**U.S. Department of Energy
Washington, DC**

**Environment, Safety and Health
Office of Environmental Audit**

**Environmental Survey
Preliminary Report**

**Idaho National Engineering Laboratory
Idaho Falls, Idaho
and
Component Development and Integration
Facility
Butte, Montana**

September 1988

MASTER

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EXECUTIVE SUMMARY

Introduction

This report presents the preliminary findings of the first phase of the Environmental Survey of the United States Department of Energy's (DOE) Idaho National Engineering Laboratory (INEL) and Component Development and Integration Facility (CDIF), conducted September 14 through October 2, 1987.

The Survey is being conducted by an interdisciplinary team of environmental specialists, led and managed by the Office of Environment, Safety and Health's Office of Environmental Audit. The team includes outside experts supplied by a private contractor. The objective of the Survey is to identify environmental problems and areas of environmental risk associated with the INEL and the CDIF. The Survey covers all environmental media and all areas of environmental regulation. It is being performed in accordance with the DOE Environmental Survey Manual. The on-site phase of the Survey involves the review of existing site environmental data, observations of the operations carried on at the INEL and the CDIF, and interviews with site personnel.

The Survey team developed a Sampling and Analysis (S&A) Plan to assist in further assessing certain of the environmental problems identified during its on-site activities. The S&A Plan will be executed by the Oak Ridge National Laboratory. When completed, the S&A results will be incorporated into the INEL/CDIF Survey findings for inclusion into the Environmental Survey Summary Report.

Site Description

The INEL is located on 890 square miles of sagebrush- and basalt-covered land on the Snake River Plain in southeastern Idaho. Idaho Falls is approximately 29 miles east of the nearest site boundary. The site is government-owned and managed, although it is operated by various contractors. Westinghouse Idaho Nuclear Company (WINCO) operates the Idaho Chemical Processing Plant (ICPP), the Argonne National Laboratory (operated by the University of Chicago) operates Argonne National Laboratory - West (ANL-W), and EG&G Idaho, Inc. operates all

other facilities at the INEL that are the object of this Survey. An exception is the Radiological and Environmental Sciences Laboratory, which is run by DOE.

The INEL, formerly the National Reactor Testing Station (NRTS), was established in 1949 by the U.S. Atomic Energy Commission as an area to build, test, and operate various nuclear reactors, fuel processing plants, and support facilities with maximum safety and isolation. In 1974, the NRTS was redesignated as the INEL to reflect the broad scope of engineering activities conducted at the site. It has the world's largest and most varied collection of reactors, including research, testing, power, and ship propulsion reactors. The number of INEL reactors built has reached 52; 14 are still in an active status.

The CDIF is located in Silver Bow County, Montana, approximately 3 miles south of the Butte City limits. It is located on a 53-acre tract owned by the United States Government and is operated by Mountain States Energy, Inc. The mission of the CDIF is to test magnetohydrodynamic (MHD) components and to obtain data to evaluate component performance and scale-up requirements. MHD is a process that generates electric power by two means. First an electrically conductive high-temperature gas, obtained from combustion of fossil fuels, is passed through a strong magnetic field. The still-hot gas is then passed through a conventional steam turbine generator. The site was procured in the mid-1970s and construction began in January 1977. Testing of the power plant began in December 1980, and the first power generation occurred in April 1981.

There was significant interest in the Environmental Survey at the INEL by Federal and state regulatory agencies. Several issues of concern common to Region X of the U.S. Environmental Protection Agency (EPA) and the Idaho Department of Health and Welfare focused on groundwater contamination from past and present radioactive and chemical waste storage and disposal practices. The DOE Idaho Operations Office and Region X of the EPA have entered into a Consent Order/Compliance Agreement on the remediation of Solid Waste Management Units and Land Disposal Units at the INEL. There were no significant concerns raised by Montana regulatory agencies regarding the CDIF.

Summary of Findings

The major preliminary findings of the Environmental Survey for the INEL and the CDIF are as follows:

INEL

- Trichloroethylene (TCE) has been found in a drinking water well at Test Area North (TAN), in concentrations which exceed the EPA maximum concentration level guidelines for drinking water. The specific source and extent of the groundwater contamination have not been determined;
- Liquid wastes, potentially containing hazardous chemical and radioactive constituents, are or have been disposed of at surface percolation ponds, as well as at other active and inactive waste disposal sites at the INEL and may be contaminating the soil and groundwater;
- Organics, radionuclides, and possibly inorganics have been and may continue to be released into the soil and the groundwater from disposal sites at the Radioactive Waste Management Complex (RWMC); and
- The environmental and health-related impacts of many of the nonradioactive contaminants released from the Main Stack at the ICPP cannot be fully assessed because the emission rates and ambient concentrations of contaminants which are reasonably expected to be present have not been determined.

CDIF

- Rips and holes in the CDIF pond and basin liners have released unknown concentrations and quantities of organic and inorganic contaminants into the soil and potentially into the groundwater.

Overall Conclusions

The Survey found no environmental problems at the INEL or the CDIF that represent an immediate threat to human life. The preliminary findings identified at the INEL and the CDIF indicate that the site is affected by several environmental problems which are the result of current and past operational practices. The most pressing problem facing the INEL is the continuing contamination of the groundwater. The CDIF faces a similar problem although to a much lesser extent.

The environmental problems described in this report vary in terms of their magnitude and risk. Although the Survey-related sampling and analyses will assist in further identifying some suspected environmental problems, a complete understanding of the significance of these and other identified environmental problems requires a level of study and characterization that is beyond the scope of this Survey. Actions currently under way or planned will contribute toward meeting this requirement.

Transmittal and Follow-Up of Findings

The preliminary findings of the Environmental Survey for the INEL and the CDIF were shared with the DOE Idaho and Chicago Operations Offices and the INEL and the CDIF site contractors at the Survey closeout briefing held on October 2, 1987. By April 1988, the Idaho and Chicago Operations Offices had developed a draft action plan to address the Survey preliminary findings. A final action plan addressing all the Survey findings cited herein will be prepared by the Idaho and Chicago Operations Offices within 45 days after receiving this Preliminary Report. Those problems that involve extended studies and multi-year budget commitments will be the subject of the Environmental Survey Summary Report and the DOE-wide prioritization.

Within the Office of the Assistant Secretary for Environment, Safety and Health, the Office of Environmental Guidance and Compliance (OEG) has immediate responsibility for monitoring environmental compliance and the status of the INEL/CDIF Survey findings. The Office of Environmental Audit will continue to assess the environmental problems through a program of systematic environmental audits

that will be initiated toward the conclusion of the DOE Environmental Survey in 1989.

The preliminary findings of the INEL/CDIF Environmental Survey were shared with the Idaho and Chicago Operations Offices and site contractors at the Survey closeout briefing held on October 2, 1987. A final action plan addressing all the Survey findings cited herein will be prepared by the Idaho and Chicago Operations Offices within 45 days after receiving this Preliminary Report. Those problems that involve extended studies and multi-year budget commitments will be the subject of the Environmental Survey Summary Report and the DOE-wide prioritization.

Within the Office of the Assistant Secretary for Environment, Safety and Health, the Office of Environmental Guidance and Compliance has immediate responsibility for monitoring environmental compliance and the status of the INEL/CDIF Survey findings. The Office of Environmental Audit will continue to assess the environmental problems through a program of systematic environmental audits that will be initiated toward the conclusion of the DOE Environmental Survey in 1989.

PRELIMINARY

1.0 INTRODUCTION

The purpose of this report is to present the preliminary findings made during the Environmental Survey, September 14 through October 2, 1987, at two Department of Energy (DOE) sites: the Idaho National Engineering Laboratory (INEL), Idaho Falls, Idaho, and the Component Development and Integration Facility (CDIF), Butte, Montana. As a Preliminary Report, the contents are subject to revision. Revisions to the preliminary findings, based on technical accuracy review comments from the DOE Idaho and Chicago Operations Offices and results from the Survey's Sampling and Analysis program at the INEL, will be incorporated into the Environmental Survey Summary Report. All facilities within the INEL and the CDIF were covered by the Survey, with the exception of the Naval Reactor Facility (NRF) and the Specific Manufacturing Capability, which are both located at the INEL. The DOE manages the INEL and the CDIF, which are operated for DOE by various contractors.

The INEL/CDIF Survey is part of the larger DOE-wide Environmental Survey announced by Secretary John S. Herrington on September 18, 1985. The purpose of this effort is to identify, via "no fault" baseline surveys, existing environmental problems and areas of environmental risk at DOE facilities, and to rank them on a DOE-wide basis. This ranking will enable DOE to more effectively establish priorities for addressing environmental problems and allocate the resources necessary to correct them. Because the Survey is "no fault" and is not an "audit," it is not designed to identify specific isolated incidents of noncompliance or to analyze environmental management practices. Such incidents and/or management practices will, however, be used in the Survey as means of identifying existing and potential environmental problems.

The INEL/CDIF Environmental Survey was conducted by a multidisciplinary team of technical specialists headed and managed by a Team Leader and Assistant Team Leader from DOE's Office of Environmental Audit. A complete list of the INEL/CDIF Survey participants and their affiliations is provided in Appendix A.

The Survey team focused on all environmental media, using Federal, state, and local environmental statutes and regulations, accepted industry practices, and professional judgment to make the preliminary findings included in this report. The team carried out its activities in accordance with the guidance and protocols of the

DOE Environmental Survey Manual. Substantial use of existing information and of interviews with knowledgeable field-office and site-contractor personnel accounted for a large part of the on-site effort. A summary of the site-specific Survey activities is presented in Appendix B, and the Survey Plan is presented in Appendix C.

This document is divided into two parts, with the INEL Preliminary Report in the first part and the CDIF Preliminary Report in the second part. Preliminary Survey findings for each site, in the form of existing and potential environmental problems, are presented in the respective Sections 3.0 and 4.0. Section 3.0 includes findings that pertain to a specific environmental medium (e.g., air or soil), whereas Section 4.0 includes those that are non-media-specific (e.g., waste management, direct radiation, and quality assurance). Because the findings are highly varied in magnitude, risk, and characterization, and consequently require different levels of management attention and response, they are further subdivided into four categories within Sections 3.0 and 4.0. A list defining the abbreviations, acronyms, and initialisms appearing throughout the two parts is provided in Appendix D.

The criteria for placing a finding into one or more of the four categories are as follows:

- Category I includes only findings that, based on information available to the Team Leader, involve immediate threat to human life. Findings of this category shall be conveyed immediately to the Environment, Safety and Health personnel at the scene or in control of the facility or location in question for action. Category I findings are environmental problems with the highest potential risk, the strongest confidence in the finding, based on the information available, and the most restrictive appropriate response in terms of alternatives.
- Category II findings encompass one or more of the following situations:
 - Multiple or continuing exceedances, past or present, of a health-based environmental standard where there is immediate potential for human exposure, or a one-time exceedance where residual impacts pose an immediate potential for human exposure.

- Evidence that a health-based environmental standard may be exceeded, as discussed in the preceding situation, within the time of the DOE-wide Survey.
- Evidence that the likelihood is high for an unplanned release due to, for example, the condition or design of pollution abatement or monitoring equipment or other environmental management practices.
- Noncompliance with significant regulatory procedures (i.e., substantive technical regulatory procedures designed to directly or indirectly minimize or prevent risks), such as inadequate monitoring or failure to obtain required permits.

Category II findings include environmental problems where the risk is high but where the definition of risk is broader than in Category I. The information available to the Team Leader is adequate to identify the problem but may be insufficient to fully characterize it. Finally, in this category, most discretion is available to the Operations Offices and Program Offices as to appropriate response; however, the need for that response is such that management should not wait for the completion of the DOE-wide Survey to respond. Unlike Category I findings, a sufficient near-term response to Category II findings by the Operations Offices may include further characterization before any action is taken to rectify the situation.

Category III findings encompass one or both of the following criteria:

- The existence of pollutants or hazardous materials in the air, water, groundwater, or soil resulting from DOE operations that pose or may pose a hazard to human health or the environment.
- The existence of conditions at a DOE facility that pose or may pose a hazard to human health or the environment.

Category III findings are environmental problems for which the broadest definition of risk is used. As in Category II, the information available to the Team Leader may not be sufficient to fully characterize the problems. Under this category, the range of alternatives available for response and the corresponding time limits for response are the greatest. Environmental problems included within this category will typically require lengthy investigation and remediation phases, as well as multiyear budget commitments. These problems will be included in the DOE-wide prioritization to ensure that DOE's limited resources are used effectively.

In general, levels of pollutants or materials that constitute a hazard or potential for hazard are those that exceed some Federal, state, or local regulations for release of, contamination by, or exposure to such pollutants or materials. However, in some cases, the Survey may determine that the concentration of some nonregulated material is sufficient to be included as an environmental problem. Likewise, concentrations of regulated materials even though below limits established by regulatory authorities, that nevertheless present a potential for hazard or concern may be classified as an environmental problem. In general, however, conditions that meet regulatory or other requirements, where such exist, should not present a potential hazard and will not be identified as an environmental problem.

Conditions that pose or may pose a hazard are generally those that are violations of regulations or requirements (e.g., improper storage of hazardous chemicals in unsafe tanks). Such conditions present a potential hazard to human health and the environment and should be identified as an environmental problem. Additionally, potentially hazardous conditions are those where the likelihood of the occurrence of release is high.

The definition of the term "environmental problem" is broad and flexible to allow for the wide differences among the DOE sites and operations. Therefore, a good deal of professional judgment must be applied to the identification of environmental problems.

- Category IV findings include instances of administrative noncompliance and of management practices that are indirectly related to environmental risk but are not appropriate for inclusion in Categories I through III. Such findings can be based on any level of information available to the Team Leader, including direct observations by the team members. Findings in this category are generally expected to lend themselves to relatively simple, straightforward resolution without further evaluation or analysis. These findings, although not part of the DOE-wide prioritization effort, will be passed along to the Operations Offices and appropriate program offices for action.

Based on the professional judgment of the Team Leader, the findings within categories are arranged in order of relative significance. Comparing the relative significance of one finding to another, either between categories within a section or within categories between sections, is neither appropriate nor valid. The categorization and listing of findings in order of significance within this report constitute only the first step in a multistep, iterative process to prioritize DOE's problems.

The next phase of the INEL/CDIF Survey will be Sampling and Analysis (S&A). The Oak Ridge National Laboratory (ORNL), the S&A team for the INEL and the CDIF, will collect samples in mid-1988. An S&A Plan is being prepared by DOE and the ORNL in accordance with the protocols in the DOE Environmental Survey Manual. The S&A Plan is designed to fill existing data gaps or weaknesses. Results generated by the S&A effort will be used to assist the Survey team in further defining the existence and extent of potential environmental problems identified during the Survey.

It is clear that certain of the findings and observations contained in this report are highly variable in magnitude, risk, and characterization. Consequently, the priority, magnitude, and timeliness of near-term responses will require careful planning to ensure appropriate and effective application. The information in this Preliminary Report, albeit provisional, will assist the Idaho and Chicago Operations Offices in planning these near-term responses.

The Idaho and Chicago Operations Offices submitted a draft action plan dated April 12, 1988, in response to the preliminary findings presented at the conclusion of the on-site Survey activities and summarized in the INEL/CDIF Survey Status Report dated December 5, 1987. The draft action plan for the INEL/CDIF Survey has been reviewed by the OEG, which has immediate responsibility for monitoring the status and overseeing the adequacy of corrective actions taken by the Operations Offices in response to the Survey findings.

As required in the December 2, 1987, memorandum from the Assistant Secretary for Environment, Safety and Health to the Operations Office Managers entitled, Follow-up of Environmental Survey Findings, the Idaho and Chicago Operations Offices will prepare and submit a final action plan to the Deputy Assistant Secretary (DAS) for Environment within 45 days after receiving this Preliminary Report. The final action plan for the INEL/CDIF Survey will address all of the preliminary findings cited herein, and will incorporate OEG's comments on the draft action plan.

PRELIMINARY

INEL

PRELIMINARY

2.0 GENERAL SITE INFORMATION

Much of the information contained in this section was summarized from the Site Characteristics section of the Idaho National Engineering Laboratory Site Development Plan (EG&G Idaho, Inc., 1986a).

2.1 Site Setting

The INEL site covers approximately 890 square miles of sagebrush- and basalt-covered land on the Snake River Plain in southeastern Idaho. The nearest INEL boundary is 29 miles west of Idaho Falls, 32 miles northwest of Blackfoot, 50 miles northwest of Pocatello, and 7 miles east of Arco. The site encompasses portions of five Idaho counties: Butte, Jefferson, Bonneville, Clark, and Bingham. Figure 2-1 provides a map of the INEL vicinity.

The INEL is a government-owned reservation managed by the DOE. In 1975, the INEL site was designated a National Environmental Research Park, providing a controlled outdoor laboratory where scientists from all fields can study changes in the natural environment caused by human activities.

The topography of the INEL site is flat to gently rolling with frequent lava outcrops. The Lemhi, Lost River, and Bitterroot Mountain ranges border the site on the north and west. The average elevation of the INEL is 5,000 feet above sea level. East, Middle, and Big Southern Buttes are near the southern boundary of the INEL and have elevations of 6,410 feet, 6,572 feet, and 7,575 feet above sea level, respectively.

The Big Lost River enters the southwestern corner of the INEL, flows north, and percolates into the Snake River Plain aquifer at the Big Lost River Sinks near Howe, Idaho. During peak flows, water is diverted to spreading areas approximately 5 miles east of where the river enters the site. In the past, the Little Lost River and Birch Creek entered the INEL along the western and northern borders, respectively. However, both rivers are now diverted for agricultural irrigation before reaching the site and only occasionally flow onto the INEL.

FIGURE 2-1

There are no permanent residents within the INEL; the nearest populated area is Atomic City (about 35 residents), less than 1 mile from the southern INEL boundary. Figure 2-2 shows the population distribution around the INEL, with the radii centered in the south-central portion of the site. The population residing within a 30-mile radius is shown in Figure 2-2 to be 4,625, and within a 50-mile radius, 119,957. The INEL employs 9,986 persons, including workers both on and off the site. Approximately 6,500 employees are present at the INEL during the day shift and about 700 during each of the other shifts.

The location of the INEL in a flat valley surrounded by mountains, its altitude above sea level, and its latitude affect the climate and the day-to-day weather systems. All air masses entering the Snake River Plain from the west first cross a mountain barrier, where a large percentage of their moisture is lost to precipitation. Annual rainfall at the INEL is light, and the region has semiarid characteristics. The local northeast-southwest orientation of the plain and bordering mountain ranges tends to channel prevailing west winds so that a southwest wind predominates over the INEL; the second most frequent winds come from the northeast.

The relatively dry air and infrequent low clouds permit intense solar heating of the surface during the day and rapid radiational cooling at night. These factors combine to give a wide diurnal range of temperature near the ground. Due to the moderating influence of the Pacific Ocean, most of the air masses flowing over this area are usually warmer during winter and cooler in summer than air masses flowing at a similar latitude in the more continental climate east of the Continental Divide. The Centennial and Bitterroot Mountain Ranges keep most of the shallow, but intensely cold, winter air masses from entering the Eastern Snake River Plain (ESRP) when they move southward from Canada. Occasionally, however, the cold air can spill over the mountains. When this happens, the cold air is held in the ESRP by the surrounding mountains, and the INEL experiences low temperatures for periods lasting a week or longer.

The annual average air temperature is 5.4°C at the INEL. Monthly average temperatures at the INEL are lowest in January, at -9°C, and highest in July, at 20.1°C. Wind directions at the INEL are mostly from the southwest or northeast quadrants, due to airflow channeling by the bordering mountains. The record of average wind speeds shows a minimum of about 2.2 feet/second (ft/s) in December

HUMAN POPULATION DISTRIBUTION AROUND THE INEL FIGURE 2-2

and a maximum of 4 ft/s in April and May. Calm conditions prevail 11 percent of the time.

The average annual precipitation is 9.07 inches. Yearly totals range from 4.50 to 14.40 inches. Individual months have had as little as no measurable precipitation to as much as 4.42 inches. Maximum observed 24-hour precipitation amounts are less than 2.0 inches and maximum 1-hour amounts are just over 1.0 inch. About 26.0 inches of snow fall each year. The maximum yearly total was 40.9 inches and the smallest total was 11.3 inches. The greatest 24-hour total snowfall was 8.6 inches. The greatest snow depth observed on the ground was 27 inches. January and February average about 7.0 inches for a monthly maximum depth on the ground. The ground is usually free of snow from mid-April to mid-November. The INEL is subject to violent thunderstorms and tornadoes; however, their frequency is low. Tornado risk probability per year is about 0.0078 percent.

The INEL contains evidence of archaeological remains and trail crossings, although glimpses of past cultures are rare except for a few survival tools, bones of food animals, and remnants of structures. Big Southern Butte was a major source of quality obsidian for stone tools. The stone from these sources was distributed widely and has been found at many archaeological sites. Further, the INEL contains stone piles or cairns that mark trails or hunting ambush sites. Prehistoric rock paintings exist at Indian Cave on the INEL.

The INEL lies within an area designated as a "sagebrush ecosystem." This broad ecosystem occupies vast plains and plateaus derived from lava flows, ancient lake beds, and broad basins of alluvium. It is characterized by shrubs, principally sagebrush, with an understory of perennial grasses and forbs. The dominant and most conspicuous plant on the INEL is large sagebrush that covers approximately 80 percent of the area (460,000 acres). Other commonly occurring species include rabbitbrush, winterfat, bluebunch wheatgrass, bottlebrush squirreltail, Indian rice grass, and needle-and-thread grass.

The INEL contains a variety of animal species. At least 55 species of non-avian resident vertebrates have been observed. One hundred and sixty-four bird species are known to exist on the INEL at some time during the year, of which 36 species are permanent residents. Twenty-nine species of game birds have been recorded on the

INEL; 23 of these are waterfowl. The number of waterfowl on the INEL depends to a large degree on the flow of the Big Lost River at the site boundary.

One amphibian and nine reptile species occur on the INEL. The only amphibian observed on the INEL is the Great Basin spadefoot toad. This toad is known to occur in two major areas of the site, the Big Lost River Sinks and the Big Lost River Spreading Areas. Of the nine reptile species on the INEL, the short-horned lizard, sagebrush lizard, gopher snake, and western rattlesnake are common.

Thirty-nine species of mammals are found on the INEL, eighteen of which are rodents. The Townsend's ground squirrel, least chipmunk, Great Basin pocket mouse, Ord's kangaroo rat, western harvest mouse, deer mouse, bushy-tailed wood rat, and montane vole are the most common small mammals on the INEL. These rodents are relatively common throughout sagebrush regions of the intermountain west.

Four species of rabbits occur on the INEL: black-tailed jackrabbits, white-tailed jackrabbits, Nuttall cottontails, and pygmy rabbits. All but the white-tailed jackrabbit are considered abundant.

Six species of carnivore occur on the INEL. Of these, the coyote, long-tailed weasel, and badger are considered common. The bobcat occurs throughout the INEL, but is generally uncommon; the spotted skunk is uncommon; the mountain lion is rare.

The INEL supports resident populations of mule deer and pronghorn antelope. Mule deer are considered uncommon and are generally concentrated in the southern and central portion of the INEL. They occur in greater numbers on the buttes and mountains surrounding the INEL. Pronghorn antelope are found throughout the INEL and are generally considered abundant. Most pronghorn antelope in southeastern Idaho are migratory, and during the winter, 4,500 to 6,000 of them, or about 30 percent of Idaho's total population, may be on the INEL.

Sage grouse are the most common resident game birds on the INEL. The site provides important wintering and breeding/nesting habitat for this species. Other game birds on the INEL are the pheasant, gray partridge, chukar, blue grouse, and mourning dove.

Over 70 species of passerines have been recorded on the INEL. The most common species are the horned lark, black-billed magpie, robin, sage thrasher, Brewer's sparrow, sage sparrow, and western meadowlark. These species occur throughout the INEL.

The INEL is an important nesting and wintering area for raptors (hawks, falcons, owls, and vultures), 22 species of which have been observed on the INEL. Ten species of raptors nest on or near the site. The most abundant breeding raptors on the site are American kestrels and long-eared owls. American rough-legged hawks, American kestrels, prairie falcons, and golden eagles are the most abundant raptors observed on the INEL during the nonbreeding season.

Two plant species found on the INEL are currently under Federal review for endangered or threatened status. Both of these are species of milkvetch.

Three plant species on the Idaho State Watch List that occur on the INEL are considered rare and are of special interest, but their populations are not in jeopardy and they may be common elsewhere.

The bald eagle and the American peregrine falcon are the only species of wildlife observed on the INEL that are classified as endangered or threatened. Several bald eagles live on or near the site during most winters. Bald eagle roosts are known to exist in the lower Little Lost River Valley just north of the site. The peregrine falcon has been observed infrequently on the northern portion of the INEL.

Several species of wildlife observed on the INEL are of special concern to the United States Bureau of Land Management and Idaho Department of Fish and Game. These species include the ferruginous hawk, merlin, gyrfalcon, osprey, burrowing owl, white-faced ibis, long-billed curlew, and bobcat. Some species of sculpins and whitefish are also of special concern and may occur in the Big Lost River on the INEL.

Habitats on the INEL can be considered sensitive if they are necessary to maintain a viable population of any wildlife species. Further, habitats are also considered sensitive if they occupy relatively small areas of the INEL and thus could be eliminated by some perturbation (e.g., fire, changes in water flow). Because many

wildlife species on the INEL are dependent on sagebrush (e.g., sage grouse, sage sparrow, sagebrush lizard), all sagebrush habitats within the INEL are very important. However, the northern end of the site contains an interspersion of low sagebrush and big sagebrush habitats that provide critical winter and spring range for sage grouse and pronghorn antelope. The small area of this sagebrush interspersion and its extreme importance to wildlife justifies its classification as sensitive.

2.2 Overview of Major Site Operations

The INEL was established in 1949 by the U.S. Atomic Energy Commission (AEC) as an area to build, test, and operate various nuclear reactors, fuel processing plants, and support facilities with maximum safety and isolation. Originally known as the National Reactor Testing Station (NRTS), the site was renamed as the INEL in 1974 to reflect the broad scope of engineering activities conducted at the site.

During World War II, prior to the INEL's establishment, approximately 270 square miles of the site was used by the U.S. Navy as a gunnery range. An area southwest of the Naval range was used by the U.S. Army Air Corps as an aerial gunnery range. The present site, which encompasses 890 square miles, includes all former military areas and a large adjacent area withdrawn from public domain for use by the AEC. The former Navy administrative, shop, warehouse, and housing area is today the Central Facilities Area (CFA) of the INEL.

During its 38-year history, 52 nuclear reactors have been built at the INEL; approximately 14 are presently operable. In 1953, the Idaho Chemical Processing Plant (ICPP) began operation and has served as an engineering-scale demonstration facility to process highly enriched spent reactor fuel for recovery of uranium and krypton gas. In addition to numerous nuclear energy-related programs, the INEL is also engaged in alternative energy process research and development, nuclear waste management, and chemical and environmental sciences.

There are approximately 450 buildings and well over 2,000 other support structures at the INEL. The laboratory provides over 3 million square feet (ft²) of floor space for its associated technical and support activities.

Despite the large size of the site, most INEL operations are located at eight relatively small (generally less than 200 acres), discrete areas including the Test Area North

(TAN), the Test Reactor Area (TRA), the CFA, the Radioactive Waste Management Complex (RWMC), the Auxiliary Reactor Area (ARA), the Power Burst Facility/Special Power Excursion Reactor Test (PBF/SPERT), the ICPP, and the Argonne National Laboratory-West (ANL-W) (Figure 2-3).

Most INEL facilities are operated by one of five government contractors: Argonne National Laboratory (operated by the University of Chicago); EG&G Idaho, Inc.; Westinghouse Electric Corporation (WEC); Rockwell International (RI); and Westinghouse Idaho Nuclear Company (WINCO). These contractors conduct various programs at the INEL under the administration of three DOE offices: Idaho Operations Office (ID), Pittsburgh Naval Reactors Office (PNRO), and Chicago Operations Office (CH). Another government contractor, American Protective Service, provides security services for the INEL under the administration of the ID.

The ID is the INEL site manager and is responsible for common site services, site environmental control and management, and overall site safety and emergency planning functions. It provides certain of these services directly and the rest through its contractor, EG&G Idaho. However, the other DOE program operations offices (PNRO and CH) working at the INEL are responsible for activities within their own designated test facility boundaries. The ID performs functions or services at these designated sites only through interface agreements with the PNRO and CH.

EG&G Idaho is a prime operating contractor and the site services contractor for the INEL. As such, EG&G Idaho provides a variety of programmatic and support services related to nuclear reactor design and development, nonnuclear energy development, materials testing and evaluation, operational safety, and radioactive waste management. EG&G Idaho currently operates the TAN, TRA, CFA, RWMC, ARA, and PBF/SPERT areas at the INEL and provides all services for total site operation, including support services to the University of Chicago, WEC, RI, WINCO, and American Protective Service contractors. EG&G Idaho is also responsible for the management, including decontamination and decommissioning (D&D), of facilities that have completed their research missions. This responsibility encompasses facilities operated by past site services contractors as well as by EG&G Idaho, and also includes facilities operated by other contractors for which the site services contractor has accepted responsibility. For example, the Boiling Water Reactor Experiment (BORAX) site was operated by ANL-W, but the inactive site is managed by EG&G Idaho.

LEGEND

ANL-W	Argonne National Laboratory-West
ARA	Auxiliary Reactor Area
ARVFS	Army Reentry Vehicle Facility Site
BORAX	Boiling Water Reactor Experiment
CFA	Central Facilities Area
EBR I	Experimental Breeder Reactor I
EOCR	Experimental Organic Cooled Reactor
FTA	Fire Training Area
ICPP	Idaho Chemical Processing Plant
IET	Initial Engine Test
LCCDA	Liquid Corrosive Chemical Disposal Area
LOFT	Loss-of-Fluid Test (Facility)
NODA	Naval Ordnance Disposal Area
OMRE	Organic Moderated Reactor Experiment
PBF	Power Burst Facility
RWMC	Radioactive Waste Management Complex
SPERT	Special Power Excursion Reactor Test
TAN	Test Area North
TRA	Test Reactor Area
TSF	Technical Support Facility
WRRTF	Water Reactor Research Test Facility

Source: EG&G Idaho, Inc., 1986a

LOCATION OF THE INEL AREAS

FIGURE 2-3

WINCO operates the ICPP for the reprocessing of enriched "unburned" uranium from spent nuclear fuel elements, mostly from government-owned reactors.

The University of Chicago's programs at the INEL are administered by the CH and include the operation of the ANL-W, all in support of the Liquid Metal Fast Breeder Reactor (LMFBR) Program. These facilities are the Experimental Breeder Reactor-II (EBR-II), Transient Reactor Test (TREX) Facility, Zero Power Physics Reactor (ZPPR), and Hot Fuel Examination Facilities (HFEF).

WEC manages the Naval Reactor Facility (NRF) at the INEL under the administration of the PNRO. Assessment of the environmental status of the NRF is the responsibility of the DOE Office of Naval Reactors. Accordingly, this facility is not within the scope of this report.

An overview of the eight major INEL areas and other areas shown in Figure 2-3 is presented below:

TAN

The TAN complex is the northernmost facility within the INEL and consists of several experimental reactor and support facilities conducting research and development activities on reactor performance. These include the Technical Support Facility (TSF), the Loss-of-Fluid Test (LOFT) Facility, the Water Reactor Research Test Facility (WRRTF), and the Initial Engine Test (IET) Facility. IET, LOFT, and WRRTF activities have been discontinued.

TAN/TSF

The TSF (Figure 2-4) is in the center of the TAN. The facility provides support of energy research and defense programs, and maintains specialized equipment and personnel for technical engineering and radioactive materials handling programs and utility functions. This facility is currently involved in the program to examine and analyze the core contents from the Three Mile Island (TMI) accident.

TAN/LOFT

The LOFT Facility (Figure 2-5) is located approximately 1.5 miles west of the TSF in

FIGURE 2-4

TAN/TSF SITE PLAN

FIGURE 2-5

TAN/LOFT SITE PLAN

the TAN complex, and was a scaled duplicate of a pressurized water reactor designed to perform loss-of-coolant safety testing and behavior studies and has been used to develop and verify sophisticated computer codes to predict reactor behavior during severe accident scenarios. The facility has been decontaminated and is currently used as the site to decontaminate and decommission (D&D) the reactors from the Aircraft Nuclear Propulsion (ANP) Program.

TAN/WRRTF

The WRRTF (Figure 2-6) is located approximately 1.5 miles south of the TSF in the TAN complex. The first facilities were built in the late 1950s and were used to experiment with pool and table reactors. These reactors were D&D'd in the early 1960s and a new reactor, the Experimental Beryllium Oxide Reactor (EBOR), was constructed. Although fuel was loaded, the reactor never started up and was decommissioned. In the mid-1960s, the Semiscale Project was undertaken. This was a non-nuclear program that simulates thermal-hydraulic features of a commercial nuclear reactor to predict effects of loss-of-coolant accidents and other transients. Two other projects begun more recently in existing facilities included the blowdown facility and the Two-Phase Flow Loop, designed to support loss of fluid tests. The facility is currently not in use.

TAN/IET

The IET area (Figure 2-7) is located in the TAN complex approximately 1.5 miles north of the TSF and includes buildings and structures constructed for the ANP Program during the 1950s. Three Heat Transfer Reactor Experiments (HTRE) were conducted to develop and test a J47 turbo-jet operated by a nuclear reactor. After the ANP Program, the IET was used for the Space Nuclear Auxiliary Power Transient (SNAPTRAN) program in the early 1960s and the Hallam D&D project in 1977 and 1978. The area was D&D'd and is currently not in use.

TRA

The TRA is located in the south-central section of the INEL. The TRA provides facilities for studying the performance of reactor materials and equipment components under high neutron flux conditions, primarily for furthering the DOE's

FIGURE 2-6

TAN/WRRTF SITE PLAN

TAN/IET SITE PLAN

FIGURE 2-7

reactor development programs. The TRA contains the Engineering Test Reactor (ETR) (Building 642) and the Advanced Test Reactor (ATR) (Building 670), as well as three low-power reactors, including the Engineering Test Reactor Critical (ETRC) facility (Building 642), the Advanced Test Reactor Critical (ATRC) (Building 670) facility, and the Advanced Reactivity Measurement Facility (ARMF) (Building 660) (Figures 2-8 and 2-9). The area also contains non-nuclear support equipment and facilities.

CFA

The CFA (Figure 2-10) is located in the south-central section of the INEL and provides support services for outlying operational areas. This area encompasses approximately 400 acres and includes the DOE Radiological and Environmental Sciences Laboratory (RESL) (Building 690), maintenance shops (Buildings 621 and 622), vehicle fleet facilities (Building 665), photographic services, fire station (Building 666), dispensary (Building 603), cafeteria (Building 662), and laundry (Building 617) for radioactively and nonradioactively contaminated garments, and the Hazardous Waste Storage Facility (HWSF) (Building 637). The HWSF is located in the northern portion of the CFA, and is used to store nonradioactive hazardous wastes generated at the INEL prior to shipment off-site for disposal. Hazardous wastes generated off-site are also accepted, but this waste consists only of laboratory packs from the INEL contractor facilities in Idaho Falls, Idaho. The electrical power dispatch substation, the INEL sanitary landfill, and technical support facilities are also located here.

RWMC

The RWMC (Figure 2-11) was established in the southwest corner of the INEL in 1952 to accommodate the radioactive wastes generated by laboratory and research operations. In addition to wastes generated at the INEL, the RWMC has also received radioactive wastes from the DOE's Rocky Flats Plant and other associated facilities. The RWMC consists of the Subsurface Disposal Area (SDA), the Transuranic Storage Area (TSA), and a compactor and equipment building. The Stored Waste Examination Pilot Plant (SWEPP) (Building 610) is also located at the RWMC. SWEPP examines and verifies transuranic solid waste drums which will eventually be buried

FIGURE 2-8

SITE PLAN FOR THE NORTHERN PORTION OF TRA

SITE PLAN FOR THE SOUTHERN PORTION OF TRA

FIGURE 2-9

CFA SITE PLAN

FIGURE 2-10

FIGURE 2-11

RWMC SITE PLAN

at a DOE-approved site. The RWMC is a restricted area consisting of 144 acres of storage and radioactive waste disposal cells.

The RWMC receives solid radioactive waste from generating sources both within and outside the INEL. The SDA is a fenced, 88-acre site used for near-surface burial of nontransuranic solid low-level radioactive waste generated at INEL facilities. The TSA consists of asphalt pads adjacent to the SDA that are used for interim storage of transuranic wastes.

ARA

The ARA, previously known as the Army Reactor Area, is located in the south-central portion of the INEL. The area has the following four facilities:

- ARA-I (4 acres)
- ARA-II (3 acres)
- ARA-III (5 acres), and
- ARA-IV (20 acres).

ARA buildings and structures were constructed in 1957 for the U.S. Army as a working area to develop a compact power reactor. In 1965, this program was phased out and all reactors were removed or dismantled. Since then, the buildings have been used as office space and test facilities for a variety of research programs.

ARA-I (Figure 2-12) was originally constructed to support the Stationary Low Power Reactor No. 1 (SL-1) which was located at ARA-II. It more recently has been used for materials sciences programs and operation of two hot cells (Building 626). ARA-II (Figure 2-13) originally housed the SL-1. The SL-1 was accidentally destroyed in 1961. Contaminated materials from the reactor are buried in a 4.6-acre burial ground, 1,600 feet northeast of ARA-II. Since the accident, the facility has been used for offices and a welding shop. ARA-III (Figure 2-14) housed the Army Gas Cooled Reactor Experiment (GCRE), which was placed in standby in 1961. During 1963, the reactor building (Building 608) and control room (Building 607) were modified for testing of the Mobile Low Power Plant reactor; this was phased out in 1965. Presently the facility supports instrumentation research. ARA-IV was used from 1957 to 1964 for the Mobile Low Power Plant No. 1 reactor (ML-1). From mid-

FIGURE 2-12

ARA-I SITE PLAN

FIGURE 2-13

ARA-II SITE PLAN

ARA-III SITE PLAN

FIGURE 2-14

1967 to mid-1970, a small Nuclear Effects Reactor was operated on the site. The area was closed down until 1975, at which time it was temporarily used for welding qualification. In 1984 and 1985, the facility underwent D&D and has since been abandoned.

PBF/SPERT

The PBF and SPERT areas are located in the south-central portion of the INEL. The PBF and support structures were built in 1970 to support studies of normal and off-normal operating conditions of nuclear reactors, including a number of hypothetical accident scenarios. Studies were completed in 1985 and the facility is currently in standby mode. The PBF Control Area, including the PBF Control Building (Building 601; Figure 2-15), is located approximately 1 mile from the PBF reactor, while the PBF reactor (Building 620; Figure 2-16) is situated alongside the former SPERT-I area.

SPERT-I, as well as SPERT-II, III, and IV, were built in the middle to late 1950s and early 1960s for reactor transient behavior tests and water-moderated, enriched-fuel reactor systems. All four of the SPERT reactors have been removed and the site has undergone partial or complete (radiological) D&D. The SPERT-I reactor began testing in 1956. It was the first of the four reactors, built for the transient behavior and safety studies. SPERT-I was decommissioned in 1967 and received D&D in 1984 through 1985.

SPERT-II (Figure 2-17), built in 1960, was chronologically the third of the series of four. Its purpose was to obtain experimental results on kinetic behavior to provide information on reactor safety. Light water and heavy water were used as moderators and reflectors to study the influence of prompt neutron lifetime on reactor transient behavior. SPERT-II was placed on standby in 1964 and received D&D in 1980. It is currently being used for projects such as solidification processing.

The SPERT-III (Figure 2-18) reactor site, chronologically the second SPERT, was built in the late 1950s. The purpose of this facility was to conduct studies of high-power, high-temperature, heterogeneous light-water reactors. The SPERT-III achieved criticality in 1958. It was placed on standby in 1968 and received D&D in 1980. Ancillary support structures, such as drain lines and the leach pond, underwent D&D

FIGURE 2-15

PBF CONTROL AREA SITE PLAN

FIGURE 2-16

PBF REACTOR AREA/SPERT-I SITE PLAN

FIGURE 2-17

PBF/SPERT-II SITE PLAN

PBF/SPERT-III SITE PLAN

FIGURE 2-18

in 1983. The remaining structures now house the Waste Experimental Reduction Facility (WERF) (Building 609). The WERF reduces the size of radioactive waste by incineration, melting, or cutting to decrease the cost of disposal.

SPERT-IV (Figure 2-19) was constructed to extend the range and type of controlled parameters and to provide for kinetic testing of advanced-design reactor cores. The reactor building (Building 613) was a large pool-type facility with a 27-foot-deep basement. This allowed forced coolant flow, water height variations, hydrostatic head, and other hydrodynamic effects related to reactor stability. Initial criticality was achieved in 1961 and the reactor operated until 1970, when it was put on standby. Some characterization work has been performed on the leach pond (Area 758) and D&D is planned in 1989. The old reactor building is currently used for storage of mixed waste.

ICPP

The 146-acre ICPP (Figure 2-20) is located in the south-central portion of the INEL. Construction began in the early 1950s and the plant began operation in 1953 as an engineering-scale demonstration facility to process highly enriched spent reactor fuel. It presently supports approximately 230 buildings and structures.

The mission of the ICPP is to receive and store Government and other irradiated fuels, recover the uranium and isotopes in these fuels, safely manage the generated radioactive wastes, and manage the future Special Isotope Separation (SIS) Project. Liquid, solid, and gaseous radioactive wastes generated during fuel processing are handled at ICPP. Liquid wastes stored underground in tanks are eventually reduced to solid wastes in the New Waste Calcining Facility (NWCF) (Building 694). Solid wastes from the calcining are then stored in partially underground surface bins. The remaining facility categories, technical, administrative, and support, consist of several laboratories, offices, maintenance shops, cafeteria, decontamination facility, utilities, and a coal-fired boiler house.

ANL-W

The ANL-W facility (Figure 2-21) is situated on the extreme southeastern portion of the INEL. It presently consists of five major complexes: the EBR-II (Building 767), the

FIGURE 2-19

PBF/SPERT-IV SITE PLAN

ICPP SITE PLAN

FIGURE 2-20

ANL-W SITE PLAN

FIGURE 2-21

ZPPR (Building 776), the HFEF (Buildings 765 and 785), the Laboratory and Office (L&O) (Building 752) and support area, and the TREAT facility, which is located 3/4-mile northwest of the main area depicted in Figure 2-21.

Activities conducted at these facilities involve experimental testing and development in conjunction with the LMFBR development program. In general, these activities consist of irradiating reactor fuels and structural materials, high-temperature nuclear experiments, reactor physics experiments, diagnostic inspections, and laboratory analyses.

ANL-W/EBR-II

EBR-II, located at ANL-W, is an LMFBR, which is coupled to a 20-megawatt electrical generation plant. EBR-II is used to prove LMFBR (sodium metal) concept feasibility, conduct materials studies, fuel cycle process evaluations, and gain practical on-line experience of LMFBR generating and electrical systems. Research in alternate liquid metal reactor systems is being implemented on cadmium-based systems.

ANL-W/TREAT

TREAT is a uranium-oxide-fueled, graphite-moderated, air-cooled reactor designed to produce short, intense bursts of nuclear energy. The purpose is to simulate accident conditions leading to fuel melting or vaporization in test specimens in the center of the core, while leaving the reactor's driver fuel undamaged.

ANL-W/ZPPR

ZPPR is designed for studying those properties of breeder-reactor cores that are most conveniently studied at low power. Radioactivity is minimal, and the cooling system is very simple.

Other Areas

The following facilities, as shown on Figure 2-3, are not located in any of the eight discrete areas previously discussed but were reviewed during the Survey. These facilities are the Naval Ordnance Disposal Area (NODA), EBR-I/BORAX, Army Reentry

Vehicle Facility Site (ARVFS), Experimental Organic Cooled Reactor/Organic Moderated Reactor Experiment (EOCR/OMRE), Liquid Corrosive Chemical Disposal Area (LCCDA) and off-site facilities.

NODA

The NODA is located in the southwest section of the INEL. This area was used by the U.S. Navy to dispose of unexploded ordnance (UXO). The U.S. Navy and the U.S. Army Air Corps have in the past used portions of what is now the INEL for gunnery and bombing ranges.

EBR-I/BORAX

The EBR-I/BORAX is located in the southwestern portion of the INEL. EBR-I occupies about 10 acres and BORAX occupies 6 acres, including the leach pond and BORAX-I contaminated area.

The EBR-I area (Figure 2-22) was developed in 1949 and the early 1950s for the Experimental Breeder Reactor program. EBR-I (Building EBR-601) achieved criticality in 1951 and several reactor cores were tested. In 1963, EBR-I was decommissioned and designated a National Historic Landmark. Today, the facility houses historical displays and offices in adjoining buildings.

The BORAX facility (Figure 2-23) was originally developed in 1953 as BORAX-I, to test the ability of an open-top boiling water reactor to protect itself against sudden increases in reactivity. The last test of BORAX-I was in 1954 when the reactor was intentionally destroyed. The reactor was buried in place and the site was cleared and abandoned. A new site, 100 yards northeast of BORAX-I, was chosen for subsequent BORAX testing. The BORAX-II through V experiments were conducted in a reactor housed in one of two main buildings and were conducted from 1954 through 1964. They were designed to test various aspects of boiling water reactors. This facility has been D&D'd.

FIGURE 2-22

EBR-I SITE PLAN

Source: EG&G Idaho, Inc., 1986a

BORAX SITE PLAN

FIGURE 2-23

ARVFS

The ARVFS is located in the central portion of the INEL and comprises less than 1 acre. The ARVFS was constructed in 1965 for experiments conducted in the late 1960s by the U.S. Department of Defense. The facility consisted of a test pit, an underground bunker, and a system of pulleys and cables. The steel-lined, open-top test pit was filled with water into which nuclear fuel elements were placed. After this program was completed, the test pit was decontaminated. ARVFS remained inactive until 1974 when four drums of radioactively contaminated NaK from EBR-I were placed in the bunker, where they remain today. In 1980, a protective shed and crane were built above the pit and, in 1980 and 1981, a series of explosive tests were conducted in the pit.

EOCR/OMRE

The EOCR/OMRE Facility (Figure 2-24) is located in the south-central portion of the INEL. The two areas are adjacent to one another, although all OMRE facilities have been completely removed.

The OMRE was completed in May 1957 and continued operating until reactor shutdown in 1963. It consisted of a reactor control building, the reactor, heat exchangers, septic system, leach pond, and water tank. The overall objective of the OMRE was to achieve an economical power supply generated by an organic coolant. In 1978 and 1979, the entire facility was D&D'd and removed.

The EOCR was constructed directly northwest of the OMRE in 1962. The project was terminated shortly before construction was completed in 1962 and never operated. However, some systems, including boilers and cooling water systems, were tested.

In 1978 to 1979, EOCR offices were used during the demolition of the OMRE. Since 1978, the facility has been used for material storage, security force practice maneuvers, and explosives testing. Recently much of the exterior piping and the asbestos which surrounded the piping were removed.

EOCR/OMRE SITE PLAN

FIGURE 2-24

LCCDA

The LCCDA, approximately 1 acre, is located approximately 1/2-mile east-northeast of the RWMC along its access road. The inactive facility has been closed and the seepage pits filled in; however, the site is still relatively bare, or sparsely vegetated. It is therefore visible from the road along the south side. This facility consisted of two surface percolation units used for disposal of nonradioactive liquid chemicals.

Other

Also located at the INEL site are facilities for the RESL, the U.S. Geological Survey (USGS), and the National Oceanic and Atmospheric Administration (NOAA).

Office buildings, a computer center, a major research and development (R&D) laboratory complex, and the Field Research Office of NOAA's Air Resource Laboratories are located in Idaho Falls. A portion of INEL-related technical, analytical, and administrative support capability is concentrated in these Idaho Falls facilities.

2.3 State and Federal Concerns

Members of the Survey team met with representatives from the Idaho Department of Health and Welfare, Division of Environment, and members of the U.S. Environmental Protection Agency (EPA), Region X, on August 5, 1987, and with the EPA, Region X, on August 10, 1987. At these meetings, the Team Leader requested that the Federal and state representatives identify and discuss their concerns about the INEL facility so that the concerns could be reviewed during the Survey.

The EPA, Region X, representatives raised the following issues:

- Concern over lack of available information on groundwater beneath INEL.
- Concern that some air emissions may not have the required prevention of significant deterioration (PSD) permits.

- Possibility that radionuclide releases from the percolation ponds at the TRA are affecting the groundwater.
- Possibility of plutonium and carbon tetrachloride contamination in the groundwater beneath the RWMC.
- Concern over lack of standardized rules governing cleanup at D&D projects.
- Concern that all land disposal units have not been located.
- Concern that ICPP percolation waste pond discharges may be contaminating the aquifer.
- Concern about inadequate hazardous waste manifesting when hazardous waste is transported over public highways.
- Concern that radionuclide and chemical discharges into injection wells may be causing groundwater contamination.
- Possibility that inorganic, organic, and radionuclide discharges from the ANL-W percolation pond may be contaminating the aquifer.
- Concern that tritium-contaminated groundwater at the INEL may be moving off-site.
- Concern that potential hazardous wastes going into the RWMC storage area may not be adequately containerized to prevent leaks.
- Concerns with hazardous waste storage, handling, and accumulation at the INEL.

The state representatives raised the following issues:

- Possibility of groundwater contamination, including organics and radionuclides, beneath the RWMC.

- Possibility of chromium contamination in the NRF ditch.
- Possibility of tritium and chromium contamination in the perched water beneath the TRA.
- Concern about antimony emissions from the ICPP.
- Concern about nitrogen oxide emissions from the waste calciner stack at ICPP.
- Presence of asbestos lagging at the EOCR.

The environmental concerns discussed above were made known to the Survey team members prior to their going on-site. The concerns were reviewed during the Survey and the information presented herein should be useful to the EPA and the State of Idaho in addressing these issues.

Two of the issues are not discussed in this report. The issue of additional PSD permits required by the INEL turns on a controversial interpretation of the PSD regulations. A final decision has not been reached by the State of Idaho, which has primary responsibility for the PSD program, or by EPA Region X, which has oversight authority.

The question of "proper" manifest requirements for hazardous waste shipped intra-boundary by the INEL, but over "public highways," has also not been settled. A form of manifest system is used by the INEL, but EPA has not yet decided if the system is adequate.

3.0 MEDIA-SPECIFIC SURVEY FINDINGS AND OBSERVATIONS

The discussions in this section pertain to existing and potential environmental problems in the air, soil, surface water, and groundwater media at the INEL. The discussions include a summary of the available background environmental information related to each medium, a description of the sources of pollution and their control techniques, a review of the environmental monitoring program specific to each medium, and a categorization and explanation of the environmental problems found by the Survey team related to each medium.

3.1 Air

3.1.1 Background Environmental Information

As shown in Figure 2-1, the INEL encompasses portions of Bingham, Bonneville, Butte, Clark, and Jefferson Counties in Idaho, which are part of the Eastern Idaho Intrastate Air Quality Control Region (AQCR) 61. Nonradioactive air contaminant emissions from the INEL and other sources within this area are controlled by the requirements of the Idaho Department of Health and Welfare (IDHW) and Region X of the EPA. In addition, the INEL is a source of radioactive and other hazardous air emissions also regulated by IDHW and Region X.

3.1.1.1 Background Radioactive Air Contaminants

Worldwide background atmospheric radioactivity is composed largely of fallout from past atmospheric nuclear weapons tests, natural radioactive constituents from the decay chains of thorium and uranium in soil, and materials resulting from interactions with cosmic radiation (e.g., natural tritiated water vapor produced by interactions of cosmic radiation and stable water). Atmospheric particulates result in part from soil particles that are blown by the wind. Consequently, changing meteorological conditions often cause large daily and seasonal fluctuations in airborne radioactivity levels, although all are very low. Windy, dry days can result in relatively high concentrations of airborne particulates, whereas precipitation (rain or snow) can wash out many particles from the atmosphere.

The DOE Radiological and Environmental Sciences Laboratory (RESL) conducts off-site sampling at the distant localities of Blackfoot, Craters of the Moon National Monument, Idaho Falls, and Rexburg to provide background radiological measurements for comparison with site-impact measurements. These sampling sites are shown in Figure 3-1. The background measurements are reported in Table 3-1 and indicate the occurrence of low concentrations of no health consequence to the surrounding population.

3.1.1.2 Background Nonradioactive Air Quality

Table 3-2 lists the National Ambient Air Quality Standards (NAAQS), and the IDHW Air Quality Standards. The NAAQS were instituted by the Clean Air Act to protect the health and welfare of the general public. The air quality in the vicinity of the INEL in AQCR 61 has been designated by EPA as being (1) better than the NAAQS for sulfur dioxide (SO_2) and total suspended particulates (TSP), and (2) unclassifiable, or better than the NAAQS for ozone (O_3), carbon monoxide (CO), and nitrogen dioxide (NO_2) (Bureau of National Affairs, Inc., 1985). The 1986 annual geometric mean TSP concentration from the RESL off-site particulate sampling at the four above-mentioned distant localities was $39 \mu\text{g}/\text{m}^3$, compared to the IDHW secondary air quality standard of $60 \mu\text{g}/\text{m}^3$ (Hoff, Chew, and Rope, 1987).

The Clean Air Act Amendments of 1977 also include requirements related to the Prevention of Significant Deterioration (PSD) of air quality conditions in attainment areas. These requirements include preconstruction review, Best Available Control Technology for emissions, permissible pollutant increment levels, visibility protection, and air quality monitoring. Those areas designated as Class I areas have the most stringent criteria on the allowable impact from major new sources. Craters of the Moon National Monument, about 12 miles southwest of the INEL boundary at its closest point, contains the nearest Class I area to the INEL. Construction of any significant sources of air pollutants at the INEL would require extensive regulatory review under the PSD requirements.

At the present time there is a growing national concern relative to emissions of toxic air contaminants. Many state air regulatory agencies have developed, or are in the process of developing, regulations governing these air contaminants. In Section 16.01.1011.01 of the "Rules and Regulations for the Control of Air Pollution in

FIGURE 3-1

INEL SITE AND VICINITY AIR SAMPLING NETWORK

TABLE 3-1

**AMBIENT MEASUREMENTS SUMMARY OF SPECIFIC AIRBORNE
RADIONUCLIDE ACTIVITY (1986)^a**

Radionuclide	Distant (10 ⁻¹⁵ μ Ci/mL)	Boundary (10 ⁻¹⁵ μ Ci/mL)	On-Site (10 ⁻¹⁵ μ Ci/mL)	Derived Concentration Guide ^b (10 ⁻¹⁵ μ Ci/mL)
Ce-141	NSS ^c	NSS ^c	0.6	1,000,000
Ce-144	NSS ^c	NSS ^c	0.9	30,000
Co-60	NSS ^c	NSS ^c	NSS ^c	80,000
Cs-134	3	3	3	200,000
Cs-137	6	6	6	400,000
Mn-54	NSS ^c	NSS ^c	NSS ^c	2,000,000
Ru-103	8	8	8	2,000,000
Ru-106	3	4	1.7	30,000
Sb-125	NSS ^c	NSS ^c	4	1,000,000
Sr-90	NSS ^c	NSS ^c	NSS ^c	9,000
Am-241	NSS ^c	NSS ^c	NSS ^c	20,000,000
Pu-238	NSS ^c	NSS ^c	NSS ^c	30,000,000
Pu-239/240	NSS ^c	NSS ^c	NSS ^c	20,000,000
Gross Beta	70	76	80	-

Source: Hoff, Chew, and Rope, 1987

^a Annual arithmetic average of all results from distant, boundary and on-site samplers, respectively.

^b Derived concentration guide given in Stern, 1986, as reported by Hoff, Chew, and Rope, 1987. It is based on interim DOE radiation standards for protection of the public.

^c NSS: not statistically significant.

TABLE 3-2
FEDERAL AND IDAHO AMBIENT AIR QUALITY STANDARDS

Air Contaminant	Averaging Time	Primary Standard ^a ($\mu\text{g}/\text{m}^3$)	Secondary Standard ^a ($\mu\text{g}/\text{m}^3$)	Measured Concentrations ($\mu\text{g}/\text{m}^3$)
Sulfur dioxide (SO_2)	Annual 24-Hour 3-Hour	80 365 None	None None 1300	— — —
Particulate matter ^b	Annual 24-Hour	50 150 ^c	50 150 ^c	— —
Total Suspended Particulate (TSP) ^d	Annual 24-Hour	75 260	60 150	23-39 ^f
Carbon monoxide (CO)	8-Hour 1-Hour	10,000 40,000	10,000 40,000	— —
Ozone (O_3)	1-Hour	235 ^g	235 ^g	—
Nitrogen dioxide (NO_2)	Annual	100	100	—
Lead (Pb)	Calendar Quarter	1.5	1.5	—

Sources: 40 CFR 50.4-50.12; Idaho Air Pollution Control Regulations, Section 16.01.1101

- ^a Not to be exceeded more than once a year (except where noted), other than those based on annual averages.
- ^b Particles with an aerodynamic diameter less than or equal to 10 micrometers; Federal NAAQS not yet adopted by IDHW.
- ^c No more than one expected exceedance per year.
- ^d IDHW standard only.
- ^e Annual geometric mean.
- ^f As measured in 1986 by the RESL Air Monitoring Program. The lower value represents the composite of on-site samples, while the upper value represents the composite of distant, off-site values.
- ^g The ozone standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 235 $\mu\text{g}/\text{m}^3$ is equal to or less than 1.

Idaho," IDHW prohibits the emission of toxic substances that could injure or unreasonably affect health or vegetation. This section also indicates that ambient concentration criteria and emission limits for toxic contaminants will be specified as information becomes available.

3.1.1.3 Meteorology

The location of the INEL in a flat valley surrounded by mountains, along with its altitude and latitude, affects the climate and the day-to-day weather systems. All air masses entering the Snake River Plain must first cross a mountain barrier, precipitating a large percentage of their moisture on the windward side of the barrier. Annual rainfall at the INEL is light, and the region has semiarid characteristics. The local northeast-southwest orientation of the Eastern Snake River Plain and bordering mountain ranges tends to channel the prevailing west winds so that a southwest wind predominates over the INEL; the second most frequent wind comes from the northeast.

Terrain significantly influences localized atmospheric transport and diffusion characteristics at the INEL. The most obvious influence is the subtle channeling of the diurnal, low-wind-speed flows across the valley floor where relative topographic relief is very small. This influence can be seen during both daytime heating and nocturnal cooling of the surface. The terrain surrounding the INEL can also channel and redirect the upper-level winds and determine the character of their interaction with the layer of air near the valley surface. Down-valley winds formed in the surrounding valleys and interaction of the mountains with nearby frontal systems are also a significant cause of channeled valley winds. Winds at the INEL are influenced by:

- Northwesterly, down-valley winds, which develop in the Little Lost River and Birch Creek Valleys and blow out onto the Eastern Snake River Plain toward the southeast;
- Mountains that realign the westerly winds aloft with the Eastern Snake River Plain;

- Elevated terrain north of the INEL, above which air cools and descends at night to develop northerly or northeasterly winds over the INEL;
- Reversals in wind direction that occur when shallow surface-layer winds are overcome by winds aloft moving in an opposite direction as a result of surface heating or cooling;
- Stagnations in areas where light winds converge or within topographic depressions; and
- Large horizontal eddies, which form as a result of convergence, mountain lee effects, or pressure systems effects from larger-scale weather systems (EG&G, 1985).

Low-level wind roses from four geographically separated meteorological towers from the INEL meteorological telemetry system (discussed in Section 3.1.3.3) that illustrate some of these phenomena are presented in Figure 3-2. The southwest/northeast principal flow directions are evident in the PBF and Terreton wind roses. Channeled down-valley, northwesterly winds from the Birch Creek Valley dominate the wind direction distribution at the TAN. The Idaho Falls tower reflects the occurrence of nocturnal drainage winds from the north (Start, 1984).

Since the region has semidesert characteristics, the air near the surface experiences rapid radiational cooling at night. As a result, surface-based inversions extending from a few hundred feet to over 5,000 feet form on 96 percent of all nights during a year. More intense inversions occur during those nights of the winter months when a snow cover is present (Yanskey et al., 1966). Elevated plumes released during surface-based inversion conditions can be transported considerable distances downwind with only limited plume spread.

Because of the pronounced width of the Eastern Snake River Plain, horizontal plume dispersion at the INEL is not limited by topography, and the site is well-ventilated. Hence, dispersion conditions in the valley are generally good. On occasion, light and variable winds can persist in the valley for 24 hours or more. Under these stagnation conditions, a released plume will not be transported far from its source.

REPRESENTATIVE 1980-1982 ANNUAL, LOW-LEVEL
WIND ROSES: IDAHO FALLS, POWER BURST FACILITY, TERRETON,
AND TEST AREA NORTH

FIGURE 3-2

3.1.2 General Description of Pollution Sources and Controls

Various radioactive and nonradioactive gaseous, liquid, and solid effluents are generated by the INEL facilities. When compared with liquid and solid releases, gaseous releases from stacks account for the highest percentage of radioactive releases to the environment (EG&G, 1985). Table 3-3 summarizes the radionuclide composition of airborne effluents released from the INEL during 1986. The table shows that virtually all the radioactivity released originated from three facilities at the INEL: the ICPP, the TRA, and the ANL-W.

Significant nonradioactive airborne releases originate from five primary sources at the INEL: calcination of liquid wastes at ICPP, combustion of coal for steam generation at ICPP, waste burial activities at RWMC (raising fugitive dust), combustion of fuel oil for heating, and motor vehicle exhausts (EG&G, 1985). Table 3-4 provides estimates of nonradioactive airborne effluents released from INEL combustion sources during 1986. The table shows that the major air contaminants released from INEL combustion sources are SO_2 and oxides of nitrogen (NO_x).

The following general practices are used in controlling radioactive air releases at the INEL. The general design philosophy of the ventilation systems within buildings is to provide an air pattern that results in air flowing from clean areas toward areas with a possibility of contamination, and from these areas toward those with greater possibility of contamination. Emissions with potential for exceeding radioactive material release guidelines are filtered and/or monitored. Control systems designed to meet requirements for removal of particulate radioactivity also meet requirements for nonradioactive particulates.

Air streams that normally do not contain radioactivity, but could contain minor amounts due to abnormal conditions, are passed through at least one stage of high-efficiency particulate air (HEPA) filtration prior to release. Streams that normally contain significant amounts of radioactivity are passed through one or two filtration stages prior to release. Generally, such streams are collected and processed separately and released through a common release point. Emission monitoring is provided at most central release points to verify the effectiveness of control systems. Emission monitoring is further discussed in Section 3.1.3.1.

TABLE 3-3

**RADIONUCLIDE COMPOSITION OF AIRBORNE EFFLUENTS RELEASED FROM
INEL FACILITIES IN 1986**

	Radionuclide	Airborne Effluent (Ci)				
		ANL-W	ICPP	TRA	All Other Sources	Total
Noble Gases	Kr-85	4.8	10,800	--	3×10^{-3}	10,805
	Ar-41	66	--	1,800	2.6×10^{-2}	1,866
	Xe-133	500	--	18	2	520
	Xe-138	5	--	410	5	420
	Xe-135	280	--	120	10	410
	Kr-88	21	--	140	--	161
	Kr-87	13	--	140	--	153
	Xe-135m	3	--	82	--	85
	Kr-85m	33	--	38	--	71
Particulates	Ba-139	--	--	7.5	--	7.5
	Cs-138	--	--	0.93	--	0.93
	Sb-125	--	0.93	2.7×10^{-5}	--	0.93
	Rb-88	--	--	0.42	--	0.42
	Cr-51	--	--	1.2×10^{-2}	--	1.2×10^{-2}
	Br-82	1.0×10^{-2}	--	--	--	1.0×10^{-2}
	Cs-137	--	1.8×10^{-3}	4.0×10^{-4}	1.0×10^{-4}	2.3×10^{-3}
	Rb-89	--	--	2.3×10^{-3}	--	2.3×10^{-3}
	Na-24	--	--	9.3×10^{-4}	7.0×10^{-5}	1.0×10^{-3}
	Co-60	--	--	4.2×10^{-5}	4.0×10^{-4}	4.4×10^{-4}
	Sr-90	--	1.7×10^{-4}	4.7×10^{-5}	--	2.2×10^{-4}
	Cs-134	--	--	1.2×10^{-4}	--	1.2×10^{-4}
	Pu-238	--	1.2×10^{-5}	--	--	1.2×10^{-5}
	Pu-239/240	--	1.2×10^{-6}	--	--	1.2×10^{-6}
H-3, C-14 and Iodine Isotopes	H-3	3.1	26	--	3.6×10^{-2}	29
	C-14	--	6.9×10^{-2}	--	3.3×10^{-1}	0.4
	I-129	--	6.1×10^{-3}	--	--	6.1×10^{-3}
	I-131	--	6.7×10^{-5}	6.9×10^{-5}	7.4×10^{-4}	8.8×10^{-4}
	I-133	--	--	1.6×10^{-5}	--	1.6×10^{-5}
	I-132	--	--	6.7×10^{-7}	--	6.7×10^{-7}
All Other Isotopes		9.4×10^{-6}	1.1×10^{-5}	6.3×10^{-4}	5.2×10^{-4}	1.2×10^{-3}
Grand Totals		929	10,801	2,757	17	14,500

Source: Hoff, Chew, and Rope, 1987

TABLE 3-4

**NONRADIOACTIVE AIRBORNE EFFLUENTS RELEASED FROM INEL
COMBUSTION SOURCES IN 1986**

Facility	Air Contaminant	
	NO _x ^a (tons)	SO ₂ (tons)
ANL - W	3	6
CFA	1	2
ICPP - CFSGF ^b	62	18
ICPP - other	1	4
TAN	10	40
TRA	13	50
Other, including RWMC, PBF/SPERT	21	96
Totals	111	216

Source: Hoff, Chew, and Rope, 1987

^a Oxides of nitrogen

^b Coal-Fired Steam-Generating Facility

Generally, offices, shops, warehouses, and similar sources do not have special cleanup systems for airborne effluent because the emissions are small. Oil-fired boilers are not monitored for air pollution releases. Rather, vendors of fuels must provide compliance certification for sulfur content. Laboratory hoods and glove boxes in which radiological work is conducted are usually exhausted by dedicated systems equipped with their own filtration systems and exhaust vents.

The following sections address major sources of air contaminants and important emission control systems within the TAN, TRA, CFA, RWMC, PBF/SPERT, ICPP, and ANL-W facilities. The locations of the facilities are shown in Figure 2-3.

3.1.2.1 TAN

Principal air emission sources at the TAN include the LOFT Facilities (now known as the Contained Test Facility), the Radioactive Liquid Waste Storage Facility (RLWSF) (TAN-666), the Decontamination Facility (TAN-607), and the Process Experimental Pilot Plant (PREPP) (scheduled to be operational in 1988).

The LOFT Reactor has been removed and the facilities are being decommissioned. Potentially radioactive emissions from the LOFT heating and ventilation system (serving the containment vessel, chemistry lab, sampling areas, sumps, and other potentially contaminated areas) are exhausted through the LOFT stack. The air from this system flows through roughing filters and then through HEPA filters. The HEPA filters collect particles as small as 0.3 microns with 99.97 percent efficiency. The exhaust gas is then passed through a silver zeolite filter which removes 99.99 percent of elemental iodine and 98 percent of the methyl iodide. Currently, much of the exhaust gas radioactive release consists of cesium-137.

The RLWSF receives and stores low-level radioactive liquid wastes generated during periodic decontamination operations conducted in the TAN Hot Cell Complex and the Decontamination Facility. The RLWSF contains two 15,000-gallon tanks. The tanks are vented to the atmosphere without filters or emission monitors. The principal radionuclide emitted in small quantities is cesium-137.

The TAN-607 stack receives exhaust from the Decontamination Facility and Hot Cell areas. The Decontamination Facility is used to decontaminate radioactively contaminated equipment. The Hot Cell areas provide postirradiation examination

support to the testing program at the Contained Test Facility. The TAN-607 emissions are double-HEPA-filtered and continuously monitored for releases of beta-emitting particulates, noble gases, and halogens (EG&G Idaho, Inc., 1987a).

The primary objective of the PREPP is to process select transuranic-contaminated waste that has been generated in national defense programs. This waste has been received and stored at the INEL RWMC. The process is designed to convert the waste into a form acceptable for disposal at the Waste Isolation Pilot Plant (WIPP). During the initial years of operation, the principal PREPP activity will be the incineration of hazardous waste. Although the facility has the potential to release toxic air pollutants, its current application for the IDHW air permit does not specify hazardous waste incineration. PREPP staff indicated that a permit application revision that reflects hazardous waste incineration activities will be submitted.

Waste processing consists of shredding, incineration, off-gas treatment, and the immobilization of ash and process radioactive residues by cementing in waste product drums. Further specifics on PREPP operations are found in Section 4.1.1.1. All waste processing operations are conducted in enclosures maintained at negative atmospheric pressures. Enclosure atmospheres are processed through the off-gas treatment systems and through exhaust HEPA filters. The PREPP incinerator off-gas is treated by a quencher, a venturi scrubber, moisture entrainment and mist eliminators, electric reheaters, a prefilter, and two stages of HEPA filtration before release up the PREPP stack. A water and sodium carbonate solution is used in the quencher and scrubber. Estimated pollutant removal efficiencies are as follows (Baxter, 1986):

<u>Pollutant</u>	<u>Quencher</u>	<u>Venturi</u>	<u>Dual-Stage HEPA Filters</u>	<u>Combined</u>
HCl	47%	>99%	0	>99.47%
SO ₂	45%	>90%	0	>94.5%
Particulate	49%	>95%	99.97%	99.999%

Identified radionuclides that will be released during incineration of transuranic waste include plutonium-239, 240, 241, and 242; americium-241; curium-241; and uranium-233. There is an absence of an interlock on the secondary combustion chamber of the PREPP incinerator; an interlock would automatically prevent loading to the incinerator if the secondary chamber was not operating properly.

3.1.2.2 TRA

Radioactive air emission sources at the TRA include the Advanced Test Reactor (ATR) and Materials Test Reactor (MTR) stacks, Hot Cell ventilation stacks (TRA-632), and the Alpha-Wing Laboratory stack (TRA-661). The only significant nonradioactive air emission source is the Steam Plant (TRA-609).

Several emission sources discharge to the ATR and MTR stacks. Most sources with significant potential for radionuclide releases (chemistry and physics laboratories, and hot cells) are individually filtered prior to release to the main stacks. Other sources (building ventilation air, the ATR chemistry hood and ATR coolant degassing system) are exhausted to the ATR and MTR stacks unfiltered. Principal emissions from the ATR stack are radioactive halogens, noble gases, and particulates. Primary emissions from the MTR stack are tritium from the Tritium Laboratory and iodine-131 from the Hot Waste Evaporator System.

The TRA Hot Cell Laboratories provide postirradiation examination support to the reactor testing program. TRA-632 discharges are HEPA- and silver-zeolite-filtered before release to the atmosphere through three stacks. Radioactive Waste Management Information System (RWMIS) data from 1981 to 1986 indicate that the largest release of a single isotope was antimony-125; the next largest release was iodine-131.

The Alpha-Wing Laboratory hoods are exhausted through HEPA filters to remove alpha and beta-emitting particulate prior to release to the atmosphere.

Three boilers, each rated at about 17,500 lb/hr steam generation capacity, are housed in TRA-609. The boilers are fired with No. 5 fuel oil that complies with IDHW fuel sulfur content regulations and are used for space heating. These boilers are uncontrolled sources of SO₂ and NO_x. Current plans call for this Steam Plant to be phased out during the winter of 1987/88.

3.1.2.3 CFA

The only significant radioactive air emission source at the CFA is the Laundry Decontamination Facility (CF-617). Sources of nonradioactive emissions include an

asphalt plant, two concrete batch plants, fuel-burning boilers, laboratories at the RESL (CF-690), and two paint spray shops (CF-665, CF-623).

The Central Laundry Facility contains separate areas for laundering radioactively contaminated clothing, respirators, and noncontaminated clothing. The radioactive-clothing laundry has a lint filter and scrubber on the dryer vent, and HEPA filters on the three respirator cleaning hoods. A small quantity of radioactive particulate is released from this facility.

An asphalt plant at the CFA manufactures hot mix asphalt paving. There are two major sources of emissions from this plant: particulate emissions ducted from the rotary dryer, and open dust sources emitted directly to the ambient air. Particulate emissions from the rotary dryer are controlled by a baghouse that consists of about 900 bags. However, recently an inspector from IDHW noted that emissions from this source exceeded the state opacity standard (Idaho Air Pollution Control Regulations Section 01.1201). On the day of the Survey team visit, particulate emissions were observed to be low. Although spray controls were used to wet down the gravel-crushing and gravel-screening operations, substantial asphalt plant fugitive-dust emissions were observed during the Survey from the excavated gravel pit due to front-end loader activities, truck traffic, and gravel crushing and screening.

At the concrete batch plants, sand, aggregate, cement and water are all gravity fed from a weigh hopper into the concrete mixer trucks. There are no air contaminant controls. Fugitive dust sources include the transfer of sand and aggregate, truck loading, mixer loading, vehicle traffic, and wind erosion from sand and aggregate storage piles. Visible particulate emissions were observed at a transfer point where gravel and sand were loaded from a conveyor to a hopper.

There are 14 oil- or gas-fired boilers at the CFA, ranging in size from 15 to 300 horsepower. Two boilers in the cafeteria are used for heating and cooking, and one in the Central Laundry Facility is used for heating water; the other 11 are used for space heating. The oil-fired boilers burn No. 2 and No. 4 oil with a sulfur content of 0.05 and 0.4 percent, respectively, which comply with IDHW fuel sulfur content regulations. The principal emissions are NO_x and SO₂. The boilers have no emission controls.

At the Bioassay Laboratory in CF-690, about 1 gallon per week of nitric acid is used in urinalysis work. Some of the acid is released without treatment from a vent on the building roof. The laboratory vents are washed down weekly to remove perchloric acid so that nitric salts do not form. Perchloric acid and nitric salts can explode when exposed to an oxidizing substance. Because of odor complaints, fecal analyses are carried out at the laboratory only at night when the wind blows away from other CFA buildings.

At CF-623, sign painting is carried out. In the paint spray booth of CF-665, motor vehicles from all the INEL facilities are spray painted. These activities release uncontrolled volatile organic compounds (VOCs) to the atmosphere from building openings and exhaust vents.

3.1.2.4 RWMC

Fugitive-dust emissions are released at, and in the vicinity of, the Waste Pit of the RWMC as a result of excavation activities, wind erosion, and vehicular traffic traveling haul roads (EG&G, 1985). Although operating procedures call for watering down the haul roads, substantial dust raised by haul trucks was observed during the Survey.

3.1.2.5 PBF/SPERT

The only sources of significant radioactive releases to the air from the PBF/SPERT area are the PBF reactor stack and the Waste Experimental Reduction Facility (WERF) incinerator.

The PBF reactor is currently in shutdown mode. The airborne effluent from this facility is solely the result of cleanup and decontamination operations being carried out to prepare the facility for a future program. In this mode of operation, radioactive effluent has been projected to consist nearly solely of argon-41 and amount to about 25 Ci/year (Clark, 1987). The discharge is controlled by HEPA and silver zeolite filtration prior to release (EG&G Idaho, Inc., 1987a).

The WERF is a low-level-radioactive-waste incinerator established as an experimental facility for research and development of radioactive and radioactive mixed waste handling and volume reduction techniques. The WERF can achieve a 250:1 reduction in combustible waste through incineration and a 4:1 reduction in metal volume through sizing operations. Currently, during radioactive waste processing, the principal airborne effluent of concern consists of radioactive particulates. The major isotopes released are cobalt-60, cesium-137, strontium-90, molybdenum-99, and manganese-54. It is estimated that WERF operations discharge approximately 1,400 $\mu\text{Ci}/\text{year}$ through its stack. Incineration of solid wastes will also produce SO_2 and NO_x . In addition, small amounts of hydrochloric acid, sulfuric trioxide, carbon monoxide, metallic fumes, and ozone (Clark, 1987) will be released.

The compactor has its own containment enclosure and a dedicated ventilation system with an in-line HEPA filter system. All exhaust gas goes through a secondary combustion chamber, a prefilter, and a HEPA filtration system with an overall particle removal efficiency of 99.97 percent. There is an absence of automatic shutdown capability of the incinerator in case of after-gas cooler failure or secondary combustion chamber failure. A draft permit application for WERF to burn mixed waste has been prepared and submitted to the IDHW.

3.1.2.6 ICPP

Westinghouse Idaho Nuclear Company, Inc. (WINCO), operates the ICPP, which generates, stores, and treats radioactive waste. The facilities at the ICPP are designed to recover uranium from irradiated nuclear fuels. The fuel is dissolved and the uranium is separated from the fission products and cladding materials. The uranium is further purified, solidified, and shipped off the site for future use. The waste is stored first as a liquid and then converted to a solid and stored in stainless steel bins inside concrete vaults.

The ICPP contains facilities required for the operation of a nuclear fuel reprocessing plant. These include offices for the support personnel, chemical laboratories, pilot plants, facilities for storage of both irradiated and unirradiated fuel, fuel dissolution areas, processing areas to separate the uranium from the rest of the dissolved fuel, waste processing facilities, utility areas, and other buildings as

required. In this overview, only the following air emission sources and their controls will be covered: significant gaseous waste systems exhausting to the Main Stack, the New Waste Calcining Facility (NWCF) (CPP-659, 694), the Fluorinel and Storage Facility (FAST) (CPP-666), the Coal-Fired Steam-Generating Facility (CFSGF) (CPP-687), and the Maintenance Facilities (CPP-662, 663).

Gaseous waste treatment at the ICPP is dependent on the type of contamination present in the gaseous stream. Gas streams known to contain quantities of radioactive materials, such as gases from dissolver and process vessels, are scrubbed and filtered before being released. Other gas streams, such as cell ventilation streams, are filtered to remove any contaminants before release to the environment. Gaseous streams released to the Main ICPP Stack are filtered in the Atmospheric Protection System (APS) containing HEPA filters as a final filtering step. Figure 3-3 shows ICPP gaseous waste systems that exhaust to the Main Stack.

The APS functions primarily to minimize the release of radioactive particulate material to the atmosphere. The APS provides continuous filtration of all ventilation air from processing buildings, and backup filtration of all process off-gases, using 117 HEPA filters in parallel. The NO_x-bearing gases are directed through liquid separation devices and filters for removal of both radioactive and nonradioactive particles.

The off-gas cleanup systems (Figure 3-3) remove radioactive particulates to well below allowable EPA airborne radioactivity standard levels for airborne releases (WINCO, 1986a). The Vessel Off-Gas (VOG) system is a complex system through which all the process vessels (except the dissolvers and waste storage vessels) in the Process Building (CPP-601) and other buildings are vented. The primary hazard in the VOG effluent is radioactivity because of the radioactive solutions contained in the vessels. Gases from the VOG system are directed through a condenser and a demister, then through filters for removal of particulate contamination, before being exhausted to the APS. The gases include the following radioactive components: tritium, rubidium-106, strontium-90, cesium-137, cerium-144, and zirconium/niobium-95.

Gases and aerosols generated during fuel dissolution are the major contributors of radioactive waste treated by dissolver off-gas systems (Figure 3-3). Fuel dissolution

Source: Adapted from Burr et al., 1983

FIGURE 3-3

GASEOUS WASTE SYSTEMS EXHAUSTING TO
THE MAIN STACK AT THE ICPP

takes place in the process building (CPP-601) and in the Remote Analytical Facility Building (CPP-627). As the irradiated fuels are dissolved, radioactive particulates and gaseous fission products are released. The particulate materials become entrained in the liquid aerosols and are carried to the dissolver off-gas systems along with the gaseous waste. The liquid and particulate contaminants are removed by condensation and filtration, respectively. Most of the gaseous fission products are allowed to decay before processing the fuel. However, since krypton-85 and tritium have relatively long half-lives, they still exist in the fuel at the time of processing. Normally the rare gases are released to the atmosphere via the Main Stack, but cryogenic distillation equipment, located in the Rare Gas Plant, is used for intermittent extraction of krypton for industrial and research purposes. Gaseous tritium is also released to the atmosphere during fuel dissolution (WINCO, 1986a).

Process support and pilot plant studies are carried out at the labs of the Process Improvement Facility (CPP-637). There are a number of major experimental modules in the Low-High Bay area dealing with fluorine dissolution, calcining, and fluidized beds. Two inside rooms are HEPA-filtered and exhausted through a small stack. The off-gas from the 30-cm Calciner Pilot Plant exhausts to the VOG line and from there ultimately to the APS and the Main Stack. In the Low Bay addition, several experimental tests are carried out each year in which an estimated 30 to 40 pounds of cadmium are used per test. Only a negligible quantity of cadmium is given off from the tests as particulate, which is then collected by a HEPA filter.

The NWCF converts high-level liquid radioactive wastes to a granular solid by use of a fluidized-bed calcining process in which evaporation and solidification of the liquid waste occur within a heated bed of fluidized particles. The NWCF is equipped to utilize waste solvent as a source of fuel at a rate of approximately 8 gallons/hour in its combustion system together with its normal fuel, which is kerosene. The kerosene is piped in from an outside storage tank. The effluent from the calciner, consisting of NO_x , radioisotopes (principally tritium), acids, and organics, passes through a cyclonic fines separator, a quench tower, a venturi scrubber, a de-entrainment separator, a heater, and to the first bank of HEPA filters. The gases then pass through a condenser, a demister, a heater, and a second bank of HEPA filters. Next the gases are combined with ventilation air and sampler off-gas, which has passed through a glass-fiber prefilter and banks of HEPA filters, and together the gases are emitted from the Main Stack. Currently, NO_x emissions from the

NWCF are about 475 tons/yr. During the Survey, an orange plume from the Main Stack caused by NO₂ emissions was visible during most daylight hours. Also, a ribbon-like plume from the Main Stack was observed to extend to considerable downwind distances in the early morning hours.

The ID proposes to expand the throughput capacity for fuel processing at the ICPP, so that more high-level radioactive liquid wastes will be created. When calcined, NO_x emissions at the NWCF will triple. These emissions will be released from the Main Stack. The Idaho Air Quality Board issued a conditional PSD permit for this action which requires DOE to install NO_x control equipment prior to operation. The permit gives DOE the choice of two control options (either the use of thermal decomposition technology, or selective catalytic reduction technology) and allows pilot testing prior to design and installation (Hardesty, 1987).

The FAST facility is comprised of two major systems: spent radioactive fuel storage and fuel dissolution. On the storage side, fuel from defense propulsion awaiting processing are stored underwater in basins. Off-gas flow is filtered, monitored, and released through the FAST stack. On the process side, fuels are monitored, and released through the FAST stack. Fuels are then dissolved using nitric acid, hydrofluoric acid (HF), and aluminum nitrate. Cadmium is usually used in this operation, although boron is used in those processes involving HF. Principal airborne releases are krypton-85, tritium, antimony-125, iodine-129, and carbon-14, and, potentially, acids, bases, organics, boron, cadmium, and fluoride. The gaseous effluent is treated through a complexer, scrubber, demister, and HEPA filters before release through the FAST stack. Since WINCO demonstrated that radionuclide emissions from this facility comply with the National Emission Standard for Hazardous Air Pollutants (NESHAP), this facility received new source approval from the EPA.

The CFSGF is a coal-burning facility that provides steam for the ICPP. It consists of two fluidized-bed combusters, each rated at 35,000 lb/hr of steam generation capacity. The plant is currently complying with a 0.5 lb/10⁶ Btu (British thermal units) SO₂ emission limit by burning 0.7 percent low-sulfur coal and by flue gas scrubbing. The EPA's New Source Performance Standards applicable to this source require a 70 percent or greater SO₂ removal efficiency; the plant is currently operating with an 80 percent removal efficiency. The CFSGF has an NO_x emission

limit of 0.5 lb/10⁶ Btu as set by the EPA and the IDHW. Because this limit was occasionally exceeded in spring and fall, the plant received a permit modification to 0.7 lb/10⁶ Btu at certain low steam loads. The facility is currently in compliance with all emission standards. In 1986 the CFSGF obtained a PSD permit from the EPA.

Coal is unloaded from hopper cars in a closed structure; effluent dust releases from this structure are filtered. At the flyash loading station, dry flyash is loaded into a cement truck several times a week; the quantity of flyash on the ground in the vicinity of the station indicates that considerable leakage and spillage of dust occur.

The Maintenance Facilities provide plant services to the CPP. Sources of air contaminants within these buildings include paint shops (CPP-663), grinding and welding fume areas (CPP-662, -663), a Hot Shop (CPP-663) with double HEPA filters, and garage and motor fume exhausts (CPP-663). With the exception of the Hot Shop, these sources are uncontrolled releases.

3.1.2.7 ANL-W

The mission of the ANL-W is to support the Breeder Reactor Program for DOE. Principal potential air emission sources at the ANL-W include the Transient Reactor Test Facility (TREAT), the Experimental Breeder Reactor (EBR)-II, the Zero Power Physics Reactor (ZPPR), the Hot Fuel Examination Facility/North (HFEF/N) and the Hot Fuel Examination Facility/South (HFEF/S), and support facilities including the Fuel Assembly and Storage Building, the Laboratory and Office (L&O) support building, and four oil-fired boilers.

The TREAT was designed for transient tests of fuel specimens. It is now used mainly for safety tests of breeder-reactor fuels. The TREAT facility airborne effluent is the source of nearly all argon-41 released as gaseous effluent from ANL-W. As a design safeguards feature, all airborne effluent from the reactor is exhausted through a bank of six parallel HEPA filters. The airborne effluent discharges into a 54-foot-high exhaust stack (Holzemer and Witbeck, 1987).

EBR-II is a pool-type sodium-cooled reactor, designed to operate with metallic fuel. EBR-II produces electricity as a by-product for the INEL power grid. Since 1974 EBR-II steam has also been used for space heating at the ANL-W, reducing the

consumption of fuel oil. The current mission of EBR-II has focused on the study of the milder but more probable types of fuel and reactor malfunctions that could lead to an accident sequence. Radioactive airborne effluents from EBR-II consist primarily of krypton-85, krypton-85m, krypton-87, krypton-88, xenon-133, xenon-135, and tritium. A cover-gas cleanup system continuously removes condensible gases from the EBR-II argon cover gas. The effluent is HEPA-filtered and then passes through a blower to a 200-foot stack (Holzemer and Witbeck, 1987).

At the ZPPR, full-scale core-physics studies of breeder reactors that would produce up to 1,000 megawatts (MW) are carried out. All air collected from the potentially radioactive areas is channeled through hoods into an exhaust system, which discharges the air through three banks of HEPA filters, then out a stack (Holzemer and Witbeck, 1987). The stack discharges small quantities of xenon-135.

The two Hot Fuel Examination Facilities, HFEF/N and HFEF/S, are inert-atmosphere, hot-cell facilities used for disassembly, inspection, and reassembly of irradiated reactor subassemblies. At the HFEF/N and HFEF/S Buildings, all radioactive airborne effluents are processed through 30 and 36 HEPA filters installed in parallel, respectively. These facilities discharge small quantities of xenon-133.

The Fuel Assembly and Storage Building is equipped for assembly of EBR-II driver-fuel pins into fuel elements, fabrication of EBR-II driver and experimental subassemblies, and inspection and storage of elements and finished subassemblies. All air is exhausted through three parallel banks of HEPA filters consisting of six filters per bank. The effluent contains radioactive particulate matter.

The L&O support building houses analytical laboratories, sodium chemistry laboratories, a nondestructive assay laboratory, and a hot cell facility. The effluent contains radioactive particulate matter and iodine-131. Radioactive exhaust is drawn through 20 HEPA filters in parallel and then discharged out a 50-foot stack.

Four boilers, three of which are rated at 18,000 lb/hr steam generation capacity, with the fourth at 20,000 lb/hr, are located at the ANL-W. The boilers are fired with No. 2 fuel oil with a sulfur content ranging from 0.2 to 0.5 percent. They are uncontrolled SO₂ and NO_x sources. Each boiler has an opacity monitor, which sets

off an alarm when the effluent opacity reaches 1.5 on the Ringelmann scale. The IDHW opacity standard is 2.

3.1.2.8 Other Facilities

There are no significant radioactive or nonradioactive air emission sources at the following facilities: the Auxillary Reactor Area (ARA), the Naval Ordnance Disposal Area (NODA), the Experimental Breeder Reactor No. 1 (EBR-I), the BORAX, the Zero Power Reactor (ZPR), the ARVFS, the EOGR, the OMRE, the LCCDA, and the Idaho Research Center (IRC).

3.1.3 **Environmental Monitoring Programs**

The atmospheric monitoring program at the INEL has three major components: stack emission monitoring, ambient air monitoring for radioactive and nonradioactive particulates and tritiated water vapor, and meteorological monitoring. Direct radiation is also monitored within and around the INEL; this program is discussed in Section 4.3.3. Data on stack emissions and meteorological conditions are used in atmospheric models to estimate the off-site radiation dose to the public on an annual basis and for any unusual or unplanned releases that might occur. A discussion of the calculation of radiation doses from airborne emissions is found in Section 4.3.2.1. The radiological ambient air monitoring program also provides confirmatory data on the radiological emission monitoring program and the effectiveness of emission controls.

Emission monitoring is carried out by the individual facility contractor. Ambient air monitoring off-site and on-site but outside the contractor facilities is the responsibility of the RESL. Environmental monitoring within facility fences is conducted by the individual facility contractor. Meteorological monitoring is the responsibility of the RESL and the National Oceanic and Atmospheric Administration/Air Resources Lab/Field Research Division (NOAA/ARL/FRD).

Quality assurance programs have been developed by the RESL and the site contractors as part of their monitoring programs, including:

- Written procedures for sample collection; for example, WINCO personnel involved in ambient monitoring activities use written standard operating procedures (WINCO, NDa);
- Periodic internal and external evaluation of the program;
- Routine calibration of instrumentation; for instance, the emission monitors at the CFSGF are calibrated monthly with a known concentration of gas; and
- Frequent equipment performance checks, such as the automatic daily span checks for the CFSGF continuous emission monitors.

Each contractor and RESL maintain their own Standard Operating Procedure (SOP) Manual, which presents a comprehensive protocol for environmental sampling and subsequent analysis. The SOP Manual identifies the location of each sampling point, the frequency of sampling at that location, the sampling technique including the appropriate preservation requirements, and outlines chain-of-custody procedures as well as labeling and documentation protocols. The SOP Manual also delineates the responsibilities of personnel directly associated with the acquisition and analysis of environmental samples.

The following sections present information on the emission monitoring program, the ambient air sampling program, and the meteorological monitoring system. Quality control and assurance activities associated with analyzing environmental monitoring samples are discussed in Section 4.4.3.

3.1.3.1 Emission Monitoring

Because most of the environmental impacts of the INEL site operations are not readily measurable by ambient environmental monitoring due to the low level of emissions, meteorological effects causing plume dilution, and the significant distance to receptors, an extensive emissions monitoring program is carried out. Effluents are also measured for the following reasons: (1) to ensure that releases are as low as reasonably achievable (ALARA) (DOE Order 5480.1); (2) to evaluate the relative importance of various effluents; (3) to provide the source terms for

calculating environmental impacts; and (4) to assess any potential for buildup over periods of time (EG&G, 1985). Emission monitoring at facilities is the responsibility of the appropriate ID program managers and is performed by the individual facility contractor. Routine effluent releases from the INEL facilities are reported through the Radioactive Waste Management Information System (RWMIS) and the Industrial Waste Management Information System (IWMIS) (EG&G Idaho, Inc., 1987d,e).

Table 3-5 summarizes routine emissions monitoring carried out at six of the facilities discussed in Section 3.1.2. A variety of radionuclides, and NO_x emissions, are monitored at the ICPP Main Stack. The flow in the stack is also monitored by a pitot tube velocity sensor. However, several system components that ensure that the sample flow is proportional to the stack flow were not functioning at the time of the Survey. Also, although radiological emission monitoring is carried out at a number of ANL-W stacks, the airflow through these stacks is not monitored. In addition, the ANL-W sample flow instruments are not calibrated.

3.1.3.2 Ambient Air Monitoring

Airborne particulate radioactivity is monitored continuously by a network of 12 low-volume air samplers on-site and 11 low-volume air samplers off-site (Figure 3-1). The system is operated by the RESL. Seven off-site air samplers are located near the site boundary, in communities when possible or at noncommunity locations when needed to encompass the perimeter of the site. Four samplers are located at distant localities to provide background measurements for comparison with data from boundary or on-site samplers that might be affected by site operations. In addition to the 23 fixed stations, field quality assurance/quality control (QA/QC) is augmented by "Sampler Station X," which is a duplicate low-volume sampler that is moved to one of the 23 sampling stations every quarter. Samplers for tritium in water vapor are located at one off-site location (Idaho Falls) and two on-site locations (Experimental Field Station and Van Buren) to monitor background levels and on-site operations, respectively. Krypton-85 is monitored at one on-site location (CFA).

The filters from the low-volume air samplers are collected weekly and are subjected to a gross beta (particulate beta) analysis. At the end of each quarter, the membrane filters are composited according to location and analyzed for specific

TABLE 3-5
SUMMARY OF EMISSIONS MONITORING CARRIED OUT AT THE INEL^a

Facility	Source	Radiological/Nonradiological Component Measured	Monitor Systems
TAN	Hot Shops and Hot Cells, Hot Cell Annex, and Decontamination Shop.	- Radioactive halogens, noble gases, and beta particulates	- Stack particulate, iodine, and noble gas (SPING) monitor (continuous)
	PREPP	- Specific radionuclides	- Sample filters
TRA	ATR	- Radioactive halogens, noble gases, and beta particulates	- SPING-3 monitor (continuous)
	Hot Cell Building and Addition	- Iodine, noble gas, Sr-90, alpha and beta particulates	- SPING monitor (continuous), sample filters
	Alpha and Chemistry Lab	- Gross alpha and beta activities, alpha-beta, gamma-emitting isotopes	- Sample filters
CFA	Central Laundry and Respirator Facility	- Gross radioactivity	- Continuous monitor
PBF	PBF	- Beta particulates, iodine, noble gas	- SPING-4 monitor (continuous)
	WERF Incinerator	- Gross beta and gamma particulate	- Continuous monitor
		- Gross alpha activity and specific gamma-emitting radionuclides	- Sample filters
ICPP	Main Stack	- Gamma- and beta-emitting radionuclides	- Scintillation detector (continuous)
		- Sr-89, Sr-90, gross alpha and beta particulate	- Sample filters
		- Gaseous H-3, C-14, I-129, Sb-125, Kr-85, NO _x	- Continuous monitor

TABLE 3-5

SUMMARY OF EMISSIONS MONITORING CARRIED OUT AT THE INEL (Continued)

Facility	Source	Radiological/Nonradiological Component Measured	Monitor Systems
ICPP (Continued)	NWCF Ventilation Stack	- Sr-89, Sr-90, gross alpha and beta particulate	- Sample filters
	FAST Stack	- Sr-89, Sr-90, gross alpha and beta particulate	- Sample filters
		- Gaseous H-3, C-14, I-129, Sb-125, Kr-85	- Continuous monitor
	CFSGF	- SO ₂ , NO _x , CO, opacity	- Continuous monitors
ANL-W	EBR-II	Gamma gases	- Gamma-sensitive radiation detector
		Xe-133, Xe-135, Kr-85	- 3 single-channel pulse height analyzers (continuous)
		Rare gas fission products	- Germanium-lithium argon scanning system
		Ar-41	- Continuous monitor
	TREAT	Radionuclide constituents and concentrations	- Periodic cryogenic gas samples
	ZPPR	Alpha-, beta-, gamma-emitting isotopes	- Alpha, beta, and gamma detectors
	HFEF	Beta activity	- Beta detector

Source: Adapted from EG&G, 1985

aFor sources discussed in Section 3.1.2

radionuclides by gamma spectrometry. Averaged 1986 radionuclide monitoring results and derived concentration guides for radiation protection are given in Table 3-1. The derived concentration guides are based on interim DOE radiation standards for protection of the public. As shown in Table 3-1, measured concentrations on-site, at the site boundary, and at distant locations are very small fractions of the derived concentration guides.

In the tritium in water vapor samplers, air is passed through a column of silica gel at a rate of 0.65 ft³/hr. The silica gel columns are changed and analyzed only when the columns are nearly saturated with water vapor (about every 3 weeks). During 1986, no concentration of tritiated water exceeded the approximate minimum detectable limit of 1×10^{-11} $\mu\text{Ci/mL}$ (Hoff, Chew, and Rope, 1987).

Krypton-85 is monitored by allowing ambient air to be pumped continuously in a large Tedlar bag. Twice a month, the sample, about 26 ft³ of air, is compressed into a cylinder. The cylinders are shipped each month to the EPA Environmental Monitoring Systems Laboratory in Las Vegas for analysis. The 1986 annual average krypton-85 concentration of 3.7×10^{-11} $\mu\text{Ci/mL}$ is only 0.001 percent of the derived concentration guide for radiation protection of the public (Hoff, Chew, and Rope, 1987).

Nonradioactive particulate matter is also routinely monitored at the 23 low-volume air stations, using the same membrane filters. In 1986 the concentrations of the samples ranged from 7 to 150 $\mu\text{g/m}^3$. Because the air monitoring program focuses on sampling for particulate radioactivity, standard 24-hour TSP sampling and analysis are not performed; rather, the nonradioactive particulate analysis involves determining the net weight of the particulate matter on the quarterly composite of weekly filters at each station. As shown in Table 3-2, the distant annual geometric mean was 39 $\mu\text{g/m}^3$, the boundary annual mean was 31 $\mu\text{g/m}^3$, and the on-site annual mean was 23 $\mu\text{g/m}^3$, compared to the IDHW secondary ambient air quality standard for TSP of 60 $\mu\text{g/m}^3$. Most of the airborne particulates in the site vicinity are windblown dust from the desert floor (Huff, Chew, and Rope, 1987).

EG&G Idaho, Inc., also conducts low-volume air sampling at the RWMC, WERF, PREPP, and the Radioactive Mixed Waste Storage Facility (RMWSF). During 1986, measured concentrations were small fractions of the derived concentration guides

(Reyes et al., 1987). However, particulate concentrations at the RWMC potentially could be underestimated because it was observed that radioactive particulates could be lost from the air filters during handling, and the samples may not be representative due to the sampling and analytical procedures used.

3.1.3.3 On-Site Meteorological Monitoring

The INEL meteorological telemetry system collects meteorological measurements from 26 locations on and around the INEL. The locations are shown in Figure 3-4. The system is operated by the RESL, and is maintained by EG&G. Data are analyzed by the NOAA/ARL/FRD. These data are used as input to annual dose models to estimate annual doses for the INEL.

All telemetry stations have sensors to measure wind speed and direction. Temperature is measured at nine stations with a dual thermistor that is shielded and aspirated. Wind measurements are made at most stations at a 49-foot height.

Each station is interrogated once every 6 minutes. Data are transmitted by frequency modulation to a central receiving station at the INEL. The data are converted to digital form and processed by a microcomputer into conventional engineering units. The data are stored on magnetic tape every 6 minutes, and an hourly average is printed each hour. The meteorological instruments in this system are calibrated once per year. The calibration program, however, does not conform with standard quality assurance criteria for meteorological instrumentation.

There is also an independent, eight-tower, real-time meteorological system operated by the NOAA/ARL/FRD used for radiological emergency response.

3.1.4 Findings and Observations

3.1.4.1 Category I

None

INEL SITE AND VICINITY METEOROLOGICAL
TELEMETRY SYSTEM

FIGURE 3-4

3.1.4.2 Category II

1. Lack of quantification of contaminants from Main and FAST ICPP Stacks. The environmental and health-related impacts of many of the nonradioactive contaminants (including cadmium, fluoride, mercury, boron, and nitrogen dioxide) released from the Main Stack and FAST stack at the ICPP cannot be assessed because emission rates and ambient concentrations of many of these contaminants have not been fully quantified.

Supporting information identifying nonradioactive toxic contaminants that may be released but are not quantified, and the ICPP area associated with each release are given in Table 3-6 for the Main Stack and FAST stack.

WINCO has studied the releases of some toxic air contaminants and the various processes associated with these contaminants. Contaminants studied include organics, boron, cadmium, inorganic fluoride, lead compounds, mercury, and selenium. Some limited source tests have also been carried out. However, comprehensive source sampling tests to define emission rates and definitive ambient impact studies have not been conducted.

Because NO_x emissions are continuously monitored at the Main Stack, the magnitude of NO_x emissions is well-defined. However, ambient impacts have not been determined in a comprehensive manner. Under certain meteorological conditions during daylight hours, a looping plume can be observed from the Main ICPP Stack. This causes high nitrogen dioxide (NO₂) concentrations to occur within the ICPP area, which has the potential to expose the INEL and contractor personnel working outside to concentrations in excess of the NO₂ industrial hygiene short-term exposure limit (STEL) of 10 ppm.

3.1.4.3 Category III

None

TABLE 3-6

**POTENTIAL SOURCES OF UNMONITORED NONRADIOACTIVE
RELEASES TO ICPP STACKS**

MAIN STACK

Area	Potential Release
Fast Dissolution Process ^a	Cd, F, B, Acids and Bases
601 Dissolution Process ^a	Hg, F, B, Acids and Bases
Low Bay, Process Improvement Facility	Cd, Hg, Acids and Bases

FAST STACK^b

Area	Potential Release
Dissolution Cell and Fuel Cutting	B, Cd, F, acids, bases
Water Treatment Area	Acids, bases
Dissolver Off-Gas	B, Cd, F, acids
Make-up, Preparation, Storage	B, Cd, F, acids, bases

^a From telephone conversation between K. Krivanek of ICPP and T. Koss of DOE Survey team, September 25, 1987; modified according to 4/88 DOE-ID written comments on Draft Preliminary Report.

^b Hohorst, 1986.

3.1.4.4 Category IV

1. Potential adverse visibility impact of emissions from Main ICPP Stack. Because the NO_x emissions in the plume from the Main ICPP Stack are visible within the boundaries of the Craters of the Moon National Monument, they may cause an adverse visibility impact within the Craters of the Moon National Monument Prevention of Significant Deterioration Class I area.

Class I areas are pristine regions established by the Clean Air Act in which the least amount of air quality degradation is allowed. Section 169A of the Clean Air Act establishes as a national goal the remedying of existing and prevention of future, man-made visibility impairment in Class I areas. The National Park Service has expressed concerns over the visibility impact of the Main ICPP Stack plume on the Craters of the Moon Class I area.

The plume from the Main ICPP Stack is visible from the Craters of the Moon National Monument, usually during early morning hours, remains visible within the park boundaries, and may also have an effect on the visibility and the ambient NO₂ concentrations within the designated Class I area of the park. During one morning of the Survey, the visible plume was observed to be between two identifiable landmarks that were later determined to be within the park boundaries. Also, interviews with park personnel during the Survey indicated that the plume is often visible from within the park, and occasionally intrudes within the park boundaries.

2. Potential violation of IDHW fugitive dust air regulation and health threat from fugitive dust emissions. Fugitive-dust emissions from the flyash loading station at the CFSGF at the ICPP, the asphalt plant at the CFA, and haul roads at the RWMC may violate the IDHW fugitive dust control regulation and pose a health threat to workers and passersby in the vicinity.

The state fugitive dust regulation (01.1251-01.1300) indicates that reasonable precautions should be taken to prevent particulate matter from becoming airborne. Medical evidence supporting the promulgation of the inhalable particulate matter ambient standard indicates that suspended particulates can penetrate deeply into lung passages and cause respiratory problems.

At the flyash loading station at the CSFSG, dry flyash is loaded into a cement truck several times a week. Considerable leakage and spillage occur, causing a fugitive-dust problem. Flyash to a depth of about 0.5 inch was found on the ground, within approximately a 100-foot radius of the operation, and on nearby equipment and facilities. WINCO staff indicated to the Survey that this was a recurring problem that may be caused by unsuitable equipment design.

At the asphalt plant in the CFA area, fugitive-dust emissions that may have contravened the fugitive-dust regulation were observed from the gravel pit due to gravel crushing, gravel screening, front-end loader activities, and truck traffic. The front-end loader piled finely pulverized gravel into a pile 20 to 30 feet high. Although winds were very light on the day of the Survey team visit, minimizing wind erosion, it is likely that this pile would be a substantial source of windblown particulate matter during moderate to strong winds. Although spray controls were used to wet down the gravel-crushing and gravel-screening operations, some fugitive emissions were still observed. The pit superintendent stated that the gravel pit was routinely watered down twice a day; however, it had not been watered as of the Survey team visit late that morning.

At the RWMC, it was observed that although the road systems are periodically wetted, substantial fugitive dust was caused by haul trucks. The quantity of fugitive dust raised is a function of vehicle speed, tire size, tread type and condition, vehicle weight and road conditions.

3. Lack of written operating procedures at the INEL paint spray shop operations. Written operating procedures governing the operation and ventilation of a number of paint spray facilities at the INEL (CPP-663, CF-665, CF-623) have not been developed, which may result in unnecessary releases of volatile organics into the atmosphere.

At the ICPP maintenance facility (CPP-663) a worker in the new paint shop indicated that the procedures for operating the shop and paint spray booth ventilation systems were unclear. Also, there are no written operating instructions in effect.

