyses were, for the most part, within this range. One exception of concern is the result of (0.34 ± 0.10) pCi/composite for ^{90}Sr in the quarterly air composite analyzed by Severn-Trent. However, the reagent blank analyzed by the laboratory at the same time had a result of (0.33 ± 0.11) pCi/sample. Therefore, the activity reported for the field blank is not due to contamination, but rather is an artifact of the laboratory analysis. All results were corrected for the activity observed in the reagent blank.

The EAL also analyzes reagent blanks to help determine if the analysis will yield a zero result when no activity is present. Three such blanks were analyzed for tritium in the third quarter. The results were less than the calculated MDCs and less than three standard deviations.

7. REFERENCES

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DOE Order 5400.1, "Radiation Protection of the Public and the Environment," U.S. Department of Energy, January 1993.

40 CFR 50.6, "National Primary and Secondary Ambient Air Quality Standards for Particulate Matter," Code of Federal Regulations, Office of the Federal Register, 1996.

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NRC, 2002, Fact Sheet on The Biological Effects of Radiation, Web page http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/bio-effects-radiation.html. U.S. Nuclear Regulatory Commission, Washington, D.C.

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APPENDIX A

SUMMARY OF SAMPLING MEDIA & SCHEDULE

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

Sample Type Analysis	Collection Frequency	LOCATIONS		
		Distant	Boundary	INEEL
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, Blue Dome, FAA Tower, Howe, Monteview, Mud Lake	Main Gate, EFS, Van Buren
Gamma Spec	quarterly	Blackfoot, Craters of the Moon, Dubois, Idaho Falls, Jackson WY, Rexburg	Arco, Atomic City, Blue Dome, FAA Tower, Howe, Monteview, Mud Lake	Main Gate, EFS, Van Buren
^{90}Sr, Transuranics	quarterly	Rotating schedule	Rotating schedule	Rotating schedule
ATMOSPHERIC MOISTURE				
Tritium	4 to 13 weeks	Blackfoot, Idaho Falls, Rexburg CMS	Atomic City	None
PRECIPITATION				
Tritium	monthly	Idaho Falls	None	CFA
Tritium	weekly	None	None	EFS
PM-10				
Particulate Mass	every 6th day	Rexburg, Blackfoot	Atomic City	None
WATER SAMPLING				
SURFACE WATER				
Gross Alpha, Gross Beta, ^{3}H	semi-annually	Twin Falls, Buhl, Hagerman, Idaho Falls, Bliss	None	None
DRINKING WATER				
Gross Alpha, Gross Beta, ^{3}H	semi-annually	Aberdeen, Carey, Fort Hall, Idaho Falls, Minidoka, Moreland, Roberts, Shoshone	Arco, Atomic City, Howe, Monteview, Mud Lake	None
ENVIRONMENTAL RADIATION SAMPLING				
TLDs				
Gamma Radiation	semi-annually	Aberdeen, Blackfoot, Craters of the Moon, Dubois, Idaho Falls, Jackson WY, Minidoka, Rexburg, Roberts	Arco, Atomic City, Birch Creek, Blue Dome, Howe, Monteview, Mud Lake, Reno Ranch	None

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

Sample Type Analysis	Collection Frequency	LOCATIONS Distant	Boundary	INEEL
SOIL SAMPLING				
SOIL				
Gamma Spec, ^{90}Sr, Transuranics	biennially	Aberdeen, Blackfoot, Carey, St. Anthony	Atomic City, Birch Creek, Butte City, FAA Tower, Howe, Monteview, Mud Lake (2)	None
FOODSTUFF SAMPLING				
MILK				
Gamma Spec (^{131}I)	weekly	Idaho Falls	None	None
Gamma Spec (^{131}I)	monthly	Blackfoot, Carey, Dietrich,	Howe, Terreton	None
Tritium, ^{90}Sr	Semi-annually	Blackfoot, Carey, Dietrich, Idaho Falls, Moreland, Roberts, Rupert	Howe, Terreton	None
POTATOES				
Gamma Spec, ^{90}Sr	annually	Idaho Falls, Rupert, occasional samples across the U.S.	Arco, Howe, Monteview, Mud Lake, Tabor	None
WHEAT				
Gamma Spec, ^{90}Sr	annually	Aberdeen, Carey, Idaho Falls, Menan, Rockford	Arco, Howe, Terreton	None
LETTUCE				
Gamma Spec, ^{90}Sr	annually	Blackfoot, Carey, Idaho Falls	Arco, Atomic City, Howe, Monteview	EFS
BIG GAME				
Gamma Spec	varies	Occasional samples across the U.S.	Occasional samples along roads near the INEEL	INEEL roads
SHEEP				
Gamma Spec	annually	Blackfoot or Dubois	None	N. INEEL, S. INEEL
WATERFOWL				
Gamma Spec, ^{90}Sr, Transuranics	annually	None	Mud Lake	TRA NE Cold Pond, ANL-W waste ponds
MARMOTS				
Gamma Spec, ^{90}Sr, Transuranics	annually	Pocatello zoo, Tie Canyon	None	RWMC

APPENDIX B

SUMMARY OF MDC's, DCG's, AND SDWA LIMITS

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The minimum detectable concentration (MDC) is used to assess measurement process capabilities. The MDC indicates the ability of the laboratory to detect an analyte in a sample at desired concentration levels. The ESER requires that the laboratory be able to detect radionuclides at levels normally expected in environmental samples, as observed historically in the region. These levels are typically well below regulatory limits. The MDC is instrument and analysis specific, and is established by the analytical laboratory at the beginning of each analytical run.

Table B-1. Summary of Approximate Minimum Detectable Concentrations for Radiological Analyses Performed During First Quarter 2003

Sample Type	Analysis	Approximate Minimum Detectable Concentration[a] (MDC)	Derived Concentration Guide[b] (DCG)
Air (particulate filter)[e]	Gross alpha[c]	8.8×10^{-16} µCi/mL	2×10^{-14} µCi/mL
	Gross beta[d]	1.7×10^{-15} µCi/mL	3×10^{-12} µCi/mL
	Specific gamma (^{137}Cs)	1.3×10^{-12} µCi/mL	4×10^{-10} µCi/mL
	^{238}Pu	1.6×10^{-18} µCi/mL	3×10^{-14} µCi/mL
	$^{239/240}$Pu	1.1×10^{-18} µCi/mL	2×10^{-14} µCi/mL
	^{241}Am	1.5×10^{-18} µCi/mL	2×10^{-14} µCi/mL
	^{90}Sr	5.4×10^{-17} µCi/mL	9×10^{-12} µCi/mL
Air (charcoal cartridge)[e]	^{131}I	1.2×10^{-15} µCi/mL	4×10^{-10} µCi/mL
Air (atmospheric moisture)[f]	^{3}H	1.1×10^{-7} µCi/mL	1×10^{-7} µCi/mL
Air (precipitation)	^{3}H	1.1×10^{-7} µCi/mL	2×10^{-3} µCi/mL
Milk	^{131}I	0.5 pCi/L	--
	^{137}Cs	2.9 pCi/L	--
Game Animal Tissue[g]	^{137}Cs	4.3 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 570 m^3/week.

f The approximate MDC is expressed for tritium (as tritiated water) in air, and is based on an average filtered air volume of 39 m^3, assuming an average sampling period of eight weeks.

g The approximate MDC assumes a sample size of 500 g.

