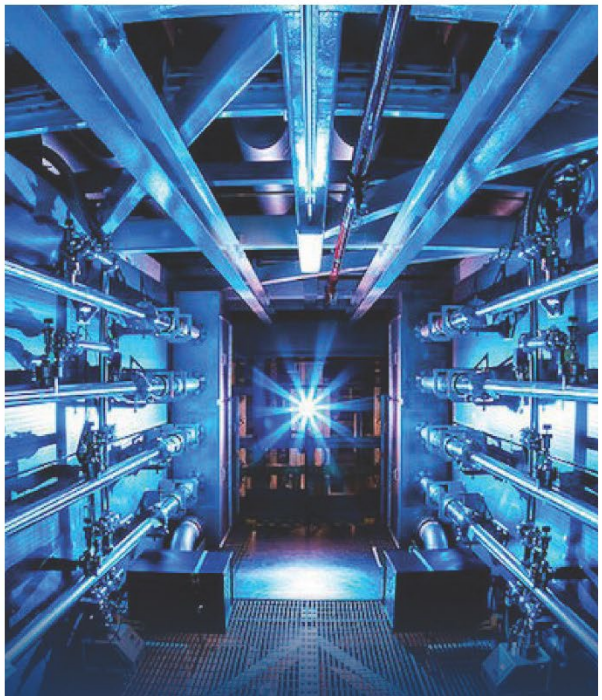
Initial Assessment of Per- and Polyfluoroalkyl Substances at Department of Energy Sites



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EXECUTIVE SUMMARY

The release of per- and polyfluoroalkyl substances (PFAS) into the environment is a topic of growing public health and environmental concern. PFAS are a class of over 9,000 man-made fluorinated chemicals used since the 1940s in many industrial processes and in a wide array of commercial and consumer products. PFAS are often found in commercial products such as stain-resistant carpeting, water-resistant clothing, non-stick and grease-resistant food contact materials (e.g., cookware and food packaging), and firefighting foams.

Environmental releases of PFAS from manufacturing and processing practices, along with widespread usage of PFAS products by consumers, government, and commercial entities, have resulted in the presence of PFAS in soil, drinking water, surface water, groundwater, and biota. Due to their chemical stability, PFAS are highly persistent in the environment and have been detected in humans and wildlife. There is evidence that some PFAS can bioaccumulate and lead to adverse ecological and human health effects.

The Department of Energy (DOE or the Department) has a unique historical relationship to PFAS, which were first produced on an industrial scale for use in uranium separation activities during the Manhattan Project. DOE sites have also used commercial products, including firefighting foams, that are known to contain PFAS.

In 2016, the U.S. Environmental Protection Agency (EPA) designated PFAS as "emerging contaminants" and set a drinking water health advisory (HA) level of 70 nanograms per liter (ng/L), i.e., parts per trillion (ppt) combined for perfluorooctanoic acid (PFOA) and perfluorooctanesulfonic acid (PFOS), two of the most prevalent and closely studied PFAS. On June 15, 2022, EPA announced new interim updated HAs for PFOA and PFOS of 0.004 ppt and 0.02 ppt, respectively. EPA also issued final HAs for two other PFAS: perfluorobutane sulfonic acid and its potassium salt (PFBS) and hexafluoropropylene oxide (HFPO) dimer acid and its ammonium salt ("GenX chemicals") of 2000 ppt and 10 ppt, respectively. In April 2021, EPA identified PFAS as a top priority and established the new EPA Council on PFAS to develop a multi-year PFAS strategy and continue close interagency coordination.

This report, *Initial Assessment on Per- and Polyfluoroalkyl Substances (PFAS) at Department of Energy Sites*, summarizes the Department's current knowledge about its uses and releases of PFAS. The Report draws upon responses to a survey that the Department, including the National Nuclear Security Administration (NNSA), distributed to its operating facilities to begin to assess its PFAS equities. The Report is based on the information collected from 53 DOE sites across the country. The Department will use this information to identify data gaps and evaluate the need for further action.

The survey solicited information from sites on a number of PFAS topics, including sampling of environmental media such as drinking water, surface water, groundwater, soil, and biota; identification of facilities and processes that may have used or released PFAS; and inquiries about PFAS from regulators and other external parties. Drinking water was an area of particular focus in the survey.

Drinking water is supplied to sites in two ways. Most DOE sites are supplied by an off-site public water system, typically operated by a county or municipality. Smaller numbers of DOE sites operate an onsite drinking water supply system. Of the nine sites with onsite drinking water supply systems that sampled for PFAS, only Brookhaven National Laboratory (BNL) and Idaho National Laboratory (INL) detected PFAS presence. BNL detected the PFAS chemical PFOS at concentrations greater than the 10 ppt New York State drinking water standard[1]. At INL, PFAS were detected in drinking water at concentrations less than 10 ppt. No drinking water standard currently exists for Idaho. DOE is continuing to assess drinking water at sites where the Department is the onsite supplier.

Our results show that 13 sites have conducted onsite sampling or monitoring of environmental media beyond drinking water, with each site reporting some detections. Four sites have active PFAS monitoring programs. In addition, 17 sites have conducted historical records searches to identify possible use of PFAS in production and firefighting operations.

All but two sites indicated the presence of at least one on-site facility or event that may have involved PFAS-related activity. Landfills, fire departments, water treatment plants, Cold War-era liquid waste discharges, and fire training facilities are the top five facilities/events identified by DOE sites. All but seven sites indicated that they track and maintain inventories of PFAS-containing materials. None of those inventories meet regulatory criteria that would trigger reporting under the Toxic Release Inventory requirements.

To continue the effort to better understand PFAS at DOE, the Department formed a PFAS Coordinating Committee (PCC) to work with DOE program offices to appropriately characterize historic PFAS use and releases at the site level. The PCC led the development of the *PFAS Strategic Roadmap: DOE Commitments to Action, 2022-2025* (Roadmap), released on August 18, 2022[2]. The Roadmap describes how the Department will continue to build on this Initial Assessment Report to identify the use and possible environmental release of PFAS from its current and past activities, as well as the actions DOE will take to ensure protection of workers, the public, and the environment. The Roadmap also details how the Department is working to identify solutions to PFAS-related challenges and how it will engage with regulators, tribal entities, and stakeholders.

[1] "Public Water Systems and NYS Drinking Water Standards for PFAS and Other Emerging Contaminants" https://www.health.ny.gov/environmental/water/drinking/docs/water_supplier_fact_sheet_new_mcls.pdf

[2] DOE PFAS Strategic Roadmap: DOE Commitments to Action 2022-2025 (energy.gov)

ACRONYM LIST

AFD	Argonne Fire Department
AFFF	Aqueous Film Forming Foam
ANL	Argonne National Laboratory
BNL	Brookhaven National Laboratory
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CESER	Office of Cybersecurity, Energy Security, and Emergency Response
D&D	Deactivation and Decommissioning
DNR	Department of Natural Resources
DOD	Department of Defense
DOE	Department of Energy
EHSS	Office of Environment, Health, Safety and Security
EPA	Environmental Protection Agency
EPCRA	Emergency Planning and Community Right to Know Act
ELG	Effluent Limitations Guidelines
EM	Office of Environmental Management
ETEC	Energy Technology Engineering Center
ETTP	East Tennessee Technology Park
FECM	Office of Fossil Energy and Carbon Management
FYR	CERCLA Five-Year Review
HA	Health Advisory
HFPO	Hexafluoropropylene Oxide Dimer Acid ("GENX chemicals")
ICP	Idaho Cleanup Project
INL	Idaho National Laboratory
KAPL	Knolls Atomic Power Laboratory
KAPL-KS	Knolls Atomic Power Laboratory-Kesselring
KCNSC	Kansas City National Security Campus
KCP-BFC	Kansas City Plant Bannister Federal Complex
KCNSC-NMO	Kansas City National Security Campus New Mexico Operations
LANL	Los Alamos National Laboratory
LBS	Pounds
LEHR	Laboratory for Energy-Related Health Research
LLNL	Lawrence Livermore National Laboratory
LM	Office of Legacy Management
LTS&M	Long-term Surveillance and Maintenance
MOU	Memorandum of Understanding
M&O	Management and Operations
N3B	Newport News Nuclear BWXT
NE	Office of Nuclear Energy
NETL	National Energy Technology Laboratory
NETL-ALB	National Energy Technology Laboratory, Albany, Oregon
NETL-PGH	National Energy Technology Laboratory, Pittsburgh, Pennsylvania
NETL-MGN	National Energy Technology Laboratory, Morgantown, West Virginia

NMED	New Mexico Environment Department
NNFD	Newport News Fire Department
NNSA	National Nuclear Security Administration
NNSS	Nevada National Security Site
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NR	Naval Reactors Program
NREL	National Renewable Energy Laboratory
NREL-STM	The National Renewable Energy Laboratory South Table Mountain Campus
NRF	Naval Reactors Facility
OREM	Oak Ridge Office of Environmental Management
ORNL	Oak Ridge National Laboratory
ORR	Oak Ridge Reservation
PCC	PFAS Coordinating Committee
PFAS	Per- and Polyfluoroalkyl Substances
PFBS	Perfluorobutanesulfonate
PFHpA	Perfluoroheptanoic Acid
PFHxA	Perfluorohexanoic Acid
PFHxS	Perfluorohexanesulfonate
PFNA	Perfluorononanoic Acid
PFOA	Perfluorooctanoic Acid
PFOS	Perfluorooctanesulfonic Acid
PPPL	Princeton Plasma Physics Laboratory
PNNL	Pacific Northwest National Laboratory
PPT	Parts Per Trillion
PWS	Public Water Systems
RCRA	Resource Conservation and Recovery Act
SAP	Sampling and Analysis Plan
SC	Office of Science
SLAC	SLAC National Accelerator Laboratory
SNL	Sandia National Laboratories
SNL-CA	Sandia National Laboratories, Livermore, California
SNL-NM	Sandia National Laboratories, Albuquerque, New Mexico
SNL-TTR	Sandia National Laboratories, Tonopah Test Range
SPR	Strategic Petroleum Reserve
SRS	Savannah River Site
SRTE	Savannah River Tritium Enterprise
SWMU	Solid Waste Management Unit
TJNAF	Thomas Jefferson National Accelerator Facility
TRI	Toxic Release Inventory
UCMR	Unregulated Contaminant Monitoring Rule
UCOR	United Cleanup Oak Ridge
VPDES	Virginia Pollutant Discharge Elimination System
WIPP	Waste Isolation Pilot Plant
WVDP	West Valley Demonstration Project
Y-12	Y-12 National Security Complex

1. INTRODUCTION

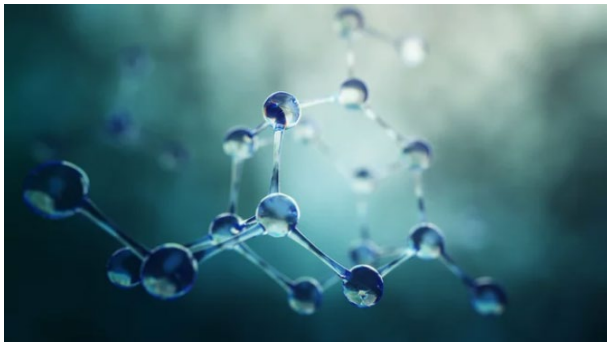
DOE recognizes the growing concerns over the presence of per-and polyfluoroalkyl substances (PFAS) in the environment and is working to understand its current and past uses and releases of PFAS. PFAS are a class of man-made chemicals that have been manufactured and used in a variety of industries since the 1940s. Since then, thousands of chemical formulations have been developed and widely used in manufacturing and processing facilities due to their resistance to grease, water, oil, and heat. They are found in many industrial and commercial products, most notably in firefighting foams, that have been used at DOE sites.

DOE developed a survey to compile existing knowledge and gain a baseline understanding of PFAS use, releases, and stakeholder/regulator engagement at its sites. The Department has prepared this Initial Assessment Report on PFAS at its sites as a first step in understanding the risks PFAS may pose to DOE employees, the public and the environment. This report captures current knowledge of historical and on-going uses of PFAS, presence of PFAS in the environment and drinking water, and stakeholder/regulatory engagement.

The *DOE PFAS Strategic Roadmap: DOE Commitments to Action, 2022-2025* (Roadmap), released on August 18, 2022, identifies additional activities the Department will undertake to determine the potential liabilities and risks associated with PFAS use and environmental releases (See Section 1.2.3 for more information on the Roadmap). Both this Report and the Roadmap will inform future information collection activities to refine DOE's understanding of PFAS at its sites.

This Report introduces the issue of PFAS at DOE sites and the program offices that support those sites (Section 1), explains the information collected from the survey (Section 2), presents survey responses (Section 3), discusses the preliminary results and their relation to the actions of the Roadmap (Section 4), and concludes with follow-on activities the Department plans in order to expand DOE's PFAS knowledge base (Section 5). It also provides the survey questionnaire and the DOE sites that participated in the survey (Appendix A and Appendix B, respectively) along with site narratives (Appendix C) summarizing PFAS presence at DOE sites.

1.1. Overview of PFAS



PFAS are a class over 9,000 synthetic fluorinated chemicals commonly used since the 1940s (EPA 2021) for their non-stick, heat resistant, and waterproof properties (ITRC 2020). Consumer products containing PFAS include fast food wrappers, waterproof clothing, non-stick pans, cosmetics, and stain resistant carpeting. PFAS are known to have been used industrially as wetting agents for mist suppression during chrome plating and other electroplating processes, and also in a variety of industrial products (e.g., tubing, piping, seals, gaskets, cables, paints, coatings, and flame retardants), processes, and materials across multiple industries and more than 200 use categories (Gluge et al., 2020). Of relevance to DOE, Manhattan Project-era uranium processing operations are among the first industrial-scale uses of per-fluorinated chemicals.

PFAS are exceptionally long-lasting due to the strength of the carbon-fluorine bond. They are very persistent in the environment and tend to bioaccumulate in people, wildlife, and food chains. Because of their breadth of use and environmental longevity, PFAS have been found in lakes (Boulanger et al., 2004), rainwater (Cousins et al., 2022), groundwater (Sharma et al., 2016), soils (Baduel et al., 2017), birds (Route et al., 2014), fish (Schuetze et al., 2010), and humans (Center for Disease Control and Prevention (CDC), 2021). A growing body of scientific evidence shows that exposure at certain levels to specific PFAS can adversely impact human health and other living things.

Aqueous film forming foam (AFFF) used in firefighting training and response contain PFAS chemicals (EPA 2021a), and their use for these purposes can result in releases to the environment (Hu et al., 2016; Houtz et al., 2013). In recent years, focus on AFFF as a widespread source of PFAS contamination has intensified; many U.S. states are moving to limit use of AFFF, and Congress has funded efforts to find a replacement for AFFF and has required the Department of Defense (DOD) to accelerate its efforts to remediate military installations contaminated by AFFF releases. As DOE looks to better understand its use of PFAS, the Department is paying particular attention to those of its sites with fire training facilities, firefighting equipment, or fixed fire suppression systems that have used AFFF.

Although several states have set enforceable limits on certain PFAS compounds, currently there are no federal enforceable limits on any PFAS compounds. EPA in 2016 announced a lifetime Health Advisory[3] (HA) drinking water concentration of 70 parts per trillion (ppt) for the two most studied PFAS chemicals, perfluorooctanoic acid (PFOA) and perfluorooctanesulfonic acid (PFOS) (EPA 2016a). On June 15, 2022, EPA announced new interim updated HAs for PFOA and PFOS of 0.004 ppt and 0.02 ppt, respectively. EPA also issued final health advisories for two other PFAS, perfluorobutane sulfonic acid and its potassium salt (PFBS) and for hexafluoropropylene oxide (HFPO) dimer acid and its ammonium salt ("GenX chemicals"). In recent years, federal and state regulatory efforts have gathered momentum toward setting enforceable limits on PFAS across a variety of environmental media.

1.2. DOE PFAS Initiatives

1.2.1 DOE PFAS Working Group

In 2019, the DOE Office of Environment, Health, Safety, and Security (EHSS) established an internal PFAS Working Group, open to federal and contractor staff from across the DOE enterprise. The PFAS Working Group provides a valuable forum for internal communication and information exchange.

The PFAS Working Group also includes participation from DOE's National Laboratories that are actively researching technologies related to PFAS

[3] Health advisories provide information on contaminants that can cause human health effects and are known or anticipated to occur in drinking water. They are not enforceable regulatory requirements. (Drinking Water Health Advisories for PFOA and PFOS: Questions and Answers | US EPA)

identification, quantification, treatment, remediation, and destruction. These research and development activities are on-going at several locations, including Argonne National Laboratory (ANL), Brookhaven National Laboratory (BNL), Fermi National Accelerator Laboratory (FermiLab), Pacific Northwest National Laboratory (PNNL), and Thomas Jefferson National Accelerator Facility (TJNAF). DOE PFAS research activities are described in more detail in the Roadmap.

In addition to forming the PFAS Working Group, EHSS developed and distributed an official safety notification, known as an Operating Experience Level 3 ("OE-3") document, to all DOE facilities on PFAS as an issue of concern.[4] The OE-3 provided information on increasing federal and state regulatory focus on PFOA and PFOS in particular, and encouraged DOE sites to prepare for regulatory engagement by considering questions related to operations, sampling, and provision of drinking water onsite. EHSS subsequently developed another official safety document, an Operating Experience Summary, describing BNL's experience with environmental characterization and remediation of PFAS.[5]

1.2.2 DOE Internal Policy Memorandum

In September 2021, Deputy Secretary David Turk issued a policy memorandum, *Addressing Per- and Polyfluoroalkyl Substances at the Department of Energy,* to address PFAS management for DOE operations. The memorandum required that DOE program offices and sites discontinue use of AFFF except for use in actual fire emergencies; required fire protection personnel to wear appropriate protective personal protective equipment when working with PFAS,; suspended disposal of waste containing PFAS until further notice, absent an approved waiver granted on a case-by-case basis in limited situations; and established reporting requirements for PFAS-related releases or spills (DOE, 2021).

The Deputy Secretary's memorandum also established the PFAS Coordinating Committee (PCC), comprised of senior-level representatives from all DOE program offices with PFAS equities. The PCC, which is chaired by EHSS, tracks progress in meeting the requirements identified in the memorandum and is reviewing Departmental orders, other directives, and regulations that may need changes to achieve the requirements in the memorandum. The PCC serves as the management-level counterpart to the DOE PFAS Working Group. (DOE, 2021)

1.2.3 DOE PFAS Strategic Roadmap

The DOE PFAS Strategic Roadmap outlines the Department's overall approach, goals and objectives, and planned actions to assess and manage PFAS risk at DOE sites, and in so doing, is intended to help ensure the protection of human health and the environment. The Roadmap describes the actions DOE will take to continue to address the findings identified in this Report.

The Roadmap positions the Department to engage with regulators and other interested stakeholders proactively and in a manner that demonstrates commitment to environmental protection and public health.

[4] DOE EHSS Operating Experience Level 3 (OE-3) Per-and Polyfluoroalkyl Substances (PFAS) Awareness (September 2019).
[5] Operating Experience Summary https://www.energy.gov/ehss/downloads/operating-experience-summary-2020-02-march-26-2020 (March 26, 2020).

2. PFAS SURVEY/DISTRIBUTION

DOE developed a survey tool to get a preliminary understanding of existing knowledge of PFAS in drinking water, current and historical uses and inventories, known or suspected releases to the environment, and stakeholder/regulator engagement at its sites. A copy of the survey that was distributed to the sites is presented in Appendix A.

This Report is based on the survey responses received from DOE sites and programs. DOE received responses from sites supported by the Office of Environmental Management (EM), the National Nuclear Security Administration (NNSA), the Office of Legacy Management (LM), the Office of Science (SC), the Office of Nuclear Energy (NE), the Office of Fossil Energy and Carbon Management (FECM), and the Office of Energy Efficiency and Renewable Energy (EERE). Sites managed by the Office of Naval Reactors (NR) did not complete the survey, but NR provided information about them that has also been incorporated into this report. Figure 1 presents a map with the location of all the sites that provided information in response to the survey, and a detailed table of the sites and their associated program offices is presented in Appendix B. Site-specific narratives are presented in Appendix C.

Sites and program offices reporting no PFAS equities did not respond to the survey and are not included in this report. This includes the four federal Power Marketing Administrations, which operate electric systems and sell the electrical output of federally owned and operated hydroelectric dams in 34 states.

The PFAS survey was organized into four lines of inquiry covering the following topical areas:

1. Onsite drinking water at DOE sites, and sampling results for PFAS from those supplies.
2. Historical and current site operations using or disposing of PFAS-containing chemicals and materials.
3. Sampling and monitoring of PFAS in soil, groundwater, surface water, wastewater, or other environmental media.
4. Requests for PFAS information from local stakeholders and federal and state regulators.

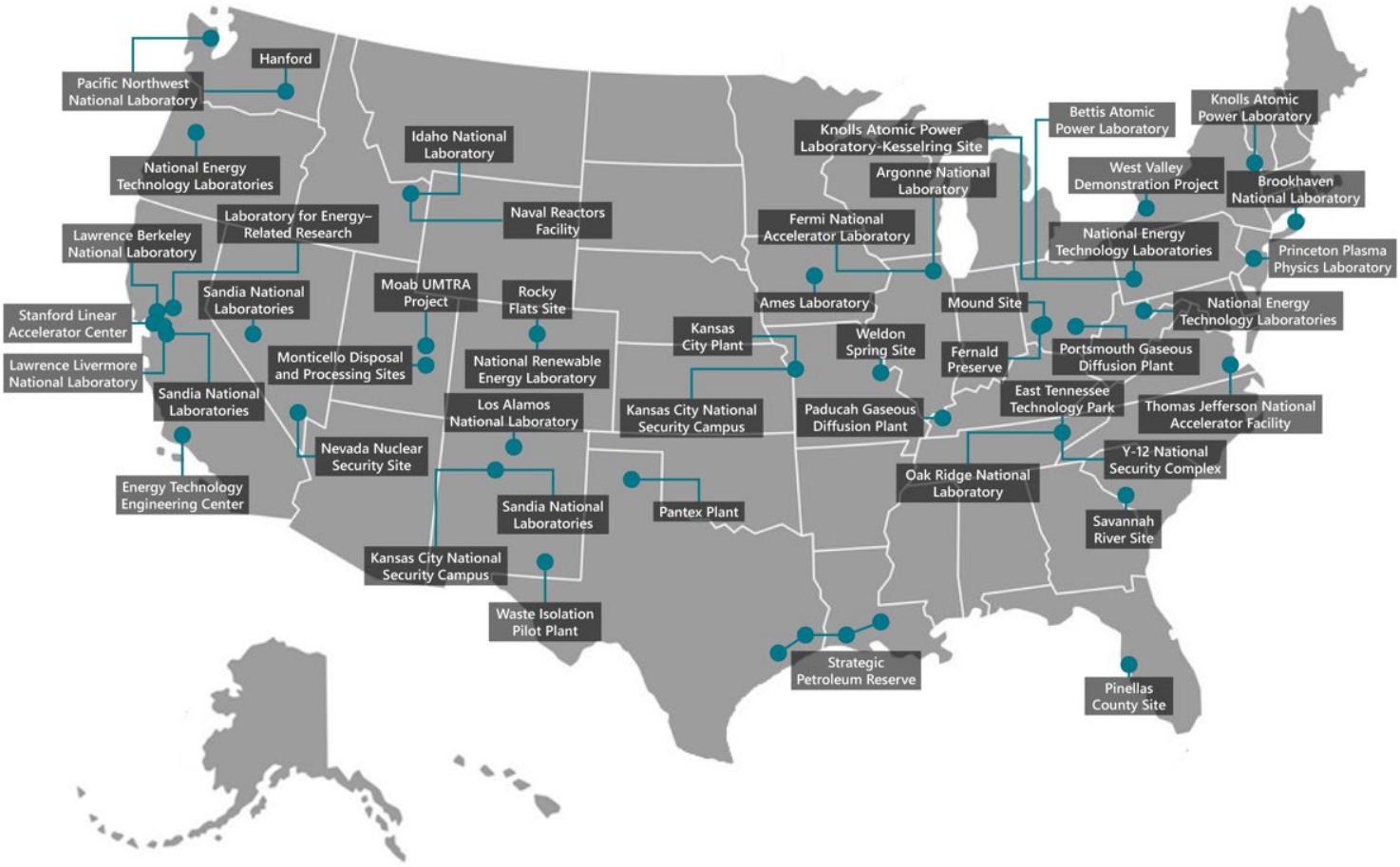


Figure 1. Location of Sites Providing PFAS Information

3. SUMMARY OF PFAS SURVEY RESULTS

The survey solicited information from sites on a number of PFAS topics, including sampling of environmental media such as drinking water, surface water, groundwater, soil, and biota; identification of facilities and processes that may have used or released PFAS; and inquiries about PFAS from regulators and other external parties. Drinking water was an area of particular focus in the survey.