For the paint spray shop in CF-665, there are no written operating procedures in effect covering such items as filter changeout and ventilation system operation. A room exhaust air filter was observed to be missing. A very strong solvent odor was noted in the shop. The superintendent indicated that written operating procedures were being prepared.

At the paint shop in CF-623, there are also no written procedures, nor plans to develop them.

Since all paint shops on the INEL were not reviewed, other paint shops may also have similar procedural deficiencies.

4. Lack of IDHW air permits at INEL air contaminant sources. At least 26 air contaminant sources located at the INEL (most of which are relatively minor sources) have been constructed and are operating without IDHW air permits.

Section 16.01.1012,02 of the IDHW air pollution regulations requires source owners or operators of major and minor air contaminant sources to obtain a permit to construct prior to construction. According to Section 16.01.1012,03, an operating permit is required for any source with a permit to construct. The operating permit establishes an emission standard different from those in the Idaho rule and regulations, or as required by the Director of IDHW.

The State of Idaho Air Pollution Program was reinitiated on January 1, 1983 when the program was taken over from the EPA. This transition may have affected permitting requirements for sources commencing construction at that time.

Sources located at the INEL for which construction started after January 1, 1982, that have not obtained permits to construct are listed in Table 3-7. Except for the Asphalt Batch Plant, all the other sources on Table 3-7 for which permits have not been submitted appear to be relatively minor air contaminant sources.

TABLE 3-7

**INEL SOURCES CONSTRUCTED AFTER 1/1/82
THAT DO NOT HAVE AIR PERMITS**

Source	Location
Paint Room Exhaust	WMF-610
Emergency Generator Exhaust	WMF-610
Diesel Generator	ILF
Rock Room Dust Exhaust	ILF
Gasoline Emergency Generator	ILF
Battery Fume Hood Exhaust	ILF
WERF Incinerator ^{a,b}	SPERT III
Asphalt Batch Plant ^b	CFA
Emergency Diesel Generator	CFA-604
Laundry Vents (3) ^b	CF-617
Welding Fume Exhaust Vents (6)	CF-622
Boiler Replacement, No. 2 Fuel 11.7 M Btu/hr	CF-671
Boiler, No. 2 Fuel, 1.2 M BTU/hr	CF-608
Craft Shop Vents (Paint, Welding and Carpentry Shops) ^b	CF-623
Blueprint Duplicator (Ammonia) Vent	CF-688
Emergency Diesel Generator	TRA-674
MTR Emergency Power Battery Room Vent	TRA-604
Emergency Power Battery Room Vent	TRA-670
Remote Analytical Laboratory ^b	ICPP
Paint Shop ^b	CPP-663
60,000-gallon tank (#2 fuel oil)	North of Bldg. 755, ANL-W
TREAT emergency diesel (30 KW)	Bldg. 720, ANL-W
Fuel Mfg. Fac. emergency diesel (50 KW) ^b	Bldg. 704, ANL-W
Fuel Mfg. Fac. emergency diesel tank (94 gallons) ^b	Bldg. 704, ANL-W
Fuel Mfg. Fac. reject hood (alcohol bath) ^b	Bldg. 704, ANL-W
Fuel Mfg. Fac. alloy preparation furnace ^b	Bldg. 704, ANL-W
Sodium Process Fac. caustic storage tank (1,000 gallons) ^b	Bldg. 799, ANL-2

^a A draft permit application for the WERF incinerator has been prepared and submitted to IDHW.

^b Visited by DOE Survey team Air Specialist.

There could be additional, more recent sources that have not obtained permits. Also, there are other INEL emission sources which commenced construction prior to 1982 that have not obtained permits. IDHW has not requested any information on these latter sources.

5. Potential violation of Idaho opacity standard by Concrete Batch Plant particulate emissions. Particulate emissions from a conveyor transfer point at the Burns Brothers Concrete Batch Plant in the CFA may violate the State of Idaho opacity standard.

The State opacity regulation (01.1201) prohibits the discharge of contaminants exceeding 20 percent opacity from any point of emission for more than 3 minutes in a 60-minute period. At the Burns Brothers Concrete Batch Plant in the CFA, visible particulate emissions were observed at a transfer point where gravel and sand were loaded from a conveyor to a hopper. These emissions may violate the Idaho opacity standard.

6. Failure of INEL Meteorological Telemetry System Calibration Program to meet standard quality assurance criteria. The calibration program for the meteorological sensors in the 26-station INEL Meteorological Telemetry System does not meet standard quality assurance criteria, which could affect the validity of the meteorological data used as input to dose models.

The meteorological instruments in this system are calibrated once per year. The EPA and the U.S. Nuclear Regulatory Commission (NRC) recommend meteorological system calibration at least once every 6 months.

The RESL calibration of the temperature sensors consists of electronically challenging the recording system with voltages within the operating range and verifying that the output is within the accuracy specification. The EPA recommends that calibration procedures for temperature sensors include the use of an insulated bath, employing the triple point of water as an absolute reference.

In addition, the RESL calibration procedures for the telemetry system consist only of four pages of handwritten material, which do not provide sufficiently

detailed instructions. For example, the logging of instrument adjustments and calibration dates is not discussed.

If, as a result of an instrument calibration, RESL technicians determine that drift has occurred, the instrument is adjusted accordingly. However, no correction to the data set is made, nor is the drift reported to the NOAA/ARL/FRD staff who analyze and process the data.

7. Lack of interlock on the secondary combustion chamber of the PREPP Incinerator. The ability to operate the PREPP Incinerator at TAN without the secondary chamber at design conditions is a potential source of uncontrolled toxic air emissions, and the facility may not meet the permit requirements of the State of Idaho.

The secondary combustion chamber on an incinerator is a control device to ensure complete combustion of the wastes. Failure of the secondary chamber burner can cause incompletely incinerated materials to leave the burn chamber. The primary concern at the PREPP centers on the lack of an interlock on the secondary chamber. An interlock would automatically prevent loading to the incinerator if the secondary chamber is not operating properly. Without an interlock, the PREPP incinerator can be operated without the secondary chamber being at the specified design temperature range required to ensure nearly total destruction of hazardous wastes in the feed. This could result in greater-than-expected discharge of toxic air emissions.

Also, interim incinerator operations have been initiated, which precipitates the need to report stack testing results to the IDHW within 180 days. The facility does not have plans to perform compliance testing within this timeframe.

8. Lack of automatic shutdown capability of the WERF Incinerator. Lack of automatic shutdown capability for the WERF Incinerator at the PBF, in case of after-gas cooler failure or secondary chamber failure, can lead to unplanned releases of radioactive and nonradioactive pollutants to the atmosphere.

Loss of air flow to the air cooler in the WERF Incinerator can cause hot effluent gases from the incinerator to contact the fabric filters and HEPA filters, resulting in failure of the particulate filtering system and release of radioactive material to the environment. The potential radioactive release would be determined by the amount of radioactivity in the burn at the time. The air cooling system is also not interlocked to the steam quench system and would require quick operator response to prevent loss of the baghouse and HEPA filters, which are the primary means to control emissions from the incinerator during operation.

The secondary chamber on an incinerator is a control device to ensure complete combustion of the wastes. Failure of the secondary chamber burner can cause incompletely incinerated materials to leave the burn chamber. The fabric filters and HEPA filters will also experience increased loadings, due to increased penetration rates of the filters, and there can be an increase in emissions to the atmosphere. Currently, the lack of an interlock on the secondary chamber, as described in Finding 7 of this section, is handled by administrative procedures. The operators are instructed not to operate the WERF Incinerator unless the secondary chamber is operating at prescribed temperatures; however, this requires total attention by the operator to ensure correct operation, which, because of the human factor, may not be fully reliable. An interlock would automatically prevent the loading to the incinerator if the secondary chamber is not operating properly. The operator does have a quick shutdown capability should the loss of the secondary chamber during a burn be noticed.

9. Improper ambient air sampling and analytical procedures at the RWMC.
Improper sampling and sample preparation of the air monitoring filters at the RWMC may result in underestimates of ambient radioactive particulate levels.

Radioactive particulates could be lost from the air filters due to the sampling and analytical procedures used at the RWMC. Air filters changed during windy conditions at the RWMC may lose surface particulate material from the filter pad and therefore some possible radioactive material. Special precautions for changing filters during windy conditions have not been developed. Additionally, the gross alpha and gross beta analyses are performed on

punchouts from the air filters which may not contain a representative sample of material. The particulate matter and therefore radioactive particulates on air filters may not be uniformly distributed. Preparation also dislodges material from the air filter and the procedures in place do not address returning the dislodged material to the filter. This could bias analysis results and give results lower than actual.

10. Deficiencies in radioactive emission monitoring at ANL-W stacks and ICPP Main Stack. Radioactive monitoring system deficiencies in the ANL-W effluent stacks and the ICPP Main Stack result in uncertain off-site radioactive releases and dose estimates.

There are no flow monitoring devices in the air effluent stacks at the ANL-W. The flow estimate is based on the horsepower curves of the exhaust fans, which may not be accurate due to vent system leaks. Secondly, the sample flow from the stack is not proportional to the exhaust flow. This prevents the air particulate sample from being isokinetic even though the proper sampling probes are used. A correction of this problem is not possible with the current equipment. Finally, the sample flow devices are not calibrated; however, a program is under way to establish a calibration program for these devices. These deficiencies contribute to questions of the accuracy of the radioactive atmospheric release data and therefore the off-site dose assessment reported in the Annual Environmental Monitoring Program report.

Several system components in the ICPP Main Stack that ensure that sample flow is proportional to stack flow do not function. This prevents the air particulate sample from being isokinetic even though the proper sampling probes are used. The sample is therefore not representative, which could result in errors in release data. Release estimates are based on assumed stack and sample flow from previous observations and not on the flow measurement devices. This leads to uncertainties in the total radioactive emissions from the ICPP Main Stack and therefore the calculated off-site dose assessment. An upgrade of this system is also under way.

3.2 Soils

3.2.1 Background Environmental Information

In general, INEL soils have formed as a result of alluvial or eolian deposition over basalt lava flows and are derived from silicic volcanic and Paleozoic rocks from nearby mountains and buttes. Rock outcrops are common and some soils are relatively shallow.

Thirteen soil series known to occur on the INEL site are shown in Table 3-8. Ten of the 13 soil series are loams and the remaining 3 are sands. All but one of the series (Bondfarm) are moderate to very deep soils. Although many soils are relatively deep, well-drained loams, most of the INEL is considered to have moderate to severe irrigation limitations. Permeability can range from 10^{-7} to 10^{-3} centimeter per second in the unsaturated zone. Examination of Figure 3-5, which is a soils map of the INEL site, and of Table 3-9, which describes the INEL soils identified on Figure 3-5, shows that the deeper soils are located in the central and northern portions of the site, while the shallower, rocky soils are generally found in the southern portion of the site.

The soils at the INEL are generally not chemically contaminated except for those areas where there were localized accidents and/or spills, and where releases or disposal have occurred. These areas have been reviewed and are discussed in Sections 3.3.2 (Surface Water), 3.4.2 (Groundwater), 4.1.1 (Waste Management), and 4.5.1 (Inactive Waste Sites and Releases). The soils at the INEL are also radioactively contaminated as a result of worldwide fallout and INEL operations. Worldwide fallout is discussed in Section 3.1.1 (Air), while the localized radioactive soil contamination from INEL operations, with the exception of the RWMC soil contamination (Section 3.2.3.1), is discussed in Sections 4.1.1 and 4.5.1.

3.2.2 General Description of Pollution Sources and Controls

The major pathways for potential contamination of soil at the INEL are routine and accidental airborne releases, routine and accidental liquid releases, and activities associated with waste disposal practices. To avoid soil contamination, the site has established controls on handling radioactive and hazardous materials. The controls

TABLE 3-8

CLASSIFICATION OF SOILS KNOWN TO OCCUR ON THE INEL

Series	USDA Texture	Characteristics
Aecet	Very stony sandy loam	Moderately deep, well drained
Bereniceton	Loam, or clay loam	Deep and very deep, well drained
Bockston	Sandy loam, loam, silt loam	Very deep, well drained on river terraces
Bondfarm	Sandy loam	Shallow, well drained
Grassy Butte	Sand, loamy sand	Very deep, somewhat excessively drained
Malm	Sandy loam, loamy sand	Moderately deep, well drained
Matheson	Sandy loam	Very deep, well drained
Pancheri	Silt loam	Very deep, well drained
Polatis	Silt loam	Moderately deep, well drained
Terreton	Loamy sand, sandy loam	Very deep, well drained on old lakebeds
Whiteknob	Gravelly loam	Very deep, well drained on alluvial fans
Wolverine	Sand	Very deep, excessively drained, on old lakebeds
Zwiefel	Fine sand	Very deep, well drained on old lakebeds

Source: Adapted from EG&G Idaho, Inc., 1985

SOILS MAP OF THE INEL

FIGURE 3-5

TABLE 3-9
DESCRIPTION OF THE INEL SOILS

Mapping Units ^a	Description
A	Thin loam over deep sands and gravels, low water-holding capacity (surface glacial till underlying surface loam), limestone alluvium in Birch Creek valleys.
B	Similar to A but on upper slopes of alluvial fans near the mountains of the Little Lost River.
C	Sandy loams largely from eolian sands. Strongly calcareous with cemented calcium carbonates. Overlies basalt. In northern INEL, has low water-holding capacity and is stony to rocky.
D	Similar to C but with greater depth to bedrock.
E	Sandy loams largely from eolian sands. Strongly calcareous. Overlies basalt.
F	Playas in the Big Lost River sinks area. Clay loam over low-permeability clay at root zone. Strongly calcareous.
G	Similar to F but with high sodic alkalinity.
H	Deep, well-drained, laminated clay loam. Moderately calcareous, slightly sodic.
I	Sandy loam surface, low-permeability clay at root zone. Sand dunes in places. Includes remnants of prehistoric Lake Terreton.
J	Sandy loam on alluvial fans adjacent to the Lemhi Range. Moderate water-holding capacity, shallow in places, locally rocky.
K	Very shallow soils, steep slopes, very rocky, mixed geologic materials of hills and mountains.
L	Barren lava plains of geologically recent lava flows. Soil is shallow and rocky.
M	Thin loess-covered basalt plains; small areas surrounded by bare basalt.
N	Similar to M but more rocky.
O	Similar to M but contains deeper and less rocky soils.
P	Similar to O but more rocky.
Q	Stream bottoms of the INEL Big Lost River. Moderate soil depth and water-holding capacity. Some areas are shallow with low water-holding capacity.
R	Lower alluvial plains of the Little Lost River.

Source: EG&G Idaho, Inc., 1985

^aSee Figure 3-5

include packaging, handling, storage, and disposal requirements, air filtration, water treatment systems, and incineration systems. The INEL also contains numerous localized on-site areas of soil contamination by radionuclides and hazardous materials resulting from past spills, releases of liquid wastes, and waste disposal practices. With the exception of the RWMC soil contamination, these sources and controls for soils are discussed in Sections 3.1.2 (Air), 3.3.2 (Surface Water), 3.4.2 (Groundwater), 4.1.1 (Waste Management), and 4.5.1 (Inactive Waste Sites and Releases).

3.2.3 Environmental Monitoring Program

This section discusses the environmental monitoring performed for soil and foodstuffs at and around the INEL. A soil study performed at the RWMC for radioactive constituents is also discussed.

3.2.3.1 Soil

Soil is sampled primarily as an indicator of contamination by particulate radionuclides, while tritium, carbon-14, and iodine are analyzed for in vegetation, milk, and foodstuff samples. Noble gases do not deposit on soil and are not incorporated into vegetation and foodstuffs and therefore are not analyzed for in any media.

To establish background levels of natural and fallout radioactivity in surface soil, soil samples were collected by the RESL from off-site distant and boundary undisturbed locations each year from 1970 to 1975 (except 1972). Concentrations of natural radioactivity in the off-site INEL area surface soil as found in 1970-1975 are shown in Table 3-10. The thorium-232 and uranium-238 activities were determined from those of the progeny radionuclides, actinium-228 and lead-214. Past studies of surface soils worldwide indicated that the average concentrations of uranium-238, thorium-232, and potassium-40 in the earth's upper crust are 0.9, 1.1, and 17 pCi/g, respectively (ERDA, 1977), so at the INEL, off-site soils are higher in natural radioactivity than earth crustal averages. The higher radioactivity is caused by the fact that the local soil is largely derived from silicic volcanics, which have higher uranium, thorium, and potassium concentrations than other soil types (ERDA, 1977).

TABLE 3-10

NATURAL RADIONUCLIDES IN THE INEL AREA SURFACE SOILS (1970 to 1975)^a

Radionuclide	Geometric Average ^b		Number of Samples	~ Detection Limit	
	pCi/g	pCi/m ² x 10 ³		pCi/g	pCi/m ² x 10 ³
U-238 ^c	1.52 ± 0.05	95.1 ± 4.8	116	0.04	3
Total Series ^d	21	1300			
Th-232 ^e	1.34 ± 0.05	84 ± 4	114	0.04	3
Total Series ^d	13	840			
K-40	195 ± 6	1220 ± 49	125	0.05	4

Source: Adapted from ERDA, 1977

- ^a Soil samples collected to a depth of 5 cm.
^b Geometric average $x/\pm 2$ standard geometric deviations of the mean. If data is $1.52 x/\pm 1.03$, then upper 95% confidence level is $1.52 x 1.03$, and lower 95% confidence level is $1.52 x/1.03$.
^c Based on the Pb-214 activity.
^d Secular equilibrium assumed. Does not account for radon diffusion.
^e Based on the Ac-228 activity.

Concentrations of cesium-137, strontium-90, plutonium-238 and 239/240, and americium-241 in surface soil as found in 1970-1975 are shown in Table 3-11. Cobalt-60 has not been detected in any background samples in the vicinity of the INEL. A comparison of the mean concentrations of each radionuclide at distant and boundary locations indicates that both means are from the same population.

The RESL performs the Radiological Environmental Monitoring Program at the INEL. The biennial soil sampling program was established in 1978. Soil is sampled to determine if activities on the INEL are contaminating the off-site environment. Figure 3-6 shows routine off-site soil sampling locations. Concentrations of cesium-137, strontium-90, plutonium-238 and 239/240, and americium-241 in off-site surface soil, as found in 1970 through 1975, are compared to biennial soil samples since 1978 in Table 3-12. The data in Table 3-12 show that there is no statistical difference between the background levels, as found in 1970 through 1975, and the biennial soil samples since 1978. Therefore, the RESL concluded that all the radionuclides detected are present as a result of worldwide fallout. Soil samples are not analyzed for nonradioactive contaminants.

In addition to routine environmental monitoring of soil discussed above, the surface soil around the RWMC has been evaluated for radioactive constituents. However, there has been no evaluation of hazardous constituents in the surface soil around the RWMC. The RWMC receives solid radioactive waste from generating sources both within and outside the INEL. The Subsurface Disposal Area (SDA) is a fenced, 88-acre area at the RWMC for near-surface burial of nontransuranic low-level solid waste generated at the INEL facility. The SDA received transuranic and hazardous wastes for burial prior to 1972. A more detailed discussion of the location, history, and current activities at the RWMC is presented in Section 4.1.1.

Plutonium-238 and 239 and americium-241 were detected at above-background levels around the SDA of the RWMC (Markham et al., 1978). The highest concentrations of plutonium-238 and 239 and of americium-241 in surface soils occurred on the perimeter drainage area where water drains from the SDA surface. The highest concentrations were 51 pCi/g americium-241, 36.5 pCi/g plutonium-239, and 0.8 pCi/g plutonium-238. The highest surface soil concentrations sampled outside the perimeter drainage area were 8.4 pCi/g americium-241, 2.6 pCi/g plutonium-239, and 0.06 pCi/g plutonium-238.

TABLE 3-11
RADIONUCLIDES IN THE INEL AREA SURFACE SOILS (1970 TO 1975)^a

Radionuclide	Location	Geometric Average ^b		Number of Samples	~ Detection Limit	
		pCi/g	pCi/m ² x 10 ³		pCi/g	pCi/m ² x 10 ³
Cs-137	Boundary Distant	0.83 ± 0.17	50 ± 10	41	0.04	3
		1.141 ± 0.342	66 ± 20	18	0.04	3
Sr-90	Boundary Distant	0.50 ± 0.10	29 ± 6	36	0.09	10
		0.55 ± 0.16	40 ± 8	18	0.09	10
Pu-238	Boundary Distant	0.0025 ± 0.0010	0.14 ± 0.03	35	0.002	0.2
		0.0030 ± 0.0012	0.18 ± 0.05	18	0.002	0.2
Pu-239/240	Boundary Distant	0.018 ± 0.004	0.98 ± 0.20	35	0.004	0.3
		0.022 ± 0.009	1.17 ± 0.47	18	0.004	0.3
Am-241	Boundary Distant	0.0043 ± 0.0013	0.26 ± 0.08	22	0.004	0.3
		0.0050 ± 0.0030	0.31 ± 0.12	14	0.004	0.3

Source: Adapted from ERDA, 1977

^a Soil samples collected to a depth of 5 cm.

^b Geometric average $\bar{x}$ / $\pm$ 2 standard geometric deviations of the mean.

FIGURE 3-6

SOIL SAMPLING LOCATIONS FOR THE INEL SITE VICINITY

TABLE 3-12

RADIONUCLIDES IN OFF-SITE SURFACE SOILS^a

Radionuclide	Year ^d	Geometric Mean ^b		Number of Samples	~MDC ^c	
		pCi/g	nCi/m ²		pCi/g	nCi/m ²
Cs-137	1970-75	0.94 (0.78-1.1)	54 (49-59)	60	0.01	1
	1978	0.94 (0.72-1.2)	58 (44-75)	10	0.01	1
	1980	0.64 (0.46-0.90)	41 (29-57)	10	0.01	1
	1982	0.90 (0.64-1.2)	44 (31-62)	10	0.01	1
	1984	0.69 (0.49-0.97)	43 (31-60)	7	0.01	1
	1986	0.81 (0.54-1.2)	48 (34-67)	13	0.01	1
Sr-90	1970-75	0.54 (0.43-0.59)	34 (31-37)	55	0.09	10
	1978	0.52 (0.40-0.68)	32 (23-45)	10	0.09	10
	1980	0.35 (0.25-0.49)	22 (15-33)	10	0.09	10
	1982	0.37 (0.26-0.52)	18 (11-29)	10	0.09	10
	1984	0.45 (0.32-0.63)	28 (20-39)	7	0.09	10
	1986	0.52 (0.43-0.62)	30 (25-37)	13	0.09	10
Pu-238	1970-75	0.0028 (0.0023-0.0034)	0.15 (0.13-0.18)	55	0.002	0.1
	1978	0.0010 (0.0005-0.0020)	0.06 (0.03-0.11)	10	0.002	0.1
	1980	0.0007 (0.0005-0.0009)	0.05 (0.04-0.07)	10	0.002	0.1
	1982	0.0011 (0.0007-0.0017)	0.05 (0.03-0.08)	10	0.002	0.1
	1984	0.0015 (0.0008-0.0027)	0.08 (0.04-0.15)	7	0.002	0.1
	1986	0.0021 (0.0010-0.0046)	0.12 (0.06-0.27)	13	0.002	0.1
Pu-239/240	1970-75	0.020 (0.017-0.024)	1.06 (0.96-1.17)	54	0.002	0.1
	1978	0.018 (0.013-0.025)	1.09 (0.98-1.53)	10	0.002	0.1
	1980	0.010 (0.006-0.017)	0.63 (0.37-1.07)	10	0.002	0.1
	1982	0.022 (0.016-0.031)	1.06 (0.75-1.48)	10	0.002	0.1
	1984	0.016 (0.011-0.022)	1.02 (0.73-1.43)	7	0.002	0.1
	1986	0.018 (0.012-0.027)	1.05 (0.70-1.58)	13	0.002	0.1
Am-241	1970-75	0.004 (0.003-0.005)	0.24 (0.20-0.29)	37	0.003	0.2
	1978	0.006 (0.004-0.009)	0.38 (0.29-0.49)	10	0.003	0.2
	1980	0.003 (0.002-0.004)	0.20 (0.14-0.28)	10	0.003	0.2
	1982	0.004 (0.003-0.006)	0.21 (0.13-0.34)	10	0.003	0.2
	1984	0.004 (0.002-0.007)	0.26 (0.15-0.44)	7	0.003	0.2
	1986	0.004 (0.002-0.007)	0.23 (0.13-0.41)	13	0.003	0.2

Source: RESL, 1987

^a Soil samples collected to a depth of 5 cm.^b Geometric mean with the 95% confidence interval for the mean.^c Approximate minimum detectable concentration.^d Excluding 1972, when no samples were taken.

The general contamination patterns for plutonium-238, plutonium-239, and americium-241 were similar and had spread in the northeast-southwest direction (Figure 3-7). Contamination by plutonium-238 was detected over a relatively small distance of approximately 3,300 feet northeast and 750 feet southwest of the SDA. Contamination by plutonium-239 was detected for approximately 8,000 feet northeast and 1 mile southwest of the SDA. Although the data were not sufficient to definitely establish the extent of americium-241 contamination in the northeast-southwest direction, it was concluded that the americium-241 has spread at least 8,200 feet northeast and 6,600 feet southwest of the SDA. Highest concentrations, located near the perimeter of the SDA, are likely due to floods at the SDA in 1962 and 1969 and to localized drainage of water from the SDA surface. Lower concentrations away from the SDA perimeter likely resulted from wind transport.

Additionally, cesium-137, strontium-90, and cobalt-60 were detected at above-background levels around the SDA (Markham, 1978). The maximum cesium-137 concentration, 16.1 pCi/g, was about 12 times the average concentration from background surface soils. The average cesium-137 concentration was 4.2 pCi/g and extended 1,200 feet from the SDA (Figure 3-7). The maximum strontium-90 level measured was 26 pCi/g, while the average strontium-90 concentration was 6.8 pCi/g, or 15 times the average concentration in background soils. Contamination by strontium-90 extended 1,200 feet from the SDA. The maximum cobalt-60 concentration was 11.3 pCi/g and was detected up to 3,700 feet from the SDA.

After these studies were completed, portions of the surface of the SDA were covered with additional topsoil from noncontaminated areas and were seeded for ground cover. Other improvements were also made, such as grading for improved drainage to lower the potential for spreading of contamination from the SDA surface.

The average concentration of these radionuclides in the contaminated soil is less than or equal to the INEL site's generated environmental concentration guidelines for radionuclides in soil. These guideline concentrations were derived using DOE-recommended procedures and correspond to the DOE limit of 100 mrem effective dose equivalent (EDE) to a homesteader in the first year after release of the facility for public use.

CONTAMINATION IN THE SURFACE SOIL NEAR
THE INEL SUBSURFACE DISPOSAL AREA

FIGURE 3-7

3.2.3.2 Foodstuffs

To determine if activities on the INEL are having a radiological impact on the general population, foodstuff samples are collected around the INEL site by the RESL. Milk, wheat, leafy garden lettuce, and muscle and liver tissue from sheep are sampled annually at the INEL. Muscle and liver tissue from beef cattle are sampled biennially. These foodstuffs are part of the typical public diet and therefore could be pathways to the general public for radionuclides from the INEL-site operations. Boundary areas are compared to distant areas to assess possible impacts from INEL operations. Milk, wheat, and lettuce sampling locations are shown in Figure 3-8. Sheep are sampled from the southern and eastern on-site grazing areas, and control samples are taken from sheep grazing only at the U.S. Sheep Experimental Station near Dubois, Idaho. Two sheep are sampled from each area and from the control location. Two beef cattle which graze on the site in the southern grazing area near the RWMC are also sampled.

Milk samples are collected from dairies and single-family-owned milk cows around the INEL. Samples are normally collected monthly except in Idaho Falls, where a sample is collected weekly. All milk samples are analyzed by RESL for iodine-131, strontium-90, and tritium once during each year. In addition, three October samples, one each from Carey, Idaho Falls, and Mud Lake, are submitted to RESL for iodine-129 analysis. In 1986, iodine-131 was detected in some milk samples. This was attributed to the Chernobyl accident, when iodine-131 was found in milk across the United States by the Environmental Protection Agency (EPA, 1986c). Additionally, strontium-90 was detected in some milk samples but was consistent with strontium-90 levels reported by the EPA for background levels (EPA, 1986c). No tritium or iodine-129 was detected in any of the milk samples (RESL, 1986). All lettuce and wheat samples were analyzed for strontium-90 and gamma-emitting radionuclides. No man-made gamma-emitting radionuclides were detected, except strontium-90. Comparison of average concentrations of strontium-90 for boundary and distant communities (background) showed no statistical difference between the two groups (RESL, 1987).

OFF-SITE FOODSTUFFS SAMPLING LOCATIONS
IN THE VICINITY OF THE INEL

FIGURE 3-8

The analysis of sheep and beef cattle samples showed elevated levels of cesium-137. This activity was attributed to fallout from the Chernobyl accident and not to any INEL site operations (RESL, 1987).

3.2.4 Findings and Observations

The findings which involve soil contamination are the result of current and past releases, spills, or disposal practices and are therefore discussed within the context of other findings in Sections 3.3.4 (Surface Water), 3.4.4 (Groundwater), 4.1.2 (Waste Management), and 4.5.2 (Inactive Waste Sites and Releases). The one Category III soils finding for the RWMC is discussed in this section because of the extensive soil monitoring performed at this location.

3.2.4.1 Category I

None

3.2.4.2 Category II

None

3.2.4.3 Category III

1. Soil contamination at the RWMC. The soil in and around the SDA of the RWMC area is contaminated with radionuclides and potentially hazardous wastes, which are a source for further contamination of the surrounding environment through surface water and wind transport.

The RWMC receives solid radioactive waste from generating sources both within and outside the INEL. The SDA is a fenced, 88-acre area at the RWMC used for near-surface burial of nontransuranic low-level solid waste generated at the INEL facility. The SDA received transuranic and hazardous wastes for burial prior to 1972 (see Section 4.1.1). The soil around the RWMC has been evaluated for radioactive constituents. However, there has been no evaluation of hazardous constituents.

The soil in and around the SDA of the RWMC area is contaminated with plutonium-238 and 239, americium-241, cesium-137, strontium-90, and cobalt-60. The average concentration of these radionuclides in the contaminated soil is less than or equal to the INEL site's generated environmental concentration guidelines for radionuclides in soil. These guideline concentrations were derived using DOE-recommended procedures and correspond to the DOE limit of 100 mrem EDE to a homesteader in the first year after release of the facility for public use.

The highest concentrations of plutonium-238 and 239 and of americium-241 in surface soils occurred on the perimeter drainage area where water drains from the SDA surface. The highest concentrations were 51 pCi/g americium-241, 36.5 pCi/g plutonium-239, and 0.8 pCi/g plutonium-238. The highest surface soil concentrations sampled outside the perimeter drainage area were 8.4 pCi/g americium-241, 2.6 pCi/g plutonium-239, and 0.06 pCi/g plutonium-238. As Figure 3-7 shows, the general contamination patterns for plutonium-238 and 239 and for americium-241 were similar and had spread in the northeast-southwest direction. Contamination by plutonium-238 was detected over a relatively small distance of approximately 3,300 feet northeast and 750 feet southwest of the SDA. Contamination by plutonium-239 was detected for approximately 8,000 feet northeast and 1 mile southwest of the SDA. Although the data were not sufficient to definitely establish the extent of americium-241 contamination in the northeast-southwest direction, it was concluded that the americium-241 has spread at least 8,200 feet northeast and 6,600 feet southwest of the SDA.

The maximum cesium-137 concentration, 16.1 pCi/g, was about 12 times the average concentration for background surface soils. The average cesium-137 concentration was 4.2 pCi/g and extended 1,200 feet from the SDA (Figure 3-7). The maximum strontium-90 level measured was 26 pCi/g, while the average strontium-90 concentration was 6.8 pCi/g, or 15 times the average concentration in background soils. Contamination by strontium-90 extended 1,200 feet from the SDA. The maximum cobalt-60 concentration was 11.3 pCi/g and was detected up to 3,700 feet from the SDA.

The source of this contamination is probably floods at the SDA in 1962 and 1969 and localized drainage of water from the SDA surface. Additionally, wind transport probably further distributed this contamination in the northeast and southwest directions (the two most prevalent site wind directions) from the SDA. Since the time of these analyses, portions of the surface of the SDA were covered with additional topsoil from noncontaminated areas and were seeded for ground cover. Other improvements, such as grading for improved drainage to lower the potential for spreading of contamination from the SDA surface, were also made. The contamination was not removed and is still present. This activity is extremely small compared to the more than 5.6 million curies of radioactive material buried at the SDA of the RWMC. However, it does illustrate the fact that radioactive contamination of the surficial soil has occurred within a limited areal extent.

3.2.4.4 Category IV

None

3.3 Surface Water

3.3.1 Background Environmental Information

The principal surface-water bodies at the INEL are the Big Lost River, Birch Creek, and Little Lost River (Figure 3-9). These surface-water bodies drain toward the INEL from the mountain watersheds to the north and northwest. Local rainfall and snowmelt are the primary contributors to the surface-water flows, which are intermittent due to the semi-arid climate associated with the INEL. The rivers usually begin to flow in the spring and subside by early to mid-summer. Because the INEL is located in a closed drainage basin, there is no surface-water flow off-site from the INEL.

The major surface-water feature influencing the INEL is the Big Lost River. This river flows onto the site from the southwest and continues in a northeasterly direction, ending in the Big Lost River Playas 1 through 3 (Figure 3-9). In years of very high flow the Big Lost River may overflow these playas and enter the Birch Creek Playa. The Big Lost River has the potential to flood the RWMC. However, any flooding events that would adversely affect the RWMC are rare because of a flood-water diversion system near the RWMC (Figure 3-9). This system provides the RWMC with a diversion system involving four separate spreading areas which can contain a flood of approximately 297 cubic meters per second (m^3/s). This exceeds the expected 300-year flood event of 150 m^3/s by nearly 100 percent.

Birch Creek enters the INEL from a northerly direction and ends approximately 1 mile northwest of the TAN (Figure 3-9). Because most of the Birch Creek flow is diverted for irrigation purposes prior to its entry onto the site, flows onto the INEL are usually low or nonexistent. However, in years of very high flow, Birch Creek will flow into the Birch Creek Playa and subsequently percolate into the subsurface soils at the northern end of the INEL.

The Little Lost River does not enter the site under normal flow conditions. However, during high-flow years, it enters the site on the west side and subsequently infiltrates into the subsurface soils (Figure 3-9).

MAJOR FACILITIES AND SURFACE-WATER FEATURES
IN THE VICINITY OF THE INEL

FIGURE 3-9

Each of these three surface-water bodies recharges the Snake River Plain aquifer. The aquifer is significant since it is large (containing approximately 2×10^9 acre-feet of water and covering an area of 9,575 square kilometers), and is the primary source for drinking water and irrigation of crops in the Snake River Plain. The direction of local groundwater movement is complicated although the regional flow pattern has a south and southwesterly direction (Figure 3-10).

The average annual precipitation in the area is 9.07 inches/year, with a maximum monthly observed amount being 4.42 inches. The maximum observed 24-hour precipitation was less than 2.0 inches, while the maximum hourly precipitation rate was slightly above 1 inch. These relatively modest rates of precipitation are usually readily absorbed into the area's highly porous surface soils. Some of the INEL facilities have drainage ditch networks to channel precipitation away during major precipitation events. In these circumstances, the precipitation (either local rainfall or snowmelt) is channeled toward a drainage ditch that leads to a natural low-lying area or to a percolation pond or injection well.

Surface-water quality sampling and analysis is conducted by the RESL and by facility contractors. The USGS monitors such parameters as streamflow on the Big Lost River as well as infiltration rates in the INEL spreading areas and the Big Lost River Sinks. Additionally, the USGS provides surface-water samples from streams and lakes on and near the INEL site to RESL for analysis of gross alpha, gross beta, and tritium and nonradiological constituents. A discussion of the INEL surface water monitoring program is provided in Section 3.3.3.

Water is supplied to the INEL by separate water distribution systems at each facility. These systems are served by production wells tapping into the Snake River Plain aquifer. Some of the facilities have dedicated drinking water wells while other locations have wells that can serve multiple purposes. Typically, water is pumped out of the Snake River Plain aquifer and piped to aboveground storage facilities prior to its general distribution. Stored water can be for either domestic use, fire protection, or a combination of uses. Water slated for domestic use typically is not treated with a microbiological control agent such as chlorine. However, most of the production wells are fitted with chlorine injection systems at the pumphouse should the need arise to apply a bactericide. Drinking water wells are monitored monthly for bacterial contamination. Other schedules have been developed by the various

GENERALIZED GROUNDWATER FLOWS
HYPOTHESIZED FOR
THE SNAKE RIVER PLAIN AQUIFER

FIGURE 3-10

INEL contractors for more in-depth monitoring. Section 3.3.3 contains a discussion of drinking water monitoring.

3.3.2 General Description of Pollution Sources and Controls

The primary active wastewater pollution sources of concern at the INEL are sanitary wastewater, process wastewater, and stormwater. As described in Section 3.3.1, stormwater results from precipitation runoff and, at some facilities, is channeled toward low-lying areas, percolation ponds, or injection wells.

Sanitary wastes are typically those effluents from showers, kitchens, and lavatories. All sanitary wastewaters are sewered to their respective treatment facilities prior to discharge into drainfields or pond systems. However, many of the sanitary systems at the INEL are not totally dedicated systems. For example, the sanitary system at the CFA receives process wastewaters in addition to sanitary influents. None of the dedicated process waste treatment systems are known to receive raw sanitary wastes.

Process wastewater consists of recycled or once-through cooling water, boiler water blowdown, boiler and process condensate, miscellaneous laboratory water, laundry washwater, equipment washwater, and demineralizer system waste effluent. Process wastewater may be radioactively and chemically hazardous in some instances, depending on the types of constituents and their concentration levels. The process wastewater is either sewered to sanitary waste treatment facilities or allowed to discharge into unlined waste ditches and percolation ponds, resulting in the percolation of wastewater into the soils. There are no known discharges of wastewater directly into any of the natural surface-water bodies. Although direct disposal of process wastewater into the aquifer by surface well injection was once common, this practice ceased in 1984.

No established programs exist at the INEL for the regular inspection and assessment of the wastewater piping systems associated with both industrial process and sewage effluents.

The wastewater pollution sources, water and wastewater treatment systems, drainage pathways, and supply systems as they affect the INEL are discussed on a facility-specific basis in the following subsections.

3.3.2.1 TAN

TAN/TSF

Sanitary Wastewater: Sanitary wastewater from the TAN/TSF is processed through the TAN/TSF sewage plant (Building 623 in Figure 2-4). The plant provides primary and secondary treatment for all sanitary wastes. Effluent is treated with chlorine prior to discharge into the unlined TAN/TSF Disposal Pond. The Disposal Pond is located on the west side of the facility, across Nile Avenue from Building 655, the Liquid Lift Station (Figure 2-4).

Process Wastewater: Boiler blowdown, softener regenerant water, and lightly radioactive drain wastewaters are discharged into the unlined TAN/TSF Disposal Pond. Other effluents also discharged to the pond include corrosive liquids, paint thinners, and solvents. Lightly radioactive boric acid wastewater from the TAN/LOFT is injected into a process waste line upstream of the TAN/TSF Disposal Pond. Intermediate-level liquid wastewater is stored in tanks until it can be transported to the ICPP calciner for processing.

Stormwater: Stormwater is channeled away from the TAN/TSF complex via drainage ditches and percolates into the soil. Thus, stormwater, and, in particular, snowmelt, can act as a driving force to transport existing contaminants in the vadose zone both vertically and horizontally. This is particularly important in those areas where natural or man-made depressions tend to concentrate runoff. These issues are discussed in detail in Section 4.5.

TAN/LOFT

Sanitary Wastewater: Sewage disposal at TAN/LOFT consists of three interconnected septic tanks that discharge into a subsurface drainfield (Figure 3-11). Visual observations by the Survey revealed no signs of system deficiencies. Based on site interviews, the system is dedicated exclusively to treating sewage and other domestic-type wastewater.

Source: EG&G Idaho, Inc., 1986a

SCHEMATIC OF THE LOFT LIQUID WASTE SYSTEMS

FIGURE 3-11

Process Wastewater: Process wastewater from TAN/LOFT is made up of chemical and cold wastes, low-level radioactive wastes which do not exceed concentration limits for uncontrolled surface pond disposal per DOE Order 5480.1A, and intermediate-level radioactive wastes that are transported to the ICPP for processing. The sources of this radioactive waste stream include primary component heat exchanger cooling water, low-pressure injection system pump cooling water, personnel changeroom showers, and miscellaneous floor drains and cooling water from small heat exchangers.

Nonradioactive chemical process wastewater includes boiler blowdown and chemical wastes from demineralizer and softener systems. The major constituents of these wastes are sodium chloride from the softening systems, sodium hydroxide and sulfuric acid from the demineralizer system, and miscellaneous inorganic salts from boiler blowdown. Small quantities of laboratory waste also contribute to the makeup of process wastewater. Typically, undefined small quantities of waste acid and carbon tetrachloride (200 mL/year) are the primary waste constituents.

Figure 3-11 shows the final disposition of process wastewater at the TAN/LOFT. The chemical wastes and the low-level radioactive wastes are discharged to an unlined disposal pond. Recycled cooling water, described as cold waste, also is disposed of at this pond.

Stormwater: Stormwater is channeled away from the TAN/LOFT complex by drainage ditches and usually percolates into the soil. However, a surface-water injection well is used for site drainage when surface soils become saturated. Stormwater, and, in particular, snowmelt, can act as a driving force to transport existing contaminants in the vadose zone both vertically and horizontally. This is particularly important in those areas where natural or man-made depressions tend to concentrate runoff. These issues are discussed in detail in Section 4.5.

TAN/IET

Currently the TAN/IET is an inactive site (Figure 2-7). The TAN/IET sanitary waste treatment facility consisted of a septic tank system (Facility 710) that chlorinated its

discharge, directed it through a sand filter, and subsequently discharged its effluent into the TAN/IET Injection Well (Facility 332).

Process wastes disposed of in the TAN/IET Injection Well during active operation included regenerant wastes from demineralizer processes. The injection well and the specific wastes disposed of in the injection well are discussed in Section 4.5.1.3.

TAN/WRRTF

Sanitary Wastewater: Only sanitary-related wastes are treated at the TAN/WRRTF sanitary treatment plant. Incoming flow is piped to a septic tank (Facility 737 in Figure 2-6), then through a sand filter, and into a percolation pond (Facility 762). The system is not operationally taxed, as only two or three staff members operate the TAN/WRRTF.

Process Wastewater: Since 1984, intermittent operations at this facility have produced domestic type wastewater and solutions bearing brine, sulfite, phosphates, and spent demineralizer effluent. These wastes have been discharged into the TAN/WRRTF percolation pond.

Stormwater: Stormwater is channeled away from the TAN/WRRTF by drainage ditches and percolates into the soil. Thus, stormwater and, in particular, snowmelt, can act as a driving force to transport existing contaminants in the vadose zone both vertically and horizontally. This is particularly important in those areas where natural or man-made depressions tend to concentrate runoff. These issues are discussed in detail in Section 4.5.

3.3.2.2. TRA

Sanitary Wastewater: Sanitary wastewater at the TRA flows by gravity into a collection manhole and subsequently to an Imhoff treatment tank (Facility 624 in Figure 2-9). Liquid-solids separation is accomplished within this unit prior to effluent discharge into a trickling filter. From the trickling filter, the sanitary waste stream passes through a chlorine contact chamber and finally into a leach pond, located east of Trout Street, where it percolates into the subsoil. Two leach ponds are available for disposal of sanitary wastes generated at the TRA. Usage of the ponds is alternated annually. Field interviews indicated that the central sanitary

facility is essentially dedicated to sanitary wastes but that some laboratory drain wastes may be diverted to the sanitary treatment facility.

Process Wastewater: Process wastewater such as cooling water and boiler water blowdown, as well as any other nonradiologically contaminated building waste streams, discharges into the cold-waste pond (Facility 702 in Figure 2-9). Other chemical wastes, such as spent demineralizer regenerants, are diverted to the chemical waste pond (Facility 701 in Figure 2-8).

Radiologically contaminated waste streams are divided into warm and hot liquid wastes. Hot wastes are stored in closed systems with ultimate disposal to the ICPP. The warm liquid radiological wastes, upon meeting pre-established concentration guidelines, are pumped to the warm-waste percolation pond (Facility 758 in Figure 2-9).

Stormwater: Stormwater is channeled away from the TRA Facility by drainage ditches and percolates into the soil. Thus, stormwater and, in particular, snowmelt, can act as a driving force to transport contaminants in the vadose zone both vertically and horizontally. This is particularly important in those areas where natural or man-made depressions tend to concentrate runoff. These issues are discussed in detail in Section 4.5.

3.3.2.3 CFA

Sanitary Wastewater: Sanitary wastewater is channeled to the primary sewage treatment/disposal facility (Facility 691 in Figure 2-10) within the CFA. In addition to sanitary wastewater, process wastewater such as once-through cooling water, boiler blowdown water, motor pool washwater, and various other maintenance shop wastewaters is discharged to the CFA main sewage treatment facilities. Laboratories such as the RESL, the Industrial Hygiene Laboratory, and the Environmental Chemistry Laboratories also discharge to the CFA Sewage Treatment Plant. These laboratory wastewaters possibly contain some hazardous or toxic constituents.

Inflow to the treatment plant from the aforementioned sources is first directed through a shredding device to minimize the effect of inorganic debris downstream

of the shredder. All system wastes from the CFA pass through the shredder and onto a screen-like mechanism for further removal of large filterable objects. After filtration, the sewage flows into a Dorr clarifier where up to 65 percent of the settleable solids and 40 percent of the biochemical oxygen demand (BOD) are removed (in these two processes up to 60 percent of the biological population is removed).

At this point, the partially clarified waste stream is directed toward a trickling filter (Facility 766) for further clarification while the sludge from the clarifier is directed to an anaerobic digester. The liquid effluent leaving the trickling filters is directed to a secondary Dorr clarifier prior to discharge. During the trickling filter process, approximately 70 to 90 percent of the remaining settleable solids and 65 to 95 percent of the remaining BOD load, 90 to 95 percent of the remaining bacterial count, and 50 percent of the remaining viruses are removed (EG&G Idaho, Inc., 1987b). Effluent from the main sewage plant at the CFA is discharged from the secondary clarifier to the lift station after chlorination. At the lift station, the sanitary waste stream is combined with the laundry and respirator washwaters, then subsequently pumped northeast a distance of between 650 and 1,000 feet to a drainfield. Once the CFA waste streams have reached the drainfield, the wastes percolate through the soils.

Process Wastewater: In addition to the once-through cooling water, boiler blowdown water, motor pool washwater, and other maintenance shop wastewaters described above, process wastewater at the CFA also includes the CFA laundry washwater. Generally, the CFA laundry washwater has low levels of radioactivity. If monitoring indicates that the radioactivity of the laundry washwater is below predetermined guidelines for radiological contamination, it is channeled to the Navy septic system through a concrete piping system. Like the sanitary and process waste streams described above, the final disposition of the radiologically acceptable laundry effluent is by subsurface drainage. This is accomplished by combining the laundry and sanitary wastewaters at a lift station and subsequently pumping the combined flow to a drainfield. However, if the washwater exceeds radiological contamination guidelines, the washwater system is designed to set off an alarm and shut down flow to the system. The washwater is then transported by truck to the ICPP for calcining.

Stormwater: Stormwater is channeled away from the CFA Facility by drainage ditches and percolates into the soil. Thus, stormwater and, in particular, snowmelt can act as a driving force to transport existing contaminants in the vadose zone both vertically and horizontally. This is particularly important in those areas where natural or man-made depressions tend to concentrate runoff. These issues are discussed in detail in Section 4.5.

3.3.2.4 RWMC

Sanitary Wastewater: Currently there are three sanitary disposal facilities within the RWMC boundaries. Sanitary waste streams at the RWMC are discharged into septic tanks and subsequently into drainfields. Ultimate disposal is through subsurface soil percolation. The sanitary systems are dedicated systems that process only lavatory and similar discharges from administrative support areas.

Process Wastewater: No process wastewaters are known to discharge onto site soils or into ponds within the complex.

Stormwater: From within the Subsurface Disposal Area (SDA) at the RWMC (Figure 2-11), heavy rainfall or snowmelt could cause stormwater runoff. This could be a pathway for the transport of radionuclides to off-site areas. However, the runoff water does not represent a hazard to on-site personnel or to the off-site population because the pathway is not connected with any potable water source (EG&G Idaho, Inc., 1986a).

Currently there is no evidence of radionuclide releases to surface waters migrating off the RWMC. A large drainage ditch, approximately 10 feet wide and 5 feet deep, has been constructed around the SDA perimeter. This ditch directs surface water/overland flow to one outfall point which has an automatic sampler. A sluice gate at the discharge point can be utilized to stop flow if necessary.

3.3.2.5 ARA

Sanitary Wastewater: Sanitary wastewater at the ARA-I site is generated by a staff of three people. The sanitary waste treatment system consists of a septic tank and

leach field. It is unknown if any waste other than sanitary waste or potable-quality water has been discharged to this treatment facility.

ARA-III is currently an inactive site. However, during operation the wastewater was treated in a septic system and drainfield. It is reported that between 1980 and 1983 small quantities of laboratory wastes were sent to this treatment system (EG&G Idaho, Inc., 1986a).

Process Wastewater: An evaporation pond in the southern end of ARA-I (Figure 2-12, Facility 745) receives process waste streams such as laboratory sink water. Visual observation indicates that the process water is piped to a ponding area and allowed to discharge onto the soils, with eventual subsurface infiltration taking place. The zone in which the water is discharged is marked as a "radiation zone." The pond itself was established in 1971 for disposal of various types of wastewater. Small quantities of suspected hazardous wastes from former laboratory operations are thought to have been discharged on this site. EG&G (EG&G Idaho, Inc., 1986a) reports that the contaminants identified as going to the site were below their respective reportable quantities, as identified in 40 CFR, Part 302. This pond has been identified by the INEL as a solid waste management unit (ARA-01) under the INEL Installation Assessment Reports as discussed in Section 4.1 of this report.

Until 1984 the ARA-III leach field (Facility 740 in Figure 2-14) received chemically contaminated liquid effluent. During the Survey, two waste lines were observed at this site, each discharging small amounts of liquid onto surface soils with subsequent evaporation or soil infiltration occurring. It was reported to the Survey that some of the wastewaters could be radioactive. Currently the RESL is profiling this leach field for chemical hazards.

Stormwater: Stormwater is channeled away from the ARA facilities by drainage ditches and percolates into the soil. Thus, stormwater and, in particular, snowmelt can act as a driving force to transport existing contaminants in the vadose zone both vertically and horizontally. This is particularly important in those areas where natural or man-made depressions tend to concentrate runoff. These issues are discussed in detail in Section 4.5.

3.3.2.6 PBF/SPERT/WERF

Sanitary Wastewater: The sanitary wastewater at the PBF Control Area (Figure 2-15) is discharged to three individual septic tank and drainfield systems (Facilities 724 and 735, 738 and 739, and 744 through 748). As the primary functions in this area are support-related, the wastes being processed through the sanitary treatment facilities are deemed to be nonhazardous by EG&G. The photographic laboratory within the PBF Control Area discharges its chemical wastes into the 601 sanitary system with the exception of its silver nitrate, which is collected and reprocessed.

Sanitary wastewaters generated within the PBF Reactor/SPERT-I Area are also treated with a septic tank and leaching bed arrangement (PBF-728, Figure 2-16). There are no signs of drainage problems with this system, as the surface soils associated with the system are dry.

Sanitary wastewater generated at PBF/SPERT-II, III, and IV is treated by a subsurface septic tank and leaching bed. They are Facilities 725 and 760 at PBF/SPERT-II (Figure 2-17), 726 and 754 at PBF/SPERT-III, and 727 and 757 at PBF/SPERT-IV. The systems are all exclusively for sanitary use and all systems except PBF/SPERT-III (WERF) appeared to be properly functioning, since the surface soils appeared dry. Some surface seepage near the WERF septic tank was noted during the Survey, indicating that the system was not draining properly.

Process Wastewater: Due to the non-process-related functions of the PBF Control Area, process wastewater generation does not take place.

Some process wastewaters are currently produced within the PBF Reactor Area, PBF/SPERT-I. Process cooling water for air compressors is discharged into site infiltration ditches and is considered nonhazardous. Process wastewater at the PBF Reactor site primarily results from the secondary loop cooling water that discharges into the Corrosive Waste Disposal Sump (Facility 731, Figure 2-16). In addition to the cooling water, demineralizer regenerant wastewater is also sent to this sump. Hazardous constituents are no longer a part of the reactor cooling water because of the elimination of chromate treatment for corrosion inhibition. A chemical profile

of the wastewater was performed by RESL and the wastewater was found to be nonhazardous.

The process wastewaters currently associated with SPERT-II include borated water, untreated process cooling water, and lavatory washwater. These effluents all discharge into the SPERT-II Leaching Pond, which is located within a fenced area to the south of the facility (Figure 2-17). The surface area upon which ponding occurs is minimal, covering between a 2-foot and 4-foot-diameter area. The majority of the flow enters the subsurface soils through percolation. During previous operations, corrosive liquids may have been discharged into the SPERT-II percolation pond from the discharge of un-neutralized demineralizer regenerant wastewater. The Leaching Pond has been identified by the INEL as an active solid waste management unit (PBF-16) under the INEL Installation Assessment Reports as discussed in Section 4.1 of this report.

Within the PBF/SPERT-III (WERF) area, a dry well is used for disposal of a small amount of waste brine solution being generated on this facility by a small sodium zeolite softening unit as well as for flushing water from the fire hydrant system. Based upon site interviews, no process effluent is discharged at the PBF/SPERT-III.

The process wastewater sources associated with SPERT-IV are primarily floor drain wastewater, boiler blowdown, and heater drainwater (condensate). The combined quantity of these wastewaters is minimal. Prior to their on-site discharge to the SPERT-IV Lake, these waste streams must collect inside a building sump.

Stormwater: Stormwater is channeled away from the PBF facilities by drainage ditches and percolates into the soil. Thus, stormwater and, in particular, snowmelt can act as a driving force to transport existing contaminants in the vadose zone both vertically and horizontally. This is particularly important in those areas where natural or man-made depressions tend to concentrate runoff. These issues are discussed in detail in Section 4.5.

3.3.2.7 ICPP

Sanitary Wastewater: The majority of sanitary wastes generated at the ICPP are treated at the central treatment facility, which is located in the northeastern corner

of the ICPP (Figure 2-20). However, the coal-fired power plant, located in the southeastern corner of the ICPP (Building 687), and some other facilities still remain tied to sanitary septic tank/drainfield systems (Figure 2-20). Approximately 30,000 gallons per day (gpd) of sanitary wastewater are processed through the central treatment facility. The system consists of two lift stations at opposite ends of the plant, each equipped with commutators designed to break down trash-like objects. The wastes are combined in an equalization basin near the head of the plant. From this point, the flow is directed into an aeration cell. The holding time for this process is 22 days. After the first aeration cell, the flow is channeled to a secondary aeration cell, which is identical to the first in design.

Upon completed aeration, the sanitary wastewater flow is directed into one or two quiescent settling ponds that have an 11-day retention time. Upon discharge from these settling ponds, the sanitary wastewater is directed into one of four infiltration beds outside the northeast fence that allows the treated water to percolate into the subsurface soils. Based upon information gathered by the Survey, there is no reason to suspect that any wastes other than sanitary are processed through the system.

Process Wastewater: All the ICPP process wastewater is piped via two lift stations (east and west) to one of two percolation ponds located immediately south of the facility. The percolation ponds were put into service to replace on-site injection wells. The ponds are essentially designed to allow for wastewater evaporation and subsurface infiltration. Influent to the pond appears clear and some wildlife inhabits this pond. Depth appears to vary. The pond is approximately 5.2×10^5 square feet in area. Discharge to the pond is between 1 and 2 million gallons per day (mgd) of influent. The primary constituents of the waste streams flowing into the percolation ponds are cooling water, demineralizer and softener backwash and spent regenerant streams, and the process equipment waste (PEW) stream. Other waste streams making up the service wastewater stream are boiler blowdown wastes and calciner wastewaters. These ponds have been designated by the INEL as solid waste management unit CPP-67 under the INEL Installation Assessment Reports as discussed in Section 4.1 of this report.

Stormwater: Stormwater drainage requirements are adequately being met on the western side of the ICPP with four, or possibly five, surface-water French drains. Two are located near the west main gate, one on the northwestern corner of

Building 663, and another northwest of Building 603 (Figure 2-20). The possible fifth surface-water French drain is northwest of Building 637. Surface drainage on the eastern side of the plant is channeled off the site through a culvert or ditch system. The ditch ends approximately 200 yards off-site in a shallow depression or catch basin. Stormwater percolates into the soil. Thus, stormwater and, in particular, snowmelt can act as a driving force to transport existing contaminants in the vadose zone both vertically and horizontally. This is particularly important in those areas where natural or man-made depressions tend to concentrate runoff. These issues are discussed in detail in Section 4.5.

3.3.2.8 ANL-W

Sanitary Wastewater: Sanitary wastewater at the ANL-W originates from lavatory, toilet, shower, and perhaps kitchen operations. There was no observed evidence of current or past cross-contamination of industrial wastes during the site Survey.

The main ANL-W sanitary system channels most of the sewage effluent into a central lift station (Facility 778 in Figure 2-21). The lift station's waste volume is controlled by a level control mechanism that initiates a pump that transfers the waste to a primary settling lagoon. Simultaneously with the sanitary transfer pump, an air-injector aerates the sanitary effluent as it leaves the lift station. After being transferred from the lift station, the sanitary stream is directed to a primary settling lagoon lined with bentonite. The primary lagoon acts as a quiescent settling zone, allowing for the microbiological degradation of sanitary wastes. From the primary settling basin, the flow is channeled to a secondary lagoon for further settling and biodegradation. The secondary lagoon is constructed of a bentonite-lined bottom and Hypalon sides. A third sanitary lagoon exists at this site but currently does not accept flow. It is intended to serve as an overflow. These three lagoons are located immediately northwest of the ANL facility (Figure 2-21). There were no visible signs of free-floating raw sewage or malodor emanating from this system.

The only active subsurface sewage treatment system is associated with the TREAT Reactor Building 720. The system is composed of a septic tank system (covered by asphalt) that flows to a drainfield. There were no signs of surface seepage to indicate system malfunction. The system receives only sanitary-type wastes.

Process Wastewater: Process wastewater primarily consists of once-through cooling water, boiler blowdown, EBR-II treatment plant water, cooling tower blowdown, and surface-water drainage. As observed during the Survey, two main open-drainage-ditch systems flow across the facility, one designated the North Loop and the other the South Loop. The North Loop drainage ditch primarily receives once-through cooling water from compressors, chillers, and furnaces. Additionally, water from a photographic laboratory, an analytical laboratory, and some surface-water runoff is serviced by this drainage ditch. The South Loop drainage system receives once-through cooling water, cooling tower water blowdown, auxiliary boiler blowdown water, and surface-water drainage. There are no known chemical treatments being applied to these once-through cooling waters that would chemically affect their makeup. Cooling tower blowdown water, however, is treated with phosphate-based corrosion inhibitors and the organic biocide Betz C-30, which contains methylene bis thiocyanate and dimethylformamide, described on site MSDSs as reproductive toxins.

The chemical constituents associated with the boiler water that discharge into the drainage ditch are sodium phosphate, sodium sulfite, and caustic soda. An additional product known as Liquamine is also used as a boiler condensate water treatment additive. As an amine, it is a volatile compound that may not show on a chemical profile of the industrial effluents. Its primary function is the elevation of condensate pH for the purpose of rendering it less corrosive. The final contributor of inorganic constituents to the ANL-W industrial waste stream is demineralizer regenerant wastewater. Prior to discharge into the drainage ditches, both acid and caustic regenerants are neutralized, thus negating the effects of corrosivity associated with demineralizer waste streams. The only waste streams discharging into the open drainage ditches that are known to have radioactivity are those associated with the EBR-II turbine condensate. Approximately 1,000,000 gallons/year of tritiated turbine condensate, having an average concentration value of 159 picocuries per liter (pCi/L), are discharged to the drainage ditches, with ultimate disposal at the industrial waste pond. Ambient tritium levels in the industrial waste pond have never exceeded detection limits of 3.3 pCi/mL (personal communication, B. Fritz, CH).

The final area of disposition for the industrial wastewater generated at ANL-W is the industrial waste pond, as shown on Figure 2-21. The pond is an unlined 3-acre evaporative percolation pond having a maximum depth of approximately 13 feet.

Data presented from a December 9, 1986, report by ANL-W, titled A Study of the Chemistry of Chromates in the ANL-W Industrial Waste Pond, indicate that cooling water and boiler blowdown from EBR-II operation are the primary constituents of industrial wastewater. The industrial waste pond also receives wastewaters which flow through the two main open-drainage-ditch systems described above.

Stormwater: Stormwater is channeled away from the ANL-W by drainage ditches and percolates into the soil. Thus, stormwater and, in particular, snowmelt can act as a driving force to transport existing contaminants in the vadose zone both horizontally and vertically. This is particularly important in those areas where natural or man-made depressions tend to concentrate runoff. These issues are discussed in detail in Section 4.5.

3.3.2.9 Other Facilities

Apart from the main facilities previously discussed, there are other on-site facilities which are of minor importance in relation to their impact upon sanitary and process wastewater and stormwater issues. The following discussion applies to these other facilities.

NODA

Current NODA activity is limited to an intermittent schedule of open pit burning of reactive/explosive materials. There are no known sanitary wastewater, process wastewater, or stormwater issues at this facility.

EBR/BORAX/ZPR-III

Sanitary Wastewater: The sanitary waste treatment system associated with the EBR-I facility consists of four separate septic tanks and associated drainfields. The systems are described as solely receiving sanitary influents such as lavatory wastewater. Based on visual observations, the systems showed no signs of malfunction. The sanitary waste treatment system at the BORAX Reactor area consists of a subsurface septic tank and drainfield arrangement. Because the BORAX area is used exclusively for storage, the system is seldom if ever operational. As with the EBR-I sanitary system, there is no reason to suspect system malfunction or that waste other than that of a sanitary nature would enter the system. The

sanitary waste treatment system of the Zero Power Reactor Number Three (ZPR-III) has been previously described within the context of the EBR-I system as being one of the four separate septic/drainfield systems for subsurface sewage disposal.

Process Wastewater: Currently there are no waste streams of any type being generated at the EBR-I facility. The facility serves as a public National Historic Monument. The BORAX Reactor Area associated with the EBR-I facility produces no process wastewater streams. The unit has been nonoperational for approximately 20 years. As with EBR-I and the BORAX facility, the ZPR-III produces no process waste streams.

Stormwater: Stormwater is channeled away from these facilities by drainage ditches and percolates into the soil. Thus, stormwater and, in particular, snowmelt can act as a driving force to transport existing contaminants in the vadose zone both horizontally and vertically. This is particularly important in those areas where natural or man-made depressions tend to concentrate runoff. These issues are discussed in detail in Section 4.5.

ARVFS

There are no known sanitary wastewater, process wastewater, or stormwater issues at this facility.

EOCR/OMRE

Sanitary Wastewater: Sanitary wastewater is usually discharged to a septic tank and leachfield. However, sanitary wastewater from this site bypasses the designed subsurface sewage disposal systems and discharges onto surface soil. Signs of raw sewage were observed by the Survey within a shallow pond approximately 200 yards east of the main EOCR complex. Only sanitary wastewater is disposed of in this septic field.

OMRE was decontaminated and decommissioned (D&D'd) in 1980 so no sanitary waste streams are generated. Although little information exists concerning the OMRE facility's sewage treatment system, it is believed to have been designed as a typical subsurface sanitary waste treatment system (i.e., a septic tank and

drainfield). Figure 2-24 indicates the existence of a septic tank on the EOCR/OMRE site. It is not known whether streams other than those of a sanitary nature were directed to this system during actual OMRE operation. There is no reason to suspect that the system served any purpose other than to process sanitary wastewaters.

Process Wastewater: Currently no known process wastewaters are being generated at the EOCR. All effluent from this site is of a sanitary nature. Because this facility never became operational, only minimal amounts of aqueous discharges were generated. The timeframe for the most recent generation of wastes was the late 1970s. The process wastewaters would probably have consisted of demineralizer regenerant waste streams that were ultimately discharged to a leaching pond, which is discussed in Section 4.5 of this report. Additionally, boiler blowdown water, most likely treated with sodium sulfite and sodium phosphate, would have been part of the process effluent.

Currently, there are no process waste streams being generated by OMRE operations since the site was D&D'd in 1980.

Stormwater: Stormwater is drained by drainage ditches and overland flow away from the EOCR/OMRE and percolates into the soil. Thus, stormwater and, in particular, snowmelt can act as a driving force to transport existing contaminants in the vadose zone both horizontally and vertically. This is particularly important in those areas where natural or man-made depressions tend to concentrate runoff. These issues are discussed in detail in Section 4.5.

LCCDA

There are no sanitary or process wastewaters generated at the LCCDA.

Stormwater: Stormwater is allowed to flow and seep into the ground without any form of channelization. Thus, stormwater and, in particular, snowmelt can act as a driving force to transport existing contaminants in the vadose zone both horizontally and vertically. This is particularly important in those areas where natural or man-made depressions tend to concentrate runoff. These issues are discussed in detail in Section 4.5.

IRC

Sanitary Wastewater: All sanitary wastes generated at this site are discharged to the municipal treatment plant of Idaho Falls.

Process Wastewater: As with the sanitary wastewater, all process waste streams are discharged to the municipal receiving authority. Prior to discharge to the municipal system, the process wastewater effluent must meet pH constraints between 5 and 9. An on-site sump with a pH sensor has an alarm to indicate when IRC effluent is 0.5 pH unit outside these constraints. If pH is outside this range, the wastewater is neutralized prior to discharge from this sump. Since this is a chemical laboratory, it is suspected that small amounts of waste laboratory chemicals are discharged and are the principal cause of any pH excursions in the waste stream.

Stormwater: Currently there are no known stormwater issues of concern relevant to the IRC. The runoff waters go through the City of Idaho Falls stormwater collection system.

3.3.3 Environmental Monitoring Program

The environmental monitoring programs for surface waters, drinking waters, and sanitary wastewaters within the INEL are performed by EG&G, WINCO, ANL-W, RESL, or USGS. Each contractor or agency is responsible for compliance with specific DOE regulations. The following information relating to the environmental monitoring program at the INEL has been generated from Survey interviews and field investigations. Additionally, a meeting was held on September 29, 1987, between contractors, agencies, and the Survey team, to present an overview of the monitoring programs at the INEL. From this meeting, it was learned that the various monitoring programs are not uniformly operated and can be quite complex. The following is a discussion of the sampling portion of the monitoring programs and some of the resulting data collected at the INEL for each of the site contractors or agencies. A discussion of the analytical portion of the environmental monitoring programs and the associated quality assurance appears in Section 4.4 of this report.

3.3.3.1 EG&G Environmental Monitoring Program

Drinking Water: EG&G personnel collect drinking water samples for all EG&G facilities. Drinking water sampling protocols, including chain-of-custody procedures, have been developed for bacteriological parameters and special organic and inorganic parameters, as required. During the Survey, team members did not observe an EG&G drinking water sampling event.

All functional EG&G facilities that consume production water for drinking purposes are monitored monthly for total coliform bacteria. Water samples are taken on a monthly basis at different point-of-use areas within each operating INEL facility. The samples are analyzed for coliform bacteria, usually by the EG&G Hygiene Laboratory.

On October 27, 1986, coliform bacterial contamination was found by the contractor in drinking water samples from three buildings at CFA, and the November 17 samples showed that the entire CFA water distribution system was slightly contaminated. The system was shut down on November 18. The underground water storage reservoir was drained for examination and found to be the source of the contamination. The entire system was chlorinated, the underground storage reservoir was bypassed, and all subsequent water usage was switched to an aboveground storage tank. Samples from December 2, 1986, showed no coliform bacteria present. Recommendations for permanent resolution of the problem were under consideration at the time of the Survey.

Chemical analysis for metals, pesticides, and volatile organics is conducted every 3 years on each EG&G production well, although groups of wells are analyzed on different 3-year cycles. If volatile organics are discovered, an organics scan is performed. Included for reference are representative analyses of the EG&G production wells reported in 1985 and 1987 (Tables 3-13 and 3-14, respectively). As shown on the tables, there was an exceedance of Maximum Contaminant Levels (MCL) for mercury at the TRA and for mercury and arsenic at EBR-I. Three subsequent samples were taken from both wells and retested. Those results indicated levels of mercury and arsenic below the respective MCL. However, the TRA well was shut down because of the one positive result. More testing will be conducted and the well will be reopened if all tests are negative.

TABLE 3-13

EG&G DRINKING WATER QUALITY DATA, 1985 (mg/L)

VCLs (mg/L)	Parameters	CFA-1 (CFA-642)	CFA-2 (CFA-653)	PBF-1 (PBF-602)	PBF-2 (PBF-614)	ARA-2 (ARA-601)	ARA-3 (ARA-611)	EBR-1 (WMO)	RWMC (WMF-603)	EG&G (Security)	OMRE	LOFT-1 (TAN-632)	LOFT-2 (TAN-639)	TAN-1 (TAN-612)	TAN-2 (TAN-613)	WRRIF (TAN-614)	TRA-1 (TRA-601)	TRA-3 (TRA-650)	TRA-4 (TRA-672)
	Inorganic																		
0.05	Arsenic	< 01	< 01	< 01	< 01	< 01	< 01			< 01	< 01	< 01			< 01				< 01
1	Barium	< 01	01	01	01	< 01	01			01	01	01			01				< 01
0.010	Cadmium	< 005	< 001	< 001	< 001	< 001	< 001			0017	< 001	< 001			< 001				< 001
0.05	Chromium	01	014	< 01	< 01	< 01	< 01			< 01	< 01	< 01			< 01				< 01
1.4-2.4	Fluoride	27	26	26	38	60	53			28	30	33			26				28
0.05	Lead	012	< 01	< 01	02	< 01	< 01			< 01	< 01	< 01			< 01				< 01
0.002	Mercury	< 0005	< 0005	< 0005	< 0005	< 0005	< 0005			< 0005	< 0005	< 0005			< 0005				< 0005
10	Nitrate (as N)	3.72	4.91	688	481	1.03	882			760	976	726			918				1.14
0.01	Selenium	< 005	< 005	< 005	< 005	< 005	< 005			< 005	< 005	< 005			< 005				< 005
0.05	Silver	< 001	< 001	< 001	< 001	< 001	< 001			< 001	< 001	< 001			< 001				< 001
0.2	Cyanide	< 005	< 005	< 005	< 005	< 005	< 005			< 005	< 005	< 005			< 005		< 005		< 005
	Pesticides																		
0.0002	Endrin	< 00002	< 00002	< 00002	< 00002	< 00002	< 00002			< 00002	< 00002	< 00002			< 00002				< 00002
0.004	Lindane	< 0004	< 0004	< 0004	< 0004	< 0004	< 0004			< 0004	< 0004	< 0004			< 0004				< 0004
0.1	Methoxychlor	< 01	< 01	< 01	< 01	< 01	< 01			< 01	< 01	< 01			< 01				< 01
0.005	Toxaphene	< 0005	< 0005	< 0005	< 0005	< 0005	< 0005			< 0005	< 0005	< 0005			< 0005				< 0005
0.1	2,4-D	< 01	< 01	< 01	< 01	< 01	< 01			< 01	< 01	< 01			< 01				< 01
0.01	2,4,5-TP Silvex	< 001	< 001	< 001	< 001	< 001	< 001			< 001	< 001	< 001			< 001				< 001
	Other Parameters																		
	Sodium									10.2									
0.005	Trichloroethylene															2.4 ppb			
	Tetrachloroethylene															4.6 ppb			
	Chloroform															3.9 ppb			

TABLE 3-14
EG&G DRINKING WATER QUALITY DATA, 1987 (mg/L)

MCLs (mg/L)	Parameters	CFA-1 (CFA-642)	CFA-2 (CFA-651)	PBF-1 (PBF-602)	PBF-2 (PBF-614)	ARA-2 (ARA-601)	ARA-3 (ARA-611)	EBR-1 (WMO)	RWMC (WMF-603)	EG&G (Security)	OMRE	LOFT-1 (TAN-632)	LOFT-2 (TAN-639)	TAN-1 (TAN-612)	TAN-2 (TAN-613)	WRRTF (TAN-644)	TRA-1 (TAN-601)	TRA-3 (TRA-650)	TRA-4 (TRA-672)
	Inorganic																		
0.05	Arsenic							0.80	< 0.05				< 0.05	< 0.05		0.07	< 0.05	< 0.05	
1	Barium							< 10	< 10				10	11		10	< 10	< 10	
0.010	Cadmium							0.06	< 0.01				< 0.01	< 0.01		< 0.01	< 0.01	< 0.01	
0.05	Chromium							0.1	0.1				< 0.1	< 0.1		< 0.1	< 0.1	< 0.1	
1.4-2.4	Fluoride							1.2	1.7				18	17		18	10	10	
0.05	Lead							< 0.05	< 0.05				< 0.05	< 0.05		< 0.05	< 0.05	< 0.05	
0.002	Mercury							0.042	< 0.05				< 0.005	0.008		0.006	0.01	0.11	
10	Nitrate (as N)							50	75				90	78		83	1.02	1.05	
0.01	Selenium							< 0.05	< 0.05				0.08	0.09		0.06	< 0.05	0.06	
0.05	Silver							< 0.05	< 0.05				< 0.05	< 0.05		< 0.05	< 0.05	< 0.05	
0.2	Cyanide							< 0.05	< 0.05				< 0.05	< 0.05		< 0.05	< 0.05	< 0.05	
	Pesticides																		
0.0002	Endrin							< 0.0002	< 0.0002				< 0.0002	< 0.0002		< 0.0002	< 0.0002	< 0.0002	
0.004	Lindane							< 0.004	< 0.004				< 0.004	< 0.004		< 0.004	< 0.004	< 0.004	
0.1	Methoxychlor							< 0.1	< 0.1				< 0.1	< 0.1		< 0.1	< 0.1	< 0.1	
0.005	Toxaphene							< 0.005	< 0.005				< 0.005	< 0.005		< 0.005	< 0.005	< 0.005	
0.1	2,4-D							< 0.1	< 0.1				< 0.1	< 0.1		< 0.1	< 0.1	< 0.1	
0.01	2,4,5-TP Silverx							< 0.01	< 0.01				< 0.01	< 0.01		< 0.01	< 0.01	< 0.01	

TABLE 3-14
EG&G DRINKING WATER QUALITY DATA, 1987 (mg/L) (Continued)

MCLs (mg/L)	Parameters	CFA-1 (CFA-642)	CFA-2 (CFA-651)	PBF-1 (PBF-607)	PBF-2 (PBF-614)	ARA-2 (ARA-601)	ARA-3 (ARA-611)	EBR-1 (WMO)	RWMC (WMF-603)	EG&G (Security)	OMRE	LOFT-1 (TAN-632)	LOFT-2 (TAN-639)	TAN-1 (TAN-612)	TAN-2 (TAN-613)	WRRIF (TAN-644)	TRA-1 (TAN-601)	TRA-3 (TRA-650)	TRA-4 (TRA-672)
	pp-DDE Pesticide								<3.0ppt								<3.0ppt		
	Other Parameters																		
	Sodium							11.0	18.0				15.0	6.5		15.0	16.0	11.0	
	Alkalinity							125.0	144.0				151.0	156.0		152.0	186.0	183.0	
	Conductivity							386.0	332.0				396.0	403.0		364.0	407.0	417.0	
	Corrosivity							0.2	0.2				0.0	+0.1		+0.2	+0.5	+0.4	
	pH							8.2	7.7				7.8	7.9		8.0	7.8	7.9	
	Calcium							27.5	44.9				52.2	56.8		50.4	53.9	56.4	
10	Trihalomethanes							<0.001	0.0016				<0.001	0.122		0.074	<0.001	<0.001	
	Dibromochloromethane													0.110		0.058			
	Chloroform								0.0016					0.012		0.016			
	Total Dissolved Solids							190.0	245.0				255.0	270.0		230.0	270.0	275.0	
	PCP							0.05ppb	0.4ppb										
0.005	Carbon tetrachloride													0.192ppb					

In 1987, testing encountered carbon tetrachloride in well TAN-1 at a level of 0.19 part per billion (ppb), which is below human health criteria of 0.4 ppb for a 10⁻⁶ cancer risk. In addition, concentrations of trihalomethanes were 12 percent of the MCL (Table 3-14) at this well. Supplementary sampling and analysis (not shown for 1987) indicated concentrations of trichloroethylene (TCE) ranging between about 5 ppb and 8 ppb and tetrachloroethylene at 3 ppb. The MCL for TCE in drinking water is 5.0 ppb. Further analysis is being conducted.

EG&G monitors gross alpha, gross beta, and tritium at most production wells on a monthly basis (RESL, 1987). The samples are analyzed by the RESL. When the activity levels are calculated into a yearly dose level as described in DOE Orders, all results fall below the published 4-mrem/year maximum dose guideline for a community drinking water supply as established by the U.S. Environmental Protection Agency (EPA).

Sanitary Wastewater: The sanitary wastewater monitoring program at EG&G facilities typically covers the CFA, TRA, ICPP, TAN, and WRRTF wastewater systems. Written protocols for sampling of radiological and nonradiological sanitary wastewater have not been developed. Typically the EG&G operators perform the following duties for monitoring the sanitary wastewater program. Each of the aforementioned plants is visited daily. Raw sewage and final effluent samples are collected for daily analysis of suspended solids and pH. On a weekly basis, grab samples are taken to monitor BOD reduction at EG&G facilities. With the exception of BOD samples collected at the ICPP, plant operators have these analyses performed at the CFA waste treatment facility since this facility has the appropriate laboratory equipment for these tests. The BOD analysis for the ICPP is performed at an ICPP laboratory.

Radiological monitoring for sanitary wastewaters is also conducted. For each operating treatment unit, with the exception of the ICPP, a composite sample consisting of daily aliquots is prepared and delivered to the TRA Radiation Measurements Laboratory for radioactive analysis. The ICPP performs its own radioactive analysis of its effluent sample. The results of effluent monitoring are summarized by month, facility, and radionuclide (EG&G, 1987e).

Other monitoring duties are in effect at EG&G's sewage treatment plants. For example, each facility must provide a quarterly effluent sampling for fecal coliform. Additionally, monthly treated effluent sampling for total suspended solids is required, as are monthly chlorine readings. The chlorine readings are taken directly before discharge to drainfields or percolation ponds at the CFA, TRA, and TAN (EG&G Idaho, Inc., 1987b). Based on a review of analytical data from 1986 and 1987, the quality of the discharges from the sanitary treatment facilities appeared to be within the expected ranges of adequately operating sanitary wastewater treatment plants.

Process Wastewater: EG&G personnel collect all process wastewater samples from EG&G facilities in accordance with written protocols, including chain-of-custody procedures as developed in EG&G's Standard Operating Procedures for Environmental Chemistry (EG&G Idaho, Inc., 1987c). The Survey team did not observe a field sampling event for process wastewater.

At least 18 different sampling points from effluents at the TRA, PBF, ARA, TAN, LOFT, WRRTF, CFA, IRC, Willow Creek Building (WCB) and Computer Science Center (CSC) are monitored quarterly. The normal parameters analyzed at these sites in 1987 are as follows:

Metals: Ag, As, Ba, Cd, Cr, Cu, Hg, Ni, Pb, Se, Tl, Zn

Anions: F⁻, Cl⁻, Br⁻, NO₃⁻, PO₄⁻, SO₄⁻

TSS - total suspended solids

TOX - total organic halogens, to be replaced with the DOE Organics Protocol

Table 3-15 summarizes the annual mean concentration ranges for most of the above-mentioned analytes found in the EG&G process waste streams in 1986 (EG&G Idaho, Inc., 1987d). Although currently there are no applicable regulatory standards for the INEL site wastewater effluents, some regulatory values are included in the table for purposes of comparison only, to provide a reference point for addressing environmental concerns. Although the inclusion of the regulatory comparison guidelines in the table does not imply that adherence to these guidelines is required, it can be seen that only sulfate exceeded any of the guidelines and that this exceedance was for a drinking water standard which is much more stringent than would be expected for a process wastewater.

TABLE 3-15

EG&G PROCESS WASTEWATER EFFLUENT DATA, FY 1986

Parameter	FY 1986 Annual Mean Range	Regulatory Comparative Guidelines
pH	5.9 - 8.5	2.0 - 12.5 ^a
Conductivity	34 - 3200 μ S ^b	NA ^c
TDS	20 - 2800 mg/L	NA
TOC	0.99 - 69 mg/L	NA
TOX	0.0024 - 0.17 mg/L	NA
F ⁻	0.19 - 3.6 mg/L	2.4 mg/L ^d
Cl ⁻	16 - 280 mg/L	250 mg/L ^e
NO ₃ ⁻	3.3 - 16 mg/L	44 mg/L ^f
PO ₄ ⁻³	<d.l. ^g - 38 mg/L	NA
SO ₄ ⁻²	45 - 2100 mg/L	250 mg/L ^e
Ag	<d.l. - 7.7 μ g/L	5000 μ g/L ^a
As	<d.l. - 180 μ g/L	1000 μ g/L ^a
Cd	<d.l. - 6.7 μ g/L	1000 μ g/L ^a
Cr	13 - 120 μ g/L	5000 μ g/L ^a
Ba	40 - 150 μ g/L	1,000,000 ^a
Hg	<d.l.	200 μ g/L ^a
Pb	<d.l. - 120 μ g/L	5000 μ g/L ^a
Se	<d.l.	1000 μ g/L ^a

Source: EG&G Idaho, Inc., 1987g

- a. 40 CFR 261
- b. microsiemen
- c. Not applicable
- d. EPA-440/5-86-001
- e. 40 CFR 143
- f. 40 CFR 141
- g. detection limits

3.3.3.2 WINCO Environmental Monitoring Program

Drinking Water: Bacteriological analysis is completed monthly for selected drinking water samples from the ICPP under the direction of EG&G's Industrial Hygiene Laboratory. As at other INEL locations, these analyses target coliform bacteria to indicate if any problems exist with microbial contamination. Results indicate that applicable regulatory standards are being met.

Drinking water is also radiologically monitored for alpha, beta, strontium-90, and tritium. The RESL performs these analyses. Results (RESL, 1987) indicate that the ICPP potable water supply meets applicable regulatory standards for a community drinking water supply. Concentrations of monitored parameters are at least one order of magnitude below the most restrictive drinking water standards.

Nonradiological analyses are performed monthly on the ICPP drinking water. Inorganic constituents, consisting of arsenic, barium, cadmium, chloride, chromium, lead, mercury, nitrate, selenium, and silver are monitored by the ICPP's Analytical Chemistry Group. To assess pesticide contamination, annual grab samples from the potable water wells are analyzed. A typical analysis for organic contaminants consists of TOC, endrin, lindane, methoxychlor, toxaphene 2,4-D, and 2,4,5-TP Silvex. These organic analyses are performed by the IRC. The chemistry parameters and data for WINCO drinking water are presented in Table 3-16. All results indicate that applicable regulatory standards are being met for a community drinking water supply (WINCO, 1986d). The ICPP also reports that the organic analyses are considered questionable due to analytical delays.

Sanitary Wastewater: Sanitary wastewater at the ICPP is sampled by EG&G personnel. Written protocols have not been developed for this sampling. During the Survey, no observations of a sanitary wastewater sampling event to determine adequacy of procedures were performed. The EG&G staff samples the raw sewage and treatment plant effluent daily and performs suspended solids, pH, and dissolved oxygen testing. The EG&G operators also prepare a 5-day composite to be used for a weekly analysis of BOD, pH, chlorine, and dissolved oxygen. These analyses are performed by the ICPP Analytical Chemistry Group. Other analyses for ICPP sewage effluent are a scan for gamma-emitting radionuclides on the weekly sample, and a monthly analysis for strontium-89 and 90 (performed by RESL). All

TABLE 3-16
WINCO NONRADIOLOGICAL POTABLE WATER WELL MONITORING DATA - 1986 (in mg/L)

Trace Metals	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Drinking Water Standards
Arsenic (As)	7E-03	<5E-03	<5E-03	<5E-03	<5E-03	<5E-03	<5E-03	<5E-03	<5E-03	<5E-03	<5E-03	<5E-03	5E-02
Barium (Ba)	1.4E-01	9.1E-02	8.9E-02	1.1E-01	8.8E-02	8.3E-02	8.7E-02	7.4E-02	8.1E-02	8.1E-02	7.9E-02	7.0E-02	1E+00
Cadmium (Cd)	<9E-03	<5E-03	<2.2E-03	1.4E-03	<1.5E-03	<2E-03	<2E-03	<1.7E-03	<1.8E-03	<1.8E-03	<2E-03	<3E-03	1E-02
Chromium (Cr)	2.0E-01	<1.0E-02	1.8E-02	8.5E-03	2.3E-03	2.2E-02	1.6E-02	6E-03	<2E-03	<2E-03	6E-03	5E-03	5.0E-02
Lead (Pb)	1E-02	1E-02	<2.3E-02	<2.4E-02	<1.6E-02	<3E-02	<2.9E-02	<1.6E-02	<1.6E-02	<1.6E-02	<2.8E-02	<3-02	5.0E-02
Mercury (Hg)	<5E-04	<5E-04	<5E-04	<5E-04	<5E-04	<5E-04	<5E-04	<5E-04	<5E-04	<5E-04	<5E-04	<5E-04	2.0E-03
Selenium (Se)	<2E-03	<2E-03	<2E-03	<2E-03	<2E-03	<2E-03	<2E-03	2E-03	<2E-03	<2E-03	2E-03	<2E-03	1.0E-02
Silver (Ag)	<8E-03	1.1E-02	<1.1E-03	<1E-03	1.7E-03	<8E-04	<1.3E-02	<1E-03	<1E-03	<1E-03	<1E-03	1E-03	5.0E-02

Organic Chemicals - February 1986	Drinking Water Standards
Endrin	2E-04
Lindane	4E-03
Toxaphene	5E-03
2,4-D (TBP)	1E-01
Methoxychlor	1E-01
2,4,5-TP Silvex (MIBK)	1E-02

Source: Idaho Chemical Processing Plant Environmental Monitoring Report, CY-1986

analyses indicate that wastewater discharged from the ICPP is within the Radioactivity Concentration Guides established by DOE Order 5480.1 (WINCO, 1986d).

WINCO reports in its 1986 Annual Effluent Report that the treatment efficiency of its sanitary treatment plant exceeds 90 percent, based on the results of its BOD testing in the daily effluent.

Process Wastewater: Water in the active percolation pond is sampled for radionuclide and heavy metal concentrations every 6 months. Additionally, RESL samples the water in the active percolation pond monthly for radionuclide concentrations. Currently, two stations are used to monitor the ICPP's waste flow to the percolation pond. One station monitors the East Side Service Waste system and the other monitors the West Side Service Waste system. Both systems converge before entering the pond. These stations provide continuous information relating to gamma activity associated with the ICPP effluent. Daily proportional samples from both monitors are collected and analyzed for gamma-emitting radionuclides. Other radiological contaminants are monitored by preparing monthly composites from these samples. For example, strontium-89 and 90, tritium, carbon-14, iodine-129, uranium-235 and 238, and plutonium-238, 239, and 240 are monitored monthly. Both gross alpha and beta values are also determined from the monthly composites. In general, the overall radioactivity associated with the percolation pond falls below the DOE Radioactivity Concentration Guides for release to the environment established by DOE Order 5480.1 (WINCO, 1986d).

The composite samples from the ICPP active percolation pond monitoring stations are also analyzed for arsenic, barium, cadmium, chloride, chromium, cyanide, fluoride, lead, mercury, nitrate, selenium, silver, sulfate, specific conductivity, total dissolved solids, and pH. The 1986 data indicate that all concentrations of trace metals were below regulatory release limits for the pond (WINCO, 1986d).

Triennially, an organic analysis is conducted on the ICPP effluents. Normally, TOC, endrin, lindane, methoxychlor, toxaphene, 2,4-D, and 2,4,5-TP Silvex concentrations are determined. As with the radioactive and inorganic contaminants, the concentrations of the organics are less than the regulatory release limits (WINCO,

1986d). However, the concentrations of organic materials are questionable due to analytical delays.

Sampling protocols have been developed for all process wastewater sampling events at the ICPP. However, sample protocols call for adding a preservative to metals samples after the sample is collected instead of before, as required by accepted sampling practice. A sampling event for wastewater was not observed by the Survey team.

3.3.3.3 ANL-W Environmental Monitoring Program

Drinking Water: On a monthly basis, the drinking water system (two site production water wells) at the ANL-W is monitored for coliform bacteria. Samples are drawn from various locations within ANL-W to help ensure that there are no stagnant lines harboring bacteria. It is the responsibility of ANL-W personnel to draw the drinking water sample. However, EG&G's Industrial Hygiene Laboratory performs the analysis. There was no indication of any bacteriological contamination within the ANL-W based upon site interviews. The Survey team did not observe a sampling event.

Annually, samples are drawn at the wellhead, primarily for a metals analysis. Arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver are the common metals monitored in the chemistry profile, while some anions, nitrate and cyanide for example, are also monitored. Once every 3 years, potable water is also analyzed for organic contamination. Table 3-17 presents the inorganic results for wells ANL-1 and ANL-2 for 1987 and the results of a pesticide screening for both wells.

In addition to the microbiological and chemical assessments of the production wells, drinking water is also monitored for radiological contamination. Monthly samples are procured by Plant Service personnel. It is their responsibility to not only take the sample, but also to ensure its delivery to the RESL for radiological analysis. The RESL routinely monitors drinking water for alpha, beta, and tritium concentrations. EPA community drinking water standards for the radiological parameters (RESL, 1987) were not exceeded in 1986.

TABLE 3-17

ANL-W PRODUCTION WELLS INORGANICS AND PESTICIDES - 1987

	ANL-1 Well (mg/L)	ANL-2 Well (mg/L)	Drinking Water Standards (mg/L)
Arsenic	<0.005	0.006	0.05
Barium	<0.10	<0.10	1.0
Cadmium	<0.001	0.005	0.01
Calcium	39.7	39.9	
Chromium	<0.01	<0.01	0.05
Lead	<0.005	<0.005	0.05
Mercury	0.0009	0.0010	0.002
Selenium	<0.005	<0.005	0.01
Silver	<0.005	<0.005	0.05
Sodium	18	20	-
Endrin	<0.00002	<0.00002	0.0002
Lindane	<0.0004	<0.0004	0.004
Methoxychlor	<0.01	<0.01	0.1
Toxaphene	<0.0005	<0.0005	0.005
2, 4-D	0.18 ppb	0.21 ppb	0.1
2, 4, 5-TP Silvex	<0.001	0.03 ppb	0.01
PCP	0.04 ppb	0.04 ppb	-
Dinoseb	0.01 ppb	not present	-

The ANL-W has no written protocols for sampling of drinking water.

Sanitary Wastewater: Sanitary wastes within the ANL-W are analyzed monthly for BOD, pH, dissolved oxygen, and suspended solids. Samples for these analyses are taken by ANL-W's Plant Service personnel and subsequently delivered to the ICPP for analysis. Typically, a pair of samples is taken to compare sanitary influent to final treated effluent. There are no written protocols for sampling dissolved oxygen, pH, or suspended solids. Written sampling protocols, however, are developed for BOD. During a sampling event, observed by Survey team members, samples were not preserved or cooled prior to shipment to the laboratory for analysis.

Radiologically, the sanitary wastes are monitored monthly for alpha, beta, and tritium concentrations. In addition to these parameters, plutonium concentrations are monitored twice per year.

Based on the general nature of the sanitary wastes (i.e., drinking water, cafeteria, personnel changerooms, and lavatory wastewater), the aforementioned parameters are not expected to exceed the DOE Order 5480.1 Radioactivity Concentration Guides. Data published in the 1985 Environmental Monitoring Report for Argonne National Laboratory-West indicate that the average alpha, beta, tritium, and plutonium concentrations found in the sanitary water are orders of magnitude below these guides. Additionally, other chemical analyses such as BOD, pH, and dissolved oxygen fall within the expected ranges of an adequately operating sewage treatment operation.

Process Wastewater: The industrial waste Pond at the ANL-W is sampled monthly. Plant Services personnel are required to draw the samples from the pond and deliver them to the site laboratory for analysis. The parameters normally monitored are total chromium, hexavalent chromium, pH, sulfate, phosphate, chloride, sodium, silver, and zinc. Pond water is also monitored for radioactivity. On a monthly basis, alpha, beta, and gamma scans are performed, and tritium concentrations are determined. Average concentrations do not exceed Radioactivity Concentration Guides established by DOE Order 5480.1 as reported in the 1985 Environmental Monitoring Report for Argonne National Laboratory-West.

Industrial waste pond water samples have been collected monthly April through October and analyzed for chemicals which are routinely used for EBR-II cooling water treatment. Analytical results for 1985, the most recent data available, are summarized in Table 3-18. Since this water is not used for human consumption, the Idaho water quality standards for stock and wildlife use are considered the most applicable standards. The data indicate that all chemical concentrations were below these regulatory levels.

Written sampling protocols for percolation pond water samples have been developed for some radionuclides and inorganics. There are no protocols for other process wastewater sampling. During a sampling event observed by the Survey team, preservatives were not added in the field and sample bottle rinsing procedures as developed in the ANL-W protocols for metals were not followed. Also, pH measurements were not performed in-situ.

3.3.3.4 RESL Monitoring Programs

All off-site water distribution system monitoring for radiological parameters is conducted by the RESL. This consists of 12 locations and includes water distribution systems at various towns in the INEL vicinity. These samples are collected semiannually and are analyzed for gross alpha, gross beta, and tritium. Off-site sampling locations are shown on Figure 3-12. The resulting data for 1986 (RESL, 1987) indicate that gross alpha activity was essentially undetectable at off-site locations and that beta concentrations approached the minimum detectable concentration level. Because of these low concentrations, it is difficult to draw any firm conclusions about the presence of radioactivity. The concentrations of tritium are below detectable limits. All measured concentrations of the three radiological parameters for 1986 were below EPA standards for community drinking water supplies.

A RESL sampling event was not observed during the Survey. During the field team's site sampling meeting, held on September 27, 1987, RESL personnel referenced an Environmental Sciences Branch document published in 1985. This document, the Operating Procedures Details Manual (RESL, 1985), outlines surface water sampling protocols that are to be followed. These protocols appear acceptable except for the omission of an acid preservation step for drinking water and aquifer monitoring.

TABLE 3-18
CHEMICAL ANALYSIS OF WATER FROM INDUSTRIAL WASTE POND (mg/L)

Chemical	Average Concentration	Range	Idaho Water Quality Standard (Based on California Quality Criteria for Stock and Wildlife Watering)
Chloride	30	24 - 37	1500
Total Chromium	<0.5	All values < 0.5	5
Hexavalent Chromium	<0.2	All values <0.2	5
pH (no units)	9.3	8.9 - 9.9	No standard
Phosphate Ion	2.9	1.5 - 4.3	No standard
Sodium Ion	68	50 - 95	2000
Sulfate Ion	273	190 - 347	500
Zinc Ion	<0.2	All values <0.2	50

Note: Industrial waste pond sampled monthly April through October

FIGURE 3-12 OFF-SITE SURFACE WATER AND GROUNDWATER SAMPLING LOCATIONS IN THE VICINITY OF THE INEL

This step is described in EPA sampling guidelines (40 CFR 136), which indicate that a nitric acid fixative with a pH adjustment to less than 2 is recommended for gross alpha and beta sampling.

3.3.4 Findings and Observations

3.3.4.1 Category I

None

3.3.4.2 Category II

1. TCE in a drinking water well at the TAN. Trichloroethylene (TCE) has been found in a drinking water well at the TAN in concentrations ranging between 5 ppb and 8 ppb, which exceeds the MCL of 5.0 ppb for community drinking water. Although the INEL is not a community drinking water supply, the Survey is using the MCL as a benchmark.

A comparison of TCE concentrations between 1985 and 1987 suggests that the concentration of this contaminant is increasing over time. In 1985, levels of approximately 2.5 ppb were identified in the TAN-1 well. Recent data show the TCE levels in this well to be between about 5 ppb and 8 ppb. The extent of contamination is not known at this time. The presence of this contamination is also reported in the findings in Section 3.4.4.3. The INEL is conducting further analyses to better define the problem. The Survey is also going to sample the production well at the TAN for a wide variety of organic and inorganic contaminants.

2. Discharge of sewage onto the surface from EOGR, WERF, and CFA. Sewage is discharging onto the ground surface from the EOGR, WERF, and CFA, resulting in a potential health hazard and soil contamination.

During the site Survey, it was observed that the sanitary effluent leaving the EOGR is either bypassing or short-circuiting the designated subsurface sanitary waste treatment system. The original design for sanitary waste handling at the EOGR is subsurface disposal through a septic tank and drainfield. The

distance from where the septic tank is thought to be located to where raw sewage is viewed as flowing onto the surface soil is estimated to be roughly 200 yards. The affected surface area at the EOCR where sewage is observed is approximately 10 feet in diameter. The liquid influent to this area is beginning to pond.

To a lesser degree than EOCR, the WERF is showing signs of a malfunctioning subsurface sewage treatment system. Directly above the area thought to be the WERF septic system, an area approximately 2 feet in diameter is being continuously wetted from subsurface sewage. At the CFA, a similar wet area exists near the junction of what are termed primary and secondary laterals that lead into the CFA drainfield.

Approximately 12 communicable diseases are sustained in humans by the pathogens that leave in the excreta of an infected person and find their way by water, food, or soil to another human being.

3.3.4.3 Category III

1. Discharge of radioactively contaminated laundry wastewater into the CFA drainfield. The CFA radioactively contaminated laundry wastewater is discharging into the CFA drainfield and may be concentrating in the subsurface soils and contaminating them with radionuclides. The increased radionuclide concentration could result in the potential for a more concentrated release of radionuclides to the groundwater than would otherwise be suspected from influent radionuclide monitoring.

The "hot" laundry facility discharges all its wastewater to the Navy septic system, bypassing the main CFA Sewage Treatment Plant. The main sanitary effluent and the laundry stream combine at a lift station that pumps both streams to a large drainfield. Flow to a drainfield is designed to saturate an area beneath the surface and percolate into the subsurface. Although the radionuclide levels are low in the discharge waters, the radionuclide discharges have been occurring since 1945 and are potentially concentrating in the subsurface soils beneath the drainfield. This buildup could now be

impacting the groundwater by a gradual release of concentrated radionuclides.

2. Potential transport of hazardous wastes from the RESL to the CFA Sewage Treatment Plant. The Sanitary Sewage Treatment Plant (STP) at CFA may be receiving hazardous inorganic and organic wastes from the RESL, thereby potentially releasing hazardous waste into the soil and groundwater and requiring the treatment plant to obtain a RCRA Part B permit.

During the site Survey, it was learned that the RESL analytical chemistry laboratories in Rooms 120 through 128 lacked waste containers to receive liquid chemical wastes. These liquid wastes, including organic and inorganic compounds such as waste acids and bases, digested samples, and organic nonflammables, are likely poured into laboratory sinks that connect to the CFA STP. The STP at the CFA does not have the capability to remove the numerous hazardous complex organics and toxic wastes from these laboratories. Thus, the contaminants may be transported from the STP into the lift station and finally into the drainfield. Although the hazardous waste concentrations are expected to be low in the STP effluent, the contaminants, if present, may be concentrating in the subsurface soils beneath the drainfield and moving toward the groundwater. Sampling and analysis on the soils beneath the drainfield will be conducted by the Survey to determine if the hazardous wastes are present.

3. Lack of inspection of the INEL aboveground and belowground piping systems. The integrity of the INEL underground piping, which carries inorganic, organic, and radiologically contaminated wastewater, is suspect and may be causing soil and potentially groundwater contamination.

With the exception of the TRA, the INEL has no program for the routine inspection and assessment of the underground piping system which carries, or may carry, potentially hazardous chemical and radioactive wastewater. The piping in question is that associated with process effluents and the pipelines leading to and from the percolation ponds, evaporation ponds, underground and aboveground tanks, and sanitary treatment plants and septic fields. The one program that does exist is associated with TRA and involves the

monitoring of radioactive wastewater between holding tanks to ensure that wastewater is not lost during transfer operations.

For transfer of radioactive wastewater, stainless steel piping is used and in many instances, it is cathodically protected. Additionally, some systems are constructed with coaxial piping that provides a double wall of protection against leaks. Although it is unlikely that piping failures would occur in stainless steel or coaxial piping, the possibility exists. If a leak did occur in a highly radioactive system, subsurface soils and potentially the groundwater could become contaminated.

For chemically contaminated or mixed wastewater, there were no underground pipeline inspection protocols identified to the Survey team. Since these pipelines tend to be old and have been constructed of many different types of materials, their integrity is of concern. A small leak from these lines could go unnoticed for years and could result in significant contamination of the soil and potentially the groundwater.

Additional findings regarding piping systems are found in Section 4.2.2.4 (Findings 5 and 6).

3.3.4.4 Category IV

1. Inadequate sampling protocols and procedures. Some inorganic and organic sampling procedures for drinking water, sanitary wastewater, and process wastewater at the INEL may be resulting in data of uncertain validity and defensibility.

During the Survey, environmental monitoring procedures were reviewed and sampling problems surfaced for EG&G, WINCO, ANL-W, and RESL. The problem areas are as follows:

EG&G

- No written sampling protocols for sanitary wastewater;

- pH samples are analyzed at the laboratory instead of in the field as required under the "Guidelines Establishing Test Procedures for the Analysis of Pollutants," 40 CFR 136;
- BOD and suspended solids samples are not cooled after collection as required in 40 CFR 136; and
- No written chain-of-custody procedures are in place for the collection of sanitary wastewater samples.

WINCO

- No written chain-of-custody procedures are developed for drinking water, sanitary wastewater, and process wastewater.

ANL-W

- No written sampling protocols exist for drinking water and sanitary wastewater;
- No written sampling protocols exist for process wastewater except for selected inorganic parameters from the percolation pond;
- Dissolved oxygen, suspended solids, chloride, and BOD sanitary wastewater samples are being sent to the CFA or the ICPP for analysis without cooling the samples or, in the case of pH and dissolved oxygen, sample analyses exceed the holding times as specified in 40 CFR 136;
- Process wastewater samples for metals analyses were not preserved in the field and sample water bottles were not rinsed in accordance with ANL-W sampling protocols and standard field sampling techniques; and
- No written chain-of-custody procedures are in place for collection of drinking water, sanitary wastewater, and process wastewater.

RESL

- No written chain-of-custody procedures are developed for the off-site water distribution system radiological sampling program.

PRELIMINARY

3.4 Hydrogeology

3.4.1 Background Environmental Information

3.4.1.1 Regional Geology

The INEL is located on the central-northern edge of the Eastern Snake River Plain (ESRP), approximately 30 miles northwest of the Snake River. The Snake River Plain is a semicircle-shaped basin, approximately 400 miles long and 30 to 70 miles wide (Figure 3-13). In general, the land drops from an elevation of about 6,500 feet mean sea level near the Idaho/Wyoming/Montana border to about 2,500 feet mean sea level near the Idaho/Oregon border. Mountains are located north and south of the plain, with the Snake River generally flowing along the entire southern boundary of the plain. The plain is divided into two sections, the ESRP and the Western Snake River Plain. The ESRP extends from the northeastern corner of Idaho near the Idaho/Wyoming border southwest approximately to Twin Falls, Idaho. The Western Snake River Plain extends from Twin Falls northwest toward the Idaho-Oregon border near Boise, Idaho. Since the Western Snake River Plain is different from the ESRP and has no bearing on the INEL, it will not be discussed further.

The formation of the ESRP began during the Middle Tertiary Age, about 15 million years ago. The plain is essentially a graben, downfaulted between two large blocks represented by the mountains to the north and south. As the mountainous areas to the north and south spread away from each other, the terrain between them dropped. Silicic volcanism occurred and lava flows filled large areas of the plain. During the final stages of silicic volcanism, large lava domes were formed, which have resulted in the buttes currently on the plain. Once this period of volcanism ended, the ground above the evacuated magma chambers collapsed and formed calderas that are many miles wide.

During and after this period of volcanism, large lakes were formed. These lakes resulted in thick accumulations of alluvial and lacustrine deposits throughout the plain. Subsequent eruptions and lava flows buried these deposits beneath hundreds of feet of lava.

Source: EG&G Idaho, Inc., 1986a

GEOLOGIC MAP OF SOUTHERN IDAHO

FIGURE 3-13

The end of the silicic stage of volcanism was followed by basaltic volcanism, which began about 400,000 years ago. The basalt lava flowed along and helped to fill depressions in the plain. Basaltic eruptions were concentrated along selected rift zones. Figure 3-14 presents four of these rift zones in the vicinity of the INEL. These basalt flows have continued most recently at Craters of the Moon National Monument, which was formed about 2,100 years ago and is located about 40 miles west of the INEL.

The lava flows formed layers of hard rock varying from 10 to 100 feet thick. During periods of volcanic activity, sediments transported by wind and water were deposited in depressions. The resulting stratigraphy is a complex sequence of interlocking flows, unconsolidated sediments, and breccia.

This period of basaltic volcanism resulted in the present condition of the Snake River Plain. Basaltic eruptions were greatest along the central axis of the plain. Lava from these eruptions raised the ground surface and effectively reduced the heights of the silicic lava domes to the present heights of the buttes.

