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In Summary: Idaho National Engineering and Environmental Laboratory Site Environmental Report for Calendar Year 1998

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DISCLAIMER

THE INEEL'S ENVIRONMENT DURING 1998
AT A GLANCE

Each year, the state of the environment at the Department of Energy's Idaho National Engineering and Environmental Laboratory (INEEL) is assessed in a site environmental report. In 1998, the Environmental Science and Research Foundation, Inc. compiled data collected from routine environmental surveillance and monitoring programs conducted on and around the INEEL and published it in the *Idaho National Engineering and Environmental Laboratory Site Environmental Report for Calendar Year 1998*. The Environmental Science and Research Foundation prepared this summary to highlight findings from that report. The site environmental report, as well as other environmental reports concerning the INEEL, can also be viewed on the Internet through the Foundation's web page at http://esrf.org. Highlights from the *INEEL Site Environmental Report for Calendar Year 1998* include:

- Scientists from the Environmental Science and Research Foundation, Lockheed Martin Idaho Technologies Company (LMITCO), the U. S. Geological Survey, the Naval Nuclear Propulsion Program Naval Reactors Facility, Argonne National Laboratory-West, and others monitored the environment on and around the INEEL to find contaminants attributable to the INEEL. During 1998, exposures from the INEEL to the public were found to be negligible.

- Prior to 1998, comprehensive investigations had been completed at three of the 10 Waste Area Groups on the INEEL. An additional three investigations were completed in 1998. Comprehensive investigations at the remaining four Waste Area Groups are in progress. These investigations determine what contamination is present at waste sites, the risks associated with the sites, and form the basis for decisions on plans for final site cleanup.

- The U.S. Department of Energy (DOE) and LMITCO made progress in developing and implementing a site-wide Environmental Management System. This system provides an underlying structure to make the management of environmental activities at the INEEL more systematic and predictable.

- Permit applications, operating and quality assurance plans, and a draft Environmental Impact Statement were submitted by British Nuclear Fuels, Inc. for the proposed Advanced Mixed Waste Treatment Project.

- All liquid, non-sodium bearing, high-level waste was reprocessed into solid waste four months ahead of the Idaho Settlement Agreement milestone.

- The Department of Energy completed construction of the Three Mile Island dry storage facility, fulfilling another milestone in the Idaho Settlement Agreement.

- After missing two Idaho Settlement Agreement milestones concerning Pit 9 in 1997, LMITCO's subcontract with Lockheed Martin Advanced Environmental Systems (the Pit 9 subcontractor) was terminated in 1998. In response to this, DOE informed the state of Idaho and the Environmental Protection Agency of its decision to pursue a jointly developed contingency plan, called the Staged Interim Action. This will satisfy the requirements of the Record of Decision for Pit 9.

- Pathways by which INEEL contaminants might reach people off of the INEEL were monitored. These included air, precipitation, water, locally grown food (milk, lettuce, wheat, and potatoes), livestock, game animals, soil, and direct ionizing radiation.

- Results from samples collected to monitor these pathways often contain "background radioactivity," which is radioactivity from natural sources and nuclear weapons tests carried out between 1945 and 1980. According to results obtained in 1998, radioactivity from operations at the INEEL could not be distinguished from this background radioactivity in the regions surrounding the INEEL.

- Gross alpha radioactivity in air was generally higher at distant locations than at boundary and onsite locations. Some gross beta concentrations in air were found to be statistically higher at onsite locations than at distant locations when statistical tests were performed. Some impact from INEEL operations may be indicated by the tests, but gross beta levels can vary widely as a result of a number of factors.

- The human-made radionuclides americium and strontium were found in the air both onsite and offsite, but most were near the lower limit at which these radionuclides can be detected. The concentrations of these radionuclides were well below health and safety guidelines.

- Extensive ground-water monitoring continued to be performed by the U.S. Geological Survey. Recent data indicated the extent of tritium and strontium plumes on the INEEL has remained about the same since 1991, but that tritium concentrations in water from wells inside the plume have generally decreased over this period.

- Because radioactivity from the INEEL was not detected by offsite environmental surveillance methods, computer models were used to estimate the radiation dose to the public. The hypothetical maximum dose to an individual from INEEL operations was calculated to be 0.008 millirem. That is 0.002 percent of an average person's annual dose of 360 millirem from natural background radiation in southeast Idaho.

- Above-background concentrations of radionuclides were found in some waterfowl, dove, big game, and marmot samples collected near the site facilities. The potential dose to a hunter consuming the entire muscle and liver from one big game animal sampled on the INEEL was 0.03 millirem, or about 0.009 percent of the annual natural background dose.

Introduction

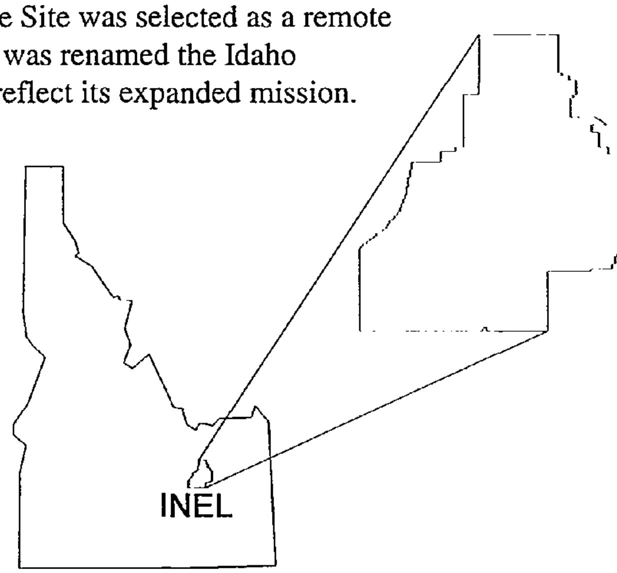
Every human is exposed to natural radiation. This exposure comes from many sources, including cosmic radiation from the sun, naturally-occurring radon, and radioactivity from natural potassium-40 in our bodies. In addition to natural sources of radiation, humans can also be exposed to human-generated sources of radiation. Some examples of these sources include nuclear medicine, X-rays, nuclear weapons tests, and accidents at nuclear power plants.

