ESRF-011(2QT95)

INEL Offsite Environmental Surveillance Program Report for the Second Quarter of 1995

Environmental Science and Research Foundation

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May 1996

Idaho National Engineering Laboratory

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Report Series, Number 011(2QT95)

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Program is Conducted for the
U.S. Department of Energy, Idaho Operations Office
Under Contract DE-AC07-94ID13268 by the
Environmental Science and Research Foundation
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Executive Summary

The Environmental Science and Research Foundation conducts the Idaho National Engineering Laboratory (INEL) offsite environmental surveillance program. The Foundation's environmental surveillance program is designed to monitor the effects, if any, of Department of Energy activities on the offsite environment, to confirm compliance with applicable environmental laws and regulations, and to observe any trends in environmental levels of radioactivity. This report for the second quarter of 1995 includes the results of analyses conducted on samples of air, water, milk, foodstuffs, and environmental radiation. All concentrations of radioactivity found in these samples were consistent with historical levels, and no evidence of the presence of radionuclides from the INEL was found in offsite samples. Concentrations of radionuclides found in all samples were below the guidelines set by both the Department of Energy and the Environmental Protection Agency for radiation protection of members of the public.

Program Description

The Foundation collected filters weekly from low-volume air samplers at 11 offsite locations (four at distant or background locations and seven at INEL boundary locations). An additional three samplers were operated on the INEL. Weekly measurements were made of gross alpha and gross beta concentrations in airborne particulates. Charcoal cartridges were screened weekly for the presence of Iodine-131. At the end of the quarter, weekly filters from each location were combined to form a composite sample for each location. These composites were then analyzed for gamma-emitting radionuclides. Selected composites were also submitted for Strontium-90 and transuranic analyses (Plutonium-238, Plutonium-239/240, and Americium-241).

Atmospheric moisture and precipitation samples were collected to monitor for tritium. Atmospheric moisture samples were collected over a period of approximately 10 weeks, on average. The Foundation collected two precipitation samples monthly (one onsite and one offsite) as well as a weekly onsite sample.

Drinking water samples were collected from 13 sites surrounding the INEL; five surface water samples were collected in the Idaho Falls and Magic Valley areas. All water samples were analyzed for gross alpha, gross beta, and tritium concentrations.

The Foundation collected a weekly milk sample from a dairy in Idaho Falls and collected monthly milk samples from eight additional dairies around the INEL. All milk samples were analyzed for Iodine-131. Samples from May were also analyzed for tritium or Strontium-90.

Annual sheep samples from flocks grazing on the INEL and in an area distant from the INEL were collected and analyzed for gamma-emitting radionuclides. Three road-killed pronghorn were sampled and analyzed for gamma-emitting radionuclides.

The Foundation collected 13 offsite TLDs (environmental radiation dosimeters) that are analyzed semiannually to determine environmental radiation levels around the INEL.

Summary of Second Quarter Results

During the second quarter of 1995, gross alpha and gross beta concentrations in low-volume air samples were within the expected range of values for natural background radioactivity. Mean concentrations of both gross alpha and gross beta were similar at onsite, distant, and boundary locations. Iodine-131 was not found in any air sample. No transuranic radionuclides were detected on the air filter composites; Strontium-90 was found at one distant location at just above the minimum detectable concentration. Tritium was found in two atmospheric moisture samples, and in two of 13 precipitation samples. The data indicate that the INEL is not likely the source, since similar concentrations of tritium were detected at distant locations. Detectable atmospheric tritium is likely due to contributions from historic nuclear weapons tests and natural atmospheric processes.

Six of 19 water samples indicated a concentration of tritium just above the minimum detectable concentration. A more sensitive laboratory counting system than used in the past enables the detection of lower concentrations of tritium in water samples. The tritium is likely due to historic nuclear weapons testing and natural processes. Gross alpha concentrations were detected in two of the water samples. Seven samples, including four drinking water and three surface water samples, contained detectable concentrations of gross beta. Gross alpha and gross beta radioactivity in water samples are attributed to naturally occurring radionuclides in the earth's crust.

None of the milk samples collected during the second quarter contained detectable concentrations of Iodine-131 or tritium. Strontium-90 was detected in all milk samples. The concentrations were higher for the distant stations. The concentrations were consistent with previous results and are likely due to world-wide fallout from historic nuclear weapons testing.

Muscle samples from three of four sheep grazing onsite, and one of two sheep grazing at a control location, showed detectable concentrations of Cesium-137. One liver sample and one muscle sample from onsite road-killed game animals (each from a different pronghorn) showed detectable levels of Cesium-137. (A third pronghorn showed no detectable levels of manmade radionuclides.) While Cesium-137 attributable to soil contamination at the INEL has been found in some game animal samples in the past, the concentrations seen during the second quarter in sheep and pronghorn are consistent with those found both onsite and offsite in recent years, and are more likely due to world-wide fallout from historic nuclear weapons testing.

All of the environmental radiation results were consistent with previously reported data and indicate no detectable levels of environmental radiation from INEL activities at the offsite locations.

Helpful Information for Readers

Radionuclide Nomenclature

Radionuclides are sometimes expressed with the one- or two-letter chemical symbol for the element. (A radionuclide is an unstable or radioactive form of an element.) A given element may have many different radionuclides. Each is designated by a superscript number to the left of the chemical symbol. This number is the atomic weight of the radionuclide (the number of protons and neutrons in its nucleus). Radionuclides which may be used in this report are shown in the following table:

Symbol	Radionuclide	Symbol	Radionuclide
^{3}H	Tritium	^{137}Cs	Cesium-137
^{7}Be	Beryllium-7	^{238}Pu	Plutonium-238
^{90}Sr	Strontium-90	$^{239/240}Pu$	Plutonium-239/240
^{131}I	Iodine-131	^{241}Am	Americium-241

Scientific Notation

Scientific notation is used to express numbers which are very small or very large. A very small number will be expressed with a negative exponent, e.g., 1.3×10^{-6}. To convert this number to the more commonly used form, the decimal point must be moved <u>left</u> by a number of places equal to the exponent (in this case 6). The number thus becomes 0.0000013.

For large numbers, those with a positive exponent, the decimal point is moved to the <u>right</u> by the number of places equal to the exponent. The number 1,000,000 (or one million) can be written as 1.0×10^{6}.

Unit Prefixes

Units for very small or very large numbers are commonly expressed with a prefix. One example is the prefix *kilo* (abbreviated k), which means 1,000 of a given unit. A kilometer is therefore equal to 1,000 meters. Prefixes that may be used in this report are:

Prefix	Abbreviation	Meaning
milli	m	1/1,000 (=1 x 10^{-3})
micro	µ	1/1,000,000 (=1 x 10^{-6})
pico	p	1/1,000,000,000,000 (=1 x 10^{-12})

Units of Radioactivity and Radiation Exposure and Dose

The basic unit of radioactivity used in this report is the curie (abbreviated Ci). The curie is based on the radionuclide Radium-226, of which one gram decays at the rate of 37 billion disintegrations per second. For any other radionuclide, one curie is the amount of that radionuclide that decays at this same rate.

Radiation exposure is expressed in terms of the Roentgen (R), the amount of ionization produced by gamma radiation in air. Dose is given in units of "Roentgen equivalent man," or "rem," which takes into account the effect of radiation on tissues. For the types of environmental radiation generally encountered, the unit of Roentgen is approximately numerically equal to the unit of rem.

Units of Environmental Concentrations

Concentration of radioactivity in air and milk samples is expressed in units of microcuries per milliliter (µCi/mL) of air or milk. Concentrations in water samples are expressed as picocuries per liter (pCi/l) of water (federal standards are expressed in these units). Radioactivity in foodstuffs is expressed in microcuries per gram (µCi/g), dry weight. Radioactivity in soil samples is expressed as picocuries per gram (pCi/g), dry weight. Annual human radiation exposure, measured by environmental dosimeters, is expressed in units of milliRoentgens (mR). This is sometimes expressed in terms of dose as millirem (mrem). (NOTE: Not all of the above sample types may appear in this particular report.)

Uncertainty of Measurements

Due to a variety of variables, there is always an uncertainty associated with the measurement of environmental contaminants. For radioactivity, the predominant source of uncertainty is due to the inherent statistical nature of radioactive decay events, particularly at the low activity levels encountered in environmental samples. The uncertainty of a measurement is denoted by following the result with a "±" (uncertainty) term. This report follows convention in reporting the uncertainty as a 95% confidence limit (or interval), designated in the tables as "±2s". That means there is approximately a 95% level of confidence that the real concentration in the sample lies somewhere between the measured (reported) concentration minus the uncertainty term and the measured (reported) concentration plus the uncertainty term.

