DOE/ID/13042--43

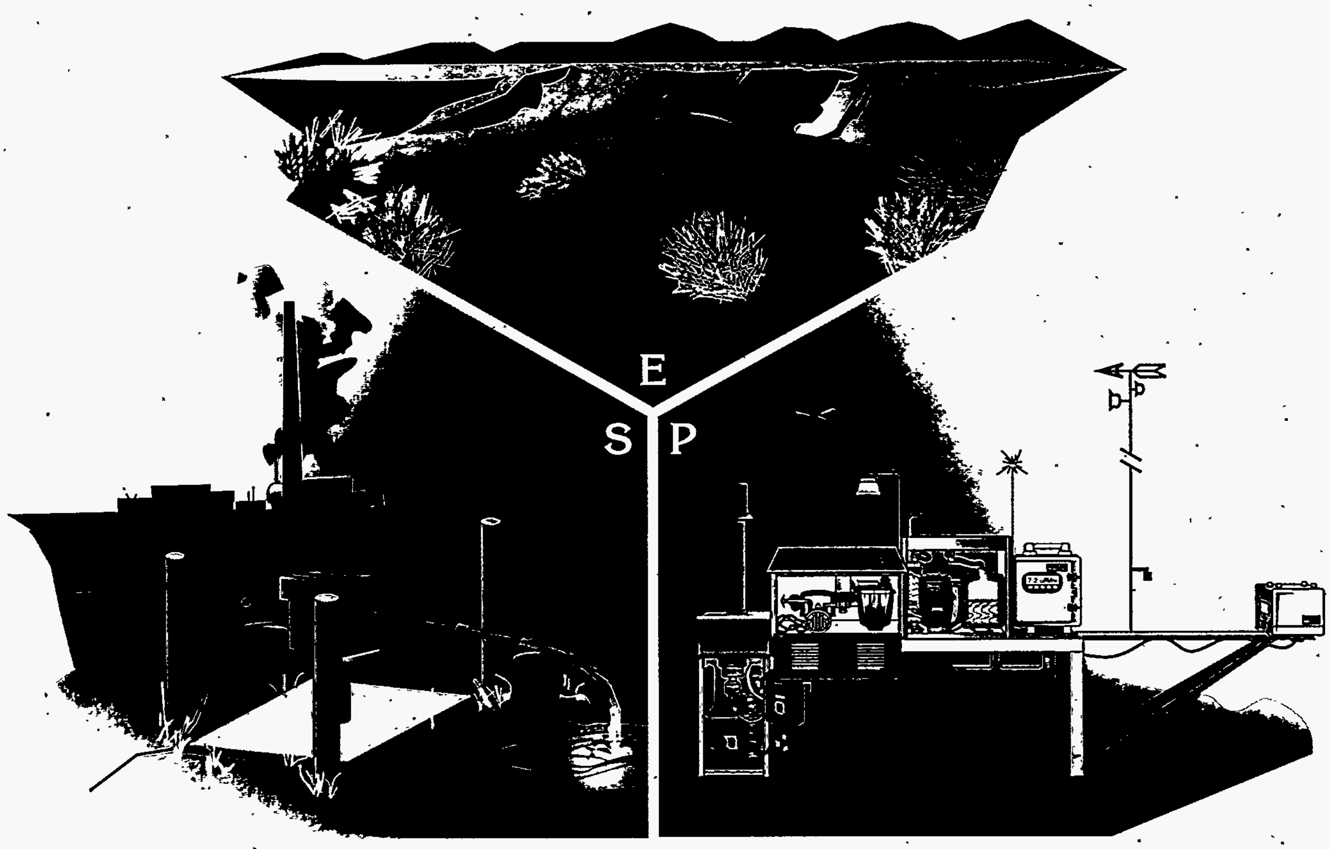
OPESP 93-01

State of Idaho

INEL Oversight Program

Environmental Surveillance Program Quarterly Progress Report

July—September, 1993



Environmental Surveillance Program Quarterly Progress Report July—September, 1993

Environmental Surveillance Program Team Leader
Douglas W. Walker

Data Management/Reporting Coordinator
L. Flint Hall

Quality Assurance/Quality Control Coordinator
Dr. Jerry Downs

Radiological Analysis Coordinator
Dr. Bernard Graham
Idaho State University

Nonradiological Analysis Coordinator
Jim Dodds
IDWH Bureau of Laboratories

Environmental Sampling Teams
Air: Douglas W. Walker
Terrestrial: Chris Briggs
Water: L. Flint Hall
Lin Campbell - IDWR

Database Support
Venna L. Murray

Cover Design
Cheryl Flood

State of Idaho
INEL Oversight Program
OPESP 93-01

Boise Central Office
1410 N. Hilton
Boise, ID 83706
208/334-0498

Idaho Falls Field Office
900 N. Skyline
Idaho Falls, ID 83402
208/528-2600

Idaho State University
Environmental Measurements Laboratory
College of Pharmacy
Pocatello, ID 83209-8288
208/236-4368

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

EXECUTIVE SUMMARY

This report contains data developed from monitoring site measurements and laboratory analyses of environmental samples that were collected during the period of July—September, 1993. Because some laboratory procedures are lengthy and could adversely affect the desired timeliness of reports, results of some analyses from this time period will be included in the next quarterly report. Quarterly reports, then, will be routine periodic documents that present continually updated information concerning the potential presence of environmental contaminants in the vicinity of the Idaho National Engineering Laboratory (INEL).

During the third calendar quarter of 1993, Environmental Surveillance Program (ESP) measurements did not reveal unexpected levels of contaminants in any environmental samples measured or analyzed. Most of the results reported in this document are related to off-site air and ground water measurements. Future reports will include results of monitoring at additional locations and for additional environmental materials.

Annual reports from the ESP will contain data generated during the previous four calendar quarters, and will display measurement trends for various combinations of locations, contaminants and environmental media. The annual report will also include more interpretive material and discussions than will normally be found in quarterly reports.

SECTION 1. ENVIRONMENTAL SURVEILLANCE PROGRAM

1.1. Overview

The ESP is a field monitoring system primarily conceived to determine the environmental presence of contaminants that may have originated from INEL facilities or operations. The ESP was designed, and is operated in collaboration with Idaho State University (ISU), to monitor air, water and terrestrial components of the INEL and surrounding environments. It was also designed to support radiological emergency response capability for the State of Idaho.

This progress report presents the results of analyses performed on samples collected during the third quarter (July—September), 1993. Not all sample analyses are complete at this time. Therefore, some results from samples collected during this period will appear in the next quarterly progress report.

Not all possible contaminants are monitored at all possible locations. Rather, strategic and achievable surveillance objectives were established within the ESP to meet public, State, INEL Oversight Program (OP) goals and Department of Energy (DOE) surveillance objectives. The ESP routinely monitors for high priority contaminants (in terms of dose and risk) at highest probability locations (based on climatological history and dispersion model predictions). Infrastructure documents available from the OP support ESP design and operational factors. These reports include a *Siting and Instrument Selection Technical Report* which is related to the air monitoring system, the *Environmental Surveillance Program Plan*, the *Environmental Surveillance Program QA/QC Plan*, the *Environmental Surveillance Program Standard Operating Procedures* (SOPs) and other technical accounts that have derived from the process of consolidating previous monitoring efforts into the current comprehensive environmental surveillance program.

The ESP is, by specific design, a complementary program. It provides data to complement, supplement, and verify monitoring coverage provided by other groups. Taken collectively, the total amount of data available is expected to provide a more complete view of environmental conditions. These arrangements improve verification (or identify potential discrepancies) without sacrificing necessary elements of independent performance. Besides its technical value, ESP's contribution to the overall surveillance database is of significant value in public communication and education.

The ESP is operated out of the OP Idaho Falls Field Office (IFFO). A team of environmental scientists with appropriate expertise is directed by a team leader with radiological training. Assignments within the group ensure that samples are correctly obtained and that data are properly handled, evaluated, and presented. The team is supported by other OP staff members at the IFFO and Boise offices, and by investigators at the Idaho Department of Water Resources and the State Bureau of Laboratories. The team also has formal collaborative arrangements with ISU's Environmental Measurements Laboratory (ISU-EML), the National Oceanographic and Atmospheric Administration Air Resources Laboratory Field Research Division and the U.S. Geological Survey (USGS).

1.2. ESP Objectives

The objectives of the ESP are to:

- Support the overall OP objectives through independent surveillance activities;
- Identify and determine long-term trends of contaminant levels in the on-site and off-site environment of the INEL;
- Supplement, complement and validate the existing INEL monitoring programs;
- Make environmental monitoring results available to the public and other programs conducting related activities; and
- Provide real-time environmental monitoring data to assist the Emergency Response Action Plan.

1.3. Environmental Data

Data generated by the ESP are the result of radiological and chemical laboratory analyses of collected environmental media, vendor supplied reports of thermoluminescent dosimeter (TLD) readings, gamma radiation information telemetered real-time via radio modems from the sampling stations to an IFFO computer, and gamma emitter identifications determined in the field with a portable spectrometer. Where possible, consistent data formats and templates have been established to facilitate rapid electronic transfer between laboratories and the ESP Data Manager. All data are screened by the ESP Data Manager prior to entry into the system database. The Data Manager and the Quality Assurance/Quality Control (QA/QC) Officer verify that data quality objectives were met and identify any unexpected outcomes that would require immediate ESP team review.

Validated data, once entered into the database, are available for review by any interested parties. Access to the data can be accommodated by the ESP Data Manager. Certain segments of current data, typically in graphical form, will be posted at the ESP permanent air monitoring stations and at other locations in the communities surrounding the INEL. Within eight weeks of the end of each calendar quarter, data collected during the past three month period are presented along with explanations, interpretations, and qualifications in the form of a quarterly report. To expedite the release of the data, some late-coming results will be included in the following quarterly report. Summarized data with more elaborate narratives will be presented in an annual ESP report.