The Idaho National Engineering and Environmental Laboratory (INEEL) is a U. S. Department of Energy (DOE) research facility that deals, in part, with studying nuclear reactors and the storage and cleanup of radioactive materials. Careful handling and rigorous procedures do not completely eliminate the risk of releasing radioactivity. So, there is a possibility for a member of the public near the INEEL to be exposed to radioactivity from the INEEL.

Extensive monitoring of the environment to search for radionuclides and other contaminants takes place on and around the INEEL. The results of these monitoring and surveillance programs are presented each year in a site environmental report. This document summarizes the *Idaho National Engineering and Environmental Laboratory Site Environmental Report for Calendar Year 1998.*

INEEL History

This federal reserve was founded by DOE's predecessor, the Atomic Energy Commission, as the National Reactor Testing Station in 1949. The Site was selected as a remote place for building and testing nuclear reactors. It was renamed the Idaho Nation Engineering Laboratory in 1974 to better reflect its expanded mission. In 1997, the words "and Environmental" were added to the name to demonstrate DOE's commitment to protecting the environment. Today, the INEEL's mission encompasses advanced systems engineering; safe storage of radioactive waste, hazardous waste, and spent nuclear fuel; and environmental management. The INEEL employs approximately 8,100 people.



The INEEL is located in southeast Idaho.

Where is the INEEL?

Located on the eastern Snake River Plain of southeastern Idaho at an average elevation of 4,900 feet, the INEEL encompasses 890 square miles. It extends 39 miles from north to south and is up to 36 miles wide in its southern portions. The land is a high, cool desert, known as sagebrush steppe. The INEEL's activities take place largely at eight facilities. Most of the INEEL's land is open, with about 94 percent of the site undeveloped. Lands immediately beyond the boundaries of the INEEL are either open desert or farms, with most of the nearby farming conducted northeast of the INEEL. About sixty percent of the INEEL's lands are open to grazing.

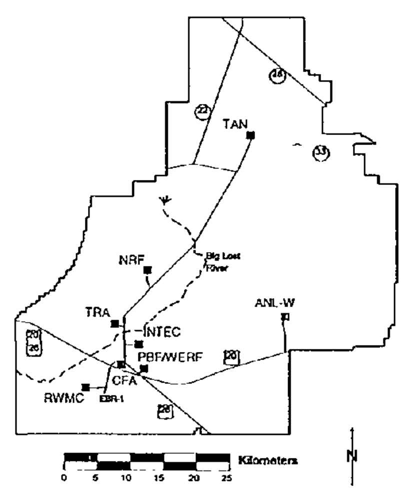
Beneath the INEEL is the Snake River Plain Aquifer, a vast underground water body. Much of the water in the aquifer comes from the mountainous area around the Henry's Fork of the Snake River, with additional contributions from the Big and Little Lost Rivers and the Birch Creek drainages. The underground water moves southwest at a rate of about 5 to 20 feet per day. It reappears in springs along the Snake River between Burley and Bliss, Idaho. Both the groundwater and surface waters of the Snake River Plain are used for crop irrigation and drinking water.

INEEL Facilities

During 1998, six of the eight major INEEL facilities were operated by Lockheed Martin Idaho Technologies Company (LMITCO). The Naval Reactors Facility was managed by Bechtel Bettis, Inc. and Argonne National Laboratory-West was managed by the University of Chicago. Several INEEL buildings in Idaho Falls house research, support, and oversight personnel.

The eight major facilities at the INEEL are:

- Argonne National Laboratory-West (ANL-W)
- Idaho Nuclear Technology and Engineering Center (INTEC)
- Test Area North (TAN)
- Test Reactor Area (TRA)
- Power Burst Facility (PBF)
- Naval Reactors Facility (NRF)
- Radioactive Waste Management Complex (RWMC)
- Central Facilities Area (CFA)



INEEL Facilities

Environmental Laws and Regulations

The INEEL strives to operate in compliance with all environmental laws, regulations, executive orders, DOE Orders, and compliance agreements with the Environmental Protection Agency and the state of Idaho. Major environmental laws and regulations include:

- Comprehensive Environmental Response, Compensation, and Liability Act (Superfund)
- Emergency Planning and Community Right-to-Know Act
- Clean Air Act
- Clean Water Act
- State of Idaho Wastewater Land Application Permit Regulations
- Resource Conservation and Recovery Act
- National Environmental Policy Act
- Safe Drinking Water Act
- National Historic Preservation Act
- Native American Grave Protection and Repatriation Act
- Endangered Species Act

Chapter 2 in the *Idaho National Engineering and Environmental Laboratory Site Environmental Report for Calendar Year 1998* reviews the current compliance status with these environmental statutes.

One of the largest programs at the INEEL is the Environmental Restoration Program, which focuses on site remediation under the Comprehensive Environmental Response, Compensation, and Liability Act. Remediation includes characterization, risk assessment, contaminant removal, soil stabilization, and decontamination and dismantlement of radioactively-contaminated buildings. To make this complex process simpler, the INEEL was divided into 10 Waste Area Groups (WAGs). Within each WAG are up to as many as 70 individual studies involving waste. During 1998, comprehensive investigations were completed on three of these WAGs and four more were underway. Comprehensive investigations on the remaining three WAGs were completed before 1998. The purpose of the comprehensive investigations is to determine what is known about the contamination in each WAG, if anything more needs to be learned, and what risks the contamination poses. Based on this information, a cleanup plan is proposed. After a period of public scrutiny, a revised plan for each WAG will be implemented.