Negative Numbers as Results

Environmental measurements are frequently conducted at levels where the contaminant (such as radioactivity) cannot be distinguished from natural background levels. In this case, the result will still be reported by the analytical laboratory, even though it is below the measurement system's approximate minimum detectable concentration (MDC), or is less than zero. Negative values occur when the measured result is less than a pre-established average background level for the particular system and procedure used. These values, rather than "not detectable" or "zero," are reported to better enable statistical analyses and to observe trends or bias in the data.

Gross versus Specific Analyses

Many of the radiological analyses of environmental samples yield information only about the overall (or gross) amount of a particular type of radiation (e.g., gross beta), rather than identifying and quantifying specific radionuclides. For example, rather than performing an analysis for particular gamma-emitting radionuclides, called gamma spectroscopy, one can do a gross gamma or, more commonly, a gross beta analysis (since gamma-emitting radionuclides also emit beta particles). This type of analysis is an effective screening tool and is much quicker and less costly than specific radionuclide analyses.

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1. Introduction

Consistent with requirements of applicable Department of Energy (DOE) Orders, the Foundation's environmental surveillance program is designed to monitor the effects, if any, of DOE activities on the offsite environment, to collect data to verify compliance with applicable environmental laws and regulations, and to observe trends in environmental levels of radioactivity. This work is performed under DOE Contract DE-AC07-ID13268.

This quarterly report summarizes the data collected by the Foundation's INEL offsite environmental surveillance program during the period April 1 through June 30, 1995. The scope of the Foundation's sampling program is outlined in Table 1.

Most analyses for the surveillance program were performed by Idaho State University's Environmental Monitoring Laboratory. Some analyses were performed by Quanterra Laboratory in Richland, Washington.

A significant portion of environmental results are near background levels of radioactivity. All results are reported with an associated 2s ("two sigma") uncertainty term. The Foundation has adopted the following method for interpreting analytical results near background levels. Results less than or equal to the 2s uncertainty term, which includes some results that are negative, are considered as zero or "not detected." For results greater than 2s (the 95% confidence level), but not exceeding 3s (the 99% confidence interval), detection of the radioactivity is questionable. These results may exceed the 2s level simply due to random statistical fluctuations. This is expected to occur approximately 2.5% of the time. Results exceeding 3s are interpreted as indicating that radioactivity was detected.

Table 2 summarizes the approximate minimum detectable concentrations (MDC) of radioactivity that the laboratories can detect and quantify for a given sample type and analysis.

Where appropriate, the results in this report are compared to the following:

- For air, concentrations are compared to the DOE Derived Concentration Guide. This is the concentration of a radionuclide that, under conditions of continuous exposure, would result in an effective dose equivalent of 100 mrem (the DOE standard for members of the public);
- For drinking water, concentrations are compared to the Environmental Protection Agency Maximum Contaminant Level. This is the maximum permissible level of a contaminant in water that is delivered to any user of a community water system.

Table 1
Summary of the Foundation's Environmental Surveillance Program

Sample Type Analysis	**Collection Frequency**	**Locations**		
		Distant	**Boundary**	**INEL**
Air				
Gross Alpha	weekly	Blackfoot, Craters of the Moon	Arco, Mud Lake	Main Gate, EFS
Gross Beta ^{131}I	weekly	Blackfoot, Craters of the Moon, Idaho Falls, Rexburg	Arco, Atomic City, FAA Tower, Howe, Monteview, Mud Lake, Reno Ranch	Main Gate, EFS, Van Buren
Gamma Spec Particulate Mass	quarterly	Blackfoot, Craters of the Moon, Idaho Falls, Rexburg	Arco, Atomic City, FAA Tower, Howe, Monteview, Mud Lake, Reno Ranch	Main Gate, EFS, Van Buren
^{90}Sr Transuranics	quarterly	Rotating schedule	Rotating schedule	Rotating schedule
Air Moisture				
Tritium	4 to 13 weeks	Idaho Falls	Atomic City	None
Precipitation				
Tritium	monthly	Idaho Falls	None	CFA
Tritium	weekly	None	None	EFS
Surface H_2O				
Gross Alpha, Gross Beta, ^{3}H	quarterly→ semiannually→	Twin Falls, Buhl, Hagerman Idaho Falls, Bliss	None	None
Drinking H_2O				
Gross Alpha Gross Beta, ^{3}H	semiannually	Aberdeen, Blackfoot, Carey, Idaho Falls, Fort Hall, Minidoka, Roberts, Shoshone	Arco, Atomic City, Howe, Monteview, Mud Lake, Reno Ranch	None
Milk				
^{131}I	weekly	Idaho Falls	None	None
^{131}I	monthly	Blackfoot, Carey, Dietrich, Minidoka, Roberts	Howe, Terreton, Arco	None
Tritium ^{90}Sr	annually	Blackfoot, Carey, Dietrich, Idaho Falls, Minidoka, Roberts	Howe, Terreton, Arco	None
Potatoes				
Gamma Spec ^{90}Sr	annually	Blackfoot, Idaho Falls, Rupert	Arco, Mud Lake	None
Wheat				
Gamma Spec ^{90}Sr	annually	American Falls, Blackfoot, Dietrich, Idaho Falls, Minidoka, Carey	Arco, Monteview, Mud Lake, Tabor, Terreton	None
Lettuce				
Gamma Spec ^{90}Sr	annually	Blackfoot, Carey, Idaho Falls, Pocatello	Arco, Atomic City, Howe, Mud Lake	None
Fish				
Gamma Spec	annually	None	None	Big Lost River
Sheep				
Gamma Spec	annually	Blackfoot	None	INEL grazing areas
Waterfowl				
Gamma Spec ^{90}Sr Transuranics	annually	Fort Hall	None	Waste disposal ponds
Game				
Gamma Spec	Varies	None	None	INEL roads
Soil				
Gamma Spec ^{90}Sr Transuranics	biennially	Carey, Crystal Ice Caves, Blackfoot, St. Anthony	Butte City, Monteview, Atomic City, FAA Tower, Howe, Mud Lake (2), Reno Ranch	None
TLDs				
Gamma Radiation	semiannual	Aberdeen, Blackfoot, Craters of the Moon, Idaho Falls, Minidoka, Rexburg, Roberts	Arco, Atomic City, Howe, Monteview, Mud Lake, Reno Ranch	None

Table 2
Summary of Minimum Detectable Concentrations for Radiological Analyses
(Second Quarter 1995)

Sample Type	Analysis	Approximate Minimum Detectable Concentration[a] (MDC)	Derived Concentration Guide[b] (DCG)	Drinking Water Detection Limits[c]
Air (particulate filter)[d]	Gross alpha	1×10^{-15} µCi/ml	2×10^{-14} µCi/ml	--
	Gross beta	5×10^{-15} µCi/ml	3×10^{-12} µCi/ml	--
	Specific gamma (^{137}Cs)	2×10^{-15} µCi/ml	4×10^{-10} µCi/ml	--
	^{238}Pu	2×10^{-18} µCi/ml	3×10^{-14} µCi/ml	--
	$^{239/240}Pu$	2×10^{-18} µCi/ml	2×10^{-14} µCi/ml	--
	^{241}Am	3×10^{-18} µCi/ml	2×10^{-14} µCi/ml	--
	^{90}Sr	4×10^{-17} µCi/ml	9×10^{-12} µCi/ml	--
Air (charcoal cartridge)[d]	^{131}I	5×10^{-15} µCi/ml	4×10^{-10} µCi/ml	--
Air (atmospheric moisture)[e]	^{3}H	4×10^{-12} µCi/ml	1×10^{-7} µCi/ml	--
Air (precipitation)	^{3}H	1.6×10^{-7} µCi/ml	2×10^{-3} µCi/ml	--
Water (drinking & surface)	Gross alpha	1 pCi/l	30 pCi/l	1.5 pCi/l
	Gross beta	1 pCi/l	100 pCi/l	4 pCi/l
	^{3}H	160 pCi/l	2×10^{6} pCi/l	1000 pCi/l
Milk	^{131}I	2×10^{-9} µCi/ml	--	--
	^{3}H	5×10^{-7} µCi/ml	--	--
	^{90}Sr	5×10^{-10} µCi/ml	--	--
Muscle tissue	Specific gamma (^{137}Cs)	2×10^{-9} µCi/g	--	--
Liver tissue	Specific gamma (^{137}Cs)	5×10^{-9} µCi/g	--	--
Thyroid tissue	Specific gamma (^{131}I)	3×10^{-7} µCi/g	--	--

a. The minimum detectable concentration (MDC) is an estimate of the concentration of radioactivity in a given sample type that can be identified with a 95% level of confidence and a 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. These limits are required by the National Primary Drinking Water Regulations (40 CFR 141). The "detection limit" is the terminology used by the EPA and means the same as the MDC defined above.
d. The approximate MDC is based on an average filtered air volume (pressure corrected) of 570 m^3/week.
e. The approximate MDC is expressed for tritium (as tritiated water) in air, and is based on an average filtered air volume of 20 m^3, assuming an average sampling period of eight weeks.