SECTION 2. AIR MONITORING

2.1. Surveillance Network

2.1.1. Background

To provide the State of Idaho with independent data regarding the impact on air quality from INEL operations, the OP has developed an air monitoring network. Monitoring locations were selected during 1992, based upon locations with the highest probability for detecting routine releases from the INEL. Low-volume air samplers, on loan from the Environmental Protection Agency (EPA)-Las Vegas and the INEL, were obtained by the OP to initiate routine sampling until instruments could be purchased.

Beginning in 1993, the OP purchased an array of instruments for establishing a permanent air surveillance network at locations around the perimeter of the INEL. The permanent stations were designed to provide a range of monitoring capabilities in selected locations. The system was activated on July 1, 1993, as part of the ESP. The network design and instruments are described below, along with the analytical results for the third quarter of 1993.

2.1.2. Network Design

The ESP operated five permanent air monitoring stations during the third quarter of 1993. The locations included Mud Lake, Monteview, Howe, Big Lost River Rest Area, and Atomic City. Two additional stations are planned for future installation. An Idaho Falls station will serve as a control (background) location for comparison with the perimeter sites. A portable station is also being developed that will operate on solar power. Plans are to locate this station near Big Southern Butte in 1994. Locations of air monitoring stations are illustrated in Figure 2.1.

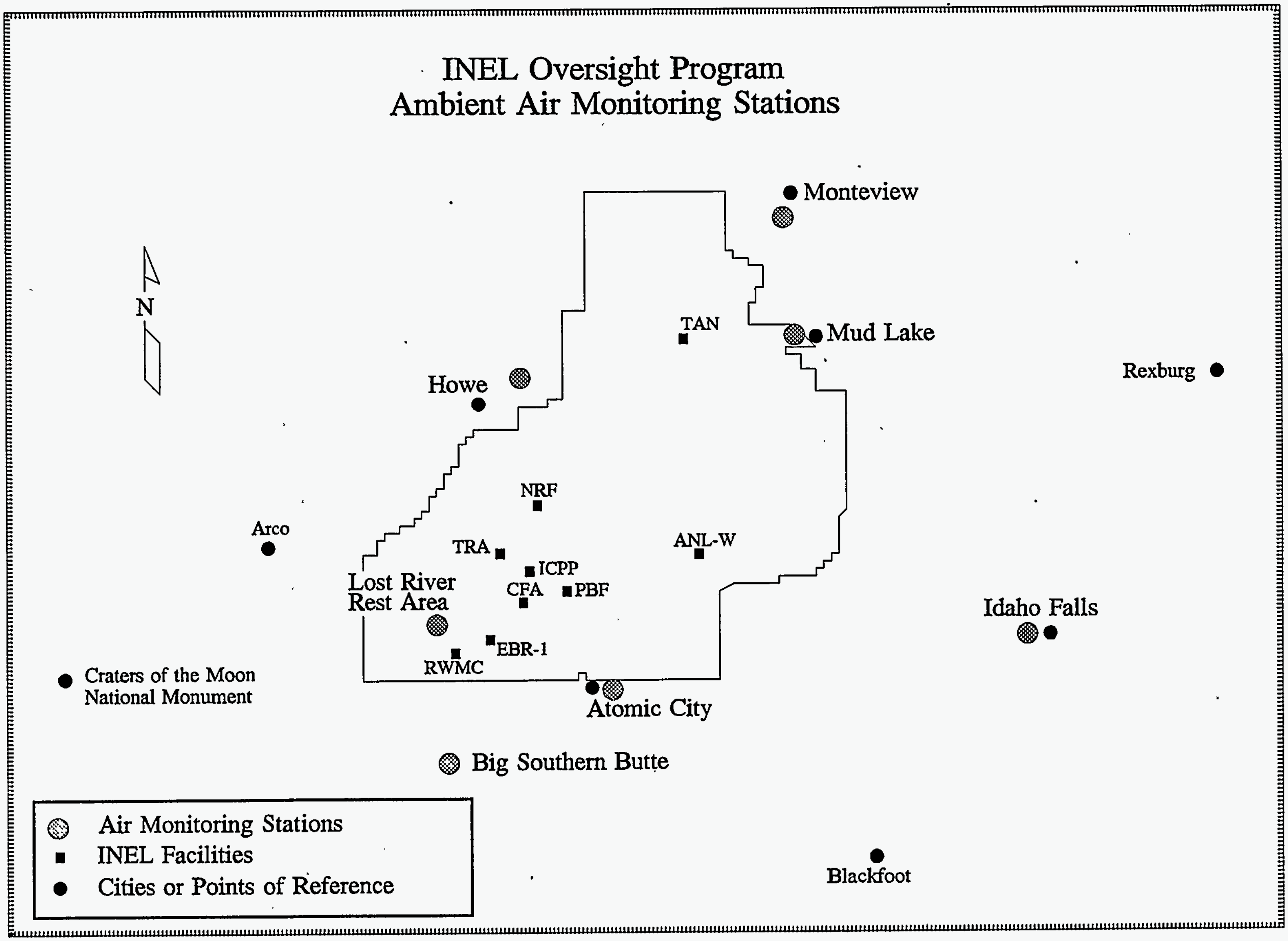


Figure 2.1 Location of Oversight Program Ambient Air Monitoring Stations

The permanent air monitoring stations employ instruments to collect airborne particulate matter, gaseous radioiodine, precipitation, and tritium (in water vapor). Included at each station, is a pressurized ionization chamber (PIC) and one or more TLD for measuring direct ambient gamma radiation. No other noble gasses or non-radioactive chemicals are collected and analyzed at this time.

2.2. Air Sampling

2.2.1. Sampling and Analysis Procedures

Continuous air samplers are operated at each station for collection of airborne particulate matter and gaseous radioiodine.

Particulate filters are collected weekly from low-volume total suspended particulate (TSP) and intermediate flow PM_{10} (particulate matter smaller than 10 micrometers) samplers at each location. Particulate filters are submitted to the ISU-EML after a delay time of five days to allow naturally occurring, short lived radon and thoron daughters to decay. Weekly filters are then analyzed for gross alpha and beta activity. At the end of each calendar quarter, filters are composited by location and analyzed by gamma spectroscopy for specific gamma-emitting radionuclides.

Charcoal cartridges for collection of radioiodine are incorporated into the PM_{10} sampler. Cartridges are collected weekly with the particulate filters. The cartridges are analyzed at the laboratory using gamma spectroscopy.

2.2.2. Results

Results for the low-volume air filters are listed in Table 2.1. Alpha activity ranged from 0.1 to 5.7E–3 picocuries per cubic meter (pCi/m^3). Beta activity ranged from 13 to 50E–3 pCi/m^3.

Results for the PM_{10} particulate filters are listed in Table 2.2. Alpha activity ranged from 0.5 to 7.8E–3 pCi/m^3. Beta activity ranged from 4 to 46E–3 pCi/m^3.

Concentrations of alpha and beta activity, as reported for the low-volume and PM_{10} samplers, are within the range of expected background levels. Monthly averages for gross beta concentrations for each location are presented in Figures 2.2 through 2.6. Both the TSP and PM_{10} monthly averages were plotted in each graph. A relative decrease in beta activity was measured for each location during the second quarter of 1993. This decrease may be due to normal seasonal variation. The ESP will continue to investigate this variation.

Low-volume air samplers were operated under a research and development project with ISU over the period from August, 1992 through June, 1993. Collection was under an associate quality assurance program operated by ISU. In July, these samplers were incorporated into the ESP program and operated under the ESP quality assurance program.

Typically, gamma spectroscopy results are only reported for those analytical results which exceed a minimum detectable concentration (MDC)[1]. Table 2.3 displays the gamma spectroscopy results for the third quarter. The only measurable radionuclide was naturally occurring Beryllium-7. No other radionuclides were detected on the filters for the third quarter composites. Also, no radioactive isotopes of iodine were detected on the weekly charcoal cartridges.

---

[1] The MDC is an *a priori* estimate of the activity concentration that can be practically achieved under a set of specified measurement conditions. The MDC value is calculated using 4.66 times the standard deviation of the background counting rate with appropriate correction factors, including those for sample volume and detector efficiency. The MDC is the level at which the risk of false detection or false non-detection is five percent or less.

Table 2.1. Weekly Results for Gross Alpha and Gross Beta Analyses for Low-volume Particulate Filters, Third Quarter, 1993.

Station Location	Collection Period 1993	Concentration (pCi/m^3 ± 1 S.D.) Gross Alpha	Gross Beta
Mud Lake	07/02—07/09	1.2 ± 0.6	16 ± 4
	07/09—07/16	0.1 ± 0.3	28 ± 4
	07/16—07/23	1.6 ± 0.6	27 ± 4
	07/23—07/30	1.5 ± 0.6	19 ± 4
	07/30—08/06	2.1 ± 0.7	26 ± 3
	08/06—08/13	1.6 ± 0.6	18 ± 3
	08/13—08/20	0.9 ± 0.5	21 ± 4
	08/20—08/27	1.4 ± 0.6	26 ± 4
	08/27—09/03	1.4 ± 0.6	19 ± 4
	09/03—09/10	1.2 ± 0.5	42 ± 4
	09/10—09/18	2.0 ± 0.6	33 ± 3
	09/18—09/24	2.9 ± 0.4	41 ± 4
	09/24—10/01	3.3 ± 0.4	41 ± 4
Monteview	07/02—07/09	0.3 ± 0.3	15 ± 3
	07/09—07/16	1.0 ± 0.5	24 ± 3
	07/16—07/23	2.3 ± 0.6	21 ± 3
	07/23—07/30	0.6 ± 0.4	14 ± 3
	07/30—08/06	1.7 ± 0.6	27 ± 3
	08/06—08/13	1.4 ± 0.5	17 ± 3
	08/13—08/20	1.0 ± 0.5	20 ± 3
	08/20—08/27	0.5 ± 0.4	23 ± 3
	08/27—09/03	0.9 ± 0.4	16 ± 3
	09/03—09/10	1.6 ± 0.5	33 ± 3
	09/10—09/18	1.0 ± 0.4	24 ± 3
	09/18—09/24	1.9 ± 0.6	40 ± 4
	09/24—10/01	2.2 ± 0.6	35 ± 3
Howe	07/02—07/09	1.4 ± 0.6	22 ± 3
	07/09—07/16	2.3 ± 0.7	18 ± 3
	07/16—07/23	2.5 ± 0.7	28 ± 3
	07/23—07/30	NS	NS
	07/30—08/06	0.9 ± 0.5	32 ± 3
	08/06—08/13	1.4 ± 0.6	23 ± 3
	08/13—08/20	1.5 ± 0.6	29 ± 3
	08/20—08/27	1.1 ± 0.5	31 ± 3
	08/27—09/03	2.0 ± 0.6	23 ± 3

Table 2.1. (Continued).