The lava flows spread southward, forcing the Snake River to the southern boundary of the plain. Lava flows also spread northward and cut off the southward flow of the streams and rivers in the north. As the ground level rose too rapidly for these streams to cut channels toward the south, the water eventually ponded and sank into the ground. The basaltic activity has resulted in a ridge along the central axis of the Snake River Plain with a basin in the north. The INEL is located in this basin, which is referred to as the Pioneer Basin. The thickness of the lava flows beneath the INEL exceeds 10,000 feet in some areas. Due to a complete absence of recorded seismic activity on the Plain and the geologic conditions present, the Snake River Plain is considered geologically aseismic. Since the end of basaltic volcanism, surficial sediments up to 15 feet thick have been deposited by air and water.

North and west of the INEL are three mountain ranges: the Lost River and Lemhi Ranges to the west and the Beaverhead Mountains of the Bitterroot Range (Figure 3-13) to the north. Between these ranges flow Birch Creek and the Little Lost River, while the Big Lost River flows to the south of the Lost River Range (Figure 3-9).

INTERPRETED BOUNDARIES OF VOLCANIC RIFT ZONES IN THE VICINITY OF THE INEL FIGURE 3-14

All these streams initially flow southward toward the INEL. During the irrigation season, which extends from spring through fall, almost all the flow from the Big Lost River, the Little Lost River, and Birch Creek is used for irrigation before it reaches the INEL. However, during all but dry years, the flow from the latter two streams reaches playas near or on the INEL. The Big Lost River flows south until it enters the site, then is directed north by the central ridge of the Snake River Plain (described earlier) and sinks into terminal playas (Figure 3-9).

3.4.1.2 Hydrogeology

Potable groundwater for the INEL is obtained from the Snake River Plain aquifer. This aquifer is approximately 200 miles long and 30 to 60 miles wide and may contain more than 500 million acre-feet of recoverable water. Because of the volcanic history of the Snake River Plain, groundwater flows through fractures, fissures, pore spaces, and lava tubes in the basalt and the interbedded sediments. Consequently, local groundwater movement is extremely complicated. However, the overall flow direction within the aquifer is from the northeast to the southwest. Depth to the groundwater in the vicinity of the INEL ranges from 200 to 1,000 feet below the ground surface.

Recharge to the Snake River Plain aquifer amounts to about 9 million acre-feet/year and is primarily from rivers and streams draining the areas to the north-northwest and northeast of the Eastern Snake River Plain (USGS, 1984). Discharge from the aquifer consists of a similar amount and occurs at springs and rivers along the Snake River Canyon and from irrigation. Permeabilities of the surficial soil layer have been estimated to range from 10^{-3} centimeter per second (cm/sec) to 10^{-7} cm/sec. Permeability of the fractured basalt would range from greater than 10^4 cm/sec in an open fracture to less than 10^{-7} cm/sec in unfractured rock.

Based on limited data, it appears that the Snake River Plain aquifer consists of two layers of water separated by a low-permeability layer of sedimentary interbeds and altered and mineralized basalts. The upper layer is approximately 1,200 feet thick, including the unsaturated and saturated zones, and is highly permeable. The lower layer is entirely saturated, is about 8,500 feet thick, and is confined by the low-permeability layer such that upward gradients occur (Mann, 1986). Based on a mass balance of tritium disposal from INEL facilities, it was concluded that only the upper

250 feet of the aquifer system interacts with disposed radionuclide wastes (Schmalz, 1972). This lack of deep contamination in the aquifer by tritium can be explained by the small amount of recharge to the aquifer from the INEL area and the resultant limited extent of mixing of this recharge with the regional flow in the underlying aquifer. However, other contaminants with different specific gravities and different solubilities may behave differently.

Figure 3-15 presents the regional water table and inferred flow beneath the INEL, indicating a north-northeast to south-southwest direction. The average hydraulic gradient at the INEL is about 5 feet per mile while aquifer transmissivity ranges from 30,000 to 20 million gallons per day per foot (mgd/ft). Groundwater velocities have been estimated to range from 5 to 20 feet/day (EG&G Idaho, Inc., 1986a).

The only significant natural recharge to the aquifer on the INEL is the Big Lost River. However, small amounts of recharge occur from the Little Lost River, Birch Creek, Mud Lake, which is northeast of the INEL, and the Spreading Areas of the river diversion system near the RWMC. Table 3-19 presents the areas of the INEL that are affected by recharge from these various sources. Sources of artificial recharge to the aquifer include the INEL injection wells and percolation ponds which, until recently, returned about 1.3 billion gallons of water per year to the aquifer (EG&G Idaho, Inc., 1984b). However, injection wells are no longer used as a means of waste disposal at the INEL and recharge is slightly less due to evaporation from percolation ponds. The amount of precipitation which results in groundwater recharge from the INEL area is not known, but is expected to be very slight. Pan evaporation rates at the INEL are about 36 inches/year while rainfall is about 8 inches/year. However, most precipitation occurs during the period of the year when evaporation rates are lowest. It can be assumed that some recharge by precipitation will occur in basins that drain large areas after significant rainfall or snowmelt.

Perched water is present in scattered areas at the INEL. The perched layers result from three mechanisms. An initial perched layer can be present at the interface of the top sediments and the underlying basalt. This perched layer is the result of the fine material in the sediments being washed into the fractures in the basalt and greatly reducing the vertical permeability. Lower perched water zones are formed when water that is flowing downward in the basalt encounters lenses of buried

GENERALIZED ALTITUDE CONTOURS
ON THE REGIONAL WATER TABLE, AND
INFERRED DIRECTIONS OF GROUNDWATER FLOW IN
THE INEL AND VICINITY

FIGURE 3-15

TABLE 3-19

LOCAL SOURCES OF NATURAL WATER TABLE RECHARGE ON THE INEL

INEL Area	Local Water Table Recharge Areas
Central	Big Lost River.
Southwest Corner	Big Lost River. Spreading Areas A, B, C, D.
West	Big Lost River.
Southern Boundary	No major local recharge. Big Lost River has minor effect.
East	Mud Lake. Streams from the northeast. Minor effect from Big Lost River.
North	Birch Creek. Other area streams.

Source: EG&G Idaho, Inc., 1985

sediment deposited between lava flows. Due to the rapid change in permeability, water will be perched above and in the sediment layer. These perched zones result from minor amounts of downward percolation and frequently occur only after heavy precipitation or snowmelt. These first two perched zones also result from on-site disposal practices as discussed in the following paragraph. A final perched condition is that caused by recharge from the Big Lost River. This results in a fully saturated condition from the ground surface down to the phreatic surface of the Snake River Plain aquifer. Water from each of these perched conditions will eventually migrate down to the aquifer.

In general, the first two causes of perched water described above result in minor amounts of free water, but do cause saturated conditions. Perched saturated zones with very little free water have been encountered above sediment interbeds at the ANL-W (ANL-W, 1987) and RWMC sites, and are expected to be present elsewhere at the INEL. Exceptions occur in areas of major recharge from percolation ponds at facilities such as the TRA and the ICPP. At these locations, lenses of free water ranging from 30 feet to 150 feet deep have formed on top of sediment layers present within the basalt. The sources of this water are the six waste percolation ponds at the TRA, a seepage pit and two percolation ponds at the ICPP, and a failed casing of the injection well at the ICPP. Detailed descriptions of all these sources, except the injection well, are given in Section 4.1; the ICPP injection well is described in Section 4.5.

As reported previously, the Big Lost River is the most significant source of recharge to the groundwater on the INEL. The average flow of the Big Lost River below Mackay Dam (Figure 3-9) is 210,000 acre-feet/year, with peak annual flows approaching 400,000 acre-feet. The flow acts as recharge to the aquifer or is lost to evaporation/transpiration. Seasonal periods of high flow result in increases of 6 feet in the Snake River Plain aquifer water table in the vicinity of the Big Lost River. In addition, the water level in a well near the NRF rose nearly 21 feet over an 8-year period of high flow rates of the Big Lost River (ANL-W, 1987).

Storage and diversion areas on the Big Lost River include Mackay Dam, approximately 40 miles northwest of the point where the Big Lost River enters the INEL, several irrigation diversions west of the INEL, and the INEL flood diversion dam

and Spreading (Diversion) Areas west of the RWMC. This is discussed in detail in Section 3.3.

The presence of the Spreading (Diversion) Areas near the RWMC (Figure 3-16) has modified the local groundwater flow in this area. An extensive study (USGS, 1976) indicated the presence of a groundwater mound 5 to 10 feet high directly beneath Spreading Area A (Figure 3-16). Consequently, the groundwater will flow east from Spreading Area A toward the RWMC before being pushed southward by the regional groundwater flow. Figure 3-16 presents a map depicting this movement.

Twenty-four production wells supply water to the INEL from the Snake River Plain aquifer. The wells are located at the various contractor facilities and pump about 2 billion gallons per year, in total. This has been estimated to be less than 1 percent of the total flow of the aquifer beneath the INEL and less than 0.1 of the volume that surfaces as springs downgradient from the site (EG&G Idaho, Inc., 1986a).

The only domestic well within 2 miles of the site boundaries is at Atomic City. Atomic City is located along the southern INEL border and has a population of about 35 people. This well is located directly downgradient of ANL-W (Figure 3-15) and is monitored twice a year. The monitored parameters are listed in Section 3.4.3 under the USGS and RESL subsections.

3.4.2 General Description of Pollution Sources and Controls

3.4.2.1 Sources of Groundwater Pollution

Sources of groundwater pollution at the INEL consist of active and inactive waste disposal areas where the potential for contamination exists as a result of site operations. More than 300 known or potential sources of groundwater contamination exist at the INEL. The types of sources at the INEL of known or potential groundwater contamination include:

- Underground storage tanks
- Landfills
- Percolation ponds and ditches
- Inactive injection wells

Source: USGS, 1976

FIGURE 3-16
WATER TABLE CONTOURS OF THE SNAKE RIVER PLAIN AQUIFER AND
INFERRED DIRECTIONS OF GROUNDWATER MOVEMENTS IN
THE SOUTH-CENTRAL PART OF THE INEL

- French drains and dry wells
- Significant spills and leaks.

The potential sources of groundwater contamination from active and inactive sites at the INEL are summarized below and are described in detail in Sections 4.1 (Waste Management) and 4.5 (Inactive Waste Sites and Releases), respectively. Underground storage tanks are described in Section 4.2.

Underground Storage Tanks

The underground storage tanks (USTs) at the INEL generally contain either petroleum products or radioactive waste materials and have been constructed in the surficial alluvial soil layer at the INEL. Releases from these tanks would contaminate the adjacent soil. If the volume of release were sufficient, the contamination could extend through the fractured basalt down to the Snake River Plain aquifer. Although the depth to the aquifer is measured in hundreds of feet, the presence of open fractures and fissures in the basalt would facilitate the downward movement of the contamination.

Landfills

Landfills have been located at nearly every site at the INEL. In general, these sites have been operated as cut-and-fill or were developed in gravel pits or natural depressions. The landfills have received domestic garbage, construction debris, and a variety of liquids including solvents and waste oils. All the landfills have been unlined and the inactive landfills are presently covered with native topsoil and vegetated with grasses.

Although liquids have been disposed of in the landfills, the driving force for contamination toward the Snake River Plain aquifer would largely result from precipitation. While precipitation is minor at the INEL, it has been documented that in low areas, such as at the RWMC, rapid snowmelt has caused large volumes of water to form and rapidly percolate downward, drawing with it any contamination that may be present. Repeated cycles of snowmelt or heavy rainfall may result in contamination reaching the Snake River Plain aquifer.

Percolation Ponds and Ditches

Most of these units are between 3 and 10 feet deep, built directly into the surficial alluvial soil, and are unlined. They are open to the atmosphere and are wider or longer than they are deep. In general, the liquids they have received have been conveyed in ditches or through pipes and have then been retained and percolated into the soil or evaporated into the atmosphere. In discussions while at the INEL, USGS personnel estimated that the great majority of the wastewater received by the ponds would percolate downward toward the Snake River Plain aquifer, especially those ponds subjected to continual use such as at TRA, ICPP, and ANL-W. At units subjected to periodic use, such as infrequently used drainage ditches, the likelihood of contamination reaching the Snake River Plain aquifer is significantly less.

Inactive Injection Wells

Until 1983, injection wells were used at the INEL for disposal of liquid wastes. The conditions of underlying fractured basalt allowed rapid transmission of the wastes from the well into the subsurface.

In general, the wells were constructed by drilling a hole to a specified depth and inserting and telescoping smaller diameter steel casing through larger casing as the borehole progressed. Well screens were made in some of the well casings to allow liquid wastes to move into the surrounding subsurface environment. However, in some wells, wastes were injected into the subsurface directly through the open bottom of the well. Some of the wells, such as at TRA and ICPP, disposed of the wastes directly into the Snake River Plain aquifer. Others, such as at PBF, disposed of the wastes into the basalt above the aquifer. The liquid wastes then percolated downward to the aquifer.

French Drains and Dry Wells

French drains and dry wells have been used at all facilities at the INEL. These units are constructed in the surficial soil and have been used for the disposal of liquid wastes delivered in pipes or as overflow from tanks. The wastes may percolate through the surficial alluvial soil, to the fractured basalt and ultimately to the Snake River Plain aquifer if there is sufficient volume and driving force. The addition of rapid snowmelt would increase the likelihood of aquifer contamination.

Significant Spills and Leaks

Most spills have been the result of line and tank failures, leaking valves, and equipment and tank overfilling. They occurred on or just below the ground surface. Volumes ranged up to 45,000 gallons. Leaks of this size could potentially reach the Snake River Plain aquifer by their size alone. If these spills occurred in low areas, the addition of rapid snowmelt, if of sufficient volume, would increase the likelihood of aquifer contamination.

3.4.2.2 Controls of Groundwater Pollution

The INEL has an extensive waste management program, as discussed in Section 4.1, and wastewater treatment facilities, as discussed in Section 3.3, which prevent much of the waste generated at the INEL from reaching the groundwater.

The INEL is in the process of preparing closure plans for various waste disposal facilities, assessing soil and groundwater contamination, and evaluating closure options. As a result, groundwater controls (closure options) are being developed but implementation of the controls has not begun. Current programs for control of groundwater pollution include the use of a lined pond at PBF, waste minimization programs, and the use of labpacks for waste disposal. Details on these programs are discussed in Section 4.1.

Current disposal practices at the INEL have been documented to be contaminating the Snake River Plain aquifer, as discussed in Section 3.4.3.2. The level of contamination is a function of the release rates and the volume and velocity of flow of the Snake River Plain aquifer. Because programs assessing groundwater contamination of individual disposal sites have not been completed, the effects of the individual disposal sites on the aquifer have not been determined.

3.4.3 Environmental Monitoring Program

On-site groundwater monitoring and reporting has been conducted in a routine manner since 1949. This surveillance program has been continuously maintained to determine the concentrations of radionuclides in the environment of the INEL. The

scope of the Environmental Monitoring Program at the INEL has increased significantly during the years since plant startup. The types of wells sampled, the procedures for sampling, and the analytical procedures used in the laboratories are representative of these changes. Additionally, the National Environmental Policy Act (NEPA) and the Resource Conservation and Recovery Act (RCRA) have added further parameters and requirements to the monitoring program. Data are typically summarized in annual and quarterly reports prepared by the various site contractors, USGS, and RESL.

3.4.3.1 General Description of the Groundwater Monitoring Program

The groundwater monitoring program at the INEL is divided among five entities, EG&G, WINCO, ANL-W, RESL, and USGS. All the groups except the RESL monitor for inorganics, organics, and radionuclides. The RESL monitors only for radionuclides. Details of each groundwater monitoring program are discussed below and in Section 3.3.3.

EG&G monitors production wells at each of its facilities. These facilities are TAN, TRA, CFA, ARA, PBF/SPERT, EBR-I, EOCR, OMRE, and RWMC. The results of radiation monitoring of production wells are summarized in the quarterly and annual "INEL Site Environmental Monitoring Data" reports prepared by the RESL. Organic, inorganic, and bacteriological data are taken and kept on file by EG&G but are not published.

EG&G conducts special environmental monitoring programs at RWMC and prepares annual reports on each. One, entitled "Environmental Surveillance for the EG&G Idaho Radioactive Waste Management Areas at the Idaho National Engineering Laboratory," contains results of groundwater analysis near the RWMC. The second report, entitled "Subsurface Investigation Program at the Radioactive Waste Management Complex of the Idaho National Engineering Laboratory," contains information on the program to install shallow wells in the sediment interbeds beneath the RWMC and lysimeters placed in the surface soils of the site. Data from this study are currently being evaluated as the program is developing.

WINCO monitors production wells at the ICPP. Results of radiation monitoring are summarized in the RESL quarterly and annual reports and in the ICPP "Quarterly

Environmental Report." Results of inorganic and organic monitoring are presented in the ICRP "Annual Environmental Monitoring Report." The details of the WINCO environmental monitoring program for production wells are discussed in Section 3.3.

The ANL-W monitors production wells at the ANL-W. The results of radiation monitoring are summarized in the RESL quarterly and annual reports. Results of inorganic and organic monitoring are presented in the annual "Environmental Monitoring Report for Argonne National Laboratory-West." The details of the ANL-W environmental monitoring program for production wells are discussed in Section 3.3.

The RESL monitors 12 off-site water distribution systems for radionuclides, as discussed in Section 3.3. The off-site sampling locations are shown on Figure 3-12. The results are summarized in its annual report.

The USGS monitors over 130 on-site and off-site perched water and aquifer wells at the INEL. These include water quality monitoring wells and those contractor production wells located within known contaminant plumes. Water levels in the wells and various radiological and nonradiological components of the aquifer are monitored. The purpose is to determine whether INEL operations have caused changes to the general hydrologic conditions of the region. Results are reported every 3 to 5 years in update reports.

The type, frequency, and depth of USGS sampling generally depend on the information needed in a specific area. The program includes analyses for tritium, strontium-90, iodine-129, cobalt-60, chromium-51, cesium-137, and other gamma emitters, plutonium-238, plutonium-239/240, americium-241, specific conductance, sulfate, sodium, chloride, nitrate, and 19 of the more common inorganic parameters. Special studies are performed nearly every year for additional parameters. Data from 1985 to 1987 include metals analysis, iodine-129, and purgeable organics. The results of these studies are published once the reports have been suitably reviewed by USGS.

Additionally, the USGS has a water-table-level observation-well program to (1) determine changes in gradient that influence the rate and direction of

groundwater and radionuclide movement, (2) identify sources of recharge to the aquifer, and (3) measure the areal extent of recharge. Water levels are measured in both the regional aquifer and perched water bodies. Water levels are monitored continuously in 7 wells, monthly in 53 wells, and annually in 47 wells to study the regional water table. To study perched water bodies, 2 wells are monitored continuously, 39 are measured weekly, 27 are measured monthly, and 91 are measured annually.

3.4.3.2 Sampling Well Locations

In total, over 130 wells are monitored for water quality in and around the INEL. These wells consist of 39 wells monitoring perched water and approximately 95 wells monitoring the Snake River Plain aquifer. Included in this number are 24 production wells. Figures 3-17 and 3-18 present locations and monitoring frequency of monitoring wells from which water level measurements are taken at the INEL. The sampling locations and frequency of monitoring wells from which water samples are taken are shown in Figures 3-19 and 3-20 and are discussed in Section 3.4.3.7. The wells that monitor the aquifer have been located to monitor overall contamination of the aquifer but not contamination by individual waste disposal sites. The wells that monitor the perched water at the INEL have been located around percolation ponds at the ICPP (7 wells) and the TRA (30 wells). Ongoing additions to monitoring programs are continually increasing the number of monitored wells. In addition to the monitoring wells, eight surface-water runoff injection wells and nine inactive wastewater injection wells are at the INEL and are discussed in Sections 4.1 and 4.5. Three of these injection wells, which are no longer used for waste disposal except in emergencies, are used as monitoring wells by the USGS and are located at the TRA, the TAN/TSF, and the TAN/IET.

3.4.3.3 Well Construction

Wells at the site generally have been constructed using 6-inch- to 8-inch-diameter steel casing. The wells have been constructed with either an open borehole into the water table or a screened or perforated interval below the water table. This open section of the well usually extends from the water table surface and remains open for at least 50 feet and in some wells for over 200 feet. The great majority of the wells have been perforated after casing placement as opposed to having been

LOCATIONS OF WELLS AND THE FREQUENCY
OF WATER-LEVEL MEASUREMENTS AT
THE INEL AND VICINITY

FIGURE 3-17

LOCATIONS OF WELLS AND THE FREQUENCY
OF WATER-LEVEL MEASUREMENTS IN
THE TRA-ICPP AREA

FIGURE 3-18

LOCATIONS AND FREQUENCY OF WATER-SAMPLE COLLECTIONS AT THE INEL AND VICINITY

FIGURE 3-19

LOCATIONS AND FREQUENCY OF WATER-SAMPLE COLLECTIONS IN THE TRA-ICPP AREA

FIGURE 3-20

installed with screens. Except for a few well installations in recent years, most wells have no annular seal outside the casing. However, wells monitoring the aquifer which penetrate perched water have had the annular spaces sealed to minimize migration of perched water into the aquifer.

A complete inventory of installation reports for wells is maintained by the USGS. Virtually every well installed at the INEL has an installation record, and geophysical logging has been performed on many of them. However, specifics on the finer construction details are often lacking. Plans and specifications for the installation of monitoring wells are changing in order to comply with RCRA requirements. Closure plans, groundwater monitoring plans, and monitoring analysis and testing plans are being prepared for the disposal sites at the INEL. These plans include well designs which will satisfy RCRA requirements.

3.4.3.4 Sampling Frequency

Groundwater sampling frequency and monitored parameters vary considerably for the different programs and contractors and government agencies at the INEL. This is a result of having the different groups respond to their individual program requirements. The major sampling programs and the associated responsible groups are listed below.

<u>Sampling Program</u>	<u>Responsible Group</u>
Site-wide groundwater monitoring	USGS
Perched water monitoring	USGS
Potable water monitoring at ICPP	WINCO
Potable water monitoring at ANL-W	ANL-W
Potable water monitoring at EG&G sites	EG&G
Off-site water distribution system monitoring	RESL
Wet and dry wells at ICPP tank farm	WINCO

A general summary of the number of wells sampled by each group and the frequency are included in Table 3-20. It should be noted that some of the wells are sampled by more than one group and that different parameters are sampled with different frequency. Thus, the number of wells sampled at the various frequencies may not equal the total number of wells sampled. This summary is intended to cover only the major programs currently in place and is not intended to be all-inclusive.

TABLE 3-20

**FREQUENCY AND NUMBER OF WELLS SAMPLED FOR MAJOR PROGRAMS BY
INEL CONTRACTORS, RESL, AND USGS**

Sampler	Sampling Frequency							
	3 Years	Annually	Semi-annually	Quarterly	Monthly	Periodically	Continuously	Weekly
USGS ^a	-	1	80	45	-	-	-	-
WINCO ^a	-	3	-	-	3	44	-	-
ANL-W ^a	2	2	-	-	2	-	-	-
EG&G ^a	18	-	-	-	18	-	-	-
RESL ^a	-	-	12	-	-	-	-	-
USGS-1 ^b	-	47	-	-	53	-	7	-
USGS-2 ^c	-	91	-	-	27	-	2	39

^a denotes chemical contamination monitoring

^b USGS-1 denotes regional water level monitoring

^c USGS-2 denotes perched water level monitoring

3.4.3.5 Monitoring Parameters

As noted in the previous section, there are a number of major sampling programs at the INEL. Since each program usually has a specific goal, the groundwater analytical parameters selected by each program vary based on the goal. In addition, analytical parameters monitored at various wells within the USGS program vary based on well location. Table 3-21 presents a summary of the major sampling programs and the associated parameters. Specific lists of all monitored parameters are included in the referenced tables.

Until recently, the primary emphasis of the monitoring program has been to analyze groundwater samples for radionuclides and water levels. However, the individual contractors are now including limited organic and inorganic analyses in the programs. Last year the USGS began collecting groundwater samples for metals analysis and purgeable organics. Results of these studies were pending at the time of the Survey. The USGS also plans to sample wells for semi-volatiles in 1988. Additional parameters are monitored every 2 to 5 years by the USGS and the results are summarized in periodic update reports prepared by the USGS. A list of these additional parameters is presented in Table 3-27. A discussion of the specific parameters and programs that are conducted at each site or by contractor is included in Section 3.4.3.7. Since the sampling programs and monitored parameters have been modified over time, a listing of the years of record for data from each well would result in confusion. However, all of the wells on the INEL, except 30 (those numbered USGS 86 and above), have been in operation since 1962 or before.

3.4.3.6 Sampling Procedures

Sampling of wells at the INEL is done by the various contractor, RESL, or USGS personnel. EG&G, WINCO, and ANL-W each sample their own production wells. Sampling procedures are discussed in Section 3.3. The RESL samples water distribution systems of off-site water supply systems. All samples are collected at the production wellhead tap. USGS samples on-site and off-site water quality monitoring wells and those production wells located in contaminant plumes. In some cases the analyzing laboratory may be the site contractor; in other cases it may be an outside laboratory.

TABLE 3-21

SUMMARY OF MONITORED PARAMETERS FOR MAJOR SAMPLING PROGRAMS

Contractor	Approx. Number of Parameters Monitored	Primary Types of Parameter	List of All Parameters
USGS	3-10	Inorganics, radionuclides	Table 3-22
WINCO	18	Inorganics, organics, radionuclides	Table 3-23
ANL-W	14	Inorganics, organics, radionuclides	Table 3-24
EG&G	29	Inorganics, organics, radionuclides	Table 3-25
RESL	3	Radionuclides	Table 3-26
USGS	1	Water levels	

TABLE 3-22
LIST OF TYPICAL USGS GROUNDWATER PARAMETERS AND SAMPLING FREQUENCY AT THE INEL

Well No.	Method	Freq.	Analysis Type (See Code)			
			January	April	July	October
Atomic City*	Tap	S		1		1 + Na
Badging Facility Well*	Pump	S		1		1 + Na + NO ₃
Cerro Grande*	Thief-560'	S		4		4 + Na
CFA #1*	Pump	Q	2 + Na	3 + Na	2 + Na	3 + Na + NO ₃
CFA #2*	Pump	Q	2 + Na	3 + Na	2 + Na	3 + Na + NO ₃
CPP #1*	Pump	Q	6 + Na	6 + Na	6 + Na	6 + Na + NO ₃
CPP #2*	Pump	Q	6 + Na	6 + Na	6 + Na	6 + Na + NO ₃
CPP #4*	Pump	Q	6 + Na	6 + Na	6 + Na	6 + Na + NO ₃
CWP 1 Perched Water	K-Pump	S		2		2
CWP 2 Perched Water	K-Pump	S		2		2
CWP 3 Perched Water	K-Pump	S		2		2
CWP 4 Perched Water	K-Pump	S		2		2
CWP 5 Perched Water	K-Pump	S		2		2
CWP 6 Perched Water	K-Pump	S		2		2
CWP 7 Perched Water	K-Pump	S		2		2
CWP 8 Perched Water	K-Pump	S		2		2
EBR-1*	Pump	S		1		1 + Na + NO ₃
Fire Station #2*	Pump	Q	2	2	2	2 + Na + NO ₃
Highway #3*	Tap	S		1		1 + Na + NO ₃
Leo Rogers Well*	Pump	A			4 + Na	
MTR Test*	Pump	S		2 + Na		2 + Na + NO ₃
OMRE*	Pump	S		1		1 + Na + NO ₃
P&W #2	Pump	S		1		1
PW-1 Perched Water	K-Pump @ 105'	Q	3	5	3	3 + Na
PW-2 Perched Water	K-Pump @ 115'	Q	3	5	3	3 + Na
PW-3 Perched Water	K-Pump @ 121'	Q	3	5	3	3 + Na
PW-4 Perched Water	K-Pump @ 115'	Q	3	5	3	3 + Na
PW-5 Perched Water	K-Pump @ 115'	Q	3	5	3	3 + Na

TABLE 3-22
LIST OF TYPICAL USGS GROUNDWATER PARAMETERS AND SAMPLING FREQUENCY AT
THE INEL (Continued)

Well No.	Method	Freq.	Analysis Type (See Code)			
			January	April	July	October
PW-6 Perched Water	K-Pump @ 130'	Q	3	5	3	3 + Na
PW-7 Perched Water	K-Pump @ 220'	Q	2	9	2	2 + Na
PW-8 Perched Water	K-Pump @ 145'	Q	2	9	2	2 + Na
PW-9 Perched Water	K-Pump @ 195'	Q	2	9	2	2 + Na
RWMC Production*	Pump	Q	3	8	3	9 + Na + NO ₃
Site #9	Thief - 700'	S		1		1 + Na + NO ₃
Site #19	Pump	S		2		2 + Na
SPERT*	Pump	S		1		1 + Na + NO ₃
SWP 8 (A) Perched Water	Bailer	S		5		5 + Na + NO ₃
SWP 13 (A) Perched Water	Bailer	S		5		5 + Na + NO ₃
TRA #1*	Pump	S		2		2 + Na
TRA #3*	Pump	S		2		2 + Na
TRA #4*	Pump	S		2		2 + Na
TRA A-13 Perched Water	Bailer	Q	2	9	2	9 + Na
TRA A-77 Perched Water	Bailer	Q	2	9	2	9 + Na
TRA Disp.	Pump	Q	9	9	9	9 + Na + NO ₃
Water Supply for INEL-1	Pump	S		2		2 + Na
USGS #8	Thief - 790'	S		4		4
USGS #9	Pump	S		1		1 + Na
USGS #11	Thief - 690'	S		4		4
USGS #13	Thief - 1,000'	S		4		4
USGS #14	Thief - 740'	S		4		4
USGS #19	Thief - 295'	S		1		1
USGS #20	Thief - 530'	S		3		3 + Na + NO ₃
USGS #22	Thief - 640'	S		1		1 + Na

TABLE 3-22
LIST OF TYPICAL USGS GROUNDWATER PARAMETERS AND SAMPLING FREQUENCY AT
THE INEL (Continued)

Well No.	Method	Freq.	Analysis Type (See Code)			
			January	April	July	October
USGS #27	Thief - 255'	S		1		1
USGS #34	Thief - 580'	S		3		3 + Na + NO ₃
USGS #35	Thief - 520'	S		3		3 + Na + NO ₃
USGS #36	Thief - 540'	S		3		3 + Na + NO ₃
USGS #37	Pump	Q	3	3	3	3 + Na + NO ₃ + Pu
USGS #38	Thief - 540'	S		3		3 + Na + NO ₃
USGS #39	Thief - 500'	S		3		3 + Na + NO ₃
USGS #40	Pump	Q	5 + Pu	5 + Pu	5 + Pu	5 + Na + NO ₃ + Pu
USGS #41	Thief - 500'	S		3		3 + Na + NO ₃
USGS #42	Thief - 500'	S		3		3 + Na + NO ₃
USGS #43	Pump	S		5		5 + Na + NO ₃ + Pu
USGS #44	Thief - 500'	S		5		5 + Na + NO ₃
USGS #45	Thief - 500'	S		3		3 + Na + NO ₃
USGS #46	Thief - 500'	S		5		5 + Na + NO ₃
USGS #47	Pump	Q	5	5	5	5 + Na + NO ₃ + Pu
USGS #48	Thief - 520'	S		3		3 + Na + NO ₃
USGS #49 (partially filled)	Bailer - 460'	S		3		3 + Na + NO ₃
USGS #50 Perched Water	Thief - 390'	Q	5	5	5	5 + Na + NO ₃
USGS #51	Thief - 500'	S		3		3 + Na + NO ₃
USGS #52	Thief - 500'	S		3		3 + Na + NO ₃
USGS #53 Perched Water	K-P 'mp @ 80'	S		9		2 + Na
USGS #54 Perched Water	K-Pump @ 80'	Q	2	9	2	2 + Na

TABLE 3-22
LIST OF TYPICAL USGS GROUNDWATER PARAMETERS AND SAMPLING FREQUENCY AT
THE INEL (Continued)

Well No.	Method	Freq.	Analysis Type (See Code)			
			January	April	July	October
USGS #55 Perched Water	K-Pump @ 75'	S		9		2 + Na
USGS #56 Perched Water	K-Pump @ 75'	S		9		2 + Na
USGS #57	Thief - 550'	S	3	3	3	3 + Na + NO ₃
USGS #58	Pump	S		9		2 + Na + NO ₃
USGS #59	Thief - 500'	S		3		3 + Na + NO ₃
USGS #60 Perched Water	K-Pump @ 90'	Q	2	9	2	2 + Na
USGS #61 Perched Water	K-Pump @ 105'	S		9		2 + Na
USGS #62 Perched Water	K-Pump @ 150'	S		9		2 + Na
USGS #63 Perched Water	K-Pump @ 95'	S		9		2 + Na
USGS #65	Pump	Q	7	7 + Na	7	7 + Na + NO ₃
USGS #66 Perched Water	S-Pump < 185' Thief > 185'	S		9		2 + Na
USGS #67	Pump	S		3		3 + Na + NO ₃
USGS #68 Perched Water	K-Pump @ 85'	Q	2	9	2	2 + Na
USGS #69 Perched Water	K-Pump @ 100'	S		9		2 + Na
USGS #70 Perched Water	K-Pump @ 85'	S		9		2 + Na
USGS #71 Perched Water	S-Pump @ 170'	S		9		2 + Na
USGS #72 Perched Water	S-Pump < 150' Thief > 150'	S		9		2
USGS #73 Perched Water	K-Pump @ 100'	S		9		2 + Na
USGS #74 Perched Water	Thief - 190'	S		9		2 + Na

TABLE 3-22
LIST OF TYPICAL USGS GROUNDWATER PARAMETERS AND SAMPLING FREQUENCY AT
THE INEL (Continued)

Well No.	Method	Freq.	Analysis Type (See Code)			
			January	April	July	October
USGS #76	Pump	Q	7	7	7	7 + Na + NO ₃
USGS #77	Thief - 540'	S		3		3 + Na + NO ₃
USGS #79	Thief - 550'	S		2		2 + Na
USGS #82	Thief - 500'	S		3		3 + Na + NO ₃
USGS #83	Pump	S		1		1 + Na + NO ₃
USGS #84	Bailer - 490'	S		2		2 + Na
USGS #85	Thief - 570'	S		3		3 + Na + NO ₃
USGS #86	Pump	S		1		1
USGS #87	Pump	Q	3	8	3	8 + Na + NO ₃
USGS #88	Pump	Q	3	8	3	8 + Na + NO ₃
USGS #89	Pump	Q	3	8	3	8 + Na + NO ₃
USGS #90	Pump	Q	3	8	3	8 + Na + NO ₃
USGS #92 Perched Water	Bailer - 213'	S		8		8
USGS #97	Pump	Q	2	2	2	2 + Na + NO ₃
USGS #98	Pump	Q	2	2	2	2 + Na
USGS #99	Pump	Q	2	2	2	2 + Na
USGS #100	Pump	Q	2	2	2	2 + Na
USGS #101	Pump	S		2		2 + Na
USGS #103	Pump	Q	1	1	1	1 + Na
USGS #104	Pump	Q	1	1	1	1 + Na + NO ₃
USGS #105	Pump	S		1		1 + Na
USGS #106	Pump	Q	1	1	1	1 + Na
USGS #107	Pump	S		1		1 + Na + NO ₃
USGS #108	Pump	S		1		1 + Na
USGS #109	Pump	S		1		1 + Na
USGS #110	Pump	S		1		1 + Na

TABLE 3-22
LIST OF TYPICAL USGS GROUNDWATER PARAMETERS AND SAMPLING FREQUENCY AT
THE INEL (Continued)

Well No.	Method	Freq.	Analysis Type (See Code)			
			January	April	July	October
USGS #111	Pump	Q	3	3	3	3 + Na + NO ₃
USGS #112	Pump	Q	3	3	3	3 + Na + NO ₃
USGS #113	Pump	Q	3	3	3	3 + Na + NO ₃
USGS #114	Pump	Q	3	3	3	3 + Na + NO ₃
USGS #115	Pump	Q	3	3	3	3 + Na + NO ₃
USGS #116	Pump	Q	3	3	3	3 + Na + NO ₃

Analysis Type No.

1 - 3H, Sp.C., Cl

2 - 3H, Sp.C., Cl, Cr^t

3 - 3H, 90Sr, Cl, Sp.C.

4 - 3H, Sp.C., Cl, γ Spec, B, α

5 - 3H, 90Sr, Sp.C., Cl, γ Spec

6 - 3H, 90Sr, Sp.C., Cl, Cr^t

7 - 3H, 90Sr, Sp.C., Cl, Cr^t, γ Spec

8 - RWMC list - 3H, 90Sr, 238Pu, 239-240Pu, 241Am, Sp.C, Cl, γ Spec.

9 - 3H, Sp.C., Cl, Cr^t, γ Spec.

* Denotes production well.

S = Semiannually

Q = Quarterly

A = Annually

CWP = Cold Waste Pond

MTK = Materials Testing Reactor

OMRE = Organic Material Reactor Experiment

P&W = Philips and Wilson

PW = Perched Water

SWP = Surface Waste Pond

TABLE 3-23

LIST OF TYPICAL WINCO GROUNDWATER PARAMETERS
AND SAMPLING FREQUENCY AT THE INEL

Parameter	Frequency	Parameter	Frequency
Arsenic	Monthly	Endrin	Annually
Barium	Monthly	Lindane	Annually
Cadmium	Monthly	Toxaphene	Annually
Chromium	Monthly	2, 4-D (TBP)	Annually
Lead	Monthly	Methoxychlor	Annually
Mercury	Monthly	2, 4, 5-TP Silvex	Annually
Selenium	Monthly	Gross Alpha	Monthly
Silver	Monthly	Gross Beta	Monthly
		Tritium	Monthly
		Strontium -90	Monthly
		Gamma Scan	As Necessary
		Bacteriological	Monthly

TABLE 3-24

LIST OF TYPICAL ANL-W GROUNDWATER PARAMETERS
AND SAMPLING FREQUENCY AT THE INEL

Parameter	Frequency	Parameter	Frequency
Arsenic	Annually	2, 4, 5-TP Silvex	Every 3 Years
Barium	Annually	Selenium	Annually
Cadmium	Annually	Silver	Annually
Chromium	Annually	Gross Alpha	Monthly
Lead	Annually	Gross Beta	Monthly
Calcium	Annually	Tritium	Monthly
Sodium	Annually	Bacteriological	Every 2 Months
Endrin	Every 3 Years		
Lindane	Every 3 Years		
Methoxychlor	Every 3 Years		
Toxaphene	Every 3 Years		
2, 4-D	Every 3 Years		

TABLE 3-25

**LIST OF TYPICAL EG&G GROUNDWATER PARAMETERS
AND SAMPLING FREQUENCY AT THE INEL**

Parameter	Frequency	Parameter	Frequency	Parameter	Frequency
Arsenic	Every 3 Yrs	Selenium	Every 3 Yrs	Gross Alpha	Monthly
Barium	Every 3 Yrs	Silver	Every 3 Yrs	Gross Beta	Monthly
Cadmium	Every 3 Yrs	Endrin	Every 3 Yrs	Tritium	Monthly
Chromium	Every 3 Yrs	Lindane	Every 3 Yrs	Trihalomethanes	Every 3 Yrs
Cyanide	Every 3 Yrs	Methoxychlor	Every 3 Yrs	Some wells additionally sampled for:	
Fluoride	Every 3 Yrs	Toxaphene	Every 3 Yrs	Carbon Tetrachloride	As Necessary
Lead	Every 3 Yrs	2, 4-D (TBP)	Every 3 Yrs	Trichloroethylene	As Necessary
Mercury	Every 3 Yrs	2, 4, 5-TP Silvex	Every 3 Yrs	Chloroform	As Necessary
Nitrate	Every 3 Yrs		Every 3 Yrs	Tetrachloroethylene	As Necessary
				Bacteriological	Monthly

TABLE 3-26

LIST OF TYPICAL RESL GROUNDWATER PARAMETERS
AND SAMPLING FREQUENCY AT THE INEL

Parameter	Frequency
Gross Alpha	Semiannually
Gross Beta	Semiannually
Tritium	Semiannually

PRELIMINARY

TABLE 3-27

USGS PARAMETERS MONITORED PERIODICALLY*

Alkalinity	Temperature
Aluminum	Bromide
Calcium	Fluoride
Hexavalent chromium	Silica
Iron	Total Chromium
Lead	Bicarbonate
Manganese	Carbonate
Magnesium	Mercury
Dissolved metals	
Potassium	
pH	

* Monitored every 2 to 5 years

One sampling event by the USGS was observed at USGS Well #89 with a dedicated pump. The well is located west of the RWMC. Sampling protocols consisted of standard USGS sampling protocols and updates contained in the USGS office at the INEL. The protocols are published in a series of USGS reports entitled "Techniques of Water Resources Investigations" and "National Handbook of Recommended Methods for Water-Data Acquisition." Before sampling new parameters, the USGS protocols are reviewed by the USGS sampling team and discussions with the Denver USGS Office are conducted, if clarifications are required. There are no sampling protocols developed specifically for the INEL by USGS.

General observations of the sampling event at Well 89 are as follows:

- Groundwater sampling was accomplished by dedicated pumps. Pump rates were checked with a flow meter during purging or by volumetric measurements.
- Field measurements of pH, temperature, alkalinity, and specific conductivity were taken during purging to determine when sampling should begin. At least 3 to 5 wellbore volumes were purged before sampling was conducted. Purged water was disposed of on the ground surface near the wellhead. Turbidity was checked before sampling in a white bucket. If sediment was present, purging continued until the purged water was clear.
- Groundwater samples were collected in special containers prepared by the analytical laboratory which receives the samples for analysis. Parameters which were analyzed can be found in Tables 3-22 and 3-27. The containers were labeled and placed in separate boxes for each well to reduce possibilities of sample mixup. Preservatives, when used, were added after the sample was placed in the sample bottle. Containers were observed to be correctly filled, labeled, and placed in iced coolers. Chain-of-custody documentation was not reviewed, due to lack of time. Field blanks and duplicates were not taken during the observed sampling effort.
- In general, the sampling program conducted by the USGS was observed to be in accordance with established protocols. Surface disposal of purge

water from the observed well is considered acceptable because historic data indicate only very low levels of contamination are present. All monitoring wells visited were locked and correctly numbered. Piezometric wells, however, were not secure. Sample delivery to off-site analytical laboratories is typically achieved by overnight delivery services so that samples are received within 24 hours of collection.

3.4.3.7 Environmental Monitoring Data

Groundwater monitoring at the INEL has been conducted since the late 1940s. The primary groundwater monitoring parameters have been radionuclides. However, in more recent years the number of parameters has increased substantially to include more routine sampling for organic and inorganic constituents. Lists of monitored parameters are included in Tables 3-22 to 3-27. Site monitoring under RCRA regulations has not begun; however, monitoring plans are being developed for numerous waste sites at the INEL.

Data from all current and historical analytical results for groundwater monitoring are maintained and reported by the three individual on-site contractors, USGS and RESL, as discussed in Section 3.4.3.1. Aside from the publications, which are a summary of only a portion of the collected data, the raw monitoring data are kept in widely dispersed files and non-centralized computer data bases by the contractors, RESL, USGS, and DOE. Retrieval of this information by the Survey team was difficult.

Details of non-production well monitoring data made available to the Survey team are presented below. Production well monitoring data obtained by the various site contractors, USGS, and RESL personnel, are presented in Section 3.3.3.

EG&G

Radioactive monitoring is conducted at the RWMC by shallow sediment wells and in deep wells down to sediment interbed levels within the basalt. A geologic cross-section of the RWMC area is presented in Figure 3-21. Five studies involving the sediment interbeds have been conducted at the RWMC. The studies, conducted in 1970 to 1974, 1975, 1976 to 1977, 1978, and 1979, involved deep wells down to the

Source: EG&G Idaho, Inc., unpublished data

FIGURE 3-21

GEOLOGIC CROSS-SECTION BENEATH THE RWMC

110-foot and 240-foot sediment interbeds. Only 5 to 10 percent of the soil samples showed indications of transuranic migration. Shallow sampling in the surface sediments beneath the trenches and pits has shown evidence of radionuclide migration but attenuation through the soil had resulted in scattered presence at the surficial sedimentary basalt interface.

Recent studies have verified the presence of plutonium-239 and 238 at the 110-foot interbed at concentrations of 7.4×10^{-7} and 1.7×10^{-8} microcuries per gram ($\mu\text{Ci/g}$), respectively. The low concentrations, however, are reported by EG&G to not present a near-future health concern since, once in the sediments of the interbed layer, the plutonium is strongly bound to the soil particles (USGS, 1984). This is in contrast to the relative ease of plutonium transport through the fissured lava.

Groundwater from monitoring wells drilled into the Snake River Plain aquifer near the RWMC has also been analyzed by EG&G for organic and radionuclide contamination. Carbon tetrachloride, 1,1,1-trichloroethane, and trichloroethylene have been detected. The source of the organics is speculated to be a portion of 88,000 gallons of waste organics received from the Rocky Flats Plant. The organics were reported by RWMC personnel to have been disposed of in sealed drums and buried in trenches at the RWMC. Additional information on disposal practices at the RWMC is provided in Section 4.1. Studies are continuing to determine conclusively the extent of radionuclide migration and the source of the organic contamination.

WINCO

The three production wells at the ICPP are monitored by WINCO. The results of this monitoring are presented in Section 3.3.3.2. Because of the locations and depths of the production wells, it is not possible to analyze the effects of strictly ICPP waste disposal, particularly with respect to the percolation ponds, on these production wells since other waste sites may also have an effect.

In addition to the monitoring of 3 production wells at the ICPP, approximately 44 shallow monitoring wells are located in the high-level radioactive waste storage area (tank farm) at the ICPP (Figure 3-22). These wells were installed by the USGS and are used to generate radiation migration data. These wells are of two types,

FIGURE 3-22

ICPP TANK FARM OBSERVATION WELLS LOCATION MAP

Source: WINCO, Form WINCO-6420(8-86)

wet and dry. The wet wells provide groundwater sampling capability, and the dry wells allow direct instrument surveys of the subsurface activity and allow WINCO personnel to determine the extent of the soil contamination.

The wet wells are monitored monthly and a gamma scan is performed. On a quarterly basis, the wet and dry wells are surveyed with direct radiation measurement instrumentation. Testing of water samples from these wells has indicated no release of radioactivity from this area. Since any contaminated water in this area is expected to be radioactive and none of the samples tested to date have been radioactive, it has been concluded by the INEL that chemical contamination could not occur. As a result, chemical analysis is not conducted on these water samples. The depths of the wells are presented in Table 3-28. Monitoring of the wet wells has indicated the lack of a perched water body above the basalt due to a lack of free water in these wells.

WINCO is in the process of evaluating the existing USGS groundwater monitoring program with respect to (1) projected requirements to be imposed by the EPA and (2) specific potential sources of effluents to the groundwater which are generated by the ICPP facilities. WINCO plans to issue a draft proposal to upgrade the present groundwater monitoring system. This draft proposal will also include sampling requirements, frequency of sampling, and specific analyses required. Specific conductance, pH, water-level elevation, bicarbonate concentration, and temperature are proposed for measurement at the time of sampling. The Extraction Procedure-toxic (EP-toxic) materials and certain radionuclides (tritium, chromium-51, cobalt-60, and strontium-90) are also proposed to be analyzed. In addition, calcium, magnesium, sodium, potassium, chloride, sulfate, carbonate, silicate, fluoride, and nitrate will be analyzed so the charge-balance error can be calculated for each data set to ensure that the values given for each data set are valid.

There are a number of USGS wells that may require replacement or extensive retrofitting to meet the new EPA guidelines with respect to groundwater monitoring wells. Most, if not all, of the existing wells are cased with carbon steel rather than with stainless steel. Eventually, WINCO anticipates a comprehensive on-site groundwater monitoring program that complements the USGS site-wide monitoring program. In areas where WINCO concerns overlap those of the USGS

TABLE 3-28

**DEPTH OF EACH WET WELL AND
"DRY" RADIATION PIPE IN TANK FARM**

Well	Depth (ft)
A-44*	Plugged
A-45*	37
A-46*	24
A-48*	46
A-49*	46
A-50*	50
A-52*	55
A-56*	40
A-53-7	20
A-53-11	20
A-53-19	24
A-53-20	20
B-2	13
B-7	19
81-1	20
81-2	30
81-4	20
81-5	14
81-6	30
81-7	20
81-8	20
81-9	23
81-10	30
81-11	20
81-12	13
81-13	20
81-14	30
81-15	15
81-16	20
81-17	20
81-18	20
81-19	24
81-20	30
81-21	15
81-22	25
81-23	20
81-24	15

Source: WINCO, Form WINCO-6420 (8-86)

NOTE: Each "wet" well (USGS Well) was drilled 6 inches into bedrock to act as a seat in which the well casing was set. The sides of the casing are slotted to permit flow into the well.

* - Indicates wet well.

(e.g., the area in which the percolation ponds are located), WINCO will work closely with the USGS.

RESL

Almost all off-site well monitoring for radiological parameters is conducted by the RESL, as discussed in Section 3.3.3.4. EPA maximum contaminant levels for public community drinking water systems for tritium, gross alpha, and gross beta have never been exceeded at off-site locations, as a result of INEL operations.

USGS

Water samples are collected at the INEL and in adjacent areas by the USGS, to define the chemical character of the groundwater entering and leaving the INEL. Numerous samples are taken in areas of detailed study, such as the TRA and the ICPP, to establish contamination levels and to follow the migration of waste in perched water and in the Snake River Plain aquifer. Current results of the USGS perched water and the Snake River Plain aquifer monitoring programs are discussed in the two subsections below.

Perched Water Monitoring

Large zones of perched water have been discovered in both the alluvium and basalt below the percolation ponds at the TRA, the ICPP, and ANL-W. Currently, other large perched water zones have not been encountered. As a result, only these three areas will be discussed here.

TRA

Five perched water zones have formed in the subsurface at the TRA because of seepage from disposal ponds. Four of these zones are perched above the basalt/alluvium interface below the site (Figure 3-23). A large zone of perched water has formed in the alluvium beneath and to the west of the radioactive waste disposal ponds. Zones of perched water have also formed in the alluvium beneath the chemical and cold waste disposal ponds. The fourth perched zone is located between the radioactive and chemical waste disposal ponds. The fifth zone of

LOCATION OF DISPOSAL PONDS, OBSERVATION
WELLS, AND THE EXTENT OF THE PERCHED
GROUNDWATER ZONE IN ALLUVIUM AT THE TRA

FIGURE 3-23

perched water is the largest, covering a 0.2-mile area, and has formed in the basalt beneath the perched zone in the surficial alluvium (Figure 3-24). This saturated zone in the basalt is perched on a sediment bed approximately 150 feet below the land surface.

The water that seeps from the percolation ponds infiltrates through the surface alluvium and is perched on fine-grained sediment at the basalt/alluvium interface, about 50 feet below the land surface. The extent of the perched groundwater in the alluvium is about twice the pond total area. The shallow perched water then percolates through the fine-grained sediment and into the basalt and moves downward until it reaches another layer of fine-grained sediment that is interbedded with the basalt. This deeper sediment layer, which averages about 50 feet in thickness and is about 150 feet below the land surface, also perches the percolating water. The extent of this deeper perched water zone in the basalt beneath the TRA is much greater than that of the shallower perched zones.

The deeper perched water is derived from seepage from all of the TRA ponds and by percolation from lawn irrigation at the TRA and from precipitation. In 1981, the extent of the perched water zone in the basalt was an area about 2,800 feet by 1,700 feet, with the maximum water thickness being about 60 feet (Figure 3-24). The extent and thickness of this large perched water zone had decreased significantly in the previous 3 or 4 years. Radioactive and nonradioactive constituents have been detected in the perched water at the TRA. The analytical parameters studied at various times have included tritium, cobalt-60, strontium-90, cesium-137, specific conductance, sodium, total chromium, chloride, sulfate, nitrate, and phosphate.

Concentrations of all these parameters vary over time and by location within the perched water. In general, concentrations are greatest near the center and to the south edge of the perched water. For comparison purposes, concentrations of tritium and strontium-90 frequently range from two to five times the community drinking water standards in the perched water; however, the remaining parameters only infrequently exceed community drinking water standards. It should be noted that the perched groundwater is not used for drinking or any other purpose and the possibility of its use in the future is extremely remote.

WATER-LEVEL CONTOURS
ON THE SURFACE OF THE PERCHED GROUNDWATER
IN THE BASALT AT THE TRA, OCTOBER 1981

FIGURE 3-24

Although this water is perched, it does seep through the sediment layer and enters the unsaturated basalt below the sediment. Once into the basalt, it travels downward to the Snake River Plain aquifer at a depth of about 450 feet and contaminates the aquifer. This contamination is monitored by wells placed in the Snake River Plain aquifer, as discussed later in this section.

At the time of the Survey, a report was being developed by the USGS on the perched water beneath the TRA. The report is to be published in 1988 as an update report for monitoring studies from 1982 to 1985. All analytical data are available from the USGS office at the INEL.

ICPP

Perched water monitoring wells have also been constructed around the ICPP percolation pond, which receive process water at a rate of 1 to 2 million gallons per day (mgd). The well locations are shown on Figure 3-20 and are listed as PW-1 through WP-6, SWP-8, and SPW-13. To date, the extent of the perched zone has not been delineated, and only one water sample has been recovered from each well. The sampling date was January 16, 1987. The parameters analyzed were chloride, tritium, and specific conductivity. Chloride levels averaged about 200 $\mu\text{g/L}$, tritium levels averaged about 9,000 picocuries per liter (pCi/L), and specific conductivity averaged about 1,000 micromhos per centimeter ($\mu\text{mho/cm}$). All these values are below community drinking water standards. As at the TRA, the perched water is not used for drinking or any other purpose, and the possibility of its use in the future is remote. However, this perched water will eventually seep downward and contaminate the Snake River Plain aquifer. This contamination is monitored by wells placed in the Snake River Plain aquifer, as discussed later in this section.

ANL-W

In the fall of 1987, ANL-W began a program to characterize the hydrogeology of the industrial waste pond. At the time of the Survey, wells located to the north, east, and south of the pond had not encountered perched water above a sediment interbed at a depth of 50 feet. However, wells placed along the west side of the pond encountered water at depths between 20 and 40 feet. It is believed by ANL-W that this water is not perched above sedimentary layers in the basalt but is flowing through fissures in the basalt. The Survey has not reviewed these data. Additional

wells are being constructed. Chemical analysis of recovered water samples is being conducted; however, analysis is not complete.

Snake River Plain Aquifer Monitoring

The USGS monitoring program has identified several radiological and non-radiological plumes in the Snake River Plain aquifer. These plumes include tritium, strontium-90, iodine-129, specific conductance, sodium, chloride, and nitrate, and are discussed below.

Tritium

The disposal of tritium at the ICPP and the TRA has been monitored since 1952. Since that time, a total of over 18,000 curies of tritium has been discharged at the ICPP. At the ICPP, the tritium had been disposed of directly to the Snake River Plain aquifer through the deep disposal well until 1983 and indirectly since 1983 by percolation of the tritiated water discharged to the percolation ponds. At the TRA, the tritium has been disposed of in percolation ponds exclusively. The rate of tritium disposal has declined to a small fraction of its average of over 700 curies per year prior to 1981 due to waste minimization programs and, as a result, the peak concentrations are declining from a current level of about 80 pCi/mL (discussions with on-site USGS and RESL personnel). This level compares to Derived Concentration Guides of 2×10^9 pCi/mL. A discussion of Derived Concentration Guides can be found in Section 4.3. This direct injection of wastewater into the regional aquifer and subsequent percolation of wastewater from the percolation ponds at the ICPP and the TRA have resulted in a large, dispersed plume of tritium in the regional groundwater system.

The October 1985 tritium plume presented as Figure 3-25 illustrates the wide lateral dispersion and the preferred southward flow. The tritium plume covers about 50 square miles and is contained within the surface 250 feet of the Snake River Plain aquifer. The highest tritium values were found south of the ICPP and south of the disposal ponds at the TRA. Tritium has migrated about 9.5 miles downgradient from the ICPP injection well and 10 miles from the TRA ponds since disposal began. The arrival of the tritium plume at the RWMC was first detected in 1975. The apparent velocity of tritium migration, based on first arrivals, from either the TRA radioactive waste ponds or the ICPP injection well ranges from 4 to 5 feet per day since the beginning of disposal operations in 1952 and 1953.

DISTRIBUTION OF TRITIUM IN THE SNAKE RIVER
PLAIN AQUIFER IN THE SOUTH-CENTRAL PART
OF THE INEL

FIGURE 3-25

Cobalt-60

Cobalt-60 has been discharged to the radioactive waste ponds at the TRA, and detectable concentrations are present in the basalt perched aquifer underlying the TRA ponds. During the years prior to the 1979 to 1981 period of record, no cobalt-60 was detected in samples of water taken from wells that tap the Snake River Plain aquifer. However, during the past 3 years, several water samples taken from Well 65, located about 1/2-mile downgradient from the TRA radioactive waste ponds (Figure 3-20), have contained minor concentrations of cobalt-60. For example, a Well 65 water sample collected in July 1984 contained 40 pCi/L of cobalt-60. This compares to a Derived Concentration Guide of 5,000 pCi/L for drinking water. These positive results indicate that after 30 years of disposal of cobalt-60 to the radioactive waste ponds, minor concentrations of cobalt-60 have percolated from the basalt perched aquifer to the Snake River Plain aquifer. Although near-term concentrations may continue at or possibly above current levels in Well 65, the continued decline of cobalt-60 discharged to the pond that has occurred over the past several years may result in a long-term reduction in the concentration of cobalt-60 in the aquifer.

Very low concentrations of cobalt-60 were also disposed of through the deep well at the ICPP, but to date no water samples taken in the immediate area from the regional aquifer, except for Well 65, have contained detectable amounts of the radioisotope.

Strontium-90

Over 20 curies of strontium-90 were discharged to the ICPP injection well from 1952 through 1981. This is an average of about 0.7 curie per year (Ci/year) of strontium-90. The current discharge of strontium-90 is less.

Figure 3-26 shows the distribution of strontium-90 in the Snake River Plain aquifer in October 1985. The strontium-90 plume covers about 2.0 square miles and has been detected less than 3 miles southwest of the injection well at the ICPP. The overall size of the plume and concentrations within the plume have not changed much over the last 5 years. It appears that the decreased strontium-90 discharge for

DISTRIBUTION OF STRONTIUM-90 IN
THE SNAKE RIVER PLAIN AQUIFER IN
THE SOUTH-CENTRAL PART OF THE INEL

FIGURE 3-26

the past several years, coupled with the isotope's relatively long half-life of 28.6 years, causes a dynamic equilibrium within the regional aquifer system. Size of the plume will change directly with discharge changes and radioactive decay will slowly tend to decrease the plume's size. Concentrations of strontium-90 range from 1 to about 60 pCi/L in monitor wells. These values compare to current Derived Concentration Guides of 1×10^3 pCi/L.

Iodine-129

Results of the monitoring for iodine-129 in 1985 have not been finalized. Based on earlier studies (USGS, 1984), it has been determined that less than 1 curie of iodine-129 has been disposed of through the ICPP injection well from startup in 1952 through 1977. This is an average of about 0.01 to 0.03 Ci/year of iodine-129 discharged. Actual monitoring of iodine-129 radioactivity in wastewater was begun in May 1976. In 1977, a total of 0.02 curie was discharged to the ICPP injection well, and in 1978, 0.14 curie of iodine-129 was discharged to the well. During the next 3-year period, iodine-129 discharge was reduced to about 0.04 Ci/year, which illustrates the variations in waste discharge due to plant operations.

Concentrations of iodine-129 in sampled wellwater in October 1981 are presented in Figure 3-27; they ranged from 0.05 to 4.1 pCi/L for statistically positive values and were high near the ICPP injection well. These values compare to current Derived Concentration Guides of 500 pCi/L. Iodine-129 has migrated about 6.3 miles from the ICPP injection well since discharge began in 1953, and it will remain in the aquifer for many years because of its very long half-life of about 16.4 million years.

Cesium-137

Less than 30 curies of cesium-137 have been discharged to the ICPP injection well and percolation ponds since disposal began. However, it is sorbed more readily than strontium-90 and is detectable in only a few wells in the immediate area of the ICPP injection well. Wells 43 and 40 (Figure 3-20) contain water with the highest concentration of cesium-137, about 100 pCi/L for November 1986; Wells 44 and 47 contain water with considerably smaller concentrations. These values compare with Derived Concentration Guides of 3×10^3 pCi/L. Therefore, after 30 years of disposal, detectable quantities of cesium-137 have migrated a maximum of about 1,800 feet

DISTRIBUTION OF IODINE-129 IN
THE SNAKE RIVER PLAIN AQUIFER
IN THE SOUTH-CENTRAL PART OF THE INEL

FIGURE 3-27

from the ICPP injection well. Cesium-137 has not been detected in any water samples from the regional aquifer near the TRA.

Transuranics

Monitoring of plutonium-238 and of plutonium-239 and 240 (undivided), which were disposed of through the ICPP injection well, began in 1974. Prior to that time, they were not separable in the undifferentiated alpha activity that was measured. From 1974 through 1981, a total of about 0.13 curie of plutonium-238 and 0.05 curie of plutonium-239 and 240 was discharged through the well. This represents a respective average discharge of 0.016 Ci/year and 0.006 Ci/year. Plutonium was disposed of in wastewater that contained an average concentration of 0.012 picocurie per milliliter (pCi/mL) of plutonium-238 and 0.005 pCi/mL of plutonium-239 and 240. The decay rates of plutonium-238, plutonium-239, and plutonium-240 are 89 years, 24,360 years, and 6,600 years, respectively. This indicates that very small but detectable amounts of plutonium-239 and 240 may remain in part of the regional aquifer for many years regardless of future disposal practices.

Three consecutive monthly samples were taken from groundwater in Well 47, located 740 feet south of the ICPP injection well (Figure 3-20), from October through December of 1975 to evaluate the effects on the Snake River Plain aquifer of the disposal of wastes containing isotopes of plutonium. Several other wells were sampled, but Well 47 was the only one that contained statistically positive concentrations of the plutonium isotopes. Analysis of these samples determined that the concentration of the plutonium isotopes in the regional groundwater, while detectable, were very low. The mean concentration of plutonium-238 in the three samples from Well 47 was 6.5×10^{-6} pCi/mL, and the mean value for plutonium-239 and 240 was 2.4×10^{-6} pCi/mL. These concentrations are approximately 6 orders of magnitude lower than the Derived Concentration Guides for unrestricted discharge. The concentrations of plutonium-238 and plutonium-239 and 240 in the observation well samples were also several orders of magnitude lower than those for the same nuclides in the wastewater being discharged through the injection well. This concentration reduction over a relatively short distance is an indication of dilution, dispersion, and retardation of the soluble radioisotopes by sorption.

Samples from Well 47 were also analyzed for americium-241, but it was not detected. This is expected since americium-241 has not been detected in water discharged through the ICPP injection well.

During the summer of 1980, another study found very low concentrations of plutonium in Wells 37, 40, 43, and 67 near the ICPP (Figure 3-20). However, only plutonium-238 in Well 40 was found to be statistically above the detection limit of 10×10^{-6} pCi/mL. Three consecutive samples of Well 40 water contained an average concentration of about 66×10^{-6} pCi/mL of plutonium-238.

Detectable quantities of certain plutonium and americium isotopes were present in water samples taken from Well 90 near the RWMC (Figure 3-17), but measurements thus far have been inconsistent. For example, samples collected during April 1981 contained detectable amounts of americium-241 and plutonium-238 that were determined to be about 2.0×10^{-4} and 1.1×10^{-4} pCi/mL, respectively; but an October 1981 sample contained only a detectable quantity of americium-241, which was measured at about 1.4×10^{-4} pCi/mL. Three quarterly samples taken prior to 1981 did not contain statistically positive amounts of any plutonium isotope. The source of the plutonium isotopes occasionally present in water from Well 90 has been determined from recent sediment studies to be due to downward migration of waste from the RWMC. The low concentrations in the sediment are reported to not present a near-future health concern due to their lack of mobility (discussions with EG&G personnel).

Results of sampling in the RWMC area since 1984 have been supplied to the Survey. These data are recorded only to 1×10^{-2} pCi/mL and do not show the presence of plutonium isotopes above this level.

Specific Conductance

Chemical wastes were also discharged to the ICPP injection well and percolation ponds. The industrial waste ditch and waste disposal ponds at the NRF are also used to discharge wastewater containing dissolved salts and some nonhazardous chemicals. NRF sewage treatment ponds also receive nitrate-rich sewage. This wastewater increases the mineral content and, therefore, the specific conductance of the regional groundwater. The specific conductance of groundwater in the

Snake River Plain aquifer containing no wastewater generally ranges from 300 to 325 $\mu\text{mho/cm}$ (at 25°C) in the ICPP-TRA area.

Wastewater disposed of through the ICPP injection well and percolation ponds and the NRF industrial waste ditch, and seepage from the TRA chemical waste disposal ponds and the NRF sewage treatment ponds have increased the specific conductance of the regional groundwater significantly (USGS, 1984), as shown in Figure 3-28. The specific conductance plume extends south of the CFA.

Sodium

The background or normal concentration of sodium in water from the Snake River Plain aquifer is from 8 to 10 mg/L. Figure 3-29 shows the concentration of sodium in wellwater and the area covered by the ICPP waste plume in October 1984.

The effects of sorption, ion exchange, or other chemical reactions on the migration of sodium are shown in the figure. A large amount of sodium is discharged to the chemical waste disposal ponds at the TRA and the industrial waste ditch at the NRF (USGS, 1984). However, as wastewater migrates downward toward the Snake River Plain aquifer from the TRA and NRF disposal areas, most of the sodium is apparently removed by the above-mentioned chemical reactions.

Total Chromium

Chromium was discharged directly to the Snake River Plain aquifer via the TRA deep injection well from 1964 to 1972. Since 1972, a different corrosion-inhibiting process has been employed that does not contain chromium. Chromium has also been discharged to the TRA radioactive waste ponds in the past and is present in the underlying perched groundwater in the basalt. The total chromium content of the regional groundwater was augmented by the direct disposal of wastewater prior to 1972 and by percolation from the overlying perched zone. Well 65, located approximately 1,500 feet south of the TRA facility (Figure 3-20), is the only well that taps the regional aquifer that contained water with statistically positive total chromium concentrations. Quarterly samples of water from Well 65 during the 1984 period of record contained an average total chromium concentration of about 0.20 mg/L (USGS, 1984). More recent data covering 1986 and 1987, supplied by the

SPECIFIC CONDUCTANCE OF WATER IN
THE SNAKE RIVER PLAIN AQUIFER IN
THE SOUTH-CENTRAL PART OF THE INEL

FIGURE 3-28

DISTRIBUTION OF SODIUM IN
THE SNAKE RIVER PLAIN AQUIFER
IN THE SOUTH-CENTRAL PART OF THE INEL

FIGURE 3-29

USGS, indicate decreased levels of 0.08 mg/L. This compares with the EPA primary drinking water standard of 0.05 mg/L.

Chloride

The background, or normal, concentration of chloride in the Snake River Plain aquifer in the south-central INEL vicinity is usually between 8 and 15 mg/L (USGS, 1984). The Idaho Drinking Water Standards (1977) set the secondary quality standard for chloride concentration of drinking water at 250 mg/L. This concentration limit is based primarily on taste.

Figure 3-30 shows the distribution of chloride in the Snake River Plain aquifer in October 1984. The highest chloride values are found south of the ICPP and the NRF, with slightly higher-than-background concentrations being present near and immediately downgradient from the CFA and RWM facilities (USGS, 1984).

Sulfate

Sulfate has been disposed of from the ICPP, the NRF, and the TRA (USGS, 1984). A sulfate plume in groundwater was not mapped since the only water samples above the normal level are adjacent to and immediately south of the ICPP injection well and south of the TRA deep injection well. The area south of the TRA is the largest area affected, with a measured value slightly above normal being recorded 1.3 miles from the facility (USGS, 1984). This small plume is a result of waste sulfate disposed of through the deep well and of recharge from the overlying perched aquifer in the basalt. Sampled wells downgradient from the NRF contain no sulfate concentrations significantly above background levels (USGS, 1984).

Nitrate

The first recent comprehensive sampling of the observation wells in the regional aquifer for nitrate analyses was completed in January 1979 and indicated that a large nitrate waste plume existed. The January 1979 waste plume covered an area of about 8.7 square miles and was elongated to the south of the ICPP injection well. A second comprehensive sampling program for nitrate analyses was conducted between October and December of 1981. The 1981 plume was similar in shape and

DISTRIBUTION OF CHLORIDE IN
THE SNAKE RIVER PLAIN AQUIFER IN
THE SOUTH-CENTRAL PART OF THE INEL

FIGURE 3-30

in interior nitrate concentrations to the January 1979 plume. However, the nitrate plume size increased to 10.1 square miles over the 3 years, and the nitrate concentrations in the sampled water from wells nearer the ICPP injection well generally increased over the same time period (USGS, 1984). The expanded plume size and concentration increases were results of the sustained higher nitrate disposal rate (USGS, 1984).

Figure 3-31 shows the configuration of the waste plumes in October 1984. The plume from the ICPP had increased in size to about 12 square miles, and the concentrations had decreased slightly (USGS, 1984). Two other waste plumes were also noted. One, near the TRA, had concentrations only slightly higher than background. Another plume, present directly south of the NRF, originated from the NRF sewage pond and was similar in extent and concentration to the ICPP plume.

Summary of Snake River Plain Aquifer Monitoring

Analytical data from the USGS monitoring wells have been supplied to the Survey for the years 1949 to 1986. Review of a limited number of parameters at a dozen wells in the south-central INEL area has indicated that contamination of the Snake River Plain aquifer exists, that the source of the contamination is the INEL, and that contaminant levels in the groundwater have fluctuated widely in the past. Since 1982, however, it appears that there is a downward trend in contaminant levels in this area based on a review of the aforementioned data. Within this apparent trend is still a wide fluctuation of concentration levels, which makes determination of a trend difficult.

The causes of the decreasing contaminant levels can only be speculated on; however, in 1982 and 1983 usage of the injection wells in this area was reduced to emergency disposal only. As a result, process waste was disposed of in percolation ponds. This change in disposal practices may be the cause of the downward trend, since migration through the soil may filter out some contaminants and allow others to decay due to the time taken in reaching the aquifer. In addition, the waste from the ponds will seep into the aquifer over a very wide area and be quickly diluted as it enters the rapidly flowing aquifer. The injection wells disposed of concentrated waste at a point location, and dilution would correspondingly take a longer time.

DISTRIBUTION OF NITRATE IN
THE SNAKE RIVER PLAIN AQUIFER
IN THE SOUTH-CENTRAL PART OF THE INEL

FIGURE 3-31

Another factor that may affect concentration levels in the groundwater may be reductions in concentration levels in the waste effluent as efforts are made to reduce the amount of waste disposed of. These efforts have been documented for tritium, strontium-90, and chromium. Due to the potentially lower concentrations in the effluent, a corresponding decrease in concentration levels in the aquifer could be expected.

3.4.4 Findings and Observations

3.4.4.1 Category I

None

3.4.4.2 Category II

None

3.4.4.3 Category III

1. Contamination of Snake River Plain aquifer. Radioactive, inorganic, and organic waste releases from active and inactive waste sites have resulted in contamination of the Snake River Plain aquifer.

Current active and inactive sites at the INEL consist of landfills, percolation ponds, injection wells, ditches, French drains, and dry wells. All of these sites have received hazardous wastes and/or hazardous constituents. Some have definitely released, and others may be releasing, wastes or hazardous constituents to the environment. These releases, consisting of radionuclides, organics, and inorganics, have the potential to contaminate the groundwater. In the case of landfills, ditches, French drains, and dry wells, hydrogeologic principles indicate that migration down to the groundwater would most likely occur from hydraulic driving forces caused by a combination of liquid disposal at the site and precipitation recharge of the aquifer. Migration down to the groundwater table for the injection wells and percolation ponds could occur from the hydraulic head of the waste itself.

The hydraulic pressure forces the leachate and effluent down through the soil and into the fissures in the basalt. Once in the basalt, flow is governed by the direction of the fissures and cracks. As a result, the flow may travel horizontally for long distances before encountering a vertical crack, allowing vertical flow. The presence of sediment zones within the basalt can retard the downward migration and may result in perched water such as has been encountered below the percolation ponds at the TRA and the ICPP. The perched water will migrate through the sediment layer, albeit at a slower rate than through the basalt, and continue to flow toward the Snake River Plain aquifer in an unsaturated condition.

Eventually, if there is enough leachate or effluent so that the hydraulic force will not expend itself, the flow will reach and contaminate the aquifer. The volume of flow needed to reach the aquifer cannot be precisely estimated, but it is projected that the length of time for flow from one of the percolation ponds (ANL-W Industrial Waste Pond) to reach the aquifer would be less than a year (Robertson, 1977). Other percolation ponds are expected to have similar flow regimes due to similar geologic conditions. For injection wells, the time would be much less.

Current monitoring of the Snake River Plain aquifer by the USGS indicates the presence of tritium, sodium, strontium-90, chloride, nitrate, and iodine-129 contamination plumes. Of greatest concern is the tritium plume, which extends from the TRA and the ICPP to the southern boundary and covers an estimated 50 square miles at a level above 500 pCi/L. Readings as great as 39 nanocuries per liter (nCi/L) were detected in 1986 at the CFA-1 drinking water well. These plumes are discussed in detail in Section 3.4.3.7. An earlier study (Schmalz, 1972) determined that radionuclide wastes will remain in the upper 250 feet of the aquifer. However, organic and inorganic contaminants may behave differently due to their different specific gravities and different solubilities.

Sampling and analysis requests have been developed for the Survey using USGS and contractor production wells. Groundwater samples will be analyzed for a wider range of organics and metals than is currently analyzed. In addition, anions and radiological parameters will be monitored.

2. Release of contaminants to the groundwater at RWMC. Volatile organics, radionuclides, and potentially inorganics have been released into the soil and potentially the groundwater from the waste disposal sites at the RWMC.

On June 3, 1987, test results from USGS Well 88, located about 1/4-mile south of the RWMC (Figure 3-32), indicated the presence of carbon tetrachloride in the Snake River Plain aquifer. The concentration was 6.6 parts per billion (ppb). Subsequent sampling between July and September indicated concentrations of about 3 ppb. In addition, 1,1,1-trichloroethane was present at a concentration of 0.6 ppb and trichloroethylene was present at a concentration of 1.2 ppb. On September 24, 1987, organic vapors were measured at two drill sites on the RWMC, at boring locations D02 and D10. Preliminary analysis of the vapors at the borehole indicated the presence of carbon tetrachloride, trichloroethane, trichloroethylene, tetrachloroethylene, and other volatiles at low concentrations. Carbon tetrachloride was present in the air sample at a concentration of up to 900 milligrams per cubic meter (mg/m³) and the other volatiles were at lower levels. Monitoring is continuing.

Past inventories indicate that 24,000 gallons of carbon tetrachloride, 39,000 gallons of Texaco Regal Oil and 25,000 gallons of miscellaneous organics (trichloroethane, tetrachloroethylene, etc.) of unknown individual amounts have been disposed of at RWMC from the Rocky Flats Plant. Additional organics may have been disposed of at RWMC in unknown amounts.

Radionuclides have also been disposed of at the RWMC. Analytical data of surface sediments at various locations beneath the RWMC are presented in Table 3-29. The presence of plutonium and uranium isotopes has been verified in these surficial soil deposits down to the sediment/basalt interface. Analytical data of soil samples recovered from the 110-foot sediment interbed located beneath the RWMC are presented in Tables 3-30 and 3-31. The presence of plutonium isotopes has been verified in this layer, indicating that these radionuclides are migrating toward the Snake River Plain aquifer. A geologic profile of the RWMC is presented in Figure 3-21.

Source: EG&G Idaho, Inc., 1986a

USGS WELL LOCATIONS AT THE RWMC AREA

FIGURE 3-32

TABLE 3-29

RWMC SDA 1986 SURFICIAL SOIL ACTIVITY CONCENTRATIONS

Location	Pu-239,240 1986 Range of Soil Concentrations ($\mu\text{Ci/g}$)	Am-241 1986 Range of Soil Concentrations ($\mu\text{Ci/g}$)	U-234 1986 Range of Soil Concentrations ($\mu\text{Ci/g}$)
SDA Active Area	3.3E-7 $\pm$ 0.3 5.2E-7 $\pm$ 0.4 5.0E-7 $\pm$ 0.4 6.0E-8 $\pm$ 1.0	1.8E-6 $\pm$ 0.2 7.9E-7 $\pm$ 0.6 7.1E-7 $\pm$ 0.4	5.0E-7 $\pm$ 1.0 6.0E-7 $\pm$ 1.0 4.0E-7 $\pm$ 1.0
SDA Pad A	4.2E-7 $\pm$ 0.6 3.6E-7 $\pm$ 0.3	7.1E-7 $\pm$ 0.4 5.0E-7 $\pm$ 1 1.5E-7 $\pm$ 0.1 1.4E-7 $\pm$ 0.1	6.0E-7 $\pm$ 1.0 5.0E-7 $\pm$ 1.0 6.0E-7 $\pm$ 1.0 5.0E-7 $\pm$ 1.0
SDA Previously Flooded Areas	4.7E-7 $\pm$ 0.5 2.4E-6 $\pm$ 0.2 2.4E-6 $\pm$ 0.3 3.5E-6 $\pm$ 0.3 4.8E-6 $\pm$ 0.3	2.8E-7 $\pm$ 0.1 7.5E-7 $\pm$ 0.8 8.1E-6 $\pm$ 0.3 3.4E-6 $\pm$ 0.3 4.3E-6 $\pm$ 0.8	5.0E-7 $\pm$ 1.0 5.0E-7 $\pm$ 1.0 6.0E-7 $\pm$ 1.0 6.0E-7 $\pm$ 1.0
SWEPP Operational Area	4.0E-8 $\pm$ 1.0 4.8E-6 $\pm$ 0.3	4.0E-8 $\pm$ 1.0 5.5E-8 $\pm$ 0.8 9.0E-8 $\pm$ 1.0 4.2E-8 $\pm$ 0.7 4.5E-6 $\pm$ 0.8	Not Analyzed

Source: Written communication from EG&G personnel

TABLE 3-30
WELL 79-2 110-FOOT SEDIMENT INTERBED RESULTS

Sample No.	Depth	Am-241 (10 ⁻⁹ µCi/g)	Pu-239,240 (10 ⁻⁹ µCi/g)	Pu-238 (10 ⁻⁹ µCi/g)
79-2-1 (A)	99'11"	31 ± 3	61 ± 4	2.1 ± 0.9
79-2-1 (B)	99'11"	22 ± 2	56 ± 4	2.2 ± 0.8
79-2-2 (A)	101'8"	13 ± 3	34 ± 3	ND
79-2-2 (B)	101'8"	18 ± 2	37 ± 3	ND
79-2-3 (A)	102'1"	24 ± 3	38 ± 3	ND
79-2-3 (B)	102'1"	20 ± 3	36 ± 3	ND
79-2-4 (A)	103'	ND	ND	ND
79-2-4 (B)	103'	ND	ND	ND

Source: Written communication from EG&G personnel.

ND - None detected at the 95% confidence level.

TABLE 3-31

TW-1 110-FOOT SEDIMENT INTERBED RESULTS* (units of 10⁻⁹ μ Ci/G)

Sample	Depth	EG&G				RESL		
		Am-241	Pu-239,240	Pu-238	Am-241	Pu-239,240	Pu-238	
D42(1)	101'	440 $\pm$ 20	740 $\pm$ 40	17 $\pm$ 2	No	Split	Available	
D42(2)	101'	470 $\pm$ 20	610 $\pm$ 30	11.8 $\pm$ 1.7	No	Split	Available	
D43(1)	101'5"	103 $\pm$ 8	197 $\pm$ 13	4.6 $\pm$ 1.4	84.7 $\pm$ 9.5	178 $\pm$ 13	10 $\pm$ 3	
D43(2)	101'5"	106 $\pm$ 9	190 $\pm$ 13	6.3 $\pm$ 1.7	90.8 $\pm$ 7.5	168 $\pm$ 9	ND	
D43(3)	101'5"	137 $\pm$ 11	200 $\pm$ 13	6.5 $\pm$ 1.6	107 $\pm$ 8.8	170 $\pm$ 9	3.9 $\pm$ 1.3	

Source: Written communication from EG&G personnel

ND = None Detected at the 99% Confidence Level.

* All 1000 Min. Counts.

Migration of contaminants could occur by movement of precipitation through the soil and as a result of spring flooding from snow deposited in the 600-acre basin in which the RWMC is located. Floods have occurred on three previous occasions. The floods caused open pits to be inundated by meltwater to a depth of about 8 feet. The floods did not cover the entire site, only low areas such as open excavations. Some water was pumped out but much of the water soaked into the soil and added to the potential for the spread of contamination.

Surface soil subsidence has been reported subsequent to flooding events at the RWMC. The cause of the subsidence is unknown, but could be due to subsurface voids resulting from collapsing drums or inadequate soil compaction during placement. These voids collapsed when the area was inundated, which resulted in the surface subsidence. Sampling for organics, inorganics, and radionuclides is planned by the Survey from wells near the RWMC.

3. Inadequate monitoring well placement at the TAN and ANL-W. Inadequate monitoring well placement at the TAN and the ANL-W could allow the extent of aquifer contamination to be undetermined.

There is evidence of aquifer contamination at the TAN. Recent analytical testing of water from the TAN drinking water well indicated the presence of trichloroethylene at a concentration of about 5 ppb to 8 ppb. In addition, tetrachloroethylene was present at a concentration of 3 ppb. The TAN area, however, has only one well used exclusively for monitoring the groundwater. This well is located upgradient of the site (Figure 3-19) and, therefore, would not detect contamination caused by the TAN. All other monitoring at the facility is conducted from drinking water wells. As a result, the extent, magnitude, and source of the trichloroethylene contamination are not known. The presence of this contamination is also reported in the findings in Section 3.3.4.2.

At the ANL-W, only wells numbered USGS 100 and 101 are located approximately downgradient of the facility (Figure 3-19). In addition, Well 101 is located so that aquifer flow beneath the ANL-W would be to the west

(Figure 3-15) and contamination would probably not be detected at this well. Monitoring of these wells, as discussed in Section 3.4.3, is conducted, and contamination has not been detected. As at the TAN, groundwater is also monitored in the drinking water wells, but current well placement in and around ANL-W would not clearly delineate the extent or magnitude of contamination.

4. Lack of characterization of individual waste disposal sites. The groundwater monitoring program at the INEL addresses only gross contamination of the Snake River Plain aquifer and does not attempt to characterize the chemical and physical hydrogeologic parameters resulting from each individual waste disposal site. As a result, the relative effect of each site on the Snake River Plain aquifer cannot be determined.

In general, the existing monitoring program determines the extent of groundwater contamination within INEL boundaries, but does not determine the source of the contamination. For example, although low levels of carbon tetrachloride have been encountered at USGS Well 88 south of the RWMC, the source of the contamination has not been adequately determined. However, groundwater monitoring plans are currently being developed for various waste disposal sites in accordance with regulatory requirements.

5. Insufficient number of monitored parameters. The current groundwater monitoring program does not analyze for all constituents that may reasonably be expected to be released from the INEL waste disposal sites.

Currently, monitoring programs include analysis for radionuclides, some metals, and some organics. However, constituents of past and present waste streams indicate that a wider range of semi-volatiles and volatiles also needs to be monitored, such as purgeable organics, in order to obtain a more accurate understanding of the type and extent of contamination in the aquifer. In addition, the lack of adequate monitoring for groundwater and unsaturated zone environmental impacts constitutes non-compliance by the INEL with DOE Order 5484.1. The Survey has developed sampling and analysis requests to address these concerns, as discussed in Finding 1 of this section.

3.4.4.4 Category IV

1. Potential for ICPP Injection well to act as contaminant conduit to Snake River Plain aquifer due to ungrouted annular space. Deteriorated annular space around the outside of the well casing at the ICPP injection well may provide a direct conduit for migration of contaminants to the aquifer.

Review of construction details has indicated that the ICPP injection well consists of a 16-inch-diameter casing in a 24-inch-diameter borehole with gravel and sand in the annular space. This gravel pack extends from the surface to the bottom of the well at a depth of 580 feet. Several attempts have been made to grout the annular space; however, continued influx of gravel through the perforations in the casing and building up inside the casing indicate that the attempts have not been entirely successful. The ungrouted annular space could provide a route for rapid migration of contaminants such as acids leaking from subsurface pipelines located in the vicinity and perched water from the percolation ponds. However, the extent of perched water has not been identified. Leaks from pipes could migrate to the injection well along the top of the basalt and flow down the annular space of the well into the groundwater.

4.0 NON-MEDIA-SPECIFIC FINDINGS AND OBSERVATIONS

This section discusses findings and observations pertaining to waste management, toxic and chemical materials, radiation, quality assurance, and inactive waste sites and releases. These discussions do not include background environmental information because the areas addressed are not necessarily tied to one medium as was the case with the discussions in Section 3.0.

4.1 Waste Management

4.1.1 General Description of Waste Management Procedures

The INEL is a nuclear reactor research and development laboratory where engineering and physics experiments are carried out utilizing radioactive and chemical substances. As a result, wastes generated from INEL operations consist of hazardous, mixed, radioactive, and nonhazardous wastes. The majority of wastes originate from reactor research and are generally similar in makeup. Wastes from support shops and research laboratories are relatively heterogeneous and smaller in quantity.

In general, wastes are handled uniformly throughout the INEL. Hazardous wastes, both liquid and solid, are accumulated by laboratory or shop personnel in satellite storage areas at each facility. When 55 gallons of waste have accumulated at the satellite storage areas, the site hazardous waste representative or environmental coordinator is contacted to label and manifest the containers for internal transport and to make arrangements for the wastes to be taken to one of the three 90-day accumulation areas at CFA, ICPP, or IRC. The Hazardous Waste Storage Facility (HWSF) at the CFA, described in Section 4.1.2.3, handles wastes from EG&G, ANL-W, and the Radiological and Environmental Sciences Laboratory (RESL) operations, with infrequent small shipments from the ICPP. The HWSF is a permitted facility under RCRA. The accumulation/storage area at the ICPP and IRC handles only their own wastes and the accumulation. Upon arrival at the HWSF or ICPP accumulation/storage area, the containers are inventoried, inspected, repackaged (if necessary), stabilized, and stored, as well as manifested, and logged for shipment to an off-site contractor, currently United States Pollution Control Incorporated (USPCI), for treatment, storage, or disposal.

Some used oil from various operations, solvents from degreasing units, and silver from silver recovery units are handled and recycled by off-site contractors, currently Cowboy Oil and Safety-Kleen Corporation, respectively. Additionally, special hazardous waste, including waste explosives and highly reactive, unstable chemicals, is treated on-site at NODA, a RCRA permitted facility. Section 4.1.2.9 provides additional information on NODA.

Mixed wastes, which contain both hazardous or toxic, and radioactive constituents, are presently being stored at the Radioactive Mixed Waste Storage Facility (RMWSF) at PBF/SPERT-IV until adequate treatment methods and disposal facilities become available. Radioactively contaminated asbestos is currently being stored at TRA and ICPP. At this time, mixed waste is not accepted for on-site or off-site disposal. Section 4.2 contains further discussions on mixed wastes at the INEL.

Radioactive waste is separated into low-level, intermediate-level, high-level, and transuranic (TRU) wastes. Low-level and intermediate-level wastes are those radioactive wastes not classified as high-level, TRU waste, spent nuclear fuel, or by-product material. High-level waste is defined to be the highly radioactive waste material that results from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid waste derived from the liquid, that contains a combination of TRU waste and fission products in concentrations sufficient to require permanent isolation. TRU waste is radioactive waste contaminated with alpha-emitting transuranium radionuclides with half-lives longer than 20 years and concentrations greater than 100 nCi/g, regardless of source or form (DOE Order 5820.20).

Low-level radioactive liquid wastes are generally combined with nonradioactive liquid effluent streams and are discharged to percolation ponds, septic fields, evaporation ponds, and treatment plants within the various facilities at the INEL. Intermediate-level and high-level radioactive liquid wastes generated at the INEL are generally held in unlined concrete retention basins or underground tanks to reduce short-half-life activities. These wastes from EG&G and ICPP facilities are transported to the ICPP to be solidified through a process called calcining. The solid waste is then stored on the site in large, specially designed tanks (bins) for later recovery and reprocessing. Additionally, waste at ANL-W is condensed/solidified at

the Radioactive Liquid Waste Treatment Facility (RLWTF) at ANL-W. The containerized material is then stored/disposed of at the RWMC. Sections 4.1.2.7, 4.1.2.8, and 4.1.2.4, contain additional process information on calcining, the RLWTF, and the RWMC, respectively.

Low-level radioactive solid wastes are segregated for disposal at each laboratory, shop, or process area by the individual generator. Dedicated containers are provided in each area to separate wastes for reduction purposes into combustible, compactible, and non-compactible types. Combustible wastes are those wastes that can be incinerated; compactible wastes are those that are crushable but not burnable, and noncompactible wastes are neither combustible nor compactible. Intermediate and high-level wastes such as those generated at the Hot Fuel Examination Facility (HFEF) complex at ANL-W are remotely handled in limited, restricted areas and are stored at RWMC (TSA) or processed and stored at ICPP. These wastes are to be ultimately disposed of at the DOE Waste Isolation Pilot Plant (WIPP) in New Mexico, which is scheduled to be operational in fiscal year (FY) 1989.

Training in proper disposal and monitoring procedures is mandatory for those site personnel generating radioactively contaminated waste to ensure correct waste segregation. The previously mentioned containers are lined with yellow plastic bags labeled with the magenta radiation symbol to indicate radioactive wastes. When the bags within the containers are full, Health Physics (HP) technicians remove the bags and monitor the waste for activity level and type. The bags are then sealed with yellow and magenta radioactive materials tape, labeled with monitoring information, and placed in appropriate containers for transport and disposal. Combustible and compactible wastes are transported to the incinerator at WERF, and noncompactible wastes are stored or disposed of at the RWMC. Sections 4.1.2.6 and 4.1.2.4 provide further information on operations and criteria for waste disposal at WERF and the RWMC, respectively.

Nonhazardous, non-sanitary liquid waste, which may contain low-level radioactive waste and small quantities of various hazardous and nonhazardous chemicals and other innocuous wastes (also called industrial or service waste), is mainly discharged to percolation ponds at the INEL. These ponds are discussed later in this section as well as in Section 3.3; sanitary waste systems are discussed in Section 3.3.

Nonhazardous solid waste (e.g., trash, construction debris), which is placed in a green dumpster to indicate nonradioactive waste, from all facilities at the INEL is disposed of at the CFA Landfill III.

For 1986, 28,644 gallons of hazardous wastes were shipped off-site from the INEL and 3,069 gallons were accumulated/stored on-site. A total of 6 pounds of special hazardous waste was burned at NODA. Mixed waste stored at the INEL totaled 9,465 gallons. On-site disposal of liquid wastes (radioactive and industrial) totaled approximately 6.35 billion gallons. Total solid waste (radioactive and industrial) disposed of on-site was 20,300 cubic meters, with 79 cubic meters of radioactive waste being stored on-site. Additionally, approximately 1,850 cubic meters of low-level radioactive waste was incinerated and/or compacted on-site. Waste quantity summaries by facility are presented in Tables 4-1 through 4-3.

4.1.2 General Description of Pollution Sources and Controls

Waste management issues, the processes through which the wastes are generated, and active waste site and pollution sources are discussed by INEL facility in this section.

The issues, processes, and active waste site and pollution sources described are based on the Environmental Survey conducted from September 14 through October 2, 1987, the INEL Part B Permit Application (DOE, 1985), the INEL Installation Assessment Reports (IARs) (ANL-W, 1986b; EG&G Idaho, Inc., 1986a; WINCO, 1986c), Initial Assessments of Solid Waste Management Units (SWMUs) and Land Disposal Units (LDUs) (ANL-W, 1986a; EG&G Idaho, Inc., 1986c; WINCO, NDb), and other information including employee interviews, unusual occurrence reports, INEL Site Development Plan (EG&G Idaho, Inc., 1986), the INEL Industrial Waste Management Information System (IWMIS) (EG&G Idaho, Inc., 1987d), and the INEL Radioactive Waste Management Information System (RWMIS) (EG&G Idaho, Inc., 1987e). These sources represent the most current and comprehensive information available on waste sites and releases at the INEL and, as such, served as major references.

The IARs and the SWMU and LDU Initial Assessments, as required by DOE Order 5480.14 and Consent Order and Compliance Agreement between the DOE Idaho Operations Office (DOE-ID) and EPA Region X, pursuant to Section 3008(h) of RCRA,

TABLE 4-1
1986 HAZARDOUS AND MIXED WASTES SUMMARY FOR THE INEL a,b

Facility	Hazardous Waste			Mixed Waste
	Shipped Off the Site	12/31/86 Storage	SHW ^c Burned at NODA	
TAN	2,545	455	0	4,180
TRA	220	275	0	0
CFA	2,539	555	5 lb	0
ARA	0	18	0	0
RWMC	0	0	0	0
PBF	8,810	415	0	4,460
SPERT	0	0	0	0
NODA	55	61	0	0
IRC	0	410	0	0
ICPP	11,880	660	1 lb	605
ANL-W	2,595	220	0	220
Total	28,644	3,069	6 lb	9,465

Source: Nishimoto, 1987

- a All quantities are in gallons except where indicated
- b Data exclude 860 gallons of degreaser waste handled by an off-site service contractor
- c Special hazardous waste

TABLE 4-2

1987 ESTIMATED RADIOACTIVE WASTE SUMMARY FOR THE INEL

Facility	Liquid		Solid					
	On-site Disposal		On-site Disposal		On-site Storage		On-site Incineration/Compaction	
	Volume (Liters)	Curies	Volume (m ³)	Curies	Volume ^a (m ³)	Curies	Volume (m ³)	Curies
TAN	1.198 x 10 ⁸	1.254 x 10 ⁻¹	6.123 x 10 ²	5.268 x 10 ¹	4.160 x 10 ⁻¹	2.402 x 10 ⁰	1.658 x 10 ²	1.740 x 10 ⁻²
TRA	7.506 x 10 ⁷	1.248 x 10 ²	3.806 x 10 ¹	4.980 x 10 ²	4.160 x 10 ⁻¹	1.802 x 10 ²	2.308 x 10 ²	5.320 x 10 ⁻²
CFA	9.038 x 10 ⁷	2.240 x 10 ⁻¹	--	--	--	--	1.345 x 10 ²	1.178 x 10 ⁻²
RWMC	--	--	2.244 x 10 ¹	4.180 x 10 ⁻¹	--	--	8.836 x 10 ⁰	4.000 x 10 ⁻³
ARA	2.066 x 10 ⁶	4.180 x 10 ⁻⁴	1.450 x 10 ¹	5.040 x 10 ⁻¹	--	--	--	--
PBF	--	--	3.134 x 10 ¹	2.496 x 10 ⁰	--	--	3.619 x 10 ¹	7.810 x 10 ⁻²
SPERT	--	--	7.250 x 10 ⁰	1.143 x 10 ⁻⁵	--	--	--	--
NODA	--	--	--	--	--	--	--	--
IRC	--	--	--	--	--	--	--	--
ICPP	2.306 x 10 ⁹	4.024 x 10 ²	8.592 x 10 ²	1.211 x 10 ²	--	--	1.204 x 10 ³	4.464 x 10 ⁰
ANL-W	2.152 x 10 ⁶	3.420 x 10 ⁻¹	1.394 x 10 ²	2.122 x 10 ⁵	7.079 x 10 ⁰	2.929 x 10 ⁴	7.266 x 10 ¹	1.182 x 10 ⁻¹
Total	2.596 x 10 ⁹	5.279 x 10 ²	1.724 x 10 ³	2.129 x 10 ⁵	7.911 x 10 ⁰	2.947 x 10 ⁴	1.853 x 10 ³	4.747 x 10 ⁰

Source: EG&G Idaho, Inc., 1987e

^aRadioactive solid wastes generated at these areas are stored at TSA at RWMC with the exception of approximately 1.133 x 10⁰ m³ (2.916 x 10⁴ Ci) which is stored at ANL-W.

TABLE 4-3

1987 ESTIMATED ANNUAL NONHAZARDOUS (INDUSTRIAL) WASTE DISPOSED OF AT THE INEL^a

Facility	Liquid(L) ^b	Solid (m ³) ^e
TAN	c1,381 x 10 ⁸	3,727
TRA	9,145 x 10 ⁸	2,334
CFA	8,512 x 10 ⁷	4,485
ARA	1,056 x 10 ⁸	105
RWMC		282
PBF	d1,538 x 10 ⁷	235
SPERT		--
NODA		--
IRC		--
ICPP	2,308 x 10 ⁹	5,374
ANL-W	1,869 x 10 ⁸	2,037
Total	3,754 x 10 ⁹	18,579

Source: EG&G Idaho, Inc., 1987d

- a Does not include sewage/sanitary wastewater disposal
b Volume for surface disposal only
c This number combines totals for TAN/TSF + TAN/LOFT (CTF)
d This number combines totals for PBF/SPERT + WERF
e Disposal at CFA Landfill III.

have identified nearly 350 SWMUs and LDUs. SWMUs include both active and inactive sites and releases that may contain nonhazardous, hazardous, or radioactive wastes and did not receive wastes prior to November 19, 1980, while LDUs include active and inactive sites that received hazardous wastes after November 19, 1980.

The list of approximately 350 SWMUs and LDUs includes several categories of both active and inactive sites, for example active and inactive septic systems, landfills, tanks, and percolation ponds. Since the various types of units are the responsibility of different Environmental Survey disciplines, the Survey team allocated each SWMU and LDU to the appropriate discipline as follows:

- Inactive waste sites, Section 4.5
- Underground tanks, Section 4.2
- Aboveground tanks, Section 4.2
- Active waste management concerns, Section 4.1
- Active sanitary treatment systems, Section 3.3.

Thus, of the nearly 350 SWMUs and LDUs, 28 of the SWMUs and 5 of the LDUs were chosen for evaluation as active waste management units for the purpose of this report and are located at discrete facilities at the INEL (Table 4-4). When discussed, they are identified by the INEL SWMU and LDU code numbers. No waste management concerns were identified at the TAN/IET, EBR-I, BORAX, ZPR, EOCR, OMRE, or LCCDA.

4.1.2.1 TAN

The TAN Facility houses experimental reactors and support facilities for reactor performance (Figure 2-3). The TAN, which is operated by EG&G Idaho, consists of three active sites: the TAN/LOFT (Figure 2-5), the TAN/TSF (Figure 2-4), and the TAN/WRRTF (Figure 2-6). Wastes generated at the TAN include hazardous, mixed, radioactive, and nonhazardous.

TAN/LOFT

A limited amount of hazardous wastes is currently being generated at TAN/LOFT. These wastes, produced through maintenance operations, include solvents and

TABLE 4-4

ACTIVE WASTE MANAGEMENT SWMUs AND LDUs AT THE INEL

INEL Code # ^a	Name
LOFT-02	LOFT Disposal Pond
TSF-07	TSF Disposal Pond
TSF-09	TSF Intermediate-Level (Radioactive) Waste Disposal System
WRRTF-02	WRRTF Two-Phase Pond (TAN-763)
WRRTF-03	WRRTF Evaporation Pond (TAN-762)
TRA-06	TRA Chemical Waste Pond (TRA-701)
TRA-03	TRA Warm-Waste Leach Pond (TRA-758)
TRA-15	TRA Hot Waste Tanks #2, #3, #4 at TRA-613
TRA-04	TRA Warm-Waste Retention Basin (TRA-712)
TRA-20	TRA Brine Tank (TRA-731) at TRA-631
TRA-08	TRA Cold Waste Disposal Pond (TRA-702)
CFA-08	CFA Sewage Plant (CFA-691), Septic Tank (CFA-716) and Drainfield
RWMC-04	RWMC Subsurface Disposal Area (SDA)
RWMC-05	RWMC Transuranic Storage Area (TSA) (Temporary Storage)
ARA-01	ARA-I Chemical/Evaporation Pond To SE (ARA-745)
ARA-19	ARA-II Detention Tank for Fuel Oil/Radionuclides (ARA-719)
ARA-16	ARA-I Radionuclide Tank (ARA-729)
PBF-10	PBF Reactor Area Evaporation Pond (PBF-733)
PBF-16	PBF SPERT II Leach Pond
CPP-66	CPP CFSGP Flyash Pit
CPP-67	CPP Percolation Ponds #1 and #2
ANL-01	Industrial Waste Pond and Cooling Tower Blowdown Ditches (3)
ANL-15	Dry Well by 768
ANL-16	Dry Well by 759 (2)
ANL-17	Dry Well by 720
ANL-21	TREAT Suspect Waste Tank and Leaching Field (non-Radioactive)
ANL-24	Lab and Office Acid Neutralization Tank
ANL-25	Interior Building Coffin Neutralization Tank
ANL-26	Critical Systems Maintenance Degreasing Unit
ANL-27	Plant Services Degreasing Unit
ANL-28	EBR-II Sump (Regeneration)
ANL-29	Industrial Waste Lift Station
ANL-31	Industrial/Sanitary Waste Lift Station

a Code # used by the INEL to identify Solid Waste Management Units (SWMUs) and Land Disposal Units (LDUs).

petroleum distillates, and are accumulated in a satellite storage area located in Building 630 (Figure 4-1). As previously mentioned, when the 55-gallon limit has been reached at the satellite storage area, the hazardous waste site representative or environmental coordinator is contacted to manifest the containers for internal transport and make arrangements for the wastes to be taken to the HWSF at CFA. Section 4.1.1 and Section 4.1.2.3 contain additional information on the HWSF. Waste oils and waste degreasing solvents also generated at the TAN/LOFT through maintenance and shop operations are recycled by off-site contractors. Another process which may generate hazardous waste because of metals concentrations is demineralizer water processing/aqueous makeup operations. Demineralized water is used in all reactor and TRU/high-level and intermediate-level waste processing and storage coolant systems at the INEL. Water must be processed or demineralized to eliminate metals (lead, mercury, chromium, etc.), which become irradiated through time when exposed to radioactivity, and hardwater elements (calcium, magnesium), which would build up and clog coolant pipes. This processing generates liquid hazardous and solid and liquid nonhazardous wastes. Effluent constituents which may be released in de minimis quantities may include metals (arsenic, boron, barium, cadmium, chromium, lead, manganese, mercury, silver).

Low-level radioactive liquid waste from reactor and laboratory operations is discharged to the TAN/LOFT and TAN/TSF percolation ponds (LOFT-02, TSF-07). Waste cooling tower water and laboratory wastewater contribute low levels of radioactive contaminants such as strontium, cobalt, tritium, cesium, cerium, silver, manganese, zirconium, niobium, and other miscellaneous fission products to this liquid waste stream. Solid low-level radioactive waste from reactor and laboratory operations are separated into combustible, compactible, and non-compactible waste types. Typical wastes may consist of papers, rags, glassware, and labware, among other items. As described previously, waste is segregated into separate containers by type, with yellow plastic bags labeled with the magenta radiation symbol. Health Physics technicians remove the bags and monitor the waste for activity level and type. The bags are then sealed with yellow and magenta radioactive materials tape marked with the monitoring information and placed in boxes for transport to WERF, described in Section 4.1.2.6, or RWMC, described in Section 4.1.2.4.

TAN/LOFT SATELLITE STORAGE AREAS

FIGURE 4-1

Liquid nonhazardous waste from cooling equipment and demineralizer water processing/aqueous makeup operation is discharged to the TAN/LOFT percolation pond. Demineralized water contains some solid and liquid nonhazardous wastes as well. Effluent constituents which are being released may include acids, caustics, phosphates, and hydrazine.

Nonhazardous solid wastes such as trash, scrap metals, and construction debris (wood, concrete, etc.) are placed in green dumpsters and disposed of at the CFA Sanitary Landfill III, as described in Section 4.1.2.3.

TAN/TSF

Hazardous waste at the TAN/TSF is generated from maintenance, craft, and machine shop operations. These wastes include crankcase oil contaminated with lead and thallium, petroleum distillates, paints, and solvents. Satellite storage areas for these wastes are located in Buildings TAN-604, TAN-609, TAN-636, and TAN-653 (Figure 4-2). When the 55-gallon waste limit has been accumulated, the waste is shipped internally to the HWSF at CFA. Refer to the previous discussion under TAN/LOFT and Section 4.1.2.3-CFA, for further waste handling detail. Degreaser units containing Stoddard solvent at TAN/TSF are serviced by Safety-Kleen Corporation, an off-site contractor. Some used oil is picked up by another off-site contractor, Cowboy Oil. Both of these substances are recycled.

Mixed waste at the TAN/TSF consists of radioactively contaminated metals and decontamination solutions. The TSF intermediate-level (radioactive) waste disposal system (TSF-09) consists of three underground tanks containing low-level radioactive waste as well as lead, mercury, cadmium, chromium, and PCBs. The tanks are scheduled for D&D in the near future. Generally, most radioactively contaminated metal waste will be sent to the WERF for storage and later processing as described in Section 4.1.2.6.

Radioactively contaminated sodium and lead materials which will be reused and, therefore, are not considered waste, are currently being stored in Building 753 at TAN/TSF. The sodium will be recycled at the ANL-W when processing at the Sodium

FIGURE 4-2

TAN/TSF SATELLITE STORAGE AREAS

Component Maintenance Shop begins. The contaminated lead will be reused within the facility or installation.