3.1 Drinking Water Sampling

DOE recognizes drinking water as a primary source of exposure for PFAS and is committed to ensuring the health and safety of its workforce and the public through the provision of drinking water that meets all applicable health and safety requirements.

Drinking water is supplied to sites in several ways. The most common drinking water supply scenario for DOE sites is drinking water conveyed from off-site public water systems (PWS), such as a county or municipality. Not only is this water treated off site, but it is also sourced from off-site surface and groundwater.[6] Thirty-four sites receive drinking water from off-site PWSs. PWSs must comply with state and federal drinking water regulations. DOE relies on PWSs for their PFAS analytical information.

For a limited number of DOE sites, there is no on-site drinking water supply system (i.e., pipes, faucets, etc.). These are typically underdeveloped sites without permanent onsite staff or offices. Bottled water is brought on site as necessary. Of the 53 sites surveyed, six sites reported not supplying drinking water to their sites.

Of greatest interest to DOE is drinking water sourced and supplied by onsite drinking water systems. Across the country, 15 DOE sites supply onsite drinking water. Of the 15 sites, nine sites have sampled for PFAS in their source water and/or treated water.

DOE is continuing to assess drinking water at sites where the Department is the onsite supplier. DOE will follow up with its sites to ensure proper testing and monitoring of onsite potable water. Further, the Roadmap includes a commitment to sample all DOE-owned water systems where DOE supplies drinking water. The site summaries in Appendix C provide additional information on the source of drinking water at the sites.

This information is summarized in Figure 2.

[6] One exception is Los Alamos National Laboratory (LANL) where the offsite PWS sources a portion of its water from groundwater underlying LANL.

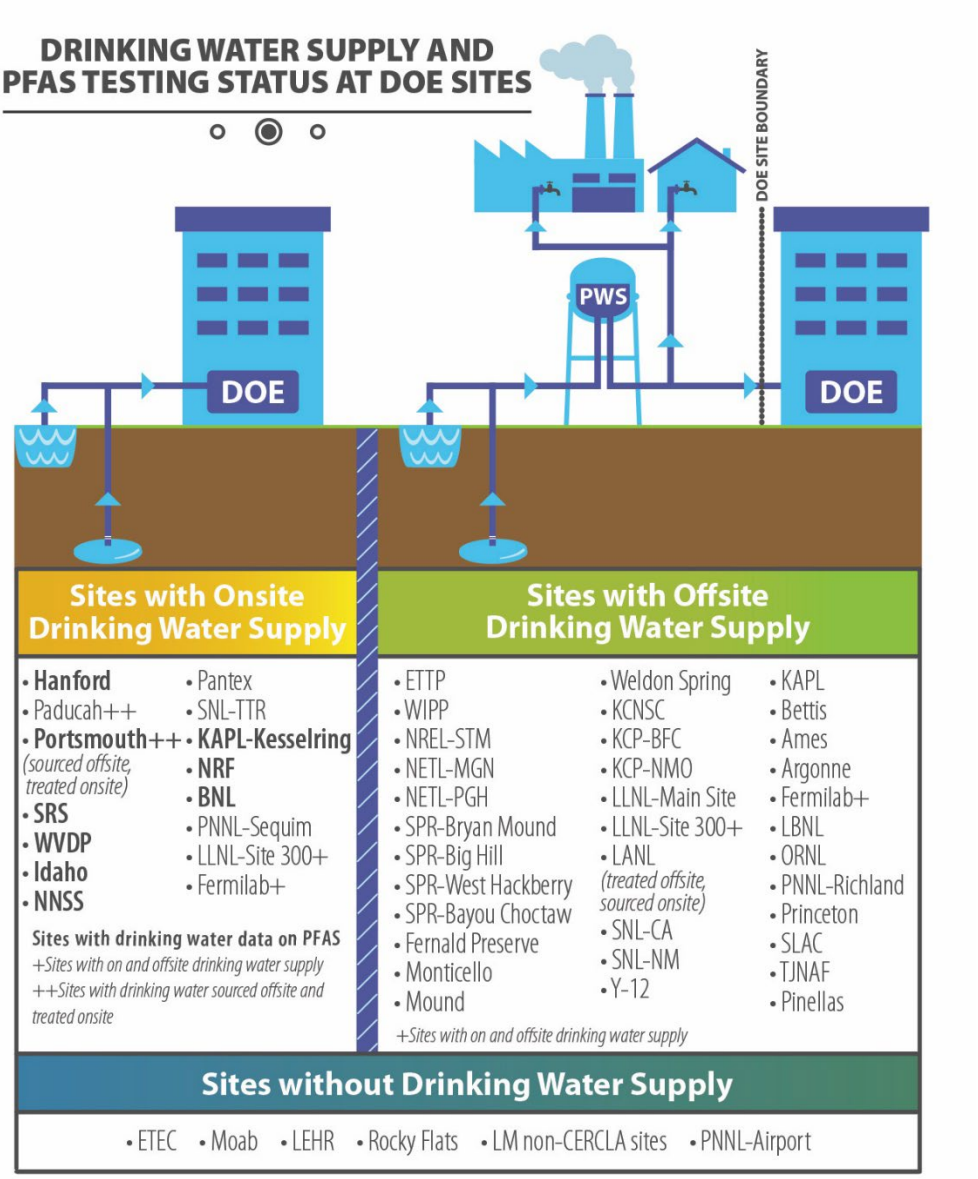


Figure 2. Drinking water supply information and PFAS testing status at DOE sites.

3.2 Environmental Sampling and Monitoring

DOE is committed to understanding the type of PFAS and their extent in the environment at its sites, including any potential migration off-site from DOE releases. Environmental sampling at sites known or suspected to have released PFAS is important to developing an accurate understanding of the presence of PFAS at DOE sites. It is also an essential element to inform determinations about whether further characterization or risk management activities may be necessary.

DOE sites conducting environmental sampling have taken a variety of approaches, including one-time sampling at a single location, one-time sampling at multiple locations on site, and monitoring over an extended period. Table 1 summarizes DOE's environmental sampling and monitoring of PFAS to date.

Site	Media Sampled						Active Monitoring Program
	Groundwater	Surface Water	Leachate	Soil	Wastewater	Biota	
BNL	√	-	-	√	√	-	√
ETTP	√	√	-	-	-	-	-
Idaho	√	-	-	-	-	-	-
KAPL	√	-	-	√	-	-	-
KAPL-KS	√	-	-	√	-	-	-
KCP-BFC	√	-	-	√	-	-	-
LANL	√	√	-	√	√	√	√
LLNL Site 300	√	-	-	-	-	-	-
ORNL	-	√	-	-	-	-	-
Paducah	√	-	-	-	-	-	-
Rocky Flats	√	√	√	-	-	-	√
SRS	√	-	-	-	-	-	√
Y-12	-	√	-	√	-	-	

Table 1. Summary of DOE's environmental sampling and monitoring to date.

In its PFAS Roadmap, DOE commits to supporting sites' sampling efforts by developing environmental sampling guidance so that sites have the resources to make informed sampling decisions in coordination with their regulatory partners.

3.2.1 Sampling

Eight sites have sampled for PFAS in environmental media apart from drinking water. Three of the eight sites (ORNL, ETTP, Y-12) are located on the Oak Ridge Reservation (ORR). PFAS were found at three ORNL surface water locations, with PFOA detected at 2.98 ppt, 2.84 ppt and 7.3 ppt, and PFOS detected at 11.8 ppt, 7.24 ppt and 22.4 ppt.

At ETTP, surface water samples were collected downstream of a fire training facility and a process pond. Surface water samples collected downstream of the fire training facility contained up to 30.2 ppt PFOA and up to 40 ppt of PFOS. In the process pond, PFOA was detected at concentrations up to 9.52 ppt and PFOS up to 10.1 ppt. PFAS sampling of groundwater detected PFAS to 46.2 ppt (PFOS) at a location where oils were historically managed and burned.

At Y-12, soils were co-sampled with the Tennessee Department of Environment and Conservation. The results identified low concentrations (0.1 ng/g – 4.8 ng/g) of multiple PFAS, including perfluorononanoic acid (PFNA), PFOA, PFOS, perfluorodecanoic acid (PFDA), perfluoroheptanoic acid (PFHpA), perfluorohexane sulfonic acid (PFHxS), perfluorohexanoic acid (PFHxA), and perfluoroundecanoic acid (PFUnDA). Surface water sampling performed on the Y-

12 site resulted in detections for PFOA at 12.1 ppt and 1.51 ppt and PFOS at 10.1 ppt and 2.44 ppt.

Kansas City Plant Bannister Federal Complex (KCP-BFC) conducted PFAS sampling of soil and groundwater as part of the decommissioning of the facility. Perfluoroheptanoic acid (PFHA), PFBS, PFHxS, PFHxA, PFNA and PFOA were detected in groundwater at concentrations from 1 to 37 ppt, and PFNA in soil at 0.24 ng/g.

At LLNL 300 Site, the Central Valley Regional Water Quality Control Board requested a groundwater sample downstream of a known fire training location. Detected PFAS included perfluorohexanesulfonate (PFHxS) at 7.6 ppt and 7.8 ppt and PFOA at 2.8 ppt and 3.2 ppt.

The state of New York requested Knolls Atomic Power Laboratory (KAPL) and Knolls Atomic Power Laboratory-Kesselring (KAPL-KS) to sample for PFOA and PFOS in groundwater and soil at various locations on both sites. PFOA concentrations at KAPL and KAPL-KS ranged from non-detect to 34.6 ppt and 0.96 to 14 ppt, respectively. PFOS concentrations at KAPL and KAPL-KS ranged from non-detect to 71.7 ppt and 2.18 to 327 ppt, respectively.

At Paducah, groundwater sampling activities undertaken at the request of EPA identified high levels of PFAS near a former fire training area. Maximum PFOA and PFOS concentrations in groundwater were 5,230 ppt and 128,000 ppt, respectively. PFBS, perfluoroheptanoic acid (PFHpA), PFHxS, and perfluorohexanoic acid (PFHxA) were also detected at maximum concentrations between 1,420 ppt and 63,200 ppt.

3.2.2 Active Monitoring

Four sites (BNL, LANL, Rocky Flats, and SRS) actively monitor PFAS concentrations. In 2017, PFAS were detected in several of BNL's water supply wells. To date, BNL has obtained PFAS data from over 360 permanent on-site and off-site groundwater monitoring wells, 170 temporary groundwater profile wells, 11 on-site and off-site groundwater treatment systems, and at the Laboratory's wastewater treatment plant. A small number of soil samples have also been collected. The highest PFAS concentrations in groundwater are associated with three former fire training areas, where PFOS and PFOA were detected at concentrations up to 12,200 ppt and 1,400 ppt, respectively. BNL is the only site where PFAS have been detected in groundwater beyond the DOE site boundary. The source of the offsite detections by BNL has not definitively been determined. It will require the completion of a Remedial Investigation/Feasibility Study.

At LANL, PFAS monitoring programs are in place for groundwater, surface water, soil, biota, and wastewater. PFAS have been detected in all media. During monitoring year 2020, PFAS were detected in 44 out of the 153 total sites sampled, including groundwater monitoring wells and surface water. Four groundwater wells (two alluvial and two perched intermediate wells) exceeded the State of New Mexico screening level (70 ppt for the cumulative sum of PFHxS, PFOS, and PFOA concentrations). As part of the biota sampling, PFAS were detected in animals that travel across site boundaries; however, the source of PFAS bioaccumulation in the biota is undetermined.

PFAS have been detected in Rocky Flats groundwater, surface water, and landfill leachate. Sample locations, which were selected through consultation with the State of Colorado and EPA, are associated with the former fire department training area, both former landfills, a former

facility that was involved in metallurgical work, both former oil burn pits, a groundwater treatment system, and two creeks. Samples were initially analyzed only for PFOA and PFOS, but are now analyzed for 27 PFAS derived from State policy. One or more PFAS have been detected at each location sampled. The highest concentration reported to date is 310 ppt PFOS in groundwater near the former fire training area. Several other PFAS have been reported at concentrations exceeding 100 ppt. Groundwater near the former fire department training area contains the highest concentrations of PFAS detected to date (70-130 ppt for PFOA and 240-310 ppt for PFOS), followed by leachate from one of the former landfills.

At SRS, the State of South Carolina and EPA worked with the site to develop a PFAS monitoring approach for groundwater downstream of an onsite firefighting training location. Nine separate PFAS were detected in the groundwater samples collected, with concentrations to 1,910 ppt PFNA. PFOA and PFOS concentrations exceeded regional screening levels and the HA.

3.2.3 Sampling Equipment

Sampling for PFAS is complicated by its widespread use in plastics. Notably, PFAS are found in some sampling infrastructure and equipment and in some personal protective equipment (PPE). This can lead to inadvertent contamination of samples from PFAS-containing equipment such as, well liners, sampling collectors, tubes, vials, and PPE.

Several sites have assessed their monitoring and sampling equipment for PFAS. Sites have identified the need for new sampling supplies (11 sites), new PPE (10 sites), new monitoring wells (7 sites) and replacement monitoring well liners (2 sites). Eleven (11) sites have already taken measures to mitigate PFAS contamination during sampling or have equipment that does not contain PFAS. Sites may need to assess their sampling infrastructure and revise their procedures or use different equipment to ensure that samples are not inadvertently contaminated by PFAS during collection and processing.

3.3 Known Historical and Current PFAS Use/Inventory

To assess known or potential PFAS use, the survey requested information on past and present PFAS inventories, as well as information regarding operations and activities often associated with PFAS. This information provides potential sources of environmental releases. For example, PFAS have been extensively used in firefighting foams, known as AFFFs, as surfactant additives that spread the foam to cool and suppress the fire. The use of AFFF for fire suppression in training or emergency situations is a common release mechanism of PFAS into the environment.

3.3.1. Past and Present PFAS Use

Many sites indicated multiple facility types or events that are associated with PFAS use on their premises. Landfills, fire departments, water treatment plants, Cold War era liquid waste discharges, and fire training facilities are the top five facilities/events identified. In addition, AFFF-based fire suppression systems have been used at many DOE locations. Approximately one-third of the sites surveyed indicated documented release of AFFF onsite. All but two sites

(KCNSC-NMO and TJNAF) have facilities that may have or had operations using PFAS. Site-specific uses can be found in Appendix C.

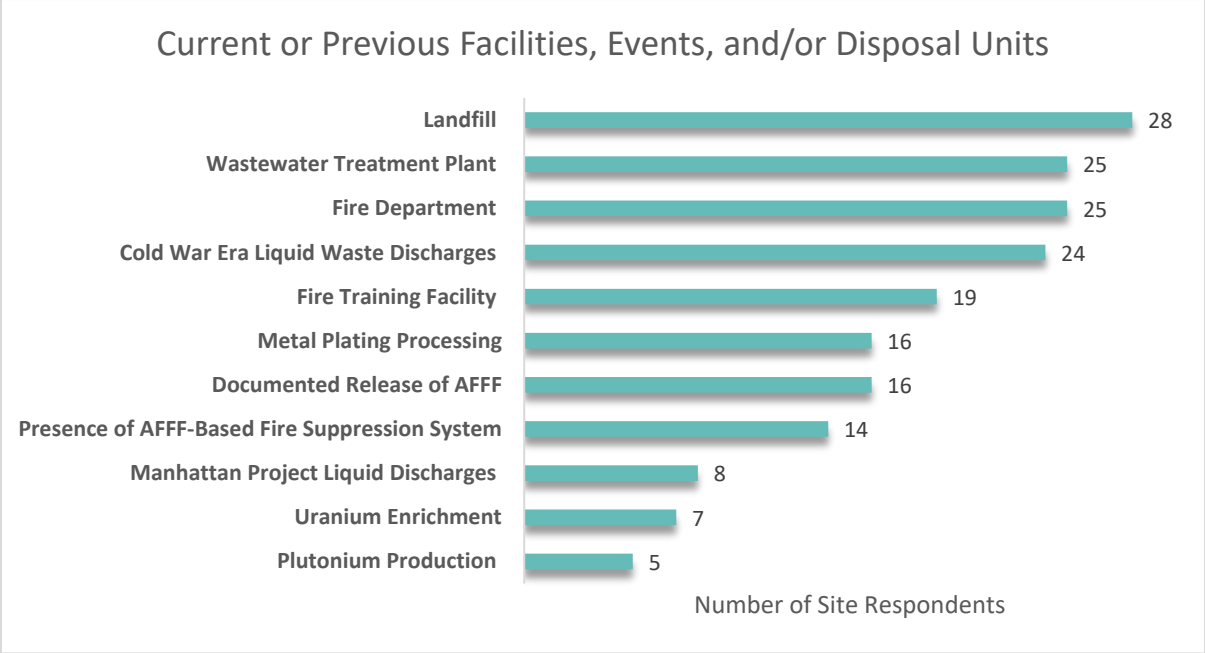


Figure 3. Survey responses across all DOE offices/sites indicating on-site presence of PFAS-related facility types/events, past or present.

3.3.2 PFAS Inventory

The survey also asked sites to report if they track or maintain records of past or present PFAS chemical inventories. More than half of the sites (28 sites) report some PFAS inventory (see Figure 4). Quantities of over 100 pounds of 172 different PFAS must be reported via the Emergency Planning and Community Right to Know Act (EPCRA) Toxic Release Inventory (TRI) requirements if the site manufactures, processes, or otherwise uses the chemical in excess of the applicable 100 pounds threshold quantity for PFAS.

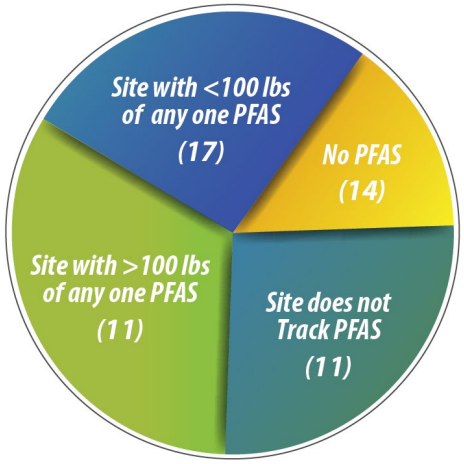


Figure 4. Survey responses across all DOE offices/sites indicating whether, if applicable, site tracks and maintains past and current inventories of PFAS

The 11 sites reporting quantities over 100 pounds of any one PFAS are storing the chemicals for future disposal or emergency use so are not reporting to TRI. They are:

- KCNSC
- LBNL
- LLNL-Main site
- ORNL
- Paducah
- Portsmouth
- Princeton
- NETL-ALB
- NETL-PGH
- NETL-MGN
- SPR

The following 17 sites report less than 100 lbs. of any product(s) known to contain at least one PFAS at this time. The 17 sites are:

- Ames
- Argonne
- BNL
- ETTP
- Hanford
- INL
- LANL
- NETL-Albany
- NETL-Morgantown
- NETL-Pittsburgh
- NNSS
- NREL
- SLAC
- SNL-TTR
- SRS
- TJNAF
- Y-12

The following 14 sites report no PFAS in their chemical inventories:

- ETEC
- Fermilab
- Fernald Preserve
- KCP-BFC
- KCP-NMO
- LEHR
- Monticello
- Mound
- Pantex
- Pinellas
- Rocky Flats
- SNL-NM
- Weldon Spring
- WIPP

The 11 sites that do not track or maintain records of past and present inventories of PFAS are:

- Bettis
- KAPL
- KAPL-KS
- NRF
- LLNL -300 Site
- Moab
- PNNL-Airport
- PNNL-Richland
- PNNL-Sequim
- SNL-CA
- WVDP

3.4 Regulatory and Stakeholder Engagement

With the rising national interest in PFAS and broad DOE presence across 22 states, DOE is seeing increasing engagement from federal and state regulators and stakeholders. Understanding DOE's engagement with regulators and stakeholders on PFAS provides insight into actions already taken and future engagements. The final section of the PFAS survey addressed interactions with regulators and stakeholders. Emerging PFAS regulations and interest in PFAS vary significantly by state. The survey asked whether sites have been contacted by tribal, local, state, or federal entities and whether that contact prompted any site response. The site narratives allowed for the sites to elaborate on their survey responses.

Over half of the sites (30 of the 53 sites) surveyed indicated that they have been contacted by a regulator or stakeholder regarding PFAS, see Figure 5. The sites have addressed some inquiries while others are having ongoing communications. These inquiries primarily pertain to PFAS records searches, one-time sampling events, or modifications to monitoring programs. Most engagement is at the federal and state levels. Only LANL reported being contacted directly by a Tribal Nation regarding PFAS. The most frequently requested information involved PFAS sampling at sites followed by records searches.

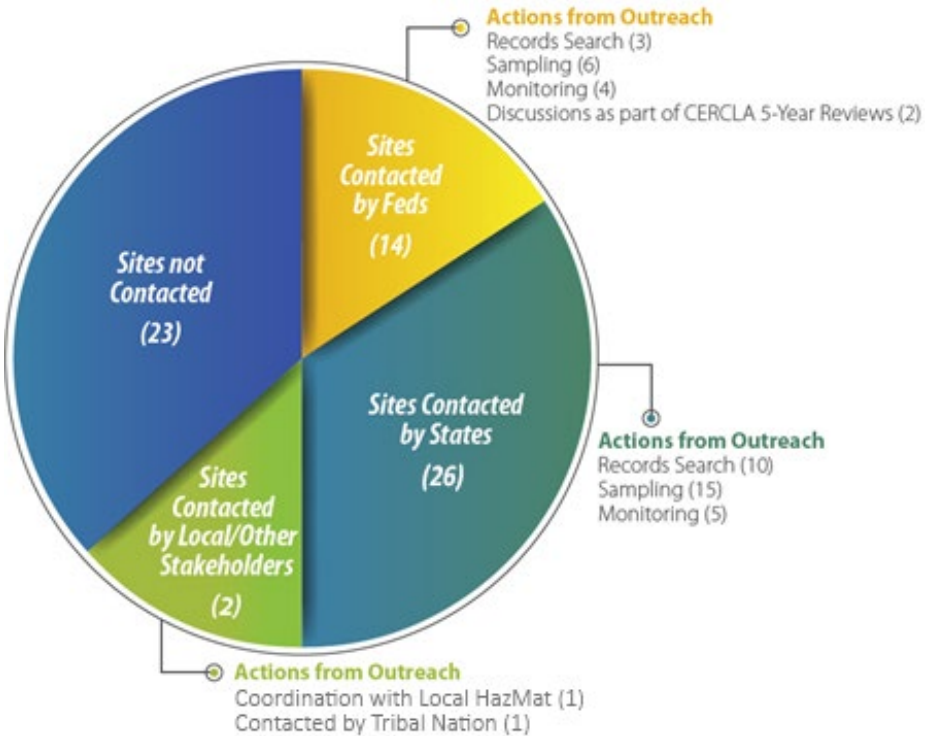


Figure 5. Survey responses indicating distribution of sites contacted by stakeholders regarding PFAS and the type of response prompted by the outreach. Sites may have been contacted by multiple parties with multiple response requests.

The 14 sites contacted by federal entities (EPA) are:

- Argonne
- BNL
- ETTP
- Fernald Preserve
- Hanford
- LEHR
- Mound
- ORNL
- Paducah
- Pantex
- Rocky Flats
- SNL-NM
- SRS
- Y-12

EPA has primarily notified the sites that PFAS activities (records searches, sampling, and monitoring) are being considered for those DOE sites with upcoming CERCLA 5-Year Reviews. Additionally, EPA contacted Argonne to review releases (records searches) as part of the Toxics Release Inventory (TRI) program.

Twenty-six (26) sites have been contacted by state regulators/stakeholders:

- Ames (IA)
- BNL (NY)
- ETEC (CA)
- ETTP (TN)
- Hanford (WA/OR)
- INL (ID)
- KAPL – KS (NY)
- KAPL – (NY)
- LANL (NM)
- LBNL (CA)
- LEHR (CA)
- LLNL – Main (CA)
- LLNL – Site 300 (CA)
- NRF (ID)
- ORNL (TN)
- Paducah (KY)
- Pinellas (FL)
- Portsmouth (OH)
- Princeton (NJ)
- Rocky Flats (CO)
- SLAC (CA)
- SNL – NM
- SRS (SC)
- TJNAF (VA)
- WVDP (NY)
- Y-12 (TN)

State environmental agencies have a variety of interests in PFAS at DOE sites. Most states that have engaged with DOE are interested in understanding more about historical PFAS uses and release (records searches), discrete environmental sampling, and broader environmental monitoring. The state of New Mexico has notified LANL and SNL-NM that PFAS monitoring will soon be part of stormwater discharge requirements; the state of Virginia has notified TJNAF of the same.

The seven sites contacted by local or other regulators/stakeholders are: Ames, BNL, ETEC, Hanford, Rocky Flats, WVDP, and LLNL.