The Waste Management Program aims to protect humans and the environment, while properly handling, treating, storing, and disposing of wastes at the INEEL. An emerging philosophy is to prevent generating pollution in the first place, and to minimize the amount when waste production can not be avoided. As a major component of this program, the INEEL has been named the lead DOE laboratory in devising new technologies and techniques for managing mixed waste — that which is both hazardous and radioactive. A facility for mixed waste treatment, under a contract awarded to British Nuclear Fuels Limited, Inc. is in the permitting and licensing process. In 1998, permit applications, operating and quality assurance plans, and a draft Environmental Impact Statement were all completed.

The 1995 agreement between DOE, the U.S. Navy, and the state of Idaho contains a number of milestones and commitments for receipt, treatment, and disposal of radioactive and mixed hazardous wastes. The New Waste Calcining Facility within INTEC converts liquid waste into a more stable granular form. This process is called calcining. During 1998, DOE completed calcining its inventory of liquid non-sodium bearing high-level waste, four months ahead of the scheduled date set in the Settlement Agreement with the state of Idaho. Also in 1998, DOE began calcining liquid sodium-bearing high-level waste.

Chapter 3 in the *Idaho National Engineering and Environmental Laboratory Site Environmental Report for Calendar Year 1998* explains the activities of both the Environmental Restoration and Waste Management programs in more detail. This chapter also describes the ways in which the public is kept informed about, and involved in, environmental activities at the INEEL.

Environmental Monitoring

Normal operations at INEEL facilities regularly release various materials into the environment. These releases may contain radioactive materials, though they usually do not. An extensive environmental monitoring program is conducted to identify and quantify all releases resulting from INEEL activities.

Why Monitor the Environment?

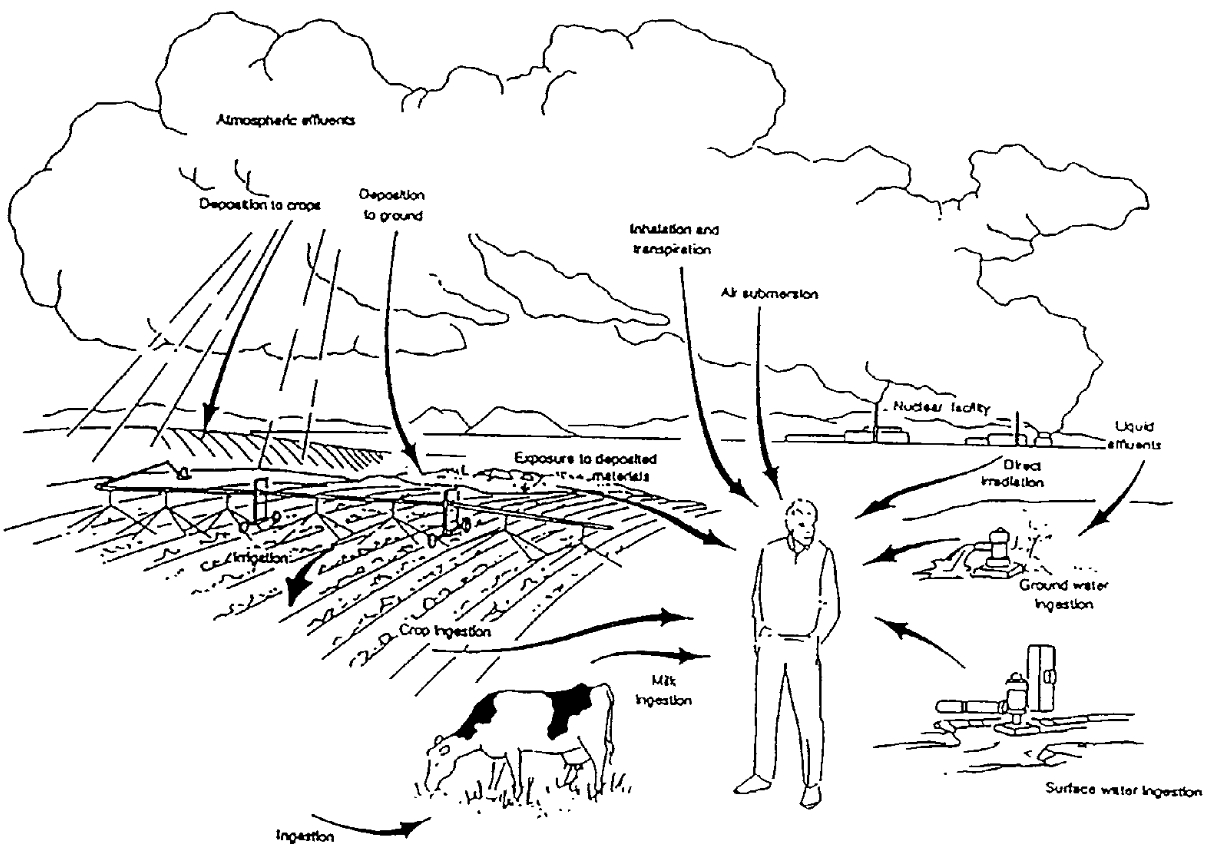
According to agency regulations as well as federal and state laws, environmental monitoring and surveillance must be conducted to monitor the environmental effects, if any, of DOE activities. The environmental monitoring and surveillance programs are designed to:

- protect the health of the public and the environment;
- verify compliance with applicable environmental laws and regulations, and with commitments made in official DOE documents;
- look for trends in the physical, chemical, and biological conditions of the environment on and around the INEEL; and
- assess the potential radiation dose to members of the public from INEEL operations.

