Chapter 2: Environmental Compliance Summary

CHAPTER 2

Operations at the Idaho National Laboratory (INL) Site are subject to numerous federal and state environmental statutes, executive orders, and 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 have been issued to the INL Site, primarily by the State of Idaho (Table 2-5). There were no reportable environmental releases at the INL Site during calendar year 2022. In 2022, 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. Environmental compliance status for 2022 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, 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 (https://echo.epa.gov/) 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.

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.

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

REGULATORY PROGRAM DESCRIPTION	2022 COMPLIANCE STATUS	PERMIT REQUIRED Y/N	REPORT SECTIONS
AIR QUALITY AND PROTECTION			
40 CFR 61, "National Emission Standards for Hazardous Air Pollutants," 42 USC 7401 et seq. The CAA is the basis for national air pollution control. Emissions of radioactive hazardous air pollutants are regulated by EPA, via the National Emission Standards for Hazardous Air Pollutant (40 CFR 61, Subpart H).	EPA has not delegated the 40 CFR Part 61, Subpart H regulations and is the primary agency to which DOE-ID reports compliance. Idaho DEQ incorporates the requirements of the subpart into the sitewide PTC-FEC and is therefore included in all reporting and non-compliance occurrences. The INL Site is in compliance, as reported in compliance report, *National Emission Standards for Hazardous Air Pollutants – Calendar Year 2022*.	N	2.2.1 4.2 4.3 8.2.1
40 CFR 84, "Phasedown of Hydrofluorocarbons" In October 2021, EPA issued regulations to decrease the production of hydrofluorocarbons (HFCs) over the next fifteen years, thereby decreasing the supply. HFCs were developed and manufactured to replace chlorofluorocarbons, which damage the stratospheric ozone layer. HFC uses include refrigerants, solvents, fire suppressants, and aerosols. Through these regulations, 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. The DOE Office of Environment, Health, Safety, and Security published OE-3: 2021-06, "Hydrofluorocarbon Phasedown," to provide information and suggestions to DOE programs and sites about these new regulations.	A summary of the INL and Idaho Cleanup Project (ICP) contractors' HFC uses, replacements, procurement, and proactive measures taken as a result of the HFC phasedown can be found in Section 4.2.1.	N	4.2.1
Clean Air Act (1970), 42 USC 7401 et seq. 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 addition to EPA, states, tribes, and local governments play a key role in the implementation of the CAA. *Other environmental statutes and regulations apply, in whole or in part:* • 40 CFR 50, "National Primary and Secondary Ambient Air Quality Standards."	The 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 (IDAPA 58.01.01). DOE-ID holds a synthetic minor, sitewide, air quality permit from Idaho DEQ. This permit to construct (PTC) contains a facility emission cap (FEC) component which enforces a limit on criteria air pollutants (CAP) and hazardous air pollutants emissions 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 require Tier I/Title V permit. This permit covers all the non-exempt air emission sources located on the INL Site, but does not cover air emitting sources located at the Research and Education Campus in Idaho Falls, Idaho. All air emission sources located at the Research and Education Campus have been	Y	4.3 8.2

Table 2-1. continued.

REGULATORY PROGRAM DESCRIPTION	2022 COMPLIANCE STATUS	PERMIT REQUIRED Y/N	REPORT SECTIONS
	determined minor and have been exempted from the permitting requirements in IDAPA 58.01.01. As reported in the annual compliance report required by the PTC-FEC, the INL Site emitted CAP and HAP emissions significantly below the permitted limits in calendar year 2022. No air quality inspections were performed by the Idaho DEQ during calendar year 2022.		
CULTURAL AND ENVIRONMENTAL RESOURCES PROGRAMS			
Endangered Species Act (1973), 16 USC 1531-1544 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. *Other environmental statutes and regulations apply, in whole or in part:* • 50 CFR 17, “Endangered and Threatened Wildlife and Plants” • 50 CFR 226, “Designated Critical Habitat” • 50 CFR 402, “Interagency Cooperation – Endangered Species Act of 1973, as Amended” • 50 CFR 424, “Listing Endangered and Threatened Species and Designating Critical Habitat” • 50 CFR 450-453, “Endangered Species Exemption Process.”	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 to conserve and protect Greater sage-grouse and sagebrush habitat on the INL Site prior to the Service determining the species was not warranted for listing. In 2022, DOE-ID published an annual report of sage-grouse and sagebrush monitoring activities and held an annual meeting with the U.S. Fish and Wildlife Service and other stakeholders to discuss the report and progress towards achieving conservation objectives. The INL Natural Resources Group conducts ecological research, field surveys, and NEPA evaluations regarding resources on the INL Site. These program activities complied with all requirements. Details of related activities can be found in Chapter 9.	Y	9.1.1.1
Executive Order 11988, “Floodplain Management” Executive Order (EO) 11988 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. *Other environmental statutes and regulations apply, in whole or in part:* • 10 CFR 1022, “Compliance with Floodplain and Wetland Environmental Review Requirements.”	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 under NEPA, alternative floodplain evaluation requirements are established through the INL Site Environmental Checklist process. For the Big Lost River, 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 characterization of flows and hazards are expected to use this report.	N	N/A

Table 2-1. continued.

REGULATORY PROGRAM DESCRIPTION	2022 COMPLIANCE STATUS	PERMIT REQUIRED Y/N	REPORT SECTIONS
	For facilities at Test Area North, the 100-year floodplain has been delineated in a U.S. Geological Survey report (USGS 1997).		
Executive Order 11990, "Protection of Wetlands" EO 11990 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 Big Lost River corridor and Big Lost River Sinks. The U.S. Fish and Wildlife Service National Wetlands Inventory map is used to identify potential jurisdictional wetlands and non-regulated sites with ecological, environmental, and future development significance. In 2022, a review of these areas was performed by the U.S. Army Corps of Engineers: no new actions took place within potential wetland areas on the INL Site that would require an update to the Jurisdictional Determination.	N	N/A
Executive Order 13751, "Safeguarding the Nation from the Impacts of Invasive Species" This EO 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. *Other environmental statutes and regulations apply, in whole or in part:* • Federal Noxious Weed Act (1974), 7 USC 2801 • IDAPA 02.06.09, "Rules Governing Invasive Species and Noxious Weeds" • Idaho Statute Title 22, Chapter 19, "The Idaho Invasive Species Act of 2008" • Idaho Statute Title 22, Chapter 24, "Noxious Weeds."	INL implements a sitewide plan for managing invasive species. This sitewide plan addresses each requirement of federal agencies as outlined in EO 13112, as amended by EO 13751. Additionally, federal agency requirements outlined in The Federal Noxious Weed Act of 1974 and State of Idaho requirements related to invasive species and noxious weeds are met with compliance of EO 13112, as amended by EO 13751. For more detail on how this plan is carried out and how requirements are met, see Section 9.4.3.	N	9.4.3
Executive Order 14008, "Tackling the Climate Crisis at Home and Abroad" The purpose of EO 14008, "Tackling the Climate Crisis at Home and Abroad" is to make climate considerations an essential element of U.S. foreign policy and national security planning, and to understand how domestic policy can address the implications of climate change. Overarching goals for domestic policy include strengthening clean air and water protections, holding polluters accountable, delivering environmental justice, and driving the mitigation of climate-related risks in our economy.	At INL, several initiatives have been undertaken to address EO 14008. These initiatives include activities as diverse as evaluating infrastructure to identify opportunities to increase efficiency in electricity and water use, assessing the materials supply chain to reduce INL's carbon footprint, implementing the INL Net-Zero Plan, and aligning land use/land stewardship objectives with ecosystems resilience and ecosystem services priorities. With respect to ecological resource conservation, INL implements several conservation plans. Land stewardship activities prioritize conserving and restoring native communities to maximize ecosystem services such as carbon sequestration. Wildland fire management is an important focus for INL land stewardship, particularly minimizing losses of native plant communities to wildland fire and restoring	N	3.7 Chapter 9

Table 2-1. continued.

REGULATORY PROGRAM DESCRIPTION	2022 COMPLIANCE STATUS	PERMIT REQUIRED Y/N	REPORT SECTIONS
	communities affected by wildland fire to their historical ecological function. Another aspect of maintaining healthy, native ecosystems at INL is consistent implementation of the site-wide noxious weed plan. Ecological monitoring activities are conducted to continuously evaluate the condition of natural resources and ensure the local sagebrush steppe ecosystem remains healthy and resilient in its ability to respond to the stresses associated with climate change. See Chapter 9 for a more thorough discussion of the ecological aspects of implementing EO 14008 on the INL Site. Concerning site resiliency, INL is taking actions to bolster adaptation and increase the resilience of DOE-ID facilities and operations. INL is currently working on several sustainable actions. For example, in 2021, INL included sustainable acquisition clauses in electronic purchases. These new acquisitions use the Electronic Product Environmental Assessment Tool products to reduce energy use. In 2021, INL committed to becoming a national model for achieving net-zero emissions by 2031. INL will do this by developing and implementing carbon-free and carbon-capture technologies on the forefront of the move to zero-carbon emissions. INL and ICP contractors issued the Vulnerability Assessment and Resiliency Plan. The Vulnerability Assessment and Resiliency Plan documents climate vulnerabilities, implementable solutions, lays out a path to institutionalize climate adaptation policies, provides climate adaptation tools, and socializes the need to deploy emerging climate technologies. The performance status of current sustainable activities and further details of new initiatives are further discussed in Chapter 3.		
Migratory Bird Treaty Act (1918), 16 USC 703-712 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. *Other environmental statutes and regulations apply, in whole or in part:* • EO 13186, "Responsibilities of Federal Agencies to Protect Migratory Birds" • Bald and Golden Eagle Protection Act (1940), 16 USC 668-668d • Idaho Statute Title 36, Chapter 1, 106 e.5.	DOE-ID has a U.S. Fish and Wildlife Service Special Purpose Permit for limited nest relocation and destruction and the associated take of migratory birds, if necessary, for mission-critical activities. DOE-ID and INL and ICP contractors also have permits from the Idaho Department of Fish and Game to manage migratory birds and collect other wildlife specimens for scientific research. All stipulated reporting requirements were met for 2022. One instance of a take was reported in 2022 and is further discussed in Chapter 9.	Y	7.2.6 9.2.4

Table 2-1. continued.

REGULATORY PROGRAM DESCRIPTION	2022 COMPLIANCE STATUS	PERMIT REQUIRED Y/N	REPORT SECTIONS
National Environmental Policy Act (1969), 42 USC 4332(2) NEPA requires federal agencies to consider 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. *Other environmental statutes and regulations apply, in whole or in part:* • 10 CFR 1021, "National Environmental Policy Act Implementing Procedures" • 40 CFR 1500-1508, "National Environmental Policy Act (NEPA), Purpose, Policy, and Mandate."	As a federal agency, DOE complies with the NEPA requirements (procedural provisions, 40 CFR 1500 through 1508), as outlined in DOE's NEPA Implementing Procedures (10 CFR 1021). DOE's commitment to NEPA is performed by thoroughly evaluating the potential impacts of proposed federal actions that affect the quality of the environment at INL Site. DOE ensures that reasonable alternatives for implementing such actions have been considered in the decision making process and that such decisions are documented in accordance with DOE and the Council on Environmental Quality regulations. Such a prescribed evaluation process ensures the proper level of environmental review (called a NEPA review) is performed before an irreversible commitment of resources is made while considering other statutory requirements. The INL contractor enters the scope for proposed projects into the Environmental Review Process (ERP), an electronic system developed specifically for INL, in which project personnel, laboratory environmental staff, and other identified personnel can review the scope to identify the regulatory requirements that project proponents will need to meet for proposed actions to proceed. In 2022, laboratory staff reviewed approximately 575 proposed projects. The output of the ERP is the issuance of an Environmental Compliance Permit (ECP). An ECP states the level of NEPA compliance needed for the proposed project as well as project specific instructions project proponents will follow to ensure compliance to regulatory requirements. Of the approximately 575 projects reviewed in 2022, 70 were issued a new categorical exclusion determination under NEPA. Other projects were covered under existing categorical exclusion determinations (i.e. facility improvements), existing Environmental Assessments or Environmental Impact Statements (i.e. Environmental Assessment for Use of DOE-Owned High-Assay Low-Enriched Uranium Stored at Idaho National Laboratory [DOE/EA-2087]), or required the completion of a new NEPA review. DOE-ID projects categorically excluded from further NEPA review can be viewed at https://www.id.energy.gov/NEPA/nepa.htm. The ICP contractor uses an Environmental Checklist (EC) which captures the purpose and need of a project proposal and identifies environmental aspects associated with the project. The Environmental Checklist identifies project specific instructions the project is required to follow to meet NEPA compliance to regulatory requirements. The ICP contractor reviewed six ECs, all of which were covered by existing Environmental Assessments, Environmental Impact Statements, Records of Decision, or other previously approved NEPA documents.	N	NA

Table 2-1. continued.

REGULATORY PROGRAM DESCRIPTION	2022 COMPLIANCE STATUS	PERMIT REQUIRED Y/N	REPORT SECTIONS
	The proposed projects or activities that do not have coverage under existing NEPA documents or do not meet the requirements of categorical exclusion require new or additional analyses. In July of 2022, DOE began to develop an Environmental Assessment for the proposed Molten Chloride Reactor Experiment (MCRE) project. The proposed MCRE project would be sited within existing facilities at the Materials and Fuels Complex (MFC) on the INL Site and use existing infrastructure. The proposed MCRE project is intended to confirm key physics phenomena relevant to the design and safe operation of fast spectrum molten salt reactors and reduce the uncertainty associated with predicting those phenomena. The Environmental Assessment is drafted and is currently being processed.		
National Historic Preservation Act (NHPA) (1966), as amended, 54 USC 300101 et seq. The 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 sites to determine their qualification for inclusion in the National Register of Historic Places. In addition, NHPA requires federal agencies to consult with State Historic Preservation Offices, affected tribes, and the Federal Advisory Council on Historic Preservation, 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. *Other environmental statutes and regulations apply, in whole or in part to DOE-INL's cultural resource management obligations:* • The Archaeological Resources Protection Act (1979), 16 USC §470aa-470mm • 36 CFR 79, "Curation of Federally Owned and Administered Archaeological Collections" • 36 CFR 800, "Protection of Historic Properties" • 43 CFR 7, "Protection of Archaeological Resources"	The INL Cultural Resource Management Office (CRMO) works with DOE-ID's Cultural Resource Coordinator to steward archaeological and architectural cultural resources across INL. During 2022, the CRMO continued to operate under the INL Cultural Resource Management Plan (DOE-ID 2016a) which was developed through a programmatic agreement with the Idaho State Historic Preservation Office and the Advisory Council on Historic Preservation in 2004. A new programmatic agreement is being negotiated among DOE-ID, Idaho State Historic Preservation Office, Advisory Council on Historic Preservation, the Shoshone-Bannock Tribes, and other consulting parties to tailor the Section 106 process to the current needs of the INL Site. The CRMO has been integrated into the National Environmental Policy Act (NEPA) Environmental Review Process since April 2022, allowing better coordination with NEPA reviews and greater streamlining of the Section 106 review process. Archaeologists conducted multiple field surveys to identify and record or re-record archaeological resources that would be impacted by proposed INL activities under Section 106. Additionally, archaeologists surveyed 535 acres and recorded or re-recorded 53 archaeological resources, including both sites and isolates, pursuant to Section 110. Work continued on the built environment inventory update. Individual resources and historic districts constructed prior to 1980 were surveyed, recorded, and evaluated to determine which were eligible for inclusion on the National Register. The CRMO continues to support DOE-ID with their government-to-government consultation efforts with the Shoshone-Bannock Tribes under the Agreement-in-Principle (AIP). The DOE-ID, CRMO, and the Shoshone-Bannock Heritage Tribal Office collaborate regularly and tribal representatives contribute to Sections 106 and 110 projects in the field, as report co-authors, and reviewers, and lead visits for tribal members. DOE-ID and CRMO provided an annual update to the Fort Hall Business Council on June 29, 2022, and facilitates meetings of the INL Site Cultural Resource Working Group.	N	9.5

Table 2-1. continued.

REGULATORY PROGRAM DESCRIPTION	2022 COMPLIANCE STATUS	PERMIT REQUIRED Y/N	REPORT SECTIONS
• Native American Graves Protection and Repatriation Act (1990), as amended, 25 USC 3001-3013 • American Indian Religious Freedom Act (1996), 42 USC 1996 Religious Freedom Restoration Act (1993), 42 USC §200bb-200bb4 • EO 13007, "Indian Sacred Sites" • EO 13175, "Consultation and Coordination with Indian Tribal Governments."			
HAZARDOUS MATERIALS AND WASTE MANAGEMENT			
Comprehensive Environmental Response, Compensation, and Liability Act (1980), 40 CFR 300, 42 USC 9601 et seq 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. *Other environmental statutes and regulations apply, in whole or in part:* • 40 CFR 300, "National Oil and Hazardous Substance Pollution Contingency Plan."	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. The DOE-ID, the State of 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 Waste Area Groups (WAGs) as a result of the FFA/CO, and each WAG is further divided into smaller cleanup areas called operable units. Field investigations are used to evaluate potential release sites within each WAG and operable unit 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" listing is possible, or whether it is appropriate to proceed with an interim cleanup action, the Operable Unit 10-08 Plug-In Remedy action, or further investigation using a remedial investigation/feasibility study (RI/FS). Results from the 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. After consideration of public comments, DOE, EPA, and Idaho DEQ develop a record of decision (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 of 1991, the INL Site has cleaned up release sites containing asbestos, petroleum products, acids and bases, radionuclides, unexploded ordnance and explosive residues, polychlorinated	N	Table 2-2 6.5

Table 2-1. continued.

REGULATORY PROGRAM DESCRIPTION	2022 COMPLIANCE STATUS	PERMIT REQUIRED Y/N	REPORT SECTIONS
	biphenyls, heavy metals, and other hazardous materials. All 24 RODs that were scheduled have been signed and are being implemented or have been completed. Comprehensive RI/FSs have been 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 and operations and maintenance activities at these sites are ongoing and will continue to be monitored under the *Site-Wide Institutional Controls and Operations and Maintenance Plan* (DOE-ID 2022a). The status of on-going active remediation activities at WAGs 1, 3, 7, and 10 are described in Table 2-2. Documentation associated with the remedial actions and other removal actions are publicly available in the CERCLA Administrative Record and can be accessed at https://idahoenvironmental.com/ARIR/. Decontamination and decommissioning activities are also performed at the INL Site in accordance with the CERCLA (42 USC 9601 et seq.), as amended by the "Superfund Amendments and Reauthorization Act of 1986" (Public Law 99-499), and in accordance with the "National Oil and Hazardous Substances Pollution Contingency Plan" (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, "Superfund Implementation," as recognized by Section 5.3 of the FFA/CO (DOE-ID 1991). In accordance with 40 CFR 300.415(j) and DOE guidance, on-INL Site removal actions conducted under CERCLA are required to meet ARARs 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.		
DOE Order 435.1 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, "Radioactive Waste Management," and the accompanying DOE Manual 435.1-1, "Radioactive Waste Management Manual," which set forth the requirements for	The INL contractor manages all radioactive waste generated at INL facilities. The Waste Management Program is the lead organization for ensuring compliant cradle-to-grave waste management of containerized waste as described in PDD-17000, "Waste Management Program." The INL contractor maintains facility-specific Radioactive Waste Management Basis documents to demonstrate DOE O 435.1 compliance. The INL and ICP contractors manage all hazardous, mixed low-level waste, low-level, transuranic, high level, remote handled, recyclable waste, waste with no	N	N/A

Table 2-1. continued.

REGULATORY PROGRAM DESCRIPTION	2022 COMPLIANCE STATUS	PERMIT REQUIRED Y/N	REPORT SECTIONS
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, 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, (2) transuranic (TRU) waste, and (3) low-level waste • 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 have been identified, analyzed, and mitigated. *Other environmental statutes and regulations apply, in whole or in part:* • DOE O 435.1, Change 2, "Radioactive Waste Management" • DOE Manual 435.1, Change 3, "Radioactive Waste Management Manual (January 2021)."	identified path to disposal, industrial, Toxic Substances Control Act (TSCA), and universal waste streams that are generated and stored at the INL Site and approved off-INL Site waste streams. Management activities include, but are not limited to, storing waste, treating waste, 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" and the ICP contractor manages waste that is generated and stored at the ICP facilities, and approved off-Site waste streams per PDD-234, "Waste Management Program." All waste management activities described herein are conducted in compliance with all applicable provisions of DOE O 435.1. See Table 2-3 for information on wastes managed at the INL Site by INL and ICP 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 and ICP contractors.		
Federal Facility Compliance Act of 1992, as amended. Enacted by Congress on October 6, 1992, the *Federal Facility Compliance Act of 1992* amends Section 6001 of the Resource Conservation and Recovery Act of 1976 (RCRA) to	The INL and ICP 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	N	N/A

Table 2-1. continued.

REGULATORY PROGRAM DESCRIPTION	2022 COMPLIANCE STATUS	PERMIT REQUIRED Y/N	REPORT SECTIONS
specify that the U.S. waives sovereign immunity from civil and administrative fines and penalties for RCRA violations. In addition, RCRA requires EPA to conduct annual inspections of all federal facilities. Authorized states are given authority to conduct inspections of federal facilities to enforce compliance with state hazardous waste programs. DOE-ID is required to submit and receive approval of the INL Site Treatment Plan from the Idaho DEQ.	described in PDD-17000, "Waste Management Program." Waste Management at ICP facilities is described in PDD-234, "Waste Management Program." The INL and ICP contractors maintain facility-specific Radioactive Waste Management Basis documents to demonstrate DOE O 435.1 compliance. DOE-ID submitted the fiscal year (FY) 2023 Site Treatment Plan Annual Update and FY 2022 Site Treatment Plan Annual Report to Idaho DEQ in November 2022 in accordance with sections 2.3.3 and 2.3.4. DOE-ID and INL Site contractors met quarterly with Idaho DEQ to discuss the status of milestones, treatment projects, and other activities conducted under the Site Treatment Plan.		
Federal Insecticide, Fungicide, and Rodenticide Act (1996), 7 USC 136 et seq. The Federal Insecticide, Fungicide, and Rodenticide Act is the federal statute that governs the registration, distribution, sale, and use of pesticides in the United States. The FIFRA regulations found in 40 CFR parts 150-189 are promulgated and administered by the EPA. *Other environmental statutes and regulations apply, in whole or in part:* • IDAPA 02.03.03, "Rules Governing Pesticide and Chemigation Use and Application" • Idaho Statute Title 22 Chapter 34, "Idaho Pesticides and Chemigation Law."	All pesticide applications on the INL Site are conducted in accordance with the specific pesticide label instructions in accordance with the Federal Insecticide, Fungicide, and Rodenticide Act. Additionally, all appropriate records associated with pesticide applications are kept for a minimum of three years by each pesticide applicator in accordance with IDAPA 02.03.03, "*Rules Governing Pesticide and Chemigation Use and Application*." For details on pesticide application on the INL Site see Section 9.4.3.	N	9.2.4
Resource Conservation and Recovery Act (1976), 40 CFR 259-282, 42 USC 6901 et seq. The Resource Conservation and Recovery Act established regulatory standards for generation, transportation, storage, treatment, and disposal of hazardous waste. *Other environmental statutes and regulations apply, in whole or in part:* • 40 CFR 270.13, "Contents of Part A of the Permit Application" • 40 CFR 262, "Standard Applicable to Generators of Hazardous Waste" • 40 CFR 263, "Standards Applicable to Transporters of Hazardous Waste"	*RCRA Permits:* Form 8700-23, along with maps, drawings, and photographs, as required by 40 CFR 270.13, is included with the Part A permit (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, Idaho Nuclear Technology and Engineering Center (INTEC) Tank Farm Facility. One interim status unit, TSA1/R at the Radioactive Waste Management Complex (RWMC), is not included in Volume 1. Information on this unit is found in the Advanced Mixed Waste Treatment Project Hazardous Mixed Waste Management Act (HWMA)/RCRA Transuranic Storage Area Interim Status Document (DEQ 2021). 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, ID4890008952. Therefore, each of the seven Part B permit volumes is called a partial permit. Each partial Part B Permit includes the Part	Y	N/A

Table 2-1. continued.

REGULATORY PROGRAM DESCRIPTION	2022 COMPLIANCE STATUS	PERMIT REQUIRED Y/N	REPORT SECTIONS
• 40 CFR 263, "Standards Applicable to Transporters of Hazardous Waste" • 40 CFR 264, "Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities" • 40 CFR 265, "Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities" • 40 CFR 266, "Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Units" • 40 CFR 267, "Standard for Owners and Operators of Hazardous Waste Facilities Operating Under a Standardized Permit" • 40 CFR 268, "Land Disposal Restrictions" • 40 CFR 270, "EPA Administered Permit Programs: The Hazardous Waste Permit Program" • 40 CFR 273, "Standards for Universal Waste Management" • 40 CFR 273, "Standards for Universal Waste Management" • 40 CFR 279, "Standards for the Management of Used Oil."	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 applicable sections of 40 CFR 262 through 270.27. *RCRA Reports.* As required by Idaho DEQ, the INL Site submitted the 2022 annual Idaho Hazardous Waste Generator Annual Report (CCN 330317) 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 the Idaho DEQ by March 1 of every even-numbered year for the previous calendar year. The biennial report was submitted to the electronic RCRA Info Industry Application (CCN 328539) for 2022. *RCRA Closure Plan.* There were no closure activities completed in 2022. *RCRA Inspection.* For FY 2022, Idaho DEQ performed an RCRA inspection from May 16–19, 2022. On July 21, 2022, Idaho DEQ issued a warning letter to DOE-ID and IEC related to two previously self-disclosed events resulting in permit noncompliances and one area of concern identified by Idaho DEQ during the May inspection. *RCRA Consent Order.* 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 $1,458,000 for the period of noncompliance from March 1, 2021, to March 30, 2022. Supplemental environmental projects were utilized in lieu of the Original payment, and the fines were reduced due to adverse impacts to IWTU's outage schedule resulting from the COVID-19 global pandemic.		
OTHER ENVIRONMENTAL REQUIREMENTS			
DOE Order 231.1B, "Environmental, Safety, and Health Reporting" Environmental, Safety, and Health Reporting requires the timely collection and reporting of information on	This report, "*2022 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.	N	All chapters

Table 2-1. continued.

REGULATORY PROGRAM DESCRIPTION	2022 COMPLIANCE STATUS	PERMIT REQUIRED Y/N	REPORT SECTIONS
environmental issues that could adversely affect the human and safety of the public and the environment at DOE sites. *Other environmental statutes, regulations, and directives apply, in whole or in part:* • DOE O 458.1, Change 4, "Radiation Protection of the Public and the Environment."			
DOE Order 232.2A, "Occurrence Reporting and Processing of Operations Information" In accordance with DOE O 232.2A, Occurrence Reporting and Processing of Operations Information, 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 the credibility of the Department. Events are provided report levels (High, Low, and 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, 2022, to December 31, 2022, INL reported one event related to an environmental release. This event was reported and tracked in LabWay under Condition CO 2022-0600. On April 6, 2022, while conducting a corrective maintenance activity on MFC-786 substation transformer N-TF-055, a holding tank in the subcontractors self-contained filtration trailer failed and spilled approximately 200 gallons of transformer dielectric fluid to the ground. The process to filter the dielectric fluid (a soy-based oil) involves draining the oil to a tank, then heating and filtering it to remove impurities until it is clean enough to return it to the transformer. The cause of the tank failure is unknown. As a vegetable-based oil, the transformer dielectric fluid is deemed eco-friendly with no known hazardous constituents. No injuries or facility impacts resulted from the oil tank failure. Work was immediately stopped, and actions were taken to mitigate the spread of the oil by applying floor dry, pig mats, and spill blankets. Management, Environmental, and DOE were notified. Oil on the pavement was cleaned up on April 6, 2022. Oil that was spilled on the soil was cleaned and the INL Environmental Group evaluated the area on April 28, 2022, and determined no further action was required.	N	N/A
Emergency Planning and Community Right-to-Know Act (1986), 42 USC 11001, et seq. The Emergency Planning and Community Right-to-Know Act (EPCRA) of 1986 was created to help communities plan for emergencies involving hazardous substances. The Act helps 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. *Other environmental statutes and regulations apply, in whole or in part:*	The INL Site's 2022 compliance with key EPCRA provisions is summarized below. • *Section 304: Extremely Hazardous Substance Release Notification* – There were no CERCLA-reportable chemicals released at the INL Site during 2022. 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 chlorine, cyclohexylamine, nitric acid, nitrogen dioxide, and sulfuric acid were among the chemicals reported in 2022.	N	2.5

Table 2-1. continued.

REGULATORY PROGRAM DESCRIPTION	2022 COMPLIANCE STATUS	PERMIT REQUIRED Y/N	REPORT SECTIONS
• IDAPA 58.01.02.851, "Petroleum Release Reporting, Investigation, and Confirmation."	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 are also 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 Idaho Falls facilities that exceed regulatory thresholds. In 2022, the chemical inventory report included 75 individual chemicals at INL Site facilities and 14 at Idaho Falls 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, diisocyanates, lead,naphthalene, nickel, nitrates and nitric acid, to EPA and Idaho DEQ 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 EPCRA 313 reporting include transfers to waste treatment and disposal facilities off the INL Site, air emissions, recycling, and other activities. *Reportable Environmental Releases* – No reportable spills for INL and ICP contractors in 2022.		
DOE Order 436.1, "Departmental Sustainability" The order defines requirements and responsibilities for managing sustainability withing DOE and to ensure that the department carries out its missions in a sustainable manner that addresses national energy security and global environmental challenges, and advances sustainable, efficient and reliable energy for the future.	DOE contractors at INL Site have developed site sustainability plans and have implemented environmental management systems (EMS) that are incorporated with the contractors' integrated safety management systems to promote sound stewardship practices and ensure compliance with DOE Order 436.1. Each contractor's EMS has been certified to the ISO 14001 Standard since 2005 and is certified by an external registrar every three years. Chapter 3 contains details on contractor EMS.	N	Chapter 3

Table 2-1. continued.

REGULATORY PROGRAM DESCRIPTION	2022 COMPLIANCE STATUS	PERMIT REQUIRED Y/N	REPORT SECTIONS
Other environmental statutes and regulations apply, in whole or in part: • EO 13990, "Protecting Public Health and the Environmental and Restoring Science to Tackle the Climate Crisis" • EO 14057, "Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability."			
Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations" The purpose of this EO is to focus federal attention on the environmental and human health effects of federal actions on minority and low-income populations with the goal of achieving environmental protection for all communities. *Other environmental statutes and regulations apply, in whole or in part:* • EO 14008, "Tackling the Climate Crisis at Home and Abroad" • EO 14057, "Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability."	DOE-ID and the INL evaluate the potential for environmental justice matters as part of the review processes implemented to identify potential environmental impacts from any and all proposed federal actions routinely as part of the NEPA compliance program. Consideration of environmental justice in NEPA analysis is driven by EO 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," and is further supported by EO 14008. The executive orders effectively direct federal agencies to identify disproportionately high and adverse human health or environmental effects of federal programs, policies, and activities on minority, low-income, and minority and low-income populations and to take action to address such impacts. Section 2.3 contains details of DOE-ID and INL's promotion of environmental justice and the outreach efforts that were taken in 2022.	N	2.3
RADIATION PROTECTION			
DOE Order 458.1, Change 4, "Radiation Protection of the Public and the Environment" "Radiation Protection of the Public and the Environment" 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 2022. The annual dose to the maximally exposed individual in 2022, as determined using Clean Air Act Assessment Package 88-PC, was 0.018 mrem (0.18 µSv). DOE standard DOE-STD-1196-2022 (DOE 2022), Derived Concentration Technical Standard, supports the implementation of DOE O 458.1. 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 or air that results in a member of the public receiving 100 mrem (1 mSv)	N	Chapter 4 Chapter 5 Chapter 6 Chapter 7 Chapter 8 Appendix A

Table 2-1. continued.