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APPENDIX C

SAMPLE ANALYSIS RESULTS

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

Sample Group & Location	Sampling Date	GROSS ALPHA Result ± Uncertainty (1s) ($x10^{-15}$ µCi/mL)			GROSS ALPHA Result ± Uncertainty (1s) ($x10^{-11}$ Bq/mL)			GROSS BETA Result ± Uncertainty (1s) ($x10^{-14}$ µCi/mL)			GROSS BETA Result ± Uncertainty (1s) ($x10^{-10}$ Bq/ml)		
BOUNDARY													
ARCO	1/8/2003	0.6	±	0.4	2.2	±	1.3	2.3	±	0.1	8.5	±	0.4
	1/15/2003	2.4	±	0.5	8.9	±	1.7	4.5	±	0.1	16.5	±	0.5
	1/22/2003	1.4	±	0.3	5.0	±	1.2	5.1	±	0.1	18.7	±	0.5
	1/29/2003	0.9	±	0.3	3.4	±	0.9	2.4	±	0.1	8.8	±	0.3
	2/5/2003	0.7	±	0.3	2.4	±	0.9	1.5	±	0.1	5.4	±	0.3
	2/12/2003	1.3	±	0.3	4.7	±	1.2	3.0	±	0.1	10.9	±	0.4
	2/19/2003	0.3	±	0.4	1.0	±	1.4	1.7	±	0.1	6.3	±	0.4
	2/26/2003	1.1	±	0.3	4.1	±	1.0	2.2	±	0.1	8.0	±	0.3
	3/5/2003	1.5	±	0.3	5.6	±	1.2	3.2	±	0.1	12.0	±	0.4
	3/12/2003	0.7	±	0.2	2.6	±	0.9	1.1	±	0.1	4.0	±	0.2
	3/19/2003	0.5	±	0.3	2.0	±	1.1	1.7	±	0.1	6.4	±	0.4
	3/26/2003	0.9	±	0.3	3.4	±	0.9	1.5	±	0.1	5.7	±	0.3
ATOMIC CITY	1/8/2003	0.8	±	0.3	3.0	±	1.3	2.4	±	0.1	8.7	±	0.3
	1/15/2003	0.7	±	0.3	2.5	±	1.2	4.0	±	0.1	14.7	±	0.4
	1/22/2003	1.0	±	0.3	3.6	±	1.1	5.0	±	0.1	18.4	±	0.5
	1/29/2003	0.4	±	0.2	1.6	±	0.9	2.0	±	0.1	7.4	±	0.3
	2/5/2003	0.4	±	0.2	1.3	±	0.9	1.1	±	0.1	4.2	±	0.3
	2/12/2003	1.1	±	0.3	3.9	±	1.0	3.1	±	0.1	11.4	±	0.4
	2/19/2003	1.0	±	0.4	3.6	±	1.5	1.8	±	0.1	6.5	±	0.4
	2/26/2003	1.1	±	0.3	4.1	±	1.2	2.6	±	0.1	9.4	±	0.4
	3/5/2003	1.9	±	0.3	6.9	±	1.2	3.3	±	0.1	12.0	±	0.4
	3/12/2003	0.6	±	0.3	2.1	±	1.0	1.1	±	0.1	3.9	±	0.3
	3/19/2003	0.9	±	0.4	3.5	±	1.3	1.4	±	0.1	5.3	±	0.4
	3/26/2003	1.2	±	0.3	4.4	±	1.0	1.6	±	0.1	6.0	±	0.3

BLUE DOME	1/8/2003	0.2	±	0.4	0.6	±	1.3	1.6	±	0.1	5.8	±	0.3
	1/15/2003	1.8	±	0.5	6.5	±	1.7	3.2	±	0.1	12.0	±	0.5
	1/22/2003	2.3	±	0.4	8.4	±	1.4	4.1	±	0.1	15.2	±	0.5
	1/29/2003	0.8	±	0.3	2.9	±	1.0	3.1	±	0.1	11.4	±	0.4
	2/5/2003	0.7	±	0.2	2.6	±	0.9	1.5	±	0.1	5.4	±	0.3
	2/12/2003	0.8	±	0.3	2.8	±	0.9	2.8	±	0.1	10.4	±	0.4
	2/19/2003	0.4	±	0.4	1.5	±	1.3	1.6	±	0.1	5.8	±	0.3
	2/26/2003	0.7	±	0.3	2.7	±	1.0	1.9	±	0.1	7.0	±	0.3
	3/5/2003	1.7	±	0.3	6.4	±	1.1	3.1	±	0.1	11.5	±	0.4
	3/12/2003	0.7	±	0.3	2.4	±	0.9	1.0	±	0.1	3.7	±	0.3
	3/19/2003	0.4	±	0.3	1.4	±	1.0	1.6	±	0.1	6.1	±	0.3
	3/26/2003	0.8	±	0.2	2.9	±	0.9	1.6	±	0.1	5.8	±	0.3
FAA TOWER	1/8/2003	0.3	±	0.4	1.1	±	1.4	2.0	±	0.1	7.4	±	0.4
	1/15/2003	2.2	±	0.5	8.1	±	1.8	3.7	±	0.1	13.6	±	0.5
	1/22/2003	1.1	±	0.3	4.2	±	1.3	4.0	±	0.1	14.7	±	0.5
	1/29/2003	0.3	±	0.3	1.0	±	1.0	1.7	±	0.1	6.2	±	0.4
	2/5/2003	0.3	±	0.2	1.0	±	0.9	1.2	±	0.1	4.5	±	0.3
	2/12/2003	0.7	±	0.3	2.7	±	1.1	2.9	±	0.1	10.9	±	0.4
	2/19/2003	1.2	±	0.5	4.6	±	1.8	1.5	±	0.1	5.6	±	0.4
	2/26/2003	1.1	±	0.3	4.0	±	1.3	2.2	±	0.1	8.0	±	0.4
	3/5/2003	1.4	±	0.3	5.2	±	1.2	3.1	±	0.1	11.3	±	0.4
	3/12/2003	0.8	±	0.3	2.9	±	1.1	1.1	±	0.1	4.2	±	0.3
	3/19/2003	0.3	±	0.3	1.0	±	1.1	1.5	±	0.1	5.4	±	0.3
	3/26/2003	0.9	±	0.3	3.1	±	1.1	1.9	±	0.1	7.0	±	0.4
HOWE	1/8/2003	1.4	±	0.5	5.0	±	1.9	2.5	±	0.1	9.2	±	0.4
	1/15/2003	3.1	±	0.5	11.6	±	1.9	5.0	±	0.1	18.6	±	0.5
	1/22/2003	1.3	±	0.3	4.9	±	1.2	5.3	±	0.1	19.8	±	0.5
	1/29/2003	1.0	±	0.3	3.7	±	1.1	3.6	±	0.1	13.4	±	0.4
	2/5/2003	0.9	±	0.3	3.2	±	0.9	1.7	±	0.1	6.3	±	0.3
	2/12/2003	1.6	±	0.3	6.0	±	1.1	3.4	±	0.1	12.4	±	0.4
	2/19/2003	0.8	±	0.4	3.0	±	1.4	2.1	±	0.1	7.7	±	0.4
	2/26/2003	1.2	±	0.3	4.4	±	1.1	2.1	±	0.1	7.6	±	0.3
	3/5/2003	1.8	±	0.3	6.5	±	1.2	3.6	±	0.1	13.1	±	0.4
	3/12/2003	1.1	±	0.3	3.9	±	1.0	1.0	±	0.1	3.8	±	0.2
	3/19/2003	1.0	±	0.3	3.7	±	1.1	1.7	±	0.1	6.3	±	0.3
	3/26/2003	1.6	±	0.3	6.0	±	1.1	1.6	±	0.1	5.9	±	0.3

MONTEVIEW	1/8/2003	1.5	±	0.3	5.6	±	1.3	2.2	±	0.1	8.1	±	0.3
	1/15/2003	2.7	±	0.4	10.0	±	1.6	4.0	±	0.1	14.9	±	0.4
	1/22/2003	2.1	±	0.4	7.6	±	1.5	4.9	±	0.1	18.1	±	0.5
	1/29/2003	1.2	±	0.3	4.6	±	1.2	3.5	±	0.1	12.8	±	0.4
	2/5/2003	0.7	±	0.3	2.6	±	0.9	1.8	±	0.1	6.5	±	0.3
	2/12/2003	0.8	±	0.2	2.9	±	0.9	3.1	±	0.1	11.4	±	0.4
	2/19/2003	1.1	±	0.4	4.1	±	1.4	2.2	±	0.1	8.3	±	0.4
	2/26/2003	1.3	±	0.3	4.8	±	1.1	2.4	±	0.1	8.8	±	0.3
	3/5/2003	2.8	±	0.3	10.4	±	1.3	3.8	±	0.1	13.9	±	0.4
	3/12/2003	1.1	±	0.3	4.1	±	1.0	1.3	±	0.1	4.6	±	0.3
	3/19/2003	0.6	±	0.3	2.0	±	1.0	1.6	±	0.1	6.0	±	0.3
	3/26/2003	1.7	±	0.3	6.1	±	1.1	1.9	±	0.1	7.1	±	0.3
MUD LAKE	1/8/2003	1.9	±	0.5	7.1	±	1.8	3.1	±	0.1	11.6	±	0.4
	1/15/2003	3.7	±	0.6	13.5	±	2.1	5.2	±	0.2	19.1	±	0.6
	1/22/2003	2.2	±	0.4	8.2	±	1.5	5.3	±	0.1	19.7	±	0.5
	1/29/2003	1.1	±	0.3	4.2	±	1.2	4.4	±	0.1	16.1	±	0.5
	2/5/2003	1.3	±	0.3	4.8	±	1.2	2.0	±	0.1	7.3	±	0.4
	2/12/2003	1.9	±	0.4	7.1	±	1.4	3.5	±	0.1	13.1	±	0.4
	2/19/2003	0.6	±	0.4	2.2	±	1.5	2.2	±	0.1	8.0	±	0.4
	2/26/2003	1.5	±	0.3	5.4	±	1.2	2.6	±	0.1	9.5	±	0.4
	3/5/2003	1.9	±	0.3	6.9	±	1.2	3.5	±	0.1	13.1	±	0.4
	3/12/2003	0.7	±	0.3	2.4	±	1.1	1.4	±	0.1	5.0	±	0.3
	3/19/2003	1.3	±	0.3	4.8	±	1.2	1.5	±	0.1	5.6	±	0.3
	3/26/2003	1.1	±	0.3	4.0	±	1.1	1.9	±	0.1	7.1	±	0.4
MUD LAKE (Q/A-2)	1/8/2003	1.5	±	0.5	5.6	±	1.8	3.4	±	0.1	12.7	±	0.5
	1/15/2003	1.3	±	0.5	4.9	±	1.7	5.0	±	0.2	18.3	±	0.6
	1/22/2003	2.4	±	0.4	8.7	±	1.4	4.8	±	0.1	17.6	±	0.5
	1/29/2003	1.3	±	0.3	4.8	±	1.3	4.4	±	0.1	16.4	±	0.5
	2/5/2003	0.8	±	0.3	2.8	±	1.0	2.0	±	0.1	7.5	±	0.3
	2/12/2003	0.6	±	0.3	2.1	±	1.3	3.6	±	0.1	13.4	±	0.5
	2/19/2003	1.1	±	0.4	4.2	±	1.6	2.6	±	0.1	9.7	±	0.4
	2/26/2003	1.6	±	0.4	5.8	±	1.3	2.8	±	0.1	10.3	±	0.4
	3/5/2003	1.6	±	0.3	5.8	±	1.2	4.3	±	0.1	15.9	±	0.5
	3/12/2003	0.9	±	0.3	3.3	±	1.0	1.3	±	0.1	4.9	±	0.3
	3/19/2003	1.7	±	0.3	6.2	±	1.3	1.5	±	0.1	5.6	±	0.3
	3/26/2003	0.9	±	0.3	3.3	±	1.0	2.0	±	0.1	7.5	±	0.3