Monitoring vs. Surveillance: What's the Difference?

Environmental monitoring consists of two separate activities: *effluent monitoring* and *environmental surveillance*. Effluent monitoring measures contaminants where they are released. Environmental surveillance looks for and measures contaminants that have dispersed into the environment. Potential environmental pathways by which contaminants could be transported from the INEEL include food grown in the vicinity of the INEEL, inhaled air, game animals which live on the INEEL and are later taken by hunters, and ground and surface water.

The operating contractors at each INEEL facility are responsible for monitoring the releases from their facilities and for any surveillance performed within their facilities. Results of these programs are reported annually by each organization. Throughout 1998, the offsite portion of the environmental surveillance program was conducted by the Environmental Science and Research Foundation, a nonprofit organization also active in INEEL ecology research and environmental education. The onsite environmental surveillance program for the INEEL was conducted by LMITCO. Ground-water surveillance was conducted by the U.S. Geological Survey (USGS), and weather patterns were characterized by the National Oceanic and Atmospheric Administration. These data were used in part to compute radiation doses to members of the public. A separate program was also operated by the state of Idaho's INEEL Oversight Program to verify results obtained by other programs.



Potential environmental pathways from the INEEL to humans

Program Descriptions

Radiological Effluent Monitoring Program

Known and measured amounts of radionuclides were released as airborne and liquid effluents at the INEEL in 1998. All airborne and liquid effluents released to the environment were carefully monitored at potential release points. INEEL contractors reported these releases in several manners, as required by state and federal regulations.

Radiological Surveillance Program

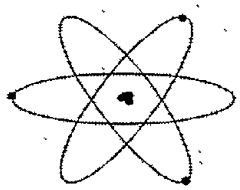
Air is the most direct pathway for contaminants from the INEEL to reach the offsite environment. Therefore, air is sampled continuously, using low-volume air samplers to measure airborne radioactivity. Fifteen low-volume air samples were located on the INEEL, and an additional 16 low-volume air samplers were located off of the INEEL in 1998. Air filters from the samplers were changed weekly.

Tritium, a radioactive form of hydrogen, is monitored using samplers that collect moisture from the air and in precipitation. Atmospheric moisture samplers were operated at two onsite and three offsite locations. Monthly precipitation samples were collected in Idaho Falls and on the INEEL; a weekly sample was collected on the INEEL when measurable precipitation occurred.

INEEL contractors collected onsite drinking water samples from their facilities quarterly. The Foundation collected water from the Snake River and from 14 offsite drinking water supplies, at both boundary and distant locations, twice per year. In addition, the Foundation collected samples quarterly from three springs in the Magic Valley of south-central Idaho.

No stream or river flows from within the INEEL to offsite locations. However, water monitoring is still an important surveillance activity because the INEEL is located directly above the Snake River Plain Aquifer, and past waste management practices included injecting wastes directly into the aquifer. The U.S. Geological Survey (USGS) monitors the Snake River Plain Aquifer under and near the INEEL, as well as "perched" pockets of ground water above the aquifer. Perched water is below the surface, but is not within the aquifer.

Speaking the Radiation Language



Samples from environmental pathways and effluent streams are tested for radioactivity and other contamination. When discussing results from these tests, scientists use many special terms. In order to understand the implications of the results of these tests, one must first understand the radiation "language."

Some atoms contain too much energy and are unstable. They try to become stable by releasing their excess energy as either waves or particles. These waves and particles are called **radiation.**

A **radionuclide** is a radioactive form of an element. For example, tritium is a radioactive form of hydrogen.

A **curie** is a unit used to measure the amount of radioactivity in a sample. A **microcurie** is 1/1,000,000 (one-millionth) of a curie.

A **rem** is a unit used to measure the amount of radiation dose to humans. A **millirem** is 1/1000 (one thousandth) of a **rem.**

A **person-rem** is the sum of the doses received by all individuals in a population. This concept can also be expressed in **person-millirem.**