REGULATORY PROGRAM DESCRIPTION	2022 COMPLIANCE STATUS	PERMIT REQUIRED Y/N	REPORT SECTIONS
	effective dose following continuous exposure for one year via each of the following pathways: (1) ingestion of water, (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. DOE O 458.1 specifies the limits for unrestricted release of property to the public. All INL and ICP contractors use a graded approach for 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, diskettes, compact disks, and other office media • Paper, cardboard, plastic products, aluminum beverage cans, toner cartridges, and other items for recycling • Office trash • 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 the listed categories are either surveyed prior to release to the public, or a process knowledge evaluation is conducted to verify that material 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 are also 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 that material and equipment are not being released with inadvertent contamination.		

Table 2-1. continued.

REGULATORY PROGRAM DESCRIPTION	2022 COMPLIANCE STATUS	PERMIT REQUIRED Y/N	REPORT SECTIONS
	All contractors complete material surveys prior to release and transport to the state-permitted landfill at the Central Facilities Area. 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 the 2022 calendar year there were 1,419 releases of personal property items with over 99% of these releases being for reuse at the INL (i.e., instruments for calibration, miscellaneous tools, and equipment). Those that were not released for reuse were released for appropriate disposal. 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 of the release of metals from DOE sites remain in effect. INL and ICP contractors continue to follow the requirements of these Secretarial Memorandums. No scrap metal directly released from radiological areas is recycled.		
Toxic Substance Control Act (1976), 15 USC 2601 et seq The TSCA, which is administered by the EPA, requires the regulation of production, use, or disposal of chemicals. TSCA supplements sections of the CAA, the Clean Water Act (CWA), and the Occupational Safety and Health Act. *Other environmental statutes and regulations apply, in whole or in part:* • 40 CFR 761, Subpart J, "General Records and Reports."	Because the INL Site does not produce chemicals, compliance with the TSCA is primarily directed towards the use and management of certain chemicals—particularly polychlorinated biphenyls (PCBs). The INL Site manages radioactive mixed waste containing PCBs received from other DOE Sites many years ago for disposal. Environmental remediation activities include the re-processing of these waste materials for disposition off-site. 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, "General Records and Reports." These regulations require a facility to maintain a written record documenting all PCB management activities until the PCBs are disposed of; the written record must be available for inspection or submission if requested by the EPA. It must be prepared each year by July 1 and maintained at the facility for at least three years after the	Y	N/A

REGULATORY PROGRAM DESCRIPTION	2022 COMPLIANCE STATUS	PERMIT REQUIRED Y/N	REPORT SECTIONS
	facility ceases using or storing PCBs and PCB items. INL Site prepares the required annual documentation each year. It includes an inventory of PCB/radioactive waste in storage at INL for the previous year and documents progress made toward disposal in accordance with applicable regulations. The written record for the annual documentation is issued on the Electronic Document Management System by July 1 in accordance with CCN 246686 and the "Interface Agreement between INL, ICP, and NRF contractors for Environmental Reporting," IAG-681 (INL 2022). CCN 246686 documents EPA's approval to revise our procedures for issuing the written record to match the TSCA regulations. The INL contractor manages TSCA Risk-based Disposal Approval (RBDAs) at the ATR Complex that establishes an agreement with the EPA to properly dispose of and/or contaminate PCB waste in accordance with 40 CFR 761. TSCA RBDAs are situation based off discovery with the intentions 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 the short-term cleanup and disposal of PCBs under 40 CFR 761.61(c) that have penetrated the concrete flooring from the application of PCB paint. The ICP contractor holds RBDAs, granted by EPA Region 10, which allow for processing of PCB-contaminated legacy sludge wastes from Rocky Flats Plant at two of the facilities located at the RWMC. Per 40 CFR 761.20(c)(2)(ii), processing activities which are primarily associated with and facilitate treatment or disposal require a TSCA PCB approval. Work performed under these RBDAs ensures that these wastes can be accepted for disposal at the Waste Isolation Pilot Plant near Carlsbad, New Mexico.		
WATER QUALITY AND PROTECTION			
Clean Water Act (1972), 40 CFR 109-140, 33 USC 1251, et seq. The 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 EPA, as well as regulating water quality standards for surface water. The CWA also provided for the National Pollutant Discharge Elimination System permit program, requiring permits for discharges into regulated surface waters. *Other environmental statutes and regulations apply, in whole or in part:*	The Idaho DEQ is authorized by the 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 and ICP 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. The INL Research Center complied with an Industrial Wastewater Acceptance permit for discharges to the city of Idaho Falls in Idaho. This program is set out in Title 8, Chapter 1 of the Municipal Code of the city of Idaho Falls, Idaho. All discharges in 2022 were within levels established in the INL Research Center Industrial Wastewater Acceptance permit. The city of Idaho Falls, Idaho, did not perform an inspection in 2022.	Y	N/A

Table 2-1. continued.

REGULATORY PROGRAM DESCRIPTION	2022 COMPLIANCE STATUS	PERMIT REQUIRED Y/N	REPORT SECTIONS
• IDAPA 58.01.16, "Wastewater Rules" • IDAPA 58.01.25, "Rules Regulating the Idaho Pollutant Discharge Elimination System Program."			
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. *Other environmental statutes and regulations apply, in whole or in part:* • IDAPA 58.01.11, "Ground Water Quality Rule" • IDAPA 58.01.16, "Wastewater Rules" • IDAPA 58.01.17, "Recycled Water Rules."	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. The Idaho DEQ encourages reuse, which is the practice of using recycled water for irrigation, ground water recharge, landscape impoundments, toilet flushing in commercial buildings, dust control, and other beneficial uses. The 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. The Idaho DEQ issues these permits in accordance with IDAPA 58.01.17, "Recycled Water Rules;" IDAPA 58.01.16, "Wastewater Rules;" and IDAPA 58.01.11, "Ground Water Quality Rule." The following facilities have reuse permits at the INL Site: • Advanced Test Reactor Complex Cold Waste Ponds (I-161-03) • INTEC New Percolation Ponds (M-130-06) • MFC Industrial Waste Pond (I-160-02). Idaho DEQ inspected the INL and ICP contractors reuse systems in April 2022. All reuse systems at the INL Site were operated in substantial compliance with permit requirements during 2022.	Y	Chapter 5 Chapter 6 Appendix A
Safe Drinking Water Act (1974), 40 CFR 141-143, 42 USC 300f, et seq. The Safe Drinking Water Act establishes primary standards for public water supplies to ensure it is safe for consumption. *Other environmental statutes and regulations apply, in whole or in part:* • 40 CFR 141, "National Primary Drinking Water Regulations"	INL Site drinking water complied with all applicable federal and state water quality standards in 2022. 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	N	2.3.2 6.7

Table 2-1. continued.

REGULATORY PROGRAM DESCRIPTION	2022 COMPLIANCE STATUS	PERMIT REQUIRED Y/N	REPORT SECTIONS
• 40 CFR 143, "National Secondary Drinking Water Regulations" • IDAPA 58.01.08, "Idaho Rules for Public Drinking Water Systems."	contaminants, and per- and poly-fluoroalkyl substances in 2022. The ICP contractor did not sample for per- and poly-fluoroalkyl substances in 2022.		
QUALITY ASSURANCE			
10 CFR 830, Subpart A, "Quality Assurance Requirements" 10 CFR 830, Subpart A establishes quality assurance requirements for contractors conducting activities, including providing items or service that affect, or may affect, nuclear safety of DOE nuclear facilities. *Other environmental statutes and regulations apply, in whole or in part:* • DOE O 414.1D, Change 2, "Quality Assurance"	Quality assurance and quality control programs were maintained in 2022 by INL Site contractors and laboratories performing environmental analyses. Results are summarized in Chapter 10, Section 10.3. 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 multi-faceted 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.	N	Chapter 10

Table 2-2. 2022 status of active Waste Area Groups.

WASTE AREA GROUP	FACILITY	STATUS
1	Test Area North	Groundwater cleanup of trichloroethene for Operable Unit 1-07B continued through 2022 in accordance with EPA and Idaho DEQ approved plans (DOE-ID 2022b, 2022c). 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 Test Area North will continue. Two ISB injection wells were constructed in 2015 to further ISB efforts and 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 institutional controls (IC) and operations and maintenance (O&M) requirements were maintained during 2022. However, the required daily inspections were completed during this time. The agencies were notified and corrective actions were completed.
3	Idaho Nuclear Technology and Engineering Center	The Idaho CERCLA Disposal Facility, 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 Idaho CERCLA Disposal Facility (ICDF) are carried out in accordance with EPA and Idaho DEQ approved plans (DOE-ID 2018a, 2019b, 2019c). Consolidation of waste at the 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 (SRPA). 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 SRPA are sampled annually; results are sent to the EPA and Idaho DEQ. Remedial actions and monitoring required by the WAG 3, Operable Unit 3-14 ROD (DOE-ID 2007a) are implemented through EPA- and Idaho DEQ-approved plans (DOE-ID 2018b, 2018c). Remedial actions at the Tank Farm Facility (TFF) are designed to reduce water infiltration that potentially could transport contaminants from the vadose zone and the perched water 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 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 2022.
7	Radioactive Waste Management Complex	WAG 7 includes the Subsurface Disposal Area (SDA), a 97-acre radioactive waste landfill that is the major focus of remedial response actions at the RWMC (Figure 2-2). Waste is buried in approximately 35 of the 97 acres within 21 unlined pits, 58 trenches, 21 soil vault rows, and, on Pad A, an above grade disposal area. Disposal requirements have changed in accordance with laws and practices current at the disposal time. Initial operations began in 1952 and were limited to shallow, landfill disposal of waste generated at the INL Site. Beginning in 1954, the DOE Rocky Flats Plant near Boulder, Colorado, was authorized to send waste to the RWMC for disposal. The Rocky Flats Plant was a nuclear weapons production facility with peak operations during the Cold War era.

Table 2-2. continued.

WASTE AREA GROUP	FACILITY	STATUS
		Various types of radioactive waste streams were disposed of, including process waste (e.g., sludge, graphite molds and fines, roaster oxides, and evaporator salts), equipment, and other waste incidental to production (e.g., contaminated gloves, paper, clothing, and other industrial trash). Much of the Rocky Flats Plant waste was contaminated with transuranic (TRU) isotopes and solvents (e.g., carbon tetrachloride). In 1970, burial of TRU waste was prohibited. In 1984, disposal practices were modified to eliminate disposal of mixed waste. Since 1984, only low-level waste was disposed of in the SDA at the active low-level waste disposal facility (ALLWDF). Disposal of waste from offsite generators was discontinued in the early 1990s, and disposal of contact-handled waste was discontinued at the end of FY 2008. Disposal operations at the ALLWDF were completed in May 2021, and interim closure of the ALLWDF was completed in August 2022 (MacRae 2022). Final closure of the SDA and ALLWDF is addressed under the Operable Unit (OU) 7-13/14 ROD. The OU 7-13/14 ROD (DOE-ID 2008) is consistent with DOE's obligations for TRU waste removal under the *Agreement to Implement U.S. District Court Order Dated May 25, 2006*, between the Idaho DEQ and DOE-ID, effective July 3, 2008 (U.S. District Court 2008). The ROD calls for exhuming and packaging a minimum of 6,238 m^3 (8,159 yd^3) of targeted waste from a minimum combined area of 5.69 acres. Targeted waste for retrieval contains TRU elements (e.g., plutonium), uranium, and collocated organic solvents (e.g., carbon tetrachloride). Targeted waste retrievals in specific areas of the SDA commenced in 2005 and were completed in December 2021. The retrieved targeted waste is packaged, certified, and shipped out of Idaho. As of April 2022, 10,417.5 m^3 (13,625.58 yd^3) of targeted waste has been retrieved and packaged for off-site shipment. In addition to targeted waste retrieval, the ROD addresses remaining contamination in the SDA through a combination of vapor-vacuum extraction and treatment of solvent vapors from the subsurface (completed in July 2022; RPT-1904) and in situ grouting of specified waste forms containing mobile contaminants (completed in 2010; DOE-ID 2011a). Quarterly monitoring of the solvent vapors in the vadose zone will continue in accordance with the Operations and Maintenance Plan (DOE-ID 2017a). The third and final phase of the ROD includes constructing an evapotranspiration surface barrier over the entire SDA landfill, followed by long-term management and control after construction is complete. Construction is scheduled to be complete by 2028.
10	10-04 INL Site-wide 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 2022, under the site-wide IC/O&M Plan (DOE-ID 2017b). The fourth site-wide CERCLA five-year review covering the period from 2015 through 2019 was finalized in January 2021. The purpose of the CERCLA five-year review is to verify that implemented cleanup actions continue to meet cleanup objectives documented in RODs.
	10-08 INL Sitewide Groundwater, Miscellaneous Sites, and Future Sites	OU 10-08 addresses site-wide 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. Biennial groundwater monitoring will continue in 2023 (DOE-ID 2014) to verify that there is no unacceptable threat to human health or the environment from commingled plumes or along the southern INL Site boundary.

Table 2-3. Radioactive wastes managed at the INL Site.

FACILITY	GENERATION	TREATMENT	STORAGE	DISPOSAL
INL CONTRACTOR				
Advanced Test Reactor Complex	LLW[a]	—	LLW	—
Central Facilities Area	LLW	—	LLW	—
MFC/INTEC	TRU[a]/LLW	LLW	TRU/LLW	—
Material Security and Consolidation Complex	LLW	—	LLW	—
Remote-Handled Low-Level Waste Disposal Facility	LLW	—	LLW	LLW
Research and Education Campus	LLW	—	LLW	—
Specific Manufacturing Capability	LLW	LLW	LLW	—
ICP CONTRACTOR				
Advanced Mixed Waste Treatment Project	TRU/LLW	TRU/LLW	TRU/LLW	—
ICDF	—	—	—	LLW
INTEC Calcined Solids Storage Facility	—	—	HLW	—
INTEC Tank Farm Facility	—	—	HLW	—
IWTU	—	HLW[a]	HLW	—
RWMC Accelerated Retrieval Project	TRU/LLW	TRU/LLW	TRU/LLW	—
RWMC ALLWDF	—	—	—	LLW

a. HLW – high-level waste; LLW – low-level waste; TRU – transuranic.

Table 2-4. Listing of the status of each phase of the LLW management process for sites authorized to manage a LLW facility.

PHASE	REMOTE-HANDLED LLW DISPOSAL FACILITY	RADIOACTIVE WASTE MANAGEMENT COMPLEX (RWMC) ACTIVE LLW DISPOSAL FACILITY	ICDF
Performance Assessment (PA)	DOE/ID-11421 (DOE-ID 2018d), “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”
Composite Analysis (CA)	DOE/ID-11422 (DOE-ID 2016b), “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 2006), “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 2012)

Table 2-4. continued.

PHASE	REMOTE-HANDLED LLW DISPOSAL FACILITY	RWMC ACTIVE LLW DISPOSAL FACILITY	ICDF
PA/CA 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 PA/CA Summary Report	INL/RPT-23-70876 (INL 2023), "Annual Summary Report for the Remote-Handled Low-Level Waste Disposal Facility – FY 2022"	RPT-2080, "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 2022"	RPT-2079, "Annual Summary Report: Review for Continued Adequacy of the Performance Assessment, Composite Analysis, and Supporting Documents for the ICDF Landfill – FY 2022"
Disposal Authorization Statement (DAS)	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	Marcinowski, F., memorandum to R. Provencher, April 7, 2011, "Revision of the Disposal Authorization Statement for the Idaho Comprehensive Environmental Response, Compensation, and Liability Act Disposal Facility," CCN 311791

2.3 Environmental and Energy Justice

The DOE defines environmental justice (EJ) as the fair treatment and meaningful involvement of all people, regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies (energy.gov). Several executive orders require federal departments to address EJ: EO 12898*, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, Section 1-1; EO 14008, *Tackling the Climate Crisis at Home and Abroad*, Section 219; and EO 14057, *Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability*, Section 402.

Additionally, the federal government established the Justice40 Initiative with a goal that 40 percent of the overall benefits of certain federal investments flow to disadvantaged communities, which have been marginalized, underserved, and overburdened by pollution. The seven categories of investment include climate change, clean energy and energy efficiency, clean transit, affordable and sustainable housing, training and workforce development, remediation and reduction of legacy pollution, and the development of critical clean water and wastewater infrastructure. Through the Inflation Reduction Act, Bipartisan Infrastructure Law, and the American Rescue Plan, federal agencies are making historic levels of investment to advance EJ.

To aid in the identification and tracking of these disadvantaged communities, the President's Council on Environmental Quality has developed the Climate and Economic Justice Screening Tool (CEJST). The tool identifies U.S. communities that have faced historic injustices and have been overburdened and underserved. This includes federally recognized tribes, including Alaska Native Villages. CEJST contains an interactive map tied to several datasets and uses established thresholds to determine if census tracts meet the definition of a disadvantaged community. The eight categories for burden indicators include: climate change, energy, health, housing, legacy pollution, transportation, water, and wastewater, and workforce development. Additionally, the categories must be at or above the threshold for an associated socioeconomic burden to be highlighted as a disadvantaged community. The CEJST has identified several tracts within the Idaho counties of Bingham, Clark, Butte, and Jefferson as disadvantaged. CEJST also identifies the entirety of the Fort Hall Indian Reservation as a disadvantaged community.

2.3.1 Initiatives

The INL Site established an Environmental Justice Program (EJP) in 2021. The INL Site's EJP recognizes that communities across the globe will be tackling similar challenges in the transition to clean energy. The INL Site aspires to be an EJ leader, setting an example of how to incorporate multiple voices and viewpoints in efforts to ensure a just energy transition inclusive of EJ priorities and community engagement. The program focuses on the sustainable stewardship of natural resources through relationships between humans and environmental systems.

DOE-ID established a Working Agreement with the Shoshone-Bannock Tribes in 1992 that was later developed into an Agreement-In-Principle or AIP. DOE-ID and the Tribes have negotiated multiple five-year AIPs since that initial Working Agreement, the latest of which was signed in September 2022 (https://idweb.id.doe.lcl/IDMSOther/PDF/AIP_Signed.pdf). The AIP is designed to promote increased interaction and cooperation on issues of mutual concern. This AIP reflects the understanding and commitment between the parties to increase the tribes' level of assurance that activities conducted at the INL Site protect the health, safety, environment, and cultural resources and address tribal interests in DOE-administered programs. It is applicable to actions and operations of DOE-ID and its contractors on the lands of the INL Site that affect original ancestral territory and tribal lands. DOE-ID considers the AIP as an important mechanism through which environmental and energy justice matters are addressed. Annual funding from DOE-ID through Cooperative Agreements support the Tribal DOE and Office of Emergency Management programs.

The INL Site established a Memorandum of Understanding with the Shoshone-Bannock School District #537 and collaborated closely with the tribes to create meaningful education and career pathways for tribal students. This Memorandum of Understanding creates a place-based, culturally responsive program designed to both bring opportunities to tribal schools and bring students to the laboratory for work-based learning. The K–12 Education team assisted faculty and administration to design culturally responsive teaching and learning through project-based, place-based and service-learning approaches as they work towards science, technology, engineering, and mathematics (STEM) school designation. At the request of a tribal elder, students received a valuable cultural lesson making a *bodo'* (stick), which is traditionally used to dig up bulbs harvested on tribal lands.

First-year coursework was successfully designed and delivered in both the industrial mechanics and construction trades pathways. Shoshone-Bannock High School Career technical students studying either industrial mechanics or construction trades were eligible to participate in a six-week paid summer internship at the INL Site, working under the supervision of instructors and safety personnel through the INL Site Future Corps Program. In 2022 the first cohort of high school students for the Work-Based Learning Program spent six weeks working onsite with mentors from INL Site's Facilities and Site Services and MFC directorates to explore trades, crafts, fabrication, and operations. The coursework and Work-Based Learning Program prepares students with the skills and experience necessary for entry-level trades and crafts positions at the INL Site.

The INL Site K–12 Education team collaborated with the lab's INL Site's Cultural Resource Management Office to sponsor Earth Day activities for every age group, including an art contest, a traditional native ceremony, a cultural resource tour of the Middle Butte Cave, and a Shoshone-Bannock-led dancing exhibition at the lab's Central Facilities Area for nearly 80 Shoshone-Bannock Tribal members and students. The INL Ste also held an event at Chief Tahgee Elementary Academy in Fort Hall with hands-on activities for students. Nearly 1,800 Earth Day STEM learning kits were distributed to local and regional classrooms (Figure 2-1).

The INL Site's K–12 Education team hosted community STEM nights at all Shoshone-Bannock lodges and at the Shoshone-Bannock High School on the Fort Hall Indian Reservation for students and their families with interactive STEM learning activities.

Figure 2-1. Students from the Shoshone-Bannock Tribes discussing salmon migration with INL staff.

The DOE Idaho Cleanup Project (DOE-ICP) is working towards the end state and long-term stewardship (LTS) of the INL Site. It is commonly accepted amongst DOE, tribes, and stakeholders that LTS is the actions that survey/monitor and maintain Land Use Controls and ensures the protection of human and health and the environment is accomplished in perpetuity. In FY 2022, DOE-ICP provided funding for the Shoshone-Bannock Tribal DOE and Air Quality Program and Heritage Tribal Office cultural resources program involvement in LTS activities to develop and implement a Tribal LTS Program on the INL Site. The Tribal LTS Program will work to integrate culturally based knowledge and principles into existing ICP LTS plans and activities. The tribal LTS Program will form a "Tribal LTS Collaborative Group" to ensure the Tribes' goals are implemented in coordination with the Fort Hall Business Council, Tribal Departments, and the DOE-ICP.

The DOE-ID and INL Site evaluate the potential for EJ matters as part of the review processes implemented to identify potential environmental impacts from all proposed federal actions routinely as part of the NEPA compliance program. Consideration of EJ in NEPA analysis is driven by EO 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," and is further supported by EO 14008. The EOs effectively direct federal agencies to identify disproportionately high and adverse human health or environmental effects of federal programs, policies, and activities on minority populations and low-income populations and to take action to address such impacts. Although EJ has been a part of the INL Site NEPA processes since President Clinton signed the EO 12898 in 1994, the INL Site's NEPA team and the EJ program have made significant efforts in recent months to become a leader in EJ within the national laboratory system.

In the sustainability realm, the DOE Bioenergy Technologies Office (BETO), Argonne National Laboratory, and the INL Site K–12 Education Team created a bioenergy toolkit for educators as part of the Bioenergy Research and Education BRIDGES project. The toolkit translates DOE scientific bioenergy research to the classroom, providing equitable access to high quality learning materials and easing the transition from academics to industry, as part of a workforce development and diversity, equity, and inclusion initiative. The INL Site designed and field tested two case studies aligned to the laboratory's Bioenergy Science and Technology portfolio and industry needs, called "Regional Feedstocks: Are They the Answer to Achieving Net Zero?" and "Solid Waste to Energy: Traditional Ecology and Environmental Justice." The case studies draw inspiration from BETO science and technology research for long-term adaptation, resiliency, and sustainable practices and policies for historically marginalized communities across the United States. BRIDGES is built on a framework that allows for place-based learning and culturally responsive teaching, supporting diversity, equity, and inclusion initiative.

2.4 INL Site Agreements

DOE-ID has three major site agreements that contain regulatory commitments and milestones. These major site agreements are known as the Site Treatment Plan (STP), the Idaho Settlement Agreement (ISA), and the Notice of Noncompliance/Consent Order (NON/CO).

The Federal Facility Compliance Act of 1992 requires the preparation of site treatment 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 STP 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 the mixed waste streams, called the backlog, and identifies onsite and offsite mixed low-level waste treatment capabilities.

During 2022, DOE-ID completed four STP milestones including two milestones associated with the treatment of remote-handled waste, one certification milestones of original volume TRU-contaminated contact-handled waste, and the treatment of sludge contaminated waste. DOE-ID made a request to the Idaho DEQ to extend milestones associated with the start-up of the IWTU and treatment of sodium bearing waste, which the state approved in October of 2022.

On October 16, 1995, DOE-ID, the U.S. Navy, and the Idaho DEQ entered into an agreement (also known as ISA) that guides management of Spent Nuclear Fuel (SNF), high-level waste, and TRU waste at the INL Site. The agreement (DOE 1995) limits shipments of DOE-ID and Naval SNF into the state and sets milestones for shipments of SNF and radioactive waste out of the state.

The ISA, as related to requirements found in the Agreement to Implement, dated May 25, 2006, required the exhumation of transuranic waste from the SDA at the RWMC. The DOE and the ICP workforce safely completed the required 5.69-acre exhumation and removal of associated targeted waste ahead of the regulatory milestone due date.

The STP and the ISA required DOE-ID to process and ship all covered waste out of Idaho by December 31, 2018, respectively, stored as TRU waste on the INL Site in 1995, when the agreements were signed. The estimated volume of that waste was 65,000 m^3 (85,016 yd^3). This milestone was not achieved; however, revised STP milestones were agreed upon with the Idaho DEQ; an addendum to the ISA was signed on November 6, 2019, to address the milestone.

As of December 31, 2022, a total of 61,508 m^3 (80,449 yd^3) of original volume TRU-contaminated waste had been processed (i.e., shipped or certified for disposal to Waste Isolation Pilot Plant [WIPP]). DOE-ID completed certification of 25% of the original volume TRU contaminated waste remaining inventory to be certified for shipment and disposal at WIPP. DOE-ID made 150 shipments of ISA TRU waste to WIPP in 2022, comprised of 148 shipments of legacy TRU waste and two shipments of buried TRU.

The ICP contractor manages and operates several projects to facilitate the disposition of radioactive waste as required by the ISA and STP. The Advanced Mixed Waste Treatment Project performs retrieval, characterization, treatment, packaging, and shipment of TRU waste currently stored at the INL Site. Most of the waste processed at the Advanced Mixed Waste Treatment Project 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).

The final agreement, the NON/CO and recent modification, in conjunction with the STP, requires the treatment of sodium-bearing waste to be stored at the INTEC Tank Farm at the IWTU. To meet the milestones in the NON/CO and STP, DOE-ID and its ICP contractor continued their methodical approach to start up the IWTU, which is designed to process 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, and 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 have been emptied, cleaned, and closed. The waste was originally scheduled to begin processing in 2012, but several technical problems have delayed IWTU.

The 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, the 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 re-commenced its test run in May. 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 shutdown and entered a planned outage to inspect process vessels/components, conduct maintenance and make minor modifications which concluded in November. The facility-initiated plant start-up for simulant testing in late 2022 with the intent to transition into radiological waste treatment operations. Radiological operations were targeted to begin in early calendar year 2023. The facility initiated a controlled shutdown in late December 2022 to investigate and repair an observed solids leak in a canister fill cell.

2.5 Low-Level and Mixed Radioactive Waste

In 2022, approximately 994 m^3 (1,300 yd^3) of mixed low-level waste and 360 m^3 (471 yd^3) of low-level waste was shipped off the INL Site for treatment, disposal, or both, by the ICP contractor. In 2022, no low-level waste was disposed of at the SDA (Figure 2-2).

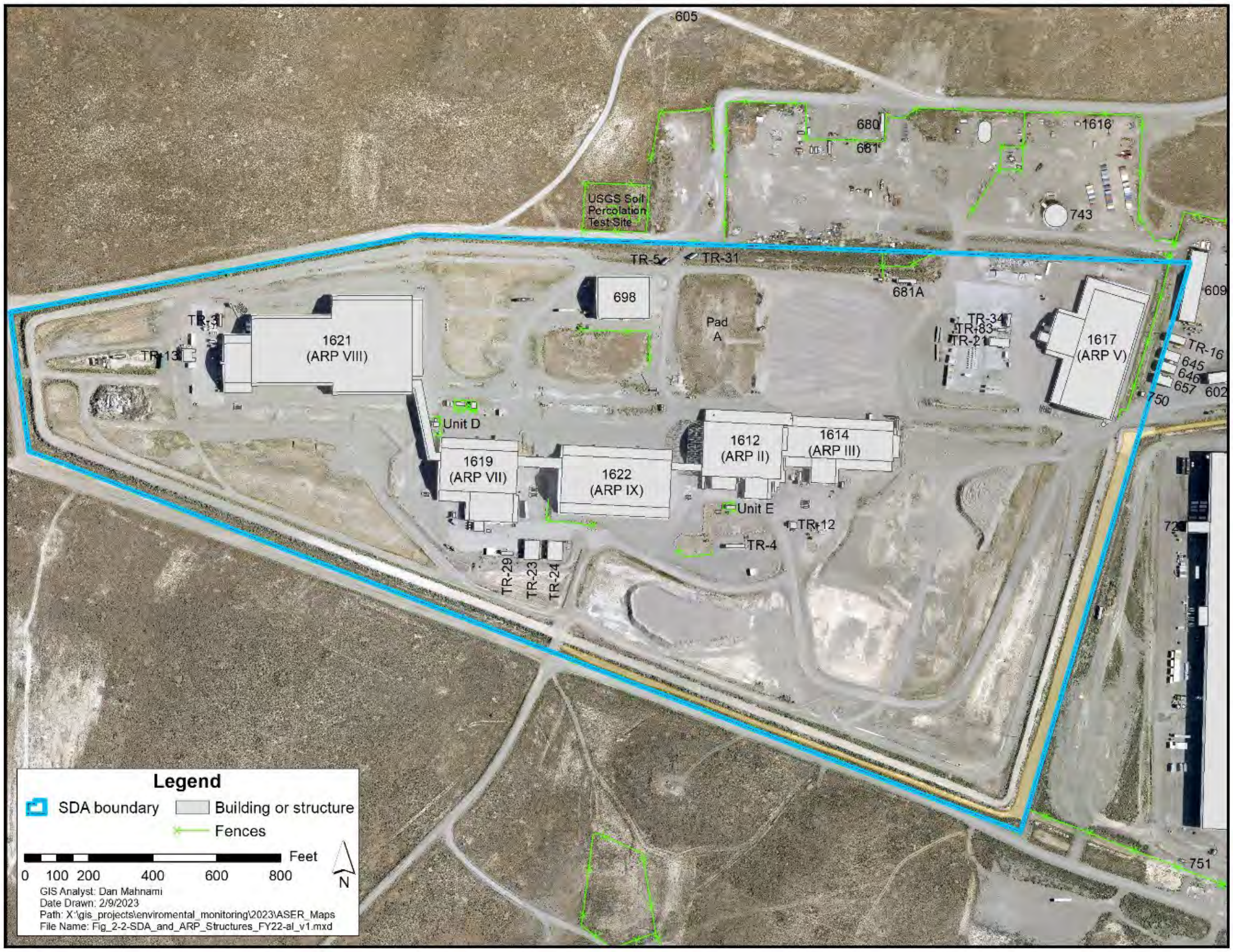


Figure 2-2. Radioactive Waste Management Complex Subsurface Disposal Area (2022).

2.5.1 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. SNF contains unreacted uranium and radioactive fission products. Because of its radioactivity (primarily from gamma rays), it must be properly shielded. DOE-ID's SNF 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 Idaho Energy Coalition, the ICP contractor at INTEC, the Naval Nuclear Propulsion Program at the Naval Reactors Facility, and the INL contractor at the Advanced Test Reactor Complex and MFC.

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

- DOE-ID shall complete the transfer of spent fuel from wet storage facilities by December 31, 2023 (Paragraph E.8)

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

Meeting these remaining milestones comprise the major objectives of the SNF program.

2.6 Release and Inventory Reporting at the INL Site

2.6.1 Spills and Releases

There were no reportable spills for INL or ICP in 2022.

2.6.2 Unplanned Releases

INL and ICP had no unplanned release of a hazardous substance that required notification to the regulatory agencies for 2022.

2.7 Environmental Permits

Table 2-5 presents the complete list of all federal and state permits active during 2022 for INL Site operations. This table includes those pertaining to air emissions, groundwater, surface water, RCRA, and ecological.

Table 2-5. Environmental permits for the INL Site (2022).

