

2024 IDAHO NATIONAL LABORATORY ANNUAL SITE ENVIRONMENTAL REPORT

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ANNUAL SITE ENVIRONMENTAL REPORT

Idaho National Laboratory

September 2025

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As we present this report, we also take a moment to honor and celebrate the remarkable career of Betsy Holmes. Betsy has dedicated her professional life to the U.S. Department of Energy, Idaho Operations Office, where her expertise, commitment, and passion have made a significant impact. Her contributions have been invaluable, and her legacy will continue to inspire us.

Thank you, Betsy, for your years of service and dedication. We wish you all the best in your well-deserved retirement.



Rabbit at the Idaho National Laboratory (INL) Site.

To Our Readers:



The Idaho National Laboratory (INL) Site Environmental Report for Calendar Year 2024 is an overview of environmental activities conducted on and in the vicinity of the INL Site from January 1 through December 31, 2024. This report includes the following components:

- Effluent monitoring and environmental surveillance of air, water, soil, vegetation, biota, and agricultural products for radioactivity. These results are compared with the historical data, background measurements, and applicable standards and requirements to verify the INL Site does not adversely impact the environment or the health of humans or biota.
- A summary of environmental management systems in place to protect air, water, land, and other natural and cultural resources potentially impacted by INL Site operations.
- Ecological monitoring and other scientific research conducted onsite that may be of interest to the reader.

The report addresses three general levels of reader interest:

- The first level is a brief summary with a take-home conclusion. This is presented in the chapter highlights text box at the beginning of each chapter. There are no tables, figures, or graphs in the highlights. This section is intended to highlight general findings for an audience with a limited scientific background.
- The second level is a more in-depth discussion with figures, summary tables, and summary graphs accompanying the text. The chapters of the annual report represent this level, which requires some familiarity with scientific data and graphs. A person with some scientific background can read and understand this report after reading the subsection entitled, “Helpful Information.”
- The third level includes links to supplemental and technical reports and websites that support the annual report. This level is directed toward scientists who would like to see original data and more in-depth discussions of the methods used and the results.

A significant portion of the Annual Site Environmental Report (ASER) focuses on radioactivity levels measured in environmental media such as air, water, soil, and plants. To assist individuals with limited or no familiarity with radiological data or radiation dose, a guide was developed. This [guide](#) explains the terminology and concepts used in the ASER to help the reader understand the information. Additionally, a [glossary](#) of frequently used terms is available for reference.

Previous ASERs and links to other reference reports may be found in the [Environmental Publications](#) tab of the webpage.

The INL contractor is responsible for contributing to and producing the ASER.

Other contributors to the ASER include the Idaho Cleanup Project (ICP) contractor; DOE-ID; NOAA, Air Resources Laboratory, Special Operations and Research Division; and the USGS. Links to their websites are as follows:

- [INL](#)
- [ICP](#)
- [U.S. Department of Energy–Idaho Operations](#)
- [NOAA, Air Resources Laboratory, Special Operations and Research Division](#)
- [USGS](#).

Environmental activities for the Naval Reactor Facility are not included in this ASER since NRF publishes their own Environmental Monitoring Report (FMP 2025).

The term INL Site contractors used throughout the report is referring to the INL and ICP contractors.



Scarab beetle.

Executive Summary:



Introduction

The INL Site is a U.S. Department of Energy (DOE) reservation located in the southeastern Idaho desert, approximately 23 miles west of Idaho Falls (see Figure ES-1). At 890 square miles (569,600 acres), the INL Site is roughly 85% of the size of Rhode Island. It was established in 1949 as the National Reactor Testing Station, and for many years, it was the site of the largest concentration of nuclear reactors in the world. Fifty-two nuclear reactors were built, including the Experimental Breeder Reactor-I, which, in 1951, produced the first usable amounts of electricity generated by nuclear power (INL Timeline). Researchers pioneered many of the world's first nuclear reactor prototypes and advanced safety systems at the INL Site. During the 1970s, the laboratory's mission broadened into other areas such as biotechnology, energy and materials research, and conservation and renewable energy.

Today, INL is a science-based, applied engineering national laboratory dedicated to supporting DOE's nuclear and energy research, science, and national defense missions.

INL's mission is to discover, demonstrate, and secure innovative nuclear energy solutions, other clean energy options, and critical infrastructure with a vision to change the world's energy future and secure the nation's critical infrastructure.



Figure ES-1. Regional location of the INL Site.



To mitigate environmental impacts and clear the way for the facilities required for the new nuclear energy research mission, the ICP has been charged with the environmental cleanup of the legacy wastes generated from World War II-era conventional weapons testing, government-owned reactors, and spent fuel reprocessing. The overarching aim of the project is to reduce risks to workers and production facilities, the public, and the environment, and to protect the Snake River Plain Aquifer.

PURPOSE OF THE INL SITE ENVIRONMENTAL REPORT

The INL Site's operations and ongoing cleanup mission involve a commitment to environmental stewardship and full compliance with environmental protection laws. As part of this commitment, the INL Site Environmental Report is prepared annually to inform the public, regulators, stakeholders, and other interested parties of the INL Site's environmental performance during the year. This report is published for the U.S. Department of Energy, Idaho Operations Office (DOE-ID) in compliance with DOE Order 231.1B, "Environment, Safety and Health Reporting." The purpose of the report is to provide the following:

- Present the INL Site, mission, and programs
- Report compliance status with applicable federal, state, and local regulations
- Describe the INL Site environmental programs and activities
- Summarize the environmental monitoring results
- Discuss potential radiation doses to the public residing in the vicinity of the INL Site
- Report on ecological monitoring and research conducted by contractors and affiliated agencies and by independent researchers through the Idaho National Environmental Research Park
- Present property clearance activities
- Describe quality assurance methods used to ensure confidence in monitoring data
- Provide supplemental technical data and reports that support the ASER.

MAJOR INL SITE PROGRAMS AND FACILITIES

INL is a combination of all operating contractors and DOE-ID, and includes the Idaho Falls campus and the research and industrial complexes termed the "INL Site" that is located approximately 23 miles west of Idaho Falls. For the purpose of this report, INL consists of those facilities operated by Battelle Energy Alliance, LLC (the INL contractor), or by the Idaho Environmental Coalition, LLC (the ICP contractor). INL Site contractors are referred to by their noted acronyms and include all facilities under their individual responsibilities.

The INL Site consists of several primary facilities situated on an expanse of otherwise undeveloped terrain. Buildings and structures at the INL Site are clustered within these facilities, which are typically less than a few square miles in size and separated from each other by miles of undeveloped land. In addition, DOE-ID owns or leases laboratories and administrative offices in Idaho Falls, some 23 miles east of the INL Site border. About 30% of employees work in administrative, scientific support, and non-nuclear laboratory programs at offices in Idaho Falls.

The major facilities at the INL Site are the Advanced Test Reactor (ATR) Complex, Central Facilities Area (CFA), Critical Infrastructure Test Range Complex (CITRC), Idaho Nuclear Technology and Engineering Center (INTEC), Materials and Fuels Complex (MFC), Naval Reactors Facility (NRF), Radioactive Waste Management Complex (RWMC), and Test Area North (TAN), which includes the Specific Manufacturing Capability (SMC). The Research and Education Campus (REC) is in Idaho Falls. Facility missions are outlined in Chapter 1, Subsection 1.5.3.

ENVIRONMENTAL COMPLIANCE (CHAPTER 2)

One measure of the achievement of the environmental programs at the INL Site is compliance with the applicable environmental regulations, which have been established to protect human health and the environment. The compliance of INL Site and DOE-ID programs with federal and state environmental protection requirements, such as statutes, acts, agreements, executive orders, and DOE directives are presented in Table 2-1.

ENVIRONMENTAL RESTORATION (CHAPTER 2)

Environmental restoration at the INL Site is conducted under the Federal Facility Agreement and Consent Order (FFA/CO) among DOE, the state of Idaho, and the U.S. Environmental Protection Agency (EPA). The FFA/CO specifies actions that must be completed to safely cleanup sites in compliance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and with the corrective action requirements of the Resource Conservation and



Recovery Act. The INL Site is divided into ten Waste Area Groups (WAGs) as a result of the FFA/CO, and each WAG is divided into smaller cleanup areas called Operable Units. Since the FFA/CO was signed in 1991, the INL Site has cleaned up sites containing asbestos, acids and bases, radionuclides, unexploded ordnance and explosive residues, polychlorinated biphenyls, heavy metals, and other hazardous materials. Comprehensive remedial investigation/feasibility studies have been conducted at all WAGs and closeout activities have been completed at six WAGs. In 2024, all institutional controls and operational and maintenance requirements were maintained, and active remediation continued on WAGs 1, 3, and 7.

ENVIRONMENTAL PROTECTION PROGRAMS (CHAPTER 2, CHAPTER 3)

Directives, orders, guides, and manuals are DOE's primary means of establishing policies, requirements, responsibilities, and procedures for DOE offices and contractors. Among these are a series of orders directing each DOE site to implement sound stewardship practices that are protective of the public and the environment. These orders require the implementation of an environmental management system (EMS), a Site Sustainability Plan, a radioactive waste management program, and programs addressing radiation protection of the public and the environment. The INL Site contractors have each established and implemented an EMS and have contributed to the INL Site Sustainability Plan, as required by DOE and executive orders. Each EMS integrates environmental protection, environmental compliance, pollution prevention, and waste minimization into work planning and execution throughout all work areas. The INL Site Sustainability Plan contains strategies and activities that will lead to continual greenhouse gas reductions, as well as energy, water, and transportation fuels efficiency at the INL Site. Plan requirements are integrated into each INL Site contractor's Integrated Safety Management System and EMS.

ENVIRONMENTAL MONITORING OF AIR (CHAPTER 4)

Airborne releases of radionuclides from INL Site operations are reported annually in a document prepared in accordance with the 40 CFR 61, Subpart H, "National Emission Standards for Emissions of Radionuclides Other than Radon from Department of Energy Facilities." An estimated total of 1,588 curies (5.88×10^{13} Bq) of radioactivity, primarily in the form of short-lived noble gas isotopes, were released as airborne effluents in 2024. This represents a significant decrease in emissions compared to 2023. These airborne releases of radionuclides are reported to comply with the regulatory requirements and are considered in the design and conduct of INL Site environmental surveillance activities.

The INL Site environmental surveillance monitoring programs, which are conducted by the INL Site contractors, emphasize the measurement of airborne radionuclides because air transport is considered the major potential pathway from INL Site releases to human receptors. During 2024, the INL contractor monitored ambient air at 36 locations (e.g., 20 onsite, seven boundary locations, nine offsite). The ICP contractor focused on ambient air surveillance monitoring of waste management facilities, namely INTEC and RWMC.

Air particulate samples were collected weekly by the INL contractor and biweekly by the ICP contractor. These samples were initially analyzed for gross alpha and gross beta activity. The particulate samples were then combined into composite samples and analyzed for gamma-emitting radionuclides and specific alpha- and beta-emitting radionuclides. Charcoal cartridges were also collected weekly by the INL contractor and analyzed for radioiodine.

All radionuclide concentrations in ambient air samples were below DOE radiation protection standards for air. There were a few statistical differences between the monthly and quarterly datasets collected by the INL contractor during 2024 that can be attributed to expected statistical variation in the data and not to INL Site releases. All concentrations were within the historical measurements made during the past ten years (2014–2024) and were well below the DOE Derived Concentration Technical Standards for these radionuclides.

The INL contractor collected atmospheric moisture samples at three stations onsite, three stations offsite, and two boundary stations in 2024. Precipitation was collected at one location onsite, two boundary locations, and one offsite location. The samples were all analyzed for tritium. The results were within measurements made historically and below the DOE Derived Concentration Technical Standards. Tritium measured in these samples is most likely the result of natural production in the atmosphere and not the result of INL Site effluent releases.

ENVIRONMENTAL MONITORING OF GROUNDWATER, DRINKING, AND SURFACE WATER (CHAPTER 5, CHAPTER 6)

The INL Site contractors monitor liquid effluents (wastewater), drinking water, groundwater, and storm water runoff at the INL Site, for both radioactive and nonradioactive constituents, and for compliance with applicable laws and regulations, DOE orders, and other requirements. Wastewater is typically discharged from INL Site facilities to infiltration ponds or to



evaporation ponds. Wastewater effluent discharges occur at percolation ponds southwest of INTEC, the ATR Complex Cold Waste Ponds, and the MFC Industrial Waste Pond. DOE-ID complies with the state of Idaho groundwater quality, wastewater, and reuse rules for these effluents through reuse permits, which provide for monitoring of the wastewater and groundwater in the area. During 2024, liquid effluent and groundwater monitoring were conducted in support of reuse permit requirements. An annual site performance report for each permitted reuse facility was prepared and submitted to the Idaho Department of Environmental Quality. No permit limits were exceeded at INTEC or MFC. One groundwater chromium result in one monitoring well at the ATR Complex slightly exceeded the groundwater quality standard. The source of this elevated chromium is unlikely to be a result of current effluent discharges to the ATR Complex Cold Waste Ponds but rather due to other factors, such as historical contamination.

In addition to the monitoring conducted in support of the reuse permits, liquid effluent and groundwater surveillance monitoring also was performed at the ATR Complex Cold Waste Ponds, INTEC, and the MFC Industrial Waste Pond to comply with environmental protection objectives of DOE orders. The 2024 results were consistent with the historical measurements. All radioactive parameters were below the applicable health-based levels.

Drinking water parameters are regulated by the state of Idaho under the authority of the Safe Drinking Water Act. The INL Site contractors monitored 11 drinking water systems at the INL Site in 2024. (The NRF contractor monitors an additional drinking water system; those results are reported separately by NRF). The results were below limits for all relevant drinking water standards.

Surface water flows off the Subsurface Disposal Area (SDA) following periods of heavy precipitation or rapid snowmelt. During these times, water may be pumped out of the SDA retention basin into a drainage canal, potentially carrying radionuclides originating from radioactive waste or contaminated surface soil off the SDA. Surface water is collected when it is available. The detected radioactive concentrations were well below the standards established by DOE for radiation protection of the public and the environment.

ENVIRONMENTAL MONITORING OF THE EASTERN SNAKE RIVER PLAIN AQUIFER (CHAPTER 6)

The eastern Snake River Plain Aquifer is perhaps the single-most important aquifer in the state of Idaho. Composed of layered basalt lava flows and some sediment, it covers an area of approximately 27,972 km² (10,800 mi²). The highly productive aquifer has been declared a sole source aquifer by the EPA due to the nearly complete reliance on the aquifer for drinking water supplies in the area.

The USGS began monitoring the groundwater below the INL Site in 1949. Currently, the USGS performs groundwater monitoring, analyses, and studies of the eastern Snake River Plain Aquifer under and adjacent to the INL Site. These activities use an extensive network of strategically placed monitoring wells on and around the INL Site. In 2024, the USGS continued to monitor localized areas of chemical and radiochemical contamination beneath the INL Site produced by past waste disposal practices, in particular, the direct injection of wastewater into the aquifer at INTEC. Results for monitoring wells sampled within the plumes show nearly all wells had decreasing trends of tritium and ⁹⁰Sr concentrations over time.

Volatile organic compounds (VOCs) are present in water from the eastern Snake River Plain Aquifer because of historical waste disposal practices at the INL Site. Several purgeable VOCs were detected by the USGS in at least one of the 24 groundwater monitoring wells sampled at the INL Site in 2024. Most concentrations of the 61 analyzed compounds were either below the laboratory reporting levels or their respective primary contaminant standards. Trend test results for tetrachloromethane concentrations in water from the RWMC production well show a decreasing trend in that well since 2005. The more recent decreasing trend indicates that remediation efforts designed to reduce VOC movement to the aquifer are having a positive effect. Concentrations of tetrachloromethane from USGS-87 and USGS-120, south of RWMC, have had an increasing trend since 1987; however, concentrations have decreased through time at USGS-88. Trichloroethene and Tetrachloromethane were detected above the maximum contaminant level (MCL) in one perched well sampled by the USGS at RWMC, which was collected prior to the abandonment of this well.

Groundwater surveillance monitoring continued for the CERCLA WAGs onsite in 2024. At TAN (WAG 1), groundwater monitoring continues to monitor the progress of remediation of the plume of trichloroethylene and to monitor strontium-90 (⁹⁰Sr) and cesium-137 (¹³⁷Cs). Remedial action consists of three components: in situ bioremediation, pump and treat, and monitored natural attenuation. Amounts of ⁹⁰Sr and ¹³⁷Cs were present in the wells in the source area at levels higher than those prior to starting in situ bioremediation. The elevated concentrations of these radionuclides are due to chemical processes associated with in situ bioremediation activities. The radionuclide concentrations will continue to be evaluated to determine whether they will meet the remedial action objectives by 2095.



Groundwater samples were collected from seven aquifer wells in the vicinity of the ATR Complex (WAG 2) during 2024 and were analyzed for ^{90}Sr , cobalt-60 (^{60}Co), tritium, and chromium. Chromium and tritium were the only analytes detected but the concentrations were below the respective drinking water MCL established by the EPA.

Groundwater samples were collected from 14 aquifer monitoring wells at and near INTEC (WAG 3) during 2024 and analyzed for a suite of radionuclides and inorganic constituents. The detections of ^{90}Sr , technetium-99 (^{99}Tc), and nitrate + nitrate (as nitrogen) exceeded their respective drinking water MCLs in one or more aquifer monitoring wells at or near INTEC, with ^{90}Sr exceeding its MCL by the greatest margin in a downgradient well south of the former INTEC injection well. All other well locations showed ^{90}Sr levels similar to or slightly lower than those reported in previous samples.

Monitoring groundwater at CFA (WAG 4) consists of CFA landfill monitoring and the monitoring of a nitrate plume south of CFA. Wells at the landfill were monitored in 2024 for metals (filtered), VOCs, and anions (e.g., nitrate, chloride, sulfate). No CFA landfill monitoring samples exceeded an MCL, but the manganese secondary maximum contaminant level (SMCL) was exceeded in one well, and two other wells exceeded a pH SMCL. Nitrate continued to exceed the EPA MCL in one well in the plume south of the CFA in 2024; however, the data show a downward trend since 2006.

Groundwater samples were collected from 12 monitoring wells near and downgradient of the RWMC (WAG 7) in May 2024, which were analyzed for radionuclides, inorganic constituents, and VOCs. Concentrations did not exceed an MCL at any well and were consistent with the historical detections.

Groundwater monitoring at MFC as part of WAG 9 CERCLA monitoring was discontinued in 2022, as discussed in Chapter 6. In 2024, groundwater monitoring continued in support of the MFC Industrial Waste Pond Reuse Permit and DOE orders. Three wells were sampled for radionuclides, metals, and other water quality parameters in the spring and fall of 2024. Overall, the results remain below the primary constituent standard/secondary constituent standards and continue to show no evidence of impacts from MFC activities.

Wells along the southern INL Site boundary (as part of WAG 10) are sampled every two years. Groundwater samples were not collected in 2024. The next sampling event will occur in 2025.

Groundwater is monitored annually at the Remote-Handled Low-Level Waste Facility for gross alpha, gross beta, carbon-14 (^{14}C), iodine-129 (^{129}I), ^{99}Tc , and tritium. Samples were collected from three monitoring wells in the spring of 2024. Measurements of ^{14}C , ^{129}I , and ^{99}Tc were not detected in any samples. The results for gross alpha, gross beta, and tritium remain below the primary constituent standard/secondary constituent standard and show no discernible impacts to the aquifer from Remote-Handled Low-Level Waste Facility operations. Tritium in all three wells continue to gradually decline over time.

Drinking water and surface water samples were sampled downgradient of the INL Site and analyzed for gross alpha and beta activity and tritium. Tritium was not detected in the surface water samples or drinking water samples. The gross alpha and beta results were within the historical measurements and below the EPA's screening level. The data appear to show no discernible impacts from activities at the INL Site.

ENVIRONMENTAL MONITORING RESEARCH CONDUCTED BY USGS (CHAPTER 6)

The USGS INL Project Office drills and maintains research wells that provide information about subsurface water, rock and sediment, and contaminant movement in the eastern Snake River Plain Aquifer at and near the INL Site. In 2024, the USGS published two research reports, two software packages, and five data releases covering hydrogeologic conditions and monitoring at the INL Site.

ENVIRONMENTAL SURVEILLANCE MONITORING OF AGRICULTURAL PRODUCTS, WILDLIFE, SOIL, AND DIRECT RADIATION MEASUREMENTS (CHAPTER 7)

To help assess the impact of contaminants released to the environment by operations at the INL Site, agricultural products, wildlife, and direct radiation were sampled and analyzed for radionuclides in 2024. The agricultural products were collected onsite, offsite, and at boundary locations by the INL contractor. The results are as follows:

- **Agricultural Products.** No human-made radionuclides were detected in any of the agricultural products (e.g., lettuce, grain, potatoes, alfalfa) collected in 2024. An amount of ^{90}Sr was detected in a milk sample collected in Terreton but



the measurement was within the range of the historical values and well below the Derived Concentration Standard of ^{90}Sr in milk (5,800 pCi/L).

- **Big Game.** No human-made radionuclides were detected in big game animal samples collected in 2024.
- **Waterfowl.** Amounts of ^{60}Co and ^{90}Sr were detected in exterior subsamples of waterfowl collected at CFA and from the Sewage Lagoons at the INL Site. An amount of ^{90}Sr was detected in an exterior subsample of a control duck collected from the South Fork of the Snake River. All results were within the historical measurements.
- **Direct Radiation.** Direct radiation measurements made at onsite, offsite, and boundary locations were consistent with the historical and natural background levels.

RADIATION DOSE TO THE PUBLIC AND BIOTA FROM INL SITE RELEASES (CHAPTER 8)

Humans, plants, and animals potentially receive radiation doses from various INL Site operations. DOE sets dose limits for the public and biota to ensure that exposure to radiation from INL Site operations is not a health concern. Potential radiological doses to the public from INL Site operations were calculated to determine compliance with pertinent regulations and limits (see Table 8-5). The calculated dose to the maximally exposed individual in 2024 from the air pathway was 0.015 mrem (0.15 μSv), which is well below the 10-mrem standard established by the Clean Air Act. The maximally exposed individual is a hypothetical member of the public who could receive the maximum possible dose from INL Site releases as determined by the air dispersion model. This person is assumed to live at a location east of INL's east entrance and south of Highway 20. For comparison, the dose from natural background radiation was estimated in 2024 to be 388 mrem (3.9 mSv) to an individual living on the Snake River Plain.

The maximum potential population dose to the approximately 358,426 people residing within an 80 km (50 mi) radius of any INL Site facility was calculated as 0.012 person-rem (0.00012 person-Sv), below that expected from exposure to background radiation (139,069 person-rem or 1,391 person-Sv).

In 2024, no human-made radionuclides were detected in edible portions of big game animals or waterfowl, indicating there is no dose associated with ingestion of game animals. Therefore, the total dose the representative person off the INL Site could potentially receive was estimated to be 0.015 mrem (0.15 μSv) in 2024. This is 0.015% of the DOE health-based dose limit of 100 mrem/yr (1 mSv/yr) from all pathways for the INL Site.

Tritium has been detected previously in two USGS monitoring wells located onsite along the southern boundary. A hypothetical individual ingesting the maximum concentration of tritium (3,250 pCi/L) via drinking water from these wells would receive a dose of approximately 0.136 mrem (0.00136 mSv) in one year. This is an unrealistic pathway to humans because there are no drinking water wells located along the southern boundary of the INL Site. The maximum contaminant level established by the EPA for tritium (20,000 pCi/L) corresponds to a dose of approximately 4 mrem (0.04 mSv [40 $\mu\text{Sv/yr}$]).

A dose to a maximally exposed individual located in Idaho Falls, near the DOE Radiological and Environmental Sciences Laboratory and the INL Research Center, both within the REC, was calculated for compliance with the Clean Air Act. For 2024, the dose was conservatively estimated to be 0.005 mrem (0.05 μSv), which is less than 0.1% of the 10-mrem/yr federal standard.

Doses also were evaluated for nonhuman biota at the INL Site using a graded approach. Based on the conservative screening calculations, there is no evidence that INL Site-related radioactivity in soil or water is adversely affecting the populations of plants or animals.

NATURAL AND CULTURAL RESOURCES CONSERVATION AND MONITORING (CHAPTER 9)

Natural resources conservation, monitoring, and land-stewardship activities onsite are organized in four categories: (1) planning and implementing conservation efforts for high-priority natural resources; (2) frequently evaluating the regulatory rankings, distribution, and populations for special status species; (3) ongoing monitoring and research to provide baseline and trend data for specific taxa and broader ecological communities; and (4) conducting land-stewardship activities to minimize impacts to natural resources and restore ecological conditions, where appropriate.

DOE has developed conservation plans to address species of elevated conservation concern and the valuable ecosystems they inhabit. Conservation plans that are specific to or include the INL Site are the Candidate Conservation



Agreement for Greater sage-grouse (*Centrocercus urophasianus*), the INL Site Bat Protection Plan, the Sagebrush Steppe Ecosystem Reserve, and the Migratory Bird Conservation Plan and Avian Protection Planning documents. Many of these plans include conservation measures; best management practices; monitoring programs; and annual reports to facilitate, evaluate, and communicate results of conservation efforts for resources with high-conservation priority.

To better inform conservation efforts, biologists regularly evaluate the regulatory status of key special status species identified by state or federal agencies. For animals, these include 28 species of birds, 11 species of mammals, one species of reptile, and one species of amphibian. There are also currently 29 special status plant species that have been documented to occur or have appropriate habitat onsite. Many of the plant species are rare and occur very infrequently within their optimal habitats. While several animals and plants listed as threatened or endangered under the Endangered Species Act are present in the state of Idaho, none are known to occur onsite.

Additional ecological monitoring has been conducted for more than 70 years, with some studies dating back to the 1950s. The focus of this work is to better understand the INL Site's ecosystem and biota and to determine the impact on populations of these species from activities conducted at the INL Site. Natural resource monitoring activities include breeding bird surveys, a midwinter raptor survey, long-term vegetation transect surveys, and vegetation mapping. Furthermore, the INL Site was designated as a National Environmental Research Park in 1975 and serves as an outdoor laboratory for environmental scientists to study Idaho's native plants and wildlife in an intact and relatively undisturbed ecosystem. Ongoing National Environmental Research Park activities range from characterizing sagebrush steppe ecohydrology to identifying high-quality foodscape for sage-grouse.

Land-stewardship activities involve managing ecosystems to increase habitat connectivity and enhance ecosystem services through planning, assessment, restoration and rehabilitation activities. Areas where DOE-ID is actively employing land-stewardship activities include wildland fire-protection planning, management, and recovery; restoration and revegetation; and weed management.

The INL Cultural Resource Management Office coordinates cultural resource-related activities at the INL Site and implements the 2023 Programmatic Agreement (DOE-ID 2023) and the INL Cultural Resource Management Plan (DOE-ID 2016) with oversight by DOE-ID's Cultural Resource Coordinator. Cultural resource identification and evaluation studies in 2024 included: (1) archaeological field surveys, (2) cultural resource monitoring and recorded updates related to INL Site project activities and research, (3) comprehensive evaluations of 45-year-old and older built environment resources, and (4) meaningful collaboration with members of the Shoshone-Bannock Tribes and public stakeholders.

QUALITY ASSURANCE (CHAPTER 10)

Quality assurance and quality control programs are maintained by contractors conducting environmental surveillance monitoring and by laboratories performing environmental analyses to help provide confidence in the data and ensure data completeness. Programs involved in environmental surveillance monitoring developed quality assurance programs and documentation that follow requirements and criteria established by DOE. Environmental surveillance monitoring programs implemented quality assurance program elements through quality assurance project plans developed for each contractor. Adherence to procedures and quality assurance project plans was maintained during 2024. Data reported in this document were obtained from several commercial, government, and government-contractor laboratories. To ensure quality results, these laboratories participated in several laboratory performance testing and evaluation programs. Quality issues that arose with laboratories used by INL Site contractors during 2024 were addressed with those laboratories and have since been resolved.



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Acronyms:



AEA	Atomic Energy Act	ECP	Environmental Compliance Permit
AEC	Atomic Energy Commission	EFS	Experimental Field Station
ALLWDF	active low-level waste disposal facility	EIS	Environmental Impact Statement
AMWTP	Advanced Mixed Waste Treatment Plant	EMS	Environmental Management System
ARIR	Administrative Record Information Repository	EO	Executive Order
ARP	Accelerated Retrieval Project	EPA	U.S. Environmental Protection Agency
ASER	Annual Site Environmental Report	EPCRA	Emergency Planning and Community Right-to-Know Act
ATR	Advanced Test Reactor	EPEAT	Electronic Product Environmental Assessment Tool
BBS	breeding bird survey	ERP	Environmental Review Process
BCG	Biota Concentration Guide	ES&S	Environmental Support and Services
BEA	Battelle Energy Alliance, LLC	ESA	Endangered Species Act
BLM	Bureau of Land Management	ET	evapotranspiration
BLR	Big Lost River	FEC	facility emission cap
BMP	best management practices	FFA/CO	Federal Facility Agreement and Consent Order
BORAX	Boiling Water Reactor Experiment	FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
CAA	Clean Air Act	FSV	Fort St. Vrain
CAP	criteria air pollutant	FY	fiscal year
CAP88-PC	Clean Air Act Assessment Package-1988 computer model, PC	HeTO	Heritage Tribal Office
CARP	Climate Adaptation and Resilience Plan	HFC	hydrofluorocarbons
CCA	Candidate Conservation Agreement	HFEF	Hot Fuel Examination Facility
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act	HTTF	High Temperature Test Facility
CFA	Central Facilities Area	HVAC	heating, ventilation, and air conditioning
CFR	Code of Federal Regulations	HWMA	Hazardous Waste Management Act
CITRC	Critical Infrastructure Test Range Complex	HYSPLIT	Hybrid Single-particle Lagrangian Integrated Trajectory
CRMO	Cultural Resource Management Office	IC	institution controls
CTF	Contained Test Facility	ICDF	Idaho CERCLA Disposal Facility
CWA	Clean Water Act	ICP	Idaho Cleanup Project
CWP	Cold Waste Pond	ICPP	Idaho Chemical Processing Plant
D&D	decontamination and decommissioning	IDAPA	Idaho Administrative Procedures Act
DCS	Derived Concentration Standard	IDFG	Idaho Department of Fish and Game
DEQ	Department of Environmental Quality (state of Idaho)	IEC	Idaho Environmental Coalition, LLC
DOD	U.S. Department of Defense	INEEL	Idaho National Engineering and Environmental Laboratory
DOE	U.S. Department of Energy		Idaho National Laboratory
DOECAP	U.S. Department of Energy Consolidated Audit Program	INL	
DOE-ID	U.S. Department of Energy, Idaho Operations Office	INL Site	
DOME	Demonstration of Microreactor Experiments	Contractors	INL contractor and ICP contractor
DOSEMM	dose multi-media	INTEC	Idaho Nuclear Technology and Engineering Center (formerly Idaho Chemical Processing Plant)
DQO	data quality objective	IPDES	Idaho Pollutant Discharge Elimination System
EA	Environmental Assessment	IRC	INL Research Center
EBR-I	Experimental Breeder Reactor No. 1	ISA	Idaho Settlement Agreement
EBR-II	Experimental Breeder Reactor No. 2	ISB	in situ bioremediation
EC	Environmental Checklist	IWP	Industrial Waste Pond



IWTU	Integrated Waste Treatment Unit	RCL	Radioanalytical Chemistry Laboratory
IWTS	Integrated Waste Tracking System	RCRA	Resource Conservation and Recovery Act
LAN	local area network	REC	Research and Education Campus
LED	light-emitting diode	RESL	Radiological and Environmental Sciences Laboratory
LLW	low-level waste		
LTV	long-term vegetation	RHLLW	Remote-Handled Low-level Waste Disposal Facility
MAPEP	Mixed Analyte Performance Evaluation Program	ROD	Record of Decision
MBTA	Migratory Bird Treaty Act	RRTR	Radiological Response Training Range
MCL	maximum contaminant level	RWMC	Radioactive Waste Management Complex
MCLG	maximum contaminant level goals	SARA	Superfund Amendments and Reauthorization Act
MEI	maximally exposed individual		
MFC	Materials and Fuels Complex	SCS	Secondary Constituent Standard
MOA	Memorandum of Agreement	SDA	Subsurface Disposal Area
MOI	Museum of Idaho	SDWA	Safe Drinking Water Act
MTR	Materials Test Reactor	SGCA	Sage-grouse Conservation Area
NA	not applicable	SGCN	Species of Greatest Conservation Need
NAREL	National Analytical Radiation Environmental Laboratory	SGIN	Species of Greatest Information Need
ND	not detected	SMC	Specific Manufacturing Capability
NEPA	National Environmental Policy Act	SMCL	secondary maximum contaminant level
NERP	National Environmental Research Park	SNF	spent nuclear fuel
NESHAP	National Emission Standards for Hazardous Air Pollutants	SSER	Sagebrush Steppe Ecosystem Reserve
NHPA	National Historic Preservation Act	STEAM	science, technology, engineering, arts, and mathematics
NHS	National and Homeland Security	STP	Sewage Treatment Plant
NM	not measured	SWAP	Statewide Wildlife Action Plan
NOAA	National Oceanic and Atmospheric Administration	TAN	Test Area North
NRC	Nuclear Regulatory Commission	TCE	trichloroethylene
NRF	Naval Reactors Facility	TFF	Tank Farm Facility
NRG	Natural Resources Group	TRA	Test Reactor Area
NRIC	National Reactor Innovation Center	TREAT	Transient Reactor Experiment and Test Facility
NS	no sample	TRU	transuranic
NSUF	National Scientific User Facility	TSCA	Toxic Substances Control Act
O&M	Operations and Maintenance	USFWS	U.S. Fish and Wildlife Service
OPEX	Operating Experience	USGS	U.S. Geological Survey
ORPS	Occurrence Reporting and Processing System	UTL	upper tolerance limit
OSLD	optically stimulated luminescence dosimeter	VISTA	Inventory of INL equipment, laboratories, and expertise for research
OU	Operable Unit	VOC	volatile organic compound
PCB	polychlorinated biphenyls	WAG	waste area group
PCC	Precontact Context	WFMC	Wildland Fire Management Committee
PCS	primary constituent standard	WIPP	Waste Isolation Pilot Plan
PDD	program description document	WWII	World War II
PE	performance evaluation		
PFAS	perfluoroalkyl substances		
PL	primary line		
PT	performance testing		
PTC	permit to construct		
PWS	public water system		
QA	quality assurance		
QC	quality control		
R&D	research and development		
RBDA	risk-based disposal approval		

Units:



Bq	becquerel	μS	microsiemen (10 ⁻⁶) siemen
C	Celsius	μSv	microsievert (10 ⁻⁶) sievert
cfm	cubic feet per minute	Ma	million years
CFU	colony forming unit	mCi	millicurie (10 ⁻³) curies
Ci	curie	MeV	mega electron volt
cm	centimeter	mg	milligram (10 ⁻³) grams
cps	counts per second	MG	million gallons
d	day	mGy	milligray (10 ⁻³) gray
F	Fahrenheit	MI	million liters
ft	feet	mi	mile
g	gram	min	minute
gal	gallon	mL	milliliter (10 ⁻³) liter
Gy	gray	mR	milliroentgen (10 ⁻³) roentgen
ha	hectare	mrads	millirad (10 ⁻³) rad
keV	kilo-electron-volts	mSv	millisievert (10 ⁻³) sievert
kg	kilograms (10 ³) gram	oz	ounce
km	kilometer (10 ³) meter	pCi	picocurie (10 ⁻¹²) curies)
L	liter	R	roentgen
lb	pound	rad	radiation absorbed dose
m	meter	rem	roentgen equivalent man
μCi	microcurie (10 ⁻⁶) curies	Sv	sievert
μg	microgram (10 ⁻⁶) grams	yd	yard
μR	microroentgen (10 ⁻⁶) roentgen	yr	year



Abronia mellifera.

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Chapter 1: Introduction



1. INTRODUCTION

This annual report is prepared in compliance with the following United States (U.S.) Department of Energy (DOE) orders:

- [DOE O 231.1B](#), “Environment, Safety, and Health Reporting”
- [DOE O 458.1](#), “Radiation Protection of the Public and the Environment.”

The purpose of the report, as outlined in [DOE O 231.1B](#), is to present summary environmental data to accomplish the following:

- Characterize the environmental performance at the Idaho National Laboratory (INL) Site
- Summarize the environmental occurrences and responses at the INL Site during the calendar year
- Confirm compliance with environmental standards and requirements
- Highlight significant facility programs and efforts
- Describe property clearance activities.

This report is the principal document that demonstrates compliance with the requirements in [DOE O 458.1](#); therefore, it describes the impact the Idaho National Laboratory (INL) Site has on the public and the environment with an emphasis on radioactive contaminants.

1.1 Site Location

The INL Site encompasses about 2,305 square kilometers (km²) (890 square miles [mi²]) of the upper Snake River Plain in southeastern Idaho. Over 60% of the INL Site is located in Butte County, while the rest is distributed across Bingham, Bonneville, Clark, and Jefferson counties. It extends 63 km (39 mi) from north to south and is approximately 58 km (36 mi) at its broadest east to west portion. By highway, the southeast entrance of the INL Site lies approximately 37 km (23 mi) west of Idaho Falls. Other towns surrounding the boundaries include Arco, Atomic City, Blackfoot, Rigby, Rexburg, Terreton, and Howe. Pocatello is approximately 66 km (41 mi) to the southeast.

Federal lands surround much of the INL Site, including U.S. Bureau of Land Management lands and Craters of the Moon National Monument and Preserve to the southwest, the Salmon-Challis National Forest to the west, and the Targhee National Forest to the north. Mud Lake Wildlife Management Area, Camas National Wildlife Refuge, and Market Lake Wildlife Management Area are within 32 km (20 mi) of the INL Site. The Fort Hall Reservation is located approximately 48 km (30 mi) to the southeast.

Information about the INL Site history can be found [here](#).

1.2 Environmental Setting

The INL Site is located in a large, relatively undisturbed expanse of sagebrush steppe. Approximately 94% of the land is open and undeveloped. It has an average elevation of 1,500 m (4,900 ft) above sea level and is bordered on the north and west by mountain ranges and on the south by volcanic buttes and open plain. Lands immediately adjacent to the INL Site are open sagebrush steppe, foothills, or agricultural fields. Agriculture is concentrated in the northeast areas.

About 60% of the INL Site is open to livestock grazing. [Controlled hunting](#) is permitted but restricted to very small northeast and northwest portions of the INL Site.

The climate of the high-desert environment is characterized by sparse precipitation of about 20.7 cm/yr (8.16 in./yr), warm summers with a normal daily temperature of 18.9°C (66.1°F), and cold winters with a normal daily temperature of -7.4°C (18.6°F), based on observations at the Central Facilities Area (CFA) from 1994 through 2024 (NOAA 2025). The altitude, intermountain setting, and latitude of the INL Site combine to produce a semi-arid climate. Prevailing weather patterns are from the southwest, moving up the Snake River Plain. Air masses, which gather moisture over the Pacific Ocean, traverse



several hundred miles of mountainous terrain before reaching southeastern Idaho. Frequently, the result is dry air with limited cloud cover. Solar heating can be intense, with extreme day-to-night temperature fluctuations.

Basalt flows cover most of the Snake River Plain, producing rolling topography. Over 400 different kinds of taxa plants have been recorded within the boundaries of the INL Site (Anderson et al. 1996). Vegetation is dominated by big sagebrush (*Artemisia tridentata*) with grasses and wildflowers beneath that have adapted to the harsh climate.

The INL Site is also home to many kinds of animals. Vertebrate animals found in this area include small burrowing mammals, snakes, birds, and several large mammals. Published species records include six types of fish, one amphibian, nine reptiles, 164 birds, and 39 mammals (Reynolds et al. 1986).

The Big Lost River that runs through the INL Site property is diverted, flowing northeast, ending in a playa area on the northwestern portion, called the Big Lost River Sinks. Here, the river evaporates or infiltrates to the subsurface, with no surface water moving from the INL Site. The Big Lost River is diverted at the INL Diversion to avoid the potential for flooding. Normally, the riverbed is dry due to upstream irrigation and rapid infiltration into the desert soil and underlying basalt. In 2024, no surface-water flow was measured at three U.S. Geological Survey (USGS) surface-water sites on the INL Site.

Fractured volcanic rocks under the INL Site form a portion of the eastern Snake River Plain Aquifer that stretches 320 km (199 mi) from Island Park to King Hill, which is 9.7 km (6 mi) northeast of Glenns Ferry, and stores one of the most bountiful supplies of groundwater in the nation. An estimated 247–370 billion m³ (200–300 million acre · ft) of water is stored in the aquifer's upper portions. The aquifer is primarily recharged from Henry's Fork and the south fork of the Snake River, and to a lesser extent, the aquifer is recharged from the Big Lost River, Little Lost River, Birch Creek, and irrigation. Beneath the INL Site, the aquifer moves laterally southwest at a rate of 1.5 to 6 m/day (5–20 ft/day) (Lindholm 1996). The eastern Snake River Plain Aquifer emerges in springs along the Snake River between Milner and Bliss, Idaho. Crop irrigation is the primary use of both surface water and groundwater on the Snake River Plain.

1.3 Human Populations Near the INL Site

The population of the region within 80 km (50 mi) of the INL Site is estimated to be 358,426, based on the 2020 U.S. Census and projected growth. Over half of this estimated population (198,787) resides in the census divisions of Idaho Falls (121,578) and northern Pocatello (77,209). Another 41,321 are projected to live in the Rexburg census division. Approximately 22,542 are estimated to reside in the Rigby census division, with 15,464 in the Blackfoot census division. The remaining population resides in small towns and rural communities throughout southeastern Idaho.

1.4 INL Site Primary Program Missions and Facilities

The mission of the INL Site is to operate a multiprogram national research and development (R&D) laboratory and to complete environmental cleanup activities stemming from past operations. The U.S. Department of Energy, Idaho Operations Office (DOE-ID), receives implementing direction and guidance primarily from two DOE Headquarters offices—the Office of Nuclear Energy (DOE-NE) and the Office of Environmental Management (DOE-EM). DOE-NE is the Lead Program Secretarial Office for all DOE-ID-managed operations on the INL Site.

DOE-EM provides direction and guidance to DOE-ID for environmental cleanup on the INL Site and functions in the capacity of the Cognizant Secretarial Office. Operations conducted by the Naval Reactors organization on the INL Site report to the Pittsburgh Naval Reactors Office. These operations fall outside the purview of DOE-ID, and therefore, are not included in this report.

1.4.1 Idaho National Laboratory

The INL mission is to discover, demonstrate, and secure innovative nuclear energy solutions, other clean energy options, and critical infrastructure. Its vision is to change the world's energy future and secure our nation's critical infrastructure. To fulfill its assigned duties during the next decade, INL will work to transform itself into a laboratory leader in nuclear energy and homeland security research, development, and demonstration. This transformation will develop nuclear energy and NHS leadership as highlighted by recent achievements such as the demonstration of Generation IV reactor technologies; the creation of national user facilities, including the Advanced Test Reactor (ATR) National Scientific User Facility, the Wireless National User Facility, and the Biomass Feedstock National User Facility; the Critical Infrastructure Test Range Complex (CITRC); piloting advanced fuel cycle technology; the rise to prominence of the Center for Advanced Energy Studies; and recognition as a regional clean energy resource and world leader in safe operations.



On February 22, 2021, an addendum to the 2019 memorandum of understanding between DOE and the U.S. Nuclear Regulatory Commission (NRC) formalized the coordination between these two federal agencies in regard to National Reactor Innovation Center (NRIC) projects. This addendum specifically focuses on research, development, and demonstration projects. It also solidifies a partnership to deliver successful nuclear reactor demonstrations. NRIC is a national DOE program led by INL in allowing collaborators to harness the world-class capabilities of the U.S. National Laboratory System. The center is charged with and committed to demonstrating advanced reactors by the end of calendar year 2025. BEA is responsible for the management and operation of INL.

1.4.2 Idaho Cleanup Project

The ICP involves the safe environmental cleanup of the INL Site, which was contaminated with waste generated during World War II-era conventional weapons testing, government-owned research and defense reactor operations, laboratory research, fuel reprocessing, and defense missions at other DOE sites. The ICP focuses on meeting the Idaho Settlement Agreement (DOE 1995) and other environmental cleanup milestones while reducing risks to workers. Protection of the Snake River Plain Aquifer, the sole drinking water source for more than 350,000 residents in eastern Idaho, was the principal concern addressed in the Settlement Agreement. IEC is responsible for ICP management and operation.

Most of the cleanup work under the contract is driven by regulatory compliance agreements. The two foundational agreements are: (1) the 1991 Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)-based Federal Facility Agreement and Consent Order (DOE 1991), which governs the cleanup of contaminant releases to the environment; and (2) the 1995 Idaho Settlement Agreement (DOE 1995), which governs the removal of transuranic waste, spent nuclear fuel (SNF), and high-level radioactive waste from the State of Idaho. Other regulatory drivers include the Federal Facility Compliance Act-Based Site Treatment Plan for the treatment of hazardous wastes and other environmental permits, closure plans, federal and state regulations, Records of Decision, and other implementing documents.

The ICP mission involves treating about 900,000 gallons of sodium-bearing liquid waste; preparing the Subsurface Disposal Area (SDA) for the construction of an evapotranspiration barrier; managing SNF in dry storage; retrieving and treating high-level waste calcine; treating both remote- and contact-handled transuranic waste for disposal at the Waste Isolation Pilot Plant (WIPP) in the state of New Mexico; and the demolition and disposal of more than 200 contaminated structures, including reactors, storage basins for SNF, and laboratories used for radioactive experiments.

1.4.3 Primary INL Site Facilities

Most INL Site buildings and structures are located within developed areas that are typically less than a few square miles in size and separated by miles of undeveloped land. DOE controls all the land within the INL Site boundary. In addition to the INL Site, DOE owns or leases laboratories and administrative offices in Idaho Falls, about 40 km (25 mi) east of the INL Site.

Advanced Test Reactor (ATR) Complex. The ATR Complex was established in the early 1950s and has been the primary operations location for three major test reactors: (1) the Materials Test Reactor (1952–1970); (2) the Engineering Test Reactor (1957–1982); and (3) the ATR (1967–present). The primary mission at the ATR Complex is the operation of the ATR, the world's premier test reactor used to study the effects of radiation on materials. This reactor also produces rare and valuable medical and industrial isotopes. The ATR is a Nuclear Scientific User Facility. The ATR Complex also features the ATR Critical Facility, the Test Train Assembly Facility, the Radiation Measurements Laboratory, the Radiochemistry Laboratory, and the Safety and Tritium Applied Research Facility, which also serves as a National Scientific User Facility. The ATR Complex is operated by the INL contractor.

Central Facilities Area (CFA). CFA is the main service and support center for the Site's desert facilities. Activities at CFA support transportation, maintenance, medical, construction, radiological monitoring, security, fire protection, warehouse storage, and instrument calibration activities. It is operated by the INL contractor.

Critical Infrastructure Test Range Complex (CITRC). The CITRC area is located in the south-central section of the INL Site and supports the National and Homeland Security missions of the laboratory, including program and project testing (e.g., critical infrastructure resilience, nonproliferation testing and demonstration). Wireless test-bed operations, power line and grid testing, unmanned aerial vehicle testing, accelerator testing, explosives detection and training, and radiological counter-terrorism emergency response take place at the CITRC area. It is operated by the INL contractor.



Idaho Nuclear Technology and Engineering Center (INTEC). The Idaho Chemical Processing Plant was established in the 1950s to recover usable uranium from SNF used in DOE and U.S. Department of Defense (DOD) reactors. Over the years, the facility recovered more than \$1 billion worth of highly enriched uranium that was returned to the government fuel cycle. In addition, an innovative high-level liquid-waste-treatment process, known as calcining, was developed at INTEC. Calcining reduced the volume of liquid-radioactive waste generated during reprocessing and placed it in a more-stable granular-solid form. In the 1980s, the facility underwent a modernization, and safer, cleaner, and more efficient structures replaced most major facilities. SNF reprocessing was discontinued in 1992. In 1998, the plant was renamed INTEC. Current operations include the Integrated Waste Treatment Unit, designed to treat approximately 3,406,871 L (900,000 gal) of sodium-bearing liquid waste for closure of the remaining liquid-waste storage tanks, SNF storage, environmental remediation, the disposal of excess facilities, and the expansion and management of the Idaho CERCLA Disposal Facility. The Idaho CERCLA Disposal Facility is the consolidation point for CERCLA-generated wastes within the INL Site boundaries. INTEC is operated by the ICP contractor.

Materials and Fuels Complex (MFC). MFC is located in the southeastern corner of the INL Site and is the foundation for nuclear research, development, and demonstration testing of advanced reactors. This complex is the nexus of R&D for new reactor fuels and related materials. As such, it will contribute to increasingly efficient reactor fuels and the important work of nonproliferation—harnessing more energy with less risk. Certain facilities at MFC also support the manufacturing and assembling of components for use in space applications. It is operated by the INL contractor.

Transient Reactor Test Facility (TREAT). TREAT is a Nuclear Scientific User Facility that provides transient testing of nuclear fuels and materials. It is an air-cooled, thermal spectrum test facility specifically designed to evaluate the response of reactor fuels and structural materials to accident conditions ranging from mild upsets to severe accidents. TREAT is used to study fuel melting behavior, interactions between fuel and coolant, and the potential for propagation of failure to adjacent fuel pins. TREAT has an open core design that allows for ease of experiment instrumentation and real-time imaging of fuel motion during irradiation, which also makes TREAT an ideal platform for understanding the irradiation response of materials and fuels on a fundamental level. It is operated by the INL contractor.

Naval Reactors Facility (NRF). The NRF is operated by Fluor Marine Propulsion, LLC. As established in [Executive Order 12344](#) (1982), the Naval Nuclear Propulsion Program is exempt from the [DOE O 458.1](#), and [DOE O 414.1D](#) requirements. Therefore, activities conducted at NRF are excluded from this report. The director of the Naval Nuclear Propulsion Program establishes reporting requirements and methods implemented within the program, including those necessary to comply with appropriate environmental laws. The NRF program is documented in the NRF Environmental Monitoring Report (FMP 2025).

Radioactive Waste Management Complex (RWMC). Established in the 1950s, DOE used RWMC to manage, store, and dispose of waste contaminated with radioactive elements generated in national defense and research programs. RWMC currently provides treatment, temporary storage, and transportation of transuranic waste destined for WIPP. Cleanup of RWMC is managed by the ICP contractor.

Subsurface Disposal Area (SDA). The SDA is a 39-ha (96-acre) radioactive-waste landfill at the RWMC that was used for more than 50 years. Approximately 14 of the 39 ha (35 of the 96 acres) contain waste, including radioactive elements, organic solvents, acids, nitrates, and metals from historical operations, such as reactor research at the INL Site and weapons production at other DOE facilities. A [CERCLA Record of Decision \(OU-7-13/14\)](#) was signed in 2008 (DOE-ID 2008) and included offsite disposition of targeted waste and construction of an evapotranspiration surface barrier. Targeted buried waste exhumation at the SDA was completed in 2022 and construction of the surface cover over the SDA will be completed in the near future. SDA cleanup is managed by the ICP contractor.

Remote-Handled Low-Level Waste-Disposal Facility. The Remote-Handled Low-Level Waste-Disposal Facility is a Hazard Category 2 nuclear facility providing a below-grade, permanent radioactive-waste-disposal capability critical for nuclear research and Naval Reactors missions at the INL Site. Remote-handled low-level waste is generated from nuclear programs conducted at INL Site facilities, including the ATR Complex, NRF, and MFC. The facility began operations in 2018 and will support an anticipated 20 years of waste-disposal operations with an expansion capability for up to 50 years. The facility comprises an administration building, a maintenance building, and a 175,000-ft² vault yard that includes monitoring wells, a robust drainage system, and 446 below-grade concrete waste-disposal vaults sized to accommodate 939 stainless steel waste canisters of various configurations depending on the waste type and waste generator facility. It is operated by the INL contractor.

Research and Education Campus (REC). The REC is the collective name for the administrative, technical support, and computer facilities of INL in Idaho Falls, Idaho, as well as for the in-town laboratories where researchers work on a wide



variety of advanced scientific R&D projects. The REC also hosts the Biomass Feedstock National User Facility. As the name implies, the REC uses both basic science research and engineering to apply new knowledge to products and processes that improve the quality of life. This reflects the emphasis INL is placing on strengthening its science base and increasing the commercial success of its products and processes. Two laboratory facilities—the Energy Systems Laboratory and Energy Innovation Laboratory—were constructed in 2013 and 2014. In 2019, the Idaho Board of Education and INL completed the construction of two new research facilities: (1) the Cybercore Integration Center, and the (2) Collaborative Computing Center. The Cybercore Integration Center leads national efforts to secure critical infrastructure control systems from cybersecurity threats, while the Collaborative Computing Center will advance the computational science needs of INL and provide academia and industry with unprecedented access to high-performance computing. These and other facilities are integral to transforming INL into a world-renowned research laboratory. It is operated by the INL contractor.

DOE Radiological and Environmental Sciences Laboratory (RESL). RESL is located within the REC and provides a technical component to DOE oversight of contractor operations at DOE facilities and sites. As a reference laboratory, RESL conducts cost-effective measurement quality assurance programs that help ensure key DOE missions are completed in a safe and environmentally responsible manner. By ensuring the quality and stability of key laboratory measurement systems throughout DOE and by providing expert technical assistance to improve those systems and programs, RESL ensures the reliability of data on which decisions are based. The core scientific capabilities conducted at RESL are in analytical chemistry and radiation calibrations and measurements. The DOE Laboratory Accreditation Program (DOELAP) is performed by RESL as well, which provides irradiation instruments for the testing and accreditation of dosimetry programs across the DOE Complex.

Test Area North (TAN). TAN is located in the northern portion of the INL Site. Initially, TAN consisted of facilities built between 1954 and 1961 by the U.S. Air Force and the AEC Aircraft Nuclear Propulsion Program to handle, store, examine, research, and develop SNF for nuclear-powered aircraft research. After the termination of this research in 1961, the primary program at TAN became the Loss-of-Fluid Test, which focused on reactor-safety testing and behavior studies until it ended in 1985. Additionally, starting in 1980, TAN was used to work with material from the Three Mile Island reactor accident, a project that concluded in 2001. Remedial actions at TAN were completed in 2007, followed by the decontamination and decommissioning of non-operational facilities in 2008. Since 1961, TAN buildings have been repurposed for various programs, including the operations at the North Radiological Response Training Range and the work being conducted at the New Pump-and-Treat Facility. The Specific Manufacturing Capability Project, which is also located at TAN, is operated by the INL contractor for the DOD and manufactures protective armor for the Army M1-A1 and M1-A2 Abrams tanks. It is operated by the INL contractor.

1.5 Independent Oversight and Public Involvement and Outreach

DOE encourages information exchange and public involvement in discussions and decision-making processes regarding INL Site activities. Active participants include the public; Native American tribes; local, state, and federal government agencies; advisory boards; and other entities in the public and private sectors. The roles and involvement of selected organizations are described in the following sections.

1.6 Citizens Advisory Board

The Citizens Advisory Board is a federally appointed citizen panel formed in 1994 that provides advice and recommendations on ICP activities to Idaho Cleanup Project. The Citizens Advisory Board consists of 12 to 15 members who represent a wide variety of key perspectives on issues of relevance to Idaho citizens. Board members comprise a variety of backgrounds and viewpoints, including environmentalists, natural resource users, previous INL Site workers, members of the Shoshone-Bannock Tribes, representatives of local government, health care, higher education, business, and the general public. These diverse backgrounds assist the ICP Environmental Management program in making decisions and having a greater sense of how cleanup efforts are perceived by the public. Members are appointed by the DOE Environmental Management Assistant Secretary and serve voluntarily without compensation. Three additional nonvoting liaisons include representatives from DOE-ID, Environmental Protection Agency Region 10, and the Idaho Department of Environmental Quality (DEQ). These liaisons provide information to the Citizens Advisory Board on the policies and views of their respective agencies.

The Citizens Advisory Board is chartered by DOE through the Federal Advisory Committee Act. The charter for the Citizens Advisory Board is to provide input and recommendations to DOE on topics such as cleanup standards and environmental restoration, waste management and disposition, stabilization and disposition of non-stockpile nuclear



materials, excess facilities, future land use and long-term stewardship, risk assessment and management, and cleanup science and technology activities.

1.7 Sitewide Monitoring Committees

Sitewide monitoring committees include the INL Site Monitoring and Surveillance Committee and the INL Site Water Committee. The INL Site Monitoring and Surveillance Committee was formed in March 1997 and meets at least quarterly, or as often as needed, to coordinate activities among groups involved in environmental monitoring activities both on and off the INL Site. This standing committee includes representatives from DOE-ID, INL Site contractors, the Shoshone-Bannock Tribes, the State of Idaho DEQ-INL Oversight Program, the National Oceanic and Atmospheric Administration, the NRF, and the USGS. The INL Site Monitoring and Surveillance Committee has served as a valuable forum to review monitoring, analytical, and quality assurance methodologies; coordinate efforts; and avoid unnecessary duplication.

The INL Site Water Committee was established in 1994 to coordinate drinking-water-related activities across the INL Site and to provide a forum for exchanging information related to drinking water systems. In 2007, the INL Site Water Committee expanded to include all Sitewide water programs—drinking water, wastewater, storm water, and groundwater. The committee includes monitoring personnel, operators, scientists, engineers, management, data entry, and validation representatives of DOE-ID, INL Site contractors, the USGS, and the NRF. The committee serves as a forum for coordinating water-related activities across the INL Site and exchanging technical information, expertise, regulatory issues, data, and training. The INL Site Water Committee interacts on occasion with other committees that focus on water-related topics or programs, such as the INL Site Monitoring and Surveillance Committee.

1.8 Environmental Oversight and Monitoring Agreement

A new five-year Environmental Oversight and Monitoring Agreement (DOE-ID 2021) consisting of DOE-ID, the Naval Reactors Laboratory Field Office/Idaho Branch Office, and the Idaho DEQ was signed in March 2021. The 2021 version is the latest in a succession of agreements that was first implemented in 1990. The Environmental Oversight and Monitoring Agreement governs the activities of the DEQ-INL Oversight Program and DOE-ID's cooperation in providing access to facilities and information for non-regulatory, independent oversight of the impact to public health and the environment at the INL Site. The first agreement established in 1990 created the state of Idaho INL Oversight Program. The main activities for the DEQ-INL Oversight Program include environmental surveillance, emergency response, and public information. More information can be found on the [DEQ-INL Oversight Program](#) website.

1.9 Environmental Education Outreach

The K-12 environmental educational outreach for 2024 by the INL Site contractors included the following:

- [Bring Idaho Alive](#)
- [East Idaho Science Bowl](#)
- [Museum Summer Camps](#)
- [My Amazing Future](#)
- [Rocky Mountain Adventures summer workshops](#)
- [Roaring Youth Jam](#)
- [weSTEAM classroom visits](#).

Community outreach efforts during 2024 by the Site contractors' education programs included the following:

- [Bat Night at the Zoo and State Parks](#)
- [Earth Day](#)
- [Family Nuclear Night](#)
- [Idaho Falls Water Festival Day](#)
- [Science, Technology, Engineering, Arts, and Mathematics \(STEAM\) Day at the Zoo](#).



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Anderson's Larkspur.

Chapter 2: Environmental Compliance Summary



CHAPTER 2

Operations at the Idaho National Laboratory (INL) Site are subject to numerous federal and state environmental statutes, regulations, executive orders, and United States (U.S.) Department of Energy (DOE) directives. As a requirement of many of these regulations, the status of compliance with the regulations and releases of non-permitted hazardous materials to the environment must be documented. Environmental permits were issued to the INL Site, primarily by the state of Idaho (see Table 2-5).

There was one reportable environmental spill at the INL Site during 2024, as discussed in Subsection 2.5.1.

In 2024, the U.S. Department of Energy, Idaho Operations Office (DOE-ID) operated in compliance with most of the requirements defined in governing documents. Instances of noncompliance were reported to regulatory agencies and resolved. The environmental compliance status for 2024 at the INL Site is provided in Table 2-1.

2. ENVIRONMENTAL COMPLIANCE SUMMARY

This chapter presents the compliance status for operations at the INL Site and DOE-ID programs that are subject to federal and state environmental protection requirements, such as statutes, regulations, acts, agreements, executive orders, and DOE directives.

2.1 Enforcement and Compliance History Online Database

The U.S. Environmental Protection Agency (EPA) developed the [Enforcement and Compliance History Online website](#) that provides integrated compliance and enforcement that can be used to search and view information on permit data, inspection dates and findings, violations, enforcement actions, and penalties assessed for INL Site operations. The Enforcement and Compliance History Online website also allows users to sort and analyze data in many ways, according to their individual needs.

2.2 Compliance with Requirements

INL Site activities must adhere to environmental standards established by federal, state, and local regulations; DOE directives, permits, and compliance; and settlement agreements where applicable. The EPA and Idaho Department of Environmental Quality (DEQ) are the principal regulating agencies that issue permits, review compliance reports, and participate in joint monitoring programs, inspect facilities and operations, and enforce compliance with applicable requirements as identified in Table 2-1. The 2024 status of active Waste Area Groups (WAGs) are shown in Table 2-2.



Table 2-1. Federal, state, and local laws and regulations established for protection of human health and the environment.

REGULATORY PROGRAM DESCRIPTION	2024 COMPLIANCE STATUS	REPORT SECTIONS
AIR QUALITY AND PROTECTION		
40 Code of Federal Regulations (CFR) 61, “<u>National Emission Standards for Hazardous Air Pollutants</u>,” 42 USC 7401 et seq. These standards are the basis for national air pollution control. Emissions of radioactive hazardous air pollutants are regulated by the EPA.	The EPA has not delegated the <u>40 CFR Part 61, Subpart H</u>, “National Emission Standards for Emissions of Radionuclides Other Than Radon from Department of Energy Facilities,” regulations, and is the primary agency to which DOE-ID reports compliance. The Idaho DEQ incorporates the requirements of the subpart into the Sitewide Permit To Construct (PTC)-Facility Emissions Cap (FEC) and is therefore included in all reporting and noncompliance occurrences. The INL Site is in compliance, as reported in the compliance report, “National Emission Standards for Hazardous Air Pollutants – Calendar Year 2024” (INL 2025a).	4.2 4.3 8.2.1
40 CFR 84, “<u>Phasedown of Hydrofluorocarbons</u>” In October 2021, the EPA issued regulations to decrease hydrofluorocarbon (HFC) production over the next 15 years, thereby decreasing the supply. HFCs were developed and manufactured to replace chlorofluorocarbons (CFCs), which damage the stratospheric ozone layer. The use of HFCs include refrigerants, solvents, fire suppressants, and aerosols. Through these regulations, the EPA seeks to reduce HFC consumption and production to 15% of a 2011–2013 baseline by 2036. These regulations do not prevent entities from using equipment containing HFCs that have already been purchased and are currently in use. However, as the phasedown progresses, these HFCs will become less available and more expensive. In October 2023, the EPA issued regulations to restrict the use of some HFCs in specific applications; compliance dates vary depending on the application. In October 2024, the EPA issued HFC management regulations; the compliance date is January 1, 2026.	A summary of the INL Site contractors’ HFC uses, replacements, procurement, and proactive measures taken as a result of the HFC phasedown can be found in Subsection 4.5. The INL contractor issued a program description document to implement the HFC use restrictions and is working on implementing the HFC management regulations as discussed in Subsection 4.5.	4.5
<u>Clean Air Act (1970), 42 USC 7401 et seq.</u> The Clean Air Act (CAA) provides the EPA with broad authority to implement and enforce regulations to reduce air pollutant emissions with an emphasis on cost-effective methods. In	Idaho DEQ has been delegated authority to implement the CAA through the development of an EPA-approved state implementation plan and is codified in Idaho Administrative Code, “Rules for the Control of Air Pollution in Idaho” (<u>IDAPA 58.01.01</u>). DOE-ID holds a synthetic minor, Sitewide, air quality permit from Idaho	4.3 8.2



Table 2-1. continued.

REGULATORY PROGRAM DESCRIPTION	2024 COMPLIANCE STATUS	REPORT SECTIONS
addition to the EPA, states, tribes, and local governments play a key role in implementation of the CAA. <i>Other environmental statutes and regulations apply, in whole or in part:</i> 40 CFR 50, "<u>National Primary and Secondary Ambient Air Quality Standards.</u>"	DEQ. This PTC contains an FEC component that enforces a limit on the emissions of criteria air pollutants (CAP) and hazardous air pollutants to less than major source thresholds. Without the synthetic limits on Sitewide CAP emissions, the INL Site would be considered a major source for CAP emissions and would require a Tier I/Title V permit. This permit covers all non-exempt air emission sources located on the INL Site but does not cover air-emitting sources located at the Research and Education Campus (REC) in Idaho Falls, Idaho. All air emission sources located at the REC were determined to be minor and were exempted from the permitting requirements in <u>IDAPA 58.01.01</u>. As reported in the annual compliance report required by the PTC-FEC, the INL Site emitted CAP and hazardous air pollutants were below the permitted limits in 2024. Idaho DEQ performed an air quality inspection of the Material and Fuels Complex (MFC) on April 15, 2024. Sources inspected were found to be in compliance. There were no Idaho DEQ CAA inspections at Idaho Cleanup Project (ICP) facilities in 2024.	
CULTURAL AND ENVIRONMENTAL RESOURCES PROGRAMS		
<u>Endangered Species Act (1973), 16 USC 1531-1544</u> The Endangered Species Act requires that all federal departments and agencies seek to conserve endangered and threatened species and use their authorities to further the purposes of this Act. <i>Other environmental statutes and regulations apply, in whole or in part:</i> 50 CFR 17, "<u>Endangered and Threatened Wildlife and Plants</u>" 50 CFR 226, "<u>Designated Critical Habitat</u>" 50 CFR 402, "<u>Interagency Cooperation – Endangered Species Act of 1973, as Amended</u>" 50 CFR 424, "<u>Listing Endangered and Threatened Species and Designating Critical Habitat</u>"	There are currently no resident INL Site species listed as threatened or endangered under the Endangered Species Act and there is no designated critical habitat on the INL Site. In 2014, DOE-ID entered into a voluntary candidate conservation agreement with the U.S. Fish and Wildlife Service (USFWS) to conserve and protect Greater sage-grouse and their sagebrush habitat on the INL Site prior to the USFWS determining the species was not warranted for listing. In 2024, DOE-ID published an annual report of Greater sage-grouse and sagebrush monitoring activities and held an annual meeting with the USFWS and other stakeholders to discuss the report and progress toward achieving the conservation objectives. In 2018, DOE-ID produced a Bat Protection Plan for the INL Site and has since produced an annual report providing current information on the conservation of bats and their habitat on the INL Site. The INL Natural Resources Group also conducts ecological research, field surveys, and National Environmental Policy Act (NEPA) evaluations regarding resources on the INL Site.	9.1.2 9.1.3



Table 2-1. continued.

