STOLLER-ESER-104

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 2006

June 2007

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 any of the samples collected during the fourth quarter of 2006 could be directly linked with INL Site activities. One probably exception was waterfowl taken directly from wastewater ponds located on the INL Site. Levels of other 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 2006 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, 2006. All sample types (media) and the sampling schedule followed during 2006 are listed in Appendix A. Specifically, this report contains the results for the following:

- Air sampling, including air filters and charcoal cartridges, atmospheric moisture, and 10-micron particulate matter (PM_{10})
- Precipitation sampling
- Surface water sampling
- Drinking water sampling
- Milk sampling
- Large game animal sampling
- Waterfowl sampling
- Environmental Radiation

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 fourth quarter of 2006. Because of this, these data were statistically analyzed using nonparametric methods, including the use of the median to represent central tendency. At no time during the fourth quarter were monthly or quarterly gross alpha or gross beta concentrations in air collected at Boundary locations statistically greater than corresponding data for Distant locations, as one would expect if the INL Site were a significant source of radionuclide contamination. Weekly comparisons of gross alpha concentrations at Distant and Boundary locations showed a statistical difference during the week of November 29. In this case, the Distant locations were statistically greater than the Boundary locations.

There were no statistical differences between gross beta results when grouped by location on quarterly, monthly and weekly bases. There were statistical differences found during the weeks of November 8 and November 29. In the first instance, the Boundary locations were statistically greater than the Distant locations; in the second case, the Distant locations were statistically greater. These differences appear to be due to random variability in the data.

Iodine-131 (^{131}I) was not detected in any batch of charcoal cartridges during the fourth quarter.

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). Cesium-137 was detected at Arco within the range of historical measurements and well below the DOE Derived Concentration Guide (DCG). No other manmade radionuclides were found.

Fourteen atmospheric moisture samples were obtained during the fourth quarter of 2006 and analyzed for tritium. Two from sampling location exceeded their respective 3s levels. The maximum value was well below the DOE DCG for tritium in air.

The ESER Program operates three PM_{10} samplers for particulate sampling, one each at Rexburg, Blackfoot, and Atomic City. Sampling of PM_{10} is primarily informational as no analyses are conducted for contaminants. The maximum 24-hour particulate concentration was 30.9 µg/m^3 on October 13, 2006, at Rexburg. This is well below the EPA Air Quality Standard of 150 µg/m^3.

Storm events in the fourth quarter of 2006 produced sufficient precipitation to yield 12 samples –three from Idaho Falls and CFA, and six weekly samples from the EFS. Three of the samples contained a detectable concentration of tritium, within the range reported by the EPA across the western United States.

Fourteen drinking water samples and one duplicate were collected from selected taps throughout southeast Idaho during the fourth quarter of 2006. Samples were analyzed for gross alpha, gross beta, and tritium (^{3}H). Two of the samples exceeded its 3s value for gross alpha and two samples contained tritium above the detection limit, but within historical measurements. The maximum value was below the EPA limits established under the Safe Drinking Water Act and DOE DCGs. All but one sample exceeded the 3s value for gross beta. The maximum gross beta concentration measured, (7.89 ± 0.63) pCi/L, was from Fort Hall and was below the EPA Safe Water Drinking Water Act (SDWA) screening limit of 50 pCi/L and the DOE DCG of 100 pCi/L. Levels of gross beta activity observed are not unusual given the basaltic terrain.

Milk samples were collected weekly in Ucon and monthly at nine other locations around the INL Site. All samples were analyzed for manmade gamma-emitting radionuclides. Iodine-131 was not detected in any sample Cesium-137 was detected in two samples at background level. Low levels of ^{90}Sr were found in most samples. Tritium was measured in two of four samples analyzed.

Cesium-137 was detected in two potato samples, including one collected from out of the state. The detected concentrations were similar to those found in recent years.

Waterfowl were collected from wastewater ponds at two facilities located on the INL and one distant location (American Falls, ID). Several manmade radionuclides above background, including Americium-241, Cesium-137, Chromium-51, Cobalt-60, Strontium-90, Zinc-65 and Plutonium-238 and 239/240 were found in tissues from birds collected at the Reactor Technology Complex. Only Americiium-241 and Strontium-90 were found in the control samples. Concentrations of radionuclides were lower in 2006 than the previous year, and lower than in an earlier study. The potential dose to a person eating the entire edible mass of the duck with the highest concentration of radionuclides measured was calculated to be 0.013 mrem.

Comment [edk1]: Consider replacing the term "waste pond" with "wastewater pond" throughout the document. This commentis one of semantics as a reader could envision ponds of bubbling sludge, etc.

Comment [edk2]: Consider identifying the distant location (Firth, ID), so there is not any potential inference that INL is responsible for the "distant location".

Comment [t3]: Recommend that the year of the "study" and a reference to the document be provided.

Table E-1 Summary of results for the fourth quarter of 2006.

Media	Sample Type	Analysis	Results
Air	Filters	Gross alpha, gross beta	There were no statistical differences noted for monthly or quarterly gross alpha or gross beta concentrations measured at INL Site, Boundary and Distant locations. Some weekly differences were noted but these appear to be normal variability in the data. 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	Cesium-137 was found in one sample. The reported detection was within the range of historical measurements. No other manmade radionuclides were found.
	Charcoal Cartridge	Iodine-131	No detections of ^{131}I were made during the fourth quarter.
	PM_{10}	Particulate matter	Forty-eight valid samples were collected from three locations. No regulatory limits were exceeded.
Atmospheric Moisture	Liquid	Tritium	A total of 14 samples were collected. Eight of these samples had tritium result s greater than the 3s uncertainty. Concentrations were consistent with those reported across the region and with previous results.
Precipitation	Liquid	Tritium	Twelve samples were collected. Three of the results were greater than the 3s uncertainty. No sample result exceeded the DCG for tritium in air.
Drinking Water	Liquid	Gross alpha, gross beta, tritium	Gross alpha activity was detected in two samples. Gross beta activity was measured in 14 of 15 samples collected (including duplicate). The maximum was well below the EPA Safe Drinking Water Act limits. Tritium was detected in two samples.
Surface Water	Liquid	Gross alpha, gross beta, tritium	Six samples were collected. The 3s value was exceeded for gross alpha in one sample, tritium in two samples and gross beta in all samples. All concentrations were below EPA and DOE limits, and were within historical measurements.
Milk	Liquid	Iodine-131, gamma-emitting radionuclides, and ^{90}Sr & tritium (select samples only)	Cesium-137 was detected in two samples analyzed for gamma-emitting radionuclides.. Iodine-131 was not found in any sample. Strontium-90 was detected at low levels in four of five samples analyzed for ^{90}Sr. Tritium was detected on two of four samples. Results were within historical measurements.
Potatoes	Vegetation	Gamma emitting radionuclides, ^{90}Sr	Cesium-137 was detected in one sample from the state of Idaho and an out-of-state sample from Colorado. No ^{90}Sr was detected.
Waterfowl	Tissue	Gamma emitting radionuclides, select actinides (^{241}Am, ^{238}Pu, and ^{239,240}Pu), ^{90}Sr	Eight radionuclides were found in tissues from ducks collected at the Reactor Technology Complex, including four radionuclides found in edible tissue. Concentrations were generally lower than those found in the previous year. The estimated dose from eating the entire edible

			mass of the duck with the highest concentrations was estimated at 0.013 mrem.
Environmental Radiation	TLD	Ambient ionizing radiation	Values were consistent with expected exposures given the altitude and location of the TLD's. There were no statistical differences between Boundary and Distant location results.

TABLE OF CONTENTS

Executive Summary ii
Table of Contents vi
List of Figures vii
List of Tables viii
List of Abbreviations ix
List of Units x
1. ESER Program Description 1-1
2. The INL Site 2-1
3. Air Sampling 3-1
   Low-Volume Air Sampling 3-1
   Atmospheric Moisture Sampling 3-7
   PM_{10} Air Sampling 3-8
4. Water Sampling 4-1
   Precipitation Sampling 4-1
   Drinking Water 4-1
   Surface Water 4-13
5. Agricultural Product and Wildlife Sampling 5-1
   Milk Sampling 5-1
   Potato Sampling 5-12
   Large Game Animal Sampling 5-2
   Waterfowl Sampling 5-2
6. Environmental Radiation 7-1
7. Quality Assurance 7-1
   Method Uncertainty 7-1
   Data Completeness 7-1
   Data Accuracy 7-1
   Data Precision 7-15
   Blanks 7-11
   Other QA Problems Noted 7-12
8. References 8-1

Appendix A Summary of Sampling Schedule .... A - 1
Appendix B Summary of MDCs and DCGs .... B - 1
Appendix C Sample Analysis Results .... C - 1
Appendix D Statistical Analysis Results .... D - 1

LIST OF FIGURES

Figure 1. Example of overlap of blank and sample measurement distributions. 1-3
Figure 2. Low-volume air sampler locations. 3-1
Figure 3. Gross alpha concentrations in air at ESER INL Site, Boundary and Distant locations for the fourth quarter of 2006. 3-3
Figure 4. October gross alpha concentrations in air at ESER INL Site, Boundary and Distant locations. 3-4
Figure 5. November gross alpha concentrations in air at ESER INL Site, Boundary and Distant locations. 3-5
Figure 6. December gross alpha concentrations in air at ESER INL Site, Boundary and Distant locations. 3-6
Figure 7. Gross beta concentrations in air at ESER INL Site, Boundary and Distant locations for the fourth quarter 2006. 3-9
Figure 8. October gross beta concentrations in air at ESER INL Site, Boundary and Distant locations. 3-10
Figure 9. November gross beta concentrations in air at ESER INL Site, Boundary and Distant locations. 3-101
Figure 10. December gross beta concentrations in air at ESER INL Site, Boundary and Distant locations. 3-12
Figure 11. Drinking and surface water sampling locations. 4-2
Figure 12. ESER Program milk sampling locations. 5-1
Figure 13. TLD sampling locations. 6-1

LIST OF TABLES

Table E-1. Summary of results for the fourth quarter of 2006. iv

Table 1. Summary of 24-hour PM_{10} values. 3-8

Table 2. Drinking water results greater than (>) 3s. 4-3

Table 3. Surface water results greater than (<) 3s. 4-3

Table 4. TLD Exposures from May to November 2006. 6-1

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

Table B-1. Summary of Approximate Minimum Detectable Concentrations for Radiological Analyses Performed During Fourth Quarter 2006 .... B-1

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

Table C-2 Weekly Iodine-131 Activity in Air C-6

Table C-3 Quarterly Americium-241, Cesium-137, Plutonium-238, Plutonium-239/240, & Strontium-90 Concentrations in Composite Air Filters.................................... C-11

Table C-4 Tritium Concentrations in Atmospheric Moisture. C-13

Table C-5 PM_{10} Concentrations at Atomic City, Blackfoot CMS, and Rexburg CMS C-14

Table C-6 Monthly and Weekly Tritium Concentrations in Precipitation. C-15

Table C-7 Gross Alpha, Gross Beta and Tritium Concentrations in Drinking and Surface Water. C-16

Table C-8 Weekly and Monthly Iodine-131 & Cesium-137 Concentrations in Milk C-19

Table C-9 Strontium-90 and Tritium Concentrations in Milk.. C-21

Table C-10 Cesium-137 and Strontium-90 Concentrations in Potatoes. C-22

Table C-11 Gamma-emitting Radionuclides, Actinides and Strontium-90 in Waterfowl C-23

Table C-12 Environmental Radiation Results. C-30

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

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

LIST OF ABBREVIATIONS

AEC	Atomic Energy Commission
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
ICP	Idaho Cleanup Project
INL	Idaho National Laboratory
INEEL	Idaho National Engineering and Environmental Laboratory
ISU	Idaho State University
LCS	Laboratory Control Standard
MAPEP	Mixed Analyte Performance Evaluation Program
MDC	minimum detectable concentration
NIST	National Institute of Standard and Technology
NRTS	National Reactor Testing Station
PM_{10}	particulate matter less than 10 micrometers in diameter
QA	Quality Assurance
QAPP	Quality Assurance Project Plan

LIST OF UNITS

Bq	becquerel
Ci	curie
g	gram
L	liter
µCi	microcurie
mL	milliliter
mR	milliroentgens
mrem	millirem (rem = unit of dose equivalent [roentgen-equivalent-man])
mSv	millisieverts
pCi	picocurie
R	Roentgen
µSv	microsieverts

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 2006, 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 2006 (October 1–December 31, 2006).

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
- surface water at five locations on the Snake River
- drinking water at 14 locations around the INL Site
- agricultural products, including milk at 10 dairies around the INL Site, potatoes from at least five local producers, wheat from approximately 10 local producers, lettuce from approximately nine home-owned and portable gardens on and around the INL, and four sheep from two operators which graze their sheep on the INL Site
- 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), waterfowl and doves 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 2006). 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.

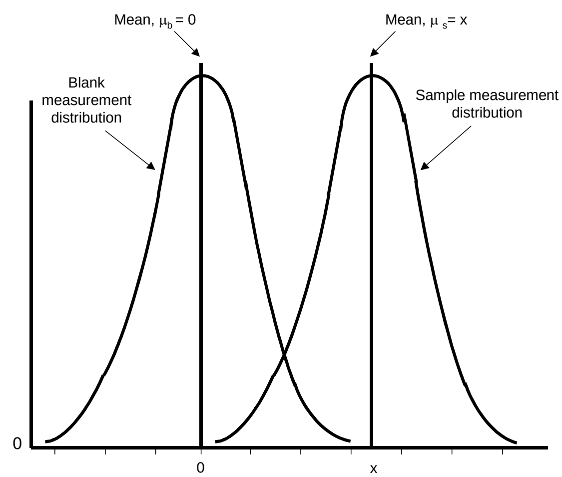


Figure 1. Example of overlap of blank and sample measurement distributions.

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 (2,300 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. 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 fourth quarter of 2006 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 2006 (Figure 2). Four of these samplers are located on the INL Site, eight 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 year to a new location. One replicate sampler was placed at Mud Lake (a Boundary location) and one at the Experimental Field Station (an INL Site location) during 2006. An average of 16,148 ft^3 (457 m^3) of air was sampled at each location, each week, at an average flow rate of 1.60 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.

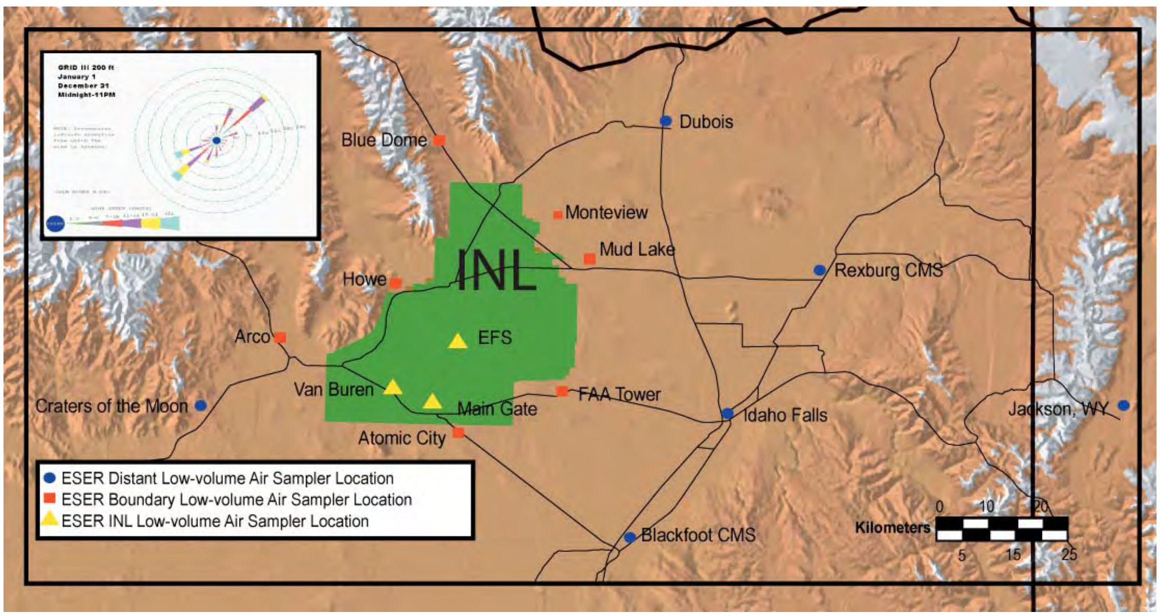


Figure 2. Low-volume air sampler locations.

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. 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 2006 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 25^{th} and 75^{th} 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 fourth 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. The outlier values lie within the range of measurements made within the past several years. Thus, rather than dismissing the outliers, they were included in the subsequent statistical analyses.

Figure 3 graphically shows that the gross alpha measurements made at INL Site, Boundary and Distant locations are similar for the fourth 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. 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. There was no statistical difference in gross alpha concentrations between location groups during the fourth quarter of 2006.

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.

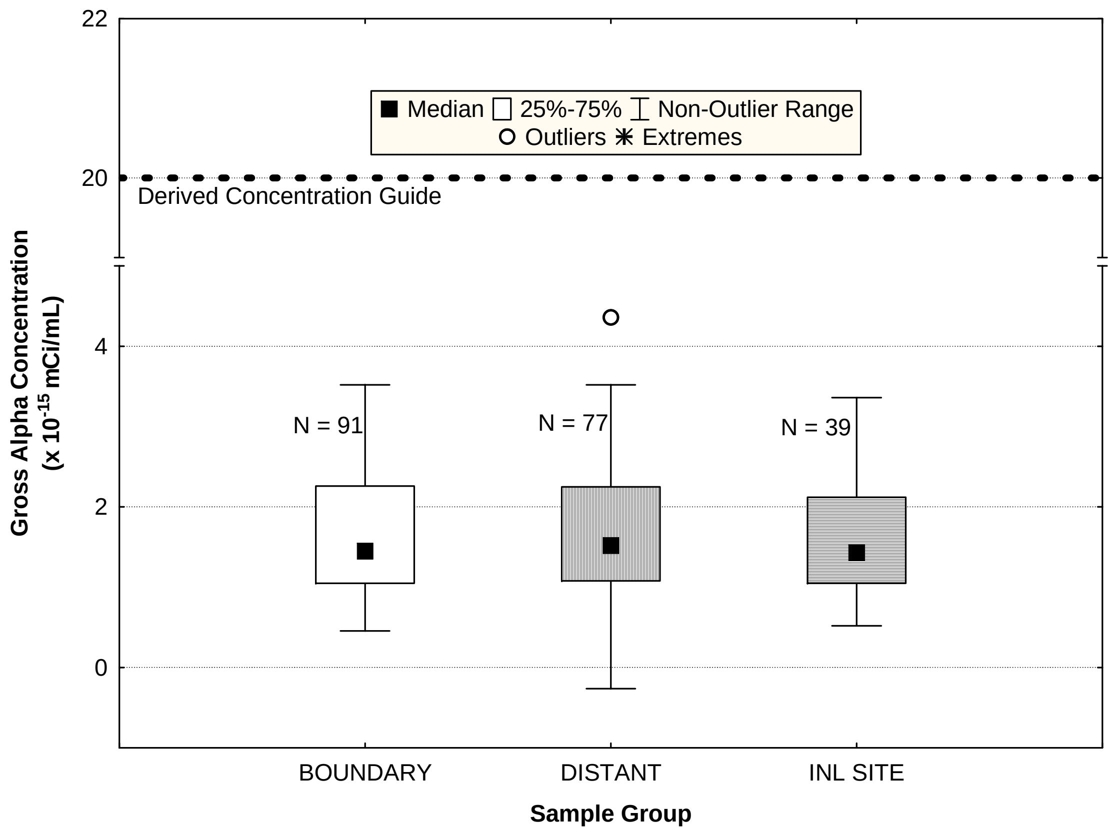


Figure 3. **Gross alpha concentrations in air at ESER INL Site, Boundary and Distant locations for the fourth quarter of 2006.**

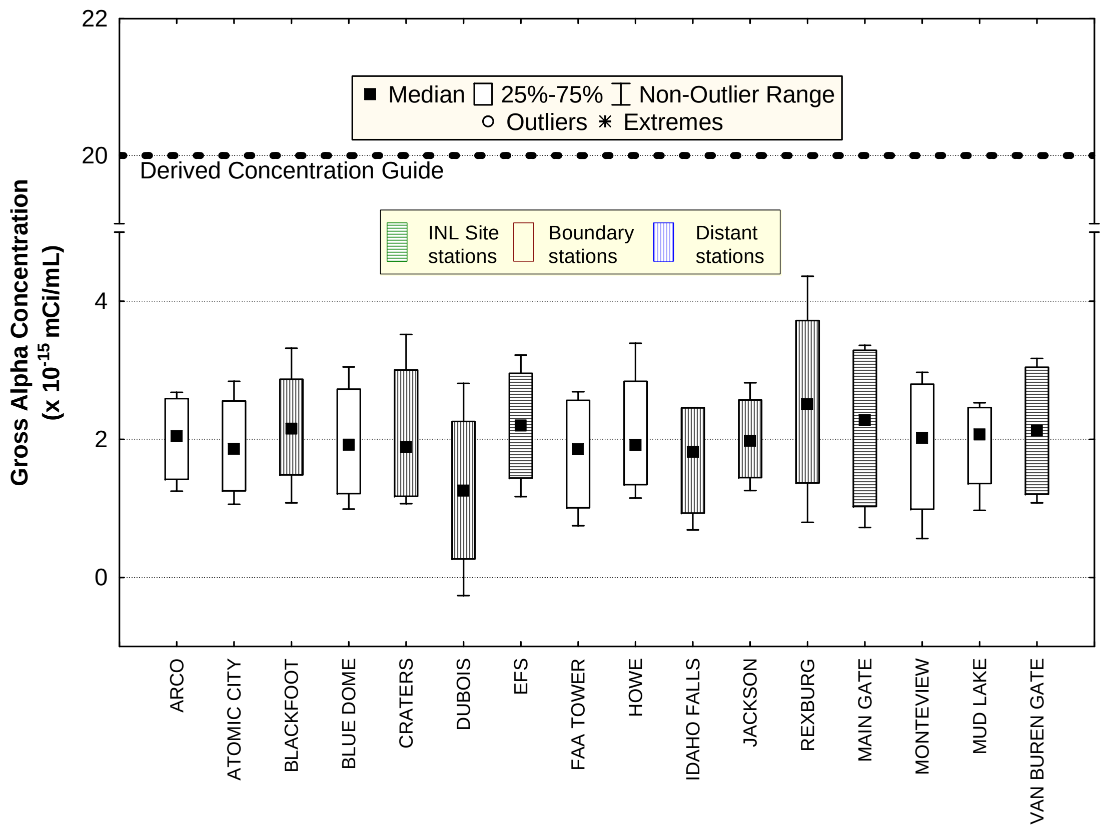


Figure 4. **October gross alpha concentrations in air at ESER INL Site, Boundary and Distant locations. Number of samples (N) = 4 at each location.**