PERMIT TYPE	ACTIVE PERMITS
AIR EMISSIONS	
Synthetic Minor	1
ECOLOGICAL	
Migratory Bird Treaty Act Special Purpose Permit	2
Wildlife Collection/Banding/Possession Permit	2
GROUNDWATER	
Injection Well	2
Well Construction	3[a]
RESOURCE CONSERVATION AND RECOVERY ACT	
Part A (Interim Status)	2[b]
Part B	7[b]
RECYCLED WATER	
Reuse Permits	3
SURFACE WATER	
Industrial Wastewater Acceptance	1
TOXIC SUBSTANCES CONTROL ACT	
Risk-Based Disposal Approval[c]	4

a. Construction of wells USGS-151, and USGS-152 have been cored and continued construction is planned for FY 23-24. Borehole USGS-150 is planned for abandonment in FY 23-24. Permits are only required for construction of wells, not operation.

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 the Part B application. The Part A addresses each of the permitted units in the Part B, and the Part B includes specific details and permit operating requirements. A partial permit that includes the unit-specific Part A and B is considered a RCRA partial Part B permit. There are seven RCRA partial Part B permits for the INL Site.

c. Risk-Based Disposal Approvals are permit-like documents granted by the EPA.

2.8 References

10 CFR 830, 2023, Subpart A, “Quality Assurance Requirements,” Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration, https://www.ecfr.gov/cgi-bin/text-idx?SID=074233709c29153b42bc0e7e25e68307&mc=true&node=sp40.10.61.a&rgn=div6.

10 CFR 1021, 2023, “National Environmental Policy Act Implementing Procedures,” Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration, https://www.energy.gov/sites/prod/files/10CFRPart1021.pdf.

10 CFR 1022, 2023, “Compliance with Floodplain and Wetland Environmental Review Requirements,” Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration, https://www.energy.gov/sites/prod/files/10CFRPart1022.pdf.

36 CFR 79, 2023, “Curation of Federally Owned and Administered Archeological Collections,” Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration, https://www.ecfr.gov/current/title-36/chapter-I/part-79.

36 CFR 800, 2023, “Protection of Historic Properties,” Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration, https://www.ecfr.gov/current/title-36/chapter-VIII/part-800?toc=1.

40 CFR 50, 2023, “National Primary and Secondary Ambient Air Quality Standards,” Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration, https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-50?toc=1.

40 CFR 61, Subpart H, 2023, “National Emission Standards for Emissions of Radionuclides Other Than Radon from Department of Energy Facilities,” Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration, https://www.ecfr.gov/cgi-bin/text-idx?SID=11c3269295aab799456dcba14addb85a&mc=true&node=pt40.10.61& rgn=div5#ap40.10.61_1359.c.

40 CFR 84, 2023, “Phasedown of Hydrofluorocarbons,” Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration, https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-84.

40 CFR 141, 2023, “National Primary Drinking Water Regulations,” Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration, https://www.ecfr.gov/current/title-40/chapter-I/subchapter-D/part-141.

40 CFR 142, 2023, “National Primary Drinking Water Regulations Implementation,” Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration, https://www.ecfr.gov/current/title-40/chapter-I/subchapter-D/part-142.

40 CFR 143, 2023, “National Primary Drinking Water Standards,” Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration, https://www.ecfr.gov/current/title-40/chapter-I/subchapter-D/part-143.

40 CFR 150–189, 2023, “Pesticide Program,” Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration, https://www.ecfr.gov/current/title-40/chapter-I/subchapter-E.

40 CFR 262, 2023, “Standard Applicable to Generators of Hazardous Waste,” Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration, https://www.ecfr.gov/current/title-40/chapter-I/subchapter-I/part-262.

40 CFR 263, 2023, “Standards Applicable to Transporters of Hazardous Waste,” Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration, https://www.ecfr.gov/current/title-40/chapter-I/subchapter-I/part-263.

40 CFR 264, 2023, “Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities,” Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration, https://www.ecfr.gov/current/title-40/chapter-I/subchapter-I/part-264?toc=1.

40 CFR 265, 2023, “Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities,” Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration, https://www.ecfr.gov/current/title-40/chapter-I/subchapter-I/part-265?toc=1.

40 CFR 266, 2023, “Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Units,” Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration, https://www.ecfr.gov/current/title-40/chapter-I/subchapter-I/part-266.

40 CFR 267, 2023, “Standard for Owners and Operators of Hazardous Waste Facilities Operating Under a Standardized Permit,” Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration, https://www.ecfr.gov/current/title-40/chapter-I/subchapter-I/part-267.

40 CFR 268, 2023, “Land Disposal Restrictions,” Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration, https://www.ecfr.gov/current/title-40/chapter-I/subchapter-I/part-268.

40 CFR 270, 2023, “EPA Administered Permit Programs: The Hazardous Waste Permit Program,” Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration, https://www.ecfr.gov/current/title-40/chapter-I/subchapter-I/part-270.

40 CFR 270.13, 2023, “Contents of Part A of the Permit Application,” Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration, https://ecfr.io/Title-40/Section-270.13.

40 CFR 273, 2023, “Standards for Universal Waste Management,” Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration, https://www.ecfr.gov/current/title-40/chapter-I/subchapter-I/part-273.

40 CFR 279, 2023, “Standards for the Management of Used Oil,” Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration, https://www.ecfr.gov/current/title-40/chapter-I/subchapter-I/part-279.

40 CFR 300, 2023, “National Oil and Hazardous Substances Pollutant Contingency Plan,” Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration, https://www.ecfr.gov/current/title-40/chapter-I/subchapter-I/part-300.

40 CFR 761, Subpart J, 2023, “General Records and Reports,” Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration, https://www.ecfr.gov/current/title-40/chapter-I/subchapter-R/part-761/subpart-J.

40 CFR 761.20, “Prohibitions and Exceptions,” Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration, https://www.ecfr.gov/current/title-40/chapter-I/subchapter-R/part-761/subpart-B/section-761.20.

40 CFR 1500–1508, 2023, “National Environmental Policy Act (NEPA), Purpose, Policy, and Mandate,” Code of Federal Regulations, National Archives and Records Administration, Office of the Federal Register, https://www.energy.gov/sites/prod/files/NEPA-40CFR1500_1508.pdf.

43 CFR 7, 2023, “Protection of Archeological Resources,” Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration, https://www.ecfr.gov/current/title-43/subtitle-A/part-7?toc=1.

50 CFR 17, 2023, “Endangered and Threatened Wildlife and Plants,” Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration, https://www.ecfr.gov/current/title-50/chapter-I/subchapter-B/part-17.

50 CFR 226, 2023, “Designated Critical Habitat,” Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration, https://www.ecfr.gov/current/title-50/chapter-II/subchapter-C/part-226?toc=1.

50 CFR 402, 2023, “Interagency Cooperation – Endangered Species Act of 1973, as Amended,” Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration, https://www.ecfr.gov/current/title-50/chapter-IV/subchapter-A/part-402.

50 CFR 424, 2023, “Listing Endangered and Threatened Species and Designating Critical Habitat,” Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration, https://www.ecfr.gov/current/title-50/chapter-IV/subchapter-A/part-424.

50 CFR 450, “General Provisions,” Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration, https://www.ecfr.gov/current/title-50/chapter-IV/subchapter-C/part-450.

50 CFR 451, “Application Procedure,” Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration, https://www.ecfr.gov/current/title-50/chapter-IV/subchapter-C/part-451.

50 CFR 452, "Consideration of Application Procedure by the Secretary," Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration, https://www.ecfr.gov/current/title-50/chapter-IV/subchapter-C/part-452.

50 CFR 453, "Endangered Species Committee," Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration, https://www.ecfr.gov/current/title-50/chapter-IV/subchapter-C/part-453.

42 USC § 2011, 1954, Congressional Declaration of Policy, United States Code, Title 42 – The Public Health and Welfare.

American Indian Religious Freedom Act (1996), 42 USC 1996.

Atomic Energy Act (AEA) of 1954 (42 USC §2011 et seq.). (Amended by the Price-Anderson Act).

Bald and Golden Eagle Protection Act, 1940, Public Law 86-70, Effective June 8, 1940, 92 Stat. 3114.

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.

Bureau of Reclamation, 2005, Big Lost River Flood Hazard Study, Idaho National Laboratory, Idaho, Report 2005-2.

Clean Air Act (CAA) of 1970 (42 USC § 7401).

Clean Water Act (CWA) of 1972 (the Federal Water Pollution Control Act) (33 USC § 1251).

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, (42 USC §9601). Amended by the Superfund Amendments and Reauthorization Act (SARA).

DEQ, 1995, Federal Facility Compliance Act Consent Order and Site Treatment Plan, (transmittal letter and signed enclosure from Curt Fransen, Idaho Deputy Attorney General, to Brett R. Bowhan, U.S. Department of Energy Idaho Operations Office), Idaho Division of Environmental Quality.

DOE, 1991, "Idaho National Engineering Laboratory ("INEL") Federal Facility Agreement and Consent Order, Administrative Docket Number: 1088-06 120," U.S. Department of Energy, Office of Environmental Management; U.S. Environmental Protection Agency, Region 10; State of Idaho, Department of Health and Welfare.

DOE, 1995, "1995 Settlement Agreement," U.S. Department of Energy, U.S. Department of the Navy, and State of Idaho.

DOE, 2022, "Derived Concentration Technical Standard," DOE-STD-1196-2022, U.S. Department of Energy, December 2022.

DOE and EPA, 1995, "Policy on Decommissioning of Department of Energy Facilities Under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)," KLF-211-95, Rev. 0, U.S. Department of Energy and U.S. Environmental Protection Agency, May 22, 1995.

DOE-ID, 2006, "Composite Analysis for the INEEL CERCLA Disposal Facility Landfill," DOE/NE-ID-10979, U.S. Department of Energy, Idaho Operations Office.

DOE-ID, 2007a, "Record of Decision for Tank Farm Soil and INTEC Groundwater, Operable Unit 3-14," Rev. 0, DOE/ID-11201, U.S. Department of Energy, Idaho Operations Office.

DOE-ID, 2007b, "Performance Assessment for the RWMC Active Low-Level Waste Disposal Facility at the Idaho National Laboratory Site," Rev. 0, DOE/NE-ID-11243, U.S. Department of Energy, Idaho Operations Office.

DOE-ID, 2008a, "Record of Decision for Radioactive Waste Management Complex Operable Unit 7-13/14," Rev. 0, DOE/ID-11359, U.S. Department of Energy Idaho Operations Office.

DOE-ID, 2008b, "Composite Analysis for the RWMC Active Low-Level Waste Disposal Facility at the Idaho National Laboratory," Rev. 0, DOE/NE-ID-11244, U.S. Department of Energy, Idaho Operations Office.

DOE-ID, 2009, "Operable Unit 10-08 Record of Decision for Site-Wide Groundwater, Miscellaneous Sites, and Future Sites," Rev. 1, DOE/ID-11358, U.S. Department of Energy, Idaho Operations Office.

DOE-ID, 2011a, "Interim Completion Report for Phase 2 Operable Unit 7-13/14," Rev. 0, DOE/ID-11436, U.S. Department of Energy Idaho, Operations Office.

DOE-ID, 2011b, “Performance Assessment for the Idaho CERCLA Disposal Facility Landfill,” DOE/NE-ID-10978, U.S. Department of Energy, Idaho Operations Office.

DOE-ID, 2012, “ICDF Complex Remedial Action Work Plan,” DOE/ID-10984, U.S. Department of Energy Idaho Operations Office.

DOE-ID, 2014, “Post-Record of Decision Groundwater Monitoring and Field Sampling Plan for Operable Unit 10-08,” Rev. 0, DOE/ID-11420, U.S. Department of Energy, Idaho Operations Office.

DOE-ID, 2016a, “Idaho National Laboratory Cultural Resource Management Plan,” Rev. 6, DOE/ID-10997, U.S. Department of Energy Idaho Operations Office.

DOE-ID, 2016b, “Composite Analysis for the Idaho National Laboratory Remote-Handled Low-Level Waste Disposal Facility,” DOE/ID-11422, U.S. Department of Energy Idaho Operations Office.

DOE-ID, 2017a, “Operable Unit 7-13/14 Operations and Maintenance Plan,” Rev. 2, DOE/ID-11393, U.S. Department of Energy, Idaho Operations Office.

DOE-ID, 2017b, “INL Site-Wide Institutional Controls, and Operations and Maintenance Plan for CERCLA Response Actions,” Rev. 2, DOE/ID-11042, U.S. Department of Energy, Idaho Operations Office.

DOE-ID, 2018a, “ICDF Complex Operational and Monitoring Sampling and Analysis Plan,” Rev. 4, DOE/ID-11005, U.S. Department of Energy, Idaho Operations Office.

DOE-ID, 2018b, “Operable Unit 3-14 Tank Farm Soil and INTEC Groundwater Operation and Maintenance Plan,” Rev. 4, DOE/ID-11337, U.S. Department of Energy, Idaho Operations Office.

DOE-ID, 2018c, “Operable Unit 3-14 Tank Farm Soil and INTEC Groundwater Long-Term Monitoring Plan,” Rev. 3, DOE/ID-11334, U.S. Department of Energy, Idaho Operations Office.

DOE-ID, 2018d, “Performance Assessment for the Idaho National Laboratory Remote-Handled Low-Level Waste Disposal Facility,” DOE/ID-11421, U.S. Department of Energy Idaho Operations Office.

DOE-ID, 2019a, “ICDF Complex Groundwater Monitoring Plan,” Rev. 7, DOE/ID-10955, U.S. Department of Energy, Idaho Operations Office.

DOE-ID, 2019b, “ICDF Complex Operations and Maintenance Plan,” Rev. 10, DOE/ID-11000, U.S. Department of Energy, Idaho Operations Office.

DOE-ID, 2022a, “Site-Wide Institutional Controls and Operations and Maintenance Plan,” Rev. 0, DOE/ID-11042, U.S. Department of Energy, Idaho Operations Office.

DOE-ID, 2022b, “ISB Rebound Test Plan for TAN Groundwater Remediation,” Rev. 5, DOE/ID-11444,, U.S. Department of Energy, Idaho Operations Office.

DOE-ID, 2022c, “Monitoring Plan for Test Area North, Operable Unit 1-07B,” Rev. 5, DOE/ID-11412, U.S. Department of Energy, Idaho Operations Office.

DOE O 231.1B, 2012, “Environmental, Safety, and Health Reporting,” Administrative Change 1, U.S. Department of Energy.

DOE O 232.2A, 2017, “Occurrence Reporting and Processing of Operations Information,” U.S. Department of Energy.

DOE O 414.1D, Change 2, 2011, “Quality Assurance,” U.S. Department of Energy.

DOE O 435.1, 2011, “Radioactive Waste Management,” Change 2, U.S. Department of Energy.

DOE O 436.1, 2011, “Departmental Sustainability,” U.S. Department of Energy, May 2, 2011.

DOE O 458.1, 2013, “Radiation Protection of the Public and the Environment,” Administrative Change 4, U.S. Department of Energy.

DOE Manual 435.1, Change 3, 2021, “Radioactive Waste Management Manual,” U.S. Department of Energy.

DOE Policy 451.1, 2017, “National Environmental Policy Act Compliance Program,” U.S. Department of Energy.

Emergency Planning and Community Right to-Know-Act (EPCRA) of 1986 (42 USC § 11001 et seq.). (Also known as SARA Title III.)

Endangered Species Act (ESA) of 1973 (16 USC § 1531 et seq.).

Executive Order 11988, 1977, "Floodplain Management."

Executive Order 11990, 1977, "Protection of Wetlands."

Executive Order 12580, 1987, "Superfund Implementation," President Ronald Reagan, January 23, 1987.

Executive Order 12898, 1994, "Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations."

Executive Order 13007, 1996, "Indian Sacred Sites."

Executive Order 13112, 1999, "Invasive Species."

Executive Order 13175, 2000, "Consultation and Coordination with Indian Tribal Governments."

Executive Order 13186, 2001, "Responsibilities of Federal Agencies to Protect Migratory Birds."

Executive Order 13287, 2003, "Preserve America."

Executive Order 13751, 2016, "Safeguarding the Nation from Impacts of Invasive Species."

Executive Order 13990, 2021, "Protecting Public Health and the Environmental and Restoring Science to Tackle the Climate Crisis."

Executive Order 14008, 2021, "Tackling the Climate Crisis at Home and Abroad."

Executive Order 14057, 2021, "Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability."

Federal Facility Compliance Act 1992, as amended.

Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) (7 USC § 136).

Federal Noxious Weed Act (1974), 7 USC 2801.

Idaho Statute Title 22, Chapter 19, "The Idaho Invasive Species Act of 2008."

Idaho Statute Title 22, Chapter 24, "Noxious Weeds."

Idaho Statute Title 22 Chapter 34, "Idaho Pesticides and Chemigation Law."

Idaho Statute Title 36, Chapter 1, 106 e.5, "Fish and Game Commission."

IDAPA 02.03.03, 2023, "Rules Governing Pesticide and Chemigation Use and Application," Idaho Administrative Procedures Act, Idaho Department of Environmental Quality, https://adminrules.idaho.gov/rules/current/02/020609.pdf.

IDAPA 02.06.09, 2023 "Rules Governing Invasive Species and Noxious Weeds," Idaho Administrative Procedures Act, Idaho Department of Environmental Quality, https://adminrules.idaho.gov/rules/current/02/020609.pdf.

IDAPA 58.01.01, 2023, "Rules for the Control of Air Pollution in Idaho," Idaho Administrative Procedures Act, Idaho Department of Environmental Quality, https://adminrules.idaho.gov/rules/current/58/580102.pdf.

IDAPA 58.01.02.851, 2023, "Petroleum Release Reporting, Investigation, And Confirmation," Idaho Administrative Procedures Act, Idaho Department of Environmental Quality, https://adminrules.idaho.gov/rules/current/58/580102.pdf.

IDAPA 58.01.08, 2023, "Idaho Rules for Public Drinking Water Systems," Idaho Administrative Procedures Act, Idaho Department of Environmental Quality, https://adminrules.idaho.gov/rules/current/58/580108.pdf.

IDAPA 58.01.11, 2023, "Ground Water Quality Rule," Idaho Administrative Procedures Act, Idaho Department of Environmental Quality, https://adminrules.idaho.gov/rules/current/58/580111.pdf.

IDAPA 58.01.16, 2023, "Wastewater Rules," Idaho Administrative Procedures Act, Idaho Department of Environmental Quality, https://adminrules.idaho.gov/rules/current/58/580116.pdf.

IDAPA 58.01.17, 2023, "Recycled Water Rules," Idaho Administrative Procedures Act, Idaho Department of Environmental Quality, https://adminrules.idaho.gov/rules/current/58/580117.pdf.

IDAPA 58.01.25, 2023, “Rules Regulating the Idaho Pollutant Discharge Elimination System Program,” Idaho Administrative Procedures Act, Idaho Department of Environmental Quality, https://adminrules.idaho.gov/rules/current/58/580125.pdf.

IDEQ, 2021, “Advanced Mixed Wast Project (AMWTP) Hazardous Waste Management Act (HWMA)/Resource Conservation and Recovery Act (RCRA) Transuranic Storage Area (TSA) Interim Status (IS) Document,” EPA ID No. ID4890008952, Idaho Department of Environmental Quality.

INL 2022, “Interface Agreement between INL, ICP, and NRF contractors for Environmental Reporting,” CCN 246686 (IAG-681), Idaho National Laboratory, Idaho Falls, ID.

INL 2023, “Annual Summary Report for the Remote-Handled Low-Level Waste Disposal Facility—FY 2022,” INL/RPT-23-70876, Idaho National Laboratory.

MacRae, J., memorandum to A. Nebeker, September 15, 2022, “Contract No. 89303321DEM000061 – Declaration of Physical Completion of Performance Based Incentive (PBI) 2.1.04 – Closure Preparations for Active Low-Level Waste Disposal Facility (ALLWDF) – Complete Closure Plan RPT-576, Revision 4, Closure Activities for ALLWDF – FY 2022,” CCN 329703.

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.

Marcinowski, F., memorandum to R. Provencher, April 7, 2011, “Revision of the Disposal Authorization Statement for the Idaho Comprehensive Environmental Response, Compensation, and Liability Act Disposal Facility,” CCN 311791.

Migratory Bird Treaty Act (MBTA) of 1918, as amended (16 USC § 703 et seq.).

National Environmental Policy Act (NEPA) of 1969 (42 USC § 4321).

National Historic Preservation Act of 1966, as amended (16 USC § 470 et seq.).

Native American Graves Protection and Repatriation Act (1990), as amended, 25 USC 3001-3013.

PLN-3370, 2012, “Preliminary Closure Plan for the Idaho National Laboratory Remote-Handled Low-Level Waste Disposal Facility,” Idaho National Laboratory.

PLN-3368, 2021, “Maintenance Plan for the Remote-Handled Low-Level Waste Disposal Facility Performance Assessment and Composite Analysis,” Idaho National Laboratory.

PDD-234, 2020, “Waste Management Program,” Rev. 3, Idaho Cleanup Project Core.

PDD-17000, “Waste Management Program,” Rev. 15, Idaho National Laboratory.

Religious Freedom Restoration Act (1993), 42 USC §200bb-200bb4.

Resource Conservation and Recovery Act (RCRA) of 1976 (42 USC § 6901 et seq.).

RPT-431, 2019, “Performance Assessment and Composite Analysis Maintenance Plan for the RWMC Active Low-Level Waste Disposal Facility,” Rev. 2, Idaho Cleanup Project.

RPT-576, 2016, “Interim Closure Plan for the RWMC Active Low-level Waste Disposal Facility at the Idaho National Laboratory Site,” Rev. 4, Idaho Cleanup Project.

RPT-791, 2019, “Performance Assessment and Composite Analysis Maintenance Plan for the Idaho CERCLA Disposal Facility Landfill,” Rev. 1, Idaho Cleanup Project.

RPT-1904, 2022, “Soil Vapor Extraction Rebound Test Report for Operable Unit 7-13/14,” Rev. 1, Idaho Cleanup Project.

RPT-2079, “Annual Summary Report: Review for Continued Adequacy of the Performance Assessment, Composite Analysis, and Supporting Documents for the ICDF Landfill – FY 2022,” Rev. 0, Idaho Cleanup Project.

RPT-2080, “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 2022,” Rev. 0, Idaho Cleanup Project.

Safe Drinking Water Act (SDWA) of 1974 (42 USC § 300f).

The Archaeological Resources Protection Act (1979), 16 USC §470aa-470mm.

Toxic Substances Control Act (TSCA) of 1976 (15 USC § 2601 et seq.).

U.S. District Court, 2008, “Agreement to Implement U.S. District Court Order Dated May 25, 2006, Between the State of Idaho and DOE,” effective July 3, 2008.

USGS, 1997, “Simulation of Water-Surface Elevations for a Hypothetical 100-Year Peak Flow in Birch Creek at the Idaho National Engineering and Environmental Laboratory, Idaho, U.S. Geological Survey Water-Resources Investigation Report 97-4083,” DOE/ID-22138, U.S. Geological Survey.

Chapter 3: Environmental Management Systems

CHAPTER 3

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

3. ENVIRONMENTAL MANAGEMENT SYSTEMS

The framework that DOE has chosen to use for Environmental Management Systems (EMSs) and sustainable practices is the International Organization for Standardization (ISO) Standard 14001:2015, “Environmental Management Systems – Requirements with Guidance for Use.” The ISO 14001:2015 model uses a system of policy development, planning, implementation, operation, checking, corrective action, and management review. Ultimately, ISO 14001:2015 aims to improve performance as the management cycle repeats. The EMS must also meet the criteria of Executive Order 14057, “Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability,” and DOE O 436.1, “Departmental Sustainability,” which require federal facilities to put EMSs into practice. Sites must maintain their EMS either by being certified for use or in conformance with the ISO 14001:2015 standard following the accredited registrar provisions or self-declaration instructions.

INL balances research, development, and demonstration; waste management; and decontamination and decommissioning activities in support of the INL mission with the protection and preservation of human health and the environment. INL complies with applicable laws, regulations, and other requirements. INL’s EMS integrates environmental protection, environmental compliance, pollution prevention, and continual improvement into work planning and execution throughout work areas as a part of the Integrated Safety Management System.

INL is a combination of all operating contractors and the U.S. Department of Energy, Idaho Operations Office (DOE-ID), and includes the Idaho Falls campus and the research and industrial complexes termed the “INL Site” that is located 50 miles west of Idaho Falls, Idaho. For the purpose of this report, INL consists of those facilities operated by Battelle Energy Alliance, LLC (INL contractor), or by the Idaho Environmental Coalition, LLC (Idaho Cleanup Project [ICP] contractor). INL and ICP contractors are referred to by their noted acronyms and include all facilities under their individual responsibilities.

The two main contractors have established EMSs for their respective operations. The INL and ICP have been certified to meet the requirements of ISO 14001 since 2005. In 2019, the INL contractor became the first DOE national laboratory to be certified by the Nuclear Quality Assurance Certification Program. Many elements of the Nuclear Quality Assurance-1 align with and complement the ISO 14001:2015 standard.

INL and ICP contractors have established EMSs for their respective operations and were last certified to the ISO 14001:2015 standard in 2020. Recertification of the EMS is required every three years. INL and ICP contractors will undergo a recertification audit in 2023 to the current standard. The EMS is audited annually to verify that it is operating as intended and in conformance with ISO 14001:2015 standards. INL and ICP contractors were both audited in 2022 by an external, accredited auditor and were recommended for continued certification to the ISO 14001:2015 standard. Results from the INL contractor audit showed no nonconformities, four management system strengths, and no opportunities for improvement. Results from the ICP audit showed no nonconformities and four management system strengths.

3.1 Environmental Management System Structure

The INL and ICP contractors' EMSs incorporate a Plan-Do-Check-Act approach to provide a framework under which the environmental, safety, and health programs are managed.

- Plan – Defines work scope, identifies environmental aspects, analyzes hazards, and develops hold points and mitigations
- Do – Implements defined controls and performs the work scope
- Check – Evaluates performance, management reviews, and contractor's assurance practices
- Act – Incorporates corrective actions, improvements, and lessons learned into practices.

This approach is interactive and iterative through the various work activities and functions, including policies, programs, and processes. The approach is also an integral part of the overall management of the Site's environmental compliance and performance. The main focuses of this cycle are on (1) environmental policy, (2) planning, (3) implementation and operation, (4) checking and corrective action, and (5) management review.

3.2 Environmental Policy

INL and ICP contractors state their commitments to the environment through an overarching policy that is displayed to employees. The policy commits specifically to do the following:

- Environmental protection
- Environmental compliance
- Pollution prevention
- Continual improvement.

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

3.3 Plan

3.3.1 Environmental Aspects

INL and ICP contractors have evaluated their activities, products, and services to identify the environmental aspects of its work activities that could affect the environment or the public or result in noncompliance with regulatory requirements. INL and ICP contractors perform these evaluations against all applicable federal and state regulations, state permits, and local laws. These regulations and permits are the foundation for environmental standard operating procedures and implementing documents. INL and ICP 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 environmental aspects as necessary. Environmental aspects are listed below:

Air Emissions. Air emissions applies to 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. INL and ICP 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 risk of radiation. 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*.** Chemical use and storage apply to activities that purchase, store, or use laboratory or industrial chemicals, pesticides, or fertilizers. INL and ICP contractors have processes in place to maintain adequate inventory of appropriate emergency response equipment and to report inventories and releases.

Contaminated Sites Disturbance. Contaminated site disturbance applies to activities in Comprehensive Environmental Response, Compensation, and Liability Act areas of contamination or Resource Conservation and Recovery Act corrective action sites. INL and ICP contractors have processes to properly identify contaminated sites.

Discharging to Surface, Storm, or Groundwater. Discharging to surface water, storm water, or groundwater applies to activities that have the potential to contaminate U.S. groundwater or water. INL and ICP contractors have spill prevention and response plans in place for areas that have the potential to contaminate U.S. groundwater or water.

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

Disturbing Cultural Resources. Cultural resource disturbance applies to 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 also applies to the protection of sensitive cultural or biological resources from disturbance. The potential for adverse effects also applies to modifying or demolishing historical buildings or structures that are 50 years old or older. 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. Regulated, hazardous, or radioactive material and waste packaging and transportation applies to activities that generate, store, treat, or dispose of hazardous, radioactive, or industrial waste. INL and ICP contractors have a waste management program that integrates and dispositions containerized hazardous, radioactive, or industrial waste and gives guidance on how to minimize the amount of regulated waste generated.

Releasing Contaminants. Releasing contaminants applies to activities that may release potentially hazardous contaminants into water, soil, or other noncontaminated or previously contaminated locations. All INL and ICP contractors' employees are trained to report any release to either their Program Environmental Lead or to the Spill Notification Team. Releases are tracked to verify that they are cleaned up properly. Planned operations and research with the potential to release contaminants are evaluated to mitigate any significant environmental impacts.

***Polychlorinated biphenyls (PCB) Contamination*.** PCB contamination applies to activities that use PCB-contaminated equipment or store and dispose of PCB-contaminated waste. INL and ICP 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*.** Interaction with wildlife/habitat activities includes the potential to disturb or affect wildlife or their habitat or activities involving revegetation and weed control. INL and ICP contractors have processes in place to ensure that 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 revegetation of disturbed sites.

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

3.4 Do (Implementation and Operations)

3.4.1 Structure and Responsibility

The organizational structures INL and ICP contractors have in place establish 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 communicate environmental regulatory requirements and required document submittals to the U.S. Environmental Protection Agency, the Idaho Department of Environmental Quality (DEQ), and other stakeholders. The technical points of contact work with the projects, researchers, and facilities to ensure the requirements are implemented.

3.4.2 Competence, Training, and Awareness

INL and ICP contractor training directorates conduct training analysis and designs and develop and evaluate environmental training. Environmental training gives personnel the opportunity to gain 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 awareness of environmental protection practices and pollution and prevention/waste minimization opportunities
- Take action in an emergency.

3.4.3 Communication

INL and ICP 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. Examples include the Media and Community Relations Program and the Strategic Initiatives Program, which distribute information to the public through public briefings, workshops, personal contacts, news releases, media tours, public tours, and news conferences. The programs also coordinate tours of INL 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 evaluate each work activity at INL to determine the level of environmental review needed. Environmental personnel also apply administrative and engineering controls. Administrative controls include procedures and best management practices. Engineering controls include using protective equipment and barriers to minimize or avoid environmental impact.

3.4.5 Document and Record Control

Environmental documents are prepared, reviewed, revised, and issued per INL and ICP contractors' standards and procedures. INL's document control system maintains the current version of documents and makes legible and dated copies available to employees.

3.5 Check

INL and ICP contractors internally monitor compliance with environmental laws and regulations through the Assurance Portfolio process in the Contractor Assurance System. INL and ICP 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. Examples of contractor assurance activities include monitoring progress toward environmental objectives for each organization and an internal assessment of the EMS against the ISO 14001:2015 standard. Contractor assurance activities in the environmental organization are documented in a management review.

Various regulators also perform external assessments. Idaho DEQ conducts several inspections annually to verify that INL is complying with state permits. The U.S. Environmental Protection Agency 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 results of the annual external agency audits and inspections of INL’s Environmental Program.

Annually, INL and ICP contractors perform a surveillance audit as required by the ISO 14001 standard. Additionally, every three years, INL and ICP contractors are audited for recertification to the ISO 14001 standard. A qualified party outside the control or scope of the EMS must perform the formal recertification of the EMS audit. INL and ICP contractors have been certified to the ISO 14001 standard since 2005.

3.6 Act

INL and ICP contractors establish, implement, and maintain an issues management program in accordance with an internal procedure for contractor assurance. It 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. Throughout all operations, environmental concerns, safety, and emergency preparedness issues are documented and submitted for management review.

INL and ICP contractors’ management review of EMS occurs through a process that includes weekly, monthly, quarterly, and annual meetings with committees and councils. Management review identifies issues that carry the largest environmental risks and provides mitigations and hold points. Through the Contractor Assurance System, EMS performance trends, audit findings, objectives and targets, improvements, and risks are documented in a management review 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 and recommends actions to continually improve environmental performance.

3.7 INL Site Resiliency

Resilience includes the ability to withstand and recover from deliberate attacks, accidents, or naturally occurring threats or incidents. Energy resiliency is the ability to prepare, prevent, and recover from energy and water disruptions that impact mission assurance on federal installations. This means providing reliable power under routine and off-normal conditions, including those caused by extreme weather events. Adaptation refers to actions taken to reduce risks from changed climate conditions and to prepare for expected future changes.