2. Air Sampling

2.1 Sampling Methods

2.1.1 Low-Volume Air Samplers

Airborne particulate radioactivity was continuously monitored by a network of 14 air samplers (Figure 1), designed to provide effective coverage in the event of an INEL release of radioactivity. Four offsite air samplers are designated as distant (or background) stations and seven are designated as boundary stations. Three air samplers are situated on the INEL. Distant locations are used to make comparisons of airborne concentrations of radioactivity with boundary and onsite locations. Two replicate samplers, located in Rexburg and Atomic City, were operated adjacent to regular air samplers to provide quality assurance information.

Each air sampler averaged a flow of approximately 50 l/min (2 ft^3/min) through a filter head consisting of two types of filters--a 1.2-micrometer pore size particulate filter and a charcoal cartridge for the monitoring of radioactive iodine. Filters on each sampler were changed weekly. In order to be considered a valid sample, each filter must sample a pressure-corrected air volume of at least 200 m^3 (or about 7000 ft^3). Filters sample an average air volume of about 570 m^3 (20,000 ft^3).

Charcoal cartridges were screened weekly for gross (nonspecific) gamma activity. Particulate filters were counted each week for gross (nonspecific) beta activity in a low background beta counter after waiting a minimum of four days for the naturally occurring decay products of radon and thoron to decay. The particulate filters were also counted for gross (nonspecific) alpha activity.

At the end of the quarter, weekly filters from each location were combined to form a composite. All composites were then analyzed by gamma spectrometry for specific radionuclides. Selected composites were also analyzed for ^{90}Sr or transuranic radionuclides (^{238}Pu, $^{239/240}$Pu, and ^{241}Am).

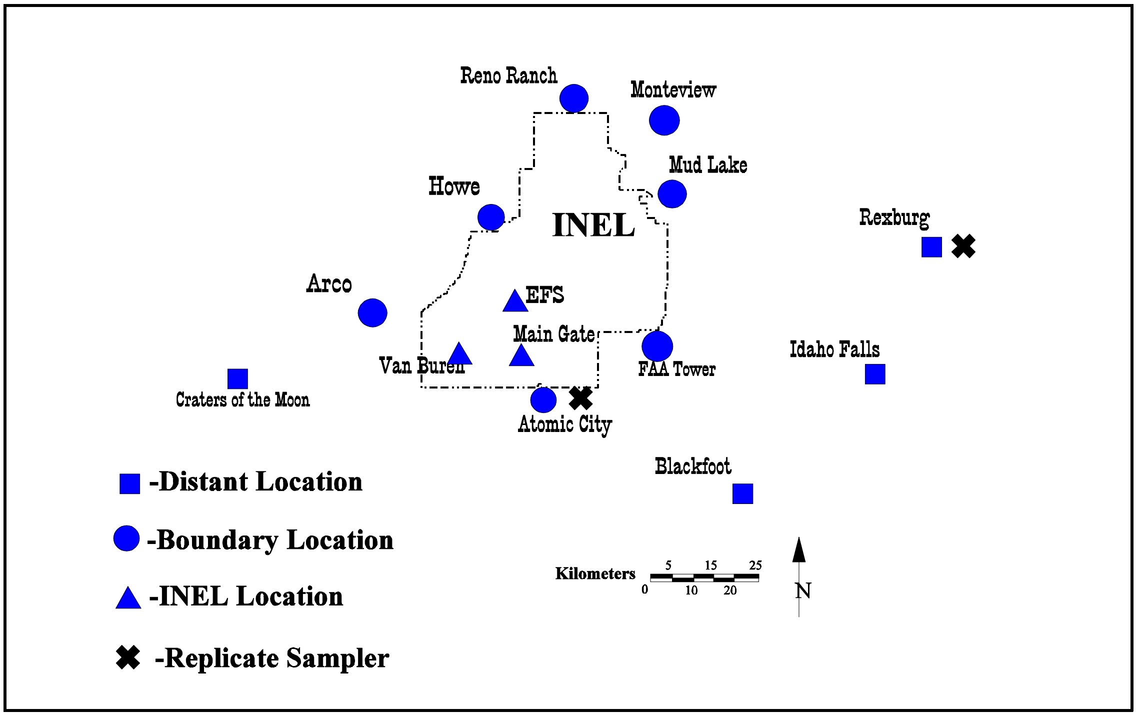

Figure 1 Air Sampling Location Map

2.1.2 Atmospheric Moisture Samplers

Two air samplers, located in Atomic City and Idaho Falls, were used to collect atmospheric moisture for tritium analysis. Air was passed through a column of silica gel that absorbs water vapor in the air. Tritium concentrations were determined by extracting water from the silica gel and counting it by liquid scintillation.

2.1.3 Precipitation Samplers

When available, weekly precipitation samples were collected at the Experimental Field Station (EFS) on the INEL. In addition, two samples were collected monthly: one at the Central Facilities Area on the INEL and one in Idaho Falls. All precipitation samples were analyzed for tritium by liquid scintillation.

2.2 Results

2.2.1 Low-Volume Air Samplers

No Iodine-131 was detected in any of the charcoal cartridges analyzed during the second quarter. The minimum detectable concentration for these analyses was approximately 3 x 10^{-15} µCi/ml.

All gross alpha concentrations were within the expected range of background levels (Figure 2 and Table A-1, Appendix A). Gross alpha concentrations ranged from (-0.7 ± 1.3) x 10^{-15} µCi/ml during the week of April 5-12 at Van Buren to (4.0 ± 1.8) x 10^{-15} µCi/ml during the week of April 12-19 at Rexburg. The quarterly mean gross alpha concentrations for the onsite and boundary locations were not statistically higher than the mean for the distant locations: (0.8 ± 0.3) x 10^{-15} µCi/ml (onsite), (0.8 ± 0.1) x 10^{-15} µCi/ml (boundary), and (1.1 ± 0.2) x 10^{-15} µCi/ml (distant). These results are summarized in Table 3.

Except for low gross beta concentrations found at Mud Lake, all gross beta concentrations were also within the expected range of background levels (Figure 3

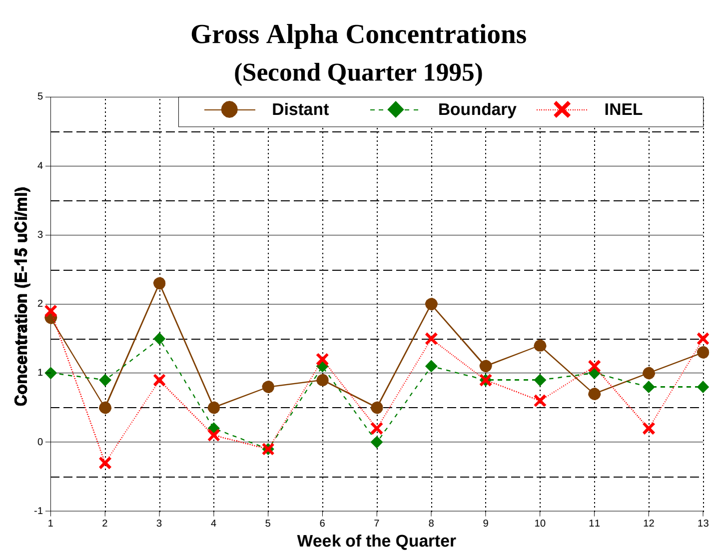

Figure 2 Weekly Gross Alpha Concentrations

Table 3
Gross Alpha Concentrations in Air
(Second Quarter 1995)

Group	Location	Number of Samples	Gross Alpha Concentration ($\times 10^{-15}$ µCi/ml) Range of Samples	Mean with 95% Confidence Interval
Distant	Blackfoot	13	-0.1 - 2.8	1.3 ± 0.5
	Craters of the Moon	12	-0.5 - 2.4	0.6 ± 0.5
	Idaho Falls	13	0.2 - 2.4	1.4 ± 0.5
	Rexburg (Replicate)	13 (13)	-0.4 - 4.0 (-0.5 - 2.9)	1.2 ± 0.6 (1.3 ± 0.6)
			Group Mean	**1.1 ± 0.2**
Boundary	Arco	13	-0.2 - 2.5	0.7 ± 0.4
	Atomic City (Replicate)	13 (13)	-0.3 - 1.5 (0.1 - 2.6)	0.8 ± 0.4 (1.2 ± 0.4)
	FAA Tower	13	0.3 - 2.7	1.1 ± 0.4
	Howe	13	-0.1 - 1.5	0.9 ± 0.3
	Monteview	13	-0.4 - 2.5	0.9 ± 0.5
	Mud Lake	13	-0.4 - 1.4	0.5 ± 0.4
	Reno Ranch	13	-1.1 - 1.8	0.5 ± 0.5
			Group Mean	**0.8 ± 0.1**
INEL	EFS	13	-0.6 - 2.4	0.8 ± 0.6
	Main Gate	13	-0.5 - 1.9	0.7 ± 0.4
	Van Buren	13	-0.7 - 2.3	0.8 ± 0.5
			Group Mean	**0.8 ± 0.3**
			DOE Derived Concentration Guide	20

and Table A-2, Appendix A). Consistently low concentrations (including gross alpha, gross beta, and specific radionuclides) were noted for the Mud Lake station beginning in late 1994. The Foundation is investigating possible causes for these low concentrations, including possible leaks in the sampling system or intermittent flow meter malfunctions. Gross beta concentrations ranged from (-4 ± 3) x 10^{-15} µCi/ml during the week of June 21-28 at Idaho Falls to (58 ± 11) x 10^{-15} µCi/ml during the week of April 19-26 at Idaho Falls. Quarterly means of gross beta concentrations for the onsite and boundary locations were not statistically higher than the mean for the distant locations: (20 ± 2) x 10^{-15} µCi/ml (onsite), (19 ± 2) x 10^{-15} µCi/ml (boundary),