DISTANT													
BLACKFOOT, CMS[a]	1/15/2003	1.9	±	0.5	7.0	±	1.8	4.6	±	0.2	17.2	±	0.6
	1/22/2003	0.8	±	0.3	2.9	±	1.0	3.4	±	0.1	12.4	±	0.4
	1/29/2003	0.7	±	0.3	2.4	±	1.0	1.7	±	0.1	6.1	±	0.3
	2/5/2003	0.6	±	0.2	2.3	±	0.8	1.1	±	0.1	3.9	±	0.2
	2/12/2003	1.7	±	0.3	6.1	±	1.2	2.6	±	0.1	9.5	±	0.4
	2/19/2003	1.0	±	0.4	3.8	±	1.4	1.8	±	0.1	6.6	±	0.4
	2/26/2003	1.2	±	0.3	4.4	±	1.2	2.1	±	0.1	7.8	±	0.3
	3/5/2003	2.3	±	0.4	8.5	±	1.3	3.3	±	0.1	12.2	±	0.4
	3/12/2003	1.0	±	0.3	3.6	±	1.1	1.3	±	0.1	4.9	±	0.3
	3/19/2003	0.9	±	0.3	3.3	±	1.1	1.5	±	0.1	5.6	±	0.3
	3/26/2003	1.5	±	0.3	5.5	±	1.2	1.8	±	0.1	6.6	±	0.3
BLACKFOOT (Q/A-1)[b]	1/8/2003	0.0	±	0.0	0.0	±	0.0	0.0	±	0.0	0.0	±	0.0
	1/15/2003	1.3	±	0.4	5.0	±	1.5	4.7	±	0.1	17.3	±	0.5
	1/22/2003	1.2	±	0.3	4.6	±	1.1	4.3	±	0.1	15.9	±	0.4
	1/29/2003	0.7	±	0.3	2.4	±	1.0	2.2	±	0.1	8.3	±	0.3
	2/5/2003	0.3	±	0.3	1.0	±	1.0	1.2	±	0.1	4.5	±	0.4
	2/12/2003	1.0	±	0.3	3.7	±	1.1	2.9	±	0.1	10.7	±	0.4
	2/19/2003	0.9	±	0.5	3.2	±	1.9	1.9	±	0.1	7.1	±	0.5
	2/26/2003	1.1	±	0.4	4.0	±	1.4	2.4	±	0.1	9.0	±	0.4
	3/5/2003	1.4	±	0.4	5.2	±	1.3	3.4	±	0.1	12.6	±	0.5
	3/12/2003	1.2	±	1.8	4.3	±	6.5	1.1	±	0.4	4.1	±	1.5
	3/19/2003	1.0	±	0.5	3.6	±	1.7	1.6	±	0.1	5.8	±	0.4
	3/26/2003	1.6	±	0.4	5.8	±	1.3	1.8	±	0.1	6.7	±	0.4
CRATERS OF THE MOON	1/8/2003	0.4	±	0.4	1.4	±	1.5	1.9	±	0.1	6.8	±	0.4
	1/15/2003	0.8	±	0.4	3.1	±	1.6	3.9	±	0.1	14.4	±	0.5
	1/22/2003	1.7	±	0.4	6.3	±	1.4	3.7	±	0.1	13.6	±	0.4
	1/29/2003	0.8	±	0.3	2.9	±	1.2	1.5	±	0.1	5.6	±	0.3
	2/5/2003	0.4	±	0.3	1.3	±	1.0	1.0	±	0.1	3.7	±	0.3
	2/12/2003	0.5	±	0.3	2.0	±	1.2	2.9	±	0.1	10.7	±	0.5
	2/19/2003	0.8	±	0.5	2.9	±	1.9	1.4	±	0.1	5.2	±	0.4
	2/26/2003	0.3	±	0.3	1.3	±	1.2	2.3	±	0.1	8.3	±	0.4
	3/5/2003	1.7	±	0.3	6.4	±	1.3	3.2	±	0.1	11.8	±	0.4
	3/12/2003	0.6	±	0.3	2.1	±	1.1	0.9	±	0.1	3.2	±	0.3
	3/19/2003	0.6	±	0.3	2.3	±	1.2	1.6	±	0.1	5.7	±	0.4
	3/26/2003	1.0	±	0.4	3.6	±	1.3	1.9	±	0.1	7.1	±	0.4

DUBOIS	1/8/2003	0.4	±	0.5	1.5	±	2.0	1.5	±	0.1	5.4	±	0.4
	1/15/2003	1.7	±	0.5	6.3	±	1.7	3.7	±	0.1	13.8	±	0.5
	1/22/2003	1.2	±	0.4	4.4	±	1.6	4.2	±	0.2	15.4	±	0.6
	1/29/2003	0.7	±	0.3	2.4	±	1.1	3.0	±	0.1	11.0	±	0.4
	2/5/2003	0.9	±	0.3	3.4	±	1.0	1.5	±	0.1	5.7	±	0.3
	2/12/2003	1.4	±	0.3	5.2	±	1.1	2.7	±	0.1	10.0	±	0.4
	2/19/2003	2.0	±	1.2	7.4	±	4.4	2.7	±	0.2	9.8	±	0.9
	2/26/2003	1.5	±	0.4	5.6	±	1.5	2.3	±	0.1	8.6	±	0.4
	3/5/2003	1.5	±	0.3	5.5	±	1.3	3.8	±	0.1	13.9	±	0.5
	3/12/2003	0.5	±	0.2	1.8	±	0.9	1.3	±	0.1	4.8	±	0.3
	3/19/2003	0.6	±	0.3	2.3	±	1.2	1.6	±	0.1	5.8	±	0.3
	3/26/2003	1.4	±	0.3	5.2	±	1.2	1.8	±	0.1	6.5	±	0.3
IDAHO FALLS	1/8/2003	0.3	±	0.5	1.0	±	1.9	2.8	±	0.1	10.2	±	0.5
	1/15/2003	3.4	±	0.6	12.4	±	2.2	5.0	±	0.2	18.5	±	0.6
	1/22/2003	3.6	±	0.6	13.2	±	2.1	4.4	±	0.2	16.4	±	0.6
	1/29/2003	1.0	±	0.3	3.6	±	1.3	2.2	±	0.1	8.0	±	0.4
	2/5/2003	0.9	±	0.3	3.5	±	1.2	1.2	±	0.1	4.4	±	0.3
	2/12/2003	1.8	±	0.4	6.6	±	1.4	2.7	±	0.1	10.0	±	0.4
	2/19/2003	0.8	±	0.5	2.8	±	1.7	1.8	±	0.1	6.6	±	0.4
	2/26/2003	1.4	±	0.4	5.2	±	1.3	2.2	±	0.1	8.2	±	0.4
	3/5/2003	1.7	±	0.4	6.3	±	1.3	3.2	±	0.1	11.7	±	0.4
	3/12/2003	1.4	±	0.3	5.3	±	1.2	1.4	±	0.1	5.3	±	0.3
	3/19/2003	0.9	±	0.3	3.4	±	1.3	1.5	±	0.1	5.7	±	0.4
	3/26/2003	2.3	±	0.4	8.5	±	1.4	1.9	±	0.1	6.9	±	0.4
REXBURG, CMS	1/8/2003	1.3	±	0.5	4.9	±	1.8	2.5	±	1.3	9.3	±	4.7
	1/15/2003	3.7	±	0.6	13.5	±	2.3	4.9	±	2.5	18.2	±	9.1
	1/22/2003	2.0	±	0.4	7.5	±	1.5	3.7	±	1.8	13.5	±	6.8
	1/29/2003	1.1	±	0.4	3.9	±	1.3	2.3	±	1.2	8.5	±	4.3
	2/5/2003	0.8	±	0.3	2.8	±	1.0	1.4	±	0.7	5.1	±	2.6
	2/12/2003	1.8	±	0.4	6.5	±	1.4	2.6	±	1.3	9.8	±	4.9
	2/19/2003	1.4	±	0.5	5.1	±	1.8	1.9	±	0.9	6.9	±	3.4
	2/26/2003	0.4	±	0.3	1.5	±	1.3	2.2	±	1.1	8.2	±	4.1
	3/5/2003	2.4	±	0.4	8.9	±	1.5	3.3	±	1.6	12.1	±	6.1
	3/12/2003	0.9	±	0.3	3.4	±	1.1	1.2	±	0.6	4.6	±	2.3
	3/19/2003	1.0	±	0.3	3.7	±	1.3	1.5	±	0.8	5.6	±	2.8
	3/26/2003	2.0	±	0.4	7.4	±	1.4	2.1	±	1.0	7.6	±	3.8