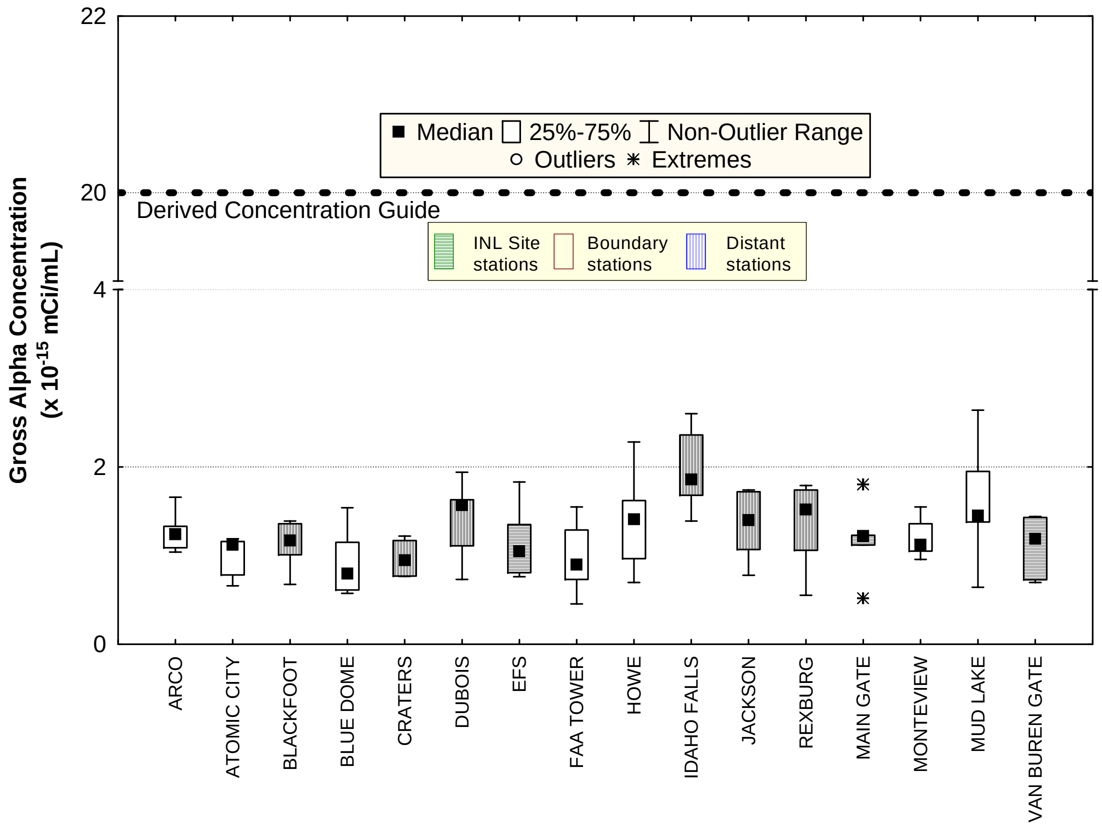


Figure 5. **November gross alpha concentrations in air at ESER INL Site, Boundary and Distant locations. Number of samples (N) = 5 at each location, except at Craters, where N = 4.**

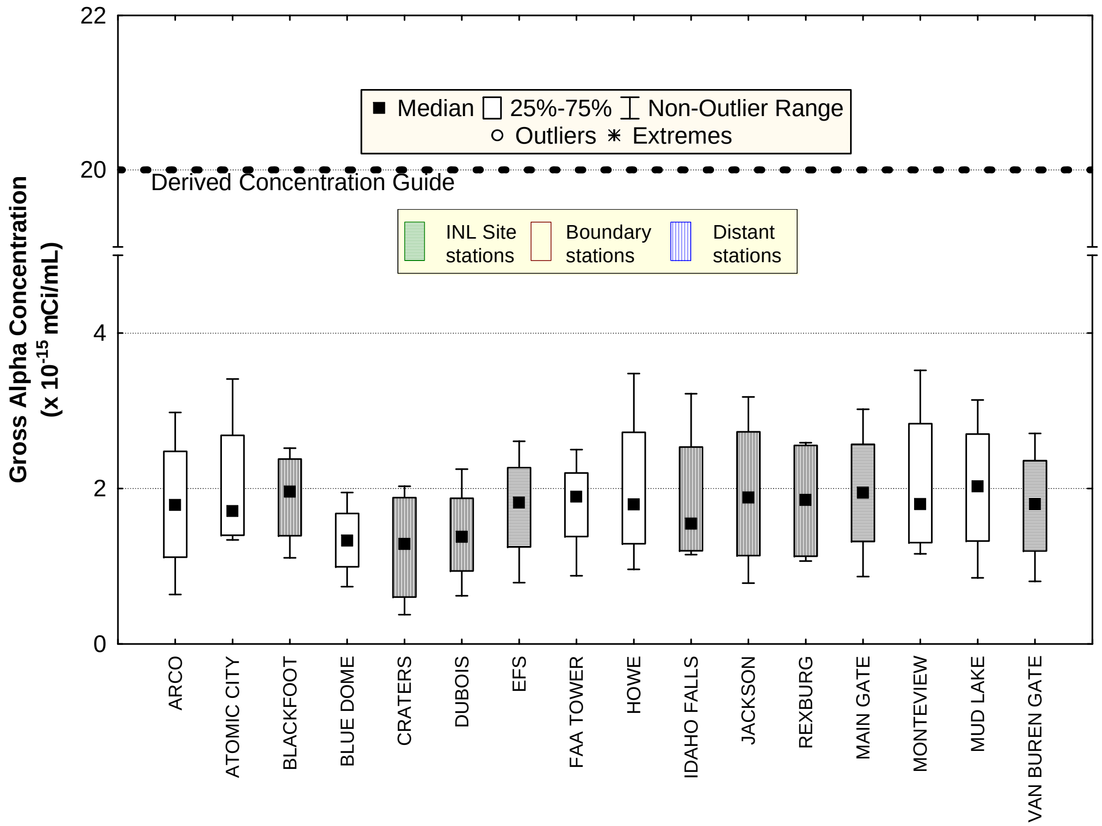


Figure 6. **December gross alpha concentrations in air at ESER INL Site, Boundary and Distant locations. Number of samples (N) = 4 at each location.**

There were no statistical differences in gross alpha concentrations between Distant and Boundary locations during any month of the fourth 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 (November 29) where a statistical difference existed between the two sample groups (Table D-2). In this week, the gross alpha concentrations measured at Distant locations were statistically greater than those measured at Boundary locations, not indicative of an impact from the INL Site.

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 2006 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. The quarterly data for each group appear to be similar and were determined using the Kruskal-Wallace test to be statistically the same (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 were no statistical differences in gross beta between groups for any month during the quarter (Table D-1).

Comparison of weekly Boundary and Distant gross beta data sets, using the Mann Whitney U test, showed statistical differences between Boundary and Distant measurements during two weeks of the fourth quarter (Table D-2). In one of these cases, the week of November 8, the Boundary group was statistically greater than the Distant group. Examination of the data for this week indicates lower concentrations in some of the eastern valley locations (Idaho Falls, Jackson, and Rexburg) than some of the sampling locations in the northern part of the sampling area (e.g. Howe and Mud Lake). No particular distribution was seen in the data to indicate an INL Site-related cause, and it is more likely due to random variability in the data. In the second case, the week of November 29, the Distant group was statistically higher than the Boundary group.

No ^{131}I was detected in any of the charcoal cartridge batches collected during the fourth quarter of 2006. 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 detected near the detection limit in two of the 26 measured batches of cartridges. The analytical laboratory considers these detections a result of the materials used in the charcoal filters.

Weekly filters for the fourth quarter of 2006 were composited by location. All samples were analyzed for gamma-emitting radionuclides, including ^{137}Cs (see Table C-3, Appendix C.). Cesium-137 was detected in one composite from Arco near the detection limit. A recount did not find detectable ^{137}Cs.

Composites were also analyzed for ^{90}Sr, ^{238}Pu, $^{239/240}Pu$ and ^{241}Am. None of these radionuclides were detected during the fourth quarter.

ATMOSPHERIC MOISTURE SAMPLING

Fourteen atmospheric moisture samples were obtained during the fourth quarter of 2006 from Atomic City, Blackfoot CMS, Idaho Falls and Rexburg CMS. 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.

Eight samples exceeded the 3s uncertainty level for tritium—two from each sampling location. All samples with detectable tritium were significantly below the DOE DCG for tritium in air of 1×10^{-7} μCi/mL, ranging from $(3.9 \pm 1.2) \times 10^{-13}$ $\mu Ci/mL_{air}$ at Blackfoot in November/December to $(14.2 \pm 1.3) \times 10^{-13}$ $\mu Ci/mL_{air}$, at Rexburg in October/November. All results are shown in 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 [CFR 2006]). 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 $\mu g/m^3$, with a maximum 24-hour concentration of 150 $\mu g/m^3$.

The ESER Program operates three PM_{10} particulate 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. The maximum 24-hour particulate concentration was 30.9 $\mu g/m^3$ on October 13, 2006, at Rexburg. The average, maximum, and minimum results of the 24-hour samples are shown are shown in Table 1. Results for all PM_{10} samples are listed in Table C-5, Appendix C.

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

	Concentration[a]		
Location	**Minimum**	**Maximum**	**Average**
Atomic City	0.0	22.4	3.5
Blackfoot, CMS	0.8	20.6	6.9
Rexburg, CMS	0.0	30.9	19.7

a. All concentrations are in ($\mu g/m^3$).

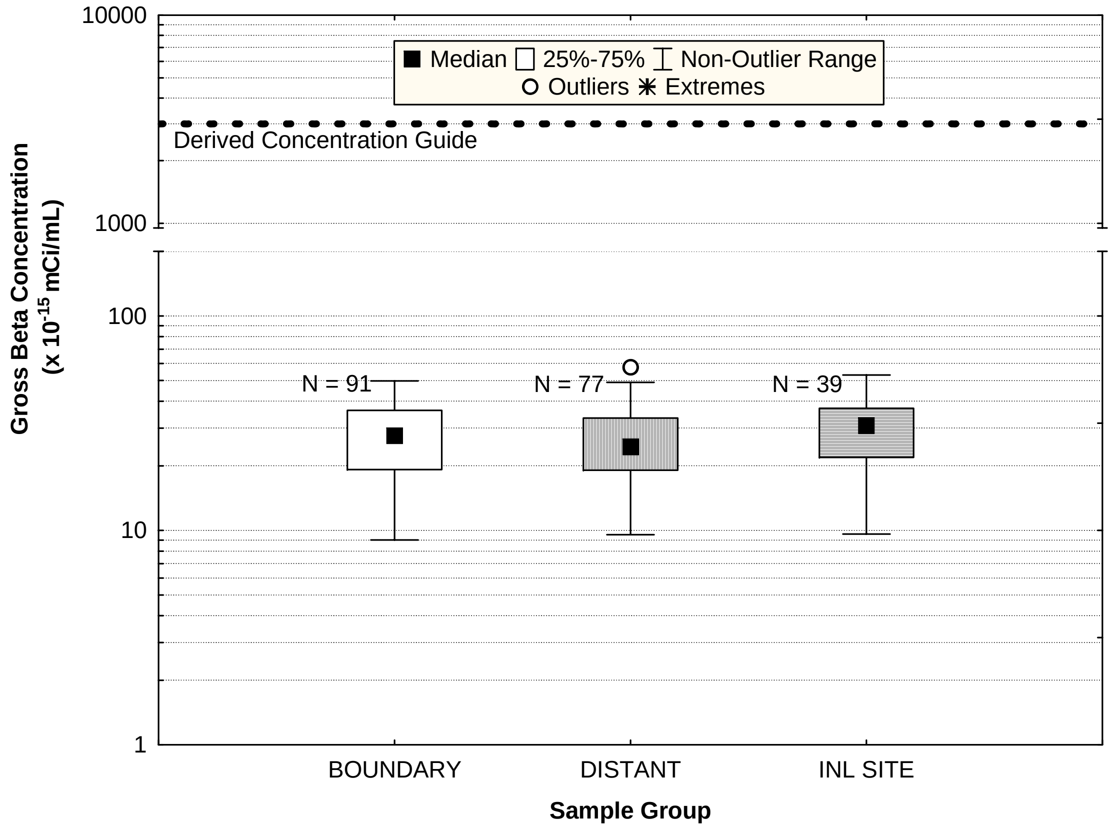


Figure 7. **Gross beta concentrations in air at ESER INL Site, Boundary and Distant locations for the fourth quarter 2006.**

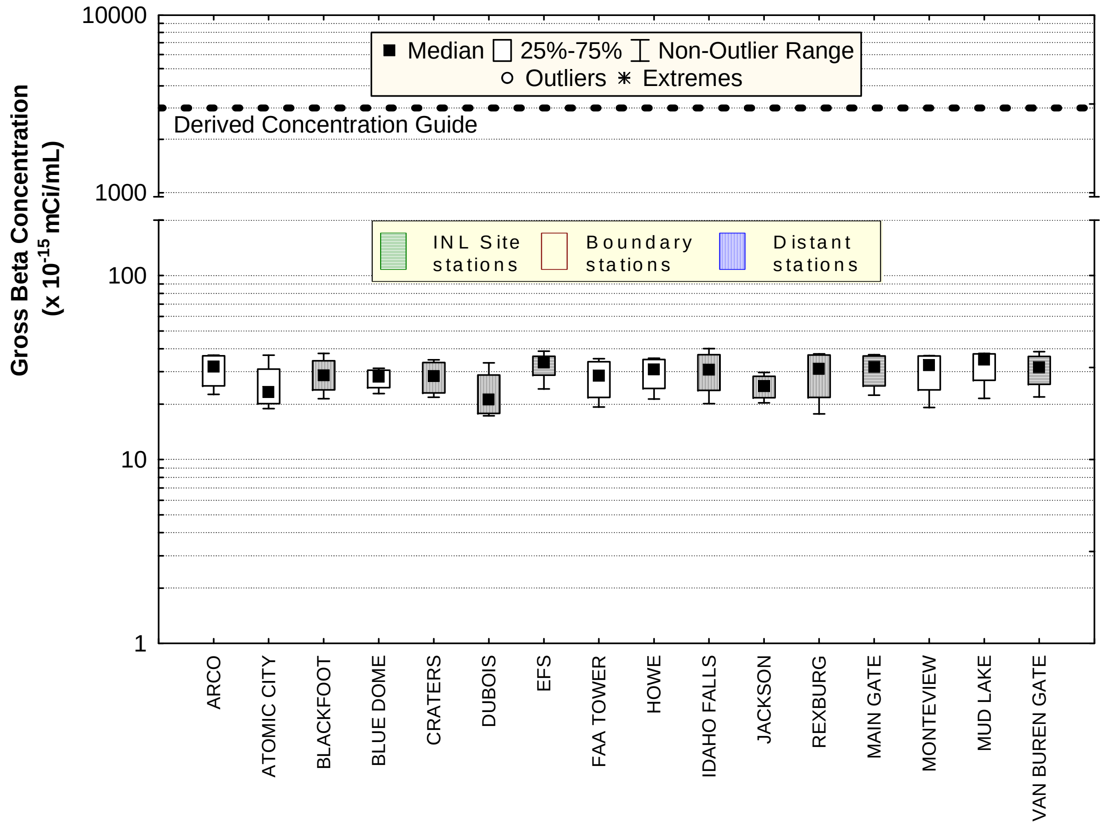


Figure 8. **October gross beta concentrations in air at ESER INL Site, Boundary and Distant locations. Number of samples (N) = 4 at each location.**

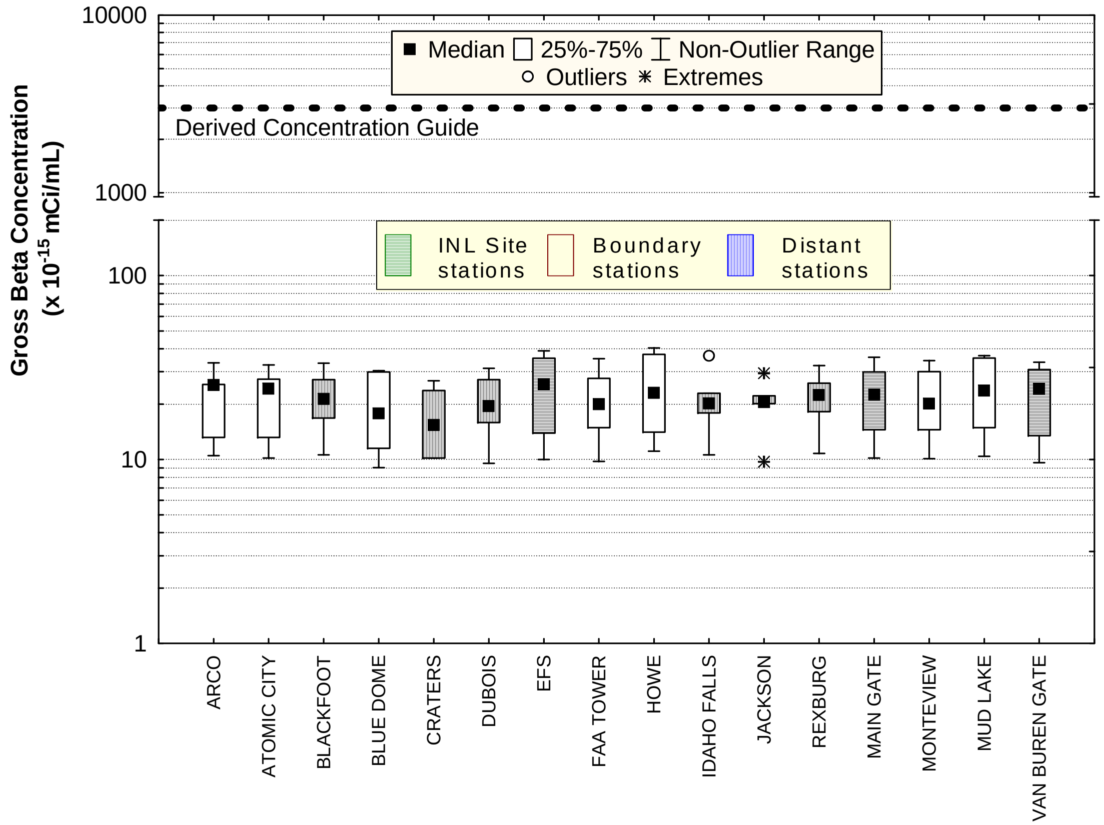


Figure 9. November gross beta concentrations in air at ESER INL Site, Boundary and Distant locations. Number of samples (N) = 5 at each location, except at Craters, where N = 4.

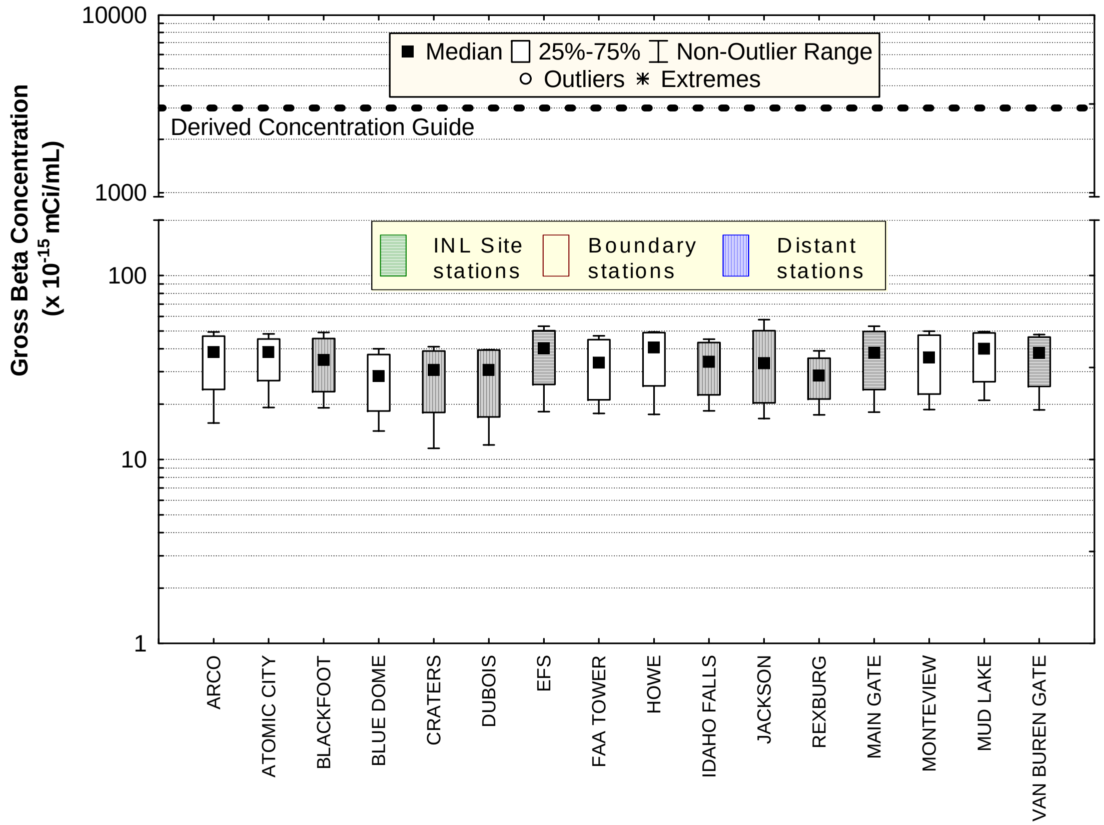


Figure 10. December gross beta concentrations in air at ESER INL Site, Boundary and Distant locations. Number of samples (N) = 4 at each location.

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 INL Site. Weekly precipitation samples are collected from the Experimental Field Station (EFS) on the INL Site. Surface and/or drinking water are sampled twice each year at 19 locations around the INL Site. This occurs during the second and fourth quarters.

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 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 2006 produced sufficient precipitation to yield 12 samples –three from CFA and Idaho Falls and six weekly samples from the EFS.

Tritium was measured above the 3s value in three of the 12 samples collected during the fourth quarter of 2006. 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 2005, tritium measured in samples from Region 10 (which includes Idaho) ranged from -200 to 7500 pCi/L (EPA 2006). Tritium measured in all second quarter ESER samples were within this range and were consistent with historical measurements at the INL Site, with a maximum of 124.0 ± 30.3 pCi/L at CFA. Data for all fourth quarter 2006 precipitation samples collected by the ESER Program are listed in Table C-6 (Appendix C).

DRINKING WATER

Fourteen drinking water samples and one duplicate were collected from selected taps throughout southeast Idaho (Figure 11). Samples were analyzed for gross alpha, gross beta, and tritium (^{3}H).

Two of the samples exceeded the 3s value for gross alpha. It is not unusual to detect this constituent in water of the Snake River Plain, related to natural production from the basalts that make up the aquifer. The maximum detectable result, a sample from Atomic City, had a gross alpha concentration of 1.81 ± 0.38 pCi/L. This value is below the EPA and DOE limits for gross alpha in drinking water of 15 pCi/L and 30 pCi/L, respectively

Of the fifteen drinking water samples (including the duplicate) collected, all samples but one exceeded their 3s value for gross beta (Table 2). The EPA Safe Drinking Water Act (SDWA) limits gross beta in drinking water based on an annual exposure of 4 mrem/yr. Since data are reported from the laboratory as a concentration (i.e., pCi/L) a screening concentration of 50 pCi/L is used to meet this level (Appendix B-1). The maximum concentration of gross beta detected was from Fort Hall and was lower than the SDWA screening value. Levels of gross beta observed in drinking water are not unusual given the basaltic terrain (USGS 2003). All values are similar to those recorded in previous years, and are well below the levels outlined for drinking water protection (Table B-1). All drinking water sample results may be found in Appendix C, Table C-7.

Tritium was detected in two of the samples collected. Detectable tritium concentrations were 92 ± 24 pCi/L at Mud Lake and 93 ± 29 pCi/L at Shoshone. Both values are well below the EPA limit of 20,000 pCi/L and the DOE DCG of 2.0 x 10^6 pCi/L. Tritium values were within historical data collected by the ESER and within EPA measurements made through the RadNet program in Region 10 (Alaska, Idaho, Oregon, and Washington), which ranged from -87 ± 37 pCi/L to 1402 ± 63 pCi/L in the period 2000-2005.