Station Location	Collection Period 1993	Concentration (pCi/m^3 ± 1 S.D.)	
		Gross Alpha	Gross Beta
Howe	09/03—09/10	1.4 ± 0.6	45 ± 3
	09/10—09/18	2.3 ± 0.6	27 ± 3
	09/18—09/24	2.3 ± 0.7	44 ± 4
	09/24—10/01	1.8 ± 0.6	42 ± 4
Rest Area	07/02—07/09	0.7 ± 0.4	13 ± 3
	07/09—07/16	NS	NS
	07/16—07/23	2.1 ± 0.6	18 ± 3
	07/23—07/30	1.7 ± 0.6	21 ± 3
	07/30—08/06	1.0 ± 0.5	20 ± 3
	08/06—08/13	1.1 ± 0.5	17 ± 3
	08/13—08/20	1.0 ± 0.5	21 ± 3
	08/20—08/27	0.9 ± 0.4	16 ± 3
	08/27—09/03	0.8 ± 0.4	20 ± 3
	09/03—09/10	1.8 ± 0.6	37 ± 3
	09/10—09/18	1.0 ± 0.4	22 ± 3
	09/18—09/24	2.1 ± 0.7	29 ± 3
	09/24—10/01	2.1 ± 0.6	36 ± 3
Atomic City	07/02—07/09	1.0 ± 0.5	25 ± 3
	07/09—07/16	1.0 ± 0.5	30 ± 3
	07/16—07/23	1.4 ± 0.6	28 ± 3
	07/23—07/30	2.0 ± 0.6	25 ± 3
	07/30—08/06	2.0 ± 0.6	25 ± 3
	08/06—08/13	1.7 ± 0.6	24 ± 3
	08/13—08/20	1.7 ± 0.6	32 ± 3
	08/20—08/27	2.0 ± 0.6	23 ± 3
	08/27—09/03	1.9 ± 0.6	25 ± 3
	09/03—09/10	1.9 ± 0.6	52 ± 4
	09/10—09/18	1.9 ± 0.6	28 ± 3
	09/18—09/24	1.9 ± 0.7	50 ± 5
	09/24—10/01	5.7 ± 1.0	50 ± 4

NS — No sample obtained

Table 2.2. Weekly Results for Gross Alpha and Gross Beta Analyses for PM_{10} Particulate Filters, Third Quarter, 1993.

Station Location	Collection Period 1993	Concentration (pCi/m^3 ± 1 S.D.) Gross Alpha	Gross Beta
Mud Lake	07/02—07/09	2.4 ± 0.6	16 ± 1
	07/09—07/16	1.9 ± 0.5	23 ± 1
	07/16—07/23	1.9 ± 0.5	25 ± 1
	07/23—07/30	1.2 ± 0.4	20 ± 1
	07/30—08/06	2.5 ± 0.5	34 ± 1
	08/06—08/13	3.4 ± 0.6	23 ± 2
	08/13—08/20	NS	NS
	08/20—08/27	2.6 ± 0.5	24 ± 1
	08/27—09/03	4.0 ± 0.7	19 ± 1
	09/03—09/10	7.8 ± 0.8	35 ± 2
	09/10—09/18[b]	3.6 ± 0.5	11 ± 1
	09/18—09/24[c]	5.0 ± 0.7	38 ± 1
	09/24—10/01	1.2 ± 0.4	25 ± 1
Monteview	07/02—07/09	2.5 ± 0.6	16 ± 1
	07/09—07/16	2.8 ± 0.6	23 ± 1
	07/16—07/23	2.8 ± 0.6	24 ± 1
	07/23—07/30	1.7 ± 0.5	24 ± 1
	07/30—08/06	3.5 ± 0.6	30 ± 1
	08/06—08/13	2.8 ± 0.5	17 ± 1
	08/13—08/20	3.2 ± 0.5	23 ± 1
	08/20—08/27	2.3 ± 0.5	29 ± 2
	08/27—09/03	2.9 ± 0.6	25 ± 2
	09/03—09/10	6.4 ± 0.7	38 ± 2
	09/10—09/18[a,b]	3.4 ± 0.5	11 ± 1
	09/18—09/24[a,c]	4.2 ± 0.6	41 ± 1
	09/24—10/01	4.4 ± 0.6	23 ± 1
Howe	07/02—07/09	1.8 ± 0.5	14 ± 1
	07/09—07/16	2.5 ± 0.6	18 ± 1
	07/16—07/23	1.6 ± 0.5	19 ± 1
	07/23—07/30	1.4 ± 0.5	16 ± 1
	07/30—08/06	2.4 ± 0.5	26 ± 1
	08/06—08/13	NS	NS
	08/13—08/20	NS	NS
	08/20—08/27	2.4 ± 0.5	23 ± 2
	08/27—09/03	2.8 ± 0.6	22 ± 1

Table 2.2. (Continued).

Station Location	Collection Period 1993	Concentration (pCi/m^3 ± 1 S.D.) Gross Alpha	Gross Beta
Howe	09/03—09/10	4.6 ± 0.6	30 ± 2
	09/10—09/18[b]	2.5 ± 0.5	10 ± 1
	09/18—09/24[c]	3.8 ± 0.6	38 ± 1
	09/24—10/01	2.3 ± 0.5	22 ± 1
Rest Area	07/02—07/09	1.4 ± 0.5	17 ± 1
	07/09—07/16	2.9 ± 0.6	23 ± 1
	07/16—07/23	2.5 ± 0.6	26 ± 1
	07/23—07/30	2.0 ± 0.5	25 ± 1
	07/30—08/06	4.0 ± 0.6	37 ± 1
	08/06—08/13	0.5 ± 0.2	4 ± 1
	08/13—08/20	2.8 ± 0.5	23 ± 1
	08/20—08/27	2.3 ± 0.5	28 ± 2
	08/27—09/03	2.2 ± 0.5	26 ± 1
	09/03—09/10	5.9 ± 0.7	46 ± 2
	09/10—09/18[b]	3.4 ± 0.5	13 ± 1
	09/18—09/24[c]	3.0 ± 0.5	46 ± 1
	09/24—10/01	4.1 ± 0.6	22 ± 1
Atomic City	07/02—07/09	3.1 ± 0.6	16 ± 1
	07/09—07/16	2.2 ± 0.5	23 ± 1
	07/16—07/23	2.3 ± 0.5	22 ± 1
	07/23—07/30	1.9 ± 0.5	23 ± 1
	07/30—08/06	3.7 ± 0.6	28 ± 1
	08/06—08/13	2.8 ± 0.5	18 ± 1
	08/13—08/20	0.8 ± 0.2	7 ± 1
	08/20—08/27	2.4 ± 0.5	23 ± 1
	08/27—09/03	2.6 ± 0.6	23 ± 1
	09/03—09/10	6.2 ± 0.7	38 ± 2
	09/10—09/17[b]	3.4 ± 0.5	13 ± 1
	09/17—09/24[c]	3.8 ± 0.6	40 ± 1
	09/24—10/01	3.1 ± 0.5	25 ± 1

NS — No sample obtained
[a] — Oil present on the filter
[b] — Eight-day collection period
[c] — Six-day collection period

Table 2.3. Gamma Spectroscopy of Low-volume Particulate Filters, Composite Sample, Third Quarter, 1993.

Station Location	Concentration ($pCi/m^3 \pm 1$ S.D.) Beryllium-7	Other Radionuclides
Mud Lake	106 ± 1E–03	ND
Monteview	91 ± 1E–03	ND
Howe	129 ± 2E–03	ND
Rest Area	87 ± 1E–03	ND
Atomic City	135 ± 1E–03	ND

ND — Not Detected

Table 2.4. Gamma Spectroscopy of PM_{10} Particulate Filters, Composite Sample, Third Quarter, 1993.