INEEL													
EFS	1/8/2003	0.2	±	0.3	0.7	±	1.2	2.9	±	0.1	10.7	±	0.4
	1/15/2003	1.7	±	0.4	6.3	±	1.6	4.5	±	0.1	16.6	±	0.5
	1/22/2003	1.5	±	0.3	5.6	±	1.2	5.4	±	0.1	19.9	±	0.5
	1/29/2003	1.2	±	0.3	4.3	±	1.2	3.4	±	0.1	12.5	±	0.4
	2/5/2003	0.9	±	0.3	3.4	±	1.0	1.7	±	0.1	6.2	±	0.3
	2/12/2003	1.6	±	0.3	5.7	±	1.3	3.5	±	0.1	13.0	±	0.4
	2/19/2003	0.4	±	0.4	1.6	±	1.5	2.2	±	0.1	8.3	±	0.4
	2/26/2003	1.0	±	0.3	3.7	±	1.2	2.3	±	0.1	8.4	±	0.4
	3/5/2003	1.9	±	0.3	7.1	±	1.2	3.5	±	0.1	12.9	±	0.4
	3/12/2003	1.0	±	0.3	3.6	±	1.1	1.1	±	0.1	4.1	±	0.3
	3/19/2003	0.8	±	0.3	2.9	±	1.1	1.6	±	0.1	5.8	±	0.3
	3/26/2003	1.8	±	0.3	6.5	±	1.2	2.0	±	0.1	7.2	±	0.3
MAIN GATE	1/8/2003	0.7	±	0.3	2.4	±	1.2	2.3	±	1.4	8.7	±	5.2
	1/15/2003	2.0	±	0.4	7.3	±	1.6	4.4	±	2.2	16.2	±	8.1
	1/22/2003	1.2	±	0.3	4.3	±	1.1	4.4	±	2.4	16.4	±	9.0
	1/29/2003	0.9	±	0.3	3.4	±	1.1	3.3	±	1.5	12.2	±	5.6
	2/5/2003	0.6	±	0.3	2.3	±	1.0	1.3	±	0.7	4.7	±	2.4
	2/12/2003	0.9	±	0.3	3.4	±	1.1	3.0	±	0.0	11.1	±	0.1
	2/19/2003	0.4	±	0.4	1.5	±	1.5	2.0	±	0.9	7.3	±	3.4
	2/26/2003	1.2	±	0.3	4.5	±	1.1	1.9	±	1.1	7.1	±	4.2
	3/5/2003	1.3	±	0.3	4.7	±	1.1	3.8	±	1.7	13.9	±	6.4
	3/12/2003	0.5	±	0.2	2.0	±	0.9	1.2	±	0.6	4.5	±	2.1
	3/19/2003	0.8	±	0.3	2.9	±	1.1	1.6	±	0.7	5.9	±	2.6
	3/26/2003	1.1	±	0.3	4.1	±	1.1	1.6	±	0.5	6.0	±	1.8
VAN BUREN	1/8/2003	0.9	±	0.4	3.2	±	1.4	2.8	±	0.1	10.4	±	0.4
	1/15/2003	2.0	±	0.4	7.5	±	1.6	4.4	±	0.1	16.3	±	0.5
	1/22/2003	1.4	±	0.3	5.3	±	1.2	4.9	±	0.1	18.1	±	0.5
	1/29/2003	1.1	±	0.3	4.0	±	1.1	3.0	±	0.1	11.2	±	0.4
	2/5/2003	0.6	±	0.3	2.4	±	1.0	1.3	±	0.1	4.8	±	0.3
	2/12/2003	1.6	±	0.3	6.1	±	1.2	0.0	±	0.0	0.1	±	0.2
	2/19/2003	1.2	±	0.5	4.5	±	1.9	1.8	±	0.1	6.8	±	0.4
	2/26/2003	1.5	±	0.4	5.6	±	1.5	2.3	±	0.1	8.4	±	0.4
	3/5/2003	1.0	±	0.3	3.8	±	1.0	3.5	±	0.1	12.8	±	0.4
	3/12/2003	1.0	±	0.3	3.6	±	1.0	1.2	±	0.1	4.3	±	0.3
	3/19/2003	0.8	±	0.3	2.8	±	1.1	1.4	±	0.1	5.1	±	0.3
	3/26/2003	1.2	±	0.3	4.4	±	1.1	1.0	±	0.1	3.6	±	0.3

OUT OF STATE

JACKSON, WYOMING	1/8/2003	0.6	±	0.4	2.3	±	1.5	1.6	±	0.1	6.0	±	0.3
	1/14/2003	2.6	±	0.6	9.8	±	2.4	5.2	±	0.2	19.4	±	0.7
	1/22/2003	0.3	±	0.2	0.9	±	0.6	1.0	±	0.1	3.8	±	0.2
	1/29/2003	0.6	±	0.3	2.2	±	0.9	1.1	±	0.1	4.0	±	0.3
	2/5/2003	0.4	±	0.2	1.4	±	0.8	1.0	±	0.1	3.6	±	0.2
	2/12/2003	1.3	±	0.3	5.0	±	1.1	2.6	±	0.1	9.7	±	0.4
	2/19/2003	0.9	±	0.4	3.5	±	1.6	1.8	±	0.1	6.5	±	0.4
	2/26/2003	1.0	±	0.3	3.6	±	1.1	1.7	±	0.1	6.3	±	0.3
	3/5/2003	1.5	±	0.3	5.4	±	1.2	3.0	±	0.1	11.2	±	0.4
	3/12/2003	0.4	±	0.2	1.3	±	0.8	1.2	±	0.1	4.5	±	0.3
	3/19/2003	0.7	±	0.3	2.5	±	1.0	1.3	±	0.1	5.0	±	0.3
	3/26/2003	1.4	±	0.3	5.1	±	1.1	1.6	±	0.1	5.9	±	0.3

a. 1/8/2003 Blackfoot CMS: No Sample - Filter Missing
b. 1/8/2003 Blackfoot (Q/A-1): No Sample - Filter Missing

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

Sampling Group and Location	*Sampling Date*	*Result ± Uncertainty (1s) (x 10^{-6} μCi)*			*Result ± Uncertainty (1s) (x 10^{-2} Bq)*		
BOUNDARY							
ARCO							
	1/8/2003	0.6	±	1.8	2.1	±	6.6
	1/15/2003	0.7	±	0.8	2.6	±	2.9
	1/22/2003	2.7	±	0.9	9.9	±	3.4
	1/29/2003	-0.8	±	1.2	-3.0	±	4.6
	2/5/2003	1.5	±	1.8	5.5	±	6.5
	2/12/2003	1.4	±	1.4	5.2	±	5.1
	2/19/2003	1.0	±	0.8	3.7	±	3.0
	2/26/2003	0.4	±	1.4	1.5	±	5.1
	3/5/2003	1.4	±	1.5	5.1	±	5.7
	3/12/2003	0.8	±	0.8	2.9	±	2.9
	3/19/2003	-1.5	±	1.3	-5.4	±	4.6
	3/26/2003	0.0	±	0.0	0.0	±	0.0
	4/2/2003	0.8	±	1.1	3.1	±	3.9
ATOMIC CITY							
	1/8/2003	0.6	±	1.8	2.1	±	6.6
	1/15/2003	0.7	±	0.8	2.6	±	2.9
	1/22/2003	2.7	±	0.9	9.9	±	3.4
	1/29/2003	-0.8	±	1.2	-3.0	±	4.6
	2/5/2003	1.5	±	1.8	5.5	±	6.5
	2/12/2003	1.4	±	1.4	5.2	±	5.1
	2/19/2003	1.0	±	0.8	3.7	±	3.0
	2/26/2003	0.4	±	1.4	1.5	±	5.1
	3/5/2003	1.4	±	1.5	5.1	±	5.7
	3/12/2003	0.8	±	0.8	2.9	±	2.9
	3/19/2003	-1.5	±	1.3	-5.4	±	4.6
	3/26/2003	0.0	±	0.0	0.0	±	0.0
	4/2/2003	0.8	±	1.1	3.1	±	3.9