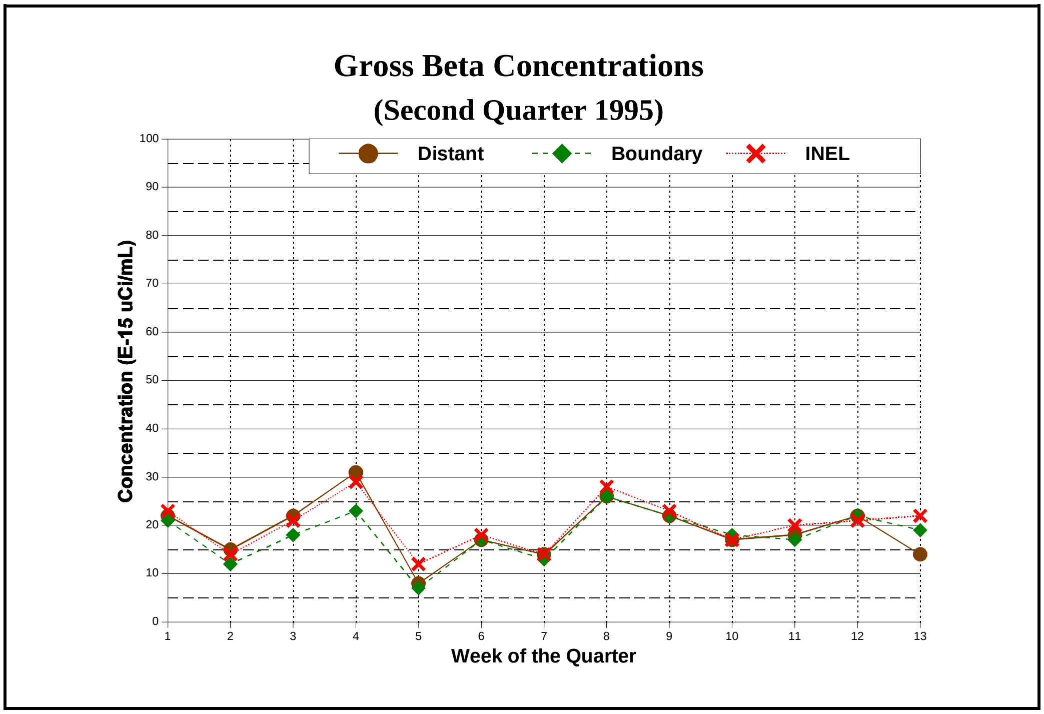

Figure 3 Weekly Gross Beta Concentrations

and (19 ± 2) x 10^{-15} μCi/ml (distant). The results are summarized in Table 4. (A Student's unpaired, one-tailed t-test showed the Mud Lake mean to be statistically different from the mean of all other boundary stations grouped together, likely due to one of the possible reasons noted above. It was thus concluded the data were not representative of the distribution and, for this reason, not included in the boundary group mean.)

The gross beta data for the Rexburg and Atomic City quality assurance replicates assisted data validation for those locations. Student's t-tests (two-tailed) indicated the Rexburg and Atomic City mean values were statistically the same as their respective replicate mean values.

Beryllium-7, a naturally-occurring gamma-emitting radionuclide produced by cosmic rays in the atmosphere, was detected in all of the quarterly composites (Table 5). No other gamma-emitting radionuclides were found on any of the composite samples. Strontium-90 was detected on one of the composite samples from a distant location at just above the minimum detectable concentration (Table 5). No transuranic radionuclides were detected on any of the quarterly composites.

Table 4
Gross Beta Concentrations in Air
(Second Quarter 1995)

			Gross Beta Concentration ($\times 10^{-15}$ µCi/ml)	
Group	**Location**	**Number of Samples**	**Range of Samples**	**Mean with 95% Confidence Interval**
Distant	Blackfoot	13	10 - 26	19 ± 3
	Craters of the Moon	12	2 - 32	20 ± 5
	Idaho Falls	13	-4 - 58	18 ± 8
	Rexburg (Replicate)	13 (13)	11 - 25 (11 - 31)	19 ± 3 (20 ± 3)
			Group Mean	**19 ± 2**
Boundary	Arco	13	9 - 21	16 ± 2
	Atomic City (Replicate)	13 (13)	12 - 51 (11 - 28)	22 ± 6 (20 ± 3)
	FAA Tower	13	6 - 32	20 ± 4
	Howe	13	10 - 22	18 ± 2
	Monteview	13	12 - 32	20 ± 4
	Mud Lake[a]	13	0 - 20	13 ± 3
	Reno Ranch	13	0 - 27	18 ± 4
			Group Mean[b]	**19 ± 2**
INEL	EFS	13	10 - 25	19 ± 2
	Main Gate	13	8 - 31	19 ± 4
	Van Buren	13	12 - 45	22 ± 5
			Group Mean	**20 ± 2**
		DOE Derived Concentration Guide		3000

a. Low values noted during quarter; see text for explanation.
b. Excludes Mud Lake data; see text for explanation.

2.2.2 Atmospheric Moisture Samplers

Two atmospheric moisture samples were collected during the second quarter of 1995, one each from Idaho Falls and Atomic City. Tritium was detected in both samples. The ^3H concentrations in air were $(6.0 \pm 1.5) \times 10^{-13}$ µCi/ml and $(1.6 \pm 1.3) \times 10^{-13}$ µCi/ml, respectively (the DCG is 1×10^{-7} µCi/ml). Since the concentration is greater in Idaho Falls, the source is not likely from the INEL. Tritium (mostly as tritiated water) results from natural (cosmic ray interactions in the atmosphere) and man-made sources.

2.2.3 Precipitation Samplers

Thirteen precipitation samples were collected in the second quarter and analyzed for ^{3}H. Detectable concentrations of ^{3}H were found in two of the samples. A weekly sample from the Experimental Field Station in June showed a concentration of (1.32 ± 0.94) x 10^{-7} µCi/ml and the June sample from Idaho Falls contained tritium at (1.04 ± 0.90) x 10^{-7} µCi/ml.

Table 5
Radionuclide Analyses for Particulate Filter Quarterly Composites[a]
(Second Quarter 1995)

Location	^{7}Be (10^{-15} µCi/ml ± 2s)	Other Gamma Emitters Detected (10^{-15} µCi/ml ± 2s)	^{90}Sr (10^{-15} µCi/ml ± 2s)
Distant Locations			
Blackfoot	137 ± 17	None	0.06 ± 0.05
Craters of the Moon	161 ± 18	None	NA[b]
Idaho Falls	126 ± 18	None	NA
Rexburg	145 ± 17	None	0.01 ± 0.03
Rexburg Replicate	149 ± 16	None	0.00 ± 0.05
Boundary Locations			
Arco	136 ± 14	None	0.01 ± 0.02
Atomic City	144 ± 18	None	NA
Atomic City Replicate	92 ± 14	None	NA
FAA Tower	168 ± 19	None	NA
Howe	142 ± 20	None	NA
Monteview	154 ± 16	None	0.02 ± 0.03
Mud Lake	90 ± 11	None	NA
Reno Ranch	145 ± 16	None	NA
INEL Locations			
EFS	145 ± 14	None	NA
Main Gate	149 ± 15	None	-0.01 ± 0.04
Van Buren	143 ± 18	None	NA
DOE Derived Concentration Guide	40,000,000	N/A	9000

a. Concentrations decay-corrected to mid-point of the quarter.
b. NA = not analyzed for ^{90}Sr.

3. Water Sampling

3.1 Methods

Water samples were collected in early May from 14 drinking water locations and from five surface water locations, four in the Magic Valley area and one from Idaho Falls (Figure 4). Drinking water sampling locations were local businesses. Surface water locations included three springs in the Thousand Springs area--some of the outlets for the Snake River Plain Aquifer, which flows beneath the INEL (Figure 4). Each water sample was analyzed for gross (nonspecific) alpha and gross beta activity by evaporating a portion of the sample on a stainless steel plate and counting the residue. Tritium concentrations were determined by analyzing samples using liquid scintillation.