Solidified decontamination solutions which have mixed and radioactive portions are segregated at the TSF. The mixed waste is sent to PBF/SPERT III and the radioactive waste is sent to the RWMC landfill for temporary storage (EG&G, Idaho, 1984a).

Both liquid and solid radioactive wastes are generated at the TAN/TSF. Low-level liquid waste is combined with nonhazardous liquid waste and discharged to the TAN/TSF percolation pond. Radionuclides within this waste stream may include tritium, cobalt, silver, manganese, and miscellaneous fission products. Intermediate-level and high-level liquid wastes are discharged from radioactive process drains. This liquid is retained in tanks at the Radioactive Liquid Waste Storage Facility (Building TAN-666) until such time as it can be processed at the ICPP calciner. Section 4.1.2.7 contains a description of ICPP waste management and treatment methods. Drain waste, which is discharged to the percolation pond at TAN/TSF, may be contaminated with cobalt, tritium, cesium, and strontium (EG&G Idaho, Inc., 1984a).

Solid low-level radioactive wastes are segregated at generation points in laboratories and shops into combustible, compactible, and non-compactible waste. Refer to the previous discussion in TAN/LOFT for further disposal details. Low-level solid waste from maintenance operations and hot shops that may be contaminated with cobalt, cesium, strontium, uranium, and rubidium is disposed of at the RWMC landfill (EG&G Idaho, Inc., 1984a). Intermediate-level and high-level radioactive wastes are sent to the RWMC for storage or disposal, as discussed in Section 4.1.2.4.

Recently, the Process Experimental Pilot Plant (PREPP) at TAN/TSF was activated into its testing phase. The primary objective of the PREPP is to process select TRU-contaminated waste that has been generated in national defense programs. This waste is being received and stored at the RWMC. The process is designed to convert the waste into a form acceptable for disposal at the WIPP. Waste processing will consist of shredding, incineration, off-gas treatment, and the immobilization of ash and process residues by cementing in product drums. PREPP processing operations are divided into two campaigns. The initial phase will require that all incoming drums, boxes, and bins contain less than or equal to 10 grams of plutonium each.

The initial phase will continue for approximately 6 months processing an anticipated 1,000 containers at a rate of approximately 9 containers per day, equivalent to 7 tons of waste. The second operational phase will be full-scale operations processing an average of 9 containers per 8-hour shift. The allowable quantity of plutonium per container may be increased to a maximum of 200 grams of plutonium per drum. The average number of grams per drum during the second operational phase will be 13 grams (Baxter, 1986).

Additionally, with respect to high-level waste, the INEL is conducting the Three Mile Island Unit-2 (TMI-2) Core Examination Program at the TAN/TSF facility to provide the analytical data necessary to understand the accident sequence that occurred in the TMI-2 reactor, and to obtain a data base for predicting nuclear fuel behavior during degraded core cooling situations. On July 24, 1986, the INEL began receiving the ceramic-like radioactive core debris, which consists primarily of melted fuel and control rods. The radioactive waste is placed in sealed canisters at TMI-2 and the canisters are then loaded into shielded cask(s) for shipment by flatbed railcars to the INEL. The sealed canisters are then removed from the cask(s) and placed into a water pool in Building TAN-607 for storage. The empty cask(s) are then returned by rail to TMI-2 for reloading. Approximately 5 tons of core debris are scheduled for shipment; however, the full extent of this effort is unknown to date.

Liquid nonhazardous wastes from photoprocessing laboratory operations, demineralizer water processing/aqueous makeup, and heat transfer operations are discharged to the TAN/TSF percolation pond. Some waste coolant water from TAN/LOFT is also discharged to this pond. Chemical constituents from photoprocessing, ion exchange regeneration wastewater, and boiler and cooling tower blowdowns include acids, bases, phosphates, sulfates, photographic fixers, metals (arsenic, barium, cadmium, chromium, lead, manganese, mercury, and silver). Low-level radioactive constituents from blowdowns include tritium, cobalt, silver, manganese, and miscellaneous fission products.

Solid nonhazardous wastes such as trash, rags, and wood are placed in green dumpsters at the facility and disposed of at the CFA Sanitary Landfill. Asphalt, concrete, and other construction debris are also disposed of at the CFA Sanitary Landfill III.

TAN/WRRTF

The TAN/WRRTF currently generates nonhazardous liquid wastes from demineralizer water processing/aqueous makeup and laboratory wastewater and nonhazardous solid waste. This waste is currently discharged to the percolation ponds at TAN/WRRTF (WRRTF-03). Chemical constituents within this discharge consist of small amounts of acids, caustics, and metals (arsenic, barium, cadmium, chromium, lead, manganese, mercury, silver) from the demineralizer water makeup. In the past, liquid was discharged to the TAN/WRRTF two-phase pond (WRRTF-02). Nonhazardous solid waste consists of trash (paper, wood, rags) and construction debris, which is placed in large green containers and disposed of at the CFA Sanitary Landfill.

4.1.2.2 TRA

The TRA Facility (Figures 2-8 and 2-9), which is operated by EG&G Idaho, studies the performance of reactor materials and equipment components under high neutron flux condition. TRA reactors include the Materials Test Reactor (MTR), the Engineering Test Reactor (ETR), and the Advanced Test Reactor (ATR). The ATR is the only active reactor at the TRA. Hot cells are also utilized at the TRA. This facility generates hazardous, mixed, radioactive, and nonhazardous wastes.

Hazardous waste at this facility is generated through ATR, laboratory, hot cell, and maintenance operations (Nishimoto, 1987). These wastes consist of solvents, acids, bases, paints, and thinners, light ballasts potentially contaminated with polychlorinated biphenyls (PCBs), and crushed fluorescent lights potentially contaminated with mercury. Wastes from all the above-mentioned operations are accumulated at satellite storage areas located in Buildings 606, 625, 632, and 661 (Figure 4-3) until they are ready to be shipped to the HWSF at the CFA. Sections 4.1.2.1 and 4.1.2.3 contain further details on waste handling practices and the HWSF. In addition to these hazardous substances, lead is stored outside in the North Storage Area on the site at the TRA pending reuse.

Mixed liquid wastes are generated through hot cell and laboratory operations. Wastes consist of acids such as nitric, hydrochloric, and hydrofluoric, and solvents such as acetone, methylene chloride, and ethyl alcohol contaminated with cobalt,

FIGURE 4-3

cesium, chromium, tritium, and zirconium (EG&G Idaho, Inc., 1984a). These wastes are temporarily stored at TRA and will be internally shipped to the ICPP for solidification. Radioactively contaminated lead and asbestos are currently stored at TRA as well. Lead is stored outside in the North Storage Area awaiting recycling, and the asbestos is stored in specially designed wooden boxes awaiting disposal. Section 4.2 provides additional information on asbestos.

Radioactive wastes are generated through ATR, laboratory, and hot cell operations. Low-level radioactive liquid waste from the ATR and the laboratories is discharged to the TRA warm-waste ponds (TRA-03 in Figure 4-3) after the wastewater is run through an ion exchange bed. Some wastes are retained in the TRA warm-waste retention basin (TRA-04) for activity reduction of short half-life radionuclides. This basin is reported to be leaking. High-level wastewater from the ATR and laboratories is collected in tanks on-site, the TRA hot waste tanks #2, #3, and #4 (TRA-15), then hauled to the ICPP for processing. Solid radioactive wastes are segregated at the point of generation into compactible, noncompactible, and combustible types, as described in Section 4.1.2.1. Compactible and combustible wastes are taken to the WERF for processing, as described in Section 4.1.2.6, and noncompactible wastes are taken to the RWMC for land disposal, as described in Section 4.1.2.4.

Nonhazardous liquid wastes from demineralizer water/aqueous makeup, coolant, ATR, laboratory, and maintenance operations are discharged to three different types of percolation ponds. These ponds are grouped into three warm-waste ponds (TRA-03 in Figure 4-3), two cold-waste ponds (TRA-08), and one chemical/corrosion pond (TRA-06). Combined flow and area of all six ponds is 1.22×10^6 gpd and 6.73×10^5 square feet, respectively. Liquid wastes from the ATR laboratories and loop coolant are influents to the warm waste ponds. Cooling tower blowdown from the ATR discharges into the cold-waste ponds, and demineralizer/regeneration wastewater goes through the TRA brine tank (TRA-20) to the chemical/corrosive pond. Until 1982, all liquid waste (hazardous, radioactive, and nonhazardous) discharged to the warm-waste ponds with the exception of cooling tower blowdown, which was routed to an injection well by the ponds from 1964 to 1982. Also, in the 1970s, there was dumping of drums of unknown chemicals into the warm-waste and the chemical/corrosive waste ponds. Chemical constituents disposed of in the TRA ponds may include acids, caustics, solvents, pesticides, PCBs,

heavy metals, (chromium, arsenic, lead, barium, mercury) and inorganics (phosphate, sulfates). Low-level radioactive constituents include tritium, chromium, cobalt, strontium, cesium, and other miscellaneous fission products.

Nonhazardous solid wastes, consisting of trash, scrap lumber, scrap metal, and garbage, are placed in green dumpsters and hauled to the CFA Landfill III.

4.1.2.3 Central Facilities Area

The CFA, operated by EG&G Idaho, provides centralized support services for programmatic and non-programmatic efforts for all INEL contractors and DOE (Figure 4-4). Some of the major facilities and services located here are vehicle service and maintenance, power management, contaminated laundry, light laboratories, fire station, warehouses, sanitary landfill, and the HWSF (Nishimoto, 1987). Waste types generated here include hazardous, radioactive, and nonhazardous.

Hazardous wastes are generated through motor pool, maintenance, and laboratory operations. These wastes consist of solvents, acids, caustics, oils, waste paint, and pesticides. These wastes are accumulated at satellite storage areas in Buildings 605, 612, 617, 623, 633, 665, 667, and 689 (Figure 4-4) and when the 55-gallon limit has been reached, the containers are transported to the HWSF in Building CF-637 for inspection, repackaging, and manifesting for off-site shipment to a contractor where the waste will be treated, stored, or disposed of.

The HWSF is a RCRA-permitted storage facility for hazardous waste pending shipment off-site to a commercial hazardous waste treatment, storage, and/or disposal (TSD) facility. This contractor, United States Pollution Control, Inc. (USPCI), is located in Utah. Typical wastes that are accepted at the HWSF include corrosives, ignitables, reactives, and oxidizers. However, radioactive and mixed wastes are not accepted. Guidelines to generators throughout the INEL and the IRC are given in the Hazardous Storage Facility Waste Acceptance Criteria Manual published by the Hazardous Waste Programs of EG&G Idaho. This document outlines types of wastes accepted, and container, packing, and shipping requirements. The HWSF is a former ammunition bunker with a floor space of approximately 2,000 square feet that has been modified and upgraded to meet the requirements of 40 CFR 264 for

FIGURE 4-4

the storage of containerized hazardous wastes. The HWSF has two separate rooms: one small, flammable-waste storage room, and a large, nonignitable-waste storage room. The larger room has three areas or bays divided by 4-inch-high concrete curbing, which, in conjunction with the ramps used to provide access to each bay, acts as a liquid containment system. The designed maximum inventory of 55-gallon drums in storage at any given time will not exceed 336 (18,480 gallons) (DOE, 1985). Drained PCB transformers and PCB-contaminated oil are accepted here for storage before off-site shipment. Refer to Section 4.2 Toxic and Chemical Materials for more information on PCBs.

Shipments of hazardous wastes come from all the facilities and contractors on-site and one off-site facility (IRC). The INEL possesses an EPA generator permit for the entire installation. The IRC Facility holds its own EPA generator permit and follows U.S. Department of Transportation (DOT) hazardous waste shipping requirements as well. Some individual facilities at the INEL use public-access highways for internal transport to the HWSF and do not hold their own generator permits. However, the INEL maintains that the facilities are covered under the installation-wide permit. The INEL uses an internal manifesting system which provides information on waste transport to the HWSF. DOT requirements, coding, and labeling are utilized for both internal and external (off-site) shipping. A Spill Prevention, Control, and Countermeasures (SPCC) Plan is in place in the event of a highway accident. The IRC in Idaho Falls generally ships its waste to the HWSF unless the waste volume is large enough to warrant a separate shipment to USPCI. Once waste is received at the HWSF, it is logged, remanifested, and prepared for off-site shipment to USPCI.

Liquid low-level radioactive waste is generated through the Laundry and Respirator Cleaning and Maintenance Facility operations in Building CFA-617. Radioactive contaminants in this wastewater include tritium and strontium, and are discharged to the CFA "Navy Septic Tank" (CFA-08 in Figure 4-4). Further information on the Navy Septic Tank can be found in Section 3.3.2.

Solid low-level radioactive wastes are segregated into combustible, compactible, and noncompactible wastes by the producer at the point of generation. These wastes are handled as described in Section 4.1.2.1. Intermediate-level and high-level radioactive wastes are not generated at the CFA.

Liquid nonhazardous wastes from photoprocessing, laboratory, and coolant operations are discharged to the STP and its associated drain at CFA. Chemical constituents from photographic developing, laboratory wastewater, and boiler blowdown include photodeveloper and fixers, sodium hydroxide, and hydrazine. Constituents within the laboratory wastewater are undetermined (EG&G Idaho, Inc., 1984b).

Solid nonhazardous wastes, such as trash, garbage, wood, and scrap metal produced at this facility as well as at all the other facilities at the INEL are currently disposed of at Landfill III at the CFA.

The CFA Landfill III is located approximately 1 mile northeast of the CFA complex on Portland Avenue. The inactive CFA Landfill I is located on adjoining land near CFA Landfill III, and the inactive CFA Landfill II is located just north of the CFA. Landfill I closed in 1970 and Landfill II in 1982, at which time Landfill III became operational. Specific information regarding Landfills I and II can be found in Section 4.5.1. The size of Landfill III is approximately 30 acres and it is comprised of 19 trenches with dimensions of 1,750 feet long by 36 feet wide by 12 feet deep. The anticipated life of Landfill III is approximately 10 years and it is used for the disposal of nonhazardous solid waste from the INEL. Projected waste volumes for 1987 were estimated to be:

Trash	22,971 cu. yds.
Cafeteria waste	5,898 cu. yds.
Wood scrap	3,604 cu. yds.
Masonry	1,446 cu. yds.
Metal scrap	286 cu. yds.
Other	8,717 cu. yds.
Total	41,832 cu. yds.

A portion of the 8,717 cubic yards of other wastes is asbestos. Approximately 3,113 cubic yards of asbestos and asbestos-contaminated soil are disposed of at a segregated area of Landfill III each year. The asbestos disposal area is clearly

marked, with a sign posted to control access. Most of this waste is delivered in sealed wooden boxes or wrapped in plastic, which adequately controls fugitive emissions. Six inches of soil cover is placed over the asbestos waste daily.

CFA/RESL

Part of the CFA Facility includes the DOE's RESL, located in Building CF-690 (Figure 4-4). The RESL conducts radiochemical analysis and environmental monitoring for the INEL activities as well as research in areas such as revegetation of burned areas and wildlife behavior and population studies. Environmental media sampled for radiological analysis include soil, air, surface water, groundwater, and biota. Foodstuff such as beef, wheat, lettuce, milk, and mutton is also sampled and a thermoluminescent dosimetry network is utilized to monitor environmental radiation. RESL generates hazardous, mixed, radioactive, and nonhazardous wastes.

Hazardous flammable waste solvents are accumulated in 2.5-liter bottles and labpacked in vermiculite for eventual shipment as a hazardous waste. Some nonflammable hazardous liquids and nonhazardous waste liquids are poured down sinks in each laboratory, which are connected to the CFA sanitary sewer system. A broad spectrum of inorganic and organic reagent solutions is being discharged into the CFA sewer in small quantities from RESL laboratories. Containers for nonflammable liquid waste were not available in any of the laboratories at RESL.

Approximately 11,000 vials of 20-mL capacity of mixed waste, containing solvent-based scintillation fluid from the radiation counting instruments, are generated each year at RESL. The vials are packed in vermiculite and shipped to the RMWSF at PBF/SPERT-IV until an approved disposal method can be determined.

Low-level radioactive solid waste generated by the RESL is bagged and sent to the CFA Hot Laundry to be combined with the laundry low-level solid waste for eventual shipment to the RWMC for disposal or to the WERF for incineration as appropriate.

The low-level radioactive liquid waste generated at the CFA laundry bypasses the main sewage treatment plant and is channeled to the Navy Septic system and its associated drainfield, as described in Section 3.3.

The nonhazardous solid wastes are disposed of at the CFA Landfill III.

4.1.2.4 RWMC

The RWMC, operated by EG&G Idaho, is located on a 154-acre tract in the southwest portion of the INEL (Figure 2-3). This facility provides radioactive waste management services for the INEL and for other off-site DOE installations which generate solid low-level and TRU waste such as Argonne-East, Bettis, Battelle Columbus, Mound, and Rocky Flats (only TRU). The RWMC itself generates low-level radioactive and nonhazardous waste. Low-level radioactive solid wastes are generated through the storage and disposal processes at the facility. These wastes are disposed of on-site. Nonhazardous solid wastes, consisting of trash, garbage, etc., are taken to the CFA Landfill III for disposal.

The RWMC was established in 1952 to provide storage and disposal of solid and liquid radioactive and mixed wastes. The primary disposal method at the RWMC is underground burial. The buried waste consists of a variety of radioactively contaminated materials including construction and demolition material, laboratory equipment, protective clothing, maintenance equipment, decontamination materials, and waste processing products. Some hazardous waste was also disposed of here in the past. The hazardous materials known to be buried at the RWMC include acetone and other organics, antimony, asbestos, benzene, cadmium, hydrofluoric acid, mercury, thallium, beryllium, gasoline, lead, nitrates, oil, palladium, PCBs, and zirconium. Exact quantities of these hazardous materials are not known. Table 4-5 illustrates hazardous wastes received from other areas of the INEL which are or may be present at the RWMC. Table 4-6 shows the hazardous materials that are stored with the TRU wastes from the various generators (EG&G, Idaho, Inc., 1986b).

The RWMC is made up of two areas for waste management (Figure 4-5): the Subsurface Disposal Area (SDA) (RWMC-04) and the Transuranic Storage Area (TSA) (RWMC-05). The SDA was the first area established for waste disposal. From 1952

TABLE 4-5

HAZARDOUS WASTES AT THE RWMCA

Source	Materials	Hazardous Rating
ARA	Pb - Pb shielding	Very-likely-present hazardous material ^b
	Zr - not fine enough to be ignitable	Very-likely-present hazardous material
CFA	Pb - Pb dross from Pb Shop	Identifiable hazardous material ^c
	Pb - Pb pig for shielding source	Very-likely-present hazardous material
CPP	Pb, Cd, Pb - brick form uranium - nonpyrophoric form	Identifiable hazardous material ^c
	Pb, Cd, Hg	Very-likely-present hazardous material ^a
	Zr, acids, - raffinate grab samples "everything" basin cleanup sludge, acids and nitrates in 1983 soil	Known-to-be-present hazardous material ^d
NRF	Asbestos, Pb-Pb shielding	Very-likely-present hazardous material
	Resins containing chromate	Known-to-be-present hazardous material
PBF	Pb - Pb shielding	Very-likely-present hazardous material
TAN	Pb - shielding for "hot" waste in waste package	Very-likely-present hazardous material
TRA	U, UO ₂ - uranium scrap	Identifiable hazardous material
	Be - Be reflect pieces	Very-likely-present hazardous material
	Cr, Na - resin	Known-to-be-present hazardous material

Source: EG&G Idaho, Inc., 1986b

- ^a Information taken from correspondence written by T. Watanabe and sent to D.L. Uhl from E. A. Jennrich.
- ^b Very-likely-present hazardous material constituent - depended on the knowledge of the waste based on a description, building of origin, timeframe, and other sources of the person interviewed.
- ^c Identifiable Hazardous Material - if hazardous material was specifically mentioned, i.e., lead pig or lead bricks.
- ^d Known-to-be-present hazardous material constituent - same basis as "very likely present" but more of an educated guess or inference.

TABLE 4-6

HAZARDOUS MATERIALS INCLUDED IN STORED TRU WASTES

Hazardous Material	Waste Generators				
	MND	BCL	ANL-E	RFP	INEL
Mercury (elemental)	X			X	
Beryllium (compounds)	X		X	X	X
Asbestos		X			X
Nitrated Wastes	X		X	X	
Organic Wastes (mixtures unknown)			X	X	
Polychlorinated Biphenyl (PCB)		O	O	X	
Other Chemical Unknown				X	
Gas Generation/Pressurization in Waste Containers	O			X	
Pressurized Vessels				O	
Batteries (lithium, mercury)				X	
Biological Wastes				X	
Pyrophorics				O	

Source: EG&G Idaho, Inc., 1986b

MND = Mound Laboratory
 BCL = Battelle Columbus Laboratory
 ANL-E = Argonne National Laboratory - East
 RFP = Rocky Flats Plant
 INEL = Idaho National Engineering Laboratory
 X = Hazard identified as existing in stored waste
 O = Hazard identified as potentially existing in stored waste

to 1954, only wastes contaminated with beta-gamma-emitting radionuclides were buried at this area. From 1954 to the 1960s, the SDA received TRU waste for disposal in shallow pits. During that time the SDA expanded from its original 13 acres to 88 acres. It should be noted that nonretrievable TRU-contaminated waste materials were buried at the SDA prior to 1970. In 1970 a TRU waste management policy was adopted that required all waste contaminated with TRU radionuclides above 100 nCi/g to be placed in interim storage until a Federal repository was available for permanent disposal. At that time, the 56-acre TSA was established adjacent to the SDA. Figure 4-5 illustrates the growth of the RWMC from 1952 to 1970. Figure 4-6 illustrates waste burial areas by waste type.

The TSA is a secure TRU waste storage area dedicated to content and structural integrity examination of storage containers, and to waste certification. TRU waste stored at TSA will ultimately be shipped to the WIPP in New Mexico for permanent storage. Major facilities located in the TSA (Figure 4-7) are:

1. Stored Waste Examination Pilot Plant (SWEPP) is the waste examination and certification area.
2. Certified and Segregated (C&S) building provides segregated storage for certified waste scheduled for WIPP.
3. Drum Venting Building (DVB) houses the Drum Venting System that installs a carbon composite fibers venting system in the lids of pre-1984 stored waste drums. This system prevents hydrogen buildup inside the drums.
4. TSA Pads 1 and 2 are used for covered storage of TRU waste and are designed to provide a minimum of 20 years of retrievable storage. Pad 1 has been filled (28,939 cubic meters) and covered with earth. Pad 2 is approximately half filled (10,044 cubic meters) and is protected from the weather by an Air Support Weather Shield (ASWS).
5. TSA-R is an asphalt storage pad originally dedicated for the storage of retrieved TRU waste from the SDA. The pad is currently being used to

FIGURE 4-5

RWMC GROWTH FROM 1952 TO 1970

Source: EG&G Idaho, Inc., 1985a

RWMC DISPOSAL AREAS DEFINED BY WASTE TYPES

FIGURE 4-6

Source: EG&G Idaho, Inc., 1986a

RWMC TRANSURANIC STORAGE AREA (TSA)

FIGURE 4-7

store contact-handled TRU waste in fiberglass-reinforced boxes and metal bins from off-site waste generators.

6. TSA Pad 3 was built in 1983 to support the SWEPP activities. The C&S building is constructed over a major portion of this pad.
7. The Intermediate-Level Transuranic Waste Storage Facility (ILTSF) is located in the southwest corner of TSA. Waste stored here is retrievable and has activity levels of less than or equal to 4,500 R/hr. Earth bermed vaults are utilized at the ILTSF for shielding and retrieval. These vaults are made of carbon steel and are plugged with concrete. Each vault is capped and sealed against moisture.

4.1.2.5 Auxiliary Reactor Area

The Auxiliary Reactor Area (ARA) Facility, operated by EG&G-Idaho, at one time consisted of four sites (I-IV) which housed three experimental reactors and reactor support facilities (Figure 2-3). Current activities include a radiochemistry laboratory at ARA-I (Figure 2-12) and welding qualification testing at ARA-II (Figure 2-13). Hot cell testing operations at ARA-I are currently scheduled for decommissioning. ARA-IV has been decommissioned. Waste types generated at the ARA include hazardous, radioactive, and nonhazardous.

Small quantities of hazardous wastes are generated from a materials laboratory at ARA-I. There is a satellite storage area at this laboratory. Waste accumulation containers are transported to the HWSF at the CFA when the 55-gallon limit has been reached.

Low-level radioactive liquid waste may be generated at the radiochemistry laboratory at ARA-I in very small quantities and discharged to an evaporation pond at the area. During the cleanup of the SL-1 Reactor area, the ARA-II detention tank for fuel oil/radionuclides (ARA-19) was utilized. The radioactive liquid is still in this tank.

Low-level solid radioactive waste is segregated into combustible, compactible, and non-compactible. Waste is handled as described in Section 4.1.2.1. Liquid

radioactive wastes from the current decontamination and decommissioning (D&D) of the ARA-1 hot cells are taken to the ICPP calciner for solidification and storage.

Solid intermediate-level, and high-level radioactive wastes from the D&D of the ARA-1 hot cells will be taken to the RWMC for disposal. In the past, the ARA-1 Radionuclide Tank (ARA-16) was utilized for hot cell washwater. Waste contaminants consist of miscellaneous fission products and miscellaneous activation products. No other waste of this type is generated here.

Laboratory activities also produce nonhazardous wastewater, which discharges dilute amounts of hazardous chemicals to an evaporation pond (ARA-01). Discharge to this system has not been fully characterized. Small quantities of a wide variety of chemicals and radionuclides have been and are utilized in the operations.

Nonhazardous solid wastes such as trash and construction debris are disposed of at the CFA Sanitary Landfill.

4.1.2.6 PBF/SPERT

The PBF/SPERT area is located in the south-central portion of the INEL, about 6 miles northeast of the CFA, in an area originally developed for the SPERT (Figure 2-3). The PBF/SPERT Control Area (Figure 2-15) was built to support the Thermal Fuel Behavior Program's testing on pressurized-water reactor fuel rods under normal and off-normal operating conditions and hypothetical reactor accidents. The four SPERT reactor areas were built in the late 1950s for investigations involving reactor transient behavior tests and safety studies on water-moderated, enriched-fuel reactor systems (Figures 2-16 through 2-19). All the SPERT reactors have been removed and most of the facilities have since undergone partial or complete D&D.

WERF is a permitted waste minimization operation located at PBF/SPERT-III. This facility utilizes incineration and compaction for low-level radioactive solid waste reduction.

In general, wastes generated at PBF/SPERT from laboratory, decontamination, demineralization/aqueous makeup, and maintenance activities include hazardous, mixed, radioactive, and nonhazardous.

Hazardous wastes such as solvents and oils are generated from some of the operations described by specific areas (i.e., PBF/SPERT-I) below. These wastes are accumulated at satellite storage areas and handled as described in Section 4.1.2.1.

Liquid waste in the form of laboratory wastewater, demineralizer regenerant, and cooling tower blowdown was discharged into a hypalon-lined, corrosive waste evaporation pond at PBF from 1979 to 1984. Contaminants to the evaporation pond from the previously mentioned sources may have included acids, bases, inorganics, organic solvents, chromium and other metals, and radionuclides (mixed activation products, mixed fission products). Currently this pond is on standby and has approximately three inches of dried, possibly mixed-waste sludge on its bottom.

Mixed wastes generated at this facility consist of flyash and particulates in incinerator baghouse filters from the WERF. These filters are contaminated with heavy metals and radionuclides and are transferred to PBF/SPERT-IV for storage at the RCRA-permitted RMWSF, described later in this section.

Solid radioactive wastes such as ion exchange resin columns are sent to the RWMC for burial, as discussed in Section 4.1.2.4, and liquid radioactive wastes from decontamination operations are transported to ICPP for calcining, as discussed in Section 4.1.2.7. Nonhazardous solid wastes such as trash, garbage, etc., are placed in green dumpsters and hauled to the CFA Landfill III for disposal.

PBF/SPERT Control Area

The PBF/SPERT Control Area functions as an administrative/support center for this facility and is mainly used for offices and storage space. Waste generation consists of general trash and debris which is placed in green dumpsters and hauled to the CFA Landfill III for disposal.

PBF/SPERT-I

The PBF reactor achieved criticality in 1972 and was used until February 1985 to study the behavior of fuel rods under a variety of conditions. Major components of the PBF reactor system include a 32,000-gallon open tank reactor, a 22,000-gallon

canal for temporary storage of reactor fuel and test fuel assemblies, a central flux region containing a cylindrical in-pile tube in which the test fuel is isolated, and various coolant systems. Other structures that supported PBF operations are the cooling towers, the auxiliary building where the secondary cooling water was chemically treated, the hot-waste storage tank, the warm-waste injection well, the corrosive waste injection well, the corrosive waste disposal sump, and the corrosive waste evaporation pond. These inactive waste disposal sites are discussed in detail in Section 4.5.

The PBF Demineralization Plant, which is currently on standby status, consists of two mixed-bed demineralizers that, when operating, are regenerated after treating about 15,000 gallons of water each. Regeneration involves successive flushes with sulfuric acid, sodium hydroxide, and about 3,000 gallons of rinsewater (possibly hazardous). These corrosive solutions are drained to a common 12,000-gallon sump where they are neutralized by mixing. From 1972 to 1978, neutralized wastes containing an average of 1,500 kg/yr of sodium hydroxide and 1,300 kg/yr of sulfuric acid were pumped from the sump and discharged into the corrosive waste injection well, as is discussed in Section 4.5. From 1979 to 1984, these neutralized wastes, which contained an average of 1,300 kg/yr of sodium hydroxide and 1,200 kg/yr of sulfuric acid, were sent to the previously described hypalon-lined corrosive waste evaporation pond (PBF-10). This lined evaporation pond prohibited the percolation of wastes into the environment, unlike the other waste ponds at the INEL, which are designed to allow wastes to percolate into the subsoils. After 1984, the evaporation pond was placed on standby and the effluent was redirected to a disposal sump. The pH of the sump effluent has been monitored since late 1984 and has usually been between 6.5 and 7.0. Prior to that the pH was not checked. However, since the neutralization and disposal methods have not been changed, it is likely that previous releases were also nonhazardous prior to 1984.

Other wastes generated at the PBF/SPERT-I include disposable ion exchange resins that are used to maintain water purity in the reactor vessel, canal, and experimental loop. These resins, which may contain radioactive contaminants, are sent to the RWMC for burial when depleted. Waste solvent (TURCO-4521 and TURCO-4502) is also generated during decontamination of the sampling system. These wastes are sent to the ICPP for treatment, along with the other hot wastes generated at the PBF. Waste hydraulic oil is generated during the maintenance of mechanical

equipment. This waste oil was stored in 55-gallon drums on a concrete pad and then transferred to the CFA for disposal.

PBF/SPERT-II

The Waste Engineering Development Facility located at PBF/SPERT-II conducts research on hazardous waste stabilization. The stabilization process has received tentative approval from the EPA as a hazardous waste treatment process. If successful, the stabilization process would render certain hazardous wastes nonhazardous by chemically or physically modifying their hazardous properties. A small discharge from Building 612 where the testing is taking place trickles to the SPERT-II leach pond (PBF-16). This effluent may contain dilute amounts of boric acid only. The pond received wastewater from demineralizer and reactor operations from 1960 to 1964 and contained sulfuric acid, sodium hydroxide, and small levels of arsenic, cadmium, chromium, lead, mercury, and low-level radioactive waste.

The hazardous waste used for the research is not generated at PBF/SPERT-II. The current research effort is directed at the WERF flyash, which is a mixed waste. Only small samples of the wastes are brought to PBF/SPERT-II for stabilization. The research waste materials are disposed of at the RWMC if they are nonhazardous and radioactive, or, if they remain hazardous and radioactive, they are returned to the hazardous waste container from which they were extracted. All the mixed wastes are stored at SPERT-IV until an approved disposal method can be developed. This entire research effort is closely monitored and is supported by an off-site analytical laboratory to determine the hazardous characteristics of both the raw waste samples and the stabilized waste.

PBF/SPERT-III (WERF)

Since about 1982, the SPERT-III facility has been used to house the WERF project. The WERF was established in 1982 to reduce the size and volume of low-level beta-gamma contaminated metals and is a RCRA permitted waste minimization facility. The principal wastes generated here consist of bottom ash and slag, which are nonhazardous but radioactive and are sent to the RWMC for burial. However, the flyash and particulate matter removed from the baghouse filter are handled as a mixed waste because of their heavy-metal content. This waste is being stored at

PBF/SPERT-IV. WERF receives metal wastes from all facilities at the INEL except for ARA, NODA, and the IRC, as these areas do not generate this type of waste.

WERF operations provide several processes for the management of low-level radioactive metal wastes. Oversized wastes can be sized with saws and cutting torches to accommodate special waste disposal techniques. Facilities are also available for compacting and decontaminating activities. In addition, low-level metallic wastes can be melted and poured into ingots for disposal at the RWMC. However, the primary waste management activity performed at the WERF is incineration. The WERF incinerator is a dual-chambered, controlled-air type. Principal components include a gravity-fed loading chute that acts as an airlock for introducing boxed waste into the lower chamber, the lower or primary chamber where the boxed waste is first introduced and ignited, the upper or secondary chamber that acts as an afterburner for the volatile gases from the burning waste, and an ash ram that periodically strokes forward to push residual ash toward the rear of the lower chamber and the ash cooling hopper (Figure 4-8).

Three types of waste are identified for incineration at the WERF--solids, liquids, and absorbed liquids. The solid wastes consist of materials such as nonchlorinated plastics and papers generated at the site. These wastes are placed in 2-foot by 2-foot by 2-foot cardboard boxes and are then fed to the incinerator. Combustible, hazardous, radioactive, or mixed liquid wastes are brought to the WERF in drums and fed to the incinerator through an experimental liquid waste feed system. Liquid waste injection is not routinely performed and has been temporarily suspended until a RCRA permit is obtained for this activity at the WERF.

Some liquid wastes cannot be processed through the liquid waste feed system because of their small quantities or their physical properties (i.e., solids content or viscosity). However, these wastes may be incinerated by absorbing them into combustible material, boxing the waste-laden absorbent, and processing it as with solid waste. This waste may also consist of liquid waste that is already absorbed into material such as rags or spill control material. This incineration method is called in-box incineration and the incineration of these prepared boxes proceeds as with normal solid waste.

WERF RADIOACTIVE WASTE CONTROLLED AIR INCINERATOR

FIGURE 4-8

PBF/SPERT-IV

The RMWSF at PBF/SPERT-IV is currently used to store mixed solid and liquid wastes. This storage facility is RCRA permitted. Presently, mixed wastes from all over the INEL site are manifested to SPERT-IV, since there are no approved mixed waste treatment or disposal facilities available either on the site or off the site for the INEL to utilize. When an approved facility is located, it is planned to remanifest the mixed waste to that location. PBF/SPERT-IV does not generate waste itself except sanitary waste from a lavatory facility.

4.1.2.7 ICPP

The ICPP, operated by WINCO, processes irradiated nuclear fuel to recover uranium and other radionuclides and safely manage the generated radioactive waste (EG&G Idaho, Inc., 1986a) (Figure 2-3). Wastes at this facility are generated through fuel storage and dissolution, effluent treatment, waste solidification, demineralized water/aqueous makeup waste, maintenance shops, laboratories, and pilot plants. Waste types include hazardous, mixed, radioactive, and nonhazardous.

Hazardous wastes are generated at the ICPP through demineralized water/aqueous makeup, laboratory, pilot plants, and maintenance operations. Wastes include waste paints and thinners, solvents, acids, caustics, corrosives, inorganics, pesticides, and heavy metals. Liquid wastes from laboratory and maintenance operations are accumulated at satellite storage areas located in Buildings 601, 637, and 663 (Figure 4-9) until the volume limit is met, at which time containers are picked up by the waste coordinator and taken to the 90-day accumulation area within the ICPP or transferred to the HWSF at the CFA. Wastes are then inventoried, inspected, repackaged, stabilized, as well as manifested, logged, and shipped off-site, to USPC, an outside contractor.

Mixed waste consists mainly of heavy metals such as cadmium, mercury, and lead with low-level radioactive contamination. This waste is drummed and shipped to on-site storage (the RMWSF at PBF/SPERT-IV). Mixed waste may also be associated with the Process Equipment Waste (PEW) system discussed below. Additionally, radioactively contaminated asbestos is stored at ICPP, as discussed in Section 4.2.

ICPP SATELLITE STORAGE AREAS

FIGURE 4-9

Liquid radioactive waste is generated through fuel dissolution/uranium separation, waste solidification, laboratory, pilot plant, and maintenance operations. This waste mainly consists of solutions generated during fuel reprocessing and wastewater from the water treatment facilities, heating/cooling systems, and laboratory and floor drains (Ostby, 1987). Some organic constituents are also associated with these waste streams. Liquid radioactive wastes at the ICPP are classified as high-, intermediate-, and low-level. All high- and intermediate-level wastes are solidified through a process called calcining. This waste is

... routed to the Process Equipment Waste (PEW) evaporators for concentration and separation into high- and low-level fractions. The evaporators concentrate the liquids by vaporizing the water and other volatiles. The high-activity fraction collected in the bottom of the evaporator is transferred to one of the high-level liquid waste storage tanks for processing with the other high-level waste. The low-level 'overhead' vapors are collected, condensed, sometimes treated by ion exchange, and combined with the service waste system. The combined service waste stream is discharged to [the] percolation [pond]... After some interim storage period in the tank farm, the high- and intermediate-level wastes are transferred to the New Waste Calcining Facility (NWCF), combined with chemical additives to minimize corrosion, and then sprayed into a heated fluidized bed of granular solids. The liquid waste is transformed into metallic oxides (called calcine) within the bed... The calcine is removed near the bottom of the bed and pneumatically transported to storage bins (EG&G Idaho, Inc., 1985).

Solid low-level radioactive waste is produced through effluent treatment, fuel storage, fuel dissolution/uranium separation, waste solidification, laboratories, and pilot plants, and maintenance/utility operations. These low-level wastes are segregated into compactible, noncompactible, and combustible wastes at the point of generation. All low-level wastes are then placed in locked cages throughout the facility by Health Physics technicians, where they are collected and taken to the PBF/SPERT-IV if they are mixed wastes or the RWMC if they are radioactive waste.

Liquid nonhazardous or low-level radioactive wastes from effluent treatment, demineralizer water processing/aqueous makeup, maintenance, and laboratory and pilot plant operations are discharged as service waste to the percolation ponds (CPP-67 in Figure 4-9) on the site at the ICPP. Although there are two ponds, one has not functioned properly and is not used. The other operating pond has been in service since 1985 and has a flow of approximately 1.5×10^6 gpd. Service waste consists of cooling tower and heat exchanger blowdowns, laboratory effluent, floor drains, raw water from the demineralizer, and PEW condensate. It contains metals (arsenic, barium, cadmium, chromium, lead, mercury, silver), solvents, pesticides [endrin, lindane, 2, 4-D (tributyl phosphate)], and radionuclides (tritium, plutonium, strontium, rubidium, iodine, carbon, cesium, cerium, cobalt); however, it does meet the Uncontrolled Area Guide (UAG) limits which are used for exposure limits in areas of public access as defined in DOE Order 5480.1 (WINCO, 1986b).

Solid nonhazardous wastes such as trash and construction debris from laboratories, offices, and maintenance operations are disposed of in green dumpsters and taken to the sanitary landfill at the CFA. Other solid wastes such as flyash from the Coal-Fired Steam Generating Facility (CFSGF) are disposed of in the CFSGF flyash pit (CPP-66 in Figure 4-9) near the facility.

4.1.2.8 Argonne National Laboratory West

ANL-W/TREAT

The TREAT Facility, located 3/4-mile northwest of the main ANL-W installation, performs high-power transient operation for safety tests for reactors (EG&G Idaho, Inc., 1986a). Waste types generated include radioactive and nonhazardous.

Radioactive liquid wastes generated from personnel and equipment decontamination activities at the TREAT discharge to a retention tank near this site. Tank contents are monitored for radioactivity and may either be discharged to a drainfield or pumped into a tank truck and taken to the Radioactive Liquid Waste Treatment Facility (RLWTF) at the ANL-W for processing. The decision to release the liquid to the environment is based on Derived Concentration Guides (DCGs) for specific isotopes. If the activity of the liquid is below the DCGs, this liquid is discharged to the drainfield and the surrounding soils, where radioactive

constituents may accumulate through time. The RLWTF separates liquids and solids through "...evaporation by forming a sludge within a disposal unit called a shielded hot-air drum evaporator (SHADE). When full, a SHADE is encased in concrete within a steel drum and sent to the ... RWMC for interim storage" (Holzemer and Witbeck, 1987).

Radioactive solid wastes from cleanup activities are segregated into compactible, noncompactible, and combustible waste types by the generator as described in Section 4.1.2.1. These wastes are taken to the outside radioactive waste storage area at the ANL-W to await disposal at the PBF/SPERT-III (WERF) and the RWMC.

Nonhazardous liquid waste is discharged to a septic tank and leachfield (ANL-21) dedicated to the TREAT Facility. Nonhazardous solid wastes (trash, rags, etc.) are placed in green dumpsters and hauled to the CFA Landfill III for disposal.

ANL-W/EBR-II

Much of the main ANL-W site is dedicated to support the EBR-II, an experimental liquid-metal-cooled fast breeder reactor. This facility also provides irradiation tests and operational reliability tests (EG&G Idaho, Inc., 1986a). A majority of the shops and laboratories are located here. Waste types generated include hazardous, mixed, radioactive, and nonhazardous.

Hazardous wastes generated through the laboratories and shops include acids, caustics, solvents, waste paints and thinners, waste oil, and heavy metals. The majority of wastes are acids and solvents, which come from metal etching processes, maintenance shops, and paint shops. Hazardous wastes from laboratories and shops are accumulated at satellite storage areas located in Buildings 752, 753, 765, 768, and 782 (Figure 4-10). The site waste management engineer arranges for the wastes to be shipped internally to the CFA HWSF for later off-site disposal. Waste oil is recycled through Cowboy Oil, an outside contractor. Silver from the photoprocessing developer is recovered and sent off-site for contractor recycling. Degreaser units in Buildings 788 and 753 (ANL-26 and ANL-27, respectively, in Figure 4-10) are serviced by Safety-Kleen, another off-site contractor.

ANL-W WASTE MANAGEMENT FACILITIES

FIGURE 4-10

Mixed wastes include solvents and heavy metals contaminated with radioactivity that are generated through maintenance, reactor/hot cell operations, and the Sodium Component Maintenance Shop (SCMS). Radioactive sodium from the reactor will be reprocessed on-site at the SCMS. Liquid radioactive waste from this operation will be routed to the RLWTF at the ANL-W. Solid mixed waste is transported to the RMWSF at the PBF/SPERT-IV.

Radioactive liquid and solid wastes are generated at ANL-W. Liquid wastes are processed internally, with solid waste being shipped to the RWMC. Hot liquid waste lines and drains from radioactive processes at the Hot Fuel Examination Facility (HFEF) and EBR-II and chemistry laboratories throughout this facility bring effluent to the RLWTF as previously described in the previous section on TREAT. Low-level radioactive solid wastes are handled as described in Section 4.1.2.1. Fissile materials from fuel assembly processing conducted at the HFEF are sent to the ICPP for processing. The end pieces of the assemblies are taken to the RWMC. Assemblies are temporarily stored on the site while awaiting examination and processing.

Liquid nonhazardous waste is generated through demineralizer water process aqueous makeup, cooling systems, and laboratory operations. Wastewater from cooling towers, air conditioners and compressors, boilers, resin column regenerators, and water chemistry and photoprocessing laboratories is released into dry wells (ANL-16 and ANL-18) and lift stations (ANL-29, ANL-30) and then discharged to a drainage ditch system and eventually to the industrial waste pond (ANL-01) at ANL-W, which acts as a percolation pond (Figure 4-9). Chemical constituents from past discharges may have included acids, bases, heavy metals (chromium, cadmium, silver, barium, lead), inorganics (nitrate, sulfate), organic solvents, biocides (Betz Slimicide C-30 containing methylene bis thioisocyanate, dimethylformamide, bis (trichloromethyl) sulfone), other organics (hydrazine, dimethylamine) and radionuclides (tritium, cesium, cerium, cobalt, zirconium, niobium).

Current discharges include sulfate, monoethylamine, the biocide Betz C-30, and tritium. Acids and bases are now neutralized in tanks (ANL-24, ANL-25) and a sump (ANL-28) prior to discharge (Figure 4-10). Chromates are no longer used in the cooling tower and silver recovery units have been added to all photoprocessing equipment. The only radionuclide discharged at measurable concentrations is

tritium in the turbine condensate and this is within the concentration permitted by DOE Orders.

Solid wastes, such as trash and rags, are put on green dumpsters and disposed of at the CFA Sanitary Landfill III.

ANL-W/ZPPR

The ZPPR, also located on the main ANL site, is an ANL-W low-power operation for studying the physics of very large breeder-reactor cores (EG&G Idaho, Inc., 1986a). Waste types generated include radioactive and nonhazardous.

Radioactive liquid waste is produced by personnel and equipment decontamination facilities. Liquid is treated at the RLWTF at the ANL-W (as discussed earlier). Radioactive solid wastes consisting of rags, paper, etc., are handled as described in Section 4.1.2.1.

Nonhazardous liquid industrial waste effluents are discharged to the industrial waste pond on the site as previously described. Solid wastes such as trash and construction debris are put on green dumpsters and disposed of at the CFA Landfill III.

4.1.2.9 Other Facilities

Other smaller facilities at the INEL, notably NODA, ARVFS, and the IRC, contain waste management facilities that are described in this section.

NODA

The NODA at the CFA is an open burning ground for waste explosives and highly reactive, unstable chemicals (DOE, 1985) (Figure 2-3). This facility is RCRA permitted for thermal treatment. Partially detonated explosives can be seen throughout the area. Reactive wastes are exploded and completely burned in three firing pits in the area. This facility is under EG&G jurisdiction.

ARVFS

The ARVFS is an inactive site formerly used by the U.S. Department of Defense for unspecified testing (Figure 2-3). Presently, four containers containing a total of approximately 165 gallons of plutonium-contaminated NaK, a sodium-potassium alloy, are stored in a bunker at this facility until the plutonium can be recovered and the metal alloy reprocessed. The containers have an argon atmosphere and are stored within a dumpster packed with vermiculite. This area is secure and under EG&G control.

IRC

The IRC, located in Idaho Falls, Idaho, is a nonnuclear scientific and engineering research and development (R&D) laboratory complex (LaCombe, 1982) (Figure 4-11). This facility is operated by EG&G. Hazardous, mixed, and nonhazardous wastes are generated at this facility. No radioactive wastes are generated at this facility.

Hazardous wastes produced at the IRC from laboratory activities include a variety of solvents, metals, acids, and caustics. These wastes are accumulated at satellite storage areas in laboratories within the complex. There is a 90-day accumulation point in a large bay area for staging the waste for shipment from the facility to either the HWSF at the CFA for later off-site disposal by USPCI, an off-site contractor, or directly to USPCI. Shipment route is determined by quantity of wastes to be disposed of. Labpacks make up a large percentage of waste shipped. The HWSF is described in Section 4.1.2.3.

A very limited amount of mixed waste is generated through microbial tracer experiments. Toluene-based scintillation fluids in vials with the tracers are currently shipped to PBF/SPERT-IV at the INEL for storage.

Liquid nonhazardous wastes and neutralized acids and bases from the laboratories are discharged to drains and flow through a dedicated laboratory effluent sewer system and tank within the building to the Idaho Falls sewer system and POTW. Acceptable pH of effluent from the flowthrough tank is 5.5 to 8.5. Neutralization at the IRC must occur if the discharge does not meet this range.

IRC FACILITY PLAN

FIGURE 4-11

Solid nonhazardous wastes, such as trash, glassware, and paper, are disposed of at the Idaho Falls Municipal Landfill.

4.1.3 Findings and Observations

4.1.3.1 Category I

None

4.1.3.2 Category II

None

4.1.3.3 Category III

1. Contamination by waste percolation ponds—Liquid wastes that contain or may contain hazardous and radioactive constituents are being disposed of in surface percolation ponds, and are or may be contaminating the soils and groundwater.

Percolation ponds at the INEL which may be receiving or may have received hazardous and/or radioactive contaminants include the TAN/TSF disposal pond, the TAN/LOFT disposal pond; the TRA warm-waste ponds, the TRA chemical/corrosive pond, the TRA cold-waste pond, the ARA-I chemical/evaporation pond, the ICPP percolation ponds 1 and 2, and the ANL-W industrial waste pond.

TAN

The TAN/TSF disposal pond, which has a capacity of 1.14×10^6 gallons and a 40,500-square-foot area, receives cooling water and liquids from process drains. There also was a one-time disposal of 61 gallons of carbon tetrachloride (EG&G, 1986c). Contaminants from the cooling water and process drains include chromium and radionuclides (tritium, cobalt, silver, manganese, cesium, strontium, and other miscellaneous fission products). Contamination from various process chemicals is also likely. The sediment in

the pond and the unsaturated zone beneath the pond is also likely to be contaminated with waste chemicals and radionuclides from current and historic discharges. The depth to groundwater is approximately 200 feet through fractured basalt, so aquifer contamination potential exists.

The TAN/LOFT disposal pond, which has a capacity of 1.8×10^7 gallons and a 125,000-square-foot area, receives cooling tower and boiler blowdown and liquid effluent from operations housed at the TAN/LOFT complex. Contaminants from the TAN/LOFT blowdown water may currently or historically include metals (lead, mercury, arsenic, cadmium, boron, barium, silver, and chromium), acids, caustics, phosphates, hydrazine, and radionuclides (tritium, cesium, cerium, cobalt, zirconium, niobium, strontium, and other miscellaneous fission products). The pond sediment and the unsaturated zone beneath the pond is likely to be contaminated. As the depth to groundwater is approximately 200 feet through fractured basalt, aquifer contamination potential exists.

TRA

There are six TRA waste ponds, with a combined flow of 1.22×10^6 gpd and combined area of 6.73×10^5 square feet, that function primarily as percolation ponds. Three are warm-waste ponds (in service since 1952, 1957, and 1964, respectively), one is a chemical/corrosive pond (in service since 1962), and two are cold-waste ponds (in service since 1982). After 1957, the 1952 and 1957 warm-waste ponds received essentially the same contaminated effluent because the 1957 pond served as overflow for the 1952 pond. Prior to 1964, all TRA liquid waste was discharged to these ponds. Discharge consisted of cooling tower blowdown, heat exchanger blowdown and condensate, sanitary wastes, floor, sink, and equipment drains, and demineralizer resin waste. The third warm-waste pond was constructed in 1964 and served as an overflow for the 1952 and 1957 ponds. The 1964 ponds received the same effluent as the previous ponds with the exception of cooling tower water, which was diverted to an injection well when this pond was established.

Within the discharge flow system to the TRA warm-waste ponds there is a leaking retention basin which is releasing effluent to the soils and

groundwater as well. The basin is utilized to hold the waste to reduce the activity levels from radionuclides with shorter half-lives before discharge to the warm-waste ponds. Contaminants from the aforementioned effluent sources included or may include acids, caustics, solvents, inorganics, metals (arsenic, lead, barium, mercury, chromium), and radionuclides (tritium, chromium, cobalt, strontium, cesium, and other miscellaneous fission products). Approximately 48,000 curies of beta-gamma activity in the form of miscellaneous activation and fission products were released to the warm-waste ponds between 1952 and 1977. Sediment samples contained organic contaminants, including heptachlor, PCB, DDT, DDE, DDD, dieldrin, and endrin, which may have entered the pond as a result of dumping of chemicals in the 1970s and local pesticide applications (EG&G, 1986c).

The TRA chemical/corrosive pond receives regenerant from a bypass demineralizer. Contaminants expected from the demineralizer resin are mainly heavy metals (mercury, chromium, barium, lead, cadmium). During the mid-1970s, unknown contents of miscellaneous drums from the CFA were commonly dumped into this pond as well. (Employee Interview, 1987). Documentation states that organics are present in the sediments [PCBs, toluene, BHC, bis (2-ethyl-hexyl) phthalate] (EG&G Idaho, Inc., 1986c).

The two TRA cold-waste ponds receive cooling tower blowdown. Chromium and radionuclides (tritium, cesium, cerium, cobalt, and other miscellaneous fission products) from the blowdown may be contaminating these ponds.

Contaminants from both current and historic use are expected to be present in the porous sediments, unsaturated soil zone, and groundwater beneath each of these ponds at TRA. Studies have shown contaminant plumes (i.e., iodine-129) from this area, as described in Section 3.4.

ARA

The ARA-I chemical/evaporation pond (in service since 1970) is a collection basin near the laboratory drain discharge point from Building 627. This pond has an approximate functional area of 10,000 square feet and estimated flow of 77 gpd. Contaminants from the operations within the building that may be

entering the pond consist mainly of organic solvents in addition to heavy metals, acids, and low-level radionuclides. However, quantities of chemicals disposed of are unknown. Discharge from the effluent line is directly onto the soil; it flows approximately 3 feet before disappearing. Contaminant concentration and reaction within the soil are possible. The unsaturated zone below the discharge point may potentially be contaminated as well.

ICPP

The ICPP percolation pond 1 (in service from February 1984 to October 1985) and pond 2 (in service since October 1985), whose combined flow and area are approximately 1.5×10^6 gpd and 3.2×10^5 square feet, respectively, have received and are receiving discharges in the form of process equipment waste overhead condensate, cooling water and heat exchanger blowdown, waste from water demineralization, and potentially contaminated liquids from laboratory sinks and drains. Environmental contaminants within this waste stream may include metals (chromium, cadmium, arsenic, barium, silver, mercury, lead), inorganics (nitrates, sulfates), organics (solvents, petroleum-based liquids), pesticides, and radionuclides (tritium, cesium, plutonium, rubidium, carbon, cobalt, strontium, iodine, cerium). It is likely that the sediment within the ponds and the soil directly below have received and are receiving and concentrating these contaminants. It is uncertain whether the contaminants have reached the perched aquifer created by the ponds approximately 40 feet below ground surface; however, the potential for groundwater contamination does exist.

ANL-W

The industrial waste pond at the ANL-W (in service since 1959), with an estimated flow and area are 15,600 gpd and 2.1×10^5 square feet, respectively, receives discharge in the form of cooling tower blowdown, and historically, photoprocessing waste and wastewater from laboratory drains and sinks. Environmental contaminants from these sources to the pond may include acids, bases, metals (chromium, cadmium, silver, barium, lead), inorganics (nitrate, sulfate), organic solvents, biocides [Betz C-30 containing bis (trichloromethyl) sulfone, methylene bis thioisocyanate, dimethylformamide],

other organics (dimethylamine, hydrazine), and radionuclides (tritium, cesium, cerium, cobalt, zirconium, niobium). The basalt zone beneath the installation may potentially be receiving these contaminants as well.

These ponds, with the exception of the ARA-I chemical/evaporation pond, will be sampled to determine if hazardous and radioactive constituents within the effluent discharges have migrated within and through the soil and are contaminating the sediment and saturated zone. Sampling media will include pond surface water, sediment, and saturated-zone soil. Constituents to be analyzed for include volatiles, semi-volatiles, metals, anions, radionuclides, and in-situ pH. In some instances, pesticides will be analyzed for as well.

2. Contamination by wastes in ditches and ponds: Certain active drainage ditches that flow to the industrial waste pond at the ANL-W are receiving and have received hazardous and/or radioactive constituents in the past and as a result may have released contaminants to the soil and potentially the groundwater.

Historically, the HFEF/N ditch and the ditches east and west of the cooling towers that flow to the industrial waste pond at the ANL-W have received hazardous and/or radioactive constituents discharges in the form of cooling tower blowdown and photoprocessing chemicals. The HFEF/N ditch, which received photoprocessing waste until 1986, may contain silver contamination. Ditches on the east and west sides of the cooling towers, whose estimated area is 1,800 square feet, received cooling tower blowdown, and may be contaminated with acids, bases, inorganics, heavy metals (chromium, lead, barium, cadmium, silver), inorganics (nitrate, sulfate), organic solvents, biocides [Betz C-30 containing bis (trichloromethyl) sulfone, methylene bis thiocyanate, dimethylformamide], other organics (dimethylamine, hydrazine), and radionuclides (tritium, cesium, cerium, cobalt, zirconium, niobium). Soil within these ditches, the unsaturated zone, and the basalt zone beneath may have received these contaminants. Currently, the ditches are known to be receiving EBR-II turbine condensate contaminated with tritium.

The active ditch system to the ANL-W percolation pond will be sampled to determine if hazardous constituents are present in the system and if these

contaminants have migrated through the soil. Constituents to be analyzed for include volatiles, pesticides, metals, anions, and radionuclides. In-situ pH will be taken as well.

3. Mixed waste in the CFA drying beds. The sewage sludge in the sludge-drying beds at the CFA STP may require disposal as a mixed waste or as a RCRA hazardous waste.

The CFA STP receives discharge from all the buildings at CFA. Effluent from the RESL is, however, of particular concern. The RESL is discharging a broad spectrum of inorganic and organic wastes into the CFA sanitary sewage system. These wastewaters may contain RCRA-listed hazardous wastes or may result in the sludge within the sanitary sewage system being RCRA Extraction Procedure (EP) toxic waste. This sludge is known to be radioactively contaminated. Sludge totaling 512 cubic feet has been boxed and prepared for shipment to a yet-undetermined disposal site. Samples taken from this sludge are not currently being analyzed to determine if it is a RCRA EP toxic and listed waste. It is being stored until the analytical results are reported. If the sludge is determined to be a low-level radioactive waste, it will be sent to the RWMC for disposal. If it is determined to be a mixed waste, the sludge will be stored at PBF/SPERT-IV until a suitable disposal method is identified. In the past the sludge may have been disposed of in the CFA Landfills.

4. Hazardous waste in the PBF Evaporation Pond. The sludge in the lined wastewater evaporation pond at PBF may require disposal as a mixed waste or as a RCRA hazardous waste.

The 24,000-square-foot PBF evaporation pond, whose average flow was approximately 1,015 gpd, received corrosive and chemical wastes from laboratory, aqueous makeup, and cooling operations from 1978 to 1984. Wastes disposed of in this 0.03-inch thick hypalon-lined pond included acids, bases, chromium and other metals, and radionuclides (tritium, cesium, cobalt, strontium, and other miscellaneous fission products). The wastewaters containing these contaminants had originally been disposed of via two injection wells at PBF from 1972 to 1980 as discussed in Section 4.5.2.3, Finding 1. Discharge to the pond ceased in late 1984. The pond, presently in

standby status, is dry and has 3 inches of sludge on the bottom. The liner integrity is in question and there are no plans to clean the pond. The chromium concentrations within the sludge may cause it to characteristically be a RCRA EP toxic waste. The sludge has not been analyzed to determine if it is a mixed waste.

5. Potential RCRA violation. Percolation and evaporation ponds at the INEL may be operating in violation of RCRA since they may be receiving, treating, storing, and disposing of hazardous wastes.

The percolation and evaporation ponds at the INEL are considered to be surface impoundments as defined under RCRA. These ponds include the three TRA warm-waste ponds, the TRA chemical/corrosive pond, the two TRA cold-waste ponds, the TAN/TSF pond, the TAN/LOFT pond, the ARA-I chemical/evaporation pond, the two ICPP percolation ponds, and the PBF Reactor Area Evaporation Pond. All ponds are active with the exception of the ICPP percolation pond #1, not used since 1985, and the PBF pond, on standby since 1984. The only pond which has a liner is the PBF pond. However, uncharacterized sludge still remains in this lined (single layer) pond, as discussed in Finding 4 above.

In the past, hazardous waste had been disposed of in many of the ponds, as discussed in Finding 1 above. However, it is unknown if these ponds are currently receiving hazardous waste since the influents into the ponds have not been tested for the representative character of the waste in accordance with EPA regulation 40 CFR 265.13. If these percolation and evaporation ponds are receiving hazardous wastes or mixtures of hazardous constituents, RCRA regulations require permitting as treatment, storage, and disposal facilities. Also, pond liners (two or more), leachate detection systems, and groundwater monitoring would be required by November 8, 1988, under RCRA regulations, or the ponds would have to undergo closure under EPA regulation 40 CFR 265 Subpart K. If these ponds are subject to RCRA regulations and are closed, then the INEL would be required to conduct post-closure care and monitoring for a 30-year period, and would be required to obtain a permit for such activities.

6. Lead storage practices. Radioactively contaminated and clean lead bricks, sheets, and shot being stored unprotected outside at the TRA and the TAN may result in lead and mixed waste contamination in soils.

Approximately 8,500 pounds of clean lead bricks and sheets and approximately 100,000 pounds of radioactively contaminated lead bricks and sheets are presently being stored outside in the southeastern section of the TRA North Storage Area. The lead is unprotected from the weather. A small percentage show signs of oxidation, which may result in the leaching of lead and mixed waste to the soil. Some of the lead materials are on pallets, a few of which have deteriorated, allowing the lead to come in contact with the soil, while some are being stored directly on the ground.

Clean lead shot in burlap bags was observed near TRA-673. This lead is stored on pallets but is also unprotected from the weather; this mode of storage may allow oxidizing lead to contaminate the soil.

Approximately 2,000 pounds of radioactive lead bricks is located near TAN-647. This lead is stored on a deteriorating pallet, and the leaching of lead and mixed waste to the soil may result.

4.1.3.4 Category IV

1. Lack of drum identification. Lack of identification of waste/materials in drums and other containers at the INEL may result in improper disposal/storage.

Although all facilities were not visited during the Survey, many drums and containers that lacked identification were found at the INEL. This could therefore result in improper handling, storage, or disposal. The unidentified drums and containers observed are as follows: at TAN Building 607, one 55-gallon drum was found outside near the north side of the east wing; at TAN Building 660, four 55-gallon drums were observed in the SMC Storage Area; at TRA Building 625, three 55-gallon drums were found in the south corner of the machine shop; at TRA Building 670, four 1-gallon containers were observed north of this building; at CFA Building 605, one 55-gallon drum and one 5-gallon drum were observed in the laboratory area; at ARA-III, 13 55-gallon

drums were observed outside in the eastern corner of the site; at NOAA Fire Training Center, twelve 55-gallon drums were found outside the facility; at IRC, one 5-gallon container was observed in Room B-14; and at ICPP, two 55-gallon drums were found inside the Low Bay Addition of Building 637.

2. Inadequate liquid storage practices. The storage of product material and hazardous waste near open drains and outside in unprotected storage areas may allow the release of product material and hazardous waste into the soil and potentially the surface water.

There are many drums and containers of product material and hazardous waste stored in unprotected storage areas. This mode of storage may allow the products and wastes to be released directly to the soil or to the sanitary sewers via open drains with potentially a subsequent release to the soil or surface water. Although not all sites or areas were visited during the Survey, many examples of drums being stored near open drains and in areas unprotected from the weather were noted. At CFA Building 617, one 55-gallon drum and one 5-gallon drum of unknown liquid were found in the laboratory area near a drain. This drain discharges to the CFA sanitary sewer system. At CFA Building 633, four 1-gallon glass bottles of hazardous waste were observed in the organic laboratory near a safety shower drain. This drain also discharges to the CFA sanitary sewer system. At the EG&G Willow Creek Photoprocessing Laboratory, four 1-gallon product containers of photoprocessing chemicals were observed near the room drain. This drain discharges to the building sanitary sewer lines that flow to the Idaho Falls POTW. A release of hazardous waste or materials to a treatment plant could result in untreated waste being released into treatment plant drainfields as is the case at CFA or to the Snake River as is the case with the Idaho Falls POTW.

Those drums and containers observed outside and unprotected from the weather include the following: at TAN Building 602 (Loading Shed), ten 55-gallon drums of motor oil product and four 55-gallon drums of lubricant oil; at TAN Building 607, one 55-gallon drum of an unknown solid and twenty-one 55-gallon drums of radioactively contaminated lead shot; at TAN Building 609, seventeen 5-gallon drums of antifreeze product, eleven 5-gallon drums of resin solution product, thirty 5-gallon drums of motor oil product, one 55-

gallon drum of windshield-washer-fluid product, one 55-gallon drum of hydraulic oil product, one 55-gallon drum of lubricant oil product, and one 55-gallon drum of motor oil product; at TAN Building 660, nine 55-gallon drums of synthetic lubricant product, four 55-gallon drums of an unknown solid; at TRA Building 625, one 55-gallon drum of 1,1,1-trichloroethane product; at TRA Building 657, nine 55-gallon drums of Amberlite resin product; at TRA Building 650, five 55-gallon drums of sodium sulfate product; at TRA Building 670 (North) two 55-gallon drums of oil, four 1-gallon containers of an unknown liquid; at TRA North Storage Area twelve 55-gallon drums of Dowtherm oil product; at CFA Building 621 (South) one 55-gallon drum of fluorescent light ballast waste; at CFA Building 646 (West) two 55-gallon drums of recyclable oil, one 55-gallon drum of ethylene glycol product, and one 55-gallon drum of asphalt crack-sealant product; at ARA-III, thirteen 55-gallon drums of an unknown liquid; at PBF/SPERT-III, three 55-gallon drums of ethylene glycol; at NOAA Fire Training Center, twelve 55-gallon drums of an unknown liquid; at ICPP Hazardous Waste Storage Area (south of Building 660), five 55-gallon drums of nonhazardous cleanup liquid waste, one hundred 55-gallon drums of liquid cadmium characteristic waste, and ten 55-gallon drums of corrosive liquids; at ICPP Product Storage (south of Building 660), twenty-one 55-gallon drums of hexone product, twenty-five 55-gallon drums of dodecane product; at ANL-W Building 783, one 55-gallon drum of Stoddard solvent product; at ANL-W Building 793 (West), one 55-gallon drum of nitric acid product; and at ANL-W Boneyard, six 55-gallon drums of mineral oil product. Although drums were out in the open, their integrity appeared sound. However, over time the drums could deteriorate and contaminate the soil.

4.2 Toxic and Chemical Materials

4.2.1 General Description of Pollution Sources and Controls

4.2.1.1 Polychlorinated Biphenyls (PCBs)

There are two types of PCB-containing equipment in use at the INEL -- transformers and capacitors -- both of which employ dielectric fluids that contain varying levels of PCBs.

The transformers are divided by the Toxic Substances Control Act (TSCA) definition into three classes: PCB transformers, which contain 500 parts per million (ppm) or greater concentrations; PCB-contaminated transformers, which contain 50 ppm or greater, but less than 500 ppm concentrations; and non-PCB transformers, which may be contaminated with PCBs, but at concentrations less than 50 ppm. Most of the TSCA regulations on management of PCB-containing equipment pertain to the first two classes. The INEL currently has 25 PCB transformers, 40 PCB-contaminated transformers, and 61 non-PCB transformers. A summary of PCB transformers and capacitors containing greater than 500 ppm PCB is presented in Table 4-7.

Most transformers are located outside buildings on concrete pads with aprons of loose gravel over soil or are pole-mounted and are surrounded by padlocked chain-link security fences. Observations during the Survey regarding transformer labeling and containment are noted in Table 4-7.

Capacitors are also defined in TSCA by PCB content as described above. The INEL currently has only PCB capacitors. At ANL-W, there are 67 PCB capacitors in a 6-bank array in the electrical vault adjacent to the sodium boiler plant. The 67 capacitors contain a total of 716 kilograms (kg) of 100-percent PCB dielectric fluid. They are located near a sump that has a pump which purges contents to the ground outside the electrical vault.

Management of PCB-containing equipment, with a few exceptions, is the responsibility of the EG&G Power Management Group. Exceptions are those units with power ratings less than 13.8 kilovoltampere (kVA) located at the TAN, PBF, and ANL-W, and those units less than 12.5 kVA located at the CFA. These smaller units at the specified locations are managed by the individual site contractors. The capacitors at ANL-W are also managed by ANL-W personnel. The management performed by the EG&G Power Management Group consists of maintaining an

TABLE 4-7

**ACTIVE PCB TRANSFORMERS AND CAPACITORS CONTAINING
GREATER THAN 500 ppm PCB AT THE INEL**

Building #	ID Serial #	PCB Content	Power Rating (kVA)	Comments
ARAI-608	5-131	1437 ppm	1000	Remediated, no curbing
PBF-620	5-407	100%	750	No curbing
SPERT. Sub.	5-543	100%	25	No curbing
TAN-607	5-141	670 ppm	500	No curbing
TAN-650	5-139	100%	2000	No curbing
TAN-650	5-140	100%	750	No curbing
TAN-650	5-425	1091 ppm	1000	No curbing
TAN-Sub. 6	5-551	100%	25	No curbing
TAN-Sub. 8	5-552	100%	25	No curbing
TRA-626	626-Ti	100%	N/A	No curbing
WRRTF-645	5-411	609 ppm	2500	No curbing
TRA-639	5-165	9999 ppm	500	No curbing
ANL-W-768	3-687	100%	2000	No curbing
ANL-W-768	4-687	100%	2000	No curbing
ANL-W-768	5-731	100%	2000	No curbing
ANL-W-768	6-731	100%	2000	No curbing
ANL-W-766 67 Capacitors		100%	N/A	Labels obscurely located, no curbing
TRA-657	5-183	100%	2500	No curbing
CPP-705	5-150	9999 ppm	750	No curbing, fence not labeled
CPP-705	5-153	9999 ppm	500	No curbing, fence not labeled
CPP-704	5-164	9999 ppm	500	No curbing, fence not labeled
CFA-666	5-309	712 ppm	50	No curbing, fence not labeled
PBF-620	5-407	1000 ppm	750	No curbing
EBR-II	5-553	9999 ppm	4	No curbing
EBR-II	YY-1	9999 ppm	225	No curbing
PBF-620	5-081	590 ppm	N/A	Pole-mounted, weeping, no containment

Adapted from EG&G Idaho, Inc., Power Management Inventory, "Transformer Report for Active Transfers 9-17-1987"

inventory, posting PCB placards, inspecting, repairing leaks, and cleaning up and disposing of PCB-contaminated oil, gravel, and soil.

The Power Management Group inventory contains, for each unit, a record of the location, identification number, analysis of PCB level, kVA rating, weight, dates of performance testing, volume of dielectric fluid, and specific type of fluid in cases where the PCB concentration is greater than 1,000 ppm.

The Power Management Group inspects all PCB- and PCB-contaminated units quarterly. Any unit found leaking or weeping is repaired and the leaked material cleaned up within 48 hours of discovery. The leaked oil and any contaminated soil, gravel, or other material are taken to the Hazardous Waste Storage Facility (HWSF) at Building CFA-637 where they are drummed, labeled, and stored until enough is accumulated to be shipped to a Resource Conservation and Recovery Act (RCRA)-approved treatment, storage, and disposal (TSD) facility. Any unit repaired is then re-inspected weekly for 1 month; if the leak does not recur, the inspections revert to the quarterly schedule.

Those units under the control of the individual site contractors are managed in a similar manner in that inspections are performed, PCB placards are posted, and leaks and weeps are repaired.

Out-of-service PCB transformers are stored in the HWSF (personal communication, Power Management Personnel). The hazardous waste storage enclosure has a separate area for PCB storage that is locked and prominently labeled, with a 6-inch-high concrete curb for spill containment. Before removal, PCB transformers are drained of dielectric fluid and the empty carcasses removed from the site as PCB-contaminated material by permitted off-site contractors. Partially full 55-gallon drums of fluid are occasionally retained temporarily on the site in the secure hazardous waste storage facility inside CFA Building 637. Full drums of PCB oil are immediately removed by a licensed disposal contractor. Disposal manifests are retained by the Waste Management group for the entire INEL.

During the Survey, two 55-gallon drums of PCB-contaminated oil and three PCB-contaminated transformers were in interim storage within Building CFA-637, and one partially full drum of PCB-contaminated oil was found in a fenced yard south of Building 667 at the CFA. The drum was on the soil, exposed to the elements and

unprotected from collision with mechanical equipment operating within the yard. In addition, a 55-gallon drum of capacitors from fluorescent lighting fixtures suspected to contain PCBs was found in an area with no spill containment south of CFA Building 621 awaiting off-site disposal.

The ultimate goal of PCB management at the INEL is to replace all PCB-containing equipment with non PCB-containing units. The effort to date has prioritized those units which are larger and older. The INEL has been replacing 13 to 15 units per year, although in 1988, 30 units are scheduled to be replaced. Given the limited inventory of 60 units, plus a smaller number controlled by the individual site contractors, it is likely that all PCB-containing equipment will be replaced within the next few years.

4.2.1.2 Asbestos

Asbestos and asbestos-containing materials were used extensively throughout the INEL from the 1930s to the present. The material was most commonly used as insulation cladding on pipes and as cover for structural members, ceiling and roof fireproofing in buildings, and as insulation on the outside storage tanks.

Two separate groups are responsible for asbestos management at the INEL, the Industrial Hygiene (IH) section of WINCO and the EG&G IH section. The IH section of WINCO is responsible for monitoring asbestos at the ICPP. Small-scale removal and/or patching of existing material at the ICPP is handled by Waste Management personnel under the direction of the EG&G IH section. Larger operations are contracted to licensed off-site companies. The rest of the INEL facilities are managed entirely through EG&G's IH section at the CFA.

All nonradioactively contaminated asbestos currently removed from INEL facilities is sealed in plastic bags, labeled, and placed in 4-foot by 8-foot plastic-lined plywood crates, which are banded, labeled, and buried in the asbestos area of CFA Landfill III. The asbestos trench at the landfill is segregated from other waste and appropriately marked with "Caution Asbestos" signs and a roped-off buffer zone. From 1971 to 1986, the CFA Landfills received 43,243 cubic feet of asbestos including 482 cubic yards in 1985, 165.3 cubic yards in 1986, and 180 cubic yards of asbestos and 600 cubic yards of asbestos-contaminated soil in 1987 (EG&G Idaho, Inc., 1987d,

e). Past decontamination and decommissioning (D&D) projects have also openly disposed of asbestos in small dumps at the TRA (described in Section 4.5.1.3), the CFA, and the RWMC.

All radioactive asbestos is treated as radioactively contaminated waste. Historically it was crated, similar to regular asbestos, but was marked as radioactive asbestos and buried with radioactive waste at the RWMC. The total volume to date is approximately 3,500 cubic feet. Containerized radioactive asbestos is currently being stored at the TRA and ICPP pending resolution of RWMC requirements for receiving this material. The crates were sealed and placarded but were stored temporarily in open areas unprotected from weathering. These records are maintained indefinitely by IH.

Both the ICPP and the CFA have laboratories qualified to analyze asbestos. During the ongoing asbestos removal and disposal program, decontamination records are compiled on each location that include photographs, total volume, type of material removed, and final disposition.

4.2.1.3 Pesticides (Herbicides, Insecticides, Rodenticides, Algicides)

Pesticides are applied at all facilities of the INEL, usually by the plant services or site maintenance personnel of the individual site contractors. However, the pesticides used, as identified on Table 4-8, are stored and mixed only at those facilities identified on Table 4-9. Exceptions to application of pesticides by individual site contractors occur at the ICPP where EG&G personnel apply pesticides, and at those facilities shown in Table 4-8, where the pesticides noted with an asterisk are applied by outside contractors. In all cases, the application personnel, both on-site and off-site contractors, are trained in proper procedures for application and handling of pesticides, and in use of protective equipment.

Mixing at all sites is done outside in the application equipment tanks, which are then used until empty. Pesticide containers are triple-rinsed with fresh water. The rinsewater is poured back into the application equipment tank; the rinsed containers are disposed of as nonhazardous waste. Specific features of pesticide storage areas at the INEL are summarized in Table 4-9.

TABLE 4-8

AREAS WHERE PESTICIDES ARE USED AT INEL - 1987

CFA Diazinon * Ficam W * Ramik * Bare Spot Round-Up Urheabor OSMO Plastic PCP Wood Preservative 2,4-D-Amine Banvel D Casoron	TAN Warfarin Pramitol 5 PC Round-Up Spike 80 Banvel Diazinon 4E
PBF/SPERT Bolt Betz J12	RWMC Pramitol Echonox Rat-A-Rest * DECON Echocide 2,4,D-Amine
IRC Bolt Echocide Peco-7418 Peco-7416 SPA-Algicide OAT Bait RAT-Pellets Dacamine 4D Diazinon 50 W Ramik * Pramitol 5PS	ANL-W Spike 80 Round-Up Banvel 2,4,D-Amine * DECON Rat Bait Mouse Poison 2,4,D-Butyl Ester Ramik Weedar 64A *
WCB/TSA/CSC Triox Weatherblok Warfarin 7415 Microbiocide 7416 Algicide Formula 26L 8412P Diazinon * 2,4-D * Banvel *	TRA Betz 3612 Round-Up Banvel 4-0-S Pramitol 5PS Oust Royal Slo Gro Spike 80 Embark Dacamine 360D Weed & Feed Scotts Turf Builder Kuron Krovar I Ficam W Ramik *

Source: Adapted from DOE, 1987

* These products are applied by outside contractors.

TABLE 4-9
FEATURES OF PESTICIDE STORAGE AREAS

	CFA (Building CFA-667)	TAN (Northeast of Building 604)	RWMC (Northeast of Building 609)	TRA (Building TRA-640)	ANL-W (Plant Services north equipment areas)
Protection from Elements	X	X	X	X	X
Placarding	X	X	O	O	X
Security	O	X	O	X	X
Segregation from Other Materials	X	O	X	X	X
Spill Containment	O	O	O	X	O
Fire/Explosion Proofing	O	O	X	X	X
Ventilation	O	X	X	O	O

X = Compliance with 40 CFR 165.10
O = Non-Compliance with 40 CFR 165.10

4.2.1.4 Toxic and Process Chemicals

Procurement and Inventory Control

Bulk liquid laboratory and process chemicals are shipped directly to tank farms and receiving areas at each contractor facility throughout the INEL. EG&G maintains a complete computer-managed chemical inventory for each EG&G contractor facility and updates its files every 6 months. EG&G bulk chemical orders are placed to private chemical distributors, and files are stored at the CFA and Idaho Research Center (IRC). WINCO orders bulk chemicals and maintains its own computer inventory, as does the ANL-W. The EG&G, WINCO, and ANL-W methods of material control are similar and are described below.

Requisitions submitted to the CFA, the IRC, the ICPP, and the ANL-W by laboratory managers describe the chemicals needed, quantity required, order number, date, signature of requisitioner, and building number. Purchase orders are then issued and materials sent directly to the requestor. Small quantities of chemicals and reagents may also be purchased and received directly from a distributor by individual laboratory managers.

Each laboratory maintains small-quantity chemicals and reagents at each point of use with interim storage in cabinets and lockers.

Laboratory managers maintain Material and Safety Data Sheets (MSDSs) on items specific to their laboratories. The MSDS Procedures Manual outlines procedures for emergency response to spills or releases during handling and storage. New MSDSs are provided when updated data on specific materials become available.

Receiving, Distribution, and Storage

Incoming laboratory and process chemical shipments are inspected for damage and leakage by the distribution center for each contractor to ensure that bung holes are tightly sealed and lids are properly closed.

On receipt by the requestor, hazardous chemicals are checked to see that they are properly labeled in accordance with Occupational Safety and Health Administration

(OSHA) regulations, dated, and segregated in appropriate storage cabinets according to hazard class.

Bulk storage facilities at these areas of the INEL, ICPP, TRA, and RESL were observed during the Survey. At the ICPP, bulk storage is provided in several areas. Flammable and corrosive stores are at Building 660 both inside the structure and in a fenced yard outside. They are contained in 55-gallon drums, plastic carboys, and 60-pound bags. In Building 637 near the acid fractionator, the low bay satellite storage area houses bulk miscellaneous acids, caustics, and process chemicals on elevated pallets situated over metal containment troughs.

The TRA facility maintains a bulk hazardous chemical storage area in Building TRA-610. The building is primarily used to store 55-gallon drums of oil, hydraulic fluid, 1,1,1-trichloroethylene, paints, lacquers, and unrestricted pesticides. Some pesticides are contained in well-stacked bags on elevated racks. The building is compartmented and internally curbed to provide spill containment (Table 4-9).

The RESL facility at CFA-690 maintains three separate but adjacent rooms in the main building to store bulk chemicals. One is reserved for solvent and volatile chemical storage, one for acids, and one for reagents and standards. No evidence of recent spills or leakage was observed in any of the RESL storage areas; however, strong odors were detected in each storage location upon entry, indicating slow evaporative leakage of substances from partially sealed containers and inadequate ventilation. The RESL solvent storage room was also used as an interim satellite storage area for hazardous waste labpacks (Section 4.1).

4.2.1.5 Oil and Hazardous Substance Storage Tanks

Oil and hazardous substances are stored in both aboveground storage tanks (ASTs) and underground storage tanks (USTs) at the INEL. The oil stored in these tanks includes Numbers 2 and 5 fuel oil, jet fuel, and waste oil. Hazardous substances include sulfuric and nitric acid, sodium hydroxide, and radionuclides.

Aboveground Storage Tanks

The majority of aboveground liquid storage tanks at the INEL outwardly appear to be structurally sound. Their primary material of construction appears to be mild steel metallurgy. Tank ages range from less than 1 year to more than 35 years, with the majority having been constructed over 15 years ago.

Secondary containment around the majority of most aboveground tanks consists of an unlined containment area surrounded by an earthen berm. Both the base soils underlying the containment area and the berms consist of highly porous soils, which would allow for rapid subsurface infiltration and releases through the dikes.

Table 4-10, derived from site Survey information, lists the ASTs visited during the Survey, the commodity stored, the volume, the visual integrity, and a description of the containment. Although they are by no means all of the ASTs at the INEL, they do represent some of the more significant ones.

Most of the facilities at the INEL (excluding the TRA and CFA), do not have a rigid aboveground tank inspection program. Exceptions are tanks associated with storing radioactive liquid wastes for which leak-detection and tank-inspection programs are conducted in detail.

The aboveground tank inspection program at the TRA consists of a visual check of storage tanks for leaks and a visual check of the surrounding dikes for areas that might allow releases from the containment site in the event of a spill. At the CFA, fluid levels for active product tanks are monitored weekly and are compared to product delivery and usage to determine if leaks are present. As at the TRA, containment dikes are visually observed for signs of deterioration.

Underground Storage Tanks

Based on U.S. Environmental Protection Agency (EPA) UST Notification lists supplied to the Survey by the INEL, there are nearly 180 listed active and inactive USTs at the INEL (Table 4-11). Twenty-seven of the USTs, as provided in the EPA UST Notification lists, are considered Solid Waste Management Units (SWMUs) and Land Disposal Units (LDUs) in the Consent Order/Compliance Agreement between the U.S. Department of Energy Idaho Operations (DOE-ID) and the EPA Region X, because they are considered potential hazardous waste contamination sources.

TABLE 4-10
INEL ABOVEGROUND STORAGE TANKS
VISITED DURING THE ENVIRONMENTAL SURVEY

INEL Location	Tank I.D. Number	Volume (gal)	Commodity Stored	Visual Integrity	Containment Description
CPP-701	VES-681	230,000	#5 fuel oil	Sound	Earthen-gravel diking; no visible liner
CPP-701	VES-682	50,000	#5 fuel oil	Sound	Earthen-gravel diking; no visible liner
CPP-702	WDS-100	20,000	Kerosene	Sound	Earthen-gravel diking; no visible liner
CPP-702	WDS-101	20,000	Kerosene	Sound	Earthen-gravel diking; no visible liner
CPP 719-B	CS-151	18,400	Nitric acid	Sound	Concrete vault with 125% of tank volume
CFA Tank Farm	Structure No. CFA-754	6,060 to 66,780	Petroleum products	Sound	Earthen-gravel diking; no visible liner
CF-688 Supply Tank	Unknown	42,420	Fuel oil	Small leak in transfer piping	Earthen-gravel diking; no visible liner
CFA	Unknown	~500	Ethylene glycol	Sound	No containment
ARA III	Unknown	42,500	#2 fuel oil	Sound	Earthen-gravel diking; no visible liner

TABLE 4-10

INEL ABOVEGROUND STORAGE TANKS
VISITED DURING THE ENVIRONMENTAL SURVEY (Continued)

INEL Location	Tank I.D. Number	Volume (gal)	Commodity Stored	Visual Integrity	Containment Description
WERF (PBF/SPERT-III)	No. 1 & No. 2 Incinerator Supply	~4,000	#2 fuel oil	Sound	Earthen-gravel diking; no visible liner
ANL-W	Feedwater-Demineralizer Acid Tank	~2,000	Sulfuric acid	Sound	Earthen-gravel diking; limestone base, no visible liner
ANL-W	Main Acid Storage Tank	~4,000	Sulfuric acid	Sound	Earthen-gravel diking; limestone base, no visible liner
ANL-W	No. 1	56,000	Fuel oil	Sound	Earthen-gravel diking; no visible liner
ANL-W	No. 2	96,000	Fuel oil	Sound	Earthen-gravel diking; no visible liner
TSF	TAN-704	190,680	#2 fuel oil	Sound	Earthen-gravel diking; no visible liner
TSF	TAN-702	101,464	#5 fuel oil	Sound	Earthen-gravel diking; no visible liner

TABLE 4-10
INEL ABOVEGROUND STORAGE TANKS
VISITED DURING THE ENVIRONMENTAL SURVEY (Continued)

INEL Location	Tank I.D. Number	Volume (gal)	Commodity Stored	Visual Integrity	Containment Description
TSF	TAN-724	190,680	#5 fuel oil	Sound	Earthen-gravel diking; no visible liner
TRA	MTR-727 A & B	440,000	#5 fuel oil	Sound	Earthen-gravel diking; no visible liner
TRA	MTR-727 C (3 separate tanks)	~35,000 each	#2 fuel oil	Sound	Earthen-gravel diking; no visible liner
TRA	MTR-731 A & C	25,836 each	Sodium hydroxide	Sound	Combined concrete in earthen/gravel berms; no visible liner.
TRA	MTR-731 B & E	21,500 each	Sulfuric acid	Sound	Concrete noted to be cracked

TABLE 4-11

ACTIVE/INACTIVE UNDERGROUND STORAGE TANKS AT THE INEL AS LISTED ON THE EPA UST NOTIFICATION FORMS

Tank No.	Age (yrs)	Capacity (gal)	Construction Material	Protection		Contents	Remarks	INEL Code #a
				Internal	External			
CFA-604	5	500	Steel	None	Painted	Diesel		
CFA-608	1	12,000	Steel	Lined	Painted	Jet Fuel		
CFA-641	37	500	Steel	None	Painted	Fuel Oil	Out of Service, Contains 500 Gallons of Fuel	CFA-23
CFA-645-6	25	10,000	Steel	None	Painted	Diesel		
CFA-645-7	25	10,000	Steel	None	Painted	Diesel		
CFA-674	30	1,000	Steel	None	Unknown	Fuel Oil	Out of Service, Contains 200 Gallons of Fuel	
CFA-658	36	1,000	Steel	None	Painted	Empty		
CFA-659	36	1,000	Steel	None	Painted	Empty		
CFA-664-4	35	10,000	Steel	None	Painted	Gasoline		
CFA-664-5	35	8,000	Steel	None	Painted	Gasoline	Out of Service	
CFA-664	35	2,000	Steel	Unknown	Unknown	Waste Oil	Out of Service	CFA-29
CFA-665	26	1,000	Steel	None	None	Waste Oil		CFA-30
CFA-667	35	6,000	Steel	None	Painted	Fuel Oil	Out of Service, Contains 1,000 Gallons of Fuel	CFA-33
CFA-669	33	18,000	Steel	None	Painted	Fuel Oil	Out of Service, Contains 500 Gallons of Fuel	CFA-27
CFA-675	23	500	Steel	None	Painted	Diesel		
CFA-680	35	Unknown	Unknown	Unknown	Unknown	Gasoline	Out of Service, Contains Unknown Amount of Gasoline	CFA-36
CFA-682	36	500	Steel	None	Painted	Diesel		

TABLE 4-11

ACTIVE/INACTIVE UNDERGROUND STORAGE TANKS AT THE INEL AS LISTED ON THE EPA UST NOTIFICATION FORMS
(Continued)

Tank No.	Age (yrs)	Capacity (gal)	Construction Material	Protection		Contents	Remarks	INEL Code #a
				Internal	External			
CFA-683	36	1,000	Steel	None	Painted	Fuel Oil	Out of Service, Contains 500 Gallons of Fuel	CFA-38
CFA-754	Unknown	10,000-15,000	Steel	Unknown	Unknown	Waste Oil	Out of Service, Contains Unknown Amount of Oil	CFA-31
CFA-688	23	2,000	Steel	None	Painted	Diesel		
WMO-704	30	200	Steel	Unknown	Unknown	Empty	Out of Service	EBR-09
Bus Lot-1	29	10,000	Steel	Unknown	Unknown	Diesel		
Bus Lot-2	29	10,000	Steel	Unknown	Unknown	Diesel		
Bus Lot-3	29	10,000	Steel	Unknown	Unknown	Gasoline		
ILF Vehicle Dispatch	1	6,000	Steel	None	Painted	Gasoline		
PBF-752	5	10,000	Stainless Steel	None	Inside Concrete Vault	Liquid Radio-active Waste		
TAN-626A	10	50,000	Stainless Steel	None	Inside Concrete Vault	Liquid Radio-active Waste		
TAN-626B	10	50,000	Stainless Steel	None	Inside Concrete Vault	Liquid Radio-active Waste		

TABLE 4-11

ACTIVE/INACTIVE UNDERGROUND STORAGE TANKS AT THE INEL AS LISTED ON THE EPA UST NOTIFICATION FORMS
(Continued)

Tank No.	Age (yrs)	Capacity (gal)	Construction Material	Protection		Contents	Remarks	INEL Code #a
				Internal	External			
PBF-721	16	500	Steel	None	Painted	Gasoline		
PBF-625(T-13)	20	5,000	Steel	None	Painted	Diesel		
PBF-722	16	10,000	Steel	None	Painted	Fuel Oil		
PBF-619	19	2,000	Steel	None	Painted	Fuel Oil		
PBF-601 South Side	30	2,000	Steel	None	Painted	Fuel Oil		
PBF-601 East Side	30	1,000	Steel	None	Painted	Fuel Oil		
PBF-632	6	2,000	Steel	None	Painted	Fuel Oil		
PBF-732	5	10,000	Stainless Steel	None	None	Radionuclides		
PBF-719	29	3,000	Steel	None	Painted	Fuel Oil		
PBF-612	26	2,000	Steel	None	Painted	Fuel Oil		PBF-14
PBF-716	25	3,000	Steel	None	Painted	Fuel Oil		
ARA-729	27	1,000	Stainless Steel	None	None	Radionuclides		
ARA-629	26	Unknown	Steel	Unknown	Unknown	Gasoline		
ARA-602	30-35	1,000	Steel	None	Painted	Fuel Oil and Radionuclides		
ARA-611	10	1,000	Steel	None	None	Diesel		
ARA-606	30	1,000	Steel	None	Painted	Fuel Oil		
TAN-739	28	1,000	Steel	None	Painted	Diesel		
TAN-640	6	12,000	Steel	None	Painted	Diesel		

TABLE 4-11

ACTIVE/INACTIVE UNDERGROUND STORAGE TANKS AT THE INEL AS LISTED ON THE EPA UST NOTIFICATION FORMS
(Continued)

Tank No.	Age (yrs)	Capacity (gal)	Construction Material	Protection		Contents	Remarks	INEL Code #a
				Internal	External			
TAN-789	30	5,000	Steel	None	Painted	Diesel		
TK-103	26	2,500	Steel	None	Painted	Empty	Out of Use	
TAN-644	32	550	Steel	None	Painted	Empty	Out of Use	
TRA-614	32	300	Stainless Steel	None	None	Radio-nuclides	Out of Use, Contains 150 Gallons of Radionuclides	TRA-16
TRA-605	35	100-500	Steel	None	None	Empty	Out of Use	TRA-14
DF-T-14	27	50,000	Steel	None	Painted	Diesel		
LOFT Diesel Waste Tank	27	5,000	Steel	None	Painted	Empty	Out of Use	
LOFT Diesel "A" Day Tank	12	500	Steel	None	Painted	Diesel		
TAN-792	1	10,000	Steel	None	Cathodic Protection	Diesel		
TAN-779	25	300-500	Steel	None	Painted	Empty	Out of Use	
TAN-607	34	3,000	Steel	None	Painted	Empty	Out of Use	TSF-01
TAN-794	1	1,000	Fiberglass	None	None	Diesel		
TAN-603	2	1,000	Steel	None	Painted	Diesel		TSF-14,15
TAN-610	34	550	Unknown	Unknown	Unknown	Gasoline	Out of Use, Contains 200 Gallons of Gasoline	TSF-13
TAN-777	34	3,000	Steel	None	None	Diesel	Out of Use, Contains Unknown Amount of Fuel	

TABLE 4-11

ACTIVE/INACTIVE UNDERGROUND STORAGE TANKS AT THE INEL AS LISTED ON THE EPA UST NOTIFICATION FORMS
(Continued)

Tank No.	Age (yrs)	Capacity (gal)	Construction Material	Protection		Contents	Remarks	INEL Code # ^a
				Internal	External			
TAN-783	22	12,000	Steel	None	Painted	Gasoline		
TAN-616	31	4,000	Steel	Unknown	Unknown	Sodium Hydroxide		TSF-19
TAN-616	31	Unknown	Stainless Steel	Unknown	Unknown	Radio-nuclides		
V-1 TSF	31	10,000	Stainless Steel	None	None	Radio-nuclides		
V-2 TSF	31	10,000	Stainless Steel	None	None	Radio-nuclides		
V-3 TSF	31	10,000	Stainless Steel	None	None	Radio-nuclides		
TAN-710A	31	50,000	Steel	None	Painted	Radio-nuclides	Out of Use, Contains 500 Gallons of Radwaste	TSF-26
TAN-710B	31	50,000	Steel	None	Painted	Radio-nuclides	Out of Use, Contains 700 Gallons of Radwaste	TSF-26
TRA-619	35	500	Steel	Unknown	Painted	Gasoline	Out of Use, Contains 200 Gallons of Radwaste	TRA-18
TRA-620	34	5,000	Steel	Unknown	Unknown	Diesel		
TRA-630	34	10,780	Concrete	Lining	Painted	Sulfuric Acid and Sodium Hydroxide		
TRA-606	6	3,500	Steel	None	Painted	Gasoline		

TABLE 4-11

ACTIVE/INACTIVE UNDERGROUND STORAGE TANKS AT THE INEL AS LISTED ON THE EPA UST NOTIFICATION FORMS
(Continued)

Tank No.	Age (yrs)	Capacity (gal)	Construction Material	Protection		Contents	Remarks	INEL Code #a
				Internal	External			
Tank No. 2 TRA-613	35	8,400	Steel	Lining	Painted	Radionuclides		TRA-15
Tank No. 3 TRA-613	30	10,000	Stainless Steel	None	None	Radionuclides		TRA-15
Tank No. 4 TRA-613	30	10,000	Stainless Steel	None	None	Radionuclides		TRA-15
TRA-616	35	1,000	Steel	Unknown	Unknown	Empty	Out of Use	TRA-17
TRA-776	22	1,500	Steel	None	Painted	Diesel		
TRA-712 East	35	360,000	Concrete	None	Painted	Radionuclides		
TRA-712 West	35	360,000	Concrete	None	Painted	Radionuclides		
TRA-648	30	275	Steel	None	Inside Concrete Vault	Diesel		
TRA-1	Unknown	1,500	Stainless Steel	None	Inside Concrete Vault	Radionuclides		TRA-19
TRA-2	Unknown	1,500	Stainless Steel	None	Inside Concrete Vault	Radionuclides		
TRA-3	Unknown	1,500	Stainless Steel	None	Inside Concrete Vault	Radionuclides		
TRA-4	Unknown	1,500	Stainless Steel	None	Inside Concrete Vault	Radionuclides		TRA-19

TABLE 4-11

ACTIVE/INACTIVE UNDERGROUND STORAGE TANKS AT THE INEL AS LISTED ON THE EPA UST NOTIFICATION FORMS
(Continued)

Tank No.	Age (yrs)	Capacity (gal)	Construction Material	Protection		Contents	Remarks	INEL Code #a
				Internal	External			
SPD-1	4	30	Steel	None	Painted	Kerosene		
HFEF/N-1	12	500	Steel	None	Painted	Diesel		
HFEF/S-1	25	500	Steel	None	Painted	Diesel		
ZPPR-1	17	1,000	Steel	None	Painted	Diesel		
TREAT-1	6	1,000	Steel	None	Painted	Diesel		
701	7	300	Steel	None	Painted	Diesel		
742D	7	6,000	Steel	None	Painted	Diesel		
742G	7	4,000	Steel	None	Painted	Gasoline		
750G	25	3,000	Steel	None	Painted	Gasoline		
750D	25	560	Steel	None	Painted	Diesel		
752	18	1,000	Steel	None	Painted	Diesel		
PIG-T714	25	3,000	Steel	None	Painted	Diesel		
CFG-6003	2	3,000	Steel	None	Cathodic	Diesel		
UTI-614	35	30,000	Concrete	None	None	Empty	Out of Use	
UTI-625	1	50,000	Concrete	None	None	Saltwater		
UTI-660	33	20,000	Concrete	None	None	Water		
HBF-102	5	1,000	Steel	None	Unknown	Kerosene		
NCE-140-1	6	5,000	Steel	None	Cathodic	Diesel		
NCE-140-2	6	5,000	Steel	None	Cathodic	Diesel		

TABLE 4-11

ACTIVE/INACTIVE UNDERGROUND STORAGE TANKS AT THE INEL AS LISTED ON THE EPA UST NOTIFICATION FORMS(Continued)

Tank No.	Age (yrs)	Capacity (gal)	Construction Material	Protection		Contents	Remarks	INEL Code #a
				Internal	External			
SAA-152	10	1,000	Steel	None	Cathodic	Diesel		
SAA-153	10	2,000	Steel	None	Cathodic	Gasoline		
UTI-652	12	565	Steel	Unknown	Unknown	Gasoline	Out of Use	CPP-68
UTI-653	35	1,000	Steel	Unknown	Unknown	Diesel		
UTI-654	36	55	Steel	Unknown	Unknown	Used Oil		
UTI-655	36	1,000	Steel	Unknown	Unknown	Diesel		
YDA-106	35	550	Steel	Unknown	Painted	Hexone		
WC-115-1	24	15,000	Stainless Steel	None	Concrete Vault	Dry Calcined Solids		
WC-115-2	24	15,000	Stainless Steel	None	Concrete Vault	Dry Calcined Solids		
WC-115-3	24	15,000	Stainless Steel	None	Concrete Vault	Dry Calcined Solids		
WC-115-4	24	15,000	Stainless Steel	None	Concrete Vault	Dry Calcined Solids		
WC-136-1	21	30,000	Stainless Steel	None	Concrete Vault	Dry Calcined Solids		
WC-136-2	21	30,000	Stainless Steel	None	Concrete Vault	Dry Calcined Solids		
WC-136-3	21	30,000	Stainless Steel	None	Concrete Vault	Dry Calcined Solids		
WC-136-4	21	30,000	Stainless Steel	None	Concrete Vault	Dry Calcined Solids		
WC-136-5	21	30,000	Stainless Steel	None	Concrete Vault	Dry Calcined Solids		

TABLE 4-11

ACTIVE/INACTIVE UNDERGROUND STORAGE TANKS AT THE INEL AS LISTED ON THE EPA UST NOTIFICATION FORMS
(Continued)

Tank No.	Age (yrs)	Capacity (gal)	Construction Material	Protection		Contents	Remarks	INEL Code #a
				Internal	External			
WC-136-6	21	30,000	Stainless Steel	None	Concrete Vault	Dry Calcined Solids		
WC-136-7	21	30,000	Stainless Steel	None	Concrete Vault	Dry Calcined Solids		
WCS-139	19	47,000	Stainless Steel	None	Concrete Vault	Dry Calcined Solids		
WCS-140-1	19	40,000	Stainless Steel	None	Concrete Vault	Dry Calcined Solids		
WCS-140-2	19	40,000	Stainless Steel	None	Concrete Vault	Dry Calcined Solids		
WCS-140-3	19	40,000	Stainless Steel	None	Concrete Vault	Dry Calcined Solids		
WCS-140-4	19	40,000	Stainless Steel	None	Concrete Vault	Dry Calcined Solids		
WCS-140-5	19	40,000	Stainless Steel	None	Concrete Vault	Dry Calcined Solids		
WCS-140-6	19	40,000	Stainless Steel	None	Concrete Vault	Dry Calcined Solids		
WCS-142	10	44,000	Stainless Steel	None	Concrete Vault	Dry Calcined Solids		
WCS-143	10	44,000	Stainless Steel	None	Concrete Vault	Dry Calcined Solids		
WCS-144	10	44,000	Stainless Steel	None	Concrete Vault	Dry Calcined Solids		
WCS-146	5	33,000	Stainless Steel	None	Concrete Vault	Dry Calcined Solids		

ACTIVE/INACTIVE UNDERGROUND STORAGE TANKS AT THE INEL AS LISTED ON THE EPA UST NOTIFICATION FORMS
(Continued)

Tank No.	Age (yrs)	Capacity (gal)	Construction Material	Protection		Contents	Remarks	INEL Code #a
				Internal	External			
WCS-147	5	33,000	Stainless Steel	None	Concrete Vault	Dry Calcinced Solids		
WCS-148	5	33,000	Stainless Steel	None	Concrete Vault	Dry Calcinced Solids		
WCS-149	5	33,000	Stainless Steel	None	Concrete Vault	Dry Calcinced Solids		
WCS-150	5	33,000	Stainless Steel	None	Concrete Vault	Dry Calcinced Solids		
WCS-151	5	33,000	Stainless Steel	None	Concrete Vault	Dry Calcinced Solids		
WCS-152	5	33,000	Stainless Steel	None	Concrete Vault	Dry Calcinced Solids		
WCS-154	2	58,000	Stainless Steel	None	Concrete Vault	Dry Calcinced Solids		
WCS-155	2	58,000	Stainless Steel	None	Concrete Vault	Dry Calcinced Solids		
WCS-156	2	58,000	Stainless Steel	None	Concrete Vault	Dry Calcinced Solids		
WCS-157	2	58,000	Stainless Steel	None	Concrete Vault	Dry Calcinced Solids		
WCS-158	2	58,000	Stainless Steel	None	Concrete Vault	Dry Calcinced Solids		
WCS-159	2	58,000	Stainless Steel	None	Concrete Vault	Dry Calcinced Solids		
WCS-160	2	58,000	Stainless Steel	None	Concrete Vault	Dry Calcinced Solids		

TABLE 4-11

ACTIVE/INACTIVE UNDERGROUND STORAGE TANKS AT THE INEL AS LISTED ON THE EPA UST NOTIFICATION FORMS
(Continued)

Tank No.	Age (yrs)	Capacity (gal)	Construction Material	Protection		Contents	Remarks	INEL Code #a
				Internal	External			
WG-100	35	4,000	Stainless Steel	None	Stainless Steel - Lined Concrete Vault	Liquid Radwaste		
WG-101	35	4,000	Stainless Steel	None	Stainless Steel - Lined Concrete Vault	Liquid Radwaste		
WH-100	35	4,000	Stainless Steel	None	Stainless Steel - Lined Concrete Vault	Liquid Radwaste		
WH-101	35	4,000	Stainless Steel	None	Stainless Steel - Lined Concrete Vault	Liquid Radwaste		
WL-101	36	18,400	Stainless Steel	None	Stainless Steel - Lined Concrete Vault	Liquid Radwaste		
WL-102	36	18,400	Stainless Steel	None	Stainless Steel - Lined Concrete Vault	Liquid Radwaste		

TABLE 4-11

ACTIVE/INACTIVE UNDERGROUND STORAGE TANKS AT THE INEL AS LISTED ON THE EPA UST NOTIFICATION FORMS
(Continued)

Tank No.	Age (yrs)	Capacity (gal)	Construction Material	Protection		Contents	Remarks	INEL Code #a
				Internal	External			
WL-103	32	5,000	Stainless Steel	None	Concrete Vault	Liquid Radwaste		
WL-104	32	5,000	Stainless Steel	None	Concrete Vault	Liquid Radwaste		
WL-105	32	5,000	Stainless Steel	None	Concrete Vault	Liquid Radwaste		
WL-132	2	6,000	Stainless Steel	None	Stainless Steel - Lined Concrete Vault	Liquid Radwaste		
WL-133	2	18,000	N-50	None	Stainless Steel - Lined Concrete Vault	Liquid Radwaste		
WM-100	36	18,400	Stainless Steel	None	Stainless Steel - Lined Concrete Vault	Liquid Radwaste		
WM-101	36	18,400	Stainless Steel	None	Stainless Steel - Lined Concrete Vault	Liquid Radwaste		

TABLE 4-11

ACTIVE/INACTIVE UNDERGROUND STORAGE TANKS AT THE INEL AS LISTED ON THE EPA UST NOTIFICATION FORMS
(Continued)

Tank No.	Age (yrs)	Capacity (gal)	Construction Material	Protection		Contents	Remarks	INEL Code #a
				Internal	External			
WM-102	36	18,400	Stainless Steel	None	Stainless Steel - Lined Concrete Vault	Liquid Radwaste		
WM-180	36	300,000	Stainless Steel	None	Concrete Vault	Liquid Radwaste		
WM-181	36	300,000	Stainless Steel	None	Concrete Vault	Liquid Radwaste		
WM-182	31	300,000	Stainless Steel	None	Concrete Vault	Liquid Radwaste		
WM-183	31	300,000	Stainless Steel	None	Concrete Vault	Liquid Radwaste		
WM-184	31	300,000	Stainless Steel	None	Concrete Vault	Liquid Radwaste		
WM-185	26	300,000	Stainless Steel	None	Concrete Vault	Liquid Radwaste		
WM-186	26	300,000	Stainless Steel	None	Concrete Vault	Liquid Radwaste		
WM-187	26	300,000	Stainless Steel	None	Concrete Vault	Liquid Radwaste		
WM-188	26	300,000	Stainless Steel	None	Concrete Vault	Liquid Radwaste		
WM-189	23	300,000	Stainless Steel	None	Concrete Vault	Liquid Radwaste		

TABLE 4-11

ACTIVE/INACTIVE UNDERGROUND STORAGE TANKS AT THE INEL AS LISTED ON THE EPA UST NOTIFICATION FORMS
(Continued)

Tank No.	Age (yrs)	Capacity (gal)	Construction Material	Protection		Contents	Remarks	INEL Code # ^a
				Internal	External			
WM-190	23	300,000	Stainless Steel	None	Concrete Vault	Liquid Radwaste		
SFE-106	14	25,000	Stainless Steel	None	Concrete Vault	Liquid Radwaste		
SFE-126	9	2,000	Stainless Steel	None	Concrete Vault	Liquid Radwaste		
SFE-20	31	640	Stainless Steel	None	Concrete Vault	Liquid Radwaste		CPP-69
WM-103	33	30,000	Stainless Steel	None	Cathodic	Empty		
WM-104	33	30,000	Stainless Steel	None	Cathodic	Empty		
WM-105	33	30,000	Stainless Steel	None	Cathodic	Empty		
WM-106	33	30,000	Stainless Steel	None	Cathodic	Empty		

Source: EPA UST Notification forms reviewed in September 1987 by Survey team members and various INEL contractor Initial Assessment forms.

a Code number used by the INEL to identify Land Disposal Units and Solid Waste Management Units.

