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**In Summary:
Idaho National Engineering and
Environmental Laboratory Site
Environmental Report
for Calendar Year 1997**

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THE INEEL'S ENVIRONMENT DURING 1997 AT A GLANCE

Each year, the state of the environment at the Idaho National Engineering and Environmental Laboratory (INEEL) is assessed in a site environmental report. The Environmental Science and Research Foundation, Inc. compiles data collected from routine environmental monitoring programs conducted on and around the INEEL. Recently, the report *Idaho National Engineering and Environmental Laboratory Site Environmental Report for Calendar Year 1997* was prepared and published. 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 home page at <http://esrf.org>.

- Scientists from the Environmental Science and Research Foundation, Lockheed Martin Idaho Technologies Company, the U.S. Geological Survey, and other INEEL contractors monitored the environment on and around the INEEL to find contaminants attributable to the INEEL. During 1997, exposures from the INEEL to the public were found to be negligible.
- Comprehensive investigations were completed or were underway at all 10 Waste Area Groups at the INEEL. 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.
- Several cleanup projects were completed during 1997, including efforts to remove petroleum-contaminated soils at the Central Facilities Area and remedial action (capping) at two reactor burial sites. Two milestones were not met, however, in conjunction with the Pit 9 project, resulting in the termination of the subcontract in 1998 and development of a revised plan for cleanup activities at the site.
- Pathways by which INEEL contaminants might reach people were monitored. These included air, precipitation, water, locally grown food (wheat, milk, potatoes, and lettuce), livestock, game animals, and direct radiation.
- Results from samples collected to monitor these pathways often contain radioactivity from natural sources and nuclear weapons testing carried out in the 1950s and 1960s, termed "background radioactivity." According to the results obtained in 1997, 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 detailed tests were performed on

monthly and annual data. Some impact from the INEEL may be indicated by the statistical tests, but gross beta levels can vary widely as a result of a number of factors.

- The man-made radionuclides americium, plutonium, 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 Foundation is currently investigating the apparent high incidence of americium detections during the past two years. The concentrations of all three radionuclides found during 1997 were well below health and safety guides.
- 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 a radiation dose to people. The hypothetical maximum individual dose from the INEEL was calculated to be 0.03 millirem. That is 0.008 percent of an average person's annual dose from background radiation in southeast Idaho.
- Above-background concentrations of radionuclides were found in some waterfowl and dove samples collected near the Test Reactor Area. The potential dose to a hunter consuming the bird with the highest concentrations of radionuclides was 1.4 mrem, or about 0.4% of the annual natural background dose.

Introduction

Every human is exposed to natural radiation. This exposure comes from many sources, including cosmic radiation from outer space, naturally-occurring radon, and radioactivity from substances 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 testing, 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 takes place on and around the INEEL. These programs search for radionuclides and other contaminants. The results of these 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 1997*.

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 National Engineering Laboratory in 1974 to better reflect its expanded mission. In January 1997, the words "and Environmental" were added to the name to demonstrate the Site'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. It employs approximately 8,000 people and operates on a budget of about \$750 million.

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 a 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 60 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 ground water and surface waters of the Snake River Plain are used for crop irrigation and drinking water.

INEEL Facilities

During 1997, six of the eight major INEEL facilities were operated by Lockheed Martin Idaho Technologies Company (LMITCO). The Naval Reactors Facility was managed by Westinghouse Electric Corporation, 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); and
- Central Facilities Area (CFA).

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;
- Toxic Substances Control 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 1997* 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 1997, comprehensive investigations were in progress or were complete at all 10 INEEL WAGs to determine what is known about the contamination there, 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 is implemented.

A number of environmental restoration program cleanup activities were in progress or were completed in 1997. Among the cleanup projects completed at the Central Facilities Area were efforts to excavate and remove soils contaminated with petroleum at three sites. In addition, work was completed on the remediation of three landfills formerly used for disposal of municipal-type and industrial wastes from the INEEL. At two reactor burial sites, the Stationary Low Power Reactor-1 and Boiling Water Reactor Experiment-1 facilities, reseeded and recountouring work completed cleanup activities at these locations.