As outlined in Executive Order 14008, “Tackling the Climate Crisis at Home and Abroad,” the DOE Climate Adaptation and Resilience Plan issued in August of 2021 and the Climate Adaptation Policy Statement build upon prior DOE actions that were taken to bolster adaptation and increase the resilience of DOE facilities and operations. INL and ICP contractors completed the studies for the Climate Vulnerability Assessment and Resilience Plan (VARP) (INL/RPT-22-68812) (CCN 329748) in 2022 as a tool for decision makers to establish resilient priorities across INL and associated communities.

3.7.1 Performance Status

All sustainable activities support energy resiliency and, by default, make the INL Site a more resilient institution. Sustainable activities include the following:

- Replace permanent closure of an aged underground diesel storage tank, thereby increasing environmental protection and lessening the environmental risks of maintaining underground storage tanks. This is an interim step as INL moves toward net-zero emissions.
- Add sustainable acquisition clauses in electronics acquisition blanket purchase orders. As noted in the INL Green Purchaser award, using Electronic Product Environmental Assessment Tool (EPEAT) products reduces energy use, thus helping to reduce electric load and demand.
- Ensure procurement requirements lend preference to local suppliers and manufacturers, thereby shortening the supply chain and reducing the chances of delivery disruptors.
- Complete the annual update of operational procedures, engineering documents and processes guidelines to address sustainability, emergency planning, and operational resiliency.
- Complete energy and water-reduction projects, resulting in lower energy use and load demands on the servicing utility.
- Evaluate and consider alternative energy solutions ranging in scope from microgrid renewable generation to potential small modular reactor projects capable of providing local clean alternative energy.
- INL contractor continues developing net-zero carbon strategies and reporting.

Ecosystem resiliency is also an integral component of sustainability. Because much of the INL Site is managed as a native sagebrush steppe ecosystem, it is vulnerable to the effects of climate change. Proactive land stewardship practices can mitigate the effects of climate change and preserve natural ecosystem services such as water balance, nutrient cycling, wildlife habitat availability, and carbon sequestration. A brief list of activities INL undertook that support ecosystem sustainability are included here, but additional information can be found in Chapter 9:

- Continued to implement conservation planning documents for sage-grouse, bats, migratory birds, and their habitats
- Managed the Sagebrush Steppe Ecosystem Reserve according to the Environmental Assessment and Management Plan
- Restored sagebrush to several hundred acres where it had been lost to wildland fire and continued to monitor natural vegetation recovery according to current fire recovery plans
- Stabilized disturbed soils using revegetation of native species, where appropriate
- Controlled noxious weeds to limit the risk of spreading and maintained the integrity of native plant communities
- Continued monitoring the abundance and distribution of vegetation and several wildlife taxa across the INL Site
- Facilitated ongoing ecological research led by university collaborators through the National Environmental Research Park.

Comprehensive emergency response procedures are in place that cover all INL Site facilities:

- The INL contractor procedures include PLN-114, "Idaho National Laboratory (INL) Emergency Plan/Resource Conservation and Recovery Act (RCRA) Contingency Plan," which addresses the elements of—and is the primary component in—defining and directing the INL Emergency Management Program. The plan implements DOE policy and requirements for an EMS and an RCRA contingency plan specified in INL Requirements Document 16100, "Emergency Management System," which includes citations to DOE O 151.1D, "Comprehensive Emergency Management System," and other DOE requirements. The plan was updated in Fiscal Year (FY) 2022.

- The ICP contractor procedures include PLN-2012, "ICP Emergency Plan/RCRA Contingency Plan," and the emergency response elements that are required in DOE O 151.1D, "Comprehensive Emergency Management System," for the Idaho Nuclear Technology and Engineering Center (INTEC), the Radioactive Waste Management Complex, the Advanced Mixed Waste Treatment Project, Accelerated Retrieval Project, and the ICP contractor-operated buildings in Idaho Falls, Idaho.

Several INL Emergency Management procedures, including PLN-4267, "INL Continuity of Operations Plan" were updated to better prepare the INL Site for naturally occurring phenomenon. INL's emergency plans and emergency plan implementing procedures (EPIs) are reviewed at least annually and revised if necessary. The plans and EPIs may be revised based on the following factors:

- Changes in emergency planning or company operations, policy, concept of operations, procedures, organization and staffing, and facility operations or mission
- Direction of the DOE-ID Emergency Management Program administrator
- Failure of emergency plan implementing procedures during drills, exercises, and real events
- Results of audits, evaluations, appraisals, and self-assessments
- New facility information.

3.7.2 Plans and Projected Performance

The concept of resiliency is evolving in real time. In this season of change, all built environments will require careful reconsideration, and it will fall to the facility management to promote a building culture that stands on the pillars of safety, quality, and efficiency.

INL and ICP contractors will be guided by science to build resilience into DOE-ID-managed lands, facilities, and equipment. A general framework used in resiliency planning includes identifying exposure, translating that exposure into potential impacts, prioritizing risk, devising solutions, and securing funding. INL and ICP contractors will work with internal and external stakeholders to address threats to missions and programs.

Both INL and ICP contractors completed and submitted a VARP to the DOE Sustainability Dashboard for the facilities within their respective stewardships. The VARP enables INL and ICP to identify, prepare for, and meet the challenges posed by climate change, and will build upon other existing DOE risk assessments processes.

In FY 2022, DOE sites were required to complete a Climate Change VARP. Both INL and ICP contractors completed and submitted a VARP to the DOE Sustainability Dashboard for the facilities within their respective stewardships. The VARP is both a plan and a process. It is a plan that lays out climate change vulnerabilities of specific facilities and systems, and it is the process of managing climate change-related risks to DOE's assets and operations. Therefore, it begins the implementation of the five priority adaptation actions found in the VARP: (1) assess vulnerabilities and implement resilience solutions; (2) enhance climate adaptation and mitigation co-benefits; (3) institutionalize climate adaptation and resilience across INL policies, directives, and processes; (4) provide climate adaptation tools, technical support, and climate science information; and (5) advance deployment of emerging climate technologies.

The INL contractor VARP identified 11 categories of resilient solutions to be tracked for implementation:

- Upgrade or replace older, inefficient heating, ventilation, and air conditioning systems
- Upgrade site drainage plan and systems
- Harden energy supply and infrastructure, including modular reactor installation, electric distribution and system upgrades, and install a second point of interconnect to the utility
- Harden/stabilize road infrastructure.
- Enhance fire-safe protective design (i.e., enhance firebreaks around structures, such as parking lots or landscaping)

- Fortify critical infrastructure and supply chains (i.e., develop a next generation Continuity of Operations Plan, identify vendors of critical supplies within a 500-mile radius)
- Install additional backup power for vulnerable critical buildings and operations
- Support the study, development, and installation of microgrid infrastructure systems.
- Update existing underperforming infrastructure and implement adaptable infrastructure strategies (upgrading building envelope, installing efficient lighting and controls, and other energy and water efficiency measures).
- Improve human capital systems that contribute to increasing human resilience
- Implement processes that allow for a healthy and robust ecosystem that sustains sagebrush-dependent species.

The IEC contractor VARP identified seven categories of resilient solutions to be tracked for implementation:

- Dust damage and heat exposure prevention through heating, ventilation, and air conditioning updates and maintenance
- Weatherization and hardening of infrastructure
- Worker education and on mitigating risks around outdoor work
- Partnership with INL to limit the spread and damage from wildfires
- Flood mitigation through local stormwater evaluation, maintenance, and potential landscaping
- Establishment of additional monitoring wells
- Additional backup energy generation.

The VARP will be improved and updated continuously to account for changing climate conditions and new strategies to mitigate climate risks. Resilience solutions proposed in the VARP will be tracked on DOE's Sustainability Dashboard, and progress on those solutions will be reported at least annually. As specified in the Vulnerability Assessment and Resilience Planning Guidance, VARPs will be revised at least every four years to incorporate new information and data from the latest National Climate Assessment.

INL contractor continues the process of incorporating resilient design into new and existing buildings. Engineering specification documents were updated to reflect current federal energy efficiency requirements and an updated *INL High Performance and Sustainable Building* guidebook will be published early in FY 2024.

Highly energy-efficient lighting, roofing, and automation systems continue to be installed in new buildings and during retrofit activities. The result is not just an increase in the resilience of the building but of the surrounding community as well because it decreases the demand for available resources and infrastructure.

Proactive land stewardship is an important component of supporting continued mission-critical activities and future development with minimal disruption. INL's Natural Resources group continues to monitor the ecological condition of wildlife and vegetation resources across the INL Site, which includes assessing current resource conditions and the effects of stressors like climate change on the ecosystem. While the region is adapted to current climate trends and events, increased frequency and severity of hazards can alter the integrity of the ecosystem without proactive land stewardship to implement adaptive management solutions.

The resiliency team across the Natural Resources group identified the following recommended resilience solutions:

- Adaptive landscape management using ecological monitoring data
- Inventory sensitives species vulnerable to climate change
- Update/Develop biological/ecological resource planning documents
- Reduce wildland fire risk and enhance natural resource recovery strategies
- Update restoration/revegetation guidance documents
- Develop and implement integrated pest management system

- Manage wildlife/human interactions and reduce conflicts
- Engage agency stakeholders for developing best management practices.

INL is well-positioned to address the need for organizational resilience elements in future plans. With leadership commitment, INL will continue to ensure that appropriate events and risk elements are considered as part of INL Site programs and planning activities. Policies and procedures will be evaluated to determine whether they should be modified to consider organizational risks. Emergency response, workplace safety and health, and the most updated scientific knowledge will continue to be incorporated into all facets of organizational resilience.

3.8 Sustainability Goals

In 2021, Executive Order 14057, "Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability," was issued. The executive order establishes sustainable environmental stewardship goals that advance sustainable practices. Specifically, it directs agencies to reduce emissions across federal operations, invest in American clean energy industries and manufacturing, and create clean, healthy, and resilient communities. The president's executive order directs the federal government to use its scale and procurement power to achieve five goals:

1. By 2030, 100% carbon pollution-free electricity, at least half of which will be locally supplied clean energy to meet 24/7 demand.
2. By 2035, 100% zero-emission vehicle acquisitions, including 100% zero-emission light-duty vehicle acquisitions by 2027.
3. Net-zero emissions from federal procurement no later than 2050, including a "Buy Clean" policy to promote the use of construction materials with lower embodied emissions.
4. A net-zero emissions building portfolio by 2045, including a 50% emissions reduction by 2032.
5. Net-zero emissions from overall federal operations by 2050, including a 65% emissions reduction by 2030.

The evolving priorities for sustainability are incorporated into the annual update of the *Idaho National Laboratory Site Sustainability Plan* (DOE-ID 2022) at the beginning of each new fiscal year. It describes the overall sustainability strategy for INL and ICP contractors for the current fiscal year and includes a performance status in the areas of greenhouse gas emission reduction, energy management, water management, waste diversion, fleet management, clean and renewable energy, green buildings, and other areas for the completed fiscal year. Each sustainability goal, INL and ICP contractors' performance status, and planned actions are detailed in Table 3-1.

3.9 Environmental Operating Objectives and Targets

INL establishes objectives based on the environmental policy, legal and other requirements, environmental aspects, INL's Strategic Plan, and the perspectives of its stakeholders. The INL contractor plans, implements, monitors, and reports quarterly on these objectives and targets in management review reports and in 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 95% of the EMS objectives and targets in FY 2022. Each year, the ICP contractor identifies environmental objectives and targets to be met during the FY. During FY 2022, the ICP contractor had 10 objectives implemented by 10 targets; 90% of the EMS Objectives and Targets were completed.

3.10 Accomplishments, Awards, and Recognition

The INL and ICP contractors were both audited in 2022 by an external, accredited auditor and achieved recertification for conformance to the ISO 14001:2015 standard. The results from the INL contractor audit found no nonconformities, four management system strengths, and no opportunities for improvement. Results from the ICP audit showed no nonconformities and four management system strengths.

INL and ICP contractors' EMS performance data was submitted to DOE's EMS Database Application and received a "green" for the EMS performance metrics listed below:

- Environmental aspects were identified or reevaluated using an established procedure and were updated as appropriate.
- Measurable environmental goals, objectives, and targets were identified, reviewed, and updated as appropriate.
- Operational controls were documented to address how significant environmental aspects that were consistent with objectives and targets were fully implemented.
- Environmental training procedures were established to ensure that training requirements for individual competence and responsibility were identified, conducted, monitored, tracked, recorded, and refreshed, as appropriate, to maintain competence.
- EMS requirements were included in all appropriate contracts. Contractors fulfilled defined roles and specified responsibilities.
- EMS audit/evaluation procedures were established, audits were conducted, and nonconformities were addressed or corrected. Senior leadership review of the EMS was conducted, and management responded to recommendations for continual improvement.
- Using an established procedure(s), previously identified activities, products, and services (and their associated environmental aspects) and all newly identified activities, products, and services (and their associated environmental aspects) were evaluated for significance within the past fiscal year. In addition, the results of the analysis were documented, and any necessary changes were made or are scheduled to be made. Documented, measurable environmental objectives are in place at relevant functions and levels, and by the end of FY 2022, at least 80% of the objectives had either already been accomplished or scheduled to be met.
- Within the past fiscal year, operational controls associated with identified significant environmental aspects are established, implemented, controlled, and maintained in accordance with operating criteria.
- Within the past fiscal year, an environmental compliance audit program was in place, audits were completed according to schedule, audit findings were documented, and corrective and preventative actions were defined/documented and on schedule for completion by an established date.

INL was named one of 76 winners nationwide for the 2022 EPEAT Purchaser Awards. The EPEAT awards recognize leadership in the procurement of sustainable electronics. INL has earned the prestigious annual award since 2015 and earned the 5-star award level two years in a row.

Now in the award program's eighth year, the Green Electronics Council—the organization that manages the EPEAT ecolabel—recognized INL for contributing to DOE reaching a savings of $10.7 million from their purchases of IT products. 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.

The council honored 2022 EPEAT winners on July 28 at a virtual ceremony. Award winners earned one star for each product category in which they purchased EPEAT registered products, and INL was recognized as a 4-star winner.

Table 3-1. Summary table of DOE sustainability goals (DOE-ID 2023).

DOE GOAL	CURRENT PERFORMANCE STATUS	PLANNED ACTIONS AND CONTRIBUTIONS	OVERALL RISK OF NON-ATTAINMENT
ENERGY MANAGEMENT			
Reduce energy-use intensity (Btu per gross square foot) in goal-subject buildings	Energy-use intensity was 146,033.7 Btu/ft² for FY 2022, which represents a decrease of 5.4% from FY 2015 and 2.9% from FY 2021.	Twenty light-emitting diode lighting and other projects are planned for FY 2023, providing an estimated $72K (1,160 megawatt hours [MWh]) in energy savings at total a cost of $772K. Investigate feasibility of a large energy-reduction performance contract project from the compiled results of the energy and water audits.	**Medium/Financial** Low cost of energy and water make project payback difficult to justify on a lifecycle basis.
Energy Independence and Security Act Section 432 continuous (four-year cycle) energy and water evaluations	Energy and water evaluations were completed in 16 covered buildings in FY 2022. These audits represent 15% of the current covered buildings for the second year of the third four-year audit cycle (June 1, 2020, through May 31, 2024). INL contractor is on track with its planned and scheduled audits.	Complete annual energy audits for 25% of INL's 105 covered buildings for each year of the third four-year audit cycle (June 1, 2020, through May 31, 2024). INL plans to audit 23 buildings in FY 2023. ICP plans to audit 35 buildings in FY 2023, ensuring all ICP covered buildings will be evaluated.	**Low/None** INL contractor's building audit program is fully established.
Meter individual buildings for electricity, natural gas, steam, and water, where cost-effective and appropriate	Idaho Falls: 42 buildings metered for electricity with either standard or advanced metering. Twenty-five buildings use and are metered for natural gas with standard meters. Twenty-one buildings are metered for water with standard meters. Research and Industrial Complexes: 87 buildings with electric meters, 65 of which have advanced meters.	Two new INL buildings planned for completion in FY 2023 will have advanced metering. Advanced electric and natural gas meters are planned in INL Idaho Falls buildings (approximately 44 meters) to connect to SkySpark energy management system. This activity is planned for FY 2023 and FY 2024.	**Low/None** New INL buildings are specified for advanced metering, and selected appropriate buildings are specified for sub-metering.

Table 3-1. continued.

DOE GOAL	CURRENT PERFORMANCE STATUS	PLANNED ACTIONS AND CONTRIBUTIONS	OVERALL RISK OF NON-ATTAINMENT
Reduce potable water-use intensity (gal per gross square foot)	Water intensity was 119.7 gal/ft² in FY 2022, a decrease of 31.2% from FY 2007 and 14.6% from FY 2021. Updated water balance and identified high water use intensity processes and buildings.	Prepare and implement a more detailed water balance evaluation. Implement audit-identified low and moderate cost water conservation measures, including high-efficiency water technologies.	**Medium** Water usage is highly dependent upon the varying process water consumption at the Advanced Test Reactor Complex and INTEC.
WATER MANAGEMENT			
Reduce non-potable freshwater consumption (gal) for industrial, landscaping, and agricultural	Not applicable. Water obtained from the Snake River Plain Aquifer and is considered potable.	Industrial, landscape, and agricultural (water is not applicable).	**Low/None** Industrial, landscape, and agricultural water is not used.
WASTE MANAGEMENT			
Reduce nonhazardous solid waste sent to treatment and disposal facilities	Generated 2,748,832.5 lbs (1,246.9 metric tons [MT]) of nonhazardous municipal solid waste in FY 2022. In FY 2021, 2,695,757.0 lbs (1,222.8 MT) was generated, resulting in an increase of municipal solid waste generated of 2.0% year-over-year (YOY). Diverted 53.8% of nonhazardous solid waste in FY 2022 by recycling 1,478,831.6 lbs (670.8 MT) of materials.	Continue to educate personnel emphasizing the priority of waste reduction from the previous year. Continue to evaluate potential outlets and expansion of recyclable waste. Explore glass recycling partnership with the city of Idaho Falls. Investigate and develop a regional composting facility based on West Yellowstone pilot project.	**Medium** Fluctuations in building use, including classified spaces, employee engagement, and market forces, greatly affect this goal.
Reduce construction and demolition materials and debris sent to treatment and disposal facilities	Generated 11,794.4 MT of construction and demolition (C&D) waste in FY 2022 compared to 23,184.3 MT in FY 2021, resulting in a decrease of 49.13% of C&D waste generated YOY. Diverted 28.1% (7,304,071.1 lbs or 3,313.1 MT) of its C&D waste in FY 2022.	Continue employee education and contract language inclusion and incorporate additional materials into current C&D waste diversion processes. Work with regional industrial recycle entities and develop a strategy to recycle two construction waste streams: concrete and gypsum.	**Medium** Construction continues to increase while markets accepting construction debris are limited. The cost of transporting to an acceptable recycler is a major factor in the decision process.

Table 3-1. continued.

DOE GOAL	CURRENT PERFORMANCE STATUS	PLANNED ACTIONS AND CONTRIBUTIONS	OVERALL RISK OF NON-ATTAINMENT
FLEET MANAGEMENT			
Reduce petroleum consumption	Fuel usage data indicate 725,392 gasoline-gal equivalents of petroleum-based fuels was used in FY 2022, which is a 22.7% reduction from FY 2005 and a 9.4% reduction from FY 2021. This data was unavailable at time of submission due to the Federal Automotive Statistical Tool reporting schedule being later than DOE Dashboard reporting schedule. INL resumed its use of R99 renewable diesel as a sustainable alternative to aid INL in reaching its zero-emission goals.	The INL contractor implements its Net Zero Plan, a greater emphasis will be placed on acquiring electric buses and heavy equipment along with electrifying its light-duty fleet and installing supporting charging stations. Hydrogen-powered vehicles are also being considered. Optimize fleet composition by reducing vehicle size, eliminating underused vehicles, and acquiring vehicles to match local fuel infrastructure.	**Medium** The petroleum reduction goal will be challenging due to the cost and availability of electric motor coaches and heavy equipment.
Increase alternative fuel consumption	Data indicates 70,426 gasoline-gal equivalents of alternative fuels were used in FY 2022, which is a 7.9% reduction from FY 2005 and a 97.5% increase from FY 2021. INL contractor installed three electric vehicles (EVs) charging stations for a total of 23 and installed one electric bus charging station.	Determine less-costly sources of R99 for the interim while electric buses are being evaluated and procured.	**Medium** The alternative fuel increase goal will be challenging due to cost and availability of EVs and the excessive cost of renewable diesel.
Acquire alternative fuel and EVs	Acquired 29 new light-duty vehicles in FY 2022, five of which were alternative fuel vehicles (AFVs) or EVs.	Identify the next group of petroleum-fueled vehicles for replacement with AFVs or EVs and ensure that all existing AFVs are replaced EVs when available. Work with General Services Administration to achieve 75% or greater AFV and EV light-duty acquisitions.	**Medium** This goal has historically been met but it may be difficult to reach in the future due to the availability of appropriate EV light-duty vehicle fuel types supplied by General Services Administration.

Table 3-1. continued.

DOE GOAL	CURRENT PERFORMANCE STATUS	PLANNED ACTIONS AND CONTRIBUTIONS	OVERALL RISK OF NON-ATTAINMENT
CLEAN AND RENEWABLE ENERGY			
Increase consumption of clean and renewable electric energy	Procured 16,488 MWh of renewable energy certificates from Idaho Falls Power at a total cost of $90,684. This purchase of renewable energy certificates, in addition to the 78.1 MWh of onsite generation (e.g., microgrid and, small photovoltaic) plus bonuses, totals 17,274 MWh (7.9%) of renewable energy for FY 2022.	The INL contractor implements its recently developed Net Zero Plan, a greater emphasis will be placed on the internal applications of renewable energy generation to meet this goal. Incremental increases of purchased renewable energy certificates and onsite generation will continue to be made to meet a minimum of the 7.5% goal each YOY.	**Low** Established process for procuring renewable energy certificates.
Increase consumption of clean and renewable non-electric thermal energy	Two buildings with solar-transpired walls to provide make-up air preheating.	Investigate the additional use of solar water heating, make-up air preheating, or ground source heat pumps in select locations.	**Medium** Due to the low cost of electric energy, it is challenging to justify the installation of thermal renewable energy.
SUSTAINABLE BUILDINGS			
Increase the number of owned buildings that are compliant with the Guiding Principles for Sustainable Buildings	At the end of FY 2022, 26 DOE-owned buildings were compliant with the Guiding Principles for Sustainable Federal Buildings (Guiding Principles), which represents 40.63% of applicable buildings. This includes 21 buildings with less than 25,000 gross square feet. Completed update to INL High Performance and Sustainable Building Strategy.	Document Guiding Principles compliance on two new construction buildings in FY 2023 and four additional new construction buildings by the end of FY 2024. Implement a program to reassess buildings on a four-year cycle per the 2020 Guiding Principles.	**Low** The 15% goal was achieved.

Table 3-1. continued.

DOE GOAL	CURRENT PERFORMANCE STATUS	PLANNED ACTIONS AND CONTRIBUTIONS	OVERALL RISK OF NON-ATTAINMENT
ACQUISITIONS AND PROCUREMENT			
Promote sustainable acquisition and procurement to the maximum extent practicable, ensuring all sustainability clauses are included as appropriate	In FY 2022, 97.8% of the contracts contained applicable clauses.	Achieve 100% compliance. Continue to incorporate improvements to the Sustainable Acquisition Program, including procedures, policies, and enhanced work processes that increase visibility, availability, and use of sustainable products.	**Low** The goal continues to be achieved.
EFFICIENCY AND CONSERVATION MEASURE INVESTMENTS			
Implement lifecycle cost-effective efficiency and conservation measures with appropriated funds or performance contracts	Fifteen energy-reduction projects were completed in FY 2022, providing over $45K in energy cost-savings. No additional Energy Savings Performance Contract (ESPC) projects were developed in FY 2021.	Light-emitting diode lighting projects are planned for 20 buildings. Continue to evaluate the cost effectiveness of ESPC options.	**Low** While there are no current plans for an additional ESPC project, the INL Site does have established plans and goals for projects awarded and targeted in FY 2023.
ELECTRONIC STEWARDSHIP AND DATA CENTERS			
Electronics stewardship from acquisition and operations, to end of life	In FY 2022, 100% of electronic devices were reused or recycled; however, only 96.4% were recycled with a certified recycler.	Unless federal requirements dictate otherwise, 100% of electronics are reused or recycled. Continue to partner with Information Management and Property Disposal Services to improve electronics end-of-life disposition.	**Low** This goal continues to be achieved.
Increase energy and water efficiency in high-performance computing and data centers	Continued consolidating server infrastructure in the old high-performance computing data center by virtualizing physical machines and taking advantage of cloud and container hosting options.	Install and monitor advanced energy meters in all data centers and accurately quantify power usage effectiveness.	**Medium** Low energy costs and long construction times may prohibit major investments in updated resiliency measures.

Table 3-1. continued.

DOE GOAL	CURRENT PERFORMANCE STATUS	PLANNED ACTIONS AND CONTRIBUTIONS	OVERALL RISK OF NON-ATTAINMENT
ORGANIZATIONAL RESILIENCE			
Implement climate adaptation and resilience measures	Completed a comprehensive VARP initiative. INL contractor identified 11 categories of resilient solutions categories and ICP contractor identified 7. INL contractor emergency plans and EPIs were reviewed and revised, as necessary. Operating policies and procedures were evaluated to determine whether they should be modified to consider organizational risks.	Initiate detailed analysis (e.g., cost estimates and schedules) for projects identified in the VARP process. Emergency response, workplace safety and health, and updated scientific knowledge will be incorporated into all facets of organizational resilience, procedures, and protocols. Pursue lifecycle cost-effective energy resilience solutions that provide the most reliable energy to critical mission operations.	**Low to Medium** Investment upgrades in existing buildings are a long-term process. New buildings are being built to include resiliency measures.
MULTIPLE CATEGORIES			
Reduce Scopes 1 and 2 greenhouse gas emissions	Scopes 1 and 2 emissions were 77,267.1 MT of carbon dioxide equivalent (MT CO_2e) compared to 89,391.4 MT CO_2e in FY 2021, for a YOY reduction of 13.6% and a 45.2% reduction from the FY 2008 baseline. Emissions decreased due to the reduced Emissions and Generation Resource Integrated Database (eGRID) emission factors and a slight decrease in facility energy use.	Refine a targeted list of high-value, low-cost energy conservation measure projects with a focus on those reducing total emissions 45% by the end of FY 2024. Reduce or minimize the quantity of toxic and hazardous chemicals acquired, used, or disposed that will assist INL in pursuing agency greenhouse gas reduction targets.	**Medium** INL contractor has committed to be carbon net-zero by the end of FY 2031. Significant progress was made toward exceeding the overall goal, but YOY Scopes 1 and 2 greenhouse gases emissions may continue to vary.
Reduce Scope 3 greenhouse gas emissions	FY 2022 Scope 3 emissions were 20,366.8 MT CO_2e compared to 15,586.6 MT CO_2e in FY 2021, for a YOY increase of 30.7% and a 42.2% reduction from the FY 2008 baseline. The increase from previous year is due mainly to lifting of restrictions on business travel.	Continue to encourage teleworking, video conferencing, and carpooling as effective ways to reduce the amount of air and ground travel, including employee commuting. Achieve a YOY 2% annual reduction for five years for a total 10% reduction.	**Medium** Significant progress was made toward exceeding the overall goal, primarily due to ongoing telework and travel restrictions. YOY Scope 3 greenhouse gases emissions may continue to vary.

3.11 References

DOE-ID, 2022, "FY 2022 Idaho National Laboratory Site Sustainability Plan," DOE/ID-11383, Rev. 13, Idaho National Laboratory, December 2021.

DOE O 151.1D, 2019, "Comprehensive Emergency Management System," Change 1, U.S. Department of Energy, October 4, 2019.

DOE O 436.1, 2011, "Departmental Sustainability," U.S. Department of Energy, May 2, 2011.

DOE O 458.1, 2013, "Radiation Protection of the Public and the Environment," Administrative Change 4, U.S. Department of Energy.

Endangered Species Act (ESA) of 1973 (16 USC § 1531 et seq.).

Executive Order 14008, 2021, "Tackling the Climate at Home and Abroad," the U.S. White House, Office of NEPA Policy and Compliance, January 27, 2021.

Executive Order 14057, 2021 "Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability," the U.S. White House, Executive Office of President, December 8, 2021.

INL/RPT-22-68812, 2022, "Climate Vulnerability Assessment and Resilience Planning for Idaho National Laboratory," September 2022.

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

Migratory Bird Treaty Act (MBTA) of 1918, as amended (16 USC § 703 et seq.).

PLN-114, 2022, "Idaho National Laboratory (INL) Emergency Plan/Resource Conservation and Recovery Act (RCRA) Contingency Plan," Idaho National Laboratory, September 12, 2022.

PLN-2012, 2022, "ICP Emergency Plan/RCRA Contingency Plan," Rev. 64, Idaho Cleanup Project, February 21, 2022.

PLN-4267, 2021, "Idaho National Laboratory Continuity of Operations Plan," Rev. 9, Idaho National Laboratory, May 2, 2022.

American pronghorn

Chapter 4: Environmental Monitoring Programs – Air

CHAPTER 4

An estimated total of 357 Ci (1.32×10^{13} Bq) of radioactivity, primarily in the form of short-lived noble gas isotopes, was released as airborne effluents from Idaho National Laboratory (INL) Site facilities in 2022. The highest contributors to the total release were the Materials and Fuel Complex (MFC) at 73.7%, the Radioactive Waste Management Complex (RWMC) at 13.5%, the Radiological Response Training Range (RRTR) at 9.31%, and the Advanced Test Reactor (ATR) Complex at 2.78%. Other INL Site facilities contributed less than 0.67% per facility to the total. The estimated maximum potential dose to a member of the public from all INL Site air emissions (0.018 mrem/yr) is below the regulatory standard of 10 mrem/yr (see Chapter 8 for details).

The INL Site environmental surveillance programs emphasize measurements of airborne contaminants in the environment because air is the most important transport pathway from the INL Site to receptors living 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 2022.

Particulates were filtered from the air using a network of low-volume air samplers, and the filters were analyzed for gross alpha activity, gross beta activity, and specific radionuclides—primarily cesium-137, americium-241, plutonium-239/240, plutonium-238, uranium-234, uranium-238, zinc-65, and strontium-90. Results were compared to 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 trend analyses, which indicated fluctuations were observable that correlate with seasonal variations in natural radioactivity.

Specific gamma-emitting (primarily cesium-137) radionuclides were not detected by the INL contractor during 2022. Strontium-90 was detected in six quarterly composited samples during 2022. Plutonium-239/240 and americium-241 were detected in a quarterly composited samples collected during the fourth quarter. All concentrations were within historical measurements made during the past ten years (2012-2021) and well below the DCSs for these radionuclides. Plutonium-238 was not detected in any quarterly composite samples during 2022.

Airborne particulates were also collected biweekly around the perimeters of the Subsurface Disposal Area (SDA) at the RWMC and the Idaho Comprehensive Environmental Response, Compensation, and Liability Act Disposal Facility at the Idaho Nuclear Technology and Engineering Center (INTEC). Gross alpha and gross beta activities measured on the filters were comparable with historical results, and no new trends were identified in 2022. Americium and plutonium isotopes were detected within levels measured in previous years. The results were three to four orders below the DCS values 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 INL Site releases. All measured results were below 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 regulatory limits during an operational upset or emergency incident situation. In such an event, pathway vectors, such as air, soil, plants, animals, and groundwater, may transport these constituents to nearby populations. Figure 4-1 is a conceptual model showing potential routes of exposure for these potential releases. 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 impact to the environment over time.

This chapter presents results of radiological analyses of airborne effluents and ambient air samples collected on and off the INL Site. The results include those from the INL and the Idaho Cleanup Project (ICP) contractors. Table 4-1 summarizes 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 2021).