REGULATORY PROGRAM DESCRIPTION	2024 COMPLIANCE STATUS	REPORT SECTIONS
50 CFR 450–453, “Endangered Species Exemption Process.”	These program activities complied with all requirements. Details of related activities can be found in Chapter 9.	
<i>Executive Order 11988, “Floodplain Management”</i> This Executive Order requires federal agencies to consider, evaluate, and avoid to the extent possible, adverse impacts associated with the occupancy and modification of floodplains, to reduce the risk of flood loss, to minimize the impacts of flood on human safety, health, and welfare, and to restore and preserve the natural and beneficial values of floodplains. <i>Other environmental statutes and regulations apply, in whole or in part:</i> 10 CFR 1022, “<u>Compliance with Floodplain and Wetland Environmental Review Requirements.</u>”	It is the intent of EO 11988 that federal agencies implement floodplain requirements through existing procedures, such as those established to implement NEPA. 10 CFR 1022 contains DOE policy and floodplain environmental review and assessment requirements through the applicable NEPA procedures. In those instances where impacts of actions in floodplains are not significant enough to require the preparation of an Environmental Impact Statement (EIS) under NEPA, alternative floodplain evaluation requirements are established through the INL Site Environmental Compliance Permit (ECP) process. DOE-ID has accepted the “Big Lost River Flood Hazard Study” (Bureau of Reclamation 2005). This flood hazard report is based on geomorphological models and has undergone peer review. All activities on the INL Site requiring the characterization of flows and hazards are expected to use this report. A 1996 study entitled, “Estimated 100-Year Peak Flows and Flow Volumes in the Big Lost River and Birch Creek at the Idaho National Engineering Laboratory, Idaho” (Kjelstrom and Berenbrok 1996), was conducted by the U.S. Geological Survey. This study provided an estimated extent of the 100-year floodplain for the Big Lost River (BLR) and Birch Creek on the INL Site. Test Area North (TAN) was the facility included in this study. A few years later, another study was completed by the Bureau of Reclamation on the INL Site entitled, “Big Lost River Flood Hazard Study” (Ostenaa and O’Connell 2005). The objective of this study was to develop probabilistic flood-stage estimates for specific facility locations at the Idaho Nuclear Technology and Engineering Center (INTEC) and Test Reactor Area (TRA). According to the study, the Central Facilities Area (CFA) and MFC are not within the 100-year or 500-year floodplain of the BLR. The probabilistic flood-stage estimates created from this study are to be used for all future BLR flood hazard-characterization efforts for INTEC and TRA. Together, the above-mentioned studies are to be used to characterize and identify the floodplains for their respective facilities on the INL Site.	N/A



Table 2-1. continued.

REGULATORY PROGRAM DESCRIPTION	2024 COMPLIANCE STATUS	REPORT SECTIONS
<u>Executive Order 11990, “Protection of Wetlands”</u> This Executive Order requires federal agencies to identify potential impacts on wetlands resulting from proposed activities and to minimize the destruction, loss, or degradation of wetlands and preserve and enhance the natural and beneficial values of wetlands.	The only areas of the INL Site currently identified as potentially jurisdictional wetland are the BLR corridor and BLR Sinks. The USFWS National Wetlands Inventory Map is used to identify potential jurisdictional wetlands and non-regulated sites with ecological, environmental, and future development significance. In 2024, there were no reviews or evaluations performed by the U.S. Army Corps of Engineers for the INL Site. No new actions have taken place within potential wetland areas on the INL Site that would require additional review by the U.S. Army Corps of Engineers or an update to an existing jurisdictional determination.	
<u>Executive Order 13751, “Safeguarding the Nation from the Impacts of Invasive Species”</u> This Executive Order calls on federal agencies to prevent the introduction, establishment, and spread of invasive species, as well as to eradicate and control populations of invasive species that are established. <i>Other environmental statutes and regulations apply, in whole or in part:</i> • <u>Federal Noxious Weed Act</u> (1974), 7 USC 2801 • IDAPA 02.06.09, “<u>Rules Governing Invasive Species and Noxious Weeds</u>” • Idaho Statute Title 22, Chapter 19, “<u>The Idaho Invasive Species Act of 2008</u>” • Idaho Statute Title 22, Chapter 24, “<u>Noxious Weeds.</u>”	INL Site contractors implement a Sitewide plan for managing invasive species. This Sitewide plan addresses each requirement of federal agencies as outlined in <u>EO 13112</u>, as amended by <u>EO 13751</u>. Additionally, federal agency requirements outlined in the <u>Federal Noxious Weed Act of 1974</u> and state of Idaho requirements related to invasive species and noxious weeds are met with compliance of <u>EO 13112</u>, as amended by <u>EO 13751</u>. For more details on how this plan is carried out and how the requirements are met, see Subsection 9.4.3.	9.4.3
<u>Migratory Bird Treaty Act (1918), 16 USC 703-712</u> The Migratory Bird Treaty Act prohibits taking any migratory bird, or any part, nest, or egg of any such bird, without authorization from the U.S. Department of the Interior. Permits may be issued for scientific collecting, banding and marking, falconry, raptor propagation, depredation, import, export, taxidermy, waterfowl sale and disposal, and special purposes.	DOE-ID has a USFWS Special Purpose Permit for limited nest relocation and destruction and the associated take of migratory birds for mission-critical activities if all other means to prevent such take were explored and/or exhausted. DOE-ID and INL Site contractors also have permits from the Idaho Department of Fish and Game (IDFG) to manage migratory birds and collect other wildlife specimens for scientific research. All stipulated reporting requirements were met for 2024.	7.1.3



Table 2-1. continued.

REGULATORY PROGRAM DESCRIPTION	2024 COMPLIANCE STATUS	REPORT SECTIONS
<i>Other environmental statutes and regulations apply, in whole or in part:</i> • EO 13186, “<u>Responsibilities of Federal Agencies to Protect Migratory Birds</u>” • <u>Bald and Golden Eagle Protection Act</u> (1940), 16 USC 668-668d • Idaho Statute Title 36, Chapter 1, <u>Fish and Game Commission</u>, 106 e.5.		
<u>National Environmental Policy Act (1969)</u> The National Environmental Policy Act (NEPA) requires federal agencies to consider the potential environmental impacts of proposed actions in the decision-making process. Federal agencies are required to provide a detailed statement on proposals for major federal actions significantly affecting the quality of the human environment. The purpose and function of NEPA is satisfied if federal agencies have considered relevant environmental information and the public has been informed regarding the decision-making process. <i>Other environmental statutes and regulations apply, in whole or in part:</i> • 10 CFR 1021, “<u>National Environmental Policy Act Implementing Procedures</u>”	As a federal agency, DOE complies with NEPA requirements as outlined in DOE’s “<u>NEPA Implementing Procedures</u>” (10 CFR 1021). DOE fulfills its obligation to comply with NEPA by providing timely and appropriate analysis of proposed activities in accordance with current guidance and implementing regulations.	9.2.2 9.3.1
<u>National Historic Preservation Act (NHPA) (1966), as amended, 54 USC 300101 et seq.</u> The National Historic Preservation Act (NHPA) requires federal agencies to establish programs to identify, record, and protect cultural resources and to assess the impacts of proposed projects on historic or culturally important sites, structures, or objects within the area of potential effect for a proposed project. The NHPA further requires federal agencies to assess archaeological sites, historical buildings, and objects on such	The INL Cultural Resource Management Office (CRMO) works with the DOE-ID Cultural Resource Coordinator to steward archaeological and architectural cultural resources across the INL Site.	9.5



Table 2-1. continued.

REGULATORY PROGRAM DESCRIPTION	2024 COMPLIANCE STATUS	REPORT SECTIONS
sites to determine their qualification for inclusion in the National Register of Historic Places. In addition, the NHPA requires federal agencies to consult with State Historic Preservation Offices, affected Indian tribes, the Federal Advisory Council on Historic Preservation, and other interested parties, as appropriate, when determining whether the proposed actions would adversely affect properties eligible for listing on the National Register of Historic Places. Compliance is achieved via adherence to Sections 106 and 110 of the NHPA. <i>Other environmental statutes and regulations apply, in whole or in part:</i> • <u>Archaeological Resources Protection Act</u> (1979), 16 USC §470aa-470mm • 36 CFR 79, "<u>Curation of Federally Owned and Administered Archaeological Collections</u>" • 36 CFR 800, "<u>Protection of Historic Properties</u>" • 43 CFR 7, "<u>Protection of Archaeological Resources</u>" • <u>Native American Graves Protection and Repatriation Act</u> (1990), as amended, 25 USC 3001-3013 • <u>Protection and Preservation of Traditional Religions of Native American</u> (1996), 42 USC 1996 • Religious Freedom Restoration Act (1993), 42 USC §200bb-200bb4 • EO 13007, "<u>Indian Sacred Sites</u>" • EO 13175, "<u>Consultation and Coordination with Indian Tribal Governments</u>."		
HAZARDOUS MATERIALS AND WASTE MANAGEMENT		
<u>Comprehensive Environmental Response, Compensation, and Liability Act (1980), (amended by the Superfund</u>	Nuclear research and other operations at the INL Site left behind contaminants that pose a potential risk to human health and the environment. The INL Site was placed on the National Priorities List under CERCLA on November 29, 1989.	Table 2-2 6.5



Table 2-1. continued.

REGULATORY PROGRAM DESCRIPTION	2024 COMPLIANCE STATUS	REPORT SECTIONS
<u>Amendments and Reauthorization Act [SARA]], 40 CFR 300, 42 USC 9601 et seq.</u> The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) provides the process to assess and remediate areas contaminated by the release or threat of release of chemically hazardous, radioactive substances, or both. <i>Other environmental statutes and regulations apply, in whole or in part:</i> 40 CFR 300, "<u>National Oil and Hazardous Substances Pollutant Contingency Plan.</u>"	DOE-ID, Idaho DEQ, and the EPA Region 10 signed the Federal Facility Agreement and Consent Order (FFA/CO) in December of 1991 (DOE 1991). Environmental restoration is conducted under the FFA/CO, which outlines how the INL Site will comply with CERCLA. It identifies a process for DOE-ID to work with its regulatory agencies to safely execute the cleanup of past release sites. The INL Site is divided into ten WAGs as a result of the FFA/CO, and each WAG is further divided into smaller cleanup areas called operable units (OUs). Field investigations are used to evaluate potential release sites within each WAG and OU when existing data are insufficient to determine the extent and nature of contamination. After each investigation is completed, a determination is made regarding whether a "No Action" or "No Further Action with Institutional Controls" listing is possible, or whether it is appropriate to proceed with an "Interim Cleanup Action," the "OU 10-08 Plug-In Remedy Action," or further investigation using a remedial investigation/feasibility study (RI/FS). Results from an RI/FS form the basis for risk assessments and alternative cleanup actions. This information, along with the regulatory agencies' proposed cleanup plan, is presented to the public in a document called a proposed plan. Following the consideration of public comments, DOE, EPA, and Idaho DEQ develop a ROD that selects a cleanup approach from the alternatives evaluated. Cleanup activities can then be designed, implemented, and completed. Since the FFA/CO was signed in December 1991, the INL Site has cleaned up release sites containing asbestos, petroleum products, acids and bases, radionuclides, unexploded ordnance and explosive residues, polychlorinated biphenyls, heavy metals, and other hazardous materials. All 24 scheduled RODs were signed and are being implemented or were completed. Comprehensive RI/FSs were completed for WAGs 1–5, 7–9, and 6/10 (6 is combined with 10). Active remediation is completed at WAGs 2, 4, 5, 6, 8, and 9. Institutional controls (ICs) and operations and maintenance (O&M) activities at these sites (except for WAG 8, which is managed by the Naval Reactors Facility [NRF]) are ongoing and will continue to be monitored under the "Site-wide Institutional Controls and Operations and Maintenance Plan for CERCLA Response Actions" (DOE-ID 2024a). The status of ongoing active remediation activities at WAGs 1, 3, 7, and 10 are described in Table 2-2.	



Table 2-1. continued.

REGULATORY PROGRAM DESCRIPTION	2024 COMPLIANCE STATUS	REPORT SECTIONS
	Documentation associated with the remedial actions and other removal actions are publicly available in the <u>CERCLA Administrative Record</u>. Decontamination and decommissioning activities also are performed at the INL Site in accordance with CERCLA (42 USC 9601 et seq.), as amended by the “<u>Superfund Amendments and Reauthorization Act of 1986</u>” (Public Law 99-499), and in accordance with the “<u>National Oil and Hazardous Substances Pollutant Contingency Plan</u>” (40 CFR 300). Decontamination and decommissioning activities are consistent with the joint DOE and EPA “Policy on Decommissioning of Department of Energy Facilities Under the Comprehensive Environmental Response, Compensation, and Liability Act” (DOE and EPA 1995), which establishes the CERCLA non-time-critical removal-action process as an approach for decommissioning pursuant to CERCLA, Section 104(a), and EO 12580, “<u>Superfund Implementation</u>,” as recognized by Section 5.3 of the FFA/CO (DOE 1991). In accordance with 40 CFR 300.415(j) and DOE guidance, INL Site removal actions conducted under CERCLA are required to meet applicable or relevant and appropriate requirements to the extent practicable considering the exigencies of the situation. This approach satisfies environmental review requirements and provides for stakeholder involvement, while providing a framework for selecting the decommissioning alternative.	
<u>DOE Order 435.1</u> The Atomic Energy Act of 1954 (42 U.S.C § 2011 1954) Section 161(i) authorizes DOE to regulate activity involving certain radioactive materials, including radioactive waste, to “protect human health and minimize danger to life or property.” This authority is implemented through DOE O 435.1, “<u>Radioactive Waste Management</u>,” and the accompanying DOE Manual 435.1-1, “<u>Radioactive Waste Management Manual</u>,” which set forth the requirements for assuring the safety of the generation, treatment, storage, and disposal of DOE-owned radioactive waste. These DOE directives ensure that radioactive waste management activities are systematically planned, documented,	INL Site contractors manage all radioactive waste generated at INL facilities. The Waste Management Program provides the structure for integrating/dispositioning radioactive waste and is the lead organization for ensuring compliant cradle-to-grave waste management of containerized waste as described in PDD-17000, “Waste Management Program,” (INL 2025b). INL Site contractors maintain facility-specific Radioactive Waste Management Basis documents to demonstrate <u>DOE O 435.1</u> compliance. INL Site contractors manage all hazardous waste, mixed low-level waste, LLW, TRU waste, HLW, remote-handled waste, recyclable waste, waste with no identified path to disposal, industrial waste, <u>Toxic Substances Control Act</u> (TSCA) waste, CERCLA waste, and universal waste streams that are generated and stored at the INL Site, and approved offsite-INL waste streams. Management activities include, but are not limited to, controls for waste characterization, waste certification, waste acceptance criteria compliance, storing waste, treating waste,	2.4 4.4 5.3 6.6



Table 2-1. continued.

REGULATORY PROGRAM DESCRIPTION	2024 COMPLIANCE STATUS	REPORT SECTIONS
executed, and evaluated. Specifically, the Order and the manual: • Establish requirements to implement DOE regulating authority and responsibilities for radioactive waste management • Define DOE radioactive waste types: (1) high-level waste (HLW), (2) transuranic (TRU) waste, and (3) low-level waste (LLW) • Emphasize management for disposal and establish requirements for waste characterization, waste certification, and waste acceptance criteria • Identify performance-based requirements • Require life cycle management (i.e., from generation planning to disposal) • Rely on existing nuclear safety philosophies (e.g., Integrated Safety Management System, graded approach, defense-in-depth) • Require a DOE-approved Radioactive Waste Management Basis to ensure hazards were identified, analyzed, and mitigated.	and transporting and disposing of waste. The overall responsibility for managing waste at INL contractor facilities resides in the INL contractor's Waste Management Programs organization, according to LWP-17000, "Waste Management." The ICP contractor manages waste that is generated and stored at ICP facilities and approved offsite waste streams per PDD-234, "Waste Management Program." All waste management activities described herein are conducted in compliance with all applicable provisions of <u>DOE O 435.1</u>. The ICP uses <u>DOE M 435.1-1</u>, Change 2, to meet contractual requirements. The contract will be updated in the future to reflect Change 3. See Table 2-3 for information on wastes managed at the INL Site by INL Site contractors. See Table 2-3 for the status of each phase of the LLW management process for facilities managed at the INL Site by INL Site contractors.	
<u>Federal Facility Compliance Act of 1992, as amended.</u> Enacted by Congress on October 6, 1992, the Federal Facility Compliance Act amends Section 6001 of the Resource Conservation and Recovery Act of 1976 (RCRA) to specify that the U.S. waives sovereign immunity from civil and administrative fines and penalties for RCRA violations. In addition, the RCRA requires the EPA to conduct annual inspections of all federal facilities. Authorized states are given the authority to conduct inspections of federal facilities to enforce compliance with state hazardous waste programs.	INL Site contractors manage all mixed waste generated at their respective facilities. The Waste Management Program is the lead organization for ensuring compliant cradle-to-grave management of INL containerized mixed waste as described in PDD-17000, "Waste Management Program." Waste Management at ICP facilities is described in PDD-234, "Waste Management Program." INL Site contractors maintain facility-specific Radioactive Waste Management Basis documents to demonstrate <u>DOE O 435.1</u> compliance. DOE-ID submitted the FY 2025 "Site Treatment Plan Annual Update and FY 2024 Site Treatment Plan Annual Report" to Idaho DEQ in November 2024 in accordance with Subsections 2.3.3 and 2.3.4. DOE-ID and INL Site contractors met quarterly with	2.3



Table 2-1. continued.

REGULATORY PROGRAM DESCRIPTION	2024 COMPLIANCE STATUS	REPORT SECTIONS
DOE-ID is required to submit and receive approval of the INL Site Treatment Plan from Idaho DEQ.	Idaho DEQ to discuss the status of milestones, treatment projects, and other activities conducted under the Site Treatment Plan.	
<u>Federal Insecticide, Fungicide, and Rodenticide Act (1996), 7 USC 136 et seq.</u> The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) is the federal statute that governs the registration, distribution, sale, and use of pesticides in the U.S. The FIFRA regulations found in 40 CFR Parts 150–189 are promulgated and administered by the EPA. <i>Other environmental statutes and regulations apply, in whole or in part:</i> • IDAPA 02.03.03, “<u>Rules Governing Pesticide and Chemigation Use and Application</u>” • Idaho Statute Title 22, Chapter 34, “<u>Pesticides and Chemigation.</u>”	All pesticide applications on the INL Site are conducted in accordance with the specific pesticide label instructions in accordance with the FIFRA. Additionally, all appropriate records associated with pesticide applications are kept for a minimum of three years by each pesticide applicator in accordance with <u>IDAPA 02.03.03</u> . For details on pesticide application on the INL Site, see Subsection 9.4.3.	9.4.3
<u>Resource Conservation and Recovery Act (1976), 40 CFR 259-282, 42 USC 6901 et seq.</u> The Resource Conservation and Recovery Act (RCRA) established regulatory standards for the generation, transportation, storage, treatment, and disposal of hazardous waste. <i>Other environmental statutes and regulations apply, in whole or in part:</i> • 40 CFR 270.13, “<u>Contents of Part A of the Permit Application</u>” • 40 CFR 262, “<u>Standard Applicable to Generators of Hazardous Waste</u>” • 40 CFR 263, “<u>Standards Applicable to Transporters of Hazardous Waste</u>”	RCRA Permits: Form 8700-23, along with maps, drawings, and photographs, as required by <u>40 CFR 270.13</u> , is included with the Part A permit application (Volume 1), and in each Part A application included with the partial Part B permits. The INL Site currently has one RCRA permit (Volume 1) for the interim status unit, the INTEC Tank Farm Facility (TFF). An interim status unit is a Part A (interim status) unit that has not been RCRA-closed or has not been permitted under a Part B hazardous waste permit application. The INL Part B permits are considered a single RCRA permit that comprises several volumes, all under a single EPA ID number, ID 4890008952. Therefore, each of the Part B Permit volumes is called a partial permit. Each partial Part B Permit includes the Part A application specific to the permitted units in that Part B and the Part B of the RCRA hazardous waste permit that contains detailed, site-specific information and hazardous waste operations as described in the applicable Sections of 40 CFR 262 through 40 CFR 270.27. INL currently has one RCRA post-closure permit. Post-closure permits ensure that appropriate monitoring and maintenance activities will be	N/A



Table 2-1. continued.

REGULATORY PROGRAM DESCRIPTION	2024 COMPLIANCE STATUS	REPORT SECTIONS
40 CFR 264, “<u>Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities</u>” 40 CFR 265, “<u>Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities</u>” 40 CFR 266, “<u>Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities</u>” 40 CFR 267, “<u>Standard for Owners and Operators of Hazardous Waste Facilities Operating Under a Standardized Permit</u>” 40 CFR 268, “<u>Land Disposal Restrictions</u>” 40 CFR 270, “<u>EPA Administered Permit Programs: The Hazardous Waste Permit Program</u>” 40 CFR 273, “<u>Standards for Universal Waste Management</u>” 40 CFR 279, “<u>Standards for the Management of Used Oil.</u>”	conducted on those units/land disposal units that leave hazardous waste in place closure (i.e., cannot clean close). <i>RCRA Reports.</i> As required by Idaho DEQ, the INL Site submitted the 2024 Idaho Hazardous Waste Generator Annual Report (Reno [CCN 333874]) on the types and quantities of hazardous wastes generated, shipped for treatment and disposal, and remain in storage. Federal regulations require large quantity generators to submit a report every two years regarding the nature, quantities, and disposition of hazardous waste generated at their facility. The EPA refers to this as the National Biennial RCRA Hazardous Waste Report or biennial report. The biennial report form, EPA Form 8700-13A/B, is submitted to Idaho DEQ by March 1 of every even-numbered year for the previous calendar year. The biennial report was submitted to EPA via the electronic RCRA Info Industry Application. The biennial report was not to be submitted in 2024. In addition, small and large quantity generators of hazardous waste are required to report to DEQ annually the types and quantities of hazardous waste generated and shipped in the last year, the types and quantity of waste currently stored on the INL Site, and the waste shipped and treated in Idaho or out of state. Operators of hazardous waste disposal facilities must also report annually on the types and quantities of received wastes generated in Idaho or out of state. Reports are due to Idaho DEQ by January 31 each year. The annual report was submitted to Idaho DEQ in 2024 (CCN 333874). <i>RCRA Closure Plan.</i> No RCRA INL Site facilities were closed in 2024. <i>RCRA Inspection.</i> For 2024, Idaho DEQ performed a RCRA inspection from May 20–23, 2024. On July 1, 2024, Idaho DEQ issued a warning letter to DOE-ID and the ICP related to two previously self-disclosed events resulting in permit noncompliances noted by Idaho DEQ during the May inspection. <i>RCRA Consent Order.</i> Due to DOE-ID's inability to meet commitments to initiate waste treatment in the Integrated Waste Treatment Unit (IWTU) and cease the use of the INTEC interim status tanks, Idaho DEQ assessed a penalty to DOE-ID pursuant to the provisions under Section VII of the fifth modification to the Notice of Noncompliance-Consent Order, in the amount of \$2,190,000 for the period of	



Table 2-1. continued.

REGULATORY PROGRAM DESCRIPTION	2024 COMPLIANCE STATUS	REPORT SECTIONS
	noncompliance from March 31, 2023, to March 30, 2024. Supplemental environmental projects were utilized in lieu of the original payment.	
OTHER ENVIRONMENTAL REQUIREMENTS		
<u>DOE Order 231.1B, “Environmental, Safety, and Health Reporting,” Change 1</u> Environmental, Safety, and Health Reporting requires the timely collection and reporting of information on environmental issues that could adversely affect humans and the safety of the public and the environment at DOE sites. <i>Other environmental statutes, regulations, and directives apply, in whole or in part:</i> DOE O 458.1, Change 4, “Radiation Protection of the Public and the Environment.”	This report, “2024 Idaho National Laboratory Annual Site Environmental Report,” fulfills DOE O 231.1B, the radiation protection requirements of DOE O 458.1, and documents and communicates the environmental performance to members of the public living near the INL Site and to other interested parties.	All chapters
<u>DOE Order 232.2A, “Occurrence Reporting and Processing of Operations Information”</u> In accordance with DOE O 232.2A, the INL Site ensures DOE personnel are notified of events that could adversely affect the health and safety of workers, the public, the environment, DOE’s missions, or DOE credibility. Events are provided with report levels (e.g., High, Low, Informational) to reflect the impact associated with a given occurrence in terms of health, safety, and security. INL has a Tailoring Agreement in place that allows reporting most Informational events to DOE-ID through the INL issues management software (LabWay). Other events are also reported to DOE Headquarters through the Occurrence Reporting and Processing System (ORPS).	From January 1, 2024, to December 31, 2024, INL Site contractors did not report any events related to an environmental release under ORPS criteria in Group 5 – Environmental.	N/A
<u>Emergency Planning and Community Right-to-Know Act (1986), 42 USC 11001, et seq.</u> The Emergency Planning and Community Right-to-Know Act (EPCRA) was created to help communities plan for emergencies involving hazardous substances. The Act helps	The INL Site’s 2024 compliance with key EPCRA provisions is summarized below: <i>Section 304: Extremely Hazardous Substance Release Notification.</i> There were no CERCLA-reportable chemicals released at the INL Site during 2024.	2.5.1



Table 2-1. continued.

REGULATORY PROGRAM DESCRIPTION	2024 COMPLIANCE STATUS	REPORT SECTIONS
increase the public's knowledge and access to information on chemicals at individual facilities, their uses, and releases into the environment. States and communities, working with facilities, can use the information to improve chemical safety and protect public health and the environment. <i>Other environmental statutes and regulations apply, in whole or in part:</i> IDAPA 58.01.02.851, "Petroleum Release Reporting, Investigation, and Confirmation."	- Section 304 requires owners and operators of facilities where hazardous chemicals are produced, used, or stored to report releases of CERCLA hazardous substances or extremely hazardous substances that exceed reportable quantity limits to state and local authorities (i.e., state emergency response commissions and local emergency planning committees). Section 311-312: Safety Data Sheet/Chemical Inventory. Extremely hazardous substances, such as cyclohexylamine, nitric acid, nitrogen dioxide, and sulfuric acid were among the chemicals reported in 2024. Sections 311 and 312 require facilities manufacturing, processing, or storing designated hazardous chemicals to make safety data sheets describing the properties and health effects of these chemicals available to state and local officials and local fire departments. Facilities also are required to report inventories of all chemicals that have safety data sheets to state and local officials and local fire departments. The INL Site satisfies the requirements of Section 311 by submitting a quarterly report to state and local officials and fire departments, identifying chemicals that exceed regulatory thresholds. In compliance with Section 312, the annual Emergency and Hazardous Chemical Inventory (Tier II) Report is provided to local emergency planning committees, the state emergency response commission, and local fire departments by the regulatory due date of March 1. This report includes the types, quantities, and locations of hazardous chemicals and extremely hazardous substances stored at the INL Site and REC facilities that exceed regulatory thresholds. In 2024, the chemical inventory report included 84 individual chemicals at INL Site facilities and seven at REC facilities. The INL Site also stores extremely hazardous substances, a category of chemicals that could cause serious irreversible health effects from accidental releases. Section 313: Toxic Chemical Release Inventory Reporting. The INL Site submitted Toxics Release Inventory Forms for chromium, lead, mercury, naphthalene, nickel, nitrate compounds, and nitric acid to the EPA by the regulatory due date of July 1. - Section 313 requires facilities to submit a Toxics Release Inventory Form annually for regulated chemicals that are manufactured, processed, or otherwise used above applicable-threshold quantities. Releases under	



Table 2-1. continued.

REGULATORY PROGRAM DESCRIPTION	2024 COMPLIANCE STATUS	REPORT SECTIONS
	EPCRA 313 reporting include transfers to waste treatment and disposal facilities off the INL Site, air emissions, recycling, and other activities. • <i>Reportable Environmental Releases.</i> The INL Site contractor had one reportable spill in 2024. See Subsection 2.5.1.	
RADIATION PROTECTION		
<u>DOE Order 458.1, Change 4, “Radiation Protection of the Public and the Environment”</u> The Order was established to protect the public and the environment against undue risk from radiation associated with radiological activities conducted under the control of DOE and DOE contractors.	The Order sets the public dose limit at a total effective dose not to exceed 100 mrem/yr (1 mSv/yr) above-background radiation levels. Chapter 8 presents dose calculations for INL Site releases for 2024. The annual dose to the maximally exposed individual in 2024, as determined using CAA Assessment Package 88-PC, was 0.029 mrem (0.29 µSv). The “<u>Derived Concentration Technical Standard</u>” (DOE 2022) supports the implementation of <u>DOE O 458.1</u>. The standard defines the quantities used in the design and conduct of radiological environmental protection programs at DOE facilities and sites. These quantities, known as Derived Concentration Standards, represent the concentration of a given radionuclide in either water, milk or air that results in a member of the public receiving 100 mrem (1 mSv) effective dose following continuous exposure for one year via each of the following pathways: (1) ingestion of water or milk, (2) submersion in air, and (3) inhalation. Measurements of radionuclides in environmental media sampled on and around the INL Site were all below applicable Derived Concentration Standards. <u>DOE O 458.1</u> specifies the limits for unrestricted release of property to the public. INL Site contractors use a graded approach for the release of material and equipment for unrestricted public use. Material has been categorized so that in some cases an administrative release can be accomplished without a radiological survey. Such material originates from controlled areas and includes the following: • Personal items or materials • Documents, mail, electronic storage media, and other office media • Paper, cardboard, plastic products, aluminum beverage cans, toner cartridges, and other items for recycling • Office trash	Chapter 4 Chapter 5 Chapter 6 Chapter 7 Chapter 8 Appendix A



Table 2-1. continued.

REGULATORY PROGRAM DESCRIPTION	2024 COMPLIANCE STATUS	REPORT SECTIONS
	• Non-radiological area housekeeping materials and associated waste • Breakroom, cafeteria, and medical wastes • Medical and bioassay samples • Other items with an approved release plan. Items originating from radiological areas within the INL Site's controlled areas not in listed categories are either surveyed prior to release to the public, or a process knowledge evaluation is conducted to verify the item has not been exposed to radioactive material or beams of radiation capable of creating radioactive material. In some cases, both a radiological survey and a process knowledge evaluation are performed (e.g., a radiological survey is conducted on the outside of the item and a process knowledge form is signed by the custodian for inaccessible surfaces). When the process knowledge approach is employed, the history of the material confirms that no radioactive material has passed through or contacted the item. Items advertised for public sale via an auction also are surveyed by the contractor prior to shipment to the INL Site property/excess warehouse, where the materials are again resurveyed on a random basis by personnel prior to release, giving further assurance this material is not released with inadvertent contamination. All INL Site contractors complete material surveys prior to release and transport to the state-permitted landfill at CFA. The only exception is for items that could be internally contaminated; these items are submitted to Waste Generator Services for disposal using one of the offsite treatment, storage, and disposal facilities that can accept low-level contamination. DOE-ID, using a graded approach, provides oversight of the INL clearance processes. For 2024, the INL contractor had 1,326 releases of personal property items with over 99% of these releases being for reuse at INL (i.e., instruments for calibration, miscellaneous tools, and equipment). Those that were not released for reuse were released for appropriate disposal. The ICP contractor had 1,509 releases of personal property items. Those that were not released for reuse were released for appropriate disposal. The ICP contractor diverted 1,395,272 lbs of mixed-metal scrap from onsite landfills in 2024 by sending it to an offsite recycling facility. The scrap metal was accumulated during the deactivation and decommissioning of the Submarine First Generation	



Table 2-1. continued.

REGULATORY PROGRAM DESCRIPTION	2024 COMPLIANCE STATUS	REPORT SECTIONS
	Westinghouse (S1W) and Aircraft Carrier First Generation Westinghouse (A1W) prototypes at the NRF. Before their release, these materials were characterized to ensure they were not hazardous waste and that they were deemed free of radioactive contamination based on surveys performed by Radiological Protection personnel. On January 12, 2000, the Secretary of Energy established a DOE moratorium on the unrestricted release of all volumetrically contaminated metals. On July 13, 2000, DOE suspended “the unrestricted release for recycling of scrap metal from radiological areas within DOE facilities” (DOE Secretarial Memorandum: Release of Surplus and Scrap Materials; Memorandum from Bill Richardson to Heads of Departmental Elements). The moratorium and suspension on the release of metals from DOE sites remained in effect through the end of 2024. INL Site contractors continued to follow the requirements outlined in the applicable Secretarial Memorandums during that time. No scrap metal directly released from radiological areas is recycled. However, the moratorium was officially rescinded in 2025, as documented in the Federal Register. On December 14, 2023, DOE-ID approved the use of American National Standards Institute (ANSI)/Health Physics Society (HPS) N13.12, “Surface and Volume Radioactivity Standards for Clearance” and Comparison with Existing Standards” (PNNL-13484), at INL as volumetric radioactivity screening levels for clearance of personal property and as pre-approved authorized limits. INL did not release any items under this new program in 2024.	
<u>Toxic Substance Control Act (1976), 15 USC 2601 et seq.</u> The Toxic Substance Control Act (TSCA), which is administered by the EPA, requires the regulation of production, use, or disposal of chemicals. The TSCA supplements sections of the CAA, Clean Water Act (CWA), and Occupational Safety and Health Act. <i>Other environmental statutes and regulations apply, in whole or in part:</i>	Because the INL Site does not produce chemicals, compliance with TSCA is primarily directed toward the use and management of certain chemicals—particularly polychlorinated biphenyls (PCBs)—and toward recently published EPA-use restrictions on certain chemicals under TSCA Section 6. These chemicals include methylene chloride, carbon tetrachloride, perchloroethylene, and trichloroethylene. The EPA is in the process of performing a risk analysis and writing proposed regulations for other chemicals. The INL Site manages radioactive mixed waste containing PCBs received from other DOE sites many years ago for disposal. Environmental remediation activities include the	N/A



Table 2-1. continued.

REGULATORY PROGRAM DESCRIPTION	2024 COMPLIANCE STATUS	REPORT SECTIONS
40 CFR 761, Subpart J, "<u>General Records and Reports.</u>"	reprocessing of these waste materials for disposition offsite. In addition, PCBs were used in the manufacture of many different items and materials, including liquid-filled electrical equipment, such as transformers and capacitors, paint, and caulking. Whenever any of these items or materials are discovered, they are disposed of off the INL Site at a TSCA-approved disposal facility. Requirements for the reporting of PCB-related activities are found in 40 CFR 761, Subpart J. The INL contractor manages TSCA Risk-Based Disposal Approvals (RBDAs) at the Advanced Test Reactor (ATR) Complex, which establishes an agreement with the EPA to properly dispose of and/or decontaminate PCB waste in accordance with 40 CFR 761. TSCA RBDAs are situational based off discovery with the intention of minimizing risk to human health and the environment. TRA-641 was developed to address painted surfaces in the empty canal under 40 CFR 761.62(c) for paint, and under 40 CFR 761.61(c) for PCBs, that may have penetrated the concrete. TRA-619 was developed to address short-term cleanup and disposal of applied PCB paint and interim cleanup of PCBs that have penetrated the concrete flooring from the application of PCB paint under 40 CFR 761.61(c). The ICP contractor holds one RBDA, granted by EPA Region 10, which allows for the processing of PCB-contaminated legacy sludge wastes from the Rocky Flats Plant at RWMC. Per 40 CFR 761.20(c)(2)(ii), processing activities that are primarily associated with and facilitate treatment or disposal require TSCA PCB approval. Work performed under this RBDA ensures the waste can be accepted for disposal at the Waste Isolation Pilot Plant (WIPP) near Carlsbad, New Mexico.	
WATER QUALITY AND PROTECTION		
<u>Clean Water Act (1972), 40 CFR 109-140, 33 USC 1251, et seq.</u> The Clean Water Act (CWA) established goals to control pollutants discharged to U.S. surface waters. Among the main elements of the CWA are effluent limitations for specific industry categories set by the EPA, as well as regulating water quality standards for surface water. The CWA also provided for the National Pollutant Discharge Elimination System permit	Idaho DEQ is authorized by EPA as the permitting authority over the National Pollutant Discharge Elimination System program. The Idaho DEQ program is called the Idaho Pollutant Discharge Elimination System (IPDES). INL Site contractors do not currently hold any IPDES permits, but in-town facilities discharge to the city of Idaho Falls wastewater treatment plant, which is required by the IPDES permit program to set pretreatment standards for nondomestic discharges to publicly owned treatment works. On March 15, 2023, the city of Idaho Falls notified INL that, based on a review of INL's flow data, sampling data,	5.1



Table 2-1. continued.

REGULATORY PROGRAM DESCRIPTION	2024 COMPLIANCE STATUS	REPORT SECTIONS
program, requiring permits for discharges into regulated surface waters. <i>Other environmental statutes and regulations apply, in whole or in part:</i> • IDAPA 58.01.16, "<u>Wastewater Rules</u>" • IDAPA 58.01.25, "<u>Rules Regulating the Idaho Pollutant Discharge Elimination System Program.</u>"	water savings, and low pollutant levels, the city no longer considers the INL Research Center to be a significant industrial user and a permit is no longer required for discharge into the city of Idaho Falls' publicly owned treatment works (Henricksen 2023).	
Idaho Reuse Permits Idaho defines recycled water as water that has been treated by a wastewater treatment system and is used in accordance with the Recycled Water Rules. <i>Other environmental statutes and regulations apply, in whole or in part:</i> • IDAPA 58.01.11, "<u>Ground Water Quality Rule</u>" • IDAPA 58.01.16, "<u>Wastewater Rules</u>" • IDAPA 58.01.17, "<u>Recycled Water Rules.</u>"	Wastewater is the spent water or effluent from activities and processes occurring in dwellings, commercial buildings, industrial plants, institutions, and other establishments. If the wastewater contains sewage, it is considered municipal wastewater. If it does not contain sewage, it is considered industrial wastewater. Recycled water is wastewater effluent that is treated, if necessary, and then reused for other purposes. Idaho DEQ encourages reuse, which is the practice of using recycled water for irrigation, groundwater recharge, landscape impoundments, toilet flushing in commercial buildings, dust control, and other beneficial uses. Idaho DEQ requires anyone choosing to use recycled water to obtain a reuse permit. Reuse permits consider the site-specific conditions of each facility and include site-specific limits and conditions, as applicable, to protect public health and the environment, including groundwater. Idaho DEQ issues these permits in accordance with <u>IDAPA 58.01.11</u>, <u>IDAPA 58.01.16</u>, and <u>IDAPA 58.01.17</u>. The following facilities have reuse permits at the INL Site: • ATR Complex Cold Waste Ponds (I-161-03) • INTEC Percolation Ponds (M-130-07) • MFC Industrial Waste Pond (I-160-02). Idaho DEQ inspected the INL Site contractors reuse systems in April 2024. All reuse systems at the INL Site were operated in substantial compliance with permit requirements during 2024.	Chapter 5 Chapter 6 Appendix A



Table 2-1. continued.

REGULATORY PROGRAM DESCRIPTION	2024 COMPLIANCE STATUS	REPORT SECTIONS
<u>Safe Drinking Water Act (1974), 40 CFR 141, 40 CFR 143, 42 USC 300f, et seq.</u> The Safe Drinking Water Act establishes primary standards for public water supplies to ensure it is safe for consumption. <i>Other environmental statutes and regulations apply, in whole or in part:</i> 40 CFR 141, "<u>National Primary Drinking Water Regulations</u>" 40 CFR 143, "<u>Other Safe Drinking Water Act Regulations</u>" - IDAPA 58.01.08, "<u>Idaho Rules for Public Drinking Water Systems.</u>"	INL Site drinking water complied with all applicable federal and state water quality standards in 2024. Eleven potable water systems are permitted by Idaho DEQ. Each potable water system is sampled according to a monitoring cycle that identifies specific contaminants and sampling frequency, ranging from monthly, quarterly, or once every 1, 3, 6, or 9 years. In addition to regulatorily required sampling, INL Site contractors performed additional surveillance monitoring for bacteriological contaminants, radiological contaminants, and per- and poly-fluoroalkyl substances in 2024. Idaho DEQ conducted sanitary surveys of the Critical Infrastructure Test Range Complex, the Experimental Breeder Reactor I (EBR-I), the Gun Range, and the Main Gate public water systems in 2024. No significant deficiencies were found at any of these locations.	Chapter 6
QUALITY ASSURANCE		
<u>10 CFR 830, Subpart A, "Quality Assurance Requirements"</u> 10 CFR 830 establishes quality assurance requirements for contractors conducting activities, including providing items or services that affect, or may affect, the nuclear safety of DOE nuclear facilities. <i>Other environmental statutes and regulations apply, in whole or in part:</i> DOE O 414.1D, Change 2, "<u>Quality Assurance.</u>"	Quality assurance and quality control programs for environmental surveillance monitoring were maintained in 2024 by INL Site contractors and laboratories performing environmental analyses. These results are summarized in Chapter 10, Subsection 10.4. Field sampling elements, laboratory measurements, and performance evaluation samples were reviewed and evaluated for each INL contractor laboratory. Together, this information was used to assess the quality of data provided to INL Site contractors, and to follow-up and/or conduct corrective action to improve processes when necessary. This multifaceted approach to quality assurance and quality control added value to each INL Site contractor's monitoring program by providing confidence that all laboratory data reported in this report are reliable and of acceptable quality.	Chapter 10

**Table 2-2. Status of active WAGs (2024).**

WAG	FACILITY	STATUS
1	Test Area North (TAN)	Groundwater cleanup of trichloroethene for OU 1-07B continued through 2024 in accordance with EPA- and Idaho DEQ-approved plans (DOE-ID 2022a, 2022b). The New Pump and Treat Facility generally operated four days per week, except for downtime due to maintenance, to maintain trichloroethene concentrations in the medial zone below specified targets. The in situ bioremediation (ISB) transitioned into a rebound test in 2012 to determine the effectiveness of the remedy to date. The revised test plan was finalized in early 2017 to establish how the groundwater cleanup at TAN will continue. Two ISB injection wells were constructed in 2015 to further ISB efforts, while one monitoring well was constructed in 2017 to better monitor the plume at its distal edge. During 2021, one ISB injection well was constructed, and further ISB continues in a specific area where previous efforts had not achieved the desired reduction in contaminant levels. All ICs and O&M requirements were maintained during 2024 (DOE-ID 2025a).
2	Advanced Test Reactor (ATR) Complex	The ATR Complex, formerly known as the Reactor Technology Complex and, before that, the TRA, was established in the early 1950s to study the effects of radiation on materials, fuels, and equipment. To aid in this research, several facilities were constructed, including three test reactors: the Materials Test Reactor (1952 to 1970), the Engineering Test Reactor (1957 to 1982), and the ATR (1967 to present). Some operations at the ATR Complex released radioactive and nonradioactive contaminants. Consequently, the ATR Complex was designated as WAG 2 under the FFA/CO (DOE 1991), which further divided WAG 2 into 13 OUs that contain a total of 55 release sites. OU 2-13 is the only remaining OU where remedial actions are active. OU 2-13 is the comprehensive investigation of WAG 2, the ATR Complex. Remediation is complete at the ATR Complex, except for groundwater and perched-water monitoring under an OU-specific monitoring plan (DOE-ID 2016b). No analytes exceeded EPA maximum contaminant levels in the aquifer in October 2024 (DOE-ID 2025b). All ICs and O&M requirements were maintained in 2024.
3	Idaho Nuclear Technology and Engineering Center (INTEC)	The Idaho CERCLA Disposal Facility (ICDF), located southwest of INTEC, disposes of contaminated soils and debris from CERCLA remediation operations for the protection of human health and the environment. Operations and monitoring at the ICDF are carried out in accordance with EPA- and Idaho DEQ-approved plans (DOE-ID 2018a, 2022c, 2023a). The consolidation of waste at ICDF reduces the risk of exposure to contaminants for human and ecological receptors, and the use of an engineered facility with leachate collection protects the underlying Snake River Plain Aquifer. The ICDF functions as an INL Sitewide disposal facility for CERCLA soils and debris from other WAGs in compliance with strict waste acceptance criteria. The facility continues to receive small amounts of liquid and solid waste periodically for disposal in the ICDF evaporation ponds and disposal cells, respectively. The ICDF evaporation ponds and the Snake River Plain Aquifer are sampled annually; results are sent to the EPA and Idaho DEQ. In 2022, an Explanation of Significant Differences to the OU 3-13 ROD for an Additional Cell at ICDF at the INL Site (DOE-ID 2022c) was approved. The new disposal cell approved through the explanation of significant differences increases the volume of waste that can be disposed of at ICDF through disposal at Cells 1 and 2, as well as through the construction of a third cell, which began in 2023. Remedial actions and monitoring required by the WAG 3, OU 3-14 ROD (DOE-ID 2007a) are implemented through EPA and Idaho DEQ-approved plans (DOE-ID 2024b, 2018a). Remedial actions at TFF are designed to reduce water infiltration that could potentially transport contaminants from the vadose zone and perched-water basins to the underlying aquifer. An interim low-permeability asphalt barrier was placed over the western two-thirds of the TFF during 2017 to further reduce infiltration of precipitation water until a final cover is constructed over the TFF after



Table 2-2. continued

WAG	FACILITY	STATUS
		closure of the final four tanks. Perched and groundwater monitoring under and near the TFF will continue until the risk posed by contamination left in place is below target levels. All ICs and O&M requirements were maintained in 2024.
4	Central Facilities Area (CFA)	CFA was established in the early 1950s to provide centralized support services for INL Site operations, which included the operation of several former landfills. WAG 4 groundwater monitoring consists of two different components: (1) monitoring the CFA landfill, and (2) monitoring of a nitrate plume south of CFA. Wells at the CFA landfills are monitored to determine potential impacts from the landfills, while the nitrate plume south of CFA is monitored to evaluate nitrate trends. In 2024, nitrate was above the EPA maximum contaminant level (10 mg/L-N) in Well CFA-MON-A-002, with a concentration of 13.5 mg/L-N (DOE-ID 2025c). All ICs and O&M requirements were maintained in 2024.
7	Radioactive Waste Management Complex (RWMC)	The major focus of remedial response actions at RWMC is the Subsurface Disposal Area (SDA), a 97-acre landfill that received radioactive and mixed waste from reactor research operations and Cold War weapons production (see Figure 2-3). Waste was buried in approximately 35 of the 97 acres within 21 unlined pits, 58 trenches, 21 soil vault rows, and on Pad A, which was constructed as an above-grade disposal area that has since been covered with soil. The OU 7-13/14 ROD (DOE-ID 2008a) called for exhuming and packaging a minimum of 6,238 m³ (8,159 yd³) of targeted waste from a minimum combined area of 5.69 acres. Targeted waste for retrieval contained TRU elements (e.g., plutonium), uranium, and collocated organic solvents (e.g., carbon tetrachloride). Targeted waste retrieval operations began in 2004 and were completed in 2021. The retrieved targeted waste is packaged, certified, and shipped out of Idaho. A total of 10,417.5 m³ (13,625.58 yd³) of targeted waste was retrieved and packaged for offsite shipment. In addition to targeted waste retrieval, the ROD addressed cleanup of the remaining contamination in the SDA through a combination of vapor-vacuum extraction and the treatment of solvent vapors from the subsurface (completed in August 2022; RPT-1904), in situ grouting of specified waste forms containing mobile contaminants (completed in 2010; DOE-ID 2011a), and environmental monitoring, which is ongoing and includes quarterly sampling of solvent vapors in the vadose zone and annual sampling of the Snake River Plain Aquifer in accordance with the respective plans (DOE-ID 2025d; DOE-ID 2025e). Eventually, an evapotranspiration (ET) surface barrier will be constructed over the entire SDA landfill, followed by long-term management and control. The remedial design is complete and current operations at RWMC are focused on preparing the SDA for the construction of the ET surface barrier.
10	OU 10-04 INL Sitewide Miscellaneous Sites and Comprehensive RI/FS	OU 10-04 addresses long-term stewardship functions—ICs and O&M for sites that do not qualify for unlimited use/unrestricted exposure—and explosive hazards associated with historical military operations on the INL Site. All ICs and O&M requirements were maintained in 2024, under the Sitewide IC/O&M Plan (DOE-ID 2022d). The fifth Sitewide CERCLA five-year review covering the period from 2020 through 2024 will be finalized in February 2026. The purpose of the CERCLA five-year review is to verify that implemented cleanup actions continue to meet the cleanup objectives documented in the RODs.
	OU 10-08 INL Sitewide Groundwater, Miscellaneous	OU 10-08 addresses Sitewide groundwater, miscellaneous sites, and future sites (DOE-ID 2009). Response actions for OU 10-08 are mostly complete, and ongoing activities include groundwater monitoring and evaluating and remediating potential new sites that are discovered. Sampling for OU 10-08 is biennial, and no sampling was performed in 2024.



Table 2-2. continued

WAG	FACILITY	STATUS
	Sites, and Future Sites	unacceptable threat to human health or the environment from commingled plumes or along the southern INL Site boundary.

2.3 INL Site Agreements

DOE-ID has four major agreements that contain regulatory commitments and milestones for the INL Site. These major agreements are known as the Federal Facility Agreement and Consent Order (FFA/CO) (DOE 1991), the Site Treatment Plan (DOE-ID 2023b), the Idaho Settlement Agreement (ISA) (DOE 1995), and the Notice of Noncompliance/Consent Order (NON/CO) (CCN 317575).

Federal Facility Agreement and Consent Order

Since its inception in 1949, past INL Site activities have resulted in suspected and confirmed releases of contaminants to the environment. As a result, INL was added to the EPA National Priority List of CERCLA Sites in 1989. The FFA/CO is a CERCLA-based legally binding cleanup agreement that was signed in 1991 by Idaho DEQ, the EPA, and DOE.

As a CERCLA Site, DOE conducts risk-based cleanup, which is subject to Idaho DEQ and EPA approval in accordance with the FFA/CO. This means that if a confirmed contaminant release to the soil and/or the groundwater poses an unacceptable risk to either humans or the environment, it requires cleanup or the establishment of controls to keep people, plants, or animals from coming into contact with the waste. If a CERCLA Site poses little to no risk, either limited action or no action is taken.

Since 1991, the EPA, Idaho DEQ, and DOE have signed 25 RODs on individual contaminant release sites and entire facilities at INL. Cleanup actions continue at TAN, INTEC, and RWMC. The FFA/CO subdivided INL into 10 WAGs to facilitate remediation. These groups contain individual sites that are organized into OUs based on proximity or similar characteristics. WAGs 1–9 comprise the major facilities at INL, while WAG 10 encompasses the remaining portions of the INL Site and all INL Sitewide groundwater issues. Each WAG has a comprehensive ROD that addresses human and ecological risk and has actions to restore groundwater within 100 years or protect it.

Site Treatment Plan

The Federal Facility Compliance Act of 1992 requires the preparation of plans for the treatment of mixed waste stored or generated at DOE facilities. Mixed waste contains both hazardous and radioactive components. The Federal Facility Compliance Act Consent Order and Site Treatment Plan was finalized and signed by the state of Idaho on November 1, 1995, and is updated annually (DEQ 1995). This plan outlines DOE-ID's proposed treatment strategy for mixed waste streams, called the backlog, and identifies onsite and offsite mixed LLW treatment capabilities.

During 2024, DOE-ID completed four Site Treatment Plan milestones, including two associated with the Sodium Components Maintenance Shop, one associated with Transuranic Waste Certification, and one granting approval of the project definition for the Calcine Disposition Project.

Idaho Settlement Agreement

On October 16, 1995, DOE-ID, the U.S. Navy, and Idaho DEQ entered into this agreement—also known as the ISA—that guides the management of spent nuclear fuel (SNF), HLW, and TRU waste at the INL Site. The ISA (DOE 1995) limits shipments of DOE-ID and U.S. Navy SNF into the state and sets milestones for shipments of SNF and radioactive waste out of the state.

In 2008, the DOE, state of Idaho and U.S. Environmental Protection Agency agreed to exhumate targeted radioactive and hazardous waste from the 5.69-acre SDA landfill. In March 2022, the DOE and ICP workforce safely completed retrieval of SDA buried waste more than 18 months ahead of schedule.

The Site Treatment Plan and ISA required DOE-ID to process and ship all covered TRU waste out of the state of Idaho by December 31, 2018, when the agreements were signed. The estimated volume of that waste was 65,000 m³ (85,016 yd³). This milestone was not achieved; however, revised Site Treatment Plan milestones were agreed upon with Idaho DEQ; an addendum to the ISA was signed on November 6, 2019, to address the milestone.



As of December 31, 2024, approximately 5,100 m³ of original volume TRU-contaminated waste and 610 m³ of exhumed waste remains onsite. DOE-ID made 341 shipments of TRU waste to WIPP in 2024, which consisted of 165 shipments of ISA legacy waste and 176 shipments of Accelerated Retrieval Project exhumed waste.

The ICP contractor manages and operates several projects to facilitate the disposition of radioactive waste as required by the ISA and Site Treatment Plan. The Advanced Mixed Waste Treatment Project (AMWTP) performs retrieval, characterization, treatment, packaging, and shipment of TRU waste currently stored at the INL Site. Most of the waste processed at AMWTP resulted from the manufacture of nuclear components at DOE's Rocky Flats Plant in Colorado. This waste is contaminated with TRU radioactive elements—primarily plutonium.

Notice of Noncompliance/Consent Order

The final agreement, the NON/CO and recent modification, in conjunction with the Site Treatment Plan, requires the treatment of sodium-bearing waste to be stored at the INTEC TFF at IWTU. To meet the milestones in the NON/CO and Site Treatment Plan, DOE-ID and its ICP contractor implemented a methodical approach to begin operating IWTU in early 2017, which was completed in 2023 when the facility began processing the remaining 3,407,000 L (900,000 gal) of liquid waste stored at INTEC. This waste is stored in three stainless steel underground tanks, while a fourth is always kept empty as a spare. All four tanks will be closed in compliance with hazardous waste regulations. A total of 11 other liquid storage tanks were emptied, cleaned, and closed. The waste was originally scheduled to begin processing in 2012, but several technical problems delayed IWTU from operating.

IWTU completed a facility outage implementing needed facility modifications in preparation for supporting sustained radiological waste treatment operations in July 2021. Following successful completion of readiness verification activities, IWTU commenced a final confirmatory run-on simulant waste feed in late 2021. Technical challenges delayed completion of the final confirmatory run until mid-2022. These issues were adequately resolved, and the facility restarted its test run in May 2022. The facility successfully completed the final confirmatory run in late July 2022, along with a final round of readiness assessments for radiological operations. The facility processed 137,000 gallons of simulated waste over 65 days of continuous operation, filling 125 product canisters. The facility shut down and entered a planned outage to inspect process vessels/components, conduct maintenance, and make minor modifications, which concluded in November 2022. The facility initiated a plant restart for simulant testing in December 2022; radiological operations began in April 2023. With the completion of system performance testing in August 2023, IWTU transitioned out of interim operation status. From April to September 2023, IWTU safely treated approximately 68,000 gallons of sodium-bearing waste from the INTEC TFF. IWTU suspended operations, shut down, and entered a maintenance period in September 2023 to replace expended media that had become saturated with mercury in the granular-activated carbon vessels in accordance with operating permit requirements. IWTU resumed operations in August 2024. IWTU safely treated approximately 259,000 gallons of sodium-bearing waste from the INTEC TFF in 2024.

2.4 Low-Level and Mixed Radioactive Waste

In 2024, approximately 276 m³ (361 yd³) of mixed LLW and 210 m³ (275 yd³) of LLW was shipped off the INL Site for treatment, disposal, or both, by the ICP contractor. In 2024, no LLW was disposed of at the [SDA](#). INL Site Waste types managed by the INL Site contractors can be found [here](#). The status of each phase of the LLW management process for facilities managed at the Site by the INL Site contractors is shown in Table 2-3.

Table 2-3. Status of each phase of the LLW management process for sites authorized to manage an LLW facility.

PHASE	REMOTE-HANDLED LOW-LEVEL WASTE (RHLLW) DISPOSAL FACILITY	RWMC ACTIVE LLW DISPOSAL FACILITY	ICDF
Performance Assessment	DOE/ID-11421 (DOE-ID 2018b), "Performance Assessment for the Idaho National Laboratory Remote-Handled Low-Level Waste Disposal Facility"	DOE/NE-ID-11243 (DOE-ID 2007b), "Performance Assessment for the RWMC Active Low-Level Waste Disposal Facility at the Idaho National Laboratory Site"	DOE/ID-10978 (DOE-ID 2011b), "Performance Assessment for the Idaho CERCLA Disposal Facility Landfill"



Table 2-3. Continued.

PHASE	REMOTE-HANDLED LOW-LEVEL WASTE (RHLLW) DISPOSAL FACILITY	RWMC ACTIVE LLW DISPOSAL FACILITY	ICDF
Composite Analysis	DOE/ID-11422 (DOE-ID 2012), "Composite Analysis for the Idaho National Laboratory Remote-Handled Low-Level Waste Disposal Facility"	DOE/NE-ID-11244 (DOE-ID 2008b), "Composite Analysis for the RWMC Active Low-Level Waste Disposal Facility at the Idaho National Laboratory Site"	DOE/ID-10979 (DOE-ID 2003), "Composite Analysis for the INEEL CERCLA Disposal Facility Landfill"
Closure Plan	PLN-3370, "Preliminary Closure Plan for the Idaho National Laboratory Remote-Handled Low-Level Waste Disposal Facility"	RPT-576, "Interim Closure Plan for the RWMC Active Low-Level Waste Disposal Facility at the Idaho National Laboratory Site"	A preliminary closure plan was developed for the entire ICDF Complex closure. This plan was included in the "ICDF Complex Remedial Action Work Plan" (DOE/ID-10984) (DOE-ID 2024a)
Performance Assessment/Composite Analysis Maintenance Program	PLN-3368, "Maintenance Plan for the Remote-Handled Low-Level Waste Disposal Facility Performance Assessment and Composite Analysis"	RPT-431, "Performance Assessment and Composite Analysis Maintenance Plan for the RWMC Active Low-Level Waste Disposal Facility"	RPT-791, "Performance Assessment and Composite Analysis Maintenance Plan for the Idaho CERCLA Disposal Facility"
Latest Annual Performance Assessment/Composite Analysis Summary Report	INL/RPT-24-82600 (INL 2025c), "Annual Summary Report for the Remote-Handled Low-Level Waste Disposal Facility – FY 2024"	RPT-2160, "Annual Summary Report: Review for Continued Adequacy of the Performance Assessment, Composite Analysis, and Supporting Documents for the Active Low-Level Waste Disposal Facility at the RWMC – FY 2023"	RPT-2161, "Annual Summary Report: Review for Continued Adequacy of the Performance Assessment, Composite Analysis, and Supporting Documents for the ICDF Landfill – FY 2023"
Disposal Authorization Statement	Bishop, T., memorandum to R. Provencher, May 22, 2018, "Operating Disposal Authorization Statement for the Remote-Handled Low-Level Waste Disposal Facility Idaho National Environmental Laboratory, Idaho," U.S. DOE-NE, May 22, 2018	Marcinowski, F., memorandum to E. Sellers, January 30, 2008, "Revision of the Disposal Authorization Statement for the Idaho National Laboratory Active Low-Level Waste Disposal Facility within the Radioactive Waste Management Complex," CCN 323845	Kristen G. Ellis, memorandum to Connie M. Flohr, September 22, 2023, "Revision of the Disposal Authorization Statement for the Idaho Comprehensive Environmental Response, Compensation, and Liability Act Disposal Facility," 9266728

2.4.1 Spent Nuclear Fuel

Spent Nuclear Fuel (SNF) is nuclear fuel that has been withdrawn from a nuclear reactor following irradiation and the constituent elements have not been separated. It contains unreacted uranium and radioactive fission products and must be properly shielded because of its radioactivity—primarily from gamma rays. SNF from DOE-ID is from the development of nuclear energy technology (including foreign and domestic research reactors), national defense, and other programmatic missions. At the INL Site, SNF is managed by the ICP contractor at INTEC, and the INL contractor at the ATR Complex and MFC.

The ISA put milestones into place for the management of SNF at the INL Site:

- DOE-ID shall remove all spent fuel, including naval spent fuel and Three Mile Island spent fuel, from the state of Idaho by January 1, 2035 (Paragraph C.1).

Meeting this remaining milestone comprises the major objective of the SNF program.



2.5 Environmental Releases, Response, and Reporting at the INL Site

Federal guidelines stipulate that certain environmental discharges and spills must be communicated to regulatory agencies. Releases that are subject to reporting are those discharges of hazardous substances to the environment that are not authorized by state or federal regulations. Per CERCLA Section 103, any release of a hazardous substance that reaches or surpasses predetermined reportable quantities must be reported. This includes ongoing releases that have a consistent quantity and rate yet surpass the established thresholds. These reporting obligations cover releases into the soil, groundwater or surface water, or into the atmosphere, in instances where such releases pose a threat to human health or the environment.

2.5.1 Spills

INL Site contractors had one reportable spill in 2024. Approximately 10–15 gallons of diesel fuel were spilled to the soil during an overfill event from an emergency diesel-backup generator at ATR-786 on November 8, 2024. Idaho DEQ was notified that the cleanup could not take place under the landing gear of the trailer until ATR went into outage. Cleanup will occur in 2025.

2.5.2 Unplanned Releases

INL Site contractors had no unplanned releases of hazardous substances or any events resulting in emissions exceeding reporting thresholds that would require notification to be made to regulatory agencies in 2024. All radiological emissions were accounted for in the dose received by the maximally exposed individual (see Chapter 8).

2.6 Environmental Permits

Table 2-4 presents the complete list of all active federal and state permits during 2024 for INL Site operations. This table includes those pertaining to air emissions, ecological, groundwater, RCRA, and recycled water.

Table 2-4. Environmental permits for the INL Site (2024).

ACTIVE PERMIT NAME	PERMIT NUMBER	REGULATORY AGENCY	EXPIRATION DATE
AIR EMISSIONS			
INL Permit to Construct (PTC) with a Facility Emissions Cap (FEC)	P-2020.0045	DEQ	01/29/2026
ECOLOGICAL			
Special Purpose – Miscellaneous	MB04294B	USFWS	03/31/2025
Scientific Collecting	MB13633C	USFWS	03/31/2025
Scientific Collecting	71847	IDFG	12/31/2024
Scientific Collecting	79645	IDFG	12/31/2024
GROUNDWATER			
Idaho Department of Water Resources (IDWR) Permit for the Operation of Injection Well	25W-062-001	IDWR	02/14/2028
Water Right Agreement	PER ^a -154	IDWR	NA
RCRA^b			
AMWTP Hazardous Waste Management Act (HWMA)/RCRA Permit	PER ^a -153	DEQ	03/19/2029
HWMA/RCRA Partial Permit for Storage at the Calcined Solids Storage Facility at the INTEC on the INL	PER ^a -114	DEQ	06/26/2027
HWMA/RCRA Post-closure Permit for the INTEC on the INL	PER ^a -112	DEQ	03/14/2034
HWMA/RCRA Storage and Treatment Permit for the MFC	PER ^a -116	DEQ	10/01/2025



Table 2-4. continued.

ACTIVE PERMIT NAME	PERMIT NUMBER	REGULATORY AGENCY	EXPIRATION DATE
HWMA Storage and Treatment Permit for the INTEC Waste Management Operations on the INL	PER ^a -109	DEQ	06/27/2034
Part A Permit App, Interim Status Facility, TFF at INTEC	PER ^a -101	DEQ	NA
Partial Permit for HWMA Storage and Treatment for the Liquid Waste Management System at the INTEC on the INL	PER ^a -111	DEQ	11/20/2024
RECYCLED WATER			
ATR Complex Cold Waste Ponds Reuse Permit	I-161-03	DEQ	10/10/2029
MFC Industrial Waste Pond Reuse Permit	I-160-02	DEQ	01/25/2027
Reuse Permit for the INTEC Percolation Pond	M-130-07	DEQ	06/25/2034

- a. PER is the INL document type used for regulatory permits.
- b. Part A interim status units are those units with Part A permit applications (interim status) that have not been RCRA-closed. Partial Part B permits include the Part A application and Part B application. Part A addresses each of the permitted units in Part B, while Part B includes specific details and permit operating requirements. A partial permit that includes the unit-specific Part A and Part B is considered a RCRA partial Part B permit. There are six RCRA partial Part B permits for the INL Site.

2.7 References

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Chapter 3: Environmental Management Systems



CHAPTER 3

The Environmental Management Systems (EMSs) for the Idaho National Laboratory (INL) and Idaho Cleanup Project (ICP) contractors implement the commitments of the United States (U.S.) Department of Energy (DOE) for the protection of the environment and human health. DOE strives to be in full compliance with environmental laws, regulations, and other requirements to protect the air, water, land, natural, archaeological, and cultural resources potentially affected by operations and activities conducted at the INL Site. These commitments are implemented by integrating environmental requirements, pollution prevention, and responsible practices into work planning and execution, and by taking actions to minimize the impact of INL Site operations and activities.

3. ENVIRONMENTAL MANAGEMENT SYSTEMS

INL's mission is to advance nuclear energy research, development, and deployment in ensuring the nation's energy security and environmental stewardship. INL's EMS plays a crucial role in supporting this mission by providing a structured framework for managing environmental responsibilities. The EMS ensures INL complies with regulatory requirements, minimizes environmental impacts, and promotes responsible practices across its operations. By systematically identifying and addressing environmental risks and opportunities, the EMS enhances operational efficiency, reduces waste, and conserves resources. Furthermore, INL's EMS fosters a culture of environmental stewardship among employees, bolsters community and stakeholder trust, and reinforces the laboratory's commitment to protecting the environment while achieving its strategic objectives.

INL represents a collaboration among all operating contractors and the U.S. Department of Energy, Idaho Operations Office (DOE-ID), which encompasses the Idaho Falls campus, as well as the research and industrial complexes collectively known as the INL Site, which is located 50 miles west of Idaho Falls, Idaho. For the purposes of this report, the INL Site includes facilities operated by Battelle Energy Alliance, LLC (BEA), the INL contractor, as well as the Idaho Environmental Coalition, LLC, the Idaho Cleanup Project (ICP) contractor. INL Site contractors refers to these entities, identified by their respective acronyms, and includes all facilities under their individual responsibilities.

DOE recommends using International Organization for Standardization (ISO) Standard 14001:2015, "Environmental Management Systems – Requirements with Guidance for Use," as a Best Management Practice (BMP) for EMSs. The ISO 14001:2015 standard provides a structured approach that includes policy development, planning, implementation, operation, checking, corrective action, and management review. The goal of ISO 14001:2015 is to enhance environmental performance through a continuous improvement cycle. The INL Site contractors have adopted EMSs based on this standard for their respective operations.