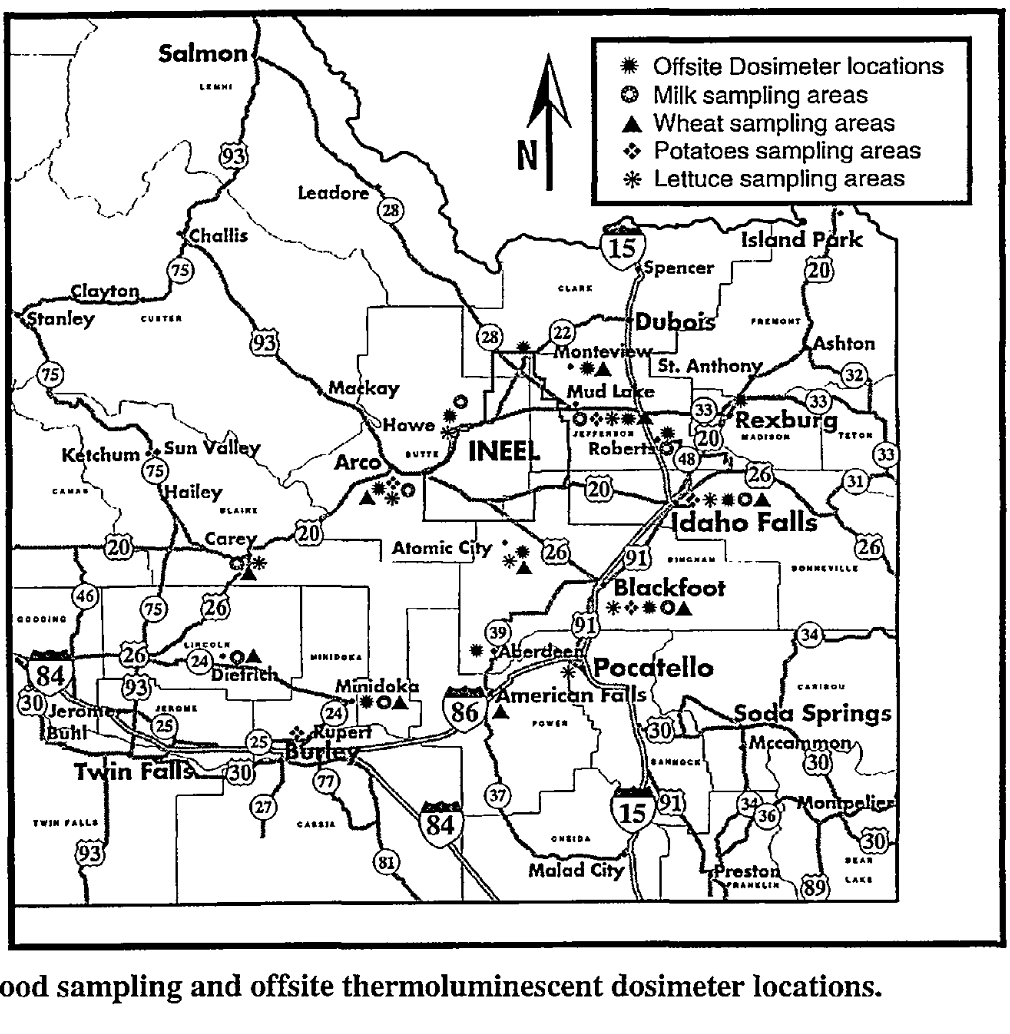
Gross analyses detect the total amount of specific types of radioactivity (**alpha, beta, gamma**), but do not identify the individual radionuclides.

Half-life is the time required for one-half of a radioactive material to decay. Therefore, the shorter the half-life, the faster a radioactive material decays.

On and near the INEEL, the USGS maintains about 125 aquifer observation wells, 45 wells for sampling perched water, and more than 120 auger holes to monitor shallow perched water. They test samples for both radiological and nonradiological contaminants. The USGS also publishes special studies detailing conditions in the aquifer. Documents released in 1998 included reports on the distribution of selected radiochemical and chemical constituents in perched water at the INEEL, the effects of activities at the INEEL on the water quality of the Snake River Plain Aquifer in the Magic Valley, and preliminary water surface elevations and boundaries of the 100-year peak flow in the Big Lost River at the INEEL. For more information about the USGS water monitoring program, call the USGS INEEL Project Office at (208) 526-2438.

The Foundation collected samples of milk, wheat, garden lettuce, and potatoes from places near the site boundary as well as distant from the INEEL. They also sampled liver, thyroid, and muscle tissues from sheep that grazed on the INEEL and from big game animals accidentally killed on INEEL roadways. In addition, the Foundation collected waterfowl on and near waste effluent ponds on the INEEL.

Milk, wheat, lettuce, and potatoes were included in the program because they are a part of a typical American diet and represent potential pathways for radionuclides from INEEL operations. Potatoes are also an important and much-publicized source of revenue for southeast Idaho. Sheep and game animals represent a potential pathway to people who might consume animals that came into contact with contaminants while on the INEEL. The INEEL is home to hundreds of game animals, many of which leave the site during summer and autumn and can be hunted during regular hunting seasons. The potential radiation dose to an individual from eating meat from game animals is calculated.



Food sampling and offsite thermoluminescent dosimeter locations.

Soil samples were collected from 12 locations surrounding the INEEL in 1998. Soil is sampled every other year. The soil is analyzed for certain human-made radionuclides. Onsite, soil at facilities is collected on a seven-year rotating schedule.

Thermoluminescent dosimeters were used to directly measure ionizing radiation in the environment. They were placed at seven distant locations, six boundary locations, and 135 locations on the INEEL. Dosimeters were collected for analysis in May and November.

Nonradiological Monitoring Programs

What Are NO_x and SO_x?

Under the federal Clean Air Act, two pollutants of concern are oxides of nitrogen (NO_x) and sulfur (SO_x). Each of these elements have more than one oxide. For instance, two common nitrogen oxides are nitrogen oxide (NO) and nitrogen dioxide (NO_2). The oxide of sulfur of most concern is sulfur dioxide (SO_2). All three of these pollutants are measured at the INEEL.

At the INEEL, these pollutants are measured at their source (as they are emitted from stacks) and in the environment. The amount that can be emitted is limited by permits issued by the state of Idaho. Concentrations found in the environment must be within guidelines set by the U.S. Environmental Protection Agency.

In addition to monitoring for radioactive contaminants in the environment, the INEEL's surveillance program also routinely checks for nonradiological contaminants in the air and water. Air is monitored for dust, nitrogen oxides, sulfur oxides, and trace elements which can impair visibility and may cause health problems.

The major sources of these nonradiological airborne emissions at the INEEL are nitrogen dioxide emissions from treatment of waste at INTEC, the burning of coal and oil, motor vehicle exhausts, and dust produced by construction activities. Liquid effluents, including sewage and chemicals used for water treatment, are similarly monitored and reported.

What is PM_{10}?

Fine particles of dust in the air are compared to a standard set by the Environmental Protection Agency. These particles, called PM_{10} because of their size (less than 10 micrometers in diameter), are small enough to be inhaled and can cause health problems. The Environmental Science and Research Foundation operates three PM_{10} samplers surrounding the INEEL. Each sampler collects a 24-hour sample every sixth day.