These tanks are indicated in Table 4-11 with the SWMU/LDU code number assigned by the INEL.

In addition to these 27 tanks, there are 31 tanks that are considered SWMUs and LDUs in the Consent Order/Compliance Agreement but do not appear to be on the EPA UST Notification lists. The 31 tanks and their assigned SWMU/LDU code numbers are identified on Table 4-12. Also, five tanks were observed during the Survey that were not included on the EPA UST Notification lists nor were considered SWMUs or LDUs. These are tanks at CFA-668, CFA-725, EOCR, TAN-609, and a diesel tank at IET. These apparent omissions may be the result of two different designations for the same tank or may be due to incomplete lists supplied to the Survey.

Of the 180 listed tanks, 74 contain petroleum products. The majority of the petroleum product tanks are located at the CFA and the remainder are scattered at other INEL facilities. None of these tanks or the associated piping have been leak-tested, regardless of age. In addition, daily inventory checks, which may detect leaks, are not conducted.

Thirty-five USTs at the ICPP, as shown in Table 4-11, contain dry calcined solids resulting from the calcination process. These tanks are in concrete vaults and, as they do not contain liquid, there is essentially no potential for a release to the environment.

Fifty USTs contain liquid radioactive waste (radionuclides) as shown in Table 4-11. These tanks are almost exclusively located at the TRA and the ICPP. The tanks are contained in concrete vaults with sumps. Any leakage that might occur is expected to drain into the sump, at which time an alarm would alert personnel to the presence of liquid in the sump (assuming the alarm is working).

Although the radioactive waste tanks are not leak-tested, the liquid level is continually monitored as a means of leak detection. This is accomplished by measuring the depth of the liquid in the tanks with high-frequency sonic waves. Sonic waves are transmitted through the liquid and reflected off the bottom of the tank. A frequency is chosen so that a harmonic results after reflection. If the liquid level drops, the harmonic is lost and an inspection is conducted. The inspection is

TABLE 4-12

**UNDERGROUND STORAGE TANKS AT THE INEL NOT LISTED ON
EPA UST NOTIFICATION FORMS**

Tank Location	INEL Code Number ^a
TAN-109 A&B	LOFT-05
TAN-318	IET-01
TAN-316	IET-09
TAN-735	WRRTF-04
TAN-103	WRRTF-09
TAN-644	WRRTF-10
TAN-603	TSF-14
Southeast of V-3 at TSF	TSF-18
TAN-601	TSF-32
TAN-602	TSF-33
MTR-643	TRA-21
ETR-648	TRA-22
CFA-640	CFA-22
CFA-641	CFA-23
Nevada Circle 2	CFA-24
CFA-656	CFA-25
CFA-674	CFA-28
CFA-665	CFA-30
CFA-667	CFA-32
West side of CFA-674	CFA-35
CFA-681	CFA-37
ARA-735	ARA-15
ARA-736	ARA-18
PBF-608	PBF-04
PBF-609	PBF-19
AEF-603	EBR-07
WMO-705	EBR-10
EBR-707	EBR-12
EBR-708	EBR-13
EBR-717	EBR-14
AEF-602	BORAX-05
AEF-601	BORAX-07

Source: Various INEL contractor Initial Assessment Forms

^aCode number used by the INEL to identify Land Disposal Units and Solid Waste Management Units.

conducted by video cameras located in the concrete vault. In addition, the liquid level is also monitored by a bubble pressure device. For this method, the pressure required to produce a stream of bubbles at a certain depth in the liquid is measured. If the pressure to produce the stream of bubbles changes, a change in fluid level is indicated and an inspection is conducted as described above.

Corrosion of the radioactive waste tanks is indirectly monitored by suspending metal coupons in the liquid and periodically retrieving and inspecting them. The coupons are made of the same material as the tanks and every 5 to 6 years they are inspected for pitting. To date, corrosion has not occurred on the coupons.

Twelve tanks at the INEL are reported to be permanently out of service and yet contain stored fluids (Table 4-11). In addition, there are nine reportedly empty tanks still in place (Table 4-11). Standard abandonment practices consist of removing all fluid from the tank, sampling the soil in the vicinity of the tank for contamination, and either filling the tank with inert material, such as sand, or removing the tank. Information supplied to the Survey indicates that removal has been followed once at the Waste Experimental Reduction Facility (WERF). Filling an abandoned tank with sand has occurred only at tank TRA-616.

During the Survey, approximately 90 percent of the UST sites listed on the EPA UST Notification lists (Table 4-11) were observed. The purpose of the observations was to detect past spills, assess methods to minimize future spills, and determine if the lists contained all on-site tanks. In general, past spills appeared to be minor. Sites of serious tank spills are discussed in Section 4.5.1.3. The INEL is beginning to install equipment that will minimize future spills. Typically this includes a flotation device that rises as the fluid level approaches the top of the tank or a funnel that has been installed above the ground to contain any excess product. Only 10 to 20 percent of the tanks now contain this equipment. The INEL does not have a UST leak-testing program which would identify tank integrity problems.

4.2.2 Findings and Observations

4.2.2.1 Category I

None

4.2.2.2 Category II

1. Transformer spills and leakage. INEL transformers containing PCB and non PCB-contaminated oil were found during the Survey to be actively leaking or weeping and pose a direct threat of contamination to soil and possibly groundwater.

During the Survey, out of a total of 125 transformers which contain PCBs, 5 were found leaking and 3 were found weeping, as follows:

- A transformer, number 5131, containing over 1,400 ppm PCB and located near Building 608 at ARA-III, was leaking a small amount (total less than 20 milliliters) of oil from the drain valve onto the concrete pad. The leak was corrected and the stain removed from the pad within 48 hours as required in 40 CFR Part 761 of TSCA. No soil contamination was observed.
- At the CFA, north of Building CF-681, transformer number 5-205 was weeping under the switch box and coating the mounting pole. The unit contained 205 ppm PCB oil. No soil contamination was observed.
- At the PBF near Building PBF-620, pole-mounted PCB transformer number 5-081, containing 590 ppm PCB, was weeping along the bottom seam weld. There was no stain evident on the ground.
- At SPERT-II, south of Building PBF-612, transformer number 5-343 was leaking oil containing 11 ppm PCB from the bottom drain valve. The unit was labeled "contains no PCB." No soil or concrete contamination was observed.
- At the TAN, north of Building 650, a PCB-contaminated transformer, number 5-128, was weeping at the drain valve. The valve evidently had leaked previously since an old stain was observed under the drain valve; however, no fresh stain was observed on the concrete pad. The unit contained 67 ppm PCB. No soil contamination was observed.

- At the TRA, south of Building MTR 648, transformer number 1646-8 was labeled "PCB Contaminated". Both upper and lower drain valves were leaking. Leakage had not progressed to form a stain or cause soil contamination.
- At the TRA south of Building MTR-648, an active transformer, serial number 5-176 was a certified non-PCB unit (Green Sticker). It was actively leaking a small amount of oil. Another active unit, number 5-177, was weeping oil. No spill containment curbing existed at either unit. The leakage had not progressed to form a stain on the concrete pad or surrounding soil.
- In addition, transformer number 1646-8, also a non-PCB unit, exhibited active leakage from two valves. No spill containment curbing was in place. No stain was evident on the concrete pad or surrounding soil.

None of the transformers had spill containment and, in the event of a leak, soil and potentially groundwater contamination could result. Additional information on inadequate containment is provided in Section 4.2.2.4, Finding I.

The INEL has a program to remove PCB and PCB-contaminated transformers. The site has been replacing 13 to 15 units per year and expects to remove 30 of them by the end of 1988. However, there was no indication as to when all the identified transformers would be removed.

2. Improper PCB storage at the CFA. Storage of a partially full drum of PCB-contaminated oil at the storage yard at the CFA and a 55-gallon drum of capacitors suspected of containing PCBs near CFA-621 presents a potential for release of toxic materials into the soil and groundwater and is a violation of 40 CFR Part 761 of TSCA.

At the CFA, a 55-gallon drum containing approximately 10 gallons of 220 ppm PCB-contaminated oil was situated directly on soil in the middle of a surface-water drainage depression in the transformer storage yard south of Building 667. No spill containment provisions had been made, nor was weather

protection provided. The drum was marked "PCB Contaminated"; however, no dates of storage or volume of contents were on the container. The drum was in good condition and properly closed. No evidence of leakage or spillage was noted.

A 55-gallon drum of small capacitors from fluorescent lighting fixtures suspected to contain PCBs was situated on the ground south of CFA Building 621 awaiting off-site disposal. This temporary storage practice is in violation of TSCA regulations as specified in 40 CFR Part 761.

3. Exposed friable asbestos. Exposed friable asbestos at the TRA-31 West rubble site may result in an airborne release and is a violation of the National Emissions Standards for Hazardous Air Pollutants (NESHAP, 40 CFR 61.153).

A small amount of friable insulating material containing ferrogedrite, amosite, and chrysotile needles has been identified as being mixed in demolition waste dumped in a 20-square-yard area approximately 100 yards west of the TRA fenceline. Soil tests currently have not delineated the extent of contamination. Airborne releases may result in contamination of larger areas and may pose a health risk. Additionally, NESHAPs require 2 feet of soil cover over friable asbestos, which the site does not have.

4. Improper chemical storage. Improper bulk chemical storage at the ICPP may allow unrestricted release of toxic chemicals.

At the ICPP, the practice of stacking reagent drums and carboys on the edge of pallets, as described below, allows possible circumvention of spill containment provisions, such as catchment trays and curbing.

- In Building CPP-660, acids and caustics are stored in drums on pallets, overhanging a 6-inch-high concrete berm. Should a spill occur from the drums, the contents could flow over the berm and into a nearby drain which discharges on soil outside the building.
- In Building CPP-637 low bay satellite storage areas, 5- and 10-gallon plastic carboys and 55-gallon metal drums of stock chemicals are placed

on pallets above, and frequently hanging partially over, the edge of metal spill capture trays intended to contain spillage. In addition, the tray volume frequently appears inadequate to hold the contents of one storage container, and multiple containers commonly share one tray. In the event of a release, the chemicals could spill onto the surrounding floor.

Outside Building CPP-637, in a courtyard area, a 55-gallon drum of hydrofluoric acid was hanging partially over soil immediately adjacent to the edge of a spill containment vessel.

4.2.2.3 Category III

1. Lack of adequate containment of INEL ASTs. Most INEL ASTs lack fully effective secondary containment, and, if leaks or ruptures in the tanks should occur, soil and potentially groundwater could become contaminated.

It is estimated that 1.6 million gallons of liquid fuels are stored at the INEL in ASTs. Additionally, approximately 100,000 gallons of corrosive chemicals are stored in a similar manner. While there is no regulation requiring that containment basins be lined, the permeability of the soils at the INEL, which can range from 10^{-7} to 10^{-3} centimeter per second (cm/sec) in the unsaturated zone, creates a situation in which the potential for rapid percolation of released liquids into the subsoils and potentially to the groundwater is quite likely if a release were to occur. Additionally, the berms constructed around the majority of aboveground INEL tanks may not contain a liquid in the event of a tank failure since the earthen-gravel dikes appear to be constructed of highly porous and loosely compacted material.

2. Insufficient UST monitoring program. The integrity of USTs is in question at the INEL and releases, if occurring, may be contaminating the soil and potentially the groundwater.

Releases of hydrocarbons from USTs may occur but go undetected because of insufficient inventory control. Dipstick measurements are periodically made

of all USTs but no effort is made to determine if level changes are the result of product usage or of leaks. Although leaks from storage tanks have been documented (Section 4.5.2.3, Finding 4, and Section 4.5.2.4, Finding 1), petroleum product USTs have never been leak-tested as described by National Fire Prevention Association (NFPA) 329. If a release were to occur, it would contaminate the subsoil and potentially the groundwater.

3. Improper abandonment of USTs. Improper abandonment procedures for USTs at the INEL could lead to a continuing source of soil and groundwater contamination.

Abandoned tanks at TAN-607, 610, 788, 789, and CFA-606 and 614, and a tank beneath the south parking lot at LOFT, as described in Table 4-11, were not abandoned in accordance with currently accepted practice. Proposed rules for tank abandonment require that the contents be removed; soil samples taken to determine the presence of past leaks; and the tank filled with an inert material or removed (Federal Register, 1987). Based on the Survey's review of USTs, this procedure was completed only once (at the WERF). In some cases, as described in Table 4-11, the abandoned and out-of-service tanks contain product and have not been leak-tested. If a tank is leaking, it would contaminate the soils and potentially the groundwater.

4.2.2.4 Category IV

1. Lack of containment for transformer fluid spill. No provisions for spill containment of PCB or non-PCB transformer oil exist at the INEL, which could result in groundwater contamination.

There are 65 PCB and PCB-contaminated transformers, 61 transformers containing between 1 and 50 ppm PCBs, and numerous other transformers containing dielectric fluid located at the INEL, and none have spill containment provisions. Transformers noted during the Survey to have a potential for significant soil and possibly groundwater contamination in the event of a leaks are as follows:

- At the ANL-W, four active Askarel-filled PCB transformers were located west of Building 768. They had no curbing. A spill of all oil from one of these units could release nearly 400 gallons of 100 percent PCB oil onto the ground surface. Surface water flow could then transport oil-contaminated soil to an industrial waste pond via open drainage channels.
- At PBF Building 620, an active transformer (serial number 5-407) contained 100 percent PCB as Inerteen. There was no concrete curbing.
- At the TAN LOFT, four active transformers (numbers 5-139, 5-140, 5-551, and 5-552) contained 100 percent PCB as Inerteen. No concrete curbing was present.
- At the PBF/SPERT Substation, an active transformer, serial number 5-543 contained 100 percent PCB as Inerteen. No concrete curbing existed.
- At the TRA south of Building MTR-648, an active transformer, serial number 5-176 was a certified non-PCB unit (Green Sticker). It was actively leaking a small amount of oil. Another active unit, number 5-177, was weeping oil. No spill containment curbing existed at either unit. The leakage had not progressed to form a stain on the concrete pad or surrounding soil.
- In addition, transformer number 1646-8, also a non-PCB unit, exhibited active leakage from two valves. No spill containment curbing was in place. No stain was evident on the concrete pad or surrounding soil.

Soils at the INEL are generally loose, granular to sandy, and have a moderately high permeability which can range from 10^{-7} to 10^{-3} cm/sec in the unsaturated zone. This profile would allow even a high-viscosity, nominal oil spill to percolate through a significant section of soil and potentially into the groundwater.

The INEL has a program to remove PCB and PCB-contaminated transformers. The site has been replacing 13 to 15 units per year and expects to remove 30 of them by the end of 1988. However, there was no indication as to when all the identified transformers would be removed.

2. Inconsistent transformer labeling. Inconsistent labeling of PCB PCB-contaminated, and non-PCB transformers and capacitors and the enclosures for those units at the INEL may result in improper implementation of control procedures by maintenance, security, and fire personnel.

Uniform labeling criteria and handling protocols have not been implemented by the INEL. Some transformers are labeled as "No PCBs", some as "Caution PCB Contaminated" or "Warning Contains PCBs" and others as "Certified Non PCB Unit." However, most transformers have no labels, leading to confusion as to contents. Several examples of the labeling inconsistencies observed during the Survey are noted below:

- At the ANL-W, PCB labels on opposing sides of a bank of capacitors in Building 766 are obscured from view of persons entering the room from the only access door.
- One portable unit in the south side of the CFA equipment storage area was marked as "No PCBs" on one side and "contains PCB" on the other side. The markings were accurate but misleading since the unit was segmented, and one side did not contain PCB.
- Most transformer and capacitor units at the INEL were not labeled at all, regardless of the results of tests to determine PCB content, which leads to confusion concerning the transformer or capacitor contents. Many transformers tested for PCBs and found to contain no PCBs are labeled "Contains No PCB" and others tested and found to contain no PCBs are not labeled. This may be interpreted to mean that unlabeled transformers have not been tested and therefore may contain PCBs. The following are a few examples from the ICPP:

<u>Location</u>	<u>Transformer Number</u>
South of ICPP-677	XFR-YDB-218
ICPP-675 Substation #30	XFR-WCE-225 (2 units)
Northeast of ICPP-654	XFR-NCE-392
Southeast of Calcine Bin	XFR-WCS-326
Substation 674	TS-DW-1, TS-DW-3, PC-DW-556

- The cyclone fence enclosures around transformers were also inconsistently labeled. The CFA had no labels on fence enclosures even though PCB transformers were operating within the enclosure.
 - At the CFA near Building CFA-682, transformer number 4-034 was marked "Contains PCB." According to Power Management personnel, this implies a PCB concentration greater than 50 ppm but less than 500 ppm. The unit actually contained 47 ppm PCB.
 - At the TRA substation, number 883-X1 was labeled "Contains PCB"; however, contractor inventory records indicate it did not contain PCBs.
3. Inadequate storage of pesticides. Pesticides at the TAN, TRA, ANL-W, CFA, and RWMC are inadequately stored in unrestricted access areas and without spill containment provisions as required by 40 CFR Part 165.

Several examples of pesticides stored in violation of 40 CFR Part 165 [the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)] were noted during the Survey as follows:

At the TAN, approximately 30 gallons of Spike 80 soil sterilant, composed of N-[5 (1,1 dimethyl) 1,3,4 thiadiazol 2-yl] N,N dimethyl urea, were stored with other chemicals on wood pallets in a corrugated fiberglass storage shed, northeast of Building 604. The walls of the shed are open where they meet the edge of the concrete floor. No concrete curb or other spill containment was in place. A spill would result in the contamination of local soil and possibly surface water runoff.

- At CFA Building 667, approximately sixteen 5-gallon cans of OSMO Plastic and one 5-gallon can of PCP Wood Preservative were temporarily stored in an open bay on a pallet with no spill containment provisions. The OSMO Plastic is used to coat utility poles and the contents consist of creosote, sodium fluoride, potassium bichromate, and 2,4 dinitrophenol. The PCP consists of pentachlorophenol and is also used on utility poles. Since the bay is used to repair machinery and motor vehicles, vehicle movements within the bay increase the possibility of an accident involving the stored pesticides which, if released, could flow out the bay door and onto the soil outside.
- At the RWMC, 8 gallons of 2,4-D-Amine Salt (liquid) and twenty-two 50-pound bags of Pramitol [5PS 2,4 bis (isopropylamino) -6 methoxy-s-triazine, simazine 2chloro 4,6-bis (ethyl-amino-s-triazine)] are stored in a metal cargo trailer which was not locked and had no spill containment provisions at the time of the Survey.
- The pesticide storage room at the TRA had spill containment, passive ventilation, fire control, and limited access but had no placard at the door.

4. Incomplete UST inventory lists The INEL EPA UST Notification lists do not identify all USTs at the INEL, and releases from these tanks, if occurring, would be undetected and could result in hydrocarbon contamination of the soil and groundwater.

During the Survey, random checks were made on the presence of USTs on the EPA UST notification listing of known tanks. Tanks at CFA-668 and 725, EOGR, TAN-609, and a diesel tank at IET were not found on the supplied list. In addition, 31 USTs included on the SWMU/LDU list (Table 4-12) developed for the INEL Consent Order/Compliance Agreement with EPA were not on the supplied EPA UST Notification lists.

5. Inadequate spill control and countermeasures for pipes broken during construction. Inadequate spill control and countermeasures for accidental

pipe breaks during construction activities at the INEL have resulted in unnecessary contaminant releases to the soil and potentially to the groundwater.

The Survey identified occurrences at the ICPP and the TRA where excavations took place in areas where buried pipeline contents and shutoff controls were not identified prior to excavation. As a result of excavation operations, pipeline breaks, as discussed below and in Finding 6 of this section, have resulted in unnecessary soil and potential groundwater contamination caused by delays in identifying and controlling ruptured pipelines.

On September 2, 1987, backhoe operations resulted in ruptures of two subsurface pipes in the ICPP. Liquid from a service waste pipe spilled into the open excavation. A Health Physicist measured the radiation level of the liquid and recommended cleanup procedures, but the chemical contents of the liquid and the location of the pipeline shutoff valve were unknown at the time of the rupture. Subsequent testing showed this waste to contain low-level radiation contamination and a pH within release limits.

On August 31, 1987, backhoe operations resulted in a rupture of a 1-1/2-inch line that had been abandoned but still contained contaminated fluid. The broken ends of the pipe were bent upward to stop the flow. About 2-1/2 gallons of fluid were released. The chemical contents and concentrations of the spilled fluid were unknown.

Additional pipe breaks have occurred at the INEL in the past. At the TRA, a pipe that transported radioactively contaminated liquid was broken. The break was located just south of TRA-666. The pipe was repaired but contaminated soil was left in place. At the TAN, abandoned fuel lines were broken during excavation operations near TAN-603. Additionally, during construction of concrete pads at the TAN Hot Shop, an abandoned Decontamination Shop hot-waste line was broken and a small spill contaminating some equipment occurred. The spill was cleaned up and the equipment decontaminated. Dates of the incidents at the TRA and the TAN are unknown, since Unusual Occurrence Reports were not produced due to the limited extent of the spills.

6. Lack of adequate care during excavation operations. Excavation operations at the INEL have led to unnecessary releases of radioactive, organic, and inorganic contaminants into the soil and potentially the groundwater from ruptured pipelines.

The Survey identified several instances of broken pipelines during excavation operations, two of which occurred within a few days of each other in the same general area and by the same contractor. The pipeline ruptures were evidence of insufficient knowledge about pipeline locations, contents, and conditions (described in more detail in Finding 5 of this section and Finding 3 of Section 3.3.4.3) and inadequate controls on excavation approvals and equipment operators.

On September 2, 1987, backhoe operations resulted in ruptures of two subsurface pipes in the ICPP. One line was a 2-inch chemical waste line; the other was a 6-inch service waste line to the percolation ponds. There was a release of wastewater to the environment from the service waste line, but not from the chemical waste line, which was unused at the time. The service waste line contained radionuclides at levels below the release limit and had a pH within the release limit.

On August 31, 1987, an abandoned 1-1/2-inch waste line was ruptured, resulting in a 2-1/2-gallon spill of radiation-contaminated condensate. Pipe breaks have also occurred at the TRA, where a radioactive waste pipe was broken just south of Building 666. At the TAN, a few fuel lines and a waste line were reported to have been broken in the past during excavation activities near TAN-603. Exact dates for the incidents at the TRA and the TAN are not known, since Unusual Occurrence Reports were not produced due to the limited extent of the spills.

4.3 Radiation

4.3.1 Background Environmental Information

Background radiation in the vicinity of the INEL is composed of both natural and man-made sources. These sources include natural cosmic radiation; natural radioactive materials in soils and building materials; fallout from past worldwide atmospheric weapons detonations; releases of radioactive materials from nuclear power plants and other facilities handling radioactive materials worldwide; and the intake of natural and man-made radioactive materials in air, drinking water, and food. The most significant of these sources in terms of dose is exposure to the lung from inhalation of background levels of naturally occurring radon. The annual average effective dose equivalent (EDE) to humans from natural background radiation in the United States is 189 millirem (mrem) (EPA, 1986a). Distribution of this dose is detailed in Table 4-13. The EDE estimates in Table 4-13 were derived using the approach of the International Commission on Radiological Protection (ICRP) in ICRP Reports 26 (ICRP, 1977) and 30 (ICRP, 1978), which allows direct comparison of the dose equivalent (DE) for different organs using "weighting factors". The weighting factors are expressed as the fraction of the total risk for the entire body attributable to the organ. The sum of the DEs for the individual organs provides an estimate of the total effect of the radiation on the whole body. About one-half of the annual EDE is attributable to the inhalation of radon-222 and its decay products. Previously accepted estimates of the background dose did not include the radon contribution and were set at about 100 mrem/year EDE.

The EPA reports the background gamma radiation dose rates for locations throughout the United States on a quarterly basis. These background gamma radiation dose rates do not measure the contribution attributable to the inhalation of radon-222 and its decay products. During the 12 months from October 1985 to September 1986, the U.S. Environmental Protection Agency (EPA) reported measured background gamma dose rates equivalent to annual doses of between 134 ± 58 mrem DE in Denver, Colorado, and 61 ± 35 mrem DE in Orlando, Florida (EPA, 1986b, c, and 1987). The national average measured background gamma dose rates equivalent to an annual dose of the 22 locations monitored throughout the United States was 92 ± 37 mrem DE.

TABLE 4-13

AVERAGE ANNUAL EFFECTIVE DOSE
EQUIVALENT TO HUMANS FROM NATURAL
BACKGROUND RADIATION

Organ	Annual Effective Dose Equivalent (mrem)
Gonads	24
Breast	14
Lung (Total)	100
Red Bone Marrow	13
Bone Surfaces	6
Thyroid	3
Other	29
Total	189

Source: Adapted from EPA, 1986a

The DOE establishes the radiation protection guidelines for DOE facilities. Radiation standards for the protection of the public in the vicinity of the INEL are given in DOE Order 5480.1A ("Environmental Protection, Safety and Health Protection Program for DOE Operations") as amended on August 5, 1985. These standards are based on the recommendations of the ICRP and the National Council on Radiation Protection and Measurements (NCRP). The amended order also included the EPA limits for the atmospheric pathway radiation dose received from DOE facilities contained in 40 CFR 61, Subpart H. The DOE dose limit is 100 mrem/year EDE (natural background and medical exposures excluded) for all pathways to any member of the general public for a prolonged period of exposure from normal DOE operations. In addition, 40 CFR 61, Subpart H, states that any member of the general public shall not receive a radiation dose from the air pathway of greater than 25 mrem/year DE to the whole body or 75 mrem/year DE to any organ from normal DOE operations.

4.3.2 General Description of Pollution Sources and Controls

This section discusses the INEL's dose assessments for the general public and the dose models and radioactive releases used in the dose assessments. A comparison of each reported dose assessment of the INEL radiological effluent releases will be made with the applicable standards. The radioactive sources and controls for air, soil, surface water and groundwater are discussed in Sections 3.1.2, 3.2.2, 3.3.2, and 3.4.2, respectively. Direct radiation and game ingestion sources are also discussed in this section.

4.3.2.1 Dose Assessment for Releases to the Atmosphere

Section 3.1.2 discusses the INEL radioactive releases to the atmosphere. The general public can be exposed to these radioactive releases through both inhalation of the contents of a release plume, and through exposure to direct penetrating radiation from standing in or near the plume. In addition, radioactively contaminated particulates may be deposited onto the soil and vegetation surrounding the facility. The radioactive constituents of the particulates deposited onto the soil and vegetation emit direct radiation, can be inhaled or ingested by humans, and are available for uptake by vegetation. The radioactive constituents in and on the vegetation may be consumed by humans either directly or indirectly through

animals that have consumed the vegetation (i.e., humans drinking milk or eating meat from a cow that has eaten grass grown in contaminated areas).

In the 1986 Annual Environmental Monitoring Program Report (AEMPR) for the Idaho National Engineering Laboratory Site (RESL, 1987), the INEL calculated the EDE due to the air pathway, using the calculated and measured quantities of radionuclides released during the year, the MESODIF meteorological model, and the DOE recommended dose conversion factors. To satisfy the requirement of complying with the limits in 40 CFR 61, Subpart H, the AIRDOS-EPA and RADRISK models were also used to calculate the maximum individual total-body and organ DEs.

The maximum individual dose above background for 1986 from the air pathway, using the AIRDOS-EPA and RADRISK codes, predicts a total-body DE of 0.003 mrem and a critical-organ (thyroid) DE of 0.019 mrem to an individual residing in Arco, Idaho (Figure 2-1). These DEs are 0.013 percent and 0.03 percent of the EPA airborne radionuclide emission standards, respectively. Using the MESODIF model, the potential 1986 above-background EDE from all radionuclides released to the atmosphere from the INEL was predicted to be 0.11 mrem to an individual residing in Atomic City, Idaho (Figure 2-1). The INEL release of radionuclides to the atmosphere is the only pathway that contributes to the off-site dose from the INEL; therefore, it is compared to the DOE limit of exposure to a member of the general public from all pathways. This EDE from the INEL airborne radionuclide emissions is 0.11 percent of the DOE radiation protection standard for a prolonged period of exposure to a member of the general public from all pathways (RESL, 1987) and represents only 0.06 percent of the expected total radiation from natural sources as shown in Table 4-13.

Examination of records and interviews with site personnel revealed that atmospheric tritium releases from the evaporation of tritium-contaminated water released on the site were not included in the above calculations. A total of 330 curies of tritium were released in liquid effluents on the site in 1986 (RESL, 1987). Depending on the evaporation rate used in the calculations (estimates from 4 percent to 15 percent were quoted by site personnel), 13.2 curies to 49.5 curies of tritium would need to be added to the airborne effluents and subtracted from the liquid effluents reported in the Radioactive Waste Management Information

System (RWMIS). The omission of atmospheric tritium releases results in a lower predicted off-site dose assessment to the general public from atmospheric releases. However, including these atmospheric tritium releases in the off-site dose assessment will not significantly increase the currently reported off-site dose. It would be less than a 1-percent increase in the total number of curies currently released to the atmosphere from the INEL.

4.3.2.2 Dose Assessment from Releases in Liquids

Sections 3.3.2 and 3.4.2 discuss the INEL radioactive releases to surface water and groundwater, respectively. The general public can be exposed to these releases through shoreline exposure and through immersion in and ingestion of the radioactively contaminated water. Additionally, the radioactive constituents in the water are available for uptake by aquatic organisms. These aquatic organisms can then be ingested by humans either directly or indirectly through the consumption of animals that have ingested the aquatic organisms. However, these pathways are not significant at the INEL because of the lack of surface water bodies and aquatic organisms.

There are no surface streams flowing from on-site to off-site locations and no liquids are released directly to the off-site environment. All process liquid radioactive effluents are discharged on the site into percolation ponds or through drainfields. In the past, liquid radioactive effluents were released to the Snake River Plain aquifer through injection wells. This practice has resulted in contamination of groundwater at the INEL (Section 3.4.3). The leading edge of the tritium plume, the most mobile radioactive waste in the aquifer, reached the site boundary in 1983; but tritium from the INEL has never been detected in any of the off-site groundwater monitoring wells. Because these releases do not yet reach the public, the INEL does not perform a dose assessment from radionuclide releases in liquids. However, if dose assessments were calculated on the existing tritium plume at the site boundary, the dose would be less than 0.02 mrem and would not measurably contribute to off-site dose to the general public.

4.3.2.3 Dose Assessment of Exposure to Direct Radiation

Direct radiation sources at the INEL result from normal and accidental release of radioactive atmospheric and liquid effluents, operating nuclear reactors, storage and burial of radioactive materials, and residual contamination from a nuclear accident in 1961 (Section 4.5.1).

These sources include the radioactive gaseous plumes and the radioactive liquid effluents released to a retention basin and percolation ponds. Additionally, radioactive air emissions can contaminate the soil around the generating facility, and radioactive liquid effluents can contaminate the soil to which they are released (Sections 3.3.2 and 3.4.2). The contaminated soil then becomes a source of direct radiation.

All operating nuclear reactors emit direct radiation. However, because of built-in shielding, very little of the direct radiation penetrates to the outside of the reactor building and is usually not detectable above background levels.

The storage and burial or disposal of radioactive materials in liquid or solid form at the INEL is a direct radiation source. This radioactive material is stored in aboveground and belowground tanks, buried at specific areas, and released to retention basins (Section 4.1.2). The Stationary Low Power Reactor No.1 (SL-1) nuclear reactor accident in 1961 left residual soil and building contamination. Additionally, the remains of the SL-1, as discussed in Section 4.5.1, are buried at the INEL.

Thermoluminescent dosimeters (TLDs) are used to measure direct penetrating radiation [beta greater than about 200 kiloelectronvolts (keV) and gamma greater than 10 keV] exposures on and off the site. The TLDs measure ionizing radiation exposures from natural and man-made radioactivity in the air and soil, cosmic radiation, radioactive effluents from the INEL operations and other industrial processes, fallout from nuclear weapons tests, and radioactivity from the burning of fossil fuel.

Off-site environmental dosimeter locations, which include boundary and distant (background) groups, are shown in Figure 4-12. The measured cumulative exposure

FIGURE 4-12
OFF-SITE DOSIMETER LOCATIONS IN THE VICINITY
OF THE INEL

for the time period from November 1985 to November 1986 for the off-site dosimeters is shown in Table 4-14. The TLD monitoring network will be discussed in Section 4.3.3.

The mean annual exposures for distant community and boundary community locations for 1986 were 112 ± 8 milliroentgens (mR) and 112 ± 5 mR, respectively, as shown in Table 4-14. These exposures are approximately equivalent to 108 mrem DE when an "f" factor of 0.96 is used to convert from mR in air to mrem in tissue. There is no statistical difference between the distant and boundary means. Therefore, there were no measurable contributions by the INEL operations to ionizing radiation exposures at boundary locations.

4.3.2.4 Dose Assessment for Game Ingestion

Potential dose to an individual from occasional ingestion of meat from game animals has been evaluated at the INEL. This pathway includes ingestion of migratory ducks, which temporarily reside in the on-site percolation ponds; sage grouse or mourning doves, which summer near the TRA-ICPP area; and antelopes grazing at the INEL. Although studies have been performed in which doses from this pathway were evaluated, no hunting is allowed on the INEL site.

One study involved the calculation of potential doses to individuals who might eat ducks that temporarily reside in on-site percolation ponds used for the disposal of low-level reactor effluents. The average potential whole-body DE from consumption of a contaminated duck is 10 mrem (RESL, 1987). This value is based on the assumption that the duck would be killed and eaten immediately after leaving the pond. Normally, a duck would not actually be killed and eaten immediately, so a lower dose would be more realistic due to biological elimination of the radioactivity. Because only about 1 duck in 4,000 passing through this part of Idaho is likely to spend time on site ponds, the probability of a hunter receiving this dose is further reduced.

The highest estimated potential whole-body DE to a person eating the entire muscle mass of a sage grouse which summers near the TRA-ICPP area of the INEL is 2 mrem (RESL, 1987). The maximum whole-body DE from consumption of sage grouse from other INEL site locations and off-site areas ranges from 0.01 to 0.04

TABLE 4-14
OFF-SITE ENVIRONMENTAL DIRECT RADIATION
EXPOSURES (1986)

Location	1986
Distant Group (Background)	Annual Exposures (mR) ^a
Aberdeen	111 ± 6
Blackfoot	113 ± 6
Craters of the Moon National Monument	111 ± 6
Idaho Falls	120 ± 8
Minidoka	97 ± 6
Rexburg	111 ± 6
Roberts	124 ± 8
Mean ^b	112 ± 8
Boundary Group	
Arco	109 ± 9
Atomic City	121 ± 7
Howe	110 ± 8
Montevideo	114 ± 6
Mud Lake	113 ± 7
Reno Ranch	107 ± 7
Mean ^b	112 ± 5

Source: Adapted from RESL, 1987

^a Annual exposure ± 2 standard deviations.

^b Arithmetic mean with the 95 percent confidence interval for the mean.

mrem (RESL, 1987). The maximum potential whole-body DE to a person eating the muscle tissue of one mourning dove from the TRA-ICPP area is 0.3 mrem (RESL, 1987). The average whole-body DE to a person consuming doves migrating from other INEL site areas is 0.01 mrem (RESL, 1987), which is the same as for control birds collected far from the INEL site. A conservative estimate of the potential whole-body DE which could be received by a single individual eating the entire muscle and liver mass of an antelope with the highest levels of radionuclides is 0.2 mrem (RESL, 1987).

While doses for the game ingestion pathway are calculated, the probability of a person receiving these doses is considered extremely small.

4.3.2.5 Summary of Exposures

As discussed in Section 4.3.1, DOE imposes a limit for radiation exposure to any member of the general public of 100 mrem/year EDE from all pathways due to normal operations at a DOE facility. The INEL evaluated the exposures to radiation from site operations for releases to the atmosphere, liquids, direct radiation, and game ingestion pathways. To determine compliance with the 100 mrem/year EDE, all exposure pathways must be summed for an individual who would receive the highest doses. Based on the 1986 AEMPR, the highest reported off-site dose for 1986 was 0.11 mrem EDE from the atmospheric pathway (Section 4.3.2.1). As previously discussed, no off-site doses were reported for the liquid or direct radiation pathways. While doses for the game ingestion pathway were calculated, the probability of a person receiving these doses was considered extremely small, resulting in these doses not being included in the total off-site dose to the general public. If the game ingestion doses were added to the 0.11 mrem EDE from the atmospheric pathway, the total maximum individual dose from all pathways for 1986 would have been approximately 13 mrem EDE, less than 14 percent of the 100 mrem/year EDE limit.

4.3.2.6 Radioactive Material Inventory Control

Many buildings at the INEL store reusable radioactive or radioactively contaminated equipment and materials in secure and posted radioactive material storage areas. These materials are packaged or wrapped and surveyed by an INEL Health Physicist

(HP) for external contamination. If determined by the HP to be free of external contamination, the material is listed on the radioactive source inventory for that building and placed in the storage area. These areas are routinely surveyed by an INEL HP to detect any leakage of radioactivity and to ensure that the radiation level in the area is correctly posted.

At Building TAN-646, interviews with building personnel and an examination of records indicated that a cardboard box of radioactive material was not on the radioactive source inventory for that building. Additionally, the amount of radioactivity, isotope name, or form of the material was not listed on the box or known by building personnel. Investigations by site personnel determined that the box contained 5 curies of tritium in a neutron generator.

4.3.3 Environmental Monitoring Program

The environmental monitoring programs for the various media are discussed in the respective sections for Air (3.1.3), Soil (3.2.3), Surface Water (3.3.3), and Groundwater (3.4.3). In addition, the TLDs used to measure the direct penetrating radiation exposure at locations on and off the INEL site are discussed below. The Radiological and Environmental Sciences Laboratory (RESL), which is part of the Environmental Sciences Branch (ESB) of the Idaho Operations Office (ID) performs the Radiological Environmental Monitoring Program at the INEL. The measurements are made to determine if activities on the INEL are contributing to the external radiation levels in the vicinity of the INEL. There are three groups of monitoring stations for the INEL: (1) INEL on-site; (2) INEL boundary; and (3) INEL distant stations.

The INEL on-site stations consist of 135 TLDs placed at 15 different areas (Figure 4-13). Additionally, there are six INEL boundary stations and seven INEL distant stations. Figure 4-12 identifies the locations for the INEL boundary and distant groups. Interviews with site personnel indicated that no documentation exists for the INEL rationale for the initial selection of radiological environmental monitoring locations.

The ionizing (direct) radiation exposure data for on-site locations for the periods of November 1985 to May 1986 and May 1986 to November 1986 are presented in

LEGEND

ARA	Auxiliary Reactor Area
ANL-W	Argonne National Laboratory-West
BORAX	Boiling Water Reactor Experiment
CFA	Central Facilities Area
EBR I	Experimental Breeder Reactor I
ICPP	Idaho Chemical Processing Plant
LOFT	Loss-of-Fluid Test (Facility)
PBF	Power Burst Facility
RWMC	Radioactive Waste Management Complex
SPERT	Special Power Excursion Reactor Test
TAN	Test Area North
TRA	Test Reactor Area
TSF	Technical Support Facility
WRRTF	Water Reactor Research Test Facility

0 5 10
Scale, Miles

Source: Adapted from EG&G Idaho, Inc., 1985

LOCATION OF THE INEL TLD MONITORING AREAS
AND NUMBER OF TLDs AT THE AREAS

FIGURE 4-13

Table 4-15. The data show there are above-background ionizing radiation exposures at the on-site TLD locations of the TRA, the RWMC, the ARA, and ICPP areas. As previously discussed in Section 4.3.2.3, background direct penetrating radiation exposures in the vicinity of the INEL are approximately 112 mR/yr. The sources that caused the elevated radiation exposures at the TRA are the storage of radioactive waste in aboveground tanks, the warm waste retention basin, and the warm waste percolation ponds. At the RWMC, the source is the buried and stored radioactive materials. The SL-1 nuclear reactor accident in 1961 resulted in residual contamination of the surrounding soil and buildings at the ARA. Storage of radioactive material is the source of direct radiation at the ICPP.

Review of the locations of TLDs at the on-site areas revealed four areas that are not currently monitored by TLDs. These areas are the SL-1 burial ground, ANL-W's Radioactive Scrap and Waste Facility (RSWF), BORAX I burial ground, and the CFA Sewage Treatment Plant. Monitoring these areas may not be necessary since direct radiation does not measurably contribute to the off-site dose at the INEL. However, monitoring by TLDs may give an indication of biointrusion, erosion of the earth covering, breach of containment, or some other process by which radioactive materials have escaped from their containments to the surrounding environment.

Visual inspection of on-site TLD stations revealed that TLD location 37 at the RWMC was shielded from direct radiation resulting from radioactive storage and disposal operations by a metal post. Interviews with site personnel indicated that no regular reviews of existing monitoring locations are performed.

Review of the locations of TLDs at the off-site boundary and distant groups as shown in Figure 4-12 indicates a lack of TLD stations at the southwestern site boundary, which, for a significant part of the time, is downwind of the radioactive atmospheric effluents from the INEL site (Section 3.1.1). Additionally, the RWMC is located in proximity to the site boundary at this point. The southeastern site boundary also lacks TLD stations. ANL-W, which has radiological emissions from reactor and reactor-related operations, is located close to the southeastern site boundary.

TABLE 4-15

ON-SITE DIRECT RADIATION EXPOSURES (1986)
Six-Month Exposure in mR_a

Facility	Dosimeter Location #	11/85-5/86	5/86-11/86
TAN/LOFT	1	58 ± 4	67 ± 5
	2	65 ± 5	72 ± 6
	3	54 ± 4	61 ± 5
	4	56 ± 4	60 ± 5
	5	53 ± 3	63 ± 6
	6	57 ± 5	70 ± 6
	7	59 ± 5	75 ± 6
TAN/WRRTF	1	54 ± 3	67 ± 7
	2	55 ± 4	63 ± 5
	3	53 ± 3	65 ± 7
	4	53 ± 4	70 ± 6
TAN/TSF	1	58 ± 5	63 ± 6
	2	59 ± 5	80 ± 7
	3	62 ± 3	79 ± 7
	4	55 ± 4	64 ± 6
TRA	1	67 ± 7	90 ± 8
	2	140 ± 11	211 ± 21
	3	b	930 ± 80
	4	616 ± 53	789 ± 60
	5	956 ± 57	991 ± 87
	6	79 ± 7	95 ± 9
	7	880 ± 105	361 ± 28
	8	202 ± 18	167 ± 16
	9	156 ± 13	131 ± 10
	10	70 ± 4	81 ± 7
	11	66 ± 5	77 ± 6
	12	62 ± 6	74 ± 6
	13	78 ± 5	76 ± 6
CFA	1	57 ± 6	69 ± 6
	2	51 ± 5	60 ± 5
	3	56 ± 5	69 ± 5
	4	52 ± 6	70 ± 7
RVVMC	1	168 ± 14	200 ± 17
	3	121 ± 8	145 ± 14
	5	225 ± 18	245 ± 23
	7	164 ± 18	184 ± 17

TABLE 4-15

ON-SITE DIRECT RADIATION EXPOSURES (1986)
Six-Month Exposure in mR_a (Continued)

Facility	Dosimeter Location #	11/85-5/86	5/85-11/86
RWMC	9	87 ± 6	104 ± 11
(cont.)	11	65 ± 7	75 ± 6
	13	b	77 ± 6
	15	69 ± 4	70 ± 6
	17	61 ± 4	75 ± 6
	19	56 ± 3	74 ± 5
	21	62 ± 4	75 ± 7
	23	61 ± 4	72 ± 6
	25	81 ± 9	91 ± 8
	27	117 ± 7	130 ± 11
	29	126 ± 10	138 ± 13
	31	107 ± 9	125 ± 9
	33	126 ± 13	229 ± 23
	35	222 ± 17	236 ± 18
	37	100 ± 7	112 ± 10
	39	77 ± 7	101 ± 8
	40b	61 ± 7	71 ± 6
	41	62 ± 5	73 ± 10
	42b	54 ± 5	68 ± 5
	43	60 ± 4	68 ± 6
	45	64 ± 5	81 ± 6
ARA	1	82 ± 8	107 ± 9
	2	186 ± 15	522 ± 48
	3	107 ± 8	159 ± 13
	4	686 ± 36	1696 ± 187
PBF/SPERT	1	55 ± 5	67 ± 5
	2	60 ± 4	70 ± 7
	3	55 ± 6	67 ± 5
	4	60 ± 5	74 ± 8
	5	59 ± 6	68 ± 5
	6	59 ± 5	71 ± 6
PBF/WERF	1	57 ± 5	70 ± 5
	2	54 ± 4	56 ± 5
	3	58 ± 5	66 ± 5
	4	53 ± 4	68 ± 5

TABLE 4-15

ON-SITE DIRECT RADIATION EXPOSURES (1986)
Six-Month Exposure in mRa (Continued)

Facility	Dosimeter Location #	11/85-5/86	5/86-11/86
PBF/WERF	5	58 ± 6	66 ± 6
(cont.)	6	57 ± 4	64 ± 5
	7	54 ± 3	72 ± 6
EBR-I	1	54 ± 5	65 ± 7
ICPP	1	75 ± 7	98 ± 8
	2	c	c
	3	c	c
	4	c	c
	5	c	c
	6	c	c
	7	c	c
	8	c	126 ± 12
	9	84 ± 7	c
	10	c	c
	11	c	c
	12	c	c
	13	c	c
	14	61 ± 6	83 ± 7
	15	69 ± 7	86 ± 7
	16	59 ± 8	77 ± 8
	17	60 ± 4	77 ± 7
	18d	64 ± 6	72 ± 7
	19d	63 ± 4	72 ± 6
	20d	87 ± 6	107 ± 8
	21d	70 ± 6	79 ± 6
	22d	b	128 ± 15
	23d	72 ± 6	83 ± 7
	24d	59 ± 5	70 ± 6
	25d	59 ± 6	71 ± 5
	26d	63 ± 6	69 ± 8
ANL-W	7	70 ± 6	82 ± 8
	8	60 ± 6	69 ± 5
	9	57 ± 5	73 ± 7
	10	52 ± 4	64 ± 6

TABLE 4-15

ON-SITE DIRECT RADIATION EXPOSURES (1986)
Six-Month Exposure in mR^a (Continued)

Facility	Dosimeter Location #	11/85-5/86	5/86-11/86
ANL-W	11	62 ± 6	63 ± 6
(cont.)	12	54 ± 4	66 ± 5
	13	55 ± 4	68 ± 5
	14	48 ± 3	59 ± 4
	15	56 ± 4	69 ± 6
	16	59 ± 7	70 ± 6
	17	51 ± 3	62 ± 5
	18	53 ± 3	73 ± 6
Lincoln Blvd.	1	57 ± 3	65 ± 6
	3	65 ± 5	74 ± 6
	5	58 ± 6	66 ± 8
	7	63 ± 4	72 ± 6
	9	61 ± 4	74 ± 7
	11	61 ± 4	76 ± 8
	13	61 ± 6	75 ± 7
	15	62 ± 6	70 ± 9
	17	63 ± 6	76 ± 7
	19	61 ± 5	69 ± 10
	21	58 ± 6	63 ± 5
	23	57 ± 4	65 ± 5
	25	60 ± 5	67 ± 6
US 20	264	56 ± 3	65 ± 5
	266	54 ± 3	63 ± 5
	268	53 ± 4	66 ± 6
	270	57 ± 5	67 ± 5
	272	50 ± 4	63 ± 5
	274	51 ± 4	d
US 26 ^c	266	54 ± 3	68 ± 5
	268	60 ± 5	71 ± 5
	270	60 ± 6	74 ± 8

Source: Adapted from RESL, 1986; 1987

- a Semi-annual Exposure ± 2 standard deviations
- b Invalid results due to sampling error.
- c Location lost when new security fence was constructed.
- d Dosimeter missing at collection time.

Finally, interviews with site personnel indicated that antimony-125 had been recently detected in the air samples at Craters of the Moon National Monument. The source of the antimony-125 is the ICPP atmospheric effluent.

4.3.4 Findings and Observations

4.3.4.1 Category I

None

4.3.4.2 Category II

None

4.3.4.3 Category III

None

4.3.4.4 Category IV

1. Inadequate reporting of known sources of tritium releases. Known sources of atmospheric tritium releases from the INEL are not reported in the Annual Environmental Monitoring Program Report, resulting in an inaccurate off-site dose assessment from the INEL operations.

Atmospheric tritium releases from the evaporation of tritium-contaminated water are not included in the RWMIS. A total of 330 curies of tritium were released in liquid effluents on the site in 1986 (RESL, 1987). Depending on the evaporation rate used in the calculations (estimates from 4 percent to 15 percent were quoted by site personnel), 13.2 curies to 49.5 curies of tritium would need to be added to the airborne effluents and subtracted from the liquid effluents reported in the RWMIS. The RWMIS information is used to summarize total radioactive releases to the environment from the INEL site in the Annual Environmental Monitoring Program Report. The omission of atmospheric tritium releases results in a lower predicted off-site dose assessment to the general public. However, including these atmospheric

tritium releases in the off-site dose assessment will not significantly increase the currently reported off-site dose. It would be less than a 1 percent increase in the total number of curies currently released to the atmosphere from the INEL. Nonetheless, elimination of these radioactive atmospheric releases from the report understates the total impact on the environment and public from the INEL operations.

2. Improper labeling of containers storing radioactive material. An inadvertent release or improper disposal of radioactive material could occur as a result of improper content labeling of radioactive storage containers identified in the radioactive storage area of Building TAN-646.

Five curies of tritium were stored in 1-gallon plastic cans in a cardboard box in the radioactive storage area of Building TAN-646. Although labeled as radioactive and as DOE Class A material, the curie content and radioisotope were not specified. Additionally, building personnel were unaware of the specific contents, and the material was not included on the source inventory for the building. Investigations by site personnel determined that the box contained 5 curies of tritium in a neutron generator. This lack of information could result in improper disposal or an inadvertent release of the radioactive material.

3. Lack of regular reviews of existing radiological environmental monitoring locations. The RESL does not conduct regular reviews of existing radiological environmental monitoring locations, resulting in samplers that are now incorrectly located because of changes that have taken place at the locations since initial placement of the samplers.

Lack of regular review of radiological monitoring locations may result in collection of data which lack validity with respect to the radiological parameters intended to be monitored. The following examples of radiological monitors which are incorrectly located with respect to the monitored parameter were identified by the DOE Survey team.

The TLD at location 37 of the RWMC was shielded by a metal post from direct radiation, the parameter it is intended to monitor. The metal post was

recently placed as part of new-fence construction. The use of Craters of the Moon National Monument as a distant location in the ambient air monitoring and distant TLD monitoring networks (locations that are not supposed to be affected by the INEL site's operations) is questionable since antimony-125 from the ICPP atmospheric effluent has recently been detected in air samples from Craters of the Moon National Monument. Additionally, an air sampler at the TAN/TSF area is located in the parking lot next to the bus waiting area. Interviews with site personnel revealed that filter loading with particulates is a problem in the winter months when the buses wait at this area for long periods.

4. Lack of documentation for selection of radiological environmental monitoring locations. The RESL has not documented its initial site selection rationale for the radiological environmental monitoring locations, resulting in a sampling network that may not be effectively assessing the parameters it is intended to monitor.

Interviews by the DOE Survey team demonstrated that there is no documentation that shows that the INEL is using any siting criteria for locating radiological monitors. Although the INEL does use DOE and DOE-ID orders as guidance for the siting of radiological environmental monitoring networks, the lack of documentation on how the guidelines are applied to each sampling location could result in a misinterpretation of siting selection rationale. As a result of the inadequacies in documented site selection rationale, the Survey team was unable to ascertain why some sites which appear to need radiological monitoring are not monitored, why some sites are being monitored, and why other sites appear to be ineffectively monitored. Examples of questionable monitoring are identified below.

First is the lack of TLD, air, vegetation, and soil sampling locations along the southwestern quadrant of the INEL boundary. The southwestern site boundary lies downwind of the radioactive atmospheric effluents from the INEL site a significant part of the time and the RWMC, which is a significant source of radionuclides, is located close to this site boundary. Additionally, the southeastern quadrant of the INEL boundary lacks TLD, groundwater, and vegetation sampling locations; the ANL-W, which has radiological emissions

from reactor and reactor-related operations, is located close to the southeastern site boundary. Another example is the use of Craters of the Moon National Monument as a distant location (a location that is not supposed to be affected by the INEL site's operations) in the ambient air monitoring and distant TLD monitoring networks when antimony-125 from the ICPP atmospheric effluent has been detected in air samples from Craters of the Moon National Monument. Also, the rationale for not monitoring the on-site SL-1 burial ground, ANL-W's RSWF, BORAX I burial ground, and the CFA Sewage Treatment Plant when other similar on-site areas are monitored was not documented. Additionally, air samplers at the RWMC are located close to the ground and next to dirt roads which could cause problems with particulate loading on the air filters.

PRELIMINARY

4.4 Quality Assurance

4.4.1 Environmental Sampling

The sampling program at the INEL is conducted by five principal organizations: EG&G Idaho, Inc., WINCO, ANL-W, the RESL, and USGS. Environmental sampling is conducted at the INEL for two basic purposes--routine environmental monitoring for use in defining sitewide impacts, and special studies to supplement the regular program for use in defining the impacts of specific facilities and waste sites on the environment from operation of the INEL facilities. The results of the sampling effort are utilized internally by the organization collecting the samples and in most instances by the RESL and USGS for defining sitewide impacts.

DOE contractors (EG&G, WINCO, and ANL-W) sample all environmental media within their own site boundaries, with the exceptions of certain groundwater monitoring wells that are managed by the USGS, and the production wells at ANL-W, where EG&G does the sampling. The RESL samples air, soil, groundwater, and biota outside the individual facility boundaries both on and off the INEL property, including some distant monitoring locations. The USGS maintains and samples a system of groundwater monitoring wells both on and off the INEL property, including locations within the individual facility boundaries.

Specific information for sampling programs and their associated QA/QC is given in the environmental monitoring sections for Air (Section 3.1.3), Soil (Section 3.2.3), Surface Water/Drinking Water (Section 3.3.3), and Hydrogeology (Section 3.4.3).

4.4.2 Analysis and Data Management

Laboratory analyses for the sampling programs discussed above are carried out by the same groups that conduct the sampling. Basically, each contractor, as well as the RESL and USGS, analyzes its own samples. Exceptions to this are the RESL, which analyzes some inorganics in groundwater samples for the USGS, and ANL-W, which contracts some of its routine monitoring and special studies analyses. The RESL also does radiological bioassays for the entire INEL.

Individual annual reports for the routine environmental monitoring are generated by each group. These reports provide an overview of the impacts of INEL operations to environmental media, including air, groundwater, surface water, drinking water, wastewater, soils, vegetation, and fauna both on and off the site. Table 4-16 presents the parameters monitored by each group. Special studies are published individually, or are not published but are used as internal working documents.

4.4.2.1 EG&G

EG&G Idaho operates two analytical chemistry laboratories responsible for analysis of environmental monitoring samples from primarily EG&G facilities, the CFA Environmental Chemistry Laboratory and the Industrial Hygiene (IH) Support Laboratory.

CFA Environmental Chemistry Laboratory

The CFA Environmental Chemistry Laboratory, located in CF-633, is responsible for inorganic and organic analyses of most wastewater, groundwater, surface water, and soil samples, primarily from the EG&G facilities. Typical parameters are identified in Table 4-16.

Instrumentation includes pH meters, conductivity meters, graphite furnace atomic absorption (AA) spectrometer, inductively coupled plasma (ICP) atomic emission spectrometer, gas chromatograph, liquid chromatograph, gas chromatograph/mass spectrometer, total organic carbon (TOC) analyzer, ion chromatograph, spectrophotometers, gel permeation chromatograph, closed-cup flash-point testers, distillation apparatus, and the usual complement of glassware, balances, ovens, refrigerators, and miscellaneous support equipment.

The equipment is maintained, clean, uncluttered, and functional, and is periodically checked for calibration to demonstrate the reproducibility of data related to environmental sampling, in accordance with written protocols outlined in the Standard Operating Procedures (SOP) Manual.

The Environmental Chemistry Laboratory maintains a QA/QC program to ensure integrity and defensibility of results. Each analysis instrument and balance has a

TABLE 4-16

TYPICAL ENVIRONMENTAL MONITORING PARAMETERS AT THE INEL

Parameter	EG&G	DOE RESL	WINCO ICPP	ANL-W	USGS Denver
Arsenic	X		X	X	X
Barium	X		X	X	X
Cadmium	X		X	X	X
Chloride	X	X	X	X	X
Chromium	X	X	X	X	X
Cyanide	X			X	X
Fluoride	X		X	X	X
Mercury	X		X	X	X
Lead	X		X	X	X
Nitrate	X		X	X	X
Selenium	X		X	X	X
Sodium	X	X	X	X	X
Silver	X		X	X	X
Endrin	X		X		
Lindane	X		X		
Methoxychlor	X		X		
2,4,5-TP Silvex	X		X		
Toxaphene	X		X		
2,4-D (TBP)	X		X		
Chloroform	X				
Tetrachloroethylene	X				
TCE	X				
Trihalomethanes	X				
Carbon Tetrachloride	X				
Tritium	X	X	X	X	X
Gross Alpha	X	X	X	X	X
Gross Beta	X	X	X	X	X
pH	X	X	X	X	X
Sulfate	X	X	X	X	X
Phosphate			X	X	X

* Other significant radionuclides are C-14, I-29, I-131, Cs-137, Ru-106, Sr-90, Pu-238, Co-60, Sb-125, and Zr-95.

daily logbook in which background, standards, and blank runs are recorded. In addition, calibration checks are required with each sample set and, on some instruments, with each analysis performed. The chain of custody is implemented by requiring every sample to be laser-bar-coded upon receipt by the laboratory. The system immediately records the date of entry, assigns a sample tracking number, identifies the client and the sample custodian, and simultaneously logs the data into a computer. Samples are locked in a storage cabinet when not being used. The laboratory participates in a number of QC intercomparison programs with other contractors, with EPA, and with off-site private laboratories.

Standard solutions are prepared from ampulated solutions obtained from the EPA Quality Assurance Materials Bank (QAMB) or from ultra-high-purity commercially available material. Traceability tests are performed on all commercially prepared standard solutions. "If the standard components are outside the stated EPA accuracy window, and are greater than 10%, the INEL standard will not be utilized. However, if the standard components are outside the EPA accuracy window but within 10%, then the standard concentration will be adjusted accordingly" (EG&G Idaho, Inc., 1987c). Prior to January 1987, no formal field sampling or analytical protocol was in place.

No formal statistical analysis is performed on environmental data generated at the CFA Environmental Chemistry Laboratory.

IH Support Laboratory

The IH Support Laboratory in Building 612 at CFA has limited analysis capability focusing on asbestos analysis, and coliform bacteria counting in potable water samples. The facilities include microscopes, balances, drying ovens, counters, and staining equipment. Comparative standards are maintained and equipment is maintained and kept in a clean, orderly environment. The other QA/QC program elements that are normally applicable to radiological and chemical laboratories do not apply to operations carried out in this laboratory.

4.4.2.2 RESL

The RESL is located in Building 690 at the CFA. The laboratory is primarily dedicated to radiological analysis, but as previously indicated, performs limited inorganic analyses on surface-water and groundwater samples for the USGS. These two analytical laboratory sections are described below.

Radiological Section

The radiological section of the laboratory performs radiological analyses on all media as well as bioassays on biota. Equipment includes gas proportional, liquid scintillation, and gamma spectroscopy systems. They are maintained, clean, uncluttered, and functional. Maintenance logs are kept and the instruments are periodically checked for calibration to demonstrate the reproducibility of data generated during environmental sampling. Samples are logged upon receipt, split, and stored in a lockable sample bank. Chain of custody is maintained on the samples. Test aliquots are logged directly on the sample bottle label and not on a separate logsheet.

A QA/QC parameter-specific program is maintained by the RESL to ensure consistent and reliable radionuclide monitoring results. An internally tailored QC program is maintained and includes adherence to written protocols for sample collection and analytical methods, documentation of program changes in SOP manuals, routine calibration of instrumentation, and frequent equipment performance checks for background and counting rates of standards. In addition, routine yield determinations of radiochemical procedures, analysis of replicate samples to determine precision, and analysis of reagent blanks to verify radiochemical purity are performed. National Bureau of Standards (NBS) QC standards in appropriate matrices are also used to test accuracy.

The calibration of counting instruments is carefully performed and is traceable to the NBS. Six times a year, tracer solutions are submitted to the RESL for analysis by gamma spectrometry. Comparisons are also made for beta emitters, including strontium-90 and tritium, and for alpha emitters such as plutonium-238 and 239 and americium-241. The results, which are reported directly to the NBS, are traceable to

within 5 percent of the standard value, or within 2 standard deviations of the actual value 99.7 percent of the time.

The RESL participates in an INEL site intercomparison program where radiological samples with known concentrations are sent to the INEL contractor analytical laboratories. An intercomparison of results from all participating contractor laboratories is made. The RESL participates in a similar intercomparison with U.S. Nuclear Regulatory Commission (NRC) laboratories.

The RESL also participates in the QA program administered by the Environmental Measurements Laboratory (EML) of DOE for radiological analyses. As time permits, the RESL participates in American Society for Testing and Materials (ASTM) round-robin testing of standard methods.

The radiological section utilizes a QA/QC protocol for data management that includes propagation of all random and systematic uncertainties, and incorporation in reporting data with accurate standard deviations and high confidence limits.

Inorganic Section

The inorganic section periodically analyzes USGS groundwater and surface water samples for four inorganic parameters, as listed on Table 4-16, and pH and specific conductance. Instrumentation includes ion selective electrodes, pH meters, conductivity meters, an AA, a kinetic phosphorescence laser analyzer, and ancillary balances, ovens, refrigerators, and support equipment. Routine maintenance on the AA and analytical balance were overdue. The analytical balance did not have a dedicated logbook which identified routine calibration checks and the AA calibration checks, if made, were not available to the Survey.

The analytical procedures used for total chromium analyses were developed by the RESL. Total chromium samples were found during the Survey in unlocked and unattended laboratories on countertops awaiting analysis. Standards for all analyses are prepared internally from ASTM, NBS, or distributor sources. The inorganic section does not participate in any round-robin or intercomparison studies although there are cross checks with the USGS laboratory in Denver, Colorado. This section does not have chain-of-custody protocols.

4.4.2.3 WINCO

WINCO operates laboratories at the ICPP, including the Remote Analytical Laboratory, which focuses on inorganic and radiologic analyses, and a support branch facility at the IRC in Idaho Falls, which is concerned with radiological analysis. Very few environmental samples have been handled by IRC. Therefore, this laboratory is not discussed in this section.

The WINCO-operated laboratories at the ICPP are located in Buildings 637, 627, 601, and 602, and are responsible for on-site environmental sample analysis for organics, including PCB and pesticides, inorganics, as identified in Table 4-16, and for asbestos identification.

Instrumentation includes pH meters, ICP, an AA, scanning electron microscope, X-ray diffractometer, infrared alternating-current spark emission spectrophotometer/spectrometer, X-ray fluorescence spectrometer, ion chromatograph, gas chromatograph, emission spectrometer, selective ion electrodes, Titramet titrimer, and a full complement of ancillary equipment.

The laboratory has an equipment maintenance program and the equipment is clean, uncluttered, and operational, and is periodically checked to demonstrate the reproducibility of instrument calibration and thus defensibility of data accumulated as a result of environmental sampling efforts. A complete QA/QC program is maintained, including instrument and duplicate/spike logbooks, which are in place and up to date. Chain-of-custody within the laboratory is implemented when samples are received. Sample-specific information is recorded on WINCO form 5351 (sample custody log) and this log follows the item through the lab. Samples are locked in a sample storage room while not in use. Internal QC sample checks are implemented daily during analytical runs, and each result must meet the criterion of ± 2 standard deviations from the known. The WINCO methods manual contains procedures culled from various sources such as ASTM, EPA, the National Institute for Occupational Safety and Health (NIOSH), Association of Official Analytical Chemists (AOAC), from open literature, and from research efforts. Standards are NBS traceable and are marked with date of preparation, date of expiration, and method

number. The QA/QC for data management consists of statistical methods for data validation.

Statistical analyses are used to generate bias and precision parameters. The data are tested for variance curve morphology, reported vs. known relationships, normality, time trends, outlier population characterization, and significance of runs. Intercomparisons with other laboratories are conducted on a regular basis.

4.4.2.4 ANL-W

ANL-W operates its own laboratory in Building 752. Prior to 1987, the laboratory was dedicated to radiological analysis as applied to research and development. However, the environmental samples generated through on-site monitoring efforts are currently analyzed for inorganic parameters (including anions and trace elements) in addition to radionuclides as a supplement to the RESL environmental program. Process and effluent water is routinely tested for physical and inorganic parameters (Table 4-16).

Instrumentation includes pH meters, conductivity meters, AA spectrometers (hot cell and cold units), thermal ionization mass spectrometer, alpha, beta, and gamma counters, liquid scintillation counters for tritium, ICP atomic emission spectrometer, ion chromatograph, hot cell electronic balances, gamma ray fluorescence spectrometer, and the usual complement of glassware, balances, ovens, refrigerators, and miscellaneous support equipment.

The laboratory equipment and instrumentation is maintained, clean, uncluttered, and operational, and is periodically calibrated to demonstrate the reproducibility of data accumulated during environmental sampling programs. Maintenance logs, if kept, were not inspected during the Survey.

In 1987, ANL-W implemented a comprehensive QA program to produce technically sound data on environmental samples. New written protocols addressing analysis and sample chain-of-custody have been initiated but the system does not have a "track record" to evaluate. Analyses conducted by the ANL-W Analytical Laboratory are performed according to standard procedures which are referenced in the formal QA/QC procedures manual.

Analytical results are compared with historically archived data, and a manual statistical evaluation is applied which defines standard deviations and helps identify anomalous data. Data which are found to be outside normal ranges are flagged and validated. ANL-W does not participate in round-robin or other laboratory intercomparisons.

4.4.2.5 USGS

The USGS collects and analyzes groundwater at the INEL and sends samples to its laboratory in Denver, Colorado, for analysis of purgeable organics, anions, and trace elements. Samples are split and sent to the RESL for scintillation counting to determine tritium, alpha, and beta activity and for analysis of total chromium, chloride, sodium, specific conductance, and pH. A review of the USGS analytical laboratory was outside the scope of the Environmental Survey.

4.4.3 Findings and Observations

4.4.3.1 Category I

None

4.4.3.2 Category II

None

4.4.3.3 Category III

None

4.4.3.4 Category IV

1. Compromising inorganic laboratory procedures. Laboratory procedures for inorganic analysis at the RESL may compromise the validity and defensibility of analytical results.

The USGS provides the RESL with primarily groundwater samples for total chromium, chloride, sodium, pH, and specific conductivity analysis. The total chromium analyses performed by the RESL are only used as a check against the USGS hexavalent chromium measurement which is performed by the USGS Laboratory in Denver, Colorado. During the Environmental Survey, the following issues were identified which may compromise the validity and defensibility of the data:

- There were no chain-of-custody procedures in place to secure the samples against tampering. Environmental samples from the USGS slated for aqueous inorganic analysis for total chromium on the atomic absorption mass spectrophotometer had been allowed to remain on a countertop in an unattended, unlocked room for over one month.
 - The analysis protocol for total chromium was not an EPA-approved method, but was a method developed by a RESL analyst that was based on standard methods.
 - Maintenance and calibration of equipment were overdue.
2. Uncoordinated groundwater monitoring. Groundwater environmental monitoring data collected and analyzed by various laboratory contractors are not being effectively compiled, manipulated, and coordinated at the INEL to define the sitewide environmental impacts or fully understand specific environmental problems.
- Not all the groundwater sampling data that are collected are entered into a centralized computerized data base or subjected to a statistical analysis. Only USGS sample analyses conducted in the Denver, Colorado, laboratory are entered into a centralized national computer system. DOE site personnel responsible for coordinating sitewide environmental monitoring programs do not access or manipulate data acquired by the USGS and the USGS does not review much of the data accumulated by DOE and its contractors.

- The INEL Annual Environmental Monitoring Program Report (AEMPR) is the only centralized data base and provides only a summary of the sampling and analysis program, and this pertains principally to radiological monitoring.
- Table III on page 13 of the May 1987 AEMPR indicates that major nonradioactive inorganic water quality constituents are sampled by USGS approximately every 5 years, and that number of samples, analysis methods, and sample locations will vary, making it difficult to correlate and model historical, present, and future sampling data.
- Independently acquired environmental sampling and analysis data are not shared between contractors. The USGS is not aware of the data accumulated by EG&G Idaho, potentially resulting in sampling redundancy and misinterpretation of analytical results.

As a result of these inefficiencies in the data handling system, correlations between cause and effect may go unrecognized. For example, production Well 3 at the TRA was removed from service when mercury was found in a sample with a concentration exceeding four times the drinking water standard of 2.0 parts per billion (ppb). Subsequent analysis has shown levels below the 2.0 ppb standard. Since no explanation concerning possible origin of the mercury was proposed, the analysis results were assumed to be in error; however, chemical disposal pond number 701 had been used to dispose of mercury and other heavy-metal-containing waste since 1962. This leaching pond is located 400 feet south of the TRA 3 well. The pond may be the source of contamination and if this is confirmed, a carefully implemented sample program may provide insight to future types of groundwater contaminants expected at specific wells.

4.5 Inactive Waste Sites and Releases

4.5.1 General Description of Pollution Sources and Controls

4.5.1.1 Introduction

This section of the report deals with the inactive waste sites that are present, and spills and other types of releases that have occurred at the INEL both before and during its establishment. Although the INEL began operations in 1949, portions of the site were used during World War II by the U.S. Navy and U.S. Army Air Corps as a gunnery range. The former Navy administrative, shop, warehouse, and housing area is today the CFA. Most sites of concern contain hazardous, mixed, or radioactive wastes.

The inactive waste sites and releases described below are based on the Environmental Survey conducted from September 14 through October 2, 1987, the INEL Installation Assessment Reports (IARs) (ANL-W, 1986b; EG&G Idaho, Inc., 1986b; WINCO, 1986c), Initial Assessments of Solid Waste Management Units (SWMUs) and Land Disposal Units (LDUs) (ANL-W, 1986a; EG&G Idaho, Inc., 1986c; WINCO, NDb), and numerous other records including aerial photographs, employee interviews, unusual occurrence reports, decontamination and decommissioning (D&D) reports, and site characteristics reports. These sources represent the most current and comprehensive information available on waste sites and releases at the INEL and, as such, served as major references.

The IARs and the SWMU and LDU Initial Assessments (IAs), as required by U.S. Department of Energy (DOE) Order 5480.14, and a Consent Order and Compliance Agreement between the DOE Idaho Operations Office (DOE-ID) and EPA Region X, pursuant to Section 3008(h) of RCRA, have identified nearly 350 SWMUs and LDUs. SWMUs include both active and inactive sites and releases that may contain nonhazardous, hazardous, or radioactive wastes while LDUs include active and inactive sites that received hazardous wastes after November 19, 1980.

The list of approximately 350 SWMUs and LDUs includes several categories of both active and inactive sites, for example active and inactive septic systems, landfills, tanks, and percolation ponds. Since the various types of units are the responsibility

of different Environmental Survey disciplines (e.g., inactive percolation ponds are covered in the Inactive Sites discipline; active landfills are dealt with in the Waste Management discipline), the Survey team allocated each SWMU and LDU to the appropriate discipline. Thus, of the nearly 350 SWMUs and LDUs, 179 were categorized as inactive sites or releases for the purposes of the INEL Survey. In addition, the team identified another 24 inactive sites and releases during the on-site portion of, and the followup after, the Survey.

Each of the 203 inactive sites is described in Section 4.5.1.3 and is identified by the name and code number that the INEL uses to denote SWMUs and LDUs. For those 24 inactive sites newly identified by the Survey team, the code number includes an "E5" (e.g., LOFT-E501). Of the approximately 170 remaining SWMUs and LDUs not addressed in this section, active units are addressed in Section 4.1 and underground storage tanks (USTs) on the list of SWMUs and LDUs are addressed in Section 4.2.1.5.

All the inactive sites and areas of spills and releases were visited to visually assess their current conditions. Since several have undergone varying degrees of remediation, the effectiveness of restoration was also noted. They are located at the following discrete facilities at the INEL (Figure 2-3):

- LAN
- LOFT
- RE
- WRRTE
- ISI
- TRA
- CEA
- ARA
- PBF/SPERT
- ICPP
- ANL-W
- NODA
- EBR-I/BORAX
- ARVFS
- EOGR
- OMRE
- LCCDA

No inactive waste sites or releases were identified at the RWMC or the Idaho Research Center (IRC).

4.5.1.2 Inactive Waste Site and Release Categories

For the purpose of this pollution sources discussion, inactive waste sites and releases located at the INEL facilities can be grouped into six categories based on the nature of the waste disposed of (e.g., liquids versus solids), the manner of disposal (e.g., surface disposal versus aquifer injection), and the potential pathway of contaminant release (e.g., atmosphere, soil, groundwater). The categories, described below, comprise the following:

- Inactive Surface Percolation Units and Ditches
- Inactive Injection Wells
- Inactive Landfills and Surface Storage Areas
- Inactive Subsurface Percolation Units
- Spills and Leaks
- Miscellaneous

Inactive Surface Percolation Units and Ditches

Inactive surface percolation units and ditches at the INEL include ponds, pits, trenches, and ditches that were used for the disposal of liquid wastes. Most of these units are between 3 and 10 feet deep, built directly into the surficial alluvial soil, and are unlined. They are open to the atmosphere and are wider or longer than they are deep. In general, the liquids they received were conveyed in ditches or through pipes and, within the unit, either percolated into the soil or evaporated into the atmosphere. The liquids contained a wide variety of constituents, including radionuclides, metals, acids, solvents, and other organics.

The major pathways of contaminant migration are downward through the unsaturated zone toward groundwater and into the atmosphere from evaporation. Approximately 35 inactive surface percolation units and ditches were identified at the INEL during the Survey. Several of them are still present although inactive since the processes which discharged to them are no longer in use or since feed lines have

been capped and effluents diverted elsewhere. However, the presence of the depressions or excavations that made up the surface percolation units and ditches may act to concentrate surface runoff from precipitation. The liquid that concentrates within the depressions could intermittently increase the driving force, moving any contaminants present in the surface soils or vadose zone downward toward the aquifer. Evidence of contamination potentially caused by these units are plumes of degraded groundwater below and downgradient of facilities where these units formerly operated, principally at TRA and ICPP. Groundwater contamination is discussed in detail in Section 3.4.

Inactive surface percolation units and ditches are located at 12 of the INEL facilities and each is described in more detail by facility in Section 4.5.1.3.

Inactive Injection Wells

The INEL and its predecessor, the National Reactor Testing Station (NRTS), commonly made use of injection wells for liquid waste disposal. In general, injection wells were an effective means of disposal of undesired liquids due to the highly transmissive nature of the underlying subsurface. The conditions of underlying fractured but still interlayered with argillaceous alluvial beds allowed these liquids to transmit or flow from the injection point into the surrounding geologic matrix. Wastes flowed into not only the Snake River Plain aquifer, but also the overlying vadose zone.

Based on records from the INEL, nine inactive injection wells are located at seven facilities. Two of those injection wells are at the PBE. The remaining seven are at TAN WARRIE, TAN HILL, TAN LOFT, TAN TSE, TRA, ICPP, and EOGR. Reportedly, the well at the EOGR was never utilized for disposal of liquid wastes because that facility was never fully operational and did not generate wastes for groundwater injection.

The common practice of injection well installation and operations was to drill to a specified depth, inserting and telescoping smaller diameter steel casing through the larger casing as the borehole progressed. A well screen length, perforated or slotted, was emplaced in the bottom. Figure 4-14 includes typical schematic drawings of three different physical arrangements of the eight injection wells used at the INEL. The first generalized schematic (left-side) represents the two wells at

GENERAL CONFIGURATION OF THE INACTIVE INJECTION
WELLS AT THE INEL

FIGURE 4-14

PBF. These wells injected liquid wastes into the unsaturated zone. Contaminants potentially migrated through the fractured basalt down to the aquifer from the screened portion of the wells. The second generalized schematic (middle figure) represents the injection well configurations at ICPP and TRA, which were screened in the aquifer. However, due to insufficient discharge capacities of these wells, additional perforations were gun-perforated through the casing at upper zones. The additional perforations allowed discharges to shallower portions of the aquifer at the TRA well and within both the aquifer and alluvial interbeds of the unsaturated zones at the ICPP well. The third generalized schematic depicted on Figure 4-14 (right-side) represents the four injection wells at TAN. These four wells, one each at TAN/IET, TAN/TSF, TAN/WRRTF, and TAN/LOFT, injected wastes directly into the Snake River Plain aquifer.

All these wells were gravity-fed injection systems; that is, the wells received liquid effluent via lines draining to a sump which overflowed into the injection well. Injection pressures were created by allowing liquid levels to rise above the discharge points in the wells. This rise in liquid level created vertical gradients which caused wastes to flow out of the well into the surrounding subsurface material matrix. Properties of the geologic matrix (soil or fractured basalt), such as permeability and vertical gradient, controlled the discharge rate of the wastes.

Depths through the unsaturated zone to the water table of the Snake River Plain aquifer vary from the highest point at approximately 200 feet deep at the northern end of the site to as much as 800 feet below the ground surface at the southwestern corner of the site. Given these depths and the fact that a considerable portion of the subsurface is unsaturated, conditions are amenable for contaminant migration via liquid phase flow through the unsaturated zone, through perched water conditions, and directly to the Snake River Plain aquifer; thus the soils and rock as well as groundwater resources may be affected by subsurface contaminant discharges through injection wells. Evidences of contamination potentially caused by these wells are plumes of degraded groundwater below and downgradient of facilities where these wells formerly operated, principally at TRA and ICPP. Groundwater contamination is discussed in detail in Section 3.4.

Inactive Landfills and Surface Storage Areas

This category includes landfills, radioactive material disposal areas, burn pits, rubble piles, and exposed storage areas. Of the 33 sites in this category, 10 are inactive landfills. Generally, these sites were operated as cut and fill or were developed in gravel pits or natural depressions. They received domestic garbage, construction debris, and a variety of liquids, including solvents and waste oils. All the landfills were unlined and most are presently covered with native topsoil and vegetated with grasses.

Six radioactive-material disposal areas were reported to be used at the INEL in the past. Trenches or pits were usually excavated specifically for the placement of contaminated soils or equipment, including decommissioned reactors. Clean native soil was then backfilled over the contaminated material.

Burn pits, of which three sets were reportedly used at the INEL, were operated in a cut-and-fill manner. Long, narrow unlined trenches were dug and burnable garbage and occasionally ignitable liquids such as waste oils and solvents were placed in them. However, observation during the Survey indicates that noncombustible materials such as construction debris, scrap metal, and glass were also disposed of into the burn pits. Burning often occurred on a routine basis (each time material was disposed of). The burn pits have been covered with native soil; their presence is obvious due to surface depressions that have formed as a result of settling.

Rubble piles were used for disposal at the INEL; they usually contain construction debris accumulated in satellite areas surrounding the facilities. Even though the INEL site is generally flat, the piles tend to be unnoticeable and blend into the surrounding basalt and vegetation. These piles were most prevalent around the outskirts of the TRA facility, where 11 were encountered. Only one other rubble pile was found at the other facilities. As observed during the Environmental Survey, these piles consisted primarily of excavation spoils such as sands and gravels or boulder-sized chunks of basalt. Other debris associated with these piles includes concrete, steel, block, fiberglass, and pipe. In the midst of one of these piles (at TRA), a small amount of asbestos was found.

Two exposed storage areas have been identified at the INEL--a solid waste storage bin area and a lead storage area. Materials such as lead and radioactively contaminated trash were exposed to precipitation and sat directly on unprotected soil. The former area has been remediated while, in the latter, most of the sources of contamination have been removed but the area has not been cleaned up.

In the case of all inactive landfills and surface storage areas, the major path of contaminant migration is downward through the unsaturated zone toward groundwater. The lack of impermeable caps and liners enables precipitation to percolate through the unit and allows contaminants to leach into the subsurface environment. These units are located in 11 of the INEL facilities and are described in more detail in Section 4.5.1.3.

Inactive Subsurface Percolation Units

Thirty four subsurface percolation units were reported to be used at the INEL. These units are of two basic types-- open at the surface and covered. French drains and dry wells that are open at the surface tend to be circular with 2- to 6-foot internal diameter concrete-lined walls and depths of 4 to 10 feet, although a few are as much as 40 feet deep. The bottoms are usually lined with sand and gravel above native soil. Limestone neutralization pits, also open at the surface, tend to be larger, typically underlying an aboveground acid storage tank. These concrete-lined, open bottom pits may be 5 to 10 feet deep and are filled with limestone.

The covered units include leachfields and sumps and are of varying lateral dimensions, but may be 4 to 5 feet deep with the top 5 to 7 feet below the surface. They are often filled with gravel above native soil. Most, though still present, are inactive, since the processes which discharged to them are no longer in use or since feed lines have been capped and effluents diverted elsewhere.

These units were used for the subsurface disposal of liquid wastes. Liquids were received through pipes or by overflow from tanks. In the case of the limestone pits, the acids percolating into the soil were first neutralized by the limestone. The path of contaminant migration was through the unsaturated zone and possibly into the groundwater, assuming sufficient volume and driving force. Unlike the surface percolation units, evaporation was only a very minor pathway. The liquids disposed

of included a wide variety of materials such as corrosives (mainly acids), radionuclides, solvents, fuel, paints, and thinners. The units are located in nine of the INEL facilities and each is described in more detail by facility in Section 4.5.1.3.

Spills and Leaks

There are 77 incidents of spills and unplanned releases identified in the INEL IAs at 7 of the INEL facilities. In addition to these spills and unplanned releases, Environmental Survey team members visually identified 11 instances of unreported spills.

Most spills and releases, both reported and unreported, were the result of line and tank failures, leaking valves and equipment, tank overfilling, and atmospheric releases. They occurred on the surface or generally within 10 feet of the surface and involved a variety of materials, including radionuclides (cesium-137, cerium-144, strontium-90); metals, especially mercury; petroleum products; polychlorinated biphenyls (PCBs); acids; and solvents. Volumes ranged from unknown or 2 gallons to 45,000 gallons. Partial or total cleanup efforts were reported at 42 of the 77 reported spill sites. The major pathways of contaminant migration are downward through the unsaturated zone toward groundwater and into the atmosphere through evaporation. Individual spills and unplanned releases are described in more detail by facility in Section 4.5.1.3.

Miscellaneous

This category includes process and treatment systems and tanks that have been abandoned in place, and surface radiation contamination of unknown origin. The process tanks, though no longer in use, may still contain liquids or sludges. Many of these tanks are generally constructed as underground or in-ground concrete vaults. They received acidic and basic liquids, mainly sulfuric acid and sodium hydroxide, and retained them until the pH was somewhat neutralized. The outlet then led to a disposal or treatment facility.

For most of the tanks, there is no indication of leakage. Thus, at present there appears to be no source for environmental contamination. However, an exception

is the set of PM-2A tanks at the TAN/TSF. The contaminant migration pathway at these tanks would be through the unsaturated zone toward the groundwater.

Surface radiation contamination of unknown origin constitutes the second major type of miscellaneous inactive sites. These areas tend to be highly localized and some effort has been made to shield them through the placement of soil cover or lead sheets. Three of these sites at two facilities at the INEL have been reported in IAs.

Miscellaneous inactive sites are described in more detail by facility in the following section.

4.5.1.3 Specific Inactive Waste Site and Release Descriptions (By Facility)

TAN/LOFT

The LOFT Facility at the TAN is located approximately 2.5 miles north-northeast of the CFA, as indicated on Figure 2-3. The TAN/LOFT comprises 34 acres (Figure 4-15), not including the percolation pond and surrounding areas. It is situated in a flat sagebrush-covered plain, typical of the INEL. The TAN/LOFT Facility was used to perform loss-of-coolant experiments which supported the nation's power water reactor safety program. These experiments were continued until 1986. The site is presently used for other experimental projects which currently use the percolation pond for disposal, as discussed in Section 4.1. Additional information on history and use of TAN/LOFT is provided in Section 2.2.

Six inactive sites are known to exist at the TAN/LOFT; five were described in the INEL IAs and one was added during the Survey. Table 4-17 lists these sites by the six categories discussed in Section 4.5.1.2, with information on dates of use, dimensions, constituents received, and their volumes. Additional supportive information, including descriptions of remediation efforts, is also provided. The sites are located on Figure 4-15 using the INEL code numbers listed on Table 4-17.

The sites consist of one set of three cryogen pits, an inactive injection well, a burial pit, a dry well, and three spills in two areas. The cryogen pits (LOFT-11), reportedly three in number, were used for the disposal of liquid nitrogen at some location

LOCATIONS OF INACTIVE WASTE SITES AND RELEASES
AT TAN/LOFT

FIGURE 4-15

TABLE 4-17
DESCRIPTORS OF INACTIVE WASTE SITES AND RELEASES AT
TAN/LOFT

Name	INEL Code # ^a	Dates of Use/ Occurrence	Size/Depth	Volume Received/Spilled	Constituents Received/Spilled	Additional Information
<u>Surface Percolation Units and Ditches</u> LOFT Cryogen Pits (3)	LOFT-11	Until 1967	Three small pits (?) of unknown size	Three small pits (?) of unknown size	Liquid nitrogen	These pits were used for disposal of liquid nitrogen. The exact location of these old pits is not known. It is believed they were somewhere directly east of the old Hangar Building (TAN-629).
<u>Inactive Injection Wells</u> LOFT Injection Well ^b	LOFT-04	1957-1980, primarily 1973-1980	10-inch diameter, 300 ft deep, capacity is 1,500 gpm	Small quantities (?) (1957-1973) 400,000 gpd (1973- 1980)	Unknown Cooling wastewater @ 25-60°C	This well received (warm - temperature) cooling wastewater from air compressors, condensers, diesel jacket water coolers, water chillers, and heat exchangers. Decommissioning was performed in 1980; gravity-flow piping supplying the well was removed, sump seal and riser/protective casing were emplaced for future monitoring well use.
<u>Inactive Landfills and Surface Storage Areas</u> Disposal Pond Burial Pit ^b	LOFT-ES01 ^c	Unknown	20 ft x 15 ft, 4 ft deep	One 30-gal drum, six 5-gal cans, and 12 paint cans (all rusted and some crushed) & copper wire	Unknown, possibly lead and copper	This pit's history and use are unknown. Due to disturbed surface, it appears that burial may be more extensive than the present limits of pit.

TABLE 4-17
DESCRIPTIONS OF INACTIVE WASTE SITES AND RELEASES AT
TAN/LOFT (Continued)

Name	INEL Code # ^a	Dates of Use/ Occurrence	Size/Depth	Volume Received/Spilled	Constituents Received/Spilled	Additional Information
<u>Subsurface Percolation Units</u> LOFT Dry Well	LOFT-13	Unknown	3 ft x 3 ft, x 8 ft deep	Unknown	Unknown	This "dry well" is a square pit constructed of plywood. The use of this pit is unknown. It is located next to an old guard shack and lavatory foundation slab. Possibly it was used for sanitary purposes.
<u>Spills</u> LOFT Diesel Fuel Spill ^b	LOFT-01	1982 (5,000- gal spill) 1984 (500- gal spill)	135 ft long, dog-leg shaped ditch	5,500 gal total	Diesel fuel	Both spills occurred while filling day tank from the main tank. Overflowed drain on outside-wall of old Hangar Building (TAN-629) and flowed in shallow ditch where it was allowed to seep into the ground.
LOFT Sulfuric Acid Spill	LOFT-10	1983	Concrete Basin 12 ft x 6 ft x 2 ft deep (minus tank base), overall capacity should be approximately 840 gallons	est. 260 gal.	Sulfuric acid	Acid spilled from a leaking pipe connection into the concrete basin. Liquid was pumped into drums and disposed of at the percolation pond (Section 4.1). Soil tested for pH--contaminated soil removed and placed in an unidentified pit north of LOFT.
<u>Miscellaneous</u> None listed or found						

- a Code # used by the INEL to identify Land Disposal Units (LDUs) and Solid Waste Management Units (SWMUs); units are located on Figure 4-15.
b Site that supports findings (see Section 4.5.2.3).
c Site not identified by the INEL as an LDU or SWMU, but found during the Environmental Survey.

directly northeast of the old hangar (Bldg. TAN-629). The inactive injection well (LOFT-04) was a gravity-fed system, with an injection capacity of 1,500 gpm, that discharged spent cooling water into the Snake River Plain aquifer. The gravity sump was sealed and a protective rise pipe installed for future monitoring use.

A burial pit (LOFT-ES01), of unknown origin, was found during the Environmental Survey near the disposal pond north of the fenced grounds. A dry well (LOFT-13) constructed of wood, for which disposal uses are unknown, is located northeast of the fenced grounds. Three spills were reported in proximity to the old hangar. Two, involving diesel fuel (LOFT-01), were caused by the same reason. In both cases, an overflow from the day tank discharged from the building into a shallow ditch and was allowed to seep into the ground. A third spill at a second location (LOFT-10) consisted of sulfuric acid. This was in the same general vicinity as the diesel spills; however, it was contained within an underlying concrete basin.

TAN/IET

The TAN/IET Facility is located approximately 28 miles north-northeast of the CFA, as indicated on Figure 2-3. The TAN/IET (Figure 4-16) comprises approximately 10 acres situated in a flat, sagebrush-covered plain, typical of the INEL. The site's use spans over 27 years but has been abandoned; some facilities have been decommissioned and decontaminated (D&D'd). Additional information on the history and use of the site is described in Section 2.2.

As a result of past operations, five inactive sites were identified in the INEL IAs and during the Survey at the TAN/IET; three were described in the INEL IA and two were newly found during the Survey. Table 4-18 lists these sites by the six categories discussed in Section 4.5.1.2, and includes data on dates of use, dimensions, constituents received, and volumes, as well as additional information such as descriptions of remediation efforts. The site locations are indicated on Figure 4-16 using the INEL code numbers listed on Table 4-18. The five sites consist of a surface percolation unit, one injection well, one landfill containing rubble from the IET stack, a suspected burial pit, and spills from the IET Hot-Waste Tank.

The use of the surface percolation unit (IET-ES01) is unknown although it may have been used for surface-water drainage control or for liquid disposal. A shallow canal

LOCATIONS OF INACTIVE WASTE SITES AND RELEASES
AT TAN/IET AREA

FIGURE 4-16

TABLE 4-18
 DESCRIPTIONS OF INACTIVE WASTE SITES AND RELEASES AT
 TAN/IET

Name	INEL Code #	Dates of Use Occurrence	Size/Depth	Volume Received/Spilled	Constituents Received/Spilled	Additional Information
Surface Percolation Units and Ditches Crater-like structure	IET-ES01c	Unknown	80 ft diameter x 8 ft deep from berm crest; 20 ft diameter at bottom	Unknown	Unknown	Previous use of this pit is unrecorded and unknown. Presumably it was used for surface runoff collection. A shallow ditch extends 600 feet out to this pit from the northwest corner of the IET Facility. Vegetation does not appear to be affected.
Inactive Injection Wells IET Injection Wellb	IET-06	1956 to 1978 primarily 1956 to 1961	324-ft-deep well; diameter unknown; depth to groundwater is 210 ft	1650 lb NaOH 1910 lb H ₂ SO ₄	Sodium hydroxide Sulfuric acid	This was used for disposal of demineralization wastewater from regeneration backwash. Also received some sanitary septic tank overflow. Currently used as a USGS monitoring well for recording water levels.
Inactive Landfills and Surface Storage Areas IET Stack Rubble Site	IET-04	Used 1961, filled and buried 1986	200 ft x 15 ft x 3 ft deep	This structure was a 156-ft tall tapered-diameter concrete stack.	Low levels of residual radioactivity Co-60, Sr-90, Cs-137, U-235	This stack was used for the HTRE projects. Filled with explosives into excavation and buried.
Suspect Burial Pitb	IET-ES02c	Unknown	15 ft x 8 ft x 5 ft deep	Unknown	Construction debris, several pipes, & wood	This unknown pit is located approximately 1,000 feet east-northeast of the IET east fence. Presumably this was a planned dump site which appeared to have had little use.

TABLE 4-18
DESCRIPTIONS OF INACTIVE WASTE SITES AND RELEASES AT
TAN/IET (Continued)

Name	INEL Code # ^a	Dates of Use/ Occurrence	Size/Depth	Volume Received/Spilled	Constituents Received/Spilled	Additional Information
Subsurface Percolation Units None listed or found						
Spills IET Hot-Waste Tank and Concrete Test Pad Drain	IET-07	1956 to 1978	15,000-gal carbon steel tank	Unknown	Radioactive liquids, sludge contained Sr-90, Cs-13, Hg	This tank was installed for the purpose of collecting radioactively contaminated wastewater and spillage from the reactor engine test pad. The tank was carbon steel. It was not tested. Mercury was found in pipe during decontamination and decommissioning.
Miscellaneous None listed or found						

a Code # used by the INEL to identify Land Disposal Units (LDUs) and Solid Waste Management Units (SWMUs); units are located on Figure 4-16.

b Site that supports findings (see Section 4.5.2.3).

c Site not identified by the INEL as an LDU or SWMU, but found during the Environmental Survey.

extends from the TAN/IET outward approximately 600 feet to this percolation pit. The injection well (IET-06) was utilized for disposal of liquid wastes from demineralization regeneration backwash. The stack rubble site (IET-04) is a buried pit containing debris from the felled stack. The stack underwent D&D and was control-blasted, falling into a pre-excavated trench and then being buried under soil cover. The suspected burial pit is located approximately 1,000 feet northeast of the fenced area. This is a 5-foot-deep pit, 8 by 15 feet across, containing what appears to be construction debris. It apparently was not used extensively. The radioactive liquid waste Hot-Waste Tank, concrete pad, and piping (IET-07) apparently may have had leaks or spills associated with the operational use of the tank. During the D&D of the piping to the tank, mercury was observed in the pipe.

TAN/WRRTF

The WRRTF at the TAN is located approximately 27 miles northeast of the CFA (Figure 2-3). The TAN/WRRTF comprises 6 acres, not including the sewage, process water, and evaporation ponds that are outside the fence (Figure 4-17). It is situated in a flat, sagebrush-covered plain, typical of the INEL. The first facilities were built in the late 1950s and over the years, WRRTF has been used for pool and table reactor experiments and non-nuclear simulated loss-of-coolant tests. Additional information on the history and use of TAN/WRRTF is provided in Section 2.2.

As a result of 30 years of operation, two inactive sites, as identified in the INEL IAs and during the Survey, are located at the WRRTF. Table 4-19 lists these sites by the six categories discussed in Section 4.5.1.2, with information on dates of use, dimensions, constituents received and their volumes, and additional data, such as descriptions of remediation efforts; the sites are located on Figure 4-17 using the INEL code numbers listed on Table 4-19. The two sites consist of an inactive injection well and an inactive landfill. The injection well (WRRTF-05) penetrated 100 feet into the aquifer. It operated during most of the history of TAN/WRRTF but was discontinued in 1984; it is presently plugged and capped. The inactive landfill is a burn pit (WRRTF-01), which operated for about 10 years from 1958 to 1967. Four pits comprised the unit, the smallest of which was used for waste oils and solvents.

FIGURE 4-17

LOCATIONS OF INACTIVE WASTE SITES AND RELEASES
AT TAN/WRRTF

TABLE 4-19

**DESCRIPTIONS OF INACTIVE WASTE SITE AND RELEASES AT
TAN/WRRTF**

Name	INEL Code # ^a	Dates of Use/ Occurrence	Size/Depth	Volume Received/Spilled	Constituents Received/Spilled	Additional Information
<u>Surface Percolation Units and Ditches</u> None listed or found						
<u>Inactive Injection Wells</u> WRRTF Injection Well ^b	WRRTF-05	1957-1984	313' deep	Unknown 50 mCi	Sanitary wastewater, NaOH, H ₂ SO ₄ Co-60	Plugged to depth and capped; depth to groundwater - 210'; corrosives are from demineralizer water; flow in 1981 - 30 million gallons, 1983 - 17.7 million gallons; liquids consisted of boiler blowdown, process water, cooling water.
<u>Inactive Landfills and Surface Storage Areas</u> WRRTF Burn Pit ^b	WRRTF-01	1958-1967	4 Pits: 200' x 20' 200' x 40'; 250' x 50'; 30' x 50' x 1.5' deep	Unknown 2,500 gallons	Garbage, construction debris (only in first 3 pits) Waste oils, solvents (e.g., Stoddard solvent) (in first 3 pits from 1958- 1962; solely in 4th pit from 1962- 1967)	Operated as cut and fill, with waste burned; now covered by topsoil although two depressions still obvious; scrap metal and burned wood observed.
<u>Subsurface Percolation Units</u> None listed or found						
<u>Spills</u> None listed or found						
<u>Miscellaneous</u> None listed or found						

a Code # used by the INEL to identify Land Disposal Units (LDUs) and Solid Waste Management Units (SWMUs); units are located on Figure 4-17.

b Site that supports findings (see Section 4.5.2.3).

TAN/TSF

The TAN/TSF is located approximately 27 miles northeast of the CFA (Figure 2-3) and comprises approximately 80 acres (Figure 4-18). It is situated near the northern border of the site on a flat, sagebrush-covered plain typical of the INEL. Local surface flooding during the spring snowmelt has occasionally occurred at the TSF.

Most of the buildings and utilities were constructed in the early 1950s as part of the Aircraft Nuclear Propulsion (ANP) Program. Facilities have been modified over the years to fit the changing research programs at the INEL. Newer programs at the TSF have included support of the LOFT Program and Three Mile Island Unit-2 Program. Additional information on the history and use of TAN/TSF is provided in Section 2.2.

As a result of these operations over 32 years, 21 inactive sites and releases, as identified in the INEL IAs and during the Survey, are located at the TSF; 19 were described in the INEL IAs, and 2 more were added during the Survey. Table 4-20 lists these sites by the six categories discussed in Section 4.5.1.2 with data on dates of use, dimensions, constituents received and their volumes, and additional information such as descriptions of remediation efforts; the sites are located on Figure 4-18 using the INEL code numbers listed on Table 4-20. The 21 sites consist of 3 surface percolation units and ditches, 1 inactive injection well, 2 inactive landfills and surface storage areas, 2 subsurface percolation units, 8 spills, and miscellaneous units.

Two of the surface percolation units (TSF-10, 29) received direct, piped discharges but also received surface runoff from radioactively and chemically contaminated areas. The design of the third surface percolation unit (TSF-31) is unknown. The injection well (TSF-05) penetrated 100 feet into the aquifer and operated until 1972; it presently is used as a monitoring well. The inactive landfills consist of a burn pit (TSF-03), the location of which is not precisely known, and a gravel pit (TSF-04), which received construction debris and one barrel of sulfuric acid; its location is also uncertain. The two subsurface percolation units consist of a covered, underground oil sump (TSF-24) and a covered, underground leachfield (TSF-27).

Three of the spills involved petroleum products (TSF-01, 02, ES01), one involved radioactivity (TSF-06), two involved both radioactive and chemical materials (TSF-09, 26), and two involved mercury (TSF-08, 22). The two mixed waste spills are believed

FIGURE 4-18
LOCATIONS OF INACTIVE WASTE SITES AND RELEASES
AT TAN/TSF

TABLE 4-20
DESCRIPTORS OF INACTIVE WASTE SITES AND RELEASES AT
TAN/TSF

Name	INEL Code #	Dates of Use/ Occurrence	Size/Depth	Volume Received/Spilled	Constituents Received/Spilled	Additional Information
Surface Percolation Units and Ditches TSF Drainage Pond (TAN- 782) ^b	TSF-10	1950s- present	300' x 250' x 8' deep	Unknown	Radionuclides (Cs-137, Sr-90, Y), Hg, inorganic chemicals, corrosives	Presently used for surface runoff control; formerly received runoff from PM-2A contaminated area, TSF acid pond, TSF-1 area, and IET valve pit (all described in this table).
TSF Acid Pond (TAN- 735) ^b	TSF-29	1950s- present	100' x 140' x 5' deep	Unknown	Radionuclides (Cs-137, Sr-90, Y), Hg, other chemicals	Presently receives surface runoff; formerly received runoff from rad and chemically contaminated areas.
TSF Acid Pit W of TAN- 647	TSF-31	Unknown	Unknown	2,500 gallons	Sulfuric acid	Delineated on site map; however, precise location uncertain.
Inactive Injection Wells TSF Injection Wells ^b	TSF-05	1955-1972	310' deep	194,500 gallons 85 gallons 55 pounds Unknown	Corrosive wastewater Ignitable wastes Chromates Pb, Hg	Protective casing installed, manhole and gravity feed system plugged; now used as a water level monitoring well. Groundwater - 206' below surface.
Inactive Landfills and Surface Storage Areas TSF Burn Pit ^b	TSF-03	1953-1958	30' x 30'?	Unknown 1,500 gallons	Garbage, construction debris Waste oils and solvents	Precise location unknown; suspected area level and vegetated; no indication of unit in 1954 aerial photography
TSF Gravel Pit/Acid Pit	TSF-04	1950	Unknown	Unknown 55 gallons	Construction debris Sulfuric acid	Materials disposed in gravel pit.

TABLE 4-20

DESCRIPTIONS OF INACTIVE WASTE SITES AND RELEASES AT
TAN/TSF (Continued)

Name	INEL Code # ^a	Dates of Use/ Occurrence	Size/Depth	Volume Received/Spilled	Constituents Received/Spilled	Additional Information
Subsurface Percolation Units TSF Oil Sumps (TAN- 609) ^b	TSF-24	1950s	6'x6'x4' deep (top is 5' below surface)	Unknown	Jet fuel, oil, wastewater	Building used for jet engine tests; sump contained coarse gravel; presently covered by gravel mound; 27 cubic feet of fuel oil residues potentially remain.
TSF Paint Shop Floor Drain Leach Field ^b	TSF-27	? to 1982	24'x24'x5' deep (top is 7' below surface)	2,500 gallons Unknown	Stoddard solvent Paints and thinners	Feedline isolated, presently under asphalt
Spills TSF Diesel Tank W of TAN-607	TSF-01	1982		800 gallons	Diesel fuel	Fuel in tank displaced by water and spilled out top; ran into storm drain. Tank has been emptied and abandoned in place.
TSF Service Station Spill (TAN-664)	TSF-02	1982		217 gallons	Gasoline	Fuel spilled from pump and was hosed down drain with water; entire area eventually excavated down to 4', back filled, and paved.
TSF-1 Area	TSF-06	1960s	560,000 ft ²	Unknown	Radionuclides	Area received radioactivity from runoff and atmospheric dispersion. Presently fenced off and posted as a Zone III radiation contamination zone

TABLE 4-20
 DESCRIPTIONS OF INACTIVE WASTE SITES AND RELEASES AT
 TAN/TSF (Continued)

Name	INEL Code # ^a	Dates of Use/ Occurrence	Size/Depth	Volume Received/Spilled	Constituents Received/Spilled	Additional Information
TSF Mercury Spill Area (including Railroad Turntable) ^b	TSF-08 and TSF-22	Mid to late 1950s	Possibly along entire 3 miles of track and turntable	Unknown	Mercury	Tracks still present and run within TSF and from TSF to LOFT and IET. Hg vapors detected under turntable recently at levels of 0.02-0.03 mg/m ³ . Incomplete clean-up of Hg spill outside TAN-607.
TSF Intermediate-Level (Radioactive) Waste Disposal System ^b	TSF-09	1955-1975	60'x50'	Unknown	Cs-137, Co-60, metals (especially Hg), PCBs?, organics?	System consists of 3-10,000 gallon underground tanks and piping; considerable surface radioactive contamination has been found especially in the top 12 to 18" of soil; area roped off and posted as a Zone II radiation contamination zone.
TSF PM-2A Tanks (TAN- 710A and B) ^b	TSF-26	1955-1975	2 acres, 6" to at least 3' deep	Unknown	Radionuclides, metals including Ba, Cr, Pb, Hg	Two 50,000 gallon tanks in concrete cradles still present 14.5' underground; spillage and possible leaks resulted in soil contamination; surface activity was measured up to 300uR/hr; area scraped and covered with soil; radioactivity remains, in subsurface, but surface is at background.
TSF Roads - Oils used as Dust Suppressant	TSF-ES01 ^c	1956-1982	Unknown	250 gallons/yr	Waste oil, Standard solvent, hydraulic fluid	Entire 250 gallons/yr applied during 1967-1977; an unknown portion of this amount was applied during 1956-1967 and 1977-1982; location: on roads throughout TSF.