In 2024, the INL Site contractors underwent audits to assess their adherence to the ISO 14001:2015 standard. The audit for the INL contractor revealed commendable results, with no nonconformities identified. In addition, the audit highlighted four notable strengths within the management system, demonstrating robust environmental practices and processes. However, the audit also identified one opportunity for improvement, providing a pathway for further EMS enhancement. Results from the audit for the ICP contractor showed no nonconformities and seven management system strengths. These findings underscore the collective commitment of the two contractors to maintain high-standards of environmental stewardship while continuously seeking ways to improve operations.



3.1 Environmental Policy

The INL Site contractors state their commitments to the environment through an overarching policy that is displayed to all employees. These policies commit to incorporate sound environmental management policies and practices into all work planning and execution in a safe, compliant, and cost-effective manner that protects human health and the environment. The environmental policies apply to all employees and they encourage all personnel to report environmental concerns to management. The INL contractor policy commits specifically to do the following:

- **Environmental Protection:**
 - The practice of conserving and preserving the natural environment and its resources for the benefit of present and future generations.
- **Environmental Compliance:**
 - The adherence and conformity to laws, regulations, standards, and other requirements set by governmental bodies and delegated authorities in order to promote and ensure environmentally responsible behavior and practices by businesses and organizations.
- **Pollution Prevention:**
 - The practice of reducing or eliminating pollution at its source, rather than treating it after it has been created. This approach aims to minimize the release of harmful substances into the environment, thereby protecting human health and ecosystems.
- **Continual Improvement:**
 - The ongoing process of making incremental advancements and enhancements in various aspects of environmental protection. It involves continuously identifying areas for growth and implementing changes to achieve better results over time.

INL contractor employees integrate environmental requirements and pollution prevention techniques into work planning and execution to minimize the environmental impacts of their activities.

The ICP contractor policy commits to do the following:

- **Leadership Commitment:**
 - Integrate appropriate environmental practices into all project operations; document environmental objectives and targets; measure progress; and report performance through the EMS.
 - Educate employees on their environmental responsibilities and train them to ensure they comply with requirements.
 - Continuously improve their EMS through self-assessments and corrective actions.
 - Promote environmental stewardship, take prompt action to address concerns and issues, and have zero tolerance for noncompliance.
- **Environmental Compliance and Protection:**
 - Identify and comply with all applicable, relevant, and appropriate environmental laws, regulations, and permits.
 - Assess the effects of operations on the environment through a comprehensive environmental monitoring program.
 - Provide full disclosure and openness with DOE and regulatory agencies regarding any noncompliance with regulatory requirements.
- **Environmental Stewardship:**
 - Protect the unique natural, biological, and cultural resources associated with the INL Site contractors.
 - Minimize the effects of operations on the environment and conserve natural resources by reusing and recycling materials, purchasing recycled materials, and performing other pollution prevention practices.
 - Use all means practicable to minimize or eliminate any newly generated wastes—whenever possible; newly generated waste shall have a clear disposition path before it is generated.
- **Client, Employee, and Stakeholder Engagement:**
 - Communicate openly and honestly with all parties and stakeholders.



- Share respective environmental policies with all employees and subcontractors and make them available to the public.
- Consider the input of all stakeholders when weighing alternative courses of action.
- Measure environmental performance, monitor the environmental impacts and communicate results to all parties.

The ICP contractor's policies are available to the public.

3.2 Environmental Management System Structure

The INL Site contractors' EMSs incorporate a plan-do-check-act approach to provide a framework under which the environmental, safety, and health programs are managed:

Plan – Define work scope, identify environmental aspects, analyze hazards, and develop hold points and mitigations

Do – Implement defined controls and perform work scope

Check – Evaluate performance, management reviews, and contractor's assurance practices

Act – Incorporate corrective actions, improvements, and lessons learned into practices.

This approach is both interactive and iterative, integrating various work activities and functions, including policies, programs, and processes. It also is an essential component of overall management of the INL Site's environmental compliance and performance. This systematic plan-do-check-act process ensures a continuous improvement loop, promoting effective management of the INL Site's environmental responsibilities while driving enhanced environmental performance and compliance.



3.3 Plan

3.3.1 Environmental Aspects

The INL Site contractors have evaluated activities, products, and services to identify the environmental aspects of work events that could affect the environment or the public, or result in noncompliance with regulatory requirements. They perform these evaluations against all applicable federal and state regulations, state permits, and local laws, which are the foundation for environmental standard operating procedures and implementing documents. The INL Site contractors use the National Environmental Policy Act planning tool for all proposed actions that would take place onsite. INL uses the Environmental Compliance Permit Process, while ICP uses the Environmental Checklist process to evaluate all activities and projects to ensure the proposed actions consider and mitigate the following environmental aspects as necessary:

Air Emissions. Operations or activities that have the potential to generate air pollutants in the form of radionuclides, chemical and combustion emissions, fugitive dust, asbestos, and refrigerants. The INL Site contractors have an Environmental As Low As Reasonably Achievable review process per DOE O 458.1, "[Radiation Protection of the Public and the Environment](#)," that protects the public and the environment against undue radiation risk. The Environmental As Low As Reasonably Achievable Committee evaluates activities that have the potential for radiological impact on the environment and the public and determines the requirements for radiological emissions.

Chemical Use and Storage. Activities that purchase, store, or use laboratory or industrial chemicals, pesticides, or fertilizers. INL Site contractors have processes in place to maintain the adequate inventory of appropriate emergency response equipment and to report inventories and releases.

Contaminated Sites Disturbance. Activities in Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) areas of contamination or Resource Conservation and Recovery Act (RCRA) corrective action sites. INL Site contractors have processes to properly identify contaminated sites.

Discharging to Surface, Storm, or Groundwater. Activities that have the potential to contaminate groundwater or water. INL Site contractors have spill-prevention policies and response plans in place for areas that have the potential to contaminate groundwater or water.



Drinking Water Contamination. Activities related to constructing, operating, and maintaining drinking water supply systems and equipment or activities with the potential to contaminate drinking water supplies. This includes the bacteriological, radiological, or chemical contamination of drinking water.

Disturbing Cultural Resources. Activities that have the potential to adversely affect cultural resources, such as disturbing soils by grading, excavating, sampling, off-road vehicle use, or removing vegetation. It applies to the protection of sensitive cultural or biological resources from disturbance as well. The potential for adverse effects also applies to modifying or demolishing historical buildings or structures that are 50 or more years old. INL has a cultural resources management team that evaluates work activities at INL to minimize the impact on historical buildings and cultural sites before an activity begins.

Generating and Managing Waste. Activities that generate, store, treat, transport, or dispose of regulated, hazardous, radioactive, or industrial waste. INL Site contractors have waste management programs that integrate and disposition containerized hazardous, radioactive, or industrial waste and provide guidance on how to minimize the amount of regulated waste that is generated.

Releasing Contaminants. Activities that may release potentially hazardous contaminants into water, soil, or other noncontaminated or previously contaminated locations. All INL Site contractor employees are trained to report the release of any contaminant to either their Program Environmental Lead or to the Spill Notification Team. Releases are tracked to verify proper cleanup is performed. Planned operations and research with the potential to release contaminants are evaluated to mitigate any significant environmental impacts.

Polychlorinated Biphenyls (PCB) Contamination. Activities that use PCB-contaminated equipment or store and dispose of PCB-contaminated waste. INL Site contractors have processes in place to identify PCBs in excess equipment and to comply with regulatory requirements related to the use, marking, storage, and disposal of PCB equipment or waste.

Interaction with Wildlife/Habitat. Activities with the potential to disturb or affect wildlife or their habitat or activities involving revegetation and weed control. INL Site contractors have processes in place to ensure identification and consideration is given to the cumulative impacts required by the National Environmental Policy Act, the Endangered Species Act, or the Migratory Bird Treaty Act. Procedures and processes are also implemented to control noxious weeds and the revegetation of disturbed sites.

Using, Reusing, and Conserving Natural Resources. Activities that use or recycle resources such as water, energy, fuels, minerals, borrow material, wood, or paper products, as well as other materials derived from natural resources. This beneficial aspect also applies to waste disposition activities, including building demolition and activities implementing responsible practices and conserving natural resources.

Identifying Environmental Aspects Offers Numerous Benefits. By systematically recognizing and evaluating the interactions between its activities, products, or services and the environment, INL Site contractors can pinpoint areas where adverse environmental impacts can be minimized. This proactive approach allows for the implementation of effective control measures, reducing the risk of noncompliance with environmental regulations and potential liabilities.

3.3.2 Compliance Obligations

The INL Site contractors are dedicated to maintaining the highest standards of environmental compliance, adhering to a comprehensive array of federal, state, and local regulations. These obligations encompass a wide range of activities, including hazardous waste management, air and water quality protection, and natural resource conservation. The environmental compliance frameworks used by the INL Site contractors are designed to ensure all operations are conducted in a manner that minimizes the environmental impact, safeguards public health, and promotes responsible environmental practices. This commitment is supported by rigorous internal policies, regular audits, continuous monitoring, and proactive engagement with regulatory agencies. Through these efforts, INL Site contractors demonstrate an unwavering dedication to environmental stewardship in their roles as responsible leaders in the scientific, technological, and environmental cleanup and restoration communities.



3.3.3 Environmental Objectives

The INL Site contractors establish objectives based on environmental policy, legal concerns, ISO 14001, environmental aspects, INL's Annual Laboratory Plan (INL 2024), and the perspectives of its stakeholders. The INL contractor plans, implements, monitors, and reports triennially on these objectives and targets in management review reports and an annual performance evaluation and measurement plan. The ICP contractor develops its objectives and targets annually and reports the status biannually to senior management through the Executive Safety Review Board.

The INL contractor completed 96% of its EMS objectives and targets in Fiscal Year (FY) 2024. Figure 3-1 identifies the progress that was made on these environmental objectives and targets.

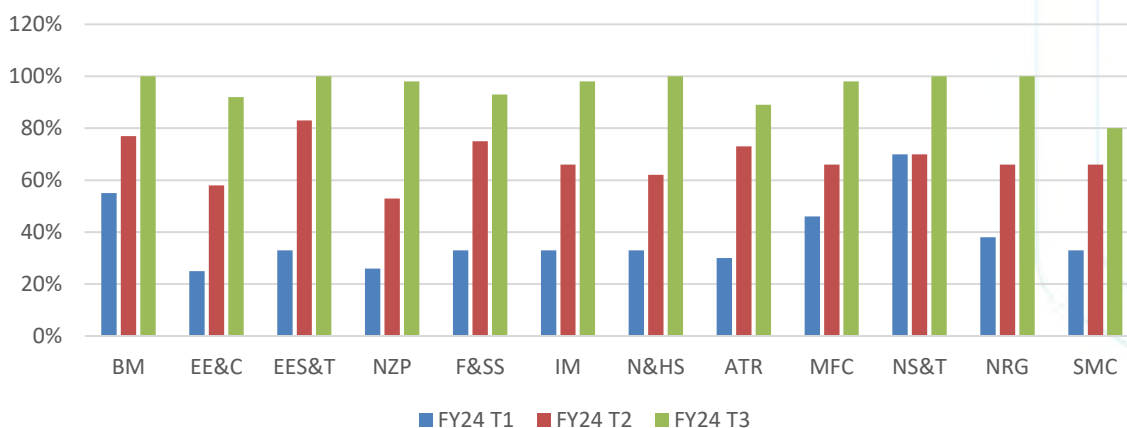


Figure 3-1. INL ISO 14001 objectives progress for FY 2024.

Each year, the ICP contractor identifies the environmental objectives and targets to be met. During FY 2024, the ICP contractor identified 15 objectives that were implemented by 15 targets. All of these objectives and targets were completed successfully during FY 2024.

3.4 Do (Implementation and Operations)

3.4.1 Structure and Responsibility

The organizational structures that INL Site contractors have in place establish the roles and responsibilities for environmental management within research, development, and demonstration; operations; waste management; decontamination and decommissioning; and other support organizations within environmental, safety, health, and quality. Identified technical points of contacts (POCs) communicate the environmental regulatory requirements and required document submittals to the U.S. Environmental Protection Agency (EPA), the Idaho Department of Environmental Quality (DEQ), and other stakeholders. The technical POCs work with the projects, researchers, and facilities to ensure the requirements are implemented as required.

3.4.2 Competence, Training, and Awareness

The training directorates for the INL Site contractors conduct training analysis and design, develop, and evaluate environmental training. This environmental training gives personnel the opportunity to gain the experience, knowledge, skills, and abilities necessary to accomplish the following:

- Perform their jobs in a safe and environmentally responsible manner
- Comply with federal, state, and local environmental laws; regulations and permits; and INL requirements and policies
- Increase the awareness of environmental protection practices and pollution and prevention/waste minimization opportunities
- Take action in an emergency.



3.4.3 Communication

INL Site contractors implement comprehensive communication programs that distribute timely information to interested parties, such as the public, news media, regulatory agencies, and other government agencies. These programs provide communications about the environmental aspects of work activities, among other topics. Two examples are the Media and Community Relations Program and the Strategic Initiatives Program, which both distribute information about INL through public briefings, workshops, personal contacts, news releases, media tours, public tours, and news conferences. These programs also coordinate INL tours for schools, members of the public, special interest groups, and government and elected officials. Internal communications regarding environmental aspects are available via intranet sites, procedures, emails, posters, brochures, booklets, trainings, and personal interaction with environmental staff.

3.4.4 Operational Control

Environmental personnel meticulously evaluate each work activity to determine the appropriate level of environmental review required. This thorough assessment ensures all potential environmental impacts are identified and managed effectively. To mitigate these impacts, environmental personnel implement both administrative and engineering controls.

Administrative controls encompass the development and enforcement of procedures, policies, and BMPs designed to guide environmentally responsible behavior and compliance with regulations. These controls help standardize operations and ensure all personnel are aware of and adhere to environmental requirements.

Engineering controls involve the application of physical measures to prevent or minimize environmental harm. This includes the use of advanced protective equipment, containment systems, and barriers designed to control emissions, manage waste, and protect natural resources. By integrating these controls, INL Site contractors not only safeguard the environment but enhance operational efficiency as well.

Together, these comprehensive measures reflect the collective commitment of the INL Site contractors to environmental stewardship, as well as a proactive approach to managing and mitigating the environmental impact of all activities.

3.4.5 Document and Record Control

Environmental documents are meticulously prepared, reviewed, revised, and issued by INL Site contractors in accordance with stringent standards and procedures. This rigorous process ensures all documentation meets the highest levels of accuracy, relevance, and compliance with the regulatory requirements.

INL's document control system plays a crucial role in this process by maintaining the most current versions of all environmental documents. The system ensures all contractor documents are easily accessible, legible, and clearly dated, providing employees with the most up-to-date information necessary for work. This accessibility and precision support informed decision-making and consistent application of environmental policies and procedures across the organization.

By leveraging this robust document control system, INL Site contractors not only uphold their commitment to environmental excellence but also enhance operational efficiency and accountability. This systematic approach ensures all personnel have the necessary tools and information to perform their duties in an environmentally responsible manner, fostering a culture of continuous improvement and compliance.

3.5 Check

INL Site contractors internally monitor compliance with environmental laws and regulations through the Assurance Portfolio process in the Contractor Assurance System. The INL Site contractors conduct assurance activities through performance metrics, observations, and assessments. Issues, trends, or improvements identified through these activities are rolled into the INL issues management database, where corrective actions are assigned and tracked to completion. Contractor assurance activities in the environmental organization are documented in a management review.

Various regulators also perform external assessments. The Idaho DEQ conducts several inspections annually to verify INL Site contractors are complying with state permits. The EPA also participates in Federal Facility Act-driven inspections and, on a determined frequency, participates alongside Idaho DEQ in compliance evaluation inspections. Chapter 2, "Environmental Compliance Summary," provides the results of the annual external agency audits and inspections of INL's Environmental Program.



3.5.1 INL Site Contractors Environmental Operating Experience

In 2024, the INL contractor received a "Green" or "Excellent" score for their EMS when graded by DOE in the DOE EMS Site Information Database, demonstrating their dedication to environmental performance and operational excellence. Environmental operating experience and performance measurement are key elements of an EMS. Numerous best management practices, initiatives, and implementation challenges were identified and summarized, as outlined in the following sections.

Similarly, the ICP contractor also received a "Green" or "Excellent" score for their EMS in 2024 when graded by DOE in the DOE EMS Site Information Database. The strong commitment to the environment by the ICP contractors is evident in their strong environmental policy.

INL Site Contractors EMS Best Practices

INL Contractor EMS Best Practices

During the EMS audits, best practices and system strengths were identified as follows:

- The recently developed regulatory analysis web-based interface tool facilitates communicating regulation changes impacting INL and soliciting responses from Environmental Support and Services Division (ES&S) technical POCs.
- The Nuclear Science and Technology Division (NS&T) has developed a tool called VISTA to assist in managing laboratory space for matching experiment needs with available laboratory resources. This tool will facilitate minimizing waste and increasing research and development efficiency while minimizing the environmental impact. The name VISTA comes from "inVentory of INL equipment, laboratories, and experTise for reseArch." It is currently being populated and tested. VISTA is not yet available for all researchers.
- A new web-based version of EMS objectives tracking and development will allow for a greater focus on environmental objectives sitewide.
- Risk messaging at the Advanced Test Reactor (ATR) Complex (e.g., posters, all employees, ATR Complex email blast) is truly innovating. The site created an easy way to communicate the "risk message" and to elevate the awareness of risk methodology.

These best practices demonstrate a strong commitment to environmental management and continuous improvement. These audits ensure compliance with environmental regulations, promote responsible practices, and help minimize environmental impact. By highlighting system strengths and weaknesses, EMS audits drive continuous improvement, foster a culture of environmental responsibility, and support the efficient use of resources. Ultimately, this process not only enhances operational efficiency and reduces risks but also demonstrates the organization's commitment to environmental responsibility.

ICP Contractor EMS Best Practices

In 2024, an EMS ISO 14001 surveillance audit was conducted at both Fort St. Vrain (FSV) and ICP facilities by an independent auditor.

A total of seven system strengths were documented (six at the INL facility and one at FSV) during this audit. The system strengths identified during the audits are as follows:

- Recognition was exhibited of the desirability to determine when available technology is ready for economically and effectively processing nuclear waste. This also can contribute to minimizing the total environmental impact of processing the waste.
- Use of the Integrated Waste Tracking System (IWTS) for managing the treatment, movement, and onsite and offsite disposal of hazardous and radioactive waste was found to be very effective. It provides an easily accessible record of the history and content of every waste container. The use of IWTS is strengthened by continued assessments of the IWTS entries. These periodic assessments ensure the data in IWTS are current and complete. Each container has a bar code that enables instant access to the pertinent IWTS files. The IWTS contains the three-axes coordinates for all waste in the Idaho CERCLA Disposal Facility.



- A strong culture of continuous improvement exists. When suggestions are made, people listen and act on those suggestions instead of ignoring them. This also contributes to a good work culture because it instills comfortability and willingness to speak up about various topics and issues.
- The care and attention that is paid to the environment was noted throughout the audit. It is apparently clear that there is a culture where people feel comfortable enough to pause work if that means doing something positive for the environment or contributing positively to their EMS aspects.
- Throughout the audit, ICP was observed to conduct thorough and comprehensive planning, to have strong environmental controls in place, and to have an effective environmental support function that ensures all environmental considerations are identified and addressed for all ICP projects and activities. The latter exhibited a proactive working relationship with all IEC personnel.
- The Submarine 1st Generation Westinghouse (S1W) decontamination and decommissioning team is in the process of introducing a technology that will enable steel painted with paint-containing PCBs to be recycled with the contaminated paint being removed. The paint will be removed by sponge blasting and the contaminated paint will be properly disposed. The effective application of this technology will enable more steel to be economically recycled.
- Integration of FSV processes into the ICP EMS has resulted in a synergistic relationship, which has benefited both organizations.

The audit team concluded that based on the results of the audit and the system's demonstrated state of development and maturity, continued management system certification is recommended. Additionally, the integration of FSV with ICP is now complete and their certifications will be merged into future assessments.

INL Site Contractors EMS Accomplishments

INL Contractor EMS Accomplishments

The most noteworthy accomplishments and successes for the INL EMS in FY 2024 include the following:

- The INL contractor completed the environmental assessment for the High Temperature Testing Facility in record time and successfully met the compressed timeframe required by the vendor.
- The INL contractor received feedback from DOE that its performance in managing the planning, development, and publication of the FY 2023 Annual Site Environmental Report was exceptional. INL was able to provide all interim report deliverables to DOE on or ahead of the required contract due dates, and its efficient and highly organized approach to integrating the contributions of five organizations and to resolving comments from 13 DOE reviewers enabled public release of the final report two weeks before the deadline mandated by the governing DOE order.
- The Cultural Resources Management Office continued to work cooperatively with DOE and the Shoshone-Bannock Tribes on the eastern Idaho Precontact Context and submitted a draft for DOE review. The Precontact Context creates efficiencies associated with the evaluation of cultural sites and is highly supported by the Shoshone-Bannock Tribes. This multi-year effort fulfills the commitments in the 2023 Programmatic Agreement, enhances the INL contractor's relationship with the Shoshone-Bannock Tribes and other agencies (i.e., Bureau of Land Management and Bureau of Reclamation), reduces reporting and consultation timeframes, and will position the Cultural Resources Management Office to produce significant scientific contributions to the field of archaeology.
- During the trimester, the ES&S University Engagement team reviewed curricula from 51 universities, initiated contact with 18 institutions, and identified 14 preferred programs. During FY 2024, ES&S staff participated in 16 recruiting events nationwide. The organization has received nine qualified student applicants and four intern hires from targeted universities.
- The INL contractor's Waste Management Program supported critical preparation efforts that allowed the inaugural ATR-5 cask shipment, which contained irradiated hardware from the ATR canal to be sent to the Remote-Handled Low-Level Waste Disposal Facility, supporting Notable Outcome 2.3.A – ATR and Materials and Fuels Complex infrastructure investment for reliability improvement. Maintaining a disposition pathway for materials stored in the canal is essential for the continued operation of ATR.

These successes include achieving regulatory compliance, reducing waste, and minimizing the organization's carbon footprint. Moreover, the EMS initiatives often result in cost savings through improved resource efficiency and energy conservation. The proactive identification and management of environmental risks further contributes to a safer and



healthier workplace. Overall, the successful deployment of an EMS reflects the dedication of an organization to environmental stewardship by fostering a positive reputation and strengthening stakeholder trust.

ICP Contractor EMS Accomplishments

During FY 2024, the ICP contractor's most noteworthy accomplishments and successes include:

- Since operations began at the Integrated Waste Treatment Unit in April 2023, more than 225,000 of 900,000 gallons of radioactive sodium-bearing liquid waste have been converted into a more stable, granular solid for packaging in stainless-steel canisters and storage in concrete vaults.
- The Advanced Mixed Waste Treatment Project completed its 7,500th transuranic waste shipment to the Waste Isolation Pilot Plant, representing about 10.5 million loaded miles.
- The remaining Accelerated Retrieval Project structures and a storage building were removed from the Subsurface Disposal Area and the initiation of capping in this area has begun. This was a 2024 DOE Office of Environmental Management priority.
- Ten transfers of Peach Bottom spent nuclear fuel from Generation 1 to Generation 2 vaults were completed.
- During FY 2024, the INL Idaho Nuclear Technology and Engineering Center Percolation Ponds Wastewater Reuse Permit (M-130-07) was reissued and six RCRA permit modification requests were submitted to meet the current environmental conditions.

These successes are key in addressing EMS priorities and making progress toward safely and successfully achieving the milestones indicated in the Idaho Settlement Agreement.

INL Site Contractors EMS Implementation Challenges

INL Contractor EMS Implementation Challenges

During the EMS audits, an opportunity for improvement was identified regarding the document control and review processes. Although these processes were determined to be effective overall, the auditor noted the organization would benefit from implementing greater oversight of the document review process. This increased oversight is necessary to minimize the risk of aging reviews, which can lead to outdated or inaccurate information being referenced in critical documents. As a result, corrective actions were incorporated to enhance the monitoring and management of the document review process. By addressing this opportunity for improvement, the organization aims to ensure all documents remain current, accurate, and reflective of the latest regulations and best practices, thereby maintaining the integrity and reliability of the EMS.

Additionally, several opportunities for improvement were identified internally that could enhance the efficiency and effectiveness of EMS:

- Internal procedures were revised to better identify specific interested parties beyond DOE. This revision facilitated clearer communication with relevant personnel about the various entities that INL collaborates with or serves, in accordance with the applicable regulations and standards.
- The practice of referencing documents by date or revision number in internal documentation was re-evaluated, particularly the 2018 INL Agenda. By removing specific dates and revision numbers, the organization avoided the need for frequent updates to maintain accuracy, thus streamlining document management.

By addressing these opportunities for improvement, the INL contractor has strengthened its EMS, enhanced its regulatory compliance, fostered its environmental responsibility, and promoted more effective internal communication and collaboration.

ICP Contractor EMS Implementation Challenges

An initial assessment of the release of per- and polyfluoroalkyl substances (PFAS) to the environment began in early FY 2024, prior to PFAS being regulated as a hazardous substance under CERCLA. The scope of the investigation was predicated on the assumption that PFAS would be regulated under CERCLA, which occurred in July 2024. Since PFAS had not been regulated previously, a lack of historical information remains today that limits the ability to perform an effective records search to confirm or rule out PFAS use or releases to the environment.



INL Site Contractors EMS Lessons Learned

INL Site contractors participate in the DOE Corporate Operating Experience (OPEX) Program, which facilitates the exchange of lessons learned and best practices across the DOE complex to prevent adverse operating incidents. The [DOE OPEXShare](#) database acts as the central, web-based repository for corporate operating experience, lessons learned, and best practices throughout the DOE complex. This collaborative platform is accessible to both government and private users.

The program encourages a graded approach to tailoring local operating experience programs based on the nature of the work, hazards, and organizational complexities. OPEX summaries inform the DOE complex of additional DOE or external operating experiences that facilities could benefit from. These summaries can include compilations of informative articles and lessons learned based on operating experience.

INL Contractor Environmental Operating Experience

Throughout FY 2024, the articles and videos sourced from DOE OPEX proved to be invaluable. Although the INL contractor encountered only two environmental issues in FY 2024, the information shared by the broader DOE community through OPEXShare enabled INL contractor employees to effectively utilize mitigation strategies and disseminate relevant information within the INL community. This likely helped prevent issues that other sites in the complex faced. OPEX remains an invaluable resource for INL contractors and other sites, promoting seamless collaboration and sharing of crucial information. Table 3-1 shows the number of environmental operating experiences shared by the INL contractor in OPEX during 2024.

Table 3-1. INL contractor environmental operating experience for 2024.

Lessons Learned Shared	8
Best Practices	0
Internally Generated Lessons Learned	2
OPEX Articles Shared to INL Community	6
Videos Shared	1

ICP Environmental Operating Experience

The Just-In-Time Lessons Learned process was established within the DOE OPEXShare Lessons Learned database in FY 2004 and was quickly adopted by the ICP contractor as a method to quickly share information to ensure that lessons learned from one facility are shared with other facilities. The ICP Just-In-Time quad chart and Lessons Learned alerts process has undergone various iterations throughout subsequent ICP contracts and is an integral part of the safety culture.

The ICP contractor continues to benefit from the shared knowledge available through the OPEXShare database. The insights gained from OPEXShare articles shared from all over the complex have helped staff apply proactive steps and problem-solving measures through the sharing of these important lessons through planning meetings, safety meetings, and other activities. This regular communication with workers about workplace safety and health matters keeps the workforce well informed on proven methods across the complex. Table 3-2 shows the number of environmental operating experiences shared by the ICP contractor in OPEXShare in FY 2024.

Table 3-2. ICP contractor environmental operating experience for 2024.

Lessons Learned Shared	50
Quad Charts	21
Internally Generated Lessons Learned	8

3.6 Act

INL Site contractors establish, implement, and maintain an issues management program in accordance with an internal procedure for contractor assurance. This program deals with actual or potential conditions of nonconformity, such as Notices of Violation, nonconformities with regulation, and opportunities for improvement from internal assessments and audits. All employees have access to the issues management software and the authority to identify and document any conceived issue. Communication of these identified issues is performed through the management review process.



Environmental concerns, safety, and emergency preparedness issues are documented and submitted for management review throughout all operations.

EMS management review is conducted by INL Site contractors through a process that includes weekly, monthly, quarterly, and annual meetings with committees and councils. This management review identifies issues that carry the largest environmental risks and provides mitigations and hold points. EMS performance trends, audit findings, objectives and targets, improvements, and risks are documented through the Contractor Assurance System in a management review report that is sent to senior management. Through this process, senior management is aware of the largest environmental risks to the INL Site. Senior management evaluates the management review report and recommends actions to continually improve environmental performance.

3.7 Accomplishments, Awards, and Recognition

The INL contractor was named as a winner of the 2024 Electronic Product Environmental Assessment Tool (EPEAT) Purchaser Awards. The INL contractor has earned the prestigious annual award since 2015. Winners were recognized for their purchases from six EPEAT product categories: (1) computers and displays, (2) imaging equipment, (3) mobile phones, (4) servers, (5) televisions, and (6) photovoltaic modules.

3.8 References

31 USC § 501. 2024. "Office of Management and Budget." Public Law 97-258. United States Code, Washington, DC.

DOE-ID. 2023. "Programmatic Agreement Among the Department of Energy, Idaho Operations Office, the Idaho State Historic Preservation Office, and the Advisory Council on Historic Preservation Concerning Management of the Manner in which the Department of Energy will meet its National Historic Preservation Act Responsibilities on the Idaho National Laboratory Site," U.S. Department of Energy, Idaho Operations Office, Idaho Falls, ID, USA.

DOE O 458.1. 2020. "Radiation Protection of the Public and the Environment." Administrative Change 4. U.S. Department of Energy, Washington, DC, USA.

INL. 2024. "Annual Laboratory Plan." INL/RPT-24-77692, April 2024. Idaho National Laboratory, Idaho Falls, ID, USA.

ISO. 2015. "Environmental Management Systems: Requirements with Guidance for Use." ISO 14001:2015, September 15, 2015. International Organization for Standardization, Geneva, Switzerland.



Saddle Mountain in the Lemhi Range.

Chapter 4: Environmental Monitoring Programs – Air



CHAPTER 4

An estimated total of 1,588 Ci (5.88×10^{13} Bq) of radioactivity, primarily in the form of short-lived noble gas isotopes, was released as airborne effluents from the Idaho National Laboratory (INL) Site facilities in 2024. The highest contributors to the total release were the Advanced Test Reactor (ATR) Complex at 69.6%, the Materials and Fuel Complex (MFC) at 27.6%, and the Radioactive Waste Management Complex (RWMC) at 2.55%. Other INL Site facilities contributed 0.19% to the total. The estimated maximum potential dose to a member of the public from all INL Site air emissions (0.015 mrem/yr) is below the regulatory standard of 10 mrem/yr (see Chapter 8 for details).

The INL Site environmental surveillance monitoring programs emphasize measurements of airborne contaminants in the environment because air is the most important transport pathway from the INL Site to receptors residing outside the INL Site boundary. Because of this pathway, samples of airborne particulates, atmospheric moisture, and precipitation were collected onsite, at INL Site boundary locations, and at offsite communities. These samples were analyzed for radioactivity in 2024.

INL Site contractors collect particulate filters from a network of air samplers and analyze them for gross alpha activity, gross beta activity, and the specific radionuclides described in Subsections 4.3.2 and 4.4.2. Then, the results were compared with the detection levels, background measurements, historical results, and radionuclide-specific Derived Concentration Standards (DCSs) established by the U.S. Department of Energy (DOE) to protect human health and the environment. Gross alpha and gross beta activities were used primarily for the trend analyses, which indicated observable fluctuations that correlate with seasonal variations in natural radioactivity.

The INL contractor detected amounts of americium-241 (^{241}Am), cesium-137 (^{137}Cs), strontium-90 (^{90}Sr), and zinc-65 (^{65}Zn) in some quarterly composited samples collected during 2024. All of these concentrations were within the historical measurements made during the past ten years (2014–2023), and well below the DCSs for these radionuclides.

The Idaho Cleanup Project (ICP) contractor detected amounts of ^{241}Am , plutonium-238 (^{238}Pu), and plutonium-239/240 ($^{239/240}\text{Pu}$) from some quarterly composited samples collected during 2024. These amounts were comparable to the last 5 years) and are likely due to resuspended soils contaminated from past burial practices in the Subsurface Disposal Area (SDA). The results were below the DCSs established for those radionuclides.

Atmospheric moisture and precipitation samples were analyzed for tritium. Tritium was detected in some samples and was most likely from natural production in the atmosphere rather than from INL Site releases. All measured results were below the health-based regulatory limits.

4. ENVIRONMENTAL MONITORING PROGRAMS – AIR

Although all INL Site facilities are carefully managed and controlled, the potential exists to release radioactive and nonradioactive hazardous constituents in amounts above the regulatory limits during an operational upset or emergency incident situation. In such an event, pathway vectors, such as air (see Chapter 4); soil, plants, animals (see Chapter 7); and groundwater (see Chapters 5 and 6) may transport these constituents to nearby populations. A conceptual model showing routes of exposure/pathways for these potential environmental releases can be found [here](#). Reviews of historical environmental data and environmental transport modeling indicate that air is a key pathway from INL Site releases to members of the general public. The ambient air monitoring network operates constantly and is a critical component of the INL Site's environmental monitoring programs. It monitors for routine and unforeseen releases, provides verification that the INL Site complies with regulatory standards and limits, and can be used to assess the impact to the environment over time. This chapter presents the INL Site contractors results of radiological analyses of airborne effluents and ambient air samples collected both on and off the INL Site. Click [here](#) for a summary of the radiological air monitoring activities relative to INL's major radiological sources, as well as the minor onsite and offsite radiological sources. Details may be found in the [INL Site Environmental Monitoring Plan](#) (DOE-ID 2023).



4.1 Organization of Air Monitoring Programs

The INL Site contractors document airborne radiological effluents at all INL Site facilities in an annual report prepared in accordance with 40 CFR 61, Subpart H, “National Emission Standards for Emissions of Radionuclides Other Than Radon from Department of Energy Facilities.” Subsection 4.2 summarizes the emissions reported in “National Emission Standards for Hazardous Air Pollutants—Calendar Year 2024 INL Report for Radionuclides” (DOE-ID 2025), referred to hereafter as the National Emission Standards for Hazardous Air Pollutants (NESHAP) Report. The report also documents the estimated potential dose received by the general public due to INL Site activities.

Ambient air monitoring is conducted by the INL contractor to ensure the INL Site remains in compliance with the requirements in DOE O 458.1, “Radiation Protection of the Public and the Environment.”

The INL contractor collects air samples primarily around the INL Site encompassing a region of 23,390 km² (9,000 mi²), which also extends to Jackson, Wyoming. In addition, the INL contractor collects air moisture samples at eight locations and precipitation samples at four locations for tritium analysis. Subsection 4.3 summarizes the results for ambient air monitoring conducted in 2024.

The ICP contractor monitors air around waste management facilities to comply with DOE O 435.1, “Radioactive Waste Management.” These facilities are the Subsurface Disposal Area (SDA) at RWMC and the Idaho Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Disposal Facility (ICDF) near the Idaho Nuclear Technology and Engineering Center (INTEC). Subsection 4.4 discusses the air sampling process the ICP contractor performs in support of waste management activities. In 2024, the ICP contractor collected approximately 210 air samples (including duplicate samples) for various radiological analyses.

The National Oceanic and Atmospheric Administration (NOAA) has collected meteorological data at the INL Site since 1950. The data historically have been tabulated, summarized, and reported in several climatology reports and used by scientists to evaluate atmospheric transport and dispersion. The latest report, “Climatology of the Idaho National Laboratory,” Fourth Edition (Clawson et al. 2018), was prepared by the Special Operations and Research Division of the Air Resources Laboratory and presents over 20 years (1994–2015) of quality-controlled data from the NOAA INL mesonet meteorological monitoring network. More recent data are provided by the Special Operations and Research Division to scientists modeling the dispersion of INL Site releases (see Chapter 8 in this annual report and a supplement to this annual report, “Meteorological Monitoring,” for more information).

4.2 Airborne Effluent Monitoring

Each regulated INL Site facility determines the airborne effluent concentrations from its regulated emission sources as required under state and federal regulations. Radiological air emissions from INL Site facilities also are used to estimate the potential dose to a hypothetical MEI, who is a member of the public (see Figures 8-1, 8-2, and 8-3 of this report). Radiological effluents and the resulting potential dose for 2024 are reported in the NESHAP Modeling Report (INL 2025a) and the NESHAP Report (DOE-ID 2025).

The NESHAP Report includes three categories of airborne emissions:

- Sources that require continuous monitoring under the NESHAP regulation are primarily the stacks at MFC, the Advanced Mixed Waste Treatment Project, and INTEC
- Releases from all other point sources (e.g., stacks, exhaust vents)
- Nonpoint—or diffuse—sources, otherwise referred to as fugitive sources, which include radioactive waste ponds, buried waste, contaminated soil areas, radiological test ranges, and decontamination and decommissioning operations.

INL Site emissions include all three airborne emission categories and are summarized in Table 4-2. The radionuclides included in this table were selected because they contribute 99.9% of the cumulative dose to the MEI estimated for each facility area. During 2024, an estimated 1,588 Ci (5.88×10^{13} Bq) of radioactivity was released to the atmosphere from all INL Site sources. The 2024 release is 110% lower than the estimated total of 3,341 Ci (1.24×10^{14} Bq) released in 2023. See DOE-ID-11441, “National Emission Standards for Hazardous Air Pollutants—Calendar Year 2024 INL Report for Radionuclides,” for further information about facility emissions. Figure 4.1 shows the facilities that were major contributors to the total emissions.

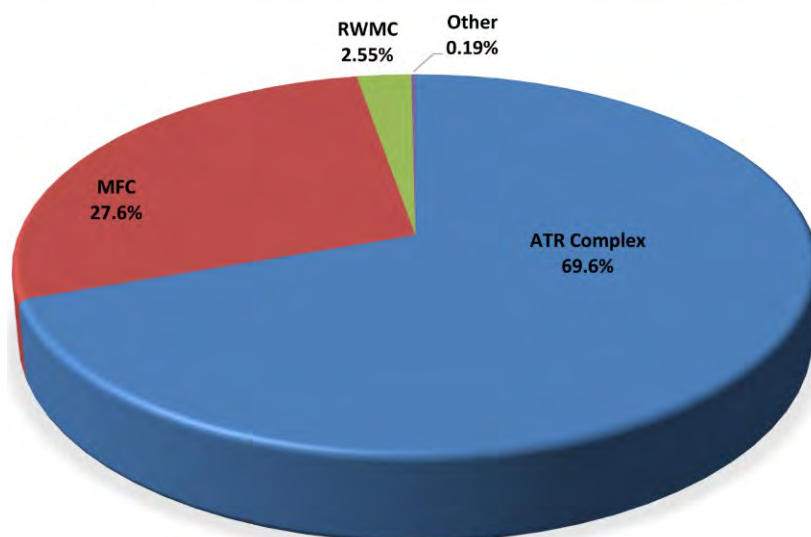


Figure 4-1. Percent contributions in Ci, by facility, to total INL Site airborne radiological releases (2024).

The estimated radionuclide releases (Ci/yr) from INL Site facilities, as shown in Table 4-1, were used to calculate the dose to the hypothetical MEI member of the public, who is assumed to reside near the INL Site perimeter. To calculate the dose to the MEI, radionuclides with very short half-lives must be converted to the first progeny with a suitable half-life for modeling, where applicable. The estimated emissions are then scaled based on the difference in activity between the parent and the progeny. The estimated dose to the MEI in calendar year 2024 was 0.015 mrem/yr (0.15 μ Sv/yr), which is below the regulatory standard of 10 mrem/yr. Six radionuclides—uranium-238 (^{238}U), uranium-234 (^{234}U), chlorine-36 (^{36}Cl), tritium (^3H), cesium-137 (^{137}Cs), and strontium-90 (^{90}Sr)—are responsible for more than 90% of the MEI dose. Potential radiation doses to the public are discussed in more detail in Chapter 8 of this report.

4.3 Ambient Air Surveillance Monitoring

Ambient air surveillance monitoring is conducted onsite and offsite to identify regional and historical trends, detect accidental and unplanned releases, and determine whether air concentrations are below the DCSs established by DOE for inhaled air (DOE 2021). Each radionuclide-specific DCS corresponds to a dose of 100 mrem for continuous exposure during the year. The Clean Air Act NESHAP regulatory standard is 10 mrem/yr (0.1 mSv/yr) (40 CFR 61, Subpart H). All ambient air surveillance monitoring sample results for 2024 are provided in the quarterly surveillance reports (INL 2025b, INL 2025c, INL 2025d, and INL 2025e).

4.3.1 Sampling Design

The INL contractor monitors a total of 36 low-volume air samplers (including four quality assurance samplers), one high-volume air sampler, eight atmospheric moisture samplers, and four precipitation samplers that operated in the network in 2024.

Historically, air samplers were positioned near INL Site facilities or sources of contamination, in predominant downwind directions from sources of radionuclide air emissions, at potential offsite receptor population centers, and at background locations. In 2015, the network was evaluated quantitatively, using atmospheric transport modeling and frequency of detection methods (Rood, Sondrup, and Ritter 2016). A Lagrangian Puff air dispersion model (CALPUFF) with three years of meteorological data was used to model atmospheric transport of radionuclides released from six major facilities and to predict air concentrations at each sampler location for a given release time and duration. The frequency of detection is defined as the fraction of events resulting in a detection at either a single sampler or within the network. The frequency of detection methodology allowed for an evaluation of short-term releases that included effects of short-term variability in meteorological conditions. Results showed the detection frequency was over 97.5% for the entire network considering all sources and radionuclides. Network intensity results (i.e., the fraction of samplers in the network that have a positive detection for a given event) ranged from 3.75 to 62.7%. An evaluation of individual samplers indicated some samplers were poorly located and added little to the overall effectiveness of the network. Using this information, some monitors were relocated to improve the performance of the network. In 2019, the frequency of detection method was used to evaluate the REC facilities in Idaho Falls (INL 2019), which resulted in the installation of an additional monitor at the INL Research Center.

**Table 4-1. Radionuclide composition of INL Site airborne effluents (2024).^a**

RADIONUCLIDE ^c	HALF-LIFE ^d	AIRBORNE EFFLUENT (Ci) ^b										TOTAL
		ATR COMPLEX	CFA ^e	CITRC ^e	INTEC	MFC	NRF ^e	RRTR ^e	RWMC	SMC ^e	TAN ^e	
Americium-243	7,350 y	NS	1.06E-05	—	—	NS	NS	—	—	—	—	1.06E-05
Argon-41	1.83 h	8.84E+02	NS	—	—	7.70E+01	—	—	—	—	—	9.61E+02
Carbon-14	5730 y	NS	NS	NS	3.19E-02	—	5.80E-01	—	NS	—	—	6.12E-01
Chlorine-36	3.01 x 10 ⁵ y	—	NS	—	NS	7.19E-03	—	—	—	—	—	7.19E-03
Cobalt-60	5.271 y	5.10E-03	NS	—	5.17E-06	NS	NS	—	NS	—	—	5.11E-03
Hydrogen-3	12.3 y	1.94E+02	3.50E-01	4.33E-01	1.77E-01	2.17E+02	NS	—	4.05E+01	—	NS	4.52E+02
Iodine-129	1.57 x 10 ⁷ y	NS	NS	NS	1.06E-04	NS	NS	—	—	—	—	1.06E-04
Krypton-85	10.756 y	—	NS	—	1.09E+00	NS	NS	—	—	—	—	1.09E+00
Krypton-87	76.3 min	NS	NS	—	—	9.96E+00	—	—	—	—	—	9.96E+00
Krypton-88	2.84 h	NS	NS	—	—	9.06E+00	—	—	—	—	—	9.06E+00
Plutonium-238	87.7 y	NS	NS	—	7.68E-08	NS	NS	—	NS	—	—	7.68E-08
Plutonium-239	24,065 y	NS	NS	—	4.26E-08	NS	2.02E-06	—	NS	—	—	2.06E-06
Plutonium-241	14.329 y	NS	NS	—	1.56E-06	NS	NS	—	NS	—	—	1.56E-06
Plutonium-242	3.75x10 ⁵ y	NS	6.50E-07	—	2.97E-16	NS	NS	—	—	—	—	6.50E-07
Strontium-90	29.12 y	2.88E-02	NS	—	2.60E-06	2.42E-03	4.53E-05	—	NS	—	3.01E-05	3.13E-02
Uranium-234	2.46 x 10 ⁵ y	NS	NS	—	NS	4.35E-02	—	—	—	2.38E-09	—	4.35E-02
Uranium-235	7.04 x 10 ⁸ y	NS	NS	1.94E-10	NS	2.63E-03	—	—	NS	NS	—	2.63E-03
Uranium-238	4.5 x 10 ⁹ y	NS	NS	1.52E-08	NS	4.34E-02	—	—	NS	1.09E-08	—	4.34E-02
Xenon-135	9.09 h	2.04E+01	NS	—	—	NS	—	—	—	—	—	2.04E+01
Xenon-138	14.1 min	NS	—	—	—	1.54E+01	—	—	—	—	—	1.54E+01
TOTAL CURIES RELEASED		1.10E+03	3.50E-01	4.33E-01	1.30E+00	3.45E+02	5.81E-01	1.50E-05	4.05E+01	1.33E-08	3.01E-05	1.49E+03
TOTAL DOSE (mrem)^h		6.83E-04	1.22E-05	2.04E-06	3.39E-06	1.39E-02	7.69E-05	1.65E-11	2.95E-04	3.78E-10	1.10E-06	1.49E-02

a. Radionuclide release information provided by the INL contractor (INL 2025a).

b. One curie (Ci) = 3.7×10^{10} becquerels (Bq).

c. Includes only those radionuclides that collectively contribute 99.9% of the total dose to the MEI estimated for each INL Site facility. Other radionuclides not shown in this table account for less than 0.1% of the dose estimated for each facility.

d. Half-life units: m = minutes, h=hours, d = days, and y = years.

e. CFA = Central Facilities Area, CITRC = Critical Infrastructure Test Range Complex, NRF = Naval Reactors Facility, RRTR = Radiological Response Training Range, SMC = Specific Manufacturing Capability, TAN = Test Area North.

f. NS = not significant. The radionuclide was estimated to not be one of the top 99.9% contributors to the total MEI dose from that facility.

g. A long dash signifies the radionuclide was not reported to be released to the air from the facility in 2024.

h. The annual dose (mrem) for each facility was calculated at the location of the MEI using estimated radionuclide releases and methodology recommended by the EPA. See Chapter 8 for details.



Tritium, a radioactive form of hydrogen with a half-life of about 12 years, is monitored at specific locations across the INL Site as part of the air surveillance monitoring program. It combines with oxygen to form tritiated water, which behaves like regular water and can be found in surface water, precipitation, and atmospheric moisture. Tritium naturally occurs in the atmosphere due to cosmic rays interacting with atmospheric gases and can be detected in precipitation. Since the 1963 Nuclear Test Ban Treaty, tritium levels in precipitation have decreased due to radioactive decay and dilution in the oceans. The International Atomic Energy Agency has participated in surveying tritium compositions in precipitation around the globe since 1961. Long-term data suggest that tritium levels in precipitation are close to their pre-nuclear test values (Cauquoin et al. 2015). At the INL Site, tritium in precipitation is likely from natural sources rather than weapons testing. Tritium present in air moisture is likely due to natural atmospheric production, past global nuclear fallout, and releases from INL Site facilities. Historical emissions data show that most tritium was released from the ATR Complex, INTEC, and RWMC. Atmospheric moisture samplers are placed at seven locations: Atomic City, Craters of the Moon, EFS, Howe, Idaho Falls (two samplers), the RHLLW Disposal Facility, and Van Buren Boulevard. The INL contractor has collocated precipitation samplers at four locations: Atomic City, EFS, Howe, and Idaho Falls. The EPA has a precipitation sampler in Idaho Falls and subsamples are collected for the INL contractor.

Although there are more particulate air surveillance monitoring stations, additional atmospheric moisture and precipitation monitoring stations are not needed as the estimated potential dose from INL Site releases is less than 0.1 mrem/yr, which is DOE's recommended limit for routine surveillance (DOE 2015). For more information on dose, see Chapter 8.

To support emergency response, the INL contractor maintains 16 high-volume event air samplers at NOAA weather towers. These event monitors are only turned on as needed for sampling if an event occurs, such as a range fire or an unplanned release of radioactivity.

4.3.2 Sampling Methods

Air Particulates

Filters are collected weekly by the INL contractor from a network of low-volume air samplers. A pump pulls air (about 57 L/min [2 ft³/min]) through a 5-cm (2-in.), 1.2- μ m particulate filter and a charcoal cartridge, at each low-volume air sampler. After a five-day holding time to allow for the decay of naturally occurring radon progeny, the filters are analyzed in a laboratory for gross alpha and gross beta activity. Gross alpha and gross beta results are considered screenings because specific radionuclides are not identified. Rather, the results reflect a mix of alpha- and beta-emitting radionuclides. Gross alpha and gross beta radioactivity in air samples is typically dominated by the presence of naturally occurring radionuclides. Gross beta radioactivity is, with rare exceptions, detected in each collected air filter. Gross alpha activity is detected intermittently, but it tends to be detected more often during wildfires and when there are temperature inversions. If the results are higher than those typically observed, sources other than background radionuclides may be suspected, and other analytical techniques are used to identify specific radionuclides of concern. Also gross alpha and gross beta activity are examined over time and between locations to detect trends, which might indicate the need for more specific analyses.

The filters are composited quarterly for each location by the analytical laboratory prior to analysis for gamma-emitting radionuclides, such as ¹³⁷Cs, which is a man-made radionuclide present in soil both onsite and offsite due to historical INL Site activities and global fallout. The contaminated soil particles can become airborne and subsequently filtered by air samplers. Naturally occurring gamma-emitting radionuclides that typically are detected in air filter monitoring include beryllium-7 (⁷Be) and potassium-40 (⁴⁰K).

The INL contractor also uses a contracted laboratory to radiochemically analyze quarterly composited samples for selected alpha- and beta-emitting radionuclides, including ²⁴¹Am, ³⁶Cl, ²³⁸Pu, ^{239/240}Pu, ^{233/234}U, ²³⁸U, and ⁹⁰Sr. In 2024, an analysis of quarterly composite samples for ³⁶Cl, ^{233/234}U, and ²³⁸U began as a result of the radionuclides being listed as contributors to the estimated MEI annual dose (see Chapter 8, Subsection 8.2.1). MFC was listed as the location with a ³⁶Cl source term that contributed >0.005%; therefore, analysis for ³⁶Cl was only performed on samples collected from MFC. Additional radionuclides were selected for analysis because they have been detected historically in air samples and may be present due to site releases or to the resuspension of surface soil particles contaminated by INL Site activities or from global fallout.

Radioiodine

Charcoal cartridges are collected and analyzed weekly for iodine-131 (¹³¹I) by the INL contractor at the same locations as the air filters. The ¹³¹I isotope is of particular interest because it is produced in relatively large quantities by nuclear fission, is readily accumulated in human and animal thyroids, and has a half-life of eight days. This means that any elevated concentration of ¹³¹I in the environment could be from a recent release of fission products.



Tritium

Air is passed through an adsorbent material (molecular sieve) that captures water vapor. Once enough moisture has been collected, the molecular sieve is sent to a laboratory for analysis. The laboratory extracts water from the material by distillation and determines the tritium concentrations through liquid scintillation counting.

Precipitation samples collected by the INL contractor are also analyzed for tritium using liquid scintillation counting.

4.3.3 Ambient Air Surveillance Monitoring Results

Gaseous Radioiodines

The INL contractor collected and analyzed approximately 1,844 charcoal cartridges—including blanks and duplicates—in 2024. There were no statistically positive measurements of ^{131}I .

Gross Activity

Gross alpha and gross beta results cannot provide concentrations of specific radionuclides. Because these radioactivity measurements include naturally occurring radionuclides, such as ^{40}K , ^7Be , uranium, thorium, and the daughter isotopes of uranium and thorium, in uncertain proportions, a meaningful limit cannot be adopted or constructed. However, elevated gross alpha and gross beta results can be used to indicate a potential problem, such as an unplanned release, on a timely basis. Weekly results are reviewed for changes in patterns between locations and groups (i.e., onsite, boundary, and offsite locations) and for unusually elevated results. Anomalies are further investigated by reviewing sample or laboratory issues, meteorological events (e.g., inversions), and INL Site activities that are possibly related. If indicated, analyses for specific radionuclides may be performed. This data provides useful information for trending of the total activity over time.

Results that detected gross alpha and gross beta by ambient air surveillance monitoring conducted by the INL contractor are summarized in Table 4-2.

Table 4-2. Gross alpha and gross beta detected in ambient air samples collected by the INL contractor in 2024.

RADIONUCLIDE	NUMBER OF DETECTED RESULTS ^a	LOCATION OF MINIMUM DETECTED CONCENTRATION	MINIMUM CONCENTRATION (10^{-15} $\mu\text{Ci/mL}$) ^b	LOCATION OF MAXIMUM DETECTED CONCENTRATION	MAXIMUM CONCENTRATION (10^{-15} $\mu\text{Ci/mL}$)
Gross Alpha	1,208 of 1,593	Craters of the Moon	0.77 ± 0.25	MFC South	7.07 ± 0.81
Gross Beta	1,579 of 1,593	EBR-I	1.08 ± 0.35	Arco	276.00 ± 3.78

a. Excludes blanks and duplicates.

b. Results $\pm 1\sigma$. Results shown are $\geq 3\sigma$ and below the DCS values for these radionuclides in air.

Gross Alpha. The elevated alpha result for the air filter collected at MFC South (7.07 ± 0.81) $\times 10^{-16}$ $\mu\text{Ci/mL}$ on December 11, 2024, is likely the result of a temperature inversion.

The maximum result is less than the DCS (DOE 2022) of 1.1×10^{-13} $\mu\text{Ci/mL}$ for $^{239/240}\text{Pu}$, which is the most conservative specific radionuclide DCS that could be—although unrealistically—applied to gross alpha activity. Gross alpha results are within the historical range, as shown in Figure 4-2.

Gross Beta. The highest detected value (i.e., greater than three sigma [3σ]) was $(27.6 \pm 0.4) \times 10^{-14}$ $\mu\text{Ci/mL}$ collected by the INL contractor at Arco on March 27, 2024. In general, median airborne radioactivity levels for the onsite, boundary, and offsite locations tracked each other closely throughout the year and are within the historical range of the past four years, as observed in Figure 4-2. The typical temporal fluctuations for natural gross beta concentrations in the air were observed, with higher values usually occurring at the beginning and end of the calendar year during winter inversion conditions (see sidebar). This pattern occurs over the entire sampling network, is representative of natural conditions, and is not caused by a localized source, such as a facility or activity at the INL Site. An inversion can lead to natural radionuclides being trapped close to

What is an inversion?

Usually within the lower atmosphere, the air temperature decreases with height above the ground. This is largely because the atmosphere is heated from below as solar radiation warms the earth's surface, which, in turn, warms the layer of the atmosphere directly above it. A meteorological inversion is a deviation from this normal vertical temperature gradient such that the temperature increases with height above the ground. A meteorological inversion is typically produced whenever radiation from the earth's surface exceeds the amount of radiation received from the sun. This commonly occurs at night or during the winter when the sun's angle is very low in the sky.



the ground. The maximum weekly gross beta concentration is significantly below the DCS of 9.6×10^{-12} $\mu\text{Ci/mL}$ for the most restrictive beta-emitting radionuclide in the air, ^{90}Sr .

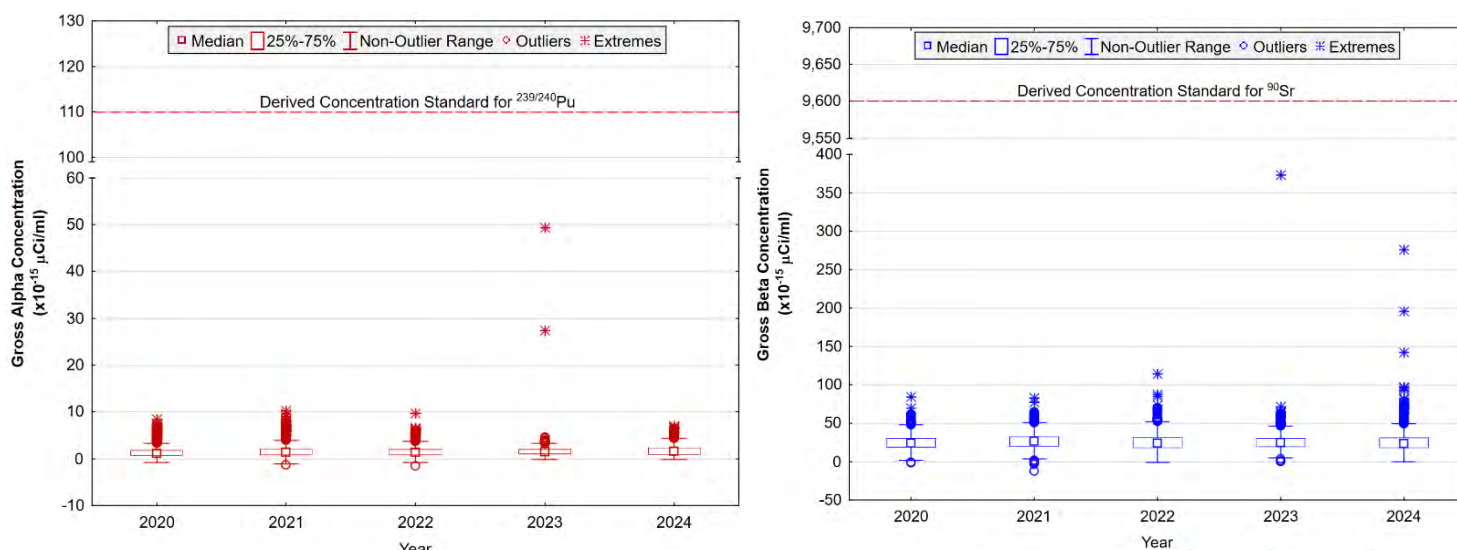


Figure 4-2. Gross alpha (left) and gross beta (right) five-year trend.

Gross Activity Statistical Comparisons. Statistical comparisons were made using the gross alpha and gross beta radioactivity data collected by the INL contractor from the onsite, boundary, and offsite locations. For these analyses, uncensored analytical results (i.e., values less than their analysis-specific minimum detectable concentrations) were included. There were a few statistical differences between the monthly and quarterly datasets collected by the INL contractor during 2024 that can be attributed to expected statistical variation in the data and not to the INL Site releases detailed in the [quarterly reports](#).

Specific Radionuclides

The INL contractor observed a detection of ^{137}Cs and ^{65}Zn in a quarterly composited sample collected from EBR-I during the third quarter, as indicated in Table 4-3. Concentrations of ^{241}Am were detected in two quarterly composited samples. The detectable concentrations ranged from 1.86×10^{-17} $\mu\text{Ci/mL}$ at Van Buren during the first quarter to 2.90×10^{-17} $\mu\text{Ci/mL}$ at RWMC during the third quarter. Concentrations of ^{90}Sr were detected in six quarterly composited samples. The detectable concentrations ranged from 5.46×10^{-17} $\mu\text{Ci/mL}$ at RHLLW during the first quarter to 6.14×10^{-16} $\mu\text{Ci/mL}$ at Van Buren also during the first quarter as well. All results were within the historical measurements made during the past ten years from 2014–2023. All results were well below the DCSs for these radionuclides in air (i.e., 3.8×10^{-11} $\mu\text{Ci/mL}$ for ^{137}Cs , 9.6×10^{-12} $\mu\text{Ci/mL}$ for ^{90}Sr , 1.2×10^{-9} $\mu\text{Ci/mL}$ for ^{65}Zn , and 1.3×10^{-13} $\mu\text{Ci/mL}$ for ^{241}Am). In addition to the radionuclides discussed earlier, the INL contractor began surveillance monitoring for uranium during 2023. The detections of uranium radionuclides, as observed in Table 4-3, occur routinely at concentrations that suggest a natural origin (INL 2024c, INL 2024d, INL 2024e). Concentrations of ^{36}Cl were not detected in the quarterly composite samples collected from the samplers located at MFC in 2024. Natural ^7Be was detected in numerous INL contractor composite samples at concentrations consistent with past concentrations. Levels of atmospheric ^7Be result from reactions of galactic cosmic rays and solar energetic particles with nitrogen and oxygen nuclei in Earth's atmosphere.



Table 4-3. Human-made radionuclides detected in ambient air samples collected by the INL contractor in 2024.

RADIONUCLIDE	NUMBER OF DETECTED RESULTS	LOCATION OF MINIMUM DETECTED CONCENTRATION	MINIMUM CONCENTRATION ($\mu\text{Ci/mL}$) ^a	LOCATION OF MAXIMUM DETECTED CONCENTRATION	MAXIMUM CONCENTRATION ($\mu\text{Ci/mL}$)
Americium-241	2 of 148	Van Buren	(1.86 $\pm$ 0.53) E-17	RWMC	(2.90 $\pm$ 0.55) E-17
Cesium-137	1 of 148	NA ^b	ND ^c	EBR-I	(3.09 $\pm$ 0.84) E-16
Strontium-90	6 of 148	RHLLW	(5.46 $\pm$ 1.80) E-17	Van Buren	(6.14 $\pm$ 0.47) E-16
Uranium-233/234	23 of 148	Blackfoot	(1.62 $\pm$ 0.50) E-17	MFC-North	(5.20 $\pm$ 1.27) E-17
Uranium-238	32 of 148	Howe	(1.26 $\pm$ 0.41) E-17	EBR-I	(4.99 $\pm$ 1.04) E-17
Zinc-65	1 of 148	NA	ND	EBR-I	(7.92 $\pm$ 1.36) E-16

a. Results $\pm$ 1 σ . Results are $\geq$ 3 σ and below the DCS values.

b. NA = Not applicable.

c. ND = Not detected.

4.3.4 Atmospheric Moisture Surveillance Monitoring Results

During 2024, the INL contractor collected 76 atmospheric moisture samples at Atomic City, Craters of the Moon, EFS, Howe, Idaho Falls, RHLLW facility, and Van Buren. Table 4-4 shows a total of four tritium detections in 2024. The observed tritium concentrations are far below the DCS for tritium in air (as water vapor) of $1.3 \times 10^{-7} \mu\text{Ci/mL}_{\text{air}}$.

Table 4-4. Tritium detected in atmospheric moisture samples collected by the INL contractor in 2024.

RADIONUCLIDE	NUMBER OF DETECTED RESULTS	LOCATION OF MINIMUM DETECTED CONCENTRATION	MINIMUM CONCENTRATION ($\text{pCi/mL}_{\text{air}}$) ^a	LOCATION OF MAXIMUM DETECTED CONCENTRATION	MAXIMUM CONCENTRATION ($\text{pCi/mL}_{\text{air}}$)
Tritium	4 of 76	Craters of the Moon	(3.60 $\pm$ 1.17) E-13	Idaho Falls	(8.23 $\pm$ 2.61) E-13

a. Results $\pm$ 1 σ . Results are below the DCS value for tritium in air (as water vapor) $1.3 \times 10^{-7} \mu\text{Ci/mL}_{\text{air}}$.

The source of tritium measured in atmospheric moisture samples collected on and around the INL Site is probably of cosmogenic origin and, to some extent, global fallout. Tritium releases from non-fugitive sources are highly localized and although they may be detected immediately adjacent to the facility, they are unlikely to be detected at current air surveillance monitoring stations because of atmospheric dispersion.

4.3.5 Precipitation Surveillance Monitoring Results

The INL contractor collects precipitation samples weekly, when available, at Atomic City, EFS, and Howe. Precipitation is collected monthly at Idaho Falls for [EPA RadNet monitoring](#) and a subsample is taken by the INL contractor for analysis. A total of 69 precipitation samples were collected during 2024 from the four sites. Tritium was not detected in any of the samples. The DCS value is $2.6 \times 10^6 \text{ pCi/L}$ for tritium in water and within the historical range (-173 to 413 pCi/L) measured from 2014–2023. Then the results were compared with tritium concentrations reported by the EPA for precipitation during the 10-year period from [2002–2011](#) (measurements discontinued after 2011) based on the query of available data. Concentrations reported by EPA for Idaho Falls during that period ranged from -84–1718 pCi/L and averaged 35.1 pCi/L.

Annual tritium concentrations in atmospheric moisture and precipitation have no discernible statistical distribution, so nonparametric statistical methods were used to assess both datasets (see "[Statistical Methods Used in the Idaho National Laboratory Annual Site Environmental Report](#)," a supplement to this annual report). To summarize these results, box plots were constructed illustrating the annual tritium concentrations measured in atmospheric moisture (as water) and precipitation samples collected by the INL contractor for the past 10 years, as observed in Figure 4-3. The results appear to be similar for each year. A statistical comparison of both datasets using the non-parametric Wilcoxon Matched Pairs Test shows there are no differences between the median annual tritium concentrations measured in atmospheric moisture and in the precipitation samples. Because low levels of tritium exist in the environment at all times as a result of cosmic ray reactions with atmospheric gases in the upper atmosphere and the decreasing influence of fallout from nuclear weapons testing in the atmosphere and because tritium concentrations do not appear to differ between precipitation and atmospheric moisture samples, the source of tritium measured in precipitation and atmospheric moisture is most likely of natural origin and past nuclear tests and not from INL Site releases.

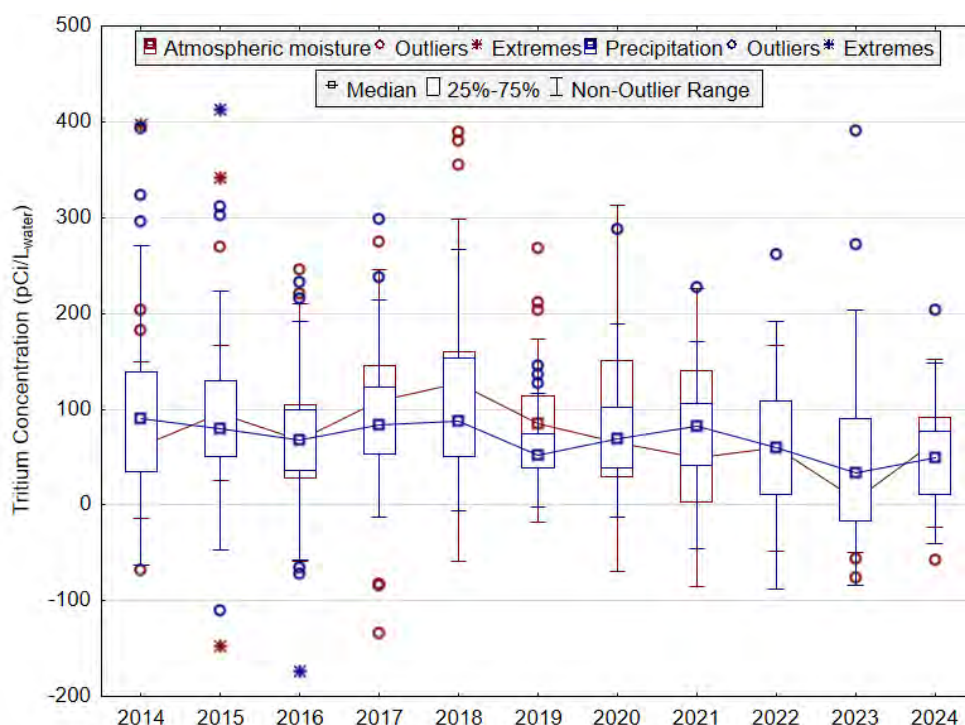


Figure 4-3. Box plots of tritium concentrations measured in atmospheric moisture and in precipitation from 2014–2024.