BLACKFOOT NOAA Q/A-1							
	1/8/2003	0.6	±	1.8	2.1	±	6.6
	1/15/2003	0.7	±	0.8	2.6	±	2.9
	1/22/2003	2.7	±	0.9	9.9	±	3.4
	1/29/2003	-0.8	±	1.2	-3.0	±	4.6
	2/5/2003	1.5	±	1.8	5.5	±	6.5
	2/12/2003	1.4	±	1.4	5.2	±	5.1
	2/19/2003	1.0	±	0.8	3.7	±	3.0
	2/26/2003	0.4	±	1.4	1.5	±	5.1
	3/5/2003	1.4	±	1.5	5.1	±	5.7
	3/12/2003	0.8	±	0.8	2.9	±	2.9
	3/19/2003	-1.5	±	1.3	-5.4	±	4.6
	3/26/2003	0.0	±	0.0	0.0	±	0.0
	4/2/2003	0.8	±	1.1	3.1	±	3.9
BLUE DOME							
	1/8/2003	-0.2	±	1.2	-0.9	±	4.3
	1/15/2003	-1.6	±	1.1	-5.9	±	4.0
	1/22/2003	-1.0	±	1.2	-3.6	±	4.5
	1/29/2003	-1.2	±	0.7	-4.4	±	2.7
	2/5/2003	0.7	±	1.6	2.6	±	5.8
	2/12/2003	1.3	±	0.8	4.9	±	3.1
	2/19/2003	-1.0	±	1.1	-3.7	±	4.1
	2/26/2003	-1.0	±	0.8	-3.6	±	3.0
	3/5/2003	1.3	±	0.9	4.7	±	3.5
	3/12/2003	-1.1	±	1.1	-4.0	±	4.1
	3/19/2003	0.9	±	1.1	3.2	±	4.1
	3/26/2003	-0.9	±	0.7	-3.4	±	2.6
	4/2/2003	2.4	±	1.5	9.0	±	5.5
FAA TOWER							
	1/8/2003	-0.2	±	1.2	-0.9	±	4.3
	1/15/2003	-1.6	±	1.1	-5.9	±	4.0
	1/22/2003	-1.0	±	1.2	-3.6	±	4.5
	1/29/2003	-1.2	±	0.7	-4.4	±	2.7
	2/5/2003	0.7	±	1.6	2.6	±	5.8
	2/12/2003	1.3	±	0.8	4.9	±	3.1
	2/19/2003	-1.0	±	1.1	-3.7	±	4.1
	2/26/2003	-1.0	±	0.8	-3.6	±	3.0
	3/5/2003	1.3	±	0.9	4.7	±	3.5
	3/12/2003	-1.1	±	1.1	-4.0	±	4.1
	3/19/2003	0.9	±	1.1	3.2	±	4.1
	3/26/2003	-0.9	±	0.7	-3.4	±	2.6
	4/2/2003	2.4	±	1.5	9.0	±	5.5

HOWE							
	1/8/2003	-0.2	±	1.2	-0.9	±	4.3
	1/15/2003	-1.6	±	1.1	-5.9	±	4.0
	1/22/2003	-1.0	±	1.2	-3.6	±	4.5
	1/29/2003	-1.2	±	0.7	-4.4	±	2.7
	2/5/2003	0.7	±	1.6	2.6	±	5.8
	2/12/2003	1.3	±	0.8	4.9	±	3.1
	2/19/2003	-1.0	±	1.1	-3.7	±	4.1
	2/26/2003	-1.0	±	0.8	-3.6	±	3.0
	3/5/2003	1.3	±	0.9	4.7	±	3.5
	3/12/2003	-1.1	±	1.1	-4.0	±	4.1
	3/19/2003	0.9	±	1.1	3.2	±	4.1
	3/26/2003	-0.9	±	0.7	-3.4	±	2.6
	4/2/2003	2.4	±	1.5	9.0	±	5.5
MONTEVIEW							
	1/8/2003	-0.2	±	1.2	-0.9	±	4.3
	1/15/2003	-1.6	±	1.1	-5.9	±	4.0
	1/22/2003	-1.0	±	1.2	-3.6	±	4.5
	1/29/2003	-1.2	±	0.7	-4.4	±	2.7
	2/5/2003	0.7	±	1.6	2.6	±	5.8
	2/12/2003	1.3	±	0.8	4.9	±	3.1
	2/19/2003	-1.0	±	1.1	-3.7	±	4.1
	2/26/2003	-1.0	±	0.8	-3.6	±	3.0
	3/5/2003	1.3	±	0.9	4.7	±	3.5
	3/12/2003	-1.1	±	1.1	-4.0	±	4.1
	3/19/2003	0.9	±	1.1	3.2	±	4.1
	3/26/2003	-0.9	±	0.7	-3.4	±	2.6
	4/2/2003	2.4	±	1.5	9.0	±	5.5
MUD LAKE							
	1/8/2003	-0.2	±	1.2	-0.9	±	4.3
	1/15/2003	-1.6	±	1.1	-5.9	±	4.0
	1/22/2003	-1.0	±	1.2	-3.6	±	4.5
	1/29/2003	-1.2	±	0.7	-4.4	±	2.7
	2/5/2003	0.7	±	1.6	2.6	±	5.8
	2/12/2003	1.3	±	0.8	4.9	±	3.1
	2/19/2003	-1.0	±	1.1	-3.7	±	4.1
	2/26/2003	-1.0	±	0.8	-3.6	±	3.0
	3/5/2003	1.3	±	0.9	4.7	±	3.5
	3/12/2003	-1.1	±	1.1	-4.0	±	4.1
	3/19/2003	0.9	±	1.1	3.2	±	4.1
	3/26/2003	-0.9	±	0.7	-3.4	±	2.6
	4/2/2003	2.4	±	1.5	9.0	±	5.5

(MUD LAKE) Q/A-2							
	1/8/2003	0.6	±	1.8	2.1	±	6.6
	1/15/2003	0.7	±	0.8	2.6	±	2.9
	1/22/2003	2.7	±	0.9	9.9	±	3.4
	1/29/2003	-0.8	±	1.2	-3.0	±	4.6
	2/5/2003	1.5	±	1.8	5.5	±	6.5
	2/12/2003	1.4	±	1.4	5.2	±	5.1
	2/19/2003	1.0	±	0.8	3.7	±	3.0
	2/26/2003	0.4	±	1.4	1.5	±	5.1
	3/5/2003	1.4	±	1.5	5.1	±	5.7
	3/12/2003	0.8	±	0.8	2.9	±	2.9
	3/19/2003	-1.5	±	1.3	-5.4	±	4.6
	3/26/2003	0.0	±	0.0	0.0	±	0.0
	4/2/2003	0.8	±	1.1	3.1	±	3.9
DISTANT							
BLACKFOOT, CMS							
	1/8/2003	0.6	±	1.8	2.1	±	6.6
	1/15/2003	0.7	±	0.8	2.6	±	2.9
	1/22/2003	2.7	±	0.9	9.9	±	3.4
	1/29/2003	-0.8	±	1.2	-3.0	±	4.6
	2/5/2003	1.5	±	1.8	5.5	±	6.5
	2/12/2003	1.4	±	1.4	5.2	±	5.1
	2/19/2003	1.0	±	0.8	3.7	±	3.0
	2/26/2003	0.4	±	1.4	1.5	±	5.1
	3/5/2003	1.4	±	1.5	5.1	±	5.7
	3/12/2003	0.8	±	0.8	2.9	±	2.9
	3/19/2003	-1.5	±	1.3	-5.4	±	4.6
	3/26/2003	0.0	±	0.0	0.0	±	0.0
	4/2/2003	0.8	±	1.1	3.1	±	3.9
CRATERS OF THE MOON							
	1/8/2003	0.6	±	1.8	2.1	±	6.6
	1/15/2003	0.7	±	0.8	2.6	±	2.9
	1/22/2003	2.7	±	0.9	9.9	±	3.4
	1/29/2003	-0.8	±	1.2	-3.0	±	4.6
	2/5/2003	1.5	±	1.8	5.5	±	6.5
	2/12/2003	1.4	±	1.4	5.2	±	5.1
	2/19/2003	1.0	±	0.8	3.7	±	3.0
	2/26/2003	0.4	±	1.4	1.5	±	5.1
	3/5/2003	1.4	±	1.5	5.1	±	5.7
	3/12/2003	0.8	±	0.8	2.9	±	2.9
	3/19/2003	-1.5	±	1.3	-5.4	±	4.6
	3/26/2003	0.0	±	0.0	0.0	±	0.0
	4/2/2003	0.8	±	1.1	3.1	±	3.9