4. RESULTS DISCUSSION

The collection of information about the presence of PFAS at DOE sites is evolving, as increasing access to new information about PFAS, new analytical methods and sampling protocols and regulatory inquiries drive DOE's PFAS characterization efforts. Information gathered during the initial DOE PFAS survey and supplemental site narratives remains preliminary. DOE identifies its commitments to follow up on the information in this Initial Assessment Report in its Roadmap, which outlines the Department's overall approach, goals and objectives, and planned actions to assess and manage PFAS risk at DOE sites, and in doing so, to help ensure the protection of human health and the environment.

4.1. Drinking Water

The health of the DOE workforce is a fundamental priority for DOE. Ingestion of drinking water is a primary exposure pathway of PFAS. Understanding the presence of PFAS in drinking water at DOE sites is a critical action and must be addressed at sites that have not yet tested their on-site sources. Therefore, this is a priority action identified in the Roadmap.

DOE sites may be required to test their drinking water by EPA under the Unregulated Contaminant Monitoring Rule (UCMR). EPA uses the UCMR to collect data for contaminants that are suspected to be present in drinking water and do not have health-based standards set under the Safe Drinking Water Act (SDWA). The SDWA requires EPA issue a list of unregulated contaminants to be monitored by public water systems (PWSs) once every five years. UCMR 5, which EPA published in the Federal Register on December 27, 2021, specifies monitoring for 29 different PFAS.

EPA will notify DOE sites if their drinking water system is subject to the requirements of UCMR 5 and will provide a sampling schedule. UCMR 5 requires each sample to be analyzed by EPA Method 537.1 and EPA Method 533. DOE sites not subject to UCMR 5 are expected to complete testing of DOE-owned water systems as described in the Roadmap using EPA Method 537.1, and if requested by the Program Office, EPA Method 533.

4.2. Current and Historical Site Operations

With the commitments outlined in the Roadmap, DOE expects to expand this knowledge base into other areas of current and historical site operations.

Fire training facilities, fire departments, and AFFF fire suppression systems continue to be the primary known source of PFAS releases and inventories at DOE sites. These activities have driven regulatory interest and environmental sampling.

Site survey responses indicate additional known PFAS sources that DOE expects to investigate further. These include use of PFAS in applications unique to DOE and its predecessor agencies, such as uranium processing, as well as activities common to many industries, such as metal plating operations. The Roadmap identifies a number of actions that are intended to allow DOE to better characterize the use of PFAS-containing products and processes.

4.3. PFAS Sampling and Monitoring

Survey data and site narratives indicate that about 25 percent of responding sites have collected PFAS samples. Sampling has generally been performed based on site-specific historical operations and after consultation with site regulatory agencies and stakeholders. Additional sites may perform PFAS assessments as the continuing body of knowledge on PFAS grows and additional regulatory standards and guidance are published.

This sampling typically has been performed proactively by sites to address data gaps or driven by site-specific regulatory requests. As EPA evaluates remedies at DOE sites in upcoming Five-Year Reviews under CERCLA, DOE expects to undertake additional PFAS sampling at subject sites.[7] As part of the Roadmap strategy, DOE expects that additional sites will undertake sampling of their own volition, to address identified data gaps.

DOE sites and programs currently do not have consistent best practices specific to PFAS sampling, analytical methods, site characterization, remediation, and waste management. Further development in these areas will ensure consistency across DOE. The Roadmap includes a commitment to develop and publish sampling guidance to establish consistent and robust procedures when executing site assessments.

4.4. Regulatory and Stakeholder Engagement

Regulatory and stakeholder interest in PFAS at DOE sites is substantial. Federal/state regulators and other stakeholders have contacted most sites about PFAS and several sites have conducted sampling or records searches in response to these inquiries. DOE anticipates continued interest as the federal government and states develop regulations governing additional PFAS across additional environmental media.

The Department intends to be as transparent as possible as it continues to assess and manage PFAS through commitments and actions in the Roadmap.

[7] Pursuant to CERCLA §121(c), after a CERCLA remedial action is commenced for sites where hazardous substances remain above levels that permit unlimited use and unrestricted exposure, EPA evaluates the remedy every five years to determine whether it remains protective of human health and the environment.

5. NEXT STEPS

DOE is committed to understanding the presence of PFAS at its sites and taking the steps needed to safeguard the health and well-being of our employees, the public, and the environment. We will leverage our scientific expertise and work with the broader research community to identify solutions to PFAS challenges. We will also engage with regulatory partners, state and tribal governments, and community stakeholders to share information and gather feedback on our approaches.

This Initial Assessment Report reflects a snapshot of the Department's understanding of PFAS at its sites as of the date of this report, and clearly suggests that more work needs to be done to understand, manage, and address the PFAS challenge. The Department issued its *PFAS Strategic Roadmap: DOE Commitments to Action 2022-2025* on August 18, 2022. While this Report represents an initial step in understanding the use and presence of PFAS at DOE sites, DOE's follow up actions and commitments are provided in the Roadmap.

The Roadmap identifies actions to be accomplished over the next few years. These include efforts to inventory current and historic PFAS use and characterize the types of PFAS and identify the extent of their presence in the environment as a result of DOE activities; mitigate risk to workers, the public and the environment from PFAS at DOE facilities; ensure compliance with federal, state, and local regulations, as well as DOE orders and other directives; assess and responsibly manage PFAS-containing products and wastes; advance technological solutions to solve PFAS issues; and engage and coordinate stakeholders and others about the Department's efforts. DOE will utilize a risk-based approach that recognizes the regulatory and programmatic frameworks by which the sites operate under to appropriately characterize and assess PFAS at DOE sites. By 2025, DOE anticipates having completed the actions identified in the Roadmap and plans to publish an updated PFAS Status Report. The updated PFAS report is intended to provide a consolidated representation of DOE's risk associated with the presence of PFAS at its sites to inform future decisions regarding the continued protection of human health and the environment.

The Department recognizes the regulatory and scientific uncertainties and dynamism surrounding PFAS, which make it likely that priorities and approaches will change as new information emerges and new requirements are promulgated. As such, DOE may update the actions in the Roadmap when deemed necessary. Regardless, DOE's actions will be guided by the Department's fundamental commitment to protecting human health and the environment.

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APPENDIX A – PFAS Survey

Emerging Contaminants: Per- and Polyfluoroalkyl Substances (PFAS) Preliminary Assessment Survey

On-Site Drinking Water

If the site provides potable drinking water, check all boxes that apply:

☐ Population served by public water system (PWS) is under 10,000
☐ Population served by PWS is over 10,000
☐ Site provides potable water to residential wells
☐ Site does not provide drinking water to workforce

Has drinking water at the site been sampled for PFAS?

☐ Yes, no PFAS were detected
☐ Yes, PFAS were detected
☐ No, drinking water has not been sampled

PFAS Usage

Does your site currently have, or previously had, any of the following facilities, events, and/or disposal units?

☐ Fire training facility
☐ Fire department
☐ Presence of AFFF-based fire suppression system
☐ Documented release of AFFF
☐ Uranium enrichment
☐ Metal plating processing
☐ Plutonium production
☐ Manhattan project liquid discharges
☐ Cold War era liquid waste discharges
☐ Landfill
☐ Wastewater treatment discharges

Does your site track and maintain past and present inventories of PFAS?

☐ Yes, the site has more than 100 pounds of any one PFAS
☐ Yes, the site does not have more than 100 pounds of any one PFAS
☐ No

On-Site Sampling/Monitoring Equipment

Check all environmental media that had been tested at the site with positive PFAS results:

☐ Drinking water
☐ Surface water
☐ Groundwater
☐ Soil
☐ Biota

☐ Wastewater
☐ Leachate
☐ Sediment
☐ Biosolids/sludge
☐ No positive detections
☐ The site has not sampled

Are on-site PFAS concentrations actively monitored?

☐ Yes, in drinking water
☐ Yes, in surface water
☐ Yes, in groundwater
☐ Yes, in soil
☐ Yes, in biota
☐ Yes, in wastewater
☐ Yes, in leachate
☐ Yes, in sediment
☐ Yes, in biosolids/sludge
☐ No; previous positive detections, but not actively monitoring
☐ No; have not detected or sampled for PFAS

Are there analytical results available from PFAS sampling?

☐ Yes
☐ No

Have PFAS been measured beyond the site boundary?

☐ Yes
☐ No

If your site has not yet sampled for PFAS, do you currently use monitoring equipment that contains PFAS (e.g., Teflon®)? Please select all that apply:

☐ Yes, new monitoring wells would be required for PFAS sample
☐ Yes, monitoring well liners would need to be replaced for PFAS sampling
☐ Yes, new sampling supplies would be required for PFAS samples
☐ Yes, new PPE would be required for PFAS sampling
☐ Other: Click or tap here to enter text.
☐ No

If your site has sampled for PFAS, was sampling conducted with the appropriate methods to avoid inadvertent contamination (*e.g.*, proper PPE, monitoring equipment, and sampling tools)?

☐ Yes
☐ No

Regulatory and Stakeholder

Has the site been contacted by regulators/stakeholders regarding PFAS?

☐ Federal
☐ State
☐ Tribal Nations
☐ Local
☐ Other: Click or tap here to enter text.
☐ No

Have regulators/stakeholders prompted any of the following responses?

☐ Search for historical uses of AFFF or other PFAS related materials
☐ Include PFAS analysis in current monitoring program
☐ Site sampling for PFAS
☐ Other: Click or tap here to enter text.
☐ No

APPENDIX B – DOE Sites

The following table represents the DOE sites that provided PFAS information in response to the survey[8], along with their respective location and DOE program office(s).

DOE Sites – Survey Participants			
Site Name	**Site Location(s)**	**Program Office Landlord**	**Additional Program Offices (if applicable)**
Ames Laboratory	Ames, IA	SC	
Argonne National Laboratory (ANL)	Lemont, IL	SC	-
Bettis Atomic Power Laboratory	West Mifflin, PA	NR	-
Brookhaven National Laboratory (BNL)	Upton, NY	SC	-
East Tennessee Technology Park (ETTP)	Oak Ridge, TN	EM	NNSA/SC
Energy Technology Engineering Center (ETEC)	Ventura County, CA	EM	-
Fermi National Accelerator Laboratory (Fermilab)	DuPage County, IL	SC	-
Fernald Preserve	Hamilton County, OH	LM	-
Hanford	Richland, WA	EM	-
Idaho National Laboratory (INL)	Idaho Falls, ID	NE	EM
Kansas City National Security Campus (KCNSC)	Kansas City, MO; Albuquerque, NM	NNSA	-
Kansas City Plant-Bannister Federal Complex	Kansas City, MO	NNSA	-
Knolls Atomic Power Laboratory (KAPL)	Niskayuna, NY	NR	-
Knolls Atomic Power Laboratory - Kesselring Site (KAPL-KS)	West Mifflin, NY	NR	-
Laboratory for Energy-Related Research (LEHR)	Davis, CA	LM	-
Lawrence Berkeley National Laboratory (LBNL)	Berkeley, CA	SC	EM
Lawrence Livermore National Laboratory (LLNL)	Livermore, CA; Tracy, CA	NNSA	EM
Los Alamos National Laboratory (LANL)	Los Alamos, NM	NNSA	EM
Moab UMTRA Project	Moab, UT	EM	-
Monticello Disposal and Processing Sites	Monticello, UT	LM	-
Mound Site	Miamisburg, OH	LM	-

[8] LM sites have undergone extensive remediation. Due to the post-closure status of the LM sites and the limited LTS&M nature of activities, LM has limited the PFAS surveys to most of LM's CERCLA/RCRA sites where probable PFAS usage could have historically occurred based on currently available information

DOE Sites – Survey Participants			
Site Name	**Site Location(s)**	**Program Office Landlord**	**Additional Program Offices (if applicable)**
National Energy Technology Laboratories (NETL)	Albany, OR; Morgantown, WV; Pittsburgh, PA	FECM	-
National Renewable Energy Laboratory (NREL)	Jefferson County, CO	EERE	-
Naval Reactors Facility (NRF)	Idaho Falls, ID	NR	-
Nevada National Security Site (NNSS)	North Las Vegas, NV	NNSA	EM
Oak Ridge National Laboratory (ORNL)	Oak Ridge, TN	SC	EM/NNSA
Pacific Northwest National Laboratory (PNNL)	Richland, WA; Seattle, WA; Sequim, WA	SC	-
Paducah Gaseous Diffusion Plant	Kevil, KY	EM	-
Pantex Plant	Amarillo, TX	NNSA	
Pinellas County Site	Largo, FL	LM	-
Portsmouth Gaseous Diffusion Plant	Piketon, OH	EM	-
Princeton Plasma Physics Laboratory (PPPL)	Princeton, NJ	SC	-
Rocky Flats Site	Jefferson County, CO	LM	-
Sandia National Laboratories (SNL)	Livermore, CA; Tonopah, NV; Albuquerque, NM	NNSA	EM
Savannah River Site (SRS)	Aiken, SC	EM	NNSA
SLAC National Accelerator Laboratory (SLAC)	Menlo Park, CA	SC	-
Strategic Petroleum Reserve (SPR)	Texas and Louisiana Gulf Coasts	CESER	-
Thomas Jefferson National Accelerator Facility (TJNAF)	Newport News, VA	SC	-
Waste Isolation Pilot Plant (WIPP)	Carlsbad, NM	EM	-
Weldon Spring Site	St. Charles County, MO	LM	-
West Valley Demonstration Project (WVDP)	West Valley, NY	EM	-
Y-12 National Security Complex	Oak Ridge, TN	NNSA	EM/SC

See Appendix C: Site-Specific PFAS Initial Assessment Summaries for more information about the sites and the survey results.

APPENDIX C – Site-Specific PFAS Initial Assessment Summaries

This appendix contains initial assessment summaries of information gained from the PFAS survey and additional discussions with site personnel for DOE sites that participated in the survey. Each summary provides a brief introduction to the site, known current and historical activities, existing PFAS inventories, PFAS occurrence in the environment and potential exposure pathways, sampling protocols, and stakeholder engagement. Other PFAS references are summarized, if available.

1. OFFICE OF ENVIRONMENTAL MANAGEMENT

The U.S. DOE's Office of Environmental Management (EM)'s mission is to address the nation's Cold War environmental legacy resulting from five decades of nuclear weapons production and government-sponsored nuclear energy research. This legacy includes some of the world's most dangerous radioactive sites with large amounts of radioactive wastes, spent nuclear fuel, excess plutonium and uranium, thousands of contaminated facilities, and contaminated soil and groundwater. Created in 1989, EM has the responsibility for completing the cleanup of this Cold War legacy and managing the remaining nuclear materials. Nine DOE-EM sites where EM is the program office landlord participated in the initial assessment.

EAST TENNESSEE TECHNOLOGY PARK

Site Description: The East Tennessee Technology Park (ETTP), part of the Oak Ridge Reservation (ORR), is located on the former K-25 Site. The ORR, located in eastern Tennessee, was one of the three original sites in the Manhattan Project. The U.S. Army Corps of Engineers began acquiring land in the area in October 1942. By March 1943, 56,000 acres were sealed behind fences and major industrial facilities were under construction. The K-25 and Y-12 plants were built to explore different methods to enrich uranium, while the X-10 site (now Oak Ridge National Laboratory) was established as a pilot plant for the Graphite Reactor and to explore how to produce plutonium.

K-25 ceased its uranium production mission in 1985 and was renamed ETTP in 1996. The Oak Ridge Office of Environmental Management (OREM) oversees activities at ETTP. OREM is also active across the ORR, including at Y-12 and ORNL, to address legacy contamination and for deactivation and decommissioning (D&D) work.

Assessment Summary

Key findings from the PFAS survey, additional discussions with site personnel, and a limited literature review are as follows:

- *Current/Historical Activities*: Survey responses indicated that ETTP has or has had a fire training facility, a fire department, two AFFF-based fire suppression systems, documented release of AFFF, uranium enchainment processes, metal plating processing, Manhattan Project- and Cold War-era liquid discharges, a landfill, and a wastewater treatment plant. A limited literature search was conducted to identify PFAS used during uranium production. Historical uses of PFAS are uncertain because the chemicals were highly classified, as were

locations of burial grounds. The records of firefighting equipment were not kept for extensive lengths of time. The City of Oak Ridge maintains a fire station on site, and other areas have or have had private businesses that have no responsibility to report PFAS inventories.

- *PFAS Inventory:* OREM tracks and maintains past and present inventories of PFAS but does not have more than 100 pounds of any one PFAS.
- *PFAS Occurrence in the Environment and Potential Exposure Pathways*: ORR does not provide on-site drinking water to the workforce. The City of Oak Ridge is the operator of the PWS, which uses offsite surface water, and it serves over 10,000 people. PFAS was not detected in drinking water samples collected and analyzed by the City of Oak Ridge. OREM has not sampled the drinking water that is provided to the site for PFAS. OREM has detected PFAS in onsite surface water and groundwater at ETTP. PFAS have not been measured beyond the ORR boundary.

  As part of OREM's surface water sampling at ETTP, it sampled three surface water sites for PFAS. One stream was sampled at Mitchell Branch near the fire training center, another in area K901, and a final location at the K-1007 Pond. Mitchell Branch is a surface water tributary that eventually flows to the Tennessee River. The site at Mitchell Branch had a concentration of 40.0 ppt for PFOS and 30.2 ppt for PFOA downstream of one of the two fire training facilities, and a second Mitchell Branch surface water sample taken downstream of the first sample had PFOS detected at 29.0 ppt and PFOA at 22.1 ppt. The results from the K-1007-P1 pond were 9.52 ppt PFOA and 10.1 ppt PFOS. The results from the K-901-A Pond were 1.13 ppt and 0.725 ppt for PFOS and PFOA, respectively. OREM currently has no plans to expand the investigation to storm drains.

  Regarding groundwater, OREM is in the process of developing a groundwater remedy with regulators, following the demolition of all the buildings at ETTP. OREM plans to include PFAS in the groundwater monitoring program rather than develop a separate monitoring program. A limited groundwater sampling effort was conducted for PFAS in 2017. Groundwater sample locations at ETTP (18 wells) were chosen for the 2017 sampling event because of their proximity to historical open burning areas and as requested by regulators were within the footprint of two of the five gaseous diffusion plant facilities that are part of an active groundwater evaluation. PFAS detected up to 46 ppt of PFOS at a location where oils were historically managed and burned at ETTP.
- *Sampling Protocols:* OREM has PFAS sampling protocols established to prevent inadvertent contamination from PFAS-containing sampling equipment.
- *Stakeholders:* OREM has been contacted by federal and state regulators/stakeholders regarding PFAS. EPA and the Tennessee Department of Environment and Conservation requested general sampling which was completed. EPA is seeking availability of PFAS results as part of its upcoming CERCLA 5-year review. No further request for sampling has occurred at this time. A presentation is being prepared to brief the state of Tennessee on non-classified aspects of the PFAS investigation. Once restrictions are lifted, a classified briefing will be held.

Key Takeaways
• The City of Oak Ridge supplies ETTP's on-site drinking water. The City did not detect PFAS in its drinking water samples. • PFAS were used in large quantities for uranium operations during World War II; relevant records regarding storage, use and disposal are limited or secured. • AFFF was used at a fire training facility and is used fire suppression systems; the site also has a landfill, wastewater treatment plant, and metal plating processing. • The fire department has switched to a fluorine free foam alternative. • Surface water and groundwater have been sampled for PFAS. The concentrations of PFOA in the surface water samples were 30.2 ppt and 22.1 ppt for PFOA and 40 ppt and 29 ppt for PFOS. Groundwater concentrations for PFOS were detected up to 46 ppt. • Continued regulator requests and inquiries regarding PFAS are expected.

ENERGY TECHNOLOGY ENGINEERING CENTER

Site Description: The Energy Technology Engineering Center (ETEC) is located at the Santa Susana Field Laboratory in Simi Valley, outside of Los Angeles, California. From the 1950s until 1988, DOE and its predecessor agencies conducted nuclear and liquid metals research at the 90-acre ETEC site. While DOE does not directly own any land at the SSFL (today owned by The Boeing Company), the Department is responsible for demolition of the DOE-owned buildings and soil and groundwater cleanup in the 290 acres of the ETEC site and the associated Northern Buffer Zone. At the beginning of 2022, DOE-EM completed demolition of DOE-owned buildings. Final soil and groundwater remediation activities remain.

Assessment Summary

Key findings from the PFAS survey and follow-up correspondence are as follows:

- *Current/Historical Activities*: Historical small-scale metal plating and processing operations were conducted at ETEC. The site does not have a fire department or conduct fire training activities. The wastewater treatment plant is located off-site and is operated by Rockwell-Boeing. ETEC also has a landfill used for bedrock disposal. Records have not been searched to identify any other historical activities that may have involved PFAS.
- *PFAS Inventory*: The survey response indicated that ETEC did not have known PFAS in inventory on-site.[9]
- *PFAS Occurrence and Potential Exposure Pathways*: ETEC does not supply potable water from an on-site source. Bottled water is provided on-site for drinking water. ETEC has not sampled environmental media for PFAS.
- *Sampling Protocols*: If groundwater sampling for PFAS analysis is planned in the future, minor well equipment (e.g., Teflon® tubing) would need to be replaced.

[9] The survey did not provide participants with instructions or guidance for estimating the amount of PFAS present in various AFFF products or for identifying products that may contain PFAS other than AFFF.

- *Stakeholders:* The California Department of Toxic Substances Control has requested that ETEC complete an evaluation of PFAS and conduct PFAS sampling. This request was supported by the Los Angeles Regional Water Quality Control Board. Additionally, the California Department of Toxic Substances Control asked ETEC to search for historical uses of AFFF, include PFAS analysis in current monitoring programs, and conduct site sampling for PFAS. ETEC will continue working with regulators to address their concerns.

Key Takeaways
• It is unknown whether PFAS were used or released at ETEC. Minor metal plating activities were conducted. • ETEC is not a drinking water provider. • State regulators have requested an evaluation of PFAS historical uses and PFAS sampling at ETEC; ETEC will continue working with regulators.

HANFORD

Site Description: The Hanford Site, a 580-square-mile section of semi-arid desert in central Washington, was established in 1943 as part of the Manhattan Project to produce plutonium for national defense. Construction began in October 1943 on the first industrial-scale nuclear reactor, B Reactor, which produced plutonium for the Trinity test and the atomic bomb used to help end World War II. During a national security mission that lasted nearly five decades, nine nuclear reactors were built along the banks of the Columbia River to provide product for five primary processing facilities that operated throughout the Cold War era. Hanford produced two-thirds of the plutonium used in the U.S. nuclear weapons stockpile.

Assessment Summary

Key findings from the PFAS survey, additional discussions with site personnel,[10] and sampling event are as follows:

- *Current/Historical Activities*: The site has, or has had, a fire training facility, fire department, and AFFF-based fire suppression system.[11] No AFFF use has been documented at the site since 2018. Fire extinguishers containing PFAS were reportedly removed from the site 10 to 15 years ago. The site has a landfill and a water treatment facility supplied by source water from the Columbia River. Historically, uranium enrichment and plutonium production occurred on-site as well as Manhattan Project and Cold War-era liquid waste discharges.
- *PFAS Inventory*: Survey responses indicated that the site does track PFAS inventories and that less than 100 pounds of any one PFAS are currently stored at the site.

[10] Clarifications were provided regarding treated drinking water samples, dedicated groundwater monitoring equipment, and regulatory interaction.

[11] Discussions clarified that known amounts of AFFF (Ansul and ANSULITE®) are present on-site in gloveboxes where fire suppressants were used; AFFF is no longer in use. An internal memo was drafted in 1996 authorizing the discharge of wastewater from a fire foam test using ANSULITE® 3% AFFF to the 200 Area Treated Effluent Disposal Facility.

- *PFAS Occurrence and Potential Exposure Pathways*: Hanford provides potable drinking water (<10,000 people).[12] Drinking water sourced from an on-site aquifer was sampled in December 2019 and no PFAS were detected above the method detection limit.[13] The water purveyor works closely with the fire department to ensure the safety of firefighting materials and to mitigate and monitor the exposure to water pathways. Hanford has not sampled for PFAS in waste streams, but waste streams would have been disposed of in a Resource Conservation and Recovery Act (RCRA)-compliant disposal facility.
- *Sampling Protocols*: In the survey, Hanford reported that there was no known equipment that would need to be adjusted for additional PFAS sampling. Further discussions indicated that Teflon® tubing in monitoring wells may need to be replaced prior to PFAS sampling.
- *Stakeholders*: Hanford was contacted by federal and State of Washington regulators to discuss PFAS. EPA informally inquired about PFAS through the soil and groundwater group.[14] The state of Oregon has asked the Washington Department of Health about PFAS, and the Washington Department of Health has contacted the site water supplier. Regulators have suggested that Hanford search for historical uses of AFFF and other PFAS products and sample for PFAS.
    - PFAS sampling has been conducted at the Hanford 400 Area in treated drinking water sourced from groundwater. The 400 Area is the only Hanford active water system that uses groundwater sources. PFAS sampling was completed in December 2019, following the September 2019 publication of the DOE OE-3. No PFAS were detected.