4.4 Waste Management Environmental Air Surveillance Monitoring

4.4.1 Gross Activity

The ICP contractor conducts environmental surveillance monitoring in and around waste management facilities to comply with DOE O 435.1, “Radioactive Waste Management.” Currently, ICP waste management operations are performed at the SDA at RWMC and the ICDF at INTEC. These operations have the potential to emit radioactive airborne particulates. The ICP contractor collected samples of airborne particulate material from the perimeters of these waste management areas in 2024. Also, samples were collected at a control location at Howe to compare with the results of the SDA and ICDF.

Samples were obtained using suspended particulate monitors similar to those used by the INL contractor. The 4-in.-diameter air filters are changed out on the closest working day to the first and the fifteenth of each month. Gross alpha and gross beta activity were determined on all suspended particulate samples. Table 4-5 shows the range of detected gross alpha and beta concentrations for 2024.

Table 4-5. Gross alpha and gross beta detected in ambient air samples collected by the ICP contractor in 2024.

RADIONUCLIDE	NUMBER OF DETECTED RESULTS	LOCATION OF MINIMUM DETECTED CONCENTRATION	MINIMUM CONCENTRATION ($\mu\text{Ci/mL}$) ^a	LOCATION OF MAXIMUM DETECTED CONCENTRATION	MAXIMUM CONCENTRATION ($\mu\text{Ci/mL}$)
Gross Alpha	167 of 182	SDA 9.3	1.71E-19	SDA 4.2C	1.82E-15
Gross Beta	167 of 182	SDA 9.3	2.89E-18	SDA 11.3	2.88E-14

a. Results $\pm 1\sigma$. Results are $\geq 3\sigma$ and below the derived concentration standard values for these radionuclides in air.

The 2024 results for the SDA and ICDF are well below their respective DCS values. Results from the SDA and ICDF were compared with the results collected from the background monitoring location in Howe. The ranges of concentrations measured at the SDA and ICDF were aligned with the range measured at the background monitoring location in Howe.



4.4.2 Specific Radionuclides

Air filters are collected by the ICP contractor, composited in a laboratory, and analyzed for human-made, gamma-emitting radionuclides and specific alpha-emitting and beta-emitting radionuclides. Gamma spectroscopy analyses are performed monthly, and radiochemical analyses are performed quarterly.

In 2024, no human-made, beta-emitting, gamma-emitting, or alpha-emitting radionuclides were detected in air samples at ICDF at INTEC. No gamma-emitting or beta-emitting radionuclides were detected in air samples at the RWMC SDA.

Table 4-6 shows human-made specific radionuclides detected in the SDA in 2024. These detections are consistent with levels measured in the air at the SDA in the last 5 years. All detections were three to four orders of magnitude below the DCS, as stipulated in [DOE 2022](#). Statistically, false positives at the 95% confidence error are possible.

Table 4-6. Human-made radionuclides detected in ambient air samples collected by the ICP contractor in 2024.

RADIONUCLIDE	NUMBER OF DETECTED RESULTS	LOCATION OF MINIMUM DETECTED CONCENTRATION	MINIMUM CONCENTRATION ($\mu\text{Ci/mL}$) ^a	LOCATION OF MAXIMUM DETECTED CONCENTRATION	MAXIMUM CONCENTRATION ($\mu\text{Ci/mL}$)
Americium-241	5 of 54	SDA 9.3	1.64E-17	SDA 4.2C	3.47E-16
Plutonium-238	1 of 27	SDA 4.2C	7.37E-18	–	–
Plutonium-239/240	3 of 27	SDA 2.3	1.02E-16	SDA 4.2C	1.34E-16
Uranium-233-234	19 of 27	SDA 6.3	1.42E-17	SDA 9.3A	7.62E-17
Uranium-238	17 of 27	SDA 9.3	1.37E-17	SDA 11.3A	8.25E-17

a. Results $\pm 1\sigma$. Results are $\geq 3\sigma$ and below the derived concentration standard values for these radionuclides in air.

In addition to the human-made, gamma-emitting radionuclides discussed above, the ICP contractor monitors for uranium. Detections of uranium radionuclides occur routinely at concentrations that suggest a natural origin, as shown in Table 4-6.

4.5 Hydrofluorocarbon Phasedown

Hydrofluorocarbons (HFCs) are the third generation of refrigerants; they were developed to replace Class II ozone-depleting substances. HFCs are used in the same applications in which ozone-depleting substances have historically been used, such as refrigeration and air conditioning, foam-blowing agents, solvents, aerosols, and fire-suppression systems. HFCs are non-ozone-depleting; however, they are also potent greenhouse gases with 100-year global warming potentials (e.g., a measure of the relative climatic impact of greenhouse gases) that can be hundreds to thousands of times more potent than carbon dioxide.

Atmospheric observations of most currently measured HFCs confirm their amounts are increasing in the global atmosphere at accelerating rates. Total HFC emissions increased by 23% from 2012 to 2016. The four most abundant HFCs in the atmosphere—in global warming potential-weighted terms—are HFC-134a, HFC-125, HFC-23, and HFC-143a (Federal Register Volume 86, Number 95, published May 19, 2021). The American Innovation and Manufacturing Act of 2020 included reductions for the production and consumption of HFCs. This is not a phaseout of HFC production, it is a phasedown. The end goal is an 80% reduction in production by 2036 as compared to the 2013 production baseline (OE-3 2021-06). This will decrease the availability of HFCs and increase their overall cost but the HFCs still will be available. The EPA recently finalized regulations restricting the use of some HFCs in certain applications; the compliance dates vary depending on the application. As with the phasedown regulations, the EPA is not prohibiting or restricting the use of existing equipment.

4.5.1 INL Contractor

The INL contractor compiled a list of equipment at its facilities containing HFCs and completed an impact analysis to better understand the potential impacts of this HFC phasedown. This list was obtained from a variety of sources: facility/operations personnel, laboratory personnel, fire-protection personnel, research and development organizations, engineering personnel, maintenance personnel, and environmental support and services personnel. The list includes heating, ventilating, and air conditioning (HVAC) systems that contain 50 pounds or more of refrigerant and computer room-air conditioning units that contain 50 pounds or more of refrigerant, fire-protection systems, and laboratory equipment. Most of the laboratory equipment containing HFCs were chillers used to cool specific pieces of equipment. Other laboratory equipment containing HFCs includes environmental chambers, a microwave digester, non-rad- and rad-



separator ion sources, non-rad- and rad-separator magnets, and a laser flash. This list does not include small HVAC equipment in units containing less than 50 pounds of refrigerant, refrigerators, drinking water fountains, or other small appliances. The INL contractor manages thousands of these small appliances at the facilities; most would be operated until failure and then replaced. The INL contractor identified 236 pieces of equipment and systems.

A list of equipment containing HFCs was obtained in March 2022. This list includes 46 HVAC systems that contain 50 pounds or more of refrigerant, 26 computer room-air conditioning units, six fire-protection systems, and 158 chillers, condensing units, etc., for laboratory equipment. There are currently no changes to operations because this is a phasedown—not a phaseout—and the EPA is not prohibiting the use of HFCs in existing equipment.

Additionally, the INL contractor is participating in the voluntary HFC Task Team led by AU-21, National Nuclear Security Administration. The goal of the task team is to better understand and address DOE's needs and determine next steps. The HFC Task Team wrote an Operating Experience Summary for the DOE Complex that provides information on operational impacts to critical systems from these regulations, which will decrease the amount of HFCs manufactured in the future (OES-2022-03, [HFC Phasedown Impacts Critical Operations](#)). The task team is currently exploring methods for documenting and sharing the review of alternatives within the DOE Complex.

The INL contractor issued a program description document (PDD) to implement the regulations for the use of HFCs and to inform applicable employees (e.g., engineers, environmental compliance professionals, project managers) of the requirements. Issuance included a required read by the applicable employees. The PDD will be listed in STD-139, "INL Engineering Standards" (INL 2021).

The INL contractor is in the process of implementing the HFC management regulations. This includes compiling a list of all HVAC equipment with a full charge of 15 pounds or more of HFC and creating a computer-based training for HVAC technicians.

4.5.1 ICP Contractor

An inventory of refrigeration equipment at ICP facilities, using HFCs scheduled for phasedown, was conducted in December 2021. This activity identified two chillers with four total circuits using HFC-134a at the Integrated Waste Treatment Unit (IWTU). The total charge for both chillers is approximately 830 lb. These units will continue to be used throughout the IWTU mission. ICP preventative maintenance practices will minimize the potential for leaks. ICP possesses an inventory of recovery cylinders dedicated to these units, ensuring that refrigerant recovered during maintenance is available to recharge the equipment. Should there be a major failure resulting in the loss of HFC-134a that renders the units inoperable, they would be replaced or retrofitted. New equipment at ICP will be specified to use refrigerants that are not subject to the HFC phasedown.

4.6 References

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Chapter 5: Environmental Monitoring Programs – Liquid Effluents Monitoring



CHAPTER 5

Wastewater (liquid effluent) discharged to land surfaces and infiltration basins (percolation ponds) at the Idaho National Laboratory (INL) Site is regulated by the state of Idaho groundwater quality and recycled water rules and requires a reuse permit. Liquid effluents and surface water runoff were monitored in 2024 by the INL contractor and the Idaho Cleanup Project (ICP) contractor for compliance with permit requirements and applicable United States (U.S.) Department of Energy (DOE) orders established to protect human health and the environment.

During 2024, permitted reuse facilities included the Advanced Test Reactor (ATR) Complex Cold Waste Ponds (CWP), the Idaho Nuclear Technology and Engineering Center (INTEC) Percolation Ponds and Sewage Treatment Plant (STP), and the Materials and Fuels Complex (MFC) Industrial Waste Pond (IWP). Liquid effluent and groundwater at these facilities were sampled for parameters required by their facility-specific permits. No permit limits were exceeded in 2024, with one exception. Groundwater chromium results in one monitoring well for the ATR Complex were elevated in 2024. The source of the elevated chromium levels is unlikely to be a result of current effluent discharges to the CWP but rather due to other factors, such as historical contamination. Chromium concentrations will continue to be monitored closely in the effluent and all permit monitoring wells.

Additional liquid effluent and groundwater surveillance monitoring was performed in 2024 at the ATR Complex, INTEC, and MFC to comply with the DOE environmental protection objectives. All parameters were below the applicable health-based standards in 2024.

Surface water that runs off the Subsurface Disposal Area (SDA) at the Radioactive Waste Management Complex (RWMC) during periods of rapid snowmelt or heavy precipitation was sampled and analyzed for radionuclides. Specific human-made gamma-emitting radionuclides were not detected. Detected concentrations of americium-241 (^{241}Am), plutonium-239/240 ($^{239/240}\text{Pu}$), and uranium isotopes did not exceed the DOE Derived Concentration Standards (DCS).

5. ENVIRONMENTAL MONITORING PROGRAMS – LIQUID EFFLUENTS MONITORING

Some INL Site operations retain wastewater in lined, total containment evaporative ponds constructed to eliminate liquid effluent discharges to the environment. Other INL Site operations discharge liquid effluents to unlined infiltration basins or ponds that may potentially contain nonhazardous levels of radioactive, or nonradioactive, contaminants. Effluent discharges are subject to specified discharge limits, permit limits, or maximum contaminant levels (MCLs). INL Site contractor personnel conduct liquid effluent monitoring through liquid effluent and surface water runoff sampling and surveillance programs to ensure compliance with applicable permits, limits, and MCLs. These programs also sample groundwater to evaluate the potential for groundwater impacts from current effluent discharges and operations.

Table 5-1 presents requirements for liquid effluent monitoring and surveillance performed at the INL Site. Maps and a comprehensive discussion of environmental monitoring, including liquid effluent monitoring and surveillance programs performed by various organizations within and around the INL Site, can be found in the “[INL Environmental Monitoring Plan](#)” (DOE-ID 2023a) and the “[Technical Basis for Environmental Monitoring and Surveillance at the Idaho National Laboratory Site](#)” (DOE-ID 2023b). To improve readability of this chapter, most data tables only contain results exceeding the specified discharge limits, permit limits, or MCLs. Data tables for other monitoring results are provided in Appendix A.

**Table 5-1. Liquid effluent monitoring and surveillance at the INL Site.**

MONITORING REQUIREMENTS			
AREA/FACILITY	IDAHO REUSE PERMIT ^a	DOE O 458.1 ^b LIQUID EFFLUENT MONITORING	DOE O 435.1 ^c SURFACE RUNOFF SURVEILLANCE
INL CONTRACTOR			
ATR Complex CWP	•	•	
MFC IWP	•	•	
ICP CONTRACTOR			
INTEC Percolation Ponds and STP	•	•	
RWMC SDA surface water runoff		•	•

- a. Required by permits issued according to Idaho Department of Environmental Quality (DEQ) Rules, IDAPA 58.01.17, “Recycled Water Rules.” This includes wastewater effluent and related groundwater monitoring.
- b. Paragraph 4(g) of DOE Order 458.1, “Radiation Protection of the Public and the Environment,” establishes specific requirements related to the control and management of radionuclides from DOE activities in liquid discharges, including protection of groundwater and drinking water. Radiological liquid effluent monitoring recommendations in DOE Handbook Environmental Radiological Effluent Monitoring and Environmental Surveillance (DOE-HDBK-1216-2015) (DOE 2015) are followed to ensure quality. DOE-STD-1196-2022, “Derived Concentration Technical Standard,” (DOE 2022) supports the implementation of DOE O 458.1 and provides the DCSs as reference values to control effluent releases from DOE facilities.
- c. The objective of DOE O 435.1, “Radioactive Waste Management,” is to ensure that all DOE radioactive waste is managed in a manner that is protective of worker and public health, as well as safety and the environment. This order requires that radioactive waste management facilities, operations, and activities meet the environmental monitoring requirements of DOE O 458.1. DOE Handbook DOE-HDBK-1216-2015 suggests that potential impacts of stormwater runoff as a pathway to humans or biota should be evaluated.

5.1 Liquid Effluent and Related Groundwater Compliance Monitoring

The discharge of liquid effluent to the land surface for treatment or disposal is known as “reuse” in the state of Idaho and is regulated by the Idaho DEQ “Recycled Water Rules” (IDAPA 58.01.17), “Wastewater Rules” (IDAPA 58.01.16), and “Ground Water Quality Rule” (IDAPA 58.01.11). The Idaho DEQ issues reuse permits for the operation of these reuse systems. Reuse permits may require the monitoring of nonradioactive constituents in the effluent and groundwater in accordance with the monitoring requirements specified within each permit. Some facilities may have specified radiological constituents monitored for surveillance purposes to comply with DOE orders (but are not required by regulations). The reuse permits may specify annual discharge volumes, application rates, and effluent quality limits. Annual reports (ICP 2025a and 2025b; INL 2025a, 2025b, 2025c, and 2025d) were prepared and submitted to the Idaho DEQ.

During 2024, the INL Site contractors monitored the following reuse facilities as required by the permits, as shown in Table 5-2:

- ATR Complex CWP (see Subsection 5.1.1)
- INTEC Percolation Ponds and STP (see Subsection 5.1.2)
- MFC IWP (see Subsection 5.1.3).



Table 5-2. 2024 status of INL Site contractors reuse permits.

FACILITY	PERMIT STATUS AT END OF 2024	PERMIT EXPIRATION DATE	EXPLANATION
ATR Complex CWP	Active	October 29, 2029	Idaho DEQ issued Reuse Permit I-161-03 on October 30, 2019 (DEQ 2019), with modifications issued May 23, 2022 (DEQ 2022a); and October 24, 2023 (DEQ 2023a).
INTEC Percolation Ponds	Active	June 25, 2034	Idaho DEQ issued Permit M-130-07 on June 25, 2024 (DEQ 2024).
MFC IWP	Active	January 25, 2027	Idaho DEQ issued Reuse Permit I-160-02 on January 26, 2017, with modifications issued March 7, 2017; May 8, 2019; and May 21, 2020 (DEQ 2020); May 23, 2022 (DEQ 2022b); and October 24, 2023 (DEQ 2023b).

Additional effluent and groundwater radiological constituents are monitored at these facilities to comply with the environmental protection objectives of [DOE O 458.1](#) and are discussed in Subsection 5.2. Surface water monitoring at RWMC is presented in Subsection 5.3.

5.1.1 Advanced Test Reactor Complex Cold Waste Ponds

Description. The Cold Waste Ponds (CWP) are located near the southeast corner of the ATR Complex compound, approximately 1.2 km (0.75 mi) northwest of the Big Lost River channel. The CWP was excavated in 1982 and consists of two unlined cells that function as percolation basins for the infiltration of nonhazardous industrial liquid effluent. This effluent consists primarily of noncontact cooling tower blowdown, once-through cooling water for air conditioning units, coolant water from air compressors, and wastewater from secondary system drains and other nonradioactive drains throughout the ATR Complex. Chemicals used in the cooling tower and other effluent streams discharged to the CWP include commercial biocides and corrosion inhibitors. The cold waste effluent reports through collection piping to a monitoring location where flow rates to the CWP are measured and effluent samples are collected using an automated composite sampler.

Effluent Monitoring Results for the Reuse Permit. Reuse Permit I-161-03 Modifications 1 and 2 require monthly sampling of the effluent to the CWP (DEQ 2022a, DEQ 2023a). The 2024 permit reporting year monitoring results are presented in the 2024 annual reuse report (INL 2025c). The 2024 calendar year monitoring results are summarized in Table A-1 in Appendix A. The total dissolved solids concentrations ranged from 195 mg/L to 1,020 mg/L. Sulfate ranged from 19.8 mg/L to 497 mg/L. Concentrations of sulfate and total dissolved solids are higher during reactor operation because of the evaporative concentration of the corrosion inhibitors and biocides added to the reactor cooling water. Due to the composition and characteristics of the effluent, the reuse permit does not require pretreatment or specify maximum constituent loading limits or concentration limits for the cold waste effluent discharged to the CWP. The 2024 constituent concentrations continue to remain stable and consistent with the historical results with no observable increasing or decreasing trends.

The permit specifies the maximum annual and five-year moving average hydraulic loading rate limits of 300 million gallons per year (MG/yr) and 375 MG/yr, respectively, based on the annual reporting year of the permit. As shown in Table A-2, the 2024 annual reporting year flow of 187.59 MG did not exceed either of these hydraulic loading limits.

Groundwater Monitoring Results for the Reuse Permit. The permit requires groundwater monitoring twice annually in April/May and September/October at the seven groundwater wells shown in Figure 5-1 to measure potential impacts from the CWP. In 2024, all constituents, with the exception of chromium, remained below their respective primary or secondary constituent standards. These constituents are presented in Table A-3. Well USGS-065 is the closest downgradient well and has historically had the highest concentrations for the constituents of interest, including chromium, nitrate + nitrite as nitrogen, sulfate, and total dissolved solids. Nitrate + nitrite as nitrogen continues to show a minor increasing trend in both



the upgradient and downgradient wells but remains well below the primary constituent standard. Sulfate and total dissolved solids are below their applicable secondary constituent standards and continue to gradually trend downward. Iron concentrations continue to remain at low levels and are consistent with the historical ranges with no observable trend. Chromium is a constituent of concern being addressed under the Comprehensive Environmental Response, Compensation, and Liability due to historical discharges that have been discontinued (see Chapter 6, Subsections 6.4 and 6.5.2 for more information). Chromium results in Well USGS-65 decreased from approximately 0.500 mg/L in the early 1970s to consistently being less than the primary constituent standard (PCS) of 0.100 mg/L starting in 2009. As shown in Figure 5-1, these concentrations remained relatively stable in the range of approximately 0.070 to 0.090 mg/L from 2010 through April 2024.

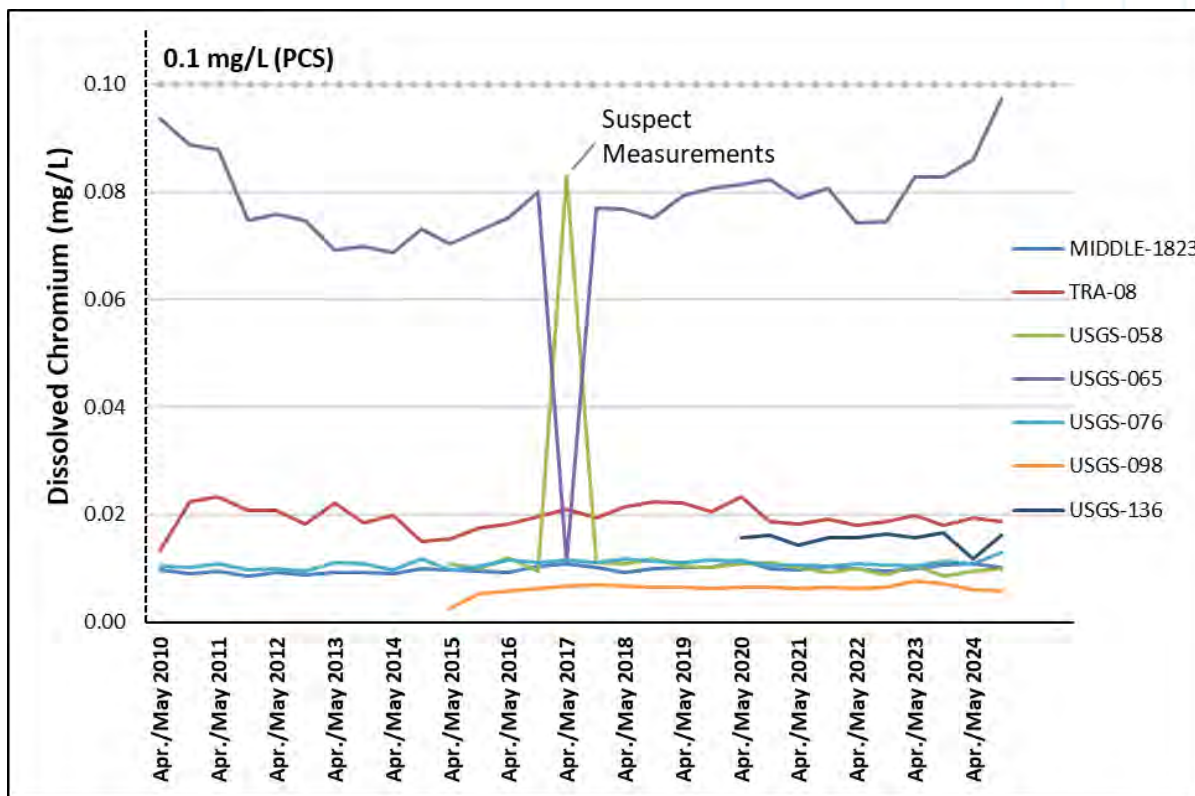


Figure 5-1. Dissolved chromium concentrations in the ATR Complex reuse permit monitoring wells (INL 2025c).

The September 2024 total and filtered chromium results collected from Well USGS-065 exceeded the PCS at 0.112 mg/L and 0.107 mg/L, respectively. During data validation, the laboratory chromium results were qualified as an estimate due to high-calibration bias. The results were reanalyzed by the laboratory and found to be below the PCS at 0.0979 mg/L and 0.0974 mg/L, respectively; however, the re-analysis results also were qualified during validation due to positive serial-dilution bias. As shown in Table A-1, the CWP effluent chromium concentrations in 2024 ranged from 0.0032 mg/L to 0.0136 mg/L, which is consistent with the historical results and significantly less than the concentrations observed in Well USGS-065. A comparison of the chromium concentrations in the CWP effluent and Well USGS-065 is shown in Figure 5-2. This difference suggests the source of these elevated chromium levels is unlikely to be a result of current effluent discharges to the CWP but rather due to other factors, such as historical contamination. Chromium concentrations will continue to be monitored closely in the effluent and all permit monitoring wells.

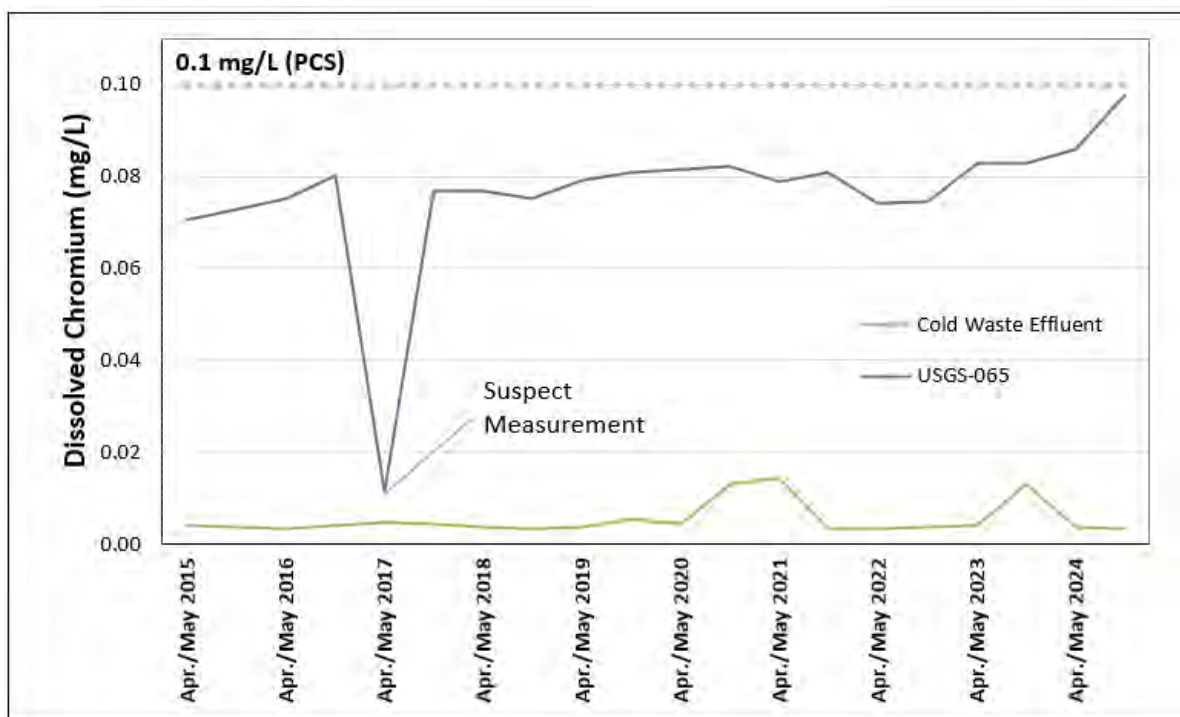


Figure 5-2. Dissolved chromium concentrations in the ATR Complex cold waste effluent from Well USGS-065 (INL 2025c).

5.1.2 Idaho Nuclear Technology and Engineering Center Percolation Ponds and Sewage Treatment Plant

Description. The INTEC Percolation Ponds are composed of two rapid infiltration ponds excavated into the surficial alluvium and surrounded by bermed alluvial material. The rapid infiltration system uses the soil ecosystem to treat wastewater. Each pond is 93 m × 93 m (305 ft × 305 ft) at the top of the berm and is approximately 3 m (10 ft) deep. Each pond is designed to accommodate a continuous wastewater discharge rate of 11.36 mL (3 mg) per day.

The INTEC Percolation Ponds receive a discharge of only industrial and municipal wastewater. Industrial wastewater (i.e., service waste) from INTEC operations consists of steam condensates, noncontact cooling water, water treatment effluent, boiler blowdown wastewater, stormwater, and small volumes of other nonhazardous/nonradiological liquids. Municipal wastewater (i.e., sanitary waste) is treated at the INTEC STP.

The STP is located east of INTEC, outside the INTEC security fence, and treats and disposes of sewage, septage, and other nonhazardous industrial wastewater at INTEC. The sanitary waste is treated by natural biological and physical processes (e.g., digestion, oxidation, photosynthesis, respiration, aeration, evaporation) in four lagoons. After treatment in the lagoons, the effluent is combined with the service waste and discharged to the INTEC Percolation Ponds.

The INTEC Percolation Ponds were permitted by Idaho DEQ to operate as a reuse facility under Reuse Permit M-130-07 (DEQ 2024).

Wastewater Monitoring Results for the Reuse Permit. Monthly samples were collected from CPP-769 (influent to STP), CPP-773 (effluent from STP), and CPP-797 (effluent to the INTEC Percolation Ponds). As required by the permit, all samples are collected as 24-hour composites, except pH, fecal coliform, and total coliform, which are collected as grab samples. The permit specifies the constituents that must be monitored at each location. The permit does not specify any wastewater discharge limits at these three locations. The 2024 reporting year monitoring results for CPP-769, CPP-773, and CPP-797 are provided in the 2024 Wastewater Reuse Report (ICP 2025a), and the 2024 calendar year monitoring results are summarized in Tables A-4, A-5, and A-6 in Appendix A.



The permit specifies maximum daily and yearly hydraulic loading rates for the INTEC Percolation Ponds. As shown in Table A-7, the maximum daily flow and yearly total flow to the INTEC Percolation Ponds were below the permit limits in 2024.

Groundwater Monitoring Results for the Reuse Permit. To measure the potential impact on groundwater from wastewater discharges to the INTEC Percolation Ponds, the permit requires that groundwater samples are collected from six monitoring wells.

The permit requires that groundwater samples are collected semiannually during April/May and September/October and lists which constituents must be analyzed. Contaminant concentrations in the monitoring wells are limited by primary constituent standards and secondary constituent standards as specified in IDAPA 58.01.11, "Ground Water Quality Rules."

Table A-8 shows the 2024 water table elevations and depth-to-water table, determined prior to purging and sampling, and the analytical results for all constituents specified by the permit for the aquifer wells. Table A-9 presents similar information for the perched water wells.

Tables A-8 and A-9 show all permit-required constituents associated with the aquifer monitoring wells were below their respective primary constituent standards and secondary constituent standards in 2024.

5.1.3 Materials and Fuels Complex Industrial Waste Pond

Description. The MFC Industrial Waste Pond (IWP) is an unlined basin that was first excavated in 1959. The industrial wastewater discharged to the IWP consists of primarily noncontact cooling water, cooling tower drains, and air wash flows. Small volumes of MFC-768 power plant cooling water system blowdown, intermittent reverse osmosis blowdown, and floor drain and laboratory sink discharges are also sent to the IWP. On occasion, with pre-approval, industrial wastewater from the MFC facility process holdup tanks discharge to the pipeline. The IWP functions as a percolation basin for the infiltration of the nonhazardous industrial effluent. The effluent reports through collection piping to a monitoring location where flow rates to the IWP are measured and the effluent samples are collected using an automated composite sampler.

Wastewater Monitoring Results for the Reuse Permit. Reuse Permit I-160-02 Modifications 4 and 5 require monthly sampling of effluent discharging into the IWP (DEQ 2022b, DEQ 2023b). The 2024 permit reporting year monitoring results are presented in the 2024 annual reuse report (INL 2025d), and the calendar year results are summarized in Table A-10. Based on the composition of the industrial effluent, the reuse permit does not require pretreatment or specify the maximum constituent loading limits or concentration limits. In 2024, concentrations of iron and manganese continued to be at or near the minimum detection levels of the laboratory instruments. Total dissolved solids ranged from 215 mg/L to 328 mg/L. The 2024 metals and total dissolved solids concentrations continue to be within historical ranges and remain stable with no observable trends. Effluent nitrate + nitrite as nitrogen concentrations are gradually trending upward at approximately the same rate and concentrations as the upgradient background groundwater concentration in Well ANL-MON-A-012. The aquifer is the source of water from which the industrial effluent is generated, and it is likely that the upgradient aquifer nitrogen concentrations are passing through the system to the effluent. As shown in Figure 5-3, there are no discernible impacts or changes between upgradient and downgradient groundwater quality. The lack of a significant difference from upgradient to downgradient indicates the reuse system is not impacting the groundwater.

The permit specifies an annual reporting year hydraulic loading limit of 17 MG/yr. As shown in Table A-11, the 2024 reporting year effluent flow of 7.753 MG/yr was well below the permit limit.

Groundwater Monitoring Results for the Reuse Permit. The reuse permit requires groundwater monitoring twice per year, in April/May and September/October, at one upgradient well and two downgradient wells, to measure potential impacts from the pond. The analytical results are summarized in Table A-12. In 2024, none of the constituents exceeded their respective primary or secondary constituent standards, and the analyte concentrations in the downgradient wells remained consistent with the background levels in the upgradient well.

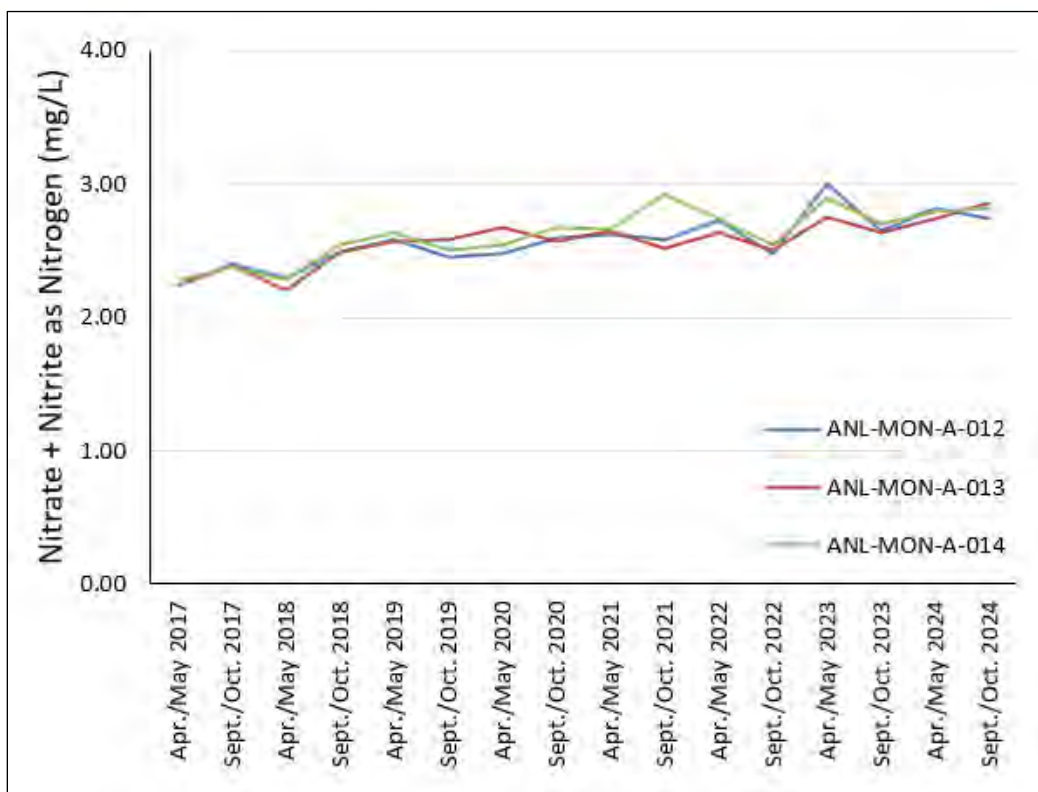


Figure 5-3. MFC groundwater nitrate + nitrite as nitrogen concentrations 2017 to 2024 (INL 2025d).

5.2 Liquid Effluent Surveillance Monitoring

The following subsections discuss the results of liquid effluent radiological surveillance monitoring performed at each wastewater reuse-permitted facility.

5.2.1 Advanced Test Reactor Complex

The effluent to the CWP is a combination of processed water from various ATR Complex facilities. Radiological surveillance of the CWP effluent is performed monthly for gross alpha, gross beta, gamma spectrometry, and tritium. The monthly CWP effluent radiological surveillance monitoring results are presented in the INL 2024 quarterly reports ([INL 2025e](#), [INL 2025f](#), [INL 2025g](#), and [INL 2025h](#)). In 2024, gross alpha and gross beta were the only surveillance constituents that were detected in the CWP effluent but were within the historical ranges with no observable trends. When gross alpha levels exceed a threshold of 5 pCi/L, additional analysis for radium-226 and radium-228 are performed as well. Radium-226 and radium-228 were analyzed in May and June 2024 but were not positively detected.

Additionally, seven groundwater monitoring wells are sampled twice per year for radiological surveillance and analyzed for gross alpha, gross beta, gamma spectrometry, strontium-90, and tritium. The groundwater radionuclide surveillance monitoring results are presented in the second and third quarter reports for 2024 ([INL 2025f](#), [INL 2025g](#)). All detected constituents, including tritium, gross alpha, and gross beta, were well below the Idaho groundwater primary constituent standards ([IDAPA 58.01.11](#)) and DCS ([DOE 2022](#)). Gross alpha and gross beta measurements remain within the historical ranges. Tritium continues to trend downward in the monitoring wells that have positive detections.

5.2.2 Idaho Nuclear Technology and Engineering Center

In addition to the permit-required monitoring summarized in Subsection 5.1.3, surveillance monitoring was conducted at CPP-797 (effluent to the INTEC Percolation Ponds), and groundwater monitoring was conducted at the INTEC



Percolation Ponds. Table A-13 summarizes the results of radiological monitoring at CPP-797, while Table A-14 provides the results of groundwater radiological monitoring in Wells ICPP-MON-A-165, ICPP-MON-A-166, ICPP-MON-V-200, and ICPP-MON-V-212.

Twenty-four-hour flow proportional samples were collected from the CPP-797 wastewater effluent and composited daily into a monthly sample. Each collected monthly composite sample was analyzed for specific gamma-emitting radionuclides, gross alpha, gross beta, and total strontium activity. As shown in Table A-13, no total strontium activity was detected in any of the samples collected at CPP-797 in 2024. Gross alpha was detected in four samples, while gross beta was detected in all 12 samples collected in 2024.

Groundwater samples were collected from the aquifer from Wells ICPP-MON-A-165 and ICPP-MON-A-166 and from perched water from Wells ICPP-MON-V-200 and ICPP-MON-V-212 in April/May 2024 and September 2024 and were analyzed for gross alpha and gross beta. As shown in Table A-14, gross alpha was detected in three of the four monitoring wells in April/May 2024 and one of the four monitoring wells in September 2024. Gross beta was detected in all monitoring wells in both the spring (April/May) and fall (September/October) sampling events. All detected constituents, including strontium-90, tritium, gross alpha, and gross beta, were below the Idaho groundwater primary constituent standards in [IDAPA 58.01.11](#).

5.2.3 Materials and Fuels Complex

Radiological surveillance of the effluent in the IWP is performed three times per year and analyzed for gross alpha, gross beta, gamma spectrometry, and tritium. Annual samples also are collected and analyzed for select isotopes of americium, strontium, plutonium, and uranium. The radiological surveillance monitoring results are presented in the second, third, and fourth quarter 2024 reports ([INL 2025f](#), [INL 2025g](#), [INL 2025h](#)). In 2024, gross alpha, gross beta, uranium-233/234, and uranium-238 were the only surveillance constituents detected in the IWP and are all well below the applicable DCS ([DOE 2022](#)) and remain within the historical ranges.

Additionally, three ground water monitoring wells are sampled twice per year for radiological surveillance and analyzed for gross alpha, gross beta, alpha spectrometry, gamma spectrometry, and tritium. The 2024 groundwater surveillance monitoring results are presented in the second and third quarter 2024 reports ([INL 2025f](#), [INL 2025g](#)). Overall, the detected results were below the Idaho groundwater primary constituent standards ([IDAPA 58.01.11](#)) and the applicable DCS ([DOE 2022](#)), remain within the historical ranges, and show no discernible impact from MFC operations.

5.3 Surface Water Runoff Surveillance Water Sampling

Radionuclides could be transported outside the RWMC boundaries via surface water runoff. Surface water runs off the SDA only during periods of rapid snowmelt or heavy precipitation. At these times, water may be pumped out of the SDA retention basin into a drainage canal, which directs the flow outside RWMC. The canal also carries runoff from outside RWMC that has been diverted around the SDA. In addition, water sheet flows across asphalt surfaces and infiltrates around/under door seals at Waste Management Facility (WMF)-636 at the Advanced Mixed Waste Treatment Project. The resulting surface water inflow accumulates in the WMF-636 Fire Water Catch Tanks A, B, C, and D. If the level of surface water in the Fire Water Catch Tanks reaches a predetermined level, the water is pumped into aboveground holding tanks, where it can be sampled, prior to discharge into the drainage canal surrounding the SDA.

In compliance with [DOE O 435.1](#), the ICP contractor collects surface water runoff samples at [RWMC SDA](#) from the WMF-636 Fire Water Catch Tanks. Surface water is collected to determine whether radionuclide concentrations exceed the administrative control levels or if concentrations have increased significantly, as compared with the historical data. A field blank is also collected for comparison. Samples from the WMF-636 Fire Water Catch Tanks were not collected during 2024 as periodic measurements of tank levels did not indicate pumping to be necessary.

A water sample was collected from the SDA Lift Station in 2024. This sample was analyzed for a suite of radionuclides that included americium-241, strontium-90, and plutonium and uranium isotopes. There were no positive three sigma (3σ) detections of americium-241, plutonium-238, plutonium-239/240, or strontium-90 in the samples taken in 2024. The maximum concentration detected for americium-241 was 0.984 (± 0.13) pCi/L, which is well below the 740 pCi/L DCS. The maximum concentration detected for plutonium-238 was 0.02 (± 0.01) pCi/L, which is well below the 430 pCi/L DCS.



The maximum concentration detected for plutonium-239/240 was $0.76 (\pm 0.07)$ pCi/L, which is well below the 400 pCi/L DCS as well. Finally, the maximum concentration detected for strontium-90 was $0.10 (\pm 0.03)$ pCi/L, which is well below the applicable DCS of 1,700 pCi/L. In addition to sampling for these nuclides, uranium isotopes were detected at levels consistent with the historical results, which were below any applicable DCS.

Table 5-3 summarizes the specific alpha and beta results of human-made radionuclides. No human-made gamma-emitting radionuclides were detected in the surface water runoff sample. ICP temporarily ceased sample collection since the teardown of the Accelerated Retrieval Project (ARP) V facility removed electrical facilities to the SDA Lift Station. The ICP contractor has revised their sampling procedure to allow for continued sampling at the SDA Lift Station considering the changes resulting from these closure activities.

Table 5-3. Radionuclides detected in surface water runoff at the RWMC SDA (2024).

LOCATION	PARAMETER	MAXIMUM CONCENTRATION ^a (pCi/L)	% DCS ^b
SDA Lift Station	Americium-241	2.35 ± 0.13	0.13
	Plutonium-238	0.02 ± 0.01	0.01
	Plutonium-239/240	0.76 ± 0.07	0.04
	Strontium-90	0.10 ± 0.03	0.04
	Uranium-234	0.53 ± 0.04	0.04
	Uranium-235	0.04 ± 0.01	0.00
	Uranium-238	0.44 ± 0.03	0.03

a. Result $\pm 1s$. Results shown are greater than 3σ .

b. See [DOE-STD-1196-2022](#), Table A-6 (DOE 2022).

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Chapter 6: Environmental Monitoring Programs – Eastern Snake River Plain Aquifer Monitoring



CHAPTER 6

One potential pathway for exposure from contaminants released at the Idaho National Laboratory (INL) Site is through the groundwater pathway. Historic waste disposal practices have produced localized areas of chemical and radiochemical contamination beneath the INL Site in the eastern Snake River Plain Aquifer. These areas are regularly monitored by the United States (U.S.) Geological Survey (USGS), and reports are published showing the extent of contamination plumes. Results for most monitoring wells within the plumes show decreasing concentrations of tritium, strontium-90 (^{90}Sr), and iodine-129 (^{129}I) over the past 20 years. The decrease is the result of radioactive decay, discontinued disposal, dispersion, and dilution within the aquifer.

In 2024, the USGS sampled 24 groundwater monitoring wells at the INL Site for analysis of 61 purgeable (volatile) organic compounds. Ten purgeable organic compounds were detected in at least one well. Most of the detected concentrations were less than the maximum contaminant levels (MCLs) established by the U.S. Environmental Protection Agency (EPA) for public drinking water supplies. One exception was carbon tetrachloride, which was detected in the production well and a perched groundwater well at the Radioactive Waste Management Complex (RWMC). This compound has shown a decreasing trend since 2005 and is removed from the water prior to human consumption. Also, trichloroethylene was also detected above the MCL at a perched groundwater well near RWMC where this contaminant has been detected in previous sampling events.

Groundwater surveillance monitoring required in area-specific Records of Decision under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) was performed at Waste Area Groups (WAGs) 1–4, and WAG 7 in 2024.

In addition to the effluent and associated ground water monitoring at the Advanced Test Reactor (ATR) Complex and the Materials and Fuels Complex (MFC), as discussed in Chapter 5, the INL contractor monitors groundwater at the Remote-Handled Low-Level Waste Disposal (RHLLW) Facility for the surveillance of select radiological analytes as well. The 2024 results continue to show no discernible impacts to the aquifer from RHLLW operations.

There are 11 drinking water systems on the INL Site monitored by INL Site contractors. All contaminant concentrations measured in drinking water systems in 2024 were below the regulatory limits.

Drinking water and springs were sampled in the vicinity of the INL Site and analyzed for gross alpha and gross beta activity and tritium. Some locations were co-sampled with the Idaho Department of Environmental Quality (DEQ) INL Oversight Program. Results were consistent with the historical measurements and do not indicate any impact from historical INL Site releases.

6. ENVIRONMENTAL MONITORING PROGRAMS – EASTERN SNAKE RIVER PLAIN AQUIFER

The eastern Snake River Plain Aquifer serves as the primary source of drinking water and crop irrigation in the upper Snake River Basin. This chapter presents the results of water monitoring conducted on and off the INL Site within the eastern Snake River Plain Aquifer hydrogeologic system. This includes the collection of water from the aquifer—including the drinking water wells—through downgradient springs along the Snake River where the aquifer discharges the water and an ephemeral stream (the Big Lost River), which flows through the INL Site and helps to recharge the aquifer.



The purpose of this monitoring program is to:

- Demonstrate that eastern Snake River Plain groundwater is protected from contamination from current INL Site activities
- Show areas of known underground contamination from past INL Site operations are monitored and trended
- Determine whether drinking water consumed by workers and visitors at the INL Site and by the public downgradient of the INL Site is safe
- Demonstrate that the Big Lost River, which occasionally flows through the INL Site, is not contaminated by INL Site activities before entering the aquifer via channel loss and playas on the north end of the INL Site.

Analytical results are compared to applicable regulatory guidelines for compliance and informational purposes. These include the following:

- State of Idaho groundwater primary and secondary constituent standards ([IDAPA 58.01.11](#))
- Health-based MCLs for drinking water according to the EPA ([40 CFR 141](#))
- U.S. Department of Energy (DOE) Derived Concentration Standards (DCSs) for the ingestion of water (DOE 2022a).

6.1 Organization of Monitoring Programs

Three organizations monitor the eastern Snake River Plain Aquifer hydrogeologic system:

- The USGS INL Project Office performs groundwater monitoring, analyses, and scientific studies to improve the understanding of the hydrogeological conditions affecting the movement of groundwater and contaminants in the eastern Snake River Plain Aquifer underlying and adjacent to the INL Site. The USGS utilizes an extensive network of strategically placed monitoring wells on the INL Site and at locations throughout the eastern Snake River Plain.

In 2024, USGS personnel collected and analyzed more than 1,200 samples for radionuclides and inorganic constituents, including trace elements, and another 24 samples for purgeable organic compounds. USGS INL Project Office personnel also published two reports, two software packages, and five data releases covering hydrogeologic conditions and monitoring at the INL Site. Links to these reports and products are available through the [bibliography website](#).

- The Idaho Cleanup Project (ICP) contractor conducts groundwater monitoring at various WAGs delineated on the INL Site for compliance with the CERCLA. The ICP contractor also conducts drinking water monitoring at the Idaho Nuclear Technology and Engineering Center (INTEC), RWMC, and Naval Reactors Facility (NRF) Deactivation and Decommissioning project. In 2024, the ICP contractor also monitored groundwater at Test Area North (TAN), the ATR Complex, INTEC, the Central Facilities Area (CFA), and the RWMC in WAGs 1, 2, 3, 4, and 7, respectively.
- The INL contractor monitors groundwater at MFC, the ATR Complex, and the RHLLW Disposal Facility. Groundwater compliance and surveillance monitoring at the ATR Complex and MFC are associated with effluent discharges and are presented in Chapter 5. As noted in Subsection 6.5.6, CERCLA groundwater monitoring for MFC in WAG 9 was discontinued in 2022. The RHLLW Disposal Facility does not generate or discharge liquid effluent. The 2024 RHLLW groundwater monitoring results are summarized in Subsection 6.6 and Table 6-12. The INL contractor also monitors the drinking water at eight INL Site facilities: the ATR Complex, CFA, the Critical Infrastructure Test Range Complex (CITRC), the Experimental Breeder Reactor-I (EBR-I), the Gun Range, the Main Gate, MFC, and TAN/Contained Test Facility (CTF).

The INL contractor also collects drinking water samples from offsite locations. Natural surface waters on and off the INL Site also are sampled for surveillance purposes as well. This includes the Big Lost River, which occasionally flows through the INL Site, and springs along the Snake River that are downgradient from the INL Site.

Details of the integrated approach used by these three organizations for their aquifer, drinking water, and surface water compliance and surveillance monitoring programs may be found in the “[Idaho National Laboratory Site Environmental Monitoring Plan](#)” (DOE-ID 2023), the “Technical Basis for Environmental Monitoring and Surveillance at the Idaho National Laboratory Site” (DOE-ID 2023b), and the “Idaho National Laboratory Groundwater Monitoring and Contingency Plan Update” (DOE-ID 2021b).



6.2 Hydrogeologic Data Management

Over time, hydrogeologic environmental data at the INL Site have been collected by various organizations, including USGS, current and past contractors, and other groups. The following data management systems are used:

- The Environmental Data Warehouse is the official warehouse for long-term management and storage of INL Sitewide environmental data. The Environmental Data Warehouse houses sampling and analytical data collected by the INL Site contractors and the USGS to support compliance-reporting, decision-making, trending, and transport modeling efforts. It also stores comprehensive information pertaining to wells, including construction, location, completion zone, type, and status.
- The Hydrogeologic Data Repository provides scientific and technical information that is compiled to support remedial investigation and feasibility study activities, Environmental Impact Statement preparation, site selection and characterization, and transport modeling in vadose and saturated zones. The available information includes: (1) well construction, video logs, and drill hole information; (2) geophysical logs; (3) historical reports; (4) aquifer characteristics; (5) soil characterization; and (6) sediment property studies.
- The USGS Data Management Program involves putting all data in the [National Water Information System](#). Data collected by the USGS at the INL Site is available [here](#).

6.3 USGS Radiological Groundwater Monitoring at the INL Site

Historical waste disposal practices have produced localized areas of radiochemical contamination in the eastern Snake River Plain Aquifer beneath the INL Site. The USGS collects samples annually from select wells at the INL Site for tritium, ^{90}Sr , gross alpha, gross beta, gamma spectrometry analyses, and plutonium and americium isotope activities. When the USGS installs new monitoring wells, a sample is collected for uranium isotope activity and stable isotope determination as well. Periodically, the USGS collects samples analysis of ^{129}I . The most recent interpretation of radiochemical trends in groundwater, from 1989 through 2021, are summarized in Treinen et al. (2024a; 2024b). Results for wells sampled in 2024 are available [here](#) (USGS 2025).

Presently, ^{90}Sr is the only radionuclide that continues to be detected by the ICP contractor and the USGS above the primary constituent standard (PCS) in some surveillance wells at TAN and between INTEC and CFA. Other radionuclides (e.g., gross alpha) have been detected above the PCS in wells monitored at individual WAGs.

Tritium. Because tritium is equivalent in chemical behavior to hydrogen—a key component of water—it has formed the largest plume of any of the radiochemical pollutants at the INL Site. The configuration and extent of the tritium contamination area, based on the most recent interpreted USGS data (2021), are shown in Figure 6-1 (Treinen et al. 2024a). The area of elevated tritium concentrations near CFA likely represents water originating at INTEC some years earlier when larger amounts of tritium were disposed. This source is further supported by the fact that there are no known sources of tritium contamination in groundwater at CFA.

Two monitoring wells downgradient of the ATR Complex (e.g., USGS-065) and INTEC (e.g., USGS-114) have continually shown the highest tritium concentrations in the aquifer over the past 20 years. For this reason, these two wells are considered representative of maximum concentration trends in the rest of the aquifer. The concentration of tritium in USGS-065 near the ATR Complex increased slightly from 1110 ± 80 pCi/L in 2023 to 1230 ± 80 pCi/L in 2024; however, considering the 1σ uncertainty of these measurements, they are considered consistent. The tritium concentration in USGS-114, which is south of INTEC, decreased slightly from $3,620 \pm 130$ pCi/L in 2023 to $3,250 \pm 130$ pCi/L in 2024.

The Idaho PCS for tritium (20,000 pCi/L) in groundwater is the same as the EPA MCL for tritium in drinking water. The values in Wells USGS-065 and USGS-114 dropped below this limit in 1997 due to radioactive decay (e.g., tritium has a half-life of 12.33 years), discontinuation of tritium disposal, advective dispersion, and dilution within the aquifer. An evaluation of long-term tritium trends at monitoring wells can be found in Treinen et al. (2024a) and Fisher et al. (2021).

Strontium-90. The configuration and extent of ^{90}Sr in groundwater, based on the latest published USGS data, are shown in Figure 6-2 (Treinen et al. 2024a). The contamination originates at INTEC from the historical injection of wastewater. All ^{90}Sr at the ATR Complex was disposed to infiltration ponds in contrast to the direct injection that occurred at INTEC. At the ATR Complex, ^{90}Sr is retained in surficial sedimentary deposits, interbeds, and perched groundwater zones.

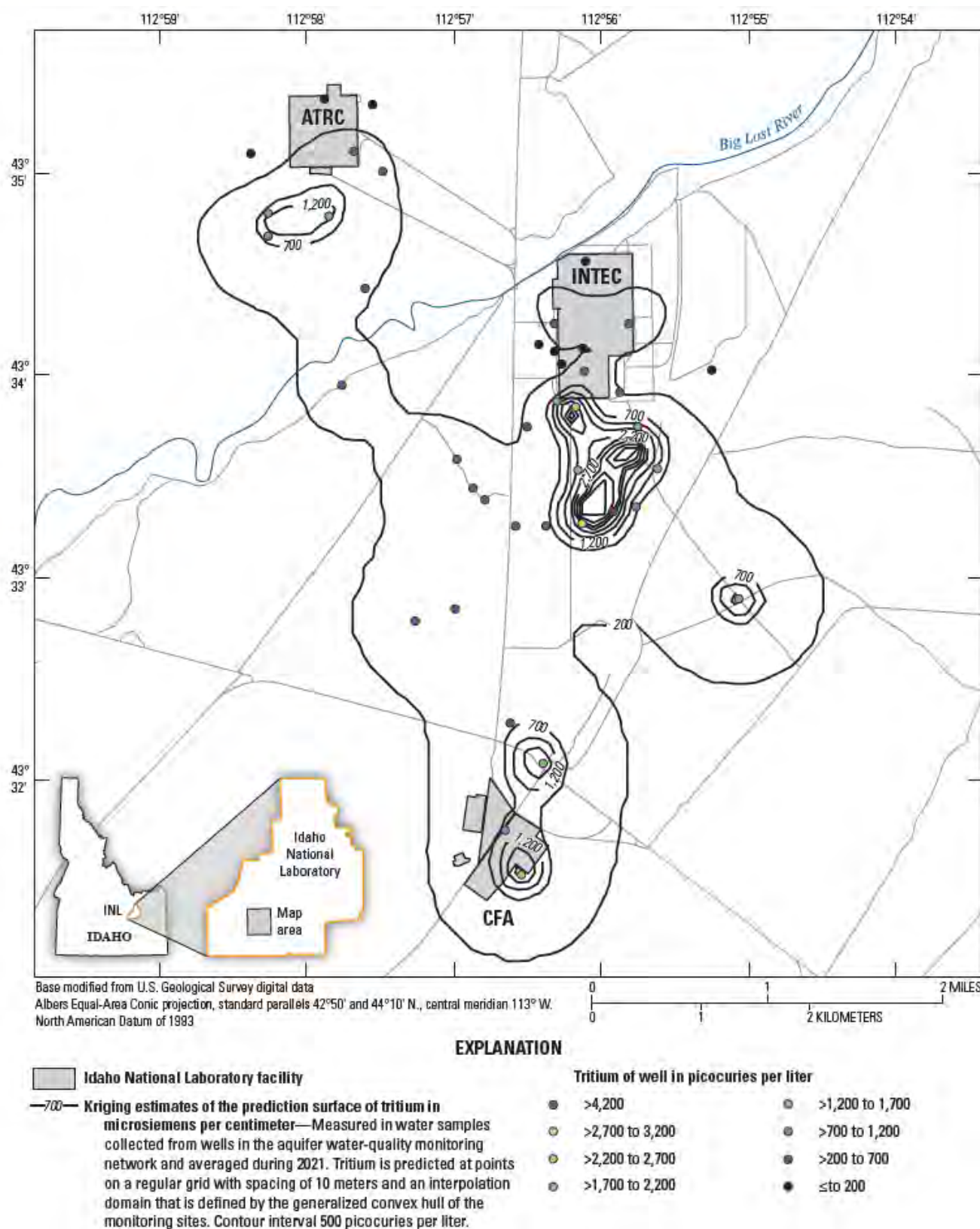


Figure 6-1. Distribution of tritium (pCi/L) in the eastern Snake River Plain Aquifer onsite in 2021 (Treinen et al. 2024a).

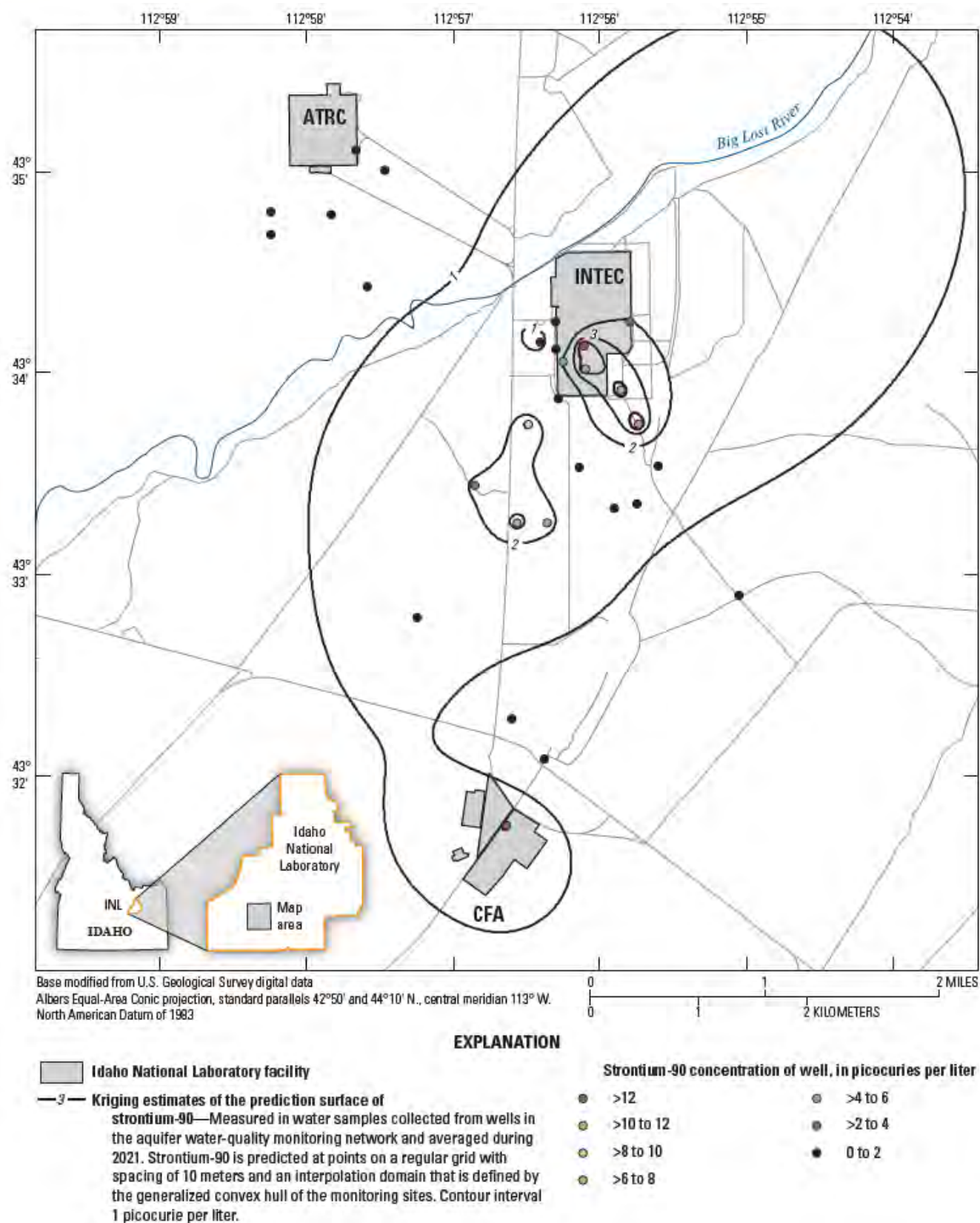


Figure 6-2. Distribution of ^{90}Sr (pCi/L) in the eastern Snake River Plain Aquifer onsite in 2021 (Treinen et al. 2024a).



The ^{90}Sr trends from 1989 to 2024 are all showing decreasing trends in Wells USGS-047, USGS-057, and USGS-113, which are all located at or downgradient from the INTEC facility. Concentrations in Well USGS-047 have varied throughout time but indicate a general decrease with a concentration of 12.2 ± 1 pCi/L in 2024. Concentrations in Wells USGS-057 and USGS-113 have generally decreased during this period, with concentrations of 6 ± 1 and 5.8 ± 1 pCi/L, respectively. A 2015 report by the USGS (Davis et al. 2015) indicated that long-term water quality trends for ^{90}Sr in all but two perched water wells at the INL Site showed decreasing or no statistically significant trend. A recent report by the USGS (Treinen et al. 2024a) documented that these two perched wells near the ATR Complex consistently have ^{90}Sr concentrations at or above the established EPA MCL of 8 pCi/L.

Summary of other USGS Radiological Groundwater Monitoring. From 2019–2021, concentrations of cesium-137 (^{137}Cs), plutonium-239/240 ($^{239/240}\text{Pu}$), and americium-241 (^{241}Am) were less than the reporting level, which is three times the standard deviation (3s) provided by the laboratory, in all sampled wells. In 2019–2021, reportable concentrations ($> 3s$) of gross alpha radioactivity were observed in seven of the 49 wells and ranged from 6 ± 2 to 125 ± 7 pCi/L. Beta radioactivity equaled or exceeded the reporting level in all of the sampled wells, while concentrations ranged from 2.1 ± 0.7 to 716 ± 40 pCi/L (Treinen et al. 2024a).

Periodically, the USGS has sampled for ^{129}I in the eastern Snake River Plain Aquifer. Periodic monitoring programs from 1977 to 2022 are summarized in Treinen et al. (2024a). The most recent USGS sampling event for ^{129}I in INL Site wells was conducted in the fall of 2021 and the spring of 2022. Concentrations ranged from slightly above the locally determined background concentration of 5.4×10^{-6} pCi/L. Overall, the average concentration of ^{129}I in 15 wells sampled by the USGS during six different sample periods decreased from 1.15 pCi/L during 1990–1991 to 0.145 pCi/L during 2021–2022. Decreasing ^{129}I trends in individual wells over time can be partly attributed to wastewater disposal practices and dilution and dispersion throughout the aquifer. The distribution of ^{129}I concentrations from the 2021–2022 sampling event near the ATR Complex and INTEC facility is shown in Figure 6-3 (Treinen et al. 2024b). Concentrations generally decrease downgradient, and with distance from, the INTEC facility (Treinen et al. 2024b).

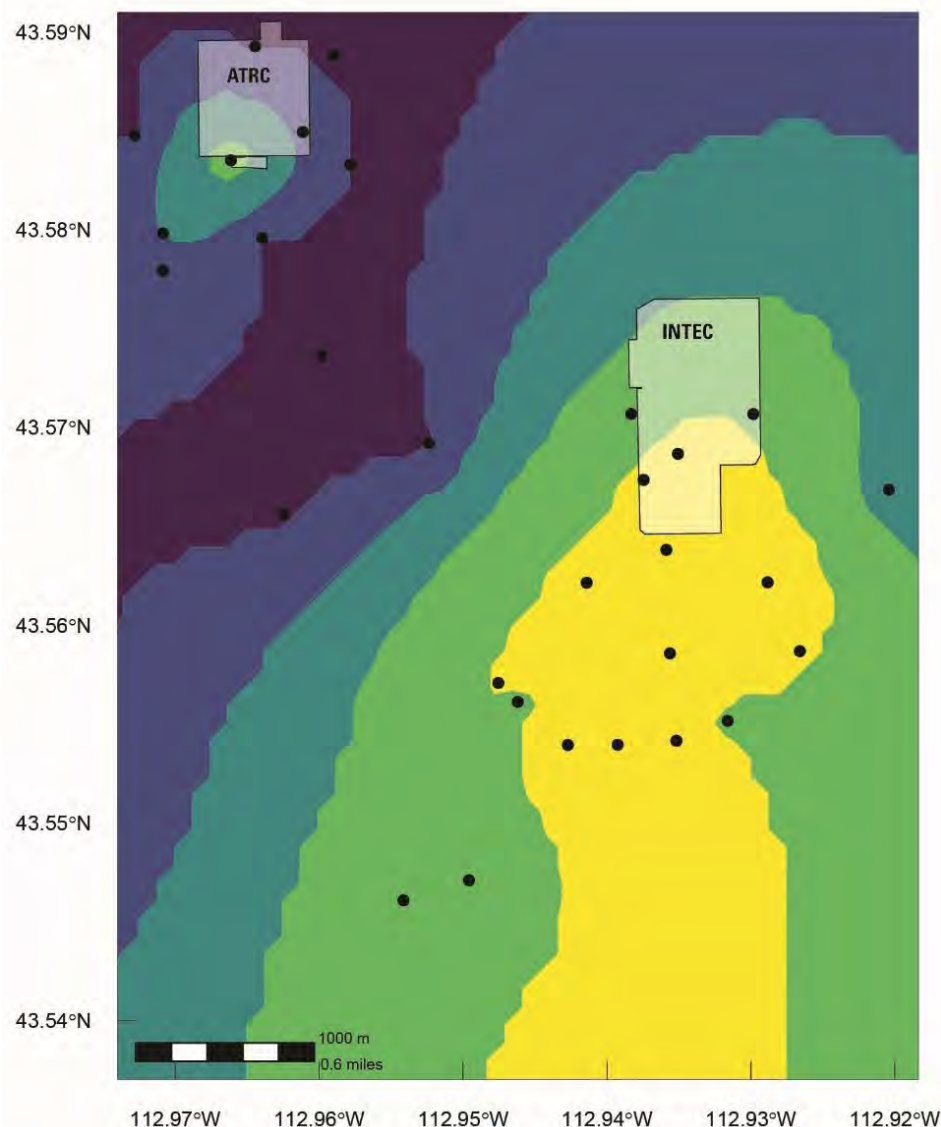
6.4 USGS Non-radiological Groundwater Monitoring at the INL Site

The USGS collects samples annually from select wells at the INL Site for chloride, sulfate, sodium, fluoride, nitrate, chromium, and other trace elements and purgeable organic compounds. Treinen et al. (2024a) provides a detailed discussion of the results for samples collected during 2019–2021. A concentration of chromium at the MCL of 100 $\mu\text{g/L}$ was observed in Well USGS-065 in 2009 (Fisher et al. 2021), and while its concentration has since been below the MCL, this concentration increased to 98.2 $\mu\text{g/L}$ in 2024. However, this well has shown a long-term decreasing chromium trend overall (Fisher et al. 2021, Appendix 7).