Radiological Results

Radiological Effluent Monitoring Results

An estimated 5,995 curies of airborne radionuclides were released during INEEL operations in 1998. Over 98 percent of this radioactivity was in the form of non-reactive gases, called noble gases. Because of the fairly rapid decay of these noble gases, several of which have half-lives of a few minutes or a few hours, the actual radioactivity that reached offsite was considerably less than 5,995 curies.

Radioactive liquids were placed into specially-designed evaporation and seepage ponds. Nearly all of this radioactivity was placed in two plastic-lined ponds at the Test Reactor Area. Of the 78.5 curies released into these ponds in 1998, 75.3 curies (96 percent) were tritium, a radioactive form of hydrogen. No liquids were released directly to the offsite environment or to the Snake River Plain Aquifer.

Radiological Surveillance Results

Radiological environmental surveillance for 1998 found most radioactivity from INEEL operations could not be distinguished from worldwide weapons testing fallout and natural radioactivity. The following table provides a summary of the results of each of the sample types, including the number of samples collected and a description of when radioactive materials were detected. In addition, an interpretation of the results with comparisons to appropriate standards and guidelines is provided. The data indicate no measurable human health risks due to INEEL operations in 1998.

Radiological Surveillance Results for 1998		
Sample Type	**What Was Found**	**What It Means**
Air 1,898 low-volume air filters were collected and analyzed.	• Gross alpha concentrations were higher at distant locations than at boundary and onsite locations.	• No impact from the INEEL was found for alpha-emitting radionuclides.
	• Gross beta concentrations were nearly the same at distant, boundary, and onsite locations. However, statistical comparisons of monthly values found INEEL locations to have higher gross beta concentrations than distant locations about 10% of the time, and boundary locations had higher concentrations than distant about 6% of the time.	• Some impact from the INEEL on gross beta may be indicated by the statistical data, but gross beta levels are known to vary widely as a result of a number of natural factors.
	• Two human-made radionuclides, strontium-90 and americium-241, were found in quarterly composites.	• Most radioactivity was just above the concentration at which it can be detected. Americium-241 had been consistently reported scattered across the air sampling network since 1995. After investigation, it was discovered that a laboratory oversight had been the cause of these detections. A corrective action has been made and americium-241 detections have returned to their expected frequency.

Radiological Surveillance Results for 1998, continued

Sample Type	What Was Found	What It Means
Atmospheric Moisture / Precipitation 31 offsite atmospheric moisture samples were collected and analyzed. 49 precipitation samples were collected and analyzed.	• Tritium was detected in 5 offsite atmospheric moisture samples. All concentrations found were very low and concentrations were similar between distant and boundary locations. • Preliminary analyses indicated that some onsite atmospheric moisture samples may have contained tritium. • Tritium was detected in 4 precipitation samples.	• Concentrations of tritium found are likely the result of the natural tritium in the atmosphere from cosmic radiation. The highest value observed in 1998 was 0.008% of the amount allowed by DOE. • Contamination in the laboratory performing these analyses was discovered, so it is not possible to definitively know tritium concentrations. • The concentrations found were within normal ranges observed in recent years are likely due to natural tritium in the atmosphere from cosmic radiation.
Water 36 offsite water samples were collected and analyzed: 28 drinking water and 8 surface water samples.	• 32 offsite water samples contained gross beta activity.	• All gross beta concentrations were within the expected concentration range for naturally-occurring radioactivity in water caused by water absorbing naturally-occurring radionuclides as it passes through the earth's crust. The highest concentration found was 16% of the maximum allowed by the EPA for drinking water.

Radiological Surveillance Results for 1998, continued

Sample Type	What Was Found	What It Means
Water, Cont. *59 onsite water samples were collected from wells and analyzed.*	• 7 onsite well samples contained detectable concentrations of gross alpha activity.	• The highest concentration of gross alpha activity observed was 47% of the maximum allowable by the EPA for drinking water.
	• 6 onsite well samples contained detectable concentrations of gross beta activity.	• All gross beta activities were within the range typical of natural background activity. The highest observed concentration was 18% of the EPA's maximum allowable concentration in drinking water.
	• Tritium was detected in 5 onsite production wells and 3 drinking water systems.	• The water samples in which tritium was detected were collected from a contaminant plume. Its presence was previously known and the concentrations show a downward trend during the last five years. The plume was not detected in the offsite groundwater.
	• An annual dose of 0.5 millirem from drinking water was estimated for workers at Central Facilities Area, the INEEL facility with the highest concentration of tritium in its water.	• The dose estimate of 0.5 millirem for a worker at Central Facilities Area represents 13% of the EPA's drinking water standard for communities.
Food *Milk* 152 milk samples were collected and analyzed.	• Strontium-90 was detected in 7 of the samples.	• All levels of strontium-90 in milk were consistent with those previously reported by the EPA nationwide as resulting from worldwide fallout from historic weapons tests.

Radiological Surveillance Results for 1998, continued		
Sample Type	**What Was Found**	**What It Means**
Food *Lettuce* 9 lettuce samples were collected and analyzed.	• Cesium-137 was detected in 1 lettuce sample. • Strontium-90 was detected in all of the lettuce samples.	• Cesium-137 is present in the soil as a result of above-ground nuclear weapons tests that occurred between 1945 and 1980. • Strontium-90 is also present in the soil as a result of historic weapons tests. Levels of radionuclides found were consistent with results seen in previous years.
Food *Wheat* 11 wheat samples were collected and analyzed.	• 1 wheat sample contained a detectable amount of cesium-137. • Measurable concentrations of strontium-90 were seen in 10 of the 11 wheat samples.	• The amount of cesium-137 found was barely in the detectable range and may be due to normal statistical fluctuations in the analysis. • The concentrations of strontium-90 found were within the range known to result from fallout from historic above-ground nuclear weapons tests.
Food *Potatoes* 7 potato samples were collected and analyzed.	• Strontium-90 was detected in 3 of the potato samples.	• The strontium-90 detected was consistent with past results in potatoes, wheat, and lettuce, and is likely obtained from the soil where it is present due to worldwide fallout from historic weapons testing.
Food *Sheep* Tissues from six sheep (4 that grazed onsite and 2 that grazed offsite) were collected and analyzed.	• Cesium-137 was detected in the muscle tissue of 3 of the 4 onsite sheep and 1 of the 2 offsite sheep. It was also detected in the livers of 2 onsite sheep.	• All cesium concentrations were similar to those found previously in both onsite and offsite sheep samples. The radionuclide is likely present due to the ingestion of soil containing cesium from worldwide fallout from historic weapons tests.