Key Takeaways

- Treated drinking water and source water from on-site groundwater was sampled for PFAS and had no detections; drinking water is provided (<10,000 people).
- Historical AFFF storage and/or use is documented at Hanford's fire training facility, fire department, and fire suppression system. Uranium enrichment and plutonium production historically occurred on site as well as Manhattan Project and Cold War era liquid waste discharges.
- Federal and state regulators have inquired about PFAS investigation at the site.

MOAB SITE

Site Description: The Moab Uranium Mill Tailings Remedial Action Project (Moab Site or Project) is located in southeastern Utah. The 480-acre Moab Site includes a former uranium-ore processing facility that operated under private ownership from 1956 to 1984. The Project includes relocation of the estimated 16-million-ton pile of uranium mill tailings near the Colorado River and other contaminated material to an engineered disposal cell constructed 30

[12] The basis for requesting information based on the point of use population is related to monitoring requirements specified in UCMR cycles 1 through 4.

[13] Discussions clarified that groundwater is chlorinated prior to distribution. One of three connected wells was voluntarily sampled prior to chlorination at a common facility. This is the only active site water system that uses groundwater for drinking water. Six PFAS including PFOS, PFOA, PFNA, PFHxS, PFHpA, and PFBS were analyzed using EPA Method 537.

[14] The inquiry followed EPA's receipt of a letter from the state of Oregon, which copied three Tribal Nations, requesting that EPA investigate PFAS at Hanford.

miles north near Crescent Junction, Utah. The scope also includes active remediation of contaminated groundwater at the Moab Site. After contaminated soil, tailings, debris, vicinity properties, and groundwater are remediated, the Moab Site will be transferred to LM for continued groundwater monitoring and potential reutilization of the site.

Assessment Summary

Key findings from the PFAS survey and follow-up email correspondence with the Moab Site are as follows:

- *Current/Historical Activities*: Cold War-era waste discharges occurred on site. A landfill is also present.
- *PFAS Inventory:* The site does not track and maintain past and present inventories of PFAS.
- *PFAS Occurrence and Potential Exposure Pathways*: The site has not sampled for PFAS. Site drinking water is imported – potable water is trucked in from the City of Moab and used for sanitary purposes only. Bottled water is provided on-site for drinking water.
- *Sampling Protocols*: Survey respondents indicated that submersible pumps and Teflon® tubing may be present in the Moab Site's monitoring wells. Email follow-up indicated that eight out of 191 existing wells have submersible pumps. The pumps are stainless steel and have a hydrophobic thermoplastic coating. It is unknown whether the pump materials contain PFAS.
- *Stakeholders:* The Moab Site has not been approached by federal, state, tribal, or local stakeholders/regulators regarding PFAS.

Key Takeaways
• The Moab Site is not a drinking water provider. • There is no known AFFF usage at the site. Cold War-era waste discharges historically occurred, and a landfill is present onsite. • There have been no regulatory or stakeholder requests regarding PFAS.

PADUCAH GASEOUS DIFFUSION PLANT

Site Description: In 1950, the Atomic Energy Commission, a predecessor agency to DOE, selected a 3,556-acre tract of government-owned land near Paducah, Kentucky, in McCracken County, as the location to construct a second gaseous diffusion uranium enrichment plant to support U.S. national security needs. The Paducah Gaseous Diffusion Plant (Paducah Site) enriched uranium from 1952 to 2013 and was the last government-owned uranium enrichment facility operating in the U.S. The Paducah Site produced low-enriched uranium originally as feedstock for nuclear weapons and later for commercial nuclear power plants.

Assessment Summary

Key findings from the PFAS survey and additional discussions with site personnel[15] are summarized below:

- *Historical Activities*: The Paducah Site has or has had a fire training facility, a fire department, uranium enrichment processes, metal plating processing, Cold War-era liquid discharges, landfills and burial grounds, a water treatment plant, and a wastewater treatment plant. The Paducah Site began investigating the potential for PFAS contamination at the site in February 2016 after the EPA requested information on PFOA and PFOS. According to employee interviews, AFFF was not used to fight a fire between 1988 and 2020 but was used for training purposes at the Fire Training Area. However, no documentation of AFFF releases at the fire training area were found. Anecdotal information and discussion with a subject matter expert suggest that PFAS may have been used during gaseous diffusion plant construction, in coolants, and in process equipment and grease and lubricants for vacuum pump oils, gaskets, valve seats, and seals.
- *PFAS Inventory:* The Paducah Site tracks and maintains past and present inventories of PFAS and reported having more than 100 pounds of at least one PFAS.[16] In 2019, drummed AFFF was determined to be present on the Paducah Site and was moved to a secure on-site storage location prior to disposal in 2020. No other PFAS-containing materials are known to be present at the site.
- *PFAS Occurrence and Potential Exposure Pathways*: The Paducah Site provides treated drinking water to the site workforce (<10,000 people). The source of the drinking water is the Ohio River, not groundwater (the onsite water treatment plant was once used to produce cooling water for the gaseous diffusion plant). Site drinking water has not been sampled for PFAS. In 2019, two monitoring wells at the on-site former fire training area were sampled for PFAS; several PFAS were detected in groundwater from a well screened nearer the surface and were also detected in groundwater from a well screened in the underlying aquifer. PFAS concentrations were several orders of magnitude greater in near surface water (14-24 ft below ground surface) than in the underlying aquifer (72-75 ft below ground surface).

  Exposure to groundwater by the public is addressed by water policy agreements under which DOE provides municipal water for domestic use to all residences that might be impacted by trichloroethylene-impacted groundwater originating from the Paducah Site. Under the Water Policy agreements, residential groundwater wells are locked and capped. The Paducah Site is not actively monitoring for PFAS and has not sampled for PFAS beyond the site boundary. A site-wide sampling of drinking water, groundwater, surface water, leachate, and pump and treat system influent and effluent is scheduled to be completed as

[15] Discussion with the Portsmouth/Paducah Project Office provided clarification regarding potential exposure pathways, stakeholder and regulatory interaction, and potential next steps.

[16] The survey did not provide participants with instructions or guidance for estimating the amount of PFAS present in various AFFF products or for identifying products that may contain PFAS other than AFFF. Follow-up discussion identified 545 gallons of drummed AFFF product stored at the Paducah Site and 15 gallons contained in a fire truck, likely containing low percentage concentrations of PFAS.

part of the Environmental Monitoring Program in FY2023. Results will be included in a subsequent project report and in the 2023 Annual Site Environmental Report.

- *Sampling Protocols*: Sampling equipment was evaluated prior to collecting PFAS samples and modified or replaced to avoid cross-contamination from Teflon® parts. The site is in the process of assessing whether a positive PFAS bias was caused by sampling equipment.

  The Paducah Site recently completed development of its PFAS Quality Assurance Project Plan worksheets and is including them in the FY2023 Environmental Monitoring Plan. The Paducah Site briefed EPA and the Commonwealth of Kentucky on its plan, including the worksheets, and will collect PFAS data in accord with its Federal Facility Agreement.

- *Stakeholders:* Federal and state regulators have contacted the Paducah Site regarding PFAS. A request from EPA in 2016 prompted groundwater sampling at Solid Waste Management Unit (SWMU) 100 Fire Training Area. Results were reported to the Commonwealth of Kentucky and EPA in April 2020.[17]

  The current Paducah Site Management Plan, produced yearly consistent with the Paducah Site's Federal Facility Agreement, does not include a project investigating the presence of PFAS or the remediation of any PFAS-containing environmental media. During recent Site Management Plan negotiations, EPA and the Commonwealth of Kentucky have expressed a preference to complete additional PFAS investigation and sampling at the Paducah Site.

  PFAS sampling results from two onsite monitoring wells over two sampling events are summarized below.

Chemical name	Detections [Out of 6 Samples]	Concentration Range [ppt]
Perfluorobutanesulfonate (PFBS)	6	15.8 – 10,100
Perfluoroheptanoic acid (PFHpA)	6	2.71 – 1,420
Perfluorohexanesulfonate (PFHxS)	6	44.7 – 63,200
Perfluorohexanoic acid (PFHxA)	6	22.2 – 14,000
Perfluorononanoic acid (PFNA)	2	1.08* – 1.26**
Perfluorooctanesulfonic acid (PFOS)	6	29.6 – 128,000
Perfluorooctanoic acid (PFOA)	6	7.38 – 5,230

PFAS Concentrations (ppt) in Groundwater Samples Collected During 2 Sampling Events at Monitoring Well 315 (includes replicate sample for each sampling event) and Monitoring Well 330 at the Paducah Site.

*For MW315 a replicate sample was collected during each sampling event.

**Concentration value is estimated

[17] Sampling was performed as part of the Paducah Site's groundwater monitoring program and not part of a CERCLA project. Separate transmittal of PFAS sampling event results to the state and EPA occurred on April 13, 2020, consistent with a schedule presented in the transmittal letter for the Paducah Gaseous Diffusion Plant CERCLA 2018 Five-Year Review.

Key Takeaways
• The Paducah Site provides treated, on-site drinking water sourced from the Ohio River; drinking water has not been sampled for PFAS. • PFAS have been detected in groundwater beneath the former fire training area. PFAS may have been used in other site operations. Additional records research may inform understanding of other potential historical uses of PFAS. • Site groundwater is not in use and agreements are in place to provide replacement water and prevent use of off-site groundwater by the public, due to the presence of non-PFAS contaminants. • Regulators have expressed a preference for additional PFAS investigation and sampling.

PORTSMOUTH GASEOUS DIFFUSION PLANT

Site Description: In August 1952, the Atomic Energy Commission selected a tract of land in the Ohio Valley along the Scioto River in Pike County, Ohio, for the site of the Portsmouth Gaseous Diffusion Plant (Portsmouth Site), the third of three gaseous diffusion plants in the United States. In 1956, construction of the plant was completed, and the plant began enriching uranium for nuclear weapons. In the 1960s, the Portsmouth Site's mission changed to focus on producing fuel for commercial nuclear power plants and other national security applications. An extensive environmental cleanup program began at the 3,777-acre site in 1989, with deactivation and decommissioning activities initiated in 2011.

Assessment Summary

Key findings from the PFAS survey and additional discussions with site personnel are summarized below:

- *Current/Historical Activities*: The Portsmouth Site has or has had a fire training facility, a fire department, uranium enrichment processing, Cold War-era liquid waste discharges, legacy landfills, and a wastewater/sewage treatment plant. It is unknown whether AFFF was used at the Portsmouth Site. Anecdotal information and discussion with a subject matter expert at the Paducah Site indicates that PFAS may have been used during gaseous diffusion plant construction and in process equipment and lubricants. The Portsmouth Site did not use hydrogen fluoride to manufacture uranium hexafluoride and took the feed from the Paducah Site.
- *PFAS Inventory:* Approximately, 1,300 gallons of perfluoro-1,3-dimethylcyclohexane are in secure storage at the Portsmouth Site.
- *PFAS Occurrence and Potential Exposure Pathways*: The Portsmouth Site provides drinking water to the workforce (<10,000 people). In 2020, the state of Ohio sampled influent and treated drinking water sourced from off-site groundwater for PFAS. PFAS were not detected in treated water. PFAS were detected in influent water, sourced from off-site groundwater wells that are located in the Scioto River floodplain, a location hydraulically separate from site groundwater. PFAS sampling of environmental media has not been conducted at the Portsmouth Site, and the Portsmouth Site is not actively monitoring for PFAS. Exposure to on-site groundwater is unlikely because groundwater is not used for any purpose. On-site groundwater discharges to surrounding drainage ditches and streams that flow off site.

With the active groundwater pump and treat systems, no plumes of other groundwater contaminants extend off-site. Treated off-site groundwater was also used as cooling water and fire water at the gaseous diffusion plant. Treated and untreated off-site groundwater is being used for dust/emission controls at the On-Site Waste Disposal Facility and the ongoing process building demolition site, respectively.

- *Sampling Protocols:* The Portsmouth Site has not conducted PFAS sampling. No discussions have been held at the Portsmouth Site concerning the data quality objectives and sampling methods that might be used for a project investigating the presence of PFAS in the environment at the Portsmouth Site.
- *Stakeholders:* The state of Ohio contacted the Portsmouth Site regarding PFAS prior to sampling site drinking water for PFAS. The state has not requested additional PFAS investigations at the Portsmouth Site.

Key Takeaways
• The state of Ohio sampled influent and treated onsite drinking water sourced from off-site groundwater; PFAS were not detected in treated drinking water but were detected in off-site groundwater that is not hydraulically connected to site groundwater. • PFAS chemicals may have been used as coolants at the Portsmouth Site. There are currently ~1,300 gallons of the coolant perfluoro-1,3-dimethylcyclohexane in a secure storage at the facility. • The Portsmouth Site plans to continue to work with state regulators to address PFAS.

SAVANNAH RIVER SITE

Site Description: The Savannah River Site (SRS), an approximately 310-square-mile-site located in South Carolina, focused on the production of plutonium and tritium for use in the manufacture of nuclear weapons from its inception in the early 1950s until the end of the Cold War. In 1992, the focus at SRS turned to DOE-EM led environmental cleanup, nuclear materials management and research and development activities.

The NNSA activities onsite are currently limited to the Savannah River Tritium Enterprise (SRTE), with future activities planned related to the NNSA pit production mission.

Assessment Summary

Two surveys were administered in 2020 (SRS) and 2021 (SRTE) by DOE-EM and NNSA, respectively. In addition to the surveys, DOE-EM conducted additional discussions with site personnel.

Key findings from the PFAS survey are as follows:

- *Historical Activities*: SRS has or has had a fire training facility, a fire department, documented release of AFFF, metal plating processing, plutonium processing, Cold War-era liquid waste discharges, a landfill, and a wastewater treatment plant. There are no known PFAS uses related to SRTE. DOE-EM personnel indicated there are no known potential risks of PFAS contamination, other than in a few select areas where fire training activities were held.

Historically, SRS has conducted fire training exercises with small AFFF releases. No site characterization activities have occurred to confirm the presence of PFAS where those fire training exercises occurred.

- *PFAS Inventory:* SRS tracks and maintains past and present inventories of PFAS but does not have more than 100 pounds of any one PFAS. The SRTE site does not track PFAS inventories.

  DOE-EM performed a chemical inventory search for PFAS using a database dating to 1996. The search revealed that SRS stores AFFF in two locations. The AFFF on-site is from 2019. No AFFF was recorded between 1996 and 2019. Further, no other PFAS (including PFAS-containing Teflon®) is stored on-site. Additional follow-up remains to be done with the SRS fire department on the historical uses of AFFF and with other site representatives on other non-AFFF historical uses. As a substitute for AFFF, SRS has begun to stock and use fluorine-free foam. This foam was analyzed to confirm it was PFAS-free before procurement.

  For the PFAS cleanup response at SRS, NNSA will clean up releases from inside the Tritium Facility and EM will remediate all other new or legacy releases.

- *PFAS Occurrence in the Environment and Potential Exposure Pathways*: SRS uses on-site groundwater sources to supply drinking water to on-site facilities (>10,000 people). The A-Area drinking water system supplies most site areas. Remote facilities, such as field laboratories, barricades, and pump houses, use small drinking water systems (four systems in total, each serving fewer than 25 people) or bottled water. PFAS have not been detected in treated drinking water. SRS has detected PFAS in groundwater. PFAS have not been measured beyond the SRS boundary. NNSA has not sampled for PFAS at SRTE.

  DOE-EM personnel indicated that in the D-Area, 10 miles from the A-area drinking water system, SRS detected PFOA and PFOS in recent groundwater and purge-water[18] monitoring samples (see table below for results). The PFAS contamination was assumed to have been caused by the release of AFFF materials at the D-Area Fire Training Facility and from an old gas station fire near the Fire Training Facility.

  SRS reported two locations in D-Area at the SRS are known to have used AFFF for fire suppression: an on-site gas station and firefighting training. In August 2019, the EPA and South Carolina Department of Health and Environmental Control (SCDHEC) identified D-Area as a potential PFAS groundwater contamination area of concern (Shull and Cornwell, 2020). In response, SRS agreed to sample existing downgradient groundwater wells over the following year. Sampling protocols were developed to minimize biasing in the sampling process from outside sources, such as sampling equipment. Nine separate PFAS were detected in the samples collected, with concentrations up to 1,910 ppt (PFNA) (Shull and Cornwell, 2020). Results are shown in the table below. SRS is developing a characterization plan for future PFAS analysis, in addition to sample collection from further downgradient monitoring wells and surface water stations.

[18] In D-Area, the SRS has a mechanism to containerize purge water, using a purge water management system. This closed system allows the purge water to go back into the well and is not generated as a waste source. This approach is supported by both EPA and SCDHEC and has been in use for over 25 years.

SRS recently identified 500 gallons of AFFF[19] in storage. SRS mixed it with concrete powder to immobilize the PFAS. The hardened AFFF is currently stored on-site in covered and lined roll-off containers.

- *Stakeholders:* Regulators and stakeholders contacted DOE-EM and prompted SRS to search for historical uses of AFFF or other PFAS and have asked SRS to include PFAS in the current monitoring program and sample the site for PFAS. NNSA has not been contacted by any regulatory or stakeholder agencies regarding SRTE.

Chemical name	Detections [Out of 11 Samples]	Concentration Range [ppt]
Perfluorodecanoic acid (PFDeA)	4	12 – 72.8
Perfluoroundecanoic acid (PFUA)	5	16.6 – 81.7
Perfluorobutanesulfonate (PFBS)	2	12.6 and 13.6
Perfluoroheptanoic acid (PFHpA)	8	15.3 – 53.4
Perfluorohexanesulfonate (PFHxS)	9	16.1 - 154
Perfluorohexanoic acid (PFHxA)	7	15.6 – 43.8
Perfluorononanoic acid (PFNA)	10	13.6 – 1910
Perfluorooctanesulfonic acid (PFOS)	11	14 – 607
Perfluorooctanoic acid (PFOA)	10	17.4 - 108

PFAS Concentrations (ppt) in Groundwater Samples Collected at SRS

Key Takeaways

- PFAS have not been detected in SRS treated on-site drinking water.
- Groundwater 10 miles from the on-site drinking water source and near firefighting facilities contains PFAS at concentrations greater than 1,900 ppt.
- SRS has phased out PFAS-containing AFFF and is now using a fluorine-free foam.
- SRS is actively working with federal and state regulatory partners to perform record searches, add PFAS analysis to current monitoring programs for the waste unit areas, and sample other locations for PFAS.
- There are no known PFAS uses at SRTE.
- SRTE has not been sampled for PFAS.

WASTE ISOLATION PILOT PLANT

Site Description: The Waste Isolation Pilot Plant (WIPP) is the nation's only repository for the disposal of transuranic waste generated by atomic energy defense activities. WIPP is located 33 miles southeast of Carlsbad, New Mexico, in the Chihuahuan Desert, far from major population centers. Waste is disposed of in a set of panels located nearly one-half mile below the surface (2,150 feet) in a deep geologic salt bed formed 250 million years ago. Construction of WIPP started in the early 1980s. The facility began operation in 1999 and celebrated 20 years of

[19] Follow-up discussion with SRS confirmed the AFFF contained short-chain PFAS but not PFOS, PFOA, or other long-chained PFAS.

operations in 2019. To date, WIPP has received approximately 13,000 shipments that were safely transported more than 15 million cumulative miles.

Assessment Summary

PFAS survey responses were reviewed; no follow-up questions were identified. Key findings from the PFAS survey are as follows:

- *Current/Historical Activities:* WIPP has a fire department on-site.
- *PFAS Inventory:* In December 2020, the WIPP Industrial Health and Safety group did a search in the Safety Data Sheet (SDS) database for AFFF used by the Fire Department. This database contains SDSs for the last ~20 years. None of the Fire Department foams contained PFAS chemicals or their degradants. The WIPP Waste Data System was reviewed with no indications of the presence of PFAS in waste disposed at the WIPP facility. Regardless, the WIPP 10,000-year performance assessment has demonstrated that waste/waste constituents disposed at the WIPP will not migrate from the repository.
- *PFAS Occurrence and Potential Exposure Pathways:* WIPP provides potable water to fewer than 10,000 people; however, the drinking water is sourced from the City of Carlsbad which serves over 10,000 people. Drinking water has not been sampled for PFAS. WIPP has not performed environmental sampling for PFAS.
- *Stakeholders:* No stakeholders or regulators have contacted WIPP regarding PFAS.

Key Takeaways
• The City of Carlsbad is responsible for sampling and analysis of site drinking water. Drinking water has not been sampled for PFAS. • No PFAS-containing AFFF used by the Fire Department was identified in a search of the safety data sheet database over the past ~20 years. • No indications of PFAS present in waste disposed of at the WIPP facility, based on a review of the WIPP Waste Data System.

WEST VALLEY DEMONSTRATION PROJECT

Site Description: The West Valley Demonstration Project (WVDP) is located at the Western New York Nuclear Service Center, 3,338-acre site 30 miles south of Buffalo, New York. The site is owned by the New York State Energy Research and Development Authority (NYSERDA) and is home to the only commercial spent nuclear fuel reprocessing facility to operate in the U.S. In 1962, Nuclear Fuel Services, Inc. (NFS) entered into agreements with the Atomic Energy Commission and New York State to construct, license, and operate the commercial spent nuclear fuel reprocessing plant. NFS built and operated the plant and two waste burial grounds from 1963 to 1972. NFS processed 640 metric tons of spent nuclear fuel and generated over 600,000 gallons of liquid high-level waste. In 1976, NFS exercised its contractual right to yield the Western New York Nuclear Service Center (WNYNSC)'s responsibility back to New York State and currently NYSERDA holds title and manages it.

Assessment Summary

PFAS survey responses were reviewed; no follow-up questions were identified. Key findings from the PFAS survey are as follows:

- *Current/Historical Activities:* The WVDP site has or has had a fire training facility, a landfill, and a wastewater treatment plant.
- *PFAS Inventory:* WVDP does not track and maintain past and present inventories of PFAS.
- *PFAS Occurrence and Potential Exposure Pathways:* WVDP provides drinking water (from an on-site groundwater source) to fewer than 10,000 people. WVDP sampled untreated drinking water for PFAS prior to treatment. Sampling was performed in two consecutive quarters in 2021; PFAS compounds were not detected at concentrations above the method detection limit. Drinking water is scheduled to be sampled again in the third quarter of 2022. PFAS have not been measured beyond the DOE site boundary.
- *Sampling Protocols:* WVDP would need new sampling supplies to perform more extensive PFAS sampling of environmental media.
- *Stakeholders:* State regulators contacted WVDP regarding PFAS and requested sampling of site drinking water for PFAS.

Key Takeaways
• On-site groundwater sourced for drinking water was sampled for PFAS in January and April 2021; no PFAS were detected. • The site has a former fire training pad. It is not known whether AFFF was used at the site. No manufacturing was conducted at the site.

2. OFFICE OF ENERGY EFFICIENCY AND RENEWABLE ENERGY

The Office of Energy Efficiency and Renewable Energy's (EERE)'s mission is to accelerate the research, development, demonstration, and deployment of technologies and solutions to equitably transition America to net-zero greenhouse gas emissions economy-wide by no later than 2050. EERE operates a national laboratory in Golden, Colorado, the National Renewable Energy Laboratory (NREL). NREL has an AFFF-based fire suppression system.

NATIONAL RENEWABLE ENERGY LABORATORY

Site Description: The National Renewable Energy Laboratory (NREL) South Table Mountain (STM) Campus in Golden, Colorado is owned by DOE and operated by the Alliance for Sustainable Energy, LLC (Alliance). The Alliance conducts activities, operates, and manages the laboratory for DOE.

Assessment Summary

Key findings from the PFAS survey and follow-up correspondence are as follows:

- *Current/Historical Activities:* The NREL STM site contains one 500-gallon AFFF-based fire suppression system. When in use, this system will contain a 3% PFAS solution. NREL did not report historical use.
- *PFAS Inventory:* The site does not track or maintain a PFAS inventory.
- *PFAS Occurrence in the Environment and Potential Exposure Pathways:* NREL-STM does not collect samples for or monitor for PFAS. NREL receives its drinking water from a PWS. The PWS has sampled for certain PFAS and no PFAS have been detected.
- *Sampling Protocols:* It is unknown whether the site will need new monitoring equipment suitable for PFAS sampling.
- *Stakeholders:* NREL has not been contacted by regulatory agencies or stakeholders regarding PFAS.

Key Takeaways
• NREL STM receives its drinking water from a PWS. • The site has one 500-gallon AFFF-based fire suppression system. • PFAS sampling has not been completed onsite. • The site has not been contacted by regulatory agencies or stakeholders regarding PFAS.