Concentrations of chloride, nitrate, sodium, and sulfate historically have been above the background concentrations in many wells at the INL Site. Current concentrations of chloride, nitrate, sodium, and sulfate for all INL wells monitored by the USGS can be found [here](#).

Volatile organic compounds (VOCs) are present in water from the eastern Snake River Plain Aquifer because of historical waste disposal practices at the INL Site. Products containing VOCs were used for degreasing, decontamination, and other activities at INL Site facilities. The USGS sampled purgeable organic compounds in groundwater at the INL Site during 2024. Samples from 24 groundwater monitoring wells were collected and submitted to the USGS National Water Quality Laboratory in Lakewood, Colorado; the samples were analyzed for 61 purgeable organic compounds. USGS reports describe the methods used to collect the water samples and ensure sampling and analytical quality (Mann 1996; Bartholomay et al. 2003; Knobel et al. 2008; Bartholomay et al. 2021). Table 6-1 identifies a subset of the ten purgeable organic compounds detected above the laboratory reporting levels of 0.2 or 0.1 $\mu\text{g/L}$ in at least one well on the INL Site.

Historically, concentrations of VOCs in water samples from several wells at and near the RWMC exceeded the reporting levels (Treinen et al. 2024a). However, concentrations for all VOCs, except tetrachloromethane (also known as carbon tetrachloride) and trichloroethene, were less than the MCL for drinking water (40 CFR 141, Subpart G). The RWMC production well was monitored monthly for tetrachloromethane during 2024 (data January through July is reported below; August through December data are still pending). Concentrations exceeded the MCL of 5 $\mu\text{g/L}$ during 3 of the 7 months that data was available, as shown in Table 6-2.



Base derived from U.S. Geological Survey National Elevation Dataset 1/3 arc-second digital elevation model. Albers Equal-Area Conic projection using a central meridian of 113°W, standard parallel of 42°50'N and 44°10'N, a false easting of 200,000 meters, and the latitude of the projection's origin at 41°30'N. North American Datum of 1983

EXPLANATION



- Selected facilities at the Idaho National Laboratory
- Well in the USGS water-quality monitoring network - Samples analyzed for iodine-129

Ranges of kriging estimates of the prediction surface of iodine-129 measured in water samples collected from wells in the water-quality monitoring network and averaged during 2021-2022. Iodine-129 is predicted at points on a regular grid with spacing of 100 meters and an interpolation domain that is defined by the generalized convex hull of the monitoring sites.

Interpreted iodine-129 measurements (pCi/L)

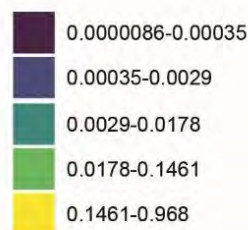


Figure 6-3. Distribution of ^{129}I (pCi/L) in the eastern Snake River Plain Aquifer onsite during 2021–2022 (Treinen et al. 2024b).

**Table 6-1. Purgeable organic compounds in annual USGS groundwater well samples (2024).**

CONSTITUENT	USGS-120	USGS-88	RWMC M3S	USGS-87	RWMC M7S	USGS-065	TAN-2312	USGS-92
1,1,1-Trichloroethane (MCL = 200 µg/L) ^a	<0.1	<0.1	<0.1	0.112	<0.1	<0.1	<0.1	1.30
cis-1,2-Dichloroethene ^b (MCL = 70 µg/L) ^a	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Ethylbenzene (MCL = 700 µg/L) ^a	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Tetrachloroethene ^b (MCL = 5 µg/L) ^a	<0.1	<0.1	0.20	0.184	0.400	<0.1	4.51	2.73
Tetrachloromethane (PCS = 2 µg/L) ^c	<0.2	1.52	<0.2	3.64	<0.2	<0.2	<0.2	11.5
Trichloroethene ^b (MCL = 5 µg/L) ^a	0.20	0.666	1.06	1.15	2.30	<0.1	0.111	15.3
Trichloromethane (MCL = 5 µg/L) ^a	<0.1	0.446	<0.1	0.315	<0.1	0.239	1.76	21.4
trans-1,2-Dichloroethene ^b (MCL = 100 µg/L) ^a	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

a. MCL = maximum contaminant level from the EPA (40 CFR 141).

b. The International Union of Pure and Applied Chemistry name for ethylene is ethene. For example, trichloroethene is equivalent to trichloroethylene. This is the name reported in the USGS database. This nomenclature is used in this table in case the reader wants to look up the constituent in the USGS database.

c. PCS = primary constituent standard values from IDAPA 58.01.11.

Table 6-2. Purgeable organic compounds in monthly production well samples at the RWMC (January through July, 2024).

CONSTITUENT	JAN	FEB	MAR	APR	MAY	JUN	JUL
1,1,1-Trichloroethane (MCL = 200 µg/L) ^a	0.214	0.229	0.232	0.220	0.221	0.210	0.227
Tetrachloroethene ^b (MCL = 5 µg/L) ^a	0.345	0.449	0.332	0.337	0.351	0.285	0.302
Tetrachloromethane (MCL = 5 µg/L) ^a	4.60	4.69	4.98	4.94	5.22	5.19	5.15
Trichloroethene ^b (MCL = 5 µg/L) ^a	3.55	3.67	3.48	3.3	3.47	2.42	2.76
Trichloromethane (PCS = 2 µg/L) ^c	1.55	1.68	1.78	1.66	1.85	1.35	1.54

a. MCL = maximum contaminant level values from the EPA (40 CFR 141)

b. The International Union of Pure and Applied Chemistry name for ethylene is ethene. For example, trichloroethene is equivalent to trichloroethylene. This is the name reported in the USGS database. This nomenclature is used in this table in case the reader wants to look up the constituent in the USGS database.

c. PCS = primary constituent standard values from IDAPA 58.01.11.



Since 1998, concentrations have routinely exceeded the MCL for tetrachloromethane in drinking water (5 µg/L) at RWMC. (Note: VOCs are removed from production well water prior to human consumption.) Trend test results for tetrachloromethane concentrations in water from the RWMC production well indicated a statistically significant increase in concentrations has occurred from 1989 through 2021; however, Treinen et al. (2024a) indicated that more recent data through 2021 showed no trend for the entire dataset and a decreasing trend for data collected since 2007. The more recent decreasing trend indicates that engineering practices designed to reduce VOC movement to the aquifer are having a positive effect. Concentrations of tetrachloromethane from Wells USGS-87 and USGS-120, which are both located south of RWMC, have had an increasing trend since 1987, but concentrations have decreased through time at Well USGS-88 (Davis et al. 2015; Bartholomay et al. 2020; Fisher et al. 2021; Treinen et al. 2024a). As observed in Table 6-1, trichloroethylene (or trichloroethene [TCE]) and trichloromethane exceeded the MCL of 5 µg/L from one sample that was collected from one perched RWMC well.

6.5 Comprehensive Environmental Response, Compensation, and Liability Act Groundwater Monitoring During 2024

CERCLA activities at the INL Site are divided into WAGs that roughly correspond to the major facilities, with the addition of the INL Site-wide WAG 10. The following subsections provide an overview of the groundwater sampling results. More detailed discussions of CERCLA groundwater sampling can be found in the WAG-specific monitoring reports within the CERCLA Administrative Record at Administrative Record Information Repository (ARIR) Home – ARIR. WAG 8 is managed by the NRF and is not discussed in this report.

6.5.1 Summary of Waste Area Group 1 Groundwater Monitoring Results

Groundwater is monitored at WAG 1 to evaluate the progress of remedial actions at TAN. The VOC groundwater plume at TAN has been divided into three zones based on the 1997 TCE concentrations with three different remedy components, which work together to remediate the entire VOC plume. The monitoring program and results are summarized by plume zone in the following paragraphs.

Hot Spot Zone (Historical TCE Concentrations Exceeding 20,000 µg/L). In situ bioremediation (ISB) was used in the hot spot near Well TSF-05 to create conditions favorable for naturally occurring anaerobic bacteria in the aquifer to break down chlorinated solvents, principally TCE. The hot spot concentration was defined using TCE data from 1997, which is identified in Figure 6-4, and is not reflective of current concentrations, as shown in Figure 6-5. With regulatory agency concurrence, an ISB rebound test began in July 2012 to determine whether the residual TCE source in the aquifer had been sufficiently treated. Currently, the ISB rebound test has been split into two components: (1) an ISB rebound test for the area near the former Injection Well TSF-05; and (2) ISB activities to treat the TCE source affecting Well TAN-28.

Data collected in 2024 during the ISB rebound test for the area near the former Injection Well TSF-05 indicated that anaerobic conditions created by ISB were still present in the hot spot area, and that the TCE concentrations were near or below the MCLs in the wells near the former Injection Well TSF-05, as shown in Figure 6-5. After background aquifer conditions are re-established, the effectiveness of the ISB part of the remedy will be re-evaluated (DOE-ID 2025a). To address the source of TCE in Well TAN-28, continued dual ISB injections into Wells TAN-2336 and TAN-1860A were made in order to increase the efficiency of the injection strategy. During 2024, a total of 19 totes of amendment (or 4,750 gal) were injected over the course of five injection events into these two wells. Five injections with a total of 11 totes of amendment (or 2,750 gal) were performed at Well TAN-2336, while five additional injections with a total of eight totes of amendment (or 2,000 gal) went into Well TAN-1860A, as recorded in the first quarter surveillance report (DOE-ID 2025a). Despite some variations, TCE concentrations have declined in Well TAN-28 due to the ISB injections, which were aimed at treating the TCE source. ISB injections will continue into these wells until it can be determined that the TCE source in Well TAN-28 has been successfully treated and a transition to a rebound test for the TCE source in this well can be made.

Medial Zone (Historical TCE Concentrations Between 1,000 and 20,000 µg/L). A pump and treat system has been used in the medial zone, which extracts contaminated groundwater, circulates the groundwater through air strippers to remove VOCs like TCE, and reinjects treated groundwater back into the aquifer. Generally throughout 2024, the Pump and Treat Facility operated Monday through Thursday, except for shutdowns due to maintenance. All Pump and Treat Facility compliance samples during 2024 were below the discharge limits. The TCE concentrations used to define the medial zone (e.g., 1,000–20,000 µg/L) are based on data collected in 1997, which is before remedial actions began, as shown in Figure 6-4, and do not reflect the current concentrations shown in Figure 6-5. In 2024, none of the wells were above the concentration of 1,000 µg/L used historically to define the medial zone. The concentrations of TCE in Wells TAN-33, TAN-36, and TAN-44 near the Pump and Treat Facility are used as indicators of TCE concentrations migrating past the Pump and Treat Facility extraction wells into the distal zone. During 2024, the TCE concentrations for Wells TAN-33, TAN-36, and TAN-44 ranged from 8.63 to 35.1 µg/L (DOE-ID 2025a).

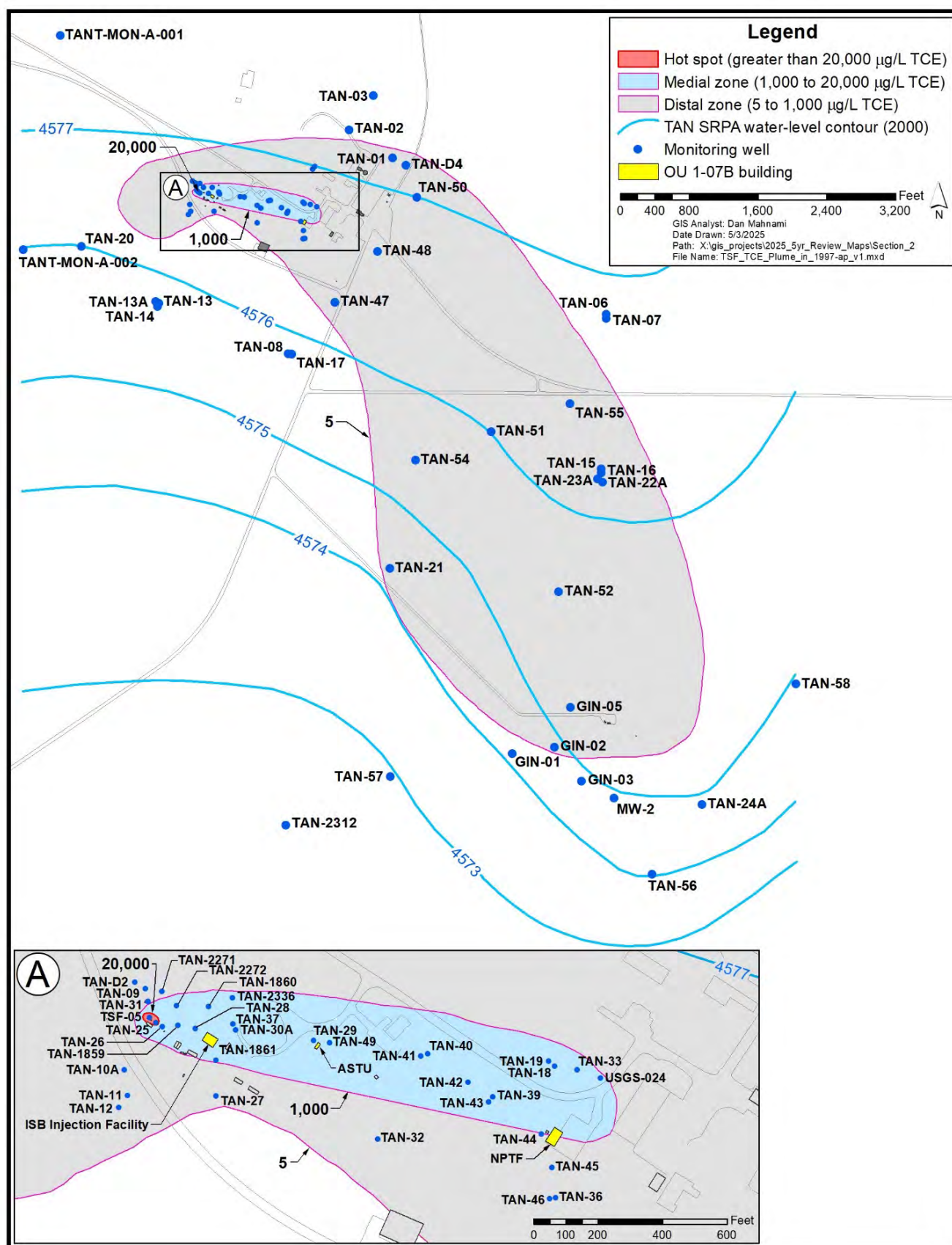


Figure 6-4. TCE plume at TAN in 1997.

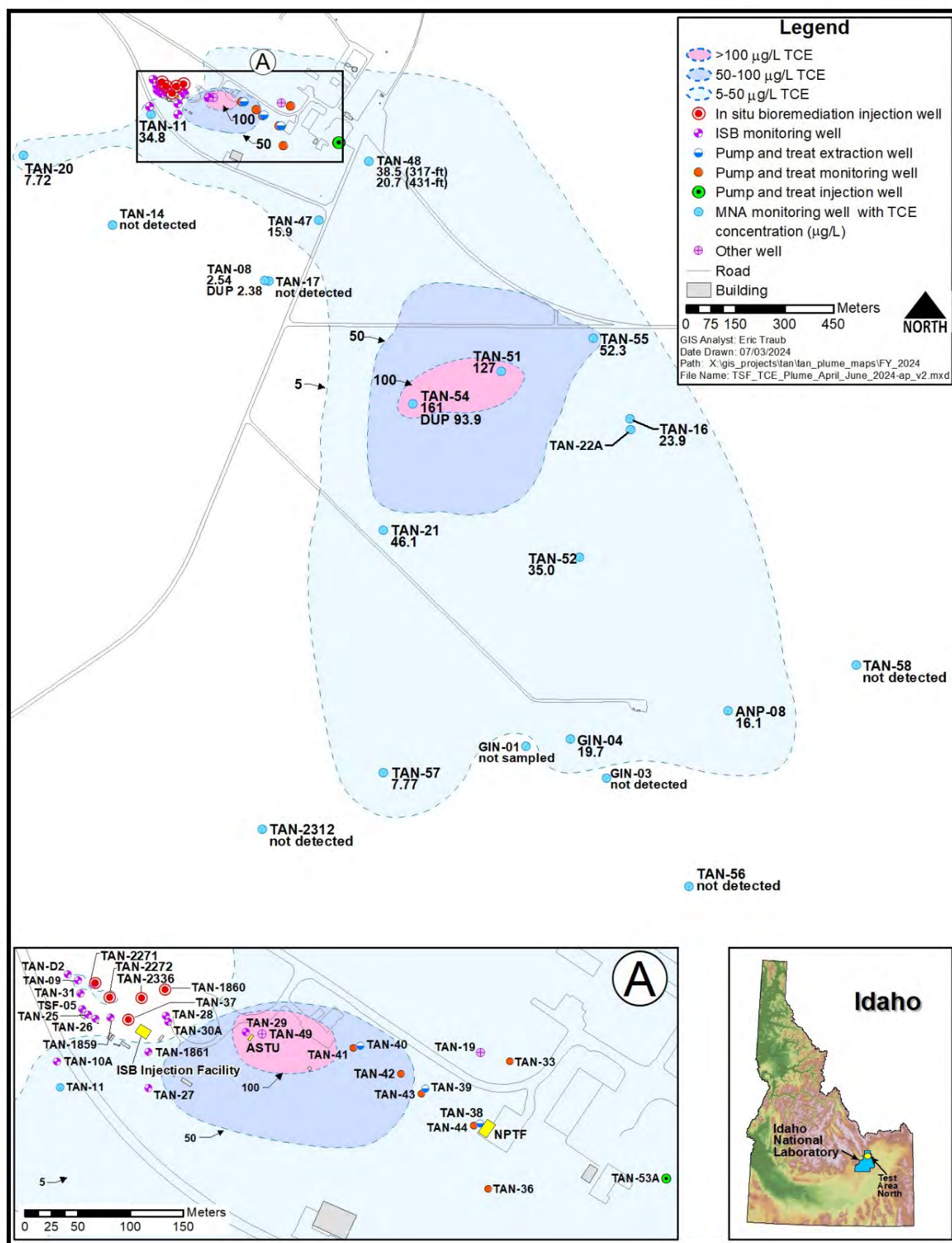


Figure 6-5. Distribution of TCE in the Snake River Plain Aquifer from April to June 2024.



Distal Zone (Historical TCE Concentrations Between 5 and 1,000 µg/L). Monitored natural attenuation is the remedial action for the distal zone of the plume, as shown in Figure 6-4. Monitored natural attenuation is the sum of physical, chemical, and biological processes that act without human intervention to reduce the mass, toxicity, mobility, volume, or concentration of groundwater contaminants. Institutional controls are in place to protect current and future users from the health risks associated with groundwater contamination until the concentrations decline through natural attenuation to levels below the MCL. The TCE data collected in FY 2024 from the distal zone wells indicate that all wells are consistent with the model predictions but additional data are needed to confirm the monitored natural attenuation part of the remedy will meet the remedial action objective of all wells below the MCL by 2095 (DOE-ID 2025a). The TCE data from the plume expansion wells suggest that the plume expansion is currently within the limits allowed in the Record of Decision Amendment (DOE-ID 2001).

Radionuclide Monitoring. In addition to the VOC plume, ^{90}Sr , ^{137}Cs , tritium, and uranium-234 (^{234}U) are listed as contaminants of concern in the Record of Decision Amendment (DOE-ID 2001). Concentrations of ^{90}Sr and ^{137}Cs are expected to naturally decline below their respective MCLs before 2095. However, wells in the source/ISB area currently show elevated concentrations of ^{90}Sr and ^{137}Cs compared with the levels prior to starting ISB. The elevated ^{90}Sr and ^{137}Cs concentrations are due to enhanced mobility created by elevated concentrations of competing cations (e.g., calcium, magnesium, sodium, potassium) for adsorption sites in the aquifer. The elevated cation concentrations are due to ISB activities to treat VOCs. As competing cation concentrations decline toward background conditions, ^{90}Sr and ^{137}Cs are trending lower. The radionuclide concentrations are expected to continue to decrease, and concentration trends will continue to be evaluated to determine whether the remedial action objective of declining below MCLs by 2095 will be met. Sampling will be conducted for ^{234}U after ISB conditions dissipate because ISB conditions suppress the uranium concentrations (DOE-ID 2025a).

6.5.2 Summary of Waste Area Group 2 Groundwater Monitoring Results

Groundwater samples were collected from six aquifer wells to monitor WAG 2 in the ATR Complex during 2024. All wells were sampled and analyzed for ^{90}Sr , gamma-emitting radionuclides (e.g., the target analyte is cobalt-60), tritium, and chromium (filtered) in accordance with the groundwater monitoring plan (DOE-ID 2016). The results for the October 2024 sampling event will be included in the FY 2025 Annual Report for WAG 2 (DOE-ID 2025b). The October 2024 sampling data are summarized in Table 6-3.

Table 6-3. WAG 2 aquifer groundwater quality summary (October 2024).

ANALYTE	MCL	BACKGROUND ^a	MAXIMUM	MINIMUM	NUMBER OF WELLS ABOVE MCL
Chromium (filtered) (µg/L)	100	4	96.7	1.70	0
Cobalt-60 (pCi/L)	100	0	ND ^b	ND	0
Strontium-90 (pCi/L)	8	0	ND	ND	0
Tritium (pCi/L)	20,000	34	2,630	ND	0

a. Background concentrations are for western tributary water for the eastern Snake River Plain Aquifer from Bartholomay and Hall (2016).

b. ND = not detected.

No analyte occurred above its MCL in the Snake River Plain Aquifer at WAG 2. The highest chromium concentration occurred in Well USGS-065 at 96.7 µg/L and was below the MCL of 100 µg/L. The second-highest chromium concentration appeared in Well TRA-07 at 84.0 µg/L. The chromium concentrations in both wells have shown short-term increases in recent years (DOE-ID 2025b).

Tritium was the only radionuclide analyte detected in the aquifer and was below the MCL of 20,000 pCi/L in all the sampled wells. The highest tritium concentration was 2,630 pCi/L in Well TRA-07 (DOE-ID 2025b). Chromium and tritium concentrations in the aquifer have declined faster than predicted by the WAG 2 models used for the Operable Unit 2-12 Record of Decision and the revised modeling performed after the first five-year review (DOE-NE-ID 2005).

The October 2024 eastern Snake River Plain Aquifer water table map prepared for the vicinity of the ATR Complex was consistent with previous maps showing general groundwater flow direction to the southwest. Aquifer water levels in the vicinity of the ATR Complex declined by approximately 0.49 ft on average from October 2023 to October 2024 (DOE-ID 2025b).



6.5.3 Summary of Waste Area Group 3 Groundwater Monitoring Results

At INTEC, groundwater samples are collected from 17 Snake River Plain Aquifer monitoring wells during odd-numbered years and from 14 wells during even-numbered years. During the reporting period, all required wells were sampled. A limited number of samples were collected from Well USGS-059 due to the sample pump losing function during the collection of the samples. Groundwater samples were analyzed for a suite of radionuclides and inorganic constituents. The data are summarized in the 2024 Annual Report (DOE-ID 2025c). Table 6-4 summarizes the maximum concentrations observed, along with the number of MCL exceedances reported for each constituent.

Table 6-4. Summary of constituents detected in WAG 3 aquifer monitoring wells (FY 2024).

CONSTITUENT	EPA MCL	UNITS	SNAKE RIVER PLAIN AQUIFER GROUNDWATER – APRIL 2024		
			MAXIMUM REPORTED VALUE	NUMBER OF RESULTS	RESULTS > MCL
Gross alpha	15	pCi/L	4.93 ± 1.88 J ^a	13	0
Gross beta	NA ^b	pCi/L	798 ± 13	13	NA
Cesium-137	200	pCi/L	ND ^a	14	0
Strontium-90	8	pCi/L	12.6 ± 1.17^c	14	4
Technetium-99	900	pCi/L	1,270 ± 73.7^c	14	1
Iodine-129	1	pCi/L	0.902 ± 0.322 J ^b	13	0
Tritium	20,000	pCi/L	1,780 ± 265	14	0
Plutonium-238	15	pCi/L	— ^d	— ^d	— ^d
Plutonium-239/240	15	pCi/L	— ^d	— ^d	— ^d
Uranium-233/234	NA MCL ^e	pCi/L	1.73 ± 0.214	14	NA
Uranium-235	NA MCL	pCi/L	0.147 ± 0.073 J ^b	14	NA
Uranium-238	NA MCL	pCi/L	1.17 ± 0.132	14	NA
Bicarbonate	NA	mg/L	151	13	NA
Calcium	NA	mg/L	60.6	13	NA
Chloride	250	mg/L	114 J ^{+b}	13	0
Magnesium	NA	mg/L	21.1	13	NA
Nitrate/Nitrite (as N)	10	mg/L	13.6^c	14	1
Potassium	NA	mg/L	4.44	13	NA
Sodium	NA	mg/L	28.6	13	NA
Sulfate	250	mg/L	34.3	13	0
Total dissolved solids	500	mg/L	438	13	0

- Data-qualifier flags:
ND = constituent not detected in sample.
J = estimated detection.
J+ = estimated detection; highly biased.
- NA = not applicable.
- Bold** values exceed MCL.
- = Gross alpha did not exceed 15 pCi/L; the constituent was not analyzed.
- NA MCL = EPA MCL is reported in mass units (µg/L), while the values listed are reported in pCi/L.

Strontium-90, technetium-99 (⁹⁹Tc), and nitrate (as N) exceeded their respective drinking water MCLs in one or more of the eastern Snake River Plain Aquifer monitoring wells at or near INTEC, with ⁹⁰Sr exceeding its MCL by the greatest margin. Concentrations of ⁹⁰Sr remained above the MCL (e.g., 8 pCi/L) at four of the well locations sampled. During 2024,



the highest level of ^{90}Sr in eastern Snake River Plain Aquifer groundwater was measured at Monitoring Well USGS-047 (12.6 ± 1.17 pCi/L), which is located south (downgradient) of the former INTEC injection well.

Technetium-99 was detected above the MCL (900 pCi/L) at eight monitoring wells. During 2024, the highest ^{99}Tc level in eastern Snake River Plain Aquifer groundwater was located at Well ICPP-MON-A-230 ($1,270 \pm 73.7$ pCi/L), which lies north of the INTEC Tank Farm. All of the sampled wells showed stable or declining trends from the previous reporting period.

Nitrate was detected in all of the wells sampled during this reporting period. Monitoring Well ICPP-20201-AQ was the only location to exceed the nitrate concentration MCL of 10 mg/L as elevated nitrate with a reported level of 13.6 mg/L. The presence of nitrate concentrations in groundwater southeast of the tank farm is attributed primarily to impacts from tank farm releases and residual vadose-zone sources. These nitrate concentrations were similar or slightly lower than those observed in previous years.

Tritium was detected at most of the sampled wells, but none of the groundwater samples exceeded the tritium MCL (20,000 pCi/L). The highest tritium concentrations in groundwater were reported at Well USGS-051 ($1,780 \pm 265$ pCi/L), situated southeast of INTEC. Tritium concentrations have declined at nearly all locations over the past few years.

During the reporting period, no plutonium isotope analyses were performed because the current monitoring plan identifies the contingency for plutonium analysis if gross alpha exceeds 15 pCi/L. Uranium-238 (^{238}U) was detected at all eastern Snake River Plain Aquifer well locations, with the highest concentration at Well ICPP-MON-A-230 (1.17 ± 0.132 pCi/L). Uranium-234 (^{234}U) was detected in all the groundwater samples as well, with the greatest concentrations of 1.73 ± 0.214 pCi/L measured at Well ICPP-MON-A-230. Uranium-234 is the daughter product (from alpha decay) of the long-lived, naturally occurring ^{238}U . All uranium results for the other wells are consistent with background concentrations reported for Snake River Plain Aquifer groundwater. The $^{234}\text{U}/^{238}\text{U}$ ratio for all samples fell within the background range of 1.5 to 3.1 (Roback et al. 2001).

Uranium-235 (^{235}U) was detected at four of the 14 sample locations. All results were reported as an estimated concentration with a validation flag of “J.” The highest reported level at any sample location for ^{235}U was measured at Well USGS-051 (0.147 ± 0.073 J pCi/L). Uranium concentrations reported in pCi/L were converted to mass-basis concentrations ($\mu\text{g/L}$) for comparison to the total uranium MCL of 30 $\mu\text{g/L}$. The highest total uranium concentration in the groundwater samples was 3.8 $\mu\text{g/L}$, which was sampled at Well ICPP-MON-A-230. Thus, the uranium results for all Snake River Plain Aquifer wells were well below the total uranium MCL.

6.5.4 Summary of Waste Area Group 4 Groundwater Monitoring Results

The WAG 4 groundwater monitoring consists of two different components: (1) monitoring the CFA landfill, and (2) monitoring a nitrate plume south of CFA. The wells at the CFA landfills are monitored to determine the potential impacts from the landfills, while the nitrate plume south of CFA is monitored to evaluate the nitrate trends. Groundwater monitoring for the CFA landfills consisted of sampling seven wells for metals (filtered), VOCs, and anions (nitrate, chloride, sulfate) and two wells for VOCs only, in accordance with the long-term monitoring plan (DOE-ID 2018). Four wells south of CFA were sampled for nitrate, sulfate, and chloride to monitor the CFA nitrate plume.

Analytes detected in groundwater are compared to the regulatory levels identified in Table 6-5. In 2024, no analytes exceeded an EPA MCL. The manganese secondary maximum contaminant level (SMCL) was exceeded in one well and two other wells exceeded a pH SMCL. The elevated pH in these two wells was due to grout placed beneath the well screens during well construction. A complete list of the groundwater sampling results will be included in the FY 2024 Annual Report for WAG 4 (DOE-ID 2025d).

In the CFA nitrate plume monitoring wells south of CFA, Well CFA-MON-A-002 continued to exceed the nitrate groundwater MCL of 10 mg/L-N. The nitrate concentration within Well CFA-MON-A-002 remained mostly stable with a reading of 12.5 mg/L-N in 2023 and 13.5 mg/L-N in 2024. However, Well CFA-MON-A-002 is consistent with a declining trend that began in 2006. The nitrate concentration of 8.08 mg/L-N in Well CFA-MON-A-003 is below the MCL and reveals a slight downtrend (DOE-ID 2025d).

Water level measurements taken at CFA showed an increase on the average of 0.40 ft from August 2023 to August 2024. A water level contour map based on August 2024 water levels showed groundwater gradients and flow directions consistent with previous maps (DOE-ID 2025d).



Table 6-5. Comparison of CFA landfill and CFA nitrate plume groundwater sampling results to regulatory levels (August 2024).

COMPOUND	MCL OR SMCL	MAXIMUM DETECTED VALUE	NUMBER OF WELLS ABOVE MCL OR SMCL
CFA NITRATE PLUME WELLS			
Chloride (mg/L)	250 ^a	70.1	0
Sulfate (mg/L)	250	32.8	0
Nitrate/nitrite (mg/L-N)	10	13.5^b	1
CFA LANDFILL WELLS			
ANIONS			
Chloride (mg/L)	250	58.4	0
Sulfate (mg/L)	250	38.5	0
Nitrate/nitrite (mg/L-N)	10	2.51	0
COMMON CATIONS			
Calcium (µg/L)	None	60,600	NA ^c
Magnesium (µg/L)	None	19,800	NA
Potassium (µg/L)	None	6,290	NA
Sodium (µg/L)	None	27,000	NA
INORGANIC ANALYTES			
Antimony (µg/L)	6	ND ^d	0
Aluminum (µg/L)	50–200	ND	0 ^e
Arsenic (µg/L)	10	2.56	0
Barium (µg/L)	2,000	97.4	0
Beryllium (µg/L)	4	ND	0
Cadmium (µg/L)	5	ND	0
Chromium (µg/L)	100	22.4	0
Copper (µg/L)	1,300	1.60	0
Iron (µg/L)	300	35.6	0
Lead (µg/L)	15	ND	0
Manganese (µg/L)	50	54.2	1
Mercury (µg/L)	2	ND	0
Nickel (µg/L)	None	46.8	NA
Selenium (µg/L)	50	2.42	0
Silver (µg/L)	100	ND	0
Thallium (µg/L)	2	ND	0
Vanadium (µg/L)	None	6.71	NA
Zinc (µg/L)	5,000	14.9	0
DETECTED VOCs			
Chloroform (µg/L)	80	1.18	0

a. Numbers in *italic* text are for the secondary MCL.

b. **Bold** values exceed an MCL or SMCL.

c. NA = not applicable.

d. ND = not detected.



6.5.5 Summary of Waste Area Group 7 Groundwater Monitoring Results

Groundwater samples collected from 12 monitoring wells near and downgradient of RWMC in May 2024 were analyzed for radionuclides, inorganic constituents, and VOCs. Of the 283 aquifer analytical results (excluding field and trip blanks), 20 met the reportable criteria established in Subsection 5.5.3 of the “Field Sampling Plan for Operable Unit 7-13/14 Aquifer Monitoring” (DOE-ID 2021c). Table 6-6 summarizes the reportable contaminants of concern in 2024. Figure 6-6 depicts the WAG 7 aquifer well monitoring network. These results are:

- **Carbon tetrachloride** – Carbon tetrachloride was reportable at seven monitoring locations in May 2024, none of which were detected above the MCL of 5 µg/L. These concentrations of carbon tetrachloride are similar to the amounts observed in 2023, as shown in Figures 6-7 and 6-8.
- **Trichloroethylene** – Concentrations of reportable TCE in May 2024 remained steady in the wells near and downgradient of RWMC, as shown in Figure 6-9. No TCE concentrations were detected above the MCL of 5 µg/L.
- **Nitrate (as Nitrogen)** – The only inorganic analyte detected above its reporting threshold (a local background concentration of 1.05 mg/L) in 2024 was nitrate (as nitrogen), which was calculated based on maximum concentrations in upgradient background wells (DOE-ID 2021c). All detections were below the MCL of 10 mg/L.

Table 6-6. Summary of WAG 7 aquifer analyses for May 2024 sampling.

ANALYTE	NUMBER OF WELLS SAMPLED	NUMBER OF SAMPLES ANALYZED ^a	NUMBER OF REPORTABLE DETECTIONS ^{a,b}	CONCENTRATION MAXIMUM ^a	LOCATION OF MAXIMUM CONCENTRATION	NUMBER OF DETECTIONS GREATER THAN MCL ^c	MCL ^c
Carbon tetrachloride	12	14	7	4.98 µg/L	M15S	0	5 µg/L
Trichloroethylene	12	14	5	3.81 µg/L	M15S	0	5 µg/L
Nitrate (as nitrogen)	12	14	8	2.08 mg/L	USGS-132:Port 22	0	10 mg/L

a. Includes field duplicate samples collected for quality control purposes and samples collected from wells with multiple ports.

b. Results that exceeded reporting criteria as established in the “Field Sampling Plan for Operable Unit 7 13/14 Aquifer Monitoring” (DOE-ID 2021c).

c. MCLs are from the “National Primary Drinking Water Regulations” (40 CFR 141).

No radiological analytes met the reportable criteria in May 2024.

As in previous years, groundwater-level measurements in the monitoring wells at RWMC were taken prior to the sample collection for the May 2024 event. The groundwater-level contour map for the 2024 sampling period indicates groundwater flow toward the south-southwest beneath the RWMC, as shown in Figure 6-10.

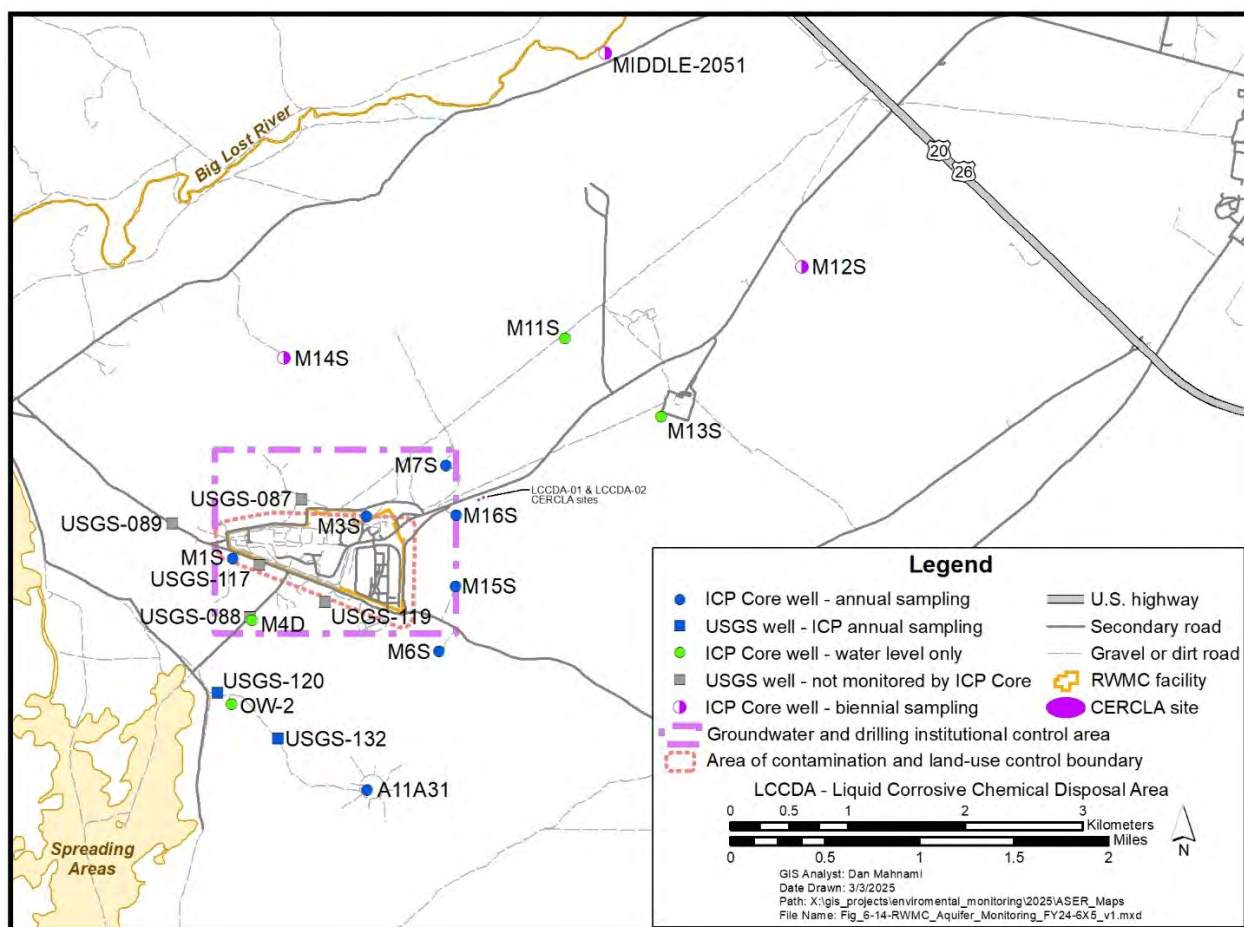


Figure 6-6. The WAG 7 aquifer well monitoring network at the RWMC (DOE-ID 2021c).

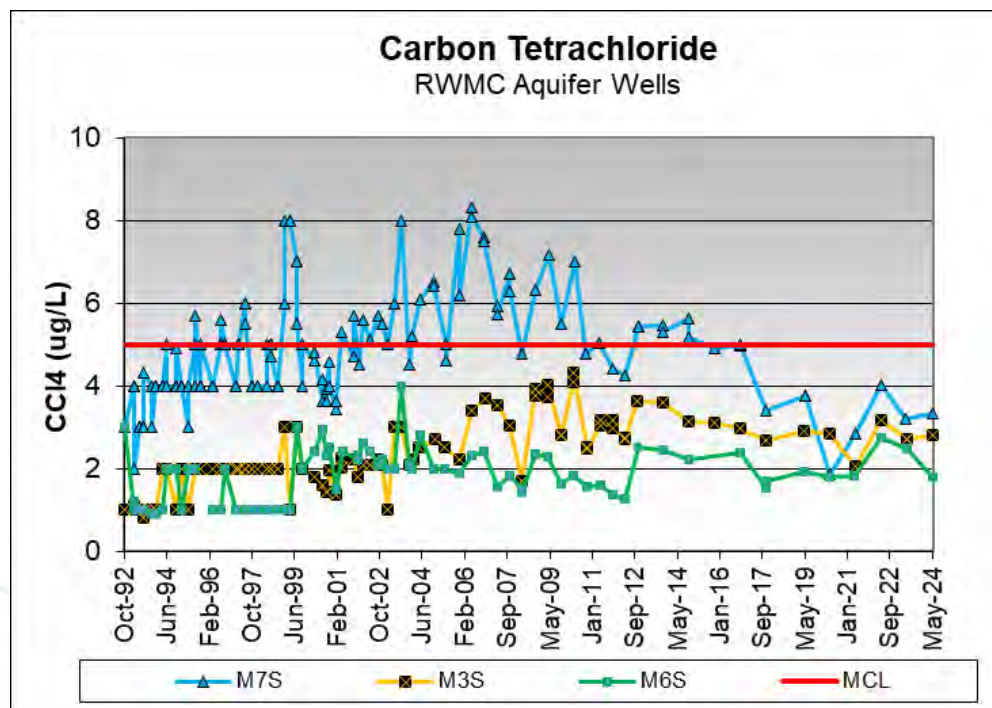


Figure 6-7. Carbon tetrachloride (CCl₄) concentration trends in RWMC aquifer Wells M7S, M3S, and M6S.

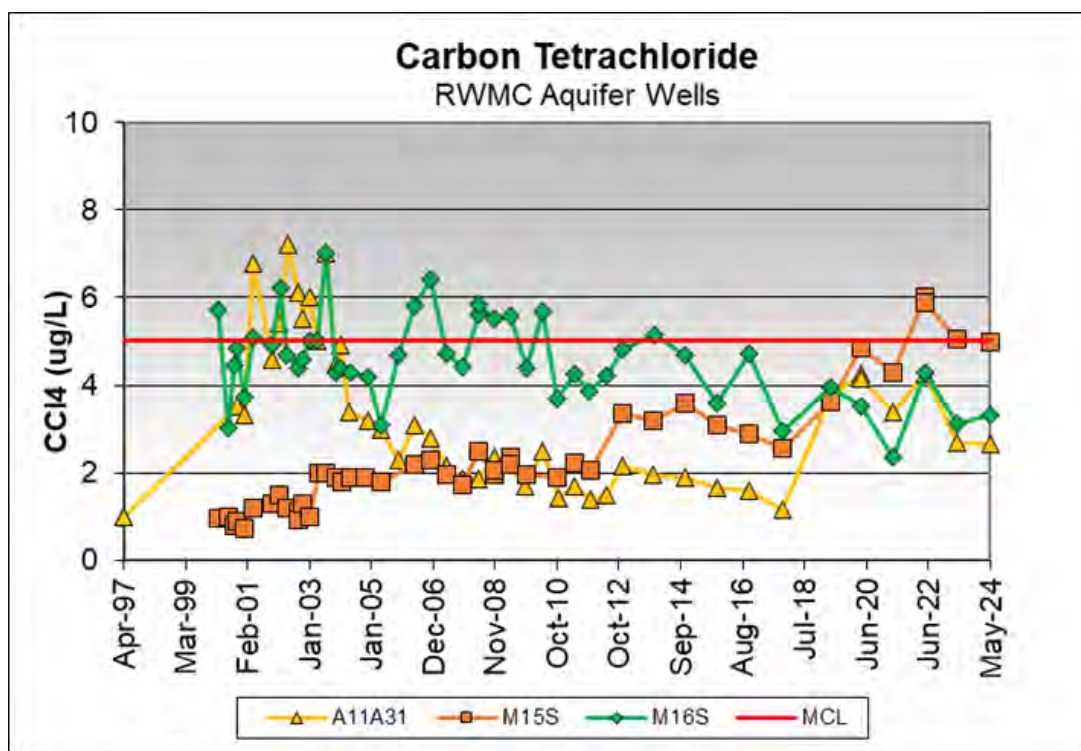


Figure 6-8. Carbon tetrachloride (CCl₄) concentration trends in RWMC aquifer Wells A11A31, M15S, and M16S.

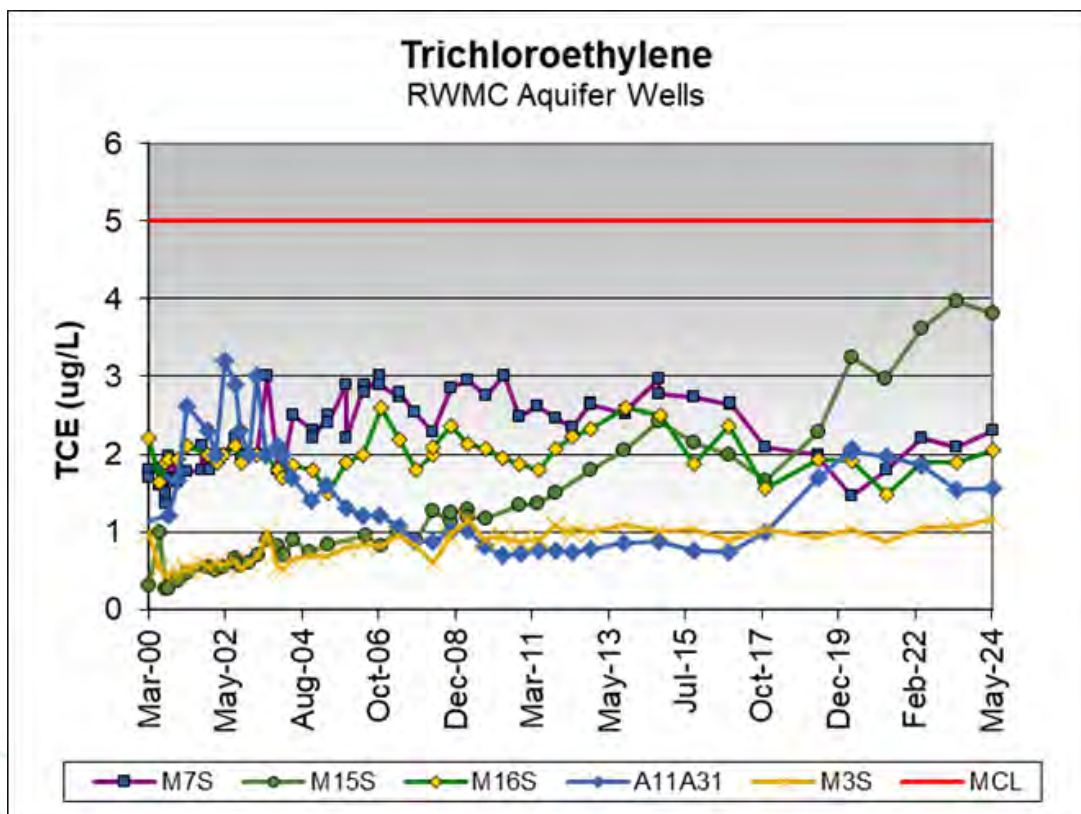


Figure 6-9. Concentration history of TCE in RWMC aquifer Wells M7S, M15S, M16S, A11A31, and M3S.

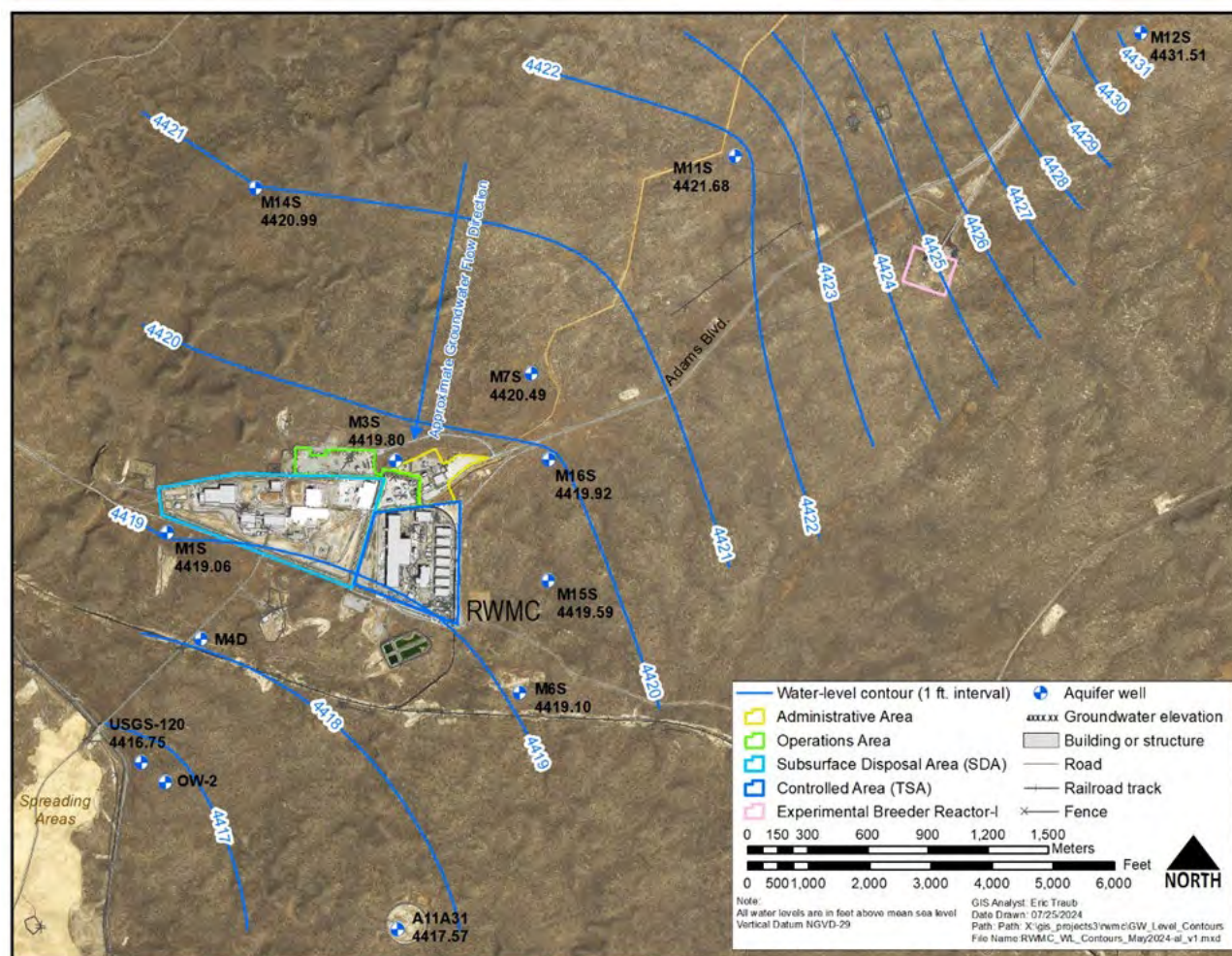


Figure 6-10. Groundwater-level contours in the aquifer near the RWMC based on 2024 measurements.

6.5.6 Summary of Waste Area Group 9 Groundwater Monitoring Results

Prior to 2023, five MFC wells (e.g., four monitoring and one production) were sampled twice per year by the INL contractor for selected radionuclides, metals, anions, cations, and other water quality parameters, as surveillance monitoring under the WAG 9 Record of Decision (ANL-W 1998).

Groundwater monitoring performed to meet the CERCLA requirements of the WAG 9 Record of Decision began in 1998 and was discontinued at the end of 2022. The “Operable Unit 9-04 Operations and Maintenance Report for Fiscal Years 2008–2014” (DOE-ID 2015) indicates the groundwater monitoring data:

- Demonstrate that concentrations of organic, inorganic, and radionuclide constituents have never exceeded the groundwater or drinking water standards at WAG 9
- Show the remedies have achieved their expected outcomes
- Show no discernible impact from previous or current activities at MFC.

Termination of CERCLA semiannual groundwater monitoring in 2022 was formalized in the “Five-Year Review of CERCLA Response Actions at the Idaho National Laboratory Site: Fiscal Years 2015–2019” (DOE-ID 2021d).

While CERCLA-specific groundwater monitoring ended in 2022, groundwater monitoring for certain metals, inorganics, and radionuclides continued in 2024 at MFC Monitoring Wells ANL-MON-A-012, ANL-MON-A-013, and ANL-MON-A-014 to meet the MFC reuse permit and the DOE environmental surveillance monitoring requirements. The 2024 MFC groundwater monitoring results related to current operations are discussed in Chapter 5.



6.6 Remote-Handled Low-Level Waste Disposal Facility

The RHLLW Disposal Facility does not generate or discharge liquid effluents; however, the INL contractor does monitor groundwater at the RHLLW Disposal Facility to demonstrate compliance with DOE O 435.1, “Radioactive Waste Management,” the surveillance requirements of DOE Order 458.1, “Radiation Protection of the Public and the Environment,” and IDAPA 58.01.11, “Ground Water Quality Rule.” Samples were collected from three monitoring wells in 2024 and analyzed for gross alpha, gross beta, carbon-14 (^{14}C), ^{129}I , ^{99}Tc , and tritium in accordance with PLN-5501, “Monitoring Plan for the INL RHLLW Disposal Facility” (INL 2024). Results for the analytes that had positive detections during sampling are summarized in Table 6-7. Gross alpha, gross beta, and tritium were detected in all three wells. Concentrations of ^{14}C , ^{129}I , and ^{99}Tc were not detected in any of the samples. The results for gross alpha, gross beta, ^{14}C , ^{129}I , and ^{99}Tc remain consistent with the concentrations measured in the aquifer that were established prior to completion of the facility (INL 2017) with no observable trends. Tritium in all three wells continue to gradually decline over time. Consistent with previous years, the 2024 results show no discernible impacts to the aquifer from RHLLW Disposal Facility operations.

While not required for compliance at the RHLLW Disposal Facility, facility performance is monitored by collecting and analyzing soil-pore water samples, where sufficient water is present, from vadose-zone lysimeters installed in native materials adjacent to and below the base of the vault arrays. For establishment of the baseline, soil-pore water samples were analyzed for the same indicator and target analytes as the aquifer compliance samples (e.g., gross alpha, gross beta, tritium, ^{14}C , ^{129}I , ^{99}Tc). The baseline monitoring results are documented in INL/RPT-23-74930, “Assessment of Baseline Monitoring Data for the Remote-Handled Low-Level Waste Disposal Facility at the Idaho National Laboratory” (INL 2023). In 2024, the post-baseline soil-pore water samples were collected from select lysimeters adjacent to each vault array and analyzed for gross alpha, gross beta, and tritium. The soil-pore water results are compared to the baseline measurements and used as early indicators of facility performance. The 2024 performance monitoring results are presented in INL/RPT-24-82600, “Annual Summary Report for the Remote-Handled Low-Level Waste Disposal Facility – FY 2024.” (INL 2025c).

Table 6-7. Radioactivity detected in surveillance groundwater samples collected at the RHLLW Facility (2024).

WELL:	USGS-136	USGS-140	USGS-141	PCS/SCS ^a
SAMPLE DATE:	04/24/2024	04/29/2024	04/30/2024	
RADIONUCLIDES ^b				
Gross alpha (pCi/L)	1.62 ± 0.395	ND ^c [1.94 ± 0.455] ^d	1.95 ± 0.512	15 pCi/L
Gross beta (pCi/L)	4.38 ± 0.372	2.34 ± 0.278 [2.73 ± 0.289]	2.96 ± 0.426	4 mrem/yr ^e
Tritium (pCi/L)	284 ± 92.5	ND [588 ± 141]	634 ± 129	20,000 pCi/L

- PCS = primary constituent standard; SCS = secondary constituent standard, as specified in IDAPA 58.01.11.
- Result ± 1σ. Only analytes with at least one statistically positive result greater than 3σ uncertainty are shown. Samples were analyzed for gross alpha, gross beta, ^{14}C , ^{129}I , ^{99}Tc , and tritium.
- ND = not detected.
- Duplicate sample results are shown in brackets.
- IDAPA 58.01.11 specifies a PCS for combined beta/photon emitters of 4 millirems/yr effective dose equivalent. Speciation of the individual radionuclides present would be necessary to determine the equivalent PCS in units of pCi/L. For comparison purposes only, the EPA specifies a 4 mrem/yr MCL for public drinking water systems and uses a screening level of 50 pCi/L. Public drinking water samples with gross beta activity greater than 50 pCi/L must be analyzed to identify the major radionuclides present.

6.7 Onsite Drinking Water Sampling

The INL Site contractors monitor drinking water to demonstrate that it is safe for consumption and meets federal and state regulations. Drinking water parameters are regulated by the state of Idaho under the authority of the Safe Drinking Water Act (40 CFR 141, 142). Parameters are sampled according to a nine-year monitoring cycle, which identifies the frequency and the specific classes of contaminants to monitor at each drinking water source. Parameters with primary MCLs must be monitored at least once every three years, unless a waiver is granted for reduced monitoring every six or nine years.



Many parameters require more frequent sampling during an initial period to establish a baseline, and a subsequent monitoring frequency is determined from the baseline results.

The INL Site has 11 drinking water systems that are monitored by the INL Site contractors. The INL contractor monitors eight of these drinking water systems, while the ICP contractor monitors three. The NRF also monitors a drinking water system; however, the results are not included in this annual report but are addressed in the “Naval Reactors Facility Environmental Monitoring Report for Calendar Year 2024” (FMP 2025). According to the “Idaho Rules for Public Drinking Water Systems” (IDAPA 58.01.08), INL Site drinking water systems are classified as either non-transient or transient, non-community water systems. The four INL contractor transient, non-community water systems are located at CITRC, EBR-I, the Gun Range, and the Main Gate. The four remaining INL contractor water systems are classified as non-transient, non-community water systems. They are located at the ATR Complex, CFA, MFC, and TAN/CTF. Two of the ICP contractor systems, located at INTEC and RWMC, are classified as non-transient, non-community water systems, while the NRF Deactivation and Decommissioning (D&D) Facility is classified as a transient, non-community water system.

As required by the state of Idaho, INL and the ICP drinking water programs use EPA-approved (or equivalent) analytical methods to analyze drinking water in compliance with the current editions of IDAPA 58.01.08 and 40 CFR Parts 141–143. State regulations also require that analytical laboratories be certified by Idaho or another state whose certification is recognized by Idaho. Idaho DEQ oversees the certification program and maintains a list of approved laboratories.

The INL Site contractors monitor certain parameters more frequently than required by regulation because of low volume usage on weekends. For example, bacterial analyses are conducted monthly rather than quarterly at all eight INL contractor drinking water systems and at the three ICP contractor drinking water systems. Because of known groundwater plumes near one ICP contractor drinking water well, additional sampling is conducted for carbon tetrachloride at RWMC.

The INL contractor enforces methods to shield the water supply from contamination threats as outlined in IDAPA 58.01.08 and the Idaho Plumbing code. A key protective strategy involves the stringent prevention of cross-connections between potable drinking water systems, industrial water systems, and fire-suppression water systems. This is achieved through the implementation of cross-connection control, which entails fitting protective devices, such as double-check valves and reduced-pressure-zone valves, at the point where a facility's plumbing meets the public water main. It is compulsory for facilities that handle hazardous materials, which might inadvertently contaminate the potable water system under conditions of low-water pressure, to install these cross-connection control devices.

During 2024, 309 cross-connection control devices were inspected at all INL facilities, including primary devices installed at interfaces to the potable water main and secondary control devices at the point of use. If a problem with a cross-connection device was encountered during testing, the device was repaired and retested to ensure proper function.

6.7.1 INL Site Drinking Water Monitoring Results

During 2024, the INL contractor collected 86 routine/compliance samples from the eight INL-operated drinking water systems. Semiannual sampling was conducted at all eight water systems for gross alpha, gross beta, and tritium. In addition, CFA was sampled for ^{129}I and ^{90}Sr due to its location downgradient of the plume around INTEC. Table 6-8 lists the results of routine/compliance and radiological surveillance monitoring. In addition to routine samples, the INL contractor collected 228 surveillance bacteriological, radiological, and per- and polyfluoroalkyl substances (PFAS) samples and 45 quality control samples in the form of blanks.

The ICP contractor collected 25 routine/compliance samples and five quality control samples from the ICP drinking water systems. ICP also collected 54 surveillance bacteriological, PFAS, synthetic organic compound, and VOC samples. Two gross alpha/beta samples were collected semiannually from both the ICP drinking water systems at INTEC and RWMC. One tritium sample also was collected from each drinking water system as well, as shown in Table 6-8.

All INL Site water systems were sampled for nitrates. Samples for total trihalomethanes and haloacetic acids were collected at the ATR Complex, CFA, INTEC, MFC, RWMC, and TAN/CTF. In compliance with the DEQ monitoring schedule, the ATR Complex and CFA were sampled for VOCs, while TAN/CTF was sampled for Phase 2 and 5 inorganic contaminants. Results for the most frequently sampled analytes are summarized in Table 6-8.

All INL Site drinking water systems were either well below the regulatory limits for drinking water or no detections were observed. No trends in the data were evident over the last five years. Tritium concentrations at CFA have hovered around 2,000 pCi/L for the last five years, but it is important to note that this facility has demonstrated a significant downward trend in tritium concentrations over the last 25 years from a high of 12,500 pCi/L in the year 2000. Since all water systems are categorized as public water systems (PWSs), the data for all but the radiological constituents are shown on the Idaho DEQ's PWS Switchboard.



Table 6-8. Summary of INL Site drinking water results (2024).

CONSTITUENT (units)	MCL	ATR COMPLEX PWS ^a 6120020	CFA PWS 6120008	CITRC PWS 6120019	EBR-I PWS 6120009	GUN RANGE PWS 6120025	INTEC PWS 6120012	MAIN GATE PWS 6120015	MFC PWS 6060036	NRF D&D PWS 6120031	RWMC PWS 6120018	TAN CTF PWS 6120013
RADIOLOGICAL SURVEILLANCE MONITORING												
Gross Alpha ^b (pCi/L)	15	ND ^c –3.13	ND–3.21	ND–3.06	ND	ND–5.02	ND	ND	ND–4.18	NA ^d	ND	ND–3.22
Gross Beta ^b (pCi/L)	50 screening	ND–2.68	6.14–7.68	4.70–6.74	2.85–3.61	3.16–5.47	1.79–2.23	2.40–3.25	3.14–4.87	NA	3.44–3.92	ND–3.85
Tritium ^b (pCi/L)	20,000	ND	1,370–2,030	ND	ND	ND–480	ND	ND	ND	NA	ND	ND
Iodine-129 (pCi/L)	1	NA	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA
Strontium-90 ^b (pCi/L)	8	NA	ND	NA	NA	NA	ND	NA	NA	NA	ND–3.10	NA
COMPLIANCE MONITORING												
Nitrate ^b (mg/L)	10	ND	2.92	ND	ND	1.03	0.564	ND	2.42–2.45	NA	0.954	ND
Total trihalomethanes ^b (ppb)	80	6.70	3.20	NA	NA	NA	5.24	NA	6.30	0.500/ 6.60 ^b	3.47	4.15
Total coliform	See 40 CFR 141.63	Absent	Absent	Absent	Absent	Absent	Absent	6 Absent 10 Present ^e	Absent	Absent	Absent	Absent
<i>E. coli</i>	See 40 CFR 141.63	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
Haloacetic acids (ppb)	60	ND	ND	NA	NA	NA	ND	NA	ND	NA	ND	ND

a. PWS = public water system.

b. Range of results (minimum – maximum) presented.

c. ND = not detected greater than or equal to the MCL.

d. NA = not applicable based on water system classification or not analyzed.

e. Includes routines, repeats, and source samples.



In February 2023, DOE published the “[Guide for Investigating Historical and Current Uses of Per- and Polyfluoroalkyl Substances at Department of Energy Sites](#)” (DOE 2023). This guide outlines a framework for DOE programs investigating historic or current PFAS uses at DOE-owned or -operated entities nationwide. INL Site contractors will continue to monitor PFAS based on the “[DOE PFAS Strategic Roadmap: DOE Commitments to Action 2022–2025](#)” (DOE 2022b), the INL PFAS Implementation Plan (Chunn 2023), and the ICP PFAS Implementation Plan (ICP 2022). In 2023, the INL Site contractors hired subcontractors to conduct a preliminary assessment on past uses of PFAS at INL, in accordance with the DOE Roadmap. This work is ongoing.

In 2024, the INL contractor sampled all operating potable water wells and entry points to the distribution system for PFAS, completing a five-year baseline sampling effort. In 2024, the ICP contractor collected PFAS samples from two drinking water wells at INTEC and one well at RWMC. CFA was the only sample location with any detections of perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS). CFA had detections of perfluorobutane sulfonic acid (PFBS), while both CFA and TAN CTF had detections of perfluorohexanesulfonic acid (PFHxS). All sample results at INL are below the final MCLs for PFAS, and levels were consistently low throughout the baseline sampling period.

6.8 Offsite Drinking Water Sampling

The public drinking water source in southeastern Idaho is primarily derived from groundwater. Due to the potential for contaminant migration beyond the INL Site boundary, surveillance monitoring of radioactivity in offsite drinking water systems are conducted by the INL contractor to meet DOE O 458.1 (DOE 2020). Samples are collected from municipal water sources that have been through a water treatment facility or a well that is used for drinking water. Samples collected offsite are included as drinking water samples but are not used for compliance with drinking water regulations. Instead, media results are used to assess groundwater quality. Public water system owners and operators are responsible for complying with state and federal regulations to monitor water quality.