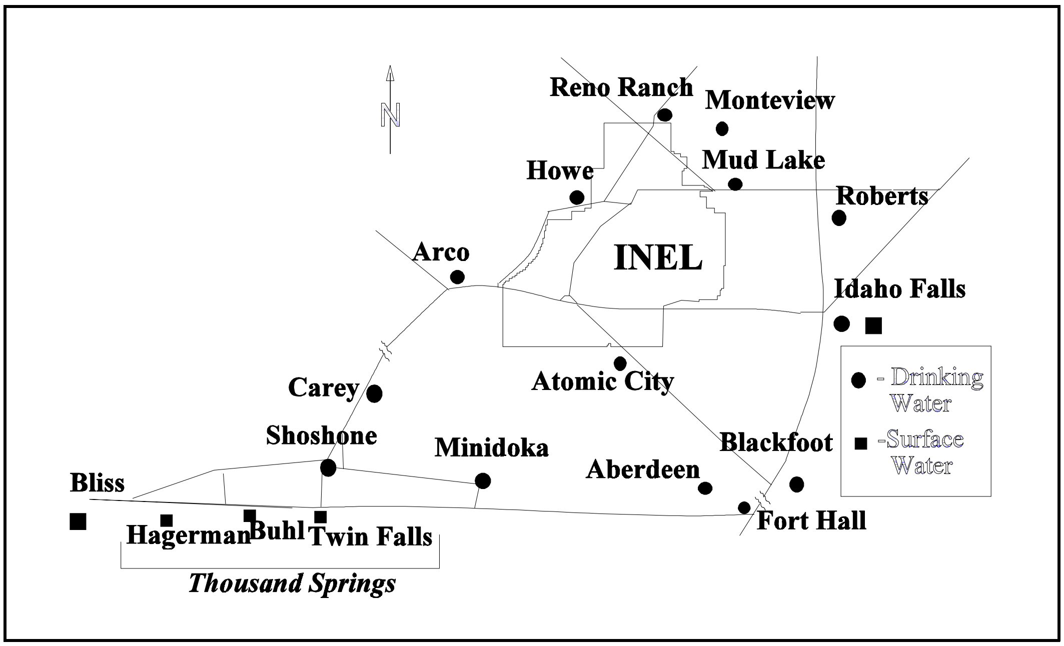

Figure 4 Water Sampling Locations

3.2 Results

Three drinking water samples (Carey, Minidoka, and Shoshone) and three surface water samples (Alpheus Spring, Bill Jones Hatchery, and Idaho Falls) showed measurable concentrations of ^{3}H (Table 6). A new counting system is currently in use that achieves minimum detectable concentrations for tritium in the 150 pCi/l range, whereas minimum detectable concentrations were generally in the 500 pCi/l range during previous years. Environmental ^{3}H is due primarily to contributions from historic nuclear weapons tests and natural processes. The results for these samples range from about one to two percent of the Environmental Protection Agency's (EPA) Maximum Contaminant Level (MCL) for ^{3}H. (Table 6 lists the MCL for each analyte of interest.) Two of the drinking water samples (from Roberts and Idaho Falls) contained detectable concentrations of gross alpha. Concentrations of gross beta were detected in drinking water samples from four locations (Aberdeen, Blackfoot, Fort Hall, and Monteview) and surface water samples from three locations (Alpheus Spring, Bill Jones Hatchery, and Clear Spring). Gross alpha and gross beta radioactivity in water samples are generally attributed to naturally occurring decay products (primarily from the uranium and thorium series) picked up by water as it travels through the earth's crust.

Table 6
Radionuclide Concentrations in Offsite Water Samples
(Second Quarter 1995)

Location	^{3}H (pCi/l ± 2s)	Gross Alpha (pCi/l ± 2s)	Gross Beta (pCi/l ± 2s)
Drinking Water			
Aberdeen	-140 ± 160	1 ± 3	4 ± 2
Arco	6 ± 160	0 ± 2	2 ± 2
Atomic City	27 ± 160	2 ± 3	0 ± 2
Blackfoot	-38 ± 170	0 ± 2	4 ± 2
Carey	290 ± 160	0 ± 2	1 ± 1
Fort Hall	-170 ± 160	0 ± 3	4 ± 2
Minidoka	240 ± 160	1 ± 3	1 ± 2
Shoshone	370 ± 160	1 ± 2	1 ± 1
Group Mean	**70 ± 170**	**1 ± 1**	**2 ± 1**
Howe	28 ± 160	-1 ± 2	1 ± 2
Howe Replicate	180 ± 160	0 ± 2	2 ± 2
Idaho Falls	100 ± 170	1 ± 3	1 ± 2
Monteview	94 ± 160	4 ± 6	6 ± 2
Mud Lake	64 ± 160	-1 ± 1	1 ± 1
Reno Ranch	3 ± 160	3 ± 3	1 ± 2
Roberts	54 ± 160	4 ± 3	2 ± 2
Control Group Mean[a]	**60 ± 40**	**2 ± 2**	**2 ± 2**
Surface Water			
Alpheus Spring (Twin Falls)	270 ± 160	0 ± 3	7 ± 2
Bill Jones Hatchery (Hagerman)	250 ± 160	0 ± 2	3 ± 2
Clear Spring (Buhl)	-160 ± 160	4 ± 5	12 ± 2
Clear Spring Replicate	270 ± 160	3 ± 6	3 ± 2
Bliss	-74 ± 160	Lost in analysis	Lost in analysis
Idaho Falls[a]	190 ± 160	3 ± 2	0 ± 1
EPA Maximum Contaminant Level (MCL)	20,000	15	50

a. The control group includes locations where the drinking water source is "upstream" from the INEL.

4. Milk Sampling

4.1 Methods

Milk samples were collected weekly in Idaho Falls and monthly at eight other locations around the INEL (Figure 5). Two types of locations were sampled: single family dairies and large commercial dairies. Each milk sample was analyzed for ^{131}I by placing the sample in a gamma spectrometer calibrated for the ^{131}I energy peak.

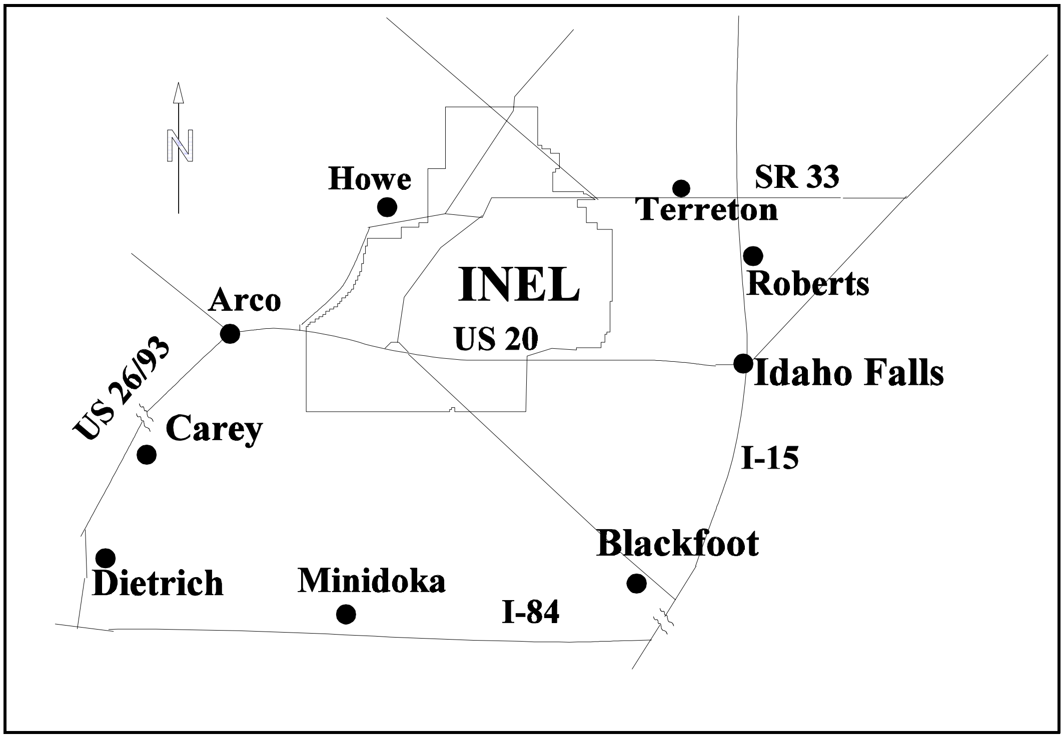

Figure 5 Milk Sampling Locations

4.2 Results

A total of 37 milk samples were collected during the second quarter. Iodine-131 was not detected in any of the samples at a minimum detectable concentration of approximately 2×10^{-9} µCi/ml. Five of the milk samples were analyzed for ^{3}H. No detectable levels of ^{3}H were found in any of the samples.