3. OFFICE OF CYBERSECURITY, ENERGY SECURITY, AND EMERGENCY RESPONSE

The Office of Cybersecurity, Energy Security, and Emergency Response (CESER) addresses the emerging threats of tomorrow while protecting the reliable flow of energy to Americans today by improving energy infrastructure security and supporting the Department of Energy's (DOE) national security mission. CESER's focus is preparedness and response activities to natural and man-made threats, ensuring a stronger, more prosperous, and secure future for the Nation. CESER's mission is to enhance the security and resilience of U.S. critical energy infrastructure to all hazards, mitigate the impacts of disruptive events and risk to the sector overall through preparedness and innovation, and respond to and facilitate recovery from energy disruptions in collaboration with other Federal agencies, the private sector, and State, local, tribal, and territory governments. It also manages the Nation's Strategic Petroleum Reserve (SPR), an emergency response tool to protect Americans from energy supply disruptions.

STRATEGIC PETROLEUM RESERVE

Site Description: The Strategic Petroleum Reserve (SPR) utilizes underground salt dome formations to store crude oil. It comprises four facilities located along the Gulf Coast (Bryan Mound (TX), Big Hill (TX), West Hackberry (LA), and Bayou Choctaw (LA)), a project management facility in New Orleans, and the Stennis Warehouse facility.

Assessment Summary

Key findings from the PFAS survey and follow-up correspondence are as follows:

- *Current/Historical Activities:* At the SPR, PFAS-containing products are stored for emergency use to extinguish fires fueled by liquid hydrocarbons (e.g., crude oil). These fire-fighting compounds are commonly referred to as aqueous film-forming foam (AFFF).
- *PFAS Inventory:* In 2021, SPR personnel completed an inventory of AFFF products and identified the maximum calendar year quantities as 13,685 gallons of the long-chain AFFF stored at Big Hill and Bryan Mound. The inventory also identified 13,880 gallons of short-chain AFFF products at Bayou Choctaw, Bryan Mound, and West Hackberry.
- *PFAS Occurrence in the Environment and Potential Exposure Pathways:* SPR sites do not collect samples for or monitor for PFAS contaminants.
- *Sampling Protocols:* In the survey, SPR reported that there was no known equipment that would need to be adjusted for additional PFAS sampling.
- *Stakeholders:* No SPR facilities have been contacted by any regulatory agencies or stakeholders.

Key Takeaways
• Drinking water is supplied by municipal PWS at the SPR facilities. • PFAS have been documented as a component of the AFFF fire-fighting systems at the SPR. • The SPR has identified significant quantities of AFFF stored for emergency usage. • The SPR has not completed PFAS sampling and analysis.

4. OFFICE OF FOSSIL ENERGY AND CARBON MANAGEMENT

The Office of Fossil Energy and Carbon Management (FECM) funds research, development, demonstration, and deployment projects to decarbonize power generation and industrial production, to remove carbon dioxide from the atmosphere, and to mitigate the environmental impacts of fossil fuel production and use. Priority areas of technology work include carbon capture, carbon conversion, carbon dioxide removal, carbon dioxide transport and storage, hydrogen production with carbon management, methane emissions reduction, and critical minerals production. Much of this work is performed at its National Energy Technology Laboratory (NETL), which operates in three locations across the country. NETL operates AFFF-based fire suppression systems and wastewater treatment plants.

NATIONAL ENERGY TECHNOLOGY LABORATORY

Sites Description: The National Energy Technology Laboratory (NETL) is the lead research and development office for FECM. NETL has expertise in coal, natural gas, and oil technologies, contract and project management, analysis of energy systems, and international energy issues. NETL sites are located in (1) Albany, Oregon (NETL-ALB), (2) Pittsburgh, Pennsylvania (NETL-PGH), and (3) Morgantown, West Virginia (NETL-MGN).

The NETL sites are all government-owned and government-operated facilities, which differs from all other DOE laboratories, which are federally-owned but operated by contractors. The Albany site began operations in 1943 as the Albany Research Center, focusing on materials research. The Pittsburgh site began operations in 1910, focusing on coal-related research. NETL-PGH is co-located with the Center for Disease Control and Prevention - National Institute of Occupational Safety and Health and the U.S. Department of Labor – Mine Safety and Health Administration. NETL-MGN began operations in 1946, focusing on synthesis gas research.

Assessment Summary

Key findings from the PFAS survey and follow-up correspondence are as follows:

- *Current/Historical Activities:*
    - NETL-ALB: NETL-ALB has no documentation of historical PFAS usage on-site. There is the potential for Cold War-era liquid waste discharges to have occurred, with a known on-site chemical waste disposal drain field; however, there are no records or quantifications of PFAS-containing chemicals being used.
    - NETL-PGH: NETL-PGH has two AFFF systems that are part of its fire protection program. These systems are located in B-92, the Chemical Handling Facility, and in B-64, a chemical storage building. NETL-PGH has had two historical discharges of the AFFF systems associated with equipment failure and maintenance activities. In January 1999, the AFFF system in the Chemical Handling Facility, B-92, discharged due to equipment failure during a cold weather episode. Follow-up documentation on the amount of the release or notifications has not been located. In June 2000, a discharge of the AFFF system in B-64 occurred while a subcontractor was conducting a test of the system. It was determined that the subcontractor, tasked with testing the system and the preventing the fire suppression foam from entering any storm sewers and into the North

Outfall storm water discharge system, failed to execute proper procedures. As a result, there was an accidental discharge of material into a regulated National Pollutant Discharge Elimination System (NPDES) point discharge system. Historical records indicate the Pennsylvania Department of Environmental Protection was notified, and a follow-up incident report was written and sent. No follow-up sampling was requested.

  - NETL-MGN: NETL-MGN has one portable AFFF system at the site, but it is empty; the associated AFFF chemical supplies have been removed from the site as waste. NETL-MGN has no documentation of any historical PFAS discharges at the site.

- *PFAS Inventory*: The NETL-ALB, NETL-MGN, and NETL-PGH sites maintain small quantities of PFAS-containing chemicals (<100 pounds) on site for use in R&D project and/or facility maintenance activities, with all chemicals being tracked using an active chemical inventory management system.
- *PFAS Occurrence in the Environment and Potential Exposure Pathways*: NETL-ALB, NETL-PGH, and NETL-MGN have not conducted PFAS sampling. The three sites receive drinking water from offsite PWS. These PWSs have tested for certain PFAS recently with non-detect results.
- *Sampling Protocols*: NETL-ALB, NETL-PGH, and NETL-MGN site do not currently have monitoring equipment suitable for PFAS sampling.
- *Stakeholders*: The NETL-ALB, NETL-PGH, and NETL-MGN have not been contacted by any regulators or stakeholders regarding PFAS.

Key Takeaways

- Drinking water is supplied by municipal PWSs at the three sites.
- NETL-ALB has no documentation of historical PFAS usage on-site; however, there is the remote potential for previous Cold War-era liquid waste discharges to have occurred with a known on-site chemical waste disposal drain field.
- Two accidental releases occurred 20+ years ago at NETL-PGH; no regulatory sampling was requested for either event. PFAS use at NETL-ALB, NETL-MGN, NETL-PGH is limited to limited small quantities (<100 pounds) of PFAS for R&D project and facility maintenance activities.
- The three sites have not sampled environmental media for PFAS.
- None of the three sites have been contacted by regulators or stakeholders regarding PFAS.

5. OFFICE OF LEGACY MANAGEMENT

The U.S. DOE Office of Legacy Management (LM), established in 2003, manages DOE's responsibilities associated with the closure of World War II and Cold War era sites that the federal government operated to research, produce, and test nuclear weapons and conduct other scientific and engineering research.

These responsibilities include, but are not limited to, protecting human health and the environment through effective and efficient long-term surveillance and maintenance (LTS&M); preserving, protecting, and making accessible legacy records and information; managing legacy land and assets, emphasizing safety, reuse, and disposition; and mitigating community impacts resulting from the cleanup of legacy waste.

LM manages 101 sites in the United States and the territory of Puerto Rico associated with past radiological and nuclear material production and testing, and energy research — some dating from as early as the Manhattan Project. At LM sites, environmental clean-up has been completed, or treatment systems for groundwater are in place. At more than half of the sites, LM performs long-term surveillance and monitoring to make certain remedies continue to protect public health and the environment. Due to the post-closure status of the LM sites and the limited LTS&M nature of activities, LM has limited the PFAS surveys to most of LM's CERCLA/RCRA sites where probable PFAS use could have historically occurred based on currently available information.

Publicly available LTS&M plans, or equivalent documents are prepared for the sites and include site descriptions, site histories, the nature and extent of contamination, site closeout conditions, present and future monitoring and surveillance programs, and institutional controls. In 2021, LM managed the long-term care of 101 sites. The regulatory or programmatic framework and the number of sites managed under each framework are identified in the table below. As active remediation of additional DOE sites is completed, they will be transferred to LM for long-term care.

Regulatory or Programmatic Framework	Site Count[a]
Comprehensive Environmental Response, Compensation, and Liability Act and Resource Conservation and Recovery Act (CERCLA/RCRA)	8
Nevada Offsites	10
Uranium Mill Tailings Radiation Control Act Title I	21
Uranium Mill Tailings Radiation Control Act Title II	6
Formerly Utilized Site Remedial Action Program	34
Decontamination and Decommissioning Program (D&D)	5
Nuclear Waste Policy Act (NWPA)	1
Manhattan Engineer District/Atomic Energy Commission Legacy Sites	10
State Water Quality Standards	1
Plowshare and Vela Uniform Program	5[b]
Total	101

Regulatory/Programmatic Framework for LM Sites

[a] Site counts are based on the October 2021 *LM Site Management Guide* (https://www.energy.gov/lm/downloads/site-management-guide). [b] One of these sites represents 166 individual projects but is counted as a single site.

Note: Maxey Flats, KY is a CERCLA site but LM's stewardship of this site is limited to records retention and stakeholder support. LM does not have ownership of this site. Accordingly, as with the non-CERCLA legacy sites, a graded approach was used, and a survey was not completed for this site.

FERNALD PRESERVE, OHIO, SITE

Site Description: The Fernald Preserve is located on the site of the former Feed Materials Production Center, a uranium processing facility that produced high-purity uranium metal products as the first step in America's nuclear weapons production cycle. The site's production mission began in 1953 and continued until 1989, when production operations ceased, and Fernald Preserve's mission changed to environmental remediation. The comprehensive environmental remediation and ecological restoration of the site was completed by DOE-EM in 2006. The site was transferred to DOE-LM in 2008 and opened to the public as a nature preserve. An active pump and treat groundwater remedy for uranium contamination remains ongoing.

Assessment Summary

Key findings from the PFAS survey and follow-up correspondence are as follows:

- *Current/Historical Activities*: A records search following the 2016 CERCLA Five-Year Review revealed that the former Fernald Materials Production Center stored approximately 50 gallons of AFFF and used less than 25 gallons of AFFF from 1976-1990. The usage was isolated to the former fire training facility, which underwent extensive soil removal during the CERCLA cleanup. LM is currently pursuing additional research on potential historical PFAS use related to other industrial processes such as pipe coatings.
- *PFAS Inventory:* None.
- *PFAS Occurrence in the Environment and Potential Exposure Pathways*: No environmental or drinking water sampling for PFAS have been performed onsite. Institutional controls prevent usage of the site's water resources as a source of drinking water. Site drinking water is supplied by the local municipal water authority.
- *Sampling Protocols*: The Fernald Preserve has not completed PFAS sampling. Sampling plans would be developed in coordination with site regulators if additional research identified a credible PFAS source that could represent a threat to human health or the environment. If sampling were to occur, it is likely that additional sampling/monitoring equipment would be necessary.
- *Stakeholders*: The Fernald Preserve has been contacted by the EPA about PFAS via the 2016 and 2021 CERCLA Five-Year Reviews.

Key Takeaways
• Drinking water is supplied by the local municipal water authority. • Small quantities of AFFF were stored and used onsite in an area that has undergone extensive soil remediation. • No PFAS sampling to date has occurred. • EPA has contacted the Fernald Preserve regarding PFAS during recent 5-year reviews.

LABORATORY FOR ENERGY-RELATED HEALTH RESEARCH

Site Description: The former Laboratory for Energy-Related Health Research (LEHR) is located at the University of California, Davis, about 1.5 miles south of the main campus and is surrounded by UC Davis research facilities and farmland. The university owns the property, which comprises about 15 acres. Former research activities at LEHR generated a variety of radiological and non-radiological wastes that were disposed of on-site. As a result, the EPA listed the facility on the National Priorities List (NPL) in 1994. Remediation at the LEHR Federal Facility is complete. Groundwater monitoring remains ongoing.

Assessment Summary

Key findings from the PFAS survey and follow-up correspondence are as follows:

- *Current/Historical Activities*: LM has performed a records search and found no record of the use of firefighting foams or other PFAS-containing materials at the site. The site did not have an onsite fire department or fire training facility. LEHR indicated in their survey response that there were Cold War era liquid discharges, a landfill and a wastewater treatment plant located onsite.
- *PFAS Inventory:* None.
- *PFAS Occurrence in the Environment and Potential Exposure Pathways*: The site does not supply drinking water.
- *Sampling Protocols*: No PFAS sampling has occurred to date. LM does not expect to perform PFAS sampling at the LEHR site.
- *Stakeholders*: In September 2019, EPA suggested DOE/University of California Davis add PFAS sampling to the groundwater monitoring program based on the March 2019 Central Valley Regional Water Quality Control Board (Water Board) PFAS sampling order for active landfills. LEHR has an inactive landfill, which is not subject to the Water Board's order. LM is not expected to participate in PFAS-related activities at LEHR.

Key Takeaways
• The LEHR site does not supply drinking water. • A record search revealed no record of use of AFFF or PFAS-containing materials onsite. • No PFAS sampling to date has occurred.

MONTICELLO, UTAH, DISPOSAL AND PROCESSING SITES

Site Description: The Monticello, Utah, Disposal and Processing Sites are located in and near the city of Monticello, which is in the southeastern corner of the state, about 250 miles southeast of Salt Lake City, Utah. The sites processed approximately 900,000 tons of uranium and vanadium ore from 1945 to 1960. Termination of ore milling and increasing awareness of its environmental effects prompted mill decommissioning and site stabilization between 1961 and 1965. Mill foundations were demolished in 1974 and 1975. Debris from the project was buried in place and the area was graded and revegetated. Additional disposal of waste was completed in June 2000. LM monitors groundwater and institutional controls at the sites. Remediation of groundwater is ongoing.

Assessment Summary

Key findings from the PFAS survey and follow-up correspondence are as follows:

- *Current/Historical Activities*: There were Cold War-era liquid waste discharges onsite, and a landfill is present onsite. Potential PFAS usage onsite has not been investigated.
- *PFAS Inventory:* None.
- *PFAS Occurrence in the Environment and Potential Exposure Pathways*: The site does not provide drinking water, nor is it used as a source of drinking water. Drinking water is supplied by the local municipality.
- *Sampling Protocols*: No PFAS sampling to date has occurred.
- *Stakeholders*: The site has not been contacted by regulators or stakeholders.

Key Takeaways
• There were Cold War-era liquid waste discharges onsite. • Drinking water is supplied by the local municipal water authority. • No PFAS sampling to date has occurred. • The site has not been contacted by regulators or stakeholders.

MOUND, OHIO, SITE

Site Description: The Mound site in Miamisburg, Ohio, is located approximately 10 miles southwest of Dayton, Ohio. The Mound site, which operated from 1948 to 2003 under the U.S. Atomic Energy Commission and later by the DOE, was built to continue Manhattan Project work on polonium-beryllium initiators used in early atomic weapons. The site later expanded into an integrated research, development, and production facility supporting weapons, energy, and space missions. The site was placed on the National Priority List in 1989 due to volatile organic contamination in the Buried Valley Aquifer. Extensive remediation was completed by DOE-EM in 2010 and the site subsequently transitioned to DOE-LM. Groundwater remediation remains ongoing.

Assessment Summary

Key findings from the PFAS survey and follow-up correspondence are as follows:

- *Current/Historical Activities*: A records search following the 2016 CERCLA Five-Year Review revealed that the Mound site historically used very small quantities of PFAS as mass spectroscopy standards which were completely consumed during analysis. Research revealed that no historical fire suppression systems onsite contain AFFF. LM is currently evaluating the potential for PFAS usage in other industrial processes that occurred during operations such as metals plating and plastics production processes. Metals plating was conducted in one building and plastics production was employed in five buildings at the Mound site, but no known PFAS was used. PFAS could be a minor ingredient in other chemicals.
- *PFAS Inventory:* None.
- *PFAS Occurrence in the Environment and Potential Exposure Pathways*: No environmental or drinking water sampling for PFAS has been performed onsite. Institutional controls prevent usage of the site's water resources as a source of drinking water. Site drinking water is supplied by the local municipal water authority.
- *Sampling Protocols*: The Mound site has not completed PFAS sampling. Sampling plans would be developed in coordination with site regulators if additional research identified a credible PFAS source that could represent a threat to human health or the environment. If sampling were to occur, it is likely that additional sampling/monitoring equipment would be necessary.
- *Stakeholders*: The Mound site has been contacted by the EPA about PFAS via the 2016 and 2021 CERCLA Five-Year Reviews. The Mound site has not been contacted by any stakeholders.

Key Takeaways
• Drinking water is supplied by the local municipal water authority. • Small quantities of PFAS were stored and used onsite and additional records searches for other uses are underway. • No PFAS sampling to date has occurred. • EPA has contacted the Mound site regarding PFAS during recent 5-year reviews.

PINELLAS, FLORIDA, SITE

Site Description: The Pinellas County site is located in Largo, Florida, about 10 miles north-northwest of St. Petersburg and across Tampa Bay from the city of Tampa. The Atomic Energy Commission and successor agencies developed and manufactured components for the nation's nuclear weapons program from 1957 to 1994. As a result of historical waste disposal practices and leaks during DOE operations, portions of the subsurface and the shallow surficial aquifer were contaminated with organic solvents and metals. Groundwater treatment and monitoring remains ongoing.

Assessment Summary

Key findings from the PFAS survey and follow-up correspondence are as follows:

- *Current/Historical Activities*: DOE has performed a historical records search that found no results of PFAS use at the Pinellas site.
- *PFAS Inventory*: None.
- *PFAS Occurrence in the Environment and Potential Exposure Pathways*: The Pinellas site does not supply drinking water, nor is it used as a source of drinking water.
- *Sampling Protocols*: The Pinellas site has not sampled for PFAS.
- *Stakeholders*: In March 2019, the Florida Department of Environmental Protection (FDEP) requested any information on PFAS usage at the Pinellas site. Additional discussions were held in 2021 that focused on a historical fire training facility.

Key Takeaways
• The Pinellas site does not supply drinking water. • A record search revealed no record of use of AFFF or PFAS-containing materials onsite. • No PFAS sampling to date has occurred at the site. • The state of Florida has engaged with DOE on PFAS use at the site including a historical fire training facility.

ROCKY FLATS, COLORADO, SITE

Site Description: The former Rocky Flats Plant is located 16 miles northwest of Denver, Colorado and was part of the nationwide nuclear weapons complex that manufactured nuclear weapons components under the jurisdiction and control of the DOE and its predecessor agencies. From 1952 to 1994, the plant's primary mission was producing nuclear and nonnuclear weapons components for America's nuclear arsenal. The site was added to the NPL in 1989. In October 2005, DOE completed an accelerated 10-year, $7 billion cleanup of chemical and radiological contamination in production buildings and limited areas across the site after nearly 50 years of production activities, removing over 800 structures and resulting in a vacant site having a more natural appearance. LM is responsible for monitoring and maintenance at the Rocky Flats site including two closed landfills, four groundwater collection systems, three groundwater treatment systems, and more than 100 water monitoring locations and stations.

Assessment Summary

Key findings from the PFAS survey and follow-up correspondence are as follows:

- *Current/Historical Activities*: The most significant potential for PFAS usage is thought to be the historic Rocky Flats Fire Department and associated training area that used AFFF onsite. The plant also had metal plating and other metallurgical research, development, and processing activities, including plutonium machining and forming processes.
- *PFAS Inventory:* None.

- *PFAS Occurrence in the Environment and Potential Exposure Pathways*: PFAS have been detected in groundwater, surface water, and landfill leachate at the Rocky Flats site. A sampling and analysis plan (SAP) for PFOA/PFOS was submitted to the Colorado Department of Public Health and Environment in April 2019, and it used a modified version of EPA method 537 to analyze PFOA and PFOS. Work related to this sampling effort included sampling at three monitoring wells, two surface water locations, influent to one groundwater and one groundwater/landfill leachate treatment system, and one landfill seep during the second and fourth quarters of CY 2019. Locations were selected to evaluate PFAS in or from the former fire department training area, both former landfills, a facility that was involved in metallurgical work, both former oil burn pits, and a groundwater treatment system. Sampling results indicated the highest concentrations were present in a groundwater monitoring well in the area of the former fire department/oil burn pit (70-130 ppt for PFOA and 240-310 ppt for PFOS) and in landfill leachate routed through the associated treatment system (59-69 ppt for PFOA and 20-23 ppt for PFOS). Surface water sampling showed concentrations up to 13 ppt PFOA and 19 ppt PFOS.
- In August 2021, DOE began quarterly sampling for PFAS in accordance with a new SAP that was provided to the Colorado Department of Public Health and Environment in January 2021. This SAP increased the number of sample locations from 8 to 12 and the target analytes from 2 to 28 PFAS[20], including PFOA, PFOS, and other PFAS listed in Colorado Water Quality Control Commission Policy 20-1. The duration of the sampling program will extend for at least eight quarters. Samples collected through February 2022 in accordance with this 2021 SAP show concentrations of PFOA and PFOS continue to be highest in the area near the former fire training area (PFOA to 73 ppt, PFOS to 270 ppt), and leachate routed through the Present Landfill Treatment System remains next highest (PFOA to 64 ppt, PFOS to 33 ppt). The site does not supply or operate a drinking water system, and neither groundwater nor surface water represent a drinking water resource.
- *Sampling Protocols*: Sampling plans have been developed in coordination with site regulators, and all equipment with a potential for contacting water to be sampled was evaluated prior to collecting PFAS samples. This equipment was modified or replaced to avoid cross-contamination from PFAS-containing (e.g., Teflon®) parts.
- *Stakeholders*: In September 2018, the Colorado Department of Public Health and Environment requested a groundwater screening proposal for sampling of PFOA and PFOS using its Colorado Hazardous Waste Act authority based upon the addition of these constituents to the Colorado Hazardous Waste Regulations, Appendix VIII.

  Additionally, PFAS were assessed in the 2022 CERCLA Five-Year Review (FYR) as an emerging contaminant. Because the risk to human and ecological receptors from PFAS at the site has not been evaluated, the following recommendations will be made in the FYR: (1) continue the collection and evaluation of water samples for PFAS for eight quarters, (2) prepare and implement a plan that identifies the data and information required to support an assessment of potential PFAS risk to human receptors and a PFAS screening-level ecological risk assessment (SLERA); and (3) complete an assessment of potential PFAS risk to human

[20] While the SAP lists 28 analytes, one cannot be analyzed directly by the laboratory; it is a salt of a GenX PFAS that is analyzed.

receptors and a PFAS SLERA. It is expected that these actions may take up to four years to complete, at which time a protectiveness determination will be made and a FYR report addendum completed.

A summary of validated PFAS detections at the Rocky Flats site is provided below. Data represent samples collected in 2019 for analysis of PFOA and PFOS, and samples collected from August 2021 through February 2022 for analysis of those plus 25 additional PFAS.

Chemical name	Detections [Out of 3 Sample Events]	Concentration Range [ppt]
6:2 fluorotelomersulfonic acid	8	0.61 - 52
8:2 fluorotelomersulfonic acid	3	1.2 - 16
N-ethyl perfluorooctanesulfonamidoacetic acid	7	18 – 35
N-methyl perfluorooctanesulfonamidoacetic acid	2	0.77 and 0.85
Perfluorobutanesulfonic acid (PFBS)	30	0.38 - 25
Perfluorobutanoic acid (PFBA)	32	0.89 - 280
Perfluorodecanesulfonic acid (PFDS)	3	0.76 – 1.4
Perfluorodecanoic acid (PFDA)	2	1 and 3.5
Perfluoroheptanesulfonic acid (PFHpS)	8	0.49 – 4.3
Perfluoroheptanoic acid (PFHpA)	28	0.51 - 100
Perfluorohexanesulfonate (PFHxS)	32	0.41 - 210
Perfluorohexanoic acid (PFHxA)	32	0.61 - 100
Perfluorononanoic acid (PFNA)	19	0.54 - 11
Perfluoroocatane sulfonamide (PFOSA)	4	0.44 – 1.5
Perfluorooctanesulfonic acid (PFOS)*	42	0.91 – 310
Perfluorooctanoic acid (PFOA)*	47	0.55 - 130
Perfluoropentane sulfonic acid (PFPS)	21	0.33 - 29
Perfluoropentanoic acid (PFPeA)	31	0.4 - 120
Perfluorotetradecanoic acid (PFTeA)	1	0.49

PFAS Concentrations (ppt) in Water Samples Collected at Rocky Flats Site

*5 sample events for this constituent (2 in 2019, balance in August 2021 through February 2022).