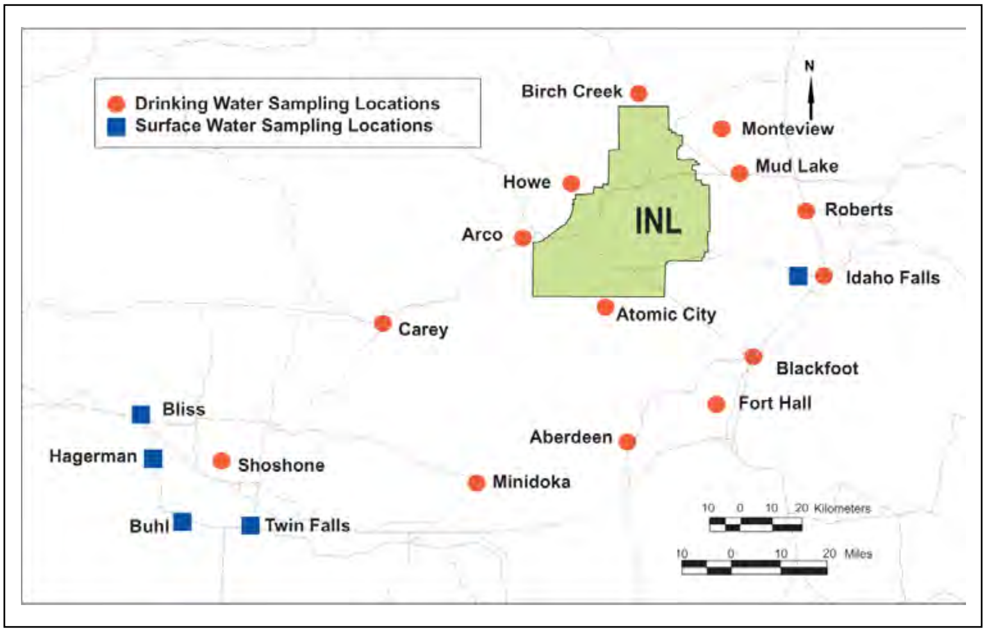


Figure 11. Drinking and surface water sampling locations.

Table 2. Drinking water results greater than (>) 3s.

Location	Sample Results[a] Result ± 1s	Limits for Comparison[a] SDWA[b]	DOE DCG[c]
Gross Alpha			
Atomic City	1.81 ± 0.38	15	30
Howe	1.03 ± 0.33	15	30
Gross Beta			
Aberdeen	5.43 ± 0.57	50	100
Arco	1.51 ± 0.48	50	100
Atomic City	3.93 ± 0.52	50	100
Carey	2.65 ± 0.54	50	100
Fort Hall	7.89 ± 0.63	50	100
Howe	1.90 ± 0.48	50	100
Idaho Falls	3.16 ± 0.52	50	100
Minidoka	5.31 ± 0.59	50	100
Monteview	4.36 ± 0.53	50	100
Moreland	6.33 ± 0.55	50	100
Mud Lake	5.46 ± 0.59	50	100
Roberts	3.72 ± 0.53	50	100
Shoshone	4.70 ± 0.55	50	100
Taber	4.31 ± 0.52	50	100
Tritium			
Mud Lake	92.0 ± 29.4	20,000	2×10^6
Shoshone	92.6 ± 29.4	20,000	2×10^6

a. All values shown are in picocuries per liter (pCi/L).
b. SDWA = Safe Drinking Water Act.
c. DCG – Derived Concentration Guide.

SURFACE WATER

Five surface water samples and one duplicate sample were collected from locations throughout southeast Idaho and were analyzed for tritium, gross alpha, and gross beta. One of samples had measurable gross alpha activity greater than 3s and two of the samples had measurable tritium activity. All six surface water samples were greater than their associated 3s values for gross beta activity (Table 3). All reported levels of these constituents were much lower than the SDWA and the DCG values (Table B-1).

Table 3. Surface water results greater than (>) 3s.

	Limits for Comparison[a]

Location	Result ± 1s	SDWA	DOE DCG
Gross Alpha			
Hagerman	1.18 ± 0.34	15	30
Gross Beta			
Bliss	5.24 ± 0.55	50	100
Buhl	4.15 ± 0.53	50	100
Buhl (duplicate)	5.24 ± 0.57	50	100
Hagerman	4.34 ± 0.52	50	100
Idaho Falls	2.55 ± 0.46	50	100
Twin Falls	7.71 ± 0.57	50	100
Tritium			
Buhl (duplicate)	90.1 ± 29.6	20,000	2×10^6
Hagerman	92.5 ± 29.7	20,000	2×10^6

a. All values shown are in picocuries per liter (pCi/L).

The presence of gross alpha and gross beta in surface water (particularly the springs) is typically related to dissolution of naturally occurring radionuclides (i.e., uranium, radium, potassium) by groundwater as it flows through the surrounding basalts (Twinning and Rattray 2003). Levels of gross alpha and gross beta in all samples are similar to results from recent years. All gross alpha and gross beta results can be found in Appendix C, Table C-7.

5. AGRICULTURAL PRODUCT 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 INL Site and Southeast Idaho. Specifically, milk, wheat, potatoes, garden lettuce, sheep, big game, doves and waterfowl are sampled. Milk is sampled throughout the year and large game animals are sampled whenever available. Sheep are sampled during the second quarter. 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 2006.

MILK SAMPLING

Milk samples were collected weekly in Ucon and monthly at nine other locations around the INL Site (Figure 12) during the second quarter of 2006. All samples were analyzed for gamma emitting radionuclides. Samples are analyzed for ^{90}Sr and tritium during the second and fourth quarters.

Cesium-137 was detected in two of the samples, one from Dietrich and one from Ucon, at values just at the detection limit. Iodine-131 was not dectected in any sample. Data for ^{131}I and ^{137}Cs in milk samples are listed in Appendix C, Table C-8.

Strontium-90 was detected in four of five samples analyzed at levels within historical measurements (Table C-9 in Appendix C.) Tritium was detected in two of four samples analyzed, also similar to previous measurements (Table C-9).

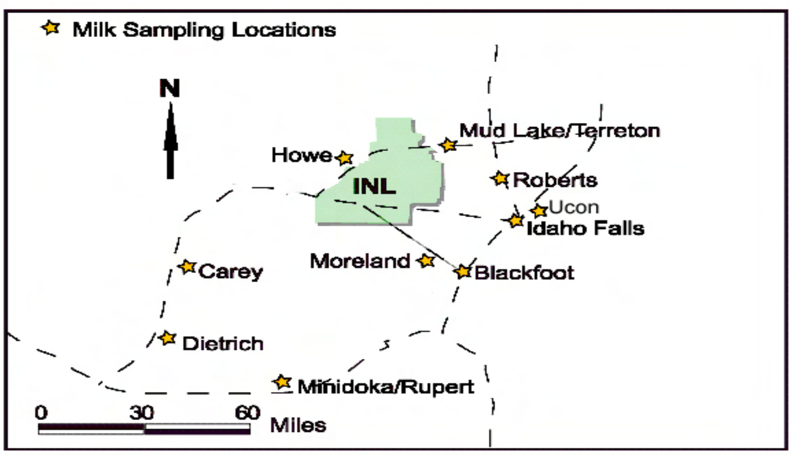


Figure 12. ESER milk sampling locations.

POTATO SAMPLING

Eight potato samples were collected from area growers and from one out-of-state location (San Juan Valley, Colorado). All samples were analyzed for gamma emitting radionuclides and ^{90}Sr. Cesium-137 was measured in two samples-the Colorado sample and the sample from Rupert. Strontium-90 was not detected in any of the samples. All values were within historic concentrations measured in potatoes collected from farms surrounding the INL and out-of-state areas.

Data for ^{137}Cs and ^{90}Sr in all potato samples taken during the fourth quarter are listed in Table C -10 (Appendix C).

LARGE GAME ANIMAL SAMPLING

No large game animals were available for sampling during the fourth quarter of 2006.

WATERFOWL SAMPLING

Seventeen ducks were collected during 2006. Nine were collected from wastewater ponds located at the Reactor Technology Complex (RTC) facility, five came from wastewater ponds near the Materials and Fuels Complex (MFC) facility, and three control samples were collected near American Falls. Each duck sample was divided into three sub-samples: one consisting of edible tissue (muscle, gizzard, heart and liver); viscera; and a remainder sample that includes all remaining tissue (bones, feathers, feet, bill, head, and residual muscle). All were analyzed for gamma emitting radionuclides, ^{90}Sr, ^{238}Pu, $^{239/240}$Pu, and ^{241}Am. Concentrations of radionuclides measured in the edible tissues of 2006 waterfowl are shown in Table C-11 (Appendix C).

Several manmade radionuclides were detected in the samples taken from the RTC ponds. These included ^{241}Am, ^{137}Cs, ^{51}Cr, ^{60}Co, ^{238}Pu, $^{239/240}$Pu, ^{90}Sr, and ^{65}Zn. Of these eight, four (^{137}Cs, ^{60}Co, ^{90}Sr, and ^{241}Am) were found in the edible tissues. Six radionuclides, ^{241}Am, ^{137}Cs, ^{60}Co, $^{239/240}$Pu ^{90}Sr and ^{65}Zn, were also detected in the birds from the MFC ponds. Two manmade radionuclides (^{241}Am and ^{90}Sr) and were found in the control samples.

Since manmade radionuclides were found more frequently and at higher concentrations in ducks taken from the INL Site, it is assumed that the INL Site is the source of these detections. Concentrations of the detected radionuclides from RTC were similar to, or significantly lower in the case of ^{137}Cs, than those found in 2005. Measured concentrations were also lower than those in ducks taken during a 1994-1998 study (Warren et al. 2001). The ducks were not taken directly from the two-celled hypalon-lined radioactive wastewater RTC Evaporation Pond but from an adjacent sewage lagoon. However, it is likely that the birds also used the RTC 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 2006 was estimated to be 0.013 mrem (0.00013 mSv). This dose is lower than dose estimates for some previous periods. The maximum dose estimated for the period from 1993 through 1998 was 0.89 mrem (0.009 mSv) and from 2000 through 2004 was 0.08 mrem (0.0008 mSv). 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 (0.54 mSv).

6. ENVIRONMENTAL RADIATION

An array of thermoluminescent dosimeters (TLDs) is distributed throughout the Eastern Snake River Plain to monitor for environmental radiation (Figure 13). TLDs are changed out in May and again in November after six months in the field. The results of the fall sampling of TLDs exposed from May to November 2006 are discussed below.

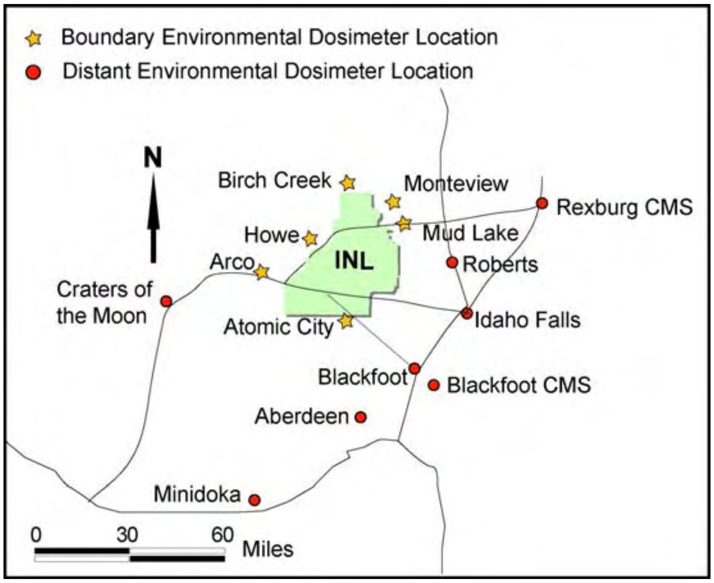


Figure 13. TLD sampling locations.

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 0.27 mR/day at Blue Dome to a high of 0.33 mR/day at Arco and Atomic City. The overall Boundary average was 0.30 mR/day. The Distant group had a high of 0.37 mR/day at Rexburg and a low of 0.25 mR/day at the Dubois location. The overall average Distant value was 0.31 mR/day. There was no statistical difference between Boundary and Distant locations. Furthermore, all values are consistent with past readings. Table 4 lists the range and average for both groups over a six-month period. All results are listed in Appendix C, Table C-12.

Table 4. TLD Exposures from May to November 2006.

	Total Exposure[a]	
Location	**Boundary**	**Distant**
Minimum	50.70	47.70
Maximum	62.60	69.60
Average	57.59	56.61

a All values shown are in milliRoentgens (mR).

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.

The following discussion briefly summarizes the results of the quality assurance program for the period from October 1 to December 31, 2006.

METHOD UNCERTAINTY

The Quality Assurance Project Plan (QAPP) establishes data quality and method quality objectives for the ESER surveillance program (Stoller 2007). Since the primary concern is with detection, the lower bound for the method uncertainty is set at zero. The upper bound is defined by the ESER program as the maximum concentration for the range of data over the past ten years, excepting those values determined to be extremes using box plots generated by a statistical data program. Each individual result is checked for acceptance on the basis of the result, whether it is below the lower limit (i.e., a negative value), greater than the upper limit, or between the lower and upper limit (the most common occurrence). The calculated method uncertainty is then compared to the 1s measured uncertainty. A sample is deemed acceptable when the measured 1s uncertainty is less than the calculated uncertainty. The upper bound values were recently re-evaluated and revised. Preliminary results indicate that more calculated method uncertainties for detected results were acceptable. In the fourth quarter of 2006, approximately 97.2 percent of method uncertainties were in the acceptable categories.

DATA COMPLETENESS

The Quality Assurance Project Plan specifies a 98 percent completeness goal for all regularly scheduled sample types. This goal does not include variable sample types such as game animals and precipitation, where the ability to produce a sample is not controllable. Data completeness for sample collection and delivery was 100 percent during the fourth quarter for all samples types with the following exceptions.

One paper air filter from Craters of the Moon during the week of November 8 was found to missing from the filter head upon return to the office. The completeness of the air filter data set is therefore 99.6 percent for the fourth quarter.

The following results were lost in analysis during the fourth quarter: one Pu-238 result in air, one Pu-239/240 result in air, 1 Am-241 result in waterfowl and three Pu-239/240 results in waterfowl.

DATA ACCURACY

SPIKE SAMPLE RESULTS

The ESER obtains spike samples from the Department of Energy’s Radiological and Environmental Sciences Laboratory, which prepares the spikes and issues data reports with the results. Some spikes are also obtained from private vendors, such as Analytics and

Environmental Resource Associates, who provide a certificate of analysis with the sample. During the fourth quarter of 2006, data were obtained for the following spikes:

- Milk spike analyzed for Iodine-131 by the EAL.

Table 5. Results for Milk Spike-Sample ID 06-MI-0114

Constituent	**ERA Activity (pCi/L ± 1σ)**	**EAL Activity (pCi/L ± 1σ)**	**Percent Deviation**	***AGREEMENT?***
Iodine-131	10.0 ± 1.7	7.12 ± 1.87	-28.8	No
Note: Subsequent recounts indicated activities of 10.1 (+1.0 percent) and 9.62 (-3.8 percent) pCi/L.				
Note: Activities are as of 10/3/06.				

Performance Evaluation Results

The QAP program was discontinued following the March 2004 distribution. Performance evaluation samples are now prepared through the Mixed Analyte Performance Evaluation Program (MAPEP), administered by the Department of Energy's Radiological and Environmental Sciences Laboratory. DOE has mandated that all laboratories performing analyses in support of the Office of Environmental Management shall participate in MAPEP. The program distributes samples of air, water, vegetation and soil for analysis in approximately January and June. Both radiological and nonradiological constituents are included in the program.

Both the Idaho State University EAL and Teledyne Brown Engineering participated in the MAPEP Study reported in November 2006. Results are tabulated below for those analyses performed by each laboratory. (A = Acceptable, W = Acceptable with warning, N = Not acceptable)

Table 6. MAPEP Results for November 2006

IDAHO STATE UNIVERSITY ENVIRONMENTAL ASSESSMENT LABORATORY					
Matrix: Air (Bq)					
Analyte	EAL Result	MAPEP Result	Bias (percent)	Acceptable Range	Evaluation
Cesium-134	2.9	3.147	-7.8	2.20-4.09	A
Cesium-137	1.8	1.805	-0.3	1.26-2.35	A
Cobalt-57	2.6	2.582	0.7	1.81-3.36	A
Cobalt-60	1.6	1.577	1.5	1.10-2.05	A
Manganese-54	2.0	1.92	4.2	1.34-2.5	A
Gross alpha	0.08	0.290	-72.4	0.0-0.580	A
Gross beta	0.34	0.359	-5.3	0.180-0.538	A
Matrix: Water (Bq/L)					
Cesium-134	97.9	112.82	-13.2	78.97-146.66	A
Cesium-137	193.6	196.14	-1.3	137.30-254.98	A

Cobalt-57	209.3	213.08	-1.8	149.16-277.00	A
Cobalt-60	47.7	47.5	0.4	33.2-61.8	A
Tritium	401.4	428.85	-6.4	300.20-557.50	A
Gross alpha	0.45	1.033	-56.4	0.0-2.066	A
Gross beta	1.05	1.03	1.9	0.52-1.54	A
Matrix: Soil (Bq/kg)					
Cesium-134	530.1	452.13	17.2	316.49-587.77	A
Cesium-137	687.5	525.73	30.8	368.01-683.45	N
Cobalt-57	845.6	676.33	25.0	473.43-879.23	W
Manganese-54	791.1	594.25	33.1	415.98-772.52	N
Potassium-40	955.9	604	58.3	423-785	N
Zinc-65	1214.9	903.61	34.5	632.53-1174.69	N
Matrix: Vegetation (Bq)					
Cesium-134	7.06	7.487	-5.7	5.24-9.73	A
Cesium-137	5.71	5.495	3.9	3.85-7.14	A
Cobalt-60	5.82	5.806	0.2	4.06-7.55	A
Manganese-54	8.28	8.351	-0.9	5.85-10.86	A
Zinc-65	6.30	5.984	5.3	4.19-7.78	A

TELEDYNE BROWN ENGINEERING					
Matrix: Air (Bq)					
Analyte	TBE Result	MAPEP Result	Bias (%)	Acceptable Range	Evaluation
Americium-241	0.124	0.142	-12.7	0.10-0.18	A
Cesium-134	2.62	3.147	-16.7	2.20-4.09	A
Cesium-137	1.98	1.805	9.7	1.26-2.35	A
Cobalt-57	2.65	2.582	2.6	1.81-3.36	A
Cobalt-60	1.63	1.577	3.4	1.10-2.05	A
Manganese-54	2.10	1.92	9.4	1.34-2.50	A
Plutonium-238	.0123	0.118	4.2	0.08-0.15	A
Plutonium-239/240	8.22e-3	--[a]			A
Strontium-90	0.549	0.62	-11.5	0.43-0.81	A
Uranium-234/233	0.140	0.134	4.5	0.09-0.17	A
Uranium-238	0.136	0.139	-2.2	0.10-0.18	A
Zinc-65	-0.163	--[a]			A
Gross Alpha	0.134	0.290	-53.8	0.0-0.580	A
Gross Beta	0.358	0.359	-0.3	0.180-0.538	A
Matrix: Water (Bq/L)					
Americium-241	2.09	2.31	-9.5	1.62-3.00	A
Cesium-134	99.8	112.82	-11.5	78.97-146.66	A
Cesium-137	191	196.14	-2.6	137.30-254.98	A
Cobalt-57	203	213.08	-4.7	149.16-277.00	A
Cobalt-60	46.2	47.5	-2.7	33.2-61.8	A
Tritium	471	428.85	9.8	300.20-557.50	A
Iron-55	173	165.4	4.6	115.8-215.0	A
Manganese-54	0.186	--[a]			A
Nickel-63	109	118.62	-8.1	83.03-154.21	A

Plutonium-238	1.50	1.39	7.9	0.97-1.81	A
Plutonium-239/240	2.01	1.94	3.6	1.36-2.52	A
Strontium-90	13.7	15.69	-12.7	10.98-20.40	A
Technetium-99	29.0	27.15	6.8	19.00-35.29	A
Uranium-234/233	2.19	2.15	1.9	1.50-2.80	A
Uranium-238	2.25	2.22	1.4	1.55-2.89	A
Zinc-65	178	176.37	0.9	123.46-229.28	A
Gross Alpha	1.52	1.033	47.1	0.0-2.066	A
Gross Beta	1.18	1.03	14.6	0.52-1.54	A
Matrix: Soil (Bq/kg)					
Americium-241	83.6	105.47	-20.7	73.83-137.11	W
Cesium-134	393	452.13	-13.1	316.49-587.77	A
Cesium-137	522	525.73	-0.7	368.01-683.45	A
Cobalt-57	636	676.33	-6.0	473.43-879.23	A
Cobalt-60	3.78	--[a]			A
Manganese-54	598	594.25	0.6	415.98-772.52	A
Nickel-63	571	672.3	-15.1	470.6-874.0	A
Plutonium-238	71.2	82	-13.2	57-107	A
Plutonium-239/240	0.487	--[a]			
Potassium-40	615	604	1.8	423-785	A
Strontium-90	178	223.3	-20.3	156.3-290.3	W
Technetium-99	175	218.01	-19.7	152.61-283.41	A
Uranium-234/233	119	152.44	-21.9	106.71-198.17	W
Uranium-238	115	158.73	-27.5	111.11-206.35	W
Zinc-65	937	903.61	3.7	632.53-1174.69	A
Matrix: Vegetation (Bq)					
Americium-241	-0.128	--[a]			A
Cesium-134	7.46	7.487	-0.4	5.24-9.73	A
Cesium-137	5.99	5.495	9.0	3.85-7.14	A
Cobalt-57	-1.15e-2	--[a]			A
Cobalt-60	5.95	5.806	2.5	4.06-7.55	A
Manganese-54	9.04	8.351	8.3	5.85-10.86	A
Strontium-90	1.19	1.095	8.7	0.77-1.42	A
Uranium-234/233	0.250	0.243	2.9	0.17-0.32	A
Uranium-238	0.216	0.253	-14.6	0.18-0.33	A
Zinc-65	6.16	5.984	2.9	4.19-7.78	A
a. False positive test. Value reported by laboratory was statistically zero.					

Internal Laboratory Spikes

The Idaho State University Environmental Assessment Laboratory uses NIST standards to prepare spiked water samples and uses commercially prepared calibration standards as NIST-traceable spiked samples. ISU considers a performance to be acceptable if results pass either the ±20 percent test specified by the ESER program or the three-sigma test described in the data precision section. A variety of checks are made each quarter on different geometries.

During the fourth quarter of 2006, 15 analyses were conducted on NIST-traceable standards for gamma-emitting radionuclides. The geometries tested were single charcoal cartridge, low-volume composite, 500-mL 1.0 g/cc and 1 L 1.0 g/cc. A total of 71 analytical results were generated. All of the results were within the ±20 percent range, with the exception of four analyses for Cobalt-57, which had gone through approximately nine half-lives at the time of analysis. All of these results were within the three standard deviation criterion.

Four gross alpha and two gross beta spiked water samples were analyzed in the fourth quarter. One of the gross alpha results was outside the 20 percent range, but was within the three standard deviation criterion. All other results were within 20 percent.

Water samples spiked with tritium received 11 analyses during the quarterly reporting period. All were well within the ±20 percent criterion, generally about 6 percent. A tritium in milk spike also had a result within approximately 6% of the known value.

Teledyne Brown analyzed a laboratory control sample (LCS) with each batch of samples submitted by the ESER. During the fourth quarter this consisted of strontium-90 and actinides in air, strontium-90 in potatoes, and strontium-90 and actinides in waterfowl.