An additional five milk samples were analyzed for ^{90}Sr (Table 7). This radionuclide was found in all samples, four from distant locations and one from a boundary location (Terreton). The concentrations of ^{90}Sr were greater for the distant stations than boundary station. All concentrations were consistent with those reported by the EPA as resulting from worldwide fallout.

Table 7
^{90}Sr Concentrations in Milk
(Second Quarter 1995)

Location	Result ($\mu Ci/ml \pm 2s$) x 10^{-9}
Blackfoot	0.9 ± 0.3
Carey	1.3 ± 0.5
Idaho Falls	1.0 ± 0.4
Minidoka	1.0 ± 0.4
Terreton	0.7 ± 0.3

5. Livestock/Game Sampling

5.1 Methods

Samples of thyroid, muscle, and liver were taken from sheep grazing at authorized locations along the eastern side of the INEL in the Tractor Flats and Circular/Antelope Butte areas (Figure 6). Control samples were taken from the Blackfoot area. In addition, similar organ and tissue samples were taken from road-killed game at onsite locations. The samples were analyzed for manmade gamma-emitting radionuclides.

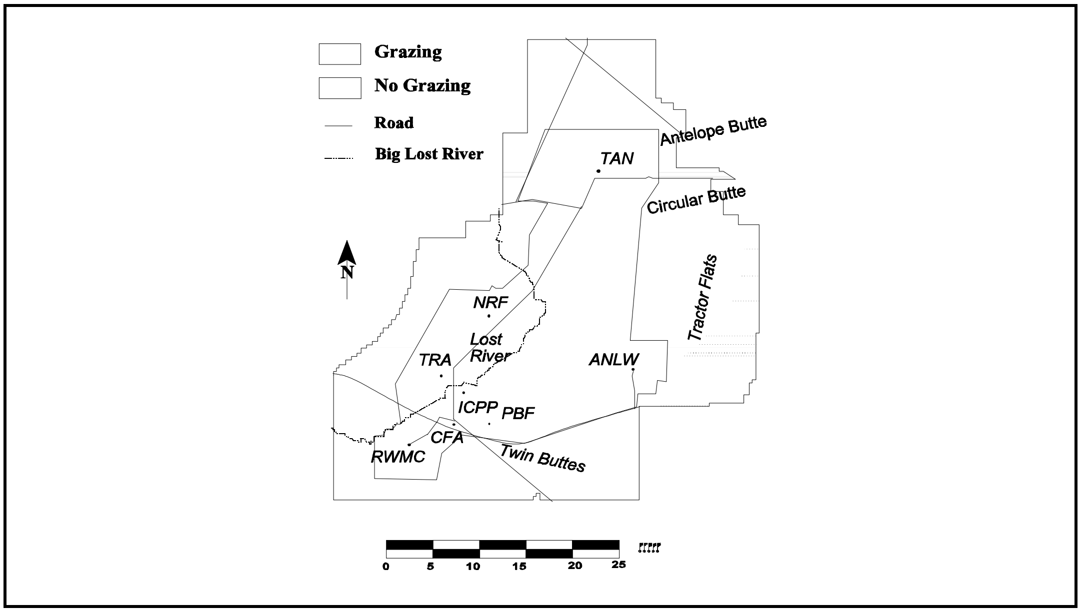

Figure 6 Livestock Grazing Locations on the INEL

5.2 Results

Muscle samples from three of four sheep grazing onsite and one of two sheep from the Blackfoot area showed detectable concentrations of ^{137}Cs (Table 8). This radionuclide is generally absorbed by all organs and tissues, but tends to concentrate in muscle tissue. These levels are consistent with previous results found in sheep both onsite and offsite, and are attributed to the universal presence of ^{137}Cs in the environment from fallout from historic nuclear weapons testing.

One liver sample and one muscle sample from two different pronghorn, killed in the Central Facilities Area, showed detectable levels of ^{137}Cs (Table 8). Samples from a third pronghorn showed no detectable levels of manmade, gamma-emitting radionuclides. Some detectable concentrations of Cesium-137 found in game animals during previous years have been attributed to ingestion of contaminated soil particles, but concentrations found in the second quarter are similar to those found both onsite and offsite in sheep and game animals resulting from historic nuclear weapons testing.

Table 8
^{137}Cs Concentrations in Sheep and Game
(Second Quarter 1995)

Location	Tissue/Organ	Result ($\mu Ci/g \pm 2s$) x 10^{-9}
	Sheep	
INEL	Muscle	4.0 ± 2.0
INEL	Muscle	11.9 ± 7.8
INEL	Muscle	12.4 ± 7.8
Blackfoot	Muscle	4.8 ± 2.0
	Road-killed Game (Pronghorn)	
INEL	Liver	14.8 ± 9.1
INEL	Muscle	5.2 ± 2.9

6. Environmental Radiation

6.1 Methods

Environmental radiation is monitored at six boundary and seven distant stations (Figure 7). Environmental radiation is monitored with the use of thermoluminescent dosimeters (TLDs) made of lithium fluoride crystals. The TLDs are placed on posts one meter above the ground at field locations and changed every six months (May and November). The crystals detect beta and gamma radiation and store this information in the form of “excited” electrons within the crystals. The TLDs are analyzed by an instrument which heats them under precisely controlled conditions and detects the light they give off. The amount of light is a measure of the amount of environmental (ionizing) radiation.

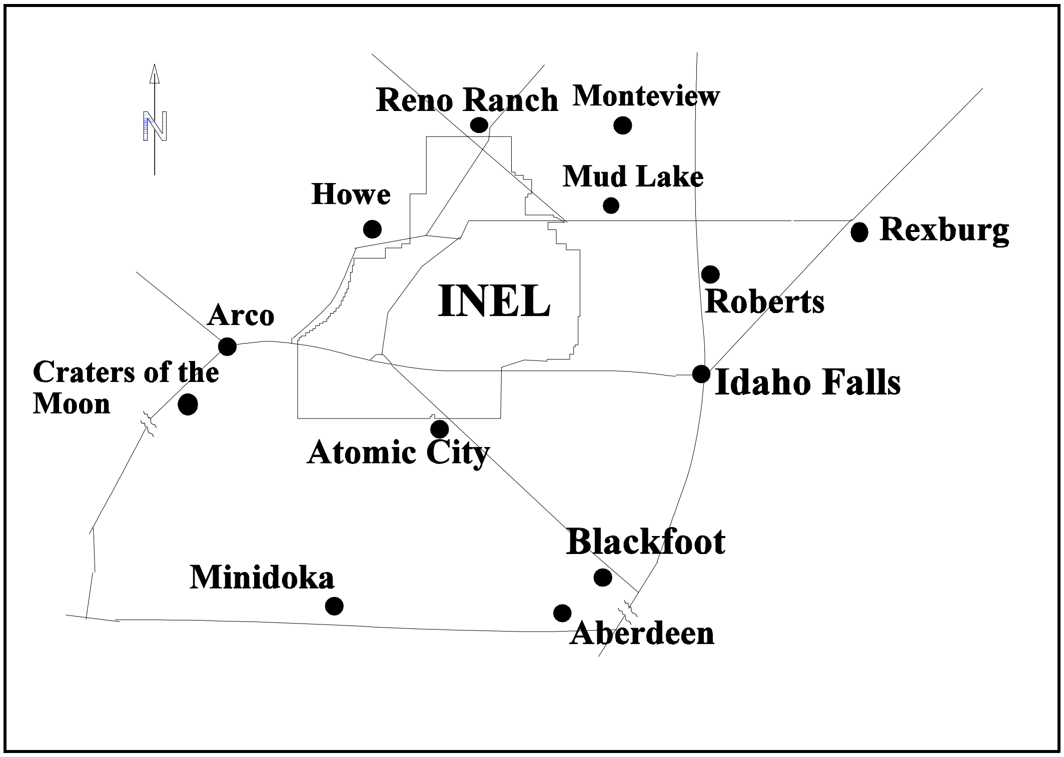

Figure 7 TLD Locations

6.2 Results

The environmental radiation results for the first half of 1995 (November 1994 through April 1995) are shown in Table 9. The results show that the exposure levels were lower during the November 1994 through April 1995 period than the previous two six-month periods. A one-tailed Student's t-test indicated that the exposure levels at the boundary stations were not statistically greater than exposure levels at the distant stations.