As part of the offsite surveillance monitoring program, drinking water samples were collected off the INL Site for radiological analyses in 2024. Two downgradient locations of the INL Site at Shoshone and Minidoka, and one upgradient location at Mud Lake, were co-sampled with the state of Idaho DEQ-INL Oversight Program (DEQ-IOP) in May and November 2024. Samples were collected at Atomic City, Craters of the Moon, Howe, Idaho Falls, and the public rest area at Highway 20/26 as well. These samples were analyzed for gross alpha and gross beta activities and for tritium. To improve the readability of this chapter, INL contractor offsite drinking water data tables are included when surveillance monitoring results exceeded 3σ . All sample media results for 2024 are provided in the INL quarterly surveillance reports ([INL 2025a](#); [INL 2025b](#)). The DEQ-IOP results are reported quarterly and annually.

Gross alpha activity was detected in several locations, as observed in Table 6-9. The concentrations were similar to previous results from offsite drinking water sampling.

Table 6-9. Gross alpha concentrations detected in offsite drinking water samples collected by the INL contractor in 2024.

LOCATION	SAMPLE RESULTS (pCi/L) ^a	
	GROSS ALPHA ^b	
	SPRING	FALL
Atomic City	2.30 ± 0.76	2.72 ± 0.84
Control	ND	0.56 ± 0.16
Craters of the Moon	ND	2.84 ± 0.73
Howe	ND	3.14 ± 0.61
Minidoka	ND	3.06 ± 0.62
Shoshone	ND	6.30 ± 0.67

a. Results $\geq 3\sigma$ are considered to be statistically positive.
b. EPA MCL = 15 pCi/L.
c. ND = not detected.



Gross beta activity was detected in all offsite drinking water samples, except for the samples collected from Idaho Falls and a control sample. The concentrations were similar to previous results from offsite drinking water sampling. Natural levels of radioactive decay products of thorium and uranium exist in the Snake River Plain Aquifer and are likely the source of the measured concentrations. The highest reported gross beta result for offsite drinking water was 8.51 ± 0.40 pCi/L in the sample collected from Howe on November 14, 2024.

Tritium was not detected in any offsite drinking water samples. The DCS for tritium in water is 2.6×10^6 pCi/L.

6.9 Surface Water Sampling

Two main sources of water could potentially be affected from activities on the INL Site: (1) the eastern Snake River Plain Aquifer, and (2) the Big Lost River. The eastern Snake River Plain Aquifer is a primary source of regional drinking water and supplies irrigation water to regional agricultural and aquaculture economy.

The Big Lost River is an intermittent, ephemeral body of water that flows only during periods of high-spring runoff and when the Mackay dam, which impounds the river upstream of the INL Site, releases water. The river flows through the INL Site and enters a depression where the water flows into the ground, which is called the Big Lost River Sinks. The river then mixes with other water in the eastern Snake River Plain Aquifer and emerges about 100 miles (160 km) away at Thousand Springs near Hagerman and at other springs downstream of Twin Falls.

Normally, the riverbed is dry due to upstream irrigation and rapid infiltration into the desert soil and underlying basalt. No Big Lost River samples were collected in 2024 due to the absence of water flow. Offsite surface water samples are collected semiannually at three locations downgradient of the INL Site: (1) Alpheus Springs near Twin Falls, (2) Clear Springs near Buhl, and (3) a trout farm near Hagerman. These locations were co-sampled with the DEQ-IOP in May and November 2024.

All sample media results for 2024 are provided in the INL quarterly surveillance reports ([INL 2025a](#); [INL 2025b](#)).

Gross alpha activity was detected in one of the surface water samples (2.38 ± 0.60 pCi/L) collected from Alpheus Springs.

Gross beta activity was detected in all surface water samples. The concentrations were similar to previous results from surface water sampling. Natural levels of radioactive decay products of thorium and uranium exist in the Snake River Plain Aquifer and are likely the source of the measured concentrations. The highest concentration was 7.46 ± 0.38 pCi/L collected from Alpheus Springs.

Tritium was not detected in any surface water sample. The DCS for tritium in water is 2.6×10^6 pCi/L.

6.10 USGS 2024 Publication Abstracts

In 1949, the USGS was asked to characterize water resources prior to the building of nuclear-reactor testing facilities at the INL Site. Since that time, USGS hydrologists and geologists have been studying the hydrology and geology of the eastern Snake River Plain and the eastern Snake River Plain Aquifer.

At the INL Site and in the surrounding area, the USGS INL Project Office:

- Monitors and maintains a network of existing wells
- Drills new research and monitoring wells, providing information about subsurface water, rock, and sediment
- Performs geophysical and video logging of new and existing wells
- Maintains the Lithologic Core Storage Library
- Provides data to the public.

Data gathered from these activities are used to create and refine hydrologic and geologic models of the aquifer, track contaminant plumes in the aquifer, and improve understanding of the complex relationships between the rocks, sediments, and water that compose the aquifer. The USGS INL Project Office publishes reports about their studies, which are available through the [bibliography website](#).

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A beetle enjoying vegetation.

Chapter 7: Environmental Surveillance Monitoring Programs – Agricultural Products, Wildlife, Soil, and Direct Radiation



CHAPTER 7

Radionuclides released by operations and activities at the Idaho National Laboratory (INL) Site have the potential to be assimilated by agricultural products and game animals, which then can be consumed by humans. These media are thus sampled and analyzed for human-made radionuclides because of the potential transfer of radionuclides to people through food chains. Iodine-131 and cesium-137 were not detected in any milk samples collected in 2024; however, strontium-90 (^{90}Sr) was detected in a milk sample collected in Terreton, Idaho. The result was within the acceptable range of historical values and well below the derived concentration standard (DCS) of ^{90}Sr in milk, which is 5,800 pCi/L. Based on this result, the milk is safe for consumption. Additionally, no human-made radionuclides were detected in any of the other agricultural products (e.g., lettuce, grain, potatoes, alfalfa) collected in 2024.

No human-made radionuclides were detected in road-killed animal samples collected in 2024. But two human-made cobalt-60 (^{60}Co) and ^{90}Sr radionuclides were detected in some exterior subsamples of waterfowl collected at Central Facilities Area (CFA) and from the Sewage Lagoons at the INL Site. Although the concentration of ^{60}Co in the subsample from the Sewage Lagoons was above the three sigma (3σ) uncertainty, it did not exceed the minimum detectable concentration. A concentration of ^{90}Sr was detected in the exterior subsample of a control duck collected from the South Fork of the Snake River. All results were within the historical measurements.

Direct radiation measurements made at the boundary and offsite locations were consistent with background levels. The average annual dose equivalent from external exposure was estimated from the dosimeter measurements to be 123 mrem off the INL Site. The total background dose from natural sources to an average individual living in southeast Idaho was estimated to be approximately 388 mrem per year.

Radiation measurements taken in the vicinity of waste storage and soil contamination areas near INL Site facilities were consistent with previous measurements. Direct radiation measurements using a radiometric scanner system at the Radioactive Waste Management Complex (RWMC) and the Idaho Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Disposal Facility (ICDF) were historically near background levels.

7. ENVIRONMENTAL SURVEILLANCE MONITORING PROGRAMS – AGRICULTURAL PRODUCTS, WILDLIFE, SOIL, AND DIRECT RADIATION

This chapter summarizes the results of the INL Site contractors' environmental surveillance monitoring of agricultural products, wildlife, soil, and direct radiation on and around the INL Site during 2024. Details of these programs may be found in the "Idaho National Laboratory Site Environmental Monitoring Plan" (DOE-ID 2023). INL Site contractors monitor soil, vegetation, biota, and direct radiation both on and off the INL Site to comply with applicable United States (U.S.) Department of Energy (DOE) orders and other requirements. The INL Site has the potential to release contaminants to the environment, which may be present in agricultural products, biota, soil, and direct radiation. To improve the readability of this chapter, detection result data tables are included when surveillance monitoring results exceed three sigma (3σ) and/or the background upper threshold limits.

7.1 Agricultural Products and Biota Sampling

Agricultural products and game animals are sampled by the INL contractor because of the potential transfer of radionuclides to people through food chains. Sampling of agricultural foodstuffs is performed on and around the INL Site to meet the following requirements and criteria for environmental surveillance of DOE facilities:

- DOE O 458.1, "Radiation Protection of the Public and the Environment"



- DOE-HDBK-1216-2015, “[Environmental Radiological Effluent Monitoring and Environmental Surveillance](#)” (DOE 2015)
- Stakeholder inputs and values.

The INL contractor agricultural sample results for 2024 are provided in the quarterly surveillance reports ([INL 2025a](#), [INL 2025b](#), [INL 2025c](#), and [INL 2025d](#)).

7.1.1 Sampling Design

Agricultural products could become contaminated by radionuclides released from INL Site facilities, which are transported offsite by wind and deposited in soil and on plant surfaces. This is important, since approximately 45% of the land surrounding the INL Site is used for agriculture (DOE-ID 1995). Additionally, many residents maintain home gardens that could be impacted by INL Site releases. In addition, animals could eat contaminated crops and transfer radionuclides to humans in turn through the consumption of meat and milk.

Agricultural product sampling began in the vicinity of the INL Site in the 1960s with milk and wheat as part of the routine environmental surveillance monitoring program. Currently, the program focuses on milk, leafy green vegetables, alfalfa, potatoes, and grains.

As specified in [DOE-HDBK-1216-2015](#) (DOE 2015), representative samples of the pathway-significant agricultural products grown within 16 km (10 miles) of the INL Site should be collected and analyzed for radionuclides that potentially could be present from INL Site operations. These samples should be collected in at least two locations: (1) the place of expected maximum radionuclide concentrations, and (2) a “background” location unlikely to be affected by radionuclides released from the INL Site.

Sample design was primarily guided by wind direction and frequencies, as well as from farming practices. Using CALPUFF and INL Site meteorological data measured from 2006 through 2008, air-dispersion modeling was performed to develop data quality objectives for radiological air surveillance monitoring for the INL Site using the methodology documented in Rood and Sondrup (2014). Then, this same methodology was used to discern the dispersion and deposition patterns resulting from these sources, which reflect wind patterns typical of the INL Site. Prevailing winds at most INL Site locations are from the southwest during daytime hours. During evening hours, the winds will sometimes shift direction and blow from the north or northeast but at a lower velocity. Model results show the maximum offsite deposition location is between the southwest INL Site boundary and the Big Southern Butte. Because there are no agricultural activities in this region, sampling is focused on other agricultural areas west and northeast of the INL Site. In addition, the sampling design considers locations of interest to the public, as well as those of historical interest, which is why some samples are collected at extended distances from the INL Site.

7.1.2 Sampling Methods

Fresh produce and milk are purchased from local farmers when available. In addition, lettuce is grown by the INL contractor in areas that have no commercial or private producers.

7.1.3 Sampling Results

Milk

Milk is sampled to monitor the pathway from potentially contaminated, regionally grown feed to cows, and then to milk, which is afterward ingested by humans. During 2024, the INL contractor collected 175 milk samples—including duplicates and controls—at [various locations off the INL Site](#) and purchased milk commercially produced outside the state of Idaho, which served as the control sample. The number and location of the dairies can vary from year to year as farmers enter and leave their businesses. Milk samples were collected weekly from dairies in Rigby and Terretton, Idaho, as well as monthly at other locations around the INL Site.

All milk samples were analyzed for gamma-emitting radionuclides, including iodine-131 (^{131}I) and cesium-137 (^{137}Cs). During the second and fourth quarters, samples were analyzed for strontium-90 (^{90}Sr) and tritium as well. Iodine is an essential nutrient and is readily assimilated by cows or goats eating plants containing the element. Iodine-131 is of particular interest because it is produced by reactor operations or nuclear weapons testing, is readily detectable, and, along with ^{134}Cs and ^{137}Cs , can dominate the ingestion dose regionally after a severe nuclear event, such as what occurred after the Chernobyl accident (Kirchner 1994) in Ukraine and the 2011 accident in Fukushima, Japan. The ingestion pathway of milk is the main route of internal ^{131}I exposure for people. Iodine-131 has a short half-life of just 8 days; therefore, it does not persist in the environment. Past releases from experimental reactors at the INL Site and fallout from



atmospheric nuclear weapons tests and the Chernobyl accident are no longer present. Iodine-131 was not detected in any of the air samples collected at or beyond the INL Site boundary (see Chapter 4), nor was it detected in any milk sample collected during 2024.

Cesium-137 is chemically analogous to potassium in the environment and behaves similarly by accumulating in many types of tissue, most notably in muscle tissue. With a half-life of about 30 years, ^{137}Cs tends to persist in soil. If in a soluble form, it can readily enter the food chain through plants. It is widely distributed throughout the world from historic nuclear weapons detonations, which occurred between 1945 and 1980, and has been detected in all environmental media at the INL Site. Potential sources of ^{137}Cs include releases from INL Site facilities and the resuspension of previously contaminated soil particles. Cesium-137 was not detected in any milk sample collected in 2024.

Strontium-90 is an important radionuclide because it behaves like calcium and can deposit in bones. Like ^{137}Cs , ^{90}Sr is produced in high yields either from nuclear reactors or from the detonation of nuclear weapons. It has a half-life of about 29 years and can persist in the environment. Strontium tends to form compounds that are more soluble than ^{137}Cs and are therefore comparatively mobile in ecosystems. A concentration of ^{90}Sr was detected in one milk sample (0.66 ± 0.13 pCi/L) collected in Terreton, Idaho, on May 20, 2024. Based on this result, the milk is safe for consumption. This level was similar to the levels reported by the U.S. Environmental Protection Agency (EPA) as resulting from worldwide fallout deposited on soil and taken up by cows through the ingestion of grass. The results for a limited dataset of seven samples collected from 2007 through 2016 in EPA Region 10, which includes the state of Idaho, ranged from 0 to 0.54 pCi/L (EPA 2017). The maximum concentration of ^{90}Sr detected in the past 10 years was 1.53 ± 0.01 pCi/L, which was measured at Blackfoot, Idaho, in May 2021.

DOE has established a DCS for radionuclides in air, water, and milk (DOE 2022). A DCS is the concentration of a radionuclide in air, water, or milk that would result in a dose of 100 mrem from ingestion, inhalation, or immersion in a gaseous cloud for one year. The DCS for ^{90}Sr in milk is 5,800 pCi/L. Therefore, the observed value of ^{90}Sr in a milk sample (0.66 ± 0.13 pCi/L) is approximately 0.01% of the DCS for milk.

Tritium, with a half-life of about 12 years, is an important radionuclide because it is a radioactive form of hydrogen, which combines with oxygen to form tritiated water. The environmental behavior of tritiated water is like that of water and can be present in surface water, precipitation, and atmospheric moisture. Tritium is formed by natural processes, as well as by reactor operations and nuclear weapons testing. Tritium enters the food chain through surface water, which people and animals drink, and from plants that contain water. Tritium was not detected in any of the milk samples collected in 2024. The DCS for tritium in milk is 12,000,000 pCi/L.

Lettuce

Lettuce was sampled because radionuclides in air can be deposited on soil and plants, which then can be ingested by people. The uptake of radionuclides by plants may occur through root uptake from the soil, as well as from deposited material absorbed into leaves. For most radionuclides, uptake by foliage is the dominant process for plant contamination (Amaral et al. 1994). For this reason, green, leafy vegetables, such as lettuce, have higher-concentration ratios of radionuclides to soil than any other kind of plant. The INL contractor collects lettuce samples every year from areas on and adjacent to the INL Site. The number and locations of gardens have changed from year to year, depending on whether vegetables were available. Home gardens have been replaced with portable lettuce planters because the availability of lettuce from home gardens was unreliable at some key locations.

In addition, planters can be placed, and lettuce samples collected in areas previously unavailable to the public, such as on the INL Site and near air samplers, can provide reliable results. The planters can allow the radionuclides deposited from the air to accumulate on the soil and plant surfaces throughout the growth cycle. The planters are placed in the spring, filled with soil and potting mix, sown with lettuce seed, and self-watered through a reservoir.

Ten lettuce samples were collected from southeast Idaho locations, as well as one duplicate from Pocatello, which were analyzed for the gamma-emitting ^{137}Cs radionuclide and for ^{90}Sr . A control sample purchased from a local grocery store was analyzed as well. Four of the ten lettuce samples were collected from portable planters at Atomic City, the Experimental Field Station (EFS), Howe, and Montevieu, in the state of Idaho. Soil from the vicinity of the sampling locations was used in the planters. This soil was amended with potting soil as a gardener in the region would typically use when growing lettuce. In addition to obtaining samples from the portable locations, duplicate samples were obtained from a home garden in Idaho Falls, Idaho, in addition to two more farms located in Blackfoot and Pocatello, Idaho. A control sample was purchased from a grocery store in the state of Washington.

These samples were analyzed for ^{90}Sr and gamma-emitting radionuclides. Strontium-90 was not detected in the lettuce samples collected during 2024. Strontium-90 is present in the environment as a residual of fallout from above-ground



nuclear weapons testing, which occurred between 1945 and 1980. No other human-made radionuclides were detected in any of the lettuce samples. Although ^{137}Cs fallout from nuclear weapons testing is measurable in soils, the ability of vegetation, such as lettuce, to incorporate cesium from soil in plant tissue is much lower than for strontium (Fuhrmann et al. 2003; Ng, Colsher, and Thompson 1982; Schulz 1965). In addition, the availability of ^{137}Cs in plants depends highly on the properties of the soil, such as the clay content or alkalinity, which can act to bind the radionuclide (Schulz 1965). Soil in southeast Idaho tends to be moderately to highly alkaline.

Grain

Grain, including wheat and barley, is sampled because it is a staple crop in the region. In 2024, the INL contractor collected grain samples at 11 locations from areas surrounding the INL Site; a duplicate sample was not collected in 2024 but a control sample was purchased from outside the state of Idaho. These locations were selected because they typically are farmed for grain and are encompassed by the air surveillance monitoring network. Exact locations may change as growers rotate their crops. No human-made radionuclides were found in any of the samples. Agricultural products, such as fruits and grains, are naturally lower in radionuclides than those found in green, leafy vegetables (Pinder et al. 1990).

Potato

Potatoes are collected because they are one of the main crops grown in the region and are of special interest to the public. Because potatoes are not exposed to airborne contaminants, they typically are not considered a key part of the ingestion pathway. Potatoes were collected by the INL contractor at nine locations in the INL Site vicinity, while a duplicate sample was collected from Raft River, Idaho. A control sample was purchased from outside the state of Idaho. None of the potato samples collected during 2024—including the duplicate—contained a detectable concentration of any human-made radionuclides. Potatoes, like grain, are generally less-efficient at removing radioactive elements from the soil than leafy vegetables, such as lettuce, can effectively remove.

Alfalfa

In addition to analyzing milk, the INL contractor began collecting data in 2010 on alfalfa consumed by milk cows. Samples of alfalfa were collected from four locations in areas surrounding the INL Site vicinity. Mud Lake, Idaho, is an agricultural area with a high potential for offsite contamination via the air pathway. (Note: The offsite location with the highest air concentration used for estimating human doses was detected southeast of the INL Site's east entrance; however, there is limited agriculture near that location.) No ^{90}Sr or gamma-emitting radionuclides were detected in the alfalfa samples collected during 2024.

Big Game Animals

Since big game historically have been documented to uptake some level of radioactive contaminants, the opportunistic sampling of road-killed game animals is important to ascertain the potential impacts of these contaminants on the animals, as well as the humans potentially consuming them (INL 2022a).

Various tissue samples were collected from seven elk under a scientific collection permit. Muscle, liver, and thyroid samples were collected from three of the elk. Only muscle and thyroid samples were collected from the remaining four elk because their livers were damaged due to vehicular strikes. The muscle and liver samples were analyzed for ^{137}Cs because it is an analog of potassium and is readily incorporated into muscle and organ tissues. Thyroids are analyzed for ^{131}I because the isotope accumulates selectively in the thyroid gland of many animals when ingested, making them an ideal bio-indicator of atmospheric releases. Iodine-131 was not detected in the thyroid samples. No ^{137}Cs or other human-made, gamma-emitting radionuclides were found in any of the muscle or liver samples.

Waterfowl

Waterfowl are collected each year at ponds on the INL Site and at a location offsite under scientific collection permits with the Idaho Department of Fish and Game and the U.S. Fish and Wildlife Service. Three waterfowl samples were collected from wastewater ponds located at the Sewage Lagoons, two control waterfowl samples were collected from the South Fork of the Snake River, and two additional waterfowl samples were collected from CFA due to unforeseen natural causes that allowed for collection. These waterfowl samples were analyzed for gamma-emitting radionuclides (^{90}Sr) and actinides (^{241}Am , ^{238}Pu , $^{239/240}\text{Pu}$). These radionuclides were selected because they have been measured historically in liquid effluents from some INL Site facilities. Each sample was divided into the following three subsamples: (1) edible tissue (e.g., muscle, gizzard, heart, liver); (2) the external portion (e.g., feathers, feet, head); and (3) all remaining tissue.

A total of two human-made radionuclides (^{60}Co and ^{90}Sr) were detected in the exterior subsamples from the waterfowl samples collected at CFA and the South Fork of the Snake River, as indicated in Table 7-1. The ^{60}Co result for an exterior subsample of a waterfowl collected from the Sewage Lagoons was above the 3σ uncertainty but did not exceed the



minimum detectable concentration. All results were within the historical measurements that were observed from 2014 to 2023. No other human-made, gamma-emitting radionuclides were found in the collected edible or remainder subsamples.

Table 7-1. Radionuclide concentrations detected in waterfowl collected in 2024.

RADIONUCLIDES DETECTED IN WATERFOWL TISSUE (pCi/kg)				
LOCATION	SPECIES	PORTION	RADIONUCLIDE	CONCENTRATION
CFA	Canada goose	Exterior	Cobalt-60	315.00 ± 34.00
South Fork of the Snake River	Canada goose	Exterior	Strontium-90	12.80 ± 4.04

7.2 Soil Sampling

DOE-HDBK-1216-2015 (DOE 2015) states that soil sampling and analysis should be used to evaluate long-term accumulation trends and to estimate environmental radionuclide inventories. It notes that soil provides an integrating medium that can account for contaminants released to the atmosphere either directly in gaseous effluents, or indirectly from the resuspension of onsite contamination or through liquid effluents released to a stream that is subsequently used for irrigation. However, while soil sampling is a useful approach for determining the accumulation of initially airborne radionuclides deposited on the ground, such sampling generally serves a supplementary role in environmental surveillance monitoring programs (Gallegos 1995; Hardy and Krey 1971; EML 1997). In addition, soil sampling is of questionable value in attempting to estimate small increments of deposition over a period of a few years or less due to the large uncertainties in sampling and the inherent variability in soil, and because it is not recommended as a routine method of environmental surveillance monitoring except in pre-operational surveys (EML 1997).

The INL contractor currently completes soil sampling on a 5-year rotation at the INL Site to evaluate long-term accumulation trends and to estimate environmental radionuclide inventories. The next soil sampling and analysis event is scheduled for 2027. Data from previous years of soil sampling and analysis on the INL Site show slowly declining concentrations of short-lived radionuclides of human origin (e.g., ¹³⁷Cs), with no evidence of detectable concentrations depositing onto surface soil from ongoing INL Site releases (INL 2017).

7.3 Direct Radiation

Environmental, direct radiation measures the exposure of the public and non-involved workers within INL Site boundaries and surrounding areas. Dosimeters are placed around INL facilities, along the INL Site perimeter, and in areas within a 50-mile radius of the INL Site boundaries. Direct radiation sample results for 2024 are provided in the quarterly surveillance reports (INL 2025b; INL 2025d).

7.3.1 Sampling Design

An array of optically stimulated luminescent dosimeters (OSLDs) is distributed throughout the Eastern Snake River Plain and on the INL Site to measure environmental radiation. In addition, neutron dose surveillance monitoring is conducted around INL facilities and buildings where neutron radiation may be present. The two sampling periods were from November 2023 to April 2024 and from May 2024 to October 2024. Dosimeters on the INL Site are placed at facility perimeters, concentrated in areas likely to detect the highest gamma radiation readings. Other dosimeters on the INL Site are located near radioactive materials storage areas and along roads.

7.3.2 Sampling Methods

Environmental OSLDs are placed in the field for 6 months. After the 6-month period, the OSLDs are collected and returned to the supplier for analysis. Transit control dosimeters are shipped with the field dosimeters to measure any dose received during shipment. Background radiation levels are highly variable; therefore, historical information establishes localized regional trends to identify variances. It is anticipated that 5% of the measurements will exceed the background dose. If a single measurement is greater than the background dose, it does not necessarily mean that an unusually high amount of radiation exists in that area. When a measurement exceeds the background dose, the measurement is compared to other values in the area and to historical data to determine whether the results may require further action as described in the report, "Data Quality Objectives Supporting the Environmental Direct Radiation Monitoring Program for the Idaho National Laboratory" (INL 2022b). The method for computing the background value as the upper tolerance limit



(UTL) is described in EPA (2009) and EPA (2016). ProUCL Version 5.1 software (EPA 2016) has been used to compute the UTL for these locations, given all available data in the area since 2012.

7.3.3 Direct Radiation Results

The 2024 direct radiation results collected by the INL contractor at the boundary, offsite, and onsite locations are provided in the INL contractor quarterly surveillance reports (INL 2025b; INL 2025d). The 2024 reported values for these field locations were primarily below the historic six-month background UTL. Table 7-2 contains the locations that exceeded their specific 6-month background UTL. As anticipated, 3% exceeded the UTL for 2024 (see Subsection 7.3.2). The results listed in Table 7-2 showed similarity to the historical data suggesting that no further action was required.

Table 7-2. Dosimetry locations above the six-month background UTL (2024).

LOCATION (BUILDING)	NOV. 2023 – APRIL 2024 SAMPLE RESULT (mrem)	MAY 2024 – OCT. 2024 SAMPLE RESULT (mrem)	BACKGROUND LEVEL UTL ^a (mrem)
EBR-I (EBR-I O-2)	— ^b	93.0 ± 4.7	91.0
Idaho Falls (IF-638W O-4)	69.7 ± 3.5	—	66.4
Idaho Falls (IF-665 O-5)	—	67.7 ± 3.4	66.2
Idaho Falls (IF-675S O-34)	65.2 ± 3.3	—	63.0
INTEC (ICPP O-15)	—	169.7 ± 8.5	146.9
INTEC (ICPP O-27)	—	269.6 ± 13.5	230.2
INTEC (ICPP O-28)	—	248.8 ± 12.4	230.2
NRF (NRF O-16)	—	84.6 ± 4.2	79.2
NRF (NRF O-19)	—	80.8 ± 4.0	79.2
Roberts (RobNOAA)	—	80.9 ± 4.0	79.2
TAN (TAN LOFT O-10)	81.7 ± 4.1	—	79.8

a. The UTL is the value such that 95% of all the doses in the area are less than that value with 95% confidence. It is anticipated that 5% of the doses should exceed the UTL.

b. — = The sample did not exceed the UTL for the collection period.

Neutron dose surveillance monitoring is conducted around buildings in Idaho Falls where sources may emit or generate neutron radiation. All of the neutron dosimeters collected in 2024 were reported as “M,” which denotes that the dose equivalents are below the minimum measurable quantity of 10 mrem. The background level for the neutron dose is zero, and the current dosimeters have a detection limit of 10 mrem. Any measured neutron dose is considered present due to sources inside the building. The INL contractor follows the recommendations of the manufacturer to prevent environmental damage to the neutron dosimetry by wrapping each in aluminum foil. Then, to keep the foil intact, the dosimeter is inserted into an ultraviolet protective cloth pouch when deployed.

Table 7-3 summarizes the calculated effective dose a hypothetical individual would receive on the Snake River Plain from various sources of natural background radiation (e.g., cosmic, terrestrial). This table includes the latest recommendations of the National Council of Radiation Protection and Measurements (NCRP) in “Exposure of the Population in the United States and Canada from Natural Background Radiation” (NCRP 2009).

The terrestrial natural background radiation exposure estimate is based on the concentrations of naturally occurring radionuclides found in soil samples collected from 1976 to 1993, as summarized by Jessmore, Lopez, and Haney (1994). Concentrations of naturally occurring radionuclides in the soil do not change significantly over this relatively short period. Data indicates the average concentrations of ²³⁸U, ²³²Th, and ⁴⁰K were 1.5, 1.3, and 19 pCi/g, respectively. The calculated external dose equivalents received by a member of the public from ²³⁸U plus decay products, ²³²Th plus decay products, and ⁴⁰K based on the above-average area soil concentrations were 21, 28, and 27 mrem/yr, respectively, for a total of 76 mrem/yr (Mitchell et al. 1997). Because snow cover can reduce the effective dose that Idaho residents receive from the



soil, a correction factor must be made each year to the estimated 76 mrem/yr. In 2024, this resulted in a reduction in the effective dose from the soil to a value of 74 mrem/yr.

Table 7-3. Calculated effective dose from natural background sources (2024).

SOURCE OF RADIATION DOSE	TOTAL AVERAGE ANNUAL DOSE	
	CALCULATED (mrem)	MEASURED ^a (mrem)
EXTERNAL IRRADIATION		
Terrestrial	74 ^b	NA ^c
Cosmic	57 ^d	NA
Subtotal	131	123
INTERNAL IRRADIATION (PRIMARILY INGESTION)^e		
Potassium-40	15	NM ^f
Thorium-232 and uranium-238	13	NM
Others (carbon-14 and rubidium-87)	1	NM
INTERNAL IRRADIATION (PRIMARILY INHALATION)^d		
Radon-222 (radon) and its short-lived decay products	212	NM
Radon-220 (thoron) and its short-lived decay products	16	NM
TOTAL	388	

- Calculated from the average annual external exposure at all offsite locations measured using OSLDs.
- Estimated using concentrations of naturally occurring radionuclide concentrations in soils in the Snake River Plain.
- NA indicates terrestrial and cosmic radiation parameters were not measured individually but were measured collectively using dosimeters located offsite and at the boundary of the INL Site.
- Estimated from Figure 3.4 of NCRP Report No. 160 (2009).
- Values reported for the average American adult in Table 3.14 of NCRP Report No. 160 (2009).
- NM = not measured.

The cosmic component varies primarily with increasing altitude. Using Figure 3.4 in NCRP Report No. 160 (NCRP 2009), it was estimated that the annual cosmic radiation dose near the INL Site is approximately 57 mrem. Cosmic radiation may vary slightly because of solar cycle fluctuations and other factors.

Based on this information, the sum of the terrestrial and cosmic components of external radiation dose to a person residing on the Snake River Plain in 2024 was estimated to be 131 mrem/yr. This is similar to the 123 mrem/yr measured at offsite locations using OSLD data. Measured values are typically within normal variability of the calculated background doses. Therefore, it is unlikely that INL Site operations contributed to background radiation levels at offsite locations in 2024.

The component of background dose that varies the most is inhaled radionuclides. According to the NCRP, the major contributor of effective dose received by a member of the public from ²³⁸U plus decay products are short-lived decay products of radon (NCRP 2009). The amount of radon in buildings and groundwater depends, in part, upon the natural radionuclide content of soil and rock in the area. The amount of radon also varies among buildings of a given geographic area depending on the materials each contains, the amount of ventilation and air movement, and other factors. The U.S. average of 212 mrem/yr was used in Table 7-3 for this component of the total background dose. The NCRP also reports that the average dose received from thoron, a decay product of ²³²Th, is 16 mrem.

Individuals also receive an internal dose from ingestion of ⁴⁰K and other naturally occurring radionuclides in environmental media. The average ingestion dose to an adult living in the U.S. was 29 mrem/yr (NCRP 2009).

With all these contributions, the total background dose to an average person living in southeast Idaho was estimated to be approximately 388 mrem/yr, as identified in Table 7-3. This value was used to calculate the background radiation dose to the population living within 50 miles of INL Site facilities (see Table 8-2).



7.4 Waste Management Surveillance Sampling

In compliance with DOE O 435.1, “Radioactive Waste Management,” vegetation and soil sampling were conducted at RWMC, while direct surface radiation was measured at RWMC and the ICDF. Soil sampling was conducted at the Subsurface Disposal Area (SDA) at the RWMC from 1994 to 2017. Soil surveillance monitoring was discontinued based on several factors, including the limited availability of undisturbed soils and sufficient historical data being collected previously to satisfy the characterization objectives.

7.4.1 Vegetation Sampling at the Radioactive Waste Management Complex

Vegetation samples were collected historically from four major areas at RWMC and a control location approximately seven miles south of the SDA at the base of the Big Southern Butte. Samples of Russian thistle, crested wheatgrass, and rabbitbrush were collected historically. Using guidance from the DOE Handbook (DOE 2015) in 2018, the Idaho Cleanup Project contractor decided to discontinue further biota sampling activities. This decision was based on an evaluation of biota sample data trends, which concluded that vegetation is not considered a major mode of radionuclide transport through the environment surrounding the SDA at RWMC.

7.4.2 Surface Radiation Survey at the Radioactive Waste Management Complex and the Idaho CERCLA Disposal Facility

Surface radiation surveys are performed to characterize gamma radiation levels near the ground surface at waste management facilities. Comparing the data from these surveys year to year helps to determine whether radiological trends exist in specific areas. This type of survey is conducted at the SDA at RWMC and at ICDF to complement air sampling. The SDA contains legacy waste, some of which is in the process of being removed for repackaging and shipment to an offsite disposal facility. The ICDF consists of a landfill and evaporation ponds, which serve as the consolidation points for CERCLA-generated waste within the INL Site boundaries.

Surface radiation mapped at RWMC occurred on October 31, 2024. Background readings were 2,534 counts per second and the SDA had a mean of 3,302 counts per second. The maximum reading was 4,464 counts per second. Historically, the average background values were around 4,000 counts per second at RWMC with most readings being at or near the background levels.

Surface radiation mapping occurred at ICDF on September 25, 2024. The background values were measured at roughly 3,700 counts per second with most readings matching near the background values. Historically, most readings at ICDF also were at or near the background.

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Swallowtail caterpillar eating turpentine wavewing plant.

Chapter 8: Dose to the Public and Biota



CHAPTER 8

Airborne emissions from operations at the Idaho National Laboratory (INL) Site were used to determine the potential radiological dose to members of the public using the Clean Air Act Assessment Package-1988 personal computer (CAP88-PC) program. The annual dose to the maximally exposed individual (MEI) in 2024, as determined using CAP88-PC, was 0.015 mrem (0.15 μ Sv), which was well below the applicable standard of 10 mrem (100 μ Sv) per year. In 2024, no human-made radionuclides were detected in edible portions of big game animals or waterfowl, indicating there is no dose associated with the ingestion of game animals. Therefore, the total dose to the MEI during 2024 was estimated to be 0.015 mrem (0.15 μ Sv). This dose is also well below the public dose limit of 100 mrem (1 μ Sv) established by the United States (U.S.) Department of Energy (DOE) for a member of the public.

The maximum potential population dose to the approximately 358,426 people residing within an 80 km (50 mi) radius of any INL Site facility was also evaluated as well. The population dose was calculated using reported releases, an air dispersion model known as the HYbrid Single-Particle Lagrangian Integrated Trajectory (HYSPLIT) used by the National Oceanic and Atmospheric Administration (NOAA) Special Operations and Research Division, and a dose calculation model. For 2024, the estimated potential population dose was 0.012 person-rem (0.00012 person-Sv). This is approximately 0.00001% of the expected dose from exposure to natural background radiation of 139,069 person-rem (1,391 person-Sv).

The potential doses to aquatic and terrestrial biota from contaminated soil and water were evaluated using a graded approach. Initially, the potential doses were screened using maximum concentrations of radionuclides detected in soil and effluents at the INL Site. Results of the screening calculations indicate that contaminants released from INL Site activities do not have an adverse impact on plants or animal populations. Additionally, maximum concentrations of radionuclides measured in waterfowl accessing INL Site ponds were used to estimate internal doses to the waterfowl. The estimated dose to waterfowl was calculated to be 0.00022 rad/d (0.0022 mGy/d). This calculation indicates the potential dose to waterfowl does not exceed the DOE limits of 0.1 rad/d (1 mGy/d).

8. DOSE TO THE PUBLIC AND BIOTA

DOE O 458.1, "Radiation Protection of the Public and the Environment," contains requirements for protecting the public and the environment against undue risk from radiation associated with radiological activities conducted under DOE control. In addition to requiring environmental monitoring to ensure compliance with the order, DOE O 458.1 establishes a public dose limit. DOE sites must perform dose evaluations using mathematical models that represent various environmental pathways to demonstrate compliance with the public dose limit and to assess collective (population) doses. In the interest of protecting the environment against ionizing radiation, DOE also developed technical standard DOE-STD-1153-2019, "A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota" (DOE 2019). This standard provides a graded approach for evaluating radiation doses to aquatic and terrestrial biota.

Title 40 CFR Part 61, Subpart H, "National Emission Standards for Emissions of Radionuclides Other Than Radon From Department of Energy Facilities," establishes federal radiation dose limits for the maximally exposed member of the public from all airborne emissions and pathways. It requires that doses to members of the public from airborne releases are calculated using U.S. Environmental Protection Agency (EPA)-approved sampling procedures, computer models, or other methods and procedures.

This chapter describes the estimated potential dose to members of the public and biota from operations at the INL Site, based on 2024 environmental monitoring measurements or calculated emissions.



8.1 Possible Exposure Pathways to the Public

Air, soil, groundwater, agricultural products, and biota are routinely sampled to document the amount of radioactivity in these media and to determine whether radioactive materials have been transported off the INL Site. The air pathway is the primary way people living beyond the INL Site boundary could be exposed to releases from INL Site operations.

Airborne radioactive materials are carried from the source and dispersed by winds. The concentrations from routine releases are too small to measure at locations around the INL Site, so atmospheric dispersion models were used to estimate the downwind concentration of air pollutants and the potential doses from these projected offsite concentrations. Also, conservative doses were calculated from the ingestion of meat from wild game animals that access the INL Site. Ingestion doses were calculated from the concentrations of radionuclides measured in game animals killed by vehicles on INL Site roads and waterfowl harvested from INL Site wastewater ponds that had detectable levels of human-made radionuclides. External exposure to radiation in the environment—primarily from naturally occurring radionuclides—was measured directly using optically-stimulated luminescence dosimeters.

Water pathways were not considered major contributors to dose, because no surface water flows off the INL Site and radionuclides associated with INL Site releases have not been measured in public drinking water wells.

8.2 Dose to the Public from INL Site Air Emissions

The potential doses from INL Site air emissions were estimated using the amounts reported to be released or could be released by the facilities. The 2024 INL National Emission Standards for Hazardous Air Pollutants (NESHAP) evaluation (DOE-ID 2025) reported potential radionuclide releases from 73 source locations at the INL Site. However, many of the sources resulted in doses that were insignificant, and many of these sources are located relatively close together, such that the sampling network response from a release would be the same for all nearby sources. Therefore, insignificant sources were not explicitly modeled, and some sources were consolidated with nearby sources. Emissions from five large operating stacks were modeled explicitly and included the Advanced Test Reactor (ATR) main stack (TRA-770), the Materials Test Reactor (MTR) stack (TRA-710), the Idaho Nuclear Technology and Engineering Center (INTEC) main stack (CPP-708), the Materials and Fuels Complex (MFC) Fuel Conditioning Facility stack (MFC-764), and the Transient Reactor Test Facility (TREAT) stack (MFC-720). All other releases within a facility were assigned as near ground-level releases from a single location within that facility. These other releases include other non-fugitive releases from stacks, ducts, and vents, as well as fugitive releases from ponds, soil, or other sources. Click [here](#) to see the location of all sources modeled in the dose assessment.

The radionuclides and source terms used in the dose calculations were presented previously in Table 4-1 of Chapter 4 and are summarized again in Table 8-1. Noble gases comprised the largest emission quantity but only contributed slightly to the dose. Radionuclides in the form of noble gases tend to have short half-lives and are not typically incorporated into the food supply. Radionuclides that contributed the most to the overall MEI estimated dose were uranium-238 (^{238}U), uranium-234 (^{234}U), chlorine-36 (^{36}Cl), tritium (^3H), cesium-137 (^{137}Cs), and strontium-90 (^{90}Sr). These radionuclides are a very small fraction of the total amount of radionuclides reported.

The following two kinds of dose estimates were made using the release data:

- **The effective dose to the hypothetical MEI, as defined by the NESHAP regulations.** The CAP88-PC model Version 4.1.1 (EPA 2020) was used to predict the maximum concentration and dose at offsite receptor locations. The receptor location with the highest estimated dose is the MEI location.
- **The collective effective dose (population dose) for the population within 80 km (50 mi) of any INL Site facility.** For this calculation, the HYSPLIT model (Stein et al. 2015) was used to model atmospheric transport, dispersion, and deposition of radionuclides released to the air from the INL Site. The population dose was estimated using the Dose Multi-Media (DOSEMM) model (Rood 2019) using dispersion and deposition factors calculated by HYSPLIT to comply with DOE O 458.1.

The dose estimates considered the air immersion dose from gamma-emitting radionuclides, internal dose from inhalation of airborne radionuclides, internal dose from ingestion of radionuclides in plants and animals, and external dose from gamma-emitting radionuclides deposited on the soil. The CAP88-PC computer model uses dose and risk tables developed by the EPA. Population dose calculations were made using: (1) DOE effective dose coefficients for inhaled radionuclides (DOE 2022), (2) EPA dose conversion factors for ingested radionuclides (EPA 2002), and (3) EPA dose conversion factors for external exposure to radionuclides in the air and deposited on the ground surface (EPA 2002).

**Table 8-1. Summary of radionuclide composition of INL Site airborne effluents (2024).**

FACILITY ^b	TOTAL CURIES ^a RELEASED										
	TRITIUM	NOBLE GASES ^c ($T_{1/2} > 40$ DAYS)	NOBLE GASES ^d ($T_{1/2} < 40$ DAYS)	FISSION AND ACTIVATION PRODUCTS ^e ($T_{1/2} < 3$ HOURS)	FISSION AND ACTIVATION PRODUCTS ^f ($T_{1/2} > 3$ HOURS)	TOTAL RADIOIODINE ^g	TOTAL RADIOSTRONTIUM ^h	TOTAL URANIUM ⁱ	PLUTONIUM ^j	OTHER ACTINIDES ^k	OTHER ^l
ATR Complex	1.93E+02	1.48E-19	9.10E+02	2.45E+00	1.19E-02	5.26E-05	2.88E-02	1.46E-05	1.75E-08	3.77E-07	3.40E-10
CFA	3.50E-01	4.21E-16	2.00E-05	1.20E-04	1.67E-06	2.54E-10	4.12E-08	1.34E-07	6.50E-07	5.98E-05	3.62E-15
CITRC	4.33E-01	—	—	3.20E-05	8.00E-08	1.81E-11	—	—	—	—	—
INTEC	1.77E-01	1.09E+00	—	—	3.20E-02	1.06E-04	2.60E-06	3.57E-07	1.68E-06	5.00E-08	—
MFC	2.17E+02	2.52E-01	1.71E+02	4.25E+01	1.80E-02	2.72E-06	7.50E+00	8.96E-02	6.18E-06	1.59E-05	—
NRF	3.90E-02	2.81E-01	—	—	5.81E-01	1.52E-05	4.53E-05	4.35E-10	2.12E-06	1.83E-07	—
RRTR	—	—	—	—	—	—	—	—	—	—	—
RWMC	4.05E+01	—	—	—	2.22E-02	—	9.02E-11	2.51E-11	5.55E-08	1.06E-07	—
TAN	1.45E-02	—	—	—	—	—	3.01E-05	—	—	—	—
SMC	—	—	—	—	—	—	—	1.34E-08	—	—	—
Total	4.52E+02	1.62E+00	1.08E+03	4.49E+01	6.65E-01	1.77E-04	7.53E+00	8.96E-02	1.07E-05	7.63E-05	3.40E-10

a. One curie (Ci) = 3.7×10^{10} becquerels (Bq).

b. ATR Complex = Advanced Test Reactor Complex; CFA = Central Facilities Area; CITRC = Critical Infrastructure Test Range Complex; INTEC = Idaho Nuclear Technology and Engineering Center; MFC = Materials and Fuels Complex; NRF = Naval Reactors Facility; RRTR-NTR = Radiological Response Training Range-Northern Test Range; RWMC = Radioactive Waste Management Complex (including the Advanced Mixed Waste Treatment Project [AMWTP]); TAN = Test Area North; and SMC = Specific Manufacturing Capability.

c. Noble gases ($T_{1/2} > 40$ days) released in 2024 = ^{39}Ar , ^{81}Kr , and ^{85}Kr .

d. Noble gases ($T_{1/2} < 40$ days) released in 2024 = ^{41}Ar , ^{83m}Kr , ^{85m}Kr , ^{87}Kr , ^{88}Kr , ^{89}Kr , ^{219}Rn , ^{220}Rn , ^{131m}Xe , ^{133}Xe , ^{133m}Xe , ^{135}Xe , ^{135m}Xe , ^{137}Xe , and ^{138}Xe .

e. Fission products and activation products ($T_{1/2} < 3$ hours) released in 2024 = ^{109m}Ag , ^{110}Ag , ^{111m}Ag , ^{94}Au , ^{196m}Au , ^{137m}Ba , ^{139}Ba , ^{80}Br , ^{83}Br , ^{84}Br , ^{117}Cd , ^{118}Cd , ^{60m}Co , ^{134m}Cs , ^{135m}Cs , ^{138}Cs , ^{139}Cs , ^{140}Cs , ^{66}Cu , ^{165}Dy , ^{167m}Er , ^{158}Eu , ^{68}Ga , ^{75}Ge , ^{78}Ge , ^{117}In , ^{117m}In , ^{118}In , ^{188}Ir , ^{142}La , ^{56}Mn , ^{101}Mo , ^{97}Nb , ^{149}Nd , ^{65}Ni , ^{111}Pd , ^{150}Pm , ^{144}Pr , ^{144m}Pr , ^{146}Pr , ^{88}Rb , ^{89}Rb , ^{90}Rb , ^{103m}Rh , ^{104}Rh , ^{106}Rh , ^{106m}Rh , ^{126m}Sb , ^{128m}Sb , ^{130}Sb , ^{77m}Se , ^{81}Se , ^{81m}Se , ^{123m}Sn , ^{127}Sn , ^{128}Sn , ^{101}Tc , ^{129}Te , ^{131}Te , ^{133}Te , ^{133m}Te , ^{134}Te , ^{206}Tl , ^{89m}Y , ^{91m}Y , and ^{69}Zn .

f. Fission products and activation products ($T_{1/2} > 3$ hours) released in 2024 = ^{108m}Ag , ^{110m}Ag , ^{111}Ag , ^{112}Ag , ^{113}Ag , ^{76}As , ^{77}As , ^{78}As , ^{195}Au , ^{196}Au , ^{198}Au , ^{133}Ba , ^{135m}Ba , ^{140}Ba , ^{10}Be , ^{207}Bi , ^{210}Bi , ^{210m}Bi , ^{80m}Br , ^{82}Br , ^{14}C , ^{45}Ca , ^{109}Cd , ^{113m}Cd , ^{115}Cd , ^{115m}Cd , ^{117m}Cd , ^{139}Ce , ^{141}Ce , ^{143}Ce , ^{144}Ce , ^{36}Cl , ^{38}Cl , ^{57}Co , ^{58}Co , ^{60}Co , ^{51}Cr , ^{132}Cs , ^{134}Cs , ^{135}Cs , ^{136}Cs , ^{137}Cs , ^{64}Cu , ^{67}Cu , ^{166}Dy , ^{169}Er , ^{171}Er , ^{172}Er , ^{152}Eu , ^{152m}Eu , ^{154}Eu , ^{155}Eu , ^{156}Eu , ^{157}Eu , ^{55}Fe , ^{59}Fe , ^{60}Fe , ^{72}Ga , ^{73}Ga , ^{152}Gd , ^{159}Gd , ^{68}Ge , ^{71}Ge , ^{77}Ge , ^{175}Hf , ^{178m}Hf , ^{179m}Hf , ^{180m}Hf , ^{181}Hf , ^{182}Hf , ^{203}Hg , ^{166}Ho , ^{167}Ho , ^{115}In , ^{115m}In , ^{189}Ir , ^{190}Ir , ^{192}Ir , ^{193m}Ir , ^{40}K , ^{140}La , ^{141}La , ^{52}Mn , ^{53}Mn , ^{54}Mn , ^{93}Mo , ^{99}Mo , ^{22}Na , ^{24}Na , ^{92m}Nb , ^{93m}Nb , ^{94}Nb , ^{95}Nb , ^{95m}Nb , ^{96}Nb , ^{147}Nd , ^{57}Ni , ^{59}Ni , ^{63}Ni , ^{66}Ni , ^{185}Os , ^{191}Os , ^{32}P , ^{33}P , ^{205}Pb , ^{210}Pb , ^{107}Pd , ^{109}Pd , ^{112}Pd , ^{147}Pm , ^{148}Pm , ^{148m}Pm , ^{149}Pm , ^{151}Pm , ^{210}Po , ^{142}Pr , ^{143}Pr , ^{145}Pr , ^{195m}Pt , ^{84}Rb , ^{86}Rb , ^{87}Rb , ^{184}Re , ^{184m}Re , ^{186}Re , ^{186m}Re , ^{187}Re , ^{188}Re , ^{105}Rh , ^{103}Ru , ^{105}Ru , ^{106}Ru , ^{122}Sb , ^{124}Sb , ^{125}Sb , ^{126}Sb , ^{127}Sb , ^{128}Sb , ^{129}Sb , ^{46}Sc , ^{48}Sc , ^{79}Se , ^{32}Si , ^{147}Sm , ^{151}Sm , ^{153}Sm , ^{156}Sm , ^{113}Sn , ^{117m}Sn , ^{119m}Sn , ^{121}Sn , ^{121m}Sn , ^{123}Sn , ^{125}Sn , ^{126}Sn , ^{179}Ta , ^{182}Ta , ^{183}Ta , ^{184}Ta , ^{160}Tb , ^{161}Tb , ^{99}Tc , ^{99m}Tc , ^{123m}Te , ^{125m}Te , ^{127}Te , ^{127m}Te , ^{129m}Te , ^{131m}Te , ^{132}Te , ^{204}Tl , ^{171}Tm , ^{172}Tm , ^{49}V , ^{181}W , ^{185}W , ^{187}W , ^{188}W , ^{88}Y , ^{90}Y , ^{90m}Y , ^{91}Y , ^{92}Y , ^{93}Y , ^{65}Zn , ^{69m}Zn , ^{71m}Zn , ^{72}Zn , ^{93}Zr , ^{95}Zr , and ^{97}Zr .

g. Radioiodine released in 2024 = ^{125}I , ^{126}I , ^{128}I , ^{129}I , ^{130}I , ^{131}I , ^{132}I , ^{132m}I , ^{133}I , ^{134}I , and ^{135}I .

h. Radiostrontium released in 2024 = ^{80}Sr , ^{85}Sr , ^{87m}Sr , ^{89}Sr , ^{90}Sr , ^{91}Sr , and ^{92}Sr .

i. Uranium isotopes released in 2024 = ^{232}U , ^{233}U , ^{234}U , ^{235}U , ^{236}U , ^{237}U , and ^{238}U .

j. Plutonium isotopes released in 2024 = ^{236}Pu , ^{238}Pu , ^{239}Pu , ^{240}Pu , ^{241}Pu , ^{242}Pu , and ^{244}Pu .

k. Other actinides released in 2024 = ^{225}Ac , ^{227}Ac , ^{241}Am , ^{242}Am , ^{243}Am , ^{252}Cf , ^{242}Cm , ^{243}Cm , ^{244}Cm , ^{248}Cm , ^{237}Np , ^{239}Np , ^{231}Pa , ^{233}Pa , ^{234}Pa , ^{234m}Pa , ^{228}Th , ^{229}Th , ^{230}Th , ^{231}Th , ^{232}Th , and ^{234}Th .

l. Other = radioisotopes of elements that are not noble gases, activation or fission products, radioiodine, radiostrontium, or actinides released in 2024. These are typically heavy elements that are decay chain members of actinides. They include ^{214}Bi , ^{214}Pb , ^{226}Ra , and ^{228}Ra .



8.2.1 Maximally Exposed Individual Dose

The EPA NESHAP regulation requires a demonstration that radionuclides other than radon released to the air from any DOE nuclear facility do not result in a dose to the public of greater than 10 mrem/yr (0.1 mSv/yr) (40 CFR 61, Subpart H). The EPA requires the use of an approved computer model, such as CAP88-PC, to demonstrate compliance with 40 CFR 61, Subpart H. CAP88-PC uses a modified Gaussian plume model to estimate the average dispersion of radionuclides released from up to six sources. It uses average annual wind files based on the data collected at multiple locations on the INL Site by NOAA.

The MEI that was calculated in 2024 remains at the same location as in previous years; however, it is now identified as Receptor 26 instead of Receptor 54. References to the MEI prior to 2019 (e.g., Receptor 1) continue to be referred to as Receptor 1 in the new arrangement (INL 2023).

The dose to the MEI from INL Site airborne releases of radionuclides was calculated to demonstrate compliance with NESHAP and is published in the *National Emissions Standards for Hazardous Air Pollutants – Calendar Year 2024 INL Report for Radionuclides* (DOE-ID 2025). To identify the MEI, the doses at 31 offsite locations were calculated and screened for the maximum potential dose to an individual who might live at one of these locations. The highest potential dose location was determined to be Location 26, which is a farmhouse and cattle operation located 3.1 km south of Highway 20 and 3 km from the east entrance of the INL Site. An effective annual dose of 0.015 mrem (0.15 μ Sv) was calculated for a hypothetical person living at Location 26 during 2024. Figure 8-1 compares the MEI doses calculated for years 2015–2024. All the doses are well below the whole-body dose limit of 10 mrem/yr (0.1 mSv/yr) for airborne releases of radionuclides established by 40 CFR 61, Subpart H. The highest dose estimated during the past ten years was in 2021.

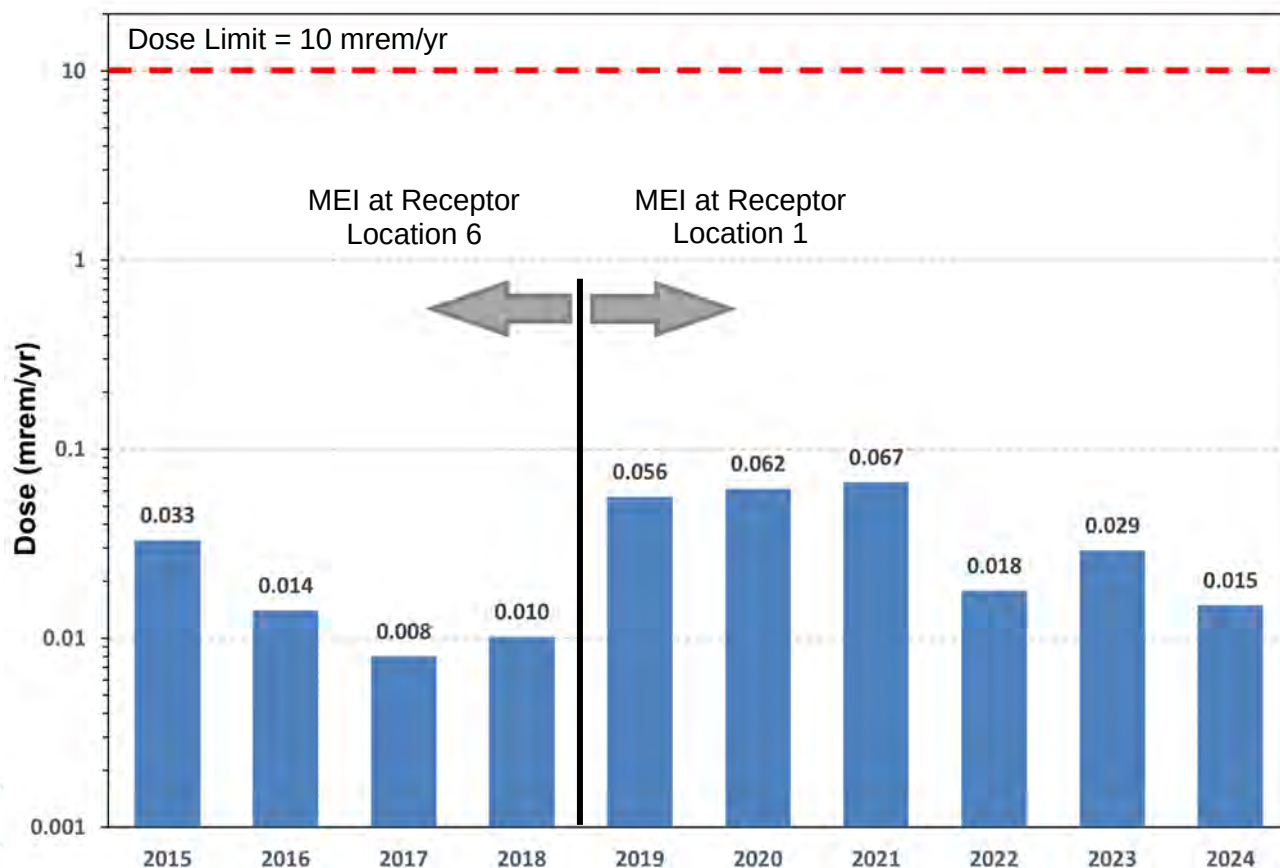


Figure 8-1. MEI dose from INL Site airborne releases estimated for 2015–2024. See INL Site receptor locations.



Although noble gases were the radionuclides that were released in the largest quantities in 2024, they accounted for less than 3.5% of the cumulative MEI dose from all pathways largely because of their relatively short half-lives and because they only affect the immersion dose (i.e., they are excluded from the food supply). For example, about 60.5% of the total INL activity released was argon-41 (^{41}Ar), as shown in Table 4-1 of Chapter 4, yet ^{41}Ar accounted for less than 3% of the estimated MEI dose. In contrast, radionuclides typically associated with airborne particulates, such as ^{238}U , ^{234}U , ^{36}Cl , ^{137}Cs , and ^{90}Sr , comprised only a small fraction (e.g., less than 0.0088%) of the total amount of radionuclides reported to be released in Table 4-1 of Chapter 4, yet the radionuclides resulted in approximately 73.5% of the estimated MEI dose, as shown in Figure 8-2.

Primary sources of the major radionuclides used to estimate the dose to the MEI, as indicated in Figure 8-3, were identified during the preparation of the annual NESHAP report (DOE-ID 2025) as follows:

- Amounts of ^{238}U and ^{234}U account for 22.7% and 19.2% of the MEI dose, respectively; the majority of which came from the Advanced Fuels Facility (MFC-784) at MFC.
- The second largest dose contribution was from ^{36}Cl , accounting for 21.2%, most of which originated at the Electron Microscopy Laboratory (MFC-774) at MFC.
- Tritium accounts for 19.0% of the MEI dose with 84.4% coming from MFC-774, 10.3% coming from the beryllium blocks buried at the RWMC Subsurface Disposal Area, 2.9% from TRA-715, 2.0% from TRA-770, and the rest from other sources.
- Amounts of ^{137}Cs and ^{90}Sr contributed 6.9% and 3.6%, respectively. The remaining 5.00% came from other radionuclides.

The largest contribution by facility to the MEI dose overwhelmingly came from MFC at 92.8%, followed by the ATR Complex at 4.57%, and RWMC at 1.98%, as shown in Figure 8-3. This is expected for Location 26 given its proximity to MFC. Additionally, primary wind directions at the INL Site are from the southwest and northeast; thus, emissions from Test Area North (TAN), the Naval Reactors Facility (NRF), INTEC, the ATR Complex, and RWMC are off axis from a receptor near MFC.

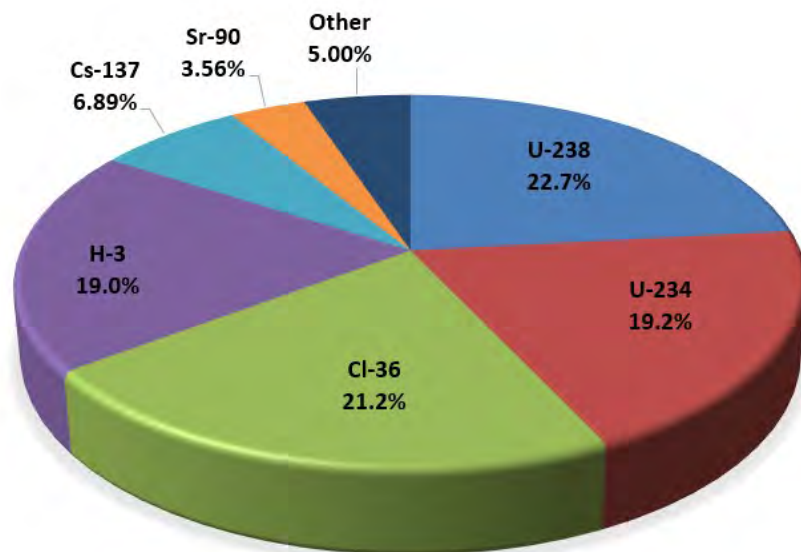


Figure 8-2. Radionuclides contributing to the MEI dose from INL Site airborne effluents as calculated using the CAP88-PC Model (2024).

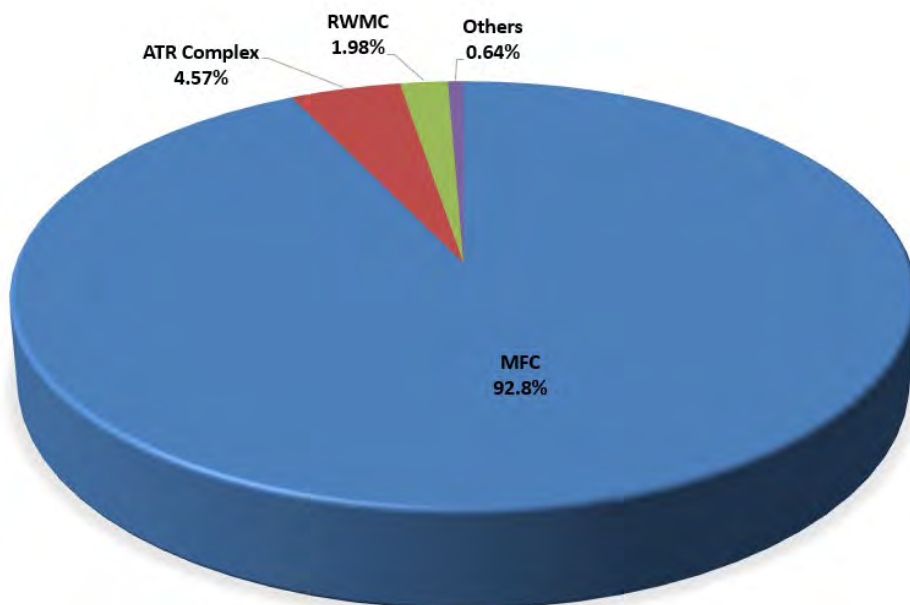


Figure 8-3. Percent contributions, by facility, to MEI dose from the INL Site airborne effluents as calculated using the CAP88-PC Model (2024).



The dose to the MEI is lower than in 2023 at 0.015 mrem/year, and is far below the regulatory standard of 10 mrem/yr (0.1 mSv/yr) (40 CFR 61, Subpart H).

8.2.2 Eighty Kilometer (50 Mile) Population Dose

The total effective population dose from airborne releases was calculated using air dispersion modeling using the NOAA HYSPLIT model (Stein et al. 2015; Draxler et al. 2013) and the DOSEMM v 190926 (Rood 2019) dose assessment model. These calculations aimed to provide a grid of total effective doses within an 80-km (50-mi) radius from any INL Site source, including Idaho Falls facilities. The data was used with geographic information system (GIS) software to compute population doses. The HYSPLIT model and its capabilities are described on the [NOAA Air Resources Laboratory website](#).

Key contributing facilities and radionuclides were modeled, selecting those that contributed more than 0.005% of the total dose at the INL Site or more than 0.1% in Idaho Falls. Data from 34 meteorological stations were used to project the transport and dispersion of contaminants by winds and their deposition onto the ground. The HYSPLIT model predicted dispersion and deposition from releases at each facility across 17,877 grid points around the INL Site, including 27 boundary receptor locations representing actual residences.

The model outputs, which included radionuclide air concentrations and deposition amounts, were converted to dispersion and deposition factors for use in DOSEMM (Rood 2024). These factors were used to estimate air concentrations and the deposition at each grid point for the year. Then, the effective dose via inhalation, ingestion, and external exposure pathways was calculated. The radionuclide source term for radionuclide-facility combinations that were used for the site and in-town population dose assessment can be found in Overin (2025).

To estimate the population dose within an 80-km (50-mi) radius, data from the 2020 census was gathered and then projected to 2024. This was done by calculating the population change rate from 2010 to 2020 and then applying that same rate to the 2020 figures. Then, a GIS was used to import the dose values from DOSEMM and average those values within each census division. These average doses were multiplied by the estimated populations and summed to get the total population dose.

The estimated potential population dose for 2024 was 0.012 person-rem (0.00012 person-Sv) for about 358,426 people. This represents a very small 0.00001% increase as compared to the natural background radiation dose of approximately 139,069 person-rem (1,391 person-Sv). The estimated population dose for 2024 was less than population doses estimated for 2020-2023 (Figure 8-4). Table 8-2 provides the contribution to estimated annual dose from INL Site facilities by pathway in 2024.

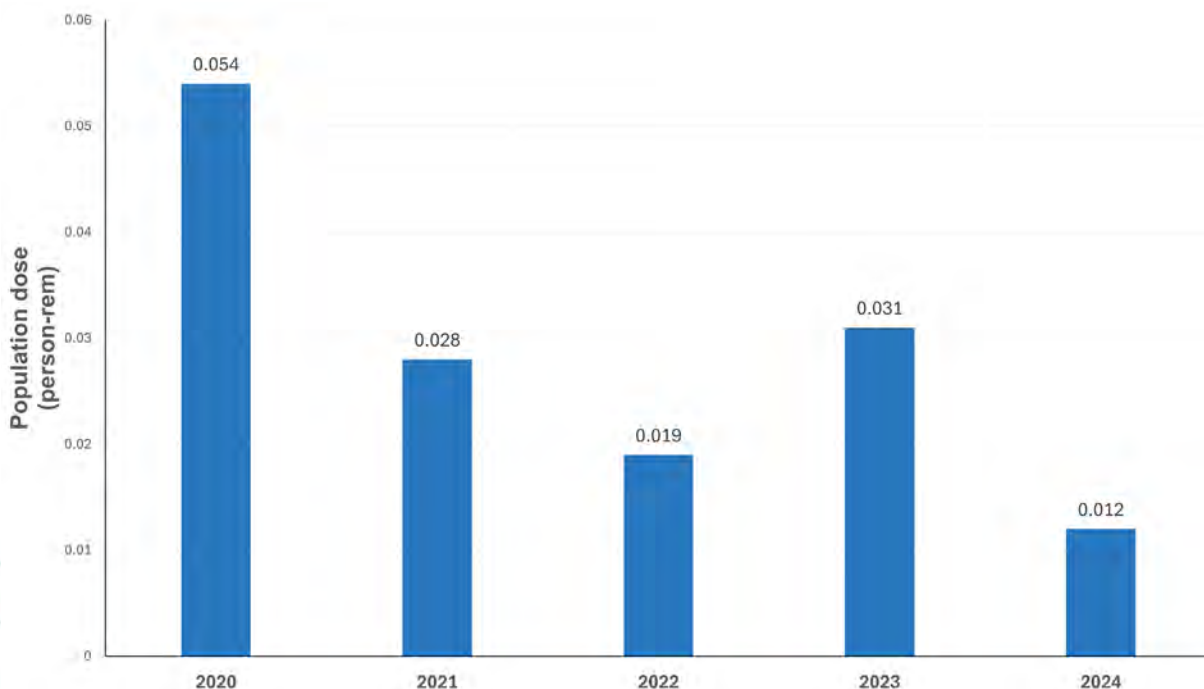


Figure 8-4. Population dose estimated for 2020-2024.