Station Location	Concentration ($pCi/m^3 \pm 1$ S.D.) Beryllium-7	Other Radionuclides
Mud Lake	118 ± 2E–03	ND
Monteview	101 ± 2E–03	ND
Howe	106 ± 2E–03	ND
Rest Area	110 ± 2E–03	ND
Atomic City	113 ± 1E–03	ND

ND — Not Detected

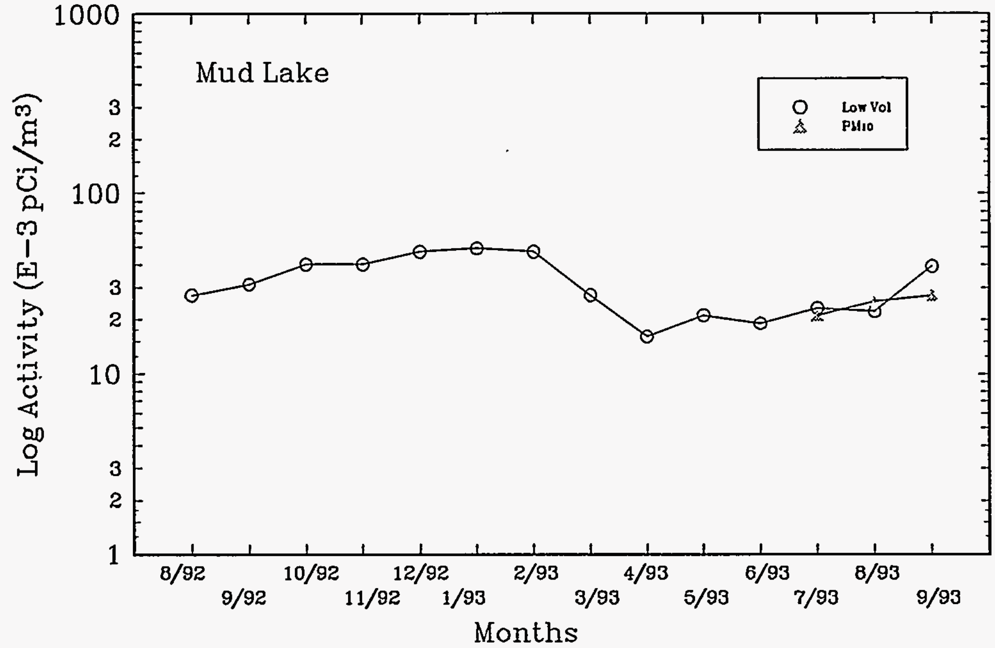


Figure 2.2 Gross Beta Results for Low-volume and PM_{10} Samplers, Mud Lake Air Monitoring Station.

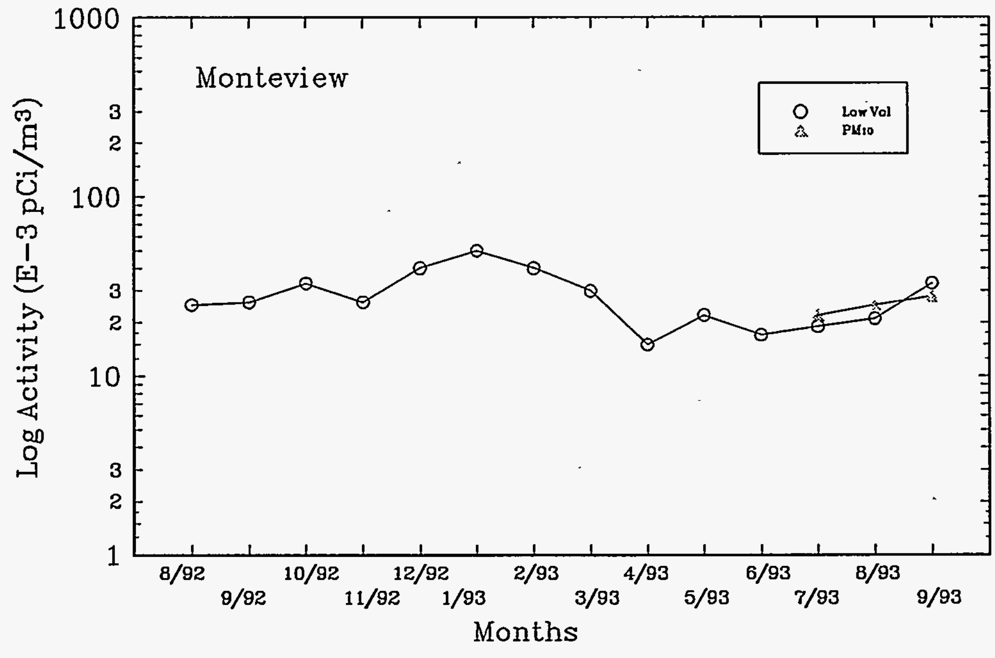


Figure 2.3 Gross Beta Results for Low-volume and PM_{10} Samplers, Monteview Air Monitoring Station.

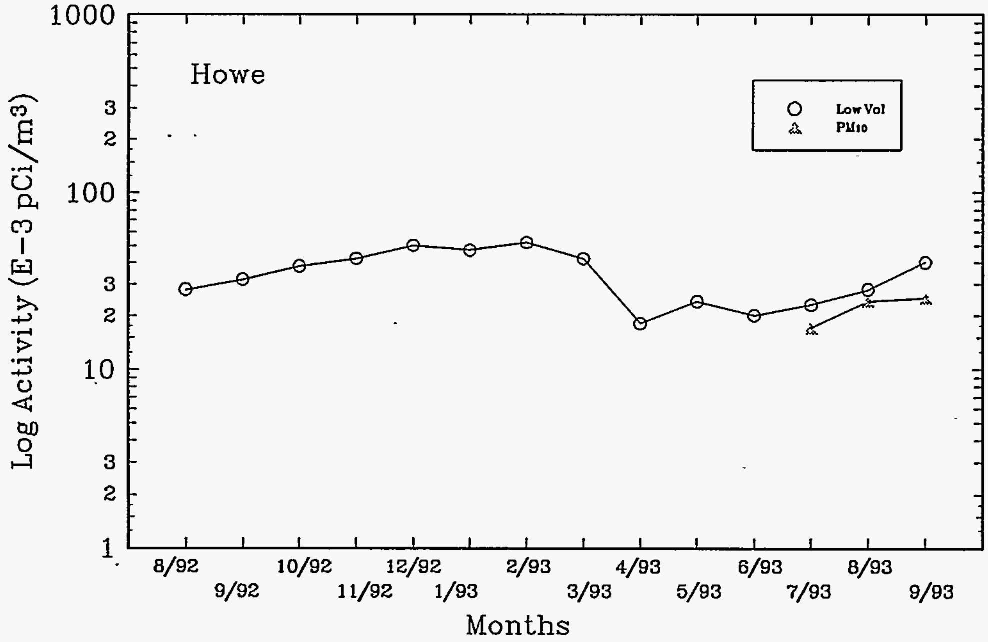


Figure 2.4 Gross Beta Results for Low-volume and PM_{10} Samplers, Howe Air Monitoring Station.

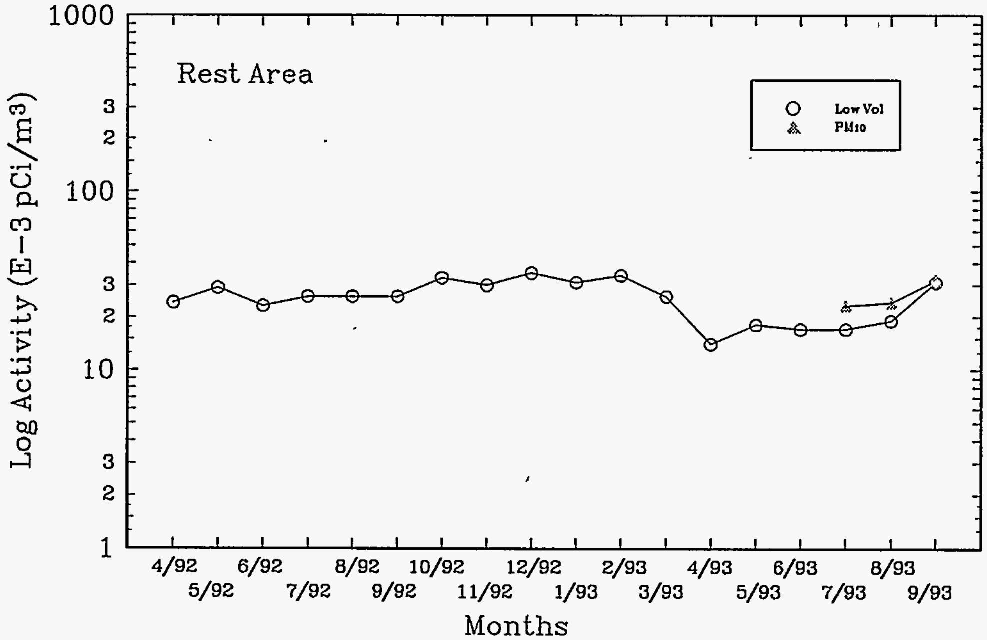


Figure 2.5 Gross Beta Results for Low-volume and PM_{10} Samplers, Big Lost River Rest Area Air Monitoring Station.

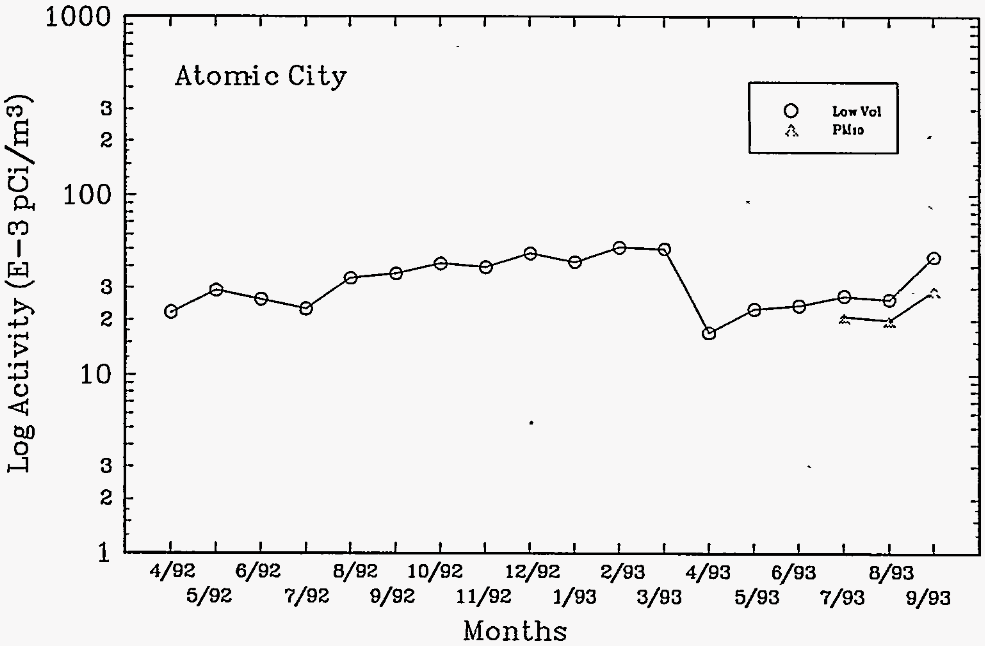


Figure 2.6 Gross Beta Results for Low-volume and PM_{10} Samplers, Atomic City Air Monitoring Station.