DUBOIS							
	1/8/2003	-0.2	±	1.2	-0.9	±	4.3
	1/15/2003	-1.6	±	1.1	-5.9	±	4.0
	1/22/2003	-1.0	±	1.2	-3.6	±	4.5
	1/29/2003	-1.2	±	0.7	-4.4	±	2.7
	2/5/2003	0.7	±	1.6	2.6	±	5.8
	2/12/2003	1.3	±	0.8	4.9	±	3.1
	2/19/2003	-1.0	±	1.1	-3.7	±	4.1
	2/26/2003	-1.0	±	0.8	-3.6	±	3.0
	3/5/2003	1.3	±	0.9	4.7	±	3.5
	3/12/2003	-1.1	±	1.1	-4.0	±	4.1
	3/19/2003	0.9	±	1.1	3.2	±	4.1
	3/26/2003	-0.9	±	0.7	-3.4	±	2.6
	4/2/2003	2.4	±	1.5	9.0	±	5.5
IDAHO FALLS							
	1/8/2003	-0.2	±	1.2	-0.9	±	4.3
	1/15/2003	-1.6	±	1.1	-5.9	±	4.0
	1/22/2003	-1.0	±	1.2	-3.6	±	4.5
	1/29/2003	-1.2	±	0.7	-4.4	±	2.7
	2/5/2003	0.7	±	1.6	2.6	±	5.8
	2/12/2003	1.3	±	0.8	4.9	±	3.1
	2/19/2003	-1.0	±	1.1	-3.7	±	4.1
	2/26/2003	-1.0	±	0.8	-3.6	±	3.0
	3/5/2003	1.3	±	0.9	4.7	±	3.5
	3/12/2003	-1.1	±	1.1	-4.0	±	4.1
	3/19/2003	0.9	±	1.1	3.2	±	4.1
	3/26/2003	-0.9	±	0.7	-3.4	±	2.6
	4/2/2003	2.4	±	1.5	9.0	±	5.5
REXBURG, CMS							
	1/8/2003	-0.2	±	1.2	-0.9	±	4.3
	1/15/2003	-1.6	±	1.1	-5.9	±	4.0
	1/22/2003	-1.0	±	1.2	-3.6	±	4.5
	1/29/2003	-1.2	±	0.7	-4.4	±	2.7
	2/5/2003	0.7	±	1.6	2.6	±	5.8
	2/12/2003	1.3	±	0.8	4.9	±	3.1
	2/19/2003	-1.0	±	1.1	-3.7	±	4.1
	2/26/2003	-1.0	±	0.8	-3.6	±	3.0
	3/12/2003	-1.1	±	1.1	-4.0	±	4.1
	3/19/2003	0.9	±	1.1	3.2	±	4.1
	3/26/2003	-0.9	±	0.7	-3.4	±	2.6
	4/2/2003	2.4	±	1.5	9.0	±	5.5

INEEL							
EFS							
	1/8/2003	-0.2	±	1.2	-0.9	±	4.3
	1/15/2003	-1.6	±	1.1	-5.9	±	4.0
	1/22/2003	-1.0	±	1.2	-3.6	±	4.5
	1/29/2003	-1.2	±	0.7	-4.4	±	2.7
	2/5/2003	0.7	±	1.6	2.6	±	5.8
	2/12/2003	1.3	±	0.8	4.9	±	3.1
	2/19/2003	-1.0	±	1.1	-3.7	±	4.1
	2/26/2003	-1.0	±	0.8	-3.6	±	3.0
	3/5/2003	1.3	±	0.9	4.7	±	3.5
	3/12/2003	-1.1	±	1.1	-4.0	±	4.1
	3/19/2003	0.9	±	1.1	3.2	±	4.1
	3/26/2003	-0.9	±	0.7	-3.4	±	2.6
	4/2/2003	2.4	±	1.5	9.0	±	5.5
MAIN GATE							
	1/8/2003	-0.2	±	1.2	-0.9	±	4.3
	1/15/2003	-1.6	±	1.1	-5.9	±	4.0
	1/22/2003	-1.0	±	1.2	-3.6	±	4.5
	1/29/2003	-1.2	±	0.7	-4.4	±	2.7
	2/5/2003	0.7	±	1.6	2.6	±	5.8
	2/12/2003	1.3	±	0.8	4.9	±	3.1
	2/19/2003	-1.0	±	1.1	-3.7	±	4.1
	2/26/2003	-1.0	±	0.8	-3.6	±	3.0
	3/5/2003	1.3	±	0.9	4.7	±	3.5
	3/12/2003	-1.1	±	1.1	-4.0	±	4.1
	3/19/2003	0.9	±	1.1	3.2	±	4.1
	3/26/2003	-0.9	±	0.7	-3.4	±	2.6
	4/2/2003	2.4	±	1.5	9.0	±	5.5
VAN BUREN							
	1/8/2003	0.6	±	1.8	2.1	±	6.6
	1/15/2003	0.7	±	0.8	2.6	±	2.9
	1/22/2003	2.7	±	0.9	9.9	±	3.4
	1/29/2003	-0.8	±	1.2	-3.0	±	4.6
	2/5/2003	1.5	±	1.8	5.5	±	6.5
	2/12/2003	1.4	±	1.4	5.2	±	5.1
	2/19/2003	1.0	±	0.8	3.7	±	3.0
	2/26/2003	0.4	±	1.4	1.5	±	5.1
	3/5/2003	1.3	±	0.9	4.7	±	3.5
	3/12/2003	0.8	±	0.8	2.9	±	2.9
	3/19/2003	-1.5	±	1.3	-5.4	±	4.6
	3/26/2003	0.0	±	0.0	0.0	±	0.0
	4/2/2003	0.8	±	1.1	3.1	±	3.9

OUT OF STATE							
JACKSON, WYOMING							
	1/8/2003	0.6	±	1.8	2.1	±	6.6
	1/14/2003	0.7	±	0.8	2.6	±	2.9
	1/22/2003	2.7	±	0.9	9.9	±	3.4
	1/29/2003	-0.8	±	1.2	-3.0	±	4.6
	2/5/2003	1.5	±	1.8	5.5	±	6.5
	2/12/2003	1.4	±	1.4	5.2	±	5.1
	2/19/2003	1.0	±	0.8	3.7	±	3.0
	2/26/2003	0.4	±	1.4	1.5	±	5.1
	3/5/2003	1.4	±	1.5	5.1	±	5.7
	3/12/2003	0.8	±	0.8	2.9	±	2.9
	3/19/2003	-1.5	±	1.3	-5.4	±	4.6
	3/26/2003	0.0	±	0.0	0.0	±	0.0
	4/2/2003	0.8	±	1.1	3.1	±	3.9

TABLE C-3: Quarterly Cesium-137, Americium-241, Plutonium-238, Plutonium-239/40 & Strontium-90 Concentrations in Composited Air Filters

Sample Group & Location	*Sampling Date*	*Analyte*	*Result ± Uncertainty (1s)* $x\ 10^{-18}\ \mu Ci/mL$			*Result ± Uncertainty (1s)* $x\ 10^{-13}$ *Bq/mL*		
BOUNDARY								
ARCO	3/31/2003	CESIUM-137	204.0	±	106.0	75.5	±	39.2
	3/31/2003	STRONTIUM-90	11.1	±	14.1	4.1	±	5.2
ATOMIC CITY	3/31/2003	CESIUM-137	101.0	±	87.0	37.4	±	32.2
	3/31/2003	STRONTIUM-90	43.3	±	18.0	16.0	±	6.7
BLACKFOOT NOAA Q/A-1	3/31/2003	CESIUM-137	164.0	±	146.0	60.7	±	54.0
	3/31/2003	STRONTIUM-90	11.7	±	17.5	4.3	±	6.5
BLUE DOME	3/31/2003	CESIUM-137	6.2	±	77.5	2.3	±	28.7
	3/31/2003	STRONTIUM-90	9.7	±	11.6	3.6	±	4.3
FAA TOWER	3/31/2003	AMERICIUM-241	2.4	±	1.2	0.9	±	0.4
	3/31/2003	CESIUM-137	0.9	±	97.0	0.3	±	35.9
	3/31/2003	PLUTONIUM-238	0.6	±	1.0	0.2	±	0.4
	3/31/2003	PLUTONIUM-239/40	1.7	±	1.0	0.6	±	0.4
HOWE	3/31/2003	AMERICIUM-241	2.4	±	1.2	0.9	±	0.4
	3/31/2003	CESIUM-137	-16.1	±	419.5	-6.0	±	155.2
	3/31/2003	PLUTONIUM-238	-0.3	±	0.3	-0.1	±	0.1
	3/31/2003	PLUTONIUM-239/40	0.9	±	0.6	0.3	±	0.2