Results from both "Real" and "Duplicate" samples are represented in the concentration ranges, but when both are collected this is only counted as one sample event.

Key Takeaways
• Groundwater and surface water at the Rocky Flats site are not currently drinking water sources. • PFAS was used at the Rocky Flats Fire Department and associated training area. • Quarterly PFAS sampling per the 2021 SAP continues. • The highest PFAS concentrations have been detected in samples from the former Rocky Flats Fire Department and associated training area, where PFOA and PFOS levels have been as high as 130 ppt and 310 ppt, respectively.

WELDON SPRING, MISSOURI, SITE

Site Description: The Weldon Spring site is located in St. Charles County, about 30 miles west of St. Louis. The site comprises two geographically distinct, DOE-owned properties: the former Weldon Spring Chemical Plant and Raffinate Pit sites (Chemical Plant) and the former Weldon Spring Quarry (Quarry). The plant converted processed uranium ore concentrates to pure uranium trioxide, intermediate compounds, and uranium metal. Uranium operations ended up contaminating the area which resulted in placement on the NPL in 1987. Remedial activities concluded in 2001. LM continues to conduct groundwater and surface water monitoring.

Assessment Summary

Key findings from the PFAS survey and follow-up correspondence are as follows:

- *Current/Historical Activities*: Potential PFAS use onsite has not been investigated.
- *PFAS Inventory:* None.
- *PFAS Occurrence in the Environment and Potential Exposure Pathways*: The Weldon Spring site does not provide drinking water, nor is it used as a source of drinking water. Drinking water is supplied by the local municipality.
- *Sampling Protocols*: No PFAS sampling to date has occurred.
- *Stakeholders*: The Weldon Spring site has not been contacted by regulators or stakeholders.

Key Takeaways
• The Weldon Spring site does not supply drinking water. • Potential PFAS use onsite has not been investigated. • No PFAS sampling to date has occurred. • The Weldon Spring site has not been contacted by regulators or stakeholders.

NON-CERCLA LEGACY MANAGEMENT SITES

PFAS surveys were not completed for any non-CERCLA sites based on a graded approach and the following risk considerations:

- LM manages sites with diverse regulatory drivers or as part of internal DOE or congressionally recognized programs and must comply with direction from those regulatory bodies.

- LM identifies stewardship responsibilities for 101 sites; however, 43 sites are limited to records retention and stakeholder support (LM Category 1 sites; described in the LM Site Management Guide).
- LM does not own all of the sites.
- PFAS usage in large application processes (ex. fire-fighting foam) is not expected based on current knowledge and understanding of historic operational mission processes.
- No DOE operational facilities remain at most of the sites.
- Onsite activities are primarily limited to inspections, monitoring and sampling, maintenance of site features such as fencing, drainage swales, and disposal cells. Groundwater sampling is not performed at some sites because the groundwater is either poor quality or limited yield and is not being used. For those sites where groundwater sampling occurs, potential exposure to site workers is reduced by use of personal protective equipment and following job safety protocols (ex. protective equipment such as gloves and goggles are used during sampling).
- Potential exposure to public is reduced by implementing institutional controls such as the following:
  - DOE land ownership
  - Fencing
  - Restrictions on water use
  - Markers and notifications
- Sites currently undergoing remediation such as Formerly Utilized Site Remedial Action Program sites under management by another entity (Army Corps of Engineers) were not evaluated because they have not yet transitioned into LM's portfolio.

<u>Assessment Summary</u>

Key findings from correspondence are as follows:

- *Current/Historical Activities*: Potential PFAS usage onsite has not been investigated at non-CERCLA LM sites.
- *PFAS Inventory:* None.
- *PFAS Occurrence in the Environment and Potential Exposure Pathways*: These sites do not provide drinking water. Tuba City, Arizona is the only site with an onsite water system with an onsite potable well. In May 2022, the water system was shutoff as no employees are onsite.
- *Sampling Protocols*: No PFAS sampling has occurred at these sites.
- *Stakeholders*: LM has not been contacted by regulators or stakeholders at these sites.

Key Takeaways
• Non-CERCLA LM sites do not supply drinking water. • Historic knowledge and understanding of site history suggest minimal potential for use of PFAS at these sites. • No PFAS sampling to date has occurred at non-CERCLA LM sites.

6. OFFICE OF NUCLEAR ENERGY

The Office of Nuclear Energy's (NE) mission is to advance nuclear energy science and technology, focusing on continued operation of existing U.S. nuclear reactors, deployment of new ones, and support of advanced reactor design development. NE's operations in nuclear energy research, development and demonstration are located at the Idaho National Laboratory (INL).

The INL site mission is to operate a multi-program national research and development laboratory and to complete environmental cleanup activities stemming from past operations. The Idaho Operations Office (DOE-ID) supports major programmatic activities under the direction of NE and EM, with NE as the lead Program Secretarial Office for the INL site.

IDAHO

Site Description: The INL site, operated by NE, is located on the ancestral lands of the Shoshone and Bannock Tribes in southeast Idaho. The site was established in 1949 as the National Reactor Testing Station. The original mission of the INL site was to develop and test civilian and defense nuclear reactor technologies and manage spent nuclear fuel. Fifty-two reactors – most of them first-of-a-kind – were built, including the Navy's first prototype nuclear propulsion plant. Of the 52 reactors, four remain in operation. The INL site was placed on the NPL in 1989.

The Idaho Cleanup Project (ICP) at the INL site operated by DOE-EM is responsible for treating, storing, and dispositioning a variety of radioactive and hazardous wastes, removing and dispositioning targeted buried waste, removing or deactivating unneeded facilities, and managing – and ultimately removing – spent nuclear fuel and high-level waste from Idaho.

Assessment Summary

Key findings from the PFAS survey and additional discussions with site personnel are as follows:

- *Current/Historical Activities*: Potential PFAS use onsite has not been investigated. Based on the survey responses, the following potential sources of PFAS were identified. INL has operated a fire department facility onsite. AFFF was reportedly used for fire training in the past. Incident response in 2000 used Class A foam; all Class B foams in NE's inventory have been transferred offsite for disposal. A detailed search of historical AFFF uses has not been performed. The site performed plutonium production at a Plutonium Uranium Reduction Extraction plant. Cold War-era liquid waste was discharged to two site injection wells, one well was permanently filled and sealed with grout in 1989, and the other is currently being used as a monitoring well. The site has a Subsurface Disposal Area that accepted CERCLA waste from the INL site and various other DOE complexes, the Idaho CERCLA Disposal Facility designed to accept CERCLA waste generated onsite, a non-municipal landfill, as well as wastewater treatment plants.
- *PFAS Inventory*: Survey responses indicated that the INL site currently maintains a small inventory of PFAS on-site but does not have more than 100 pounds of any one PFAS. Both ICP and INL chemical inventory systems established in the 1990s were queried, using a list of PFAS provided by DOE Headquarters.

- *PFAS Occurrence and Potential Exposure Pathways*: The INL site obtains all drinking water from deep onsite groundwater wells and operates ten drinking water systems. The INL site provides potable water to fewer than 10,000 people from on-site groundwater. The INL and ICP facilities have their own drinking water systems; these are classified as either transient noncommunity systems or non-transient noncommunity water systems depending on the size of population served. The INL site had not sampled its ten drinking water systems or other environmental media for PFAS at the time of the survey. The INL site was contacted by the state of Idaho in 2021 to sample some drinking water wells and the site agreed to voluntarily sample all drinking water wells that supply the potable water at both the ICP and INL site facilities. Baseline PFAS samples have been collected from a total of 15 drinking water wells. The results of the baseline sampling activities are summarized in the table below. One additional well was not sampled at this time due to a maintenance issue, but is planned to be sampled by the end of the calendar year. Both INL and ICP provided the State with the analytical results.
- *Sampling Protocols*: Before sampling for PFAS in groundwater, the Idaho site reviewed the contracted laboratories certifications to ensure that they had approved state and EPA accreditation for the methods being used. INL and ICP will need to evaluate monitoring wells for equipment that may contain PFAS.
- *Stakeholders:* The INL site has not been contacted by federal, tribal, or local stakeholders or regulators regarding PFAS.[21] The state of Idaho will potentially re-evaluate PFAS in 2023 as part of a three-year review of drinking water quality standards and asked for voluntary sampling of drinking water at the facility. INL and ICP performed voluntary drinking water sampling for PFAS and reported their data to the state of Idaho.

Chemical name	Detections [Out of 15 Wells Sampled]	Concentration Range [ppt]
Perfluorobutanesulfonate (PFBS)	1	1.45*
Perfluorobutanoic acid (PFBA)	2	2.87 and 4.86
Perfluoroheptanoic acid (PFHpA)	2	0.59* and 4.20
Perfluorohexanesulfonate (PFHxS)	5	0.76* – 7.48
Perfluorohexanoic acid (PFHxA)	2	3.61 and 12.8
Perfluorooctanoic acid (PFOA)	2	1.25* and 1.47*
Perfluoropentane sulfonic acid (PFPeS)	1	1.13*
Perfluoropentanoic acid (PFPeA)	2	5.59 and 15.7
Perfluorooctane sulfonic acid (PFOS)	2	0.70* and 1.77*

INL drinking water PFAS sampling results with positive detections.
*Concentration value is estimated.

[21] The EM CERCLA five-year review for the Idaho was just completed and EPA did not request any additional information on PFAS. However, INL EM/NE has been contacted by the state of Idaho Department of Environmental Quality to sample several on-site drinking water systems voluntarily. This request was made after the survey was conducted.

Key Takeaways
• The INL site provides drinking water to fewer than 10,000 people from on-site groundwater; drinking water systems have been sampled for PFAS. Sampling treated and raw drinking water sources provide critical information for assessing potential PFAS exposure pathways. • INL and ICP performed voluntary sampling of all drinking water systems for PFAS, at the request of the state, and reported results to the state of Idaho. The state will potentially reevaluate PFAS drinking water quality standards in 2023. • The Subsurface Disposal Area, which accepted waste from the Rocky Flats site, the INL site, and other DOE facilities, landfills, and the wastewater treatment plants are present on the site. Cold War era liquid wastes were discharged into on-site wells; wells have since been grouted or have undergone remediation. • A records review may inform an assessment of the potential for PFAS usage, storage, or disposal at the INL site.

7. NATIONAL NUCLEAR SECURITY ADMINISTRATION

The National Nuclear Security Administration (NNSA) is a semi-autonomous agency within DOE responsible for enhancing national security through the military application of nuclear science. NNSA maintains and enhances the safety, security, and effectiveness of the U.S. nuclear weapons stockpile; works to reduce the global danger from weapons of mass destruction; provides the U.S. Navy with safe and militarily effective nuclear propulsion; and responds to nuclear and radiological emergencies in the United States and abroad.

KANSAS CITY NATIONAL SECURITY CAMPUS

Site Description: The NNSA Kansas City National Security Campus (KCNSC) is comprised of three different locations: (1) KCNSC located near Kansas City, Missouri, opened in 2013. The site is leased by the NNSA and operated by Honeywell Federal Manufacturing and Technologies (FM&T), LLC. (2) The Kansas City Plant (KCP) was located at the Bannister Federal Complex (BFC), referred to as KCP-BFC in this report. The site was owned by the NNSA and operated by Honeywell FM&T until decommissioning began in 2014. The site is being redeveloped and NNSA is involved through the NNSA Long-Term Stewardship program. (3) The Kansas City National Security Campus New Mexico Operations (KCNSC-NMO) is a satellite site in Albuquerque, New Mexico. The site is leased by the NNSA and operated by Honeywell FM&T.

Assessment Summary

Key findings from the PFAS survey and follow-up correspondence are as follows:

- *Current/Historical Activities*
    - KCNSC has active metal plating processing onsite. All wastewater is captured by tanks and goes through the Industrial Wastewater Pretreatment Facility. There are no releases into the environment.
    - Since the KCP-BFC facility has been decommissioned, all potential PFAS uses are historical and no longer active. There was a fire department onsite along with metal plating processing. Cold War-era liquid waste discharges and wastewater treatment discharges occurred.
    - KCNSC-NMO has no active or historical PFAS uses onsite.
- *PFAS Inventory:* KCNSC has quantities (>100 lbs.) of several chemicals, with PFAS listed as a constituent stored onsite. KCP-BFC and KCNSC-NMO do not have PFAS in their chemical inventories.
- *PFAS Occurrence in the Environment and Potential Exposure Pathways*: The KCNSC and KCP-BFC receive drinking water from the Kansas City PWS, and KCNSC-NMO drinking water is sourced from the City of Albuquerque PWS. Both cities have completed PFAS testing, and the results were non-detect for PFAS. KCNSC and KCNSC-NMO have not sampled for PFAS. Due diligence sampling was completed at KCP-BFC during the decommissioning of the facility. Three soil samples from 2015 were analyzed for 14 PFAS. The results are considered qualitative as the samples were tested outside of the method holding time. However, PFAS

are not likely to have degraded significantly before analysis. Seven groundwater samples from 2016 were analyzed for 15 PFAS, including the six PFAS on the EPA's third Unregulated Contaminant Monitoring Rule (UCMR). Samples were collected from the influent to the groundwater treatment facility. Results for the groundwater and soil samples are provided in the tables below, respectively, and indicate no PFAS in groundwater greater than 37 ppt.

- *Sampling Protocols*: KCNSC, KCP-BFC, and KCNSC-NMO do not currently use monitoring equipment that contains PFAS.
- *Stakeholders*: The KCNSC, KCP-BFC, and KCNSC-NMO have not been contacted by any regulators or stakeholders.

Chemical name	Detections [Out of 8 Samples]	Concentration Range [ppt]
Perfluorobutanesulfonate (PFBS)	1	37
Perfluoroheptanoic acid (PFHA)	7	2* – 8
Perfluorohexanesulfonate (PFHxS)	1	9*
Perfluorohexanoic acid (PFHxA)	5	6 – 21
Perfluorononanoic acid (PFNA)	5	1* – 7
Perfluorooctanoic acid (PFOA)	8	1* – 9

KCP-BFC groundwater sampling results. PFAS water sampling results from KCP-BFC with positive PFAS detections. (Cohen 2017).
*Concentration value is estimated.

Chemical name	Detections [Out of 3 Samples]	Concentration Range [ng/g]
Perfluorononanoic acid (PFNA)	1	0.24*

KCP-BFC soil sampling results. PFAS soil sampling results from KCP-BFC with positive PFAS detections (Cohen 2017).
*Three soil samples were tested for 14 PFAS. Only one sample tested positive for PFAS.

Key Takeaways

- Drinking water is supplied by municipal PWSs and PFAS were not detected in samples.
- KCP-BFC and KCNSC-NMO had no documentation of PFAS usage onsite.
- KCNSC has small quantities of PFAS onsite; wastewater is pretreated and not released to the environment.
- The KCP-BFC groundwater sampling identified PFOA and PFBS in one or more of the samples.
- KCNSC and KCNSC-NMO have not completed PFAS environmental sampling.

LAWRENCE LIVERMORE NATIONAL LABORATORY

Site Description: The Lawrence Livermore National Laboratory (LLNL) Main Site and Site 300 are NNSA sites run by management and operations (M&O) contractor Lawrence Livermore National Security, LLC.

The DOE-EM is completing environmental restoration activities at Site 300 and D&D activities at the Livermore Site.

Assessment Summary

LLNL provided two surveys, one for the Livermore Main Site, located in Livermore, CA, and one for LLNL Site 300, located between Livermore and Tracy, CA. Key findings from the surveys, additional discussions with site personnel, and a limited literature review are as follows:

- *Current/Historical Activities:*
    - Livermore Main Site: There was a fire training facility located onsite that is no longer active; training is currently conducted offsite. There is an active fire department onsite that does not use AFFF. There is an AFFF-based fire suppression system onsite that may be active. Research scale uranium enrichment activities were done on site in the 1980s and 1990s but are not active. Metal plating processing is also active onsite. There were Cold War-era liquid waste discharges onsite. No active landfills exist onsite, but there are buried landfills managed through RCRA and CERCLA, also known as Superfund. Treated wastewater discharges onsite either go into arroyos or are re-used in cooling towers.
    - Site 300: There was also a fire training facility located at Site 300 that is no longer active and an active fire department onsite that does not use AFFF. Metal plating processing is active onsite. There were Cold War-era liquid waste discharges onsite. There are both active landfills and landfills which have undergone closure following RCRA regulations. The wastewater treatment system discharges via misting or discharges are re-injected into the ground.
- *PFAS Inventories:*
    - Livermore Main Site: Livermore Main Site has more than 100 pounds of PFAS onsite. Five-gallon containers of a PFAS-containing firefighting foam concentrate were found onsite but disposed of through Radioactive and Hazardous Waste Management.
    - Site 300: Site 300 has fewer than 100 pounds of any one PFAS onsite. There are approximately 20 gallons of a Class A firefighting foam which does not contain PFAS.
- *PFAS Occurrence in the Environment and Potential Exposure Pathways:* The LLNL Livermore Main Site is served by the city of Livermore PWS. The population served is under 10,000 people. LLNL does test their distribution of drinking water but not for PFAS as it is not a requirement. The City of Livermore has tested the PWS, and the result was non-detect for PFAS. LLNL Site 300 is served by onsite wells and the San Francisco Public Utilities Commission (SFPUC) Hetch-Hetchy water. The SFPUC tested its drinking water sources and found no PFAS contamination. The Site 300 wells have not been tested.

  There has been no environmental sampling done at the Livermore Main Site. A single groundwater sample was collected at Site 300 on September 11, 2018, at the request of the Central Valley Regional Water Quality Control Board. The sample was collected from a well located downgradient from the former Navy Fire Suppression Area onsite for well closure purposes. Care was taken to avoid any contamination of the sampling equipment. Analysis was completed using a modified EPA Method 537 which tested for 19 PFAS. PFHxS was detected at 7.6 and 7.8 ppt in the sample and duplicate sample, respectively. PFOA was

detected at 3.2 and 2.8 ppt in the sample and duplicate sample, respectively. PFOS and all other PFAS tested less than the reporting limits. The Central Valley Regional Water Quality Control Board confirmed that these are trace detections and do not indicate groundwater contamination. The well was decommissioned in 2019.

While care was taken to avoid contamination of the single groundwater sample, if further PFAS sampling is required, LLNL would need new equipment, personal protective equipment (PPE), analytical laboratory contracts and field samplers.

- *Stakeholder:* The San Francisco Bay Area Water Board (Livermore Main Site), the Central Valley Regional Water Quality Control Board (Site 300) and the California Department of Toxic Substance Control contacted LLNL regarding potential PFAS use onsite. In response, LLNL collected a groundwater sample in 2018 and provided the sampling results and historical information to the governing bodies.

Chemical Name	Detections [Out of 2 Samples*]	Concentration Range [ppt]
Perfluorohexanesulfonate (PFHxS)	2	7.6 and 7.8
Perfluorooctanoic acid (PFOA)	2	2.8 and 3.2

LLNL Site 300 PFAS Sampling Results from September 2018. (Positive detections only) (LLNL 2018)

*Duplicate samples

Key Takeaways

- LLNL Main Site drinking water sources tested non-detect for PFAS.
- The groundwater sampling event at a location with likelihood of PFAS presence at LLNL Site 300 indicated PFOA at concentrations less than 3.2 ppt.
- AFFF is not used onsite at the fire departments (Site 300 and Livermore Main Site); however, there is an AFFF-based fire suppression system (Livermore Main Site).

LOS ALAMOS NATIONAL LABORATORY

DOE Programs Onsite: Office of Environmental Management, National Nuclear Security Administration

Site Description: NNSA's Los Alamos National Laboratory (LANL) is located in Los Alamos, New Mexico. The NNSA Los Alamos Field Office (NA-LA) is active onsite with research and development activities and production. DOE-EM Los Alamos Field Office (EM-LA) also has a large presence onsite completing legacy waste cleanup activities. The M&O contractors for NA-LA and EM-LA are Triad National Security, LLC (Triad), and Newport News Nuclear BWXT-Los Alamos, LLC (N3B), respectively.

EM-LA is responsible for the cleanup of legacy contamination of radioactive and chemical materials and waste resulting from operations during the Manhattan Project and Cold War-era at LANL. EM-LA's cleanup scope includes legacy waste remediation and disposition, soil and groundwater remediation, and demolition, deactivation, and disposition of excess buildings and facilities. Newly generated waste (post-1999 waste) at LANL is the responsibility of NA-LA.

EM-LA owns a portion of one technical area (TA): TA-54 Area G. EM-LA conducts work at Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs) on NA-LA property and formerly DOE-owned property. EM-LA performs soil investigations, groundwater and surface water sampling, and remediation.

Assessment Summary

Key findings from the PFAS surveys and additional discussions with site personnel with NA-LA/EM-LA are as follows:

- *Current/Historical Activities*:
  - There is an active fire training facility onsite. NA-LA is currently characterizing the site and searching records to see if AFFF or other PFAS containing chemicals were used onsite. There is an active fire department onsite that is owned and operated by Los Alamos County. NA-LA partially funds this effort. NA-LA maintains a chemical database which lists several AFFF containers at the fire department as disposed. The US Forest Service has a firefighting station onsite at LANL that houses helicopters. There have been multiple wildfires in the area, but there are no known uses of PFAS containing fire suppression foam associated with those wildfires.
  - There are three AFFF fire suppression systems onsite at LANL. Two systems are active and currently use AFFF. All releases from quarterly tests are captured into waste containers. The third system has been decommissioned and is undergoing characterization. NNSA is exploring research alternatives to replace the AFFF. There have been AFFF releases to the Sanitary Wastewater Treatment System. These releases were stopped in 2018.
  - Metal plating processing is active onsite, but it does not discharge to the environment or the Sanitary Wastewater Treatment System. There is one active landfill onsite, and numerous locations have historically received waste materials, including Manhattan Project and Cold War-era liquid waste discharges. The Sanitary Wastewater Treatment Facility effluent discharges to a permitted NPDES outfall or is routed to the Sanitary Effluent Reclamation Facility, treated via reverse osmosis, and reused in cooling towers.
- *PFAS Inventory:* LANL tracks PFAS inventory. There are less than 100 pounds of PFAS on the site.
- *PFAS Occurrence in the Environment and Potential Exposure Pathways*: LANL does not provide potable drinking water from on-site sources; however, Los Alamos County does. The PWS onsite was transferred from the DOE to Los Alamos County in the 1990s. While DOE owns the land, Los Alamos County owns the well infrastructure. The larger county PWS serves a population of more than 10,000. N3B tested the drinking water wells for PFAS on behalf of Los Alamos County. N3B used EPA method 537.1 and found that PFAS levels were less than the detection limit. The results are publicly available on the New Mexico Intellus database.
  - PFAS sampling has been performed by N3B on behalf of EM-LA in groundwater and surface water. During monitoring year 2020, PFAS were detected in 44 out of the 153 total samples collected, including monitoring wells and surface water samples. Four

groundwater wells (two alluvial and two perched intermediate wells) exceeded the state screening level (70 ppt for the cumulative sum of PFHxS, PFOS, and PFOA concentrations). One alluvial well and two perched intermediate wells are located in Pueblo Canyon. The second alluvial well is located in Mortandad Canyon. The New Mexico Environment Department (NMED) requested EM-LA to sample for PFAS twice and to continue monitoring groundwater for PFAS if concentrations exceeded the state screening level.

  - Triad has tested several different environmental media for PFAS including soil, biota, wastewater, sediments, and biosolids/sludge. Sampling results are publicly available on the Intellus database. PFAS concentrations are actively monitored in soil, biota, and wastewater. The Soil, Foodstuffs, and Biota Program at LANL monitors ecosystem health. This program has collected deceased animals from both on and off LANL property, some of which were submitted for PFAS analysis. All sampling was and is conducted to avoid inadvertent contamination from sampling equipment.

- *Sampling Protocols*: Based on additional discussions with site personnel, current monitoring wells have dedicated Teflon™ tubing. Monitoring wells range in depth from 900 to 1,400 feet below ground surface. Protocols are in place to safely collect water samples.
- *Stakeholders:* NMED first contacted DOE about PFAS in 2018 after three PFAS (PFOS, PFOA, PFHxS) were added to the New Mexico Ground Water Toxics List, prompting the inclusion of PFAS in the current groundwater monitoring program (additional detail below). A non-government organization contacted DOE headquarters about PFAS uses at LANL, and Pueblo de San Idelfonso contacted the site for information on PFAS sampling.