4.1 Organization of Air Monitoring Programs

The INL and ICP contractors document airborne radiological effluents at all INL Site facilities in an annual report 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." Section 4.2 summarizes the emissions reported in *National Emission Standards for Hazardous Air Pollutants—Calendar Year 2022 INL Report for Radionuclides* (DOE-ID 2023), 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 and ICP contractors to ensure that the INL Site remains in compliance with 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 km^2 (9,000 mi^2) that extends to Jackson, Wyoming, as observed in Figure 4-2. In 2022, the INL contractor collected approximately 2,200 air samples (including duplicate samples and blanks) for various radionuclide analyses. The INL contractor collected air moisture at eight locations and precipitation samples at four locations for tritium analysis.

The ICP contractor collects air samples primarily on the INL Site at Low-Level Waste disposal facilities subject to DOE O 435.1, "Radioactive Waste Management," and downwind of facilities subject to an U.S. Environmental Protection Agency (EPA)-approved alternative for the NESHAP air monitoring method in accordance with 40 CFR 61.93(g). In 2022, the ICP contractor collected approximately 280 air samples (including duplicate samples) for various radionuclide analyses. While the INL contractor, being the operations and maintenance contractor for the INL Site, maintains a large network of onsite and offsite receptors, the ICP contractor's monitoring network is configured to identify potential releases from specific ICP facilities.

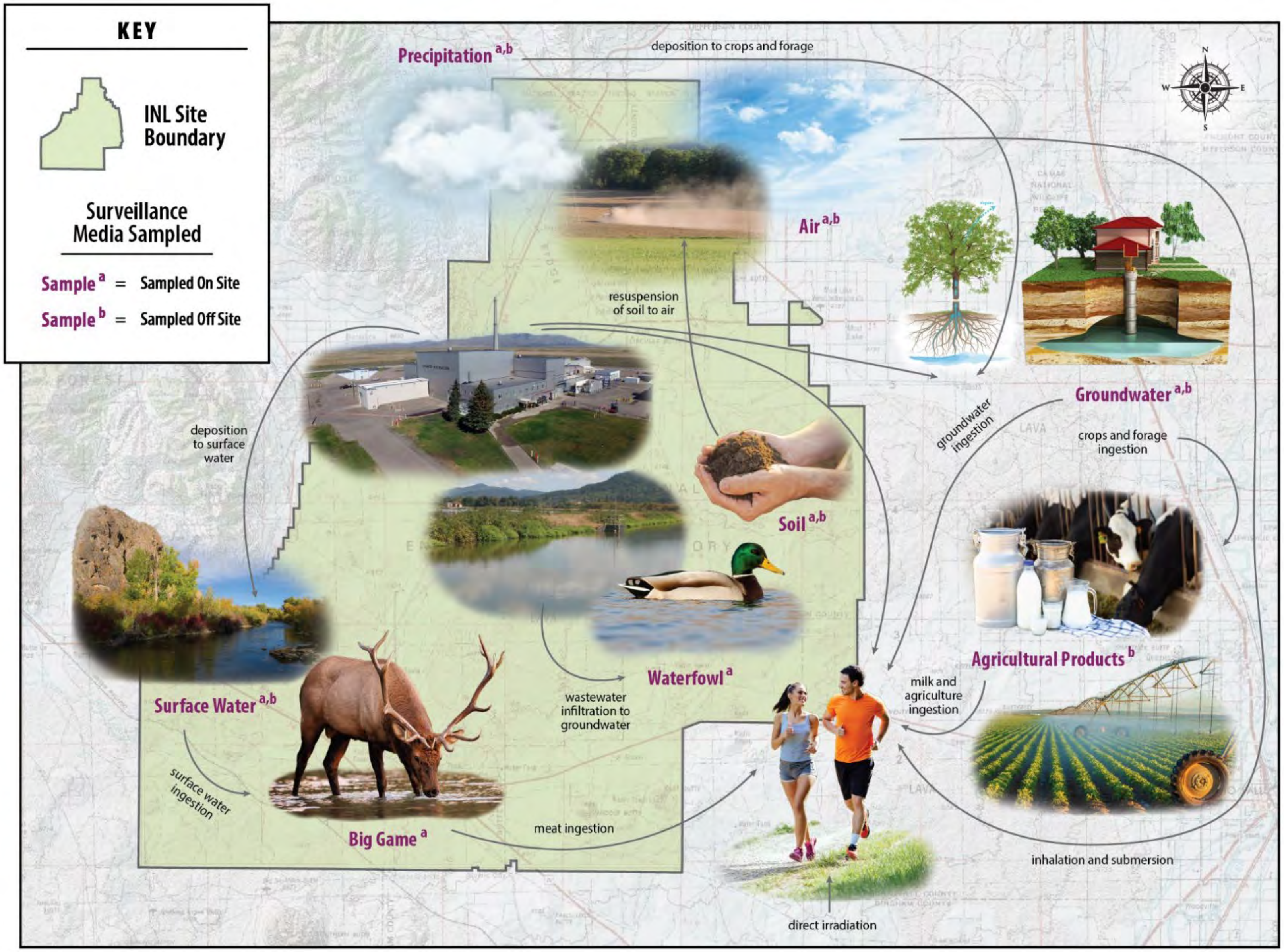


Figure 4-1. INL Site conceptual model.

Table 4-1. Radiological air monitoring activities by organization.

	AIRBORNE EFFLUENT MONITORING PROGRAMS	ENVIRONMENTAL SURVEILLANCE PROGRAMS					
AREA/FACILITY[a]	AIRBORNE EFFLUENTS[b]	LOW-VOLUME CHARCOAL CARTRIDGES (^{131}I)	LOW-VOLUME GROSS ALPHA	LOW-VOLUME GROSS BETA	SPECIFIC RADIONUCLIDES[c]	ATMOSPHERIC MOISTURE	PRECIPITATION
ICP CONTRACTOR[d]							
INTEC	•		•	•	•		
RWMC	•		•	•	•		
INL CONTRACTOR[e]							
MFC	•						
INL Site/Regional		•	•	•	•	•	•

a. ICP = Idaho Cleanup Project, INL = Idaho National Laboratory, INTEC = Idaho Nuclear Technology and Engineering Center, RWMC = Radioactive Waste Management Complex, MFC = Materials and Fuels Complex.

b. Facilities that required monitoring during 2022 for compliance with 40 CFR 61, Subpart H, "National Emissions Standards for Emissions of Radionuclides Other Than Radon from Department of Energy Facilities."

c. Gamma-emitting radionuclides are measured by the ICP contractor monthly and by the INL contractor quarterly. Cesium-137, americium-241, plutonium-239/240, plutonium-238, uranium-234, uranium-238, zinc-65 and strontium-90 are measured by the INL and ICP contractors quarterly.

d. The ICP contractor monitors waste management facilities to demonstrate compliance with DOE O 435.1, "Radioactive Waste Management." A combination of continuous monitoring and ambient air sampling are used to demonstrate compliance with 40 CFR 61, Subpart H.

e. The INL contractor monitors airborne effluents at MFC and also collects samples onsite, around, and offsite from the INL Site to demonstrate compliance with DOE O 458.1, "Radiation Protection of the Public and the Environment".

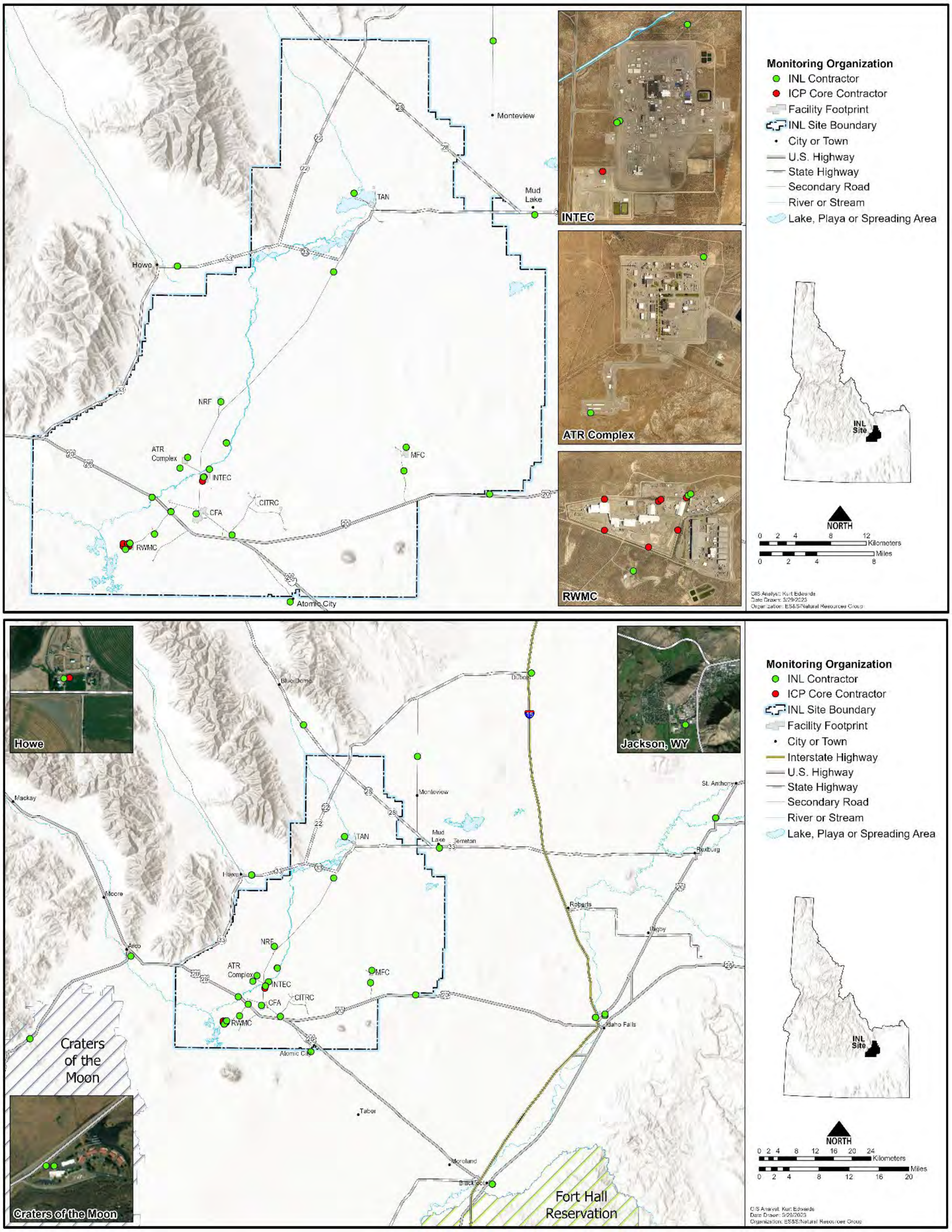


Figure 4-2. INL Site environmental surveillance radiological air sampling locations (regional [top] and onsite [bottom]).

The ICP contractor monitors air around waste management facilities to comply with DOE O 435.1, "Radioactive Waste Management." These facilities are the SDA at the RWMC and the Idaho Comprehensive Environmental Response, Compensation, and Liability Act Disposal Facility (ICDF) near the INTEC. These locations are shown in Figure 4-2. Section 4.4 discusses air sampling the ICP contractor performs in support of waste management activities. In 2022, the ICP contractor collected approximately 200 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 have historically been tabulated, summarized, and reported in several climatography reports and used by scientists to evaluate atmospheric transport and dispersion. The latest report, *Climatography of the Idaho National Laboratory*, 4th Edition (Clawson et al. 2018), was prepared by the NOAA Field Research Division (since renamed 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 (https://niwc.noaa.inl.gov/climate/INL_Climate4th_Final2.pdf). 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 *Meteorological Monitoring*, a supplement to this annual report).

4.2 Airborne Effluent Monitoring

Each regulated INL Site facility determines airborne effluent concentrations from its regulated emission sources as required under state and federal regulations. Radiological air emissions from INL Site facilities are also used to estimate the potential dose to a hypothetical maximally exposed individual (MEI), who is a member of the public (see Chapter 8 of this report). Radiological effluents and the resulting potential dose for 2022 are reported in the NESHAP Modeling Report (INL 2023) and the NESHAP Report (DOE-ID 2023a).

The NESHAP Report includes three categories of airborne emissions:

- Sources that require continuous monitoring under the NESHAP regulation are primarily the stacks at the Materials and Fuels Complex (MFC), the Advanced Mixed Waste Treatment Project, and INTEC
- Releases from all other point sources (stacks and 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 2022, an estimated 357 Ci (1.32 × 10^{13} Bq) of radioactivity was released to the atmosphere from all INL Site sources. The 2022 release is 67% lower than the estimated total of 1,076 Ci (3.98 × 10^{13} Bq) released in 2021. The reduction is primarily the result of the ATR shutdown during most of 2022 for refurbishment of the reactor core.

The following facilities were major contributors to the total emissions, as observed in Figure 4-3:

- ***MFC Emissions Sources (73.7% of total INL Site source term).*** Radiological air emissions are primarily associated with spent fuel treatment at the Fuel Conditioning Facility, waste characterization and fuel research development at the Hot Fuel Examination Facility, fuel research and development at the Fuel Manufacturing Facility, and post-irradiation examination at the Irradiated Materials Characterization Laboratory. To satisfy the requirements of 40 CFR 61 Subpart H, stack filters from the effluent streams of these four facilities are sampled and analyzed for particulate radionuclides on a regular basis because of their potential to discharge radionuclides into the air in quantities that could cause an effective dose of more than 1% of the standard. Other effluent streams with a smaller potential dose (less than 1% of the standard) such as the Transient Reactor Test Facility, are sampled and analyzed periodically to confirm the lower emissions. Gaseous and particulate radionuclides may also be released from other MFC facilities during laboratory research activities, sample analysis, waste handling and storage, and maintenance operations. While the ATR Complex is generally the greatest emissions contributor at the INL Site, the shutdown of its reactor during the core internal changeout operations resulted in reduced emissions reported from ATR. This reduction resulted in MFC being the greatest relative emissions contributor, however the actual amount in curies is still significantly lower than average ATR estimated annual emissions. While ATR emissions dropped from 827 Ci to 9.92 Ci in 2022, MFC emissions grew slightly from 188 Ci to 263 Ci from 2021 to 2022. Since overall emissions are down in 2022, the 263 Ci from MFC accounts for 73.74% of all estimated emissions.

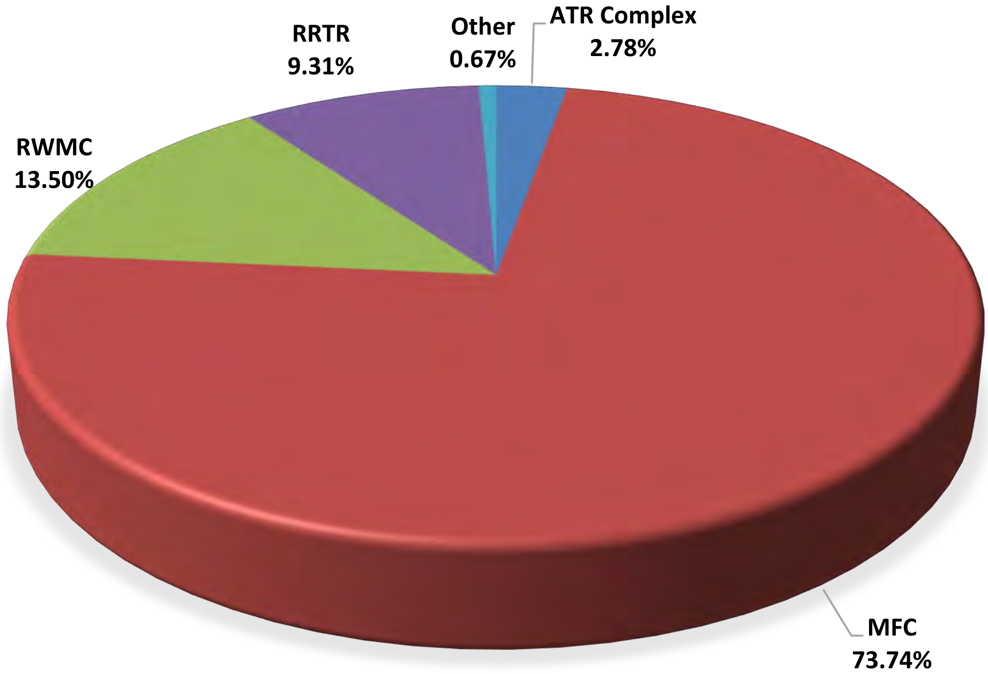


Figure 4-3. Percent contributions in Ci, by facility, to total INL Site airborne radiological releases (2022).

- ***RWMC Emissions Sources (13.5% of total INL Site source term).*** Emissions at RWMC result from various activities associated with the facility's mission to complete environmental cleanup of the area, as well as to store, characterize, and treat contact-handled transuranic waste and mixed low-level waste prior to shipment to offsite licensed disposal facilities. Various projects are being conducted to achieve these objectives: waste retrieval activities at the Accelerated Retrieval Projects (ARPs), operation of the Resource Conservation and Recovery Act permitted Sludge Repackage waste processing project, storage of waste within the Type II storage modules at Advanced Mixed Waste Treatment Project, storage and characterization of waste at the Drum Vent and Characterization facilities, storage of wastes at the Transuranic Storage Area-Retrieval Enclosure (WMF-636), and treatment of wastes at the Advanced Mixed Waste Treatment Facility (WMF-676). Data from 13 emission sources (both point and diffuse) at RWMC were reported in the 2022 NESHAP Report for Radionuclides (DOE-ID 2023), including three continuously monitored point sources. WMF-676 has two continuously monitored stacks, while WMF-636 had one continuously monitored stack, for which monitoring was ceased during 2022. Radionuclide emissions monitoring from the Comprehensive Environmental Response, Compensation, and Liability Act ARP facilities and the two Resource Conservation and Recovery Act facilities (WMF-1617 and WMF-1619) is achieved with the EPA-approved ambient air monitoring program, which has been in place since 2008. Radiological emissions at RWMC include tritium and carbon-14 associated with buried beryllium blocks at the SDA. Transuranic radionuclides releases from ARP facilities, including americium-241 (^{241}Am), plutonium-238 (^{238}Pu), plutonium-239/240 ($^{239/240}$Pu), and plutonium-241 (^{241}Pu) have declined in recent years as waste exhumation and processing activities progress to completion.
- ***RRTR Emissions Sources (9.3% of total INL Site source term).*** The north RRTR is located 1.6 km (1 mile) NNE of SMC and began operations in July 2011 to support federal agencies responsible for the nuclear forensics mission. These sites are used to train personnel, test sensors, and develop detection capabilities (both aerial and ground-based) under a variety of scenarios in which radioactive materials are used to create a radioactive field for training in activities such as contamination control, site characterization, and field sample collection activities. Previously,

emissions from RRTR were reported in combination with emissions from SMC. As described in INL/RPT-23-72759, *Update of Receptor Locations for INL NESHAP Assessments* (INL 2023b), a number of facilities that were once modeled as collocated emission sources are now modeled as separate sources, resulting in a more realistic modeling scenario. Estimated emissions from RRTR were greater in 2022 (33.2 Ci) compared to 2021 (10.6 Ci) due primarily to use of a new source (pellets containing Cu-64). Although the increase in emissions from RRTR was moderate in 2022, RRTR emissions as a percentage of total INL Site emissions increased due to the reduced emissions reported from ATR.

- ***ATR Complex Emissions Sources (2.78% of total INL Site source term).*** Radiological air emissions from the ATR Complex are primarily associated with the operation of the ATR. These emissions include noble gases, radioiodine, and other mixed fission and activation products. Other radiological air emissions are associated with sample analysis, site remediation, and research and development activities. The INL Radioanalytical Chemistry Laboratory, which has been in operation since 2011, is another emission source at the ATR Complex. Activities at the lab include inorganic, general purpose analytical chemistry, and wet chemical analysis for trace and high-level radionuclide determination. The laboratory contains high-efficiency particulate air-filtered hoods that are used for the analysis of contaminated samples. There are no sources at the ATR Complex that require continuous emissions monitoring due to the low dose contribution (see Section 8.2). On a regular basis, the ATR effluent stream is sampled and analyzed for particulate, radioiodine, and noble gas radionuclides. Effluent from the Safety and Tritium Applied Research Facility (TRA-666) is sampled and analyzed for tritium.
- ***INTEC Emissions Sources (0.37% of total INL Site source term).*** Radiological air emissions at INTEC are primarily from the operation of the ICDF landfill and ponds (located outside the fenced boundary of INTEC) and storage and containment of the Three Mile Island Unit 2 (TMI-2) core debris within the Independent Spent Fuel Storage Installation (CPP-1774), which is licensed under the U.S. Nuclear Regulatory Commission (NRC). These sources contribute gaseous radionuclides, including tritium, iodine-129, and krypton-85, with contributions of particulate radionuclides cesium-137 (^{137}Cs) and ^{90}Sr from ICDF. INTEC has one stack continuously monitored for radionuclide emissions (resulting from Waste Management activities) located outside of CPP-666. Additional sources include the INTEC Main Stack (CPP-708), which emits gaseous and particulate radionuclides associated with liquid waste operations, including effluents from the Tank Farm Facility, Process Equipment Waste Evaporator, and Liquid Effluent Treatment and Disposal facility. Other radioactive emissions are associated with remote-handled transuranic and mixed-waste management operations, dry storage of spent nuclear fuel, and maintenance and servicing of contaminated equipment.
- ***Central Facilities Area (CFA) Emissions Sources (0.20% of total INL Site source term).*** Minor emissions occur from CFA where work with small quantities of radioactive materials is routinely conducted. This includes sample preparation and verification and radiochemical research and development. Other minor emissions result from groundwater usage via evapotranspiration from irrigation or evaporation from sewage lagoons.
- ***Test Area North Emissions Sources (0.004% of total INL Site source term).*** Emissions sources at Test Area North are primarily from the New Pump and Treat Facility, which serves to reduce concentrations of trichloroethylene and other volatile organic compounds in the medial zone portion of the OU 1-07B contamination groundwater plume to below drinking water standards. Low levels of strontium-90 (^{90}Sr) and tritium are present in the treated water from the New Pump and Treat Facility and are released to the atmosphere by the treatment process.
- ***Specific Manufacturing Capability (SMC) Emissions Sources (0.000000038% of total INL Site source term).*** Operations at SMC include material development, fabrication, and assembly work to produce armor packages. The operation uses standard metal-working equipment in fabrication and assembly. Other activities include developing tools and fixtures and preparing and testing metallurgical specimens. Radiological air emissions from SMC are associated with processing depleted uranium. Potential emissions are uranium isotopes and associated radioactive progeny.
- ***Critical Infrastructure Test Range Complex (CITRC) Emissions Sources (0.000000013% of total INL Site source term).*** Emissions from CITRC are primarily the result of activity related to National and Homeland Security missions. Activities at CITRC include program and project testing for critical infrastructure resilience, nonproliferation, wireless test bed operations, power line and grid testing, unmanned aerial vehicles, explosives detection, and training

radiological counter-terrorism emergency response. Radionuclide releases from CITRC were less in 2022 due to the curtailment of some activities because of COVID-19.

The estimated radionuclide releases (Ci/yr) from INL Site facilities, shown in Table 4-2, 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 dose to the MEI, radionuclides with very short half-lives must be converted to the first progeny with a suitable half-life for modeling. The estimated emissions are then scaled based on the difference in activity between the parent and progeny. The estimated dose to the MEI in calendar year 2022 was 0.018 mrem/yr (0.18 μSv/yr) which is below the regulatory standard of 10 mrem/yr. Seven radionuclides—uranium-238 (^{238}U), chlorine-36 (^{36}Cl), uranium-234 (^{234}U), americium-241 (^{241}Am), strontium-90, (^{90}Sr), cesium-137 (^{137}Cs), and tritium (^{3}H)—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.

4.2.1 Hydrofluorocarbon Phasedown

Hydrofluorocarbons (HFC) 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. HFCs are non-ozone-depleting; however, they are also potent greenhouse gases with 100-year global warming potentials (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 emissions of HFCs 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 the consumption of HFCs.

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 that 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 with the DOE complex. HFC phasedown proactive measures being taken by the INL Site contractors are listed below.

4.2.1.1 INL Contractor

The INL contractor compiled a list of equipment at its facilities that contains 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, engineer personnel, maintenance personnel, and environmental support and services personnel. The list includes heating, ventilation, and air conditioning 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 that contained HFCs were chillers used to cool specific pieces of equipment. Other laboratory equipment that contains HFCs includes environmental chambers, a microwave digester, non-rad and rad separator ion sources, non-rad and rad separator magnets, and a laser flash. The list does not include small heating, ventilation, and air conditioning equipment (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.

4.2.1.2 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 (four circuits total) using HFC-134a at the Integrated Waste Treatment Unit. The total charge for both chillers is approximately 830 lbs. These units will continue to be used for the

Table 4-2. Radionuclide composition of INL Site airborne effluents (2022).[a]

		AIRBORNE EFFLUENT (Ci)[b]										
RADIONUCLIDE[c]	HALF-LIFE[d]	ATR COMPLEX[e]	CFA[e]	CITRC[e]	INTEC[e]	MFC[e]	NRF[e]	RRTR[e]	RWMC[e]	SMC[e]	TAN[e]	TOTAL
Americium-241	432.2 y	2.21E-05	NS[f]	–[g]	5.79E-04	2.11E-03	–	–	1.03E-04	–	–	2.81E-03
Argon-41	1.827 h	NS	NS	–	–	8.19E+01	–	NS	–	–	–	8.19E+01
Bromine-82	1.471 d	–	NS	–	–	–	–	6.02E+00	–	–	–	6.02E+00
Carbon-14	5700 y	NS	NS	–	NS	–	3.20E-01	–	2.22E-02	–	–	3.42E-01
Cadmium-109	461.4 d	NS	NS	–	–	5.28E-03	–	NS	–	–	–	5.28E-03
Californium-252	966.1 d	–	–	–	–	5.00E-05	–	–	–	–	–	5.00E-05
Cesium-137	30.16 y	5.36E-03	NS	–	3.39E-04	3.55E-03	NS	–	NS	–	–	9.24E-03
Chlorine-36	3.01E+05 y	–	–	–	NS	7.17E-03	–	NS	–	–	–	7.17E-03
Copper-64	12.7 h	–	NS	–	–	–	–	2.70E+01	–	–	–	2.70E+01
Cobalt-60	5.271 y	6.31E-03	NS	–	NS	NS	–	–	NS	–	–	6.31E-03
Europium-152	13.53 y	6.78E-05	NS	–	NS	–	–	–	–	–	–	6.78E-05
Hydrogen-3	12.32 y	9.88E+00	5.39E-01	–	NS	3.82E-01	NS	–	4.81E+01	–	NS	5.89E+01
Iodine-129	1.57E+07 y	NS	NS	–	7.93E-05	4.94E-05	NS	–	–	–	–	1.29E-04
Iodine-131	192.5 h	NS	NS	–	–	8.93E-02	NS	–	–	–	–	8.93E-02
Krypton-85m	4.48 h	NS	NS	–	–	1.01E+01	–	–	–	–	–	1.01E+01
Krypton-87	76.3 m	NS	NS	–	–	1.06E+01	–	NS	–	–	–	1.06E+01
Krypton-88	2.84 h	NS	8.95E-03	–	–	9.63E+00	–	–	–	–	–	9.64E+00
Plutonium-238	87.7 y	NS	NS	–	6.32E-06	NS	–	–	NS	–	–	6.32E-06
Plutonium-239	24110 y	8.46E-06	NS	–	2.14E-04	NS	2.70E-06	–	3.75E-05	–	–	2.63E-04
Plutonium-240	6564 y	NS	NS	–	2.14E-04	NS	–	–	8.61E-06	–	–	2.23E-04
Strontium-90	28.79 y	2.75E-02	NS	–	2.99E-03	1.97E-03	5.50E-05	–	NS	–	3.01E-05	3.25E-02
Tellurium-129	69.6 m	–	NS	–	–	2.71E+01	–	–	–	–	–	2.71E+01
Tellurium-129m	33.6 d	–	NS	–	–	3.93E-02	–	–	–	–	–	3.93E-02
Uranium-234	2.45E+05 y	NS	NS	–	NS	4.32E-02	–	–	–	2.03E-08	–	4.32E-02
Uranium-235	7.04E+08 y	NS	NS	NS	NS	2.44E-03	–	–	NS	NS	–	2.44E-03
Uranium-238	4.46 E+09 y	NS	NS	8.71E-10	NS	5.98E-02	–	–	NS	1.13E-07	–	5.98E-02

Table 4-2. continued.

						AIRBORNE EFFLUENT (Ci)[b]						
RADIONUCLIDE[c]	HALF-LIFE[d]	ATR COMPLEX[e]	CFA[e]	CITRC[e]	INTEC[e]	MFC[e]	NRF[e]	RRTR[e]	RWMC[e]	SMC[e]	TAN[e]	TOTAL
Xenon-135	9.14 h	NS	1.49E-01	–	–	NS	–	–	–	–	–	1.49E-01
Xenon-138	14.08 m	NS	NS	–	–	1.64E+01	–	–	–	–	–	1.64E+01
TOTAL CI RELEASED[h]		9.92E+00	6.97E-01	8.71E-10	4.42E-03	1.56E+02	3.20E-01	3.30E+01	4.81E+01	1.33E-07	3.01E-05	2.48E+02
DOSE (MREM)[i]		6.08E-04	3.13E-06	2.56E-11	2.77E-04	1.61E-02	4.58E-05	2.14E-04	6.12E-04	4.08E-09	1.23E-06	1.78E-02

a. Radionuclide release information provided by the INL contractor (INL 2023a).

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

c. Includes only those radionuclides which 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, y = years.

e. ATR = Advanced Test Reactor, 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 = Radiological Response Training Range, RWMC = Radioactive Waste Management Complex (including Advanced Mixed Waste Treatment Project and Accelerated Retrieval Projects), TAN = Test Area North, SMC = Specific Manufacturing Capability.

f. NS = not significant. The radionuclide contribution was estimated to be < 0.1% of 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 2022.

h. Total curies may be less than the total curies in Table 8-1 in Chapter 8 because Table 4-2 accounts only for radionuclides that collectively contribute 99.9% of the total dose to the MEI estimated for each INL Site facility. Total curies may be less than the originally reported amounts due to changes in total activity associated with conversion from short-lived radionuclides into progeny with half-lives long enough to be modeled, and for dose to be calculated.

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

Integrated Waste Treatment Unit 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 a 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.

4.3 Ambient Air Monitoring

Ambient air monitoring is conducted onsite and offsite to identify regional and historical trends, to detect accidental and unplanned releases, and to determine if air concentrations are below 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).

4.3.1 Ambient Air Monitoring System Design

Figure 4-2 shows the regional and INL Site routine air monitoring locations. A total of 38 low-volume air samplers (including four quality assurance samplers), one high-volume air sampler, eight atmospheric moisture samplers, and four precipitation samplers operated in the network in 2022, as shown in Table 4-3.

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. Frequency of detection is defined as the fraction of events resulting in a detection at either a single sampler or 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 Idaho Falls facilities (INL 2019), which resulted in the installation of an additional monitor at the IRC.

Tritium is present in air moisture due to natural production in the atmosphere, the remnants of global fallout from historical nuclear weapons testing, and releases from INL Site facilities (Table 4-2). Historical emissions data show that most tritium is released from the ATR Complex, INTEC, and RWMC. Tritium enters the environment as tritiated water and behaves like water in the environment. The air monitoring network evaluation described in the previous paragraph was used to locate atmospheric moisture samplers. The Experimental Field Station (EFS) and Van Buren Boulevard samplers are located onsite and appear to be in or near the areas of the highest projected air concentration. Atomic City and Howe are Idaho communities located close to the INL Site boundary. Idaho Falls and Craters of the Moon are good offsite locations for measuring background concentrations because they do not appear to be impacted by modeled dispersion of tritium. Thus, one or two atmospheric moisture samplers are currently placed at each of the six locations: Atomic City, Craters of the Moon, EFS (two samplers), Howe, Idaho Falls (two samplers), and Van Buren Boulevard. Although there are more particulate air monitoring stations, additional atmospheric moisture and precipitation monitoring stations are not warranted because the estimated potential dose for INL Site releases is less than 0.1 mrem/yr, which is the recommended DOE limit for routine surveillance (DOE 2015). See Chapter 8 for additional information on dose.