2.3. Precipitation

No precipitation samples were collected this quarter. Precipitation samplers will be deployed in 1994.

2.4. Tritium (Water Vapor)

No tritium samples were collected this quarter. Tritium samplers will be deployed in 1994.

2.5. Ambient Gamma Radiation

Ambient gamma radiation is measured at each monitoring locations using a PIC and one or more TLD. Both techniques are used in evaluating the environmental levels of ambient gamma radiation. The PIC is capable of capturing real time measurements, necessary for examining small changes in background levels over time. The TLD provides a cumulative total of ambient gamma radiation for the quarter.

2.5.1. Pressurized Ion Chamber Network

The PIC measures the ambient gamma radiation exposure rates (mR/hr) at each monitoring station. The PIC is a spherical chamber filled with argon gas to a pressure of 25 atmospheres. In the center of the chamber is a spherical electrode with a charge opposite to the outer shell. When gamma radiation penetrates the sphere, ionization of the gas occurs and the ions are collected by the center electrode. The generated current is measured, and the intensity of the radiation field is determined from the magnitude of this current.

The exposure rate is continuously measured from the chamber and averaged into 5 minute intervals. Data for each five minute interval are stored onto a data cartridge in the field. Once a week the data is downloaded to a field computer and processed at the IFFO. The collected, five minute values are reviewed for anomalies and trends that may need further investigating. After a formal review, the data are then processed into weekly averages for reporting purposes.

Each PIC is equipped with a digital readout screen. Ambient gamma exposure rates are displayed and updated every 30 seconds at the monitoring locations. This allows for immediate public inspection and access to information generated by the instrument. Also, during the month of November radio modems were installed at the monitoring stations to transmit the PIC data in near real-time format to the IFFO. This capability will allow immediate access to data from the remote instruments for review, compilation, or diagnostics.

2.5.2. Results of PIC measurements

Data presented in the third quarter report are based upon the weekly, calculated averages for each monitoring location. Table 2.5 contains the number of weekly values recorded, maximum and minimum values, and the average and standard deviation for the quarter. The mean ranged from .0143 mR/hr at the Big Lost River Rest Area to .0101 mR/hr at Howe.

Figures 2.7 displays the monthly average exposure rate for July, August, and September. Figure 2.8 displays the quarterly average exposure rate for each location from table 2.5. Exposure rates are within the expected values for U.S. background radiation.

Table 2.5. Average Gamma Exposure Rates (mR/hr) for Third Quarter 1993, Based on Averaged Weekly Values From PIC Network.

Location	No. Weekly Values	Maximum Week Avg	Minimum Week Avg	Average ± 1 S.D.
Atomic City	13	0.0144	0.0137	0.0140 ± 0.0002
Howe	13	0.0106	0.0100	0.0102 ± 0.0002
Mud Lake	13	0.0143	0.0136	0.0138 ± 0.0002
Monteview	13	0.0120	0.0116	0.0118 ± 0.0001
Rest Area	13	0.0147	0.0140	0.0143 ± 0.0002

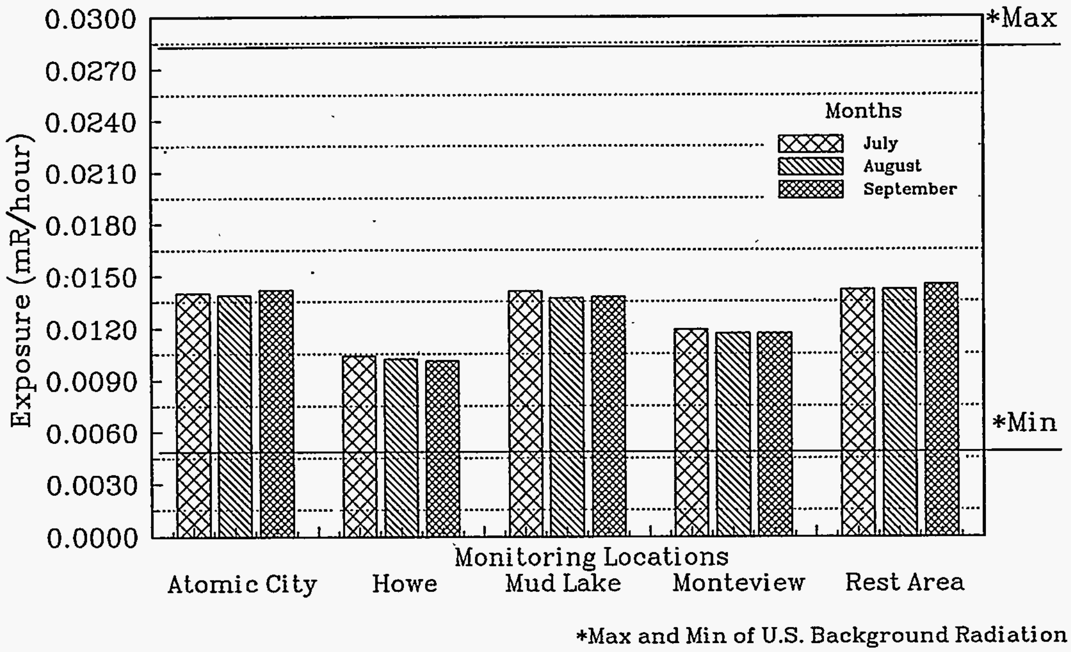


Figure 2.7 Monthly Average Gamma Exposure Rate (mR/hr) for All Locations, Based on PIC Readings, Third Quarter, 1993.

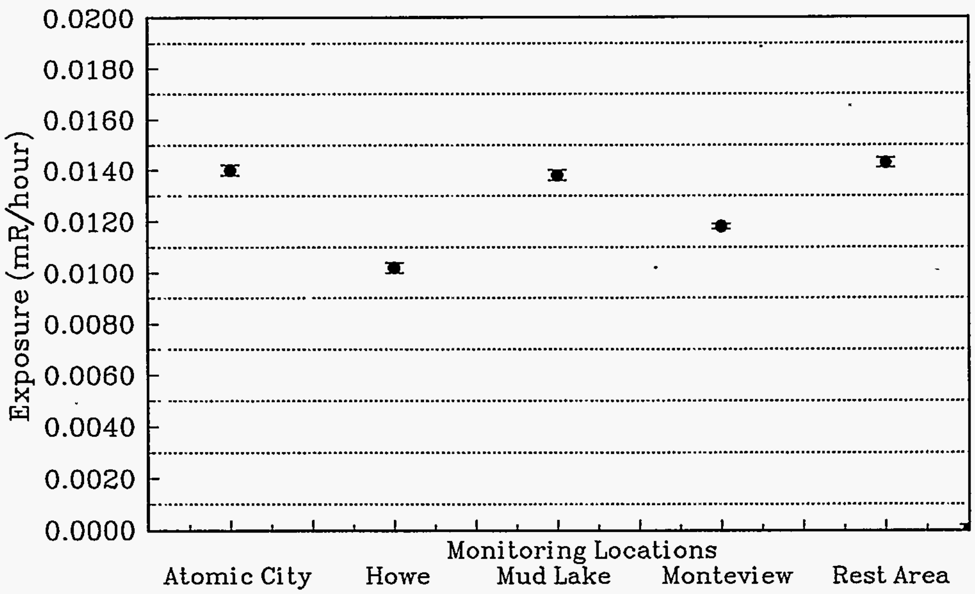


Figure 2.8 Quarterly Average Gamma Exposure Rate (mR/hr) for All Locations with One Standard Deviation About the Mean Shown, Based on PIC Readings, Third Quarter, 1993.

2.6. Thermoluminescent Dosimeters

2.6.1. TLD Placement

Environmental TLDs are deployed on a quarterly basis at each permanent air monitoring station. The primary purpose of the TLDs is to measure the total ambient gamma exposure during the three months in the field.

TLD monitoring is accomplished with Landauer X9 aluminum oxide environmental\low level dosimeter. Each dosimeter is packaged in a holder sealed in a heavy vinyl pouch for protection against environmental damage. Dosimeters are retrieved at the end of each quarter and returned to Landauer for processing.

A total of eight TLDs were placed during the third quarter of 1993. One TLD was placed at each air monitoring location. Two additional TLDs were deployed at the Idaho Falls and Mud Lake air monitoring stations as duplicates.

2.6.2. Results of TLD Monitoring

TLD monitoring results for the third quarter are presented in Table 2.6. The third quarter values for each monitoring station have been graphed in Figure 2.9. The reported results are within the expected range of background levels.

Table 2.6. Air Monitoring Station TLD Results (mR/quarter) for the Third Quarter, 1993.

Location	Date Deployed	Date Recovered	Elapsed Time (days)	Exposure (mR) (Value ± 1 S.D.)
Atomic City	7/01/93	10/01/93	93	30.2 ± 4.2
Howe	7/01/93	10/01/93	93	22.2 ± 3.3
Idaho Falls	7/01/93	10/01/93	93	22.5 ± 3.4
Idaho Falls (Dup.)	7/01/93	10/01/93	93	25.5 ± 3.7
Monteview	7/01/93	10/01/93	93	25.6 ± 3.7
Mud Lake	7/01/93	10/01/93	93	28.2 ± 4.0
Mud Lake (Dup.)	7/01/93	10/01/93	93	29.6 ± 4.1
Rest Area	7/01/93	10/01/93	93	30.7 ± 4.3

2.6.3. Comparison of PIC and TLD results

The average exposure rates obtained by the PICs at each monitoring station were compared to the TLD results. This was accomplished by calculating mR/hr from integrated TLD results. Figure 2.10 shows the comparison for each monitoring station. The Idaho Falls PIC was not operating during this quarter, therefore only the TLD result is reported for that location.