TABLE 4-20

**DESCRIPTIONS OF INACTIVE WASTE SITES AND RELEASES AT
TAN/TSF (Continued)**

Name	INEL Code # ^a	Dates of Use/ Occurrence	Size/Depth	Volume Received/Spilled	Constituents Received/Spilled	Additional Information
Miscellaneous TSF Acid Neutralization Tanks N of TAN-602	TSF-12	1957-1959	2,000 gallon capacity each	Unknown	Sulfuric acid, sodium hydroxide	Presently located under Building TAN-602. Presumed to be constructed entirely of concrete with outlet to sanitary sewer.
TSF Two Neutralization Pits N of TAN-649	TSF-17	Mid-1950s- 1979	6'x12'x7' deep	Unknown	Sulfuric acid, sodium hydroxide	Presumed to be constructed entirely of concrete with outlet to sanitary sewer; still present.
TSF Two Neutralization Pits N of TAN-607	TSF-20	Mid 1950s- 1967	8'x3'x4' deep (?)	Unknown	Sulfuric acid, sodium hydroxide	Concrete lined with outlet to sanitary sewer; still present.
TSF IET Valve Pit	TSF-21	Mid-late 1950s	1,000 gallon capacity	Unknown	Radioactively contaminated liquid	Concrete vault containing valves; pit still present but standing liquids removed.
TSF Clarifier Pit S of TAN- 604	TSF-ES02 ^c	Unknown	12'x4'x2' deep	Unknown	Unknown	Concrete lined, presumably goes to sanitary sewer; may have received liquids from paint shop; still present.

^a Code # used by the INEL to identify Land Disposal Units (LDUs) and Solid Waste Management Units (SWMUs); units are located on Figure 4-18.

^b Site that supports findings (see Section 4.5.2.3)

^c Site not identified by the INEL as an LDU or SWMU, but found during the Environmental Survey.

to be the result of leaks and spills in and around tanks and piping that are still present; mercury is the major chemical contaminant of concern. The two mercury spills, which were highly localized, are an indication of potential mercury contamination along 3 miles of railroad track that run within the TAN/TSF and between the TAN/TSF and the TAN/LOFT and the TAN/TSF and the TAN/IET. A mercury-shielded reactor formerly ran along these tracks and some of the metal may have fallen off anywhere along the tracks. The miscellaneous category consists of three neutralization pits (TSF-12, 17, 20), a valve pit (TSF-21), and a clarifier pit (TSF-ES02). All of the pits are believed to be completely concrete-lined with outlet piping to the sanitary sewer.

TRA

The TRA is located approximately 5 miles northwest of the CFA as shown on Figure 2-3. It is located in the southwestern portion of the site on a flat, sagebrush-covered plain typical of the INEL. Seventy buildings and 55 structures have been constructed at the TRA over the past 30 years (Figures 4-19 and 4-20). Past and present activities have included provision of facilities and support capabilities for agencies to conduct experiments associated with the development, testing, and analysis of materials utilized in nuclear reactor applications. Additional information on the history and use of the facility is provided in Section 2.2.

As a result of these operations during the facility's history, 30 inactive sites and releases, as identified in the INEL IAs and during the Survey, are located at the TRA. Eighteen of these were identified and described in INEL IAs and 12 more were added as a result of the Environmental Survey. Of these 12, the INEL was aware of these releases as noted in correspondence, but they were not included in the IAs. Table 4-21 lists these sites by the six categories discussed in Section 4.5.1.2 with information on dates of use, dimensions, constituents received and their volumes. Additional information, including descriptions of remediation efforts, is also provided. The sites are located on Figures 4-19 and 4-20 using the INEL code numbers listed on Table 4-21. The 30 inactive sites consist of 1 surface percolation ditch, 1 inactive injection well, 13 inactive landfills and surface storage areas, 1 subsurface percolation unit, and 14 spills.

LOCATIONS OF INACTIVE WASTE SITES AND RELEASES
AT THE SOUTH SIDE OF TRA

FIGURE 4-19

FIGURE 4-20

LOCATIONS OF INACTIVE WASTE SITES AND RELEASES
AT THE NORTH SIDE OF TRA

TABLE 4-21

DESCRIPTIONS OF INACTIVE WASTE SITE AND RELEASES AT TRA

Name	INEL Code # ^a	Dates of Use/ Occurrence	Size/Depth	Volume Received/Spilled	Constituents Received/Spilled	Additional Information
<u>Surface Percolation Units and Ditches</u> Paint Shop Ditchb	TRA-02	1957-1982	70 ft long x 5 ft x 1.5 ft deep	Estimated 2,700 gal	Paint waste - lead-based organic solvents and thinners	During July 1987, EG&G excavated two test trenches 3 feet deep through this ditch. Eight soil samples were collected for RCRA Appendix VIII constituents analysis. Results are pending
<u>Inactive Injection Wells</u> TRA Waste Disposal Wellb	TRA-05	1964-1982	Depths: Bottom of Well: 1,271 ft Screen: 1147-1271 ft Perforations: 512-697 ft 935-955 ft 960-980 ft 985-1005 ft 1045-1055 ft 1060-1070 ft	Estimated 5,955 lb	Chromium (hexavalent)	Well used until 1981; however, between 1972 and 1981 no chromates were used in the cooling towers. Reports indicate that cooling tower blowdown was characteristically 2.2 mg/L Cr + 6.
<u>Inactive Landfills and Surface Storage Areas</u> MTR Construction Excavation Pile	TRA-10	Late 1940s to early 1950s	200 x 150 ft x 15 to 20 ft high	Approximately 19,500 cy	Construction debris: sand & gravel	This pile received excavated soils during construction of the MTR prior to 1952. Three shallow depressions approximately 20 ft in diameter (depressed 2 to 3 feet deep) on the top surface of the pile.

TABLE 4-21
DESCRIPTORS OF INACTIVE WASTE SITE AND RELEASES AT TRA (Continued)

Name	INEL Code #	Dates of Use/ Occurrence	Size/Depth	Volume Received/Spilled	Constituents Received/Spilled	Additional Information
ETR Rubble Pile	TRA-23	Mid-1950s	500 ft x 20 ft (crescent shaped) x up to 12 ft high	Estimated 7,400 cy	Construction debris: • sand & gravel • concrete debris	This pile received excavated soils from ETR construction during the mid-1950s. It appears that significant borrow of sand and gravel has occurred from this pile.
Guardhouse Rubble Pile	TRA-24	Unknown	40 ft x 10 ft x 3 ft high	Estimated 74 cy	Construction debris: • sand & gravel • concrete debris	This pile received excavated soils from the TRA Guardhouse construction.
Sewer Plant Settling Pond Rubble Pile	TRA-25	Unknown	80 ft x 50 ft x 9 ft high	650 cy	Construction debris: • sand & gravel • trace concrete debris	This pile received excavated soils from construction of the sewer plant settling ponds.
Rubble Site by USGS Observation Well	TRA-26	Unknown	100 ft x 60 ft x 12 ft high	Approximately 3,000 cy	Construction debris: • all sand & gravel	This pile consists of sands and gravels of unknown origin. Vegetation cover appears to be unaffected (as observed during Survey).
North Storage Area Rubble Pile	TRA-27	Unknown	60 ft x 80 ft x 3 ft high	Estimated 350 cy	Construction debris: • sand & gravel • trace concrete debris	This pile received construction debris from the adjacent TRA facility during construction of one or more of its projects. Local vegetation appears unaffected.
North (Landfill) Rubble Site	TRA-28	Unknown	200-ft diameter, 15-ft-deep pit	Estimated 1,500 cy	Construction debris: • sand & gravel • concrete slabs • corrugated metal pipe • 3" galvanized metal pipe • concrete block • metal stakes • sod • basalt chunks & boulders	This pit received construction debris from the adjacent TRA facility during construction of one or more of its projects. Local vegetation appears unaffected.

TABLE 4-21

DESCRIPTIONS OF INACTIVE WASTE SITE AND RELEASES TRA (Continued)

Name	INEL Code #	Dates of Use/ Occurrence	Size/Depth	Volume Received/Spilled	Constituents Received/Spilled	Additional Information
ATR Rubble Pile ^b	TRA-29	1969?	300 x 1000 ft, 3 to 6 ft high	Estimated 37,000 cy	Construction debris: • sand & gravel • basalt chunks (muck) • concrete debris • asbestos (small volume)	This rubble pile received primarily blast muck from construction of the ATR structures.
Beta Rubble Pile	TRA-30	Unknown	30 ft x 25 ft x 2 ft high	Estimated 37 cy	Construction debris: • concrete debris • metal bar materials • concrete block • gravel	This pile received construction debris from the adjacent TRA facility during one of its construction projects, presumably the Beta Buildings.
West Rubble Site ^b	TRA-31	Unknown	100 ft x 80 ft x 2 to 3 ft high	Estimated 370 cy	Construction debris: • sand & gravel • concrete brick & block • concrete slab • gypsum board • steel mesh • rebar pipe • asbestos	This pile received construction debris from the adjacent TRA facility during one of its projects. Site sampling verified that the suspect material was asbestos.
West Road Rubble Pile	TRA-32	Unknown	20 ft x 15 ft x 2 ft high	Estimated 20 cy	Construction debris: • decomposed pipe • concrete debris	This pile received construction debris from the adjacent TRA facility during one of its construction projects.
West Staging Area Ditch Rubble Site	TRA-33	Unknown	3 heaped piles each 15 ft in diameter & 15 ft wide x 100 ft x 2 ft high	Estimated 20 cy in ditch, estimated 80 cy along berm	Construction debris: • sand & gravel • little concrete fragments	This pile received debris from recent construction of security area. The additional sands and gravels along the berm (extending from southwest corner of TRA) were encountered during Survey.

TABLE 4-21
DESCRIPTIONS OF INACTIVE WASTE SITE AND RELEASES AT TRA (Continued)

Name	INEL Code #	Dates of Use/ Occurrence	Size/Depth	Volume Received/Spilled	Constituents Received/Spilled	Additional Information
Suspect Burial Area (east of West Road Rubble Pile Site) ^b	TRA-ES01 ^c	Unknown	200 ft x 200 ft, unknown depth	Unknown	Unknown	Surface area is slightly depressed, sparsely vegetated and has wood- fragment debris scattered throughout
<u>Subsurface Percolation Units</u> French Drain at TRA-645	TRA-11	1957-1980	4-inch diameter, 6 to 8 ft deep	Unknown (periodically used; low volumes expected)	Sulfuric acid	This drain handled overflow from the Demineralization Building (Bldg. 645) Sulfuric Acid Tank.
<u>Spills</u> Acid Spill Disposal Area	TRA-01	1983	37 cy of neutralized soil disposed of in pit	100 gal	Sulfuric acid	Sulfuric acid spilled at a product an area. The contaminated soil was neutralized and buried 500 ft south of transformer area #757 and 100 ft SSW of tank 754. Site plans to conduct subsurface investigation to verify soil pH neutralization.
Loading Dock ^b	TRA-09	1950s to mid- 1980s	85 ft x 15 ft	Unknown	Primarily oil products and recyclable oils, also possibly some organic solvents i.e., trichloroethane, methylene chloride	This free-standing loading dock handled receiving/shipping of drummed oils, recyclable oils (90%) and organic solvents (10%). Structure was removed in mid-1980s. Surface soils are stained.
Fuel Oil Tank Spill	TRA-12	1983?	Unknown	100 gal	Fuel oil (#5 burnin oil)	Estimated 10) gallons overflowed from tank. Free liquid mopped up and remainder allowed to soak into underlying soils

TABLE 4-21

DESCRIPTIONS OF INACTIVE WASTE SITE AND RELEASES AT TRA (Continued)

Name	INEL Code #	Dates of Use/ Occurrence	Size/Depth	Volume Received/Spilled	Constituents Received/Spilled	Additional Information
Fill Station Sumps Spills	TRA-ES02 ^c	Recent?	Diesel Sump: 3 ft x 3 ft, depth unknown. Burner Oil Sump: 2 ft x 2 ft, depth unknown	Unknown	Diesel fuel & #5 burner oil fuel	Fill stations at Building MTR-627 appear to have received spillage of their respective fuels due to handling practices. Both sumps are believed to be concrete-lined. No leakage was apparent.
ETR Cooling Tower & Basin MTR Cooling Tower & Basin	TRA-E S03a ^c TRA-ES03b ^c	1957 to 1982 1952 to 1970	270 ft x 60 ft x 6 ft deep Unknown	Unknown Unknown	Both units: cooling water with chromates (11-14 mg/L), including hexavalent chromium	The site discontinued use of chromates in the cooling water in 1971. The cooling towers were known to contribute blowdown to the surrounding areas. The wood structure & concrete basin at ETR were sampled for chromates then dismantled in 1982.
West Side of ATR	TRA-ES04 ^c	1976	28,000 sq. ft.	Unknown	Radioactively contaminated ion exchange resins	Occurred when filling a transfer tank with ion exchange resins (radioactively contaminated) was over-pressurized and burst, spilling radioactivity. Area was decontaminated July 1976.
ETR Resin Discharge Area	TRA-ES05 ^c	1976	Smaller than spill on west side of ATR (TRA-ES04 above)	Unknown	Radioactive ion exchange resins	Occurred while transferring resin for shipment to RWMC. Concrete pad was decontaminated and designated clean by site Safety group.
East Side of ETR Heat Exchanger Building	TRA-ES06 ^c	1976	"Small area"	Unknown	Radioactive ion exchange resins	Contaminated during relining of ETR resin tank. Decontaminated and designated clean by Safety.

TABLE 4-21
DESCRIPTIONS OF INACTIVE WASTE SITE AND RELEASES AT TRA (Continued)

Name	INEL Code #	Dates of Use/ Occurrence	Size/Depth	Volume Received/Spilled	Constituents Received/Spilled	Additional Information
Tank Truck Loading Facility	TRA-ES07c	7 - 1976	"Small area" on concrete pad	Periodic, sporadic small spills	Radioactive liquids	Spills occurred during coupling and uncoupling of hoses at this radioactive liquid transfer (to ICPP) facility.
MTR-730 Catch Tank Area (west of MTR-611)	TRA-ES08c	Unknown	Unknown	Unknown	Radioactive liquids from laboratories	Pipeline from the MTR catch tanks leaked into subsurface soils west of MTR-611 prior to reaching retention basin. Some radioactively contaminated soils remain.
MTR Canal	TRA-ES09c	Unknown	Unknown	Unknown	Radioactively contaminated water	This canal reportedly leaked contaminated water to the ground. The canal has since been sealed off and drained.
TRA 666 Transfer Line	TRA-ES10c	Unknown	Unknown	Unknown	Radioactive liquid	Contaminated liquid transfer line just south of the TRA-666 building was broken and contaminated.
Roadway South and East of the TRA Hot Cells (MTR-632)	TRA-ES11c	1978	Unknown	Unknown	Radioactive water	Radioactive water leaked from a transfer cask (coming from ATR). Concrete road chipped out and replaced. Soils excavated to as deep as possible. Some radioactively contaminated soil remains in place.

TABLE 4-21
DESCRIPTORS OF INACTIVE WASTE SITE AND RELEASES AT TRA (Continued)

Name	INEL Code # ^a	Dates of Use/ Occurrence	Size/Depth	Volume Received/Spilled	Constituents Received/Spilled	Additional Information
Radioactive Spill East of MTR-605 at MTR Overhead Reservoir	TRA-ES12c	Unknown	Unknown	Unknown	Radioactive liquid	Reservoir overflowed at least twice, contaminating the ground beneath it. The soil was removed and replaced with clean soil. (Pipes entering ground are still radioactively contaminated.)
Miscellaneous None listed or found						

a Code # used by the INEL to identify Land Disposal Units (LDUs) and Solid Waste Management Units (SWMUs); units are located on Figures 4-19 and 4-20.

b Site that supports findings (see Section 4.5.2.3).

c Site not identified by the INEL as an LDU or SWMU, but found during the Environmental Survey.

The surface percolation unit, a ditch (TRA-02), intermittently received Paint Shop wastes such as excess paints (lead-based), thinners, and solvents. The injection well (TRA-05) discharged cooling tower blowdown containing chromates into the Snake River Plain aquifer. The inactive landfills are old rubble piles (TRA-10, 23 through 23) and a suspect burial area (TRA-ES01). The rubble piles are characteristically construction debris sites consisting of stockpiled sand and gravel with basalt (boulder-size) fragments from past excavation operations. Interspersed with this are concrete and miscellaneous construction materials. Two of these piles, TRA-29 and 31, contained small amounts of suspected asbestos products and are discussed further in Section 4.2. It is not known if any materials or wastes are buried at the suspect burial site, TRA-ES01. The French drain at Building TRA-645 (TRA-11) received sporadic, relatively small volumes of sulfuric acid.

The spills involved several different products, primarily radioactive liquids. These liquids leaked from holding tanks and underground pipelines. They received attention from the site and were cleaned up to safe levels, as determined by the INEL. Two of these, TRA-ES08 and ES11, have some remaining radioactively contaminated soils. An acid spill (TRA-01) was neutralized and the contaminated soils were buried in a pit. Two spill areas (TRA-12, ES02) are associated with petroleum products where small volumes of burner oil fuel and diesel fuel have leaked due to handling and overflow accidents. These two locations as well as the old loading dock spills area (TRA-09) are situated in the northern portion of TRA. The remaining spills were a result of Engineering Test Reactor (ETR) and Materials Test Reactor (MTR) cooling towers/basins. Cooling water blowdown, treated with corrosion inhibitors containing chromates, may have affected the surrounding soils.

CFA

The CFA is located in the south-central portion of the INEL (Figure 2-3), approximately 49 miles west of Idaho Falls. The facility is situated on a flat, sagebrush-covered plain, typical of the INEL. Most structures at the CFA were built in the 1940s and 1950s (Figure 4-21). They were originally used to house and support Naval Gunnery Range personnel and equipment and, later, NRTS personnel and equipment. The mission of the CFA has been to provide centralized support for programmatic and non-programmatic efforts of all INEL contractors and DOE. Additional information on the history and use of CFA is provided in Section 2.2.

FIGURE 4-21

LOCATIONS OF INACTIVE WASTE SITES AND RELEASES
AT CFA

As a result of these operations over approximately 45 years, 21 inactive sites and releases, as identified in the INEL IAs and during the Survey, are located at the CFA; 20 were described in the INEL IAs and 1 was found during the Survey. Table 4-22 lists these sites by the six categories discussed in Section 4.5.1.2 with data on dates of use, dimensions, constituents received and their volumes, and additional information, including descriptions of remediation efforts; the sites are located on Figure 4-21, using the INEL code numbers listed on Table 4-22. However, the Fire Training Area (CFA-17) is situated 5 miles north of CFA and its location is depicted on Figure 2-3. The 21 sites include 3 surface percolation units and ditches, 4 inactive landfills and surface storage areas, 9 subsurface percolation units, and 5 spill incidents.

The three surface percolation units (CFA-04, 05, and 17) received their discharges through open ditches from a fuel processing pilot plant, motor pool, and fire training area, respectively. Two of the four inactive landfills and surface storage areas (CFA-01 and 02) were landfills for the entire INEL; the former operated from 1951 (or earlier) to 1970 and the latter from 1970 to 1982. A third site in this category (CFA-06) was an outside storage area for lead, and the fourth (CFA-09) contains an unexploded artillery shell. French drains and dry wells were widely used at the CFA. The use of six is uncertain (one at each of CFA-12, 13, 15, and 16, and two at CFA-14), while two receive drainage from laboratories (CFA-07 and the southern one of two at CFA-12). The ninth (CFA-11) is believed to contain an artillery shell but has been backfilled with concrete. Spills at the CFA have involved petroleum products in two cases (CFA-26, 42), PCBs in one (CFA-10), various chemicals in the fourth (CFA-39), and natural and depleted uranium in the fifth (CFA-ES01).

ARA

The ARA, previously known as the Army Reactor Area, is located in the south-central portion of the INEL, 7 miles east of the CFA (Figure 2-3). The area has four facilities spread over 1.5 miles (Figure 4-22) -- ARA-I (4 acres), ARA-II (3 acres), ARA-III (5 acres), and ARA-IV (20 acres). The ARA is situated in a sagebrush- and grass-covered area with rolling topography, probably due to underlying lava flows. ARA buildings and structures were constructed in 1957 for the U.S. Army as a working area to

TABLE 4-22

DESCRIPTIONS OF INACTIVE WASTE SITES AND RELEASES AT
CFA

Name	INEL Code # ^a	Dates of Use/ Occurrence	Size/Depth	Volume Received/Spilled	Constituents Received/Spilled	Additional Information
<u>Surface Percolation Units and Ditches</u> CFA Pond (CFA-674) ^b	CFA-04	1954-1965	300'x150'x6' deep	1,320 gallons Additional unknown amounts (possibly 650 gal/yr)	Corrosives, Hg, natural U Hg, Zr, natural U, lab chemicals	Unlined; liquids received from CFA- 674 which was used for pilot plant experiments for nuclear fuel processing.
CFA Motor Pool Pond ^b	CFA-05	1951-1983	75'x60' with 600' long ditch	15,000 gallons Unknown Unknown Unknown	Battery acid (sulfuric) Diethyl phthalate Oil, grease, solvents Rad-contaminated wastewater	Pond is within borrow pit; natural bottom; received liquids from equipment repair building and service station; 12 metals analyzed in water; Fe, Mn, B above detection limit; presently receives surface runoff
CFA Fire Department Training Area, Bermed ^b	CFA-17	1979-1987	30'x50'	~130,000 gallons	Waste oil-contaminated water	Area has been graded over; received discharge from fire training tank.
<u>Inactive Injection Wells</u> None Listed or Found						
<u>Inactive Landfills and Surface Storage Areas</u> CFA Landfill 1 ^b	CFA-01	1951(?) - 1970	~10 acres?	3,700 gallons 32 gallons Unknown	Waste paint and thinners Solvents Construction debris, burned garbage, ash from incinerator, asbestos, pesticides?	Material disposed in trenches and a gravel pit with no liner; covered with native soil.
CFA Landfill 1 ^b	CFA-02	1970-1982	~37 acres	2,000 gallons 6,600 gallons 780 yd ³ 160 gallons 300 yd ³ Unknown	Waste paint and thinners TCE vapor degreasing bottoms Asbestos Solvents Chromates Construction debris, garbage, pesticides?	Material disposed in trenches and a gravel pit with no liner; covered with 12 inches of topsoil and seeded; disposal of bulk construction debris still allowed.

TABLE 4-22
DESCRIPTORS OF INACTIVE WASTE SITES AND RELEASES AT
CFA (Continued)

Name	INEL Code # ^a	Dates of Use/ Occurrence	Size/Depth	Volume Received/Spilled	Constituents Received/Spilled	Additional Information
CFA Lead Shop - Outside Areas ^b	CFA-06	1953-1986	50' x 90'	Unknown	Lead materials	Most lead removed from outside storage area; small shards still present. Leachable lead in soils measured recently: 105 mg/L
CFA Central Gravel Pit	CFA-09	Late-1940s- present	8' x 8'	One	Unexploded artillery shell	Shell buried under dirt at edge of gravel pit.
Subsurface Percolation Units CFA French Drain SE of CFA-633b	CFA-07	1950-1984	2' diameter x 6' deep	Unknown	Corrosives, xylene, toluene, possibly other laboratory chemicals Radionuclides (1976-1984)	Had gravel-lined bottom; received liquids from chemical laboratory drains. Presently covered with dirt and soon to be paved over.
CFA French Drain N of CFA-633	CFA-11	Unknown	2.5' diameter x 40' deep	One	5-inch artillery shell	Use of French drain unknown. Has been completely backfilled with cement.
CFA Two French Drains E of CFA-690b	CFA-12	1963-1984	Each 2.5' diameter x 8' deep	Unknown	Solvents, acids, radionuclides	Only the southern of the two was used. Received liquids from RESL lab drains. Still present but inactive; bottom lined with gravel.
CFA Dry Well S of CFA- 640	CFA-13	1950(?) - Unknown	Unknown	Unknown	Unknown	No longer present and exact location unknown. Building next to assumed location used as garage, machine shop, cold laundry, hoisting and rigging shop.
CFA Two Dry Wells by CFA-665	CFA-14	Unknown	Unknown	Unknown	Unknown	Identified on a plot plan; existence and location unknown.
CFA Dry Well by CFA-674	CFA-15	1952(?) - Unknown	2.5' diameter x 4' deep	Unknown	Unknown	Still present but inactive; gravel/sand bottom. Use uncertain; located next to building used for calclining pilot plant, storage, and photo lab (1986).

TABLE 4-22

**DESCRIPTIONS OF INACTIVE WASTE SITES AND RELEASES AT
CFA (Continued)**

Name	INEL Code # ^a	Dates of Use/ Occurrence	Size/Depth	Volume Received/Spilled	Constituents Received/Spilled	Additional Information
CFA Dry Well (S of CFA-682 Pumphouse)	CFA-16	1950-present	23' diameter x 5' deep	Unknown	Unknown	Believed to receive overflow from fire water pump house.
Spills CFA Transformer Yard Oil Spills	CFA-10	1985?	180' x 75'	Unknown	PCBs	No evidence of stain; transformer oil suspected of containing PCBs; spill may actually have occurred on E end of parking lot 12, which is asphalt; parking lot spill cleaned up to acceptable limits.
CFA 760 Pump Station Fuel Spill ^b	CFA-26	1979	Unknown	45,000 gallons	#1 diesel fuel	Underground line to 60,000 gallon aboveground tank developed a hole. Contents leaked over 3 months.
CFA "Drum Dock" (CFA-771)	CFA-39	1951-1986	Unknown	Unknown	Various chemicals suspected	Drum dock used as storage area for used chemical drums that may have had some residual contents. Some chemicals may have been spilled. Site also includes loading dock on NW side of CFA-674.
CFA Tank Farm Pump Station Spill ^b	CFA-42	1951-present	20' x 8'	Unknown	Petroleum products	100 gallon #2 fuel oil spill in 1987 in addition to numerous small spills at this transfer area. Contaminated soil found down to 7 ft; some removed.
CFA-674 Warehouse Roadway	CFA-ES01 ^c	Unknown	Unknown	Unknown	Natural and depleted uranium	Leaks occurred on the south end of the roadway; roadway has been resurfaced.
Miscellaneous None listed or found						

^a Code # used by the INEL to identify Land Disposal Units (LDUs) and Solid Waste Management Units (SWMUs); units are located on Figure 4-21.

^b Site that supports findings (see Section 4.5.2.3).

^c Site not identified by the INEL as an LDU or SWMU, but found during the Environmental Survey.

LOCATIONS OF INACTIVE WASTE SITES AND RELEASES
AT ARA

FIGURE 4-22

develop a compact power reactor. In 1965, this program was phased out and all reactors were removed or dismantled. Since then, the buildings have been used as office space and test facilities for a variety of research programs, including materials science, instrumentation, and welding qualifications. Additional information on the history and use of ARA is provided in Section 2.2.

As a result of these operations over 30 years, seven inactive sites and releases, as identified in the INEL IA and during the Survey, are located at the ARA; all were described in the INEL IAs. Table 4-23 lists these sites by the six categories described in Section 4.5.1.2 with data on dates of use, dimensions, constituents received and their volumes, and additional information such as descriptions of remediation efforts; the sites are located on Figure 4-22 using the INEL code numbers listed on Table 4-23. The seven sites consist of three surface percolation units and ditches, one inactive landfill/surface storage area, one subsurface percolation unit, and two miscellaneous sites.

Two of the three sites in the surface percolation units and ditches category (ARA-12 and 17) received their discharges from pipes. The former is a pond designed to receive low-level radioactive wastewater during operation of the Army Gas Cooled Reactor Experiment and the Mobile Low Power Plant Reactor, while the latter is a ditch used for boiler and process water discharge from ARA-I. The use and disposition of the third unit (ARA-05) is uncertain. The SL-1 Burial Ground (ARA-06) represents the inactive landfill category. Highly radioactively contaminated equipment and soil are buried in one trench and two pits. The contaminated leach pit at ARA-IV (ARA-20), used as a French drain for decontamination showers, has been removed. A small area of radioactively contaminated soil (ARA-03) and an inactive sanitary treatment system at ARA-III (ARA-13) comprise the miscellaneous category.

PBF/SPERT

The PBF and SPERT areas are located in the south-central portion of the INEL, approximately 6 miles northeast of the CFA (Figure 2-3). The PBF is situated alongside the former SPERT-I area. SPERT-I and the others, SPERT-II, III, and IV, were built for reactor transient behavior tests and water-moderated, enriched-fuel reactor systems. All four areas were a minimum of one-half-mile from one another

TABLE 4-23
DESCRIPTIONS OF INACTIVE WASTE SITES AND RELEASES AT
ARA

Name	INEL Code #	Dates of Use/ Occurrence	Size/Depth	Volume Received/Spilled	Constituents Received/Spilled	Additional Information
<u>Surface Percolation Units and Ditches</u>						
ARA-I Evaporation Pond to NE	ARA-05	Unknown	Unknown	None	None	Shown on site master plan; no record of use or evidence of presence.
ARA-III Radioactive Waste Leach Pond	ARA-12	1960-1961, 1964-1965	300'x50'	Unknown	Chromium, Co-60, Cs-137, Ag-108	Received low level radioactive wastewater; still receives small flow of presumably clean water; 1985 characterization: found 0.83 to 4.1 pCi/g Cs-137 (background-1.0 pCi/g) and elevated Cr in soil.
ARA-I Drain from ARA- 626	ARA-17	1960-present	150'x5'	Unknown	Unknown - liquids were from building boiler and hot cells	Site is a drainage ditch which is still evident; discharge pipe to ditch is plugged.
<u>Inactive Injection Wells</u>						
<u>None Listed or Found</u>						
<u>Inactive Landfills and Surface Storage Areas</u>						
ARA-II SL-1 Burial Grounds	ARA-06	1961 to present	4.6 acres	26,486 ft ³	Radioactive - contaminated equipment, soil and debris; lead; possibly other hazardous materials	During 1961 to 1963, highly rad- contaminated reactor components and soil were buried in 1 trench and 2 pits. Unlined trenches and pits are covered with native soil and 4.6-acre area is fenced.
<u>Subsurface Percolation Units</u>						
ARA-IV Test Area Contaminated Leach Pit No. 1	ARA-20	1961-1970	9' diameter; 16' deep	Unknown	Radionuclides (Ag, U)	Received water from decontamina- tion showers. Has been D&D'd.

TABLE 4-23
 DESCRIPTIONS OF INACTIVE WASTE SITES AND RELEASES AT
 ARA (Continued)

Name	INEL Code # ^a	Dates of Use/ Occurrence	Size/Depth	Volume Received/Spilled	Constituents Received/Spilled	Additional Information
Spills None Listed or Found						
Miscellaneous ARA-I Pad Near ARA-627	ARA-03	1961-present	4' x 8'	Unknown	Radionuclides	Radioactivity discovered in surficial soil in 1962. No clean-up. Lead shielding covers area.
ARA-III Sanitary Sewer Leach Field and Septic Tank	ARA-13	1958 to 1983	40' x 80' (leach field)	Unknown, but probably small	Sanitary and laboratory wastes including solvents (16 gallons), acids (17 gallons), and metals	System is still in place; received sanitary wastes, untreated process cooling water, and flow from floor drains

a Code # used by the INEL to identify Land Disposal Units (LDUs) and Solid Waste Management Units (SWMUs); units are located on Figure 4-22.

b Site that supports findings (see Section 4.5.2.3).

and were controlled remotely from the PBF Control Area as shown on Figure 4-23. Additional information on the history and use of the site is provided in Section 2.2. A figure is provided for three of the 'sub-areas', PBF/SPERT-I, II, III, and IV, where inactive waste sites were identified (Figures 4-24, 25, and 26, respectively). There were no inactive waste sites identified at SPERT-II. The SPERT reactors have been removed and the site has undergone partial or complete radiological D&D.

As a result of the SPERT and PBF operations over the past 31 years, 13 inactive sites and releases, as identified in the INEL IAs and during the Survey, are located at the PBF/SPERT. Ten of the 13 were described in the INEL IAs. The three not described were two small petroleum product spills and a previously unknown disposal pit discovered during the Survey. Table 4-24 lists all 13 sites by the six categories discussed in Section 4.5.1.2 with data on dates of use, dimensions, constituents received, and their volumes. Additional information related to past operations, present conditions, or remediation efforts is also provided in the table. Figures 4-23, 24, 25, and 26 indicate the inactive waste sites' locations using the INEL's code numbers listed on Table 4-24.

The 13 sites consist of 6 surface percolation units, 2 waste disposal injection wells, 1 landfill, 1 subsurface percolation unit, 2 small fuel oil spills, and 1 miscellaneous item, a disposal sump tank. Surface percolation units relied on design capacity to contain wastewater and waste liquids until seepage into the subsurface carried away the wastes. Three of the unlined surface percolation units (PBF-11, 20, and 22) received corrosive wastewater from demineralizer regeneration processes. One of these, PBF/SPERT-IV Leach Pond (PBF-22), may also have received low-level radioactive wastewater. Two unlined surface percolation units (PBF-12 and 21) are known to have received radioactively contaminated wastewater during their years of operation. The sixth unit, SPERT Lake at SPERT-IV (PBF-26), was designed to receive large quantities of wastewater; however, it is not known what constituent may have been disposed of at this unit.

Two inactive injection wells (PBF-05 and 15) are located at the PBF. Both of these wells were terminated in the unsaturated zone (i.e., above the Snake River Plain aquifer); therefore wastes were injected into the alluvial soils and/or fractured basalts of the unsaturated zone. One well (PBF-05) received low-level radioactive wastewater from PBF reactor operations. The other (PBF-15) was used for disposal of corrosive wastewaters from PBF after first being neutralized in the disposal sump tank (PBF-08). Acids and bases were detained in this tank and chromates were

FIGURE 4-23

LOCATIONS OF INACTIVE WASTE SITES AND RELEASES
AT PBF/SPERT

FIGURE 4-24

LOCATIONS OF INACTIVE WASTE SITES AND RELEASES
AT PBF REACTOR AREA (PBF/SPERT-I)

FIGURE 4-25

LOCATIONS OF INACTIVE WASTE SITES AND
RELEASES AT PBF/SPERT-III

FIGURE 4-26

LOCATIONS OF INACTIVE WASTE SITES AND
RELEASES AT PBF/SPERT-IV

TABLE 4-24

DESCRIPTIONS OF INACTIVE WASTE SITE AND RELEASES AT PBF/SPERT

Name	INEL Code #	Dates of Use/ Occurrence	Size/Depth	Volume Received/Spilled	Constituents Received/Spilled	Additional Information
Surface Percolation Units and Ditches PBF/SPERT-I Seepage Pit	PBF-11	1955 to 1964	25 ft diameter x 10 ft deep	1,350 kg 2,250 kg	Sulfuric acid Sodium hydroxide	This pit received demineralization wastewater from SPERT I facility via 8-inch clay pipe. This pit is 60 feet SW of PBF-604. Vegetation is unaffected.
PBF/SPERT-I Leach Pond	PBF-12	1955 to 1964	25 ft x 15 ft x 8 ft below grade	Unknown	Radioactively contaminated waste- water; soils contaminated principally with U-234, U-238, and Cs-137	This leach pond received radioactively contaminated water from SPERT I reactor. It was decontaminated & decommissioned in 1984-2.5' depth of max. 196 cpm contaminated soils removed from pit. Demarcated with concrete monument.
PBF/SPERT-III Small Leach Pond	PBF-20	1958 to 1968	Unknown	4,000 kg 7,000 kg	Sulfuric acid Sodium hydroxide	This unlined leach pond was used for receiving demineralization waste- water from the SPERT III reactor. Assumed acids & bases neutralized. Buried - exact location is unknown.
PBF/SPERT-III Large Leach Pond	PBF-21	1958 to 1968	65 ft x 50 ft x 7 ft below grade	Unknown	Radioactively contaminated wastewater Cs-137 Co-60	Received low-level radioactively contaminated water from the SPERT III reactor; D&D'd in 1983 - pond backfilled and concrete apron removed. 112 cpm contaminated soils covered with clean fill to background level of 68 cpm at surface. Demarcated with concrete monument.

TABLE 4-24

DESCRIPTIONS OF INACTIVE WASTE SITE AND RELEASES AT PBF/SPERT (Continued)

Name	INEL Code #a	Dates of Use/ Occurrence	Size/Depth	Volume Received/Spilled	Constituents Received/Spilled	Additional Information
PBF/SPERT-IV Leach Pondb	PBF-22	1961 to 1970 & 1983	70 ft x 70 ft x 5 ft deep; capacity is 428,000 gal	8000, kg 10,000 kg Unknown Unknown	Sulfuric acid Sodium hydroxide Chromium Lead Low-level radioactive wastewater	This unlined pond received demineralizer wastewater and low-level radioactively contaminated wastewater from the 61,000-gallon radioactive decay holding tank. Characterized in 1985 - to be D&D'd in 1989. Radioactively contaminated sediments from 1983 removed - transferred to RWMC.
PBF/SPERT-IV SPERT Lakeb	PBF-26	1961 to 1970 & 1985	110-yd diameter x 4- ft deep; capacity is 5 million gal	Unknown	Unknown; non-radioactive waste- water	Lake was a natural depression bermed to form a percolation unit for non-rad wastewater. This percolation unit awaits environmental characterization.
inactive Injection Wells PBF Warm-Waste Injection Wellb	PBF-05	Drilled in 1969, used 1973 to 1980. 1980 to 1984 used for raw water disposal.	10-inch diameter 110 ft deep, perforated from 72 ft to 105 ft; depth to groundwater is 455 ft	Flow to well intermittent 700-1000 gal/month raw cooling water; 0.5 curies of radioactivity through 1980.	Low-level radioactively contaminated wastewater and raw water possibly with chromates from utility cooling system. The radioactivity was primarily Cs-137 and a smaller percentage was thorium.	Well was used for disposal of warm waste from the 5,000-liter sump when below a specified level (?) of radioactivity.

TABLE 4-24

DESCRIPTIONS OF INACTIVE WASTE SITE AND RELEASES AT PBF/SPERT (Continued)

Name	INEL Code # ^a	Dates of Use/ Occurrence	Size/Depth	Volume Received/Spilled	Constituents Received/Spilled	Additional Information
PBF Corrosive-Waste Injection Wellb	PBF-15	Drilled 1969, used 1972 to 1979, plugged in 1979	4-inch diameter 115 ft deep	Average of: 1.1x10 ⁶ liters/yr including: 9,100 kg 10,500 kg 119 kg	Wastewater including: Sulfuric acid Sodium hydroxide Trivalent chromium	This well received wastewater from corrosive waste disposal sump; therefore waste was presumably neutralized and chromates were sulfonated to trivalent chromium.
Inactive Landfills & Surface Storage Areas PBF Reactor Area Disposal Pit/Burial Area ^b	PBF-ES01 ^c	Unknown, possibly 1969 until ?; reportedly not used after 1976	45 ft x 70 ft x 10 ft deep	2-opened 55-gallon drums, 24 5-gallon buckets, 12 paint cans, all rusted; wood debris; and concrete	Unknown	This pit may be larger and/or deeper than is presently obvious. Above it is a tipping area with a rear tire stop fabricated of poured concrete. The pit is located 600' due north of a Reactor Building in the midst of a rubble pile consisting primarily of basalt boulders and concrete spillage.
Subsurface Percolation Units PBF SPERT-IV Blowdown Pit	PBF-24	1961-1970	2.5 ft x 2.5 ft x 2.5 ft to gravel base, total depth unknown	Unknown	Phosphates	This sump received blowdown from old boiler via underground piping (not visible)

TABLE 4-24
DESCRIPTIONS OF INACTIVE WASTE SITE AND RELEASES AT PBF/SPERT (Continued)

Name	INEL Code # ^a	Dates of Use/ Occurrence	Size/Depth	Volume Received/Spilled	Constituents Received/Spilled	Additional Information
<u>Spills</u> PBF SPERT-III Fuel Oil Spill	PBF-ES02 ^c	October 1986	Est. 15 ft x 5 ft x 0.5 ft	Less than 100 gal	Fuel oil	Leak was at day tank overflow return line. Contaminated soil removed and transferred to CFA Landfill for disposal. UOR submitted. Now an above-ground tank is used.
PBF SPERT-III Diesel Fuel Spill	PBF-ES03 ^c	May 1987	5 ft x 2 ft superficial and into drum	20 to 30 gal	Diesel fuel	Transferring fuel in front of Bldg. 609 - switch inadvertently left on. Some spilled on ground, some contained in 55-gallon drum. Absorbed with diatomaceous earth.
<u>Miscellaneous</u> PBF Reactor Area Corrosive Waste Disposal Sump Brine Tank	PBF-08	1972 to 1984	20 ft x 20 ft x 30 ft deep? Present liquid level approximately 15 ft below ground surface	1200-1300 kg/yr of H ₂ SO ₄ 1300-1500 kg/yr of NaOH 33-38 kg/yr of total	Sulfuric acid and sodium hydroxide from demineralizer wastes; chromates from secondary cooling waters of PBF reactor	This structure was used for neutralization and for sulfonating chromates from demineraliza- tion/regenerant process and secondary cooling waters. Sulfo- nating done by bubbling sulfur dioxide through sump.

^a Code # used by the INEL to identify Land Disposal Units (LDUs) and Solid Waste Management Units (SWMUs); units are located on Figures 4-23, 24, 25, and 26.

^b Site that supports findings (see Section 4.5.2.3).

^c Site not identified by the INEL as an LDU or SWMU, but found during the Environmental Survey.

sulfonated into trivalent chromium prior to disposal into the wells. The corrosive wastewater well received these wastes from 1972 until 1979, when the well was plugged and discharge from the tank went to the lined PBF evaporation pond.

One landfill (PBF-ES01), which contained numerous liquid containers such as old paint cans and a couple of open 55-gallon drums, was found during the Survey. The use and timeframe of use are unknown. The burial area may be larger than the extent of the open pit.

A dry well referred to as the SPERT-IV Blowdown Pit (PBF-24) received blowdown wastes from the old boiler via underground piping. Phosphates for corrosion control were most likely used in this boiler; therefore the possibility of toxic or radiological wastes being disposed of here is unlikely.

Two small petroleum product spills of less than 100 gallons (PBF-ES02) and 30 gallons (PBF-ES03), respectively, occurred. They were promptly cleaned up and reported.

ICPP

The 146-acre ICPP (Figure 4-27) is located in the south-central portion of the INEL, 3.4 miles north of the CFA (Figure 2-3). It is situated on a flat, sagebrush- and grass-covered plain, typical of the INEL. Construction began in the early 1950s and the plant began operation in 1953 as an engineering-scale demonstration facility to process irradiated reactor fuel. The mission of the ICPP is to receive and store Government and other irradiated fuels, recover the uranium and isotopes in these fuels, safely manage the generated radioactive wastes, and manage the Special Isotope Separation Project. Additional information on the history and use of the ICPP is provided in Section 2.2.

As a result of this mission over 36 years, 80 inactive sites and releases, as identified in the INEL IAs and during the Survey, are located at the ICPP. All sites were described in 64 of the INEL IAs; several of the IAs described multiple units (for example 6 French drains, 2 limestone pits, 1 sludge pit, 1 spill, and 1 pipe trench are contained in IA CPP-45). Table 4-25 lists these sites by the six categories discussed in Section 4.5.1.2 with data on dates of use, dimensions, constituents received and their volumes, and additional information including descriptions of remediation efforts;

LOCATION OF INACTIVE WASTE SITES AND RELEASES
AT ICPP

FIGURE 4-27

TABLE 4-25
DESCRIPTIONS OF INACTIVE WASTE SITES AND RELEASES AT
ICPP

Name	INEL Code #	Dates of Use/ Occurrence	Size/Depth	Volume Received/Spilled	Constituents Received/Spilled	Additional Information
Surface Percolation Units and Ditches Trench East of CPP-603 Fuel Storage Basin	CPP-06	1960s	Unknown	300,000 gallons	Chlorides (40 ppm); radionuclides (10 ⁻³ to 10 ⁻⁴ Ci/mL)	Exact location not known; received fuel storage basin water; contaminated soil left in place.
CPP Gravel Pits #1 and #2 ^b	CPP-37	#1: 1982- 1983 #2: early 1950s-early 1980s	#1: 100' x 100' x 16' deep #2: Unknown	#1: 1-2 million gallons/day for 4 months #2: Unknown	Service water wastes (containing metals and radionuclides) Rad decon solution, possibly some organics Discharge from domestic sewage treatment plant including decon showers (rad) Rad-contaminated construction debris; spent solvents, acids	#1 used for service water waste disposal and equipment decontamination; has been decontaminated; now used for surface runoff control. #2 was used until 1982 for containment of sewage treatment plant effluent; was then filled with construction debris and covered.
Fire Training Pits (2) between CPP-602 and CP-603	CPP-41	Unknown	Unknown	Unknown	Organics generated by operation and maintenance activities	Pits were two small natural depressions; now replaced by Buildings CPP-663 and CPP-666

TABLE 4-25
DESCRIPTORS OF INACTIVE WASTE SITES AND RELEASES AT
ICPP (Continued)

Name	INEL Code #	Dates of Use/ Occurrence	Size/Depth	Volume Received/Spilled	Constituents Received/Spilled	Additional Information
Drainage Ditch W of CPP-637	CPP-42	?-1984	4' x 100' x 4' deep	Unknown	Laboratory and pilot plant chemicals (acids, aluminum nitrate)	Liquids originated in pilot plant lab; carried to ditch in small carboys; drainage ditch upgraded and cleaned out in 1986.
Grease Pit S of CPP-637	CPP-43	Unknown	Unknown	Unknown	Petroleum products and wastes	Used for vehicle servicing. Pit filled and covered by CPP-651.
Grease Pit S of CPP-608b	CPP-44	?-1980(?)	41' x 27'	Unknown	Petroleum products and wastes, miscellaneous chemicals (acids, solvents)	Using for vehicle servicing. Pit is filled in with soil; may have been concrete lined with an unlined sump.
Inactive Injection Wells CPP Injection Well (MAH- FE-304)b	CPP-23	1952-present	560'; depths of influence: 140' to 170', 200' 225', 450' to 560'	1.5 billion gallons (1952-1984) 1 to 1.5 million gal/day > 66 pounds Unknown	10,152 Ci rad contaminated liquids (mainly H-3, also Cs-137, Cs-134, Ce-144, Sb-125, Sr-90, Pu, U) Condensate, cooling water, boiler blowdown, chemicals from lab drains, corrosives	Received cooling water and condensate from process equipment waste evaporation over its life; well has been perforated at several depths. Since 1984, well sealed off, vault containing well head used for emergency storage only; eight specific incidents of accidental discharges have been recorded.

TABLE 4-25
 DESCRIPTIONS OF INACTIVE WASTE SITES AND RELEASES AT
 ICPP (Continued)

Name	INEL Code #	Dates of Use/ Occurrence	Size/Depth	Volume Received/Spilled	Constituents Received/Spilled	Additional Information
Inactive Landfills and Surface Storage Areas CPP-603 Temporary Storage Area	CPP-03	1953-late 1970s	100' x 500' trench	Unknown	Radioactively contaminated equipment	Storage area for old and abandoned radioactively contaminated equipment. 6 to 12 inches of clean soil and gravel have been placed over area.
Soil Storage Area Near Peach Bottom Fuel Storage Area	CPP-17	1955-present	75' x 75'	1,200 yd ³	<2 nCi/g radioactive soil	Soil was excavated during construction of CPP-603. Contaminated soil is covered with clean soil, some mounded, some beneath ground surface. contaminated from basin water that was discharged to ground; 100 yd ³ contaminated at levels up to 10 mR/hr.
Gas Storage Building	CPP-18	1953-mid 1970s	Unknown	Unknown	Rad contaminated gas cylinders	Gas cylinders cleaned up and removed; CPP-668 has been built on this site.

TABLE 4-25
DESCRIPTIONS OF INACTIVE WASTE SITES AND RELEASES AT
ICPP (Continued)

Name	INEL Code # ^a	Dates of Use/ Occurrence	Size/Depth	Volume Received/Spilled	Constituents Received/Spilled	Additional Information
Solid Waste Storage Bin S of CPP-601	CPP-21	Unknown	Unknown	Unknown	Bins containing rad contaminated waste paper, rags, metal	Bins and rad-contaminated soil in the area have been removed.
Soil Storage Area in the NE Corner of CPP	CPP-34	1984-present	500-1,000' x 15-45' x 10' deep	12,000 yd ³	Rad-contaminated soil < 30 mR/hr, acids, mercuric nitrate	Rad-contaminated soil removed from around a leaking tank is stored in this trench; is covered with 2' of clean soil.
Subsurface Percolation Units Dry wells associated with CPP-603 Concrete Settling Basin and Vault	CPP-01	1951-1966	Open dry well: 4' diameter x 23' deep Deep dry well: Unknown	5.6 Ci in 700,000 gallons of water during 1962 to 1966	Radionuclides, Cl ⁻ , NO ₃ ⁻	Wells are part of a fuel storage basin water cleanup system; received backwash of a filter. After 1966, no liquid was released into the ground; area has been backfilled to prevent contamination and is scheduled for decommissioning.
French Drain W of CPP- 603	CPP-02	1960s	Unknown	Unknown	Radionuclides, Cl ⁻ , NO ₃ ⁻	Drain has been removed; low-level dirt backfilled in place; site now under a building.
Sewage Treatment Plant, Leach Pit, Sewage Drain Tiles, and Outfall Line (S of CPP-664)	CPP-14	1951-1982	Unknown	Unknown	Radionuclides	Plant has been removed; drying bed sludges removed; drain tiles and outfall line left in place.
HF Storage Tank (YDB- 105), Dry Well, and Neutralization Pit.	CPP-39	? to present	Tank: 6,200 gallon capacity; dry well - 6' diameter x 8-10' deep, underlain by 10' deep limestone bed; neutralization pit - 13' x 24' x 5.5' deep	800-1,400 gal/yr	34 molar and 44 molar HF	Most HF neutralized in limestone pit; tank, pit, and dry well inactive but still present.

TABLE 4-25

DESCRIPTIONS OF INACTIVE WASTE SITES AND RELEASES AT
ICPP (Continued)

Name	INEL Code #	Date of Use/ Occurrence	Size/Depth	Volume Received/Spilled	Constituents Received/Spilled	Additional Information
CPP-621 Chemical Storage Area French Drains, Limestone Pit, Sludge Pit	CPP-45	2-1986	French drains 25" diameter x 6' deep; limestone pits: 30' x 25', 40' x 10'; sludge pit, 13' x 9' x 6' deep	Unknown	Hg, Cr, acids (into French drains); acids (into limestone pit); aluminum nitrate (into sludge pit)	System included 2 open bottom limestone pits and 6 French drains that received overflow from 8 acid tanks; and 1 aluminum nitrate sludge pit. 3 French drains containing metals (Hg, Cr) above background levels have been removed; Al has been detected in sludge pit.
Lime Pit at the Base of the CPP-601 Berm and French Drain	CPP-40	2-early 1980s	5' x 5' x 5' deep	Unknown	HF	Pit still present; contains limestone for neutralization; filled with reddish liquid.
French Drain S of CPP-633b	CPP-48	1975-1981	Ditch: 15' x 40" Drain: 5' diameter x 8-10' deep	Thousands of gallons	Acids, aluminum nitrate, calcium nitrate, other chemicals	Ditch and French drain received wastes from Waste Calcining Facility; soils sampled in 1985 and analyzed for metals; levels were below EP toxicity limits.
Soils Soil Around CPP-603 Settling Tank	CPP-04	Discovered in 1953	Unknown	Unknown	Radionuclides	Contaminated soil removed.
Soil Around CPP-603 Settling Basin	CPP-05	Discovered in 1954	Unknown	Unknown	Radionuclides	Contaminated soil removed; leak occurred from valve on line from Fuel Storage Basin to Settling Basin.
Soil Contamination NW of CPP-642 (E of CPP-603)	CPP-07	1972	575 ft ²	1 G	Radionuclides	Caused by steam leak from Basin Waste Collection Tank; contaminated soil removed.

TABLE 4-25
DESCRIPTIONS OF INACTIVE WASTE SITES AND RELEASES AT
ICPP (Continued)

Name	INEL Code #	Date of Use/ Occurrence	Size/Depth	Volume Received/Spilled	Constituents Received/Spilled	Additional Information
CPP-603 Basin Filter System Line Failure	CPP-08	1973	Unknown	21,000 gallons	Low activity liquid	Underground line failed; fuel storage basin water leaked to soil. Contaminated soil left in place.
Soil Contamination Near the NE Corner of CPP-603 South Basin	CPP-09	Discovered in 1975	Unknown	Unknown	Radionuclides (2R/hr at contact)	Occurred due to sump overflow; surface soil removed but some contamination may remain.
CPP-603 Plastic Pipeline Break	CPP-10	1976	Unknown	800 gallons	Radionuclides	Spill occurred in building; some went through door; contaminated soil removed.
CPP 603 Sludge and Water Release	CPP-11	1978	Unknown	500 gallons	Radionuclides	Fuel storage basin water and sludge released during basin cleanup. Contaminated soil removed.
Pressurization of the Solid Storage Cyclone NE of WCF	CPP-13	1976	300 ft ²	230 mCi 40 mCi 230 mCi Unknown	Sr-90 Ru-106 Cs-137 Fig	Atmospheric release of calcine; rad- contaminated soil removed and area covered with a layer of clean soil.
Solvent Burner E of CPP- 605	CPP-15	1953-mid 1970s (various releases)	Unknown	0.25 Ci Unknown	Long-lived activity (1958) Kerosene, tributyl phosphate, Pu (1974)	Burner, concrete pad, and soil have been removed; several releases (gas and liquid) were associated with burner.
Contaminated Soil from Leak in Line from WM- 181 to PEW	CPP-16	1976	25 ft ³	0.5 Ci 0.5 Ci 0.13 Ci	Sr-90 Cs-137 Ce-144	12 gallons of waste leaked; contaminated soil left in place and covered with 3 or more feet of clean soil.

TABLE 4-25

DESCRIPTIONS OF INACTIVE WASTE SITES AND RELEASES AT
ICPP (Continued)

Name	INEL Code #	Dates of Use/ Occurrence	Size/Depth	Volume Received/Spilled	Constituents Received/Spilled	Additional Information
CPP-603 to CPP-604 Line Leak	CPP-19	1978	Unknown	1 to 2 Ci in 2,000 gallons	Radionuclides	Leak developed in underground waste transfer line. 50 ml/hr to 3.5 R/hr; about 3' topsoil removed; remainder covered with clean soil; line abandoned in place.
CPP-604 Radioactive Waste Unloading Area	CPP-20	?-present	400-ft ²	Unknown	Radionuclides, Cr	Occasional spills were cleaned up as they occurred.
Particulate Air Release S of CPP-603	CPP-22	1958	Unknown	1,200 Ci	Included iodine, noble gases, ruthenium, mixed fission products	Cell ventilation filters failed at Fuel Element Cutting facility; contamination removed.
Tank Farm Area Bucket Spill	CPP-24	1954	18 ft ²	2 gallons (?)	Mercuric nitrate, nitric acid, radionuclides	Bucket containing rad-contaminated liquids spilled. Contaminated soil removed.
Contaminated Soil in Tank Farm Area North of CPP-604	CPP-25	1960	> 9 yd ³	Unknown	Mercuric nitrate, nitric acid, radionuclides	From ruptured line; contaminated soil removed.
Contaminated Soil in Tank Farm Area from Steam Flushing Operation	CPP-26	1964	3 to 4 acres	Unknown	Mercuric nitrate, nitric acid, Sr-90, Ru-106, Ce-144, Cs-137	Pipeline leaked during steam flushing; contaminated liquid and steam dispersed; contaminated area cleaned up.
Contaminated Soil in the Tank Farm Area E of CPP- 604	CPP-27	1960s-1974	> 225 yd ³	300 gallons	1,000-3,000 Ci of Cs-137, Sr-90, trace Cs-134, Eu-154; mercuric nitrate, nitric acid	Pressure relief vent line corroded and leaked; up to 25 R/hr in soil; most contaminated soil removed.
Contaminated Soil in the Tank Farm Area S of WM-181 by Valve Box A- 6	CPP-28	1955-1974	> 60 yd ³	120 gallons	6,000 Ci of Cs-137, Ru-106, Ce-144, Sr-90; mercuric nitrate, nitric acid	Leak occurred from hole in pipe; hole may have been drilled in pipe during installation in 1955; some soil removed.

TABLE 4-25
 DESCRIPTIONS OF INACTIVE WASTE SITES AND RELEASES AT
 ICPP (Continued)

Name	INEL Code #	Dates of Use/ Occurrence	Size/Depth	Volume Received/Spilled	Constituents Received/Spilled	Additional Information
Contaminated Soil N and W of the Main Stack	CPP-29	1974	9 ft ² a few inches deep	Unknown	Mercuric nitrate, nitric acid, radionuclides	Liquid seeped from 2 areas at base of stack. Contaminated soil removed, stack rebuilt over area.
Contaminated Soil in the Tank Farm Area near Valve Box B-9	CPP-30	Discovered in 1975	20 ft ²	Unknown	Mercuric nitrate, nitric acid, radionuclides	Contaminated soil removed.
Contaminated Soil in the Tank Farm Area S of Tank WM-183b	CPP-31	Discovered in 1975	150' x 20' at 12' to 25' below surface	14,000 gallons	30,000 Ci of Cs-137, Sr-90, Y-90, mercuric nitrate, nitric acid, organics (?)	High-level rad liquid waste leaked from a corroded line. Soil left in place; 800 yd ³ of contaminated soil estimated.
Contaminated Soil in the Tank Farm Area SW and NW of Valve Box B-4	CPP-32	Discovered in 1976	Unknown	Unknown	Mercuric nitrate, nitric acid, radionuclides	Spilled liquids from a leaking standpipe; soil left in place.
Contaminated Soil in the Tank Farm Area near WL-102, NE of CPP-604	CPP-33	Discovered in 1983	> 14,000 yd ³	2,000 yd ³ 12,000 yd ³	> 30 mR/hr radioactivity, nitric acid < 30 mR/hr radioactivity, nitric acid	14,000 yd ³ of contaminated soil was removed, some contaminated soil left in place.
WCF Decontamination Spill	CPP-35	1972	"Several thousand ft ² "	20-30 Ci Unknown	Long-lived fission products Acids	Spill occurred through an open valve; 10 tons of contaminated gravel were removed.

TABLE 4-25
 DESCRIPTIONS OF INACTIVE WASTE SITES AND RELEASES AT
 ICPP (Continued)

Name	INEL Code # ^a	Dates of Use/ Occurrence	Size/Depth	Volume Received/Spilled	Constituents Received/Spilled	Additional Information
Transfer Line Leak from WCF to WL-102	CPP-36	1974	70'x10' at 7' to 8' deep	750 gallons	0.5 Ci radioactivity, corrosives	Dilute decontamination solution leaked from line to manhole, then to ground. Contaminated soil left in place. 20R/hr in soil at 7 to 8 ft.
CPP-621 Chemical Storage Area Spills	CPP-45	1982	Unknown	1,200 gallons	Nitric acid	Acid spilled to limestone pit, then to the ground; contaminated soil neutralized and cleaned up.
CPP-637 Courtyard Pilot Plant Release ^b	CPP-46	1978	18'x24'	450 gallons	Zr, Cr	Tank leak; soil neutralized and most contamination removed; however, soil analysis show Zr and Cr above background.
Pilot Plant Storage Area W of CPP-620	CPP-47	1986	Unknown	A few liters	Hf	Hf leaked from a barrel; contaminated soil left in place.
PCB Transformer Yard (CPP-705)	CPP-49	1985	50'x3'	Unknown	PCBs (up to 400 ppm)	Some transformers leaked; spots noted on concrete pad; however, uncertain if PCBs leaked to soil.
PCB Transformer Yard (CPP-731)	CPP-50	1985	4'x6'	Unknown	PCBs (up to 400 ppm)	A transformer leaked, however, not known if oil reached the ground.
PCB Staging Area W of CPP-660 ^b	CPP-51	1985-1986	80'x30'	Unknown	PCBs (up to 160 ppm)	Transformers that were temporarily stored here leaked to soil; also stored were PCB-contaminated soil and debris; all was shipped out.

TABLE 4-25
DESCRIPTORS OF INACTIVE WASTE SITES AND RELEASES AT
ICPP (Continued)

Name	INEL Code # ^a	Dates of Use/ Occurrence	Size/Depth	Volume Received/Spilled	Constituents Received/Spilled	Additional Information
Pickling Shed E of CPP-631	CPP-52	1954	Unknown	Unknown	Mineral acids	Mineral acids used to treat piping and other structural materials were used in the shed; some may have been accidentally released. Present location of Building CPP-631.
Paint and Paint Solvent Area S of CPP-697	CPP-53	1978-1983	40'x50'	Unknown	Paints and paint solvents	Drums stored in this area may have leaked; soil analyses in 1986 resulted in slightly elevated Hg, Se, Pb. A building is now located over area.
Drum Storage Area W of CPP-660	CPP-54	1985	160 ft ²	Unknown	Organic solvents, miscellaneous chemicals	Stored drums may have leaked in two locations; stain observed on N and W side of CPP-660; drums removed in 8/85.
Mercury Contaminated Area S of CPP-T-15b	CPP-55	1984	30'x60'	Unknown	Used paint solvents (solvents, Hg, Cd, Pb)	Used paint solvents discharged to ground; in 1985, 7 soil samples indicated Hg at 48 to 236 ppb; background - 55 ppb.
Nitric Acid Contamination S of CPP-734	CPP-56	1968	Unknown	Unknown	Nitric acid	Underground line from non-rad liquid waste hold up tank to monitoring station leaked; waste surfaced near CPP-734. No clean up reported.
Sulfuric Acid Spills E of CPP-506	CPP-57	1984, 1985	30'x30'	4,550 gallons	Sulfuric acid	Two spills: 10/84 - 50 gallons due to tank overfilling, 6/85 - 4500 gallons due to tank leak. Both spills neutralized; in latter, soil removed.

TABLE 4-25
 DESCRIPTIONS OF INACTIVE WASTE SITES AND RELEASES AT
 ICPP (Continued)

Name	INEL Code #a	Dates of Use/ Occurrence	Size/Depth	Volume Received/Spilled	Constituents Received/Spilled	Additional Information
PEW Evaporator Overhead Pipeline Spill ^b	CPP-58	1976	38,700 ft ³	20,000 gallons	Nitric acid, metals (Hg), radionuclides (Ce-144, Cs-137, Sr-90, Ru)	Condensate leaked from underground line between Process Equipment Waste Evaporator and Service Waste Diversion System; contaminated soil left in place and covered with clean soil and asphalt.
Kerosene Tank Overflow W of CPP-63 ^b	CPP-59	1983	Unknown	260 gallons	Kerosene	Two spills, 200 and 60 gallons, within one week. No cleanup reported. Spills occurred as a result of tank overflowing to vent line.
Paint Shop (CPP-615)	CPP-60	Unknown	Unknown	Unknown	Solvents, Hg, Pb, Cd	Paint and paint solvents may have been discharged to the soil from an old paint shop. Shop has been removed and Building CPP-645 built at the location.
PCB Spill in CPP-718 Transformer Yard	CPP-61	1985	21 yd ³	400 gallons	PCBs (179 ppm)	Leaking transformer. Highest PCB in soil - 31 ppm. Contaminated soil removed down to 10 ppm.
Misc. Contaminated Area (TB-4)	CPP-62	1984	80 ft ² to a depth of 1'	Unknown	Paint solvent, Hg, Cd, Pb	Used paint solvents discharged to ground. Hg in soil measured up to 2,825 ppb (55 ppb background). Entire area excavated to 45' for construction of waste storage bin.
Hexone Spill by CPP-710	CPP-63	1982	Unknown	Unknown	Hexone	Leak in line from 550-gallon tank; contaminated soil left in place.
Hexone Spill W of CPP- 660	CPP-64	1984	Unknown	55 gallons	Hexone	Leaked from barrel onto asphalt and soil; some hexone absorbed onto vermiculite and removed.

TABLE 4-25
DESCRIPTORS OF INACTIVE WASTES SITE AND RELEASES AT
ICPP (Continued)

Name	INEL Code # ^a	Dates of Use/ Occurrences	Size/Depth	Volume Received/Spilled	Constituents Received/Spilled	Additional Information
Miscellaneous CPP-603 Concrete Settling Basin and Vault	CPP-01	1951-1977	Vault - 6'x5'x20' deep (top is 16" underground) Basin - 30'x4'x6' deep (top is 7' under- ground)	Unknown	Radionuclides, Cl ⁻ , NO ₃ ⁻	Part of a fuel storage basin water cleanup system; received backwash slurry and water. Vault and basin entirely concrete lined; vault used 1951-1962, basin 1962-1977. Until 1966, effluent from basin and vault discharged to dry wells, then to hot waste tank; still present; scheduled for D&D.
Contaminated Paint Chips and Pad S of CPP- 603	CPP-12	Discovered in 1984	Unknown	Unknown	Radioactive-contaminated paint chips	Chips came from painted concrete pad; pad, chips, and contaminated soil removed.
CPP-621 Chemical Storage Area Pipe Trench	CPP-45	?-1986	85'x5'	Unknown	Unknown	Pipes conveyed chemicals from tanks to pumphouse; samples have been taken, data not yet available.
Contaminated Soil W of CPP-693, E of Dry Fuel Storage Area	CPP-78	Discovered in 1987	70'x4'x6' deep	Unknown	Radionuclides	Origin of contamination unknown, contamination remains but clean soil has been placed on top; area is roped off and posted.

^a Code # used by the INEL to identify Land Disposal Units (LDUs) and Solid Waste Management Units (SWMUs); units are located on Figure 4-27.

^b Site that supports findings (see Section 4.5.2.3).

the sites are located on Figure 4-27, using the INEL code numbers listed on Table 4-25. The 80 sites include 8 surface percolation units and ditches, 1 inactive injection well, 5 inactive landfills and surface storage areas, 17 subsurface percolation units, 44 spills and releases, and 5 miscellaneous units.

Four of the surface percolation units received organics generated from machine maintenance (CPP-43 and 44) and for fire training (two at CPP-41). The other four units received service water (gravel pit #1 - CPP-37), domestic sewage (gravel pit #2 - CPP-37), laboratory and pilot plant chemicals (CPP-42), and storage basin water (CPP-06). The inactive injection well (CPP-23) was used as the major disposal unit for cooling water and condensate from the process equipment waste evaporator. An estimated 11 billion gallons of water containing radionuclides and metals were discharged into the injection well from 1952 to 1984. All of the inactive landfills and surface storage areas are associated with the storage of radioactively contaminated materials, mainly equipment and soils. In one case (CPP-34), chemicals (mercuric nitrate) are also stored. Two of the storage areas (CPP-18 and 21) have been removed.

Three of the subsurface percolation units received radioactively contaminated water (two in CPP-01, one in CPP-02) and two received chemical wastes (CPP-48 and the aluminum sludge pit in CPP-45). Four were limestone pits used to neutralize acids (hydrogen fluoride, hydrochloric acid, sulfuric acid) that may have overflowed from overlying tanks (CPP-39 and 40 and two in CPP-45). Seven were French drains that received discharges from the limestone neutralization pits or directly from tank overflows (one in CPP-39 and six in CPP-45). The last subsurface percolation unit was the drainfield from the abandoned sewage treatment plant (CPP-14).

Spills make up a majority of the sites at ICPP and involve both liquid and gaseous releases. Ten of the releases were radioactive only and most were associated with the operation of the CPP-603 Fuel Receiving and Storage Building. Sixteen were mixed radioactive and chemical spills; 10 of these were associated with operations in the tank farm area and involved cesium-137, strontium-90, mercuric nitrate, and nitric acid. Eighteen were chemical spills only; 5 involved acids (HF, HNO₃), 1 involved metals only (zirconium, chromium), 4 involved PCBs, 4 involved paints and paint solvents (which include such metals as mercury, cadmium, and lead), 3 involved other organics (hexone, solvents), and 1 involved petroleum products

(kerosene). Volumes of these spills, where known, ranged from "a few liters" to 21,000 gallons.

The miscellaneous sites consist of two radioactively contaminated areas (CPP-12 and 78), a vault and basin that held radioactive liquid wastes (CPP-01), and one trench that supports pipes which convey acids (CPP-45).

ANL-W

ANL-W is located in the southeastern portion of the INEL, 17 miles east of the CFA (Figure 2-3). It is situated on a relatively flat, sagebrush- and grass-covered plain. Over 50 buildings and structures are contained within the 120-acre facility (Figure 4-28). The mission and history of ANL-W, which was initially developed in the mid-to-late 1950s, has revolved around the research and development of breeder reactors by operation and maintenance of large experimental facilities. Additional information on the history and use of ANL-W is provided in Section 2.2.

As a result of these operations at ANL-W, seven inactive waste sites and releases, as identified in the INEL IAs and during the Survey, are located at the ANL-W. Six of the sites were described in the INEL IAs; a seventh was added during the Survey. Table 4-26 lists these sites by the six categories discussed in Section 4.5.1.2 with data on dates of use, dimensions, constituents received and their volumes, and additional information including descriptions of remediation efforts. The sites are located on Figure 4-28, using the INEL code numbers listed on Table 4-26. The seven sites include two surface percolation units and ditches, one inactive landfill, one subsurface percolation unit, two spills, and one miscellaneous tank.

Both surface percolation units were ditches. One (ANL-01) received cooling tower blowdown and industrial wastewater containing chromates, corrosives, and organic biocides. The other (ANL-09), normally a surface runoff control canal, received radioactive liquid during one event in 1969. The inactive landfill (ANL-05) is a series of three open burn pits that received a variety of materials. The pits are covered with topsoil but exposed materials at two test pits indicate that materials were incompletely burned. The subsurface disposal unit, a leach pit (ANL-08), received cooling tower blowdown containing chromates in 1964. However, most of the discharge it received was radioactive wastewater with activity within 100 times the

LOCATIONS OF INACTIVE WASTE SITES
AND RELEASES AT ANL-W

FIGURE 4-28

TABLE 4-26
 DESCRIPTIONS OF INACTIVE WASTE SITES AND RELEASES AT
 ANL-W

Name	INEL Code # ^a	Dates of Use/ Occurrence	Size/Depth	Volume Received/Spilled	Constituents Received/Spilled	Additional Information
Surface Percolation Units and Ditches Abandoned Drainage Ditch on West Boundary ^b	Portion of ANL-01	1959-1977	1,200' long x 6' x 4' deep	Unknown	Chromates, diethylamine, dimethylformamide, methylene bis thiocyanate, bis (trichloromethyl) sulfone, corrosives	Ditch conveyed cooling tower blowdown and other industrial wastewaters to industrial wastewater pond, filled in 1977 during security up-grade. Flows rerouted to existing ditches (see Section 4.1). Chromate use discontinued in 1980.
ANL Interceptor Canal	ANL-09	1964- Present	1,425' long x 50' x 6' deep	Unknown	Zr-Nb-95, Co-60, An-124, Ce-144, Cs- 137	Canal was built for and is used primarily for surface runoff control. Residue liquids were released during one event in 10/69. Cleaned up in 11/73 (less than 100 yd ³ dirt removed).
Inactive Injection Wells None Listed or Found						
Inactive Landfills and Surface Storage Areas ANL Open Burn Pits #1, #2, #3b	ANL-05	Early 1960s- 1970	Each estimated to be 75-100' long, 15-20' wide, 6-8' deep	Unknown	Construction debris; garbage and burnable debris, petroleum products (oil, hydraulic fluids), organic wastes (150 gallons)	Operated as cut-and-fill; combustible wastes burned. Portions of two pits exposed by test pits; remainder of pits covered. Exposed material indicates incomplete burns.

then AEC guidelines for release to controlled areas. Both spills at ANL-W involved petroleum products; they were relatively minor and one (ANL-ES01) was completely cleaned up. The miscellaneous site (ANL-12) was a steel-covered concrete pad and underground tank used to remove sodium from EBR-II components. The area was D&D'd in 1979.

Other Facilities

NODA

The U.S. Navy and the U.S. Army Air Corps had in the past used portions of what is now the INEL for gunnery and bombing ranges. As a result, there are numerous sites within the INEL where unexploded ordnance (UXO) and munitions have been found. The high explosives contained within the ordnance include TNT, RDX, Comp B, and Comp C. Although the term "NODA" refers to one specific area (6, below), 16 other areas containing UXOs and munitions have been identified and are located on Figure 4-29. The numbers on the figure are keyed to the descriptions below.

1. This area was allegedly a bombing range for B-24 Liberator aircraft. Practice bombs with spotting charges have been found and have been disposed of.
2. This was a firing site for 16- and possibly 8-inch Naval guns during the Vietnam War. There are a large number of 16-inch shells, most of which are suspected to be mono-block shot rounds. These do not contain main explosive charges, but may contain spotting charges.
3. The CFA-633 (Figure 4-21) area was a firing site for Naval guns during World War II. Many shells have been found in this area and have been disposed of. Pieces of torpedoes and 50 to 100 pounds of smokeless powder have also been found in the area. A 5-inch artillery shell is known to have been buried 40 to 50 feet deep in a French drain. This is site CFA-11 described under Subsurface Percolation Units in Table 4-22.
4. A 5-inch Naval artillery shell was buried in a gravel pit. The area is now signed as dangerous. This is site CFA-09 described under Inactive Landfills and Surface Storage Areas in Table 4-22.

5. Explosive ordnance (primarily 5-inch artillery shells) have been found in the CFA Sanitary Landfill I area.
6. The NODA was used as a disposal and experimental site for ordnance. Large concentrations of many kinds of ordnance and explosives are located in the area although many have been disposed of. Until 1982, NODA was also used as a storage area for hazardous wastes generated at the INEL. At that time, it was referred to as the Hazardous Materials Depot Area. As of October 1985, all these materials had been moved off-site or treated on the site.
7. There were at least two explosive storage magazines in this area, which were demolished in Navy tests. Five-inch shells and anti-tank mines have been found and disposed of.
8. There are numerous bomb or artillery craters in this area, known as the NOAA grid. Numerous 5-inch artillery shells and chunks of high explosives, mainly TNT, have been extracted.
9. This area was used as a bombing range for Army Air Corps bombers during the 1940s. Practice bombs with spotting charges have been found in the zone.
10. This zone was a 30-mile-long firing range, which began at CFA-633 (Figure 4-21), a firing station. Fuses, chunks of high explosives, parts of torpedoes, smokeless powder, and artillery shells, primarily 5 and 14 inches, have been found in this zone.
11. This area was used for explosives tests involving anti-tank mines. Some live anti-tank fuses and one anti-tank mine have been found.
12. In the early 1970s, an 800-acre accidental range fire thermally initiated a large number of explosive ordnance.
13. Widely scattered pieces of explosive ordnance, mainly 3- and 5-inch mono-block shot rounds, have been found in this area.

14. Approximately 25 pieces of explosive ordnance, mainly 5-inch mono-block shot rounds, have been found in this section of the Anaconda power line right-of-way.
15. There are several demolished structures or remnants that were built to serve as protected observation areas for instrumentation. The area is not depicted in Figure 4-29 but extends from CFA to east of the NRF. Ordnance has been found in this area.
16. The Navy conducted large explosive magazine tests. Some of the detonations involved three magazines, each with 500,000 pounds of explosive ordnance. Many kinds of ordnance have been found including 500- and 1,000-pound bombs and fuses, anti-tank mines and fuses, and artillery shells of various calibers. Most have been partially exploded.
17. Many concrete revetment walls, approximately 1 foot thick by 10 feet high by 12 feet long are in this area. Bomb craters are located near some of the walls and ordnance has been found near some of them.

EBR-I/BORAX

The EBR-I/BORAX is located in the southwestern portion of the INEL, 5 miles southwest of the CFA (Figure 2-3). EBR-I occupies about 10 acres and BORAX occupies 6 acres, including the leach pond and BORAX-I contaminated area (Figures 4-30 and 4-31). They are situated in a sagebrush- and grass-covered area with rolling topography, probably due to underlying lava flows. The EBR-I area was developed in 1949 and the early 1950s for the Experimental Breeder Reactor program. In 1963, EBR-I was decommissioned and designated a National Historic Landmark.

The BORAX facility, used to test boiling water reactors, was originally developed in 1953 as BORAX-I. The last test of BORAX-I was in 1954 when the reactor was intentionally destroyed. The reactor was buried in place and the site was cleared and abandoned. A new site, 100 yards northeast of BORAX-I, was chosen for subsequent BORAX-II through V experiments, which were conducted from 1954

FIGURE 4-30

FIGURE 4-31

LOCATIONS OF INACTIVE WASTE SITES AND RELEASES
AT BORAX

through 1964. Since 1964, the BORAX facility has been unused except for storage. Several buildings as well as the reactor vessel still remain.

As a result of reactor testing at EBR-I and BORAX, four inactive sites, as identified in the INEL IAs and during the Survey, are located at these facilities, one at EBR-I and three at BORAX. The three at BORAX were described in the INEL IAs, while the one at EBR-I was newly identified during the Survey. Table 4-27 lists these sites by the six categories described in Section 4.5.1.2 with data on dates of use, dimensions, constituents received and their volumes, and additional information such as descriptions of remediation efforts; the sites are located on Figures 4-30 and 4-31 using the INEL code numbers listed on Table 4-27. The four sites consist of two surface percolation units and ditches and two inactive landfills and surface storage areas.

One of the surface percolation units was a leach pond (BORAX-01) that received radioactive liquids, while the other was a ditch (EBR-I-ES01) that received cooling water condensate of unknown composition. The leach pond has been D&D'd by backfilling with clean soil. The landfills consist of the BORAX-I reactor burial site (BORAX-02) and the BORAX trash dump (BORAX-04). Although material was removed from the BORAX trash dump during D&D of the area, debris is still visible under the soil cover.

ARVFS

The ARVFS is located in the central portion of the INEL (Figure 2-3), approximately 10 miles northeast of the CFA, and comprises less than 1 acre. It is situated on a flat, sagebrush- and grass-covered plain, typical of the INEL.

The ARVFS was constructed in 1965 by the U.S. Department of Defense. Secret experiments were conducted in a steel-lined, open-top test pit in the late 1960s. After ARVFS remained inactive for over a decade, a series of explosive tests was conducted in the pit in 1980 and 1981. Additional information on the history and use of ARVFS is provided in Section 2.2.

As a result of these operations, there is one inactive site at ARVFS, the steel-lined test pit (Table 4-28). The inside of the test pit is radioactively contaminated, but it is

TABLE 4-27

**DESCRIPTIONS OF INACTIVE WASTE SITES AND RELEASES AT
EBR-I AND BORAX**

Name	INEL Code #a	Dates of Use/ Occurrence	Size/Depth	Volume Received/Spilled	Constituents Received/Spilled	Additional Information
<u>Surface Percolation Units and Ditches</u> BORAX-II through V Leach Ponds	BORAX-01	1955-1964	20' x 90' x 3' deep	Unknown	Cs-137; liquid industrial waste (cooling tower blowdown containing chromates); corrosion products (Fe, Cr, Ni); possibly PCBs	Received radioactive liquid wastes, cooling tower blowdown, ion exchange regenerants; Cs-137 measured up to 175 pCi/g in soil (background 0.94 ± 1.2 pCi/g). Area D&D'd by backfilling pond with clean soil and grading.
EBR-I Ditch to NW	EBRI-ES01c	1951-1963	4' wide x 2500' long	454 kg/yr of each Unknown	Sulfuric acid, sodium hydroxide Cooling water condensate of unknown composition	Ditch runs from NW corner of EBR-I facility to spreading area; still evident
<u>Inactive Injection Wells None Listed or Found</u>						
<u>Inactive Landfills and Surface Storage Areas</u> BORAX-I Burial Site	BORAX-02	1954-present	90' x 90'	Unknown	Radionuclides (Cs-137)	Site is burial ground for reactor components. Covered with soil and fenced.
BORAX Trash Dumpb	BORAX-04	1953-1964	120' x 240' x 6' deep	Unknown	Construction debris, asbestos	During D&D, material removed to CFA Landfill. Yet under soil cover, construction debris is visible. Also, area is obviously mounded.

TABLE 4-27

**DESCRIPTIONS OF INACTIVE WASTE SITES AND RELEASES AT
EBR-I AND BORAX (Continued)**

Name	INEL Code # ^a	Dates of Use/ Occurrence	Size/Depth	Volume Received/Spilled	Constituents Received/Spilled	Additional Information
<u>Subsurface Percolation Units</u> None Listed or Found						
<u>Spills</u> None Listed or Found						
<u>Miscellaneous</u> None Listed or Found						

^a Code # used by the INEL to identify Land Disposal Units (LDUs) and Solid Waste Management Units (SWMUs); units are located on Figures 4-30 and 4-31.

^b Site that supports findings (see Section 4.5.2.3).

^c Site not identified by the INEL as an LDU or SWMU but found during the Environmental Survey.

TABLE 4-28

DESCRIPTIONS OF INACTIVE WASTE SITE AND RELEASES AT
ARVFS

Name	INEL Code # ^a	Dates of Use/ Occurrence	Size/Depth	Volume Received/Spilled	Constituents Received/Spilled	Additional Information
<u>Surface Percolation Units</u> None Listed or Found						
<u>Inactive Injection Wells</u> None Listed or Found						
<u>Inactive Landfills and Surface Storage Areas</u> None Listed or Found						
<u>Subsurface Percolation Units</u> None Listed or Found						
<u>Spills</u> None Listed or Found						
<u>Miscellaneous</u> ARVFS Tank Containing Low-Level Rad Waste	ARVFS-02	1960s and 1980-1981	12' diameter x 16' deep	Unknown	Ex-137	Pit enclosed in 1/4-inch structural steel, open top. Late 1960s-filled with water and nuclear fuel elements; 1980-1981-exposives testing. No evidence of leakage

^a Code # used by the INEL to identify Land Disposal Units (LDUs) and Solid Waste Management Units (SWMUs).

believed that it has not leaked. As a result, there appears to be little potential for environmental migration of contaminants.

EOCR/OMRE

The EOCR/OMRE Facility is located in the south-central portion of the INEL, 2.5 miles east of the CFA (Figure 2-3). The two areas are adjacent to one another, although most OMRE facilities were completely removed in 1978 and 1979 (Figure 4-32). The 9-acre area is situated on a relatively flat, sagebrush- and grass-covered plain, typical of the INEL. The OMRE was completed in May 1957 and continued operating until reactor shutdown in 1963. The EOCR was constructed directly northwest of the OMRE in 1962. The project was terminated shortly before construction was completed in 1962 and never operated. However, some systems including boilers and cooling water systems were tested. Additional information on the history and use of EOCR and OMRE is provided in Section 2.2.

As a result of the operation of these facilities, five inactive sites and releases (four at the EOCR, one at the OMRE) as identified in the INEL IAs and during the Survey, are located at EOCR/OMRE; all were described in the INEL IAs. Table 4-29 lists these sites by the six categories discussed in Section 4.5.1.2 with data on dates of use, dimensions, constituents received and their volumes, and additional information including descriptions of remediation efforts; the sites are located on Figure 4-32 using the INEL code numbers listed on Table 4-29. The five sites consist of three surface percolation units, one injection well, and one subsurface percolation unit.

Two of the surface percolation units were at the EOCR (EOCR-01 and 03). Because the facility never became fully operational, the oxidation pond (EOCR-03) was never used and the leach pond (EOCR-01) only received corrosive regenerants during plant testing. Similarly, the injection well (EOCR-02) and the blowdown sump (EOCR-05) associated with EOCR never received discharges. The OMRE leach pond (OMRE-01) received radioactive liquids and organics. During D&D of the OMRE leach pond, highly radioactively contaminated soils were removed and the area was backfilled.

LCCDA

The LCCDA, approximately 1 acre in area, is located about one-half-mile east-northeast of the RWMC along its access road (Figure 2-3). This facility consisted of

FIGURE 4-32

TABLE 4-29
DESCRIPTIONS OF INACTIVE WASTE SITES AND RELEASES AT
EOCR/OMRE

Name	INEL Code #a	Dates of Use/ Occurrence	Size/Depth	Volume Received/Spilled	Constituents Received/Spilled	Additional Information
<u>Surface Percolation Units and Ditches</u> EOCR Leach Pond	EOCR-01	1960-1962	150'x120'x10' deep	713 gallons 1,083 gallons	Sulfuric acid Sodium hydroxide	Open pit constructed into basalt; liquids (ion exchange regenerants) were received during plant start-up testing but facility never operated.
EOCR Oxidation Pond	EOCR-03	None	150'x120'x8' deep	None	None	EOCR never operated so pond was never used; however, it is presently receiving raw sewage.
OMRE Leach Pondb	OMRE-01	1959-1963	26'x72'	137,100 gallons	2,353 mCi of Mn-54, Fe-57, Zr-95 and other radionuclides; xylene, other organics	Received radioactive wastewater. Bottom had 1 to 1.5' soil, then basalt. During D&D, highly contaminated soil (up to 6,000 pCi/g) was removed; area then backfilled.
<u>Inactive Injection Wells</u> EOCR Injection Well	EOCR-02	None	286' below surface	None	None	EOCR never operated so injection well never used; apparently has been filled in. Groundwater 450' below surface.
<u>Inactive Landfills and Surface Storage Areas</u> None Listed or Found						

TABLE 4-29

**DESCRIPTIONS OF INACTIVE WASTE SITES AND RELEASES AT
EOCR/OMRE (Continued)**

Name	INEL Code # ^a	Dates of Use/ Occurrences	Size/Depth	Volume Received/Spilled	Constituents Received/Spilled	Additional Information
Subsurface Percolation Units EOCR Blowdown Sump	EOCR-05	1960-1962	3' wide x 7' x 7' deep	Unknown	Unknown	May have received blowdown from building boiler; not used much since reactor never became operational.
Spills None Listed or Found						
Miscellaneous None Listed or Found						

^a Code # used by the INEL to identify Land Disposal Units (LDUs) and Solid Waste Management Units (SWMUs). Units are located on Figure 4-32.

^b Site that supports findings (see Section 4.5.2.3).

two surface percolation units (LCCDA-01 and 02) used for disposal of nonradioactive liquid chemicals. They were described in the INEL IAs. Table 4-30 lists dates of use, dimensions, constituents received, volumes, and additional information. The LCCDA has been closed and the seepage pits have been filled in; however, the site is still relatively bare, or sparsely vegetated, and it is therefore visible from the road along the south side. Additional information on the history and use of LCCDA is provided in Section 2.2.

The site's older seepage pit (LCCDA-01) located along the western end of the LCCDA, was used from 1961 to 1974. It was an unlined pit of unknown dimensions. Records of disposal practice were not kept; however, this pit reportedly received liquid chemicals, primarily corrosives, that were trucked to this remote location. Contents of containers such as tank trucks or drums were emptied into the unlined pit and were allowed to seep into the soil.

The Limestone Treatment and Disposal Pit (LCCDA-02) operated from 1972 until 1980. Use of the pit was officially halted in 1981 although the last records of its receiving liquid wastes was April 1980. This 10-foot-deep pit was lined with 6 feet of limestone fragments for acid neutralization. As with the old pit, drums were trucked to this location and their contents poured into the pit. An elevated ramp was provided to allow tanker trucks to back up to the pit and dispose of liquid corrosive chemicals.

4.5.2 Findings and Observations

4.5.2.1 Category I

None

4.5.2.2 Category II

None

TABLE 4-30

DESCRIPTION OF INACTIVE WASTE SITES AND RELEASES AT LCCDA

Name	INEL Code #	Dates of Use/ Occurrence	Size/Depth	Volume Received/Spilled	Constituents Received/Spilled	Additional Information
<u>Surface Percolation Units & Ditches</u>						
Old Disposal Pitb	LCCDA-01	1961-1974	Disturbed area is 35 ft x 35 ft, depth unknown	Estimated 2,675 gal (acids), estimated 92 lb (bases)	Acids, bases, and possibly other liquid chemicals of unknown quantity	This was an unlined pit used for disposal of liquid corrosive chemicals. Other chemicals may have been disposed of at this site. Spent chemicals were trucked to this location in drums and tankers.
Limestone Treatment and Disposal Pitb	LCCDA-02	1972-1980	Disturbed area is 100 ft x 70 ft, pit size: 10 ft x 5 ft x 10 ft deep, w/ 6 ft of limestone in bottom, 3 ft-high berms	Estimated 2,675 gal (acids), estimated 92 lb (bases)	Acids, bases, and possibly other liquid chemicals of unknown quantity	This was a seepage pit, "lined" with limestone fragments, for disposal of liquid corrosive chemicals. Other chemicals may have been disposed of at this site. Spent chemicals were trucked to this location (adjacent to LCCDA-01) in drums and tankers.
<u>Inactive Injection Wells</u> None listed or found.						
<u>Inactive Landfills & Surface Storage Areas</u> None listed or found.						
<u>Subsurface Percolation Units</u> None listed or found.						

TABLE 4-30
DESCRIPTION OF INACTIVE WASTE SITES AND RELEASES AT LCDA

Name	INEL Code # ^a	Date of Use/ Occurrence	Size/Depth	Volume Received/Spilled	Constituents Received/Spilled	Additional Information
<u>Spills</u> Spills adjacent to the seepage pits, due to handling and disposal practices, may have occurred; however, their effect would be composite with the effect of the infiltration of the same liquid chemicals in the pits.						
<u>Miscellaneous</u> None listed or found.						

a Code # used by the INEL to identify Land Disposal Units (LDUs) and Solid Waste Management Units (SWMUs).

b Site that supports findings (see Section 4.5.2.3).

4.5.2.3 Category III

1. Potential contamination from inactive injection wells. Eight inactive injection wells, located at TAN/IET, TAN/LOFT, TAN/WRRTF, TAN/TSF, TRA, PBF(2), and ICPP, were used to dispose of liquid wastes containing hazardous chemicals and radioactive constituents and may have contaminated the unsaturated zone and groundwater.

For this finding, the Survey team relied on well logs (descriptive and geophysical) and as-built diagrams/schematics, made available by the INEL. Past disposal practices and other pertinent information were found from observations during the Environmental Survey, the INEL's IAs, and the INEL IAR.

All these wells were gravity-fed injection systems as opposed to pressurized injection systems, and worked in conjunction with a collection sump. Liquid wastes flowed in underground piping to a cylindrical collection sump, buried below the ground. A sieve-like opening for the well head in the bottom center of the sump kept debris from entering and clogging the injection well. The liquid wastes passed through the sieve and cascaded down the well to the discharge point.

Discharge points of the injection well were constructed of well screen materials. The well's discharge capacity was therefore limited by the geologic materials' hydraulic conductivity conditions at the points of discharge and the hydraulic head. To increase discharge capacity where necessary, the INEL made additional perforations in upper casing sections of the well, thus increasing the effective area through which wastes could discharge. These additional perforations were control-blasted gun perforations at discrete zones, presumably where greater hydraulic conductivities existed. They were characteristically sandy and/or gravelly beds of alluvium, or fractured basalt zones.

Consequently, contaminants were discharged not only to the originally designed screened zones but also to other subsurface horizons (strata), both unsaturated and/or saturated zones. These saturated zones include the perched aquifer, where present, and the Snake River Plain aquifer. The Snake River Plain aquifer flows to the southwest, and is the source of potable and

irrigation water at the INEL and off-site. The injection wells at TRA, ICPP, and TAN may have contributed to plumes of contaminated groundwater centered around the former two facilities as well as contaminated drinking water at the latter facility. A discussion of contaminant presence in the groundwater is presented in Sections 3.3 and 3.4.

Of the nine inactive injections wells identified at the INEL, eight were noted to be of particular concern based on volumes and types of known or suspected constituents that were discharged into the subsurface. The ninth well, not listed, was the EOGR injection well which was never used because that facility was never activated. The remaining eight inactive injection wells are described below.

TAN/LOFT Injection Well

The TAN/LOFT Injection Well is located outside the fenced perimeter, along the eastern side of the LOFT Area of the TAN (designated LOFT-04 in Figure 4-15). This well was utilized for disposal of liquid wastes into the Snake River Plain aquifer. The well was 300 feet deep, penetrating the top of the aquifer at 202 feet below the ground surface. No data were available as to the position of perforated casing, only that the 10-inch-diameter steel casing extends to the bottom of the well. Thus, discharges likely flowed directly into the Snake River Plain aquifer.

This well was used for disposal of 400,000 gpd of cooling water during TAN/LOFT operations from 1973 to 1980. This water had no radioactivity or chemicals added so no source of contamination was injected during this period. However, the injection well was drilled in 1957 during the Aircraft Nuclear Propulsion program. There are no records indicating what may have been disposed of into this well between 1957 and 1973.

After discontinuation of use, the gravity feed piping to the well and the sump were sealed and a protective casing was installed over the well head. The USGS plans to use this well in the future as a groundwater monitoring well.

TAN/IET Injection Well

The TAN/IET Injection Well is still intact and is currently being utilized as a USGS water level monitoring well. It is located in the southeastern quadrant of the IET Facility of TAN (designated IET-06 in Figure 4-16). This well was utilized for disposal of liquid wastes via gravity-fed injection from 1956 until 1978. It is 324 feet deep; the top of the Snake River Plain aquifer is approximately 210 feet below ground surface. No data were available as to the position of the well screen or other perforations so it is not known if this well discharged wastes into the unsaturated zone. However, since it was constructed around the same time as the TAN/LOFT injection well, it is probably of similar construction, with the casing extending to the bottom of the well. Thus, discharges likely flowed directly into the Snake River Plain aquifer.

This well was used for disposal of corrosive wastes primarily between 1956 to 1961 during reactor engine testing activities. It may have also received these or other wastes from this period until 1978 when the well's collection sump and pipes were plugged and the well was converted to a USGS water level monitoring well. The INEL estimated that 1,910 pounds of sulfuric acid and 1,650 pounds of sodium hydroxide contained in demineralization unit regeneration backwash wastes were discharged into this well. Reportedly small volumes of sanitary septic tank overflow and possibly mercury may have been discharged in the liquid wastes.

TAN/WRRTF Injection Well

The TAN/WRRTF Injection Well is located south of the fenced perimeter of the TAN/WRRTF (WRRTF-05 in Figure 4-17). It is adjacent to and north of the TAN/WRRTF evaporation pond. The well was utilized for disposal of liquid wastes into the unsaturated zone and the aquifer. It was 313 feet deep, with the casing installed to the bottom. The perforated section through which discharge flowed is from approximately 189 feet to 313 feet deep. The well encounters the Snake River Plain aquifer at 210 feet below the ground surface. This well was used for disposal of corrosive chemicals resulting from demineralization regeneration operations. Some sanitary wastewater, after

draining through sand filters, discharged into the well. An estimated 50 mCi of cobalt-60 also was discharged into this well in one incident. The well was used from 1957 until August 1984. The gravity feed piping and sump was then concrete plugged; however, no decommissioning of the open borehole well was performed.

TAN/TSF Injection Well

The TAN/TSF Injection Well (designated as TSF-05 in Figure 4-18) is located in the west-southwest corner of the TAN/TSF between the drainage pond and fenceline. This well was used for disposal of corrosive wastes from demineralizer regeneration processes. The well was used from 1953 until 1972, when it was replaced by a waste disposal pond. Waste streams which were disposed of into the well included corrosive chemicals, low-level radioactive wastes, small volumes of inorganics, and petroleum products. An estimated 191,500 gallons liters of corrosive wastes, consisting of sulfuric acid and sodium hydroxide, were discharged into the well. The low-level radioactive wastes were primarily (99.9 percent) tritium wastes as reported by the INEL. Small volumes of inorganics such as chromium, lead, and mercury as well as oils likely entered the waste stream system to this well. An estimated 85 gallons of ignitable wastes and 55 pounds of chromium were discharged through this well.

Waste was discharged into both the unsaturated zone and the aquifer through this injection well. The well encounters the Snake River Plain aquifer at approximately 200 feet and penetrates further to a bottom of well depth of 313 feet. The casing is perforated primarily below the water table but some perforations are within the unsaturated zone. The perforated zones are from 180 to 244 feet and 269 to 305 feet deep.

The TAN/TSF Injection Well no longer accepts liquid wastes. In 1987 the well was converted for use as a USGS monitoring well. Waste lines entering the well sump and the sump itself were closed off from the well. A section of riser pipe and protective casing was added, to allow access for groundwater monitoring.

TRA Disposal Well

The TRA Disposal Well (designated TRA-05 in Figure 4-19) was a gravity-fed injection well, located along the southeast side of the TRA. It was used for disposal of nonradioactive liquid wastes, consisting primarily of cooling water treated with biocides and corrosion preventive chemicals such as chromates. The well went into service in 1964 to accept these wastes, diverting this waste stream from the overloaded Warm-Waste Pond. This well was later replaced by the new cold-waste disposal ponds in 1982. However, the TRA stopped using chromate-based additives in its cooling water in 1972. The concentration of chromates in the cooling waters was characteristically maintained at 11 to 14 ppm. From available documentation during 1971 through 1972, the INEL estimates that 14.8 tons of chromium was discharged into the Snake River Plain aquifer between 1964 and 1972.

Construction of the well commenced in 1962. The bottom of the well is at a depth of 1,270 feet below ground surface and was originally screened between 1,182 feet and 1,267 feet. This however, did not allow sufficient discharge capacity. Additional perforated zones were shot into the steel casing to remedy this problem. These perforated zones, all below the top of the Snake River Plain aquifer at a depth of 450 feet, were installed between 935 feet and 1,070 feet and between 521 and 697 feet deep. This later section reduced the head build-up, resulting in a tested discharge rate of 1,000 gpm without any head build-up in the well. Wastes therefore were primarily discharged into the upper reaches of the aquifer, despite the great depth of the well.

In 1982, the well was converted for monitoring use by the USGS. A section of riser pipe and protective casing was added to allow access for groundwater monitoring and the annulus around the casing was plugged with concrete.

PBF Corrosive Waste Injection Well

The PBF Corrosive Waste Injection Well was located 110 feet east-southeast of the PBF reactor building (PBF-15 in Figure 4-24). As its name implies, this well

was used for disposal of corrosive liquid wastes from demineralizer regeneration backwash. This well also received a waste stream from the secondary coolant system of the reactor, which contained biocides and corrosion inhibitors consisting of chromate-based solutions. These liquid wastes were gravity-fed to this injection well, after first mixing in the Corrosive Waste Disposal Sump Brine Tank. This allowed the corrosives an opportunity to neutralize prior to injection. The secondary cooling water wastes were treated by sulfonating with sulfur dioxide to convert hexavalent chromium present in the chromates into trivalent chromium. The effectiveness of this process was not reported. The well was put into service in 1972 and was used until 1979, when the wastes were rerouted to the new PBF evaporation pond.

This injection well was drilled in 1969 and a plastic casing with well screen was installed to a depth of 115 feet. The well screen was emplaced between 76 and 110 feet deep. Prior to installation, a 6-inch-diameter exploratory borehole was drilled below the 100-foot level, extending down to 220 feet. This exploratory boring was grouted closed prior to well installation. This injection well did not penetrate into the aquifer since the top of the Snake River Plain aquifer is believed to be approximately 455 feet below the ground surface. The liquid wastes were therefore discharged into the unsaturated zone.

The INEL estimates, from available records, that 9,100 kg of sulfuric acid, 10,500 kg of sodium hydroxide, and 119 kg of chromium (as trivalent Cr) were injected into this well during its 6 years of operation. The well was subsequently plugged with concrete.

PBF Warm-Waste Injection Well

The Warm-Waste Injection Well is located 83 feet south of the PBF reactor building (PBF-05 in Figure 4-24). This well was used from 1973 to 1980 for disposal of low-level radioactive liquid waste (warm waste) from the warm-waste sump in the reactor building. An estimated 0.5 curie of radioactivity, mainly cesium-137, was injected during this period. When enough liquids

collected in the 5,700-liter sump, they were pumped out and allowed to drain into the injection well. If radioactivity in the sump was above a certain level as determined by health physics personnel, then the wastes were diverted to hot-waste holding tanks. In addition to the warm waste, this injection well also received 700,000 gallons/month of raw water from the utility cooling system for cooling plant equipment from August 1980 to June 1984.

This well was drilled in 1969. A 6-inch exploratory borehole was drilled to a depth of 222 feet, and then grouted shut between 110 feet and the bottom. Perforated steel casing was installed between 71 and 95 feet deep. This well did not penetrate into the Snake River Plain aquifer, the top of which is believed to be approximately 455 feet below the ground surface. The liquid wastes were therefore discharged into the unsaturated zone only. In June 1984, the well's waste lines were plugged and the well and sump were filled with concrete.

ICPP Injection Well

The ICPP injection well (designated CPP-23 in Figure 4-27) is located in the west-central area of the ICPP, adjacent to the FAST Facility Building. This well was used for the disposal of both low-level radioactive liquid wastes and chemical wastes. The well went into service in 1952 and received wastes on a regular basis until February 1984, although operational problems occurred from July 1970 through March 1971. The well and its sump are presently available on an emergency basis, to be used only in the event that the present backup system is exceeded. The sump can handle up to 2,000 gallons of liquid waste, prior to releasing to the injection well.

The injection well received not only low-level radioactively contaminated wastewater and relatively low concentrations of chemically contaminated wastewater on a regular basis (Table 4-31), but it also received accidental discharges, as shown on Table 4-32. The normal radioactive releases are shown on Table 4-33. The majority of the radioactivity was due to tritium from service waste, of which an average of 1.5 million gallons per day was received.

TABLE 4-31

ICPP SERVICE WASTE STREAM COMPOSITION

Radionuclide	$\mu\text{Ci/mL}$
H-3 ^a	3.1 E-04
C-14 ^c	1.9 E-08
Mn-54 ^b	4.9 E-08
Co-60 ^c	1.5 E-08
Sr-89 ^c	1.3 E-08
Sr-90 ^a	6.0 E-08
Nb-95 ^b	3.6 E-08
Zr-95 ^c	1.1 E-08
Ru-103 ^b	3.8 E-08
Ru-106 ^b	1.7 E-06
Sb-125 ^b	4.0 E-08
I-129 ^a	3.2 E-08
I-131 ^b	5.4 E-09
Cs-134 ^b	8.3 E-09
Cs-137 ^a	5.0 E-07
Ce-144 ^b	4.6 E-08
Eu-152 ^a	1.5 E-09
Eu-154 ^a	1.5 E-09
Eu-155 ^a	1.4 E-09
Pu-238 ^a	2.0 E-07
Pu-239 ^c	2.0 E-09
Chemical Species ^a	mg/L
Cd	2E-04
Cl	4E + 0
Cr	2E-02
F	8E-01
Hg	3E-03
NO ₃	9E + 01
Pb	1E-02
SO ₄	1E + 00

^a Based on projected levels following startup of FAST and the NWCF.

^b 1982 Annual average from RWMIS.

^c November-December 1982 average from RWMIS.

TABLE 4-32

ACCIDENTAL DISCHARGES TO THE ICPP INJECTION WELL

Date	Constituents Received	Volume Received
7/1954	Beta activity	51 mCi in 900,000 liters of waste
8/1956	Long-lived fission activity	1 Ci
12/1958	Activity	22 Ci
12/1958	Sr-90	7 Ci
9/1969	Cs-134, Cs-137, Ce-144 and Sb-125	19 Ci in 12.4 liters water
12/1969	Activity of which 30% was Sr-90	1 Ci
3/1981	Mercury	30 kg
Unknown	Fuel oil	Unknown

TABLE 4-33

ANNUAL RADIOACTIVE RELEASES TO THE ICPP INJECTION WELL

Year(s)	Volume (millions of liters)	Curies	Curies Remaining at 12/31/84 After Decay
1952-74	25,876	7,651	2,220
1975	1,040	45	26
1976	1,346	45	28
1977	1,583	736	482
1978	1,620	321	220
1979	1,451	227	168
1980	1,513	111	86
1981	2,019	362	294
1982	2,045	214	189
1983	2,058	437	398
1984 ^a	296	3	3
1985	0.32	<0.01	<0.01
	40,847	10,152	4,110

^a Flow to the ICPP Injection Well was officially terminated on February 9, 1984.

The injection well was constructed in 1952 with a completion bottom depth of 555 feet below ground surface. The well penetrates the top of the Snake River Plain aquifer at approximately 450 feet and is screened from 450 to 555 feet. This however, did not allow sufficient discharge capacity. Additional perforated zones were shot into the steel casing to remedy this problem. These perforations were emplaced in the unsaturated zone along alluvial interbeds, one of which was referred to as the Upper Aquifer. These perforations were situated between 140 to 170 feet (interbed) and 200 to 225 feet deep (Upper Aquifer). The latter of these two zones within the unsaturated zone is possibly a significantly saturated, perched water-bearing zone. The additional perforated zones relieved the head build-up within the well. The resulting gravity-fed, average operating injection level was reported to be approximately 215 feet below ground surface, with an average discharge of 1.5 million gallons per day. Wastes therefore were discharged into the perched "Upper Aquifer" as well as into the Snake River Plain aquifer.