Table 9
Environmental Radiation Exposure (mR) for Nov. 1994-May 1995

Location	11/93-5/94 Exposure (mR ± 2s)	5/94-11/94 Exposure (mR ± 2s)	11/94-5/95 Exposure (mR ± 2s)
Distant Locations			
Aberdeen	60 ± 3	60 ± 3	49 ± 2
Blackfoot	63 ± 4	62 ± 3	54 ± 3
Craters of the Moon	71 ± 10	62 ± 3	52 ± 2
Idaho Falls	63 ± 3	---[b]	57 ± 4
Minidoka	63 ± 5	57 ± 3	51 ± 1
Rexburg	64 ± 5	56 ± 4	50 ± 1
Roberts	68 ± 2	70 ± 4	59 ± 3
Group Mean[a]	**65 ± 3**	**61 ± 5**	**53 ± 3**
Boundary Locations			
Arco	61 ± 5	66 ± 3	55 ± 2
Atomic City	70 ± 7	64 ± 4	59 ± 2
Howe	66 ± 4	55 ± 2	54 ± 3
Monteview	65 ± 6	55 ± 4	56 ± 3
Mud Lake	68 ± 8	62 ± 3	59 ± 3
Reno Ranch	69 ± 11	57 ± 3	55 ± 2
Group Mean[a]	**66 ± 3**	**60 ± 5**	**56 ± 2**

a. Mean ± 95% confidence interval.
b. TLD could not be read due to damage to the chips.

Appendix A

Weekly Gross Alpha and Gross Beta Concentrations in Air

Table A-1
Weekly Gross Alpha Concentrations in Air

Location	**Weekly Collection Date**	**Concentration ± 2s Uncertainty (10^{-15} µCi/ml)**
		Distant Locations
Blackfoot	4/05	1.6 ± 1.8
	4/12	0.9 ± 1.7
	4/19	2.8 ± 1.9
	4/26	-0.1 ± 1.6
	5/03	1.1 ± 1.5
	5/10	1.9 ± 1.6
	5/17	1.2 ± 1.8
	5/24	2.4 ± 1.8
	5/31	0.3 ± 0.9
	6/07	2.0 ± 1.5
	6/14	0.9 ± 1.3
	6/21	1.0 ± 1.6
	6/28	1.1 ± 1.2
Craters of the Moon	4/05	1.2 ± 1.5
	4/12	invalid sample
	4/19	0.0 ± 1.1
	4/26	0.1 ± 1.4
	5/03	0.7 ± 1.3
	5/10	0.0 ± 1.0
	5/17	-0.5 ± 1.2
	5/24	2.4 ± 1.6
	5/31	0.6 ± 0.9
	6/07	1.1 ± 1.0
	6/14	0.4 ± 1.0
	6/21	0.3 ± 1.2
	6/28	0.6 ± 0.8
Idaho Falls	4/05	2.4 ± 1.7
	4/12	0.8 ± 1.5
	4/19	2.4 ± 1.6
	4/26	2.2 ± 3.6
	5/03	0.3 ± 1.1
	5/10	0.3 ± 0.9
	5/17	0.7 ± 1.7
	5/24	2.0 ± 1.4
	5/31	1.4 ± 1.1
	6/07	1.7 ± 1.2
	6/14	0.2 ± 0.8

Table A-1 (Cont.)
Weekly Gross Alpha Concentrations in Air

Location	**Weekly Collection Date**	**Concentration ± 2s Uncertainty (10^{-15} µCi/ml)**
	6/21	1.6 ± 1.4
	6/28	2.4 ± 1.4
Rexburg (Replicate)	4/05	2.0 ± 1.5 (1.8 ± 1.5)
	4/12	0.0 ± 1.2 (1.3 ±1.5)
	4/19	4.0 ± 1.8 (2.9 ± 1.6)
	4/26	-0.4 ± 1.1 (0.4 ± 1.4)
	5/03	1.0 ± 1.2 (0.6 ± 1.2)
	5/10	1.4 ± 1.2 (0.6 ± 1.0)
	5/17	0.5 ± 1.3 (-0.5 ± 0.9)
	5/24	1.3 ± 1.2 (0.9 ± 1.2)
	5/31	1.9 ± 1.2 (2.4 ± 1.4)
	6/07	0.9 ± 1.0 (2.7 ± 1.6)
	6/14	1.1 ± 1.1 (2.0 ± 1.3)
	6/21	0.9 ± 1.2 (0.3 ± 1.1)
	6/28	1.2 ± 1.0 (1.6 ± 1.1)
Boundary Locations		
Arco	4/05	0.5 ± 1.0
	4/12	2.5 ± 1.5
	4/19	1.0 ± 1.1
	4/26	0.5 ± 1.3
	5/03	0.2 ± 0.9
	5/10	0.8 ± 1.0
	5/17	-0.2 ± 1.0
	5/24	1.5 ± 1.2
	5/31	0.3 ± 0.7
	6/07	0.5 ± 0.9
	6/14	0.6 ± 0.9
	6/21	0.7 ± 1.1
	6/28	0.8 ± 0.8
Atomic City (Replicate)	4/05	1.2 ± 1.5 (1.0 ± 1.4)
	4/12	0.7 ± 1.4 (0.7 ± 1.4)
	4/19	1.5 ± 1.4 (1.1 ± 1.3)
	4/26	0.7 ± 1.6 (1.0 ± 1.3)
	5/03	-0.3 ± 1.0 (0.1 ± 1.1)
	5/10	1.1 ± 1.1 (1.4 ± 1.2)
	5/17	-0.1 ± 1.3 (1.3 ± 1.6)
	5/24	1.3 ± 1.4 (2.6 ± 1.6)
	5/31	1.1 ± 1.1 (1.4 ± 1.1)

Table A-1 (Cont.)
Weekly Gross Alpha Concentrations in Air

Location	Weekly Collection Date	Concentration ± 2s Uncertainty (10^{-15} μCi/ml)
	6/07	1.4 ± 1.0 (1.3 ± 1.0)
	6/14	1.3 ± 1.2 (1.6 ± 1.3)
	6/21	-0.1 ± 1.0 (1.6 ± 1.5)
	6/28	1.0 ± 0.9 (0.7 ± 0.9)
FAA Tower	4/05	1.6 ± 1.8
	4/12	0.4 ± 1.5
	4/19	2.7 ± 1.9
	4/26	0.3 ± 1.7
	5/03	0.3 ± 1.3
	5/10	1.2 ± 1.3
	5/17	0.6 ± 2.0
	5/24	0.4 ± 1.2
	5/31	1.5 ± 1.3
	6/07	0.7 ± 0.9
	6/14	1.5 ± 1.4
	6/21	1.6 ± 1.7
	6/28	1.5 ± 1.5
Howe	4/05	1.5 ± 1.5
	4/12	1.1 ± 1.5
	4/19	1.5 ± 1.4
	4/26	0.4 ± 1.3
	5/03	-0.1 ± 0.9
	5/10	0.4 ± 0.9
	5/17	0.2 ± 1.1
	5/24	1.2 ± 1.2
	5/31	0.9 ± 0.9
	6/07	0.9 ± 1.0
	6/14	1.0 ± 1.0
	6/21	1.5 ± 1.3
	6/28	0.9 ± 0.9
Monteview	4/05	0.6 ± 1.2
	4/12	1.7 ± 1.6
	4/19	2.2 ± 1.5
	4/26	-0.1 ± 1.3
	5/03	-0.4 ± 0.9
	5/10	2.5 ± 1.5
	5/17	0.2 ± 1.3
	5/24	0.9 ± 1.2

Table A-1 (Cont.)
Weekly Gross Alpha Concentrations in Air

Location	Weekly Collection Date	Concentration ± 2s Uncertainty (10^{-15} µCi/ml)
	5/31	0.7 ± 0.9
	6/07	0.4 ± 0.9
	6/14	1.8 ± 1.3
	6/21	0.4 ± 1.7
	6/28	0.5 ± 0.8
Mud Lake	4/05	0.7 ± 1.2
	4/12	-0.4 ± 1.2
	4/19	1.4 ± 1.3
	4/26	0.5 ± 1.2
	5/03	-0.3 ± 0.7
	5/10	1.1 ± 1.0
	5/17	0.5 ± 1.2
	5/24	1.3 ± 1.1
	5/31	0.1 ± 0.9
	6/07	1.2 ± 1.1
	6/14	0.3 ± 0.8
	6/21	0.1 ± 0.9
	6/28	0.3 ± 0.6
Reno Ranch	4/05	1.1 ± 1.5
	4/12	0.1 ± 0.9
	4/19	0.3 ± 1.1
	4/26	-1.1 ± 1.6
	5/03	0.1 ± 1.2
	5/10	0.3 ± 1.0
	5/17	-0.9 ± 1.1
	5/24	1.2 ± 1.4
	5/31	1.8 ± 1.3
	6/07	1.5 ± 1.4
	6/14	0.4 ± 1.0
	6/21	1.1 ± 1.5
	6/28	0.8 ± 0.9
	INEL Locations	
Main Gate	4/05	1.0 ± 1.4
	4/12	-0.5 ± 1.0
	4/19	0.5 ± 1.0
	4/26	0.4 ± 1.4
	5/03	0.1 ± 1.1
	5/10	1.9 ± 1.4