  The NMED DOE Oversight Bureau began collecting groundwater PFAS samples in September 2020 and surface water PFAS samples in April 2021 which have yielded detectable levels at locations in which N3B has also detected PFAS compounds. The NMED DOE Oversight Bureau plans to continue sampling for groundwater and surface water as well as perform additional sampling for soil, and biota.

  From October to December 2019, N3B sampled surface water and groundwater in locations where PFAS were previously detected at low concentrations. The area sampled was downstream from White Rock and Los Alamos. Triad sampled effluent from the Radioactive Liquid Waste Treatment Facility (RLWTF) for three PFAS (PFOS, PFOA, and PFHxS), as required by NMED, and voluntarily sampled soil, foodstuffs, and biota. None of the three PFAS were detected in RLWTF effluent.

Key Takeaways

- Municipal drinking water originating onsite tested non-detect for PFAS.
- AFFF is used onsite within the AFFF-based fire suppression system for use in actual fire emergencies. Alternatives to AFFF will be explored.
- PFAS have been detected at limited locations across LANL during multiple sampling events, and all sampling results are publicly available through the Intellus New Mexico database.

- PFAS were detected in 44 out of the 153 total samples collected by N3B during monitoring year 2020, including groundwater monitoring wells and surface water samples.
- Testing and monitoring for PFAS concentrations continues in a variety of environmental media.
- Continued engagement with state regulators and local citizens is planned, following regulator request for PFAS sampling.

NEVADA NATIONAL SECURITY SITE

Site Description: Nevada National Security Site (NNSS) was used from 1951 to 1992 to conduct a total of 100 atmospheric and 828 underground nuclear weapons tests. As a result, some groundwater, surface soils, and industrial facilities were contaminated on the NNSS and the surrounding Nevada Test and Training Range. NNSS is located in Mercury, Nevada, 65 miles northwest of Las Vegas. NNSS remains an active NNSA-managed site where experiments are performed to support the nuclear weapons, defense, national security, and development and training programs, as well as vital programs of other federal agencies.

The DOE's EM Nevada Program (EM-NP) is responsible for completing cleanup actions at these historic nuclear testing locations, as well as waste disposal for both onsite and off-site generators. The EM-NP addresses legacy contamination from historic nuclear weapons testing at the site and permanent disposal of radioactive waste generated by environmental cleanup activities at the NNSS and other sites across the nuclear weapons complex.

NNSS supplies drinking water from on-site wells. Three PWSs on the NNSS are permitted by the state as non-community water systems (<10,000 people). Depth to groundwater at NNSS is greater than 700 feet below ground surface.

Assessment Summary

Key findings from the PFAS survey, additional discussions with site personnel, and related PFAS documents are as follows:

- *Current/Historical Activities*: NNSS has a fire training facility, a fire department which uses firefighting foam to suppress fires, Cold War-era liquid waste discharges, and active landfills surrounded by monitoring wells.
- *PFAS Inventory*: EM-NP tracks and maintains past and present inventories of PFAS and does not have more than 100 pounds of any one PFAS. No PFAS chemicals were listed in the NNSA Nevada Field Office inventory database, which dates to 2000. There is AFFF stored onsite for fire suppression where water cannot be used. A large reserve of AFFF is stored at the Remote Sensing Laboratory which is leased by the DOD. NNSS performed an inventory search for PFAS using its inventory database and found no PFAS historical inventories. Small quantities of fire suppression foams are present on-site that are not AFFF but contain PFAS. These fire suppressants are used on-site. NNSS has 5-gallon tanks of fire suppressant foams for areas where water cannot be used, and 22 gallons in storage on-site. Presently, NNSS expects to maintain this inventory. Additionally, NNSS has a reserve of 1,600 gallons of AFFF in a fire suppression system at the Remote Sensing Laboratory near Las Vegas, which DOE

occupies, and DOD owns.[22] When the system is tested, foam is not released. NNSS is uncertain whether the foam will be replaced with a non-AFFF substance as discussions for alternatives are ongoing.

- *PFAS Occurrence in the Environment and Potential Exposure Pathways:* PFAS have not been detected in NNSS treated drinking water nor the on-site groundwater which it is sourced. PFAS have not been measured beyond the NNSS boundary. Treated drinking water and source groundwater at NNSS have been sampled for PFAS with no detections, according to site personnel representing the Nevada site, EM-NP, and NNSA in post-survey discussion. The discussion confirmed that the groundwater that supplies the site drinking water was sampled for PFAS. There were no PFAS detections in the source groundwater or the treated drinking water. Currently, neither EM nor NNSA are actively monitoring for PFAS.
- *Sampling Protocols:* Sampling is conducted to avoid inadvertent contamination from sampling materials and equipment. In regard to sampling protocols, site personnel reported that no equipment would need to be replaced because of the potential for biasing from the sample collection process.
- *Stakeholders*: No federal, state, tribal, or local stakeholders or regulators have contacted NNSS regarding PFAS on-site. NNSA has voluntarily sampled for PFAS in groundwater and drinking water and plans to assess PFAS presence in buildings.

Key Takeaways
• PFAS have not been detected in NNSS treated drinking water or its on-site source groundwater. There is no evidence of Cold War-era discharges containing PFAS. • AFFF remains in use in small quantities at the site. • Active PFAS monitoring is not ongoing at the site. • NNSS has not been contacted by Nevada Department of Environmental Protection nor EPA regarding PFAS.

PANTEX PLANT

Site Description: Pantex Plant (Pantex) is an NNSA production site located in Amarillo, Texas, managed by Consolidated Nuclear Security, LLC.

Assessment Summary

Key findings from the PFAS survey and follow-up correspondence are as follows:

- *Current/Historical Activities*: There was a fire training facility onsite which became inactive in the 1980s. The fire department onsite switched to a fluorine-free alternative within the last year. There was a documented AFFF release in the 1980s during a training exercise which simulated an aircraft crash onsite. The runoff from this activity flowed into playa lakes onsite, which is where treated wastewater flows. Metal plating processing onsite is active.

[22] The arrangement between DOE and DOD is outlined in a Base Support Agreement. This agreement assigns control and all maintenance to DOE for the time while DOE uses this facility.

There were Cold War-era liquid waste discharges onsite. Several active and closed landfills are present onsite. The active landfills include one for non-hazardous demolition debris and one for remediation waste. Wastewater treatment discharges flow into a storage lagoon. There are several pump and treat systems for organics and metals which then flow into the lagoon. This water is either used for irrigation or flows into the playa lakes.

- *PFAS Inventory:* Pantex does not have any PFAS listed in current inventories or historical inventories outside of AFFF.
- *PFAS Occurrence in the Environment and Potential Exposure Pathways*: No environmental or drinking water sampling for PFAS have been conducted onsite. The PWS onsite serves employees and contractors (<10,000 people).
- *Sampling Protocols*: If PFAS sampling is required, Pantex would need new sampling supplies to avoid inadvertent contamination.
- *Stakeholders*: Some interaction with the EPA occurred several years ago when PFAS first came to light as an emerging contaminant. There were no resulting required activities. Pantex is a Superfund site which will undergo 5-year review in 2023. There has been discussion with the EPA about PFAS characterization onsite.

Key Takeaways
• The drinking water onsite serves fewer than 10,000 people and has not been tested for PFAS. • The Pantex site has documented activities where PFAS may have been present and in some cases released to the environment. • The fire department switched to a fluorine free firefighting foam alternative. • No PFAS environmental sampling has been completed onsite. • NNSA has been in discussion with EPA on PFAS characterization at the Pantex site.

SANDIA NATIONAL LABORATORIES

Site Description: Sandia National Laboratories (SNL) have three locations: Livermore, California (SNL-CA), Albuquerque, New Mexico (SNL-NM), and the Tonopah Test Range (SNL-TTR) near Tonopah, Nevada. SNL is owned by the NNSA, and the three sites are operated by National Technology and Engineering Solutions of Sandia, LLC. SNL sites are located near other organizations. SNL-CA is adjacent to LLNL, SNL-NM is within the boundaries of Kirtland Airforce Base, and SNL-TTR is within the boundaries of Nellis Air Force Range. DOE-EM is supporting the legacy environmental cleanup at the SNL-NM site.

Assessment Summary

Key findings from the PFAS survey, additional discussions with site personnel, and related PFAS documents are as follows:

- *Current/Historical Activities:*
    - SNL-CA: There is active metal plating processing onsite. SNL-CA has no active landfills onsite, but there is an old Navy landfill onsite.

  - SNL-NM: SNL-NM has had Manhattan Project liquid discharges and Cold War-era liquid discharges onsite. The active landfills are run by KAFB.
  - SNL-TTR: Most potential PFAS uses onsite are owned by the US Air Force (USAF). The USAF has a runway nearby, which is a potential source of PFAS. The USAF also had a fire training facility which discharged AFFF; however, there are no documented AFFF releases on the SNL-TTR site. The landfills onsite are either DOE legacy sites or operated by the USAF.

- *PFAS Inventory*: PFAS are not tracked at SNL-CA. SNL-NM started tracking PFAS in their chemical database in 2021. SNL-NM has less than 100 pounds of any one PFAS onsite. The only known PFAS at SNL-TTR is a 5-gallon container of AFFF on the rescue truck.
- *PFAS Occurrence in the Environment and Potential Exposure Pathways*: There has been no PFAS sampling on the SNL sites. Drinking water at SNL-CA is supplied by LLNL through the City of Livermore PWS. The city has tested its PWS, and the result was non-detect for PFAS. Drinking water at SNL-NM is supplied by Kirtland Air Force Base (KAFB). KAFB tested its drinking water, and the results came back non-detect for PFAS. SNL-TTR has two wells onsite. One is used to supply drinking water to the workforce (< 150) and the other is for construction use. The drinking water at SNL-TTR has not been tested for PFAS.
- *Sampling Protocols*: SNL-NM would need new monitoring wells, sampling supplies, and PPE to avoid inadvertent contamination during PFAS sampling. SNL-CA does not currently use monitoring equipment that contains PFAS. It is likely that additional sampling/monitoring equipment would be necessary for SNL-TTR.
- *Stakeholders*: SNL-NM was contacted by EPA. In addition, NMED contacted the site in January 2021 due to an updated permit requirement to test PFAS in stormwater. A plan to address this requirement is under development. SNL-CA and SNL-TTR have not been contacted regarding PFAS.

Key Takeaways
• Drinking water sources tested non-detect for PFAS at SNL-CA and SNL-NM while drinking water has not been tested for PFAS at SNL-TTR. • There are no known significant uses of AFFF owned by SNL-CA, SNL-NM, and SNL-TTR. • PFAS sampling has not occurred at SNL sites. • SNL-NM is addressing the updated permit requirement to test for PFAS in stormwater. Stormwater sampling is underway.

Y-12

Site Description: The Y-12 National Security Complex (Y-12) is an NNSA production site located on the DOE's ORR located in Oak Ridge, Tennessee. Y-12 is managed by Consolidated Nuclear Security.

OREM is also active at Y-12 to address legacy contamination and for D&D work.

Assessment Summary

Key findings from the PFAS survey, additional discussions with site personnel, and a limited literature review are as follows for the two program offices:

- *Current/Historical Activities*: There is an active fire training facility onsite; however, since 2017, AFFF has not been used for training. The fire department onsite has AFFF capabilities, but recently transitioned to a fluorine free foam. There are four AFFF-based suppressions systems onsite, but only one is active. Two of the four systems were transferred to OREM. The third system was converted to a water-based wet-pipe fire suppression system and completely drained of AFFF in 2018, and the AFFF waste was disposed. There is a containment dike for the active AFFF-based fire suppression system. Accidental activation of this system has resulted in the release of AFFF in the past. Annual testing of the fire suppression system also resulted in the release of AFFF. To continue to meet NFPA standards and regulatory requirements, all testing of the fire suppression system is now captured and containerized as required.

  Uranium enrichment was done in the 1940s as part of the Manhattan Project. Metal plating processing was also done in the past and currently. There were both Manhattan Project liquid discharges and Cold War-era liquid waste discharges onsite. A limited literature search was conducted to identify PFAS used during uranium production. Several landfills onsite are active but operated by OREM. The wastewater treatment systems onsite discharges under a National Pollutant Discharge Elimination System permit.

- *PFAS Inventory:* There is less than 100 pounds of any one PFAS, including the AFFF from the drained fire suppression system which is stored onsite. There are minor amounts of other chemicals which contain PFAS used in laboratories at Y-12.

- *PFAS Occurrence in the Environment and Potential Exposure Pathways:* Y-12 is served by the City of Oak Ridge PWS which serves over 10,000 people. The City of Oak Ridge tested the drinking water, and the result was non-detect for PFAS tested.

- *Sampling Protocols:* The NNSA co-sampled onsite soils with the Tennessee Department of Environment and Conservation. NNSA results show low levels of PFAS (see table below). DOE-EM performed limited surface water sampling on the Y-12 site with positive detections for PFOA (12.1 ppt and 1.51 ppt) and PFOS (10.1 ppt and 2.44 ppt). If additional sampling is required, Y-12 will need new sampling equipment to avoid inadvertent contamination, possibly including new monitoring wells, sampling supplies, and PPE.

- *Stakeholders:* The Environmental Compliance Department at Y-12 participates in a state PFAS working group hosted by the state of Tennessee.

Chemical name	Detections [Out of 6 Samples]	Concentration Range [ng/g]
Perfluorodecanoic acid (PFDA)	1	0.5*
Perfluoroheptanoic acid (PFHpA)	3	0.2* – 0.5*
Perfluorohexane sulfonic acid (PFHxS)	1	0.4*
Perfluorohexanoic acid (PFHxA)	2	0.3* and 0.3*

Perfluorononanoic acid (PFNA)	4	0.1* – 0.7
Perfluorooctane sulfonic acid (PFOS)	6	0.6* – 4.8
Perfluorooctanoic acid (PFOA)	4	0.4* – 0.9
Perfluoroundecanoic acid (PFUnDA)	4	0.2* – 0.5*

Y-12 soil sampling results. PFAS soil sampling results from Y-12 with positive PFAS detections.
*Concentration value is estimated.

Key Takeaways

- Drinking water sources tested non-detect for PFAS at Y-12.
- The fire department switched to a fluorine free foam alternative.
- AFFF is used onsite at the AFFF-based fire suppression system.
- Surface water sampling results tested positive for PFAS at Y-12.

8. OFFICE OF NAVAL REACTORS

The Naval Nuclear Propulsion Program, also known as the Naval Reactors (NR) Program, was established in 1948 and is a joint DOE and Navy organization with responsibility for all matters pertaining to naval nuclear propulsion from design through disposal. The NR program's mission is to provide the United States with safe, effective, and affordable naval nuclear propulsion plants and to ensure their continued safe and reliable operation through lifetime support, research and development, design, construction, specification, certification, testing, maintenance, and disposal.

The integrated relationship, authorities, and responsibilities between DOE and Navy for naval nuclear propulsion are specified in Executive Order 12344 and codified in 50 U.S.C. section 2511 and 50 U.S.C. section 2406. In accordance with those responsibilities and authorities, the Deputy Administrator for Naval Reactors (Director) implements and oversees requirements and practices for activities under the Director's cognizance.

Naval nuclear laboratory (NNL) includes KAPL, KAPL-KS, the Naval Reactors Facility in Idaho, and Bettis. NNL is managed and operated by Fluor Marine Propulsion, LLC.

The NR sites did not complete the survey but have provided preliminary PFAS information support this report.

KNOLLS ATOMIC POWER LABORATORY

Site Description: The Knolls Atomic Power Laboratory (KAPL) is located in Niskayuna, NY. KAPL is an engineering and research facility devoted solely to naval nuclear propulsion research. Their mission is to develop the most advanced naval nuclear propulsion technology and to provide technical support for the continued safe, reliable operation of all existing naval reactors.

Assessment Summary

Key findings are as follows:

- *PFAS Occurrence in the Environment and Potential Exposure Pathways:* Groundwater samples were taken in 2021 and analyzed for PFOA and PFOS. Results for groundwater samples are provided below. KAPL drinking water is provided by a municipal provider.
- *Stakeholders:* KAPL was contacted in 2020 by New York State Department of Environmental Conservation (NYSDEC) with a request to sample groundwater for PFOA and PFOS.

Chemical name	Detections [Out of 15 Samples]	Concentration Range (ppt)
Perfluorooctanoic acid (PFOA)	6	ND - 34.6
Perfluorooctanesulfonic acid (PFOS)	9	ND - 71.7

KAPL Groundwater Sampling Results

Key Takeaways
• Groundwater is not used for drinking water. • Drinking water for KAPL and adjacent residences is provided by a municipal water supply. • Groundwater concentrations at KAPL Closed Landfill and Land Disposal Area are less than drinking water standards. • Groundwater from KAPL flows into the Mohawk River which is a New York State Class A surface water/drinking water source. • The closest downstream public water supply is approximately 6.3 miles downriver at the Latham-Colonie Water district intake.

KNOLLS ATOMIC POWER LABORATORY-KESSELRING SITE

Site Description: The Knolls Atomic Power Laboratory-Kesselring Site (KAPL-KS) is located in West Milton, NY. At this location KAPL operates a prototype nuclear propulsion plant for training nuclear operators and for operational testing of new technologies.

Assessment Summary

Key findings are as follows:

- *Current/Historical Activities*: KAPL-KS has historically used PFAS-containing AFFF.
- *PFAS Occurrence in the Environment and Potential Exposure Pathways:* Groundwater samples were taken in 2021 and analyzed for PFOA and PFOS. Results for the groundwater samples are provided in the table below.
- *Stakeholders:* KAPL-KS was contacted in 2020 by New York State Department of Environmental Conservation with a request to sample groundwater for PFOA and PFOS.

Chemical name	Detections [Out of 13 Samples]	Concentration Range (ppt)
Perfluorooctanoic acid (PFOA)	4	0.96 - 14.0
Perfluorooctanesulfonic acid (PFOS)	9	2.18 - 327

KS Groundwater Sampling Results

Key Takeaways
• Drinking water for KAPL-KS is provided by production wells located ~ 1 mile east and hydrogeologically separate from the KAPL-KS developed area. KAPL-KS productions wells were sampled for PFOA and PFOS twice in 2021 and concentrations were non-detect. • The closest downstream drinking water supply wells are about 1.3 miles downstream from the KAPL-KS developed area and 1/3 mile downgradient from the Hogback Road Landfill. • Groundwater from KAPL-KS and Hogback Road Landfill flow into the Glowegee Creek which is a Class C Surface Water. Glowegee Creek is not classified for use as a drinking water source.

NAVAL REACTORS FACILITY

Site Description: The Naval Reactors Facility (NRF) is located on the INL site near Idaho Falls, ID. NRF examines naval spent nuclear fuel and irradiated test specimens. The data derived from these examinations are used to develop new technology and to improve the cost-effectiveness of existing designs.

Assessment Summary

Key findings are as follows:

- *Current/Historical Activities:* NRF drinking water is provided by local production wells: Well 3 and Well 14.
- *PFAS Occurrence in the Environment and Potential Exposure Pathways:* Duplicate samples were collected and analyzed by EPA Method 537.1 from each of the two drinking water wells. No PFAS were detected in these drinking water samples.
- *Stakeholders:* INL was contacted in 2021 by the Idaho Department of Environmental Quality to sample drinking water wells for PFOA/PFOS.

BETTIS ATOMIC POWER LABORATORY

Site Description: Bettis Laboratory (Bettis), located in West Mifflin, Pennsylvania. Bettis provides design and engineering support for the Nimitz Class aircraft carriers and the Seawolf Class fast attack submarines. Drinking water for Bettis is provided by a municipal water supply. Bettis did not perform an initial PFAS assessment.

Assessment Summary

Key findings are as follows:

- *Current/Historical Activities*: Bettis drinking water is provided by a municipal provider.
- *PFAS Occurrence in the Environment and Potential Exposure Pathways:* The municipal drinking water provider sampled for PFOS and PFOA in 2021 and reported none were detected.
- *Stakeholders:* Bettis has not been contacted by any stakeholders.

9. OFFICE OF SCIENCE

The Office of Science (SC) functions as nation's largest supporter of basic research in the physical sciences, the steward of 10 of the Nation's national laboratories, and the lead federal agency supporting fundamental research for energy production and security.

Several of the SC sites contain the following facilities and/or conduct operations: fire training facility, fire department, documented release of AFFF, presence of AFFF-based fire suppression system, uranium enrichment, metal plating processing, plutonium production, Manhattan Project liquid discharges, Cold War era liquid waste discharges, landfill, or wastewater treatment plant. The Thomas Jefferson National Accelerator Facility (TJNAF) is the only SC site that did not have any PFAS-related facilities on site.

AMES LABORATORY

Site Description: Ames Laboratory is a government-owned, contractor-operated national laboratory of the DOE, operated by and located on the campus of Iowa State University in Ames, Iowa. Ames Laboratory specializes in discovery, synthesis, analysis, and application of new materials, novel chemistries, and transformational analytical tools.

Assessment Summary

Key findings from the PFAS survey and follow-up correspondence are as follows:

- *Current/Historical Activities:* There is no record of historical or recent use of PFAS at Ames Laboratory. The fire suppression systems in use at Ames Laboratory do not contain AFFF.
- *PFAS Inventory:* The site has less than 100 pounds of any one PFAS located onsite.
- *PFAS Occurrence in the Environment and Potential Exposure Pathways:* From 1925 to July 1, 2020, the state of Iowa trained firefighters on the campus of Iowa State University at the Haber Road facility across the street from the fuel pumps at Iowa State University Transportation Services. AFFF was an important tool used by firefighters for controlling highly dangerous flammable liquid fires such as gasoline and aviation fuel. While that fire training facility is neither adjacent to, nor upstream from Ames Laboratory, a source well used by the City of Ames is located less than a kilometer from that location. In sampling of source water conducted by the Iowa Department of Natural Resources (DNR), PFAS was highest in samples collected from that well.

  Ames Laboratory receives its drinking water from a municipal PWS (Ames Water Treatment Plant). The PWS sampled for certain PFAS in 2020 and no PFAS have been detected. However, the Iowa DNR was able to detect and measure PFAS in four wells that supply the Ames Water Treatment Plant and in finished tap water. These results were released in January 2022, with detects up to 38 ppt.[23] Ames does not maintain onsite wastewater sampling equipment. Wastewater produced by Ames is treated at the Ames Water Pollution Control Facility in Cambridge, IA, co-mingled with wastewater generated by Iowa State University's main campus.

[23] https://www.cityofames.org/government/departments-divisions-i-z/water-pollution-control/pfas

- *Sampling Protocols:* It is unknown whether the site will need new monitoring equipment suitable for PFAS sampling.
- *Stakeholders:* Ames Laboratory is working with Iowa State University, the Iowa DNR, and the DOE to respond to inquiries, research potential historical uses of PFAS, and to monitor regulatory changes associated with safe drinking water.

Key Takeaways
• PFAS were detected in three groundwater samples used as source water and in finished drinking water produced by the City of Ames. • Ames Laboratory does not use AFFF-based fire suppression systems and has not historically used PFAS.

ARGONNE NATIONAL LABORATORY

Site Description: Argonne National Laboratory (ANL), located in Lemont, Illinois, is a multidisciplinary science and engineering research center. ANL is managed by UChicago Argonne, LLC, for DOE's Office of Science.

Assessment Summary

Key findings from the PFAS survey and follow-up correspondence are as follows:

- *Current/Historical Activities:* There is evidence of past metal plating processing taking place on site. This includes a former nickel-plating facility that was remediated as part of a RCRA cleanup project. There are three on-site landfills at ANL, all of which are closed. There is knowledge of Cold War era liquid waste discharges via French drains in at least one of the landfills. There was a burn pit on the east side of ANL that was remediated in the past. The site operates two separate wastewater treatment plants. One plant treats sanitary waste and the other treats wastewater from on-site laboratories.

  There are no AFFF-based fire suppression systems at ANL, nor is there any record of such systems on site in the past. There is also no evidence that uranium enrichment occurring on site. The Former New Brunswick Laboratory (NBL), operated by DOE, was an analytical chemistry laboratory performing actinide characterization. Processes used at NBL did not involve PFAS. ANL has its own on-site fire department.

  The Argonne Fire Department (AFD) has a controlled burn permit to conduct fire department training. There is evidence that the AFD has conducted outside fire training on a drum behind the fire station. The AFD has said AFFF was not used in this fire training. Until recently the AFD maintained a supply of AFFF that, according to the manufacturer, could release the PFAS additive into the environment. Use of this AFFF has been discontinued and supplies await disposal. The AFD now uses non-fluorinated firefighting foam that should not break down into PFAS upon exposure to the environment.
- *PFAS Inventory:* ANL has reviewed its chemical database. The site has less than 100 pounds of any one PFAS chemical on site.