DATA PRECISION

Data precision is measured using duplicate samples, split samples, and recounts. The Quality Assurance Project Plan 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 3 standard deviation criterion is the one that applies in nearly all cases. The standard deviation criterion is considered to be met if the values of the duplicate samples differ by less than the root mean square of three standard deviations of each sample result. Mathematically, this is expressed as:

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

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. The following sections of this report first check the sample results using the 3 standard deviation criterion. If this criterion is not met, the results are then listed for the relative percent difference. Other pertinent information that may have affected the sample analysis is also included under Notes.

Field duplicate samples

Duplicate milk samples were collected from Moreland on December 5 and analyzed for gamma-emitting radionuclides. The following results were reported:

Nuclide	Moreland result ±1σ (pCi/L)	Duplicate result ±1σ (pCi/L)	Within 3σ criterion?	Notes
Iodine-131	0.01 ± 0.76	2.12 ± 1.33	Yes	
Cesium-137	1.23 ± 1.03	1.24 ± 1.19	Yes	
Potassium-40	371 ± 44	369 ± 57	Yes	

Duplicate milk samples were collected from Roberts on December 5 and analyzed for gamma-emitting radionuclides. The following results were reported:

Nuclide	Roberts result ±1σ (pCi/L)	Duplicate result ±1σ (pCi/L)	Within 3σ criterion?	Notes
Iodine-131	-0.65 ± 1.44	3.14 ± 2.61	Yes	
Cesium-137	1.50 ± 1.22	-1.87 ± 3.02	Yes	
Potassium-40	360 ± 57	325 ± 89	Yes	

Duplicate potato samples were collected from Blackfoot on September 25 and analyzed for gamma-emitting radionuclides and strontium-90. The following results were reported:

Nuclide	Blackfoot result ±1σ (pCi/kg)	Duplicate result ±1σ (pCi/kg)	Within 3σ criterion?	Notes
Cesium-137	1.07 ± 0.48	1.39 ± 0.63	Yes	
Potassium-40	1340 ± 42	1350 ± 47	Yes	
Strontium-90	0.12 ± 0.19	-0.08 ± 0.16	Yes	

Duplicate drinking water samples were obtained from Arco on November 15 and analyzed for gross alpha, gross beta and tritium. Results for this sample were as follows.

Nuclide	Arco result ±1σ (pCi/L)	Duplicate result ±1σ (pCi/L)	Within 3σ criterion?	Notes
Gross alpha	0.04 ± 0.28	0.16 ± 0.28	Yes	
Gross beta	1.51 ± 0.48	0.62 ± 0.46	Yes	
Tritium	54 ± 30	34 ± 30	Yes	

Duplicate surface water samples were obtained from Buhl on November 14 and analyzed for gross alpha, gross beta, and tritium. Results for this sample were as follows.

Nuclide	Buhl result ±1σ (pCi/L)	Duplicate result ±1σ (pCi/L)	Within 3σ criterion?	Notes
Gross alpha	0.73 ± 0.35	0.47 ± 0.34	Yes	
Gross beta	4.15 ± 0.53	5.24 ± 0.57	Yes	
Tritium	29 ± 28	90 ± 30	Yes	

Duplicate air samplers are operated at two locations adjacent to regular air samplers. In the fourth quarter of 2006 these samplers, designated as QA-1 and QA-2, were in operation at the Experimental Field Station and Mud Lake, respectively. Particulate filters receive the standard analysis for gross alpha and gross beta; charcoal cartridges are analyzed specifically for iodine-

131. The following table presents gross alpha and gross beta results for the co-located samplers. Charcoal cartridge results are difficult to present because cartridges are counted in batches of ten.

Gross alpha

Week Ending	EFS result ±1σ (x 10^{-15} µCi/mL)	QA-1 result ±1σ (x 10^{-15} µCi/mL)	Within 3σ criterion?	Notes
10/4	3.22 ± 0.41	2.75 ± 0.37	Yes	
10/11	1.17 ± 0.25	0.80 ± 0.22	Yes	
10/18	2.69 ± 0.45	2.07 ± 0.43	Yes	
10/25	1.71 ± 0.25	1.53 ± 0.27	Yes	
11/1	1.36 ± 0.27	1.50 ± 0.28	Yes	
11/8	1.05 ± 0.21	1.50 ± 0.22	Yes	
11/15	0.76 ± 0.23	0.55 ± 0.21	Yes	
11/22	1.83 ± 0.23	1.53 ± 0.20	Yes	
11/29	0.81 ± 0.24	1.05 ± 0.26	Yes	
12/6	1.71 ± 0.29	2.04 ± 0.27	Yes	
12/13	1.93 ± 0.22	2.55 ± 0.25	Yes	
12/20	0.79 ± 0.14	1.08 ± 0.17	Yes	
12/27	2.61 ± 0.29	3.25 ± 0.30	Yes	
Week Ending	Mud Lake result ±1σ (x 10^{-15} µCi/mL)	QA-2 result ±1σ (x 10^{-15} µCi/mL)	Within 3σ criterion?	Notes
10/4	2.53 ± 0.32	2.91 ± 0.41	Yes	
10/11	0.97 ± 0.19	0.61 ± 0.17	Yes	
10/18	2.39 ± 0.33	3.32 ± 0.42	Yes	
10/25	1.75 ± 0.23	1.82 ± 0.25	Yes	
11/1	1.45 ± 0.27	1.49 ± 0.31	Yes	
11/8	1.95 ± 0.23	1.62 ± 0.23	Yes	
11/15	0.64 ± 0.20	0.47 ± 0.21	Yes	
11/22	2.64 ± 0.26	2.17 ± 0.24	Yes	
11/29	1.38 ± 0.25	1.13 ± 0.24	Yes	
12/6	1.80 ± 0.32	2.05 ± 0.31	Yes	
12/13	2.28 ± 0.23	2.44 ± 0.24	Yes	
12/20	0.85 ± 0.15	1.19 ± 0.17	Yes	
12/27	3.14 ± 0.31	3.72 ± 0.32	Yes	

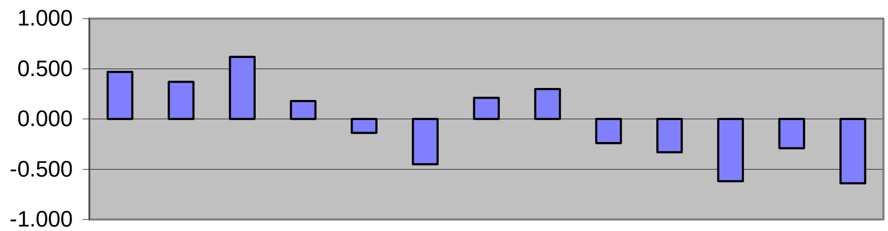
Gross beta

Week Ending	EFS result ±1σ (x 10^{-15} µCi/mL)	QA-1 result ±1σ (x 10^{-15} µCi/mL)	Within 3σ criterion?	Notes
10/4	38.8 ± 1.1	38.8 ± 1.0	Yes	
10/11	24.2 ± 0.9	24.9 ± 0.9	Yes	
10/18	33.3 ± 1.1	30.9 ± 1.1	Yes	
10/25	34.0 ± 0.9	32.8 ± 1.0	Yes	
11/1	25.6 ± 0.7	25.6 ± 0.7	Yes	
11/8	35.5 ± 0.9	32.9 ± 0.8	Yes	
11/15	10.0 ± 0.6	9.7 ± 0.5	Yes	
11/22	39.0 ± 0.9	35.5 ± 0.8	Yes	
11/29	13.9 ± 0.6	14.5 ± 0.6	Yes	

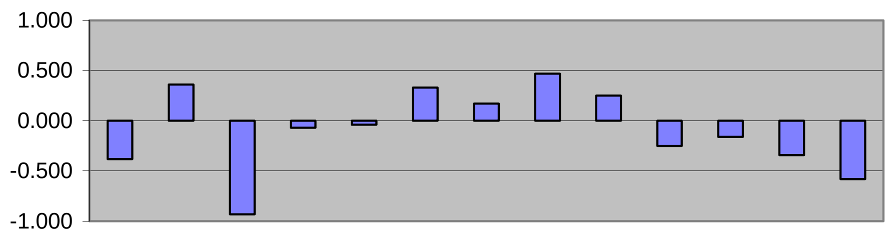
12/6	33.0 ± 0.8	32.1 ± 0.7	Yes	
12/13	53.0 ± 1.0	53.0 ± 1.0	Yes	
12/20	18.2 ± 0.6	18.8 ± 0.6	Yes	
12/27	47.3 ± 1.0	44.7 ± 1.0	Yes	
Week Ending	Mud Lake result ±1σ (x 10^{-15} µCi/mL)	QA-2 result ±1σ (x 10^{-15} µCi/mL)	Within 3σ criterion?	Notes
10/4	37.7 ± 0.9	38.4 ± 1.1	Yes	
10/11	21.5 ± 0.7	21.7 ± 0.7	Yes	
10/18	37.3 ± 0.9	39.0 ± 1.0	Yes	
10/25	32.4 ± 0.8	33.2 ± 0.9	Yes	
11/1	23.7 ± 0.7	24.3 ± 0.8	Yes	
11/8	36.7 ± 0.8	37.3 ± 0.9	Yes	
11/15	10.4 ± 0.5	11.3 ± 0.6	Yes	
11/22	35.6 ± 0.9	38.1 ± 0.9	Yes	
11/29	14.9 ± 0.6	15.8 ± 0.6	Yes	
12/6	31.9 ± 0.9	34.4 ± 0.8	Yes	
12/13	49.5 ± 0.9	53.4 ± 1.0	Yes	
12/20	21.0 ± 0.6	22.4 ± 0.7	Yes	
12/27	48.0 ± 1.0	52.8 ± 1.0	No	

A comparison of duplicate results can also show bias in the sampling system, such as if one set of results is consistently lower or higher than the other. For air sampling equipment this bias can result from a leak in the system or variations in the calibration of the flow meter. The following figures show graphs comparing the difference in the gross alpha and gross beta results for the fourth quarter of 2006.

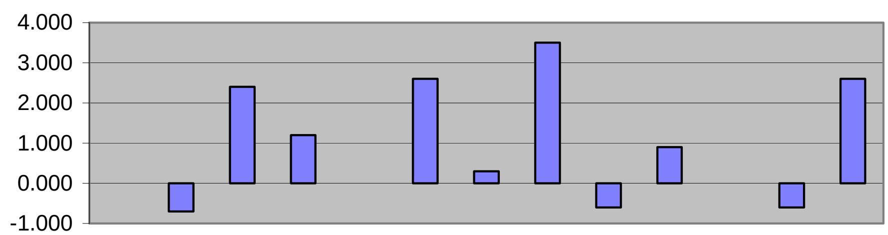
EFS - QA-1 (gross alpha)



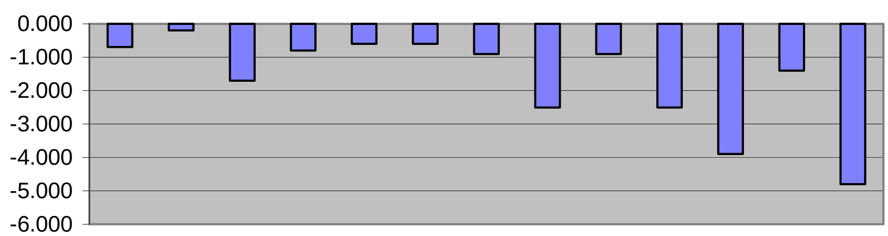
Mud Lake - QA-2 (gross alpha)



EFS - QA-1 (gross beta)



Mud Lake - QA-2 (gross beta)



Lab split samples

Idaho State University 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.

The ISU Quality Assurance Report contains spreadsheets that analyze split and recount data using a logical equation that tests for the above two criteria. The spreadsheet first tests for the ±20 percent criterion; if this test is not met, the 3σ criterion is used. Acceptable performance is considered if either test is passed.

Results of EAL split sample analyses-fourth quarter 2006

Media	Analyte	# Split Samples	# not meeting 3σ criterion	Notes
Milk	Tritium	1	0	
Milk	Potassium-40	7	0	
Water	Tritium	3	1	Sample met 20 percent criterion
Precipitation	Tritium	2	0	
Atmospheric Moisture	Tritium	2	0	

Sample recounts

The ISU EAL recounts a number of samples of each media type. The lab tests each recount using both the 20 percent criterion and the 3σ criterion, subject to the limitations described in the previous section.

A summary of the recount results for the fourth quarter is presented below.

- 68 low-volume air filters were recounted for alpha activity. All results were within the 3σ criterion.
- 68 low-volume air filters were recounted for beta activity. One result was outside the 3σ criterion but within the 20 percent criterion.
- 12 milk samples were recounted for potassium-40; two were recounted twice. All results were within the 3σ criterion.
- 8 sets of charcoal cartridges samples were recounted for iodine-131. All results were within the 3σ criterion.
- 14 quarterly composites were recounted for beryllium-7; one was recounted twice. One result was outside the 3σ criterion, but just within the 20 percent criterion.
- 6 potato samples were recounted for potassium-40; two were recounted twice. All results were within the 3σ criterion.
- 3 water samples were recounted for tritium activity. All results were within the 3σ criterion.
- 2 precipitation samples were recounted for tritium activity. Both results were within the 3σ criterion.
- 1 atmospheric moisture sample was recounted for tritium activity. The result was within the 3σ criterion.

- 1 milk sample was recounted for tritium activity. The result was within the 3σ criterion.

BLANKS

Field 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 Sr-90 and the other for transuranics.

Ideally, blank results should be within ±2σ of zero and preferably within ±1σ of zero on most analyses. It would be expected, based on counting statistics for a sample that was truly a blank (i.e., the true value of the analyte was zero), that 68.3 percent of analyses would fall within one standard deviation, 95.5 percent would fall within two standard deviations, and 99.7 percent would fall within three standard deviations.

The following tables contain the results of fourth quarter field blanks. The significance level describes the multiple of the uncertainty that the result lies from zero. Those designated as <1 are within ±1σ, those designated as 1 are between ±1σ and ±2σ, and so forth.

Results for Blank A weekly analyses

Date	Gross alpha result (x 10^{-7} uCi/filter)	Alpha significance level	Gross beta result (x 10^{-7} uCi/filter)	Beta significance level
10/4	1.16 ± 0.81	1	1.20 ± 1.75	<1
10/11	-0.16 ± 0.44	<1	0.03 ± 1.44	<1
10/18	0.21 ± 0.80	<1	1.52 ± 1.68	<1
10/25	0.06 ± 0.48	<1	-0.36 ± 1.53	<1
11/1	0.33 ± 0.85	<1	0.04 ± 1.64	<1
11/8	-1.15 ± 0.43	2	2.01 ± 1.52	1
11/15	-0.02 ± 0.77	<1	-0.55 ± 1.60	<1
11/22	-0.08 ± 0.48	<1	-1.22 ± 1.56	<1
11/29	-0.98 ± 0.72	1	0.28 ± 1.56	<1
12/6	-1.76 ± 0.74	2	-0.33 ± 1.65	<1
12/13	0.55 ± 0.44	1	1.31 ± 1.49	<1
12/20	0.79 ± 0.42	1	2.32 ± 1.47	1
12/27	-0.35 ± 0.64	<1	-3.37 ± 1.91	1

Results for Blank B weekly analyses

Date	Gross alpha result (x 10^{-7} uCi/filter)	Alpha significance level	Gross beta result (x 10^{-7} uCi/filter)	Beta significance level
10/4	0.20 ± 0.73	<1	-1.24 ± 1.69	<1
10/11	0.73 ± 0.52	1	0.83 ± 1.46	<1
10/18	-0.02 ± 0.78	<1	-0.43 ± 1.63	<1
10/25	-0.21 ± 0.46	<1	-0.23 ± 1.53	<1
11/1	-0.66 ± 0.77	<1	1.23 ± 1.66	<1
11/8	-0.32 ± 0.51	<1	-0.23 ± 1.46	<1

11/15	1.82 ± 0.90	2	-0.86 ± 1.60	<1
11/22	0.11 ± 0.49	<1	-3.29 ± 1.50	2
11/29	1.20 ± 0.89	1	3.80 ± 1.65	2
12/6	-0.54 ± 0.84	<1	0.35 ± 1.67	<1
12/13	0.29 ± 0.41	<1	0.25 ± 1.46	<1
12/20	-0.11 ± 0.31	<1	1.68 ± 1.45	1
12/27	-0.69 ± 0.61	1	-2.77 ± 1.92	1

Results for quarterly air filter composite blanks-ISU

Blank	Be-7 result (uCi/m^3)	Be-7 significance level	Cs-137 result (uCi/m^3)	Cs-137 significance level
Blank A	$(2.78 \pm 2.21) \times 10^{-9}$	1	$(-0.45 \pm 1.17) \times 10^{-10}$	<1
Blank B	$(-0.98 \pm 2.43) \times 10^{-9}$	<1	$(0.79 \pm 1.16) \times 10^{-10}$	<1

Results for quarterly air filter composite blanks-Teledyne Brown

Nuclide	Result (pCi/mL)	Significance level
Strontium-90	$(-1.85 \pm 1.44) \times 10^{-11}$	1
Plutonium-238	$(1.11 \pm 1.23) \times 10^{-12}$	<1
Plutonium-239/240	$(0.00 \pm 0.54) \times 10^{-12}$	<1
Americium-241	$(1.50 \pm 0.86) \times 10^{-12}$	1

Results for Iodine-131 in milk blanks

Date	Iodine-131 result (pCi/L)	Significance level
10/3	2.48 ± 1.80	1
11/7	0.14 ± 1.47	<1
12/5	-3.39 ± 1.32	2

Reagent Blanks

The Environmental Assessment Laboratory prepares and analyzes reagent blanks to help determine if the analysis will yield a zero result when no activity is present. ISU considers the result within specification if the concentration is less than the minimum detectable concentration (MDC) for the analysis. Fourth quarter blanks for gross alpha, gross beta and tritium met this criterion.

Teledyne Brown analyzes a blank with each set of results. All blanks for fourth quarter samples met Teledyne Brown's acceptance limits.

OTHER QA PROBLEMS NOTED

There were no additional QA problems noted in the fourth quarter.

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.

Code of Federal Regulations (CFR), 2006, 40 CFR 50.6, "National Primary and Secondary Ambient Air Quality Standards for Particulate Matter," Code of Federal Regulations, Office of the Federal Register, July 1, 2006.

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, 2006, 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.

Twinning, B.V, and Rattray, G., 2003, *Radiochemical and Chemical Constituents in Water from Selected Wells and Springs from the Southern Boundary of the Idaho National Engineering and Environmental Laboratory to the Hagerman Area, Idaho, 2001*, DOE/ID-22185, April 2003.

APPENDIX A

SUMMARY OF SAMPLING SCHEDULE

PAGE INTENTIONALLY LEFT BLANK

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	4 to 13 weeks	Blackfoot, Idaho Falls, Rexburg	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, Taber	Arco, Atomic City, Howe, Monteview, Mud Lake	None
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, 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	Ucon	None	None
Gamma Spec (^{131}I)	monthly	Blackfoot, Dietrich, Idaho Falls, Minidoka, Moreland, Roberts	Howe, Terreton	None
Tritium, ^{90}Sr	Semi-annually	Blackfoot, Dietrich, Idaho Falls, Minidoka, Moreland, Roberts	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, Pocatello	Arco, Atomic City, Howe, Mud Lake	EFS
BIG GAME				
Gamma Spec	varies	Occasional samples across the U.S.	Public Highways	INL Site roads
SHEEP				
Gamma Spec	annually	Blackfoot or Dubois	None	N. INL Site (Circular Butte), S. INL Site (Tractor Flats)
WATERFOWL				
Gamma Spec, ^{90}Sr, Transuranics	annually	Varies among: Heise, Firth, Fort Hall, Mud Lake, Market Lake, and American Falls	None	Wastewater disposal ponds
MARMOTS				
Gamma Spec	varies	Pocatello Zoo, Tie Canyon	None	RWMC

APPENDIX B

SUMMARY OF MDCs AND DCGs

PAGE INTENTIONALLY LEFT BLANK

Table B-1. Summary of Approximate Minimum Detectable Concentrations for Radiological Analyses Performed During Fourth Quarter 2006

Sample Type	Analysis	Approximate Minimum Detectable Concentration[a] (MDC)	Derived Concentration Guide[b] (DCG)
Air (particulate filter)[e]	Gross alpha[c]	6.31×10^{-16} µCi/mL	2×10^{-14} µCi/mL
	Gross beta[d]	1.63×10^{-15} µCi/mL	3×10^{-12} µCi/mL
	Specific gamma (^{137}Cs)	1.09×10^{-16} µCi/mL	4×10^{-10} µCi/mL
	^{238}Pu	3.35×10^{-18} µCi/mL	3×10^{-14} µCi/mL
	$^{239/240}$Pu	1.84×10^{-18} µCi/mL	2×10^{-14} µCi/mL
	^{241}Am	3.94×10^{-18} µCi/mL	2×10^{-14} µCi/mL
	^{90}Sr	4.46×10^{-17} µCi/mL	9×10^{-12} µCi/mL
Air (charcoal cartridge)[e]	^{131}I	9.32×10^{-16} µCi/mL	4×10^{-10} µCi/mL
Air (atmospheric moisture)[f]	^{3}H	1.03×10^{-7} µCi/mL$_{water}$	1×10^{-7} µCi/mL$_{air}$
Air (precipitation)	^{3}H	1.03×10^{-7} µCi/mL	2×10^{-3} µCi/mL
Milk	^{131}I	0.70 pCi/L	--
	^{137}Cs	2.48 pCi/L	--
	^{90}Sr	0.12 pCi/L	--
	^{3}H	106 pCi/L	--
Potatoes	^{137}Cs	2.08 pCi/kg	--
	^{90}Sr	0.71 pCi/kg	--
Game Animal Tissue[g]	^{137}Cs	0.87 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.

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.