Radiological Surveillance Results for 1998, continued

Sample Type	What Was Found	What It Means
Game Animals Tissues from 7 mule deer, 3 pronghorn antelope, 2 elk, 9 mourning doves, 12 ducks, and 9 marmots were collected and analyzed.	• 1 pronghorn, 1 elk, and 5 mule deer (including 1 collected off of the INEEL as a control) contained small amounts of cesium-137 in their muscle samples. 1 mule deer and 1 pronghorn also had small amount of cesium in their liver samples.	• The potential radiation dose to a person eating the entire muscle and liver from one big game animal from the INEEL was approximately 0.03 millirem.
	• 4 radionuclides were detected in mourning dove samples.	• The potential dose to a person eating one ounce of the mourning dove with the highest amount of radionuclides detected in 1998 was 0.0004 millirem.
	• 9 human-made radionuclides were detected in duck samples.	• The maximum potential dose to a person eating eight ounces of duck with the highest level of radionuclides detected in 1998 was 0.014 millirem.
	• 9 human-made radionuclides were detected in marmot tissues.	• The maximum potential dose to a person eating eight ounces of marmot meat was 0.014 millirem.
Soil 24 soil samples from 12 locations off of the INEEL were collected and analyzed.	• Human-made radionuclides (cesium-137, americium-241, plutonium-238, plutonium-239/240, and strontium-90) were detected in offsite soil samples.	• The human-made radionuclides found were present in concentrations consistent with radionuclides in the soil worldwide as a result of past above-ground nuclear weapons tests. Concentrations of strontium-90 and cesium-137, which have shorter half-lives than the other radionuclides detected have shown a steady decrease over the past 20 years.

Radiological Surveillance Results for 1998, continued

Sample Type	What Was Found	What It Means
Direct Ionizing Radiation 322 thermoluminescent dosimeters were collected and analyzed.	• No statistical differences were seen between environmental radiation measurements at boundary and distant locations. • Some onsite measures of environmental radiation at Argonne National Laboratory-West, Auxiliary Reactor Area, Central Facilities Area, Idaho Nuclear Technology and Engineering Center, Radioactive Waste Management Complex, Naval Reactor Facility, Test Area North, Power Burst Facility, Lincoln Blvd., and Test Reactor Area were higher than background.	• Radiation exposures off the INEEL were not measurably increased due to INEEL activities. • Higher radiation exposures at some INEEL facilities were found in the vicinity of radioactive material storage areas and areas with contaminated soils.

Nonradiological Results

Measured particulate concentrations were generally greater at distant and boundary locations than on the INEEL. The primary source of particulates in the air on and around the INEEL was considered to be soil blowing off of agricultural fields. Concentrations of fine particulates (PM_{10}) averaged between 21 and 27 micrograms per cubic meter at the three locations where fine particulates are collected. These are all well below the EPA's maximum allowable limit of an average of 50 micrograms per cubic meter per year.

Nitrogen dioxide and sulfur dioxide levels recorded on the INEEL averaged less than 10 percent of Environmental Protection Agency standards for the year. Data from IMPROVE samplers operated on the INEEL and at Craters of the Moon National Monument were examined. While analyses of these samples provided information about the presence of 22 different elements in air samples, no substantial differences were noted between the two locations.

What is IMPROVE?

Interagency Monitoring of Protected Visual Environments (IMPROVE) is a program designed to monitor visibility at national parks, monuments, and wilderness areas throughout the United States.

In 1992, an IMPROVE sampler was set up on the INEEL and another was established at Craters of the Moon National Monument, through a Memorandum of Understanding between the National Park Service and DOE.

IMPROVE sample analyses are performed by the Crocker Nuclear Laboratory at the University of California, Davis.

Concentrations of contaminants in liquid waste streams were found to comply with environmental laws and regulations. Testing of drinking water at facilities on the INEEL found no coliform bacteria in samples during 1998. USGS analyses found purgeable organic compounds in previously-known waste plumes under the INEEL. The concentrations of organic compounds found in 1998 were similar to the concentrations found in previous years.

The concentration of carbon tetrachloride in one well at the Radioactive Waste Management Complex was found to be near the EPA's maximum contaminant level for drinking water wells (this well is not used for drinking water).