MONTEVIEW	3/31/2003	AMERICIUM-241	1.4	±	0.8	0.5	±	0.3
	3/31/2003	CESIUM-137	138.0	±	73.5	51.1	±	27.2
	3/31/2003	PLUTONIUM-238	0.0	±	0.3	0.0	±	0.1
	3/31/2003	PLUTONIUM-239/40	1.9	±	0.7	0.7	±	0.3
MUD LAKE	3/31/2003	CESIUM-137	660.0	±	467.0	244.2	±	172.8
	3/31/2003	STRONTIUM-90	23.2	±	13.8	8.6	±	5.1
(MUD LAKE) Q/A-2	3/31/2003	CESIUM-137	39.8	±	85.5	14.7	±	31.6
	3/31/2003	STRONTIUM-90	15.0	±	13.6	5.6	±	5.0
DISTANT								
BLACKFOOT, CMS	3/31/2003	CESIUM-137	201.0	±	480.5	74.4	±	177.8
	3/31/2003	STRONTIUM-90	5.5	±	13.5	2.0	±	5.0
CRATERS OF THE MOON	3/31/2003	AMERICIUM-241	2.8	±	1.1	1.1	±	0.4
	3/31/2003	CESIUM-137	638.0	±	530.0	236.1	±	196.1
	3/31/2003	PLUTONIUM-238	0.0	±	0.4	0.0	±	0.2
	3/31/2003	PLUTONIUM-239/40	0.3	±	0.3	0.1	±	0.1
DUBOIS	3/31/2003	CESIUM-137	8.1	±	525.0	3.0	±	194.3
	3/31/2003	STRONTIUM-90	41.4	±	16.5	15.3	±	6.1
IDAHO FALLS	3/31/2003	AMERICIUM-241	2.0	±	0.9	0.7	±	0.3
	3/31/2003	CESIUM-137	103.0	±	128.5	38.1	±	47.5
	3/31/2003	PLUTONIUM-238	0.3	±	0.3	0.1	±	0.1
	3/31/2003	PLUTONIUM-239/40	0.3	±	0.3	0.1	±	0.1
REXBURG, CMS	3/31/2003	AMERICIUM-241	0.8	±	0.6	0.3	±	0.2
	3/31/2003	CESIUM-137	111.0	±	126.0	41.1	±	46.6
	3/31/2003	PLUTONIUM-238	-0.4	±	0.4	-0.1	±	0.1
	3/31/2003	PLUTONIUM-239/40	8.3	±	1.9	3.1	±	0.7

INEEL

EFS	3/31/2003	AMERICIUM-241	0.5	±	0.6	0.2	±	0.2
	3/31/2003	CESIUM-137	-204.0	±	112.5	-75.5	±	41.6
	3/31/2003	PLUTONIUM-238	0.0	±	0.3	0.0	±	0.1
	3/31/2003	PLUTONIUM-239/40	1.7	±	0.7	0.6	±	0.3
MAIN GATE	3/31/2003	CESIUM-137	-62.3	±	442.0	-23.1	±	163.5
	3/31/2003	STRONTIUM-90	30.0	±	15.4	11.1	±	5.7
VAN BUREN	3/31/2003	AMERICIUM-241	1.8	±	0.9	0.7	±	0.3
	3/31/2003	CESIUM-137	31.1	±	110.5	11.5	±	40.9
	3/31/2003	PLUTONIUM-238	0.0	±	0.3	0.0	±	0.1
	3/31/2003	PLUTONIUM-239/40	0.8	±	0.7	0.3	±	0.2

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JACKSON, WYOMING	3/31/2003	CESIUM-137	-102.0		79.0	-37.7	±	29.2
	3/31/2003	STRONTIUM-90	41.3		16.5	15.3	±	6.1

TABLE C-4: Tritium Concentrations in Atmospheric Moisture

Location	Start Date	Collect Date	Result ± Uncertainty (1s) ($x 10^{-13}$ $\mu Ci/mL_{Air}$)			Result ± Uncertainty (1s) ($x 10^{-9}$ Bq/mL_{Air})		
ATOMIC CITY								
	12/31/02	03/05/03	1.1	±	0.4	4.0	±	1.4
BLACKFOOT								
	12/31/02	02/12/03	1.7	±	1.0	6.4	±	3.6
	12/31/02	02/12/03	2.1	±	1.0	7.8	±	3.7
	02/12/03	03/26/03	4.5	±	1.7	16.7	±	6.2
	02/12/03	03/26/03	2.3	±	1.7	8.5	±	6.1
IDAHO FALLS								
	12/10/2002	1/30/2003	3.4	±	0.9	12.4	±	3.4
	1/30/2003	3/11/2003	4.2	±	2.0	15.6	±	7.5
	1/30/2003	3/11/2003	4.9	±	2.0	18.2	±	7.5
REXBURG, CMS								
	12/10/02	01/30/03	1.7	±	0.9	6.4	±	3.3
	01/30/03	03/17/03	5.5	±	1.6	20.5	±	5.8

Table C-5: PM10 Concentrations at Atomic City, Blackfoot CMS, and Rexburg CMS

Location	***Sampling Date***	***Concentration ($\mu g/m^3$)***
ATOMIC CITY		
	1/2/2003	0.5
	1/8/2003	1.8
	1/14/2003	2.2
	1/20/2003	3.9
	1/26/2003	-0.6
	2/1/2003	-3.8
	2/7/2003	2.6
	2/13/2003	0.7
	2/19/2003	1.7
	2/25/2003	2.4
	3/3/2003	0.8
	3/9/2003	1.9
	3/15/2003	4.2
	3/21/2003	0.9
	3/27/2003	6.9
BLACKFOOT CMS		
	1/2/2003	5.5
	1/8/2003	8.3
	1/14/2003	13.1
	1/20/2003	12.3
	1/26/2003	2.7
	2/1/2003	1.3
	2/7/2003	4.2
	2/13/2003	1.5
	2/19/2003	2.5
	2/25/2003	7.2
	3/3/2003	5.1
	3/9/2003	6.5
	3/15/2003	6.1
	3/21/2003	6.4
	3/27/2003	1.2

REXBURG CMS		
	1/2/2003	8.0
	1/8/2003	37.9
	1/14/2003	5.2
	1/20/2003	17.9
	1/26/2003	5.9
	2/1/2003	0.4
	2/7/2003	15.0
	2/13/2003	6.3
	2/19/2003	8.7
	2/25/2003	22.4
	3/3/2003	5.3
	3/9/2003	5.0
	3/15/2003	12.2
	3/21/2003	5.6
	3/27/2003	5.5

TABLE C-6: Weekly & Monthly Tritium Concentrations in Precipitation

Location	Start Date	End Date	Result ± Uncertainty (1s) pCi /L			Result ± Uncertainty (1s) Bq /L		
CFA								
	12/2/2002	1/2/2003	292.0	±	29.4	10.80	±	1.09
	1/2/2003	2/3/2003	167.0	±	28.6	6.18	±	1.06
	2/3/2003	3/3/2003	169.0	±	54.4	6.25	±	2.01
EFS								
	12/31/2002	1/8/2003	56.9	±	28.1	2.11	±	1.04
	12/31/2002	1/8/2003	84.8	±	28.3	3.14	±	1.05
	1/8/2003	1/15/2003	32.3	±	28.2	1.20	±	1.04
	1/22/2003	1/29/2003	66.6	±	28.4	2.46	±	1.05
	2/12/2003	2/19/2003	125.0	±	28.4	4.63	±	1.05
	2/12/2003	2/19/2003	134.0	±	28.6	4.96	±	1.06
	3/12/2003	3/19/2003	184.0	±	54.5	6.81	±	2.02
	3/12/2003	3/19/2003	146.0	±	54.3	5.40	±	2.01
IDAHO FALLS								
	12/31/2003	2/3/2003	53.7	±	28.3	1.99	±	1.05
	2/3/2003	3/3/2003	64.6	±	53.8	2.39	±	1.99