Historical tritium concentrations in precipitation and atmospheric moisture samples collected by the INL contractor during the 10-year period from 2011 through 2021 were compared statistically; results indicate there are no differences between the datasets. For this reason, INL contractor precipitation samplers were placed at the same locations as the atmospheric moisture samplers at Atomic City, EFS, Howe, and Idaho Falls, Idaho. In addition, Idaho Falls can be easily and readily accessed by the INL contractor personnel after a precipitation event. The EPA has a precipitation sampler in Idaho Falls and subsamples are collected for the INL contractor.

To support emergency response, the INL contractor maintains 16 high-volume event air samplers at NOAA weather towers, as shown in Figure 4-4. These event monitors are only turned on as needed for sampling if an event occurs, such as a range fire or unplanned release of radioactivity.

Table 4-3. INL Site and regional ambient air monitoring summary (2022).

MEDIUM SAMPLED	TYPE OF ANALYSIS	FREQUENCY	NUMBER OF LOCATIONS		MDC
			ONSITE	OFFSITE	
Air (low volume)[a,b]	Gross alpha	Weekly	20	18	1E-15 µCi/mL
	Gross beta	Weekly	20	18	2E-15 µCi/mL
	Specific gamma[c]	Quarterly	20	18	2E-16 µCi/mL
	Plutonium-238	Quarterly	18-19	18	3.5E-18 µCi/mL
	Plutonium-239/240	Quarterly	18-19	18	3.5E-18 µCi/mL
	Americium-241	Quarterly	18-19	18	4.6E-18 µCi/mL
	Strontium-90	Quarterly	18-19	18	3.4E-17 µCi/mL
	Iodine-131	Weekly	20	18	1.5E-15 µCi/mL
Air (high volume)[d]	Gross beta scan	Biweekly	–	1	1E-15 µCi/mL
	Gamma scan	Continuous	–	1	Not applicable
	Specific gamma[c]	Annually[e]	–	1	1E-14 µCi/mL
	Isotopic Uranium & Plutonium	Every 4 yrs	–	1	2E-18 µCi/mL
Air (atmospheric moisture)[f]	Tritium	3–6/Quarter	3	5	2E-13 µCi/mL (air)
Air (precipitation)[g]	Tritium	Monthly	0	1	88 pCi/L
		Weekly	1	2	

a. Low volume air samplers are operated on the INL Site by the INL contractor at the following locations: ATR Complex (two air samplers), CFA, Experimental Breeder Reactor No. 1 (EBR-I), Experimental Field Station (EFS), Highway 26 Rest Area, INTEC (two air samplers), Gate 4, Main Gate, MFC (two air samplers), NRF, Power Burst Facility (PBF [sampling began at the end of September 2022]), RWMC (two air samplers), SMC, and Van Buren Boulevard. Additionally, there are rotating duplicate samplers for quality assurance. In 2022, the samplers were located at INTEC (westside), RWMC, and Van Buren Boulevard. This table does not include high volume 'event' monitoring by the INL contractor.

b. The INL contractor operates low volume samplers offsite at Arco, Atomic City, Blackfoot, Blue Dome, Craters of the Moon, Dubois, Federal Aviation Administration Tower, Howe, Idaho Falls, INL Research Center (IRC) (two air samplers), Jackson (WY), Monteview, Mud Lake, Sugar City, and Terreton (sampling began at the end of September 2022). In addition, there is a rotating duplicate sampler for quality assurance. In 2022, the sampler was placed in Dubois.

c. The minimum detectable concentration shown is for cesium-137.

d. The EPA RadNet stationary monitor at Idaho Falls runs 24 hours a day, seven days a week, and sends near-real-time measurements of gamma radiation to EPA's National Analytical Radiation Environmental Laboratory (NAREL). Filters are collected by INL personnel for the EPA RadNet program and sent to NAREL. Data are reported by the EPA's RadNet at http://www.epa.gov/radnet/radnet-databases-and-reports.

e. If gross beta activity is greater than 1 pCi/m^3, then a gamma scan is performed at NAREL. Otherwise, an annual composite is analyzed.

f. Atmospheric moisture samples are collected onsite at EFS and Van Buren Boulevard by the INL contractor. Samples are collected offsite at Atomic City, Craters of the Moon, Howe, and at Idaho Falls (two samplers) by the INL contractor.

g. Precipitation samples are currently collected onsite at EFS and offsite at Atomic City, Howe, and Idaho Falls (also used as the EPA RadNet precipitation location) by the INL contractor.

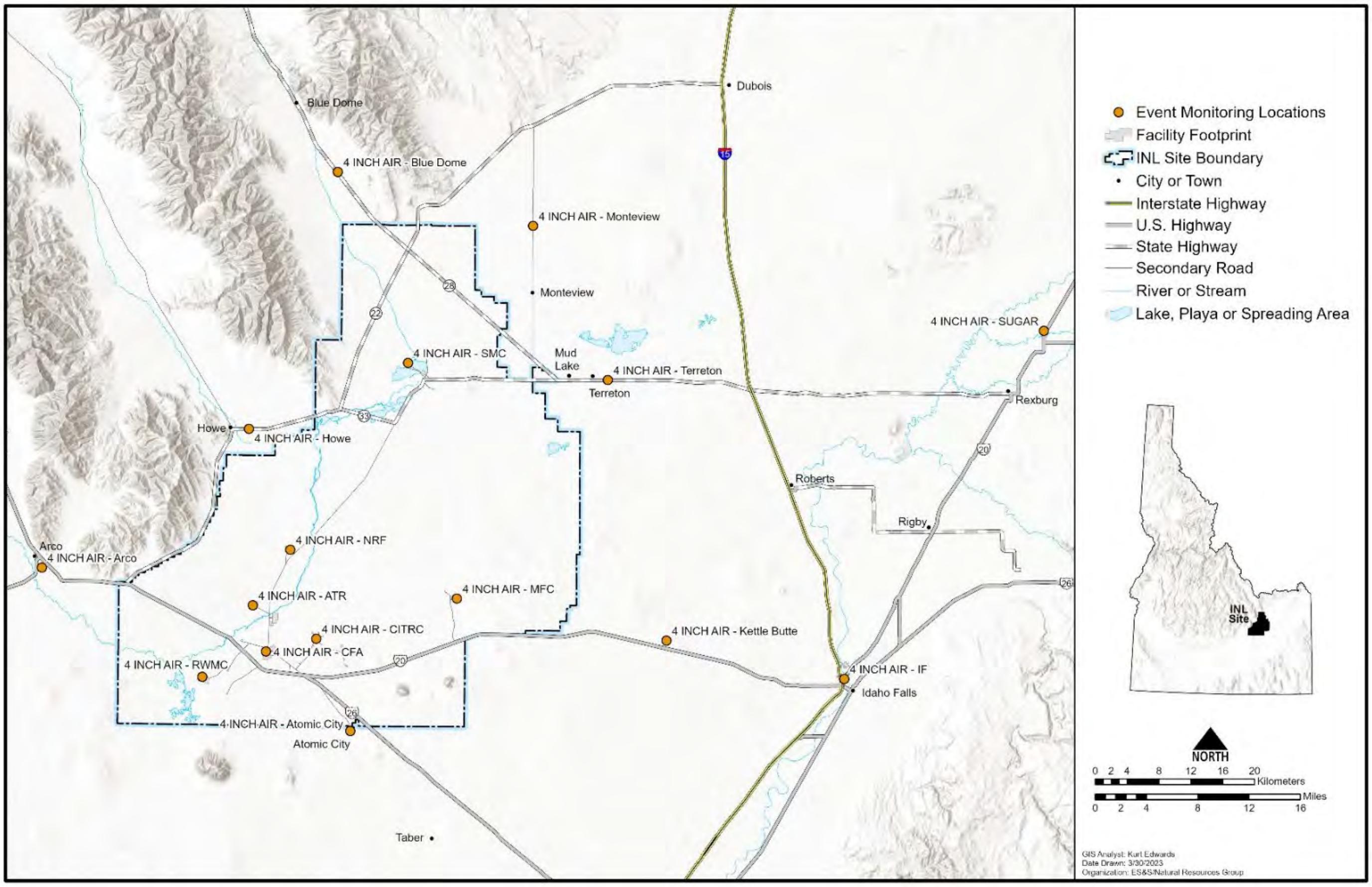


Figure 4-4. Locations of INL contractor high-volume event monitors at NOAA weather stations.

4.3.2 Air Particulate, Radioiodine, and Tritium Sampling Methods

4.3.2.1 Air Particulates

Filters are collected weekly by the INL contractor from a network of low-volume air samplers, as shown in Table 4-3. A pump pulls air (about 57 L/min [2 ft^3/min]) through a 5-cm (2-in.), 1.2-µm 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 air filter collected. Gross alpha activity is only irregularly detected, but it becomes more commonly detected during wildfires and 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. Gross alpha and gross beta activity are also 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 INL contractor for laboratory analysis of gamma-emitting radionuclides, such as ^{137}Cs, 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 are typically detected in air filters include beryllium-7 (^{7}Be) and potassium-40 (^{40}K).

The INL contractor also uses a contracted laboratory to radiochemically analyze quarterly composited samples for selected alpha- and beta-emitting radionuclides. These radionuclides include ^{241}Am, ^{238}Pu, $^{239/240}$Pu, ^{238}Pu, ^{234}U, ^{238}U, ^{65}Zn, and ^{90}Sr. They 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 global fallout. INL contractor samples are analyzed on a rotating basis; each quarter five or six composites are selected for alpha spectrometry and five or six composites are selected for beta spectrometry.

4.3.2.2 Radioiodine

Charcoal cartridges are collected and analyzed weekly for iodine-131 (^{131}I) by the INL contractor at the locations shown in Table 4-3. Iodine-131 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 level of ^{131}I in the environment could be from a recent release of fission products.

4.3.2.3 Tritium

The INL contractor monitors tritium in atmospheric water vapor in ambient air onsite at EFS and Van Buren Boulevard and offsite at Atomic City, Howe, Craters of the Moon, and Idaho Falls. Air passes through a column of molecular sieve, which is a material that adsorbs water vapor. The molecular sieve is sent to a laboratory for analysis once the material has adsorbed sufficient moisture to obtain a sample. The laboratory extracts water from the material by distillation and determines tritium concentrations through liquid scintillation counting.

Precipitation samples are collected by the INL contractor at Atomic City, EFS, Howe, and Idaho Falls and are analyzed for tritium using liquid scintillation counting.

4.3.3 Ambient Air Monitoring Results

4.3.3.1 Gaseous Radioiodines

The INL contractor collected and analyzed approximately 2,200 charcoal cartridges (including blanks and duplicates) in 2022. There were no statistically positive measurements of ^{131}I.

4.3.3.2 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, ^{7}Be, 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. The dataset provide useful information for trending of the total activity over time.

Concentrations of gross alpha and gross beta radioactivity detected by ambient air monitoring conducted by the INL contractor are summarized in Tables 4-4 and 4-5. Results are further discussed below.

Table 4-4. Median annual gross alpha concentrations in ambient air samples collected by the INL contractor in 2022.

GROUP	LOCATION[a]	NO. OF SAMPLES[b]	RANGE OF CONCENTRATIONS[c] (× 10^{-15} µCi/mL)	ANNUAL MEDIAN CONCENTRATION (× 10^{-15} µCi/mL)
Boundary	Arco	51	0.26 – 5.35	1.5
	Atomic City	50	0.29 – 6.44	1.6
	Blue Dome	50	0.43 – 5.19	1.6
	FAA Tower	51	0.29 – 3.69	1.4
	Howe	49	0.51 – 4.87	1.7
	Monteview	51	0.44 – 6.29	1.7
	Mud Lake	50	0.26 – 4.66	1.6
	Terreton	12	0.65 – 2.59	1.8
			Boundary Median:	*1.6*
Offsite	Blackfoot	88	-0.09 – 5.88	1.5
	Craters of the Moon	90	-0.36 – 5.15	1.2
	Dubois	50	0.24 – 4.20	1.6
	Idaho Falls	88	-0.21 – 4.63	1.5
	IRC[d]	51	-0.44 – 3.90	1.2
	IRC (north)	47	-0.20 – 3.90	1.3
	Jackson, WY	51	0.48 – 5.32	1.6
	Sugar City	89	-0.58 – 4.30	1.4
			Offsite Median:	*1.4*
Onsite	ATR Complex (NE corner)	47	-0.27 – 3.42	1.4
	CFA	50	0.03 – 4.20	1.3
	EBR-I	49	-0.57 – 5.16	1.1
	EFS	85	-0.42 – 5.93	1.5
	Gate 4	51	-0.42 – 5.38	1.6
	Highway 26 Rest Area	51	-0.52 – 5.21	1.5
	INTEC	48	-0.25 – 5.54	1.3
	INTEC (west side)	50	0.10 – 4.91	1.4
	Main Gate	50	0.37 – 9.73	1.6
	MFC (north)	49	-0.09 – 6.20	1.4
	MFC (south)	51	-0.53 – 4.95	1.4
	NRF	49	-0.55 – 4.98	1.3
	PBF	12	0.28 – 1.55	1.1
	RHLLW	51	-0.73 – 6.60	1.2
	RWMC	51	-0.52 – 4.04	1.3
	RWMC (South)	50	-1.50 – 4.27	1.5
	SMC	47	-0.39 – 5.62	1.1
	Van Buren Boulevard	89	-0.17 – 5.04	1.2
			Onsite Median:	*1.4*

Table 4-4. continued.

GROUP	LOCATION[a]	NO. OF SAMPLES[b]	RANGE OF CONCENTRATIONS[c] (× 10^{-15} μCi/mL)	ANNUAL MEDIAN CONCENTRATION (× 10^{-15} μCi/mL)

a. FAA = Federal Aviation Administration, RHLLW = Remote Handled Low-Level Waste Disposal Facility. See Figure 4-2 for locations on INL Site.

b. Includes valid (i.e., sufficient volume) samples only. Does not include duplicate measurements, which are made for quality assurance purposes.

c. All measurements made by the INL contractor, except for duplicate measurements made for quality assurance purposes, are included in this table and in computation of median annual values. A negative result indicates that the measurement was less than the laboratory background measurement.

d. IRC is an in-town (Idaho Falls) facility within the Research and Education Campus.

Gross Alpha – Gross alpha concentrations are measured on a weekly basis in individual air samples ranged from a low of (-1.5 ± 1.5) × 10^{-15} μCi/mL, collected by the INL contractor at RWMC (south) on June 15, 2022, to a high of (9.7 ± 1.0) × 10^{-15} μCi/mL, collected by the INL contractor at Main Gate on November 15, 2022, as shown in Table 4-4.

The median annual gross alpha concentrations were typical of previous measurements. The maximum result is less than the DCS (DOE 2021) of 1.1 × 10^{-13} μCi/mL for $^{239/240}$Pu, which is the most conservative specific radionuclide DCS that could be—although unrealistically—applied to gross alpha activity.

Gross Beta – Weekly gross beta concentrations measured in air samples ranged from a low of (1.0 ± 1.0) × 10^{-15} μCi/mL at Blackfoot, collected by the INL contractor on June 1, 2022, to a high of (11.4 ± 0.2) × 10^{-14} μCi/mL collected by the INL contractor at Main Gate on November 22, 2022, as observed in Table 4-5. The lowest detected value (i.e., greater than three sigma [3σ]) was (2.9 ± 0.38) × 10^{-15} μCi/mL collected by the INL contractor at MFC (north) on September 14, 2022. All results were less than the maximum concentration of 1.0 × 10^{-13} μCi/mL which was reported in previous Annual Site Environmental Reports (2012–2021). In general, median airborne radioactivity levels for the onsite, boundary, and offsite locations tracked each other closely throughout the year. 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 the ground. The maximum weekly gross beta concentration is significantly below the DCS of 9.6 × 10^{-12} μCi/mL for the most restrictive beta-emitting radionuclide in the air, ^{90}Sr.

Table 4-5. Median annual gross beta concentrations in ambient air samples collected the INL contractor in 2022.

GROUP	LOCATION[a]	NO. OF SAMPLES[b]	RANGE OF CONCENTRATIONS[c] ($\times 10^{-14}$ µCi/mL)	ANNUAL MEDIAN CONCENTRATION[c] ($\times 10^{-14}$ µCi/mL)
Boundary	Arco	51	1.29 – 5.37	2.4
	Atomic City	50	1.24 – 6.59	2.6
	Blue Dome	50	1.15 – 5.44	2.5
	FAA Tower	51	1.28 – 4.98	2.3
	Howe	49	1.24 – 6.21	2.7
	Monteview	51	1.28 – 6.96	2.7
	Mud Lake	50	0.41 – 6.35	2.7
	Terreton	12	1.14 – 5.05	2.4
			Boundary Median:	*2.5*
Offsite	Blackfoot	88	0.10 – 6.31	2.3
	Craters of the Moon	90	0.56 – 5.47	2.0
	Dubois	50	1.28 – 5.12	2.4
	Idaho Falls	88	0.95 – 6.05	2.4
	IRC[d]	51	0.88 – 4.67	2.4
	IRC (north)	47	0.99 – 5.57	2.3
	Jackson, WY	51	1.26 – 6.13	2.6
	Sugar City	89	0.96 – 5.02	2.4
			Offsite Median:	*2.3*
Onsite	ATR Complex (NE corner)	47	0.98 – 5.55	2.2
	CFA	50	0.93 – 5.35	2.5
	EBR-I	49	1.02 – 4.88	2.2
	EFS	85	0.52 – 8.76	2.6
	Gate 4	51	0.93 – 5.63	2.4
	Highway 26 Rest Area	51	1.16 – 4.79	2.5
	INTEC	48	0.90 – 5.61	2.5
	INTEC (west side)	50	0.74 – 5.17	2.5
	Main Gate	50	1.14 – 11.40	2.6
	MFC (north)	49	0.29 – 5.41	2.2
	MFC (south)	51	0.19 – 5.01	2.1
	NRF	49	1.04 – 4.61	2.4
	PBF	12	0.97 – 2.62	1.6
	RHLLW	51	0.99 – 4.68	2.4
	RWMC	51	0.90 – 5.57	2.4
	RWMC (south)	50	1.07 – 5.37	2.6
	SMC	47	1.05 – 4.94	2.3
	Van Buren Boulevard	89	0.92 – 5.15	2.4
			Onsite Median:	*2.4*

Table 4-5. continued.

GROUP	LOCATION[a]	NO. OF SAMPLES[b]	RANGE OF CONCENTRATIONS[c] (× 10^{-14} µCi/mL)	ANNUAL MEDIAN CONCENTRATION[c] (× 10^{-14} µCi/mL)

a. FAA = Federal Aviation Administration, RHLLW = Remote Handled Low-Level Waste Disposal Facility. See Figure 4-2 for locations on INL Site.
b. Includes valid (i.e., sufficient volume) samples only. Does not include duplicate measurements which are made for quality assurance purposes.
c. All measurements made by the INL contractor, with the exception of duplicate measurements made for quality assurance purposes, are included in this table and in computation of median annual values. A negative result indicates that the measurement was less than the laboratory background measurement.
d. IRC is an in-town (Idaho Falls) facility within the INL Research and Education Campus.

4.3.3.3 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 monthly boundary and offsite data sets collected by the INL contractor during 2022 that can be attributed to expected statistical variation in the data and not to INL Site releases. Quarterly reports detailing these analyses are provided at https://idahoeser.inl.gov/publications.html.

The INL contractor compared gross beta concentrations from samples collected at onsite and boundary locations. Statistical evaluation revealed no significant differences between onsite and boundary concentrations. Onsite and boundary mean concentrations (2.5 ± 1.0 × 10^{-14} and 2.7 ± 1.0 × 10^{-14} µCi/mL, respectively) showed equivalence at one sigma (1σ) uncertainty and are attributable to natural data variation.

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.

Specific Radionuclides – The INL contractor observed six detections of ^{90}Sr throughout 2022. The detectable concentrations ranged from 3.0 x 10^{-17} µCi/mL at Monteview during the fourth quarter to 9.4 x 10^{-17} µCi/mL at Dubois in the first quarter, as observed in Table 4-6. Plutonium-239/240 was detected in quarterly composited samples that were collected at Blue Dome, RWMC, and RWMC (duplicate) during the fourth quarter (Table 4-6). Americium-241 was detected in quarterly composited samples collected at RWMC and the RWMC (duplicate) in the fourth quarter. Plutonium-238 was not detected in any sample collected by the INL contractor. All results were within historical measurements made during the past ten years (2012-2021). The results were well below the DCSs for these radionuclides in air (i.e., 9.6 × 10^{-12} µCi/mL for ^{90}Sr, 1.1 × 10^{-13} µCi/mL for $^{239/240}$Pu, and 1.3 × 10^{-13} µCi/mL for ^{241}Am). In addition to the radionuclides discussed earlier, the INL contractor began monitoring for uranium during 2022. While not enumerated in Table 4-6, detections of uranium radionuclides occur routinely at concentrations that suggest a natural origin (INL 2023c, INL 2023d). Natural ^{7}Be was detected in numerous INL contractor composite samples at concentrations consistent with past concentrations. Atmospheric ^{7}Be results from reactions of galactic cosmic rays and solar energetic particles with nitrogen and oxygen nuclei in Earth's atmosphere.

Table 4-6. Human-made radionuclides detected in ambient air samples collected by the INL contractor in 2022.

RADIONUCLIDE	RESULT[a] (µCi/mL)	LOCATION	GROUP	QUARTER DETECTED
Americium-241	$(4.5 \pm 0.8) \times 10^{-17}$	RWMC	Onsite	4th
Americium-241	$(3.1 \pm 0.7) \times 10^{-17}$	RWMC (duplicate)	Onsite	4th
Strontium-90	$(5.0 \pm 0.9) \times 10^{-17}$	Howe	Boundary	1st
Strontium-90	$(6.6 \pm 0.6) \times 10^{-17}$	Blue Dome	Boundary	1st
Strontium-90	$(8.1 \pm 0.6) \times 10^{-17}$	FAA Tower	Boundary	1st
Strontium-90	$(9.4 \pm 0.8) \times 10^{-17}$	Dubois	Offsite	1st
Strontium-90	$(6.4 \pm 0.7) \times 10^{-17}$	Dubois (duplicate)	Offsite	1st
Strontium-90	$(3.0 \pm 0.6) \times 10^{-17}$	Monteview	Boundary	4th
Plutonium-239/240	$(3.1 \pm 0.7) \times 10^{-17}$	Blue Dome	Boundary	4th
Plutonium-239/240	$(2.6 \pm 0.6) \times 10^{-17}$	RWMC	Onsite	4th
Plutonium-239/240	$(1.8 \pm 0.5) \times 10^{-17}$	RWMC (duplicate)	Onsite	4th

a. Results ± 1σ. Results shown are ≥ 3σ.

4.3.4 Atmospheric Moisture Monitoring Results

During 2022, the INL contractor collected 66 atmospheric moisture samples at six locations. Table 4-7 presents the percentage of samples containing detectable tritium, the range of concentrations, and the mean concentration for each location. Tritium was detected in eight INL samples, with a high of $(14.5 \pm 2.9) \times 10^{-13}$ $\mu Ci/mL_{air}$ at Idaho Falls on August 24, 2022. The highest concentration of tritium detected in an atmospheric moisture sample collected since 2011 was 31×10^{-13} $\mu Ci/mL_{air}$ at EFS in 2015. The highest observed tritium concentration in a 2022 sample collected by the INL contractor is far below the DCS for tritium in air (as water vapor) of 1.3×10^{-7} $\mu Ci/mL_{air}$.

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 (see Section 4.3.5). 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 monitoring stations because of atmospheric dispersion.

4.3.5 Precipitation Monitoring Results

Tritium exists in the global atmosphere primarily from nuclear weapons testing and from natural production in the upper atmosphere by the interaction of galactic cosmic rays with atmospheric gases and can be detected in precipitation. Since the Nuclear Test Ban Treaty in 1963, the level of tritium measured in precipitation has been steadily decreasing due to radioactive decay and dilution in the world oceans. The International Atomic Energy Agency has participated in surveying tritium compositions in precipitation around the globe since 1961 (https://www.iaea.org/services/networks/gnip). Long-term data suggest that tritium levels in precipitation are close to their pre-nuclear test values (Cauquoin et al. 2015). The tritium measured in precipitation at the INL Site is most likely cosmogenic in origin and not from weapons testing.

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 (https://www.epa.gov/radnet) and a subsample is taken by the INL contractor for analysis.

A total of 74 precipitation samples were collected during 2022 from the four sites. Tritium was detected in seven samples, and detectable results ranged from 104 pCi/L at EFS in March to 203 pCi/L at Howe in April. Most detections were near the approximate detection level of 93 pCi/L. Table 4-8 shows the percentage of detections, the concentration range, the mean and median concentration for each location. The highest concentration is well below the DCS level of 2.6 × 10^6 pCi/L for tritium in water and within the historical range (-173 to 413 pCi/L) measured from 2012–2021.

Table 4-7. Tritium concentrations[a] in atmospheric moisture samples collected by the INL contractor onsite and offsite in 2022.

	ATOMIC CITY	CRATERS OF THE MOON	EFS	HOWE	IDAHO FALLS	VAN BUREN BOULEVARD
Number of samples	10	6	17	8	17	8
Number of detections[b]	1	0	4	1	2	0
Detection percentage	10%	0%	24%	13%	12%	0%
Concentration range ($\times 10^{-13}$ µCi/mL_{air})[c]	0.5 ± 0.8 – 7.2 ± 2.2	-22 ± 35 – 176 ± 480	-104 ± 49 – 14 ± 41	-4.0 ± 2.7 – 4.1 ± 1.1	-5.1 ± 22.0 – 14.5 ± 2.9	-50 ± 58 – 51 ± 32
Mean concentration ($\times 10^{-13}$ µCi/mL_{air})[c]	2.5	27.2	-3.2	1.2	2.4	0.58
Median concentration ($\times 10^{-13}$ µCi/mL_{air})	1.8	3.1	4.0	2.3	1.9	1.6
Mean detection level ($\times 10^{-13}$ µCi/mL_{air})	4.2	300	36	4.7	22	93

a. Results ± 1σ.

b. All measurements, including negative results, are included in this table and in computation of mean annual values. A negative result indicates that the measurement was less than the laboratory background measurement.

c. An analyte is considered detected when the result is greater than or equal to three times the uncertainty (sigma).

Table 4-8. Tritium concentrations in precipitation samples collected by the INL contractor in 2022.[a,b]

	ATOMIC CITY	EFS	HOWE	IDAHO FALLS
Number of samples	20	21	21	12
Number of detections	2	2	3	0
Detection percentage	10%	10%	14%	0%
Concentration range (pCi/L)	-57.4 ± 107 – 136 ± 27.2	-58.3 ± 32.6 – 167 ± 31.9	-25.1 ± 23.4 – 203 ± 35.1	-16.0 ± 33.2 – 104 ± 35.7
Mean concentration (pCi/L)	32.3	26.3	50.6	45.3
Median concentration (pCi/L)	32.5	28.7	36.5	49.9
Mean detection level (pCi/L)	92.9	93.9	93.0	95.9

a. Results ± 1σ.

b. All measurements are included in this table and in computation of mean annual values. A negative result indicates that the measurement was less than the laboratory background measurement.

The results were also comparable with tritium concentrations reported by EPA for precipitation during the 10-year period from 2002–2011 (measurements were discontinued after 2011) based on a query of available data (https://enviro.epa.gov/enviro/erams_query_v2.simple_query). Concentrations reported by EPA for Idaho Falls during that period ranged from 0–1720 pCi/L and averaged 35.1 pCi/L.

Annual tritium concentrations in atmospheric moisture and precipitation have no discernable 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 the results, box plots were constructed illustrating annual tritium concentrations measured in atmospheric moisture (as water) and precipitation samples collected by the INL contractor for the past 10 years, as can be seen in Figure 4-5. 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 median annual tritium concentrations measured in atmospheric moisture and in 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.

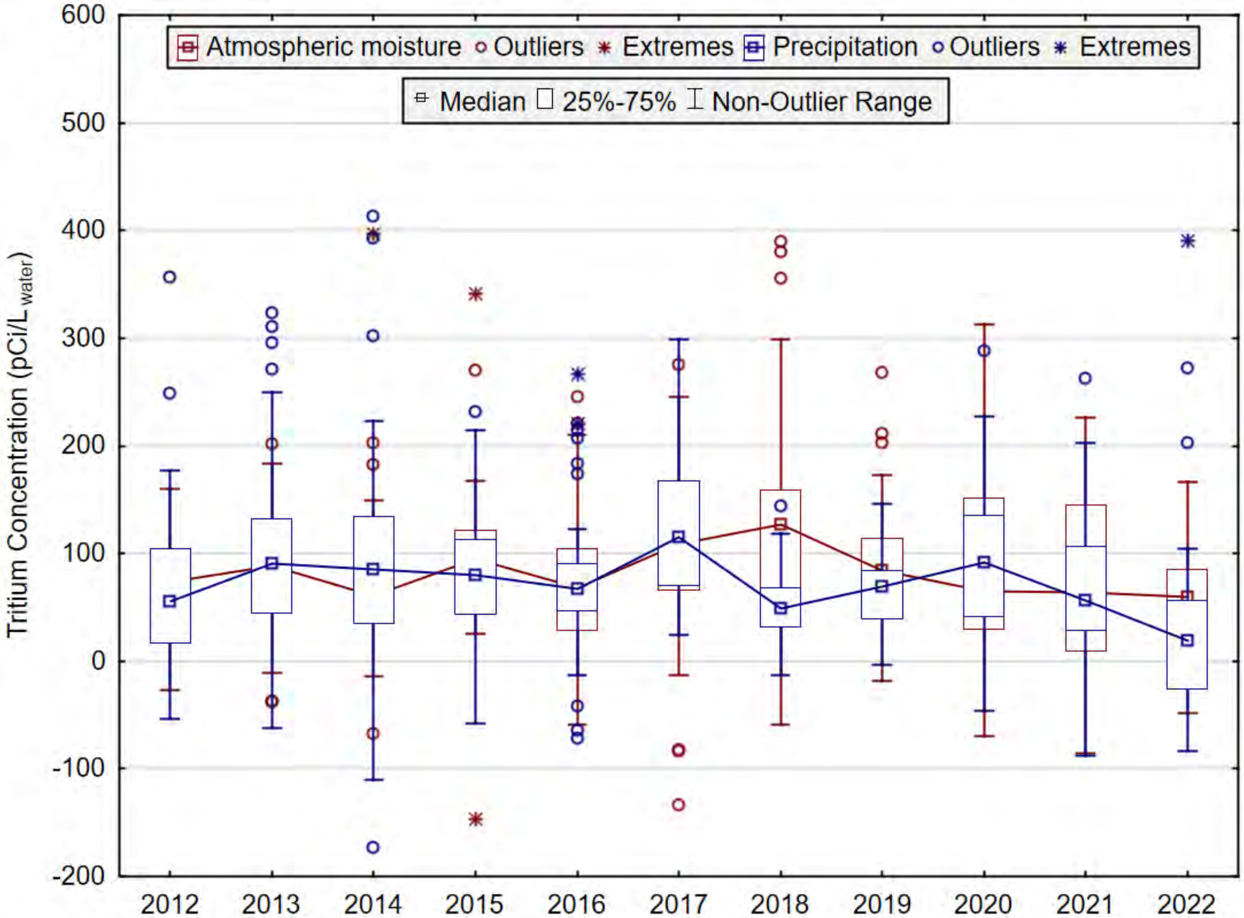


Figure 4-5. Box plots of tritium concentrations measured in atmospheric moisture and in precipitation from 2012–2022.