Subsurface samples will be obtained during the Sampling and Analysis phase of the Survey to determine the presence of contaminants within the unsaturated zone surrounding the ICPP injection well. Specifically, soil samples will be obtained from the alluvial interbeds where the well's perforated zones were situated. A monitoring well will be installed enabling groundwater from the potential perched aquifer zone to be obtained.

2. Potential contamination from inactive surface percolation units and ditches. Surface percolation units and ditches at the INEL were used to dispose of liquid effluents containing hazardous chemical and radioactive constituents and, as a result, these constituents may be contaminating the unsaturated zone and groundwater.

Approximately 35 inactive surface percolation units and ditches have been identified at the INEL. The liquids they received, which were contaminated with radionuclides and chemicals, were detained in the ponds and ditches and percolated into the underlying soil. Downward migration through the unsaturated zone toward perched groundwater or the Snake River Plain aquifer may be occurring due to hydrogeological driving forces and precipitation recharge of the aquifer, interacting with the contaminants in

and beneath the inactive ponds and ditches. Hydraulic head (pressure), now caused by infiltration of precipitation, and tensional and gravity seepage may be driving the leachate down through the surficial soil layer (usually less than 30 feet thick) and into the fissures of the basalt. Once in the basalt, contaminant migration would be governed by the orientation and interconnection of the fissures and cracks, which would provide channels for contaminant movement. The presence of alluvial zones (unconsolidated sediments of sands, silts, and clays) between basalt sequences may be serving as semipermeable, impermeable, or permeable zones that could retard flow, redirect contaminant migration, or result in contamination of a perched aquifer, if present. Eventually, with sufficient hydraulic force, the contaminants could reach the Snake River Plain aquifer. This aquifer flows to the southwest, and is the source of potable and irrigation water at the INEL and off-site. A discussion of contaminant presence in the groundwater is presented in Section 3.4.

The 35 units were evaluated based on the volumes and types of known or suspected contaminants released into them, dates of use, and the likelihood of contaminant migration. As a result, the 15 sites listed below were noted to be of particular environmental concern.

- TAN/TSF Acid Pond
- TAN/TSF Drainage Pond
- TRA Paint Shop Ditch
- CFA Pond
- CFA Motor Pool Pond
- CFA Fire Training Area, bermed
- ARA-III Waste Leach Pond
- PBF/SPERT IV Leach Pond
- PBF/SPERT IV Lake
- ICPP Gravel Pits #1 and #2
- Grease Pit South of CPP-608 at the ICPP
- ANL-W Abandoned Drainage Ditch
- BORAX II-V Leach Pond
- OMRE Leach Pond
- LCCDA Pits #1 and #2

The following paragraphs provide specific information on each of these sites.

TAN/TSF Acid Pond

The TAN/TSF Acid Pond (TAN-735) is located near the northern corner of the TSF at the TAN (Figure 4-18). It is designated as TSF-29 in the INEL IAs. The pond was built in the 1950s with the development of the TAN/TSF. It is still in use today as a surface-runoff retention basin. Its dimensions are approximately 100 feet by 140 feet by 5 feet deep and it is built directly into the ground with no liner.

The acid pond has received discharges containing sulfuric acid from process drains and runoff from TSF Area 1, an area that is superficially contaminated with radioactivity from past site activities. The period of time in which the pond received process drain discharges is unknown. The pond is situated in an area between two railroad tracks that are suspected of being contaminated with mercury. In addition, it is believed that a pipe from the IET valve pit discharged to the acid pond. The valve pit is radioactively contaminated and may also contain mercury; it is in the process of being decontaminated. It has also been anecdotally reported that maintenance personnel disposed of various materials including construction debris and solvents into the acid pond. Volumes of contaminants discharged into the pond are unknown.

Since the pond still receives surface runoff, there is a driving force to move the contaminants into the subsurface, as discussed in the introduction to this finding. The Snake River Plain aquifer is separated from the surface by about 205 feet of alternating layers of alluvium and basalt; there is no perched aquifer at TAN/TSF.

TAN/TSF Drainage Pond

The TAN/TSF Drainage Pond (TAN-782) is located in the east corner of the TSF at the TAN (Figure 4-18). It is designated as TSF-10 in the INEL IAs. The pond was built in the 1950s with the development of TAN/TSF. It is still in use today as a surface-water runoff detention basin. Its dimensions are approximately

300 feet by 250 feet by 8 feet deep and it is built directly into the ground without a liner.

As a surface-runoff control structure, the pond has received drainage from the PM-2A area, TSF Area 1, TSF acid pond, and the IET valve pit. The PM-2A area, discussed in Finding 4 of this section, is known to be radioactively contaminated and is also believed to be contaminated with metals such as mercury, lead, chromium, and barium. The TSF Area 1, TSF acid pond, and IET valve pit have been described above in the TAN/TSF acid pond discussion. The constituents contaminating these four sites have had the potential to run off into the TAN/TSF drainage pond. Two discharge pipes, one from the PM-2A area and one from the acid pond and Area 1, enter the east corner of the TAN/TSF drainage pond. This area of the pond appears to be the lowest in elevation since, during the Survey, it was moist and contained water-tolerant plants. Thus, the soil in this section would have the highest potential for being contaminated. Volumes of contaminants discharged into the pond and their concentrations are unknown although elevated levels of radioactivity have been reported throughout the pond.

Since the pond still receives surface runoff, there is a driving force to move the contaminants into the subsurface, as discussed in the introduction to this finding. The Snake River Plain aquifer is separated from the drainage pond by about 206 feet of alternating layers of alluvium and basalt. During the Sampling and Analysis phase of the Survey, bottom sediments and subsurface soils from the eastern portion of the drainage pond will be sampled and analyzed to determine the presence and movement of contaminants.

TRA Paint Shop Ditch

The TRA Paint Shop Ditch is located 30 feet west of MTR-662 in the TRA, as shown on Figure 4-19. It is designated TRA-02 for the purposes of the INEL IAs. The ditch was used as a disposal area from some time in the early 1950s through 1982. This ditch is 70 feet long by approximately 6 feet wide. This relatively shallow (2-foot deep) ditch appears to have been used for stormwater runoff collection from the adjacent roadway; however, the nearby Paint Shop (in MTR-662) also made use of the ditch for disposal of Paint

Shop wastes. This shop provided the protective coating service to TRA. Common practice during the years of its service was to dispose of excess paints, spent thinners, and solvents outside the shop into the ditch where they were allowed to seep into the ground. Volumes of these liquids are unknown due to the intermittent nature of disposal. However, due to the constituents received in the ditch and the function of the ditch for collection of stormwater runoff, the subsurface soils may be contaminated. The potential for contaminant migration toward the perched aquifer underlying TRA and the Snake River Plain aquifer, as discussed in the Introduction to this finding, is also of concern.

In July 1987 the site contractor conducted a characterization study of this LDU. Two 3-foot-deep test trenches approximately 15 to 20 feet long were excavated transecting the ditch. The trenches stratification characteristics were descriptively logged and eight samples were collected for RCRA Appendix VIII constituents analysis. At the time of the Environmental Survey, the results were still pending.

CFA Pond

The CFA Pond (CFA-674) is located on the southern side of the CFA, southeast of CFA-674 (Figure 4-21). It is designated CFA-04 in the INEL IAs. The pond is approximately 300 feet by 150 feet by 6 feet and is built directly into the ground with no liner.

Wastewater was discharged from CFA-674, which was used as a pilot plant for fuel processing, through an underground pipe directly into the pond. Although there are no records of wastes that went into the pond, it is suspected that the discharges were typical of fuel processing pilot plant operations. During 1954 through 1956, experiments were being conducted on extraction dissolution processes. During this period, effluents totaling 1,320 gallons and containing corrosives, mercury, and natural uranium were estimated to have been discharged. From 1956 through 1965, experiments were being conducted on the calciner process. During this period, an unknown volume (possibly 650 gallons per year) of wastewater was discharged and probably consisted of mercury, natural uranium, zirconium,

and small amounts of lab chemicals. Radioactive contamination has also been reported due to a spill adjacent to CFA-674 and to the natural uranium in the wastewater discharged to the pond. Radioactively contaminated soil in the pond was removed and, although past radiological studies showed minor activity, more recent studies have detected none.

The pond has been abandoned since 1965 but is still present. Runoff from the area surrounding the pond presently flows to the low portion of the pond and percolates into the soil. Thus, a driving force to move any soil contaminants downward through the subsurface environment toward the Snake River Plain aquifer, as described in the introduction to this finding, is present. The subsurface consists of alternating layers of basalt and alluvium; the Snake River Plain aquifer is about 485 feet below the surface.

CFA Motor Pool Pond

The CFA Motor Pool Pond lies within a borrow pit along Ogden Avenue to the east of the CFA and immediately east of parking lot 12 (Figure 4-21). It is designated as CFA-05 in the INEL IAs. The pond is approximately 75 feet by 60 feet with a 600-foot-long connecting ditch. From 1951 to 1983, the pond received effluents from the Equipment Repair Building (CFA-665) and the Service Station (CFA-664). In mid-1983, flow to the pond was diverted to the CFA Sewage Treatment Plant.

Wastewater discharged to the Motor Pool Pond contained unknown quantities of oils, grease, solvents, dioctyl phthalate, and radioactivity and an estimated 15,000 gallons of battery acid (sulfuric acid). Results of water and sediment samples taken from the pond in 1982 are presented in Table 4-34. Several constituents of concern were identified in the pond sediments but were below cleanup action levels. Past radiological studies of the pond have at times indicated contamination, but recent studies have yielded negative results. Although there is no apparent concern for inorganic and radioactive contamination, based on analytical results, organics have not been sampled to date.

TABLE 4-34

**WATER AND SEDIMENT ANALYSIS FOR CFA MOTOR POOL POND
SEPTEMBER 1982**

Metals	Water ($\mu\text{g/L}$)	Sediment ($\mu\text{g/g}$)
Aluminum	BDL ^a	192.0
Chromium	BDL	8.2
Barium	BDL	72.5
Cadmium	BDL	1.2
Cobalt	BDL	2.0
Copper	BDL	21.7
Iron	875	3416.7
Lead	BDL	7.5
Nickel	BDL	8.3
Manganese	115	70.0
Zinc	BDL	83.3
Boron	450	37.5
Ions	(mg/L)	Sediment ($\mu\text{g/g}$)
Chlorides	330	NA ^b
Nitrate-N	0.2	NA
Sulfate	30	NA
Organics	($\mu\text{g/L}$)	($\mu\text{g/kg}$)
Diethyl phthalate	6	4000
PCB-1016	BDL	170

Source: EG&G Idaho, Inc., 1986b

a. BDL below detection limit.

b. NA not analyzed.

The pond still receives water from surface drainage, as evidenced by the moist soil and water-tolerant plants. Thus, a driving force to move any contaminants through the subsurface environment, as described in the introduction to this finding, is present. The Snake River Plain aquifer is about 485 feet below the surface. The subsurface consists of alternating layers of basalt and alluvium.

During the Sampling and Analysis phase of the Survey, surface and subsurface soils from the pond will be sampled and analyzed to determine the presence and movement of organics.

CFA Fire Training Area, Bermed

The bermed area at the CFA Fire Training Area was located off of the northwest corner of the Fire Training Area asphalt pad. The facility is actually located 5 miles north of the CFA (Figure 2-3), but is the responsibility of the CFA facility landlord. This site is designated CFA-17 in the INEL IAs. It consisted of a 30-foot by 50-foot earthen-bermed pond with no liner, and was recently graded over.

From 1979 to 1987, the pond received discharge from a fire training tank that contained waste oils used for making fires. The waste oils were monitored such that no hazardous wastes were included. After fire training drills, which the contents of the tank were set afire and water was used to douse the fire, the solids in the tank would be allowed to settle out and the residual oils would be allowed to float to the surface. Then, usually once a week from May to October, the water would be drained through an oil separator and out to the pond. The final effluent may have had residual waste oil contamination; an estimated total of 130,000 gallons of effluent may have been discharged to the pond.

The potential pathway of contaminant migration at this site is downward through the unsaturated zone toward the groundwater approximately 500 feet below the surface. However, the driving force is presently limited to precipitation recharge.

ARA-III Waste Leach Pond

This inactive site is located across Fillmore Boulevard (west) from the ARA-III facility (Figure 4-22). For the purposes of the INEL IAs, this site is designated ARA-12. The dimensions of the pond are approximately 300 feet by 50 feet. It received low-level radioactively contaminated water during the operation of the Gas Cooled Reactor Experiment (GCRE) and Mobile Low (ML) Power Reactor Experiment from 1960 to 1965. Also, during operation of the GCRE from February 1960 through April 1961, a small amount of low-level radioactive material was released into a portion of the closed-loop cooling water system. The contamination was significantly diluted by large amounts of cooling water. This water was collected in a 75,000-gallon low-level wastewater storage tank, sampled, and then drained into the leach pond. During operation of the ML reactor from April 1964 to September 1965, several leaks occurred which resulted in radioactive silver (Ag-108) being released to the pond.

The volume of contaminants released to the pond is unknown. However, soil samples taken from the edge of the pond in 1985 contained elevated levels of chromium, probably from cooling tower discharges, cesium-137, cobalt-60, and silver-108 (Table 4-35). Activity of cesium-137 was found to range from 0.84 to 4.1 pCi/g; ambient is 0.9 pCi/g.

Although use of the ponds was discontinued in 1965, a small amount of water, probably from leakage of potable water from ARA-III buildings, still flowed into the pond until very recently. The sediment is still moist and water-tolerant plants are still present although dying off. Thus, there has been a driving force potentially moving contaminants through the subsurface environment, as described in the introduction to this finding. The Snake River Plain aquifer is approximately 450 feet below the surface.

PBF/SPERT-IV Leach Pond

The SPERT-IV Leach Pond is located 250 feet south of the old reactor building PBF-613 (Figure 4-26). It is designated PBF-22 in the INEL IAs. The pond, which

TABLE 4-35

RESULTS OF ARA-III POND 1985 SEDIMENT ANALYSIS

Parameter	Concentration (mg/kg)	Activity (pCi/g)
Antimony	< 10.0	--
Arsenic	2.4	--
Beryllium	1.0	--
Cadmium	0.6	--
Chromium	7.0	--
Copper	19.0	--
Lead	3.4	--
Mercury	< 0.005	--
Nickel	14.0	--
Selenium	< 0.2	--
Silver	< 2.0	--
Silver (108)	--	1.9 - 6.8
Thallium	< 2.0	--
Zinc	76.0	--
Boron	< 30.0	--
Chloride	< 20.0	--
Cyanide	< 0.2	--
Nitrogen (Nitrate)	5.0	--
Sulfate	< 50.0	--
Phenol	< 0.5	--
Cobalt (60)	--	3.1 - 36.9
Cesium (137)	--	0.84 - 4.1

Source: EG&G Idaho, Inc., 1986b

also includes an aboveground radioactive decay tank, has dimensions of approximately 150 feet by 180 feet. Its reported capacity is 428,000 gallons. This percolation pond received an unknown volume of warm wastewater from the decay tank during the SPERT-IV reactor experiments from 1961 to 1970. Irradiated cooling waters from the reactor were first discharged to the 61,000-gallon aboveground tank where radioactivity was allowed to decay to unspecified "safe levels" prior to discharge to the leach pond. Demineralizer regenerant wastes were also disposed of into this pond. These included corrosives such as sulfuric acid and sodium hydroxide and possibly leached metals. The site contractor has estimated that the total amount of acids and bases released to the pond was 18,000 kg. Volumes of metals leached from the demineralizer are unknown. The INEL IAR acknowledges that as recently as 1982, this pond was utilized for a short period for disposal of liquid wastes. This occurred when the ICPP was unable to accept wastes from the PBF. The contaminated soils were reportedly excavated and disposed of at the RWMC.

The pathway of potential contaminant migration at this site is downward through the unsaturated zone toward the Snake River Plain aquifer approximately 450 feet below the surface as described in the introduction to this finding. The driving force was provided by the liquid effluents and, since abandonment, local precipitation recharge. The Leach Pond underwent a characterization study in 1985. Extensive radioactivity monitoring was performed utilizing a Geiger counter. Limited soil sampling was performed. The one soil sample that was collected for analysis of chemical constituents contained chromium (5.3 mg/kg) and lead (13 mg/kg). Decontamination and decommissioning of this surface percolation unit is scheduled for 1989.

PBF/SPERT-IV-Lake

The SPERT-IV Lake is located approximately 500 to 600 feet south of the old reactor building PBF-613 (Figure 4-23). It is designated PBF-26 in the INEL IAs. The lake is approximately 110 yards in diameter and 4 feet deep. The engineered capacity is 6 million gallons. This percolation unit received an unknown volume of nonradioactive wastewater during the SPERT-IV reactor experiments from 1961 to 1970. This unit also received nonradioactive cooling water that had passed through a heat exchanger. Precautions were taken to

avoid irradiation of this cooling water via radiation monitor alarm systems. If a radiation leak occurred, then the contaminated water was diverted to the decay tank/leach pond system previously mentioned. It is not known whether the cooling waters contained chromates or other corrosion control products. During a short period in 1985, the lake received effluent from the mock-up TMI core drilling tests. This was part of the TMI Core Stratification Sampling Process Project. It is not known what constituents this effluent may have contributed to the lake.

The pathway of potential contaminant migration at this site is downward through the unsaturated zone toward the Snake River Plain aquifer approximately 450 feet below the surface as described in the introduction to this finding. The driving force was provided by the liquid effluents and, since abandonment, local precipitation recharge. The site has not conducted a characterization study of the SPERT-IV Lake although a spot-check for radioactivity was done during a SPERT-IV ancillary facilities' characterization. Two soil samples indicated no radioactivity above background levels. The presence of inorganic contaminants in the unsaturated zone soils will be determined during the Sampling and Analysis phase of the Environmental Survey.

ICPP Gravel Pits #1 and #2

The two gravel pits are located near the northeast corner of the ICPP; pit 1 is located outside the security fence while pit 2 is located inside (Figure 4-27). For the purposes of the INEL IAs, these sites are designated CPP-37. Pit 1 was first used for a 4-month period in late 1982 and early 1983. At that time, it received approximately 1 to 2 million gallons per day of service water wastes while the injection well was being relined. Possible constituents in the service water waste and their concentrations are provided in Table 4-31. During July through September, 1983, pit 1 was also used as a decontamination area for radioactively contaminated construction equipment. However, the pit has since undergone radioactive decontamination. It has also been reported that miscellaneous chemicals were disposed of into pit 1. This pit is still present, with dimensions of 100 feet by 100 feet by 16 feet deep, and is used for surface runoff control.

Before September 1982, pit 2 was used to contain the outfall from the old ICPP Sewage Treatment Plant; volume was estimated at 60,000 gallons per day. The discharge included water from personnel decontamination showers. After September 1982, the pit was used to landfill construction equipment and debris, some of which may have been radioactively contaminated. There are also reports that spent solvents and acids were disposed of into pit 2, but volumes are unknown. The size of pit 2 is not known although it was apparently enlarged to receive debris. It has since been filled in and graded to the surrounding topography.

Based on the use of these gravel pits, there is the potential that contaminants, including those listed in Table 4-31, may have been released into the soil. The use of pit 1 for surface runoff may provide a driving force for the migration of pollutants toward the groundwater, 450 feet below the ground surface. During the Sampling and Analysis phase of the Survey, soils from beneath or directly next to gravel pit 1 will be sampled and analyzed to determine the presence and movement of contaminants.

Grease Pit South of CPP-608

This inactive grease pit is located near the eastern boundary of the ICPP midway between the north and south boundaries (Figure 4-27). For the purposes of the INEL IAs, the site is designated CPP-44. The 50-foot by 20-foot pit was used before 1980 to service vehicles. As such, it received oils and grease. There have been unconfirmed reports that solvents and acids may also have been poured into the pit. However, there are no records as to the amounts of materials discharged into the pit.

The pit was filled in before 1980 and, presently, native soil covers the area. Site plans indicate that the pit may have been cement-lined but contained an unlined sump. Soil contamination is of major concern; there has been little driving force to pose a threat to the perched and Snake River Plain aquifers.

ANL-W Abandoned Drainage Ditch

An abandoned ditch, which has been filled in, ran along the western boundary of ANL-W (Figure 4-28). This site represents a portion of the INEL IA ANL-01. The ditch was approximately 1,200 feet long by 6 feet wide by 4 feet deep and was constructed around 1959 to convey industrial wastewater to the industrial wastewater pond. Specifically, this ditch carried cooling tower blowdown containing chromates; industrial wastewater containing diethylamine, dimethylformamide, methylene bis thioisocyanate, bis (trichloromethyl) sulfone; corrosives from demineralizer regeneration; and water from HFEF/S and the Laboratory and Office building.

When the EBR-II reactor began operating in 1963, much of this water, as well as radioactive wastewater, was routed to the EBR-II leach pit through a valve pit. Within 6 months, however, the cooling water blowdown, demineralizer water, and industrial wastewater were diverted within the valve pit directly to the drainage ditch. Around 1971, the valve pit was bypassed and the effluent was discharged directly to the ditch. In 1977, as a result of a security upgrade, the drainage ditch was filled and the effluent was rerouted to the presently active drainage ditch (Section 4.1).

The volume of liquids or contaminants that were conveyed through the abandoned drainage ditch is unknown. However, chromium is known to have been present in the effluents that flowed exclusively through the drainage ditches to the pond, and has been detected in the active industrial waste pond (Section 4.1). It is therefore expected to be present in the bottom sediment of the abandoned ditch. Only minor downward movement of contaminants through the unsaturated zone is expected because the only vertical driving force since use of the ditch ceased has been precipitation recharge. To characterize whether pollutants are present in the subsurface environment, soils at the abandoned drainage ditch will be sampled and analyzed for various constituents, particularly chromium, during the Sampling and Analysis phase of the Survey.

BORAX II-V Leach Pond

The BORAX II-V leach pond is located on the southeast side of the BORAX facility (Figure 4-31). It is designated BORAX-05 in the INEL IAs. The pond was 20 feet by 90 feet by 1 to 3 feet deep but was filled in during D&D operations in 1984. Its location is now marked with a stone monument.

Radioactive liquid wastes were directed through a carbon steel pipe to the leaching pond during BORAX III and IV experiments from 1955 to 1958. Nonradioactive liquid wastes, comprised primarily of cooling tower blowdown containing chromates and ion exchange regenerants (sulfuric acid and sodium hydroxide) were discharged through a carbon steel pipe to the pond during BORAX III, IV, and V experiments from 1955 to 1964. It is estimated that 454 kg/yr each of sulfuric acid and sodium hydroxide were discharged to the leach pond from 1955 to 1964, 90.8 kg/yr of boric acid from 1955 to 1964, 0.095 kg/yr of morpholine in 1957 and an unknown amount of chromates from cooling tower blowdown and other metals such as iron, chromium, and nickel, as corrosion products. In addition, PCBs were used during the BORAX experiments.

A radiological study of the pond conducted in 1982 indicated that radioactive contamination was greatest in a layer of soil 1 to 3 feet below the surface. During the radiological study, three trenches were dug: Trench C, 15 feet downstream of the pipe outlet; Trench A, 25 feet downstream of the pipe outlet; and Trench B, 55 feet downstream of the pipe outlet. Elevated levels of cesium-137 were found in all trenches between 2 and 3 feet: 175.0 ± 1.9 pCi/g and 32.3 ± 0.8 pCi/g at 24 and 30 inches, respectively, in Trench A, 70 ± 1 pCi/g at 30 inches in Trench B, and 36 ± 1 pCi/g and 2.8 pCi/g at 2 feet and 8 feet, respectively, in Trench C. Background cesium-137 at the INEL is 0.94 ± 1.2 pCi/g (Crews, 1982).

In 1984, the pond basin was backfilled with approximately 10,800 ft³ of topsoil, graded to match the surrounding terrain, planted with grasses, and marked. Since operation of the facility ceased in 1964, the only driving force to move contaminants downward has been precipitation recharge. To characterize chemical contaminants potentially contributed through the leach

pond and their potential for migration, soils beneath the former pond will be sampled and analyzed for metals and PCBs during the Sampling and Analysis phase of the Survey.

OMRE Leach Pond

The former OMRE Leach Pond is located in a field east of the EOCR facility (Figure 4-32). It is designated OMRE-01 in the INEL IAs. The pond was 26 feet by 72 feet with a slope to the pond base; the base of the pond was 16 feet by 50 feet and was 1 to 1.5 feet above the basalt. It was filled in during D&D operations in 1978 and 1979.

The OMRE reactor achieved criticality in September 1957, and was shut down in 1963. Liquid effluents were discharged to the leach pond during this period although records exist only for 1959 to 1963. During the period of record, 132,100 gallons of radioactive liquids were discharged to the pond, containing 2,353 mCi of various nuclides including manganese-54, iron-59, zirconium-95, niobium-95, ruthenium-103, cerium-141 to 144, iodine-129, strontium-90, samarium-90, iodine-131, rhodium-106, strontium-89, and cesium-137. Additionally, two radioactive liquid discharges, totaling 0.4 mCi in 0.7 gallons, were recorded as being discharged to a ditch outside OMRE. Another radioactive discharge consisting of 0.9 mCi in 6,000 gallons was reported as being released to a trench. The locations of the ditch and trench are unknown. In 1960, three releases totaling 355 gallons and consisting of xylene and possibly other organics including mono- and polyaromatic hydrocarbons, were reported. In 1961, 15,000 gallons of nonradioactive cooling water was released to the leach pond.

A radiological study of the pond, conducted in 1979, indicated that radioactive contamination was present throughout the sediment underlying the leach pond but was greatest on the surface of the basalt. Activity was due mainly to cesium-137, cobalt-60, strontium-90, and europium-152. Cesium-137 activities were found to range from 1 pCi/g at the pond surface to 1,000 pCi/g at the basalt surface; background is 0.94 pCi/g (Chapin, 1979).

During D&D of the OMRE facility, all "highly [radioactively] contaminated" sediment was removed and the area backfilled with clean soil (Hine, 1980). To characterize any chemical contaminants that may remain in the leach pond area, soils underlying the pond will be sampled and analyzed for volatile and semi-volatile organics during the Sampling and Analysis phase of the Survey.

LCCDA Pits #1 and #2

The LCCDA is located along the south side of the access road to the RWMC facility (Figure 2-3). It is one-quarter mile east of the stormwater control box culvert fronting the RWMC. There were two disposal seepage pits associated with the LCCDA. INEL has designated them LCCDA-01 and -02 for the purpose of the IAs. LCCDA-01 was used for liquid disposal from 1961 through 1974. LCCDA-02 was utilized from 1972 until 1980. The exact dimensions of these pits are unknown; estimates were made based on the disturbed vegetation (perhaps due to previous site activity) seen during the Environmental Survey. It appears that LCCDA-01 was a minimum of 35 feet by 35 feet. LCCDA-02 is estimated to have been larger, measuring 100 feet by 70 feet. Depths of each are unknown but were probably on the order of 5 to 10 feet deep. LCCDA-02 was lined with limestone fragments to neutralize the acids prior to their percolating into the ground.

The disposal practice was to transport accumulated liquid chemicals to this remote location for disposal. Tanker trucks and drummed liquids were emptied into these pits. Reportedly liquid wastes were limited to acids and bases. However, the potential exists that other chemical wastes, including organics, were disposed of at this remote location. The INEL estimates that 2,675 gallons of acids and 92 pounds of bases were disposed of at each of the seepage pits. Quantities of other liquid waste chemicals are not known.

The pits' condition, as observed during the Environmental Survey, indicated closure or partial closure activities had been performed. No records of D&D or sampling were available. Both pits were infilled with soil and leveled to ground surface. Partial stirring of any bottoms or sludge during the closure may have occurred because limestone fragments (cobble-sized) are present on the surface at LCCDA-02.

The past disposal practices at these two seepage pits has likely caused contaminants to migrate into the unsaturated zone. Since no data have been reported for these sites, the Sampling and Analysis phase of the Survey will include subsurface soil sampling and soil gas analysis to determine the presence of contaminants in the soil.

3. Potential chemical contamination from inactive landfills and surface storage areas. Inactive landfills and surface storage areas at the INEL were operated in such a manner that the chemical wastes they potentially received may be a source of contamination to the unsaturated zone and groundwater.

Approximately 33 inactive landfills and surface storage areas have been identified at the INEL. These sites were evaluated based on their use and design and the volumes and types of wastes they are known or suspected to have received. As a result, the 10 sites listed below were noted to be of particular environmental concern.

- Unknown Burial Pit S of TAN/LOFT Disposal Pond
- TAN/WRRTF Burn Pit
- TAN/TSF Burn Pit
- TRA Suspect Burial Area East of West Road Rubble Pile Site
- CFA Landfill I
- CFA Landfill II
- CFA Lead Shop Outside Storage
- Disposal Pit/Burial Area North of PBF Reactor
- ANL Open Burn Pits 1, 2, and 3
- BORAX Trash Dump

These sites did not have any engineered containment systems such as liners or caps. Additionally, there was little control over chemical wastes that were disposed of into them. As a result, precipitation and surface runoff may be migrating through the wastes and contaminants may be leaching into the subsurface environment.

Downward migration through the unsaturated zone toward perched groundwater or the Snake River Plain aquifer may be occurring due to hydrogeological driving forces and precipitation recharge of the aquifer, interacting with the contaminants in and beneath the inactive landfills and surface storage areas. Hydraulic head (pressure), now caused by infiltration of precipitation, and tensional and gravity seepage may be driving the leachate down through the surficial soil layer (usually less than 30 feet thick) and into the fissures of the basalt. Once in the basalt, contaminant migration would be governed by the orientation and interconnection of the fissures and cracks, which would provide channels for contaminant movement. The presence of alluvial zones (unconsolidated sediments of sands, silts, and clays) between basalt sequences may be serving as semipermeable, impermeable, or permeable zones that could retard flow, redirect contaminant migration, or result in contamination of a perched aquifer, if present. Eventually, with sufficient hydraulic force, the contaminants could reach the Snake River Plain aquifer. This aquifer flows to the southwest, and is the source of potable and irrigation water at the INEL and off-site. A discussion of contaminant presence in the groundwater is presented in Section 3.4.

The following paragraphs provide specific information on each of these sites.

Unknown Burial Pit South of TAN/LOFT Disposal Pond

A burial pit is located on the outskirts of the TAN/LOFT Area, approximately 100 feet southwest of the LOFT wastewater pond (LOFT-ES01 in Figure 4-15). The pit's history or disposal practices are unrecorded. The pit, as observed during the Survey, was relatively shallow, approximately 3 feet deep, and rectangular in shape. The dimensions were 15 feet by 20 feet long. The possibility exists that this is only the exposed portion of a larger burial site, because the surrounding surface area appeared disturbed and was sparsely vegetated.

The pit was observed to contain miscellaneous debris such as scattered wood and copper wire. Indications of past waste disposal included numerous old rusted paint cans and a partially crushed 30-gallon drum. These items were partially buried.

Based on the unknown disposal practices and possibility of more widespread burial at this site, the potential exists that contaminants may have been and may continue to be released to the soil. Downward driving forces are limited to precipitation recharge.

TAN/WRRTF Burn Pit

The WRRTF burn pit is located 0.5 mile east of the TAN/WRRTF along a small dirt road that runs north-south between the TAN/WRRTF and Highway 33 (Figure 4-17). For the purposes of the INEL IAs, this site is designated WRRTF-01. The site initially consisted of three pits that operated from 1958 to 1966 or 1967. They were side by side and had dimensions of 20 feet by 200 feet, 40 feet by 200 feet, and 50 feet by 250 feet. In 1961 or 1962, a fourth smaller waste oil pit was dug. This waste oil pit was 30 feet by 50 feet by 1.5 feet deep.

The initial three pits were operated as cut-and-fill landfills. Each time wastes were disposed of into the pits, they were burned. As a pit began to fill with rubble and ash, it was covered and another pit was opened. The burn pits took all garbage and burnable debris generated at the entire TAN area. No records were kept of the material disposed of at the landfill but it is suspected that waste fuel oils from boiler operations, waste oil from equipment maintenance, zinc bromide from hot shop windows and the alcohol used to clean it out, and waste Stoddard solvent from parts cleaning also went into the initial three pits until 1961 or 1962. After that time, all waste oils reportedly went into the waste oil pit. Waste oils may have included hydraulic fluids, which may have contained PCBs. When combusted, PCBs can form dioxins. It is estimated that 250 gallons of waste oil and Stoddard solvent were generated each year from the auto mechanics shop at TSF, but it is unknown how much was disposed of into the pits and how much remained after burning. Janitorial cleaning materials may also have gone into the pits but there is no evidence of significant chemical wastes being disposed of.

Presently, the burn pits have been covered with native topsoil although two 100-foot-long by 30-foot-wide depressions are apparent where material has settled. Based on the use of these burn pits and the fact that there is

insufficient capping (uncompacted topsoil) and no lining to prevent leaching into the subsurface, there is the potential that contaminants may be released into the subsurface, as described in the introduction to this finding. The surface of the Snake River Plain aquifer is 206 feet below the ground surface, although the only downward driving force, since the pits no longer receive liquid wastes, has been infiltration of precipitation. To determine whether contaminants are present in the subsurface and are migrating, soils from the burn pit area will be sampled and analyzed for a wide variety of constituents during the Sampling and Analysis phase of the Survey.

TAN/TSF Burn Pit

The precise location of the TAN/TSF burn pit is uncertain although it was situated approximately 350 feet outside the northeast fence of the TAN/TSF (Figure 4-18). This site is designated TSF-03 in the INEL IAs. The TAN/TSF burn pit operated from about 1953 to 1958 and took all garbage and burnable debris from the TAN area. This burn pit preceded the TAN/WRRTF burn pit described above and was probably constructed and operated in a similar manner. It is suspected that up to 250 gallons per year of waste oils and solvents (Stoddard solvent) from vehicle maintenance activities went into the pit. Small quantities of other unspecified hazardous materials may also have been disposed of, but there are no records of this activity. The normal operating practice was to burn every time materials were dumped.

Presently, the area in which the burn pit is believed to have been situated is completely graded and vegetated in grasses, and there is no obvious surface evidence of the pit. In addition, inspection of 1954 aerial photography gave no indication as to the location of the burn pit. However, based on reports of the use and design of the burn pit, there is a potential for the contaminants released into the pit to migrate into the subsurface environment, as described in the introduction to this finding. However, the only downward driving force, since the pits no longer receive liquid wastes, has been infiltration of precipitation.

TRA Suspect Burial Site East of West Road Rubble Pile Site

A possible landfill/burial site is situated west of the Beta warehouse buildings outside of the TRA fenced area (TRA-ES01 in Figure 4-20). Whether this area was previously used as a landfill is unknown. The indications of past burial practices are a crescent-shaped area approximately 200 feet long and 150 feet wide (from base to tips). The lengthwise portion of the crescent is oriented approximately east-west. This area is 75 feet west of the fenceline.

This area is slightly depressed, indicating possible differential settlement of fill materials. The settled area is sparsely vegetated and is randomly covered with small pieces of wood fragments.

The possibility exists that this site was a former burial site or possibly a staging area. If either case exists, contaminants may be migrating into the subsurface environment, as described in the introduction to this finding. However, the only downward driving force has been infiltration of precipitation.

CFA Landfills I and II

The original CFA landfill, which operated from 1951 or possibly from the early 1940s, during the Navy use of CFA, to 1970 is located on West Portland Avenue, one-quarter mile west of CFA. Landfill II operated from 1970 to 1982 and was located on the north side of the CFA, east of Lincoln Boulevard (Figure 4-21). For the purposes of the INEL IAs, these sites are designated CFA-01 and CFA-02, respectively. They were operated as cut-and-fill although it is believed that portions of the landfills were located in gravel pits.

Little is known about the operation of the CFA Landfill I. Its size is uncertain but may have been 10 acres. An incinerator was reportedly used until the early 1960s to burn cold waste and the ash was disposed of into the landfill. A concrete pit measuring 60 feet by 60 feet, sloping down 6 feet to 30 feet by 30 feet was found during the Survey and was believed to have underlain the incinerator and received ash. An inscription in the concrete indicated it was poured on April 2, 1943. According to two long-term employees (Bischoff, 1987; Peterson, 1987), the first part of the landfill was a borrow pit and

received mainly construction debris and ash from the incinerator. Trenches were developed later that received mainly incinerator ash, construction debris, and paper. The materials disposed of were then covered with soil. Presently, Landfill I is covered with soil, graded to surrounding topography and vegetated.

The CFA Landfill II occupied an approximately 10-acre portion of a 37-acre gravel pit. Portions of the landfill were operated as cut-and-fill while in other portions, debris, mainly from construction, was dumped into the excavated gravel pit. Hazardous wastes were generally accepted on a case-by-case basis. They were disposed of by excavating a hole deeper than the trench at the working face. The wastes were put in the hole and, through normal landfill operations, 8 to 15 feet of ordinary wastes were placed on top. A portion of Landfill II is still used for disposal of bulky wastes (e.g., construction debris), although the portion that received garbage is covered with soil and vegetated.

There were always tight controls on the receiving of radioactive materials at the landfills but few controls on receiving chemically hazardous materials. Materials came from all facilities except the TAN, which utilized the TAN/TSF and TAN/WRRTF burn pits described above. After 1967, when the TAN/WRRTF burn pit was abandoned, garbage from the TAN was disposed of at the CFA landfills. There are no records on the volumes of materials that went into the CFA Landfills before 1971. However, volumes can be inferred from amounts generated at various facilities and, after 1971, from records kept in the Industrial Waste Management Information System; it can be assumed that similar materials were buried from 1951 to 1971. Table 4-36 lists wastes assumed to have been disposed of into the landfills and estimates of their volumes. Some waste oils, such as hydraulic fluids, may have contained PCBs. It has been reported anecdotally that pesticides were also disposed of into the landfills. It is assumed that the total quantity of hazardous materials reaching the landfills was between 5,500 and 8,250 gallons per year.

Based on the use and design of the landfills and the materials they received, there is the potential that contaminants may be released into the soils. Because of inadequate capping and lining, contaminants may be leaching and

TABLE 4-36

WASTES DISPOSED OF INTO THE CFA LANDFILLS^a1. Estimates based on generator production^b.

Date	Materials	Volume	Source
1950-1983	Waste paint/paint thinners	50 gal/yr	CFA paint shop
1951-1985	Waste paint/paint thinners	132 gal/yr	CFA Equipment Repair Building
1970-1984	TCE vapor degreasing bottoms	550 gal/yr	CFA Equipment Repair Building
1951-?	Asbestos (brake linings)	Unknown	CFA Auto Maintenance
1961-1978	Waste thinners/solvents	30 gal/yr	ANL-W
1968-1985	Acetone	1 gal/yr	ANL-W
1968-1985	Freon TF	1 gal/yr	ANL-W
1968-1985	Stoddard solvent	1 gal/yr	ANL-W
1978-1983	Paint stripping solvents	10 gal/yr	ANL-W

2. Estimates from Industrial Waste Management Information System (from 1971 to 1986)^c

Paints & Thinners, Solvents	Volume
Paint thinner	106 gal
Paint	612 gal
Solvents	55 gal
Chemicals	Volume
Methylene dithiocyanate	50 lb
Carbon tetrachloride	0.5 gal
Boric acid	61 gal
Sulfuric acid	60 gal
Ether	1 gal
Ethylene glycol	827 gal
Calcium hypochlorite	160 lb
Misc. chemicals	4824.3 lb
Heavy Metals	Volume
Chromate solution	55,682 gal
Chromates	605 lb
Mercury	5 lb
Air Contaminants	Volume
Beryllium chips	0.7 ft ³
Beryllium oxide	35.3 ft ³
Asbestos	43,243 ft ³

TABLE 4-36

**WASTES DISPOSED OF INTO THE CFA
LANDFILLS^a (Continued)**

Petroleum by-products	Volume
Oil cans	13.5 ft ³
Waste oil sludge	8,122 gal
Fuel oil saturated dirt	29 yd ³
Other used oil	4 gal
Other	Volume
Resins	203.8 ft ³
Resins	38,768 lb
Boxed (unknown) hazardous material	38 yd ³

- a Landfill I operated from 1951 to 1970, Landfill II from 1970 to 1982.
- b Source: EG&G Idaho, Inc., 1986b.
- c Source: Saint Louis, 1987

migrating downward, as described in the introduction to this finding. The surface of the Snake River Plain aquifer is about 485 feet below the surface, although downward driving force is limited to infiltration of precipitation. To determine the presence and movement of contaminants in the subsurface, soils underneath and around the landfills will be sampled and analyzed for a wide range of chemicals during the Sampling and Analysis phase of the Survey.

CFA Lead Shop-Outside Storage

A lead shop (Building CFA-687) is located on the north side of the CFA (Figure 4-21, Site CFA-06). From 1953 to 1987, lead materials and scraps, including sheeting and bricks, were stored outside on the grounds surrounding this 35-foot by 90-foot building. In spring 1987, much of the larger material was removed but during the Survey, numerous lead snags were noted on the ground, especially north of the building. One soil sample was taken in this area in February 1987, and leachable lead was measured at a concentration of 105 mg/L. The EPA standard for lead as a hazardous waste is 5 mg/L leachable. The area north of the building is in a slight depression. Water may drain into this plot, thus providing the driving force for the migration of lead further into the subsurface. Lead is relatively immobile in soils and therefore contamination may be restricted to shallow soil layers. No further analyses are planned during the Survey.

Disposal Pit/Burial Area North of PBF Reactor

A disposal pit that may be part of a larger, more extensive disposal site is located 600 feet north of the PBF Reactor Building (Figure 4-23, Site PBF-ES01). The pit's history is unrecorded and unknown by PBF personnel. The pit is situated in the central edge of a much larger rubble pile site which blends into the surrounding sagebrush-covered desert. The rubble pile is similar to the ones at the TRA.

The disposal practice appears to have been that trucked wastes were dumped over the edge into the pit. This is indicated by the presence of a concrete tire-stop running along the length of the pit's south rim. The pit's dimensions are approximately 70 feet long by 45 feet wide and it has a depth of 10 feet. The

pit contained two open 55-gallon drums, 24 5-gallon buckets, and 12 paint cans. All of these were partially crushed and rusted.

Since the pit is open and unlined, the potential exists that if contaminants are present, they may be leaching into the subsurface environment, as discussed in the introduction to this finding. The Snake River Plain aquifer is approximately 450 feet below the surface although downward driving force is limited to infiltration of precipitation. Soils will be sampled during the Sampling and Analysis phase of the Survey to determine if contaminants are present.

ANL-W Open Burn Pits 1, 2, and 3

Three burn pits are located at the ANL-W, two side by side about 300 feet north of the north outer fence (Pits 2 and 3) and one between the security fences on the north side (Pit 1) (Figure 4-28). For the purposes of the INEL IAs, these sites have been collectively designated ANL-05. They may have been used as early as 1960 although it is definitely known that they were in use in 1965. Use was terminated in 1970, shortly before open burning was banned at the INEL.

The facility was operated as a cut-and-fill. Trenches were excavated and combustible wastes (paper, wood) burned. In addition, petroleum products (oil, hydraulic fluids) and organic wastes from analytical operations, including toluene, xylene, hexone, isopropyl alcohol, butylcellulose, tributylphosphate, and mineral oil, were disposed of into the burn pits. Hydraulic fluids may have contained PCBs which, when burned, can form dioxins. The organic wastes were collected in 5-gallon carboys and an estimated 150 gallons were discharged between 1965 and 1970. The volumes of other liquids disposed into the burn pits are unknown. Materials were dumped into the pit and burned the same day; it has been estimated from employee recollections that this occurred once per week. The pits were then covered with native soil.

The sizes of the pits are unknown but depressions where the waste and cover material has settled at Pits 2 and 3 are 6 feet wide and 60 to 90 feet long. Test pits have been dug across a portion of Pits 2 and 3. The materials begin at 2

feet below the surface and extend to 6 feet below. Plastic sheeting, steel wool, electric conduit with wires, metal pipe, cinder blocks, wood, scrap metal, and rubber gaskets and gloves were observed in the pits during the Survey. Based on the condition of these materials, it is concluded that some of the burns were incomplete.

Based on the use of these pits and the fact that there is insufficient capping and no lining to prevent leaching into the subsurface, there is the potential that contaminants may be released into the soil, as described in the introduction to this finding. The groundwater is approximately 600 feet below the ground surface. However, the only downward driving force, since the pits no longer receive liquid wastes, has been infiltration of precipitation. To determine the presence and movement of contaminants in the subsurface, soils from the burn pit area will be sampled and analyzed for organic and inorganic constituents during the Sampling and Analysis phase of the Survey.

BORAX Trash Dump

The BORAX trash dump is located on the northwest side of the BORAX Facility (Figure 4-31). It is designated BORAX-04 in the INEL IAs. The dump is estimated to be 240 feet by 120 feet by 6 feet deep and is situated on a steep but short slope. It was used for the disposal of construction debris during the original construction of the BORAX reactor in 1953 and during modifications to the reactor between experiments up until 1964. Asbestos is known to have been disposed of into the dump although the volumes are unknown. The landfill was not reported to have received other hazardous materials; however, it was probably loosely controlled with regard to chemical hazards.

Small quantities of hazardous chemicals, including corrosives, were used during BORAX operations. PCBs were probably used in turbine lubrication oil and transformer dielectric fluid, and solvents may have been used during metal fabrication. Lead pieces were observed throughout the BORAX Facility. It is possible that some of these contaminants may have been disposed of at the trash dump.

After activities at BORAX ceased, the asbestos was removed from the trash dump and disposed of at the CFA landfill. Presently, the trash dump is covered with soil and planted with crested wheatgrass. However, debris such as construction material, rubble, rebar, and tires is visible along the landfill edge. There is a potential for contaminants to be released into the environment, as discussed in the introduction to this finding, although the downward driving force has been limited to infiltration of precipitation. Soil samples will be taken from around the landfill and analyzed for organic and inorganic constituents during the Sampling and Analysis phase of the Survey.

4. Potential contamination of unsaturated zone and groundwater from significant spills and leaks. Several significant chemical, radioactive, and petroleum product spills and leaks have occurred at the INEL which have not been adequately cleaned up and have the potential to contaminate the unsaturated zone and groundwater.

Approximately 77 spills at the INEL have been identified in the IAs. Most are the result of line and tank failures, leaking valves and equipment, product transfer mishaps, and atmospheric releases. If not adequately cleaned up, and with sufficient volume and driving force, the constituents contained within the spilled material have the potential to migrate into the subsurface environment. Downward migration through the unsaturated zone toward perched groundwater or the Snake River Plain aquifer may be occurring due to hydrogeological driving forces and precipitation recharge of the aquifer, interacting with the spilled or leaked materials. Hydraulic head (pressure), now caused by infiltration of precipitation, and tensional and gravity seepage may be driving the spilled materials down through the surficial soil layer (usually less than 30 feet thick), and into the fissures of the basalt. Once in the basalt, contaminant migration would be governed by the orientation and interconnection of the fissures and cracks, which would provide channels for contaminant movement. The presence of alluvial zones (unconsolidated sediments of sands, silts, and clays) between basalt sequences may be serving as semipermeable, impermeable, or permeable zones that could retard flow, redirect contaminant migration, or result in contamination of a perched aquifer, if present. Eventually, with sufficient hydraulic force, the contaminants could reach the Snake River Plain aquifer. This aquifer flows to

the southwest, and is the source of potable and irrigation water at the INEL and off-site. A discussion of contaminant presence in groundwater is provided in Section 3.4.

Spills and leaks at the INEL were evaluated based on the types and volumes of known or suspected constituents, the degree of remediation, and any existing monitoring data. Fourteen were noted to be of particular environmental concern:

- TAN/LOFT Diesel Fuel Spill
- TAN/TSF Mercury Spills
- TAN/TSF Intermediate-Level Waste Disposal System
- TAN/TSF PM-2A Tank Area
- Spills at TRA Loading Dock
- ETR and MTR Cooling Towers Basins at TRA
- CFA-760 Pump Station Fuel Spill
- CFA Tank Farm Pump Station Fuel Spills
- ICPP Tank Farm Line Leak
- CPP-637 Courtyard Pilot Plant Release at the ICPP
- PCB Staging Area West of CPP-660 at the ICPP
- Mercury Contaminated Area South of CPP T-15 at the ICPP
- ICPP Process Equipment Waste (PEW) Evaporator Line Spill
- Kerosene Tank Overflow West of CPP-633 at the ICPP

The following paragraphs provide specific information on each of these releases.

TAN/LOFT Diesel Fuel Spill

On two occasions, the first in 1982 and the second in 1984, significant spills of diesel fuel occurred at the TAN/LOFT Area. Both spills occurred while filling the diesel generator day tank from the main supply tank inside of the old hangar building (TAN-629). In both cases, the day tank inadvertently overflowed, discharging the excess fuel through the overflow pipe to a ditch outside the building's south side (Figure 4-15, Site LOFT-01). The fuel flowed along this shallow, dog-leg-shaped ditch. The ditch is 135 feet long and

approximately 6-12 inches deep. The 5,000 gallons that spilled in 1982 and the 500 gallons that spilled in 1984 drained along this gently sloping ditch, ponded, and seeped into the sandy ground. No cleanup activities were recorded. Soils are therefore likely to be contaminated by these past, unplanned releases. With sufficient driving force as discussed in the introduction to this finding, contaminant migration toward the Snake River Plain aquifer, 200 feet below the surface, may also be occurring.

TAN/TSF Mercury Spills

Mercury was used extensively as shielding in the Heat Transfer Reactor Experiments (HTRE) at the TAN/TSF from the mid to late 1950s. At one time during the program, a significant portion of the world's supply of mercury was located at the TAN. Mercury was injected into the biological shield of the reactors so that workers would be protected from radioactivity. The HTRE reactors were transported among three facilities at TAN (TSF, IET, and LOFT) along 3 miles of four-rail railroad track; a turntable was located at the TAN/TSF (Figures 2-3 and 4-18).

Mercury spills occurred as a result of the amounts of the element used, and the manner in which it was handled. One spill reported in the INEL's IA (code number TSF-08) occurred outside the high bay door of TAN-607 (Figure 4-18). Approximately 1 gallon of mercury was released and was not completely cleaned up. During recent remodeling of the railroad turntable, a mercury vapor detector sensed levels of 0.02 to 0.03 $\mu\text{g}/\text{m}^3$ (IA code number TSF-22; Figure 4-18); the 8-hours-per-day, 5-days-per-week occupational exposure limit is 0.05 $\mu\text{g}/\text{m}^3$. Thus, it appears that mercury may have spilled around the turntable. Because of the vibrations the reactor may have incurred while moving along the tracks, it is assumed that mercury may have spilled from the reactors anywhere along the 3 miles of track and may have resulted in soil contamination. Because of the relative immobility of mercury in soil, contamination is probably restricted to the upper soil layers. No additional sampling and analysis is planned during the Survey.

TAN/TSF Intermediate-Level Waste Disposal System

The Intermediate-Level Waste Disposal System has interim storage capacity for all liquid wastes generated at the TSF that are too radioactively contaminated to be discharged to a controlled surface pond. Liquids are transferred to one of two underground 10,000-gallon stainless steel collection tanks (V-1 and V-3). These tanks are located immediately northeast of TAN-616, between TAN-615 and TAN-633 (Figure 4-18; identified as INEL code number TSF-09). Each of the tanks is 10 feet in diameter and 16 feet long, and is buried under 10 feet of soil. A 20-inch manhole on each tank is accessible through a 6-foot diameter corrugated steel culvert installed in 1981 (Sneed, 1983).

The liquid storage tanks were put in service in about 1954. An evaporator, installed in Building TAN-616 in 1958, was also used as part of this waste collection system but was abandoned in 1970 after a series of malfunctions. Aside from receiving radioactive liquids, the system may also have received corrosive materials from decontamination activities and heavy metals, particularly mercury, during the HTRE tests. Small quantities of potassium chromate were also used in decontamination solutions from 1970 to 1974.

As a result of liquid transfers and evaporator malfunctions during the operations of this system, spillage has occurred, causing considerable surface and subsurface contamination. Volumes and constituents contained within the spillage are not known. However, an area of about 50 feet by 80 feet on the surface above the tanks is now a Zone III contamination area (greater than 20,000 disintegrations per minute per 100 cm² for beta and gamma radiation). A radiological study of this area was conducted in 1980. Six trenches were dug to 3 feet; activity was found above background (approximately 1 pCi/g for cesium-137) at all depths although most was found within the upper 12 to 18 inches. Cesium-137 and cobalt-60 were the major gamma emitters; small amounts of cesium-134 and europium-154 were also detected (Sneed, 1983). Table 4-37 provides the results of this study.

With sufficient driving force, as described in the introduction to this finding, contaminants may be moving toward the Snake River Plain aquifer, 200 feet below the ground surface. During the Sampling and Analysis phase of the

TABLE 4-37

TRENCH SOIL-SAMPLING RESULTS IN V-1, V-2, V-3 TANK AREA--GAMMA-EMITTER ACTIVITY (pCi/g)

Square	Depth (in.)	^{137}Cs	^{60}Co	^{40}K	^{134}Cs	^{154}Eu
15	Surface	79 ± 1	38 ± 1	9 ± 1	--	1.3 ± 0
	6	307 ± 3	376 ± 3	14 ± 2	--	--
	12	112 ± 2	64 ± 1	13 ± 2	--	--
	18	15 ± 1	0.8 ± 0.2	14 ± 2	--	--
	24	7 ± 1	0.5 ± 0.1	16 ± 2	--	--
	30	10 ± 1	0.6 ± 0.2	12 ± 2	--	--
	36	15 ± 1	14 ± 1	18 ± 3	--	--
22	Surface	1072 ± 4	25 ± 3	9 ± 2	--	--
	6	2.0 ± 0.2	6.2 ± 0.5	10 ± 2	--	--
	12	16 ± 1	10 ± 1	14 ± 2	--	--
	18	2.9 ± 0.1	0.4 ± 0.1	10 ± 2	--	--
	24	2.9 ± 0.2	0.32 ± 0.08	10 ± 2	--	--
	To be revised B30	212 ± 2	460 ± 3	11 ± 2	--	--
	A36	1.7 ± 0.2	1.2 ± 0.2	4 ± 1	--	--
24	Surface	175 ± 2	32 ± 2	11 ± 2	0.9 ± 0.2	--
	6	40 ± 1	1.4 ± 0.2	6 ± 1	--	--
	12	54120 ± 60	176 ± 7	17 ± 3	8 ± 4	--
	18	28 ± 1	0.5 ± 0.1	10 ± 2	--	--
	24	2.5 ± 0.2	0.22 ± 0.7	4.7 ± 0.9	--	--
	30	3.3 ± 0.3	0.8 ± 0.2	11 ± 2	--	--
	36	2.8 ± 0.4	0.7 ± 0.2	14 ± 2	--	--
34	Surface	106 ± 2	6.2 ± 0.5	8 ± 1	0.4 ± 0.2	--
	6	50 ± 1	16.2 ± 0.7	10 ± 2	--	--
	12	38 ± 1	1.2 ± 0.2	11 ± 2	--	--
	18	2.5 ± 0.2	--	9 ± 1	--	--
	24	0.2 ± 0.1	--	12 ± 2	--	--
	30	0.5 ± 0.1	--	14 ± 2	--	--
	36	1.7 ± 0.2	20 ± 1	10 ± 2	--	--
37	Surface	179 ± 2	52 ± 1	5 ± 1	--	--
	6	515 ± 3	30 ± 1	10 ± 2	--	--
	12	0.24 ± 0.6	1.1 ± 0.2	9 ± 1	--	--
	18	45800 ± 100	500 ± 10	--	16 ± 6	--
	24	16 ± 1	18 ± 1	14 ± 2	--	--
	30	420 ± 3	17 ± 1	9 ± 1	--	--
	36	20 ± 1	15 ± 1	10 ± 2	--	--

TABLE 4-37

TRENCH SOIL-SAMPLING RESULTS IN V-1, V-2, V-3 TANK AREA--GAMMA-EMITTER ACTIVITY (pCi/g) (Continued)

Square	Depth (in.)	^{137}Cs	^{60}Co	40K	^{134}Cs	^{154}Eu
38	Surface	1242 ± 5	610 ± 4	6 ± 2	2 ± 1	7 ± 1
	6	49 ± 1	2.9 ± 0.3	10 ± 2	--	--
	12	48 ± 1	4.6 ± 0.3	7 ± 1	--	--
	18	0.2 ± 0.1	0.2 ± 0.1	12 ± 2	--	--
	24	0.20 ± 0.5	--	8 ± 1	--	--
	30	--	--	5 ± 1	--	--
	36	3.0 ± 0.2	1.2 ± 0.2	4 ± 1	--	--

Source: Sneed, 1983

Environmental Survey, the soils in this area will be sampled and analyzed for the presence of such chemical constituents as mercury and chromium.

TAN/TSF PM-2A Tank Area

This area was used for the collection, processing, and storage of intermediate-level radioactive liquid wastes. It is now inactive but contains two 50,000-gallon underground tanks (T-709 and T-710) (INEL IA code number TSF-26 in Figure 4-18). The tanks are 12.5 feet in diameter, 55 feet long, and the tops are 14.5 feet below the ground surface. They are underlain by concrete cradles filled with sand which surround the lower one-third of the tanks.

From 1958 to 1970, the tanks received, through underground piping, concentrates of intermediate-level radioactive liquid wastes. In 1970, an aboveground evaporator was installed at the PM-2A area and the tanks were then used to store unconcentrated intermediate-level radioactive liquid wastes. Both the concentrated and unconcentrated radioactive wastes may have contained corrosives and chromium from decontamination solutions and mercury from HTRE tests. In 1975, after a series of operational difficulties, the PM-2A operation was shut down. Liquids remaining in the tanks were pumped out, solidified in the immediate PM-2A area, and were then transferred to RWMC.

Liquid transfers and evaporator malfunctions during operation of the PM-2A system, and the solidification process once operations ended, resulted in leaks and spills, causing radioactive contamination of a 2-acre area. Volumes and constituents of chemicals contained within the spills are not known but are suspected to include chromium and mercury. A radiological study conducted in 1980 indicated radioactive contamination in the 2-acre area away from the underground tanks down to 3 feet with most in the top 6 inches. Activity levels in surface soils in some areas were as high as 300 μ R/h; background is 15 μ R/hr. Although the soil above the tanks was not sampled, the contamination is expected to be several feet deep (Smith, 1983). No sampling for chemical contaminants in this area has been reported.

In 1981 and 1982, the PM-2A area was decontaminated and decommissioned. Surficial contaminated soil from a 75-foot by 150-foot rectangle in the northeast corner of the PM-2A area was removed. This area, which was northeast of the buried tanks, had the highest surficial radioactive contamination. A radiological study of the surface after removal indicated background levels, except for a 75-foot by 100-foot area over the buried tanks, which had a peak of approximately 200 μ R/hr. This latter area was backfilled with 30,000 cubic feet of clean soil; surface activity was then measured as background.

During D&D, all aboveground equipment was removed. Nearly 200 cubic feet of undefined sludge contained in plastic bags from an unknown source was uncovered in the soil and disposed of. The sludge from the tanks was removed and diatomaceous earth was deposited inside (Smith, 1983). To determine whether chemical contamination is present in the subsurface, soils will be sampled and analyzed for the presence of such constituents as mercury and chromium during the Sampling and Analysis phase of the Survey.

Spills at TRA Loading Dock Area

This loading dock was a wooden, free-standing structure that received and handled shipments of drummed oils, waste oils, and recycleable oils. To a lesser extent, other drummed chemicals and organic solvents were handled at this dock. No significant spills were reported at this site; however, there may have been numerous small leaks or seeps from these drums. Oily stains and puddles have been observed, as indicated in the INEL IAR.

The structure was located in the north-central area of the TRA (INEL IA code number TRA-09 in Figure 4-20). It was used for transfer and short-term storage of drummed liquid wastes, primarily (approximately 95 percent) oils and oil products. The dock was used from the mid-1950s until the mid-1980s, when it was dismantled. During the Survey, all that remained was a bare soil patch 85 feet long and 15 feet wide located 65 feet south of Building MTR-609. The soil was cakey and darkly stained, indicating past spillage. The western end was also slightly vegetated with grasses.

The extent of contamination, if any, is not known. The surficial soils are obviously stained; the depth of subsurface contamination is dependent on driving forces which in this case is infiltration of precipitation.

ETR and MTR Cooling Towers/Basins at TRA

The cooling towers of the ETR and the MTR (TRA-FSO3a and b, respectively, in Figures 4-19 and 4-20) may have contributed significant amounts of hexavalent chromium, a hazardous constituent, to the atmosphere and surrounding soils. The MTR cooling tower supported the MTR from 1952 until 1969. The ETR cooling tower supported the ETR from 1957 until 1982. Both towers handled secondary cooling water, which until 1972 contained a chromate-based corrosion-inhibiting solution. Characteristically, concentrations of chromium were maintained at 11 to 14 mg/L.

Drift of water from the cooling towers was likely. Significant amounts of cooling water were lost from the cooling towers (for example, up to 1,000 gpm from the ETR tower) due to evaporation and high winds. Windblown losses were on the order of 100 gpm and were deposited on the ground downwind of the tower basin structure.

A characterization of the ETR, a subsequent report, and then D&D included sampling of the wood structure and cooling towers basin sludge. Although the data were not available, reportedly neither medium contained chromium at hazardous levels. The MTR cooling tower structure, basin sludges and soils surrounding the cooling towers were not characterized. The ETR cooling tower basin was 270 feet long by 60 feet wide and 6 feet deep. Dimensions for the MTR's basin are not known. The ETR basin was intact during the Survey. It was constructed of concrete and contained expansion joints of given section lengths. These joints may have provided an additional seepage path for the chromium-contaminated cooling water to enter the subsurface environment.

The extent, if any, of chromium contamination of soils surrounding the two inactive cooling towers has not been determined, although chromium is relatively immobile in soil. During the Sampling and Analysis phase of the Survey, the presence of chromium in soils will be determined.

CFA-760 Pump Station Fuel Spill

In 1979, it was discovered that a 60,000-gallon aboveground #1 diesel fuel storage tank (CFA-755) had lost much of its contents (Figure 4-21; INEL IA code number CFA-26). In December 1978, the tank was inventoried and found to be full. The tank was next inventoried in March 1979, and was found to contain only 5,000 gallons. Based on the amount of fuel used during the intervening time period, it is estimated that 45,000 gallons leaked from the tank (Grasmick, 1987).

The tank had originally contained highly viscous #6 heating oil. A steam line ran to the tank to warm the oil so it would flow more easily. Eventually an underground tank was built for the #6 oil and the CFA-755 tank was refilled with #1 diesel oil. The underground steam line was not capped or removed when the contents were changed. Condensate, which remained in the line, froze and a small hole resulted. Apparently, the #1 diesel fuel leaked underground out of this hole; there were no signs of leaks above the ground.

No remedial action was undertaken although the tank was removed in 1986 for the construction of Building CFA-623/624, a multi-craft shop, on the south side of the CFA. This building does not have a basement, so no excavation occurred during its construction. As a result, the apparently released fuel oil remains in the ground and, with sufficient volume and driving force, as described in the introduction to this finding, has the potential to move through the unsaturated zone toward the Snake River Plain aquifer, 500 feet below the surface. To determine whether fuel is present in the subsurface, soil gas samples will be taken and will be analyzed for organics during the Sampling and Analysis phase of the Survey.

CFA Tank Farm Pump Station Fuel Spills

In September 1986, a tanker truck at the CFA tank farm pump station (Figure 4-21, INEL IA code number CFA-42) was overfilled and approximately 100 gallons of #2 diesel fuel spilled to the ground. Approximately 50 cubic yards of contaminated soil was removed; 6 inches of soil was dug over a large area

but 7 feet was dug out at the pump station catwalk. At this depth, the soil was still found to be contaminated. It was also noted that diesel fuel was leaking from a valve.

As a result of these observations, it was determined that numerous small spills had occurred at the pump station, thereby contributing to the subsurface contamination (Torres, 1986a; b). With sufficient volume of spilled fuel and driving force, as discussed in the introduction to this finding, the petroleum products have the potential to move through the unsaturated zone toward the Snake River Plain aquifer, 500 feet below the surface.

ICPP Tank Farm Line Leak

High-level liquid wastes, resulting from irradiated fuel reprocessing activities at the ICPP, are temporarily stored in underground stainless steel tanks inside concrete vaults at the ICPP tank farm. The tank farm, located in the north-central portion of the ICPP (Figure 4-27), contains a complex of tanks, vaults, pipelines, and valves and is used for transferring high-level liquid wastes to the calcining facility for solidification. Ten releases at the tank farm, as identified in the INEL's IAs (code numbers CPP-24 through CPP-33), have occurred during the nearly 34 years of chemical plant operations. These releases are classified as mixed wastes since they include not only high-level radioactivity (cesium-137, strontium-90) but also acids (nitric acid) and metals (mercury).

Of the 10 releases, 1 is particularly noteworthy. In September 1975, radioactively contaminated soil was found south of tank WM-183 in the tank farm area (INEL code number CPP-31 in Figure 4-27). The contaminated soil zone was about 150 feet by 20 feet along a backfilled pipe at a depth of 12 to 25 feet below the surface. The discharged waste, estimated to be about 14,000 gallons, apparently had come from a corroded carbon steel line in the high-level radioactive liquid waste transfer system. About 30,000 curies of radioactivity, consisting primarily of cesium-137, strontium-90, and yttrium-90, as well as unknown amounts of mercuric nitrate and nitric acid, were released. Organics in decontamination solutions may have gone to the tank farm and, therefore, may have also been released.

Because of the large quantity of contaminated soil and the depth of contamination, the soil was left in place. As a result, contaminants may be migrating downward toward the perched aquifer at the ICPP and the Snake River Plain aquifer. The driving force for vertical movement is limited to infiltration of precipitation. This may not be a factor, however, since a liner is reported to be present between the surface and the area of the spill. To determine the presence of chemical hazardous wastes, the soils will be sampled and analyzed for metals during the Sampling and Analysis phase of the Survey.

CPP-637 Courtyard Pilot Plant Release at the ICPP

Chemicals used in pilot plant operations at the ICPP are stored in both permanent and temporary tanks around the pilot plant (CPP-637 and CPP-620) (located near the ICPP main entrance in Figure 4-27). In November 1978, about 450 gallons of nonradioactive simulated zirconium dissolver product drained from an aboveground permanent tank in the CPP-637 courtyard to the ground when a coupling on the bottom of the tank failed. An 18-foot by 24-foot area was contaminated. The solution was neutralized and the soil removed for disposal.

Recently, soil samples were taken in the vicinity of the spill, and aluminum, chromium, and zirconium were measured above background. Highest concentrations were 2.1 percent for aluminum versus 0.75 to 1.6 percent background, 139 parts per million (ppm) for chromium versus 18 to 34 ppm background, and 15,762 ppm for zirconium versus 7 to 12 ppm background. Other elevated zirconium values ranged from 85 to 174 ppm. Nationwide averages of aluminum and zirconium in soil are 4.5 percent and 200 ppm, respectively. With sufficient driving force, these contaminants have the potential to move through the unsaturated zone toward the perched aquifer. No additional sampling during the Survey is anticipated.

PCB Staging Area West of CPP-660 at the ICPP

In 1985, as part of the ICPP Utilities Replacement and Expansion Project, several 2,400-volt transformers containing PCBs at concentrations up to 400 ppm were removed from service. They were moved to a temporary staging

area, which occupied approximately 400 square feet, near the west fence in the central portion of the ICPP (Figure 4-27) until they could be shipped to a commercial disposal facility. This temporary staging area is designated CPP-51 in the INEL IAs.

During an inspection of the temporary staging area in July 1985, leakage around valves and fittings were noted on some transformers; some leakage to the soil had resulted although the volumes are unknown. In August 1985, approximately 40 barrels of PCB-contaminated soil and debris and a 15-ton concrete pad from CPP-718 were also placed in the temporary staging area until disposal. This barreled soil contained up to 31 ppm of PCB, and the pad was contaminated to approximately 134 ppm. Some pieces of the concrete pad fell onto the soil at the temporary staging area. All barreled soil and debris, transformers, and concrete were shipped from the area to a commercial disposal facility in 1986.

The leaking oil and sloughed pieces of contaminated concrete may have contaminated the soil at the temporary staging area with unknown concentrations of PCBs. Cleanup of the area has not been undertaken.

Mercury-Contaminated Area South of CPP T-15 at the ICPP

During a baseline study of controlled pollutants at the ICPP in 1984, painters/carpenters were observed discarding used paint solvent to the soil in an area just south of T-15. This site, located in the west-central portion of the ICPP, is designated as CPP-55 in the INEL IAs (Figure 4-27). The volume discharged is not known and it is not known if other similar incidents occurred. In August 1985, seven samples taken in this 30-foot by 60-foot area indicated levels of mercury (a component of some paint pigments) ranging from 48 to 236 ppb; the mean concentration was 121 ppb. Background mercury concentration in western U.S. soils, as reported in the IAs, is 55 ppb and the EP toxicity limit is 200 ppb. It is assumed that other contaminants contained in paint pigments that were not sampled, such as lead and organic solvents, are present in the soils. Some soil has been removed and sent to a commercial disposal site, but the area has not been fully characterized and the extent of

contamination is not fully known. No additional sampling and analysis is anticipated as part of the Survey.

ICPP PEW Evaporator Line Spill

In September 1976, an underground line connecting the PEW evaporator with the CPP-751 Service Waste Diversion System at the ICPP was discovered to have a leak. An estimated 20,000 gallons of 0.2 M nitric acid was released to the soil. The acid contained 1 mCi of cerium-144, 51 mCi of tritium, 2 mCi of strontium-90, 4 mCi of ruthenium-106, and 2 mCi of cesium-137. Liquids passing through the PEW also often contain metals. The spill occurred at the corner of Olive Avenue and Beech Street in the center of the ICPP (Figure 4-27). This spill is designated CPP-58 in the INEL IAs. The pipe was repaired shortly after the spill was discovered and the contaminated soil was covered with several feet of clean soil. Because the spill was not cleaned up, contamination of soil is of major concern. In addition, infiltration of precipitation may be driving the contaminants downward through the unsaturated zone toward the perched water and eventually the Snake River Plain aquifer, as discussed in the introduction to this finding.

Kerosene Tank Overflow West of CPP-633 at ICPP

Two kerosene spills occurred within one week in September 1983, at the ICPP fuel tank farm located in the center of the ICPP (Figure 4-27). This spill site is designated CPP-59 in the INEL IAs. On September 24, 200 gallons of kerosene overflowed and drained out of a vent line outside the containment barrier while the fuel was being transferred to the New Waste Calcining Facility. On September 29, another 60 gallons spilled. There is no record of a cleanup of either spill and, as a result, the spilled material may be contaminating the soil. It is unlikely that there was sufficient volume of spilled material such that contaminants would reach the Snake River Plain aquifer. However, the perched aquifer under the ICPP may be affected.

5. Potential contamination from inactive subsurface percolation units. Subsurface percolation units at the INEL were used to dispose of chemical and

radioactive liquid wastes and, as a result, these constituents may be contaminating the unsaturated zone and groundwater.

The design and use of subsurface percolation units at the INEL were such that liquid effluents were discharged directly into the soils and percolated into the unsaturated zone. Downward migration of contaminants through the unsaturated zone toward perched groundwater or the Snake River Plain aquifer may be occurring due to hydrogeological driving forces and precipitation recharge of the aquifer, interacting with the contaminants in and beneath the waste units. Hydraulic head (pressure), now caused by infiltration of precipitation, and tensional and gravity seepage may be driving the leachate down through the surficial soil layer (usually less than 30 feet thick) and into the fissures of the basalt. Once in the basalt, contaminant migration would be governed by the orientation and interconnection of the fissures and cracks, which would provide channels for contaminant movement. The presence of alluvial zones (unconsolidated sediments of sands, silts, and clays) between basalt sequences may be serving as semipermeable, impermeable, or permeable zones that could retard flow, redirect contaminant migration, or result in contamination of a perched aquifer, if present. Eventually, with sufficient hydraulic force, the contaminants could reach the Snake River Plain aquifer. This aquifer flows to the southwest, and is the source of potable and irrigation water at the INEL and off-site. A discussion of contaminant presence in groundwater is provided in Section 3.4.

Approximately 34 inactive subsurface percolation units have been identified at the INEL. These sites were evaluated based on the volumes and types of known or suspected contaminants released into them and their design. Five were noted to be of particular environmental concern:

- TAN/TSF Oil Sump
- TAN/TSF Paint Shop Floor Drain Leachfield
- French Drain Southeast of CFA-633
- French Drains East of CFA-690 (south one only)
- French Drain South of CPP-633

The following paragraphs provide specific information on each of the sites.

TAN/TSF Oil Sump

The TAN/TSF Oil Sump is located east of Building TAN-609 in the TSF of the TAN (Figure 4-18). The INEL IA code number for this site is TSF-24. The sump was used for the disposal of wastewater, oil, and jet fuel from Building TAN-609 which was used for non-nuclear tests of jet engines. The total volume of liquids received during its operating life in the 1950s is unknown. Based on engineering drawings, the sump is 6 feet on a side, 4 feet deep, and the top is 5 feet underground. The sump is constructed of galvanized corrugated sheets on top and possibly on all sides and the bottom, and contains coarse gravel. It is still in place and is suspected to contain 27 cubic feet of fuel oil residues. Because the engineering drawings indicate that the sump may have not been fully sealed, the wastewater and fuel it received may have seeped into the subsurface environment. Movement in the subsurface, as described in the introduction to this finding, may have been limited since the downward driving force has been due mainly to infiltration of precipitation.

TAN/TSF Paint Shop Floor Drain Leachfield

The Paint Shop floor drain leachfield is located 40 feet behind (northwest) of Building TAN-636, the carpentry and paint shop at the TAN/TSF (Figure 4-18). The INEL IA code number for this site is TSF-27. The leachfield received effluents from the floor drains of TAN-636. An estimated 2,500 gallons of Stoddard solvent and an unknown volume of paints and thinners were discharged to the leachfield. Paints often contain such metals as lead, mercury, and cadmium. Based on engineering drawings, the leachfield is 24 feet on a side, 7 feet deep, and the top is 5 feet underground. The top 2 feet of the leachfield, in which the pipes discharge, is composed of 3/4-inch gravel and the bottom 5 feet is composed of 6-inch maximum rock. The leachfield is still in place although the drain pipe discharging to the unit was capped 4 or 5 years ago. Asphalt has been placed on the surface above the leachfield.

The asphalt above the leachfield has probably reduced the driving force for downward contaminant migration. However, during the Sampling and Analysis phase of the Survey, soils below the leachfield will be sampled and

analyzed for various organic constituents and metals to determine the presence and movement of contaminants.

French Drain Southeast of CFA-633

This French drain was located on the north side of the CFA to the southeast of Building CFA-633 (Figure 4-21). The INEL IA code number for this site is CFA-07. This drain received wastewater (including laboratory sink waste) from CFA-633. Through the years, this building has housed several different laboratories: from 1950 to 1976, the Health Services Laboratory (now the Radiological and Environmental Sciences Laboratory (RESL) located at CFA-690); from 1976 through 1984, a WINCO environmental analysis laboratory; and from 1984 to the present, an EG&G analytical chemistry laboratory. The drain was about 2 feet in diameter and 6 feet deep and the bottom was lined with gravel. It was last used in 1984; the standpipe has been removed, and the area has been graded. The area was to be paved shortly after the on-site portion of the Survey.

WINCO's operation routinely generated small quantities of acids and bases that were washed down the sinks along with small quantities of radionuclides. The RESL operation probably included similar materials and may also have included small quantities of solvents such as xylene or toluene in scintillation cocktails. It is estimated that 2.3×10^{-5} curies of radioactivity were discharged to the French drain from 1976 to 1984. Volumes of radionuclides during other periods and chemicals throughout the history of the drain are not known.

During the Sampling and Analysis phase of the Survey, soils from the French drain area will be sampled and analyzed for various constituents to determine the presence and movement of contaminants. However, the newly placed asphalt above the drain will probably reduce the driving force for downward migration. Groundwater is 485 feet below the surface.

French Drains East of CFA-690

Two French drains are located east of the RESL (CFA-690), which is on the west side of the CFA (Figure 4-21). The INEL IA code number for this site is CFA-12.

Although there are two drains associated with this site, they are independent and this finding deals only with the southern drain. The northern drain may never have been used and, therefore, is not of concern. The southern French drain received wastewater from two lab sinks in CFA-690 from 1963 to 1984. It is still present, although inactive, and is a vertical 8-foot deep, 2.5-foot diameter concrete-lined pipe with a gravel-lined bottom. A 2- to 3-inch-diameter inflow pipe, which has been sealed off, enters 2 feet from the bottom. The top of the drain is flush with the ground surface and is covered by a manhole lid.

As with the French drain southeast of CFA-633, described above, this French drain is suspected of receiving corrosives, solvents including xylene and toluene, and small quantities of low-activity radionuclides. Radioactive wastes were restricted from these drains between 1982 and 1984. Volumes of discharges are unknown. These materials percolated directly into the soil, thereby resulting in contamination of the subsurface. However, vertical migration of the contaminants has probably been small due to the limited driving force present.

French Drain South of CPP-633

This French drain is located in a ditch south of the old Waste Calcining Facility (WCF) (CPP-633) at the ICPP (Figure 4-27). The INEL IA code number for this site is CPP-48. Originally, the ditch that now contains the French drain was used for the disposal of liquid wastes. Subsequently, a French drain was built at the location and was used from 1975 to 1981. The drain is still present and consists of a 5-foot-diameter steel sidewall pipe extending down 8 to 10 feet. The bottom is open and is lined with limestone; the top has a steel cover.

Small quantities (1 to 2 gallons) of liquid wastes were carried out of the WCF and poured directly into the ditch or drain. There are no records as to the types or quantities of chemicals disposed of there but it is estimated that thousands of gallons of nitric acid, aluminum nitrate, calcium nitrate, and possibly other chemicals used at the WCF were discharged to the unit. In addition, a maintenance shop is located near the drain and it is possible that liquids from this shop were discharged to the drain.

Based on the use of this unit and the driving forces present, soil is the major medium of concern. In 1985, soils in the ditch were sampled down to the basalt and analyzed for a variety of metals, including arsenic, selenium, mercury, lead, silver, chromium, cadmium, and barium. Although total metals were analyzed, a conversion factor was used to estimate leachable concentrations. These results were below the EP toxicity limits for hazardous wastes. During the Sampling and Analysis phase of the Survey, soils from the French drain and the ditch will be sampled and analyzed for volatile organics and metals to determine the presence and movement of these contaminants.

6. Chemical contamination at the SL-1 Burial Ground. Chemical, as well as radioactive wastes were disposed of at the SL-1 burial ground and, because of a lack of engineered containment, have the potential to contaminate the unsaturated zone and groundwater.

Auxiliary Reactor Area-II originally housed the Argonne Low Power Reactor Plant, which was later renamed as the Stationary Low Power Reactor Number 1 (SL-1). The Army operated this reactor from March 1958 to December 1960. On January 3, 1961, during routine maintenance and minor modifications, an accidental nuclear excursion occurred and the reactor was destroyed.

Decontamination and decommissioning operations began in April 1961, and were completed in November 1962. Two pits and one trench were dug at a 4.6-acre burial area located 1,600 feet northeast of ARA-II (Figure 4-22; INEL IA code number ARA-06). Their dimensions were 550 feet by 20 feet, 400 feet by 35 feet, and 530 feet by 35 feet. Approximately 3,000 cubic yards of highly radioactively contaminated materials, including the SL-1 reactor and soil, were buried at the site. Approximately 100 cubic yards of lead shielding was used at the SL-1, and this and other chemicals may have also been disposed of into the pits and trench.

The pits and trench were not lined before contaminated materials were put in them, nor were the materials encapsulated. The disposal area was then backfilled with native soil without specifications for grain size, permeability, or compaction. As a result, precipitation and surface runoff can infiltrate

through the waste, and hazardous materials can leach out and contaminate the subsurface environment. Although lead, because of its relative immobility in soils, may be restricted to shallow soil layers, other contaminants may have moved deeper into the unsaturated zone.

4.5.2.4 Category IV

1. Potential contamination from minor spills and leaks. Minor chemical and petroleum product spills and leaks have occurred at operating facilities at the INEL that either have not been reported or have not been cleaned up and result in localized surficial soil contamination.

Small spills and leaks were noticed at the INEL during the Environmental Survey. Many were the result of petroleum product transfer, as they were found at fuel loading areas, or leaking equipment. Several examples are provided in Table 4-38. Although these spills have minimal environmental effects, mainly localized contamination of surficial soils, their occurrence represents poor housekeeping. In addition, constant small leaks and spills in the same area over time may result in sufficient volumes so as to have adverse effects deeper in the soil column. This was evidenced at the CFA Tank Farm pump station (Section 4.5.2.3, Finding 4, eighth example) in which small spills over the years resulted in soils saturated with petroleum products 7 feet below the surface.

2. Potential sources of contamination remain unidentified. All inactive waste sites at the INEL have not been identified during remedial action activities to date; consequently, the potential exists for sources of contamination to be located on the site that may affect soils and groundwater.

As a result of actions taken under DOE Order 5480.14 and the Compliance Order and Consent Agreement, pursuant to Section 3008(h) of RCRA, between DOE-ID and EPA Region X, the INEL has identified approximately 350 SWMUs and LDUs. Of these, approximately 178 units, not including storage tanks, were characterized as inactive sites or releases by the Survey team. Under the agreement, all 350 units will be characterized further to determine whether remedial actions are necessary and, if so, to implement them.

TABLE 4-38

**EXAMPLES OF SMALL SPILLS AND LEAKS
OBSERVED DURING THE ENVIRONMENTAL SURVEY**

Facility	Leak/Spill Location	Material Spilled	Area of Stain Volume of Spill/Leak
CFA	Bus Washing Station	Petroleum Product	Contained in Washwater that Overflows Drain
ICPP	West of CPP-620	Hydrogen Fluoride	A few liters
ICPP	North & West of CPP-660	Solvents (?)	60 sq. ft.
ICPP	CPP-701a,b	#5 Fuel Oil	32 sq. ft.
ICPP	CPP-681,682	#5 Fuel Oil	Intermittent Areas
TAN/TSF	South Side TAN-607	?	12 sq. ft.
TAN/TSF	TAN-704	#2 Fuel Oil	9 sq. ft.
TRA	TRA-725	#5 Fuel Oil	Intermittent
TRA	TRA-670	Petroleum Product	100 sq. ft.
TRA	North Storage Area	Rad Contaminated Petroleum Product	10 sq. ft.
TRA	Adjacent to MTR-627	#5 burner oil	15 sq. ft.

However, during the on-site portion of, and the followup after the Survey, the Survey team identified an additional 24 inactive sites and releases, including 4 landfills, 2 surface percolation units and ditches, 17 spills, and 1 in-ground clarifier pit. They are described in Section 4.5.1.3 and are denoted with the letters "ES" in the code number. These units, as well as others possibly not yet discovered, may have received hazardous and radioactive materials. If not characterized under the site's existing remedial action program, they may be a continuing source of contamination to the soil and groundwater.

PRELIMINARY

CDIF

PRELIMINARY

2.0 GENERAL SITE INFORMATION

Much of the information contained in this section is summarized from the Installation Assessment of the Component Development and Integration Facility (CDIF) Disposal Sites (Hall, 1986) and CDIF: A Versatile Test Facility (MSE, 1986a).

2.1 Site Setting

The CDIF is located in Silver Bow County, Montana, approximately 3 miles south of the Butte city limits (Figure 2-1). The CDIF is located on a 53-acre tract of land owned by the United States Government. In addition, the government leases a tract of approximately 40 acres directly west of the 53 acres. All development thus far at the CDIF has been on the government-owned land and no use has been made of the leased tract.

The Summit Valley, in which the CDIF is located, is nearly surrounded by mountains that rise 1,000 to 4,000 feet above the valley floor. The site is bordered on the south and west by marginally improved, overgrazed rangeland; on the north by unimproved rangeland; and on the east by a rail line. Intermediate voltage transmission lines run east-west across the northeastern corner of the site.

The site is approximately 5,620 feet above mean sea level (MSL). The land slopes downward gently to the north and east. The site is located in a broad north-south valley about 3 miles wide. Basin Creek, which comprises one of the southernmost sources of the Clark Fork of the Columbia River, flows through this valley. The Continental Divide lies about 4 miles east of the CDIF and about 8 miles to the south (Figure 2-1). In the immediate vicinity of the CDIF, the Continental Divide is generally between 6,500 and 8,500 feet above MSL.

Topographic influences on climatic and atmospheric dispersion in the Butte region are considerable. The generally 2,000-foot to 3,000-foot valley-to-peak relief results in several phenomena that include mountain-valley breezes, a limited vertical mixing layer, air flow channelization, and airflow limitation. The prominent wind direction is from the west.

CDIF LOCATION

FIGURE 2-1

Temperatures in the region vary substantially because of the localizing effects of cold air drainage and radiational cooling. Average monthly temperatures range as low as -16.9°C in January to as high as 27.9°C in July.

Normal precipitation ranges from a minimum of 0.42 inches in January to 2.42 inches in June. Nearly 65 percent of the total precipitation received in a normal year occurs during the May-to-September growing season. On a seasonal basis, the winter months tend to be the most humid. This is in direct contrast to the precipitation regime but is explained by the colder temperatures and lower moisture capacity of the atmosphere.

Average annual pan-evaporation in the region is estimated to be about 35 inches with a standard deviation of 6.7 inches. Lake evaporation is estimated to average about 26 inches annually. More than 80 percent of this evaporation occurs between May and October.

Terrestrial fauna includes a number of rodent species such as ground squirrels, mountain cottontails, jackrabbits, snowshoe hares, and field mice. Other lifeforms include songbirds and other bird species, domestic and wild ungulate (hooved) grazing species, mosquitos, caddisflies, beetles, dragonflies, beetles, and water spiders. Flora on and immediately surrounding the CDIF is typical of the region and consists of rubber rabbitbrush, bluebunch wheatgrass, thistles, gumweed, knapweed, big sagebrush, shortgrass, and Idaho fescue. There are no environmentally sensitive plants at or in the vicinity of the CDIF.

2.2 Overview of Major Site Operations

The CDIF is a U.S. Department of Energy magnetohydrodynamic (MHD) test facility operated by Mountain States Energy (MSE), a Division of MSE, Inc., in Butte, Montana. The CDIF is designed to test MHD test train components and to obtain test data to evaluate component performance and scale-up requirements. Presently, major facilities at the site include offices; storage area; shops; coal and No. 2 fuel storage areas; a MHD power plant (nominal thermal output 50 MW_t) and test areas; cooling water system; waste treatment system including a thickener, evaporation ponds, and collection ponds; exit gas stack; and oxygen and nitrogen storage areas (Figure 2-2). The site was procured by the U.S. Department of Energy

FIGURE 2-2

CDIF SITE MAP

In the mid-1970s. Construction of the facility began in January 1977, testing of the power plant began in December 1980, and the first power generation occurred in April 1981.

Magnetohydrodynamics can provide the most efficient, economical, and environmentally acceptable method to use coal for future electric power generation (MSE, 1986a). The MHD generator has no moving mechanical parts; the moving conductor is a hot, approximately 4,800°F, stream of combustion gas produced by the high-temperature combustion of coal. A small amount of seed material (typically a potassium compound) is added to the combustion gas to increase the electrical conductivity. Direct current (DC) electric power is produced when the flowing hot gas interacts with the strong magnetic field in the MHD generator. The DC electricity produced is extracted by a series of electrodes located in the opposing MHD generator walls.

The still-hot, approximately 3,500°F, gas emerges from the generator and is cooled in a controlled manner in a boiler system. The steam produced in the boiler system is used to operate a conventional steam turbine generator. Thus, electric energy is produced in both the MHD portion of the process, called the topping cycle, and in the boiler system/steam turbine generator, called the bottoming cycle.

Figure 2-3 is a schematic of an open-cycle MHD power plant showing the MHD topping cycle combined with the steam bottoming cycle. An open-cycle MHD power plant offers efficiency advantages over a conventional coal-fired steam power plant. A conventional coal-fired power plant, with scrubbers, has an efficiency of 32 to 33 percent compared to anticipated MHD power plant efficiency of 40 to 50 percent (scrubbers not required).

Open-cycle MHD power plants also offer environmental advantages. One of the major advantages, when burning either low-sulfur or high-sulfur coals, is the removal of sulfur oxides (SO_x) without the need for scrubbers. This near-total SO_x removal is achieved by the naturally occurring action of the potassium (the seed material) combining with the sulfur in the coal. The potassium-sulfur compound is recovered in the boiler system and the potassium is recycled for reuse. Nitrous oxide (NO_x) pollutants and particulates are also minimized in open-cycle MHD power plants. The controlled cooldown of the combustion gas minimizes NO_x pollutants

Source : MSE, 1986a

OPEN-CYCLE MHD POWER PLANT

FIGURE 2-3

well below the U.S. Environmental Protection Agency (EPA) New Source Performance Standards (NSPS), and particulates are removed by either a baghouse (filter system) or an electrostatic precipitator.

Of all the advanced coal-to-electric power conversion technologies under development, MHD shows the greatest potential in terms of cost, efficiency, and overall environmental performance.

2.3 State and Federal Concerns

Members of the Survey team met with the State of Montana Environmental Sciences Division, Department of Health and Environmental Sciences on August 7, 1987. At this meeting the Team Leader requested the state representatives to identify and discuss their concerns about the CDIF facility so that they could be reviewed during the Survey. There were no substantive concerns raised at the meeting.

PRELIMINARY

3.0 MEDIA-SPECIFIC SURVEY FINDINGS AND OBSERVATIONS

The discussions in this section pertain to existing and potential environmental problems in the air, soil, surface water, and groundwater media within the CDIF. The discussions include a summary of the available background environmental information related to each medium, a description of the sources of pollution and their control techniques, a review of the environmental monitoring program specific to each medium, and a categorization and explanation of the environmental problems found by the Survey team related to each medium.

3.1 Air

3.1.1 Background Environmental Information

3.1.1.1 Air Quality

The National Ambient Air Quality Standards (NAAQS) were instituted by the Clean Air Act to protect the health and welfare of the general public. Table 3-1 lists the NAAQS and the State of Montana Department of Health and Environmental Sciences ambient air quality standards that are relevant to the CDIF. This table shows that the state has promulgated 1-hour ambient standards for sulfur dioxide (SO₂) and nitrogen dioxide (NO₂). This is of interest to the CDIF because maximum concentrations from stationary sources tend to threaten short-term ambient standards (e.g., 1-hour, 3-hour) more than long-term standards (e.g., annual).

The air quality in the vicinity of the CDIF in Air Quality Control Region 142 has been designated by EPA as (1) nonattainment for total suspended particulate (TSP) primary standards; (2) better than the NAAQS for SO₂; and (3) unclassifiable, or better than the NAAQS for ozone (O₃), carbon monoxide (CO), and NO₂ (Bureau of National Affairs, Inc., 1985). An area in the vicinity of Butte, several miles north of the CDIF, has been designated by the EPA as nonattainment for TSP because of particulate emissions from mining operations. Although the CDIF is also an emitter of particulates, historical ambient data obtained by the CDIF monitoring network and existing air quality modeling calculations indicate that the facility's TSP contribution to this area is well below ambient standards (Table 3-1) (Hall and Heck, 1987).

TABLE 3-1

FEDERAL AND MONTANA AMBIENT AIR QUALITY STANDARDS RELEVANT TO THE CDIF, AND MEASURED CONCENTRATIONS

Air Contaminant	Averaging Time	Federal Standards		State Standards(a)	Maximum Measured Concentration(b)
		Primary(a)	Secondary(a)		
Sulfur Dioxide (SO ₂)	Annual	0.03 ppm	None	0.02 ppm	-
	24-Hour	0.14 ppm	None	0.10 ppm	-
	3-Hour	None	0.5 ppm	None	-
	1-Hour	None	None	0.5 ppm(c)	0.014 ppm
Particulate Matter(d)	Annual	50 µg/m ³	50 µg/m ³	None	-
	24-Hour	150 µg/m ³ (e)	150 µg/m ³ (e)	None	-
Total Suspended Particulate (TSP)	Annual	None	None	75 µg/m ³	-
	24-Hour	None	None	200 µg/m ³	61 µg/m ³
Carbon Monoxide (CO)	8-Hour	9 ppm	None	23 ppm	-
	1-Hour	35 ppm	None	9 ppm	-
Nitrogen Dioxide (NO ₂)	Annual	0.053 ppm	0.053 ppm	0.05 ppm	-
	1-Hour	None	None	0.3 ppm	0.073 ppm
Settled Particulate Matter	30-Day	None	None	10 g/m ² (f)	-
Scattering Coefficient (Visibility)	Annual	None	None	3 x 10 ⁻⁵ m ⁻¹	-

Sources: 40 CFR 50.4-50.12; Montana Ambient Air Quality Standards, 1987

- a. Not to be exceeded more than once a year (except where noted), other than those based on annual averages.
- b. As measured by the CDIF ambient monitoring network during 1986 on days when the coal-fired combustor was operating.
- c. Not to be exceeded more than 18 times in 12 consecutive months.
- d. Particles with an aerodynamic diameter less than or equal to 10 micrometers.
- e. No more than 1 expected exceedance per year allowed.
- f. Not to be exceeded.

3.1.1.2 Meteorology

The CDIF is located in the south Butte Valley at an elevation of about 5,600 feet and is approximately 3 miles south of the Butte city limits. The area is semiarid with the greatest precipitation occurring during December, January, March, April, and June (Hall, 1986).

The Butte Valley is nearly surrounded by mountains that rise 1,000 to 4,000 feet above the valley floor. This topography contributes to frequent surface-based temperature inversions (about half of all the hours during a year) due to cold air draining from the surrounding mountains. Pollutants emitted from a stack tend to become trapped within the inversion layer, resulting in a visible haze when viewed from above. Winds within this inversion layer tend to be light and quite variable in direction (Hall and Heck, 1987). Effluent released from elevated sources during inversion conditions has the potential for causing high concentrations on the mountains. Predominant winds in the vicinity of the facility are from the northwest through southwest sectors.

3.1.2 **General Description of Pollution Sources and Controls**

3.1.2.1 Overall Description

The CDIF is an engineering-scale development test facility for magnetohydrodynamics (MHD) components. MHD is a process that generates electric power by passing an electrically conductive high-temperature gas, obtained from the combustion of coal, through a strong magnetic field.

In addition to air emissions from the MHD combustion process, there are also minor air emissions at the facility associated with coal preparation, process and heating boilers, and parts-cleaning operations in a machine shop. These are briefly described in the next section.

3.1.2.2 Specific Facilities

MHD Combustion Process

Figure 2-3 is a schematic showing the combustor operation. Hot exhaust gas from the test train is cooled by direct water and passed sequentially through a venturi scrubber and absorption scrubber for sulfur dioxide and solids removal. It is estimated that 99 percent of the particulate matter is removed by the venturi scrubber. The effluent is then passed to an 85-foot stack. Rough estimates of pollutant emission rates during coal-fired combustion testing are as follows (Heck, 1984):

<u>Pollutant</u>	<u>Emission Rate (lb/hr)</u>
TSP	127
CO	4480
SO ₂	119
Nitrogen oxides (NO _x)	325

Up to now, the maximum number of hours the combustor has operated during a year has been about 200. Although 24-hour tests are planned, the longest the combustor has operated continuously to date has been about 8 hours.

Coal Preparation

Coal from a storage bin is fed into a predryer by means of screw feeders. The screw feeders are internally heated by Therminol 66, a synthetic heat transfer fluid, which is a partially hydrogenated terphenyl. About 1,500-2,000 gallons of Therminol are recycled annually in the system, with an estimated loss of less than 1 percent vented to the atmosphere (Hall and Heck, 1987). Air is used to remove the water vapor and coal volatiles from the predryer. It is estimated that about 100 lb/yr of volatile matter is released to the atmosphere after passing through a wet scrubber (with 98 percent removal efficiency) (Hall and Heck, 1987).

The Coal Pulverizer and Drying Subsystem dries the coal to a specific moisture content and reduces the coal particle size to a level acceptable for combustion testing. During pulverization, partially dried coal is further dried by the combustion products from a direct-fired air heater, which is fired by natural gas or No. 2 fuel oil.

A cyclone collector separates the moist gas from the coal and sends the gas to a baghouse.

Other Sources

In a machine shop, it is estimated that less than 55 gallons/year of Stoddard solvent (mineral spirits) and 3 to 4 gallons/year of acetone are released to the air from parts cleaning operations in the machine shop (Hall and Heck, 1987). The 1986 usage of No. 2 fuel oil at the two facility boilers was estimated to be 37,200 gallons. The sulfur content of the fuel oil is 0.34 percent, which complies with Montana Department of Health and Environmental Sciences regulations.

3.1.3 Environmental Monitoring Programs

3.1.3.1 Emissions Monitoring

A continuous stack monitoring system measuring SO_2 , CO, nitric oxide/nitrogen oxides (NO/NO_x), and carbon dioxide (CO_2) was installed to monitor the combustor effluent. Checkout and shakedown of the system have been carried out throughout 1986 and 1987. High water content in the stack has been plugging the sampler lines and affecting the validity of the data. Site personnel have been attempting to correct this problem. At the time of the Survey, Mountain States Energy staff were experimenting with heating the sampling probe to evaporate the collected water. When the combustor is operating continuously for 24 hours, emission monitoring is required, as specified by the Montana Department of Health and Environmental Sciences permit.

3.1.3.2 Ambient Air Monitoring

Figure 3-1 shows the ambient monitoring network operated by Mountain States Energy in the vicinity of the CDIF. During 1986, TSP and meteorological data were collected at four stations, all within 1 mile of the site, while NO, NO_2 , and SO_2 were monitored continuously at Sites 1, 3, and 4. The SO_2 monitors are Thermo-Electron Corporation (TECO) pulsed fluorescent SO_2 analyzers, while the NO and NO_2 monitors are TECO chemiluminescent analyzers. Suspended particulate sampling was performed on CDIF test days and on the EPA sampling schedule (one 24-hour

AMBIENT AIR MONITORING NETWORK IN
THE VICINITY OF THE CDIF

FIGURE 3-1

sample every 6 days). EPA guidelines for meteorological and ambient air quality monitoring are followed.

The meteorological instruments used at the four sites consist of the following: 3-cup anemometers to monitor wind speed; wind vanes to monitor horizontal wind direction; bivanes to monitor horizontal and vertical wind direction; a pyranometer at Site 1 to monitor solar radiation; thermistors to measure ambient temperature; and dew cells to monitor the dew point temperature.

The meteorological parameters monitored at the 33-foot level at Site 1 are: temperature, mean wind speed, mean wind direction, horizontal wind direction standard deviation, mean vertical wind direction, vertical wind direction standard deviation, mean vertical wind speed, hourly solar radiation, relative humidity, dew point, daily maximum temperature and time of occurrence, daily minimum temperature and time of occurrence, daily total solar radiation, daily maximum wind speed and time of occurrence, and daily minimum wind speed and time of occurrence. At the 131-foot level at Site 1, all the same parameters are monitored except for hourly solar radiation, relative humidity, dew point, and daily total solar radiation. At the 33-foot towers at the other 3 sites, the following parameters are monitored: temperature, relative humidity, mean wind speed, mean wind direction, wind direction standard deviation, daily maximum temperature and time of occurrence, daily minimum temperature and time of occurrence, and daily maximum wind speed and time of occurrence (MSE, 1986b).

Ambient measurements of TSP, NO₂, and SO₂ obtained during 1986 are summarized in Table 3-1. The table shows that measured concentrations were well below state and Federal air quality standards (Hall and Heck, 1987).

3.1.4 Findings and Observations

3.1.4.1 Category I

None

3.1.4.2 Category II

None

3.1.4.3 Category III

None

3.1.4.4 Category IV

1. Lack of assessment of CDIF air quality impact. Since the air quality impact of the CDIF facility on surrounding elevated terrain has not been assessed, there is potential that high air contaminant concentrations approaching or exceeding ambient air quality standards could occur at these localities.

The CDIF is located in the south Butte Valley nearly surrounded by mountains rising 1,000-4,000 feet above the valley floor. Previous dispersion modeling studies for the plant have focused only on predicted impacts within the valley. Highest predicted concentrations are likely to occur on the elevated terrain during nighttime and early morning hours. These higher concentrations may be of increasing concern with respect to meeting state and Federal ambient standards as the plant operates for more hours during the year. Currently the CDIF air quality monitors are all located on the valley floor. In the absence of complex terrain modeling studies, the placement of monitors in areas where the maximum air contaminant concentrations are expected is questionable and may lead to an inaccurate assessment of the air quality impact from the CDIF.

3.2 Soil

3.2.1 Background Environmental Information

"The CDIF is situated on quaternary-tertiary alluvial deposits described as tertiary basin deposits of the Divide Valley. Locally, the deposits are known as granite wash or monzonite sand. Seismic surveys run across the valley indicate that valley fills may reach a depth of more than 800 feet. These underlying soils are very porous" (MSE, 1985).

3.2.2 General Description of Pollution Sources and Controls

The major pathways for potential soil contamination at the CDIF are routine and accidental liquid releases from product and waste handling, and from the drainage ditch and holding pond system. More detailed discussions are presented in Sections 3.3.2 (Surface Water), 4.1.1 (Waste Management), and 4.5.1 (Inactive Waste Sites and Releases).

3.2.3 Environmental Monitoring Program

The CDIF does not perform environmental monitoring for radiological or hazardous constituents in soil.

3.2.4 Findings and Observations

The findings which involve soil contamination are the result of current and past releases, spills, and disposal practices and are therefore discussed within the context of other findings in Sections 3.4.4 (Groundwater), 4.1.5 (Waste Management), and 4.5.2 (Inactive Waste Sites and Releases).

3.2.4.1 Category I

None

3.2.4.2 Category II

None

3.2.4.3 Category III

None

3.2.4.4 Category IV

None

PRELIMINARY

3.3 Surface Water

3.3.1 Background Environmental Information

The CDIF is located near the headwaters area of the Columbia and Missouri River Basins. The site itself is located on a plateau between two minor watersheds, Basin Creek to the east and Sand Creek to the west (Figure 2-1). Surface drainage flows from the site are in a northwesterly direction from the site.

There are no major surface-water features that influence or are influenced by the CDIF. Its location near the Continental Divide precludes flooding from a major river or a distant source. Due to the semi-arid climate, flooding from major precipitation events is also highly unlikely. Even with high spring peak flows from snowmelt and heavy precipitation between May and July, the porosity of the local soils results in percolation of most of the precipitation. The excellent natural drainage from the CDIF is also augmented by a drainage ditch and storm sewer system described in Section 3.3.2.

The drinking water, or potable water system, is a municipally supplied source from the City of Butte, Montana. The municipal water supply system receives its water from a reservoir approximately 4 miles south of the CDIF. Sanitary wastes are discharged into a sanitary sewer that goes to a municipally operated sewage treatment plant in Butte.

3.3.2 General Description of Pollution Sources and Controls

This section discusses the sanitary and industrial wastes from the CDIF and the site's stormwater runoff. There are no additional effluent streams from the facility.

3.3.2.1 Sanitary Waste

All sanitary wastes generated at the CDIF are piped to the Butte municipal sanitary authority for treatment. All facility drains lead to this system; therefore photographic laboratory wastewater (which may periodically contain trace amounts of silver) and cooling tower blowdown (containing phosphoric compounds) are treated by the municipal authority.

3.3.2.2 Industrial Waste

The contents of what the CDIF refers to as industrial wastewater are process cleaning waters, quench water, primary cooling water, coal-pile runoff, and miscellaneous waste streams such as waters received from non-sanitary-related floor drains at the Coal Preparation Plant. The primary constituent of these wastewaters is suspended solids in the form of coal fines. Other wastes that contribute to this waste stream are small amounts of used oils and solvents and also the organic and inorganic constituents of the coal fines.

All these waste streams are piped by gravity flow into the Coal Collection Basin, a pond approximately 40 feet wide and 80 feet long (Figure 3-2). The pond has a contiguous Hypalon liner to prevent subsurface infiltration. Adjacent to this pond and joined with an equalization line is another pond, named the Coal Collection Pond, approximately the same size as the Coal Collection Basin. The Coal Collection Pond is also lined to prevent subsurface infiltration. This pond has a manual valving arrangement that can be used to drain the pond contents to Basin Creek or to the sanitary sewer. There has never been reported an intentional discharge to the open ditch leading to Basin Creek. However, there has been a discharge within the past 12 months to the sanitary sewer.

Water from the Coal Collection Pond can be transferred to the lined West Evaporation Pond (Figure 3-2). If the flow of water into the West Evaporation Pond should increase, or if evaporation rates decrease, an overflow can spill water into the lined East Evaporation Pond. If necessary, water from the evaporation ponds can be directed to the Coal Collection Pond.

During the Survey, it was noted that all three pond liners and the basin liner had rips or holes which allowed water to percolate toward the groundwater, as described in Section 3.4.2.2.