Table 8-2. Contribution to estimated annual dose from INL Site facilities by pathway (2024).

PATHWAY ^a	ANNUAL DOSE TO MEI		PERCENT OF DOE 100 mrem/yr LIMIT ^b	ESTIMATED POPULATION DOSE		POPULATION WITHIN 80 km	ESTIMATED BACKGROUND RADIATION POPULATION DOSE (PERSON-rem) ^c
	(mrem)	(μ Sv)		(PERSON -rem)	(PERSON -Sv)		
Air	0.015	0.15	0.015	0.012	0.00012	358,426	139,069
TOTAL, ALL PATHWAYS	0.015	0.15	0.015	0.012	0.00012	NA^d	NA

- a. Waterfowl and big game animals had a 0.000 mrem as a result of no detected human-made radionuclides in edible portions. Therefore, they were not included as line items in the table.
- b. The DOE public dose limit from all sources of ionizing radiation and exposure pathways that could contribute significantly to the total dose is 100 mrem/yr (1 mSv/yr) total effective dose equivalent. It does not include dose from background radiation.
- c. The individual background dose was estimated to be 388 mrem or 0.388 rem in 2024, as shown previously in Table 7-3. The background population dose is calculated by multiplying the individual background dose by the population within an 80 km (50 mi) radius of the INL Site.
- d. NA = Not applicable.

8.3 Dose to the Public from Ingestion of Wild Game from the INL Site

The potential dose that an individual may receive from occasionally ingesting meat from waterfowl or big game animals continues to be studied at the INL Site. These studies estimate the potential dose to individuals who may eat waterfowl that may briefly reside at wastewater disposal ponds at the ATR Complex and big game animals that may reside on or migrate through the INL Site.

8.3.1 Waterfowl

Waterfowl samples collected in 2024 did not have detectable concentrations of human-made radionuclides in any edible subsample. As a result, no dose from human-made radionuclides would be associated with the consumption of these animals. As in the past, the 2024 samples were not collected directly from the warm wastewater evaporation ponds at the ATR Complex but from sewage lagoons adjacent to them.

8.3.2 Big Game Animals

A study on the INL Site from 1972–1976 conservatively estimated the potential whole-body dose that could be received from an individual eating the entire muscle (27,000 g [952 oz]) and liver mass (500 g [17.6 oz]) of an antelope with the highest levels of radioactivity found in these animals. This dose was 2.7 mrem (27 μ Sv) (Markham et al. 1982). Game animals collected at the INL Site during the past few years have generally shown much lower concentrations of radionuclides. In 2024, none of the game samples collected from seven elk had a detectable concentration of ¹³⁷Cs or other human-made radionuclides. Therefore, no dose from human-made radionuclides would be associated with the consumption of these animals.

The contribution of game animal consumption to the population dose is calculated because only a limited percentage of the population hunts game, few deceased animals have spent time on the INL Site, and most animals that migrate from the INL Site would have reduced concentrations of radionuclides in their tissues by the time they were harvested (Halford, Markham, and White 1983). The total population dose contribution from these pathways would realistically be less than the sum of the population doses from the inhalation of air, submersion in air, vegetable ingestion, and soil deposition.

8.4 Dose to the Public from Drinking Groundwater from the INL Site

Tritium has previously been detected in three U.S. Geological Survey wells located on the INL Site along the southern boundary (Mann and Cecil 1990; Bartholomay, Hopkins, and Maimer 2015; Twining et al. 2021). These wells, located in an uninhabited area, have shown a historical downward trend in tritium detections. The maximum concentration from all wells on the INL Site (3,250 $\pm$ 130 pCi/L) in 2024 is considerably less than the maximum contaminant level established by the EPA for drinking water (20,000 pCi/L). An individual drinking water from a well with the maximum concentration would



hypothetically receive a dose of 0.136 mrem (0.00136 mSv) in one year. Because these wells are not used for drinking water, this is an unrealistic scenario, and the groundwater ingestion pathway is not included in the total dose estimate to the MEI.

8.5 Dose to the Public from Direct Radiation Exposure along INL Site Borders

The direct radiation exposure pathway from gamma radiation to the public is monitored annually using optically stimulated luminescent dosimeters. In 2024, the external radiation dose of 123 mrem measured along the INL Site boundary and offsite was statistically equivalent to the calculated background radiation dose of 131 mrem; therefore, it does not represent a dose resulting from INL Site operations.

8.6 Dose to the Public from All Pathways

DOE O 458.1 establishes a radiation dose limit to a member of the general public from all possible pathways as a result of DOE facility operations. This limit is 100 mrem/yr (1 mSv/yr) above the dose from background radiation and includes the air transport, ingestion, and direct exposure pathways, as indicated in Figure 8-5. For 2024, the only probable pathways from INL Site activities to a realistic MEI include the air transport pathway.

The hypothetical individual, assumed to live at a farmhouse and cattle operation located 3.1 km south of Highway 20 and 3 km from the east entrance of the INL Site, as presented previously here, would receive a calculated dose from INL Site airborne releases reported for 2024 (see Subsection 8.2.1). No dose was calculated from eating waterfowl (see Subsection 8.3.1) or big game animals (see Subsection 8.3.2) in 2024.

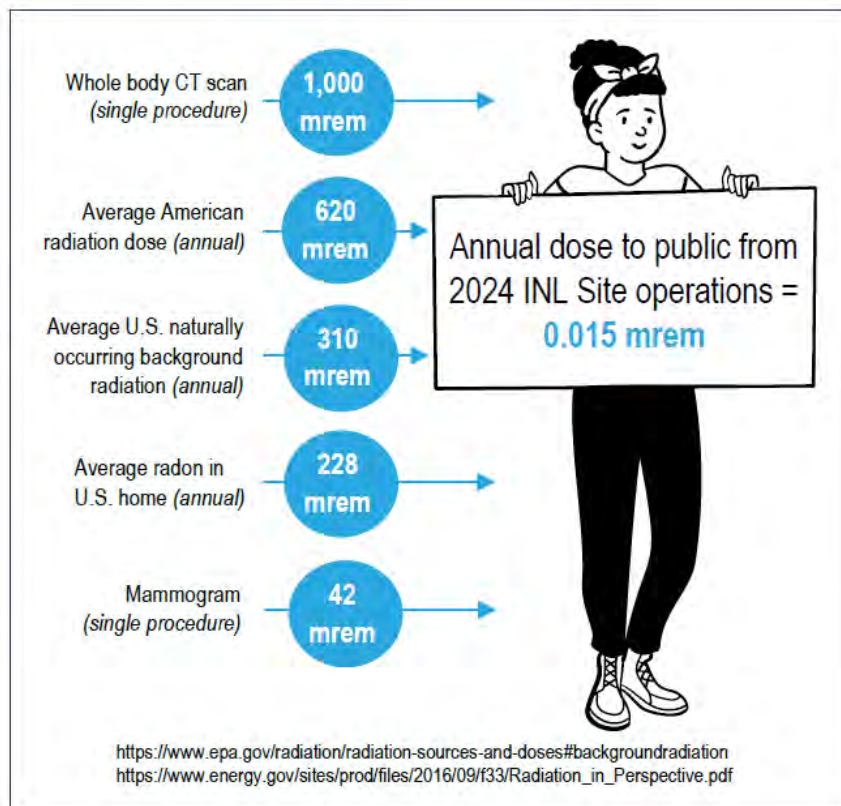


Figure 8-5. Radiation doses associated with some common sources.

Figure 8-5 compares other common sources of radiation dose to the INL Site operations. In 2024, the total dose from all pathways was conservatively estimated to be 0.015 mrem (0.15 μ Sv), as illustrated in Figure 8-5, for an offsite MEI, presented in Table 8-2. This value is significantly below the public dose limit of 100 mrem/year (1 mSv/year) set by the DOE. As discussed in the “Helpful Information” section of this report, the 100 mrem/yr limit is far below the exposure levels expected to result in acute health effects.



The dose received by the entire population within an 80-km (50-mi) radius of INL Site facilities was calculated to be 0.012 person-rem (0.00012 person-Sv), as shown in Table 8-2. This is approximately 0.00001% of the 139,069 person-rem (1,391 person-Sv) dose given in Table 8-2 to be expected from exposure to regional natural background radiation.

8.7 Dose to the Public from Operations on the INL Research and Education Campus

Facilities in Idaho Falls that reported potential radionuclide emissions for inclusion in the 2024 NESHAP report include the INL Research Center (IRC) Laboratory (IF-603), DOE Radiological and Environmental Sciences Laboratory (IF-683), and the National Security Laboratory (IF-611). These facilities are located contiguously at IRC, which is part of the INL Research and Education Campus (REC) on the north side of Idaho Falls. Though programs and operations at IRC are affiliated with INL, IRC is located within the city limits of Idaho Falls and is not contiguous with the INL Site. The nearest boundary of the INL Site is about 35 km (22 mi) west of Idaho Falls. For this reason, the 2024 INL NESHAP evaluation (DOE-ID 2025) includes a dose calculation to a member of the public that is separate from the MEI at the INL Site. (Note: The REC source term was, however, included in the population dose calculation reported in Subsection 8.2.2.) Each of the IRC buildings were modeled as separate sources in 2023. Due to radionuclide tracking limitations, IF-603 and IF-611 were modeled as one source in 2024. The MEI at IRC for 2024 is approximately 147 meters south-southeast of IF-683. Using CAP88-PC, the MEI effective dose equivalent was conservatively calculated to be 0.0048 mrem/yr (0.048 μ Sv/yr), which is less than 0.1% of the 10-mrem/yr federal standard.

8.8 Dose to Biota

8.8.1 Introduction

The impact of environmental radioactivity at the INL Site on nonhuman biota was assessed using “A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota” (DOE 2019) and its associated software, RESRAD-Biota 1.8 (DOE 2019). The graded approach includes a screening method and three additional detailed levels of analysis for demonstrating compliance with standards for the protection of biota. The threshold of protection is assumed at the following absorbed doses: 1 rad/d (10 mGy/d) for aquatic animals, 0.1 rad/d (1 mGy/d) for riparian and terrestrial animals, and 1 rad/d (10 mGy/d) for terrestrial plants.

The first step in the graded approach uses conservative default assumptions and maximum values for all currently available data. This general screening level (e.g., Level 1 in RESRAD-Biota) provides generic limiting concentrations of radionuclides in environmental media, termed “Biota Concentration Guides (BCGs).” Each BCG is the environmental concentration of a given radionuclide in soil or water that, under the assumptions of the model, would result in a dose rate of less than 1 rad/d (10 mGy/d) to aquatic animals or terrestrial plants or of 0.1 rad/d (1 mGy/d) to riparian or terrestrial animals. If the sum of the measured maximum environmental concentrations divided by the BCGs (i.e., the combined sum of fractions) is less than one, no negative impact to plant or animal populations is expected. Doses are not calculated unless the screening process indicates a more detailed analysis is necessary. A failure at this step does not necessarily imply harm to organism populations. Instead, it is an indication that more realistic model assumptions may be necessary.

If the screening process indicates the need for a more site-specific analysis, an examination is performed using site-representative parameters (e.g., distribution coefficients, bioconcentration factors) instead of the more conservative default parameters. This is termed Level 2 in RESRAD-Biota.

The next step in the graded approach methodology involves a site-specific analysis employing a kinetic modeling tool provided in Level 3 RESRAD-Biota. Multiple parameters that represent contributions to the organism internal dose (e.g., body mass, consumption rate of food/soil, inhalation rate, lifespan, biological elimination rates) can be modified to represent site- and organism-specific characteristics. The kinetic model employs equations relating body mass to the internal dose parameters. At Level 3 RESRAD-Biota, bioaccumulation—the process by which biota concentrate contaminants from their surrounding environment—can be modeled to estimate the dose to a plant or animal. Alternatively, radionuclide concentrations measured in the tissue of an organism can be input into the program to estimate the dose to the organism.

The final step in the graded approach involves an actual site-specific biota dose assessment. This would include a problem formulation, analysis, and risk characterization protocol similar to that recommended by the EPA (1998). RESRAD-Biota cannot perform these calculations.



8.8.2 Terrestrial Evaluation

The division of the INL Site into evaluation areas based on potential soil contamination and habitat types is of particular importance for the terrestrial evaluation portion of the 2024 biota dose assessment. For the INL Site, it is appropriate to consider specific areas that have been historically contaminated above background levels. Most of these areas have been monitored for radionuclides in the soil since the early 1970s (Jessmore, Lopez, and Haney 1994). In some areas, structures have been removed and areas cleaned to a prescribed, safe contamination level, but the soil may still have residual, measurable concentrations of radionuclides. These areas are associated with the following facilities:

- Auxiliary Reactor Area
- ATR Complex
- Critical Infrastructure Test Range Complex
- INTEC
- Large Grid, a 24-mile radius around INTEC
- MFC
- NRF
- RWMC
- TAN.

The most recently measured maximum concentrations of radionuclides in INL Site soil were used to perform a screening level analysis of the potential terrestrial biota dose. The soil concentrations are conservative because background concentrations were not subtracted. The analysis also assumed that animals have access to water in facility effluents and ponds. The maximum radionuclide concentrations reported in ponds at the INL Site were at the MFC Industrial Waste Pond. The radiological surveillance monitoring results are presented in the 2024 second, third, and fourth quarter reports ([INL 2025a](#), [INL 2025b](#), [INL 2025c](#)). The results for $^{233/234}\text{U}$ and ^{238}U (i.e., 0.63 pCi/L and 0.24 pCi/L, respectively) were used to represent surface water concentrations. When $^{233/234}\text{U}$ was reported, it was assumed the radionuclide present was ^{233}U since doses due to ingestion and inhalation are more conservative for ^{233}U than for ^{234}U (EPA 2002).

The combined sum of fractions was less than one for both terrestrial animals (0.21) and plants (0.002) and passed the general screening test, as indicated in Table 8-3. Based on the results of the graded approach, there is no evidence that INL Site-related radioactivity in soil is harming terrestrial plant or animal populations.

In 2024, bat carcasses found at INL Site facilities were collected under a scientific collection permit and composited into samples for each location. These samples were sent to a radioanalytical laboratory and analyzed for human-made radionuclides. The analytical results, along with radionuclide concentrations in soil and water, were used as input for the RESRAD-Biota code to calculate the internal dose the bats may have received. The estimated dose was 0.0065 rad/d, which is much lower than the safety limit of 0.1 rad/d. Based on this result, it can be assumed that members of the bat population at the INL Site receive an absorbed dose that is within the DOE standard established for the protection of terrestrial animals. More details can be found in the [Idaho National Laboratory Site Bat Protection Plan Annual Report](#).

8.8.1 Aquatic Evaluation

The maximum radionuclide concentrations reported in ponds at the INL Site were also used for aquatic evaluation. The results shown in Table 8-4 indicate that INL Site-related radioactivity in ponds and liquid effluents is not harming aquatic biota. The combined sum of fractions was less than one for both aquatic animals (0.004) and riparian animals (0.001).

Tissue data from waterfowl collected on the ATR Complex wastewater ponds in 2024 were available too, as shown previously in Table 7-1 of Chapter 7. Concentrations of radionuclides in tissue can be input into the RESRAD-Biota code at the Level 3 step to calculate the internal dose to biota. To confirm that doses to waterfowl from exposure to radionuclides in the vicinity of the ATR Complex are not harmful, a Level 3 analysis was performed using the maximum tissue concentrations from Table 7-1. The waterfowl were assumed in the model to be riparian animals, accessing both aquatic and terrestrial environments in the area. External dose was calculated using the maximum radionuclide concentrations measured in soils around the INL Site and uranium concentrations in water. The concentrations of uranium in sediment were estimated by the RESRAD-Biota code from the concentrations in water.

Results of the dose evaluation to waterfowl using radionuclide concentrations measured in tissue are shown in Table 8-5. The estimated dose to waterfowl was calculated by RESRAD-Biota to be 0.00022 rad/d (0.0022 mGy/d). This dose is significantly less than the standard of 0.1 rad/d (1 mGy/d). Based on these results, there is no evidence that water held in ponds at the INL Site is harming aquatic biota.



Table 8-3. RESRAD-Biota assessment (screening level) of terrestrial ecosystems on the INL Site (2024).

TERRESTRIAL ANIMAL						
WATER				SOIL		
NUCLIDE	CONCENTRATION (pCi/l)	BCG ^a (pCi/l)	RATIO	CONCENTRATION (pCi/g)	BCG (pCi/g)	RATIO
Americium-241	—	2.02E+05	—	1.2	3.89E+03	3.08E-04
Cobalt-60	—	1.19E+06	—	0.05	6.92E+02	7.23E-05
Cesium-134	—	3.26E+05	—	0.08	1.13E+01	7.08E-03
Cesium-137	—	5.99E+05	—	3.5	2.08E+01	1.69E-01
Plutonium-238	—	1.89E+05	—	0.043	5.27E+03	8.16E-06
Plutonium-239	—	2.00E+05	—	1.6	6.11E+03	2.62E-04
Strontium-90	—	5.45E+04	—	0.71	2.25E+01	3.16E-02
Uranium-233	0.63	4.01E+05	1.57E-06	—	4.83E+03	—
Uranium-238	0.24	4.06E+05	5.91E-07	—	1.58E+03	—
SUMMED	—	—	2.16E-06	—	—	2.08E-01
TERRESTRIAL PLANT						
WATER				SOIL		
NUCLIDE	CONCENTRATION (pCi/l)	BCG (pCi/l)	RATIO	CONCENTRATION (pCi/g)	BCG (pCi/g)	RATIO
Americium-241	—	7.04E+08	—	1.2	2.15E+04	5.57E-05
Cobalt-60	—	1.49E+07	—	0.05	6.13E+03	8.16E-06
Cesium-134	—	2.28E+07	—	0.08	1.09E+03	7.36E-05
Cesium-137	—	4.93E+07	—	3.5	2.21E+03	1.59E-03
Plutonium-238	—	3.95E+09	—	0.043	1.75E+04	2.46E-06
Plutonium-239	—	7.04E+09	—	1.6	1.27E+04	1.26E-04
Strontium-90	—	3.52E+07	—	0.71	3.58E+03	1.98E-04
Uranium-233	0.63	1.06E+10	5.95E-11	—	5.23E+04	—
Uranium-238	0.24	4.28E+07	5.60E-09	—	1.57E+04	—
SUMMED	—	—	5.66E-09	—	—	2.05E-03

a. BCG = Biota Concentration Guide. Each radionuclide-specific BCG represents the limiting radionuclide concentration in an environmental medium, which would not result in recommended dose standards for biota to be exceeded.



Table 8-4. RESRAD-Biota assessment (screening level) of aquatic ecosystems on the INL Site (2024).

AQUATIC ANIMAL						
WATER				SEDIMENT		
NUCLIDE	CONCENTRATION (pCi/l)	BCG ^a (pCi/l)	RATIO	CONCENTRATION (pCi/g)	BCG (pCi/g)	RATIO
Uranium-233	0.63	2.00E+02	3.16E-03	0.0315	1.06E+07	2.97E-09
Uranium-238	0.24	2.23E+02	1.07E-03	0.012	4.28E+04	2.80E-07
Summed	—	—	4.23E-03	—	—	2.83E-07
RIPARIAN ANIMAL						
WATER				SEDIMENT		
NUCLIDE	CONCENTRATION (pCi/l)	BCG (pCi/l)	RATIO	CONCENTRATION (pCi/g)	BCG (pCi/g)	RATIO
Uranium-233	0.63	6.76E+02	9.32E-04	0.0315	5.28E+03	5.97E-06
Uranium-238	0.24	7.56E+02	3.17E-04	0.012	2.49E+03	4.82E-06
SUMMED	—	—	1.25E-03	—	—	1.08E-05

a. BCG = Biota Concentration Guide. Each radionuclide-specific BCG represents the limiting radionuclide concentration in an environmental medium which would not result in recommended dose standards for biota to be exceeded.

Table 8-5. RESRAD-Biota assessment (Level 3 analysis) of aquatic ecosystems on the INL Site using measured waterfowl tissue data (2024).

WATERFOWL DOSE (rad/d)					
NUCLIDE	WATER ^a	SOIL ^b	SEDIMENT	TISSUE ^c	SUMMED
Americium-241	—	8.45E-07	—	—	8.45E-07
Cobalt-60	—	4.97E-06	—	1.06E-05	1.55E-05
Cesium-134	—	4.78E-06	—	—	4.78E-06
Cesium-137	—	7.58E-05	—	—	7.85E-05
Plutonium-238	—	1.76E-10	—	—	1.76E-10
Plutonium-239	—	3.27E-09	—	—	3.27E-09
Strontium-90	—	5.14E-07	—	7.29E-07	1.24E-06
Uranium-233	9.30E-05	NA	5.93E-07	NA	9.36E-05
Uranium-238	3.12E-05	NA	2.08E-07	NA	3.14E-05
TOTAL	1.24E-04	8.69E-05	8.01E-07	2.76E-04	2.23E-04^d

- a. Only uranium isotopes were measured in the MFC Industrial Waste Pond. Hence, doses were not calculated for other radionuclides in water and sediment.
- b. External doses to waterfowl were calculated using soil concentrations. Maximum concentrations of radionuclides measured in soil at the INL Site were used (Table 8-3). Note: NA = uranium isotopes were not analyzed in soil.
- c. Internal doses to waterfowl were calculated using maximum concentrations in edible tissue. Note: NA = uranium isotopes were not analyzed in tissue samples.
- d. DOE biota dose rate criteria for riparian animals is 0.1 rad/day.



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Chapter 9: Natural and Cultural Resources Conservation and Monitoring



CHAPTER 9

Natural resource information is used to demonstrate compliance with applicable rules and regulations and to ensure that the mission and goals of the Idaho National Laboratory (INL) Site can be achieved with few-to-no impacts to natural resources in four key areas of emphasis: (1) conservation planning, (2) special status species, (3) natural resource monitoring and research, and (4) land stewardship.

For species of elevated concern or with extensive populations and key habitats on the INL Site, the United States (U.S.) Department of Energy, Idaho Operations Office (DOE-ID) has developed conservation plans to protect species and the valuable ecosystems they inhabit. Conservation planning efforts include: (1) the Candidate Conservation Agreement (CCA) for Greater sage-grouse (*Centrocercus urophasianus*) on the INL Site, (2) the INL Site Bat Protection Plan, (3) the Sagebrush Steppe Ecosystem Reserve (SSER), and (4) the Migratory Bird Conservation Plan (MBTA) and Avian Protection Planning documents. In addition, DOE-ID addresses conservation concerns by continually evaluating regulatory rankings, abundance, and distribution of special status plant and animal species, which allows for prompt action in response to emerging concerns.

Natural resource monitoring and research have been conducted for more than 70 years on the INL Site, with some studies dating back to the 1950s. The focus of this work is to better understand the INL Site's ecosystem and biota and to determine the impact on these species' populations from activities conducted at the INL Site. Natural resource monitoring activities include: (1) breeding bird surveys, (2) a midwinter raptor survey, (3) long-term vegetation transects, and (4) vegetation mapping. Additionally, the INL Site was designated as a National Environmental Research Park (NERP) in 1975 and serves as an outdoor laboratory for environmental scientists to study Idaho's native plants and wildlife in an intact and relatively undisturbed ecosystem. Ongoing NERP activities include: (1) addressing ecohydrology in sagebrush steppe, (2) identifying high-quality foodscapes critical to sage-grouse, and (3) validating pygmy rabbit habitat distribution models.

Land stewardship involves managing ecosystems on the INL Site through planning, assessment, restoration, and rehabilitation activities. Areas where DOE-ID is actively employing land stewardship activities include: (1) wildland fire protection planning, management, and recovery; (2) restoration and revegetation; and (3) weed management.

The INL Cultural Resource Management Office (CRMO) coordinates cultural resource-related activities at the INL Site and implements the 2023 Programmatic Agreement (DOE-ID 2023b) and the INL Cultural Resource Management Plan (DOE-ID 2016) with oversight by DOE-ID's Cultural Resource Coordinator. The cultural resource identification and evaluation studies in 2024 included: (1) archaeological field surveys, (2) cultural resource monitoring and site record updates related to INL Site project activities and research, (3) comprehensive evaluations of 45-year-old and greater in age built-environment resources, and (4) meaningful collaboration with members of the Shoshone-Bannock Tribes and public stakeholders.

9. NATURAL RESOURCES CONSERVATION AND MONITORING

The INL Site is in the Upper Snake River Plain, near the southern extent of the Beaverhead Mountains and the Lemhi and Lost River Ranges. It is host to a variety of wildlife species including, but not limited to, large ungulates, such as elk (*Cervus canadensis*) and pronghorn (*Antilocapra americana*); ten species of bats, commonplace being the western small-footed myotis (*Myotis ciliolabrum*); and sagebrush obligates, such as the sagebrush lizard (*Sceloporus graciosus*)



and the greater sage-grouse. Herpetofauna, such as the Great Basin rattlesnake (*Crotalus oreganus* ssp. *lutosus*) and the Great Basin spadefoot toad (*Spea intermontana*), use locally appropriate habitats, as do over 100 species of birds (e.g., raptor, waterfowl, passerine, upland game species). The natural vegetation of the INL Site consists of an overstory of shrubs and an understory of grasses and forbs, or wildflowers. Big sagebrush (*Artemisia tridentata*) and green rabbitbrush (*Chrysothamnus viscidiflorus*) are the most common shrubs, while perennial grasses, such as needle and thread (*Hesperostipa comata*), Sandberg bluegrass (*Poa secunda*), and thickspike wheatgrass (*Elymus lanceolatus*), are generally the most abundant understory species. A diversity of flowering herbaceous forbs occurs in most plant communities, especially under favorable precipitation conditions.

Over the past two decades, wildland fire has affected natural resources across a substantial portion of the INL Site. The INL Site is also susceptible to nonnative species invasion and stressors like changes in precipitation patterns. Because of threats like these, the sagebrush ecosystem is considered one of the most imperiled ecosystems in the U.S. (Noss et al. 1995), and these ecosystems are being lost at an alarming rate. Consequently, natural resources on the INL Site are a high conservation priority for the survival of species that are dependent upon sagebrush steppe (Smith et al. 2023), some of which may be at the risk of local extirpation or even regional loss (Davies et al. 2011). As such, effective natural resource monitoring and land stewardship programs are imperative to executing the INL Site's mission with minimal impacts to the local flora and fauna.

The primary focus of INL's natural resources program is supporting mission critical operations across the INL Site. Support for operations ranges from implementing processes to ensure compliance with environmental requirements for existing facilities to providing information for permitting and environmental review of new industry partner projects and other federal initiatives. Natural resources conservation, monitoring, and land stewardship activities on the INL Site can be organized in four categories: (1) planning and implementing conservation efforts for high-priority natural resources; (2) evaluating the regulatory rankings, distribution, and populations for special status species; (3) ongoing monitoring and research to provide baseline and trend data for specific taxa and for broader ecological communities; and (4) conducting land stewardship activities to minimize impacts to natural resources and restore ecological condition, where appropriate. Natural resource data collected on vegetation and key wildlife species provide DOE-ID with an understanding of how species use the INL Site and provide context for analyzing trends. These data are used in National Environmental Policy Act (NEPA) analyses and enable DOE-ID to make informed decisions for project planning and to maintain up-to-date information on potentially sensitive species on the INL Site. The data are also summarized and reported to support DOE-ID's compliance with environmental regulations, agreements, policies, and Executive Orders (EOs). Finally, conservation management, wildland fire recovery, and vegetation management plans are developed and maintained to provide land management guidance for a variety of land stewardship concerns.

9.1 Conservation Planning

9.1.1 Candidate Conservation Agreement for Greater Sage-grouse

Populations of greater sage-grouse (hereafter, sage-grouse) have declined in recent decades (Coates et al. 2022), and the species range-wide distribution across western North America has been reduced to nearly half of its historical distribution (Schroeder et al. 2004, Connelly et al. 2011a). Additionally, the sagebrush habitats upon which sage-grouse rely have been greatly altered during the past 150 years and are currently at risk from a variety of pressures (Connelly et al. 2004; Davies et al. 2011; Knick et al. 2011, Doherty et al. 2022). Because of population declines and habitat losses, sage-grouse have been petitioned for listing under the Endangered Species Act of 1973 (ESA) several times. To reduce the potential for a listing to impact existing and future mission activities, DOE-ID entered a CCA with U.S. Fish and Wildlife Service (USFWS) in 2014. The CCA provides the framework to manage threats to sage-grouse and their habitat on the INL Site, and to develop conservation measures and best management practices to avoid or minimize impacts from natural phenomena like wildfire and from mission-related activities like infrastructure development. This Agreement also established a Sage-Grouse Conservation Area (SGCA), and DOE-ID committed to deprioritize the SGCA when planning infrastructure development (DOE-ID and USFWS 2014).

To evaluate sage-grouse population status with respect to their natural range of variation, the CCA established population and habitat triggers. The baseline value for the sage-grouse population trigger for the INL Site is 316 males across 27 leks. The population trigger will be tripped if the three-year running average of males on those 27 baseline leks



decreases $\geq 20\%$ (i.e., ≤ 253 males). The current baseline value for sagebrush habitat is 72,300 ha (178,656 ac) and the habitat trigger will trip if there is a reduction of $\geq 20\%$ (14,460 ha [35,731 ac]) of sagebrush habitat within the SGCA. If a trigger is tripped, an automatic response by both DOE and USFWS would be initiated, as described in the CCA (DOE-ID and USFWS 2014).

Every year, INL contractor biologists monitor sage-grouse populations, sagebrush habitats, and activities that are considered threats to sage-grouse survival on the INL Site. During 2024, the peak male attendance on baseline leks was 502—a 65.1% increase of males observed in 2023. The three-year (2022–2024) running average of peak male attendance on baseline leks increased by 35.5% to 351 males, exceeding the population trigger threshold of 253 males. Male sage-grouse attendance on the six lek routes monitored by the INL contractor also increased by 60.3% during 2024. Lek route data are used to evaluate long-term population trends and are supplied to the Idaho Department of Fish and Game (IDFG) for regional population assessments.

The habitat trigger is assessed annually with results from two monitoring tasks: (1) sagebrush habitat condition, and (2) sagebrush habitat distribution. Sagebrush habitat condition data, from field-based sampling, are used to ensure that the quality of habitat available to sage-grouse is sufficient to support the seasonal requirements of the species. The sagebrush habitat distribution task is a Geographic Information System (GIS) mapping exercise designed to track losses to sagebrush habitat following events that alter vegetation communities, such as wildland fires and land development. Habitat gains from natural or active restoration may also be captured during analyses for this task. As updates are made to vegetation polygon boundaries, the total area of mapped sagebrush habitat is compared to the baseline value established for the habitat trigger to determine the status with respect to the habitat threshold. The condition of sagebrush habitat remained high in 2024; sagebrush cover was near the upper range of its historical range of variability, herbaceous cover exceeded its range of variability, and the abundance of non-natives was generally low. The current estimated area of sagebrush habitat in the SGCA is 71,322.2 ha (176,240.9 ac) representing a 1.4% decrease from the habitat baseline.

For details about the most recent annual monitoring results, refer to [Implementing the Candidate Conservation Agreement for Greater Sage-Grouse on the Idaho National Laboratory Site 2024 Full Report](#) (Williams et al. 2025).

9.1.2 Bat Protection Plan

Over the past several decades, newly identified threats to bat populations (e.g., white-nose syndrome and large-scale commercial wind energy development) have caused widespread mortality events in bats and resulted in precipitous declines of numerous common bat species and elevated conservation concern for bats across the U.S., including additional listings under the ESA. Bats represent over 30% of mammal species described for the INL Site. Large undisturbed areas of shrub-steppe habitat, basalt outcrops, lava caves, juniper uplands, ponds and landscape trees at industrial facilities provide complex and abundant foraging and roosting habitat for a variety of resident and transient bat species. In 2011, DOE-ID and the Naval Reactors Laboratory Field Office/Idaho Branch Office decided to increase the attention they give to bat resources and initiate the development of a comprehensive INL Site-wide bat protection and monitoring program. In 2018, the INL Site Bat Protection Plan was finalized (DOE-ID 2018), which provides a framework for eliminating mission impacts associated with protected bat species, monitoring the status of bat populations, providing current data for environmental analyses, and engaging resource agency stakeholders such as the USFWS, Bureau of Land Management (BLM), and IDFG on bat issues. The INL Bat Protection Plan was also established and is being utilized to reduce the potential of bats being listed under the ESA.

Acoustic monitoring stations are used for much of the bat monitoring conducted on the INL Site. During 2024, five caves were monitored year-round, six caves were monitored seasonally, four locations around Middle Butte were monitored seasonally, and eight facilities were monitored during the summer months. Of the total number of files identifiable as bats 339,636 were from facilities, while the remaining 350,168 were from caves or around Middle Butte. Ongoing monitoring efforts show consistent patterns in seasonal bat distribution. The summer resident bat community consists predominantly of western small-footed myotis, Townsend's big-eared bat (*Corynorhinus townsendii*), big brown bat (*Eptesicus fuscus*), and western long-eared myotis (*Myotis evotis*) with some little brown myotis (*Myotis lucifugus*) and silver-haired bat (*Lasionycteris noctivagans*) detected at moderate levels at a few locations. Low levels of summer activity of hoary bat (*Lasiurus cinereus*) were detected at many monitoring locations. Western small-footed myotis was the most detected bat species at all surveyed features (e.g., facilities and caves). Little brown myotis and tree bats (e.g., hoary bats and silver-



haired bats) were more frequently detected at facilities than at cave sites. The INL Site also participated in the North American Bat Monitoring program, facilitated by the U.S. Geological Survey (USGS) in 2024, collecting acoustic data in two priority grid cells as part of a nationwide sampling framework. These data were provided to IDFG to support regional monitoring efforts.

In addition to acoustic bat monitoring at the INL Site, several other activities were conducted to address bat conservation. To support surveillance for white-nose syndrome (a disease impacting hibernating bats), humidity/temperature dataloggers were checked and reset in eight monitored hibernacula during the summer of 2024. Three live bats that were disrupting work were relocated to safe areas. Thirty-nine bat carcasses were recovered from facilities and submitted for radiological testing. Multiple public events were held at the Idaho Falls Zoo, Harriman State Park, and Museum of Idaho.

The Idaho National Laboratory Site Bat Protection Plan Annual Report 2024 provides the most detailed information about the INL Site Bat Protection Plan Monitoring Program (DOE-ID 2024a).

9.1.3 Sagebrush Steppe Ecosystem Reserve

On July 19, 2004, DOE-ID signed a Finding of No Significant Impact for an Environmental Assessment and Management Plan that outlined a framework to collaboratively manage the Idaho National Engineering and Environmental Laboratory (now INL) SSER with the BLM, USFWS, and IDFG. The SSER includes 29,945 ha (74,000 ac) of high desert land in the north central portion of the INL Site. In the 1999 Proclamation establishing the SSER, then U.S. Secretary of Energy Bill Richardson recognized that the "Reserve is a valuable ecological resource unique to the Intermountain West and contains lands that have had little human contact for over 50 years." The sagebrush steppe ecosystem across its entire range was listed as a critically endangered ecosystem by the National Biological Service in 1995, having experienced greater than a 98% decline since European Settlement." Because the SSER represents a unique ecological resource, "conservation management of the area is intended to maintain the current plant community and provide the opportunity for study of an undisturbed sagebrush steppe ecosystem." The Proclamation also specified that traditional rangeland uses will be allowed to continue under the SSER management designation and that Public Land Orders, which withdrew INL lands, would supersede SSER management objectives if the land was needed to support INL's nuclear energy research mission (DOE-ID 2004).

For more information about the SSER Environmental Assessment, the Finding of No Significant Impact, and the approved actions in the final management plan see ([DOE-ID 2004](#)).

9.1.4 Migratory Bird Conservation and Avian Protection Planning

Most activities at the INL Site are conducted within fenced, industrial complexes. General actions from day-to-day operations that may affect migratory birds include mowing vegetated areas for wildland fire protection, maintenance of utilities and infrastructure, and moving equipment such as trailers and nuclear fuel casks. As directed in [EO 13186](#) (2001) and outlined in a 2013 Memorandum of Understanding between the DOE and USFWS (2013), DOE-ID has developed a Migratory Bird Conservation Plan (DOE-ID 2022) that provides a framework for protecting and conserving migratory birds and their habitat in accordance with the Migratory Bird Treaty Act of 1918 and the Bald and Golden Eagle Protection Act of 1940.

DOE-ID also maintains a Special Purpose Permit issued by the USFWS that allows for the destruction or relocation of a predetermined number of migratory bird nests, when permit conditions are met. Additionally, a Scientific Collection Permit issued by the IDFG allows for the retrieval or harvest of certain migratory birds with the intent of using them for scientific and monitoring purposes. All practicable minimization and avoidance efforts identified in the Migratory Bird Conservation Plan are to be implemented before parties exercise their ability to take migratory birds under these permits. The conservation plan identifies measures that are designed to eliminate or minimize impacts on migratory birds and to protect their habitat. These measures include the protection of native vegetation, avoiding disturbing nesting birds, reducing the potential for conflicts with INL missions, and enhancing native habitat as practical.

In 2019, DOE-ID established a Migratory Bird/Wildlife Conservation Working Group to provide a forum for discussing, resolving, and collaborating on all activities related to migratory bird and other wildlife matters arising on the INL Site. The primary task of this group is to promote the conservation of migratory birds, share ideas to minimize the impact of



nesting birds to operations, and ensure compliance with permit requirements. Accomplishments to date include the development of online Migratory Bird Awareness Training for environmental staff, facility maintenance, operations, and program managers; mitigation actions, such as incorporating critical equipment inspections into daily operations orders to identify nesting activities; use of window dressings to reduce mortality from window collisions; and exchanging information regarding the use of relocating bird eggs or young to licensed rehabilitators in lieu of unavoidable destruction and take situations.

Finally, the INL contractor has developed an Avian Protection Plan and Bird Management Policy (INL 2016) in accordance with Avian Power Line Interaction Committee requirements (Avian Power Line Interaction Committee 2006). This plan includes documenting, tracking, and correcting conditions that resulted in a migratory bird's death. When birds are electrocuted, power poles are either retrofitted or modified with avian protection devices during the next scheduled power outage. These efforts help to reduce future electrocution events. Avian interactions are also considered when siting new power line locations and when replacing existing power poles to reduce risks to migratory birds through proactive and innovative resolutions.

9.2 Special Status Species

9.2.1 Wildlife

The INL Site provides breeding and foraging habitat for a variety of species, including 28 species of birds and 11 species of mammals, one reptile, and one amphibian species that are of elevated conservation concern by state or federal agencies. Several of these species are sagebrush obligates, while others use habitats that are very localized on the INL Site, such as juniper woodlands or surface water features. Many of these species are detected or monitored during annual survey efforts, including the midwinter raptor counts, sage-grouse lek counts, breeding bird surveys, and bat acoustic monitoring.

Several species currently listed according to the ESA have been documented in the state of Idaho, including the North American wolverine (*Gulo gulo* ssp. *luscus*) and the Canada lynx (*Lynx canadensis*); however, due to habitat requirements and the restricted ranges of these and other listed species, they are not likely to occur on the INL Site. Several species that have either been proposed for listing under the ESA or have been recovered and delisted occur seasonally or are considered residents of the INL Site. The bald eagle (*Haliaeetus leucocephalus*), delisted in 2007, is commonly seen during the winter months on or near the INL Site. Species associated with sagebrush habitats, such as the pygmy rabbit (*Brachylagus idahoensis*) and the sage-grouse, have been proposed for listing under the ESA in recent years.

While no wildlife species currently listed under the ESA are known to occur on the INL Site, there are at least 27 wildlife species of conservation concern identified by the BLM as special status species (Type 2) that have been documented on the INL Site. A BLM ranking of Type 2 indicates that a species is a candidate, was delisted within the past five years, is an experimental population, or has a proposed critical habitat by the USFWS (BLM 2008). Some of these species would also be considered sensitive if they were assigned a global or state conservation status ranking of three or less by NatureServe (2024). Of these BLM Type 2 species, some of the most common at the INL Site include the sage thrasher (*Oreoscoptes montanus*), the loggerhead shrike (*Lanius ludovicianus*), the ferruginous hawk (*Buteo regalis*), and the sage-grouse. Based on habitat requirements, an additional three birds and four invertebrates that are considered federally sensitive are likely to occur onsite but have not been formally documented.

At least 36 wildlife species identified in the Statewide Wildlife Action Plan (SWAP; IDFG 2024a) by the IDFG as Species of Greatest Conservation Need (SGCN) or Species of Greatest Information Need (SGIN) have been documented on the INL Site. These include occasional sightings of species, such as the American white pelican (*Pelecanus erythrorhynchos*) and the ring-billed gull (*Larus delawarensis*), to more commonly observed species, such as the sage-grouse and the burrowing owl (*Athene cunicularia*). State-designated species that have not been formally documented but are likely to occur on the INL Site include four birds, seven invertebrates, and four mammals.

A current list of special status wildlife species can be found [here](#).



9.2.2 Plants

On the INL Site, a concerted effort to survey rare and sensitive plant species was undertaken in the early 1980s, and another similar effort was completed during the early 1990s to fill data gaps and to inform both state and federal assessments (Cholewa and Henderson 1984; Anderson et al. 1996). The INL contractor continues to conduct botanical surveys for special status plant species to support state and federal conservation efforts, to provide information for NEPA assessments, and to facilitate mission activities in a manner that minimizes impacts to sensitive species (Atwood 1969; Cholewa and Henderson 1984; Anderson et al. 1996; [Forman 2015](#)). Currently, 64 special status plant and bryophyte species are documented or are likely to occur on the INL Site. Many species that are recognized as likely to occur were identified as such due to documented nearby occurrences or the presence of appropriate habitat. Among the documented species, many are restricted in distribution by unique habitat requirements, while a few special status plants have broader distributions across the INL Site.

Idaho has five federally listed plant species under the ESA, but none are known to be present on the INL Site. While populations of Ute ladies'-tresses (*Spiranthes diluvialis*) have been documented near the INL Site, its specific habitat type is negligible or nonexistent within the INL Site's cold desert steppe. Although appropriate habitat for slickspot peppergrass (*Lepidium papilliferum*) is available on the INL Site, the closest known populations are located hundreds of miles to the west. Occurrences of whitebark pine (*Pinus albicaulis*) near the INL Site, coupled with limited botanical surveys and the coarse resolution of suitable habitat models (Chang et al. 2014), suggest botanical surveys should be conducted to determine whether this species is present in the atypical, low-elevation microhabitats available on the INL Site. Eight BLM-ranked plant species are documented on the INL Site, and nine others are likely to occur.

In addition to those species that receive federal regulatory support, state agencies also maintain a list of sensitive species; a special status plant list is published biennially by the Idaho Native Plant Society (INPS 2024). The list is a tool for agencies to prioritize conservation efforts, promote unified conservation approaches, and proactively avoid ESA listings. Idaho manages spatial data within the Idaho Fish and Wildlife Information Systems program (IDFG 2024b), disseminating species-specific information data to support conservation and assess potential environmental impacts. The Idaho Native Plant Society list reflects the NatureServe (2024) conservation rankings where species are ranked globally (e.g., Global Rank) – occasionally at the subspecies level (e.g., Trinomial Rank) – and subnationally (e.g., State Rank). Species ranked as vulnerable (G3/T3/S3), imperiled (G2/T2/S3), or critically imperiled (G1/T1/S1) are considered special status species. The Idaho SWAP has also been updated to include plants, and species considered to be special status are ranked as either SGCN or SGIN.

The INL Site's sagebrush steppe supports documented occurrences of 29 special status plant species, including 23 wildflowers, four grasses, one shrub, and a cactus. There are an additional 35 special status plant species that are likely to occur, but for which surveys have not been completed. They include 25 wildflowers, two grasses, two shrubs, one tree, four lichens, and one moss. Most of these species have very limited distributions and are restricted to areas with unique soils, topography, and associated plant communities. Two species – white sand verbena (*Abronia mellifera*), which has been documented on the INL Site, and whitebark pine, which has not been documented, but may occur in very limited distribution – are also designated as SGCN under the Idaho SWAP.

A current list of special status plant species can be found at [here](#).

9.3 Natural Resource Monitoring and Research

9.3.1 Breeding Bird Surveys

The Breeding Bird Survey (BBS) program in North America is managed by the USGS and currently consists of over 5,100 routes, with approximately 3,000 of these being sampled each year (Ziolkowski et al. 2023). These data have been used to estimate population changes for hundreds of bird species, and they are the primary source for regional conservation programs and modeling efforts. Five official USGS BBS routes (i.e., remote routes) are on the INL Site and have been surveyed nearly every year since 1985 (except 1992 and 1993). In 1985, DOE-ID also established eight additional routes around INL Site facilities to monitor birds near human activity centers (i.e., facility routes). BBS data can directly benefit INL Site managers by providing information on local breeding bird populations, which may be useful as they consider new activities and comply with the NEPA assessment process.



A total of 3,561 birds and 61 species were documented during the 2024 surveys. Total observations were 22.9% lower than the 37-year mean of 4,615 birds (e.g., 1985–1991 and 1994–2023). The total number of species recorded was higher than the 37-year mean of 56 species. Horned lark (*Eremophila alpestris*, n = 1,534), sage thrasher (n = 312), Brewer's sparrow (*Spizella breweri*, n = 300), western meadowlark (*Sturnella neglecta*, n = 283), and sagebrush sparrow (*Artemisiospiza nevadensis*, n = 211) were the five most common species observed in 2024.

Fifteen species observed during the 2024 BBS are considered by IDFG as SGCN or as Birds of Conservation Concern by USFWS. These species included the Brewer's sparrow, sage thrasher, sagebrush sparrow, common nighthawk (*Chordeiles minor*, n = 71), Franklin's gull (*Leucophaeus pipixcan*, n = 46), grasshopper sparrow (*Ammodramus savannarum*, n = 25), loggerhead shrike (*Lanius ludovicianus*, n = 18), California gull (*Aythya americana*, n = 11), ferruginous hawk (n = 8), sage-grouse (n = 8), short-eared owl (*Asio flammeus*, n = 8), burrowing owl (n = 7), white-faced ibis (*Plegadis chichi*, n = 4), golden eagle (*Aquila chrysaetos*, n = 2), and northern pintail (*Anas acuta*, n = 1).

For more details about sampling, analyses, and results see [Owens \(2025\)](#).

9.3.2 Midwinter Raptor Survey

Midwinter eagle surveys were initiated during 1979 by the USGS to develop a population index of bald eagles in the lower 48 states, determine bald eagle distribution, and identify previously unrecognized areas of important wintering habitat. In 1983, two midwinter eagle survey routes were established on the INL Site. Initially, the counts focused on eagle populations; however, biologists recognized the importance of collecting data on raptor abundance during this survey and started recording all raptors, including owls, hawks, and falcons in 1985. In 1992, the list of recorded species expanded to include corvids and shrikes.

In early January of each year, biologists survey the two established routes to detect any target species perched, hovering, or soaring. The number of individuals per species is counted for each of the target species detected. A total of 269 birds representing eight species were observed during the 2024 midwinter raptor surveys. Common ravens and rough-legged hawks are typically the most observed species during this survey and made up 49% and 27% of the observations in 2024, respectively. The species observed were American kestrel (*Falco sparverius*, n = 3), black-billed magpie (*Pica hudsonia*, n = 32), common raven (*Corvus corax*, n = 131), golden eagle (n = 6), northern harrier (*Circus hudsonius*, n = 8), rough-legged hawk (*Buteo lagopus*, n = 73), red-tailed hawk (*Buteo jamaicensis*, n = 13), and Swainson's hawk (*Buteo swainsoni*, n = 3).

More information about the 2024 midwinter raptor survey can be found [here](#).

9.3.3 Long-term Vegetation Transects

The Long-term Vegetation (LTV) transects and associated permanent plots were established on what is now the INL Site in 1950 for the purpose of assessing the impacts of nuclear energy research and development on the surrounding ecosystems (Singley et al. 1951). As the mission of the INL Site has grown and changed over the past 70 years, so too has the purpose and utility of the LTV project. Although the LTV project was initiated to address energy development at the INL Site, it is unique in its capacity to allow investigators to observe long-term vegetation change from various sources. Consequently, the LTV project has been used to document vegetative changes from wildfire, different types of land use, and in response to shifts in weather patterns. The LTV also provides a unique context for understanding resilience in the local sagebrush steppe.

Regular vegetation data collection occurs on the LTV plots about once every five years. Eighty-nine LTV plots are still accessible, and most have been sampled consistently between 1950–2022, making the resulting dataset one of the oldest, largest, and most comprehensive for sagebrush steppe ecosystems in North America. Data were collected across the LTV plots for the fourteenth time between June and August of 2022. Plots were sampled for cover and density by species according to methodologies developed in 1950, with supplemental sampling protocols added in 1985 (see [Forman and Hafla \(2018\)](#) for details of the project sample design). The 2022 data were integrated into the larger LTV dataset, and summary results were presented in a 2024 technical report.

Notable changes between the 2016 and 2022 sample periods include decreases in shrub cover, particularly big sagebrush; decreases in native grass cover; and no significant changes in the densities of introduced annual grasses



and forbs. With respect to long-term trends, big sagebrush cover is at its lowest point in the 72-year history of the data set. Declines in big sagebrush cover are due to direct losses from wildland fire and delayed natural post-fire recovery from reduced germination and establishment due to below average spring precipitation on the INL Site over the past decade.

Introduced annuals remain much more abundant than native annuals across the LTV plots and the composition of the functional group has changed so that the most abundant introduced annual is Russian thistle (*Salsola tragus*) rather than cheatgrass. Introduced annuals have also been exhibiting fluctuations with greater magnitudes of change from one sample period to the next over the past two decades when compared with earlier sample periods. Coincidentally, average annual precipitation has declined over the past two decades and seasonal timing of precipitation has shifted away from wet spring periods to elevated precipitation in late summer and fall. Increased pressure from nonnative species, including annuals like cheatgrass and perennials like crested wheatgrass, will undoubtedly persist over the next few decades. Some of the more recent changes in vegetation distribution and structure across the LTV plots may suggest the beginning of a shift to INL Site plant communities that are less resilient than they have been in the past.

For more information about the LTV, including results from the most recent sampling effort see [Forman \(2024\)](#).

9.3.4 Vegetation Map

Following the publication of the last vegetation map in 2019 ([Shive et al. 2019](#)), the Sheep Fire burned 40,403 ha (99,839 ac) across the interior region of the INL Site. Five more fires (i.e., Telegraph, Lost River, Howe Peak, and Cinder Butte, and Central Facilities Area Complex Fires) burned in 2020 and affected an additional 1,578.5 ha (8,537.2 ac). Combined, the 2019–2020 fires burned about 18% of the Site, effectively outdating those areas of the 2019 map. New map class boundaries were updated only within the 2019–2020 burned areas because in the absence of abrupt disturbances like wildland fires, vegetation composition tends to change slowly.

Idaho National Agriculture Imagery Program imagery, consisting of four spectral bands with a spatial resolution of 0.6 m (2 ft), was acquired during the summer of 2023 and it served as the primary basemap dataset for mapping updates. Map delineations were produced through manual imagery interpretation and digitizing at a 1:6,000 mapping scale using a suite of GIS editing tools. During the summer of 2023, a total of 100 independent validation plots were also collected and used to support an accuracy assessment of the updated map areas. A standard error matrix was used to calculate map accuracy metrics including user's and producer's accuracy, overall accuracy, and the Kappa statistic.

Eight map classes were delineated within the updated map area and the Green rabbitbrush/Thickspike Wheatgrass Shrub Grassland/Needle and Thread Grassland class represented the greatest amount of area with 26,069.2 ha (64,418.5 ac). The map class with the second largest mapped area was the Green rabbitbrush/Sandberg Bluegrass – Bluebunch Wheatgrass Shrub Grassland class with 9,287.7 ha (22,950.3 ac). These two native shrubland classes account for 84.2% of the updated map area, suggesting most of the burned area is recovering well post-fire and non-native species are not becoming dominant across burned areas. The Cheatgrass Ruderal Grassland showed a 16.6% decrease in mapped area compared to the 2019 map.

The accuracy assessment results of the updated map area showed an overall accuracy of 60% and a Kappa value of 0.59 which is lower than the full map assessment conducted in 2019. The previous two map accuracy assessments in 2011 and 2019 showed that post-fire vegetation communities generally exhibited lower class accuracies than other intact classes not altered by fire. Individual class accuracies varied considerably and low sample sizes for some classes contributed to a wide range of results. The map class with the greatest sample size was the Green rabbitbrush/Thickspike Wheatgrass Shrub Grassland/Needle and Thread Grassland; this class had a producer's accuracy of 71.9% and a user's accuracy of 73%, which are both higher than the 2019 results suggesting a slight improvement in post-fire mapping accuracy throughout most of the burned area.

Additional detail about the most recent map products can be found in the INL Site Vegetation Map Update ([Shive 2024](#)).

9.3.5 National Environmental Research Park

The INL Site was designated as a NERP in 1975 through a NERP Charter, the Energy Reorganization Act, and the Non-nuclear Energy Research and Development Act. The Idaho NERP and NERPs at other DOE sites are outdoor



laboratories that provide opportunities for environmental studies on protected lands that act as buffers around DOE facilities. The objective of the NERP system is to facilitate research and education, particularly to demonstrate the compatibility of energy technology development and a quality environment. The Idaho NERP provides exceptional opportunities for research because of its established facilities, a security buffer that protects research areas, extensive historical data, and partnerships with universities. In 2024, the INL contractor facilitated university-led research on three ecological research projects through the NERP: (1) addressing ecohydrology in sagebrush steppe, (2) identifying high-quality foodscapes critical to sage-grouse, and (3) validating pygmy rabbit habitat distribution models.

The INL Site and other landscapes with sagebrush steppe vegetation are experiencing a simultaneous change in climate and plant community composition that is impacting habitat for wildlife, wildfire risks, and ecosystem services such as forage. Determining the separate and combined/interactive effects of climate and vegetation change is important for assessing future changes on the landscape and for hydrologic processes. Since the early 2000s, investigators have used an existing INL ecohydrology research facility, the former Protective Cap/Biobarrier Experiment, to study vegetation change with respect to precipitation regime, vegetation type, and soil depth. The focus of the current research is to compare the impacts of grass invasion and shifts in timing of precipitation to the function of the whole ecosystem, including biogeochemistry, carbon storage, and other attributes that relate to resistance and resilience in a changing environment. The experiment site was burned in its entirety by the 2019 Sheep Fire, which created an exceptional opportunity to test the underlying basis for the theory on resistance to exotic annual-grass invasion (cheatgrass) and resilience of sagebrush steppe. The long-term treatments conveniently create a gradient of pre-fire climate differences, and the cessation of treatment application has induced large differences in simulated drought conditions on the experiment. Researchers continue to sample the differences in cheatgrass among the treatments along with the corresponding soil nutrients and water. The research team includes Dr. Matthew Germino from the USGS Forest and Rangeland Ecosystem Science Center and Dr. Toby Maxwell and Dr. Marie-Anne DeGraff from Boise State University; their research continues to use a facility that has been in operation since 1994.

The Idaho NERP is collaborating in a multiagency research project focused on identifying high-quality foodscapes critical to sage-grouse habitat conservation across the sagebrush steppe ecosystem. The research team aims to identify the chemical phenotype (or chemotype) of sagebrush species linked with high sage-grouse forage fidelity to identify which habitats are crucial dietary hotspots for sage-grouse that should be prioritized for conservation and where seed collection should occur for local restoration of plants that are palatable to local sage-grouse populations. Field research is conducted during the winter and spring months to identify seasonal compositional changes in chemotypes of sagebrush consumed by sage-grouse. Browsed vegetation and excreta of sage-grouse are collected and used to determine diet quality using Near Infrared Spectroscopy and analytical chemistry of plants, diet composition using DNA barcoding of feces, digestibility of food using a particle size analysis of feces, and detoxification capacity by analyzing renal metabolites in uric acid. Overall, the project is focused on supporting preventative management actions, protecting functional biodiversity and palatable sagebrush, and improving the availability of locally adapted seed sources most appropriate in habitat restoration projects that aim to promote healthy populations of sage-grouse. The Principal Investigator is Boise State University researcher, Dr. Jennifer Forbey.

Pygmy rabbits are a sagebrush specialist, endemic to the western U.S., and are considered threatened by habitat alteration, habitat loss, climate change, and disease (Rachlow et al. 2021; Crowell et al. 2023). Formalized pygmy rabbit surveys were last conducted on the INL Site in 2009; however, the current distribution and habitat usage of the pygmy rabbit on the INL Site is relatively unknown. With the proposed listing of the species under the ESA in 2023, current data regarding pygmy rabbit occurrence on the INL Site is invaluable. University of Idaho researchers have developed statewide pygmy rabbit habitat distribution models (Rush et al. 2023) and validating those models in the field provides an opportunity to collect some INL Site-specific occurrence data and to understand the utility of occupancy models locally. A subset of fecal pellet samples collected on the INL Site during 2023-2024 have been tested in the lab to confirm the species identification and of 21 samples tested to date, 16 samples were molecularly confirmed as pygmy rabbit. After species identifications of the remaining pellet samples have been confirmed in the lab, pygmy rabbit occupancy rates and dynamics will be estimated using detection/non-detection surveys. By refining existing pygmy rabbit habitat modeling methodologies, this study will allow for the estimation of potential pygmy rabbit habitat in Idaho that is currently occupied, the ability to model trends in occupancy over the last 20 years (i.e., extinction/colonization rates), and assess if fine-scale climate and weather variables predict occupancy, extinction, or colonization rates. The research team for this project



includes Dr. Janet Rachlow, professor in the Department of Fish and Wildlife Sciences at University of Idaho; Dr. Leona Svancara, researcher at USGS and University of Idaho; and Fiona McKibben, doctoral student at University of Idaho.

9.4 Land Stewardship

9.4.1 Wildland Fire Protection Planning, Management, and Recovery

The INL Fire Department provides wildland fire suppression services on the rangeland within the INL Site boundary, as well as a five-mile buffer outside of the INL Site boundary. The INL Fire Department employs pre-incident strategies, such as the identification of special hazards, mitigation procedures, and mapping necessary to facilitate response to fires. DOE-ID maintains mutual aid agreements with regional agencies, including the BLM, to assist in response to high-challenge wildland fires. Additionally, the INL contractor implements PLN-14401 (INL 2022), “Idaho National Laboratory Wildland Fire Management Plan,” which incorporates essential elements of various federal and state fire management standards, policies, and agreements. A balanced fire management approach has been adopted to ensure the protection of improved laboratory assets in a manner that minimizes effects on natural, cultural, and biological resources.

Additionally, the INL contractor has established a Wildland Fire Management Committee (WFMC) to review seasonal fuel management activities and the potential impact of all fires greater than 40.5 ha (100 ac), or fires for which containment lines have been constructed. A primary responsibility of the WFMC is to determine whether a post-fire-recovery plan is warranted for a given fire. Once an ecological resources post-fire-recovery plan is requested, the INL Natural Resources Group (NRG) completes an ecological resource assessment to evaluate the resources potentially impacted by a wildland fire and drafts a recovery plan for treatment prioritization and implementation by the WFMC. To standardize and streamline the process of developing natural resource recovery plans, the NRG recently developed a Wildland-Fire-Recovery Framework for the INL Site. This framework identifies INL’s fire recovery goals, defines the fire recovery planning process, describes a post-fire ecological resource assessment process for quantifying fire impacts, presents all potential post-fire treatments that may be considered for improving natural resource recovery, establishes the basis for an annual post-fire monitoring program, and provides a template for future fire recovery plans.

There are two active wildland fire recovery plans for the INL Site, one for four fires that burned in 2020 and one that is being drafted to address the 2024 Dry Channel Fire. In 2020, an ecological resources post-fire-recovery plan was completed for four of the fires that burned that year, the Howe Peak Fire, the Telegraph Fire, the Cinder Butte Fire, and the Lost River Fire. Monitoring and treatment are ongoing within the Telegraph Fire footprint and activities to date include monitoring temporary fire suppression access roads and containment lines for natural recovery, ongoing noxious weed inventory and treatment, and sagebrush restoration. The Dry Channel Fire burned on June 26, 2024, and was likely caused by a lightning strike. Although, the recovery plan for this fire will not be finalized until the WFMC has approved it during the spring 2025 meeting, there are several actions that can and should be taken prior to completion of the plan. Emergency stabilization actions that were implemented prior to finalization of the fire-recovery plan include containment line recontouring and noxious weed control.

Click here to see [INL’s wildland fire recovery framework](#) (Forman et al. 2024), and the [2020 fires recovery plan](#) (Forman et al. 2021).

9.4.2 Restoration and Revegetation

Revegetation for Soil Stabilization

Revegetation with native species is required on the INL Site for areas where soil or vegetation are disturbed, and the area will not be physically stabilized and maintained as sterile. These areas are left exposed and vulnerable to erosion and to infestations of invasive or noxious weeds. Revegetation plans are developed for areas requiring revegetation based on site condition and disturbance size. Revegetation strategies on the INL Site include, but are not limited to, seedbed preparation, soil augmentation, drill seeding, hydroseeding, hand-broadcasting seed, planting nursery stock, mulching, and applying supplemental water.

In 2024, one revegetation project was initiated to stabilize soils and prevent the introduction of invasive species on approximately 9.5 ha (23.5 ac) disturbed by construction activities for a waterline that was constructed in 2023. A revegetation plan was drafted in the summer of 2024, and it included seedbed preparation, soil sampling to inform soil



amendments, preferred methods of seeding, seed mix recommendations, and recommended post-planting care. Due to time and logistical constraints, INL's Facilities and Site Services management chose to forgo the seedbed preparations, soil sampling, and soil amendments. The recommended seed mix was procured, and drill seeding took place beginning in the late summer of 2024. Conditions will be assessed throughout the spring of 2025 to determine if supplemental water would be advantageous for germinating and establishing seeds.

Revegetation projects on the INL Site are revisited at least one growing season after the initial revegetation effort, and revegetation assessments are used to determine whether further actions need to be taken. One revegetation assessment was completed in 2024 on the Birch Creek site, totaling approximately 0.20 ha (0.5 ac). The initial assessment of this area indicated that vegetative cover was relatively high across the revegetation area; however, the dominant species was cheatgrass. In the areas where they did occur, native species abundance lower, but their presence was encouraging. Native annual species, such as flatspine stickseed (*Lappula occidentalis*) were distributed across most of the area. These species typically function as early successional species, which suggests there is some progress toward a desirable end state. Initial restoration efforts at this site were completed in collaboration with DOE-ID, INL (NRG, Facilities and Site Services, CRMO), Heritage Tribal Office (HeTO), and BLM staff, and included nutrient supplements, hydroseeding and mulching with appropriate native grass species, planting containerized sagebrush seedlings, installing juniper windings, and supplemental watering. Because stabilization efforts were not entirely successful, additional stabilization efforts will be proposed for 2025, and monitoring will continue.

Sagebrush Habitat Restoration

Sagebrush habitat restoration on the INL Site is conducted in response to DOE-ID's goal of no net loss of sagebrush habitat. The potential to lose sagebrush habitat on the INL Site occurs primarily from two mechanisms. The first is loss due to wildland fire (see Section 9.4.1), and the second is loss due to infrastructure expansion. The INL contractor implements multiple best management practices to minimize infrastructure-related sagebrush habitat loss, such as co-locating infrastructure, but in some cases, removal of sagebrush habitat is necessary to support the INL mission. Habitat loss associated with infrastructure development is addressed through a compensatory sagebrush mitigation strategy that provides an approach for projects to provide funds for sagebrush to be restored in areas where it can provide the greatest habitat benefit. Sagebrush habitat restoration has been conducted using containerized sagebrush seedlings and aerially applying sagebrush seed. Due to the semiarid nature of the ecosystem, planting sagebrush seedlings often results in higher survivorship than trying to establish sagebrush from seed, but DOE-ID and the INL contractor continue to partner with agencies to test and develop additional planting methods.

In 2024, INL planted containerized seedlings to address infrastructure expansion-related losses and applied sagebrush seed to improve habitat in an area affected by wildfire. A total of 19,050 sagebrush seedlings were planted in portions of the Twin Buttes Fire (burned in 2007) and Middle Butte Fire (burned in 2010) burned areas. These seedlings were funded through compensatory mitigation for infrastructure development that took place in 2023. As a result of sagebrush habitat restoration on the INL Site since 2015, 349,675 sagebrush seedlings have been planted across 1,209.9 ha (2,972.4 ac). Seedlings planted on the INL Site are monitored one year and five years after planting to assess survivorship, and planting strategies are adjusted according to past survivorship data.

In addition to planting sagebrush seedlings, INL continued to pursue sagebrush habitat restoration in the Tractor Flats area of the INL Site (last burned in the 2010 Jefferson Fire), contiguous with BLM restoration efforts. In 2023, DOE-ID, INL, USFWS, and BLM received Bipartisan Infrastructure Law funding to collect sagebrush seed within the unburned areas of the southern and eastern portion of the INL Site and on adjacent BLM land. In 2024, a portion of this seed was applied to approximately one-third, or about 280 ha (700 ac) of the area scheduled to be planted on the INL Site. Seed was planted using a broadcast spreader followed by an imprinter at a rate of approximately 0.7 kg (1.5 lb) of pure live seed per 0.4 ha (1 ac).

For details about sagebrush restoration in 2024, refer to Subsection 5.2.2 of "[Implementing the Candidate Conservation Agreement for Greater Sage-Grouse on the Idaho National Laboratory Site 2024 Full Report](#)" (Williams et al. 2025).

9.4.3 Weed Management

The INL contractor maintains and funds a noxious and invasive weed-management program to address the requirements of federal agencies described in EO 13112, "[Invasive Species](#)," as amended by EO 13751, "[Safeguarding the Nation](#)



from the Impacts of Invasive Species.” The Noxious and Invasive Weed Species Management program on the INL Site fulfills these requirements by preventing the introduction, establishment, and spread of invasive species to the extent possible during all activities. The INL contractor often focuses treatment efforts along potential vectors, such as perimeter roads, and along highways, interior two-track roads, and within facility footprints. All pesticide applications on the INL Site are conducted according to specific pesticide label instructions in compliance with the Federal Insecticide, Fungicide, and Rodenticide Act (1996). All records associated with pesticide applications on the INL Site are kept for a minimum of three years in accordance with Idaho Administrative Procedures Act (IDAPA) 02.03.03, “Rules Governing Pesticide and Chemigation Use and Application” (Idaho State Department of Agriculture 2022).