The TLD values trend very well with the PIC data. As seen from the graph, the TLDs experience an under-response in comparison to the PICs. This may be due to the differences in measurement systems. The ESP will continue to look at the trends between the two instruments and will further identify the differences in background radiation between each monitoring location.

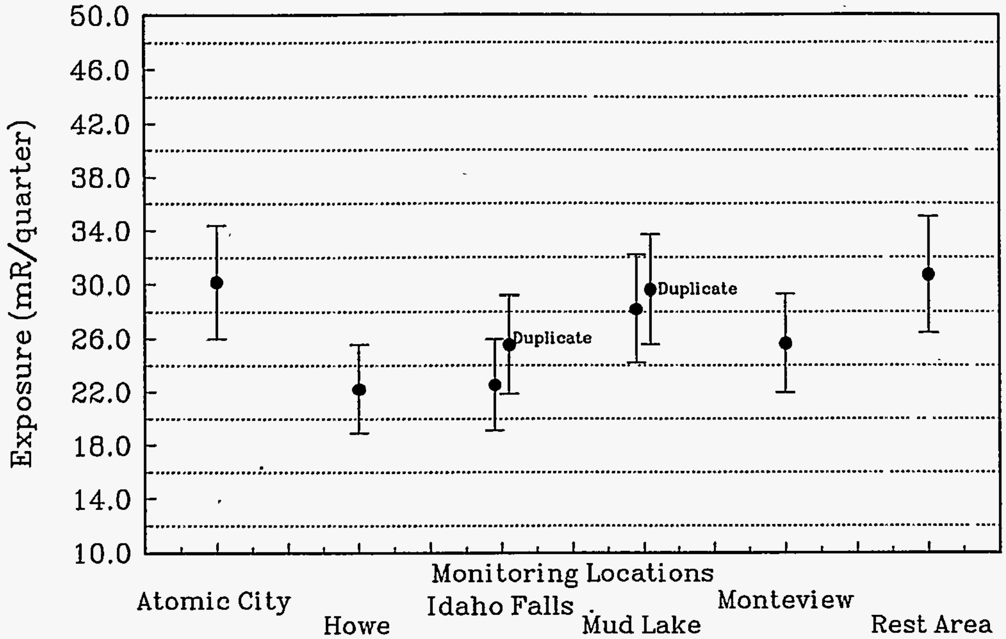


Figure 2.9 Environmental Exposure (mR/quarter) Based on TLD Results for All Locations, with One Standard Deviation About the Mean Shown, Third Quarter, 1993.

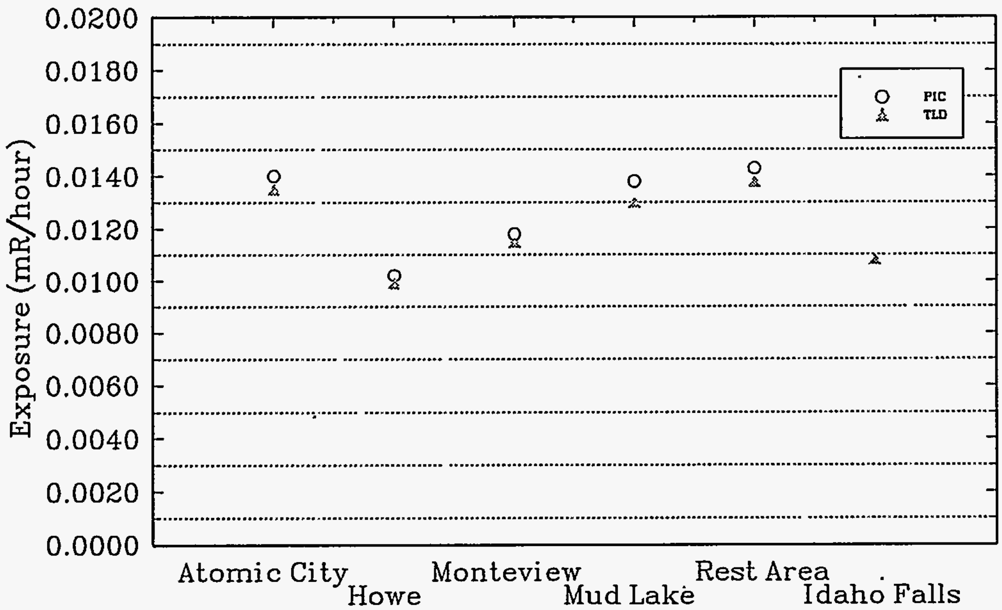


Figure 2.10 Comparison of Direct Exposure (PIC) and Environmental Exposure (TLD) Results for Third Quarter, 1993.

SECTION 3. WATER MONITORING

Monitoring of the Snake River Plain aquifer in the vicinity of the INEL has been well established since the 1950's. In addition to the monitoring done by the various DOE contractors, the OP also conducts surveillance of groundwater quality both on- and off-site. While water surveillance activities focus on ground water, due to the lack of perennial surface water features on the INEL, surface water is sampled at a limited number of sites.

3.1. Sampling Locations

Wells and springs selected for monitoring water quality of the Snake River Plain aquifer are within or near the aquifer in the vicinity of the INEL, and fit any of the following criteria:

- Water from the well is used by the public,
- The well provides continuity of long term monitoring trends,
- Sampling from the well will provide verification of, and complement monitoring by INEL contractors,
- The well will provide information at critical points along the ground water pathway.

The Big Lost River, which flows intermittently on the INEL, is the only natural surface water feature. When flowing, the Big Lost River enters the southwest portion of the INEL and flows north through the west-central portion of the site to a series of playas in the north-central portion of the INEL. The Big Lost River is sampled at least quarterly when flowing. Birch Creek, a perennial stream which flows on to the Snake River Plain, recharges the aquifer north of the INEL, and is also sampled. Sample Locations are discussed in the following sections.

3.1.1. On-site and Boundary Locations

These monitoring locations include three production wells at INEL facilities, two municipal supply wells and one private well in communities near the INEL, and one well supplying drinking water to the Big Lost River Rest Area on Highway 20/26. The remaining seventeen on-site and boundary wells sampled are located along assumed groundwater flow paths down-gradient of INEL facilities or boundaries. Most locations are sampled by OP concurrently with the DOE contractor. On-site and boundary monitoring locations are shown in Figure 3.1.

3.1.2. Off-site and Distant Locations

Off-site and distant sample locations (fifty-two wells and eight springs) consist primarily of municipal, industrial, domestic, and agricultural wells and springs distributed from the southern boundary of the INEL to the Snake River Canyon, and from Rupert to Bliss. Two of these wells and three springs are sampled semi-annually. Approximately one third of the remaining fifty-five locations are sampled every year concurrently with the USGS Magic Valley sampling program. Magic Valley sampling locations for 1993 are shown in Figure 3.2.

3.1.3. Surface Water Locations

Surface water is sampled at two locations on the INEL and at one location north of the INEL. The Big Lost River is sampled at least quarterly while flowing at the INEL flood control diversion in the southwest portion of the INEL and at the Experimental Field Station in the central portion of the INEL. Birch Creek, north of the INEL is sampled semi-annually at the USGS gauging station at Blue Dome. Surface water location are shown in Figure 3.3.

3.2. Sampling and Analysis Procedures

All of the wells sampled by the ESP are equipped with dedicated pumps. Prior to collecting samples, wells are pumped long enough to remove standing water from the well bore, discharge line, pressure tank, and any associated plumbing. Evidence of adequate purging is indicated by stable pH, specific conductance and water temperature measurements. Samples are collected from a well head sample port or faucet nearest the well head. Springs and surface water are sampled in areas of moving water nearest the discharge point or other sites that can be documented and easily found from year to year, such as near a USGS gauging station.

3.3. Results

Samples are analyzed for radiological and non-radiological constituents. When the radiological laboratory analyzes samples, an MDC is determined. The MDC for gross alpha and gross beta activity is approximately 4 pCi/L and 10 pCi/L respectively, and the MDC for tritium is approximately 0.5E+3 (500) pCi/L.

For most gamma spectroscopy results, only activities exceeding the MDC are reported. The typical MDC is in the range of 5 to 10 pCi/L. Analytical results below MDCs are reported for specific radionuclides of interest (cesium-137, and cobalt-60). These selected values are reported as an indication of the analyses sensitivity only and do not represent a true measurement. This is evident by a negative concentration, indicating that the sample count was less than the instrument's background count.

In August 1993, seventeen wells and two springs were sampled concurrent with the USGS Magic Valley sampling program. Locations are identified in Figure 3.1. The samples were submitted to the ISU-EML for radiological analysis. No samples were submitted for non-radiological analysis. No on-site or boundary aquifer wells were sampled during the period from July to September, 1993.

None of the analyses for the 1993 sampling event yielded quantities of radionuclides or radioactivity that exceeded MDCs. Third quarter results for gross alpha and gross beta radioactivity, and gamma analyses are presented in Table 3.1. Results for tritium analyses are presented in Table 3.2.