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While most cleanup activities at the INEEL adhered to schedules set by DOE, the Environmental Protection Agency, and the state of Idaho, two enforceable regulatory milestones were not met related to the Pit 9 project. In 1998, the Pit 9 subcontract was terminated for default. DOE remains committed, however, to executing the terms of the Pit 9 Record of Decision, and the agencies have developed a new scope of work and work plan for the project.

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 cannot be avoided. As a major component of the program, the INEEL has been named the lead DOE laboratory in devising new technology and techniques for managing mixed waste—that which is both hazardous and radioactive. A facility for mixed waste treatment, under a contract awarded to BNFL, Inc. in late 1996, is in the permitting and licensing process.

A key facility in the INEEL's efforts to reduce low-level radioactive waste, the Waste Experimental Reduction Facility, continued operation throughout 1997. During the year, approximately 1,800 cubic yards of low-level waste was incinerated. An additional 3,029 cubic yards of waste was cut and compacted.

The 1995 agreement between the 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 began operating again after a three-year shutdown. This facility converts liquid waste into a more stable granular form.

Chapter 3 in the *Idaho National Engineering and Environmental Laboratory Site Environmental Report for Calendar Year 1997* 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. Potential environmental pathways by which contaminants could be transported from the INEEL include foodstuffs grown in the vicinity of the INEEL, inhaled air, game animals that live on the INEEL and are later taken by hunters, and ground and surface water.

Why Monitor the Environment?

According to agency regulations as well as federal and state laws, environmental 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 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.
- Assess the potential radiation dose to members of the public from INEEL operations.

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 1997, the offsite portion of the environmental surveillance program was conducted by the Environmental Science and Research Foundation, an independent nonprofit organization also active in INEEL environmental 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 (NOAA). These data were used in part to compute radiation doses to members of the public. A separate program was 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 Surveillance Program

Air is the most direct pathway for contaminants from the INEEL to reach the offsite environment. Therefore, air is sampled more frequently than other pathways, using low-volume air samplers to measure airborne radioactivity. Air filters from the samplers were changed weekly. A total of 15 low-volume air samplers were located on the INEEL, and an additional 16 low-volume air samplers were located off the INEEL.

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

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. It is abbreviated as **Ci**. A **microcurie**, abbreviated **μCi**, 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 radiation 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**) in a sample, 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.

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 drinking water supplies, at both boundary and distant locations, twice per year. In addition, the Foundation also 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. But 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.

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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 non-radiological contaminants. The USGS also publishes special studies detailing conditions in the aquifer. Documents released in 1997 included reports on contaminants in selected wells between the INEEL and Hagerman, Idaho; a floodplain model to simulate the hypothetical 100-year peak flow in Birch Creek, and the natural geochemistry of the Snake River Plain Aquifer. For more information about the USGS water monitoring program, call the USGS INEEL Project Office, (208) 526-2438.

The Foundation collected samples of milk, wheat, garden lettuce, and potatoes, from places near the INEEL boundary as well as distant from the INEEL. They also sampled liver, thyroid, and muscle tissues from sheep that grazed on the INEEL and of big game animals accidentally killed on INEEL roadways. Sheep and game animals represent a potential pathway to people

Food sampling and environmental dosimeter locations around the INEEL

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 INEEL during summer and autumn, and can be hunted during regular hunting seasons. The potential dose to an individual from ingestion of meat from game animals is calculated.

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 agricultural crop and source of revenue for southeast Idaho.

Environmental dosimeters were used to directly measure 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.

Radiological Effluent Monitoring Program

Known and measured amounts of radionuclides were released as airborne and liquid effluents at the INEEL in 1997. Airborne and liquid effluents released to the environment were monitored at potential release points. INEEL contractors report these releases using several methods, as required by DOE as well as state and federal regulations.