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

Location	Analyte	Sampling Date	Results ± Uncertainty (1s) pCi/L			Results ± Uncertainty (1s) $x 10^{-2}$ Bq/L		
BLACKFOOT								
	CESIUM-137	1/7/2003	-0.7	±	0.8	-2.5	±	2.9
	IODINE-131	1/7/2003	0.1	±	1.2	0.3	±	4.4
	CESIUM-137	2/4/2003	-0.4	±	0.8	-1.5	±	2.8
	IODINE-131	2/4/2003	-1.1	±	1.1	-3.9	±	4.1
	CESIUM-137	3/4/2003	-2.4	±	4.0	-9.0	±	14.6
	IODINE-131	3/4/2003	-0.6	±	2.2	-2.3	±	8.1
CAREY								
	CESIUM-137	1/8/2003	-11.6	±	4.3	-42.9	±	15.8
	IODINE-131	1/8/2003	-1.4	±	2.5	-5.1	±	9.1
	CESIUM-137	2/4/2003	4.8	±	3.8	17.8	±	14.1
	IODINE-131	2/4/2003	-0.9	±	2.7	-3.3	±	10.1
	CESIUM-137	3/5/2003	0.1	±	3.9	0.4	±	14.5
	IODINE-131	3/5/2003	1.1	±	2.4	4.1	±	8.8
DIETRICH								
	CESIUM-137	1/7/2003	1.5	±	0.8	5.6	±	2.8
	IODINE-131	1/7/2003	-1.9	±	1.5	-6.9	±	5.5
	CESIUM-137	2/4/2003	0.4	±	0.8	1.6	±	2.9
	IODINE-131	2/4/2003	0.8	±	1.2	2.9	±	4.6
	CESIUM-137	3/4/2003	-0.2	±	1.4	-0.6	±	5.1
	IODINE-131	3/4/2003	2.1	±	1.4	7.9	±	5.3
HOWE								
	CESIUM-137	1/7/2003	0.6	±	1.4	2.1	±	5.3
	IODINE-131	1/7/2003	1.6	±	2.0	6.0	±	7.4
	CESIUM-137	2/4/2003	0.5	±	0.5	1.9	±	1.9
	IODINE-131	2/4/2003	-0.2	±	1.4	-0.7	±	5.2
	CESIUM-137	3/4/2003	0.5	±	1.4	1.8	±	5.1
	IODINE-131	3/4/2003	4.1	±	1.8	15.0	±	6.7

IDAHO FALLS								
	CESIUM-137	1/7/2003	0.9	±	0.8	3.5	±	2.9
	IODINE-131	1/7/2003	-0.6	±	1.2	-2.3	±	4.3
	CESIUM-137	1/15/2003	5.8	±	3.8	21.4	±	14.1
	IODINE-131	1/15/2003	0.0	±	2.2	0.0	±	8.3
	CESIUM-137	1/22/2003	1.7	±	3.9	6.4	±	14.5
	IODINE-131	1/22/2003	0.4	±	2.5	1.5	±	9.1
	CESIUM-137	1/29/2003	-0.3	±	4.0	-1.0	±	14.6
	IODINE-131	1/29/2003	-0.1	±	2.2	-0.2	±	8.1
	CESIUM-137	2/4/2003	-0.1	±	0.8	-0.2	±	2.8
	IODINE-131	2/4/2003	0.9	±	1.2	3.3	±	4.3
	CESIUM-137	2/12/2003	0.0	±	0.8	0.0	±	2.8
	IODINE-131	2/12/2003	-0.4	±	0.9	-1.4	±	3.4
	CESIUM-137	2/26/2003	0.1	±	3.9	0.4	±	14.5
	IODINE-131	2/26/2003	-1.8	±	2.0	-6.8	±	7.4
	CESIUM-137	3/4/2003	1.1	±	0.8	4.1	±	2.9
	IODINE-131	3/4/2003	0.2	±	1.0	0.9	±	3.8
	CESIUM-137	3/12/2003	0.5	±	3.8	1.9	±	13.9
	IODINE-131	3/12/2003	0.5	±	2.0	2.0	±	7.5
	CESIUM-137	3/19/2003	-0.2	±	0.8	-0.6	±	2.9
	IODINE-131	3/19/2003	0.1	±	0.9	0.4	±	3.5
	CESIUM-137	3/26/2003	-5.9	±	3.8	-21.9	±	14.1
	IODINE-131	3/26/2003	-2.5	±	2.2	-9.3	±	8.1
MORELAND								
	CESIUM-137	1/7/2003	0.1	±	1.4	0.5	±	5.2
	IODINE-131	1/7/2003	-0.2	±	1.5	-0.6	±	5.7
	CESIUM-137	2/4/2003	-1.5	±	3.9	-5.4	±	14.4
	IODINE-131	2/4/2003	-1.1	±	2.1	-4.2	±	7.9
	CESIUM-137	3/4/2003	0.9	±	0.8	3.3	±	2.8
	IODINE-131	3/4/2003	0.5	±	1.0	1.7	±	3.6
ROBERTS								
	CESIUM-137	1/7/2003	-0.9	±	1.4	-3.1	±	5.1
	IODINE-131	1/7/2003	-2.1	±	1.9	-7.7	±	7.0
	CESIUM-137	2/4/2003	1.9	±	1.4	7.1	±	5.1
	IODINE-131	2/4/2003	-1.2	±	1.9	-4.6	±	6.9
	CESIUM-137	3/4/2003	-1.9	±	0.8	-6.9	±	2.8
	IODINE-131	3/4/2003	1.2	±	1.2	4.3	±	4.4
RUPERT								
	CESIUM-137	1/7/2003	0.4	±	0.8	1.6	±	2.9
	IODINE-131	1/7/2003	1.1	±	1.1	4.0	±	4.1
	CESIUM-137	2/4/2003	-1.0	±	0.8	-3.8	±	2.8
	IODINE-131	2/4/2003	-0.8	±	1.4	-2.8	±	5.1
	CESIUM-137	3/4/2003	-6.1	±	3.9	-22.5	±	14.2
	IODINE-131	3/4/2003	0.6	±	2.0	2.2	±	7.5

TERRETON

	CESIUM-137	1/7/2003	-0.9	±	3.9	-3.4	±	14.3
	IODINE-131	1/7/2003	1.2	±	3.0	4.3	±	11.2
	CESIUM-137	2/4/2003	-1.4	±	3.8	-5.3	±	13.9
	IODINE-131	2/4/2003	2.0	±	2.8	7.5	±	10.4
	CESIUM-137	3/4/2003	1.5	±	1.4	5.4	±	5.1
	IODINE-131	3/4/2003	0.0	±	1.8	0.0	±	6.8

TABLE C-8: Cesium-137 and Iodine-131 Concentrations in Game Animals

Spiecies & Tissue	*Analyte*	*Sampling Date*	*Results ± Uncertainty (1s) (pCi/kg wet weight)*			*Results ± Uncertainty (1s) Bq/kg wet weight)*		
MULE DEER								
LIVER	CESIUM-137	3/18/2003	0.1	±	1.4	0.0	±	0.1
	IODINE-131	3/18/2003	-3.0	±	1.7	-0.1	±	0.1
MUSCLE	CESIUM-137	3/18/2003	-1.5	±	4.5	-0.1	±	0.2
	IODINE-131	3/18/2003	1.6	±	2.3	0.1	±	0.1
THYROID	CESIUM-137	3/18/2003	42.6	±	824.0	1.6	±	30.5
	IODINE-131	3/18/2003	161.0	±	358.0	6.0	±	13.2

APPENDIX D

STATISTICAL ANALYSIS RESULTS

Table D-1. Kruskal-Wallace[a] statistical results between INEEL, Boundary, and Distant sample groups by quarter and by month.

Parameter	p[b]
Gross Alpha	
Quarter	0.21
January	0.38
February	0.30
March	0.41
Gross Beta	
Quarter	0.50
January	0.71
February	0.89
March	1.00

a. See the Determining Statistical Differences of the Helpful Information section for details on the Kruskal-Wallace test.

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

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

Mann-Whitney U Test[a]		
Parameter	**Week**	**p[b]**
Gross Alpha		
	January 8th	0.37
	January 15th	0.94
	January 22nd	0.43
	January 29th	0.43
	February 5th	0.78
	February 12th	0.12
	February 19th	0.81
	February 26th	0.67
	March 5th	0.78
	March 12th	0.58
	March 19th	0.48
	March 26th	0.12
	April 2nd	0.03
Gross Beta		
	January 8th	0.57
	January 15th	0.81
	January 22nd	0.03
	January 29rd	0.06
	February 5th	0.06
	February 12th	0.004
	February 19th	0.81
	February 26th	0.89
	March 5th	0.69
	March 12th	0.25
	March 19th	0.39
	March 26th	0.35
	April 2nd	0.48

a. See the Determining Statistical Differences of the Helpful Information section for details on the Mann Whitney U test.

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

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