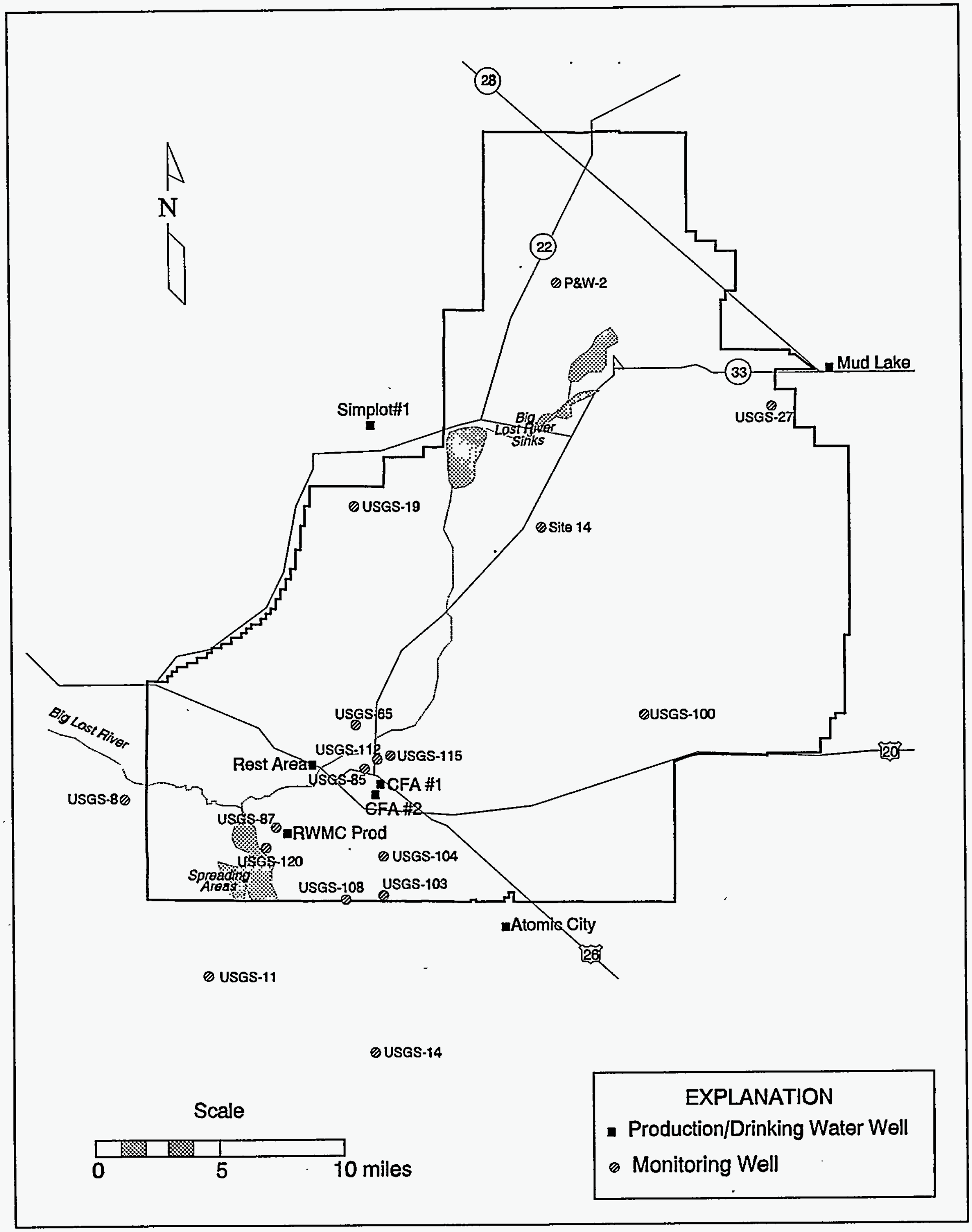


Figure 3.1 On-site and Boundary Water Monitoring Locations.

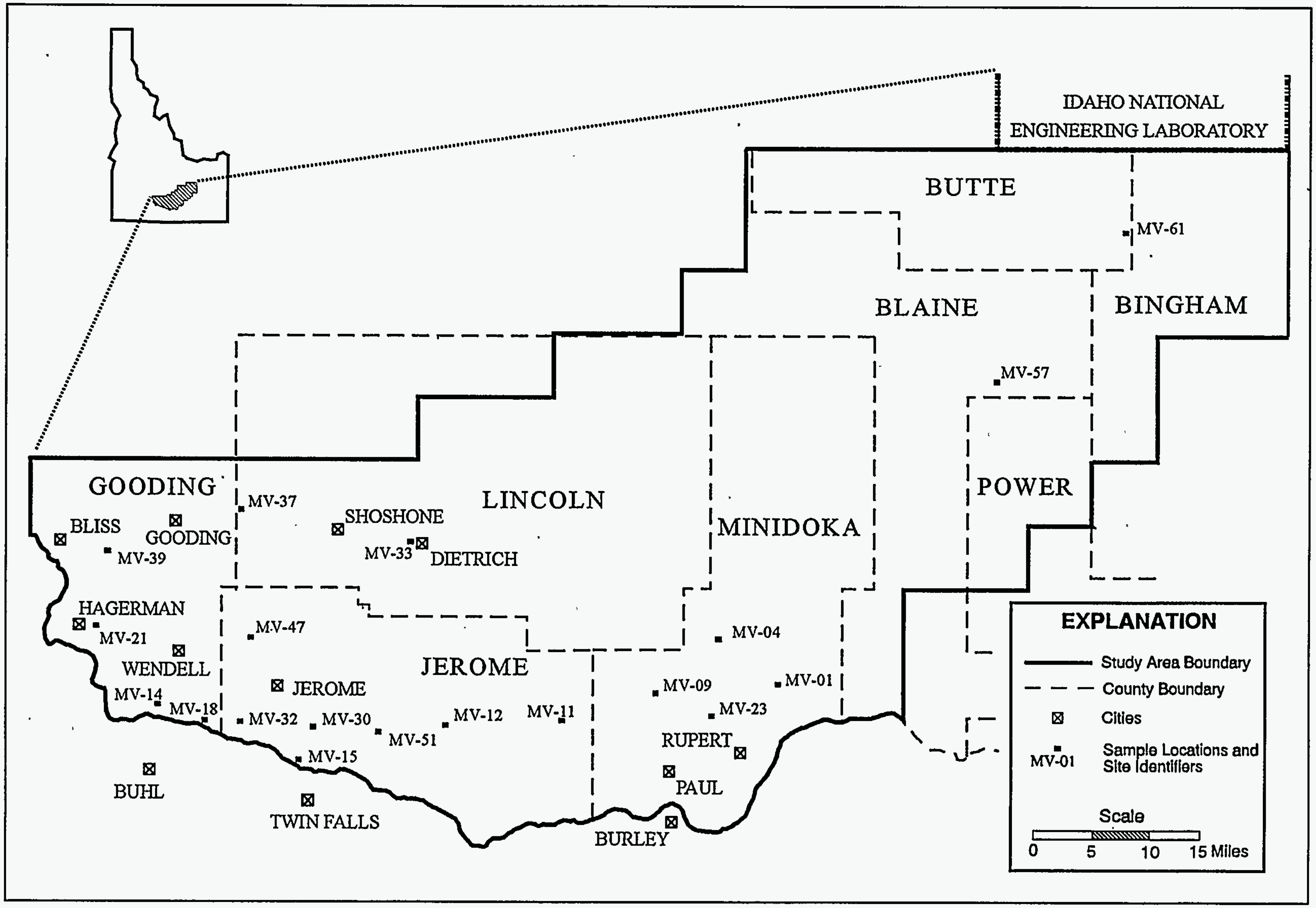


Figure 3.2 Distant Water Monitoring Locations Sampled During August, 1993.

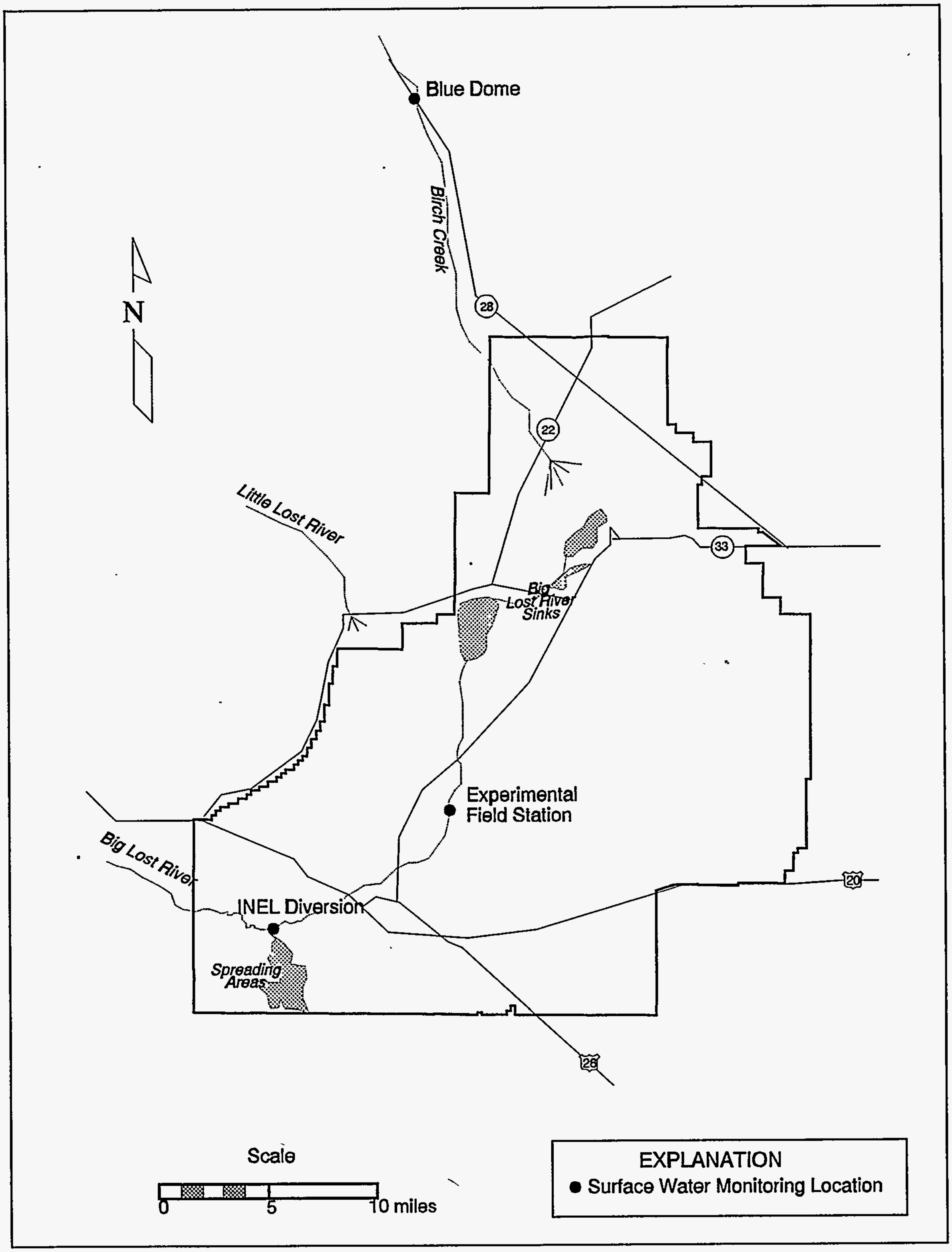


Figure 3.3 Surface Water Monitoring Locations.