APPENDIX C

SAMPLE ANALYSIS RESULTS

PAGE INTENTIONALLY LEFT BLANK

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

Sampling Group and Location	Sampling Date	GROSS ALPHA Result ± 1s Uncertainty (x 10^{-15} µCi/mL)			GROSS ALPHA Result ± 1s Uncertainty (x 10^{-11} Bq/mL)			GROSS ALPHA Result > 3s	GROSS BETA Result ± 1s Uncertainty (x 10^{-15} µCi/mL)			GROSS BETA Result ± 1s Uncertainty (x 10^{-11} Bq/mL)			GROSS BETA Result > 3s
BOUNDARY															
ARCO	10/04/2006	2.68	±	0.39	9.92	±	1.44	Y	36.30	±	1.03	134.31	±	3.81	Y
	10/11/2006	1.25	±	0.21	4.63	±	0.79	Y	22.60	±	0.77	83.62	±	2.86	Y
	10/18/2006	2.50	±	0.40	9.25	±	1.49	Y	36.90	±	1.05	136.53	±	3.89	Y
	10/25/2006	1.59	±	0.21	5.88	±	0.77	Y	27.70	±	0.75	102.49	±	2.76	Y
	11/01/2006	1.66	±	0.31	6.14	±	1.14	Y	25.60	±	0.79	94.72	±	2.93	Y
	11/08/2006	1.24	±	0.19	4.59	±	0.69	Y	25.40	±	0.68	93.98	±	2.52	Y
	11/15/2006	1.04	±	0.24	3.85	±	0.87	Y	10.50	±	0.54	38.85	±	1.98	Y
	11/22/2006	1.33	±	0.20	4.92	±	0.73	Y	33.50	±	0.81	123.95	±	3.01	Y
	11/29/2006	1.09	±	0.27	4.03	±	1.00	Y	13.20	±	0.62	48.84	±	2.29	Y
	12/06/2006	1.60	±	0.28	5.92	±	1.04	Y	32.30	±	0.78	119.51	±	2.90	Y
	12/13/2006	1.98	±	0.22	7.33	±	0.83	Y	49.40	±	0.96	182.78	±	3.54	Y
	12/20/2006	0.64	±	0.14	2.36	±	0.52	Y	15.80	±	0.62	58.46	±	2.28	Y
	12/27/2006	2.98	±	0.33	11.03	±	1.22	Y	44.20	±	1.08	163.54	±	4.00	Y
ATOMIC CITY	10/04/2006	2.84	±	0.31	10.51	±	1.14	Y	36.90	±	0.82	136.53	±	3.02	Y
	10/11/2006	1.06	±	0.19	3.92	±	0.71	Y	21.30	±	0.72	78.81	±	2.65	Y
	10/18/2006	2.27	±	0.28	8.40	±	1.03	Y	18.90	±	0.60	69.93	±	2.23	Y
	10/25/2006	1.45	±	0.20	5.37	±	0.74	Y	25.20	±	0.72	93.24	±	2.66	Y
	11/01/2006	1.12	±	0.25	4.14	±	0.94	Y	24.30	±	0.71	89.91	±	2.63	Y
	11/08/2006	1.19	±	0.19	4.40	±	0.70	Y	27.30	±	0.72	101.01	±	2.66	Y
	11/15/2006	0.78	±	0.20	2.89	±	0.73	Y	10.20	±	0.48	37.74	±	1.76	Y
	11/22/2006	1.16	±	0.18	4.29	±	0.68	Y	32.70	±	0.79	120.99	±	2.90	Y
	11/29/2006	0.66	±	0.19	2.44	±	0.69	Y	13.20	±	0.49	48.84	±	1.81	Y
	12/06/2006	1.46	±	0.32	5.40	±	1.17	Y	34.50	±	0.90	127.65	±	3.34	Y
	12/13/2006	1.96	±	0.24	7.25	±	0.89	Y	48.20	±	1.02	178.34	±	3.77	Y
	12/20/2006	1.34	±	0.21	4.96	±	0.76	Y	19.20	±	0.74	71.04	±	2.72	Y
	12/27/2006	3.41	±	0.37	12.62	±	1.36	Y	42.20	±	1.13	156.14	±	4.18	Y
BLUE DOME	10/04/2006	3.05	±	0.36	11.29	±	1.33	Y	31.30	±	0.87	115.81	±	3.22	Y
	10/11/2006	0.99	±	0.19	3.67	±	0.72	Y	22.80	±	0.75	84.36	±	2.79	Y
	10/18/2006	2.40	±	0.30	8.88	±	1.12	Y	29.90	±	0.76	110.63	±	2.81	Y
	10/25/2006	1.44	±	0.19	5.33	±	0.71	Y	26.40	±	0.71	97.68	±	2.61	Y
	11/01/2006	0.61	±	0.21	2.27	±	0.77		17.80	±	0.60	65.86	±	2.22	Y
	11/08/2006	1.15	±	0.19	4.26	±	0.70	Y	30.40	±	0.75	112.48	±	2.78	Y
	11/15/2006	0.57	±	0.17	2.12	±	0.63	Y	9.02	±	0.43	33.37	±	1.58	Y
	11/22/2006	1.54	±	0.20	5.70	±	0.74	Y	29.90	±	0.75	110.63	±	2.79	Y
	11/29/2006	0.80	±	0.21	2.95	±	0.79	Y	11.50	±	0.51	42.55	±	1.89	Y
	12/06/2006	1.25	±	0.23	4.63	±	0.85	Y	22.40	±	0.61	82.88	±	2.27	Y
	12/13/2006	1.41	±	0.18	5.22	±	0.66	Y	40.00	±	0.80	148.00	±	2.95	Y
	12/20/2006	0.74	±	0.14	2.74	±	0.53	Y	14.30	±	0.57	52.91	±	2.12	Y
	12/27/2006	1.95	±	0.23	7.22	±	0.83	Y	34.40	±	0.78	127.28	±	2.90	Y
FAA TOWER	10/04/2006	2.44	±	0.37	9.03	±	1.36	Y	35.30	±	0.99	130.61	±	3.67	Y
	10/11/2006	0.75	±	0.16	2.77	±	0.57	Y	19.30	±	0.62	71.41	±	2.31	Y
	10/18/2006	2.69	±	0.36	9.95	±	1.32	Y	32.70	±	0.89	120.99	±	3.27	Y
	10/25/2006	1.27	±	0.18	4.70	±	0.68	Y	24.20	±	0.68	89.54	±	2.51	Y
	11/01/2006	1.29	±	0.25	4.77	±	0.93	Y	20.00	±	0.64	74.00	±	2.36	Y
	11/08/2006	0.90	±	0.18	3.32	±	0.66	Y	27.60	±	0.73	102.12	±	2.69	Y
	11/15/2006	0.73	±	0.23	2.71	±	0.85	Y	9.78	±	0.55	36.19	±	2.02	Y
	11/22/2006	1.55	±	0.23	5.74	±	0.85	Y	35.30	±	0.91	130.61	±	3.35	Y
	11/29/2006	0.46	±	0.24	1.68	±	0.90		14.90	±	0.67	55.13	±	2.47	Y
	12/06/2006	1.89	±	0.32	6.99	±	1.18	Y	24.40	±	0.76	90.28	±	2.83	Y
	12/13/2006	1.90	±	0.24	7.03	±	0.90	Y	47.00	±	1.04	173.90	±	3.85	Y
	12/20/2006	0.88	±	0.16	3.25	±	0.58	Y	17.80	±	0.64	65.86	±	2.36	Y
	12/27/2006	2.50	±	0.32	9.25	±	1.18	Y	42.70	±	1.09	157.99	±	4.03	Y
HOWE	10/04/2006	3.39	±	0.34	12.54	±	1.26	Y	34.40	±	0.82	127.28	±	3.04	Y

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

Sampling Group and Location	Sampling Date	GROSS ALPHA Result ± 1s Uncertainty (x 10^{-15} µCi/mL)			GROSS ALPHA Result ± 1s Uncertainty (x 10^{-11} Bq/mL)			GROSS ALPHA Result > 3s	GROSS BETA Result ± 1s Uncertainty (x 10^{-15} µCi/mL)			GROSS BETA Result ± 1s Uncertainty (x 10^{-11} Bq/mL)			GROSS BETA Result > 3s
	10/11/2006	1.15	±	0.21	4.26	±	0.76	Y	21.30	±	0.74	78.81	±	2.75	Y
	10/18/2006	2.29	±	0.29	8.47	±	1.06	Y	35.50	±	0.78	131.35	±	2.87	Y
	10/25/2006	1.54	±	0.20	5.70	±	0.75	Y	27.40	±	0.74	101.38	±	2.74	Y
	11/01/2006	1.41	±	0.25	5.22	±	0.91	Y	23.00	±	0.65	85.10	±	2.39	Y
	11/08/2006	2.28	±	0.35	8.44	±	1.29	Y	40.40	±	1.20	149.48	±	4.44	Y
	11/15/2006	0.70	±	0.19	2.58	±	0.69	Y	11.10	±	0.48	41.07	±	1.76	Y
	11/22/2006	1.62	±	0.30	5.99	±	1.11	Y	37.30	±	1.18	138.01	±	4.37	Y
	11/29/2006	0.97	±	0.22	3.58	±	0.81	Y	14.10	±	0.54	52.17	±	1.99	Y
	12/06/2006	1.62	±	0.27	5.99	±	1.01	Y	32.70	±	0.77	120.99	±	2.83	Y
	12/13/2006	1.97	±	0.21	7.29	±	0.78	Y	49.40	±	0.91	182.78	±	3.36	Y
	12/20/2006	0.96	±	0.15	3.55	±	0.55	Y	17.60	±	0.58	65.12	±	2.14	Y
	12/27/2006	3.48	±	0.32	12.88	±	1.18	Y	48.50	±	1.02	179.45	±	3.77	Y
MONTEVIEW	10/04/2006	2.63	±	0.31	9.73	±	1.15	Y	36.70	±	0.84	135.79	±	3.09	Y
	10/11/2006	0.56	±	0.17	2.09	±	0.64	Y	19.20	±	0.74	71.04	±	2.73	Y
	10/18/2006	2.97	±	0.32	10.99	±	1.18	Y	36.40	±	0.80	134.68	±	2.96	Y
	10/25/2006	1.41	±	0.19	5.22	±	0.69	Y	28.60	±	0.71	105.82	±	2.63	Y
	11/01/2006	0.96	±	0.22	3.54	±	0.83	Y	20.10	±	0.62	74.37	±	2.29	Y
	11/08/2006	1.36	±	0.19	5.03	±	0.71	Y	30.00	±	0.73	111.00	±	2.69	Y
	11/15/2006	1.12	±	0.22	4.14	±	0.81	Y	10.10	±	0.49	37.37	±	1.81	Y
	11/22/2006	1.55	±	0.20	5.74	±	0.73	Y	34.50	±	0.79	127.65	±	2.90	Y
	11/29/2006	1.05	±	0.21	3.89	±	0.77	Y	14.50	±	0.51	53.65	±	1.89	Y
	12/06/2006	1.45	±	0.24	5.37	±	0.90	Y	26.70	±	0.66	98.79	±	2.43	Y
	12/13/2006	2.15	±	0.20	7.96	±	0.73	Y	45.00	±	0.80	166.50	±	2.94	Y
	12/20/2006	1.16	±	0.17	4.29	±	0.63	Y	18.70	±	0.63	69.19	±	2.35	Y
	12/27/2006	3.52	±	0.29	13.02	±	1.06	Y	49.80	±	0.93	184.26	±	3.43	Y
MUD LAKE	10/04/2006	2.53	±	0.32	9.36	±	1.18	Y	37.70	±	0.88	139.49	±	3.25	Y
	10/11/2006	0.97	±	0.19	3.60	±	0.69	Y	21.50	±	0.72	79.55	±	2.66	Y
	10/18/2006	2.39	±	0.33	8.84	±	1.20	Y	37.30	±	0.88	138.01	±	3.24	Y
	10/25/2006	1.75	±	0.23	6.48	±	0.83	Y	32.40	±	0.83	119.88	±	3.07	Y
	11/01/2006	1.45	±	0.27	5.37	±	0.99	Y	23.70	±	0.70	87.69	±	2.60	Y
	11/08/2006	1.95	±	0.23	7.22	±	0.85	Y	36.70	±	0.83	135.79	±	3.06	Y
	11/15/2006	0.64	±	0.20	2.38	±	0.73	Y	10.40	±	0.50	38.48	±	1.84	Y
	11/22/2006	2.64	±	0.26	9.77	±	0.95	Y	35.60	±	0.85	131.72	±	3.16	Y
	11/29/2006	1.38	±	0.25	5.11	±	0.93	Y	14.90	±	0.57	55.13	±	2.12	Y
	12/06/2006	1.80	±	0.32	6.66	±	1.19	Y	31.90	±	0.86	118.03	±	3.17	Y
	12/13/2006	2.26	±	0.23	8.36	±	0.84	Y	49.50	±	0.93	183.15	±	3.44	Y
	12/20/2006	0.85	±	0.15	3.15	±	0.55	Y	21.00	±	0.65	77.70	±	2.39	Y
	12/27/2006	3.14	±	0.31	11.62	±	1.16	Y	48.00	±	1.04	177.60	±	3.85	Y
QA-2	10/04/2006	2.91	±	0.41	10.77	±	1.53	Y	38.40	±	1.09	142.08	±	4.03	Y
	10/11/2006	0.61	±	0.17	2.26	±	0.61	Y	21.70	±	0.72	80.29	±	2.67	Y
	10/18/2006	3.32	±	0.42	12.28	±	1.56	Y	39.00	±	1.03	144.30	±	3.81	Y
	10/25/2006	1.82	±	0.25	6.73	±	0.92	Y	33.20	±	0.91	122.84	±	3.36	Y
	11/01/2006	1.49	±	0.31	5.51	±	1.16	Y	24.30	±	0.81	89.91	±	2.99	Y
	11/08/2006	1.62	±	0.23	5.99	±	0.84	Y	37.30	±	0.87	138.01	±	3.21	Y
	11/15/2006	0.47	±	0.21	1.75	±	0.77		11.30	±	0.56	41.81	±	2.06	Y
	11/22/2006	2.17	±	0.24	8.03	±	0.88	Y	38.10	±	0.86	140.97	±	3.19	Y
	11/29/2006	1.13	±	0.24	4.18	±	0.90	Y	15.80	±	0.59	58.46	±	2.19	Y
	12/06/2006	2.05	±	0.31	7.59	±	1.14	Y	34.40	±	0.82	127.28	±	3.04	Y
	12/13/2006	2.40	±	0.24	8.88	±	0.90	Y	53.40	±	1.00	197.58	±	3.70	Y
	12/20/2006	1.19	±	0.17	4.40	±	0.63	Y	22.40	±	0.66	82.88	±	2.45	Y
	12/27/2006	3.72	±	0.32	13.76	±	1.20	Y	52.80	±	1.04	195.36	±	3.85	Y
DISTANT															
BLACKFOOT CMS	10/04/2006	3.32	±	0.33	12.28	±	1.23	Y	37.70	±	0.83	139.49	±	3.08	Y
	10/11/2006	1.08	±	0.19	4.00	±	0.70	Y	21.40	±	0.70	79.18	±	2.59	Y
	10/18/2006	2.42	±	0.32	8.95	±	1.20	Y	31.10	±	0.82	115.07	±	3.02	Y

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

Sampling Group and Location	Sampling Date	GROSS ALPHA Result ± 1s Uncertainty (x 10^{-15} µCi/mL)			GROSS ALPHA Result ± 1s Uncertainty (x 10^{-11} Bq/mL)			GROSS ALPHA Result > 3s	GROSS BETA Result ± 1s Uncertainty (x 10^{-15} µCi/mL)			GROSS BETA Result ± 1s Uncertainty (x 10^{-11} Bq/mL)			GROSS BETA Result > 3s
	10/25/2006	1.89	±	0.22	6.99	±	0.80	Y	26.40	±	0.72	97.68	±	2.68	Y
	11/01/2006	1.36	±	0.29	5.03	±	1.07	Y	21.30	±	0.73	78.81	±	2.70	Y
	11/08/2006	1.01	±	0.17	3.74	±	0.64	Y	27.20	±	0.69	100.64	±	2.54	Y
	11/15/2006	0.68	±	0.23	2.50	±	0.84		10.60	±	0.57	39.22	±	2.09	Y
	11/22/2006	1.39	±	0.19	5.14	±	0.69	Y	33.40	±	0.75	123.58	±	2.79	Y
	11/29/2006	1.17	±	0.25	4.33	±	0.91	Y	16.80	±	0.61	62.16	±	2.25	Y
	12/06/2006	1.68	±	0.27	6.22	±	0.99	Y	27.70	±	0.70	102.49	±	2.60	Y
	12/13/2006	2.24	±	0.24	8.29	±	0.88	Y	49.00	±	0.97	181.30	±	3.59	Y
	12/20/2006	1.11	±	0.16	4.11	±	0.58	Y	19.10	±	0.60	70.67	±	2.23	Y
	12/27/2006	2.52	±	0.28	9.32	±	1.04	Y	41.90	±	0.96	155.03	±	3.56	Y
CRATERS OF THE MOON	10/04/2006	3.52	±	0.45	13.02	±	1.66	Y	34.80	±	1.07	128.76	±	3.96	Y
	10/11/2006	1.07	±	0.22	3.96	±	0.80	Y	21.80	±	0.80	80.66	±	2.96	Y
	10/18/2006	2.49	±	0.36	9.21	±	1.33	Y	32.50	±	0.91	120.25	±	3.36	Y
	10/25/2006	1.28	±	0.21	4.74	±	0.78	Y	24.20	±	0.78	89.54	±	2.87	Y
	11/01/2006	1.22	±	0.24	4.51	±	0.89	Y	20.60	±	0.63	76.22	±	2.33	Y
a	11/08/2006	0.00	±	0.00	0.00	±	0.00		0.00	±	0.00	0.00	±	0.00	
	11/15/2006	0.78	±	0.25	2.87	±	0.92	Y	10.20	±	0.59	37.74	±	2.18	Y
	11/22/2006	1.12	±	0.21	4.14	±	0.78	Y	26.80	±	0.83	99.16	±	3.07	Y
	11/29/2006	0.77	±	0.22	2.83	±	0.81	Y	10.20	±	0.51	37.74	±	1.89	Y
	12/06/2006	0.83	±	0.24	3.08	±	0.89	Y	24.50	±	0.70	90.65	±	2.60	Y
	12/13/2006	1.74	±	0.24	6.44	±	0.90	Y	41.00	±	1.02	151.70	±	3.77	Y
	12/20/2006	0.38	±	0.10	1.40	±	0.38	Y	11.50	±	0.47	42.55	±	1.74	Y
	12/27/2006	2.03	±	0.30	7.51	±	1.10	Y	36.80	±	1.03	136.16	±	3.81	Y
DUBOIS	10/04/2006	2.81	±	0.31	10.40	±	1.15	Y	18.30	±	0.64	67.71	±	2.38	Y
	10/11/2006	0.80	±	0.17	2.97	±	0.64	Y	17.30	±	0.65	64.01	±	2.41	Y
	10/18/2006	1.71	±	0.28	6.33	±	1.04	Y	33.50	±	0.81	123.95	±	2.98	Y
	10/25/2006	-0.26	±	0.09	-0.97	±	0.34		24.10	±	0.73	89.17	±	2.69	Y
	11/01/2006	1.11	±	0.23	4.11	±	0.86	Y	19.50	±	0.61	72.15	±	2.27	Y
	11/08/2006	1.57	±	0.20	5.81	±	0.75	Y	27.20	±	0.70	100.64	±	2.60	Y
	11/15/2006	0.73	±	0.19	2.71	±	0.71	Y	9.54	±	0.46	35.30	±	1.70	Y
	11/22/2006	1.94	±	0.23	7.18	±	0.84	Y	31.30	±	0.80	115.81	±	2.96	Y
	11/29/2006	1.63	±	0.26	6.03	±	0.94	Y	15.90	±	0.57	58.83	±	2.10	Y
	12/06/2006	1.50	±	0.29	5.55	±	1.08	Y	22.10	±	0.72	81.77	±	2.68	Y
	12/13/2006	1.26	±	0.18	4.66	±	0.67	Y	39.50	±	0.84	146.15	±	3.12	Y
	12/20/2006	0.62	±	0.13	2.30	±	0.50	Y	12.00	±	0.54	44.40	±	1.99	Y
	12/27/2006	2.25	±	0.27	8.33	±	0.99	Y	39.20	±	0.93	145.04	±	3.43	Y
IDAHO FALLS	10/04/2006	2.45	±	0.38	9.07	±	1.41	Y	40.10	±	1.07	148.37	±	3.96	Y
	10/11/2006	0.69	±	0.18	2.55	±	0.68	Y	20.10	±	0.76	74.37	±	2.79	Y
	10/18/2006	2.46	±	0.34	9.10	±	1.26	Y	34.20	±	0.88	126.54	±	3.25	Y
	10/25/2006	1.18	±	0.23	4.37	±	0.84	Y	27.40	±	0.89	101.38	±	3.29	Y
	11/01/2006	1.86	±	0.34	6.88	±	1.27	Y	22.90	±	0.82	84.73	±	3.02	Y
	11/08/2006	1.68	±	0.23	6.22	±	0.85	Y	20.20	±	0.70	74.74	±	2.59	Y
	11/15/2006	1.39	±	0.28	5.14	±	1.04	Y	10.60	±	0.59	39.22	±	2.20	Y
	11/22/2006	2.60	±	0.29	9.62	±	1.09	Y	36.70	±	0.98	135.79	±	3.64	Y
	11/29/2006	2.36	±	0.31	8.73	±	1.14	Y	17.90	±	0.64	66.23	±	2.36	Y
	12/06/2006	1.15	±	0.27	4.26	±	0.98	Y	26.60	±	0.74	98.42	±	2.75	Y
	12/13/2006	1.85	±	0.22	6.85	±	0.82	Y	41.30	±	0.91	152.81	±	3.37	Y
	12/20/2006	1.25	±	0.18	4.63	±	0.65	Y	18.40	±	0.64	68.08	±	2.36	Y
	12/27/2006	3.22	±	0.33	11.91	±	1.21	Y	45.10	±	1.05	166.87	±	3.89	Y
JACKSON	10/04/2006	2.82	±	0.35	10.43	±	1.28	Y	29.70	±	0.85	109.89	±	3.13	Y
	10/11/2006	1.26	±	0.20	4.66	±	0.74	Y	20.30	±	0.70	75.11	±	2.58	Y
	10/18/2006	2.32	±	0.33	8.58	±	1.21	Y	27.00	±	0.79	99.90	±	2.93	Y
	10/25/2006	1.63	±	0.22	6.03	±	0.81	Y	23.10	±	0.74	85.47	±	2.73	Y
	11/01/2006	1.74	±	0.31	6.44	±	1.14	Y	20.10	±	0.72	74.37	±	2.66	Y
	11/08/2006	1.07	±	0.20	3.96	±	0.75	Y	20.50	±	0.70	75.85	±	2.60	Y