4.4 Waste Management Environmental Surveillance Air Monitoring

4.4.1 Gross Activity

The ICP contractor conducts environmental surveillance 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 2022, as observed in Figure 4-6. Samples were also collected at a control location at Howe, Idaho, as shown in Figure 4-2, 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 air filters have a 4-in. diameter and are changed out on the closest working day to the first and 15th of each month. Gross alpha and gross beta activity were determined on all suspended particulate samples. Table 4-9 shows the median annual and range of gross alpha concentrations at each location. Gross alpha concentrations ranged from a low of (0.57 ± 0.09) × 10^{-15} μCi/mL collected at location SDA 6.3 on September 15, 2022, to a high of (4.62 ± 0.68) × 10^{-15} μCi/mL, collected at location SDA 9.3 on February 15, 2022.

Table 4-10 shows the annual median and range of gross beta concentrations at each location. Gross beta concentrations ranged from a low of (0.10 ± 0.01) × 10^{-14} μCi/mL at location SDA 6.3 on September 15, 2022, to a high of (5.50 ± 0.47) x 10^{-14} μCi/mL at location HOWE 400.4 on February 15, 2022.

Figure 4-7 compares gross alpha and gross beta sample results from 2011 through 2022 to the most restrictive DCS values ($^{239/240}$Pu for gross alpha and ^{90}Sr for gross beta) established by DOE for inhaled air (DOE 2021). The 2022 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, Idaho. The ranges of concentrations measured at the SDA and ICDF were aligned with the range measured at the Howe (background) monitoring location.

4.4.2 Specific Radionuclides

Air filters collected by the ICP contractor are 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 2022, no human-made, gamma-emitting radionuclides were detected in air samples at the ICDF at INTEC. However, multiple human-made specific alpha-emitting radionuclides were detected at the SDA at RWMC.

Table 4-11 shows human-made specific radionuclides detected at INTEC and the SDA in 2022. These detections are consistent with levels measured in the air at the SDA in previous years. All detections were three to four orders of magnitude below the DCS stipulated in the DOE Order (2021), as shown in Figure 4-8, and statistically false positives at the 95% confidence error are possible.

In addition to the human-made, gamma-emitting radionuclides discussed above, the ICP contractor also monitors for uranium. While not enumerated in Table 4-11, detections of uranium radionuclides occur routinely at concentrations that suggest a natural origin.

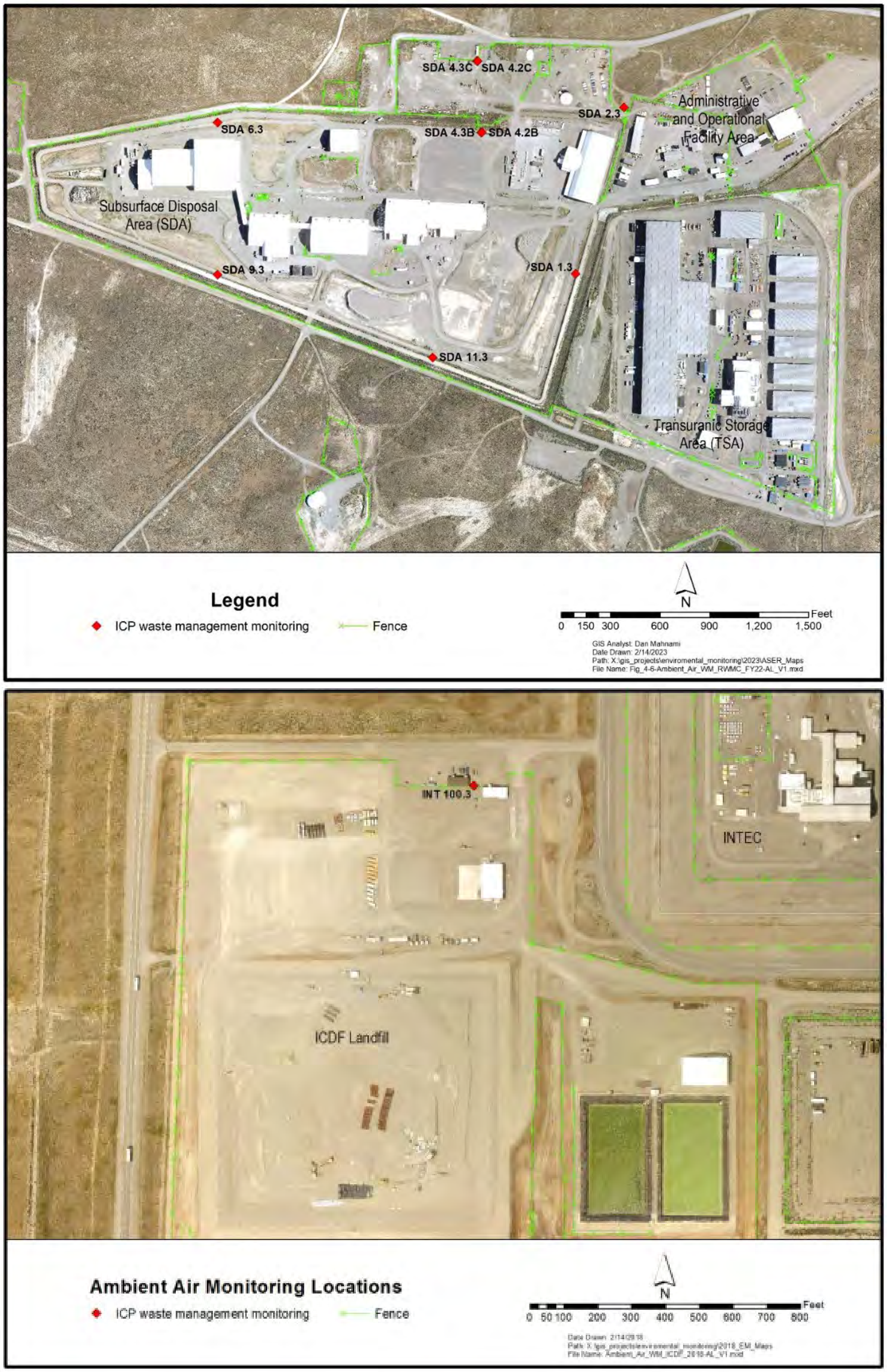


Figure 4-6. Locations of ICP contractor low-volume air samplers at waste management areas (SDA [top] and ICDF [bottom]).

***Table 4-9. Median annual gross alpha concentration in air samples collected at waste management sites in 2022.*[a]**

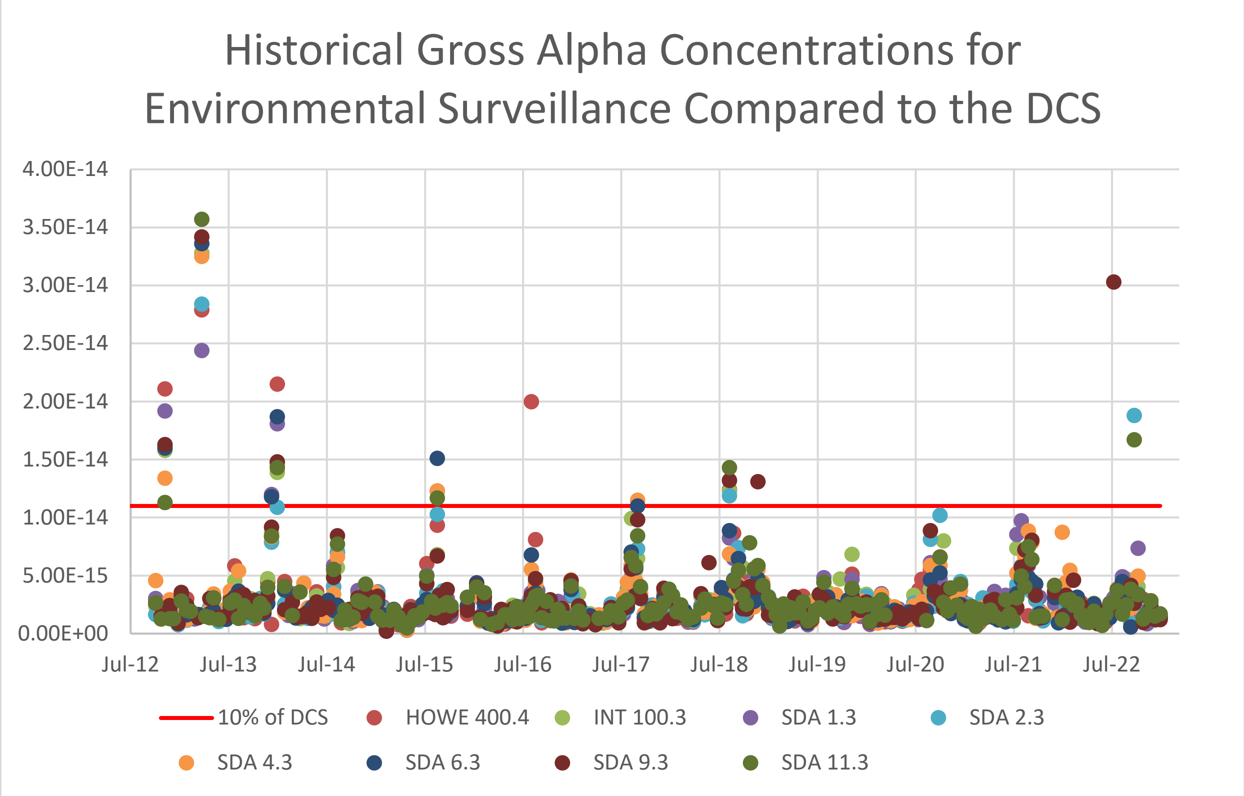
GROUP	LOCATION	NO. OF SAMPLES COLLECTED	RANGE OF CONCENTRATIONS (× 10^{-15} µCi/mL)	ANNUAL MEDIAN (× 10^{-15} µCi/mL)
SDA	SDA 1.3	16	0.86 - 3.06	1.66
	SDA 2.3	18	0.90 - 3.44	1.66
	SDA 4.2B/C and 4.3B/C [a]	26	0.79 - 3.69	1.83
	SDA 6.3	20	0.57 - 3.20	1.77
	SDA 9.3	17	0.86 - 4.62	1.84
	SDA 11.3	19	0.73 - 3.37	1.72
ICDF	INT 100.3	19	1.16 - 4.07	1.74
Boundary	HOWE 400.4	18	1.02 - 3.22	1.97

a. Results for SDA 4.2B/C, a replicate of SDA 4.3B/C, are included in the table for 2022 because of mechanical issues with SDA 4.3B/C occurring in 2022.

***Table 4-10. Median annual gross beta concentration in air samples collected at waste management sites in 2022.*[a]**

GROUP	LOCATION	NO. OF SAMPLES COLLECTED	RANGE OF CONCENTRATIONS (× 10^{-14} µCi/mL)	ANNUAL MEDIAN (× 10^{-14} µCi/mL)
SDA	SDA 1.3	16	0.28 - 3.89	0.81
	SDA 2.3	19	0.18 - 4.93	0.98
	SDA 4.2B/C and 4.3B/C [a]	29	0.13 - 4.93	1.00
	SDA 6.3	21	0.10 - 4.68	0.80
	SDA 9.3	17	0.14 - 4.91	1.16
	SDA 11.3	19	0.12 - 5.24	0.95
ICDF	INT 100.3	20	0.27 - 4.28	1.00
Boundary	HOWE 400.4	18	0.19 - 5.50	0.92

a. Results for SDA 4.2B/C, a replicate of SDA 4.3B/C, are included in the table for 2022 because of mechanical issues with SDA 4.3B/C occurring in 2022.



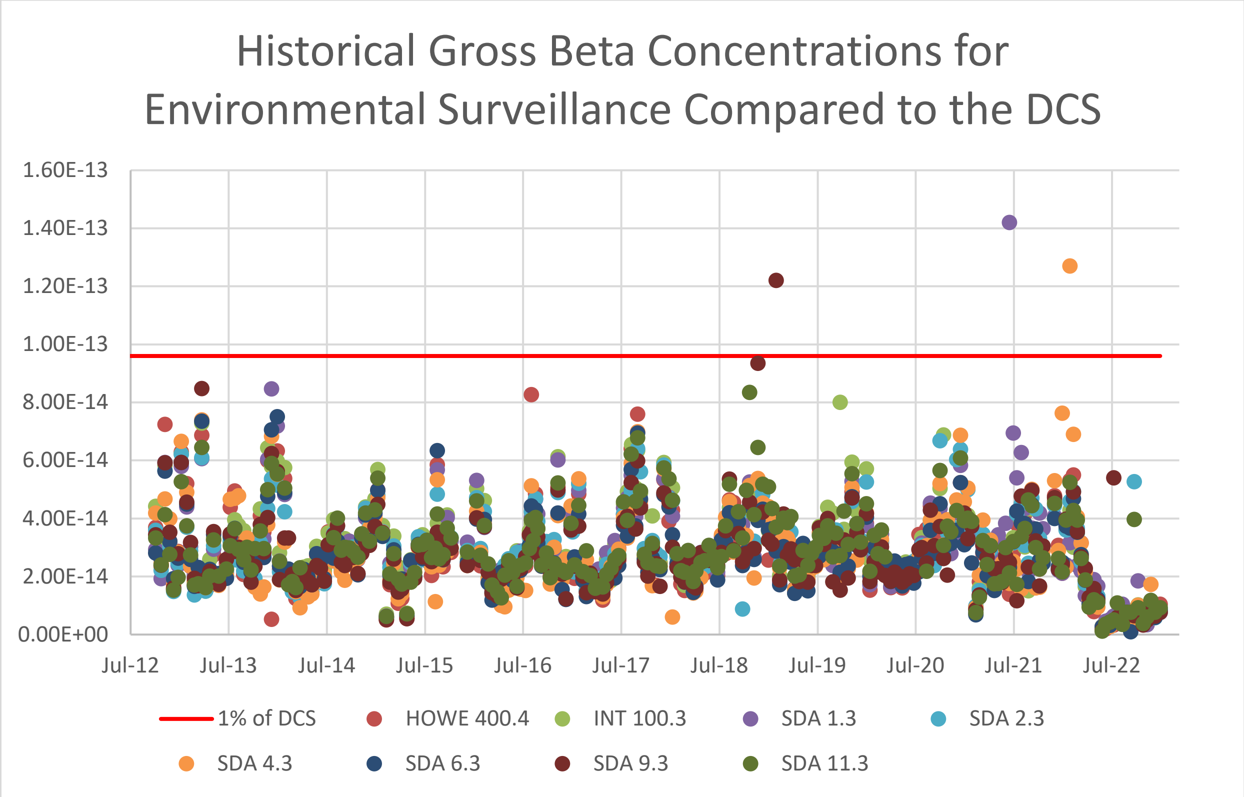


Figure 4-7. Gross alpha (top) and gross beta (bottom) results from waste management site air samples (µCi/mL) compared to their respective DCSs.

***Table 4-11. Human-made radionuclides detected in air samples collected at waste management sites in 2022.*[a]**

RADIONUCLIDE	LOCATION	RESULT (µCi/mL)	UNCERTAINTY (1 SIGMA)	PERIOD DETECTED
Americium-241	SDA 1.3	3.70E-18	9.94E-19	12/20/2021–3/31/2022
	SDA 2.3	4.11E-18	1.28E-18	12/20/2021–3/31/2022
	SDA 4.2B/C and 4.3B/C [b]	1.44E-17	2.34E-18	12/20/2021–3/31/2022
	SDA 4.2B/C and 4.3B/C [b]	8.06E-18	1.60E-18	3/31/2022–5/16/2022 [c]
	SDA 4.2B/C and 4.3B/C [b]	8.18E-18	1.76E-18	3/31/2022–5/16/2022 [c]
Plutonium-238	SDA 4.2B/C and 4.3B/C [b]	2.90E-18	7.85E-19	3/31/2022–5/16/2022 [c]
Plutonium-239/240	SDA 1.3	2.12E-18	5.15E-19	12/20/2021–3/31/2022
	SDA 2.3	1.56E-18	9.94E-19	12/20/2021–3/31/2022
	SDA 4.2B/C and 4.3B/C [b]	2.99E-18	6.16E-19	12/20/2021–3/31/2022
	SDA 4.2B/C and 4.3B/C [b]	2.70E-18	8.02E-19	12/20/2021–3/31/2022
	SDA 4.2B/C and 4.3B/C [b]	1.65E-18	5.15E-19	3/31/2022–5/16/2022 [c]
	SDA 4.2B/C and 4.3B/C [b]	4.82E-18	9.97E-19	3/31/2022–5/16/2022 [c]
	SDA 11.3	2.44E-18	9.97E-19	3/31/2022–5/16/2022 [c]

a. Results shown are $\geq 3\sigma$.

b. Results for SDA 4.2B/C, a replicate of SDA 4.3B/C, are included in the table for 2022 because of mechanical issues with SDA 4.3B/C occurring in 2022.

c. Samples collected in calendar year quarters 2–4 were not composited correctly by the laboratory as agreed upon in the task order statement of work. Laboratory staff were not aware of the need to composite the samples due to unfamiliarity (the previous lab shut down mid-year).

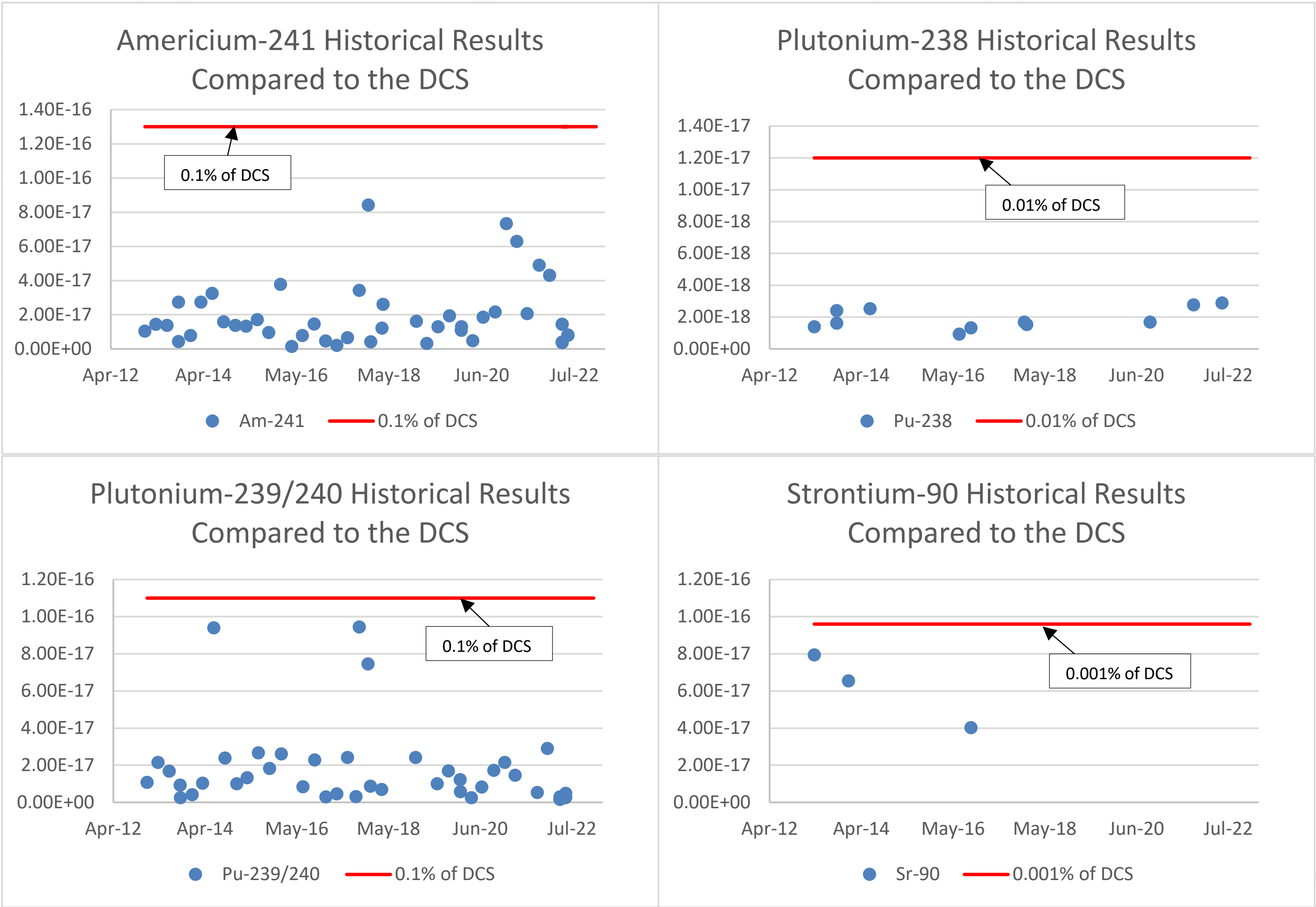


Figure 4-8. Specific human-made radionuclide detections (µCi/mL) from waste management air samples compared to various fractions of their respective DCSs.

4.5 References

40 CFR Parts 9 and 84, 2023, "Phasedown of Hydrofluorocarbons: Establishing the Allowance Allocation and Trading Program Under the American Innovation and Manufacturing Act; Proposed Rule," Code of Federal Regulations, Office of the Federal Register, https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-84.

40 CFR 61, Subpart H, 2023, "National Emission Standards for Emissions of Radionuclides Other Than Radon from Department of Energy Facilities," Code of Federal Regulations, Office of the Federal Register, https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-61/subpart-H.

Cauquoin, A., P. Jean-Baptiste, C. Risia, É. Fourré, B. Stenni, and A. Landais, 2015, "The global distribution of natural tritium in precipitation simulated with an Atmospheric General Circulation Model and comparison with observations," Earth and Planetary Science Letters, Vol, 427, pp.160–170, http://www.lmd.jussieu.fr/~acauquoin/Mes_Publications/Cauquoin%20et%20al.%202015 %20-%20EPSL.pdf.

Clawson, K. L., J. D. Rich, R. M. Eckman, N. F. Hukari, D. Finn, and B. R. Reese, 2018, "Climatography of the Idaho National Laboratory," 4th Edition, NOAA Tech, NOAA Air Resources Laboratory, https://doi.org/10.25923/ze6p-4e52.

DOE, 2015, "DOE Handbook Environmental Radiological Effluent Monitoring and Environmental Surveillance," DOE-HDBK-1216-2015, U.S. Department of Energy.

DOE, 2021, "Derived Concentration Technical Standard," DOE-STD-1196-2021, U.S. Department of Energy, July 2021.

DOE O 435.1, 2001, "Radioactive Waste Management," Change 2, U.S. Department of Energy.

DOE O 458.1, 2013, "Radiation Protection of the Public and the Environment," Administrative Change 3, U.S. Department of Energy.

DOE-ID, 2021, "Idaho National Laboratory Site Environmental Monitoring Plan," DOE/ID-11088, Rev. 5, U.S. Department of Energy Idaho Operations Office.

DOE-ID, 2023, "National Emissions Standards for Hazardous Air Pollutants—Calendar Year 2022 INL Report for Radionuclides," DOE/ID-11441, U.S. Department of Energy Idaho Operations Office.

INL 2019, "Assessment of INL Ambient Air Radiological Monitoring for Idaho Falls Facilities," INL/EXT-19-53491, Idaho National Laboratory.

INL 2023a, "Idaho National Laboratory CY 2022 National Emission Standards for Hazardous Air Pollutants Analysis, Methodology and Results for Radionuclides," INL/RPT-23-67457, Idaho National Laboratory.

INL 2023b, "Update of Receptor Locations for INL National Emissions Standard for Hazardous Air Pollutants (NESHAP) Assessments," INL/RPT-23-72759, Idaho National Laboratory.

INL 2023c, "Idaho National Laboratory Site Environmental Surveillance Program Report: Third Quarter 2022," INL/RPT-23-72026, Idaho National Laboratory.

INL 2023d, "Idaho National Laboratory Site Environmental Surveillance Program Report: Fourth Quarter 2022," INL/RPT-23-74404, Idaho National Laboratory.

Rood, A. S., A. J. Sondrup, and P. D. Ritter, 2016, "Quantitative Evaluation of an Air Monitoring Network Using Atmospheric Transport Modeling and Frequency of Detection Methods," Health Physics, 110(4): 311–327.

Elk grazing

Chapter 5: Environmental Monitoring Programs – Liquid Effluents Monitoring

CHAPTER 5

Wastewater 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 2022 by the INL contractor and the Idaho Cleanup Project (ICP) contractor for compliance with permit requirements and applicable Department of Energy (DOE) orders established to protect human health and the environment.

During 2022, permitted reuse facilities included the Advanced Test Reactor Complex Cold Waste Ponds, Idaho Nuclear Technology and Engineering Center New Percolation Ponds and Sewage Treatment Plant, and Materials and Fuels Complex Industrial Waste Pond. Liquid effluent and groundwater at these facilities were sampled for parameters required by their facility-specific permits. No permit limits were exceeded in 2022.

Additional liquid effluent and groundwater monitoring was performed in 2022 at the Advanced Test Reactor Complex, Idaho Nuclear Technology and Engineering Center, and Materials and Fuels Complex to comply with environmental protection objectives of DOE. All parameters were below applicable health-based standards in 2022.

Surface water that runs off the Subsurface Disposal Area at the Radioactive Waste Management Complex during periods of rapid snowmelt or heavy precipitation was sampled and analyzed for radionuclides. Additionally, water sheet flowed across asphalt surfaces and infiltrated around/under door seals at Waste Management Facility-636 at the Advanced Mixed Waste Treatment Project and collected in catch tanks. Specific human-made gamma-emitting radionuclides were not detected. Detected concentrations of americium-241, plutonium-239/240, and uranium isotopes did not exceed DOE Derived Concentration Standards.

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. INL and ICP personnel conduct liquid effluent monitoring through liquid effluent and surface water runoff sampling and surveillance programs to ensure compliance with applicable permits, limits, and maximum contaminant levels. These programs also sample groundwater related to liquid effluent.

Table 5-1 presents the requirements for liquid effluent monitoring 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 2021). To improve the readability of this chapter, data tables are only included when monitoring results exceed specified discharge limits, permit limits, or maximum contaminant levels. Data tables for other monitoring results are provided in Appendix A.

Table 5-1. Liquid effluent monitoring 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[d] Complex Cold Waste Ponds	●	●	
MFC[d] Industrial Waste Pond	●	●	
ICP CONTRACTOR			
INTEC[d] New Percolation Ponds and Sewage Treatment Plant	●	●	
RWMC[d] SDA[d] surface water runoff		●	●

a. Required by permits issued according to the Idaho Department of Environmental Quality Rules, IDAPA 58.01.17, “Recycled Water Rules.” This includes wastewater effluent monitoring 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 control and management of radionuclides from DOE activities in liquid discharges. 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 Standard DOE-STD-1196-2021, “Derived Concentration Technical Standard,” (DOE 2021) supports the implementation of DOE O 458.1 and provides Derived Concentration Standards 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 and 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.

d. Advanced Test Reactor (ATR), Materials and Fuels Complex (MFC), Idaho Nuclear Technology and Engineering Center (INTEC), and Radioactive Waste Management Complex (RWMC), Subsurface Disposal Area (SDA).

5.1 Liquid Effluent and Related Groundwater Compliance Monitoring

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 Recycled Water Rules (IDAPA 58.01.17), Wastewater Rules (IDAPA 58.01.16), and Ground Water Quality Rule (IDAPA 58.01.11) promulgated according to the Idaho Administrative Procedures Act. The Idaho Department of Environmental Quality (DEQ) issues reuse permits for operation of the reuse systems. Reuse permits may require 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 (but are not required by regulations). The permits may specify annual discharge volumes, application rates, and effluent quality limits. Annual reports (ICP 2023a and 2023b; INL 2023a, 2023b, 2023c, and 2023d) were prepared and submitted to the Idaho DEQ.

During 2022, the INL and ICP contractors monitored, as required by the permits, the following reuse facilities shown in Table 5-2:

- ATR Complex Cold Waste Ponds (Section 5.1.1)
- INTEC New Percolation Ponds and Sewage Treatment Plant (STP) (Section 5.1.2)
- MFC Industrial Waste Pond (Section 5.1.3).

Table 5-2. 2022 status of reuse permits.

FACILITY	PERMIT STATUS AT END OF 2022	PERMIT EXPIRATION DATE	EXPLANATION
ATR Complex Cold Waste Ponds	Active	October 29, 2029	Idaho DEQ issued Reuse Permit I-161-03 on October 30, 2019 (DEQ 2019), with Modification 1 issued May 23, 2022 (DEQ 2022a).
INTEC New Percolation Ponds	Active	June 1, 2024	Idaho DEQ issued Permit M-130-06 on June 1, 2017 (DEQ 2017).
MFC Industrial Waste Pond	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; May 21, 2020[a] (DEQ 2020); and May 23, 2022 (DEQ 2022b).

a. MFC Modification 3, issued May 21, 2020, removed the Industrial Waste Ditch as a permit Management Unit, resulting in changes to monitoring and reporting requirements. Idaho DEQ re-issued Modification 3 on September 15, 2020, to correct administrative matters.

Additional effluent constituents are monitored at these facilities to comply with environmental protection objectives of DOE O 458.1 and are discussed in Section 5.2. Surface water monitoring at the RWMC is presented in Section 5.3.

5.1.1 Advanced Test Reactor Complex Cold Waste Ponds

Description. The Cold Waste Ponds (CWP) are located approximately 137 m (450 ft) from the southeast corner of the ATR Complex compound and approximately 1.2 km (0.75 mi) northwest of the Big Lost River channel, as shown in Figure 5-1. The CWP was excavated in 1982 and consist of two unlined cells, each with dimensions of 55 × 131 m (180 × 430 ft) across the top of the berms and with a depth of 3 m (10 ft). Total surface area for the two cells at the top of the berms is approximately 1.44 ha (3.55 acres). Maximum capacity is approximately 38.69 ML (10.22 MG).

The CWP function as percolation basins for the infiltration of nonhazardous industrial liquid effluent consisting 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 using a v-notch weir and effluent samples are collected using an automated composite sampler.

Effluent Monitoring Results for the Reuse Permit. Reuse Permit I-161-03 Modification 1 requires monthly sampling of the effluent to the CWP (DEQ 2022a). The 2022 permit reporting year monitoring results are presented in the 2022 annual reuse report (INL, 2023c) and the 2022 calendar year monitoring results are summarized in Table A-1 in Appendix A. The total dissolved solids concentrations ranged from 204–266 mg/L. Sulfate ranged from 21.1 mg/L to 30.1 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 pre-treatment or specify maximum constituent loading limits or concentration limits for the cold waste effluent discharged to the CWP. The 2022 constituent concentrations continue to remain consistent with historical results.

The permit specifies the maximum annual and five-year moving average hydraulic loading rate limits of 300 MG/yr and 375 MG/yr, respectively, based on the annual reporting year of the permits. As shown in Table A-2, the 2022 annual reporting year flow of 279.21 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 seven groundwater wells (see Figure 5-1), to measure potential impacts from the CWP. In 2022, none of the constituents exceeded their respective primary or secondary constituent standards. The constituents are presented in Table A-3a and Table A-3b. The metals concentrations continue to remain at low levels and are consistent with historical ranges.