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 (NO₂). The oxide of sulfur of most concern in air is sulfur dioxide (SO₂). 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 standards set by the federal 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 dioxide, 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, the burning of oil, motor vehicle exhausts, and dust produced by construction activities. Liquid effluents, including sewage and chemicals used for water treatment, are monitored and reported in many of the same ways.

What is IMPROVE?

Interagency Monitoring of Protected Visual Environments (IMPROVE) is a program designed to test for 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.

Radiological Results

Radiological Effluent Monitoring Results

An estimated total of 5,595 curies of airborne radionuclides were released during INEEL operations in 1997. Approximately 98 percent of this radioactivity was in the form of non-reactive gases called noble gases. Because of fairly rapid decay of these noble

gases, several of which have half-lives of a few minutes or a couple of hours, the actual radioactivity that reached offsite areas was less than the amount released.

Radioactive liquids were placed into specially designed evaporation and seepage ponds. No liquids were released directly to the offsite environment. All discharges directly into the Snake River Plain Aquifer ceased in 1984. Nearly all of this radioactivity was placed in a heavy plastic-lined pond at TRA. Of the 100 curies put into the pond in 1997, 96 curies were tritium, a radioactive form of hydrogen.

Radiological Surveillance Results

Radiological environmental surveillance for 1997 found that 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.

Radiological Surveillance Results for 1997

Sample Type	What Was Found	What It Means
<p><i>Air</i></p> <p><i>Low Volume</i></p> <p>1,783 low-volume air filters were collected and analyzed.</p>	<ul style="list-style-type: none"> Radioactive iodine-131 was not found in any charcoal cartridge. Gross alpha concentrations were higher at distant locations than boundary and onsite locations. Gross beta concentrations were nearly the same at distant, boundary, and onsite locations. However, statistical comparisons of monthly values found differences about 10% of the time for onsite locations and 2% of the time for boundary locations. Three non-natural radionuclides were found on quarterly composites. 	<ul style="list-style-type: none"> No iodine-131 was present in the environment at the INEEL. No impact from the INEEL was found for alpha-emitting radionuclides. Some impact from the INEEL on gross beta may be indicated by the statistical data, but gross beta levels have also been shown to vary widely as a result of a number of factors. Most radioactivity was just above the concentration at which it can be detected. Americium-241 has been consistently reported at both onsite and offsite (distant and boundary) locations during the past two years. The relatively high incidence of detectable concentrations is currently being investigated.
<p><i>Atmospheric Moisture/ Precipitation</i></p> <p>26 offsite atmospheric moisture samples were collected and analyzed.</p> <p>37 precipitation samples were collected and analyzed.</p>	<ul style="list-style-type: none"> Tritium was detected in seven offsite atmospheric moisture samples. Tritium was detected in eight of the samples. 	<ul style="list-style-type: none"> Tritium is found in the atmosphere from a variety of sources. The highest result represents 0.006 percent of DOE's concentration guides. Higher concentrations of tritium were detected at an INEEL location, but all concentrations were close to the lower limit of detection.

Radiological Surveillance Results for 1997 (continued)

Sample Type	What Was Found	What It Means
<p><i>Drinking Water</i></p> <p>50 offsite water samples were collected and analyzed (32 drinking water and 18 surface water).</p> <p>60 onsite water samples were collected from wells and analyzed.</p>	<ul style="list-style-type: none"> No offsite samples had detectable concentrations of gross alpha radioactivity; 41 had detectable concentrations of gross beta radioactivity. One of the offsite water samples contained a just detectable amount of tritium. 22 onsite well samples had detectable gross alpha radiation; 50 had detectable concentrations of gross beta. Tritium was detected in samples from Central Facilities Area, Idaho Nuclear Engineering and Technology Center, INEEL Rifle Range, and Radioactive Waste Management Complex. Wells at the Idaho Nuclear Technology and Engineering Center did not show detectable concentrations of strontium. An annual dose of 0.6 millirem from drinking water was estimated for workers at Central Facilities Area, the INEEL facility with the highest concentration of tritium in its water. 	<ul style="list-style-type: none"> All gross beta concentrations were within the expected concentration range for naturally occurring activity in the Snake River Plain Aquifer underlying the INEEL and surrounding areas. The offsite tritium concentration represented 0.5 percent of the EPA maximum contaminant level. All gross alpha and gross beta readings were within the range expected for naturally occurring activity in Snake River Plain Aquifer. The water samples in which tritium was detected were collected from a contaminant plume beneath the facilities. Its presence was previously known and the concentrations show a downward trend during the last five years. The plume was not detected in offsite ground water. A plume of strontium lies beneath the Idaho Nuclear Technology and Engineering Center, but levels of strontium have not been detectable in drinking water during 1996 and 1997. The dose estimate of 0.6 millirem for a worker at Central Facilities Area represents 15 percent of the Environmental Protection Agency's drinking water standard for communities.