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

Sampling Group and Location	Sampling Date	GROSS ALPHA Result ± 1s Uncertainty (x 10^{-15} µCi/mL)			Result ± 1s Uncertainty (x 10^{-11} Bq/mL)			Result > 3s	GROSS BETA Result ± 1s Uncertainty (x 10^{-15} µCi/mL)			Result ± 1s Uncertainty (x 10^{-11} Bq/mL)			Result > 3s
	11/15/2006	0.78	±	0.24	2.88	±	0.87	Y	9.70	±	0.55	35.89	±	2.05	Y
	11/22/2006	1.40	±	0.26	5.18	±	0.95	Y	29.40	±	0.98	108.78	±	3.62	Y
	11/29/2006	1.72	±	0.29	6.36	±	1.06	Y	22.20	±	0.70	82.14	±	2.58	Y
	12/06/2006	1.49	±	0.31	5.51	±	1.13	Y	23.90	±	0.77	88.43	±	2.85	Y
	12/13/2006	2.28	±	0.30	8.44	±	1.09	Y	57.60	±	1.27	213.12	±	4.70	Y
	12/20/2006	0.79	±	0.15	2.90	±	0.56	Y	16.70	±	0.62	61.79	±	2.31	Y
	12/27/2006	3.18	±	0.35	11.77	±	1.31	Y	42.80	±	1.12	158.36	±	4.14	Y
REXBURG CMS	10/04/2006	4.36	±	0.47	16.13	±	1.74	Y	37.50	±	1.07	138.75	±	3.96	Y
	10/11/2006	0.80	±	0.17	2.95	±	0.64	Y	17.70	±	0.66	65.49	±	2.42	Y
	10/18/2006	3.08	±	0.37	11.40	±	1.35	Y	36.50	±	0.90	135.05	±	3.33	Y
	10/25/2006	1.94	±	0.23	7.18	±	0.84	Y	25.80	±	0.75	95.46	±	2.76	Y
	11/01/2006	1.52	±	0.29	5.62	±	1.06	Y	22.40	±	0.72	82.88	±	2.66	Y
	11/08/2006	1.06	±	0.20	3.92	±	0.74	Y	26.00	±	0.76	96.20	±	2.79	Y
	11/15/2006	0.55	±	0.24	2.05	±	0.89		10.80	±	0.61	39.96	±	2.27	Y
	11/22/2006	1.79	±	0.24	6.62	±	0.88	Y	32.40	±	0.87	119.88	±	3.22	Y
	11/29/2006	1.74	±	0.30	6.44	±	1.11	Y	18.20	±	0.68	67.34	±	2.51	Y
	12/06/2006	2.52	±	0.34	9.32	±	1.25	Y	25.20	±	0.76	93.24	±	2.80	Y
	12/13/2006	1.19	±	0.19	4.40	±	0.71	Y	39.00	±	0.91	144.30	±	3.36	Y
	12/20/2006	1.07	±	0.17	3.96	±	0.61	Y	17.50	±	0.62	64.75	±	2.31	Y
	12/27/2006	2.59	±	0.30	9.58	±	1.10	Y	32.00	±	0.91	118.40	±	3.37	Y
INL SITE															
EFS	10/04/2006	3.22	±	0.41	11.91	±	1.53	Y	38.80	±	1.05	143.56	±	3.89	Y
	10/11/2006	1.17	±	0.25	4.33	±	0.93	Y	24.20	±	0.93	89.54	±	3.45	Y
	10/18/2006	2.69	±	0.45	9.95	±	1.66	Y	33.30	±	1.10	123.21	±	4.07	Y
	10/25/2006	1.71	±	0.25	6.33	±	0.93	Y	34.00	±	0.94	125.80	±	3.49	Y
	11/01/2006	1.35	±	0.27	5.00	±	1.00	Y	25.60	±	0.74	94.72	±	2.73	Y
	11/08/2006	1.05	±	0.21	3.89	±	0.76	Y	35.50	±	0.87	131.35	±	3.23	Y
	11/15/2006	0.76	±	0.23	2.82	±	0.86	Y	10.00	±	0.55	37.00	±	2.05	Y
	11/22/2006	1.83	±	0.23	6.77	±	0.86	Y	39.00	±	0.91	144.30	±	3.36	Y
	11/29/2006	0.81	±	0.24	2.99	±	0.87	Y	13.90	±	0.59	51.43	±	2.18	Y
	12/06/2006	1.71	±	0.29	6.33	±	1.09	Y	33.00	±	0.81	122.10	±	3.00	Y
	12/13/2006	1.93	±	0.22	7.14	±	0.83	Y	53.00	±	1.00	196.10	±	3.69	Y
	12/20/2006	0.79	±	0.14	2.92	±	0.53	Y	18.20	±	0.61	67.34	±	2.25	Y
	12/27/2006	2.61	±	0.29	9.66	±	1.07	Y	47.30	±	1.02	175.01	±	3.77	Y
QA-1	10/04/2006	2.75	±	0.37	10.18	±	1.38	Y	38.80	±	1.01	143.56	±	3.74	Y
	10/11/2006	0.80	±	0.22	2.95	±	0.81	Y	24.90	±	0.92	92.13	±	3.40	Y
	10/18/2006	2.07	±	0.43	7.66	±	1.59	Y	30.90	±	1.10	114.33	±	4.07	Y
	10/25/2006	1.53	±	0.27	5.66	±	1.01	Y	32.80	±	1.04	121.36	±	3.85	Y
	11/01/2006	1.50	±	0.28	5.55	±	1.04	Y	25.60	±	0.75	94.72	±	2.77	Y
	11/08/2006	1.50	±	0.22	5.55	±	0.81	Y	32.90	±	0.82	121.73	±	3.05	Y
	11/15/2006	0.55	±	0.21	2.05	±	0.76		9.70	±	0.52	35.89	±	1.93	Y
	11/22/2006	1.53	±	0.20	5.66	±	0.73	Y	35.50	±	0.79	131.35	±	2.93	Y
	11/29/2006	1.05	±	0.26	3.89	±	0.96	Y	14.50	±	0.62	53.65	±	2.29	Y
	12/06/2006	2.04	±	0.27	7.55	±	0.99	Y	32.10	±	0.71	118.77	±	2.62	Y
	12/13/2006	2.55	±	0.25	9.44	±	0.93	Y	53.00	±	1.00	196.10	±	3.69	Y
	12/20/2006	1.08	±	0.17	4.00	±	0.61	Y	18.80	±	0.64	69.56	±	2.36	Y
	12/27/2006	3.25	±	0.30	12.03	±	1.12	Y	44.70	±	0.97	165.39	±	3.59	Y
MAIN GATE	10/04/2006	3.22	±	0.36	11.91	±	1.34	Y	35.90	±	0.91	132.83	±	3.35	Y
	10/11/2006	0.72	±	0.21	2.68	±	0.76	Y	22.40	±	0.85	82.88	±	3.13	Y
	10/18/2006	3.36	±	0.38	12.43	±	1.42	Y	37.10	±	0.92	137.27	±	3.42	Y
	10/25/2006	1.33	±	0.19	4.92	±	0.69	Y	27.80	±	0.72	102.86	±	2.65	Y
	11/01/2006	1.23	±	0.25	4.55	±	0.93	Y	22.60	±	0.67	83.62	±	2.49	Y
	11/08/2006	1.22	±	0.21	4.51	±	0.77	Y	29.90	±	0.80	110.63	±	2.96	Y
	11/15/2006	0.52	±	0.24	1.92	±	0.87		10.20	±	0.60	37.74	±	2.22	Y
	11/22/2006	1.80	±	0.25	6.66	±	0.94	Y	36.00	±	0.96	133.20	±	3.55	Y

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

Sampling Group and Location	Sampling Date	GROSS ALPHA Result ± 1s Uncertainty (x 10^{-15} µCi/mL)			GROSS ALPHA Result ± 1s Uncertainty (x 10^{-11} Bq/mL)			Result > 3s	GROSS BETA Result ± 1s Uncertainty (x 10^{-15} µCi/mL)			GROSS BETA Result ± 1s Uncertainty (x 10^{-11} Bq/mL)			Result > 3s
	11/29/2006	1.12	±	0.26	4.14	±	0.97	Y	14.50	±	0.62	53.65	±	2.28	Y
	12/06/2006	1.77	±	0.28	6.55	±	1.03	Y	29.90	±	0.74	110.63	±	2.74	Y
	12/13/2006	2.12	±	0.25	7.84	±	0.91	Y	53.00	±	1.05	196.10	±	3.89	Y
	12/20/2006	0.87	±	0.16	3.21	±	0.61	Y	18.10	±	0.67	66.97	±	2.49	Y
	12/27/2006	3.02	±	0.30	11.17	±	1.12	Y	46.30	±	1.00	171.31	±	3.70	Y
VAN BUREN GATE	10/04/2006	2.92	±	0.42	10.80	±	1.56	Y	38.60	±	1.11	142.82	±	4.11	Y
	10/11/2006	1.08	±	0.22	4.00	±	0.80	Y	21.90	±	0.81	81.03	±	2.98	Y
	10/18/2006	3.17	±	0.42	11.73	±	1.56	Y	34.10	±	1.00	126.17	±	3.70	Y
	10/25/2006	1.33	±	0.24	4.92	±	0.88	Y	29.40	±	0.92	108.78	±	3.40	Y
	11/01/2006	1.19	±	0.26	4.40	±	0.95	Y	24.30	±	0.71	89.91	±	2.62	Y
	11/08/2006	1.43	±	0.20	5.29	±	0.75	Y	30.80	±	0.76	113.96	±	2.82	Y
	11/15/2006	0.73	±	0.23	2.70	±	0.84	Y	9.61	±	0.54	35.56	±	2.01	Y
	11/22/2006	1.44	±	0.22	5.33	±	0.81	Y	33.80	±	0.88	125.06	±	3.24	Y
	11/29/2006	0.70	±	0.22	2.58	±	0.80	Y	13.50	±	0.56	49.95	±	2.06	Y
	12/06/2006	1.59	±	0.27	5.88	±	1.00	Y	31.30	±	0.75	115.81	±	2.79	Y
	12/13/2006	2.01	±	0.22	7.44	±	0.83	Y	47.80	±	0.94	176.86	±	3.49	Y
	12/20/2006	0.81	±	0.16	2.99	±	0.59	Y	18.60	±	0.67	68.82	±	2.49	Y
	12/27/2006	2.71	±	0.29	10.03	±	1.07	Y	44.70	±	0.98	165.39	±	3.63	Y

a. Invalid Sample Result

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

Sampling Group and Location	Sampling Date	Result ± 1s Uncertainty (x 10^{-15} µCi/mL)			Result ± 1s Uncertainty (x 10^{-11} Bq/mL)			Result > 3s
BOUNDARY								
ARCO	10/04/2006	-2.14	±	2.45	-7.91	±	9.07	
	10/11/2006	1.83	±	2.32	6.78	±	8.58	
	10/18/2006	3.63	±	2.57	13.44	±	9.51	
	10/25/2006	-1.81	±	1.74	-6.71	±	6.43	
	11/01/2006	-0.60	±	2.24	-2.21	±	8.29	
	11/08/2006	0.53	±	1.38	1.97	±	5.12	
	11/15/2006	-0.23	±	1.90	-0.87	±	7.03	
	11/22/2006	1.95	±	1.73	7.22	±	6.40	
	11/29/2006	-0.37	±	2.28	-1.38	±	8.45	
	12/06/2006	-1.16	±	2.16	-4.28	±	7.99	
	12/13/2006	3.27	±	1.81	12.11	±	6.69	
	12/20/2006	0.12	±	2.61	0.44	±	9.66	
	12/27/2006	-2.37	±	2.07	-8.78	±	7.66	
ATOMIC CITY	10/04/2006	-1.42	±	1.63	-5.25	±	6.02	
	10/11/2006	1.68	±	2.13	6.21	±	7.86	
	10/18/2006	2.23	±	1.58	8.24	±	5.83	
	10/25/2006	-1.81	±	1.74	-6.70	±	6.43	
	11/01/2006	-0.52	±	1.95	-1.92	±	7.21	
	11/08/2006	0.55	±	1.44	2.04	±	5.31	
	11/15/2006	-0.20	±	1.62	-0.74	±	6.00	
	11/22/2006	1.87	±	1.65	6.90	±	6.12	
	11/29/2006	-0.26	±	1.60	-0.97	±	5.92	
	12/06/2006	-1.40	±	2.62	-5.20	±	9.69	
	12/13/2006	3.77	±	2.08	13.94	±	7.71	
	12/20/2006	0.14	±	3.07	0.51	±	11.37	
	12/27/2006	-2.63	±	2.30	-9.73	±	8.49	
BLUE DOME	10/04/2006	-1.57	±	1.29	-5.81	±	4.78	
	10/11/2006	0.81	±	1.35	3.01	±	5.01	
	10/18/2006	-3.05	±	1.07	-11.28	±	3.97	
	10/25/2006	-0.06	±	1.00	-0.24	±	3.69	
	11/01/2006	2.03	±	1.10	7.52	±	4.06	
	11/08/2006	-0.28	±	1.10	-1.04	±	4.06	
	11/15/2006	0.56	±	0.87	2.07	±	3.23	
	11/22/2006	-0.69	±	1.01	-2.56	±	3.72	
	11/29/2006	0.82	±	1.04	3.03	±	3.85	
	12/06/2006	0.99	±	1.14	3.67	±	4.22	
	12/13/2006	0.41	±	0.94	1.51	±	3.46	
	12/20/2006	4.02	±	1.55	14.88	±	5.73	
	12/27/2006	1.12	±	0.87	4.15	±	3.21	
FAA TOWER	10/04/2006	-1.81	±	1.49	-6.70	±	5.50	
	10/11/2006	0.66	±	1.10	2.46	±	4.08	
	10/18/2006	-3.70	±	1.30	-13.70	±	4.82	
	10/25/2006	-0.06	±	0.99	-0.23	±	3.66	
	11/01/2006	2.10	±	1.13	7.77	±	4.19	
	11/08/2006	-0.29	±	1.12	-1.06	±	4.14	
	11/15/2006	0.77	±	1.20	2.83	±	4.43	
	11/22/2006	-0.84	±	1.23	-3.12	±	4.54	
	11/29/2006	1.07	±	1.36	3.96	±	5.03	

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

Sampling Group and Location	Sampling Date	Result ± 1s Uncertainty (x 10^{-15} µCi/mL)			Result ± 1s Uncertainty (x 10^{-11} Bq/mL)			Result > 3s
BOUNDARY								
	12/06/2006	1.34	±	1.54	4.95	±	5.70	
	12/13/2006	0.57	±	1.31	2.12	±	4.86	
	12/20/2006	4.21	±	1.62	15.57	±	6.00	
	12/27/2006	1.68	±	1.30	6.22	±	4.81	
HOWE	10/04/2006	-1.34	±	1.10	-4.98	±	4.09	
	10/11/2006	0.83	±	1.38	3.07	±	5.10	
	10/18/2006	-2.80	±	0.98	-10.35	±	3.64	
	10/25/2006	-0.07	±	1.05	-0.25	±	3.90	
	11/01/2006	1.97	±	1.06	7.27	±	3.92	
	11/08/2006	-0.51	±	2.00	-1.90	±	7.39	
	11/15/2006	0.59	±	0.93	2.20	±	3.43	
	11/22/2006	-1.26	±	1.83	-4.65	±	6.75	
	11/29/2006	0.79	±	1.01	2.93	±	3.73	
	12/06/2006	1.11	±	1.28	4.10	±	4.72	
	12/13/2006	0.43	±	0.99	1.61	±	3.68	
	12/20/2006	3.59	±	1.38	13.30	±	5.12	
	12/27/2006	1.38	±	1.07	5.11	±	3.95	
MONTEVIEW	10/04/2006	-1.32	±	1.09	-4.89	±	4.02	
	10/11/2006	0.87	±	1.45	3.23	±	5.36	
	10/18/2006	-2.90	±	1.02	-10.72	±	3.77	
	10/25/2006	-0.06	±	0.95	-0.23	±	3.53	
	11/01/2006	1.98	±	1.07	7.34	±	3.96	
	11/08/2006	-0.27	±	1.05	-1.00	±	3.90	
	11/15/2006	0.64	±	1.00	2.37	±	3.70	
	11/22/2006	-0.67	±	0.98	-2.48	±	3.61	
	11/29/2006	0.72	±	0.92	2.66	±	3.39	
	12/06/2006	0.99	±	1.14	3.66	±	4.21	
	12/13/2006	0.37	±	0.84	1.36	±	3.11	
	12/20/2006	4.02	±	1.55	14.88	±	5.73	
	12/27/2006	1.14	±	0.88	4.21	±	3.26	
MUD LAKE	10/04/2006	-1.41	±	1.16	-5.23	±	4.29	
	10/11/2006	0.78	±	1.30	2.89	±	4.81	
	10/18/2006	-3.34	±	1.17	-12.35	±	4.35	
	10/25/2006	-0.07	±	1.14	-0.27	±	4.21	
	11/01/2006	2.20	±	1.19	8.15	±	4.39	
	11/08/2006	-0.29	±	1.13	-1.07	±	4.17	
	11/15/2006	0.65	±	1.01	2.40	±	3.76	
	11/22/2006	-0.75	±	1.09	-2.79	±	4.05	
	11/29/2006	0.85	±	1.08	3.14	±	4.00	
	12/06/2006	1.37	±	1.57	5.05	±	5.81	
	12/13/2006	0.45	±	1.04	1.68	±	3.84	
	12/20/2006	3.85	±	1.48	14.25	±	5.49	
	12/27/2006	1.43	±	1.11	5.29	±	4.09	
QA-2	10/04/2006	-1.99	±	1.63	-7.36	±	6.04	
	10/11/2006	0.78	±	1.30	2.90	±	4.82	
	10/18/2006	-4.27	±	1.50	-15.79	±	5.56	
	10/25/2006	-0.08	±	1.30	-0.31	±	4.81	
	11/01/2006	2.71	±	1.46	10.02	±	5.40	

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

Sampling Group and Location	Sampling Date	Result ± 1s Uncertainty (x 10^{-15} µCi/mL)			Result ± 1s Uncertainty (x 10^{-11} Bq/mL)			Result > 3s
BOUNDARY								
	11/08/2006	-0.31	±	1.22	-1.16	±	4.50	
	11/15/2006	0.74	±	1.15	2.73	±	4.27	
	11/22/2006	-0.73	±	1.07	-2.72	±	3.94	
	11/29/2006	0.86	±	1.10	3.20	±	4.07	
	12/06/2006	1.20	±	1.39	4.46	±	5.13	
	12/13/2006	0.49	±	1.12	1.81	±	4.13	
	12/20/2006	3.85	±	1.48	14.24	±	5.48	
	12/27/2006	1.34	±	1.04	4.97	±	3.84	
DISTANT								
BLACKFOOT CMS	10/04/2006	-1.45	±	1.66	-5.37	±	6.16	
	10/11/2006	1.62	±	2.05	5.99	±	7.58	
	10/18/2006	2.67	±	1.89	9.88	±	6.99	
	10/25/2006	-1.77	±	1.70	-6.56	±	6.29	
	11/01/2006	-0.59	±	2.20	-2.18	±	8.16	
	11/08/2006	0.51	±	1.33	1.90	±	4.93	
	11/15/2006	-0.25	±	2.04	-0.93	±	7.55	
	11/22/2006	1.71	±	1.52	6.34	±	5.62	
	11/29/2006	-0.32	±	1.95	-1.18	±	7.21	
	12/06/2006	-1.07	±	1.99	-3.95	±	7.37	
	12/13/2006	3.38	±	1.87	12.49	±	6.90	
	12/20/2006	0.10	±	2.24	0.37	±	8.30	
	12/27/2006	-2.03	±	1.77	-7.51	±	6.56	
CRATERS	10/04/2006	-2.31	±	2.65	-8.56	±	9.81	
	10/11/2006	1.99	±	2.51	7.35	±	9.30	
	10/18/2006	3.09	±	2.19	11.44	±	8.09	
	10/25/2006	-2.12	±	2.03	-7.84	±	7.51	
	11/01/2006	-0.47	±	1.78	-1.76	±	6.58	
	11/08/2006	0.50	±	1.31	1.86	±	4.84	
	11/15/2006	-0.27	±	2.20	-1.01	±	8.15	
	11/22/2006	2.34	±	2.07	8.64	±	7.66	
	11/29/2006	-0.32	±	1.94	-1.17	±	7.18	
	12/06/2006	-1.16	±	2.17	-4.30	±	8.03	
	12/13/2006	4.20	±	2.32	15.56	±	8.60	
	12/20/2006	0.09	±	2.05	0.34	±	7.60	
	12/27/2006	-2.49	±	2.18	-9.23	±	8.05	
DUBOIS	10/04/2006	-1.33	±	1.09	-4.93	±	4.05	
	10/11/2006	0.76	±	1.26	2.81	±	4.68	
	10/18/2006	-3.11	±	1.10	-11.52	±	4.06	
	10/25/2006	-0.07	±	1.12	-0.26	±	4.13	
	11/01/2006	2.00	±	1.08	7.40	±	3.99	
	11/08/2006	-0.27	±	1.07	-1.02	±	3.95	
	11/15/2006	0.60	±	0.95	2.24	±	3.50	
	11/22/2006	-0.74	±	1.08	-2.74	±	3.98	
	11/29/2006	0.81	±	1.03	2.99	±	3.81	
	12/06/2006	1.30	±	1.50	4.81	±	5.54	
	12/13/2006	0.46	±	1.04	1.69	±	3.86	
	12/20/2006	4.03	±	1.55	14.93	±	5.75	
	12/27/2006	1.36	±	1.05	5.03	±	3.89	

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

Sampling Group and Location	Sampling Date	Result ± 1s Uncertainty (x 10^{-15} µCi/mL)			Result ± 1s Uncertainty (x 10^{-11} Bq/mL)			Result > 3s
BOUNDARY								
IDAHO FALLS	10/04/2006	-1.89	±	1.56	-7.01	±	5.76	
	10/11/2006	0.88	±	1.47	3.26	±	5.43	
	10/18/2006	-3.55	±	1.25	-13.15	±	4.63	
	10/25/2006	-0.09	±	1.43	-0.34	±	5.28	
	11/01/2006	2.85	±	1.54	10.53	±	5.68	
	11/08/2006	-0.33	±	1.28	-1.21	±	4.72	
	11/15/2006	0.83	±	1.30	3.07	±	4.81	
	11/22/2006	-0.94	±	1.37	-3.48	±	5.06	
	11/29/2006	0.90	±	1.15	3.34	±	4.25	
	12/06/2006	1.21	±	1.40	4.49	±	5.16	
	12/13/2006	0.50	±	1.16	1.87	±	4.28	
	12/20/2006	4.12	±	1.59	15.23	±	5.87	
	12/27/2006	1.52	±	1.17	5.61	±	4.34	
JACKSON	10/04/2006	-1.74	±	2.00	-6.45	±	7.39	
	10/11/2006	1.66	±	2.10	6.14	±	7.77	
	10/18/2006	2.78	±	1.97	10.29	±	7.28	
	10/25/2006	-2.00	±	1.92	-7.40	±	7.09	
	11/01/2006	-0.59	±	2.22	-2.20	±	8.23	
	11/08/2006	0.64	±	1.68	2.38	±	6.20	
	11/15/2006	-0.25	±	2.06	-0.94	±	7.63	
	11/22/2006	2.87	±	2.55	10.63	±	9.43	
	11/29/2006	-0.34	±	2.06	-1.25	±	7.63	
	12/06/2006	-1.36	±	2.54	-5.04	±	9.40	
	12/13/2006	4.79	±	2.64	17.71	±	9.79	
	12/20/2006	0.12	±	2.58	0.43	±	9.55	
	12/27/2006	-2.57	±	2.24	-9.51	±	8.30	
REXBURG CMS	10/04/2006	-1.95	±	1.60	-7.22	±	5.94	
	10/11/2006	0.76	±	1.26	2.81	±	4.67	
	10/18/2006	-3.54	±	1.24	-13.09	±	4.61	
	10/25/2006	-0.07	±	1.11	-0.26	±	4.09	
	11/01/2006	2.38	±	1.28	8.79	±	4.74	
	11/08/2006	-0.32	±	1.24	-1.18	±	4.59	
	11/15/2006	0.87	±	1.35	3.20	±	5.01	
	11/22/2006	-0.83	±	1.21	-3.09	±	4.48	
	11/29/2006	0.99	±	1.26	3.65	±	4.65	
	12/06/2006	1.29	±	1.49	4.78	±	5.50	
	12/13/2006	0.52	±	1.20	1.94	±	4.43	
	12/20/2006	4.09	±	1.57	15.13	±	5.83	
	12/27/2006	1.52	±	1.17	5.61	±	4.34	
INL SITE								
EFS	10/04/2006	-2.12	±	2.43	-7.83	±	8.97	
	10/11/2006	2.38	±	3.01	8.80	±	11.13	
	10/18/2006	4.14	±	2.93	15.30	±	10.82	
	10/25/2006	-2.33	±	2.24	-8.64	±	8.28	
	11/01/2006	-0.53	±	2.00	-1.98	±	7.41	
	11/08/2006	0.64	±	1.67	2.37	±	6.17	
	11/15/2006	-0.25	±	2.03	-0.93	±	7.51	
	11/22/2006	2.10	±	1.86	7.78	±	6.90	