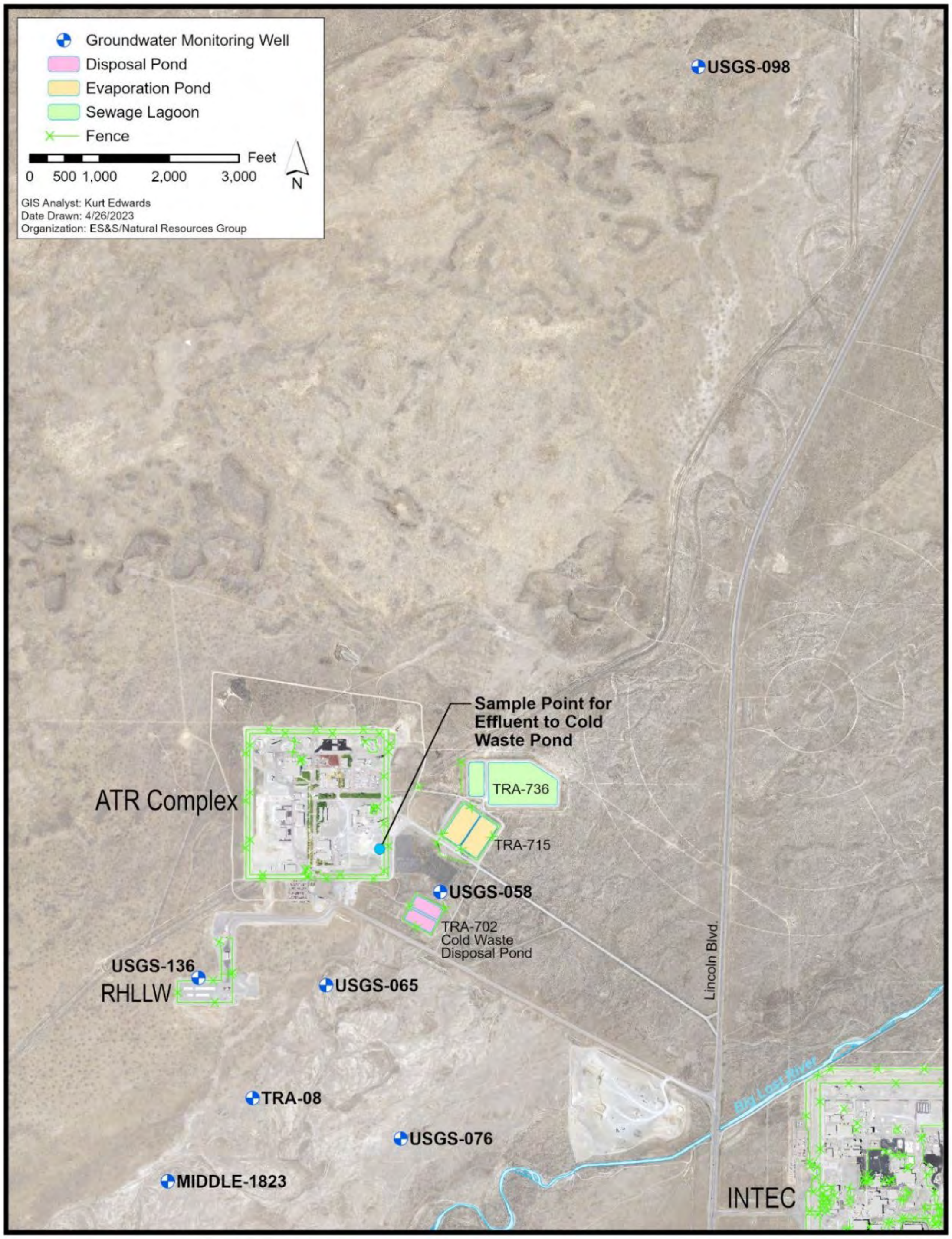


Figure 5-1. Permit monitoring locations for the ATR Complex Cold Waste Pond.

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

Description. The INTEC New Percolation Ponds are composed of two rapid infiltration ponds excavated into the surficial alluvium and surrounded by bermed alluvial material, as observed in Figure 5-2. 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 New Percolation Ponds receive 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, and evaporation) in four lagoons. After treatment in the lagoons, the effluent is combined with the service waste and discharged to the INTEC New Percolation Ponds.

The INTEC New Percolation Ponds were permitted by Idaho DEQ to operate as a reuse facility under Reuse Permit M-130-06 (DEQ 2017).

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 New Percolation Ponds), as shown in Figure 5-3. 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 2022 reporting year monitoring results for CPP-769, CPP-773, and CPP-797 are provided in the 2022 Wastewater Reuse Report (ICP 2023a), and the 2022 calendar year monitoring results are summarized in Tables B-4, B-5, and B-6 (in Appendix B).

The permit specifies maximum daily and yearly hydraulic loading rates for the INTEC New Percolation Ponds. As shown in Table A-7, the maximum daily flow and yearly total flow to the INTEC New Percolation Ponds were below the permit limits in 2022.

Groundwater Monitoring Results for the Reuse Permit. To measure the potential impact on groundwater from wastewater discharges to the INTEC New Percolation Ponds, the permit requires that groundwater samples are collected from six monitoring wells, as shown in Figure 5-2.

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 specified in IDAPA 58.01.11, “Ground Water Quality Rules.”

Table A-8 shows the 2022 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 B-8 and B-9 show all permit-required constituents associated with the aquifer monitoring wells were below their respective primary constituent standards and secondary constituent standards in 2022. The pH values in perched water well ICPP-MON-V-212 were elevated in both April and September. The pH values associated with this well are consistently higher in the spring versus the fall, indicative of surface water recharge. Historically, each recharge of this perched water well results in decreasing pH values. Purge times are being evaluated to ensure that pH values have stabilized prior to sampling.

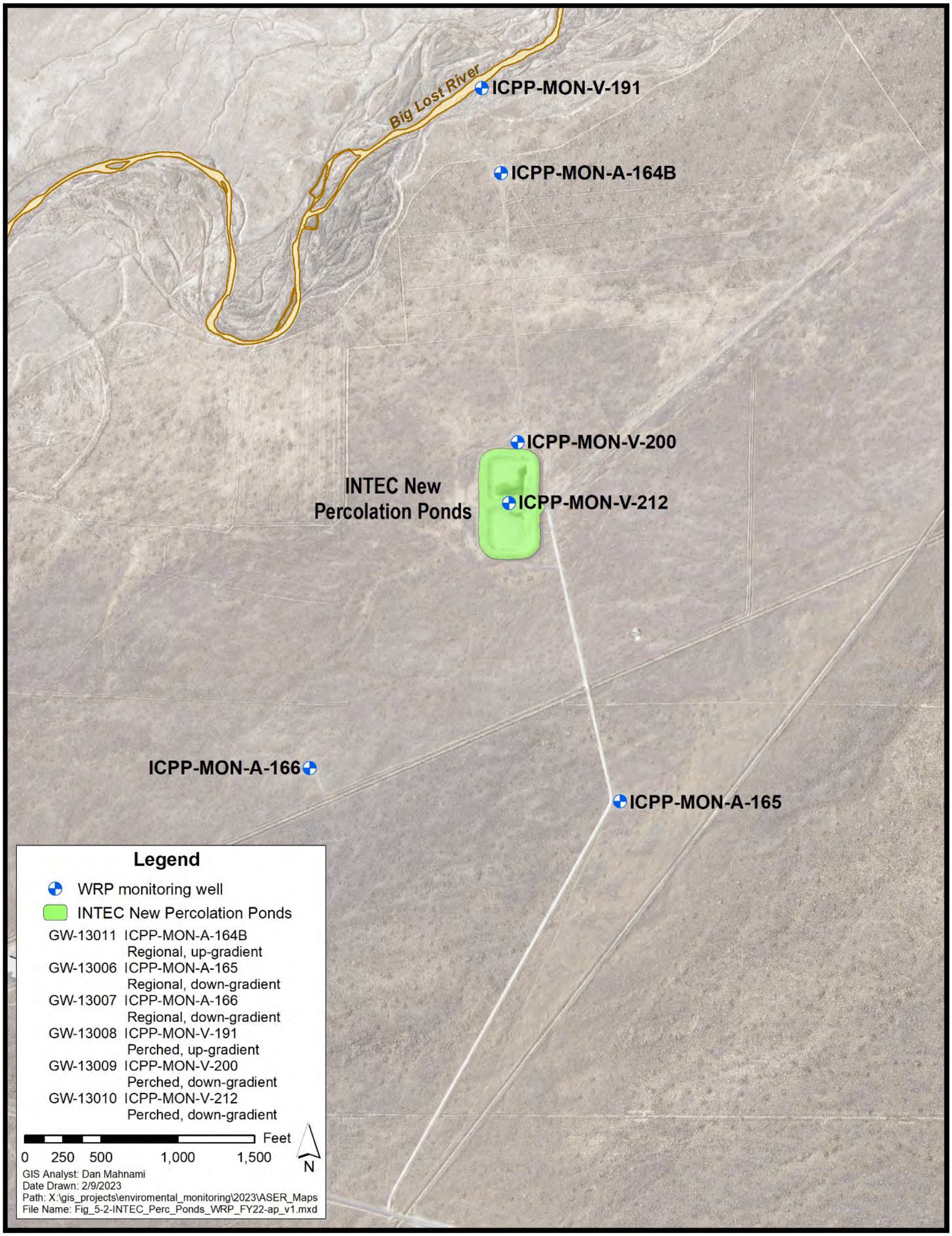


Figure 5-2. Reuse permit groundwater monitoring locations for INTEC New Percolation Ponds.

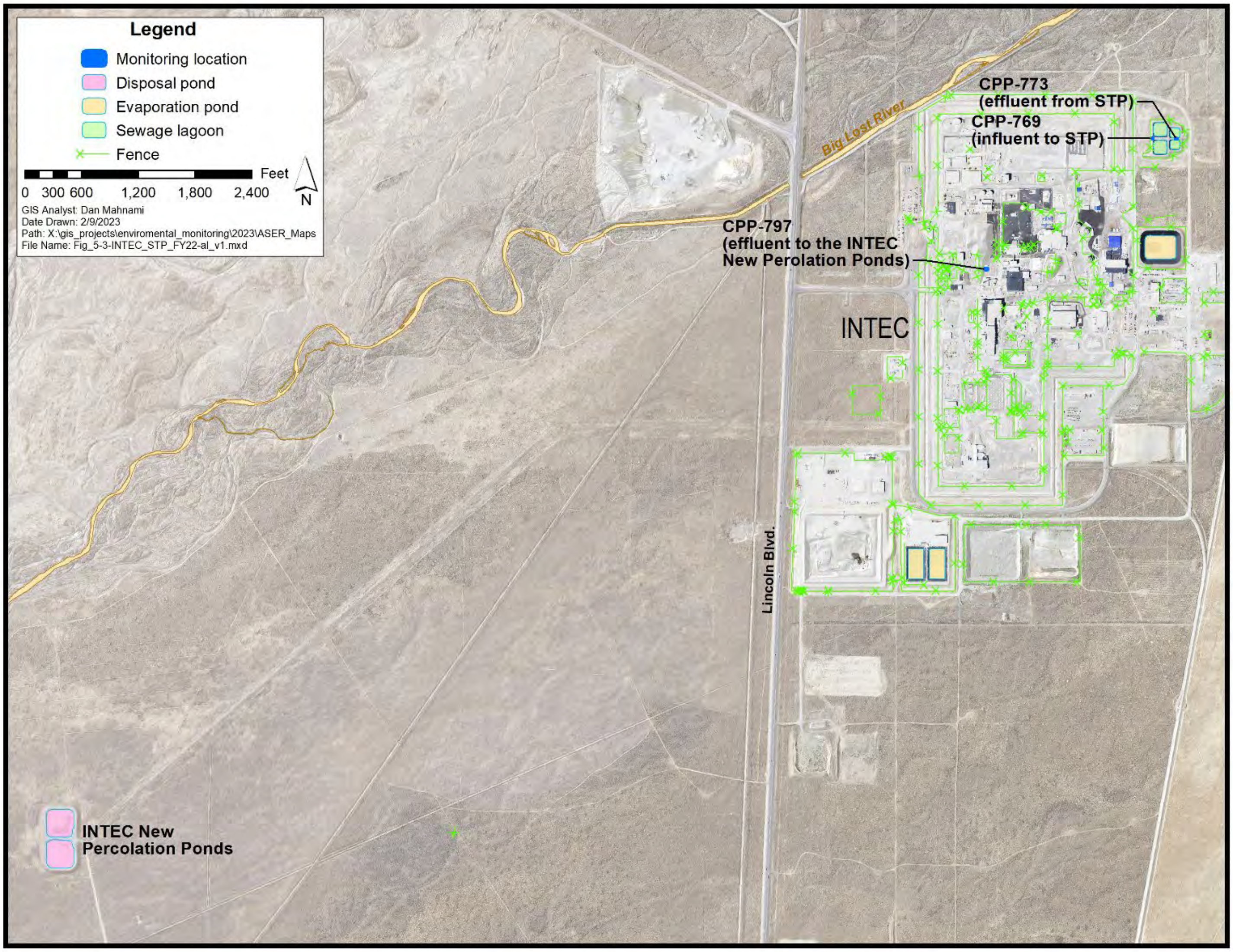


Figure 5-3. INTEC wastewater monitoring for reuse permit.

5.1.3 Materials and Fuels Complex Industrial Waste Pond

Description. The MFC Industrial Waste Pond is an unlined basin that was first excavated in 1959 and has a design capacity of 1,078.84 ML (285 MG) at a maximum water depth of 3.96 m (13 ft) identified in Figure 5-4. In previous years the pond received industrial wastewater from the stormwater runoff from the nearby areas and industrial wastewater from the Industrial Waste Ditch (IWD) (Ditch C).

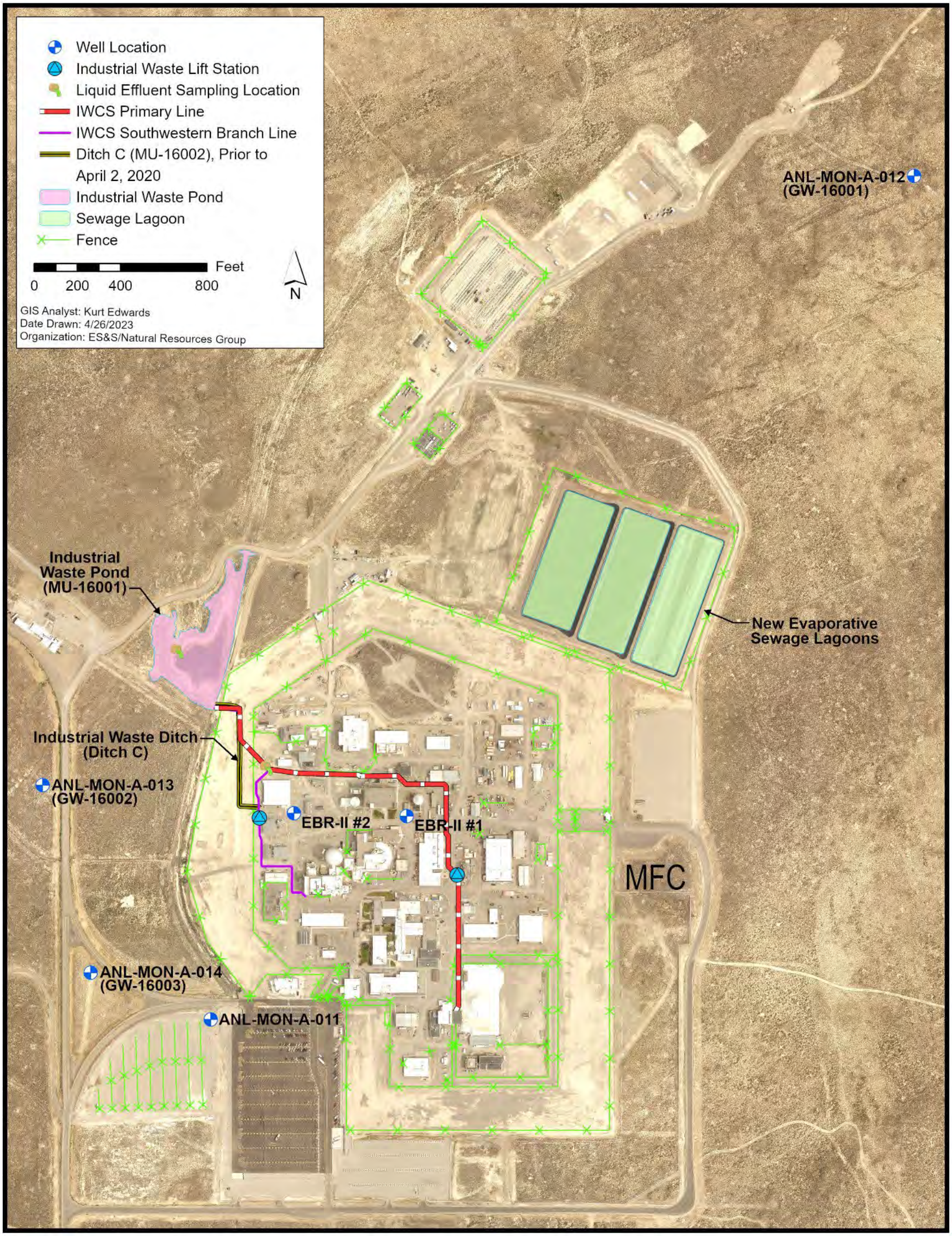


Figure 5-4. Wastewater and groundwater sampling locations MFC.

As part of the MFC Utility Corridor Upgrade Project completed in 2020, industrial wastewater discharges into the IWD (Ditch C) were eliminated. The Ditch C industrial wastewater is now collected in a new lift station and rerouted into the primary industrial waste pipeline via a new connecting pipeline. Reuse Permit I-160-02 Modification 3 issued May 21, 2020 (DEQ 2020) removed the IWD (Ditch C) Management Unit and associated monitoring from the permit as a result of INL permanently joining the industrial wastewater collection system (IWCS) pipelines together, upstream of the existing flow monitoring and sampling station, prior to discharging the combined effluent into the Industrial Waste Pond.

Now that the two MFC IWCS pipelines are joined together and have one flow/sample monitoring location, the system has been given more descriptive, common names. The combination of industrial wastewater pipelines/branches, lift stations, flow meter, sampling station, and associated components are now designated as the industrial wastewater collection system (IWCS). The pipeline, previously known as the industrial waste pipeline, that captures the majority of industrial wastewater and eventually discharges into the pond is referred to as the IWCS Primary Line (PL) since it is the pipeline that collects wastewater from all sources and on which the flow meter and sampling station are located. The pipeline that collected small amounts of industrial wastewater, which previously discharged into the IWD (Ditch C) but now discharges into the PL upstream of the existing sampling station via the new lift station and connecting pipeline, is referred to as the IWCS Southwestern Branch Line.

The Industrial Waste Pond functions as a percolation basin for the infiltration of nonhazardous industrial effluent. Industrial wastewater, which is discharged to the pond via the IWCS PL, consists primarily of noncontact cooling water, boiler blowdown, cooling tower blowdown and drain, air wash flows, and steam condensate. A small amount of wastewater collected within the IWCS Southwestern Branch Line (that now discharges into the PL via a new lift station) consists of intermittent reverse osmosis effluent and laboratory sink discharge from the MFC-768 Power Plant.

Wastewater Monitoring Results for the Reuse Permit. Reuse Permit I-160-02 Modification 4 requires monthly sampling of effluent discharging from the IWCS PL into the Industrial Waste Pond. The 2022 permit reporting year monitoring results are presented in the 2022 annual reuse report (INL 2023d), 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 pre-treatment or specify maximum constituent loading limits or concentration limits. In 2022, concentrations of iron and manganese continued to be at or near the laboratory instruments' minimum detection levels. Total dissolved solids ranged from 204–356 mg/L. The 2022 constituent concentrations continue to be within historical ranges.

The permit specifies an annual reporting year hydraulic loading limit of 17 MG/yr. As shown in Table A-11, the 2022 reporting year flow of 10.188 MG/yr was well below the permit limit.

Groundwater Monitoring Results for the Reuse Permit. The reuse permit requires groundwater monitoring twice annually, in April/May and September/October, at one upgradient well and two downgradient wells (Figure 5-4) to measure potential impacts from the pond. The analytical results are summarized in Table A-12. In 2022, none of the constituents exceeded their respective primary or secondary constituent standards, and the analyte concentrations in the downgradient wells remained consistent with background levels in the upgradient well.

5.2 Liquid Effluent Surveillance Monitoring

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

5.2.1 Advanced Test Reactor Complex

The effluent to the CWP receives a combination of process water from various ATR Complex facilities. Table A-13 lists wastewater effluent surveillance monitoring results for those constituents with at least one detected result. In 2022, gross alpha and gross beta were the only constituents detected in the CWP effluent. Groundwater radionuclide surveillance monitoring results are summarized in Table A-14. All detected constituents, including strontium-90, tritium, gross alpha, and gross beta, were well below the Idaho groundwater primary constituent standards, IDAPA 58.01.11.

5.2.2 Idaho Nuclear Technology and Engineering Center

In addition to the permit-required monitoring summarized in Section 5.1.3, surveillance monitoring was conducted at CPP-797 (effluent to the INTEC New Percolation Ponds), and the groundwater monitoring was conducted at the INTEC New Percolation Ponds. Table A-15 summarizes the results of radiological monitoring at CPP-797, while Table A-16 summarizes the results of radiological monitoring at groundwater 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-15, no total strontium activity was detected in any of the samples collected at CPP-797 in 2022. Gross alpha was not detected, while gross beta was detected in all 12 samples collected in 2022.

Groundwater samples were collected from aquifer Wells ICPP-MON-A-165 and ICPP-MON-A-166 and perched water Wells ICPP-MON-V-200 and ICPP-MON-V-212 in April 2022 and September 2022 and were analyzed for gross alpha and gross beta. As shown in Table A-16, gross alpha was detected in one of the four monitoring wells in September 2022. Gross beta was detected in all the monitoring wells in April 2022 and in three of the monitoring wells in September 2022. All detected constituents, including strontium-90, tritium, gross alpha, and gross beta, were below the Idaho groundwater primary constituent standards, IDAPA 58.01.11.

5.2.3 Materials and Fuels Complex

The Industrial Waste Pond is sampled quarterly and analyzed for gross alpha, gross beta, gamma spectrometry, and tritium, as shown in Figure 5-4. Annual samples are collected and analyzed for selected isotopes of americium, strontium, plutonium, and uranium. Gross alpha, gross beta, and uranium isotopes were detected in 2022, as summarized in Table A-17, and are below applicable Derived Concentration Standards (DCS) (DOE 2022).

Additionally, five ground water monitoring wells are sampled twice per year for select radionuclides, metals, anions, cations, and other water quality parameters as surveillance monitoring under the WAG 9 Record of Decision. The 2022 groundwater surveillance monitoring results are discussed in Chapter 6, Section 6.5.6, and summarized in Table 6-11. Overall, the detected results were below the Idaho groundwater primary constituent standards, IDAPA 58.01.11, and show no discernable impact from activities at the MFC.

5.3 Waste Management Surveillance Surface 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 the RWMC. The canal also carries runoff from outside the RWMC that has been diverted around the SDA.

Additionally, 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 (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 the RWMC SDA from the location shown in Figure 5-5. The WMF-636 Fire Water Catch Tanks are also shown in Figure 5-5. Surface water is collected to determine if radionuclide concentrations exceed administrative control levels or if concentrations have increased significantly, as compared to historical data. A field blank is also collected for comparison. Samples from the WMF-636 Fire Water Catch Tanks were not collected during 2022 as periodic measurements of tank levels did not indicate pumping to be necessary.

Two samples were collected from the SDA Lift Station in 2022. These samples were analyzed for a suite of radionuclides that includes americium-241 and strontium-90 and plutonium and uranium isotopes. There were positive detections (three sigma [3σ]) of americium-241, plutonium-238, plutonium-239/240, and strontium-90 in samples taken in 2022. The maximum concentration detected for americium-241 was 0.95 (± 0.09) pCi/L, which is well below the 740 pCi/L DCS for americium-241. The maximum concentration detected for plutonium-238 was 0.04 (± 0.01) pCi/L, which is well below the 430 pCi/L DCS. The maximum concentration detected for plutonium-239/240 was 0.17 (± 0.02) pCi/L, which is well below the applicable DCS (400 pCi/L). Finally, the maximum concentration detected for strontium-90 was 0.68 (± 0.17) pCi/L, which is also well below the applicable DCS (1,700 pCi/L). In addition to these nuclides, uranium isotopes were detected at levels consistent with historical results, which are below any applicable DCS.

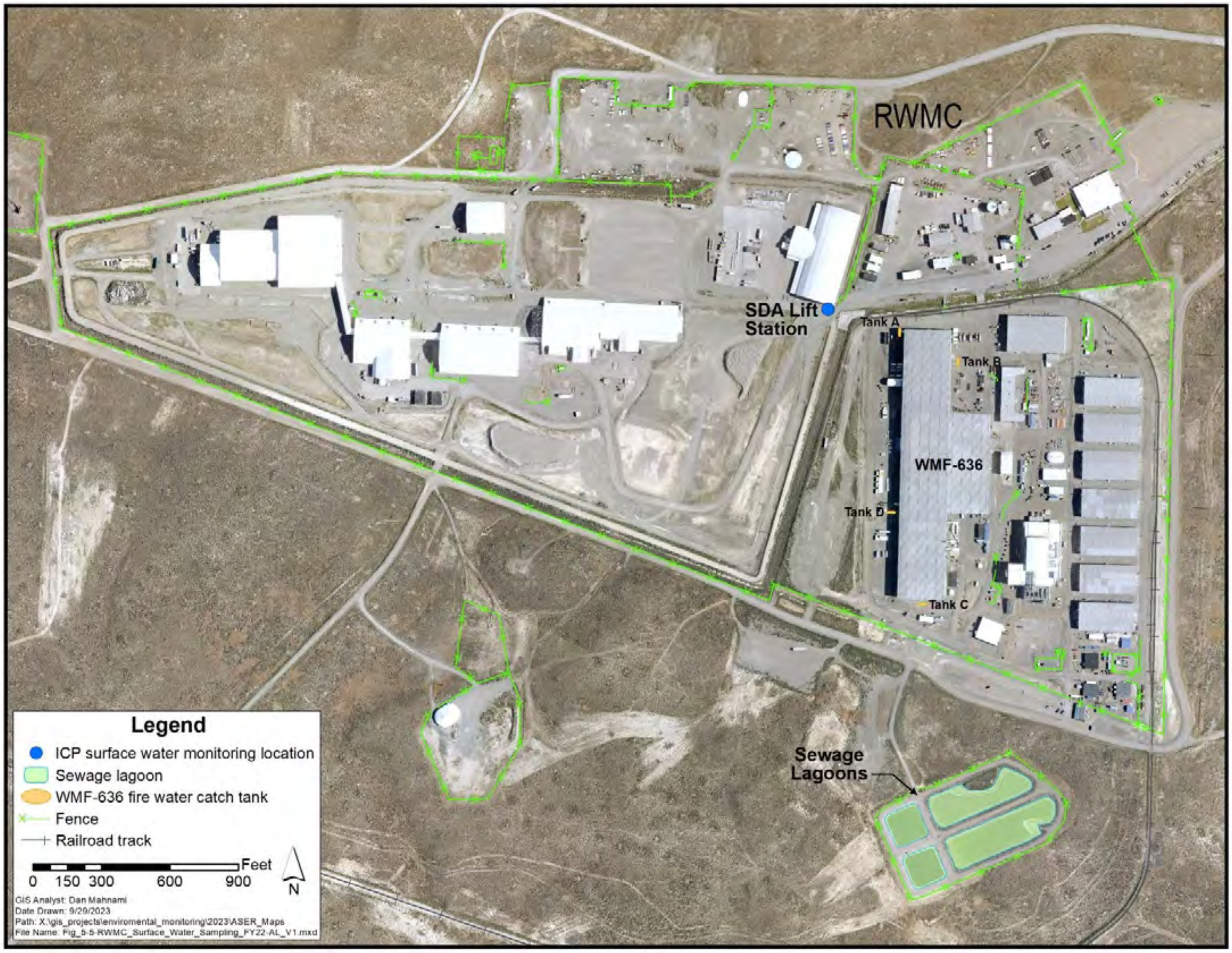


Figure 5-5. Surface water sampling location at the RWMC SDA.

Table 5-3 summarizes the specific alpha and beta results of human-made radionuclides. No human-made gamma-emitting radionuclides were detected. The ICP contractor took samples from the SDA Lift Station twice during 2022 at times when water was available and evaluated the results to identify any potential abnormal trends or results that would warrant further investigation. ICP will also continue to collect samples as necessary for the discharge of accumulated water run-in contained in the WMF-636 Fire Water Catch Tanks.

Table 5-3. Radionuclides detected in surface water runoff at the RWMC SDA (2022).

LOCATION	PARAMETER	MAXIMUM CONCENTRATION[a] (pCi/L)	% DERIVED CONCENTRATION STANDARD[b]
SDA Lift Station	Americium-241	0.95 ± 0.09	0.13
	Plutonium-238	0.04 ± 0.01	0.01
	Plutonium-239/240	0.17 ± 0.02	0.04
	Strontium-90	0.68 ± 0.17	0.04
	Uranium-234	0.46 ± 0.03	0.04
	Uranium-235	0.03 ± 0.01	0.00
	Uranium-238	0.36 ± 0.03	0.03

a. Result ±1s. Results shown are greater than 3σ.
b. See DOE-STD-1196-2021, Table A-6 (DOE 2022).

5.4 References

DEQ, 2017, “Idaho National Laboratory, Idaho Nuclear Technology and Engineering Center New Percolation Ponds,” Reuse Permit M-130-06, ICP PER-143, Idaho Department of Environmental Quality, June 2017.

DEQ, 2019, “Idaho National Laboratory (INL) Advanced Test Reactor (ATR) Complex Cold Waste Ponds – Reuse Permit I-161-03,” PER-132, Idaho Department of Environmental Quality, October 2019.

DEQ, 2020, “Idaho National Laboratory (INL) Materials and Fuels Complex (MFC) Industrial Waste Pond (IWP), Reuse Permit No. I-160-02, Modification 3,” PER-138, Idaho Department of Environmental Quality, September 2020.

DEQ, 2022a, “Idaho National Laboratory (INL) Advanced Test Reactor (ATR) Complex Cold Waste Ponds – Reuse Permit I-161-03, Modification 1” PER-132, Idaho Department of Environmental Quality, May 2022.

DEQ, 2022b, “Idaho National Laboratory (INL) Materials and Fuels Complex (MFC) Industrial Waste Pond (IWP), Reuse Permit No. I-160-02, Modification 4,” PER-138, Idaho Department of Environmental Quality, May 2022.

DOE, 2015, “DOE Handbook—Environmental Radiological Effluent Monitoring and Environmental Surveillance,” DOE-HDBK-1216-2015, U.S. Department of Energy.

DOE, 2021, “Derived Concentration Technical Standard,” DOE-STD-1196-2021, U.S. Department of Energy.

DOE O 435.1, 2011, “Radioactive Waste Management,” Change 2, U.S. Department of Energy.

DOE O 458.1, 2013, “Radiation Protection of the Public and the Environment,” Administrative Change 3, U.S. Department of Energy.

DOE-ID, 2021, “Idaho National Laboratory Site Environmental Monitoring Plan,” DOE/ID-11088, Rev. 5, U.S. Department of Energy Idaho Operations Office, October 2021.

ICP, 2023a, “2022 Wastewater Reuse Site Performance Report for the Idaho Nuclear Technology and Engineering Center New Percolation Ponds (M-130-06),” RPT-2077, Idaho Cleanup Project.

ICP, 2023b, “2022 Radiological Monitoring Results Associated with the Idaho Nuclear Technology and Engineering Center New Percolation Ponds,” RPT-2078, Idaho Cleanup Project.

IDAPA 58.01.11, “Ground Water Quality Rule,” Idaho Administrative Procedures Act, Idaho Department of Environmental Quality, https://adminrules.idaho.gov/rules/current/58/580111.pdf.

IDAPA 58.01.16, “Wastewater Rules,” Idaho Administrative Procedures Act, Idaho Department of Environmental Quality, https://adminrules.idaho.gov/rules/current/58/580116.pdf.

IDAPA 58.01.17, "Recycled Water Rules," Idaho Administrative Procedures Act, Idaho Department of Environmental Quality, https://adminrules.idaho.gov/rules/current/58/580117.pdf.

INL, 2023a, "2022 Groundwater Radiological Monitoring Results Associated with the Advanced Test Reactor Complex Cold Waste Ponds," INL/EXT-22-69967, Idaho National Laboratory.

INL, 2023b, "2022 Groundwater Radiological Monitoring Results Associated with the Materials and Fuels Complex Industrial Waste Pond," INL/RPT-22-69861, Idaho National Laboratory.

INL, 2023c, "2022 Annual Reuse Report for the Idaho National Laboratory Site's Advanced Test Reactor Complex Cold Waste Ponds," INL/RPT-22-69857, Idaho National Laboratory.

INL, 2023d, "2022 Annual Industrial Wastewater Reuse Report for the Idaho National Laboratory Site's Materials and Fuels Complex Industrial Waste Pond," INL/RPT-22-69862, Idaho National Laboratory.

Smoke on Middle Butte