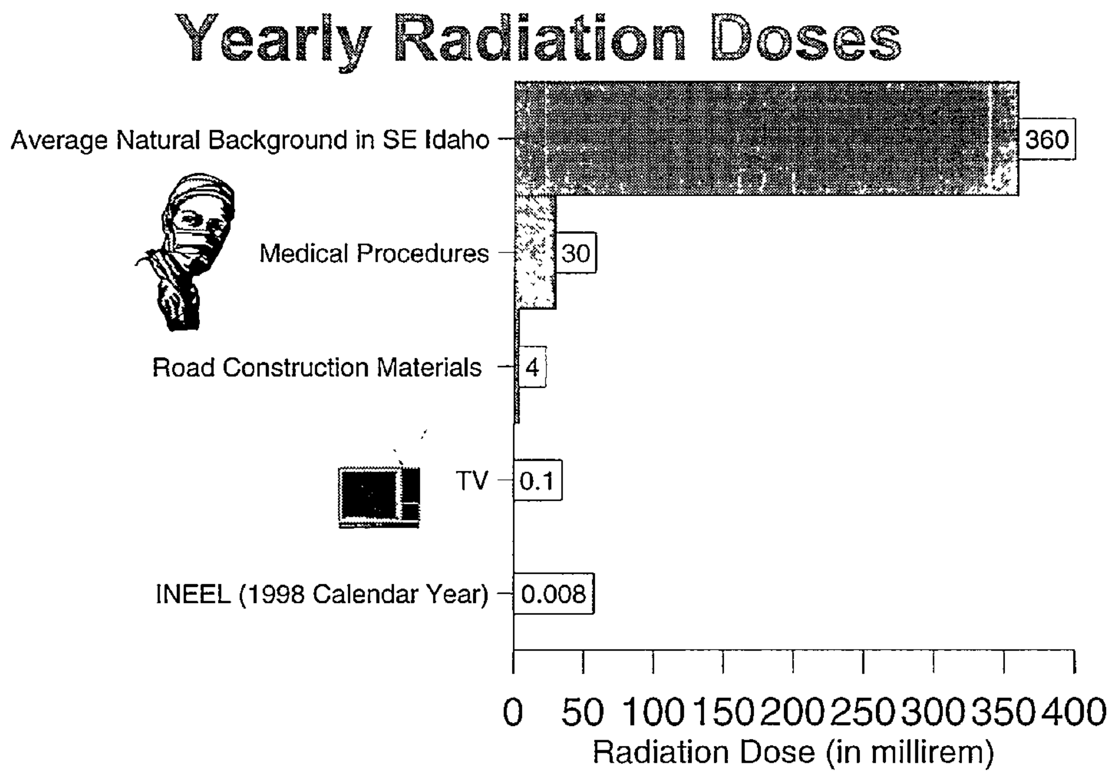
LMITCO sampled drinking water from its facilities in 1998. None of the drinking water samples from any facility exceeded the EPA's maximum contaminant level for any non-radiological contaminants in 1998.

Radiation Dose Estimates

Radiation from INEEL operations was not detected by offsite environmental surveillance methods in 1998, as has been the case in recent years. Because doses to the public are too small to be measured, computer models are used to estimate annual radiation doses from the INEEL. Two models were used, and these models produced estimates of the radiation dose to the general public from INEEL activities of 0.007 millirem and 0.008 millirem for the entire year. Those estimates are less than 0.002 percent of an average person's annual dose from background sources in southeastern Idaho, which total about 360 millirem per year. An individual's radiation dose from the INEEL is equivalent to about 12 minutes of natural radiation exposure. And, the INEEL dose is a dose for the "maximally exposed individual" – someone who spent the entire year (24 hours per day, 7 days per week) on the the INEEL boundary. That fictitious person ate only food grown on that boundary, and drank water and breathed air from that boundary location.

The consumption of game animals that have lived on the INEEL is not included in calculating any of the dose estimates because only a small percentage of the population hunts game, few of the animals killed have spent time on the INEEL, and most of the animals that do spend time on the INEEL would have reduced amounts of radionuclides in their systems by the time they are hunted. The average dose to one citizen or the entire population from this pathway would be extremely small. More information on potential radiation doses from eating game animals can be found on page 16.

A collective dose to the entire human population living within 50 miles of the center of the INEEL was calculated. This calculation considers all the pathways that contaminants could take from the INEEL (except for eating game animals), the number of people in each locale, and the ways contaminants disperse from the INEEL. The total potential population dose to the 121,500 people within 50 miles of the INEEL center was 0.075 person-rem. By comparison, background radiation exposure was calculated to account for 43,700 person-rem to the same population in southeast Idaho, which means exposure from the INEEL caused an increase in dose of 0.0002 percent. The largest population doses were found for the Idaho Falls and Hamer census divisions. Idaho Falls is relatively high because of its greater population, and Hamer is relatively high because it includes towns, such as Mud Lake and Terreton, that are in the predominant downwind direction from the INEEL.


Yearly Radiation Doses
Average Natural Background in SE Idaho
360
Medical Procedures
30
Road Construction Materials
4
TV
0.1
INEEL (1998 Calendar Year)
0.008
0
50
100
150
200
250
300
350
400
Radiation Dose (in millirem)

Quality Assurance

In order to be sure that the INEEL's environmental monitoring programs are getting accurate and reliable results, each organization maintains quality control and assurance programs. Laboratories performing analyses for these programs also have quality assurance programs. The laboratories also participate in national performance evaluation programs that further demonstrate the quality of their data.

Elements of a Quality Assurance Program

- Peer-reviewed procedures
- Documentation of program changes
- Calibration of instruments
- Equipment performance checks
- Independent audits
- Internal inspections
- Personnel training and evaluation
- Co-located samplers
- Sample tracking and accountability
- Analysis of duplicate and replicate samples
- Analysis of samples with no radiological contamination
- Analysis of samples with known amounts of contaminants
- Routine checks of the precision of radiological analyses

For More Information

For more information about the INEEL's environment, or to receive copies of reports from INEEL environmental monitoring programs, please contact:

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Internet Access

The Environmental Science and Research Foundation, Inc. home page can be accessed on the Internet at http://esrf.org. By visiting the Foundation's web site, users can view and download copies of environmental surveillance reports related to the INEEL, including the Annual Site Environmental Report and quarterly summaries of the Foundation's surveillance activities. This Internet site also provides information on the Foundation's other programs, including a list of hundreds of papers dealing with the environment of the INEEL and southeastern Idaho.