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

Sampling Group and Location	Sampling Date	Result ± 1s Uncertainty ($x 10^{-15}$ µCi/mL)			Result ± 1s Uncertainty ($x 10^{-11}$ Bq/mL)			Result > 3s
BOUNDARY								
	11/29/2006	-0.34	±	2.07	-1.25	±	7.65	
	12/06/2006	-1.21	±	2.26	-4.48	±	8.35	
	12/13/2006	3.34	±	1.84	12.35	±	6.82	
	12/20/2006	0.11	±	2.35	0.39	±	8.71	
	12/27/2006	-2.04	±	1.78	-7.55	±	6.59	
QA-1	10/04/2006	-1.95	±	2.24	-7.23	±	8.29	
	10/11/2006	2.29	±	2.90	8.47	±	10.72	
	10/18/2006	4.33	±	3.06	16.02	±	11.34	
	10/25/2006	-2.82	±	2.70	-10.44	±	10.00	
	11/01/2006	-0.55	±	2.05	-2.03	±	7.60	
	11/08/2006	0.61	±	1.59	2.26	±	5.88	
	11/15/2006	-0.23	±	1.89	-0.86	±	7.00	
	11/22/2006	1.78	±	1.58	6.60	±	5.85	
	11/29/2006	-0.36	±	2.17	-1.32	±	8.04	
	12/06/2006	-0.98	±	1.82	-3.61	±	6.74	
	12/13/2006	3.33	±	1.84	12.32	±	6.81	
	12/20/2006	0.11	±	2.48	0.41	±	9.17	
	12/27/2006	-1.96	±	1.71	-7.25	±	6.32	
MAIN GATE	10/04/2006	-1.73	±	1.98	-6.40	±	7.33	
	10/11/2006	2.15	±	2.72	7.94	±	10.05	
	10/18/2006	2.91	±	2.06	10.76	±	7.61	
	10/25/2006	-1.69	±	1.62	-6.25	±	5.99	
	11/01/2006	-0.50	±	1.87	-1.85	±	6.93	
	11/08/2006	0.62	±	1.61	2.30	±	5.97	
	11/15/2006	-0.28	±	2.25	-1.03	±	8.33	
	11/22/2006	2.45	±	2.17	9.06	±	8.04	
	11/29/2006	-0.35	±	2.16	-1.31	±	7.98	
	12/06/2006	-1.11	±	2.06	-4.09	±	7.64	
	12/13/2006	3.69	±	2.04	13.63	±	7.53	
	12/20/2006	0.13	±	2.79	0.46	±	10.31	
	12/27/2006	-2.02	±	1.76	-7.47	±	6.52	
VAN BUREN GATE	10/04/2006	-2.30	±	2.64	-8.51	±	9.75	
	10/11/2006	2.00	±	2.53	7.41	±	9.37	
	10/18/2006	3.50	±	2.47	12.94	±	9.15	
	10/25/2006	-2.46	±	2.36	-9.12	±	8.74	
	11/01/2006	-0.52	±	1.94	-1.91	±	7.17	
	11/08/2006	0.56	±	1.45	2.07	±	5.38	
	11/15/2006	-0.25	±	2.01	-0.92	±	7.42	
	11/22/2006	2.20	±	1.95	8.14	±	7.21	
	11/29/2006	-0.32	±	1.93	-1.17	±	7.14	
	12/06/2006	-1.11	±	2.06	-4.09	±	7.64	
	12/13/2006	3.27	±	1.81	12.10	±	6.69	
	12/20/2006	0.12	±	2.74	0.46	±	10.14	
	12/27/2006	-2.01	±	1.75	-7.43	±	6.49	

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 (x 10^{-18} µCi/mL)			Result ± 1s Uncertainty (x 10^{-13} Bq/mL)			Result > 3s
BOUNDARY									
ARCO	12/31/2006	CESIUM-137	512.00	±	114.00	1894.40	±	421.80	Y
		STRONTIUM-90	21.20	±	12.60	78.44	±	46.62	
ATOMIC CITY	12/31/2006	CESIUM-137	436.00	±	211.00	1613.20	±	780.70	
		STRONTIUM-90	9.79	±	10.80	36.22	±	39.96	
BLUE DOME	12/31/2006	CESIUM-137	-5.64	±	98.40	-20.87	±	364.08	
		STRONTIUM-90	-5.40	±	10.40	-19.98	±	38.48	
FAA TOWER	12/31/2006	AMERICIUM-241	-0.21	±	2.83	-0.78	±	10.47	
		CESIUM-137	-16.50	±	110.00	-61.05	±	407.00	
		PLUTONIUM-238	0.44	±	0.87	1.61	±	3.23	
		PLUTONIUM-239/40	0.65	±	0.85	2.42	±	3.13	
HOWE	12/31/2006	CESIUM-137	88.00	±	108.00	325.60	±	399.60	
		PLUTONIUM-238	1.63	±	1.19	6.03	±	4.40	
		PLUTONIUM-239/40	1.22	±	0.71	4.51	±	2.62	
MONTEVIEW	12/31/2006	AMERICIUM-241	1.49	±	0.82	5.51	±	3.02	
		CESIUM-137	-110.00	±	94.10	-407.00	±	348.17	
		PLUTONIUM-238	1.73	±	0.73	6.40	±	2.68	
		PLUTONIUM-239/40	0.99	±	0.66	3.66	±	2.43	
MUD LAKE	12/31/2006	CESIUM-137	173.00	±	206.00	640.10	±	762.20	
		STRONTIUM-90	33.80	±	11.50	125.06	±	42.55	
MUD LAKE (QA-2)	12/31/2006	CESIUM-137	276.00	±	228.00	1021.20	±	843.60	
		STRONTIUM-90	-32.20	±	14.90	-119.14	±	55.13	
DISTANT									
BLACKFOOT	12/31/2006	CESIUM-137	306.00	±	106.00	1132.20	±	392.20	
		STRONTIUM-90	13.00	±	19.70	48.10	±	72.89	

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 ($x 10^{-18}$ µCi/mL)			Result ± 1s Uncertainty ($x 10^{-13}$ Bq/mL)			Result > 3s
CRATERS	12/31/2006	AMERICIUM-241	-0.92	±	2.37	-3.40	±	8.77	
		CESIUM-137	-56.50	±	117.00	-209.05	±	432.90	
		PLUTONIUM-238	1.59	±	2.03	5.88	±	7.51	
		PLUTONIUM-239/40	-0.80	±	1.49	-2.95	±	5.51	
DUBOIS	12/31/2006	CESIUM-137	34.30	±	120.00	126.91	±	444.00	
		STRONTIUM-90	22.50	±	14.70	83.25	±	54.39	
IDAHO FALLS	12/31/2006	AMERICIUM-241	-0.07	±	0.45	-0.26	±	1.67	
		CESIUM-137	33.60	±	120.00	124.32	±	444.00	
		PLUTONIUM-238	0.28	±	0.93	1.04	±	3.43	
		PLUTONIUM-239/40	1.40	±	1.22	5.18	±	4.51	
JACKSON	12/31/2006	CESIUM-137	270.00	±	120.00	999.00	±	444.00	
		STRONTIUM-90	25.70	±	12.50	95.09	±	46.25	
REXBURG CMS	12/31/2006	AMERICIUM-241	3.52	±	1.33	13.02	±	4.92	
		CESIUM-137	95.40	±	232.00	352.98	±	858.40	
		PLUTONIUM-238	0.91	±	0.80	3.38	±	2.95	
INL SITE									
EFS	12/31/2006	AMERICIUM-241	1.33	±	0.98	4.92	±	3.64	
		CESIUM-137	-100.00	±	117.00	-370.00	±	432.90	
		PLUTONIUM-238	0.71	±	0.91	2.63	±	3.36	
		PLUTONIUM-239/40	1.42	±	0.84	5.25	±	3.10	
EFS (QA-1)	12/31/2006	AMERICIUM-241	-1.13	±	0.57	-4.18	±	2.11	
		CESIUM-137	301.00	±	114.00	1113.70	±	421.80	
		PLUTONIUM-239/40	1.98	±	1.17	7.33	±	4.33	
MAIN GATE	12/31/2006	CESIUM-137	-131.00	±	123.00	-484.70	±	455.10	
		STRONTIUM-90	4.29	±	15.20	15.87	±	56.24	
VAN BUREN GATE	12/31/2006	AMERICIUM-241	0.30	±	0.75	1.09	±	2.78	
		CESIUM-137	63.70	±	118.00	235.69	±	436.60	
		PLUTONIUM-238	-0.30	±	1.07	-1.10	±	3.96	
		PLUTONIUM-239/40	-0.30	±	0.79	-1.10	±	2.92	

TABLE C-4. Tritium Concentrations in Atmospheric Moisture.

Sampling Group and Location	Start Date	Sampling Date	Result ± 1s Uncertainty (x 10^{-13} µCi/mL_{air})			Result ± 1s Uncertainty (x 10^{-9} Bq/mL_{air})			Collection Medium	Result > 3s
BOUNDARY										
ATOMIC CITY	09/11/2006	10/04/2006	3.09	±	1.62	11.43	±	5.99	Molecular Sieve	
ATOMIC CITY	10/04/2006	10/17/2006	5.13	±	2.45	18.99	±	9.07	Molecular Sieve	
ATOMIC CITY	10/17/2006	11/13/2006	6.20	±	1.51	22.95	±	5.59	Molecular Sieve	Y
ATOMIC CITY	11/13/2006	12/13/2006	4.80	±	1.30	17.76	±	4.79	Molecular Sieve	Y
DISTANT										
BLACKFOOT	09/21/2006	10/11/2006	0.74	±	1.77	2.73	±	6.56	Molecular Sieve	
BLACKFOOT	10/11/2006	11/08/2006	9.02	±	1.39	33.38	±	5.16	Molecular Sieve	Y
BLACKFOOT	11/08/2006	12/12/2006	3.94	±	1.18	14.59	±	4.38	Molecular Sieve	Y
IDAHO FALLS	09/21/2006	10/05/2006	10.61	±	2.24	39.27	±	8.29	Molecular Sieve	Y
IDAHO FALLS	10/05/2006	10/19/2006	5.03	±	2.14	18.63	±	7.92	Molecular Sieve	
IDAHO FALLS	10/19/2006	11/10/2006	4.92	±	1.68	18.21	±	6.23	Molecular Sieve	
IDAHO FALLS	11/10/2006	12/12/2006	6.34	±	1.20	23.44	±	4.44	Molecular Sieve	Y
REXBURG CMS	09/21/2006	10/05/2006	4.43	±	2.28	16.39	±	8.45	Molecular Sieve	
REXBURG CMS	10/05/2006	10/25/2006	6.03	±	1.84	22.31	±	6.81	Molecular Sieve	Y
REXBURG CMS	10/25/2006	11/29/2006	14.17	±	1.28	52.41	±	4.73	Molecular Sieve	Y

TABLE C-5. PM_{10} Concentrations at Atomic City, Blackfoot CMS and Rexburg CMS

Location	Sampling Date	Concentration ($\mu g/m^3$)	Comments
ATOMIC CITY	10/1/2006	22.42	
	10/7/2006	1.11	
	10/13/2006	8.61	
	10/19/2006	0.82	
	10/25/2006	0.81	
	10/31/2006	4.68	
	11/6/2006	1.95	
	11/12/2006	0.00	Post-weight less than pre-weight
	11/18/2006	1.08	
	11/24/2006	0.00	Post-weight less than pre-weight
	11/30/2006	3.38	
	12/6/2006	5.68	
	12/12/2006	0.00	Post-weight less than pre-weight
	12/18/2006	2.47	
	12/24/2006	1.56	
	12/30/2006	1.96	
BLACKFOOT	10/1/2006	15.11	
	10/7/2006	3.49	
	10/13/2006	11.15	
	10/19/2006	3.01	
	10/25/2006	8.54	
	10/31/2006	9.44	
	11/6/2006	2.27	
	11/12/2006	0.81	
	11/18/2006	4.40	
	11/24/2006	1.90	
	11/30/2006	9.31	
	12/6/2006	20.06	
	12/12/2006	1.07	
	12/18/2006	7.84	
	12/24/2006	1.98	
	12/30/2006	10.17	
REXBURG	10/1/2006	21.08	
	10/7/2006	0.49	
	10/13/2006	30.91	
	10/19/2006	3.52	
	10/25/2006	15.47	
	10/31/2006	14.04	
	11/6/2006	1.54	
	11/12/2006	0.00	Post-weight less than pre-weight
	11/18/2006	7.07	
	11/24/2006	0.00	Post-weight less than pre-weight
	11/30/2006	9.15	
	12/6/2006	17.55	
	12/12/2006	0.62	
	12/18/2006	19.10	
	12/24/2006	1.98	
	12/30/2006	12.05	

TABLE C-6. 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	8/31/2006	10/2/2006	71.70	±	29.50	2.65	±	1.09	
	10/2/2006	11/1/2006	56.20	±	29.20	2.08	±	1.08	
	11/1/2006	11/30/2006	48.60	±	29.00	1.80	±	1.07	
CFA	9/1/2006	10/2/2006	124.00	±	30.30	4.59	±	1.12	Y
	10/2/2006	11/1/2006	112.00	±	30.30	4.14	±	1.12	Y
	11/1/2006	12/1/2006	59.00	±	30.40	2.18	±	1.12	
EFS	9/27/2006	10/4/2006	102.00	±	30.10	3.77	±	1.11	Y
	10/4/2006	10/11/2006	69.50	±	29.50	2.57	±	1.09	
	10/18/2006	10/25/2006	87.60	±	30.00	3.24	±	1.11	
	11/8/2006	11/15/2006	82.10	±	29.90	3.04	±	1.11	
	11/22/2006	11/29/2006	71.10	±	29.70	2.63	±	1.10	
	12/20/2006	12/27/2006	51.90	±	30.20	1.92	±	1.12	

TABLE C-7. Gross Alpha, Gross Beta and Tritium Concentrations in Drinking and Surface Water.

Sampling Type and Location	Analyte	Sampling Date	Concentration: Result ± 1s Uncertainty (pCi/L)			Concentration: Result ± 1s Uncertainty (Bq/L)			Result > 3s
DRINKING WATER									
ABERDEEN		11/7/06							
	GROSS ALPHA		0.54	±	0.39	0.02	±	0.01	
	GROSS BETA		5.43	±	0.57	0.20	±	0.02	Y
	TRITIUM		65.10	±	30.20	2.41	±	1.12	
ARCO		11/15/06							
	GROSS ALPHA		0.04	±	0.28	0.00	±	0.01	
	GROSS BETA		1.51	±	0.48	0.06	±	0.02	Y
	TRITIUM		54.20	±	29.50	2.01	±	1.09	
ARCO		11/15/06							
DUPLICATE	GROSS ALPHA		0.16	±	0.28	0.01	±	0.01	
	GROSS BETA		0.62	±	0.46	0.02	±	0.02	
	TRITIUM		33.90	±	29.60	1.26	±	1.10	
ATOMIC CITY		11/20/06							
	GROSS ALPHA		1.81	±	0.38	0.07	±	0.01	Y
	GROSS BETA		3.93	±	0.52	0.15	±	0.02	Y
	TRITIUM		31.20	±	29.50	1.16	±	1.09	
CAREY		11/13/06							
	GROSS ALPHA		0.05	±	0.29	0.00	±	0.01	
	GROSS BETA		2.65	±	0.54	0.10	±	0.02	Y
	TRITIUM		73.40	±	30.60	2.72	±	1.13	
FORT HALL		11/15/06							
	GROSS ALPHA		0.46	±	0.35	0.02	±	0.01	
	GROSS BETA		7.89	±	0.63	0.29	±	0.02	Y
	TRITIUM		33.20	±	27.90	1.23	±	1.03	
HOWE		11/15/06							
	GROSS ALPHA		1.03	±	0.33	0.04	±	0.01	Y
	GROSS BETA		1.90	±	0.48	0.07	±	0.02	Y
	TRITIUM		55.20	±	28.80	2.04	±	1.07	
IDAHO FALLS		11/10/06							
	GROSS ALPHA		0.60	±	0.32	0.02	±	0.01	
	GROSS BETA		3.16	±	0.52	0.12	±	0.02	Y
	TRITIUM		44.40	±	28.20	1.64	±	1.04	

TABLE C-7. Gross Alpha, Gross Beta and Tritium Concentrations in Drinking and Surface Water.

MINIDOKA		11/15/06							
	GROSS ALPHA		0.27	±	0.29	0.01	±	0.01	
	GROSS BETA		5.31	±	0.59	0.20	±	0.02	Y
	TRITIUM		-15.90	±	27.10	-0.59	±	1.00	
MONTEVIEW		11/14/06							
	GROSS ALPHA		0.56	±	0.34	0.02	±	0.01	
	GROSS BETA		4.36	±	0.53	0.16	±	0.02	Y
	TRITIUM		-4.32	±	27.40	-0.16	±	1.01	
MORELAND		11/7/06							
	GROSS ALPHA		0.03	±	0.36	0.00	±	0.01	
	GROSS BETA		6.33	±	0.55	0.23	±	0.02	Y
	TRITIUM		79.80	±	29.30	2.96	±	1.09	
MUD LAKE		11/16/06							
	GROSS ALPHA		0.43	±	0.25	0.02	±	0.01	
	GROSS BETA		5.46	±	0.59	0.20	±	0.02	Y
	TRITIUM		92.00	±	29.40	3.41	±	1.09	Y
ROBERTS		11/7/06							
	GROSS ALPHA		-0.25	±	0.25	-0.01	±	0.01	
	GROSS BETA		3.72	±	0.53	0.14	±	0.02	Y
	TRITIUM		31.60	±	27.90	1.17	±	1.03	
SHOSHONE		11/14/06							
	GROSS ALPHA		0.32	±	0.37	0.01	±	0.01	
	GROSS BETA		4.70	±	0.55	0.17	±	0.02	Y
	TRITIUM		92.60	±	29.40	3.43	±	1.09	Y
TABER		11/15/06							
	GROSS ALPHA		0.75	±	0.33	0.03	±	0.01	
	GROSS BETA		4.31	±	0.52	0.16	±	0.02	Y
	TRITIUM		62.30	±	28.80	2.31	±	1.07	
SURFACE WATER									
BLISS		11/14/06							
	GROSS ALPHA		0.68	±	0.35	0.03	±	0.01	
	GROSS BETA		5.24	±	0.55	0.19	±	0.02	Y
	TRITIUM		29.50	±	28.30	1.09	±	1.05	
BUHL		11/14/06							
	GROSS ALPHA		0.73	±	0.35	0.03	±	0.01	
	GROSS BETA		4.15	±	0.53	0.15	±	0.02	Y
	TRITIUM		29.10	±	28.30	1.08	±	1.05	

TABLE C-7. Gross Alpha, Gross Beta and Tritium Concentrations in Drinking and Surface Water.

BUHL		11/14/06							
DUPLICATE	GROSS ALPHA		0.47	±	0.34	0.02	±	0.01	
	GROSS BETA		5.24	±	0.57	0.19	±	0.02	Y
	TRITIUM		90.10	±	29.60	3.34	±	1.10	Y
HAGERMAN		11/14/06							
	GROSS ALPHA		1.18	±	0.34	0.04	±	0.01	Y
	GROSS BETA		4.34	±	0.52	0.16	±	0.02	Y
	TRITIUM		92.50	±	29.70	3.43	±	1.10	Y
IDAHO FALLS		11/10/06							
	GROSS ALPHA		-0.02	±	0.22	0.00	±	0.01	
	GROSS BETA		2.55	±	0.46	0.09	±	0.02	Y
	TRITIUM		20.10	±	28.40	0.74	±	1.05	
TWIN FALLS		11/14/06							
	GROSS ALPHA		-0.32	±	0.29	-0.01	±	0.01	
	GROSS BETA		7.71	±	0.57	0.29	±	0.02	Y
	TRITIUM		81.70	±	29.60	3.03	±	1.10	

Table C-8. Weekly and Monthly Iodine-131 and Cesium-137 Concentrations in Milk

Location	Sampling Date	Iodine-131 Result ± 1s Uncertainty (pCi[†]/L)			Iodine-131 Result ± 1s Uncertainty (Bq[‡]/L)			Iodine-131 Result > 3s	Cesium-137 Result ± 1s Uncertainty (pCi/L)			Cesium-137 Result ± 1s Uncertainty (Bq/L)			Cesium-137 Result > 3s
BLACKFOOT															
	10/03/2006	0.66	±	1.84	0.024	±	0.068		0.89	±	1.20	0.033	±	0.044	
	11/07/2006	-1.03	±	0.82	-0.038	±	0.030		-0.18	±	1.02	-0.007	±	0.038	
	12/05/2006	0.06	±	0.84	0.002	±	0.031		-0.21	±	1.01	-0.008	±	0.037	
DIETRICH															
	10/03/2006	1.69	±	2.04	0.063	±	0.076		-3.04	±	1.41	-0.113	±	0.052	
	11/07/2006	0.20	±	1.37	0.008	±	0.051		-0.19	±	1.24	-0.007	±	0.046	
	12/05/2006	-0.04	±	1.16	-0.002	±	0.043		3.36	±	1.00	0.124	±	0.037	Y
HOWE															
	10/03/2006	0.12	±	2.19	0.005	±	0.081		0.32	±	1.40	0.012	±	0.052	
	11/07/2006	-0.88	±	2.63	-0.033	±	0.097		-0.70	±	2.97	-0.026	±	0.110	
	12/05/2006	-2.71	±	1.84	-0.100	±	0.068		-2.42	±	1.40	-0.090	±	0.052	
IDAHO FALLS															
	10/03/2006	0.42	±	1.26	0.016	±	0.047		1.77	±	1.00	0.066	±	0.037	
	11/07/2006	-0.79	±	1.97	-0.029	±	0.073		0.34	±	1.39	0.013	±	0.051	
	12/05/2006	-2.13	±	2.56	-0.079	±	0.095		-0.44	±	2.98	-0.016	±	0.110	
MORELAND															
	10/03/2006	3.63	±	2.94	0.134	±	0.109		-1.69	±	2.98	-0.063	±	0.110	
	11/07/2006	-0.20	±	0.78	-0.007	±	0.029		1.41	±	1.01	0.052	±	0.037	
	12/05/2006	0.01	±	0.76	0.001	±	0.028		1.23	±	1.03	0.046	±	0.038	
Duplicate	12/05/2006	2.12	±	1.33	0.079	±	0.049		1.24	±	1.19	0.046	±	0.044	
ROBERTS															
	10/03/2006	1.55	±	3.23	0.057	±	0.120		-0.93	±	2.99	-0.034	±	0.111	
	11/07/2006	1.15	±	1.54	0.043	±	0.057		0.17	±	1.25	0.006	±	0.046	
	12/05/2006	-0.65	±	1.44	-0.024	±	0.053		1.50	±	1.22	0.056	±	0.045	
Duplicate	12/05/2006	3.14	±	2.61	0.116	±	0.097		-1.87	±	3.02	-0.069	±	0.112	
RUPERT															
	10/03/2006	0.28	±	0.99	0.010	±	0.037		-0.11	±	1.04	-0.004	±	0.039	
	11/07/2006	-1.01	±	2.47	-0.037	±	0.091		-2.11	±	2.99	-0.078	±	0.111	
	12/05/2006	-1.62	±	1.65	-0.060	±	0.061		-0.91	±	1.43	-0.034	±	0.053	

Table C-8. Weekly and Monthly Iodine-131 and Cesium-137 Concentrations in Milk

TERRETON														
	10/03/2006	-1.16	±	1.90	-0.043	±	0.070	-2.28	±	1.42	-0.084	±	0.053	
	11/07/2006	0.08	±	1.35	0.003	±	0.050	2.31	±	1.01	0.086	±	0.037	
	12/05/2006	-0.82	±	0.90	-0.030	±	0.033	-2.30	±	1.05	-0.085	±	0.039	
UCON														
	10/10/2006	0.27	±	1.27	0.010	±	0.047	1.56	±	1.00	0.058	±	0.037	
	10/17/2006	-0.07	±	1.24	-0.003	±	0.046	1.85	±	0.99	0.069	±	0.037	
	10/24/2006	-0.88	±	1.25	-0.033	±	0.046	0.98	±	0.98	0.036	±	0.036	
	10/31/2006	-0.87	±	1.28	-0.032	±	0.047	1.90	±	0.99	0.070	±	0.037	
	11/07/2006	3.03	±	2.85	0.112	±	0.106	-0.46	±	3.04	-0.017	±	0.113	
	11/14/2006	3.28	±	2.58	0.121	±	0.096	-1.89	±	2.93	-0.070	±	0.109	
	11/21/2006	2.14	±	1.17	0.079	±	0.043	2.07	±	0.96	0.077	±	0.036	
	11/28/2006	0.21	±	1.26	0.008	±	0.047	1.26	±	0.99	0.047	±	0.037	
	12/12/2006	1.77	±	1.27	0.066	±	0.047	1.82	±	0.97	0.067	±	0.036	
	12/19/2006	1.23	±	1.24	0.046	±	0.046	2.73	±	0.98	0.101	±	0.036	
	12/26/2006	1.07	±	1.23	0.040	±	0.046	4.14	±	0.94	0.153	±	0.035	Y