Table 3.1. Alpha, Beta, and Gamma Results for Magic Valley Ground Water Sampling, Third Quarter, 1993.

Sample Location	Collection Date 1993	Concentration (pCi/L ± 1 S.D.)[1]			
		Gross Alpha[2]	Gross Beta[3]	Gamma Analyses	
				Cesium-137[4]	Cobalt-60[4]
MV-01	08/02	1 ± 1	3 ± 2	−1.8 ± 1.2	0.5 ± 1.2
MV-04	08/02	2 ± 1	3 ± 2	0.8 ± 1.3	−0.2 ± 1.1
MV-08[5]	08/02	1 ± 1	5 ± 2	1.0 ± 1.2	1.1 ± 1.2
MV-09	08/03	0 ± 1	7 ± 3	0.9 ± 1.3	−0.9 ± 1.0
MV-11	08/03	1 ± 1	4 ± 2	−1.3 ± 1.2	1.8 ± 1.1
MV-12	08/03	2 ± 1	5 ± 2	0.2 ± 1.2	1.8 ± 1.3
MV-14	08/05	0 ± 1	5 ± 2	1.0 ± 1.3	−0.6 ± 1.0
MV-15	08/04	0 ± 1	6 ± 2	−0.5 ± 1.3	−1.2 ± 1.2
MV-18	08/04	2 ± 1	6 ± 2	−0.9 ± 1.2	1.8 ± 1.2
MV-21	08/04	1 ± 1	1 ± 2	−1.1 ± 1.2	2.1 ± 1.2
MV-23	08/03	1 ± 1	3 ± 2	−1.4 ± 1.2	0.0 ± 1.2
MV-30	08/04	0 ± 1	8 ± 2	−0.5 ± 1.3	−0.2 ± 1.1
MV-33	08/02	0 ± 1	−1 ± 2	−0.6 ± 1.3	−0.7 ± 1.0
MV-37	08/05	1 ± 1	4 ± 2	1.4 ± 1.3	−0.4 ± 1.0
MV-39	08/05	2 ± 1	2 ± 2	0.7 ± 1.3	−0.9 ± 1.3
MV-43	08/04	3 ± 1	6 ± 2	2.1 ± 1.4	−0.8 ± 1.1
MV-47	08/06	0 ± 1	−2 ± 2	−1.0 ± 1.3	−0.7 ± 1.0
MV-51	08/05	0 ± 1	1 ± 2	−1.4 ± 1.3	1.1 ± 1.1
MV-59	08/10	0 ± 1	0 ± 2	0.1 ± 1.2	0.2 ± 1.2
MV-61	08/11	0 ± 1	0 ± 2	1.4 ± 1.3	−1.6 ± 1.1

[1] — **alpha, beta and gamma results are below MDC for all locations**
[2] — MDC for alpha activity is approximately 4 pCi/L.
[3] — MDC for beta activity is approximately 10 pCi/L
[4] — MDC for cesium-137 and cobalt-60 activity is approximately 5 pCi/L
[5] — MV-08 is a duplicate of location MV-21

Table 3.2. Tritium Results for Magic Valley Ground Water Sampling, Third Quarter, 1993.

Sample Location	Collection Date 1993	Tritium Concentration[1,2] (E+3 pCi/L ± 1 S.D.)
MV-01	08/02	–0.1 ± 0.1
MV-04	08/02	–0.2 ± 0.1
MV-08[3]	08/02	–0.1 ± 0.1
MV-09	08/03	0.1 ± 0.1
MV-11	08/03	–0.1 ± 0.1
MV-12	08/03	–0.1 ± 0.1
MV-14	08/05	–0.1 ± 0.1
MV-15	08/04	0.0 ± 0.1
MV-18	08/04	0.1 ± 0.1
MV-21	08/04	–0.1 ± 0.1
MV-23	08/03	0.0 ± 0.1
MV-30	08/04	–0.1 ± 0.1
MV-33	08/02	–0.1 ± 0.1
MV-37	08/05	0.0 ± 0.1
MV-39	08/05	0.0 ± 0.1
MV-43	08/04	0.1 ± 0.1
MV-47	08/06	–0.2 ± 0.1
MV-51	08/05	–0.1 ± 0.1
MV-59	08/10	–0.1 ± 0.1
MV-61	08/11	–0.1 ± 0.1

1 — **Tritium results are below MDC for all locations**
2 — MDC for tritium is approximately 0.5 E+3 pCi/L
3 — MV-08 is a duplicate of location MV-21

SECTION 4. TERRESTRIAL MONITORING

The ESP conducts terrestrial sampling as an extension of the air pathway, thus addressing the long-term deposition and migration of contaminants in the environment that may lead to human exposure or environmental detriment. The strategy for terrestrial sampling includes consideration of source term characteristics, evaluation of monitoring activities by other groups or agents, and needs for meeting surveillance objectives. Terrestrial monitoring to address the air pathway includes soil and biological media (food stuffs, small mammals, and vegetation) sampling.

4.1. Sample Locations

The OP terrestrial monitoring includes in situ screening. In order to limit extensive laboratory commitments, ESP has opted for a field screening and spot-checking method. ESP will utilize portable equipment (gamma spectrometer, PIC, hand-held instruments, etc.) to selectively screen certain media for the presence of gamma-emitting radionuclides that may have originated at the INEL.

4.1.1. Biological Media

The basis for biological sampling includes a significant level of pathway analyses. Until such analysis can be performed under the OP program, the ESP will selectively sample agricultural products for indication of contaminants. The ESP will continue surveillance of milk processing sites previously sampled by ISU as part of the university's verification arrangement with the DOE.

Other vegetation and meat products are not currently sampled, but will be evaluated using pathway analysis information to determine necessary additions to the sampling design and objectives.

4.1.2. Soils

Soil sampling locations are selected at permanent air monitoring sites, for intersite comparison of background measurements and long-term data trends. Other sampling activities, including reevaluation of ISU soil sampling efforts, will be influenced by utilizing in situ screening methods, or site-specific methods in support of the ESP objectives.

4.2. Sampling and Analysis Procedures

A portable instrument capable of specific nuclide analysis is used to qualitatively identify radionuclides that contribute to local background radiation levels. The instrument is used in a characterization manner for screening samples in the field. When additional analyses are required, samples are physically secured and taken to the ISU-EML for complete analysis.

Ongoing applications of the in situ gamma spectrometry method include cyclic determinations of background radiation information at permanent air monitoring stations and related field index locations. The detector is deployed to specific locations of interest in support of program evaluations and risk assessment activities.

This screening technique provides the OP with a cost effective and scientifically valid method for determining needs for additional sampling. Public requests for special monitoring efforts at particular off-site locations can also be satisfied.

4.3. Results

No biological media or soils were sampled this quarter.

SECTION 5. QUALITY ASSURANCE AND QUALITY CONTROL

Details on QA/QC aspects of the ESP are included in the *Environmental Surveillance Program Quality Assurance Plan*, which is currently being finalized. Most of the field QC activity has already been implemented; additional field QC and QA activity will be implemented later as the QA plan is finalized. The laboratory QA/QC programs are already in place. QA/QC activities that have been implemented to date and some quantitative indicators of data quality are briefly described below.

Field QC activity has included developing and following standard operating procedures for routine instrument operation, instrument parameter verification, and sample collection and handling. Co-located TLDs were exposed at two of the six monitoring locations, two spiked TLDs were analyzed, and four control TLDs were shipped with those exposed in the field but kept in a lead-shielded container during the time that the others were exposed. Duplicate water samples were collected at one water monitoring location. No spiked water samples were submitted.

Data validation/verification activities include: review of field data sheets and trends of sampler parameters for data qualification or corrective actions, review of laboratory results and other reduced data for reasonableness by comparison with historical data, data from other sites, and data from other programs; comparison of electronically transmitted and/or recorded data with hard copy; verification that sample holding times and conditions have been met; and review of laboratory QA/QC reports.

Additional QC measures that will be implemented include the use of blanks (for air filter samples), collection of collocated PM_{10} samples, and verification of PIC operation with colocated measurement and measurement of radiation sources of known strength.

Low-volume and PM_{10} air filter radiation measurement results (for samples collected at the same place and time) were in very good agreement. However, the average ratio of mass concentration measured with the low-volume sampler to the PM_{10} mass concentration was 0.45. This result indicates that most of the airborne radioactive particles are in the sub-ten micrometer size fraction. All parameters were below MDCs for water monitoring samples, including duplicate samples.

Data completeness (i.e., fraction of possible samples that were successfully collected and analyzed for radioactivity) was 97 percent for low-volume air samples and 94 percent for PM_{10} samples. Data completeness for water samples was 100 percent.

Field QA activity that will be implemented in the future includes a program of independent system and performance audits of field measurement activities.

Laboratory QA/QC activities and results are described in the *Idaho State University Environmental Monitoring Program Quality Assurance Report* (ISU-EMP 111293-2). QA/QC activities included maintenance of control charts of instrument response to standards, analysis of split water samples, repeat analysis of air filter samples, analysis of spiked samples, and participation in an EPA cross check program.