In cooperation with NRG, INL applicators prioritize annual weed treatments. INL Applicators use integrated pest management principles that determine whether treatment actions are required and what type of treatment is needed (i.e., biological, cultural, physical, mechanical, or chemical). Noxious weeds are generally treated with pesticide application when the pesticide label allows but, in some cases, certain species are treated using manual or mechanical treatments. Most treatments targeting invasive species, that are not designated noxious, take place in the form of mechanical removal, such as mowing or trimming. INL applicators monitor known noxious weed and invasive species locations along with the results of any treatments that have been conducted. In 2024, 94 new noxious weed observations were made, and 116 pesticide applications were conducted. Additionally, weeds were controlled via shoveling and hand-pulling when appropriate. Noxious weed species targeted and controlled in 2024 were rush skeletonweed (*Chondrilla juncea*), scotch thistle (*Onopordum acanthium*), musk thistle (*Carduus nutans*), Russian knapweed (*Acroptilon repens*), spotted knapweed (*Centaurea stoebe*), leafy spurge (*Euphorbia esula*), plumeless thistle (*Carduus acanthoides*), Canada thistle (*Cirsium arvense*), black henbane (*Hyoscyamus niger*), and houndstongue (*Cynoglossum officinale*).

The risks from noxious weeds and invasive species are also minimized by discouraging unnecessary actions that can create spreading vectors or new introductions. Along with directly targeting and treating weeds, INL has implemented programmatic strategies to reduce the potential introduction and spread of weeds. These include both employee education and work controls. Every year, employees are provided briefings and training material about how to identify, report, and minimize the spread of weeds. Work controls to limit risks of weed introduction and spread during work activities are implemented through the Biological Resource Review process. During the Biological Resource Review process, a natural resource scientist reviews and identifies projects with the potential to create weed vectors or that may require monitoring for noxious weeds and invasive species and provides strategies for addressing those concerns.

9.5 INL Site Cultural Resource Management

The INL CRMO is managed by the INL contractor. Cultural resource professionals in the INL CRMO coordinate cultural resource-related activities at the INL Site and implement the INL Cultural Resource Management Plan (DOE-ID 2016) with oversight by the DOE-ID Cultural Resource Coordinator. Provisions to protect the unique cultural resources of the land and facilities at the INL Site are included in environmental policies issued by Battelle Energy Alliance, LLC (BEA), and other INL Site contractors and in company procedures that guide work completion. Cultural resource identification and evaluation studies in 2024 included archaeological field surveys, monitoring, and updates related to INL Site project activities, as well as studies supported by DOE-ID in facilitating meaningful collaboration with members of the Shoshone-Bannock Tribes and public stakeholders. Please see the INL Site Cultural Resource Management Annual Reports for Fiscal Years 2023 and 2024 (DOE-ID 2023a and DOE-ID 2024b) and visit the INL Cultural Resources website for more information ([Cultural Resources at INL](#)).

9.5.1 INL Section 106 Project Reviews

During 2024, the INL CRMO reviewed approximately 687 projects under Section 106 of the National Historic Preservation Act. This review included CRMO-specific programming updates developed collaboratively with an Environmental Review Process (ERP) software developer. As a result of the implementation of the 2023 Programmatic Agreement (PA) (DOE-ID 2023b), the INL CRMO revised MCP-8008, “Section 106 Compliance” (INL 2023), to better guide the project review process within the one-stop, multidisciplinary ERP system. The review process includes an analysis for possible exclusions regarding activities that do not require a Section 106 review, either because they do not rise to the level of a federal undertaking or they meet certain activity and property types, thus requiring no project-specific consultation. If no appropriate exclusions are applicable, a Section 106 Cultural Resource Review is prepared



for the assessment of effects, with outcomes limited to the following three regulatory options: (1) No Historic Properties Affected; (2) No Adverse Effect to Historic Properties; or (3) Adverse Effect to Historic Properties, which requires the mitigation of that effect. Note that no activities at the Experimental Breeder Reactor-I (EBR-I), other than ground disturbance within the fenced facility perimeter, are excluded due to its National Historic Landmark status. The results of the CRMO ERP Screening are depicted in Figure 9-1.

A “No Historic Properties Affected” finding means there are no historic properties present within the Area of Potential Effects or those that are present will not be impacted by the proposed project activities. A finding of “No Adverse Effect to Historic Properties” means there will be some level of impact to a historic property, but it is not significant enough to warrant additional management considerations. An “Adverse Effect to a Historic Property” finding means the impact to the property has risen to a level that cannot be resolved within the scope of the project activities (e.g., the demolition of a National Register of Historic Places-eligible building, irreversible alteration or destruction of character defining features of a historic property).

Two projects resulted in a finding of “Adverse Effect to Historic Properties,” so mitigation efforts were pursued as a means of resolving the adverse effects. The INL CRMO supported DOE-ID in developing creative public-facing Memoranda of Agreement to resolve the deleterious effects, as indicated in Figure 9-2.

Precontact Context

As part of DOE-ID commitments to strengthen the historic preservation program at the INL Site and in adherence to the commitments outlined in the 2023 PA (DOE-ID 2023b), as well as the *Secretary of Interior's Standards and Guidelines for Archaeology and Historic Preservation* (Federal Register 1983), the INL CRMO, DOE-ID, and Shoshone-Bannock HeTO staff continued work on the Precontact Context (PCC) in 2024, which identifies the time span as roughly 13,000 years before the present to contact with Lewis and Clark in 1805. The original 8-million-acre study area was expanded to 15 million acres and realigned to a larger region in consideration of the possibility that other Tribes visited the Eastern Snake River Plain during those years. The final document will serve as a framework for: (1) the identification and characterization of Precontact archaeological resources/properties within the study area; (2) guidelines regarding the criteria used to evaluate the National Register of Historic Places significance for that area; and (3) comprehensive preservation planning at the INL Site.

Pre-World War II Historic Contexts at INL

As with the PCC, INL CRMO staff continued their work in 2024 on the pre-World War II (WWII) historic context that covers a 6-million-acre study area. The purpose of this context is to present the breadth and depth of historic activities at the INL Site during the 1852–1942 period in two separate context statements: (1) “*Historic Networks: Migration, Transportation, and Trade across the Eastern Snake River Plain, 1852-1942*,” and (2) “*Home on the Plain: Homesteading and Agricultural Settlement on the Eastern Snake River Plain, 1855-1942*.” These time periods were identified for their abilities to convey the rich history at and surrounding the INL Site. A review of the inventory of historic resources at INL allowed for the assignment of property types and guidelines in interpreting Euro-American settlement and development in the study area. Akin to the PCC, the scope of investigation expanded to include the development of a framework for the evaluation of Euro-American resources for eligibility in the National Register of Historic Places.

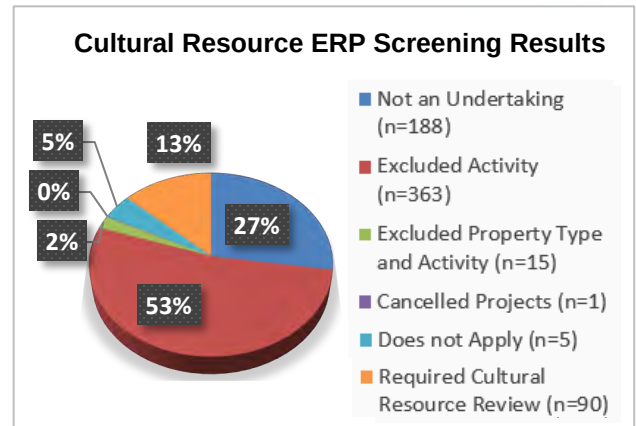


Figure 9-1. CRMO ERP screening and application of exclusions in 2024.

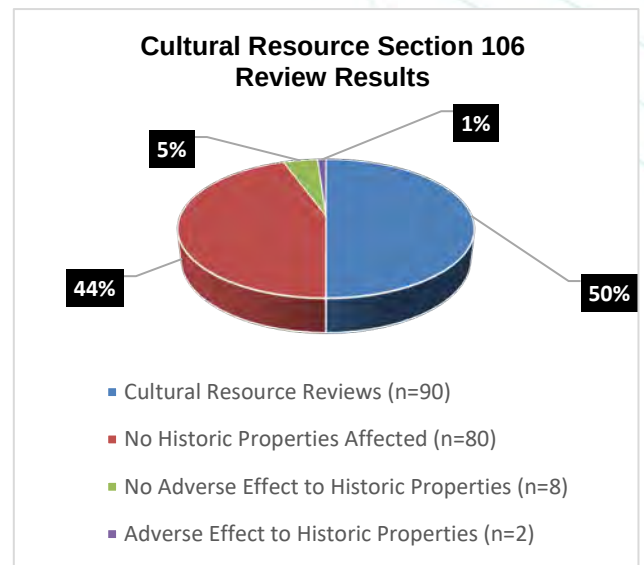


Figure 9-2. Section 106 Reviews conducted in 2024.



Other Active Research

During 2024, the INL CRMO continued work on four multiyear Section 110 research projects involving CRMO staff, offsite contractors, and a doctoral candidate student. Please see the “INL Site Cultural Resource Management Annual Report for Fiscal Year 2024” (DOE-ID 2024b), and visit the INL Cultural Resources website for more information ([Cultural Resources at INL](#)).

Built-Environment Comprehensive Inventory

In 2024, the INL CRMO continued its efforts to update the Built-Environment Inventory on the INL Site. A proposed inventory strategy for the Radioactive Waste Management Complex was prepared, and inventory updates for the Specific Manufacturing Capability and Test Area North were completed by INL CRMO Architectural Historians in accordance with the State Historic Preservation Office Guidelines and Procedures for Cultural Resource Review and Consultation in Idaho (Vihlene 2015). In total, 18 buildings, three structures, one linear resource, three objects, and three historic districts were recorded and evaluated. DOE-ID submitted these inventories to the State Historic Preservation Office on January 31, 2024, and the concurrence was received on April 10, 2024.

9.5.2 Cultural Resource Monitoring

Field work in 2024 also included a broad, annual program involving routine visits to monitor current conditions at select previously recorded archaeological resources across the INL Site. In 2024, INL CRMO Archaeologists, Shoshone-Bannock Tribes HeTO, and DOE-ID staff monitored conditions at 11 locations on the INL Site. No impact to historic properties were observed during these 2024 monitoring visits.

9.5.3 Stakeholder, Tribal, Public, and Professional Outreach

In support of the INL Historic preservation program in 2024, the CRMO successfully engaged roughly 15,700 individuals representing all ages from youth to senior citizens that were representative of stakeholders, Tribal members, the public, and professionals as part of continued public outreach. Activities included combining virtual opportunities to expand reach and accommodate schedules with in-person meetings and INL Site visits, as well as presentations and activities at the Museum of Idaho (MOI), surrounding schools, at EBR-I, and at special invitation to events, which included interviews with East Idaho News. Some highlights of these outreach efforts include presentations centering on “Architectural Ghosts” at MOI, “Wait, You Collect What?!? Obsolete Media” at the Registrars Committee Western Region, “Architectural Oddities of EBR-I” and “Ask an Architectural Historian” at EBR-I, and the “My Amazing Future” event at INL, as well as participation in school career fairs, visits to Idaho State University, the University of Nevada, Reno, and Washington State University as part of university engagement and a recruitment pipeline for interns and young professionals interested in the cultural resource management industry and potential future INL employment. In coordination with the Shoshone-Bannock HeTO, INL CRMO staff also presented virtual tours that provided a detailed history of the Precontact period on the Eastern Snake River Plain with Tribal perspectives interwoven with archaeological information in 2024.

The INL CRMO staff presented an additional virtual tour for the INL early historical period (1805–1905). These discussions covered early explorers and fur trappers, the Jeffrey-Goodale cutoff of the Oregon Trail, development of railroads, and settlement by early homesteaders. Additionally, INL CRMO staff provided two days of training at the MOI for the Wasden Archaeology Educator Camp and led two tours to the Wasden Site. Engaging face-to-face with visitors at EBR-I, and enhancing the educational exhibits at the [EBR-I Visitor's Center](#) and the Big Lost River Rest Area on U.S. Highway 20/26 within the boundaries of the INL Site, are vital public outreach tools. EBR-I has maintained the infrastructure necessary for self-guided tours through the free [TravelStories](#) app. INL CRMO staff also supported tours for the Environmental Safety, Health and Quality group and the [Idaho Cleanup Project Citizens Advisory Board](#), which included visits to several Precontact and Euro-American sites, as well as EBR-I.

On April 22, 2024, the Shoshone-Bannock Tribes hosted an [Earth Day celebration](#) for students from the Shoshone-Bannock Junior-Senior High School at the INL Site. The event began with a morning visit and ceremony at Middle Butte Cave, which was attended by over forty students, five Tribal elders, and several Tribal community members. At the cave, Shoshone-Bannock Tribal Elder Louie Martin and Fort Hall Business Council Secretary Ladd Edmo offered a prayer, followed by a speech from Council Chairman Lee Juan Tendoy on the significance of the INL Site lands to the Tribes.



After this visit to the INL Site, the group convened at the INL Energy Innovation Laboratory (EIL) for a ceremony featuring speeches from Juan Alvarez, the INL Deputy Laboratory Director for Management and Operations and Chief Operating Officer; Lance Lacroix, the DOE-ID Manager; and Mark Brown (DOE ICP Manager; in addition to Chairman Tendoy. The ceremony included a traditional song and concluded with a Friendship or Round Dance.

On May 15, 2024, INL CRMO staff and representatives from the INL Communications organization supported DOE-ID in hosting a tour of sites of Tribal and cultural significance. Attendees included Shoshone-Bannock Tribal elders, the Language and Culture Department, and the HeTO, as well as researchers from the University of Utah American West Center, who are collaborating on a DOE-ID Ethnohistory study with the Tribes.

On November 20, 2024, DOE-ID and the Fort Hall Business council signed a Memorandum of Agreement (MOA) that provides access to sacred sites and traditional use areas on the INL Site. The MOA is designed to last in perpetuity, unless terminated by mutual agreement. The INL CRMO is committed to supporting DOE-ID in facilitating the MOA.

80th Anniversary Commemoration of B24-J Liberator Heavy Bomber Crash

Instrumental to American victory during WWII, the U.S. Navy operated the Arco Naval Proving Ground, which was the only proving ground of its kind west of the Mississippi River for testing, research, and experiments involving the safe storage and transportation of live ordnance. The U.S. Navy shared this land with the Pocatello Army Air Base, which used it for training heavy bomber and fighter jet pilots, specifically B-17 and B-24 bombers and P-39 and P-47 fighters at the Arco High-Altitude Bombing Range (overlapping the INL) and the Twin Buttes Bombing Range.

On January 8, 1944, shortly after 9:05 p.m., a B-24J Liberator (42-73365) performing a nighttime bombing run at an elevation of 20,000 feet began a rapid descent, crashed into the desert, and erupted into a fiery inferno. All seven of the U.S. Army Air Forces crew members on the B-24J Liberator lost their lives: 2nd Lt. Richard Hedges (age 25), 2nd Lt. Lonnie Keepers (age 23), 2nd Lt. Robert Madsen (age 28), 2nd Lt. Richard Pitzner (age 23), Sgt. Louis H. Rinke (age 19), Sgt. Charles Eddy (age 22), and Sgt. George Pearce, Jr. (age 25).

On June 29, 2024, the INL CRMO staff organized a commemoration event in recognition of the crew members who lost their lives in this accident 80 years ago. The event was hosted by the INL Fire Department and included opening and closing remarks, as well as featuring a series of speakers, including Lance Lacroix, the DOE-ID Manager; two INL CRMO Archaeologists who investigated the crash site and provided ongoing preservation monitoring activities; and Marc McDonald of Project Remembrance, who was responsible for the relocation of the crash site in 2016 and provided additional details regarding that effort. The guest of honor was Dr. Roberta Armstrong, who is the daughter of 2nd Lt. Robert Madsen. The U.S. Air Force Auxiliary Civil Air Patrol Color Guard from the Eagle Rock Composite Squadron, Rocky Mountain Region, Unit 97, provided the presentation and retirement of the colors. The Veterans of Foreign Wars Post 2146 and the Idaho Falls Memorial Team honored the fallen airmen with a Three Volley Salute and the playing of Taps.

The event was attended by local media, BEA, and DOE-ID, resulting in significant public outreach and internal INL Laboratory media coverage. This included a statewide newspaper insert titled INL's 75 Years of Energy Innovation: Celebrating INL's Past, Present and Future, "WWII Bomber Crash Crew to be Honored on 80th Anniversary," an INL article by Paul Menser entitled, "Daughter of World War II Airman Killed in Training Accident Visits Idaho Crash Site" (Menser 2024); and an East Idaho News article and interview by Andrea Olson entitled, "What If? Woman Who Lost Father in WWII Bomber Crash at INL Reflects on His Life" (Olson 2024).

9.5.4 INL Archives and Special Collections

Following the Bomber Crash Commemoration Event, Archives Staff began digitizing Dr. Roberta Armstrong's family history. A virtual three-dimensional (3D) scanner was purchased, which enabled the capture of varied textures and relief of items that could not be captured with a flatbed scanner. In addition, the INL Archives and Special Collections group was featured in an article published in the East Idaho News entitled, "INL's Cultural Resources Management Office Provides A Historic Look At Nuclear-Related Artifacts. Here Is A Look Inside" (Nelson 2024).

INL Archives Staff completed 37 accessions, including approximately 700 archival photographs, 105 INL programs-specific booklets, articles, logbooks, reports, manuals, a map, 115 architectural and engineering drawings, 15 awards, 60 analog and digital media, and 30 archival objects. Metadata for the architectural and engineering drawings was



completed as well. A total of 349 scans were conducted in support of the INL Site Record Center transfer/destruction process, while repairs were made to 60 damaged architectural drawings.

In addition, the INL Archives and Special Collections Oral History program completed two interviews in 2024:

- Leslie Guy Backstrom of the DOE Radiological and Environmental Sciences Laboratory was interviewed on January 9, 2024. Mr. Backstrom was selected as an oral history candidate due to his long history at INL as a DOE employee (intern to management), his extensive involvement in Radiological and Environmental Sciences Laboratory's programs, and his knowledge relating to the creation, use, and history of the first Alpha Spectrometer, which will be accessioned to the INL Archives and Special Collections.
- Robert Boston, the current DOE-ID Manager, was interviewed on February 2, 2024. Mr. Boston was chosen due to his extensive and varied career at DOE-ID and INL from the Naval Reactors Facility Nuclear Sub Program to DOE-ID upper management, as well as his perspective as a leader for DOE at INL.

A list of potential oral history candidates is continuously updated, and two additional oral histories are planned for 2025.

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Imperfect buckwheat.

Chapter 10: Quality Assurance of Environmental Surveillance Monitoring Programs



CHAPTER 10

Quality assurance (QA) consists of planned and systematic activities that give confidence in the results of environmental surveillance monitoring programs (NCRP 2012). The environmental surveillance monitoring programs conducted at the Idaho National Laboratory (INL) Site in 2024 include air (e.g., air filters, quarterly composites), atmospheric moisture, precipitation, drinking water, surface water, effluents, groundwater, agricultural products (e.g., milk, alfalfa, lettuce, potato, wheat), big game, soil, bats, and direct radiation. These environmental surveillance monitoring programs should provide data of known quality for assessments and decision-making efforts. QA and quality control (QC) programs were maintained by INL Site contractors and laboratories performing environmental analyses.

GEL Laboratories, LLC (GEL), was rigorously assessed and audited in 2024 by the U.S. Department of Energy Consolidated Audit Program-Accreditation Program (DOECAP-AP). No major audit findings were identified by DOECAP-AP third-party accreditation bodies that would influence the defensibility or quality of laboratory data in 2024. Analytical laboratories who seek and maintain accreditation from DOECAP-AP must acquire and analyze proficiency testing (PT) samples from an accredited PT provider. In 2024, GEL acquired and analyzed samples from PT programs sponsored by the Environmental Resource Associates and Eckert & Ziegler Analytics, Inc. Overall, these programs showed acceptable results.

The environmental surveillance monitoring programs sent performance evaluation (PE) samples representing a variety of media in demonstrating that a laboratory can successfully analyze samples within the performance criteria during 2024. The INL Site contractors had a total of 299 analytes from various PE samples that were evaluated with 89% receiving an agreement evaluation. The nonagreements were reviewed and any unusual conditions were addressed, identified, and, when necessary, corrective actions were prepared to improve processes. The results of these nonagreements are summarized in Subsection 10.4.

The multifaceted approach to QA and QC used by the INL Site contractors provide confidence that all laboratory data reported for 2024 are reliable and of acceptable quality.

10. QUALITY ASSURANCE OF ENVIRONMENTAL SURVEILLANCE MONITORING PROGRAMS

This chapter describes the specific measures that have been taken to ensure adequate data quality, as well as the summarization of performance by the INL Site contractors in 2024.

10.1 Quality Assurance Policy and Requirements

INL Site contractors incorporate appropriate QA requirements and elements from 10 CFR 830, Subpart A, and DOE Order 414.1D, Change 2, to ensure any environmental samples are representative and complete and that the data are reliable and defensible. Additional QA program requirements in 40 CFR 61, Appendix B, Method 114, must be met for all new point sources of radiological air emissions, as required by 40 CFR 61, Subpart H.

10.2 Program Elements and Supporting Quality Assurance Process

According to the National Council on Radiation Protection and Measurements (NCRP 2012), QA is an integral part of every aspect of an environmental surveillance monitoring program from the reliability of sample collection through sample transport, storage, processing, and measurement to calculating the results and formulating the report. Uncertainties in the environmental surveillance monitoring process can lead to the misinterpretation of data and errors in decisions based on the data.



Every step in radiological environmental surveillance monitoring should be evaluated for integrity, and actions should be taken to evaluate and manage data uncertainty.

Meeting the requirements of state regulations, United States (U.S.) Environmental Protection Agency (EPA) directives, and DOE mandates are an important part of developing an environmental sampling program. Gathering quantitative and qualitative environmental data is unique to each surveillance monitoring program. All data from planning, sample collection and handling, sample analysis, data review and evaluation, and reporting is complete, precise, and representative to ensure defensibility. Approved, detailed procedures are maintained, adequate training is given, and documents are controlled by the INL Site contractors and analytical laboratories to ensure that data are of acceptable precision and accuracy.

The main elements of the environmental surveillance monitoring programs implemented at the INL Site, as well as the QA processes/activities that support them, are discussed in this chapter.

10.2.1 Planning

Environmental surveillance monitoring activities are conducted by the following:

- INL contractor
- Idaho Cleanup Project (ICP) contractor
- U.S. Geological Survey (USGS).

Each INL Site contractor determines the requirements for sampling using the EPA Data Quality Objective (DQO) process (EPA 2006) or its equivalent. During the DQO process, the project manager determines the type, amount, and quality of data needed to meet DOE O 458.1, “Radiation Protection of the Public and the Environment,” state and federal regulatory requirements, support decision-making, and address stakeholder concerns. These plans include:

Sitewide Monitoring Plans. The “Idaho National Laboratory Site Environmental Monitoring Plan” (DOE-ID 2021b), “Technical Basis for Environmental Monitoring and Surveillance at the Idaho National Laboratory Site” (DOE-ID 2023), and “Idaho National Laboratory Groundwater Monitoring and Contingency Plan Update” (DOE-ID 2021a) summarize the various monitoring programs at the INL Site, including surveillance monitoring for air, water (e.g., surface, drinking, ground), soil, biota, agricultural products, external radiation, ecological, and meteorological monitoring on and near the INL Site, as well as surveillance/compliance monitoring programs for effluent on the INL Site. These plans include the rationale for monitoring, the types of surveillance media, where the sampling is conducted, and information regarding access to the analytical results.

QA Project Plan. Implementation of QA elements for sample collection and data assessment activities are documented by each INL Site contractor using the recommended EPA approach. The EPA policy on QA plans is based on the national consensus standard ANSI/ASQC E4-1994, “Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs.” DQOs are project-dependent and determined based on the needs of data users and the purpose for which the data are generated. DQOs, sampling and analysis plans, and the “Technical Basis for Environmental Monitoring and Surveillance at the INL Site” (DOE-ID 2023) are integrated into the QA project plans of the INL Site contractors. Quality elements applicable to environmental surveillance and decision-making efforts are specifically addressed in the “EPA Requirements for Quality Assurance Project Plans” (EPA 2001).

QA project plans are developed for environmental surveillance monitoring media by each INL Site contractor to ensure that the collected data meets the requirements of all applicable federal and state regulations and DOE orders.

What is the difference between Quality Assurance and Quality Control in an environmental program?

- Quality assurance (QA) is an integrated system of management activities designed to ensure quality in the processes used to produce environmental data. The goal of QA is to improve processes so that the results are within acceptable ranges.
- Quality control (QC) is a set of activities that provide program oversight (i.e., a means to review and control the performance of various aspects of the QA program). QC provides assurance that the delivered results are what is expected.



10.2.2 Sample Collection and Handling

Defensible laboratory data is a critical component of any environmental program. Field sample collection and handling coupled with a chain-of-custody that shows unique sample identification, weight, sample preservation, volume, holding time, approved procedures, and request of laboratory analysis are important steps of defensible data.

Strict adherence to program procedures is an implicit foundation of QA. In 2024, samples were collected and handled by trained personnel according to documented program procedures. Sample integrity was maintained through a system of sample custody records. Work execution assessments were routinely conducted by personnel independent of the work activity. Deficiencies were addressed by follow-up and corrective actions. Quality assessments are tracked in contractor-maintained systems.

QC sampling elements are used by INL Site contractors to validate the collection process and verify the quality of laboratory preparation and analysis. These elements include the collection of trip blanks, field blanks, equipment blanks, split samples, sample duplicates, and PE samples. [Click here to see definitions for these elements/terms.](#)

10.2.3 Sample Analysis

Table 10-1 provides the list of analytical laboratories that were used by the INL Site contractors in 2024 to analyze their collected environmental surveillance samples.

Table 10-1. Analytical laboratories used to analyze surveillance media (2024).

ANALYTICAL LABORATORY	MEDIA					
	AIR	WATER	AGRICULTURAL PRODUCTS	BIOTA	SOIL	ENVIRONMENTAL OSLDs
GEL Laboratories, LLC	X ^a	X ^b	X	X	— ^c	—
Landauer	—	—	—	—	—	X
Radiological and Environmental Sciences Laboratory (RESL)	—	X	—	—	—	—

a. Includes atmospheric moisture.

b. Includes precipitation.

c. Not sampled in 2024.

Laboratories used for routine analyses of radionuclides in environmental media were selected based on a laboratory's capabilities to meet program objectives, such as the ability to meet the required detection levels, and past results in PT programs. The DOECAP-AP, which consists of third-party accreditation bodies, issues an annual accreditation certificate to laboratories seeking and maintaining accreditation. The rigorous accreditation process reviews each method, media, and analyte analyzed at the laboratory. An annual audit is performed to evaluate a laboratory's technical capability and competence, along with their proficiency in complying with DOE QA requirements as outlined in the Quality Systems Manual (QSM 2021). For more information on DOECAP-AP, visit the DOE Analytical Services Program webpage.

No major audit findings were identified by DOECAP-AP third-party accreditation bodies for GEL that would influence the defensibility or quality of laboratory data in 2024. GEL maintained accreditation for 2024.

GEL participates in accredited PT programs as outlined in the Quality Systems Manual (QSM 2021). The laboratory is responsible for reviewing their PT results and correcting potential quality concerns identified by the PT provider. DOECAP annual accreditation is maintained by achieving two successful studies (e.g., acceptable scores) out of their most recent three attempts. Results for the PT programs are provided in Section 10.3.

Laboratory data quality is continually verified by QC samples, and includes calibration verifications, blanks, replicates/duplicates, and intra-laboratory and PT samples.

An analytical laboratory may use several of the laboratory QC measurement elements. Results of the laboratory QC are presented to the INL Site contractors as a data package and provide assurance that the reported data are usable and defensible.



10.2.4 QC Data Review and Evaluation

Data generated by INL Site contractors are routinely evaluated to understand and sustain the quality of the data. This enables programs to determine whether the DQOs established in the planning phase were achieved and whether the laboratory is performing within its QA/QC requirements.

Environmental data may be subject to verification, validation, and quality assessment.

The Environmental Data Warehouse is the official warehouse for the long-term management and storage of environmental data collected in support of the INL Site contractors. Data stored in the Environmental Data Warehouse is used to support compliance reporting, decision-making efforts, trending, and modeling. Appropriate testing is completed in the event that any significant changes are made to the Environmental Data Warehouse database, or the server operating system on which the data system reside, in accordance with the “Software Configuration Management Plan for INL Site Environmental Data Systems” (ICP 2023).

The INL Site contractors send media-specific PE samples to the analytical laboratories for testing their ability to successfully analyze the samples within the performance criteria. These media-specific samples are compared with the PT results and can provide valuable indicators that further QC testing may be required.

Figure 10-1 shows the decision tree for the environmental surveillance field sampling data PE review process. When the PE sample results are in agreement for the INL Site contractors, a review of the remaining data continues. If no issues are identified, the data package is approved. If the PE result is identified as a nonagreement, the INL Site contractor reviews all the available PE and PT data.

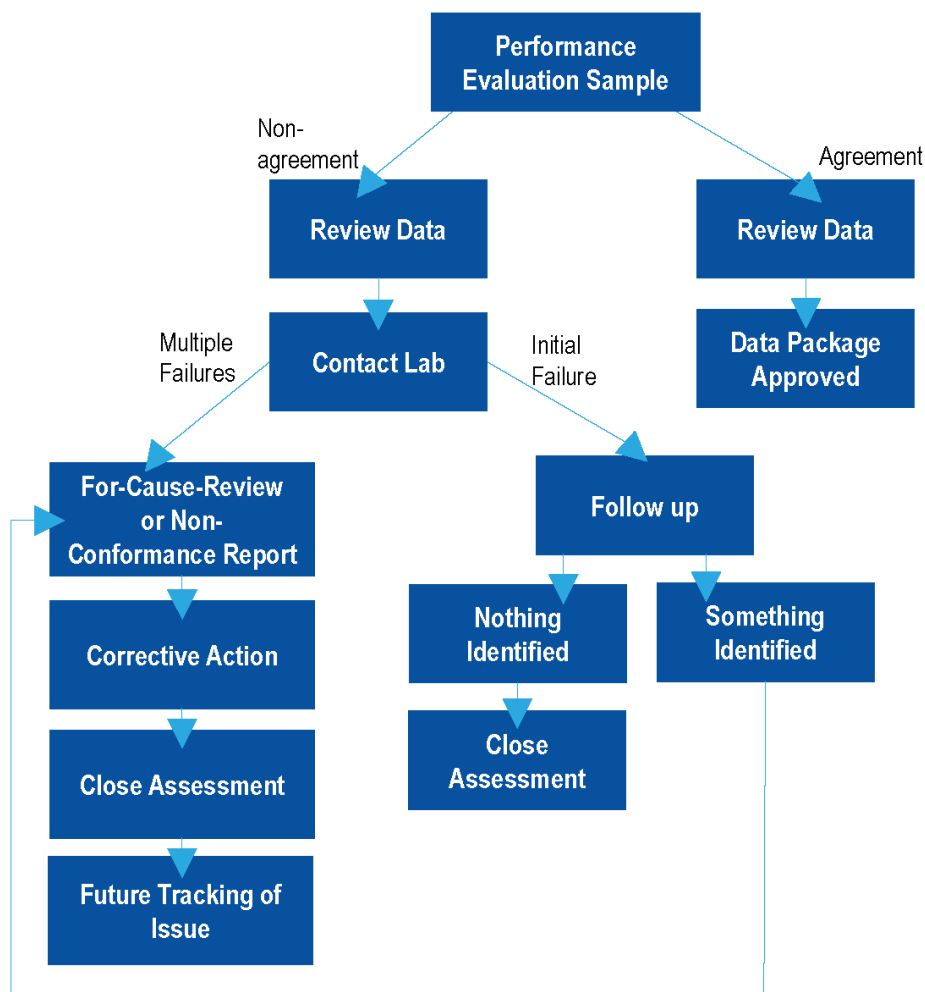


Figure 10-1. Environmental surveillance field sampling data PE review process.



A variety of items that may be considered for review include, but are not limited to, the following questions:

- Did the PE sample provider prepare the single-blind or double-blind sample within the range specified by their customer? If yes, begin looking into the other PE and PT results. If not, the PE sample may not be an accurate representation of the project-specific field conditions or field results. If the equipment is calibrated for the field concentration range, and the PE sample is not within that range, then the accuracy and representativeness of the PE sample may be called into question.
- Did the laboratory perform all required program- and method-specific QC analyses using laboratory measurement elements? Are these QC results within the acceptable parameters?
- What does a review of the long-term project results indicate? Are all project-specific and analytic-method-specific PE results within specification? If not, does the laboratory have a history of out-of-specification QC results for a specific analyte?

Upon reviewing the entire body of PE evidence and using both objective and subjective professional judgment, the INL Site contractor will determine if the nonagreement result is a one-time anomaly or if the laboratory needs to perform a review.

A "Follow-Up" review occurs after a single failure and may result in the analytical laboratory not identifying any issues leading to the nonagreement result. At this point, if the analytical laboratory passed all their qualifying criteria, the data package has good defensible data. If a laboratory qualifying criterion is not met, the analytical laboratory will prepare and analyze the samples a second time. However, if there is not enough of a sample available, the analytical laboratory may flag the data when the "QC is Not Within Criteria." When the "Follow-Up" review identifies issue(s), either a "For-Cause-Review" or a "Non-Conformance Report" may be requested.

A "For-Cause-Review" and/or "Non-Conformance Report" may be requested when multiple PE sample issues occur consecutively (e.g., a nonagreement evaluation for the same radionuclide in the same matrix) or as a result of a "Follow-Up" review. The analytical laboratory would perform an investigation (e.g., review/verify sample units, weights, calculations) during a "For-Cause-Review." Whereas a "Non-Conformance Report" would generate a rigorous analytical laboratory review (e.g., interview analysts, historical results). Both the "For-Cause-Review" and the "Non-Conformance Report" could result in a "Corrective Action" being issued, which may resolve the problem and prevent future issues from occurring. Upon acceptance of the "Corrective Action," the assessment would be closed, and the issues discussed would be monitored in future data packages.

If the analytical laboratory cannot identify issues following a "For-Cause-Review" and/or a "Non-Conformance Report" resulting from multiple PE nonagreement evaluations, the INL Site contractor will work with the laboratory to assist in the investigative process. For example, additional PE samples may be provided to the analytical laboratory to determine whether any problems arise from sample preparation, data calculations, data entry into a database, etc. As a result, the analytical laboratory will provide an acceptable "Corrective Action" to the INL Site contractor. The issue will be monitored for future PE samples. Depending on the severity, the contractor may hold onto the samples until the issue is resolved and may send a letter-of-concern to the analytical laboratory. Based on the outcome of the investigation, the INL Site contractor could terminate the contract and seek the services of another laboratory.

10.3 2024 Interlaboratory Program PT Evaluations

GEL maintained accreditation and had no major findings identified by DOECAP-AP in 2024. GEL also acquired and analyzed samples from PT programs sponsored by Environmental Resource Associates and Eckert & Ziegler Analytics, Inc. Overall, these programs showed acceptable results.

10.4 2024 INL Site Contractors QC Programs

Individual QC programs include the use of several QA and laboratory measurement elements, respectively, to evaluate the performance of a laboratory. Not all QC measurement elements are required unless specifically called out in each INL Site contractor program's contract with the laboratory, or as required by the specific analytical method.

Field QC samples are sent to laboratories along with routine environmental samples to be analyzed in tandem. The samples are prepared in a way that the QC samples are analogous to the field samples. The laboratory is not aware of which samples are blanks, duplicates, or PE samples. Blanks are submitted along with the regular samples to test for the



introduction of contamination during the process of field collection, laboratory preparation, and laboratory analysis. Duplicate/replicate samples are submitted with the regular samples to assess field collection, homogeneity, reproducibility, laboratory preparation, laboratory analysis, and precision.

A PE sample where the activity is known by the INL Site contractors, but not the analytical laboratory, is called a “single-blind” PE sample; whereas a PE sample where the activity is unknown to both the INL Site contractors and the analytical laboratory is referred to as a “double-blind” PE sample. PE samples are sent to the laboratory throughout the year. Evaluations of these samples are used to improve data accuracy by following the process identified previously in Figure 10-1.

In addition to the INL Site contractors' PE program, the Mixed Analyte Performance Evaluation Program (MAPEP) is an interlaboratory program that uses evaluations to test the ability of the laboratories to correctly analyze radiological, nonradiological, stable organic, and stable inorganic constituents' representative of those at DOE sites. MAPEP provides QA oversight for environmental analytical services by performing a semiannual evaluation of commercial laboratories. GEL participated in the MAPEP Series 50 and 51 during 2024. Laboratories publish MAPEP results in quarterly QA reports. These reports are reviewed by the INL Site contractors and compared with the internal PE results.

In the event a data quality or trending issue is identified, the concern will be documented in an Issues Management System (e.g., LabWay) to track resolutions and/or corrective actions.

10.4.1 INL Contractor QC Program

INL Contractor Blanks

A total of 192 analytes were analyzed by GEL in various media. The analyzed media included air filters, quarterly air filter composites, atmospheric moisture, precipitation, drinking water, and milk. No concerns were identified in blanks that would indicate data quality or trending issues with sampling, handling, shipment, or analysis by the laboratory contributed to the actual sample results in 2024.

INL Contractor Replicate/Duplicate

A total of 710 analytes were analyzed by GEL Laboratories. The analyzed media included air filters, quarterly air filter composites, milk, produce, surface water, effluent, and groundwater. No concerns were identified in duplicates/replicates that would indicate data quality or trending issues with sampling, handling, shipment, homogeneity, reproducibility, or preparation and analysis by the laboratory contributed to the actual sample results for 2024.

INL Contractor PE

In 2024, the INL contractor used GEL and Landauer laboratories to provide analytical results for air (e.g., air filters, quarterly composites), atmospheric moisture, precipitation, drinking water, surface water, effluents, groundwater, agricultural products (e.g., milk, alfalfa, lettuce, potato, wheat), big game, soil, bats, and direct radiation.

Of the PE samples analyzed in 2024 by GEL and Landauer, 153 (91%) PE analytes were in agreement with 15 (9%) PE analytes categorized as nonagreements.

How do these discrepancies between expected and actual PE sample results relate to field sample values? If a PE sample registers a result below the anticipated value, it indicates a low bias in the reference sample. This could imply that the true values for field samples from the same batch are understated in the laboratory's reports. On the other hand, if a PE sample records a result above the expected value, it points to a high bias. In this scenario, it is possible that the true values for field samples in the batch exceed the results reported by the laboratory.

When PE nonagreements indicate low or high biases, it is not standard practice to correct the laboratory field sample results. Such discrepancies typically do not influence decision-making efforts endeavors regarding that particular analyte in that media, and the data are not discarded due to nonagreement.

The INL contractor worked with GEL on the nonagreements in 2024 to identify processes, procedures, and methods that will lead to the improved accuracy of data.



10.4.2 ICP Contractor QC Program

ICP Contractor Blanks

A total of 266 analytes were analyzed by GEL in perched water and groundwater media. No concerns were identified in blanks that would indicate data quality or trending issues with sampling, handling, shipment, or analysis by the laboratory contributed to the actual sample results in 2024.

ICP Contractor Replicate/Duplicate

A total of 215 analytes were analyzed by GEL Laboratories in perched water and groundwater media. No concerns were identified in duplicate/replicates that would indicate data quality or trending issues with sampling, handling, shipment, homogeneity, reproducibility, or preparation and analysis by the laboratory contributed to the actual sample results for 2024. Six duplicate samples were flagged in validation and use was discouraged based on detectability criteria.

ICP Contractor PE

In 2024, the ICP contractor used GEL to provide analytical results for air filters, quarterly composite air filters, perched water, ground water, liquid effluent, and wastewater.

Of the 131 PE samples analyzed in 2024 by GEL, 112 (85%) PE analytes were in agreement with 19 (15%) PE analytes categorized as nonagreements. The ICP contractor is working with GEL to identify processes, procedures, and methods that will lead to improved accuracy of the data.

In cases of nonagreements, the ICP contractor requests the laboratory to investigate and provide possible reasons for the failures. The laboratory and ICP work together to help identify potential issues to prevent recurrence.

10.4.3 USGS QC Program

In 2024, the USGS used RESL to provide analytical results for groundwater monitoring wells. USGS submits field blanks along with environmental samples to test for the introduction of contamination during the process of field collection, laboratory preparation, and laboratory analysis ([Bartholomay and others, 2021](#)).

USGS Blanks

A total of 16 analytes were measured in three groundwater samples by RESL to evaluate blank data quality. No concerns were identified in the blanks that would indicate data quality or trending issues with the sampling, handling, shipment, or analysis by the laboratory contributed to the actual sample results in 2024.

USGS Replicate/Duplicate

A total of 20 analytes were measured in eight groundwater samples by RESL to evaluate reproducibility between environmental and sequentially collected replicates. No concerns were identified in duplicates/replicates that would indicate data quality or trending issues with sampling, handling, shipment, homogeneity, reproducibility, or preparation and analysis by the laboratory contributed to the actual sample results for 2024.

10.5 Conclusions

The quality elements presented in Figure 10-1 were implemented in 2024. The [field sampling elements](#), [laboratory measurements](#), and PE samples were reviewed and evaluated for each INL Site contractor and are summarized in Subsection 10.4. It has been determined that all laboratory data presented in this report are valid, reliable, and defensible.

10.6 References

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Appendix A: Chapter 5 Addendum



This appendix provides the data tables showing the groundwater monitoring results measured in 2024 at the INL Site and discussed in Chapter 5.

Table A-1. Advanced Test Reactor Complex cold waste pond effluent permit-required monitoring results (2024).^{a,b}

PARAMETER	MINIMUM	MAXIMUM	MEDIAN
pH (standard units)	6.30	7.87	7.57
Conductivity (µS/cm)	390	1,327	411
Chromium, filtered (mg/L)	0.00312J ^c	0.0136	0.00399
Chromium, total (mg/L)	0.00331J	0.0134	0.00394
Iron, filtered (mg/L)	0.03U ^d	0.050	0.03U
Iron, total (mg/L)	0.03U	0.0908	0.03U
Nitrate + nitrite as nitrogen (mg/L)	0.859	3.41	1.02
Solids, total dissolved (mg/L)	195	1,020	231
Sulfate (mg/L)	19.8	497	31.0

- a. Reuse Permit I-161-03 does not specify maximum effluent constituent loading or concentration limits.
- b. Duplicate samples collected in July 2024 are included in the statistical summary.
- c. The J flag qualifier indicates the associated value is an estimate and may be inaccurate or imprecise.
- d. The U qualifier indicates the result was below the detection limit.

Table A-2. Hydraulic loading rates for the Advanced Test Reactor Complex cold waste pond (2024).

	YEARLY TOTAL VOLUME
2024 flow ^a	187.59 MG ^b
Annual permit limit ^c	375 MG
5-yr moving annual average permit limit	300 MG

- a. Annual volume is reported for the 2024 permit reporting year.
- b. MG = million gallons.
- c. The reuse permit specifies an annual limit based on a 12-month reuse year from November 1 through October 31.

**Table A-3. Advanced Test Reactor Complex cold waste pond industrial wastewater reuse permit monitoring well results (2024).^a**

WELL NAME	USGS-098 (GW-161-01)		USGS-065 (GW-161-02)		USGS-076 (GW-161-04)		TRA-08 (GW-161-05)		MIDDLE-1823 (GW-161-06)		USGS-136 (GW-161-08)		USGS-058 ^b (GW-161-07)		PCS/SCS ^c
SAMPLE DATE:	04/22/24	09/23/24	04/24/24	09/25/24	04/25/24	09/26/24	04/23/24	09/24/24	04/23/24	09/24/24	04/24/24	09/25/24	04/22/24	09/23/24	
Water table depth (ft) bls ^d	431.19	432.19	477.37	477.71	486.18	487.23	492.05	493.05	495.93	496.95	491.54	492.53	474.21	475.20	NA ^e
Water table elevation (ft) ^f	4,458.02	4,457.02	4,451.20	4,450.86	4,447.03	4,445.98	4,447.01	4,446.01	4,446.94	4,445.92	4,447.19	4,446.20	4,447.68	4,446.69	NA
Borehole correction factor (ft) ^g	2.53	2.53	NA	NA	NA	NA	0.63	0.63	NA	NA	0.22	0.22	NA	NA	NA
pH (s.u.)	6.58	7.63	6.55	7.79	6.67	7.87	6.67	8.09	6.57	7.91	6.70	7.74	6.61	7.71	6.5 to 8.5 (SCS)
Conductivity (μS/cm)	421	428	576	587	416	421	414	419	415	418	410	420	416	420	NA
Temperature (°F)	53.4	56.3	55.8	56.8	55.9	56.8	55.6	56.8	55.9	57.7	57.6	58.6	54.9	57.0	NA
Nitrite + nitrate as nitrogen (mg/L)	1.29	1.61J ^h	1.46	1.38	1.04J	1.04J	1.02	1.00J	1.01	0.993J	1.26 (1.28) ⁱ	1.22	1.13	1.17J	10 (PCS)
Sulfate (mg/L)	23.3	22.7	134	131	32.6	32.5	43.5	39.8	31.6	30.0	28.6 (29.0)	28.8	31.8	30.8	250 (SCS)
Solids, total dissolved (mg/L)	229	239	367	374	217	237	249	253	270	226	231 (235)	234	229	230	500 (SCS)
Chromium, total (mg/L)	0.00625	0.00595J	0.0871	0.112J [0.0979J] ^j	0.0109	0.0134	0.0219J	0.0189J	0.0107J	0.0106	0.0116 (0.0119)	0.0153J	0.00971	0.00988J	0.1 (PCS)
Chromium, filtered (mg/L)	0.00607	0.00579J	0.0859	0.107J [0.0974J]	0.0109	0.013	0.0195J	0.0187J	0.0109J	0.0101J	0.0119 (0.0114)	0.0161J	0.00957	0.00994J	0.1 (PCS)
Iron, filtered (mg/L)	0.03U ^k	0.03U	0.03U	0.03U [0.03U]	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U (0.03U)	0.03U	0.03U	0.03U	0.3 (SCS)

a. Reuse Permit I-161-03 was issued October 30, 2019.

b. Reuse Permit I-161-03 only requires water table elevation, water table depth, pH, conductivity, temperature, total dissolved solids, and sulfate levels reported for Well USGS-058. Nitrite + nitrate as nitrogen, total chromium, filtered chromium, and filtered iron were monitored in Well USGS-058 to support observational monitoring and provide consistent evaluation of all analytes sampled from all wells specified in the reuse permit.

c. The primary constituent standards (PCS) and secondary constituent standards (SCS) in groundwater as referenced in the Idaho Ground Water Quality Rule, IDAPA 58.01.11.200.01.a and b.

d. bls = below land surface.

e. NA = not applicable.

f. Water table elevation above mean sea level (ft). Elevation data provided using the North American Vertical Datum of 1988 (NAVD 88).

g. The borehole correction factors determined from U.S. Geological Survey (USGS) gyroscopic surveys to reconcile discrepancies in water level measurements from well deviations.

h. The J flag qualifier indicates the associated value is an estimate and may be inaccurate or imprecise.

i. Results shown in parenthesis are from the field duplicate samples.

j. Results shown in brackets are re-analyzed results.

k. The U flag qualifier indicates the analyte was not detected above the instrument detection limit or the analyte was detected at or above the applicable detection limit but the value is not more than five times the highest positive amount in any laboratory blank and is given a U qualifier as a result of data validation.



Table A-4. Idaho Nuclear Technology and Engineering Center sewage treatment plant influent monitoring results at CPP-769 (2024).

PARAMETER	MINIMUM	MAXIMUM	MEAN
Biochemical oxygen demand (5-day) (mg/L)	54.4 J ^a	801 J ^a	271
Nitrate + nitrite, as nitrogen (mg/L)	0.017 U ^b	0.306	0.187
Total kjeldahl nitrogen (mg/L)	24.6	252 ^a	105.6
Total phosphorus (mg/L)	2.70	17.0	8.04
Total suspended solids (mg/L)	28.7	520	165.5

a. The J flag qualifier indicates what the material was analyzed for and that it was detected at or above the detection limit. The associated value is an estimate and may be inaccurate or imprecise.

b. The U flag qualifier indicates what the analyte was analyzed for but that it was not detected above the method detection limit.

Table A-5. Idaho Nuclear Technology and Engineering Center sewage treatment plant effluent monitoring results at CPP-773 (2024).

PARAMETER	MINIMUM	MAXIMUM	MEAN
Biochemical oxygen demand (5-day) (mg/L)	7.44	62.5	24
Nitrate + nitrite, as nitrogen (mg/L)	ND (0.0170) ^a	4.18	1.59
pH (standard units) ^b	6.27	9.27	8.23
Total coliform (MPN ^c /100 mL) ^b	61	24,192	5,508.6
Total kjeldahl nitrogen (mg/L)	6.32	88.4 J ^d	28
Total phosphorus (mg/L)	3.43	8.8	5.98
Total suspended solids (mg/L)	4 UJ ^e	118	42

a. ND = The parameter was not detected in the sample. The value in parentheses is the detection limit.

b. As required by the permit, the results for this parameter were obtained from a grab sample.

c. MPN = most probable number.

d. The J flag qualifier indicates what the material was analyzed for and that it was detected at or above the applicable detection limit. The associated value is an estimate and may be inaccurate or imprecise.

e. The UJ flag qualifier indicates what the material was analyzed for but that it was not detected. The associated value is an estimate and may be inaccurate or imprecise.



Table A-6. Idaho Nuclear Technology and Engineering Center percolation ponds effluent monitoring results at CPP-797 (2024).

PARAMETER	MINIMUM	MAXIMUM	MEAN
Chloride (mg/L)	9.75	168	37.5
Chromium (mg/L)	0.00543 U ^a	0.00663	0.00615
Coliform, fecal (MPN/100 mL) ^b	1	4	2
Coliform, total (MPN/100 mL) ^b	5.2	1,732.9	366.8
Fluoride (mg/L)	0.192	0.320	0.262
Manganese, total (mg/L)	ND (<0.002) ^c	ND (<0.002)	ND (<0.002)
Nitrate + nitrite, as nitrogen (mg/L)	0.755	3.56	1.55
pH (standard units) ^b	7.69	9.39	8.40
Selenium (mg/L)	ND (<0.002)	ND (<0.002)	ND (<0.002)
Total dissolved solids (mg/L)	210	610 J ^d	270
Total phosphorus (mg/L)	0.432	1.52	0.857

- a. The U flag qualifier indicates what the material was analyzed for and that it was detected at or above the applicable detection limit. However, the associated value was less than five times the highest positive amount in any laboratory blank.
- b. As required by the permit, the results for this parameter were obtained from a grab sample.
- c. ND = The parameter was not detected in the sample. The value in parentheses is the detection limit.
- d. The J flag qualifier indicates what the material was analyzed for and that it was detected at or above the applicable detection limit. The associated value is an estimate and may be inaccurate or imprecise.

Table A-7. Hydraulic loading rates for the Idaho Nuclear Technology and Engineering Center percolation ponds (2024).

	MAXIMUM DAILY FLOW	YEARLY TOTAL FLOW
2024 flow	1,421,240 gallons	187,236,350 gallons
Permit limit	3,000,000 gallons	1,095 MG ^a

a. MG = million gallons.



Table A-8. Idaho Nuclear Technology and Engineering Center percolation ponds aquifer monitoring well groundwater results (2024).

PARAMETER	ICPP-MON-A-165 (GW-130-06)		ICPP-MON-A-166 (GW-130-07)		ICPP-MON-A-164B (GW-130-11)		STANDARD PCS/SCS ^a
SAMPLE DATE:	04/23/2024	09/24/2024	05/30/2024	09/24/2024	04/22/2024	09/23/2024	
Water table depth (ft below brass cap)	509.79	510.75	515.79	513.45	508.45	509.42	NA ^b
Water table elevation (at brass cap in ft) ^c	4,446.48	4,445.52	4,445.86	4,448.39	4,446.69	4,445.72	NA
Chloride (mg/L)	30.1J ^d	29.9	18.1	20.3	11.0 J	10.3	250
Chromium (mg/L)	0.0145	0.0173	0.0047	0.0058	0.012	0.012	0.1
Coliform, fecal (MPN ^e /100 mL)	<1	<1	<1	<1	<1	<1	<1 CFU ^f /100 mL
Coliform, total (MPN/100 mL)	<1	<1	<1	<1	<1	<1	1 CFU/100 mL ^g
Dissolved oxygen (mg/L)	6.83	7.59	4.23	5.07	6.07	5.49	NA
Electrical conductivity (µmhos/cm)	447	446	344	341	422	409	NA
Fluoride (mg/L)	0.218 J ^h	0.251	0.236	0.320	0.201 J ^h	0.225	4
Manganese, dissolved (mg/L) ⁱ	NR ^j	NR ^j	NR ^j	NR ^j	NR ^j	NR ^j	0.05
Manganese, total (mg/L)	0.0019 J ^k	0.0019 J ^k	0.0088	0.0164	ND (<0.001) ^l	ND (<0.001) ^l	0.05
Nitrate/nitrite, as nitrogen (mg/L)	1.15	1.15	0.383	0.390	1.03	0.99	10
pH (standard units)	7.73	7.66	7.60	7.43	7.83	7.67	6.5–8.5
Selenium (mg/L)	ND (<0.0015) ^l	ND (<0.0015) ^l	ND (<0.0015) ^l	ND (<0.0015) ^l	ND (<0.0015) ^l	ND (<0.0015) ^l	0.05
Temperature (°F)	55.59	54.55	54.19	58.29	52.03	54.05	NA
Total dissolved solids (mg/L)	234	274	187	211	215	222	500
Total phosphorus (mg/L)	ND (<0.0500) ^l	ND (<0.0500) ^l	ND (<0.0500) ^l	0.0540 U	ND (<0.0500) ^l	0.0580 U ^m	NA

a. The PCS and SCS in groundwater as referenced in the Idaho Ground Water Quality Rule, IDAPA 58.01.11.200.01.a and b.

b. NA = not applicable.

c. Water table elevation above mean sea level. Elevation data provided using the North American Vertical Datum of 1988 (NAVD 88).

d. The J flag indicates the parameter was positively identified, but the reported value is an estimate. The result may be biased high.

e. MPN = most probable number.

f. CFU = colony forming unit.

g. An exceedance of the PCS for total coliform is not a violation. If the PCS for total coliform is exceeded, analysis for fecal coliform is conducted. An exceedance of the PCS for fecal coliform is a violation.

h. The J flag indicates the result is an estimated quantity, but the result may be biased low.

i. The results of the dissolved concentrations of this parameter are used for SCS compliance determinations.

j. NR = Not required since the analytical result for total manganese did not exceed the standard in the Idaho Ground Water Quality Rule, IDAPA 58.01.11.200.01.b for manganese standard of 0.05 mg/L.

k. The J flag qualifier indicates what the material was analyzed for and that it was detected at or above the applicable detection limit. The associated value is an estimate and may be inaccurate or imprecise.

l. ND = The parameter was not detected in the sample. The value in parentheses is the detection limit.

m. The U flag qualifier indicates what the material was analyzed for and that it was detected at or above the applicable detection limit. However, the associated value was less than five times the highest positive amount in any laboratory blank.



Table A-9. Idaho Nuclear Technology and Engineering Center percolation ponds perched water monitoring well groundwater results (2024).

PARAMETER	ICPP-MON-V-191 (GW-130-08)		ICPP-MON-V-200 (GW-130-09)		ICPP-MON-V-212 (GW-130-10)		STANDARD PCS/SCS ^a	
	SAMPLE DATE:	04/22/2024	09/23/2024	04/22/2024	09/23/2024	04/22/2024		09/23/2024
Depth to water (ft below brass cap)		Dry ^b	Dry ^b	120.04	119.49	239.29	238.28	NA ^c
Water table elevation (at brass cap in ft) ^d		NA	NA	4,835.56	4,836.11	4,722.11	4,723.12	NA
Chloride (mg/L)		NA	NA	50.2 J ^e	33.6	72.2 J ^e	52.2	250
Chromium (mg/L)		NA	NA	0.0063	0.0074	0.0204	0.0134	0.1
Coliform, fecal (MPN ^f /100 mL)		NA	NA	<1	<1	<1	<1	<1 MPN/100 mL
Coliform, total (MPN/100 mL)		NA	NA	<1	<1	1	<1	1 MPN/100 mL ^g
Dissolved oxygen (mg/L)		NA	NA	4.81	4.35	5.76	3.76	NA
Electrical conductivity (µmhos/cm)		NA	NA	523	453	590	568	NA
Fluoride (mg/L)		NA	NA	0.226 J ^h	0.276	0.238 J ^h	0.243	4
Manganese, dissolved (mg/L) ⁱ		NA	NA	NR ^j	NR	NR	NR	0.05
Manganese, total (mg/L)		NA	NA	0.0018 J ^j	0.00347 J ^j	0.0041 J ^j	0.0056	0.05
Nitrate/nitrite, as nitrogen (mg/L)		NA	NA	3.36	1.18	1.86	1.97	10
pH (standard units)		NA	NA	7.54	7.55	7.83	9.66	6.5–8.5
Selenium (mg/L)		NA	NA	ND (<0.0015) ^k	ND (<0.0015) ^k	ND (<0.0015) ^k	ND (<0.0015) ^k	0.05
Temperature (°F)		NA	NA	60.02	59.55	60.99	63.44	NA
Total dissolved solids (mg/L)		NA	NA	286	234	340	299	500
Total phosphorus (mg/L)		NA	NA	0.328	0.461	ND (<0.0500) ^k	ND (<0.0500) ^k	NA

a. The PCS and SCS in groundwater as referenced in the Idaho Ground Water Quality Rule, IDAPA 58.01.11.200.01.a and b.

b. Well ICPP-MON-V-191 was dry in April and September 2024.

c. NA = not applicable.

d. Water table elevation above mean sea level. Elevation data provided using the North American Vertical Datum of 1988 (NAVD 88).

e. The J flag indicates the result is an estimated quantity, but the reported value is an estimate. The result may be biased high.

f. An exceedance of the PCS for total coliform is not a violation. If the PCS for total coliform is exceeded, analysis for fecal coliform is conducted. An exceedance of the PCS for fecal coliform is a violation.

g. The results of the dissolved concentrations of this parameter are used for SCS compliance determinations.

h. NR = Not required since the analytical result for total manganese did not exceed the standard in the Idaho Ground Water Quality Rule, IDAPA 58.01.11.200.01.b for manganese of 0.05 mg/L.

i. The J flag indicates what the parameter was analyzed for and that it was detected at or above the applicable detection limit. However, the associated value is an estimate and may be inaccurate or imprecise.

j. ND = The parameter was not detected in the sample. The value in parentheses is the detection limit.

k. MPN = most probable number.



Table A-10. Materials and Fuels Complex industrial waste pond effluent monitoring results for the reuse permit (2024).^{a,b,c}

PARAMETER	MINIMUM	MAXIMUM	MEDIAN
pH (standard units)	6.49	8.61	6.88
Conductivity ^d (μS/cm)	403	576	467
Chloride ^d (mg/L)	18.9	34.5	24.6
Nitrate + nitrite as nitrogen (mg/L)	2.93	3.72	3.21
Iron (mg/L)	0.03U ^e	0.110	0.0356
Iron, filtered (mg/L)	0.03U	0.041	0.03U
Manganese (mg/L)	0.002U	0.00581	0.002U
Manganese, filtered (mg/L)	0.002U	0.00538	0.002U
Sodium ^d (mg/L)	18.1	28.9	24.9
Sodium ^d , filtered (mg/L)	19.2	31.6	24.9
Solids, total dissolved (mg/L)	215	328	276

- a. Liquid effluent results for permit-required constituents collected at the sampling station located on the Industrial Wastewater Collection System (IWCS) pipeline, prior to discharge into the pond.
- b. Duplicate samples collected in July 2024. The duplicate results are included in the data summary.
- c. Reuse permit I-160-02 does not specify maximum effluent constituent loading or concentration limits.
- d. Conductivity, chloride, and sodium are not required effluent monitoring parameters in the reuse permit.
- e. U qualifier indicates the result was below the detection limit.

Table A-11. Materials and Fuels Complex effluent hydraulic loading to the industrial waste pond (2024).

YEARLY TOTAL FLOW	
2024 flow ^a	7.753 MG ^b
Annual permit limit ^c	17 MG

- a. The annual effluent flow is reported for the 2024 permit reporting year. The annual flow is an estimate due to adjustments during instances when the flow rate exceeded the maximum measurable-flow rate of the flow meter.
- b. MG = million gallons.
- c. The reuse permit specifies an annual limit based on a 12-month reuse year from November 1 through October 31.



Table A-12. Materials and Fuels Complex industrial waste pond summary of groundwater quality data collected for the reuse permit (2024).

WELL NAME	ANL-MON-A-012 (GW-16001)		ANL-MON-A-013 (GW-16002)		ANL-MON-A-014 (GW-16003)		PCS/SCS ^a
SAMPLE DATE:	04/16/24	09/17/24	04/17/24	09/18/24	04/17/24	09/18/24	
Water table depth (ft bls) ^b	661.13	663.76	649.58	652.05	648.78	651.27	NA ^c
Water table elevation (ft above mean sea level) ^d	4,471.57	4,468.94	4,470.79	4,468.32	4,469.30	4,466.81	NA
Temperature (°F)	56.7	56.1	53.4	55.8	53.8	57.2	NA
pH (s.u)	6.69	7.85	6.73	7.71	6.73	7.76	6.5 to 8.5 (SCS)
Conductivity (µmhos/cm)	375	370	379	398	376 (374) ^e	389	NA
Nitrite + nitrate as N (mg/L)	2.82	2.74	2.74	2.86	2.79 (2.83)	2.82	10 (PCS)
Total dissolved solids (mg/L)	222	235	236	235	233 (229)	219	500 (SCS)
Iron, total (mg/L)	0.03U ^f	0.03U	0.0391	0.0719	0.03U (0.03U)	0.03U	0.3 (SCS)
Iron, filtered (mg/L)	0.03U	0.03U	0.03U	0.03U	0.03U (0.03U)	0.03U	0.3 (SCS)
Manganese, total (mg/L)	0.002U	0.002U	0.002U	0.002UJ ^g	0.002U (0.002U)	0.002UJ	0.05 (SCS)
Manganese, filtered (mg/L)	0.002U	0.002U	0.002U	0.002UJ	0.002U (0.002U)	0.002UJ	0.05 (SCS)

a. The PCS or SCS in groundwater as referenced in the Idaho Ground Water Quality Rule, IDAPA 58.01.11.200.01.a and b.

b. bls = below land surface.

c. NA = not applicable.

d. Water table elevation above mean sea level. Elevation data provided using the National Geodetic Vertical Datum of 1929.

e. Duplicate sample results are shown in parentheses.

f. The U qualifier indicates the analyte was not detected above the instrument detection limit or the analyte was detected at or above the applicable detection limit, but the value is not more than five times the highest positive amount in any laboratory blank.

g. The UJ qualifier indicates the analyte was not detected. The associated value is an estimate and may be inaccurate or imprecise.



Table A-13. Liquid effluent radiological monitoring results for the Idaho Nuclear Technology and Engineering Center Percolation Ponds CPP-797 (2024).

SAMPLE DATE	GAMMA EMITTERS ^a (pCi/L)	GROSS ALPHA ^b (pCi/L)	GROSS BETA ^b (pCi/L)	TOTAL STRONTIUM (pCi/L)
PCS/SCS ^b	NA	15 pCi/L	4 mrem/yr ^c	8 pCi/L
January 2024	ND ^d	6.61 (±1.72) J ^e	7.91 (±1.18)	ND
February 2024	ND	ND	8.04 (±0.962)	ND
March 2024	ND	ND	7.04 (±0.952)	ND
April 2024	ND	ND	4.82 (±0.815)	ND
May 2024	ND	3.19 (±1.02)	6.68 (±0.944)	ND
June 2024	ND	ND	6.26 (±0.901)	ND
July 2024	ND	ND	7.52 (±0.849)	ND
August 2024	ND	3.09 (±1.07) J	7.61 (±0.845)	ND
September 2024	ND	ND	5.55 (±0.834)	ND
October 2024	ND	ND	6.95 (±1.17)	ND
November 2024	ND	ND	7.51 (±0.908)	ND
December 2024	ND	ND	6.09 (±0.513)	ND

a. Gamma-emitting radionuclides include americium-241, antimony-125, cerium-144, cesium-134, cesium-137, cobalt-58, cobalt-60, europium-152, europium-154, europium-155, manganese-54, niobium-95, potassium-40, radium-226, ruthenium-103, ruthenium-106, silver-108m, silver-110m, uranium-235, zinc-65, and zirconium-95.

b. The detected results are shown along with the reported 1 σ uncertainty.

c. The PCS in groundwater as referenced in the Idaho Ground Water Quality Rule, IDAPA 58.01.11.200.01.a and b.

d. ND = No radioactivity was detected. The result was not statistically positive at the 95% confidence interval and was below its minimum detectable activity.

e. The J flag qualifier indicates the associated value is an estimate.



Table A-14. Groundwater radiological monitoring results for the Idaho Nuclear Technology and Engineering Center (2024).

MONITORING WELL	SAMPLE DATE	GROSS ALPHA ^a (pCi/L) 15-pCi/L AL ^b	GROSS BETA ^a (pCi/L) 50-pCi/L AL ^b
ICPP-MON-A-165	04/23/2024	ND ^c	3.44 (±0.741)
	09/24/2024	ND	5.77 (0.782)
ICPP-MON-A-166	05/30/2024	4.27 (±1.22)	5.53 (±1.00)
	09/24/2024	ND	4.29 (±0.665)
ICPP-MON-V-200	04/22/2024	2.56 (±0.922) J ^d	5.34 (±0.735)
	09/23/2024	3.14 (±0.949)	7.40 (±0.765)
ICPP-MON-V-212	04/22/2024	4.32 (±1.21)	9.19 (±0.877)
	09/23/2024	ND	57.9 (±1.80)

a. The detected results are shown along with the reported 1 σ uncertainty.

b. AL = action level.

c. ND = No radioactivity was detected. The result was not statistically positive at the 95% confidence interval and was below its minimum detectable activity.

d. The J flag qualifier indicates the radionuclide is considered to be present in the sample; however, the result may not be an accurate representation of the amount of activity actually present in the sample.