Radiological Surveillance Results for 1997 (continued)

Sample Type	What Was Found	What It Means
<p><i>Food</i></p> <p><i>Milk</i></p> <p>151 milk samples were collected and analyzed.</p>	<ul style="list-style-type: none"> Samples from Idaho Falls and Arco contained detectable amounts of radioactive iodine. Tritium was not detected in any of the nine samples analyzed. Seven of nine samples analyzed for strontium had detectable concentrations. 	<ul style="list-style-type: none"> Radioactive iodine was indicated at just above the minimum detectable concentration. No tritium was indicated in offsite milk. All levels of strontium in milk were similar to those resulting from worldwide fallout from nuclear weapons testing.
<p><i>Lettuce</i></p> <p>Nine samples were collected and analyzed.</p>	<ul style="list-style-type: none"> Cesium was detected in two lettuce samples and strontium was detected in six samples. 	<ul style="list-style-type: none"> Concentrations of these radionuclides were similar to those found in previous years. The likely source of these radionuclides is worldwide fallout onto soil from nuclear weapons testing.
<p><i>Wheat</i></p> <p>11 wheat samples were collected and analyzed.</p>	<ul style="list-style-type: none"> Strontium was detected in about half of the wheat samples. Cesium was found in a sample from Idaho Falls. 	<ul style="list-style-type: none"> Cesium was barely above the lower limit of detection. The concentrations of strontium are within the range known to result from fallout from above-ground nuclear weapons testing of the 1950s and 1960s.
<p><i>Potatoes</i></p> <p>Seven potato samples were collected and analyzed.</p>	<ul style="list-style-type: none"> No cesium was found in any potato sample; strontium was found in two samples. 	<ul style="list-style-type: none"> Strontium likely is obtained from soil where it is present due to worldwide fallout from previous weapons testing.
<p><i>Sheep</i></p> <p>Ten sheep were collected and analyzed (six that had grazed onsite and four that had grazed offsite).</p>	<ul style="list-style-type: none"> Cesium was detected in the muscle of two onsite sheep and three offsite sheep. Cesium was also found in the livers of two onsite and two offsite sheep. 	<ul style="list-style-type: none"> All cesium concentrations were similar to those found previously in both onsite and offsite sheep samples. The radionuclide is likely present due to ingestion of soil containing cesium from worldwide fallout.

Radiological Surveillance Results for 1997 (continued)

Sample Type	What Was Found	What It Means
<p style="text-align: center;"><i>Game</i></p> <p>Two mule deer, two pronghorn antelope, 18 waterfowl, and seven doves were collected and analyzed.</p>	<ul style="list-style-type: none"> No iodine was found in any game thyroids. Cesium was detected in muscle from the two pronghorn. Man-made radionuclides were detected in waterfowl from four sampling locations, including a wetland distant from the INEEL. Birds taken at the Test Reactor Area contained above-background concentrations of several radionuclides. Man-made radionuclides were found in doves from the control location, the Test Reactor Area, and the Idaho Nuclear Technology and Engineering Center. Barium appeared to be higher in INEEL doves. 	<ul style="list-style-type: none"> The concentrations in the big game samples were consistent with those found in sheep onsite and offsite, and is probably from worldwide fallout. Most concentrations represented background radiation, the source of which is natural processes and worldwide fallout. The waterfowl from Test Reactor Area were collected from a radioactive waste disposal pond. A dose of 1.4 millirem, largely from cobalt and cesium, was estimated if a person were to eat the entire edible portions of ducks from this pond. That is 0.4 percent of the average annual background dose of 360 millirem for each person in southeastern Idaho. Doves at the Test Reactor Area and Idaho Nuclear Technology and Engineering Center likely accumulate some radioactivity from water in the radioactive evaporation ponds or contaminated plants nearby. A dose of 0.018 mrem was calculated for a person eating the entire edible portion of one of these doves, compared to an annual average background dose to humans of 360 mrem.