Table A-1 (Cont.)
Weekly Gross Alpha Concentrations in Air

Location	Weekly Collection Date	Concentration ± 2s Uncertainty (10^{-15} µCi/ml)
	5/17	-0.5 ± 1.2
	5/24	1.8 ± 1.4
	5/31	0.9 ± 1.0
	6/07	1.3 ± 1.1
	6/14	0.9 ± 1.1
	6/21	0.7 ± 1.3
	6/28	1.0 ± 1.0
EFS	4/05	2.4 ± 1.6
	4/12	0.3 ± 1.2
	4/19	0.7 ± 1.1
	4/26	-0.4 ± 1.2
	5/03	-0.1 ± 1.0
	5/10	0.8 ± 1.1
	5/17	1.1 ± 1.5
	5/24	1.6 ± 1.4
	5/31	0.9 ± 1.0
	6/07	-0.1 ± 0.5
	6/14	1.2 ± 1.2
	6/21	-0.6 ± 0.8
	6/28	2.1 ± 1.3
Van Buren	4/05	2.3 ± 2.0
	4/12	-0.7 ± 1.3
	4/19	1.7 ± 1.6
	4/26	0.1 ± 1.7
	5/03	-0.3 ± 1.2
	5/10	0.8 ± 1.3
	5/17	-0.1 ± 1.5
	5/24	1.1 ± 1.2
	5/31	1.1 ± 1.0
	6/07	0.7 ± 0.8
	6/14	1.1 ± 1.2
	6/21	0.6 ± 1.3
	6/28	1.5 ± 1.2

Table A-2
Weekly Gross Beta Concentrations in Air

Location	**Weekly Collection Date**	**Concentration ± 2s Uncertainty (10^{-15} µCi/ml)**
	Distant Locations	
Blackfoot	4/05	26 ± 5
	4/12	18 ± 5
	4/19	21 ± 5
	4/26	19 ± 5
	5/03	10 ± 4
	5/10	14 ± 5
	5/17	11 ± 4
	5/24	24 ± 5
	5/31	23 ± 5
	6/07	18 ± 5
	6/14	19 ± 5
	6/21	21 ± 5
	6/28	20 ± 5
Craters of the Moon	4/05	23 ± 5
	4/12	invalid sample
	4/19	25 ± 5
	4/26	24 ± 5
	5/03	2 ± 3
	5/10	21 ± 4
	5/17	13 ± 4
	5/24	32 ± 5
	5/31	26 ± 5
	6/07	16 ± 4
	6/14	20 ± 4
	6/21	21 ± 4
	6/28	19 ± 4
Idaho Falls	4/05	20 ± 4
	4/12	15 ± 4
	4/19	19 ± 4
	4/26	58 ± 11
	5/03	10 ± 3
	5/10	18 ± 4
	5/17	15 ± 5
	5/24	23 ± 4
	5/31	14 ± 4
	6/07	14 ± 4
	6/14	15 ± 3

Table A-2 (Cont.)
Weekly Gross Beta Concentrations in Air

Location	Weekly Collection Date	Concentration ± 2s Uncertainty (10^{-15} µCi/ml)
	6/21	21 ± 4
	6/28	-4 ± 3
Rexburg	4/05	20 ± 4 (23 ± 5)
(Replicate)	4/12	13 ± 4 (15 ± 4)
	4/19	21 ± 4 (20 ± 4)
	4/26	22 ± 4 (21 ± 4)
	5/03	11 ± 3 (13 ± 4)
	5/10	14 ± 4 (16 ± 4)
	5/17	17 ± 4 (11 ± 3)
	5/24	25 ± 4 (31 ± 5)
	5/31	24 ± 4 (20 ± 4)
	6/07	21 ± 4 (25 ± 5)
	6/14	19 ± 4 (13 ± 4)
	6/21	24 ± 4 (24 ± 4)
	6/28	18 ± 4 (22 ± 5)
Boundary Locations		
Arco	4/05	17 ± 3
	4/12	10 ± 3
	4/19	17 ± 3
	4/26	19 ± 4
	5/03	9 ± 3
	5/10	16 ± 3
	5/17	10 ± 3
	5/24	21 ± 4
	5/31	18 ± 4
	6/07	18 ± 4
	6/14	16 ± 3
	6/21	18 ± 3
	6/28	15 ± 4
Atomic	4/05	25 ± 5 (20 ± 4)
City	4/12	14 ± 4 (14 ± 4)
(Replicate)	4/19	23 ± 5 (25 ± 5)
	4/26	51 ± 7 (20 ± 4)
	5/03	12 ± 4 (11 ± 3)
	5/10	19 ± 4 (16 ± 4)
	5/17	15 ± 4 (14 ± 4)
	5/24	29 ± 5 (25 ± 5)
	5/31	27 ± 5 (22 ± 4)

Table A-2 (Cont.)
Weekly Gross Beta Concentrations in Air

Location	Weekly Collection Date	Concentration ± 2s Uncertainty (10^{-15} µCi/ml)
	6/07	17 ± 4 (18 ± 4)
	6/14	19 ± 4 (21 ± 4)
	6/21	19 ± 4 (24 ± 4)
	6/28	18 ± 4 (28 ± 5)
FAA	4/05	21 ± 5
Tower	4/12	12 ± 4
	4/19	21 ± 5
	4/26	22 ± 5
	5/03	6 ± 3
	5/10	17 ± 5
	5/17	17 ± 6
	5/24	32 ± 6
	5/31	25 ± 5
	6/07	18 ± 4
	6/14	23 ± 5
	6/21	28 ± 5
	6/28	21 ± 6
Howe	4/05	22 ± 4
	4/12	16 ± 4
	4/19	20 ± 4
	4/26	19 ± 4
	5/03	10 ± 3
	5/10	16 ± 4
	5/17	13 ± 3
	5/24	22 ± 4
	5/31	21 ± 4
	6/07	16 ± 4
	6/14	13 ± 3
	6/21	21 ± 4
	6/28	20 ± 4
Monteview	4/05	21 ± 4
	4/12	14 ± 4
	4/19	20 ± 4
	4/26	21 ± 4
	5/03	12 ± 3
	5/10	15 ± 4
	5/17	13 ± 4
	5/24	31 ± 5

Table A-2 (Cont.)
Weekly Gross Beta Concentrations in Air

Location	**Weekly Collection Date**	**Concentration ± 2s Uncertainty (10^{-15} µCi/ml)**
	5/31	25 ± 4
	6/07	21 ± 4
	6/14	16 ± 4
	6/21	32 ± 6
	6/28	24 ± 5
Mud Lake	4/05	20 ± 4
	4/12	6 ± 3
	4/19	12 ± 3
	4/26	13 ± 3
	5/03	0 ± 2
	5/10	18 ± 4
	5/17	8 ± 3
	5/24	17 ± 3
	5/31	14 ± 4
	6/07	16 ± 4
	6/14	11 ± 3
	6/21	16 ± 3
	6/28	16 ± 4
Reno Ranch	4/05	23 ± 5
	4/12	7 ± 2
	4/19	17 ± 4
	4/26	18 ± 5
	5/03	0 ± 2
	5/10	17 ± 4
	5/17	15 ± 4
	5/24	27 ± 5
	5/31	22 ± 5
	6/07	22 ± 5
	6/14	18 ± 4
	6/21	25 ± 5
	6/28	21 ± 5
INEL Locations		
Main Gate	4/05	23 ± 5
	4/12	11 ± 3
	4/19	21 ± 4
	4/26	25 ± 5
	5/03	12 ± 3
	5/10	16 ± 4

Table A-2 (Cont.)
Weekly Gross Beta Concentrations in Air

Location	Weekly Collection Date	Concentration ± 2s Uncertainty (10^{-15} μCi/ml
	5/17	8 ± 4
	5/24	31 ± 5
	5/31	24 ± 4
	6/07	18 ± 4
	6/14	19 ± 4
	6/21	21 ± 4
	6/28	21 ± 4
EFS	4/05	21 ± 4
	4/12	15 ± 4
	4/19	21 ± 4
	4/26	19 ± 4
	5/03	10 ± 3
	5/10	18 ± 4
	5/17	17 ± 4
	5/24	25 ± 5
	5/31	23 ± 4
	6/07	17 ± 4
	6/14	22 ± 4
	6/21	20 ± 4
	6/28	18 ± 4
Van Buren	4/05	23 ± 6
	4/12	16 ± 4
	4/19	21 ± 5
	4/26	45 ± 7
	5/03	12 ± 4
	5/10	18 ± 5
	5/17	18 ± 5
	5/24	28 ± 4
	5/31	21 ± 4
	6/07	17 ± 4
	6/14	18 ± 4
	6/21	21 ± 4
	6/28	27 ± 5