3.3.2.3 Stormwater

Stormwater drainage on this site is provided by a series of ditches leading to a larger ditch, approximately 5 feet deep and 8 feet wide. This larger ditch parallels the

FIGURE 3-2

CDIF INDUSTRIAL WASTEWATER PONDS AND
MONITORING WELLS

western and southern boundaries of the site and ends in a large percolation pond where the water percolates into the subsoil. If flow into the percolation pond is such that percolation cannot handle the inflow, a standpipe 36 inches in diameter and 36 inches high is used to discharge overflow into Basin Creek. However, overflow into this standpipe rarely occurs.

Coal fines were observed by the Survey within the large boundary drainage ditch leading to the pond but not within the pond area itself.

3.3.3 Environmental Monitoring Program

3.3.3.1 Drinking Water

Although the City of Butte provides potable water to the site, CDIF personnel monitor the water supply. Each month a set of eight locations within the CDIF is sampled. The locations are alternated to avoid missing potential areas of bacterial growth. Typical monitoring locations consist of drinking fountains, eyewash stations, and any service water lines thought to be stagnant. Total coliform and fecal bacteria counts, as well as a turbidity analysis, are the normal monthly parameters analyzed on-site. In addition to the bacteriological analysis, the complete Contract Laboratory Program (CLP) metals list is conducted under contract every 3 years.

The sampling of drinking water samples for chemical and bacteriological analyses was not observed during the Survey. However, the Survey was told that common WHIRL-PACK sampling bags with preservative are used during drinking water sampling. CDIF sampling personnel reported that after sampling has been completed, the analyses are performed within 4 hours. Based on a review of the CDIF sampling protocols, it is believed by the Survey team that the drinking water samples are being drawn and handled in accordance with proper sampling procedures. Monitoring results for fecal coliform show no exceedances of drinking water standards (MSE, 1987).

3.3.3.2 Sanitary Wastewater

The CDIF does not monitor its sanitary (or plant) wastewater effluents released to the Butte Sanitary Treatment Plant (STP) because these releases are not regulated by the Montana Pollution Discharge Elimination System. However, the STP can refuse CDIF wastes if it is thought that the wastes will disrupt the STP process or cause the Butte STP to exceed its own discharge limitations. At this time, the Butte STP does not require the CDIF to conform to a specific set of pretreatment guidelines.

3.3.3.3 Industrial Wastewater

Current practice provides for quarterly sampling of the Coal Collection Basin, Coal Collection Pond, and both Evaporation Ponds within the CDIF for the parameters listed in Table 3-2.

Water samples are collected from the ponds using a dip sampler and are placed into bottles. Presently, preservatives, if any are required, are added immediately after the sample is in the bottle. The bottles are then tightly sealed, dried, and labeled with the date, sample type parameters, and preservative used. All samples are then placed in a chilled ice chest and placed in a vehicle for transport to the laboratory. Chain-of-custody procedures consist of the samples remaining in the sampling team's possession until they are delivered to the contractor laboratory. The sampling protocols are written and followed. However, prior to September 24, 1987, appropriate preservatives were not added, pH and dissolved oxygen measurements were not field-performed, sample refrigeration was not practiced, and a chain of custody was not established. Laboratory quality assurance and quality control (QA/QC) are discussed in Section 4.4.

Table 3-2 summarizes the range of values being reported in these ponds from 1985 through the third quarter of 1987 and compares them to Drinking Water Criteria (MSE, 1987). Although the water is not consumed and the drinking water standards are not applicable, they do provide an indication of the degree of contamination. Table 3-2 shows several parameters to be above the drinking water standards, including total dissolved solids, pH, sulfate, and nitrates, and occasionally ammonia, fluoride, arsenic, chromium-VI and, on one occasion, cadmium.

TABLE 3-2
CDIF PONDS, WATER QUALITY DATA, 1985-1987

Parameter	Drinking Water Criteria ^{a,d}	Range of Values ^{a,b,c}			
		Coal Collection Basin	Coal Collection Pond	East Evaporation Pond	West Evaporation Pond
Nitrate	10	9.4-63	3.0-106	5.4-245	4.2-266
Total Ammonia	0.5	<DL-0.52	0.06-0.60	0.050-0.27	0.022-2.8
Total Dissolved Solids	500	603-9,500	4,740-7,320	2,860-16,500	6,441-19,800
Chloride	250	0.35-13.8	1.30-6.64	0.40-15.0	0.60-14.5
Sulfate	250	65-1,430	807-1,240	235-2,510	383-1,800
Cyanide	0.2	NM ^e	NM	NM	NM
Fluoride	2.4	0.43-3.47	1.85-2.83	1.7-16	4.5-21
Arsenic	0.05	0.006-0.059	0.031-0.063	0.013-0.138	0.021-0.107
Barium	1.00	NM	NM	NM	NM
Chromium-VI	0.05	0.003-0.008	<0.011-0.070	<0.003-0.010	<0.003-0.013
Iron	0.3	0.040-0.206	0.080-0.120	0.083-0.190	<0.033-0.136
Manganese	0.05	NM	NM	NM	NM
Selenium	0.01	<0.005-0.015	<0.007-0.008	<0.005-0.009	<0.005-0.006
Mercury	0.002	<0.0001- <0.004	<0.0001- <0.0001	<0.0001- <0.004	<0.0001- <0.004
Copper	1.0	NM	NM	NM	NM
Lead	0.05	<0.002-0.008	0.002-0.009	<0.001-0.010	<0.001-0.17
Zinc	5.0	<0.015-0.238	0.010-0.064	<0.008-0.074	<0.010-0.070
Cadmium	0.01	<0.0013-5.0	0.0003-0.0004	<0.001- 0.0004	<0.0001- 0.0015
Chromium-III	17.8	NM	NM	NM	NM
Nickel	0.015	NM	NM	NM	NM
Silver	0.05	NM	NM	NM	NM
pH	6.5-8.5	9.0-10.2	10	9.0-10.2	9.0-10.0

- a All values in mg/L.
b Measurements reported for metals are for the dissolved species.
c 1985-Third Qtr., 1987.
d Drinking water standard for total metals.
e NM = Not Measured

3.3.4 Findings and Observations

3.3.4.1 Category I

None

3.3.4.2 Category II

None

3.3.4.3 Category III

None

3.3.4.4 Category IV

1. Suspect historical surface-water data. The quality of historical CDIF surface-water data is suspect because previous sampling methodologies compromised the validity and defensibility of past analytical results.

Previous to the September 24, 1987, Survey site visit, no written protocols and procedures existed that related to sample procurement, preservation, and chain-of-custody handling. As an example, samples were routinely collected in 1-gallon polyethylene containers with little or no attention being paid to sample bottle rinsing, sample bottle preservation, field analysis of pH and dissolved oxygen, sample refrigeration, and chain of custody.

Without appropriate attention being paid to sample QA/QC, the chemical analysis may not produce accurate results. For example, improper chemical preservation may cause metals to precipitate and organics to decompose, causing reported values to be higher or lower than actual concentrations.

3.4 Hydrogeology

3.4.1 Background Environmental Information

3.4.1.1 Regional Geology

The CDIF is located within the southwest corner of the Silver Bow drainage area of the Rocky Mountain physiographic division. This area is comprised of rugged mountain ranges and corresponding valleys. The mountain ranges generally trend north to northwest. The CDIF was built in a broad valley upon terrace deposits of Tertiary Age.

Initially, compressive forces in the late Cretaceous and early Tertiary developed large northwest-trending mountains. Over time, these mountains were eroded and leveled. In the late Tertiary, near-vertical faults developed in the existing granite which allowed the formation of new mountains and valley basins. While these movements were going on, the basin in which the CDIF is located gradually filled with sediments washed from the surrounding mountains. The river within the resulting valley also cut down into the rock, giving a gorge-like character to the area.

Block movements continued and may have at times cut off the release of the river, creating a lake. Sediment from the erosion of the surrounding mountains filled the basin as the water flowed into the lake. Eventually, the water level reached a point where it was able to flow out of the basin. Sediments, however, continued to fill the basin until the broad, flat valley floor currently present was formed.

It is speculated (Meinzer, 1914) that the climate of this area has alternated between dry and humid conditions on several occasions in the past. It is further speculated that during the humid periods, the amount and velocity of water flowing into the valley increased and many streams began to erode the deposited sediments. As a result, the flat area of the valley was dissected by stream valleys. Eventually, the climate again became arid, erosion ceased, and sediments were deposited. This is the situation today.

3.4.1.2 Hydrogeology

Groundwater in the Silver Bow drainage area is contained in the water-filled basin over which the CDIF is located. The granite rocks forming the surrounding mountains are practically impervious and form the confines of that basin. As these rocks extend entirely beneath and around the valley, the only outlet for water is at the northwestern end where Silver Bow Creek exits.

The water table in the basin is not entirely level. It is highest near the mountains and slopes gently toward the center and northwestern end of the valley. At the southern end of the valley the water table is far below the upland surface of the valley floor but northward the two surfaces gradually approach each other until, immediately south of Butte, the groundwater and the ground surface are nearly at the same elevation. Figure 3-3 presents reported groundwater contours in the vicinity of the CDIF (Botz, 1969). This figure presents all the hydrogeologic contour data obtained in the area to date.

The groundwater is recharged mainly by the mountain streams that flow into the valley from all directions. However, due to the very porous nature of the soils, some recharge also occurs by precipitation. Generally, most streams decrease in flow as they enter the valley and recharge the groundwater. Eventually, a point is reached where stream flow begins to increase in all streams as the groundwater recharges these streams. This is generally south of the City of Butte. Total annual recharge in the area is unknown, but water levels remain static with only slight seasonal variations.

As a result of the groundwater monitoring program at the CDIF, there are indications that the aquifer below the CDIF is confined by a clay layer at a depth of about 110 feet in the north and 140 feet in the south. The piezometric surface in these wells is at a depth of about 82 to 88 feet below the ground surface. Geotechnical studies conducted by Morrison and Myerlee in 1977 indicated the presence of a low-permeability zone beneath the CDIF site at a depth of about 30 feet. This zone may not be continuous throughout the site; however, where it is present, it may act to perch water near the ground surface.

Aquifer tests have been conducted in the Butte area (Botz, 1969). Transmissibility has been measured to range from 16,000 gallons per day per foot of depth (gpd/ft)

GROUNDWATER SURFACE ELEVATIONS IN
THE VICINITY OF THE CDIF

FIGURE 3-3

to 54,400 gpd/ft. However, the test wells did not penetrate the entire aquifer and so the reported results are less than the actual transmissibility of the aquifer.

The groundwater in proximity to the CDIF is primarily used as a source of irrigation, although some of the groundwater, particularly south of the CDIF where residences are not on city water, may be consumed.

3.4.2 General Description of Pollution Sources and Controls

3.4.2.1 Pollution Sources

Potential sources of groundwater contamination at the CDIF consist of lined ponds used for disposal of industrial wastewater. Releases from these lined ponds can eventually contaminate the groundwater through vertical migration of pond effluent. The potential sources of groundwater contamination are:

1. Coal Collection Basin
2. Coal Collection Pond
3. West Evaporation Pond
4. East Evaporation Pond

The locations of each of these areas are discussed in Sections 3.3.2.2 and 3.4.3 and shown on Figure 3-2. The basin and ponds are described in detail in Sections 3.3.2.2 and 4.1.

3.4.2.2 Pollution Controls

Pollution controls at the CDIF consist of Hypalon liners on each of the three ponds and the basin. At the time of the Survey, 1/2-inch-diameter holes were observed in the liners of the West Evaporation Pond and the Coal Collection Basin. Tears up to 6 inches long were observed in the portion of the liner beneath the inlet pipe of the East Evaporation Pond and beneath the outlet pipe of the Coal Collection Pond. The tears in these two ponds were located approximately 2 feet above the bottoms of the ponds and affected the effluent retention capacity of the Hypalon liners.

3.4.3 Environmental Monitoring Program

3.4.3.1 Description of Existing Program

The monitoring program at the CDIF consists of two wells located on the north and south sides of the site (Figure 3-2). These wells were constructed in 1978. Monitoring has been conducted from 1979 to the present in the south well and from 1979 to 1982 and from January 1987 to the present in the north well. Monitoring was not conducted between 1982 and 1987 in the north well because of the loss of a power source for the pump. It is suspected that the north well is located downgradient of the evaporation ponds and that the south well is located downgradient of the Coal Collection Pond and Basin. These conclusions are based on an earlier hydrogeologic report (Botz, 1969). However, a third well has not been placed to verify the flow direction of the aquifer. Monitoring well systems have also not been developed to monitor each area of interest.

The wells have been placed so that they monitor the top of the aquifer beneath the site. As a result, the north well extends to a depth of 120 feet and the south well extends to a depth of 150 feet. Piezometric levels in the north and south wells are reported to be about 88 feet and 82 feet below the ground surface, respectively. Surface elevations have been reported to be 5,620 feet mean sea level for the north well and 5,618 feet mean sea level for the south well.

The monitoring wells are constructed of 6-inch-diameter steel casing with 5-foot screens at the tip. The screens consist of 6-inch steel casing with 15 one-eighth-inch-wide slots. A gravel pack has been placed around the screen and a bentonite seal constructed above the screen. Soil backfill has been used to fill the annular space between the borehole wall and the well casing.

3.4.3.2 Sampling Procedures

Sampling at the on-site well is conducted by two individuals from Mountain States Energy, Inc. Field equipment is calibrated at the site using known standards. Dedicated submersible pumps are used to purge and sample the wells. Depths to the piezometric surface were not taken during the sampling event observed by the Survey. The well is purged until pH, temperature, and specific conductivity are stabilized. The volume of the purged water is estimated based on the pumping rate of the pump, which is measured volumetrically at the beginning of sampling. The

results of field measurements, names of samplers, unusual occurrences, date, time, and type of samples taken, and preservatives used are recorded in a field logbook.

Once purging is completed, samples are recovered from the spigot of the pump and placed in the sample bottles. Preservatives, if any are required, are added after the sample is in the bottle. The bottles are then tightly sealed, dried, and labeled with the date, sample type, parameters, and preservatives. All samples are then placed in a chilled ice chest and placed in a vehicle for transport to the laboratory. Chain-of-custody procedures consist of the samples remaining in the sampling team's possession until they are delivered to the contractor laboratory. Written sampling protocols are generally followed. The one exception was an aluminum cap liner for one organic sample instead of the teflon liner as called for in the site's written protocols. Laboratory quality control and quality assurance are discussed under Section 4.4.

3.4.3.3 Monitoring Data

The monitoring program at the CDIF has been instituted in response to state requirements and on-site concerns. The monitoring program was begun before the CDIF was operated so that the early data consist of groundwater conditions before any impact by the CDIF.

Monitoring was begun in December 1979 at both the north and south wells. Tables 3-3 through 3-6 present all monitoring data at the north and south wells for the monitored parameters as shown in the tables. The magnetohydrodynamic (MHD) system was first tested in December 1980, and disposal to the lined ponds did not occur until July 1984. As a result, all data before 1984 can be considered to show aquifer conditions unaffected by CDIF disposal.

At the bottom of each table are the interim primary and proposed secondary EPA drinking water standards. The tables indicate exceedances of the interim primary standards for metals in only a few instances. These cases may be due to sampling or analytical errors and do not appear to indicate contamination problems. However, the iron level is exceeded in many cases. This is probably because the wells are constructed of carbon steel and may be deteriorating. Additionally, the standard for iron is based on aesthetic, not health, criteria.

TABLE 3-3
CDIF GROUNDWATER MONITORING DATA: NORTH WELL FIELD DATA, ANIONS, AND MAJOR CATIONS*

DATE Y-M-D	Temp (°C)	pH	D.O.	SC µmho/ cm	TDS	TSS	TS	Bic- alkl	Hard- ness	NH ₃	NO ₃	PO ₄	SO ₄	F	Cl	Ca	Mg	Na	K
791207	9.0	6.60	9.1	—	183	—	—	88	109.0	0.070	1.30	0.39	51.8	0.46	8.70	—	—	—	3.70
800108	3.0	6.79	9.0	—	170	0.4	169	84	110.0	0.004	0.93	0.03	14.4	0.31	6.70	—	—	—	4.20
801211	—	6.94	—	240	120	50.0	180	88	112.0	0.002	0.31	0.14	41.1	0.21	7.70	11.0	7.52	—	3.95
810115	15.0	6.70	8.6	250	161	2.0	164	96	112.0	0.010	5.60	0.25	38.5	0.37	7.70	26.2	6.81	—	3.55
810224	17.0	6.80	8.2	290	157	7.0	164	98	109.0	0.160	0.49	0.10	35.1	0.43	8.70	32.6	6.89	—	2.59
810313	17.0	6.60	9.8	280	157	5.0	162	88	226.0	0.110	1.30	0.09	40.6	0.59	7.70	32.4	6.60	—	4.05
810416	16.0	7.94	8.6	341	185	1.0	186	98	111.5	<0.010	0.01	0.23	7.5	0.77	3.55	36.3	7.07	—	5.07
810518	19.0	7.90	1.1	255	110	3.0	112	90	108.5	0.017	2.04	<0.02	35.7	0.36	6.54	21.0	7.07	—	4.91
810618	20.0	6.88	9.1	310	280	3.0	283	86	115.0	0.090	0.84	0.26	38.4	0.42	6.60	35.2	7.35	—	6.70
810716	24.0	7.56	8.5	276	149	3.0	152	162	109.4	<0.010	1.10	0.18	43.6	0.29	7.14	27.2	7.56	15.40	3.86
810817	—	7.45	2.2	300	170	7.0	177	86	100.0	0.050	0.16	0.04	38.8	0.28	7.59	28.2	6.58	12.25	3.55
810915	19.5	6.70	8.1	293	207	4.0	211	90	107.0	<0.020	1.76	0.24	98.6	0.23	6.07	29.8	8.02	17.10	11.00
811015	16.0	7.28	2.7	220	172	19.0	191	86	108.0	<0.010	<0.020	<0.01	20.6	0.20	3.84	27.0	7.16	—	8.28
820119	—	7.86	7.1	289	585	5.0	590	88	116.0	0.045	0.98	0.25	33.0	0.18	7.80	29.0	7.20	—	11.50
820420	15.0	7.49	9.0	287	223	1.0	224	89	110.5	<0.010	1.30	0.20	41.0	0.28	8.50	30.5	7.55	—	3.83
820802	18.3	6.90	13.2	407	206	3.0	209	88	101.5	<0.010	0.16	0.30	39.0	0.50	5.40	27.7	7.51	—	4.80
821019	17.0	7.33	8.7	286	301	9.0	310	89	112.0	<0.010	1.25	0.25	45.0	0.54	8.00	28.5	6.33	—	3.69
870129	8.9	6.78	7.0	307	165	9.5	198	76	109.0	<0.010	22.00	—	15.0	0.35	6.70	32.9	7.78	—	3.70
870504	10.0	7.03	8.9	295	216	<4.0	225	82	119.0	1.220	1.70	0.34	42.5	0.33	7.35	28.5	6.89	—	4.00
870709	10.0	7.86	6.8	296	175	43.0	212	—	—	—	1.50	—	25.0	—	—	30.5	8.13	—	4.74
Drinking Water Standards	—	6.5-8.5	—	—	—	—	—	—	—	—	—	—	—	—	250	—	—	—	—

a Units in mg/L unless otherwise specified

— No applicable standards
D.O. Dissolved Oxygen
SC Specific Conductivity
TDS Total Dissolved Solids
TSS Total Suspended Solids
TS Total Solids
Bic-Alkl Bicarbonate Alkalinity

TABLE 3-4
CDJE GROUNDWATER MONITORING DATA: NORTH WELL FIELD DATA AND TRACE METAL CONSTITUENTS

DATE Y-M-D	Temp (°C)	pH	D.O.	SC µmhos/cm	As	Cd	Cr	Cu	Fe	Hg	Ni	Pb	Se	Zn
791207	9.0	6.60	9.1	—	0.0036	<0.0005	—	0.0002	0.362	0.0620	0.0121	<0.0001	0.0887	0.0060
800108	3.0	6.79	9.0	—	0.0079	—	—	0.1280	0.417	0.0037	0.0109	0.0007	0.0896	0.0057
801211	—	6.94	—	240	<0.0004	<0.0005	—	0.0057	0.546	0.0007	0.0051	0.0045	<0.0130	0.0080
810115	15.0	6.70	8.6	250	<0.0030	0.0010	—	0.0058	4.770	<0.0030	0.0280	<0.0010	0.0056	0.0320
810224	17.0	6.80	8.2	290	<0.0070	0.0054	0.0076	—	3.110	<0.0040	0.0087	<0.0010	<0.0060	0.0140
810313	17.0	6.60	9.8	280	<0.0003	0.0024	—	<0.0021	1.940	<0.0090	<0.0017	<0.0017	<0.0060	0.0190
810416	16.0	7.94	8.6	341	<0.0057	<0.0010	—	<0.0030	1.240	<0.0095	0.0140	0.0157	<0.0020	0.0170
810518	19.0	7.90	1.1	255	<0.0020	<0.0005	0.0020	—	1.630	<0.0026	—	<0.0003	<0.0078	0.0150
810618	20.0	6.88	9.1	310	<0.0030	0.0158	—	—	1.840	<0.0020	—	<0.0009	<0.0005	0.0145
810716	24.0	7.56	8.5	276	<0.0006	0.0100	<0.0000	—	1.370	<0.0002	—	<0.0010	<0.0005	0.0120
810817	—	7.45	2.2	300	<0.0020	<0.0100	<0.0100	—	4.290	<0.0003	—	0.0300	<0.0005	0.0170
810915	19.5	6.70	8.1	293	<0.0020	<0.0050	<0.0200	—	0.520	<0.0002	—	<0.0200	<0.0008	0.0230
811015	16.0	7.28	2.7	220	<0.0020	<0.0100	<0.1000	—	<0.040	<0.004	—	<0.0500	<0.0005	0.0140
820119	—	7.86	7.1	289	<0.0040	<0.0100	<0.0500	—	0.560	<0.0004	—	<0.0015	<0.0025	0.0180
820420	15.0	7.49	9.0	287	<0.0016	<0.0050	<0.0020	—	0.350	<0.0002	—	<0.0030	<0.0013	0.0120
820802	18.3	6.90	13.2	407	<0.0020	<0.0050	<0.0700	—	1.440	<0.0003	—	<0.0030	<0.0020	<0.0080
821019	17.0	7.33	8.7	286	<0.0050	<0.0060	<0.0500	—	1.500	<0.0004	—	<0.0020	<0.0020	0.0090
870129	8.9	6.78	7.0	307	<0.0050	<0.0100	<0.0180	—	<0.004	<0.0003	—	0.0030	<0.0100	<0.0080
870504	10.0	7.03	8.9	295	<0.0010	0.0006	<0.0130	—	0.170	<0.0001	—	<0.0040	0.0070	<0.0100
870709	10.0	7.88	6.8	296	<0.0030	<0.0001	<0.0030	—	0.026	<0.0001	—	0.0020	0.0030	<0.0100
Drinking Water Standards	—	6.5-8.5	—	—	0.05	0.01	0.05	1.0	0.3	0.002	10	0.05	0.01	5.0

a Units in mg/L unless otherwise specified

— No applicable standards

D.O. Dissolved Oxygen

SC Specific Conductivity

TABLE 3-5

CDIF GROUNDWATER MONITORING DATA: SOUTH WELL FIELD DATA, ANIONS, AND MAJOR CATIONS*

DATE Y-M-D	Temp (°C)	pH	D.O.	SC µmho/ cm	TDS	TSS	TS	Bic- alkl	Hard- ness	NH ₃	NO ₃	PO ₄	SO ₄	F	Cl	Ca	Mg	Na	K
791207	9.0	7.10	8.6	--	152	--	--	102	93.0	0.600	1.07	0.45	44.1	0.52	8.80	--	--	--	4.10
800108	10.0	6.46	8.4	200	134	0.2	133	98	14.0	0.003	0.80	0.33	5.0	0.35	7.50	--	--	--	4.10
801211	--	6.79	--	200	117	4.0	121	108	96.0	0.002	0.32	0.19	12.3	0.36	8.50	10.6	6.75	--	3.81
810115	15.0	6.70	8.2	220	96	1.0	97	104	95.0	0.020	4.72	0.29	11.3	0.37	7.70	22.2	5.95	--	3.34
810224	17.0	6.73	7.6	250	117	2.0	118	100	86.0	0.160	0.40	0.12	11.3	0.33	8.20	26.1	5.92	--	2.37
810313	17.0	6.70	8.3	240	137	22.0	159	100	196.0	0.110	0.80	0.07	13.9	0.60	8.80	27.4	5.60	--	3.83
810416	17.0	6.83	9.1	406	143	--	143	112	98.8	<0.010	0.13	0.26	20.8	0.64	3.95	29.3	6.15	--	3.78
810518	19.0	7.26	8.8	330	124	0.5	124	100	93.0	0.010	1.98	0.31	13.3	0.36	6.89	16.7	6.10	--	4.86
810618	20.0	6.97	--	270	74	3.0	77	100	97.0	0.110	0.98	0.27	13.2	0.45	7.60	29.9	6.25	--	4.30
810716	24.0	7.60	9.3	257	141	7.0	148	192	104.0	<0.010	1.20	0.24	16.1	0.30	8.42	23.8	6.54	16.40	4.02
810817	--	7.78	7.9	250	220	5.0	225	104	97.0	0.050	0.95	1.75	14.5	0.45	8.74	27.8	5.76	12.00	3.29
810915	19.0	6.81	5.0	260	304	10.0	314	100	90.0	<0.020	1.45	0.28	28.2	0.28	7.77	23.7	6.67	18.10	3.70
811015	16.2	7.15	1.1	202	369	4.0	371	104	93.0	<0.010	<0.020	<0.10	3.6	0.30	5.07	23.0	5.50	--	19.00
820119	--	7.78	5.1	247	233	10.0	243	98	95.0	0.710	0.92	0.87	10.0	0.34	9.00	25.0	6.20	--	4.00
820420	13.5	7.43	9.5	264	200	2.0	202	98	96.5	<0.010	0.96	0.30	19.0	0.32	8.80	25.2	6.58	--	3.60
820802	18.1	6.87	10.3	267	190	3.0	193	95	98.0	0.010	0.13	0.36	23.0	0.62	9.00	22.4	6.70	--	6.40
821019	16.0	7.51	9.1	250	286	9.0	295	92	97.0	<0.010	1.00	0.35	15.0	0.46	9.00	24.3	5.93	--	3.52
Drinking Water Standards	--	6.5-8.5	--	--	--	--	--	--	--	--	--	--	250	4.0	250	--	--	--	--

* Units in mg/L unless otherwise specified

-- No applicable standards
D.O. Dissolved Oxygen
SC Specific Conductivity
TDS Total Dissolved Solids
TSS Total Suspended Solids
TS Total Solids
Bic-alkl Bicarbonate Alkalinity

TABLE 3-5

CDIF GROUNDWATER MONITORING DATA: SOUTH WELL FIELD DATA, ANIONS, AND MAJOR CATIONS^a (Continued)

DATE Y-M-D	Temp (°C)	pH	D.O.	SC µmho/ cm	TDS	TSS	TS	Bic-alkl	Hard- ness	NH ₃	NO ₃	PO ₄	SO ₄	F	Cl	Ca	Mg	Na	K
830120	8.5	6.10	9.4	270	—	—	—	95	92.0	0.010	0.90	0.29	23.0	0.35	8.50	22.0	6.40	14.00	3.70
830719	14.9	7.05	6.4	—	46	8.0	136	88	99.0	<0.100	5.80	0.35	9.2	<0.20	8.40	60.0	6.17	—	5.22
831014	8.0	6.86	10.8	—	190	1.0	192	88	105.0	<0.020	7.40	0.29	31.3	0.17	8.50	33.5	8.10	—	5.43
840126	7.5	6.62	8.4	—	179	<10.0	184	88	100.0	0.021	0.76	0.30	31.8	0.37	8.25	26.9	6.54	—	3.92
840500	8.5	6.57	10.0	264	209	3.0	212	88	76.0	0.028	2.67	0.25	39.6	0.40	10.00	31.2	6.50	—	3.70
840712	—	6.64	—	317	256	2.0	258	99	85.0	0.014	1.84	0.44	34.6	0.18	8.60	30.1	7.90	—	5.10
841030	—	6.63	—	252	211	<5.0	214	92	150.0	<0.200	6.82	0.20	24.8	0.36	9.50	7.3	7.60	—	4.41
850128	7.0	6.82	8.8	1440	172	4.0	183	98	—	0.084	3.20	0.35	—	0.31	8.50	33.7	8.28	—	3.42
850422	4.0	7.40	6.2	292	240	11.0	249	90	106.0	0.040	4.90	0.22	35.0	0.32	9.60	30.9	7.56	—	3.71
850723	10.5	6.90	5.8	—	226	2.0	219	96	116.0	0.050	2.80	0.11	—	0.59	8.80	32.1	7.97	—	4.21
851028	9.5	6.90	7.4	296	268	11.0	261	92	106.0	0.126	2.20	0.08	34.0	0.49	9.00	30.5	7.86	—	3.96
860127	13.4	7.10	7.2	290	193	1.0	202	92	114.0	0.120	2.61	0.13	39.6	<0.50	10.00	32.3	7.94	—	3.88
860430	10.0	6.30	10.2	310	199	3.0	185	130	98.0	0.200	1.90	0.30	41.0	0.30	12.00	36.4	7.93	—	3.91
870129	8.8	6.90	6.8	316	208	11.0	174	85	113.0	<0.010	19.00	—	12.0	0.39	5.30	31.7	7.86	—	3.74
870504	9.9	6.87	7.2	442	219	8.0	245	91	110.0	0.548	1.40	0.31	35.2	0.32	10.30	24.1	7.02	—	3.65
870709	10.0	7.46	6.5	338	205	—	216	—	—	—	5.60	—	—	—	—	29.7	8.24	—	6.50
Drinking Water Standards	—	6.5-8.5	—	—	—	—	—	—	—	—	—	—	250	4.0	250	—	—	—	—

^a Units in mg/L unless otherwise specified

— No applicable standards
D.O. Dissolved Oxygen
SC Specific Conductivity
TDS Total Dissolved Solids
TSS Total Suspended Solids
TS Total Solids
Bic-Alkl Bicarbonate Alkalinity

TABLE 3-6

CDIF GROUNDWATER MONITORING DATA: SOUTH WELL FIELD DATA AND TRACE METAL CATIONS*

DATE Y-M-D	Temp (°C)	pH	D.O.	SC µmhos/cm	As	Cd	Cr	Cu	Fe	Hg	Ni	Pb	Se	Zn
791207	9.0	7.10	8.6	—	0.0055	0.0000	—	0.0012	0.354	<0.0001	0.0104	<0.0001	0.0850	0.0015
800108	3.0	6.46	8.4	206	0.0126	—	—	0.0040	0.097	<0.0002	0.0095	<0.0001	0.0580	<0.0001
801211	—	6.79	—	200	<0.0040	<0.0050	—	<0.0040	0.159	0.0040	0.0210	<0.0015	<0.0130	0.0060
810115	15.0	6.70	8.2	220	<0.0030	0.0012	—	0.0075	1.260	<0.0005	0.0052	0.0013	0.0065	0.0330
810224	17.0	6.73	7.6	250	<0.0070	0.0033	0.0050	0.0102	0.536	<0.0030	<0.0034	0.0014	0.0060	0.0450
810313	17.0	6.70	8.3	240	0.0014	<0.0079	—	0.0080	2.570	<0.0040	<0.0017	<0.0017	<0.0018	0.0063
810416	17.0	6.83	9.1	406	0.0021	<0.0004	<0.0080	<0.0030	0.117	<0.0090	0.0168	0.0140	<0.0018	0.0110
810518	15.0	7.26	8.6	330	<0.0020	<0.0003	<0.0007	—	0.410	<0.0055	—	<0.0003	<0.0078	0.0170
810618	20.0	6.97	—	270	<0.0030	<0.0060	0.0075	—	0.371	<0.0030	—	<0.0700	<0.0005	0.0134
810716	24.0	7.50	9.3	257	0.0015	0.0038	<0.0400	—	0.212	<0.0020	—	<0.0010	<0.0005	0.0090
810817	—	7.78	7.9	250	<0.0020	<0.0100	<0.0150	—	0.330	<0.0002	—	<0.0200	<0.0005	0.0140
810915	19.0	6.87	5.0	260	<0.0020	<0.0050	<0.0200	—	0.805	<0.0003	—	<0.0200	<0.0008	0.0310
811015	16.2	7.15	1.1	202	<0.0020	<0.0100	<0.1000	—	4.160	<0.0002	—	<0.0500	<0.0005	0.0280
820119	—	7.78	5.1	247	<0.0040	<0.0100	<0.0500	—	1.800	<0.0004	—	<0.0015	<0.0025	0.0240
820420	13.5	7.43	9.5	264	<0.0016	<0.0050	<0.0020	—	0.490	<0.0004	—	<0.0030	<0.0013	<0.0050
820802	18.1	6.57	10.3	267	<0.0020	<0.0050	<0.0700	—	1.050	<0.0002	—	<0.0030	<0.0020	0.0110
821019	16.0	7.51	9.1	250	<0.0050	<0.0060	<0.0500	—	0.290	<0.0003	—	<0.0020	<0.0020	0.0160
Drinking Water Standards	—	6.5-8.5	—	—	0.05	0.01	0.05	1.0	0.3	0.002	10	0.05	0.01	5.0

* Units in mg/L unless otherwise specified
 — No applicable standards
 D.O. Dissolved Oxygen
 SC Specific Conductivity

TABLE 3-6

CDIF GROUNDWATER MONITORING DATA: SOUTH WELL FIELD DATA AND TRACE METAL CATIONS^a (Continued)

DATE Y-M-D	Temp (°C)	pH	D.O. mg/L	SC µmho/cm	As	Cd	Cr	Cu	Fe	Hg	Ni	Pb	Se	Zn
830120	8.5	6.10	8.2	270	<0.0030	<0.0050	<0.0400	—	0.348	<0.0004	—	0.0240	<0.0020	0.0200
830719	14.9	7.05	6.4	—	<0.0050	<0.0100	<0.0600	—	1.590	<0.0004	—	<0.0050	<0.0020	0.0220
831014	8.0	6.86	10.8	—	<0.0050	<0.0010	<0.0100	—	1.430	<0.0050	—	<0.0050	<0.0050	<0.0300
840126	7.5	6.62	8.4	—	0.0048	<0.0010	<0.1000	—	0.360	<0.0015	—	<0.1000	<0.0050	<0.0100
840500	8.5	6.57	10.0	264	<0.0050	<0.0150	<0.0500	—	<0.050	<0.0020	—	<0.0050	<0.0050	<0.0200
840712	—	6.64	—	317	<0.0050	<0.0100	<0.1000	—	0.146	<0.0010	—	<0.0100	<0.0100	0.7820
841030	—	6.63	—	252	0.0090	<0.0010	<0.1000	—	0.233	<0.0010	—	<0.0050	<0.0100	<0.1000
850128	7.0	6.82	8.8	1440	<0.0050	<0.0013	<0.0450	—	0.149	<0.0010	—	<0.0057	<0.0064	<0.0150
850422	4.0	7.40	6.2	292	0.0065	<0.0014	<0.0450	—	<0.212	—	—	<0.0010	—	<0.0640
850723	10.5	6.90	5.8	—	<0.0040	<0.0020	<0.0060	—	<0.029	<0.0040	—	<0.0580	<0.0050	<0.0190
851028	9.5	6.90	7.4	296	<0.0040	<0.0020	<0.0060	—	0.058	<0.0040	—	<0.0580	<0.0050	<0.0190
860127	13.4	7.10	7.2	290	<0.0023	<0.0030	<0.0100	—	0.266	<0.0040	—	<0.0018	<0.0050	0.0120
860430	10.0	6.30	10.2	310	<0.0030	<0.0230	<0.0220	—	<0.015	0.0014	—	<0.0060	<0.0030	0.0200
870129	8.8	6.90	6.8	316	<0.0050	<0.0100	<0.0180	—	<0.004	<0.0010	—	0.0020	<0.0100	0.0100
870504	9.9	6.87	7.2	442	0.0080	0.0012	<0.0130	—	<0.023	<0.0003	—	<0.0040	0.0040	<0.0100
870709	10.0	7.46	6.5	338	<0.0030	<0.0001	<0.0030	—	<0.105	<0.0001	—	<0.0020	<0.0020	<0.0100
Drinking Water Standards	—	6.5-8.5	—	—	0.05	0.01	0.05	1.0	0.3	0.002	10	0.05	0.01	5.0

^a Units in mg/L unless otherwise indicated

— No applicable standards

D.O. Dissolved Oxygen

SC Specific Conductivity

3.4.4 Findings and Observations

3.4.4.1 Category I

None

3.4.4.2 Category II

None

3.4.4.3 Category III

1. Releases of pond effluent into the soil and potentially into the groundwater
Rips and holes in all CDIF pond and basin liners have released unknown concentrations and quantities of inorganic and organic contaminants into the soil and potentially the groundwater.

On September 24, 1987, the Survey team observed the condition of the pond liners at the CDIF. Tears were found in the liner below the release pipe on the east side of the Coal Collection Pond and below the inlet pipe in the northwest corner of the East Evaporation Pond. In addition, one hole about 1/2-inch in diameter was found in the liner on the east side of the West Evaporation Pond and a similar-sized hole was found in the southwest corner of the Coal Collection Basin. Neither the three ponds nor the basin have a secondary liner or a sand layer acting as a leak detection system.

The lined ponds and basin receive the coal fines from the MHD process. In addition, floor drains from Buildings 20, 50, and 60 drain into the ponds as does potassium carbonate seed and stormwater runoff. Small spills of solvents and cleaning fluids have been reported in the various buildings listed above and the residue may have entered the floor drains. Organics could also have leached from the coal fines accumulating in the Coal Collection Pond. As a result, the pond effluent may be contaminated with inorganics and organics. Once below the liner, the effluent would migrate through the soil and toward the groundwater, which is located at a depth of about 120 feet. However, a clay and silt layer at a depth of 30 feet may cause any contaminated water to

perch above this layer. There are no wells located in the assumed downgradient groundwater direction and within 2 miles of the site. Details on the contaminant levels in the pond water are reported in Section 3.3.

2. Inadequate groundwater monitoring program. The physical and chemical hydrogeologic parameters at the CDIF are not adequately characterized, which could result in a misinterpretation of groundwater data collected by the site.

Monitoring well locations at the CDIF are not located in a manner that defines the aquifer gradient and direction of flow. Currently two wells monitor the aquifer at the CDIF. Each is in a location that is suspected to be downgradient of the lined disposal ponds. However, it is not possible to measure the direction of aquifer flow from only two wells. There are no upgradient wells near or on the CDIF site that can be used to monitor background levels of contaminants. Organics are not monitored, even though tears in the pond liners may allow their release into the soil and groundwater. Also, it is not possible to assess the presence of a seasonally perched water table that may influence the location of pond monitoring wells. A perched water table is suspected because of the low permeability of a clay and silt layer at a depth of about 30 feet, which was detected from geotechnical studies.

3.4.4.4 Category IV

1. Suspect historical CDIF groundwater data. The quality of historical CDIF groundwater data is suspect because of previous sampling methodologies that compromise the validity and defensibility of past analytical results.

Prior to the September 24, 1987, site visit, written protocols and procedures that related to sample procurement, preservation, and chain-of-custody handling did not exist. For example, samples were routinely collected in 1-gallon polyethylene containers with little or no attention paid to the following: sample bottle rinsing; sample bottle preservation; field analysis of pH and DO; sample refrigeration; and chain of custody.

4.0

NON-MEDIA-SPECIFIC FINDINGS AND OBSERVATIONS

This section discusses findings and observations pertaining to waste management, toxic and chemical materials, radiation, quality assurance, and inactive waste sites and releases. These discussions do not include background environmental information because the areas addressed are not necessarily tied to one medium as was the case with the discussions in Section 3.0.

4.1

Waste Management

Wastes generated at the CDIF from the magnetohydrodynamic (MHD) operations (as discussed in Section 2.2) and support and administrative activities include hazardous and nonhazardous wastes. The CDIF has a U.S. Environmental Protection Agency (EPA) hazardous waste generator number and is considered a small-quantity generator of hazardous waste under the Resource Conservation and Recovery Act (RCRA). Radioactive and mixed wastes are not used and therefore are not generated at this facility.

In general, hazardous wastes generated at the CDIF are accumulated in 55-gallon drums at satellite storage areas. When the drums are full, they are made ready for off-site shipment. Preparation may include inventorying, inspecting, repackaging, treatment/stabilization, and manifesting by Waste Management personnel in accordance with RCRA regulations. The off-site disposal contractor transports the waste to its site where wastes are treated, stored, or disposed of. Nonhazardous wastes are placed in receptacles and taken to the Butte Public Landfill for disposal. Hazardous wastes are not accepted at the landfill. Liquid sanitary and industrial wastes and stormwater are discussed in Section 3.3.

4.1.1 General Description of Pollution Sources and Controls

4.1.1.1 Hazardous Waste

The CDIF generates a limited variety and quantity of hazardous waste from support activities. These activities include equipment maintenance and cleaning, photoprocessing, heat exchanger operations, and materials machining. Solvents, oils, and silver are the wastes generated through these activities. Waste oils and

solvents, mainly Stoddard solvent, acetone, and Chlorosolv, are accumulated at two satellite storage areas near points of generation. These areas are located in a three-sided roofed shed east of the maintenance shop (Building 26) and in a small trailer south of the experimental support shop (Building 22) (Figure 4-1). There is limited spill containment in these areas, and no emergency equipment is on hand.

Photoprocessing chemicals, including a developer containing silver, are currently being discharged to the facility's sanitary sewers from Building 11. Sewers at the CDIF are serviced by the Butte publicly owned treatment works (POTW). Washdown from coal transfer operations and spills near Building 20 flow from an asphalt drainage area to the site's unlined ditch system. Sections 3.3 and 3.4 contain additional discussions on groundwater and surface-water aspects of waste generation.

4.1.1.2 Nonhazardous Waste

Nonhazardous solid wastes (trash, garbage, wood, and scrap metal) from support and administrative activities are collected in receptacles and transported to the Butte Public Landfill. Hazardous wastes are not allowed to be disposed of at this area. In addition, solid wastes such as fly-ash waste, slag waste, and flue gas emission control waste from site processes, are discharged to one or more of the following: Coal Collection Pond, Coal Collection Basin, West Evaporation Pond, East Evaporation Pond, and the Thickener tank (Hall, 1986) (Figure 4-1). These facilities are discussed in more detail in Section 3.3. Liquid nonhazardous wastes from sanitary systems are discharged through the CDIF sewer lines to the Butte POTW.

4.1.2 Findings and Observations

4.1.2.1 Category I

None

4.1.2.2 Category II

None

CDIF SATELLITE STORAGE AREAS

FIGURE 4-1

4.1.2.3 Category III

1. Coal dust and organics soil contamination. Coal dust and organics may be entering the environment via spill washdown and surface runoff at the CDIF.

Coal dust and organics from coal transfer/spill washdown operations north of Building 20 at the CDIF may have contaminated or may be contaminating the soil in the nearby drainage area and drainage ditch system. These contaminants, which gave the washdown water a brownish cast and surface sheen, follow a surface-water drainage pattern on the asphalt that leads to a drainage area southeast of the coal transfer area. Coal dust contamination was traced from the asphalt drainage area to the site's extensive unlined drainage ditch system which leads to a percolation basin with overflow going off-site to Basin Creek. As the soil at the CDIF is sandy and highly permeable, contaminants may percolate into the soils and increase the contamination area.

4.1.2.4 Category IV

1. Improper storage of hazardous materials/wastes. Hazardous materials/wastes are stored at the CDIF in such a manner as to allow their potential release to the soil and groundwater in the event of a leak or spill.

Hazardous materials/wastes may potentially be released to the soil and groundwater at the CDIF because of improper storage practices. A satellite storage area for waste oil and solvents is located in an oil product dispensary area east of the maintenance shop (Building 26). This area does not have sufficient spill containment to prevent leaks and spills from migrating off the concrete pad on which the drums sit. These drums were not in drip pans and the cement floor sloping to the east did not have curbing to prevent contaminants from flowing onto and into the soil and subsequently down an earthen slope to a drainage ditch approximately 45 feet away. This ditch is part of the drainage system around the facility that empties into a percolation basin with overflow going off-site to Basin Creek. The drainage system is

unlined and provides a pathway for contaminant migration into the sandy, permeable soil of the area.

PRELIMINARY

4.2 Toxic and Chemical Materials

4.2.1 General Description of Pollution Sources and Controls

Generally only a small quantity of chemicals are used at the CDIF. The largest bulk-chemical usage is of potassium carbonate; Therminol, a type of hydrogenated terphenyl; Chlorasolv, a variety of carbon tetrachloride; acetone; and Stoddard solvent, an aromatic kerosene degreaser. The majority of other toxic substances are various paints and coatings.

4.2.1.1 Polychlorinated Biphenyls (PCBs)

There are no PCBs at the CDIF.

4.2.1.2 Asbestos

There is no asbestos at the CDIF.

4.2.1.3 Herbicides

All herbicide usage is subcontracted to an off-site licensed contractor. Residual product from previous applications is temporarily stored in a locked chemical storage cabinet and currently consists of a 5-gallon can containing less than half a gallon of Tordon 22K. Product use is planned for spring 1988 by the subcontractor. No future storage of herbicide is anticipated.

4.2.1.4 Pesticides (Rodenticides, Insecticides, Algicides)

No pesticides are stored on the site; use is subcontracted to an off-site licensed contractor.

4.2.1.5 Underground Storage Tanks

The CDIF has developed a list of in-service underground storage tanks (USTs). This list, presented in Table 4-1, includes tank number or location, capacity, construction material, installation date, and contents. The list was current as of September 1987.

TABLE 4-1

UNDERGROUND STORAGE TANKS AT THE CDIF, SEPTEMBER 1987

Tank No.	Building Location	Capacity (gallons)	Construction Material	Contents	Age (yrs)	Comments
1		25,000	Steel	Diesel	8	
2		1,000	Steel	Gasoline	4	
--	Building 50/60	6,000	Steel	Diesel	9	Heating
--	Machine Shop	1,000	Steel	Diesel	9	Heating
--	Warehouse	1,500	Steel	Diesel	9	Heating

Because of the age of the facility, the tanks are less than 10 years old. There are no inactive USTs at the CDIF. Tanks 1 and 2 are on the notification list to the state; however, the other three are not on the state notification list since they are used for storage of heating oil for on-site consumption.

None of these tanks have been tested to determine if they have leaks that exceed National Fire Prevention Association (NFPA) criteria of 0.05 gallon per hour. In addition, leak detection methods, such as daily dipstick measurements, are not in use. Dipstick measurements of the product level in the tank are taken only to determine if the tanks need to be filled.

4.2.2 Findings and Observations

4.2.2.1 Category I

None

4.2.2.2 Category II

None

4.2.2.3 Category III ^{unlined} and provides a pathway for contaminant migration into the sandy, permeable soil of the area.

1. Insufficient UST monitoring program. The integrity of USTs is in question at the CDIF and unknown releases may be contaminating the soil and potentially the groundwater.

Releases of hydrocarbons from the USTs at the CDIF, as listed in Table 4-1, may be occurring but are not detected because of insufficient inventory control. Dipstick measurements are periodically made on all tanks but no effort is made to determine if level changes are the result of product usage or leaks. Also, petroleum product USTs have never been leak tested as described by NFPA 329. Consequently, leaks from the tanks may be occurring but may remain undetected due to a lack of monitoring.

4.2.2.4 Category IV

None

4.3 Radiation

4.3.1 Background Environmental Information

Background radiation in the vicinity of the CDIF is composed of both natural and man-made sources. These sources include cosmic radiation; natural radiation from the ground; radionuclides in food, drinking water, and air; and fallout from past atmospheric weapons detonations. The most significant of these sources in terms of dose is exposure to the lung from inhalation of background levels of naturally occurring radon. The annual average effective dose equivalent (EDE) to humans from natural background radiation in the United States is 189 millirem (mrem) (EPA, 1986a). Distribution of this dose is detailed in Table 4-2. The EDE estimates in Table 4-2 were derived using the approach of the International Commission on Radiological Protection (ICRP) in ICRP Reports 26 and 30 (ICRP, 1977; 1978), which allows direct comparison of the dose equivalent (DE) for different organs using "weighting factors." The weighting factors are expressed as the fraction of the total risk for the entire body attributable to the organ. The sum of the DEs for the individual organs provides an estimate of the total effect of the radiation on the whole body. About one-half of the annual EDE is attributable to the inhalation of radon-222 and its decay products. Previously accepted estimates of the background dose did not include the radon contribution and were set at about 100 mrem/year EDE.

The EPA reports the background gamma radiation dose rates for locations throughout the United States on a quarterly basis. These background gamma radiation dose rates do not measure the contribution attributable to the inhalation of radon-222 and its decay products. During the 12 months from October 1985 to September 1986, EPA reported measured background gamma dose rates equivalent to annual doses of between 134 ± 42 mrem DE in Denver, Colorado, and 61 ± 55 mrem DE in Orlando, Florida (EPA, 1986b, c, and 1987). The national average measured background gamma dose rates equivalent to an annual dose of the 22 locations monitored throughout the United States was 92 ± 39 mrem DE.

The DOE establishes the radiation protection guidelines for DOE facilities. Radiation standards for the protection of the public in the vicinity of the CDIF are given in DOE Order 5480.1A ("Environmental Protection, Safety and Health

TABLE 4-2
AVERAGE ANNUAL EFFECTIVE DOSE
EQUIVALENT TO HUMANS FROM NATURAL
BACKGROUND RADIATION

Organ	Annual Effective Dose Equivalent (mrem)
Gonads	24
Breast	14
Lung (Total)	100
Red Bone Marrow	13
Bone Surfaces	6
Thyroid	3
Other	29
Total	189

Source: Adapted from EPA, 1986a

Protection Program for DOE Operations") as amended on August 5, 1985. These standards are based on the recommendations of the ICRP and the National Council on Radiation Protection and Measurements (NCRP). The amended order also includes the EPA limits for the atmospheric pathway radiation dose received from DOE facilities contained in 40 CFR 61, Subpart H. The DOE dose limit is 100 mrem/year EDE (natural background and medical exposures excluded) for all pathways to any member of the general public for a prolonged period of exposure from normal DOE operations. In addition, 40 CFR 61, Subpart H, states that any member of the general public shall not receive a radiation dose from the air pathway of greater than 25 mrem/year DE to the whole body or 75 mrem/year DE to any organ from normal DOE operations.

4.3.2 General Description of Pollution Sources and Controls

Radioactive materials are not utilized at the CDIF.

4.3.3 Environmental Monitoring Program

No environmental monitoring of direct radiation or radioactive constituents is performed at the CDIF.

4.3.4 Findings and Observations

4.3.4.1 Category I

None

4.3.4.2 Category II

None

4.3.4.3 Category III

None

4.3.4.4 Category IV

None

4.4 Quality Assurance

4.4.1 General Description of Environmental Monitoring

Environmental monitoring is conducted at the CDIF for groundwater quality, surface water quality, ambient air quality, and hazardous wastes. Two groundwater wells, four wastewater storage ponds, and a thickener process tank are sampled and analyzed quarterly. Air samples are drawn from a series of monitors located off the site and from a continuous stack monitoring system, which went on-line in early 1987.

Monitoring, sampling, and analysis are performed in accordance with U.S. Environmental Protection Agency (EPA) Methods for Chemical Analysis for Water and Wastes (revised 1983), and Montana Energy and MHD Research and Development Institute Procedures manual for the Water Quality/Biological Monitoring Program (1979). Sampling is conducted by personnel from the Multitech Division of Mountain States Energy and is supervised by the Environmental Branch of Multitech.

4.4.2 Environmental Sampling

Field samples collected for environmental monitoring are required to follow a strict quality assurance/quality control (QA/QC) protocol to ensure the integrity of the sample and accompanying data. The sampling program, along with the associated quality control/quality assurance, is discussed under the appropriate media sections, 3.1 (Air), 3.3 (Surface Water), and 3.4 (Groundwater).

4.4.3 Analytical Laboratories

Laboratory analysis of the collected environmental monitoring samples is provided under contract by Multitech, a division of Mountain States Energy Corporation. The laboratory primarily handles inorganic analysis of air, soil, and water samples. Although the laboratory is not covered by this Survey, since it is a contractor laboratory, it was visited by the Survey and the observations are presented below.

Organic analysis is infrequently performed on Extraction Procedure (EP) toxic parameters. Very few polychlorinated biphenyl (PCB) or pesticide analyses are performed and all complex analysis requiring a gas chromatograph mass spectrometer is subcontracted to another laboratory. Analytical equipment and instrumentation available include inductively coupled argon plasma (ICP) emission spectrometer, furnace atomic absorption spectrometer, ion chromatograph, particle size laser analyzer, ultraviolet-visible spectrophotometer, selective ion electrodes for cyanide, sulfide, pH, fluoride, nitrate, and standard titration apparatus. The equipment is clean, properly maintained, free of clutter, and operational.

Analytical procedures are outlined in user manuals, and maintenance and daily calibration logbooks are maintained for each instrument. Calibration logs are kept for analytical balances and calibration curves are run daily for each parameter on the ICP. Calibration curves are generated on other instruments as needed. There is no physical internal chain-of-custody security or protocol; however, plans to implement a sample storage lock-up are currently being considered.

Twenty-nine physiochemical parameters are routinely tested including anions and 11 trace metals. Analytical request forms follow the samples. Label documentation and tracking is maintained internally and archived with analytical results and a copy of the final report. Standards are prepared from National Bureau of Standards (NBS) materials and are housed in a storage area separate from the other reagents. Currently, spikes, blanks, and splits are sporadically run but no blind checks have been utilized to date.

Data generated from the environmental monitoring effort are transferred to magnetic tape and entered into a computer, which allows a compilation of daily and monthly reports. This format provides a means to quickly perform statistical analyses on raw data and enhance validation and interpretation of results. Annual averages are summarized and presented in the Environmental Monitoring Annual Report prepared by the Industrial Hygiene Department of Mountain States Energy.

Plans are in preparation to implement a comprehensive QC program, including laboratory intercomparisons, in the near future.

4.4.4 Findings and Observations

4.4.4.1 Category I

None

4.4.4.2 Category II

None

4.4.4.3 Category III

None

4.4.4.4 Category IV

None

PRELIMINARY

4.5 Inactive Waste Sites and Releases

4.5.1 General Description of Pollution Sources and Controls

During the pre-Survey visit on August 7, 1987, and during the actual Survey on September 24, 1987, the installation assessment of the CDIF disposal sites (Hall, 1986), unusual-occurrence reports, and pre- and post-development aerial photographs were reviewed and the site was surveyed. Based on these sources and observations, there are few inactive pollution sources since (1) the site was constructed on previously undeveloped grassland so there was no previous waste disposal; (2) the CDIF was developed at a time when most environmental and waste management regulations had been implemented; and (3) few hazardous wastes are generated at the facility.

As a result, the only inactive pollution sources would result from any spills or releases. These could come from fuel tanks, drums of hazardous materials (e.g., Stoddard solvent, Therminol), and the various waste process tanks and ponds. One spill of No. 2 fuel oil was noted during the Survey west of Building 60. Approximately 16 square feet of concrete pad and some surrounding soil was visibly stained. The CDIF is not presently treating and has not in the past treated or disposed of any hazardous wastes on-site. Additionally, there are no known inactive waste disposal sites at the CDIF (Hall, 1986).

4.5.2 Findings and Observations

4.5.2.1 Category I

None

4.5.2.2 Category II

None

4.5.2.3 Category III

None

4.5.2.4 Category IV

1. Soil contamination from fuel oil tank valve leak. A valve leak from a No. 2 fuel oil tank at the CDIF, west of Building 60, is contaminating soil in proximity to the leak.

Number 2 fuel oil is leaking slightly from aboveground valves controlling a No. 2 fuel oil filling station west of Building 60 at the CDIF (northeast of location 13 denoted in Figure 2-2). The valve stem is visibly stained with oil, as is approximately 16 square feet of concrete pad and some surrounding soil. Several attempts have been made to stop the leak at the valve stem, but have so far been unsuccessful. Although the release is small, the fuel could reach a nearby surface-water drainage ditch during surface runoff.

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PRELIMINARY

APPENDIX A

SURVEY PARTICIPANTS

PRELIMINARY

IDAHO NATIONAL ENGINEERING LABORATORY
IDAHO FALLS, IDAHO
COMPONENT DEVELOPMENT AND INTEGRATION FACILITY
BUTTE, MONTANA
SURVEY PARTICIPANTS
SEPTEMBER 14 THROUGH OCTOBER 2, 1987

DOE PERSONNEL

Team Leader	Joseph O. Boda ^{a, b}
Assistant Team Leader	Lee E. Stevens ^a
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NUS PERSONNEL

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APPENDIX B

SITE-SPECIFIC SURVEY ACTIVITIES

PRELIMINARY

B.1 Pre-Survey Preparation

The DOE Office of Environmental Audit, Assistant Secretary for Environment, Safety and Health, selected a Survey team for the Idaho National Engineering Laboratory (INEL) and the Component Development and Integration Facility (CDIF) in the spring of 1987. The INEL is managed by the DOE with support services provided by EG&G Idaho, Inc., Westinghouse Idaho Nuclear Company, Argonne National Laboratory (operated by the University of Chicago), and the U.S. Geological Survey. The CDIF is also managed by DOE and the support contractor is Mountain States Energy. Mr. Joseph Boda was designated the DOE Team Leader, Mr. Lee Stevens the Assistant Team Leader, and Messrs. Clifford Clark and Barrett Fritz were the designated Survey team DOE Operations Office Representatives for Idaho and Chicago, respectively. The remainder of the team was composed of contractor specialists from the NUS Corporation.

Survey team members began reviewing INEL/CDIF general environmental documents and reports in May 1987.

Messrs. Boda and Stevens, along with two members of the NUS Corporation conducted a pre-Survey site visit on August 3 to 7, 1987, to become familiar with key DOE and INEL/CDIF personnel. They toured the sites and completed a cursory review of the documents assembled in response to an information request submitted on June 19, 1987. The request listed environmental documents and reports required by the Survey team for Survey planning purposes. On June 10, 1987, Messrs. Boda, Stevens, and Clark met with representatives from the U.S. Environmental Protection Agency (EPA) to review environmental issues of concern to the agency and explain the scope of the Survey.

The Survey team reviewed the information received during the pre-Survey visit and prepared a Survey Plan (Appendix C) for the INEL/CDIF sites. This plan described the specific approach to the Survey for each of the technical disciplines and included a proposed schedule for the on-site activities. A Health and Safety Plan was also prepared for use by the Survey team.

B.2 On-Site Activities

The on-site phase of the Survey was conducted during the period of September 14, 1987, through October 2, 1987. The opening meeting was held on September 14, 1987, at the INEL and was attended by representatives from the Idaho and Chicago Operations Office, the INEL and the CDIF and the Survey team members (Appendix A). Discussions during this meeting primarily concerned the purpose of the Survey, logistics at the INEL/CDIF and an introduction of the key personnel involved in the Survey.

During the Survey, team members reviewed pertinent file documents including permits and applications, background studies, engineering drawings, accident reports, chemical releases, and spills, as well as various operating logbooks. The site activities and associated processes were carefully analyzed to identify existing and potential pollutants. Site operations and monitoring procedures were observed, where possible. Extensive interviews were held with INEL/CDIF personnel concerning environmental controls, operations, monitoring and analysis, regulatory permits, and waste management.

The Survey team members met daily to report observations, discuss findings, and evaluate progress. These meetings were also useful for planning schedule changes, if required, to meet the overall objectives of the Survey. During the last week of the Survey, the Survey team developed Sampling and Analysis (S&A) requests to better define Survey observations that had few or no supporting data. The S&A requests were presented to Oak Ridge National Laboratory (ORNL) representatives who were designated to perform the required S&A.

A site closeout briefing was held on October 2, 1987, at which the DOE Team Leader and Assistant Team Leader presented the Survey team's preliminary findings and observations. The findings were considered preliminary pending additional research and review, and, in some cases, field S&A to better define the Survey team observations.

B.3 Sampling and Analysis

ORNL will perform the S&A portion of the Survey. ORNL evaluated the S&A requests made by the Survey team for the INEL/CDIF to determine logistics, costs, and schedules and to prepare an S&A Plan. The S&A Plan prepared by ORNL includes a quality assurance plan and a health and safety plan. It was completed during the spring of 1988, and the sampling team began work at the site in the summer of 1988.

B.4 Report Preparation

The Environmental Survey Preliminary Report for the INEL/CDIF has been prepared for DOE review. The preliminary findings are subject to modification based on comments from the Idaho and Chicago Operations Offices concerning the technical accuracy of the findings and the results of the S&A. The modified findings will be incorporated into the Environmental Survey Summary Report.

APPENDIX C

SURVEY PLAN

PRELIMINARY

DOE ENVIRONMENTAL SURVEY
IDAHO NATIONAL ENGINEERING LABORATORY (INEL), IDAHO FALLS, ID
COMPONENT DEVELOPMENT AND INTEGRATION FACILITY (CDIF), BUTTE, MT
SEPTEMBER 14, THROUGH OCTOBER 2, 1987

1.0 INTRODUCTION

The Environmental Survey is a onetime baseline inventory of existing environmental information and environmental problems and risks at DOE operating facilities. The Survey will be conducted in accordance with the principles and procedures contained in the DOE Environmental Survey Manual.

The Survey is an internal management tool to aid the Secretary and Under Secretary in allocating resources for maintaining aggressive environmental programs and for mitigating environmental problems at DOE facilities.

2.0 SURVEY IMPLEMENTATION

The Environmental Survey at INEL/CDIF will be managed by the DOE Team Leader, Joseph Boda, and the Assistant Team Leader, Lee Stevens. Clifford Clark will serve as the Idaho Operations Office (ID) representative and Barry Fritz will serve as the Chicago Operations Office (CH) representative on the Survey team. Technical support will be provided by contractor personnel as follows:

Radiation:	Ernest Harr, NUS Corporation David Dougherty, NUS Corporation
Surface/Drinking Water:	James Swet, NUS Corporation
Waste Management:	Lynn Scholl, NUS * Dwight Worley, NUS Corporation
Inactive Waste Sites/Releases:	William Levitan, NUS Corporation Kurt Sichelstiel, NUS Corporation
Hydrogeology/Storage Tanks:	Fred Miller, NUS Corporation
QA and TSCA:	Wayne Downey, NUS Corporation
Air:	Theodore Koss, NUS Corporation Henry Firstenberg, NUS Corporation

* Team Coordinator

2.1 Pre-Survey Activities

Members of the Survey team began reviewing INEL/CDIF environmental documentation available at the DOE Office of Environmental Audit in May 1987. From that review, a memorandum dated June 19, 1987, was sent to the Idaho Operations Office requesting additional information. Messrs. Boda, Stevens, Worley, and Levitan conducted a pre-Survey site visit on August 3-7, 1987, to become familiar with the site, to identify any potential environmental problems, and to coordinate plans for the upcoming Survey with DOE/ID personnel. During the pre-Survey visit, the team met with representatives of DOE/ID, INEL/CDIF Contractor personnel, representatives of the US EPA, and the Idaho and Montana regulatory agencies. In addition, the team toured both facilities and gathered documents assembled by site personnel in response to the information request memorandum. Additional information was requested and received from DOE/ID personnel during and after the pre-Survey visit, based upon the review of available data on-site.

2.2 On-Site Activities and Reports

The Environmental Survey of the INEL/CDIF sites will be conducted from September 14 through October 2, 1987. The Survey will include the facilities operated by EG&G, Westinghouse Idaho Nuclear Company (WINCO) and Argonne National Laboratory West (ANL-W) located at INEL and by Mountain States Energy (MSE) located at CDIF. The agenda for this Survey can be found in the attached Table I. Table II provides a summary of the separate technical discipline agendas contained in Table I. Modifications to this plan may be made during the course of the Survey. All modifications will be coordinated with the site officials designated as Survey contacts. The on-site activities of the Survey team will consist of interviews and consultations with, among others, environmental, safety, operations, waste management, purchasing, and warehousing personnel; a review of files and documents unavailable prior to the on-site portion of the Survey; and project-specific and area-specific tours of the facility. Table III indicates specific areas of interest for each of the technical specialists.

A closeout meeting will be conducted on Friday, October 2, to describe observations and initial findings of the on-site activities. A status report stating the findings

identified at the closeout meeting will be sent to ID and CH within 4 weeks of the conclusion of the Survey. A Preliminary Report of the Survey will be prepared within about 4 months of the conclusion of the Survey. Approximately 6 months after the completion of the Survey, the Sampling and Analysis (S&A) Team will initiate its on-site sampling. Subsequently, S&A will be conducted to strengthen the Survey findings and fill important data gaps. The S&A on-site activities and data analysis will require approximately 7 months to complete. The results of this S&A effort will then be used in the preparation of an Interim Report, which should be completed 3 months after the finalized S&A data are received. The findings of each of the Interim Reports from all scheduled Surveys will be updated as appropriate and included in the Final Report to the Secretary, DOE, which is scheduled for completion in 1988.

2.3 Sampling and Analysis

Based upon the results of the on-site portion of the Survey, the Survey team will identify any sampling needs. Sampling and analysis for the INEL/CDIF Survey will be conducted by a team from the Oak Ridge National Laboratory (ORNL). Mr. John Murphy will be the ORNL Sampling and Analysis Team Leader. The ORNL sampling team will draft an S&A Plan based upon the sampling needs identified by the Survey team.

The Assistant Team Leader, Lee Stevens, will coordinate the review of this Sampling Plan with ID/CH, INEL/CDIF contractors, and EPA's Laboratory at Las Vegas, which has quality assurance responsibility for the Survey's S&A efforts. The sampling is projected to start in May 1988. The sampling will take approximately 1 month to complete. Results of the S&A will be transmitted to the Survey Team Leader for incorporation into the Interim Report. The Interim Report should be available in early 1989.

3.0 AIR

3.1 Issue Identification

The radioactive and regulated/hazardous air-related Survey activities will involve the assessment of INEL/CDIF-wide air emissions, and of emission control and monitoring equipment, and the acquisition and processing of ambient air quality

data. Areas of investigation will include the process and laboratory emissions of radionuclides, nitrogen and sulfur oxides, acid fumes, toxic metals and organics, and volatile hydrocarbons (VOCs), as well as the emissions of nitrogen and sulfur oxides from fuel burning equipment. Operational and procedural practices associated with emission control and monitoring equipment will be evaluated. Fugitive sources of radioactive and regulated/hazardous particulate and gaseous emissions, including emissions from chemical and waste storage/handling areas, will be investigated.

The general approach to the Survey will involve a review of existing environmental reports, chemical inventories, operating procedures, ventilation diagrams, stack monitoring reports, radioactive effluent reports, and other relevant documents to identify significant sources of air emissions. Following the document review will be the physical inspection of significant processes, control and monitoring equipment, and potential fugitive sources. The Survey will identify air contaminants from significant processes and fugitive sources, identify and evaluate the existing control equipment for the air contaminants, and assess the potential for environmental problems from the emissions.

The radiological air monitoring system assessment will involve inspection of the ambient air samplers and review of data acquisition, documentation and procedures, calibration procedures, data validation, and processing. The primary emphasis of the monitoring program review will be to determine the environmental impact of operations and evaluate the quality of the reported data.

3.2 Records Required

No additional air records are required at this time.

4.0 RADIATION

4.1 Issue Identification

The radiological portions of the Environmental Survey will involve an assessment of the site-wide radioactive material and effluent control, on-site and off-site monitoring equipment, and the associated impact on the environment and general off-site population. The radiological assessment will encompass three major areas:

(1) airborne radioactive emissions; (2) liquid radioactive effluents; and (3) liquid and solid radioactive waste management. Because of overlaps, the radiological assessment will be coordinated with the air, surface water, waste management, hydrogeology, and quality assurance activities.

The assessment will determine whether radioactive materials maintained on-site or released to the environment (or potentially released) create any actual or potential environmental problems. Existing environmental standards, regulations, and guidelines will be used for comparison to assess the potential magnitude of these problems. The review will also determine if appropriate actions are being taken or planned to minimize accidental releases and/or mitigate the consequences of such releases, and whether there are conditions that may lead to environmental problems.

During facility visits the team will work with appropriate INEL/CDIF staff to

1. Understand the processes involved
2. Review radioactive material control
3. Review airborne and liquid effluent control
4. Review airborne and liquid effluent monitoring
5. Review historical records of releases
6. Review laboratory practices associated with effluent monitoring

In addition, the radiological environmental monitoring program will be reviewed through review of documents and records, observation of field activities, and review of related laboratory practices. Finally, dose assessments conducted by the site staff for various purposes, including the annual environmental report, will be reviewed.

4.2 Records Required

- Calibration and maintenance records for radiation and environmental testing and measurement equipment
- Effluent monitoring and sampling records
- Process-specific radioactive inventories
- Lab results for effluent and environmental samples
- Dose calculations and printouts

5.0 SURFACE/DRINKING WATER

5.1 Issue Identification

A number of documents provided in response to the information request have been reviewed with regard to the surface water technical specialty area. INEL/CDIF activities that generate wastewaters will be reviewed through a detailed field evaluation. Discrete liquid discharge points will be identified and evaluated to develop an inventory of wastewater sources. A review of the present condition of the wastewater collection and treatment systems will be made. Liquid waste treatment, processing, collection, and handling equipment will be examined and records of operations will be reviewed. The objective of the review is to build a Survey information data base for the identification of physical evidence of existing or potential environmental contamination.

The Survey will concentrate on areas of acknowledged concern, including the discharge of contaminants into drain fields, seepage ponds and ditches. The Survey will also include an identification of potential cross-contamination between chemical/radiological, potable, sanitary, and stormwater sewer systems. Specific attention will be paid to unknown or potential discharges into an inappropriate sewer system, which might cause a particular contaminant to be undetected or untreated. This will be accomplished by a thorough review of site facilities in conjunction with a review of standard operating procedures (SOPs) for the operation and maintenance of wastewater discharge equipment, followed by record review, interviews with site personnel, and observation of procedures.

A review of past water and wastewater conveyance, treatment, and disposal systems will also be accomplished during the Survey to evaluate what environmental problems may exist as a result of past practices, if any. Site surface drainage features, including channels, swales, culverts and catch basins, will also be reviewed.

5.2 Records Required

- Chemical and sanitary sewer inspection and maintenance data
- Cooling water treatment data and analytical information

- Potable water treatment data and analytical information
- Raw data from all waste water sampling.

6.0 WASTE MANAGEMENT

6.1 Issue Identification

The Survey procedure for activities related to the waste management is to review known sources or activities and identify any additional sources or activities that have the potential to result in contamination of environmental media.

Hazardous/radioactive/solid wastes will be tracked through the system, and waste-related site activities and records will be reviewed to develop an inventory and assess INEL/CDIF's waste management practices.

The hazardous waste portion of the Survey will concentrate on those facilities mentioned in the INEL/CDIF RCRA Part B applications. The team will devote a significant portion of the time on-site to a detailed facility investigation of hazardous or mixed waste generation, storage, and treatment practices. In addition, hazardous waste storage and treatment areas will be examined.

The review of radioactive and nonhazardous solid waste will be similar to that for hazardous wastes. Procedures will be evaluated to determine the INEL/CDIF waste classification practices. The detailed investigation described above will produce information on radioactive and nonhazardous solid wastes so as to delineate any previously unidentified sources of waste that have the potential to result in environmental contamination.

Discussions will be held with individuals knowledgeable on current and past waste management practices. This will be accomplished during the investigation and in the process of reviewing facility records and documentation. The objective is to develop an understanding of past and existing waste management activities that may serve as the basis for problem identification by the Survey team.

The review of activities related to the waste management will be coordinated closely with the inactive waste site, hydrogeologic, QA/TSCA, surface/drinking water

discipline activities to identify any possible releases that may pose a threat to the environment.

Several areas for specific investigation have been identified during a review of available documentation:

- Waste oil management practices
- Hazardous waste disposal procedures and documentation
- Solid waste disposal procedures and waste segregation practices
- Storage and disposition of scrap/salvage materials

6.2 Records Required

No additional waste management records are required at this time.

7.0 INACTIVE WASTE SITES/RELEASES

7.1 Issue Identification

The inactive waste sites/releases specialty area review will identify environmental problems associated with the historical handling, storage, and disposal of hazardous and radioactive substances at the site. The review will involve the evaluation of information developed in response to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) regulations. The Survey will focus on current and future environmental problems related to past land disposal practice and past spills/releases.

Initial Assessment forms and the Installation Assessment Reports, prepared under DOE Order 5480.14 CERCLA Program for INEL, identified 338 inactive sites that could potentially result in a risk to public health or the environment. As part of the Survey, the background information sources used in developing the Installation Assessment Reports will be reviewed, including the material gathered through interviews. Records indicating the types and quantities of materials disposed of in the inactive sites will be evaluated, as will the facility design and methods of waste containment. Information available through historical aerial photography will be assessed to identify disturbed land areas and to further define site locations and associated changes in appearance over time. Visual inspections will be conducted

for many of the sites included in the Installation Assessment Reports, and for any newly-identified sites, to note surface features and to locate monitoring points.

Sites that have undergone remediation will also be addressed. Records and analytical data in support of the site cleanup will be obtained for review. Inactive tanks or containers that may have held hazardous substances will be located and their status assessed. Former storage areas and staging locations will be included in this effort. Each of these facilities will be evaluated in terms of the potential to cause a present or future risk to workers, the neighboring population, or the environment.

Several areas of concern were identified during a review of available documentation. Major areas of investigation include:

- Injection Wells
- Leaching and seepage ponds
- Radioactively contaminated soils
- Chemical contaminants at D&D sites
- Unidentified inactive waste sites and releases

7.2 Records Required

No additional inactive waste sites and release records are required at this time.

8.0 HYDROGEOLOGY

8.1 Issue Identification

A major concern for the Survey is the status of ongoing investigations of groundwater contamination. In addition, the potential impacts of the existing contamination on deeper aquifers need to be assessed by the Survey team. Furthermore, the potential impacts of off-site movement of contaminated groundwater in the shallow aquifer are also of concern.

A general review of existing data will be required to determine the usefulness of this information for the purposes of the Survey. This will include a review of sampling procedures, chain-of-custody and quality assurance/quality control

procedures, and the compatibility of data from various sources. The reliability, construction, and placement of wells used for groundwater monitoring will be examined. Interviews with site personnel will be conducted.

Several areas for specific investigation were identified during a review of available documentation:

- Underground storage tank leak testing, age, construction material, content, and location
- Aboveground storage tank spill containment
- Solid and liquid waste disposal operations
- Inadequacy of existing wells to characterize groundwater conditions in disposal areas

8.2 Records Required

- Piezometric level records for all wells for last record date
- Maps or records of locations of water supply wells within 2 miles of site boundary
- Well logs for all wells

9.0 QUALITY ASSURANCE (QA)

9.1 Issue Identification

The quality assurance (QA) review of the environmental program will examine the site S&A capabilities. The intent of this review will be to assess the quality of the environmental monitoring data. All aspects of the QA program relating to the environmental S&A effort will be reviewed.

The environmental sampling performed by INEL/CDIF personnel will be evaluated by reviewing protocols, procedures, data handling, records, and logbooks. Field techniques will be observed to determine actual sampling practices by each discipline as they visit specific sites at INEL and at CDIF.

The environmental analytical laboratories will be reviewed through the evaluation of procedures and records and the observation of laboratory operations.

Several areas for specific investigations were identified during a review of available documentation:

- Operator and technician training
- Equipment and instrument calibration/maintenance
- Precision and accuracy studies
- Blank, split, and spiked sample analyses
- Sample handling and chain-of-custody procedures
- Data reduction and validation
- Sampling procedures
- Data reporting and documentation
- Calculation and logbook reviews

9.2 Records Required

No additional QA records are required at this time.

10.0 TOXIC AND CHEMICAL MATERIALS- TSCA

10.1 Issue Identification

The toxic and chemical materials review will address the raw materials and handling of chemical products used at INEL/CDIF. The use, handling, and disposal of PCBs, asbestos, pesticides, and herbicides will also be within the scope of this effort.

All toxic and hazardous substances purchased, used, or manufactured on-site will be evaluated. The tracking, control, and management of these substances will be reviewed. Records of usage will be evaluated to determine the potential for environmental contamination.

The inventory of PCBs and PCB-contaminated electrical equipment in use at the facility will be reviewed for completeness. The condition of this equipment, its potential for leakage, and the quantity of PCB contaminated fluids will be identified. Disposal practices will be reviewed for current and past inventories to determine the methods of disposal and the locations of disposal sites. Procedures for PCB analysis, removal, handling, and disposal will be reviewed. Inspection and

reporting requirements for PCB transformers will be evaluated in an effort to focus the Survey team's attention on potential problem areas.

The use of asbestos at INEL/CDIF will be reviewed to identify pathways of contamination. Also, asbestos removal and disposal practices will be evaluated, and disposal sites visited, to define potential areas of concern.

Pesticide/herbicide usage on the site will be reviewed to determine the risks of environmental contamination. The review will focus on application records, storage and disposal practices, and environmental monitoring procedures.

Several areas for specific investigation were identified during a review of available documentation:

- Chemical procurement procedures
- Material QA procedures
- Toxic and hazardous materials inventory
- Operator and technician training
- Decontamination/disposal manifests and records
- Maintenance/inspection logbooks

10.2 Records Required

- Purchase inventory list of chemicals for the most recent year for the individual contractors
- List of PCB and non-PCB transformers for each site

TABLE I
INEL/CDIF ENVIRONMENTAL SURVEY AGENDA
DISCIPLINE: WASTE MANAGEMENT (Scholl)

9/14/87	AM	PM
MONDAY	Introduction Process Briefing Environmental Monitoring	ICPP Waste Generation Waste Storage
TUESDAY	ICPP Analytical Labs Shops PEW	ICPP Ash Disposal Area Liquid Waste Disposal Environmental Labs
WEDNESDAY	ICPP Liquid Waste Disposal	ARA I, II, III, IV ARVFS
THURSDAY	CFA RESL Laundry Hazardous Waste Storage Facility	CFA Photo Lab Vehicle Maintenance Shop Environmental Lab
FRIDAY	ILF	Prepare Preliminary Findings

TABLE I
INEL/CDIF ENVIRONMENTAL SURVEY AGENDA
DISCIPLINE WASTE MANAGEMENT (Scholl) (Continued)

9/21/87	AM	PM
MONDAY	ANL-W EBR-II HFEF TREAT ZPPR	ANL-W Analytical Lab Environmental Lab
TUESDAY	ANL-W Satellite Storage Liquid Waste Disposal	ANL-W Additional Facilities
WEDNESDAY	Team discussions	by discipline
THURSDAY	CDIF Introduction Process Briefing Waste Generation Sources Waste Management Practices	CDIF Waste Treatment/Disposal Photographic Lab Analytical Lab Shops Debriefing
FRIDAY	ILF	Prepare Preliminary Findings

TABLE I
INEL/CDIF ENVIRONMENTAL SURVEY AGENDA
DISCIPLINE: WASTE MANAGEMENT (Scholl) (Continued)

9/28/87	AM	PM
MONDAY	TAN Loft TSF Shops Satellite Storage Liquid Waste Disposal	TAN WRRTF Hotcell Labs Environmental Labs
TUESDAY	TRA RMTF ALPHA RML CFRMP Labs Shops	TRA Satellite Storage Liquid Waste Storage & Disposal
WEDNESDAY	Revisits	Prepare Findings
THURSDAY	Team Debriefing	by discipline
FRIDAY	Close Out Meeting	Travel Home

TABLE I
INEL/CDIF ENVIRONMENTAL SURVEY AGENDA
DISCIPLINE: QA/TSCA (Downey)

9/14/87	AM	PM
MONDAY	Introduction Process Briefing Environmental Monitoring	ILF PCB Inspection TSCA Review Asbestos
TUESDAY	ICPP Laboratory QA Review Inorganics	ICPP Laboratory QA Review Organics
WEDNESDAY	ICPP Site PCB Inspection TSCA Review Asbestos	TRA Site PCB Inspection TSCA Review Lab QA Asbestos
THURSDAY	RESL QA Review Inorganics	RESL QA Review Organics
FRIDAY	ARA Site PCB Inspection TSCA Review Lab QA	Prepare Preliminary Findings

TABLE I
INEL/CDIF ENVIRONMENTAL SURVEY AGENDA
DISCIPLINE: QA/TSCA (Downey) (Continued)

9/21/87	AM	PM
MONDAY	CFA Laboratory QA Review Inorganics Organics	CFA Site PCB Inspection TSCA Review Asbestos
TUESDAY	ANL-W Laboratory QA Review Inorganics Organics	ANL-W Site PCB Inspection TSCA Review Asbestos Obtain Inventory List of Chemicals for INEL
WEDNESDAY	Team discussions	by discipline
THURSDAY	CDIF Introduction Laboratory QA Review Inorganics Organics	CDIF PCB Inspection TSCA Review Asbestos Debriefing
FRIDAY	ILF QA Review Inorganics Organics	Prepare Preliminary Findings

TABLE I
INEL/CDIF ENVIRONMENTAL SURVEY AGENDA
DISCIPLINE: QA/TSCA (Downey) (Continued)

9/28/87	AM	PM
MONDAY	PBF/SPERT Sites PCB Inspection Asbestos TSCA Review	EOCR/OMRE PCB Inspection Asbestos TSCA Review
TUESDAY	TAN Sites PCB Inspection TSCA Review Asbestos	Revisits
WEDNESDAY	EBR-I/WMO/RWMC/BORAX PCB Inspection TSCA Review Asbestos	Prepare Findings
THURSDAY	Team Debriefing	by discipline
FRIDAY	Close Out Meeting	Travel Home

TABLE I
INEL/CDIF ENVIRONMENTAL SURVEY AGENDA
DISCIPLINE: HYDROGEOLOGY (Miller)

9/14/87	AM	PM
MONDAY	Introduction Process Briefing Environmental Monitoring	Meeting at USGS Office
TUESDAY	RWMC SDA TSA Underground Storage Tanks Big Lost River	RWMC Monitor Wells, Sampling A, B, C and D Spreading Areas Production Wells
WEDNESDAY	ICPP Percolation Ponds Injection Well	ICPP Flyash Pit Underground Storage Tanks Monitor Wells, Sampling
THURSDAY	CFA Landfills I, II and III Monitor Wells, Sampling	CFA Asbestos Landfill Fire Department Training Area CFA-Freach Drain
FRIDAY	CFA Underground Storage Tanks	Prepare Preliminary Findings

TABLE I
INEL/CDIF ENVIRONMENTAL SURVEY AGENDA
DISCIPLINE: HYDROGEOLOGY (Miller) (Continued)

9/21/87	AM	PM
MONDAY	ANL-W Industrial Waste Pond TREAT Suspect Leach Field RSWF	ANL-W Dry Wells Underground Storage Tanks Monitor Wells, Sampling
TUESDAY	USGS Monitor Well Sampling	USGS Monitor Well Sampling
WEDNESDAY	Team discussions	by discipline
THURSDAY	CDIF Introductions Ponds Underground Storage Tanks Records Review	CDIF Environmental Sampling at Wells Interviews Debriefing
FRIDAY	PBF/SPERT PBF-733 SPERT II and IV Leach Ponds Reactor Area Blowdown Pit Monitor Wells, Sampling Underground Storage Tanks	Prepare Preliminary Findings

TABLE I
INEL/CDIF ENVIRONMENTAL SURVEY AGENDA
DISCIPLINE: HYDROGEOLOGY (Miller) (Continued)

9/28/87	AM	PM
MONDAY	TAN TSF Disposal Pond TSF Gravel Pit LOFT Disposal Pond TSF Intermediate Level Waste Disposal System Monitor Wells Sampling TAN/TSF-1 Area TAN 710	TAN WRRTF Two Phase Pond WRRTF Evaporation Pond WRRTF Sewage Lagoon Underground Storage Tanks IET Hot Waste Tank TAN-735
TUESDAY	TRA TRA-701 TRA-758 TRA-712 TRA-702 Monitor Wells Sampling Waste Disposal Well	TRA TRA-731 Rad Tanks at TRA-630 Hot Waste Tanks at TRA-613 Underground Storage Tanks
WEDNESDAY	ARA ARA-745 ARA-740 ARA-729 ARA-719 Monitor Wells, Sampling	Prepare Findings
THURSDAY	Team Debriefing	by disciplines
FRIDAY	Close Out Meeting	Travel Home

TABLE I
INEL/CDIF ENVIRONMENTAL SURVEY AGENDA
DISCIPLINE: RADIATION (Harr)

9/14/87	AM	PM
MONDAY	Introduction Process Briefing Environmental Monitoring	ILF All Effluents Effluent Monitoring Hot Cells
TUESDAY	RWMC SDA TSA SWEPP All Effluents	RWMC ILTSF Observe Environmental Monitoring Effluent Monitoring Environmental Reports
WEDNESDAY	PBF-SPERT All Effluents Effluent Monitoring WERF Radioactive Contamination	ARA Hot Cells D&D Facilities Radioactive Contamination SL-1 Biointrusion
THURSDAY	TAN Observe Environmental Monitoring D&D Facilities	TAN Effluent Monitoring TMI-2 Fuel NMEQ
FRIDAY	Revisits & Record Review	Prepare Preliminary Findings

TABLE I
INEL/CDIF ENVIRONMENTAL SURVEY AGENDA
DISCIPLINE: RADIATION (Harr) (Continued)

9/21/87	AM	PM
MONDAY	RESL Environmental Monitoring, Sampling, Analysis, Laboratory QC, Reports, Dose	RESL-Calculations, and Environmental Reports. Trace Sample (Flow)
TUESDAY	ICPP Environmental Laboratory, Sampling, Analysis, Laboratory QC, Reports; Dose Calculations	ICPP Soil Contamination
WEDNESDAY	Team discussions	by discipline
THURSDAY	ANL-W Observe Environmental Monitoring Dose Calculations Contaminated Areas	ANL-W Leach Pit Environmental Reports D&D Facilities
FRIDAY	OMRE & EOGR Any Radiological Concerns	Prepare Preliminary Findings

TABLE I
INEL/CDIF ENVIRONMENTAL SURVEY AGENDA
DISCIPLINE: RADIATION (Harr) (Continued)

9/28/87	AM	PM
MONDAY	NOTF & NODA Any Radiological Concerns	EBRI & BORAX Soil Contamination Environmental Monitoring All Effluents & Effluent Monitoring
TUESDAY	CERT & ARVFS Any Radiological Concerns	Revisits & Record Review
WEDNESDAY	Revisits & Record Review	Prepare Findings
THURSDAY	Team debriefing	by discipline
FRIDAY	Close Out Meeting	Travel Home

TABLE I
INEL/CDIF ENVIRONMENTAL SURVEY AGENDA
DISCIPLINE: RADIATION (Dougherty)

9/14/87	AM	PM
MONDAY	Introduction Process Briefing Environmental Monitoring	ILF Observe Environmental Monitoring Sample Flow Dose Calculations
TUESDAY	TRA All Reactors All Laboratories Hot Cells Effluent Monitoring	TRA All Effluents Retention Basin, Seepage Ponds D&D Facilities Warm Waste Treatment Facility
WEDNESDAY	ICPP All Effluents Effluent Monitoring	ICPP Observe Environmental Monitoring Seepage Ponds Evaporation Ponds
THURSDAY	TAN Soil Contamination PREPP All Reactors	TAN All Hot Shops, Hot Cells Playas 1 thru 4 Seepage Ponds Evaporation Ponds
FRIDAY	Revisits & Record Review	Prepare Preliminary Findings

TABLE I
INEL/CDIF ENVIRONMENTAL SURVEY AGENDA
DISCIPLINE: RADIATION (Dougherty) (Continued)

9/21/87	AM	PM
MONDAY	ANL-W All Reactors All Effluents Effluent Monitoring	ANL-W Waste Disposal All Hot Cells RSWF
TUESDAY	CFA CLRF Paved Over Spill Landfills 1 thru 3 Open Burn Pit	Revisits & Record Review
WEDNESDAY	Not Available for Survey After Tuesday	
THURSDAY		
FRIDAY		

TABLE I
INEL/CDIF ENVIRONMENTAL SURVEY AGENDA
DISCIPLINE: SURFACE WATER (Swet)

9/14/87	AM	PM
MONDAY	Introduction Process Briefing Environmental Monitoring	ICPP*
TUESDAY	ICPP*	ICPP*
WEDNESDAY	PBF/SPERT*	ARA I, II, III, IV Waste Water Generation Above-Ground Tanks Septic Systems
THURSDAY	CFA *	CFA RESL Motor Pool & Laundry
FRIDAY	ILF Waste Water Generation Above-Ground Tanks	Prepare Preliminary Findings

*Activities include:

Inspecting wastewater generation processes, process piping, sewers, potable water treatment, cooling water treatment, septic systems, and above-ground tanks and observing environmental monitoring, where appropriate.

TABLE I
INEL/CDIF ENVIRONMENTAL SURVEY AGENDA
DISCIPLINE: SURFACE WATER (Swet) (Continued)

9/21/87	AM	PM
MONDAY	ANL-W*	ANL-W*
TUESDAY	RWMC*	BORAX/EBR-I/EOCR Septic Systems Potable Water Treatment
WEDNESDAY	Team discussions	by discipline
THURSDAY	CDIF* Introduction Interviews Records Review	CDIF* Observe Environmental Monitoring Debriefing
FRIDAY	USGS - Flood Management Review	Prepare Preliminary Findings

*Activities include:

Inspecting wastewater generation processes, process piping, sewers, potable water treatment, cooling water treatment, septic systems, and above-ground tanks and observing environmental monitoring, where appropriate.

TABLE I
INEL/CDIF ENVIRONMENTAL SURVEY AGENDA
DISCIPLINE: SURFACE WATER (Swet) (Continued)

9/28/87	AM	PM
MONDAY	TAN* TSA LOFT	TAN* IET WRRTF
TUESDAY	TRA*	TRA*
WEDNESDAY	Revisits	Prepare Findings
THURSDAY	Team debriefing	by discipline
FRIDAY	Close Out Meeting	Travel Home

*Activities include:

Inspecting wastewater generation processes, process piping, sewers, potable water treatment, cooling water treatment, septic systems, and above-ground tanks and observing environmental monitoring, where appropriate.

TABLE I
INEL/CDIF ENVIRONMENTAL SURVEY AGENDA
DISCIPLINE: INACTIVE WASTE SITES AND RELEASES (Levitán)

9/14/87	AM	PM
MONDAY	Introduction Process Briefing Environmental Monitoring	Document Review Photos UORs Spill Reports Appraisal Reports 103(c) Notification Forms
TUESDAY	CFA Landfills/Gravel Pit Drains/Dry Well Motor Pool Ponds Other Inactive Sites	CFA Other Inactive Sites Interview Long-Term Employees Document Review
WEDNESDAY	NODA/OMRE/EOCR Inactive Sites Interview Long-term Employees D&D Activities at OMRE	BORAX/EBR/ZPR D&D Activities BORAX Inactive Sites Interview Long-term Employees
THURSDAY	ARA Inactive Sites D&D Activities	ARA Interview Long-term Employees Document Review
FRIDAY	Document Review Photos UORs Spill Reports Appraisal Reports Interview Forms	Prepare Preliminary Findings

TABLE I
INEL/CDIF ENVIRONMENTAL SURVEY AGENDA
DISCIPLINE: INACTIVE WASTE SITES (Levitan) (Continued)

9/21/87	AM	PM
MONDAY	ICPP In on Well F h Dram Inactive or Inactive Sites	ICPP Inactive Sites D&D Activities
TUESDAY	ICPP Inactive Sites (Soil Contamination)	ICPP Document Review (Interview Forms, UORs, Appraisal Reports) Long-term Employee Interviews
WEDNESDAY	Team discussions	by discipline
THURSDAY	ANL-W Inactive Sites Industrial Wastewater Discharge Ditch	ANL-W D&D Activities Long-term Employees Interviews Document Review
FRIDAY	Revisits	Prepare Preliminary Findings

TABLE I
INEL/CDIF ENVIRONMENTAL SURVEY AGENDA
DISCIPLINE: INACTIVE WASTE SITES (Levitan) (Continued)

9/28/87	AM	PM
MONDAY	TAN Injection wells at LOFT, TSF, WRRTF, IET Inactive Sites	TAN Inactive Sites Long-term Employee Interviews D&D Activities
TUESDAY	Overview Tour of Inactive Sites RWMC LCCDA	Overview Tour of Inactive Sites TRA PBF
WEDNESDAY	Revisits	Prepare Findings
THURSDAY	Team debriefing	by discipline
FRIDAY	Close Out Meeting	Travel Home

TABLE I
INEL/CDIF ENVIRONMENTAL SURVEY AGENDA
DISCIPLINE: INACTIVE WASTE SITES & RELEASES (Sichelstiel)

9/14/87	AM	PM
MONDAY		
TUESDAY		
WEDNESDAY		
THURSDAY		Arrive at INEL
FRIDAY	Aerial Photos, Oblique Photos, Ground Photos, Document Review	Aerial Photos, Oblique Photos, Ground Photos, Document Review

TABLE I
INEL/CDIF ENVIRONMENTAL SURVEY AGENDA
DISCIPLINE: INACTIVE SITES (Sichelstiel) (Continued)

9/21/87	AM	PM
MONDAY	ICPP Injection Well French Drains (Inactive) Other Inactive Sites	TRA Inactive Sites Leach Pond Injection Wells Spills Pits Drains
TUESDAY	TRA Inactive Sites Leach Pond(s) Spills Pits	TRA Inactive Sites Leach Pond(s) Injection Wells Spills Pits Landfills
WEDNESDAY	Team discussions by discipline	
THURSDAY	PBF SPERT I, II Inactive Sites Leach Ponds Sumps	PBF SPERT III, IV Inactive Sites Drains Injection Well
FRIDAY	LCCDA Inactive Sites Pits NODA Inactive Sites	Prepare Preliminary Findings

TABLE I
INEL/CDIF ENVIRONMENTAL SURVEY AGENDA
DISCIPLINE: INACTIVE SITES (Sichelstiel) (Continued)

9/28/87	AM	PM
MONDAY	TAN Inactive Sites Injection Wells @ LOFT	RWMC Inactive Sites
TUESDAY	Overview Tour of CFA, ARA, OMRE, EOCR,	Inactive Sites BORAX, EBR-I, ZPR, NODA
WEDNESDAY	Records Review Revisits	Prepare Findings
THURSDAY	Team debriefing	by discipline
FRIDAY	Close Out Meeting	Travel Home

TABLE I
INEL/CDIF ENVIRONMENTAL SURVEY AGENDA
DISCIPLINE: AIR (KOSS)

9/14/87	AM	PM
MONDAY	Introduction Process Briefing Environmental Monitoring	PBF/SPERT Area PBF Fuel-Burning Facility (PBF-620) Waste Engineering Development Facility (SPERT II) Waste Experiment Reduction Facility (SPERT III) PBF Ambient Air Monitoring Station
TUESDAY	ICPP Coal-fired Steam Generating Plant (CPP-687) Atmospheric Protection System (CPP-649)	ICPP Area Powerhouse Service Building (CPP-606) Headend Process Plant (CPP-640) Fluorinel and Storage Facility (CPP-666)
WEDNESDAY	ICPP Area Process Improvement Facility (CPP-637) Maintenance Facilities (CPP-662, 663) FAST Craft Shop (CPP-655)	ICPP Area Chemical Storage Pump House (CPP-621) Chemical & Hazardous Material Storage (CPP-660) Solvent Storage (CPP-710) Ammonia Bottle Storage (CPP-680) Effluent Control & Environmental Science CPP-681
THURSDAY	Ambient Air Monitoring EBR-I, RWMC and VANB ambient air quality stations [At least one Hi-Vol, Low-Vol, Tritium, NO _x and SO ₂ sampler should be observed.]	NOAA (Review On-site Meteorological Towers, Instrumentation, Calibration Procedures, Data Acquisition, Validation & Processing, Atmospheric Dispersion Modeling)
FRIDAY	TAN Fuel-Burning Facilities (TAN-603, 630) Technical Support Facility TAN Meteorological Tower Fugitive Emission Sources	Prepare Preliminary Findings

TABLE I
INEL/CDIF ENVIRONMENTAL SURVEY AGENDA
DISCIPLINE: AIR (Koss) (Continued)

9/21/87	AM	PM
MONDAY	ANL-W EBR-II Auxiliary Boiler Facility HFEF-S ANL-W Meteorological Tower ANL-W Ambient Air Monitoring Station	ANL-W HFEF-N Sodium Component Vapor Shop (ANL-793)
TUESDAY	CFA Area Major Fuel-Burning Facilities (Technical Service Center, Material Warehouse, Vehicle Service Terminal, Cafeteria) Hot Laundry Facility CFA Meteorological Tower	CFA Area Lead Melting & Casting Facility Central Shops Concrete/Asphalt Batch Plants
WEDNESDAY	Team discussions	by discipline
THURSDAY	CDIF Introduction Records Review Interviews	CDIF Observe Environmental Monitoring Debriefing
FRIDAY	RWMC Waste Volume Reduction Facility (WMO-601) Drum Sampling Area NODA Thermal Treatment Area	Prepare Preliminary Findings

TABLE I
INEL/CDIF ENVIRONMENTAL SURVEY AGENDA
DISCIPLINE: AIR (Koss) (Continued)

9/28/87	AM	PM
MONDAY	TRA Steam Plant (TRA-609) ATR Diesel ETR Diesel Meteorological Tower (TRA-615) Air Monitoring Station	TRA Metallurgy Building Laboratories Hazardous Chemical Storage (TRA-640)
TUESDAY	ARA Fuel Burning Facilities (ARA-626, 613, 607) ARA Ambient Air Monitoring Station	Office Review of Emissions Data and Ambient Air Monitoring Data Processing and Reporting Procedures.
WEDNESDAY	Revisits	Prepare Findings
THURSDAY	Team debriefing	by discipline
FRIDAY	Close Out Meeting	Travel Home

TABLE I
INEL/CDIF ENVIRONMENTAL SURVEY AGENDA
DISCIPLINE: AIR (Firstenberg)

9/14/87	AM	PM
MONDAY	Introduction Process Briefing Environmental Monitoring	PBF/SPERT Area PBF Fuel-Burning Facility (PBF-620) Waste Engineering Development Facility (SPERT II) Waste Experiment Reduction Facility (SPERT III) PBF Ambient Air Monitoring Station
TUESDAY	ICPP Area Coal-fired Steam Generating Plant (CPP-687) Atmospheric Protection System (CPP-649)	ICPP Area Powerhouse Service Building (CPP-606) Headend Process Plant (CPP-660) Fluorinel and Storage Facility (CPP-666)
WEDNESDAY	ICPP Area Process Building (CPP-601) Remote Analytic Facility (CPP-627)	ICPP Area New Waste Calcining Facilities (CPP-659, 694) Add Storage Tanks (CPP-745, 757, 719A, 719B) Effluent Control & Environment Building (CPP-681)
THURSDAY	Ambient Air Monitoring CFA, ICPP and NRF ambient air stations NRF met tower [At least one Hi-Vol, Lo-Vol, tritium, NO _x and SO ₂ ambient sampler should be observed.]	MOAA (Review On-Site Meteorological Towers, Instrumentation, Calibration Procedures, Data Acquisition, Validation & Processing, Atmospheric Dispersion Modeling)
FRIDAY	Fuel Burning Facility (TAN-641) Process Experimental Pilot Plant TAN Ambient Air Monitoring Station Fugitive Emission Sources	Prepare Preliminary Findings Not Available for Survey After Friday

TABLE I
INEL/CDIF ENVIRONMENTAL SURVEY AGENDA
DISCIPLINE: WASTE MANAGEMENT (Worley)

9/14/87	AM	PM
MONDAY	Introduction Process Briefing Environmental Monitoring	PBF/SPERTS Air Coordination Waste Management
TUESDAY	RWMC Waste Management	RWMC Waste Management
WEDNESDAY	ICPP Waste Management	ARA/ARVFS Waste management
THURSDAY	CFA Landfill 1, 2, 3	CFA Asbestos Landfill NODA TSF
FRIDAY	ILF	Prepare Preliminary Findings

TABLE I
INEL/CDIF ENVIRONMENTAL SURVEY AGENDA
DISCIPLINE: WASTE MANAGEMENT (Worley) (Continued)

9/21/87	AM	PM
MONDAY	RESL Observe Environmental Monitoring	RESL Observe Environmental Monitoring
TUESDAY	TRA Inactive Waste Sites	TRA Inactive Waste Sites
WEDNESDAY	Team discussions	by discipline
THURSDAY	ANL-W Coordination	ANL-W Coordination
FRIDAY	USGS Flood Management Surface Water Controls	Prepare Preliminary Findings

TABLE I
INEL/CDIF ENVIRONMENTAL SURVEY AGENDA
DISCIPLINE: WASTE MANAGEMENT (Worley) (Continued)

9/28/87	AM	PM
MONDAY	TAN Inactive Waste Sites	RWMC Inactive Waste Sites
TUESDAY	TRA Hydrogeology	TRA Hydrogeology
WEDNESDAY	ARA Hydrogeology	Prepare Findings
THURSDAY	Team debriefing	by discipline
FRIDAY	Close Out Meeting	Travel Home

TABLE II

INEL/CDF ENVIRONMENTAL SURVEY AGENDA SUMMARY

		QA/TSCA (Downey)	RAD (Hart)	RAD (Dougherty)	AIR (Koss)	AIR (Firstenberg)	Surface Water (Swet)	Inactive Waste Sites (Sichelstiel)	Inactive Waste Sites (Levitian)	Hydro- geology (Miller)	Waste Mgt. and Coord. (Worley)	Waste Mgt. (Scholl)	S & A
Mon Sept. 14	AM	Meeting	Meeting	Meeting	Meeting	Meeting	Meeting		Meeting	Meeting	Meeting	Meeting	
	PM	ILF	ILF	ILF	PBF/SPERT	PBF/SPERT	ICPP		Document/ Photo Review	USGS	PBF/SPERT	ICPP	
Tue 15	AM	ICPP	RWMC	TRA	ICPP	ICPP	ICPP		CFA	RWMC	RWMC	ICPP	
	PM	ICPP	RWMC	TRA	ICPP	ICPP	ICPP		CFA	RWMC	RWMC	ICPP	
Wed 16	AM	ICPP	PBF/SPERT	ICPP	ICPP	ICPP	PBF/SPERT		NODA/ OMRE/ EOCR	ICPP	ICPP	ICPP	
	PM	TRA	ARA	ICPP	ICPP	ICPP	ARA I, II, III, IV		BORAX/ EBR-I/ZPR	ICPP	ARA/ ARVFS	ARA/ ARVFS	
Thur 17	AM	RESL	TAN	TAN	Air Monitors	Air Monitors	CFA		ARA	CFA	CFA	CFA	
	PM	RESL	TAN	TAN	NOAA	NOAA	CFA/RESL	Active PM	ARA	CFA	CFA	CFA	
Fri 18	AM	ARA	Revisits	Revisits	TAN	TAN	ILF	Document/ Photo Review	Document/ Photo Review	CFA	ILF	ILF	
	PM	Meeting	Meeting	Meeting	Meeting	Meeting	Meeting	Document/ Photo Review	Meeting	Meeting	Meeting	Meeting	

TABLE III
INEL/CDIF ENVIRONMENTAL SURVEY

AREAS OF INTEREST FOR TECHNICAL SPECIALISTS

WASTE MANAGEMENT

D. Worley
L. Scholl

- Hazardous Waste
- Non-Hazardous Waste
- RCRA/Solid Waste Permits
- Mixed Waste
- Radioactive Waste

RADIATION

D. Dougherty
E. Harr

- Radioactive Emissions and Effluents
- Source Controls and Monitoring
- Environmental Monitoring - Rad
- Laboratory Analysis - Rad
- Radioactive Waste

AIR

H. Firstenberg
T. Koss

- Meteorology
- Local Air Quality Data
- Emission Sources, Control and Monitoring
- Environmental Monitoring - Air
- Air Permits and Air Emissions Inventory

SURFACE/DRINKING

J. Swet

- Effluent Sources
- Wastewater (Process and Sanitary Treatment) Facilities
- Cooling Water System
- Drinking Water Distribution
- Stormwater Management
- Spill Prevention, Control and Countermeasure Plan
- Aboveground Storage Tanks

HYDROGEOLOGY/STORAGE
TANKS

F. Miller

- Waste Storage and Disposal Sites (Past and Active)
- Spill/Accident Locations
- Regional Geology and Groundwater
- Well Inventory and Construction
- Groundwater Monitoring Program and Studies
- Underground Storage Tanks

TABLE III
INEL/CDIF ENVIRONMENTAL SURVEY (Continued)

AREAS OF INTEREST FOR TECHNICAL SPECIALISTS

INACTIVE WASTE SITES/
RELEASES

W. Levitan
K. Sichelstiel

- Past Waste Site Locations
- Characterization Studies
- Spill/Accident Locations
- Remediation Work
- Former Production Locations

QUALITY ASSURANCE

W. Downey

- Environmental Sampling Program
- Environmental Analytical Program
- Data Management and Handling
- QA Program Overview

TOXIC AND CHEMICAL
MATERIALS-TSCA

W. Downey

- Process Chemicals and Substances Inventory
- Asbestos Use Evaluation
- Asbestos Removal and Disposal
- PCBs In-Service, Storage, and Disposal
- Pesticide Use, Storage, and Disposal
- Warehousing and Storage Tanks for Process Chemicals

PRELIMINARY

END

DATE FILMED

11 / 16 / 90