Radiological Surveillance Results for 1997 (continued)		
Sample Type	What Was Found	What It Means
<p><i>Environmental Dosimeters</i></p> <p>324 environmental dosimeters were collected and analyzed.</p>	<ul style="list-style-type: none"> No statistical differences were seen between environmental radiation measured at boundary and distant locations. Onsite measures of environmental radiation at Argonne National Laboratory-West, Auxiliary Reactor Area, Idaho Nuclear Technology and Engineering Center, Radioactive Waste Management Complex, and Test Reactor Area were higher than background. 	<ul style="list-style-type: none"> 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

Surveillance data indicated that particulate concentrations were generally greater at boundary and distant locations than on the INEEL. The primary source for particulates in the air on and around the INEEL was considered to be soil blowing off farm fields. Nitrogen dioxide and sulfur dioxide levels recorded on the INEEL averaged less than 10 percent of Environmental Protection Agency standards. Data from IMPROVE samplers operated on the INEEL and at Craters of the Moon National Monument were examined. Analyses on these samples provided information about the presence of 26 different elements in air samples. No substantial differences were noted for results between the two locations.

Concentrations of contaminants in liquid waste streams were found to comply with environmental laws and regulations. Waste streams are tested and the results are reported on schedules ranging from monthly to quarterly.

Testing of drinking water at facilities found no coliform bacteria in samples during 1997. Organic and inorganic chemicals were within drinking water standards at all facilities.

USGS analyses found organic chemicals in previously known waste plumes beneath INTEC, NRF, RWMC, TAN, and TRA. The concentration of carbon tetrachloride was found to be near

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or above the maximum contaminant level in one well at RWMC throughout the year. Carbon tetrachloride in samples taken by LMITCO from the drinking water system at RWMC remained below the maximum contaminant level during 1997.

Radiation Dose Estimates

Radiation from INEEL operations was not detected by offsite environmental surveillance methods in 1997, as has been the case in most recent years. Because doses to the public are generally 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 dose estimates from INEEL activities of 0.021 and 0.028 millirems. Those estimates are less than 0.01 percent of an average person's annual dose from background sources in southeastern Idaho, which total about 360 mrem per year. And, the INEEL dose is a dose for the "maximally exposed individual"—someone who spent the entire year living at a certain point near the INEEL boundary, which for 1997 was at Frenchman's Cabin at the foot of Big Southern Butte in one model and near Howe in the other.

A collective dose to the entire human population living within 50 miles of the center of the INEEL was also calculated as part of one model. This calculation considers all the pathways, the number of people in each locale, and the ways contaminants disperse from the INEEL. The total potential population dose for the 121,500 people within 50 miles of the INEEL's center was 0.23 person-rem. The largest population doses were in the Idaho Falls and Hamer census divisions. Idaho Falls has a relatively large population, whereas the Hamer division, which includes the communities of Hamer, Montevue, Mud Lake, and Terreton, lies in the path of prevailing daytime winds. By comparison, background radiation exposure was calculated to account for 43,700 person-rem to the same population in southeastern Idaho.

Your Radiation Dose

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 show 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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P.O. Box 51838
Idaho Falls, ID 83405-1838

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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 monitoring reports related to the INEEL, including the Annual Site Environmental Report, and quarterly summaries of the Foundation's monitoring 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 southeastern Idaho.