Table C-9. Strontium-90 and Tritium Concentrations in Milk

Location	Sampling Date	Result ± 1s Uncertainty (pCi/L)			Result ± 1s Uncertainty (Bq/L)			Result > 3s
Strontium-90								
DIETRICH	11/07/2006	0.11	±	0.04	0.004	±	0.001	
HOWE	11/07/2006	0.26	±	0.03	0.010	±	0.001	Y
MORELAND	11/07/2006	0.37	±	0.07	0.014	±	0.002	Y
ROBERTS	11/07/2006	0.38	±	0.04	0.014	±	0.002	Y
UCON	11/07/2006	0.41	±	0.04	0.015	±	0.001	Y
Tritium								
		Concentration ± 1s (pCi/L)			**Concentration ± 1s (Bq/L)**			**Result > 3s**
BLACKFOOT	11/07/2006	50.00	±	29.60	1.852	±	1.096	
IDAHO FALLS	11/07/2006	115.00	±	30.40	4.259	±	1.126	Y
RUPERT	11/07/2006	60.50	±	29.80	2.241	±	1.104	
TERRETON	11/07/2006	113.00	±	30.40	4.185	±	1.126	Y

Table C-10. Cesium-137 and Strontium-90 Concentrations in Potatoes

Sampling Date	Location	Cesium-137 Result ± 1s Uncertainty pCi/kg			Result ± 1s Uncertainty bq/kg			Result > 3s
	ARCO	2.43	±	1.72	0.09	±	0.06	
	BLACKFOOT	1.07	±	0.48	0.04	±	0.02	
	BLACKFOOT	1.39	±	0.63	0.05	±	0.02	
	COLORADO	1.55	±	0.48	0.06	±	0.02	Y
	IDAHO FALLS	-0.01	±	0.46	0.00	±	0.02	
	MONTEVIEW	3.28	±	1.68	0.12	±	0.06	
	RUPERT	1.75	±	0.49	0.06	±	0.02	Y
	TABER	0.62	±	0.61	0.02	±	0.02	
		Strontium-90						
		Result ± 1s Uncertainty pCi/kg			**Result ± 1s Uncertainty bq/kg**			**Result > 3s**
	ARCO	0.29	±	0.23	0.01	±	0.01	
	BLACKFOOT	0.12	±	0.19	0.00	±	0.01	
	BLACKFOOT	-0.08	±	0.16	0.00	±	0.01	
	COLORADO	0.05	±	0.21	0.00	±	0.01	
	IDAHO FALLS	0.53	±	0.23	0.02	±	0.01	
	MONTEVIEW	0.01	±	0.15	0.00	±	0.01	
	RUPERT	0.75	±	0.31	0.03	±	0.01	
	TABER	0.66	±	0.29	0.02	±	0.01	

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

Location	Species	Sampling Date	Analyte	Result ± Uncertainty(1s) (x 10^{-3}) pCi/g			Result ± Uncertainty(1s) (x 10^{-5}) Bq/g			Result > 3s
RTC		9/15/2006								
	Coot		AMERICIUM-241	0.22	±	2.38	0.80	±	8.81	
			CERIUM-141	279.00	±	136.00	1033.33	±	503.70	
			CESIUM-134	-65.90	±	9.90	-244.07	±	36.67	
			CESIUM-137	-16.90	±	10.50	-62.59	±	38.89	
			CHROMIUM-51	-3760.00	±	1330.00	-13925.93	±	4925.93	
			COBALT-58	-0.30	±	24.40	-1.10	±	90.37	
			COBALT-60	10.20	±	8.86	37.78	±	32.81	
			IRON-59	151.00	±	102.00	559.26	±	377.78	
			MANGANESE-54	10.80	±	10.50	40.00	±	38.89	
			PLUTONIUM-238	0.11	±	0.06	0.42	±	0.22	
			PLUTONIUM-239/40	0.13	±	0.06	0.49	±	0.21	
			STRONTIUM-90	-0.17	±	1.70	-0.62	±	6.30	
			ZINC-65	8.24	±	26.50	30.52	±	98.15	
RTC		9/15/2006								
	Coot		AMERICIUM-241	0.43	±	0.58	1.59	±	2.15	
			CERIUM-141	217.00	±	122.00	803.70	±	451.85	
			CESIUM-134	-11.20	±	8.41	-41.48	±	31.15	
			CESIUM-137	21.40	±	9.17	79.26	±	33.96	
			CHROMIUM-51	762.00	±	1030.00	2822.22	±	3814.81	
			COBALT-58	25.90	±	22.10	95.93	±	81.85	
			COBALT-60	1.34	±	7.48	4.96	±	27.70	
			IRON-59	-98.90	±	84.40	-366.30	±	312.59	
			MANGANESE-54	-5.54	±	8.55	-20.52	±	31.67	
			PLUTONIUM-238	0.17	±	0.07	0.64	±	0.25	
			PLUTONIUM-239/40	0.04	±	0.08	0.16	±	0.30	
			STRONTIUM-90	-5.83	±	2.19	-21.59	±	8.11	
			ZINC-65	31.70	±	21.40	117.41	±	79.26	
RTC		9/15/2006								
	Coot		AMERICIUM-241	-0.16	±	0.11	-0.57	±	0.39	
			CERIUM-141	-163.00	±	89.60	-603.70	±	331.85	

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

			CESIUM-134	-15.30	±	7.82	-56.67	±	28.96	
			CESIUM-137	26.30	±	8.34	97.41	±	30.89	Y
			CHROMIUM-51	271.00	±	885.00	1003.70	±	3277.78	
			COBALT-58	-2.64	±	18.90	-9.78	±	70.00	
			COBALT-60	11.70	±	14.60	43.33	±	54.07	
			IRON-59	117.00	±	82.00	433.33	±	303.70	
			MANGANESE-54	-16.00	±	7.73	-59.26	±	28.63	
			PLUTONIUM-238	0.24	±	0.12	0.90	±	0.46	
			PLUTONIUM-239/40	0.09	±	0.14	0.33	±	0.50	
			STRONTIUM-90	-2.67	±	1.94	-9.89	±	7.19	
			ZINC-65	6.49	±	22.00	24.04	±	81.48	
RTC		9/15/2006								
	Coot		AMERICIUM-241	0.07	±	0.13	0.26	±	0.49	
			CERIUM-141	-1.07	±	57.20	-3.96	±	211.85	
			CESIUM-134	2.64	±	4.08	9.78	±	15.11	
			CESIUM-137	-0.02	±	3.95	-0.08	±	14.63	
			CHROMIUM-51	-209.00	±	573.00	-774.07	±	2122.22	
			COBALT-58	-0.83	±	12.30	-3.06	±	45.56	
			COBALT-60	8.72	±	3.91	32.30	±	14.48	
			IRON-59	-90.90	±	43.70	-336.67	±	161.85	
			MANGANESE-54	0.31	±	4.83	1.15	±	17.89	
			PLUTONIUM-238	-0.08	±	1.22	-0.28	±	4.52	
			PLUTONIUM-239/40	-0.29	±	0.49	-1.09	±	1.80	
			STRONTIUM-90	-0.91	±	0.79	-3.36	±	2.93	
			ZINC-65	4.83	±	12.50	17.89	±	46.30	
RTC		11/24/2006								
	Coot		AMERICIUM-241	2.40	±	7.76	8.89	±	28.74	
			CERIUM-141	65.70	±	37.10	243.33	±	137.41	
			CESIUM-134	-43.20	±	9.43	-160.00	±	34.93	
			CESIUM-137	515.00	±	19.90	1907.41	±	73.70	Y
			CHROMIUM-51	-56.80	±	249.00	-210.37	±	922.22	
			COBALT-58	-13.40	±	11.70	-49.63	±	43.33	
			COBALT-60	17.80	±	8.62	65.93	±	31.93	
			IRON-59	-31.90	±	34.80	-118.15	±	128.89	
			MANGANESE-54	0.46	±	8.79	1.71	±	32.56	

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

			PLUTONIUM-238	0.20	±	0.10	0.74	±	0.36	
			PLUTONIUM-239/40	0.07	±	0.10	0.27	±	0.37	
			STRONTIUM-90	6.41	±	1.84	23.74	±	6.81	Y
			ZINC-65	-37.60	±	21.80	-139.26	±	80.74	
RTC		11/24/2006								
	Coot		CERIUM-141	21.90	±	13.00	81.11	±	48.15	
			CESIUM-134	0.71	±	4.33	2.63	±	16.04	
			CESIUM-137	258.00	±	9.12	955.56	±	33.78	Y
			CHROMIUM-51	122.00	±	105.00	451.85	±	388.89	
			COBALT-58	-2.95	±	6.57	-10.93	±	24.33	
			COBALT-60	28.30	±	4.28	104.81	±	15.85	Y
			IRON-59	4.42	±	16.00	16.37	±	59.26	
			MANGANESE-54	10.40	±	4.27	38.52	±	15.81	
			PLUTONIUM-238	0.17	±	0.08	0.63	±	0.31	
			PLUTONIUM-239/40	0.11	±	0.08	0.41	±	0.29	
			STRONTIUM-90	1.42	±	1.41	5.26	±	5.22	
			ZINC-65	19.40	±	11.30	71.85	±	41.85	
RTC		11/24/2006								
	Coot		AMERICIUM-241	2.08	±	0.28	7.70	±	1.04	Y
			CERIUM-141	56.00	±	19.90	207.41	±	73.70	
			CESIUM-134	-2.87	±	5.96	-10.63	±	22.07	
			CESIUM-137	1090.00	±	17.30	4037.04	±	64.07	Y
			CHROMIUM-51	-166.00	±	162.00	-614.81	±	600.00	
			COBALT-58	-5.45	±	8.17	-20.19	±	30.26	
			COBALT-60	69.50	±	6.78	257.41	±	25.11	Y
			IRON-59	-25.70	±	20.40	-95.19	±	75.56	
			MANGANESE-54	-2.30	±	5.56	-8.52	±	20.59	
			PLUTONIUM-238	0.05	±	0.09	0.17	±	0.33	
			PLUTONIUM-239/40	0.13	±	0.10	0.47	±	0.36	
			STRONTIUM-90	3.80	±	1.62	14.07	±	6.00	
			ZINC-65	12.30	±	14.70	45.56	±	54.44	
RTC		11/24/2006								
	Coot		AMERICIUM-241	1.12	±	0.21	4.15	±	0.78	Y
			CERIUM-141	53.70	±	23.30	198.89	±	86.30	

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

		CESIUM-134	-4.17	±	6.51	-15.44	±	24.11	
		CESIUM-137	468.00	±	14.00	1733.33	±	51.85	Y
		CHROMIUM-51	74.80	±	180.00	277.04	±	666.67	
		COBALT-58	-1.72	±	9.23	-6.37	±	34.19	
		COBALT-60	29.50	±	7.22	109.26	±	26.74	Y
		IRON-59	-39.30	±	24.60	-145.56	±	91.11	
		MANGANESE-54	2.10	±	6.23	7.78	±	23.07	
		PLUTONIUM-238	-0.02	±	0.10	-0.06	±	0.39	
		PLUTONIUM-239/40	0.16	±	0.11	0.60	±	0.40	
		STRONTIUM-90	-1.61	±	1.06	-5.96	±	3.93	
		ZINC-65	-7.69	±	15.70	-28.48	±	58.15	
RTC	11/24/2006								
Gadwall		AMERICIUM-241	0.11	±	0.07	0.41	±	0.25	
		CERIUM-141	-11.10	±	21.00	-41.11	±	77.78	
		CESIUM-134	-19.00	±	5.12	-70.37	±	18.96	
		CESIUM-137	314.00	±	11.10	1162.96	±	41.11	Y
		CHROMIUM-51	106.00	±	157.00	392.59	±	581.48	
		COBALT-58	-4.52	±	7.42	-16.74	±	27.48	
		COBALT-60	12.20	±	4.89	45.19	±	18.11	
		IRON-59	21.80	±	19.50	80.74	±	72.22	
		MANGANESE-54	2.93	±	4.84	10.85	±	17.93	
		PLUTONIUM-238	0.02	±	0.04	0.08	±	0.15	
		PLUTONIUM-239/40	0.05	±	0.06	0.17	±	0.21	
		STRONTIUM-90	2.18	±	1.39	8.07	±	5.15	
		ZINC-65	-1.64	±	10.80	-6.07	±	40.00	
MFC	9/15/2006								
Green-winged Teal		AMERICIUM-241	0.20	±	0.32	0.73	±	1.17	
		CERIUM-141	161.00	±	128.00	596.30	±	474.07	
		CESIUM-134	-15.20	±	10.50	-56.30	±	38.89	
		CESIUM-137	-22.60	±	10.80	-83.70	±	40.00	
		CHROMIUM-51	1340.00	±	1300.00	4962.96	±	4814.81	
		COBALT-58	28.10	±	26.00	104.07	±	96.30	
		COBALT-60	-3.22	±	8.42	-11.93	±	31.19	
		IRON-59	146.00	±	104.00	540.74	±	385.19	
		MANGANESE-54	-7.99	±	10.10	-29.59	±	37.41	

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

		PLUTONIUM-238	0.16	±	0.05	0.60	±	0.20	
		PLUTONIUM-239/40	0.13	±	0.05	0.47	±	0.18	
		STRONTIUM-90	-2.67	±	1.88	-9.89	±	6.96	
		ZINC-65	-11.50	±	27.10	-42.59	±	100.37	
MFC	9/15/2006								
Northern Shoveler		AMERICIUM-241	0.80	±	0.77	2.97	±	2.84	
		CERIUM-141	-28.20	±	74.80	-104.44	±	277.04	
		CESIUM-134	-7.43	±	4.78	-27.52	±	17.70	
		CESIUM-137	4.13	±	4.91	15.30	±	18.19	
		CHROMIUM-51	172.00	±	761.00	637.04	±	2818.52	
		COBALT-58	11.90	±	13.50	44.07	±	50.00	
		COBALT-60	0.37	±	5.12	1.37	±	18.96	
		IRON-59	-71.90	±	60.40	-266.30	±	223.70	
		MANGANESE-54	-3.70	±	5.94	-13.70	±	22.00	
		PLUTONIUM-238	0.16	±	0.08	0.60	±	0.28	
		PLUTONIUM-239/40	0.10	±	0.06	0.37	±	0.23	
		STRONTIUM-90	0.08	±	2.25	0.31	±	8.33	
		ZINC-65	20.70	±	14.40	76.67	±	53.33	
MFC	9/15/2006								
Green-winged Teal		AMERICIUM-241	0.06	±	0.14	0.22	±	0.51	
		CERIUM-141	-570.00	±	148.00	-2111.11	±	548.15	
		CESIUM-134	-1.09	±	6.69	-4.04	±	24.78	
		CESIUM-137	8.41	±	9.88	31.15	±	36.59	
		CHROMIUM-51	-869.00	±	963.00	-3218.52	±	3566.67	
		COBALT-58	-11.10	±	17.50	-41.11	±	64.81	
		COBALT-60	5.30	±	6.43	19.63	±	23.81	
		IRON-59	44.30	±	77.50	164.07	±	287.04	
		MANGANESE-54	-0.84	±	7.57	-3.13	±	28.04	
		PLUTONIUM-238	0.11	±	0.12	0.42	±	0.45	
		PLUTONIUM-239/40	0.03	±	0.09	0.09	±	0.33	
		STRONTIUM-90	-3.05	±	3.69	-11.30	±	13.67	
		ZINC-65	7.56	±	17.00	28.00	±	62.96	
MFC	9/15/2006								
Mallard		AMERICIUM-241	0.86	±	0.11	3.20	±	0.41	Y

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

		CERIUM-141	15.00	±	44.30	55.56	±	164.07	
		CESIUM-134	-4.85	±	2.80	-17.96	±	10.37	
		CESIUM-137	5.56	±	2.44	20.59	±	9.04	
		CHROMIUM-51	-474.00	±	390.00	-1755.56	±	1444.44	
		COBALT-58	-2.64	±	6.70	-9.78	±	24.81	
		COBALT-60	-0.68	±	2.44	-2.51	±	9.04	
		IRON-59	-27.70	±	27.80	-102.59	±	102.96	
		MANGANESE-54	0.85	±	2.73	3.14	±	10.11	
		PLUTONIUM-238	0.08	±	0.04	0.31	±	0.14	
		PLUTONIUM-239/40	0.04	±	0.03	0.13	±	0.11	
		STRONTIUM-90	-0.46	±	0.72	-1.70	±	2.65	
		ZINC-65	5.17	±	6.73	19.15	±	24.93	
MFC	9/15/2006								
Gadwall		AMERICIUM-241	0.32	±	0.29	1.19	±	1.08	
		CERIUM-141	-510.00	±	140.00	-1888.89	±	518.52	
		CESIUM-134	-0.78	±	6.99	-2.89	±	25.89	
		CESIUM-137	378.00	±	16.50	1400.00	±	61.11	Y
		CHROMIUM-51	57.90	±	973.00	214.44	±	3603.70	
		COBALT-58	-21.50	±	18.60	-79.63	±	68.89	
		COBALT-60	28.70	±	7.74	106.30	±	28.67	Y
		IRON-59	-119.00	±	74.70	-440.74	±	276.67	
		MANGANESE-54	-4.07	±	7.70	-15.07	±	28.52	
		PLUTONIUM-238	0.20	±	0.08	0.74	±	0.31	
		PLUTONIUM-239/40	0.23	±	0.09	0.84	±	0.33	
		STRONTIUM-90	1.57	±	1.14	5.81	±	4.22	
		ZINC-65	29.60	±	20.30	109.63	±	75.19	
CONTROL	11/25/2006								
Common Merganser		AMERICIUM-241	0.03	±	0.02	0.12	±	0.08	
		CERIUM-141	13.60	±	15.00	50.37	±	55.56	
		CESIUM-134	-28.00	±	4.22	-103.70	±	15.63	
		CESIUM-137	-0.04	±	4.81	-0.16	±	17.81	
		CHROMIUM-51	143.00	±	120.00	529.63	±	444.44	
		COBALT-58	0.27	±	7.10	0.99	±	26.30	
		COBALT-60	-0.69	±	3.87	-2.57	±	14.33	
		IRON-59	10.00	±	18.90	37.04	±	70.00	

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

		MANGANESE-54	-0.44	±	4.44	-1.64	±	16.44	
		PLUTONIUM-238	0.01	±	0.03	0.02	±	0.10	
		STRONTIUM-90	-1.80	±	0.78	-6.67	±	2.89	
		ZINC-65	-48.40	±	11.20	-179.26	±	41.48	
CONTROL	11/25/2006								
Common Goldeneye		AMERICIUM-241	0.02	±	0.10	0.06	±	0.38	
		CERIUM-141	-5.87	±	10.70	-21.74	±	39.63	
		CESIUM-134	1.10	±	2.28	4.07	±	8.44	
		CESIUM-137	-0.35	±	2.17	-1.31	±	8.04	
		CHROMIUM-51	-51.20	±	80.60	-189.63	±	298.52	
		COBALT-58	-4.09	±	3.74	-15.15	±	13.85	
		COBALT-60	2.35	±	2.16	8.70	±	8.00	
		IRON-59	2.64	±	10.20	9.78	±	37.78	
		MANGANESE-54	-0.19	±	2.49	-0.70	±	9.22	
		PLUTONIUM-238	0.10	±	0.06	0.36	±	0.21	
		PLUTONIUM-239/40	0.14	±	0.05	0.52	±	0.20	
		STRONTIUM-90	0.65	±	0.67	2.40	±	2.48	
CONTROL	11/25/2006								
Gadwall		AMERICIUM-241	0.59	±	0.19	2.20	±	0.70	Y
		CERIUM-141	-1.69	±	15.60	-6.26	±	57.78	
		CESIUM-134	-2.87	±	4.47	-10.63	±	16.56	
		CESIUM-137	6.62	±	4.05	24.52	±	15.00	
		CHROMIUM-51	18.70	±	121.00	69.26	±	448.15	
		COBALT-58	2.17	±	5.92	8.04	±	21.93	
		COBALT-60	15.80	±	6.55	58.52	±	24.26	
		IRON-59	-17.30	±	16.90	-64.07	±	62.59	
		MANGANESE-54	-3.59	±	4.14	-13.30	±	15.33	
		PLUTONIUM-238	0.15	±	0.06	0.56	±	0.23	
		PLUTONIUM-239/40	0.04	±	0.07	0.16	±	0.26	
		STRONTIUM-90	-2.12	±	0.88	-7.85	±	3.24	
		ZINC-65	-12.50	±	10.60	-46.30	±	39.26	

Table C-12. Environmental Radiation Results

Location	Start Date	End Date	Radiation Measurement ± 2s Uncertainty mR			Exposure mR/day
BOUNDARY						
ARCO	5/3/2006	11/8/2006	62.10	±	12.20	0.33
ATOMIC CITY	5/3/2006	11/8/2006	62.60	±	12.30	0.33
BIRCH CREEK	5/3/2006	11/8/2006	52.70	±	10.30	0.28
BLUE DOME	5/3/2006	11/8/2006	50.70	±	9.90	0.27
HOWE	5/3/2006	11/8/2006	55.90	±	11.00	0.30
MONTEVIEW	5/2/2006	11/8/2006	58.00	±	11.40	0.31
MUD LAKE	5/3/2006	11/8/2006	61.10	±	12.00	0.32
					Boundary Average	**0.30**
DISTANT						
ABERDEEN	5/2/2006	11/7/2006	62.50	±	12.20	0.33
BLACKFOOT	5/3/2006	11/8/2006	57.80	±	11.30	0.31
BLACKFOOT CMS	5/3/2006	11/8/2006	52.30	±	10.20	0.28
CRATERS	5/3/2006	11/8/2006	59.00	±	9.90	0.31
DUBOIS	5/3/2006	11/8/2006	47.70	±	9.40	0.25
IDAHO FALLS	5/3/2006	11/6/2006	60.20	±	11.80	0.32
MINIDOKA	5/2/2006	11/7/2006	54.10	±	10.60	0.29
REXBURG	5/3/2006	11/8/2006	69.60	±	13.60	0.37
ROBERTS	5/3/2006	11/7/2006	64.30	±	12.60	0.34
					Distant Average	**0.31**
OUT-OF-STATE						
JACKSON	5/3/2006	11/9/2006	44.80	±	8.80	0.24

APPENDIX D

STATISTICAL ANALYSIS RESULTS

PAGE INTENTIONALLY LEFT BLANK

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	0.97
October	0.68
November	0.24
December	0.79
Gross Beta	
Quarter	0.21
October	0.26
November	0.71
December	0.34

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 4th	0.25
	October 11th	0.89
	October 18th	1.00
	October 25th	1.00
	November 1st	0.25
	November 8th	0.46
	November 15th	0.89
	November 22nd	0.89
	November 29th	0.03
	December 6th	0.67
	December 13th	0.39
	December 20th	0.67
	December 27th	0.32
Gross Beta		
	October 4th	0.94
	October 11th	0.25
	October 18th	0.48
	October 25th	0.07
	November 1st	0.43
	November 8th	0.02
	November 15th	0.72
	November 22nd	0.12
	November 29th	0.05
	December 6th	0.12
	December 13th	0.25
	December 20th	0.25
	December 27th	0.12

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