- *PFAS Occurrence in the Environment and Potential Exposure Pathways:* ANL does not collect samples or monitor for PFAS. ANL receives its drinking water from a regional PWS. ANL has not been informed of any PFAS sampling that has been conducted on this water source.
- *Sampling Protocols:* The equipment currently used to sample on-site media could utilize Teflon® or other materials that can contain PFAS chemicals. This equipment potentially includes monitoring wells, monitoring well liners, sampling supplies, and personal protective equipment.
- *Stakeholders:* EPA requires ANL to review its current PFAS inventory to see if any PFAS chemicals must be included in the annual TRI report. There are no PFAS chemicals on site that trigger TRI reporting requirements. As of this time, ANL has not been requested or required to conduct sampling for PFAS in any on-site media.

Key Takeaways
• Drinking water at ANL is supplied by a regional PWSs. • ANL has not been required or voluntarily sampled for PFAS. • ANL has its own fire department which replaced its AFFF supply (which had the potential to break down into PFAS chemicals) with a supply of AFFF that should not break down into PFAS chemicals. • The site contains three closed landfills, a former metal plating facility, a former burn pit, and two operating wastewater treatment plants.

BROOKHAVEN NATIONAL LABORATORY

Site Description: Brookhaven National Laboratory (BNL) is located on Long Island, New York, approximately 60 miles east of New York City. The M&O contractor for the DOE-SC is Brookhaven Science Associates (BSA), LLC. DOE-EM funded many of the initial CERCLA (Superfund) cleanup activities, but no longer has a presence at the site. Groundwater cleanup activities, including PFAS characterization and remediation, are currently managed by DOE-SC and BSA. BNL is situated over a US EPA-designated sole source aquifer system. Due to highly permeable soils and shallow depth to groundwater (generally <50 feet), the aquifer system is highly susceptible to contamination from chemical spills and other discharges.

Assessment Summary

Key findings from the PFAS survey and follow-up correspondence are as follows:

- *Current/Historical Activities:* In 2019, BNL disposed of its remaining 100 gallons of PFAS-containing firefighting foam concentrate to prevent future impacts to the environment. The foam was disposed at a licensed treatment, storage, and disposal facility. BNL has purchased PFAS-free Class B foam for use during future emergency responses.
- *PFAS Inventory:* The site has less than 100 pounds of any one PFAS located onsite.
- *PFAS Occurrence in the Environment and Potential Exposure Pathways:* BNL has identified nine locations where PFAS-containing firefighting foam (Class B AFFF) had been released to soil during firefighter training (1966-2008) and fire suppression system testing and

maintenance (1970-1980s). PFAS have been detected in the groundwater at all nine foam release areas, as well as in the groundwater at BNL's wastewater treatment plant and at a closed (capped) landfill. PFAS released at BNL have also impacted on-site groundwater quality downgradient of these foam release areas, including in several off-site areas.

Following New York State's August 2020 promulgation of drinking water standards for PFOS (10 ppt) and PFOA (10 ppt), current and planned future remedial actions for these contaminants have been integrated into BNL's CERCLA program, which is conducted under a Federal Facilities Agreement between DOE, EPA, and the New York State Department of Environmental Conservation.

In 2017, PFAS were detected in several of BNL's water supply wells. Potable and process water used at BNL is currently obtained from four on-site water supply wells that serve an on-site population of approximately 2,500 people. Two other supply wells are no longer in active service due to the presence of high levels of PFAS in their source water contributing areas and because the wells lack granular activated carbon filters to remove PFAS. Individual PFOS concentrations in several water supply wells exceed the New York State drinking water standard of 10 ppt that was established in August 2020. BNL has returned to service granular activated carbon filters that had been previously installed at three of the operating water supply wells to ensure compliance with the New York State drinking water standards for PFOS and PFOA.

BNL has an extensive network of onsite and off-site groundwater monitoring wells that are used for the CERCLA and facility surveillance programs. To date, BNL has obtained PFAS data from over 360 permanent on-site and off-site groundwater monitoring wells, 170 temporary groundwater profile wells, 11 on-site and off-site groundwater treatment systems, and at the BNL's wastewater treatment plant. A small number of soil samples have also been collected. Although these data have provided BNL with a significantly improved understanding of the on-site and off-site extent of PFAS contamination, groundwater withdrawals and recharge activities over the years have complicated the migration and distribution of PFAS in several areas and it will require the completion of a Remedial Investigation/Feasibility Study to fill in the remaining data gaps. The highest PFAS concentrations in groundwater are found at the location of BNL's former firehouse (in operation from 1947-1985), current firehouse (1986-present), and Building 170 (1986-1990s), where routine training with firefighting foam had taken place from 1966 through 2008. At these former training areas, PFOS and PFOA were detected in groundwater at concentrations up to 12,200 ppt and 1,400 ppt, respectively. High levels (>1,000 ppt) of several other currently unregulated PFAS compounds have also been detected in the groundwater.

BNL has recently completed detailed characterization of the high concentration segments of the PFAS plumes originating from the former and current firehouse facilities and a nearby foam training area under a CERCLA Time Critical Removal Action. The data were used to design two groundwater treatment systems for source area control and to remediate downgradient segments of the plumes that have PFOS and/or PFOA concentrations >100 ppt. The contaminated groundwater will be extracted using 12 pumping wells, and the water will be treated using granular activated carbon filters. Approximately 85 new

groundwater monitoring wells were installed to verify the effectiveness of the treatment systems in controlling and remediating the plumes. The treatment systems are currently under construction, and startup testing is expected to take place by Fall 2022.

- *Sampling Protocols:* To the extent possible, BNL's sampling protocols avoid using sampling equipment that may contain PFAS.
- *Stakeholders:* Since the first detection of PFAS in BNL water supply wells in 2017, BNL has been providing employee, community, and regulatory stakeholders with detailed information on all characterization activities and findings. All monitoring results have been summarized in BNL's annual Site Environmental Reports and in more technical documents that are provided to the regulatory agencies. Following New York State's August 2020 promulgation of drinking water standards for PFOS, PFOA, and 1,4-dioxane, current and planned future characterization and remedial actions for these contaminants have been integrated into BNL's CERCLA program. Since 2017, the regulatory agencies have had the opportunity to review and comment on all aspects of the PFAS and 1,4-dioxane characterization plans, and they approved the design of the PFAS treatment systems that are currently under construction.

Key Takeaways

- Class B firefighting foams that contained PFAS were released to the ground during firefighter training and fire suppression system testing and maintenance from 1966 through 2008. Groundwater quality at each of the nine known foam release areas, at BNL's wastewater treatment plant, and at a former landfill has been impacted by PFAS.
- BNL currently maintains an inventory of PFAS-free Class B foam for emergency use.
- PFAS have been detected in BNL water supply wells, with PFOS concentrations exceeding the New York State drinking water standard of 10 ppt. Granular activated carbon filters are effectively removing the PFAS from the water prior to its distribution.
- Low levels of PFAS (generally <10 ppt) are being monitored in the groundwater near BNL's southwest boundary in proximity to an off-site public water supply wellfield operated by the Suffolk County Water Authority. BNL has met with the Suffolk County Water Authority, and both parties have agreed to holding routine meetings to review monitoring results.
- BNL is currently constructing two groundwater treatment systems to address the high concentration PFAS plumes originating from three foam training areas.
- A Remedial Investigation/Feasibility Study will be conducted as part of BNL's CERCLA program to further characterize the extent of PFAS contamination in soils, sediments, and groundwater. The data will be used to determine whether additional remedial actions are needed.
- Employee, community, and regulatory agency stakeholders are routinely briefed on the results of the PFAS characterization efforts. PFAS sampling results have been published in BNL's annual Site Environmental Report, Water Quality Reports, and in more technical documents provided to the regulatory agencies.

FERMI NATIONAL ACCELERATOR LABORATORY

Site Description: The Fermi National Accelerator Laboratory (Fermilab) is located in Batavia, Illinois. FermiLab is active onsite with high-energy physics research activities involving accelerators. FermiLab is also conducting research involving the degradation of PFAS in water via a high power, energy-efficient electron beam accelerator. The M&O contractor for FermiLab is Fermi Research Alliance, LLC.

Assessment Summary

Key findings from the PFAS survey and follow-up correspondence are as follows:

- *Current/Historical Activities:* FermiLab has an active fire department. FermiLab conducted fire training onsite in the past using AFFF that may have contained PFAS. FermiLab is currently developing a plan to characterize surface soils for PFAS in the former area where the AFFF fire training occurred. Metal plating processing is active onsite. There are no active landfills onsite. FermiLab had a construction debris landfill that closed in the 1990s. No chemicals were disposed of in the construction debris landfill.
- *PFAS Inventory:* The FermiLab fire department presently has about 75 gallons of AFFF stored, with plans to replace it. The AFFF stored is not the same that was used at the former fire training area.
- *PFAS Occurrence in the Environment and Potential Exposure Pathways:* FermiLab has not conducted any onsite sampling for PFAS to date. FermiLab plans to collect surface soil samples in the former fire training area. FermiLab purchases drinking water from the Warrenville, Illinois PWS. Warrenville wells tested for PFAS in drinking water found that PFAS levels were below the minimum reporting level of 48 ppt. The results are publicly available on the interactive dashboard and map for Illinois EPA's PFAS Statewide Investigation Network: Community Water Supply Sampling (Sampling PFAS (arcgis.com)).

  FermiLab has semi-private supply wells onsite, one deep well for ICW system top-off, one for landscaping at the director's house and five wells that are used for consumption (one each at the director's house, the bison barn, unoccupied Site 55, the former horse barn property and the Site 58 residence). These wells are open to approximately the upper 100 feet of bedrock, so they are in Class I resource groundwater but are much deeper than the surface soils FermiLab is planning to sample at the former fire training area. These wells have not been tested for PFAS.
- *Sampling Protocols:* None.
- *Stakeholders:* FermiLab has not had any engagement with regulatory agencies or stakeholders regarding PFAS.

Key Takeaways
• Offsite public drinking water sources have been tested for PFAS at Fermilab. • Onsite semi-private drinking water wells have not been tested for PFAS. • PFAS surface soil sampling is planned for the former fire training area at FermiLab. • FermiLab presently stores about 75 gallons of AFFF but plans to replace it.

LAWRENCE BERKELEY NATIONAL LABORATORY

Site Description: Lawrence Berkley National Laboratory (LBNL) is located in the City of Berkeley, CA, in the San Francisco East Bay area. The M&O contractor for the DOE Office of Science (DOE-SC) is the Regents of the University of California overseen by the University of California National Laboratory program. LBNL has not used PFAS for any training or general applications, according to historical records. To date, one release of approximately 100 gallons of PFAS-containing foam was recorded on October 14th, 2016, which was reported as in accordance with DOE incident reporting guidelines. Of the 100 gallons released, approximately 50 gallons were contained, with a concurrent rainstorm carrying approximately 50 gallons of a 6% AFFF solution into the storm drain system and offsite.

Assessment Summary

Key findings from the PFAS survey, additional discussions with site personnel, and related PFAS documents are as follows:

- *Current/Historical Activities:* LBNL currently utilizes two separate fire protection systems that contain PFAS substances. The AFFF fire suppression system for the Hazardous Waste Handling Facility at LBNL Building 85A is a fire sprinkler system that contains AFFF augmented water. Additionally, there are two separate fire hose reels associated with Building 85A that contain AFFF.

  LBNL is currently pursuing the development of a project to convert the existing AFFF fire sprinkler system to a typical wet-pipe fire sprinkler system, and to remove the AFFF fire hoses. The provision of the AFFF system is unnecessary, as a wet-pipe fire sprinkler system can provide adequate fire protection. According to available records, neither LBNL nor its contract fire department services provider, the Alameda County Fire Department have used PFAS-containing substances in training or in related suppression activities the LBNL onsite.
- *PFAS Inventory*: LBNL tracks and maintains past and present inventories of PFAS and reported having more than 100 pounds of at least one PFAS.
- *PFAS Occurrence in the Environment and Potential Exposure Pathways*: LBNL has implemented measures to seal off the leakage areas that were identified during the release of October 14, 2016. Any AFFF containing fire sprinkler water that may be released in the future, is expected to be fully contained and subject to efficient removal. LBNL does not source its drinking water from wells onsite or nearby. All domestic and fire protection water supplies are provided by the local water utility, East Bay Municipal Utilities District.
- *Sampling Protocols*: LBNL does not perform onsite environmental monitoring.

- *Stakeholders*: The LBNL Fire Protection and Engineering Team serves as members of the Alameda County Hazardous Materials Fire Prevention Officers, which directly engages with the State of California Office of Emergency Services and associated environmental regulatory agencies regarding PFAS and other environmental concerns. Additionally, a 2020 state law (SB-1044) provides a prescriptive timeline and schedule for the cessation of sale and use of PFAS-containing materials in specific instances and provides mitigating circumstances for facilities that do not have a suitable alternative. Whereas LBNL will meet and exceed the compliance dates established by SB-1044, LBNL is currently exempt from the requirements of SB-1044 as its PFAS-containing system is a fixed fire suppression system. Nevertheless, LBNL will pursue the removal and proper disposal of the AFFF affected fire sprinkler system and piping.

Key Takeaways
• The site does not supply drinking water. • LBNL currently has one fire sprinkler system and two hose reels that contain AFFF fire suppressant foam, which will be removed and replaced. • LBNL has experienced one release where PFAS-containing materials were involved. • The LBNL Fire Protection and Engineering team routinely engages with regulatory agencies on environmental topics.

OAK RIDGE NATIONAL LABORATORY

Site Description: Oak Ridge National Laboratory (ORNL) is a multiprogram research facility located on the Department of Energy's ORR in Oak Ridge, Tennessee. The M&O contractor to the DOE Office of Science, responsible for the research mission and operational support of research at ORNL, is UT-Battelle, LLC, a partnership between The University of Tennessee and Battelle Memorial Institute. Three prime contractors to DOE EM are responsible for various cleanup projects and/or operating waste collection and treatment systems on the site: UCOR, an Amentum-led partnership with Jacobs; North Wind Solutions, LLC; and Isotek Systems LLC. The PFAS results summarized here include those from activities conducted by UT-Battelle and UCOR.

Assessment Summary

Key findings from the PFAS survey, additional discussions with site personnel, and a limited literature review are as follows for the three program offices:

- *Current/Historical Activities*: Liquid discharges to the environment occurred on the ORNL site during the Manhattan project and during the cold-war era. Some radioactively-contaminated wastewaters were discharged to settling ponds followed by discharge to surface water. Some higher activity wastewaters were discharged to seepage pits. It is presently unknown whether any these discharges could have contained PFAS. There are several closed landfills on the ORNL site (solid waste storage areas) which received radioactively-contaminated and other wastes. All of these areas have received some degree of remediation (hydrologic isolation, etc.). The potential for PFAS to have been dispositioned in these landfills has not been assessed.

ORNL has two onsite wastewater treatment systems in operation which have permitted discharges of treated wastewater to surface water: the ORNL Sewage Treatment Plant (operated by UT-Battelle) and the Process Waste Treatment Complex (operated by UCOR). Discharges from both facilities are regulated under the NPDES. ORNL's NPDES permit does not presently require monitoring for PFAS.

ORNL has a fire department onsite that is owned by the DOE and operated by UT-Battelle. Training of firefighters at ORNL has included and continues to include training in the use of fire-fighting foams. Present day training utilizes PFAS-free training foam that is readily biodegradable. Training conducted in the past included AFFF that is believed to have contained PFAS compounds. Most of the training with AFFF was conducted at four locations: (1) adjacent to the former ORNL Fire Station (Building 2500), (2) at the Fire Training and Test Facility (Building 2648), (3) on the southeast corner of First Street and Bethel Valley Road (near where Building 2040 was later constructed), and (4) at a location on the north side of Old Bethel Valley Road in the Bearden Creek watershed.

The ORNL Fire Department disposed of its inventory of long-chain PFAS-containing AFFF several years ago. At that time an alternative AFFF (Chemguard C364) was procured which contained short-chain fluorochemicals, which are thought to be less toxic and have less bioaccumulation potential. Fifty gallons of that replacement product is presently stored until further guidance regarding disposal is received from the DOE and it would only be used in an actual fire emergency. The ORNL Fire Department presently carries a non-AFFF agent, F-500, aboard firefighting apparatus for use in fire emergencies. The F-500 product does not contain PFAS. No facilities at ORNL have automatic fire suppression systems that utilize AFFF.

- *PFAS Inventory:* The two PFAS-containing products known to be present on the ORNL site that are more than 100 pounds in total product weight contain mixtures of PFAS compounds: (1) ~415 pounds (50 gallons) of Chemguard C364 AFFF and (2) ~121 pounds of 3M Fluorinert Electronic Liquid FC-72. The exact compounds present in the mixtures and their respective weights are unknown; given that each product contains a broad spectrum of compounds, it is unlikely that the total weight (in site-wide inventory) of any one PFAS compound is greater than 100 lbs. Five AFFF containing fire extinguishers (6-liter capacity) have also been removed from service and are being stored until they can be dispositioned. ORNL has a Hazardous Materials Management Inventory System (HMMIS) that tracks the inventory. In the HMMIS chemical inventory that was conducted in the fall of 2021, between two locations there were a combined 11 11-pound containers of 3M Fluorinert Electronic Liquid FC-72 (perfluoro compounds, C5-18).
- *PFAS Occurrence in the Environment and Potential Exposure Pathways*: The ORNL water distribution system is registered with the Tennessee Department of Environment and Conservation Division of Water Resources as a non-transient, non-community public water system. The system is operated and maintained by UT-Battelle. The system serves a population of fewer than 10,000 people. The water that is distributed by the system is purchased from the City of Oak Ridge. The source of the city's water system is surface water

that is withdrawn from the Clinch River upstream of DOE facilities. Water from the ORNL distribution system has not been sampled for PFAS.

There are a limited number of supply wells on the ORNL site, none of which are used for drinking water (when used, uses include aquatics research, etc.).

- *Sampling Protocols:* To date, surface water is the only environmental media on the ORNL site to have been sampled for PFAS. UCOR has sampled three surface water locations for two PFAS compounds (PFOA and PFOS): 7500 Road Bridge, White Oak Dam, and Raccoon Creek Weir. PFOA was detected at 2.98 ppt (7500 Road Bridge), 7.3 ppt (Raccoon Creek Weir), and 2.84 ppt (White Oak Dam) while PFOS was detected at 11.8 ppt (7500 Road Bridge), 22.4 (Raccoon Creek Weir), and 7.24 ppt (White Oak Dam). Note: These were grab samples and are included in the EM data sets at locations south of ORNL.

  UT-B screened for PFAS presence at two surface water locations, a background location of First Creek and a potentially impacted location in Bearden Creek, using polar organic chemical integrative samplers. These devices are passive samplers that produce semi-quantitative results – the concentrations of polar organics in the sampler resin vary in proportion to the amount of organics in the water source but do not directly indicate organic concentrations in the water source. With multi-week deployment periods, they can accumulate trace pollutant concentrations and reveal the presence of polar organics that might not be detectable by grab or composite water sampling. Trace concentrations of seven PFAS compounds, including PFOA and PFOS, were detected at similar concentrations at the background site and at the potentially impacted site (though the potentially impacted site on Bearden Creek is believed to have low potential to have significant PFAS presence). It is not known yet whether the concentrations measured at both sites represent ubiquitous/background concentrations (due to the sensitivity of the sampling and analytical methods) or if the site chosen for a background site is also impacted.

  PFAS sampling crews (for both UCOR and UT-Battelle) are aware of the challenges associated with sampling for PFAS compounds and take precautions to prevent sample contamination.

- *Stakeholders:* The only regulatory or stakeholder engagement regarding PFAS for the ORNL site to date was from EPA. EPA posed questions to EM's UCOR cleanup contractor about availability of PFAS sampling results during EPA's review of the CERCLA 5-year review document.

Key Takeaways

- The ORNL fire department no longer has any AFFF in inventory which contains long-chain PFAS compounds. Fifty gallons of AFFF which contains short-chain PFAS remains in storage. ORNL does not have any automatic fire suppression systems that contain AFFF.
- All drinking water consumed on the ORNL site is purchased from the City of Oak Ridge and originates as surface water from the Clinch River. ORNL staff have not tested the distribution system for PFAS.
- Surface water is the only environmental media that has been sampled on the ORNL site to date and this limited data set is not adequate to draw conclusions about surface water contamination.

PACIFIC NORTHWEST NATIONAL LABORATORY

Site Description: Located in Richland, Washington, the Pacific Northwest Site Office provides programmatic, operational, and institutional stewardship and oversight of the Pacific Northwest National Laboratory (PNNL) in support of the Department's science and technology programs, goals, and objectives. PNNL is a multi-program DOE Office of Science laboratory operated by Battelle Memorial Institute. In addition to PNNL-Richland, other PNNL campuses that participated in the survey were PNNL-Airport (several buildings in the 300 Area of the Hanford site) and PNNL-Sequim. The PNNL-Sequim campus, in Sequim, Washington, houses the only marine research facilities in the DOE complex.

Assessment Summary

Key findings from the PFAS survey and follow-up correspondence are as follows:

- *Current/Historical Activities:* There are no active fire suppression systems at PNNL facilities that contain AFFF or other PFAS chemicals.
    - PNNL-Richland: An AFFF-based fire suppression system was used in the LSL2A facility prior to 2006. The system was removed and the AFFF material disposed. It is not believed that this fire suppression system was used, but the facility drains to a concrete containment sump with no discharge outlet.
    - PNNL-Sequim: There is a small onsite wastewater treatment plant at the PNNL Sequim campus that treats process wastewater prior to discharge to Sequim Bay under an NPDES permit.
    - PNNL-Airport: The fire suppression system at this location (both the building-wide system and a hand-held unit) do not use PFAS chemicals.
- *PFAS Inventory:* PNNL maintains a chemical inventory system, but it is not currently configured to identify PFAS chemicals as a category. Ad hoc queries of the inventory system indicate that no single PFAS chemical is present in quantities greater than 100 pounds, but this cannot be determined conclusively at this time.

- *PFAS Occurrence in the Environment and Potential Exposure Pathways:* The three PNNL sites do not collect samples for or monitor for PFAS. PNNL-Richland receives its drinking water from the municipal PWS. The PWS has not sampled for PFAS. PNNL operates a Group A non-transient, non-community PWS on the Sequim campus. This water system is supplied by a single artesian groundwater well and serves a population of approximately 100 staff. To date no PFAS testing has been either performed or required. PNNL-Airport does not provide drinking water to the workforce.
- *Sampling Protocols:* If PFAS sampling were to occur, it is likely that existing sampling equipment, PPE, tubing, containers, etc. would need to be evaluated and/or replaced to avoid PFAS cross contamination.
- *Stakeholders:* PNNL has not been contacted by regulators or stakeholders regarding PFAS chemicals. However, effective January 2023, a newly issued PFAS rule in Washington State will require all PWS to perform initial PFAS sampling for five specific PFAS chemicals no later than December 31, 2025.

Key Takeaways
• No drinking water sources (either on- or off-site) at PNNL sites have been tested for PFAS. • There are no AFFF fire suppression systems in use at PNNL. • There may be some PFAS use through chemicals, chemical products, or equipment. • No environmental media have been tested for PFAS. • Testing for five specific PFAS is expected to begin in 2023 in response to a new Washington State PFAS rule.

PRINCETON PLASMA PHYSICS LABORATORY

Site Description: Princeton Plasma Physics Laboratory (PPPL) is located on the Princeton Forrestal Center in Plainsboro Township, New Jersey. PPPL is the only national laboratory focused on the development of plasma science and technology and fusion energy. The lab occupies approximately 100 acres on land leased from Princeton University, which is also the M&O contractor.

Assessment Summary

Key findings from the PFAS survey and follow-up correspondence are as follows:

- *Current/Historical Activities:* PPPL has no active fire protection systems using AFFF and has only incidental (consumer products) PFAS-containing materials onsite. All PFAS-containing fire-fighting foam was taken out of service several years ago and is in storage awaiting disposition.

  There is no documented deployment of PFAS-based foam in firefighting operations at PPPL. Some employees reported incidental use of foam at the PPPL firehouse for new equipment testing/training. Routine training with firefighting foam took place at the county fire training center. PPPL has records for incidental use of PFAS-containing chemicals in consumer commodities of products (e.g., fabric protectant spray).

- *PFAS Inventory:* PPPL has an inventory of approximately 213 gallons (1,913 pounds) of PFAS-containing firefighting foam in secure storage awaiting disposal or treatment. PPPL has no PFAS-based fire suppression systems.
- *PFAS Occurrence in the Environment and Potential Exposure Pathways:* PPPL does not collect samples for or monitor for PFAS. PPPL receives its drinking water from a regional PWS from a combination of surface and ground water sources. The PWS monitors water quality in compliance with the New Jersey Drinking Water Regulations and provides water quality reports to the public via their website.
- *Sampling Protocols:* PPPL has not sampled environmental media for PFAS. If PFAS sampling is required, PPPL will need to evaluate the suitability and compatibility of its dedicated ground water sampling equipment which is used to monitor chlorinated volatile organic chemical (CVOC) contamination.
- *Stakeholders:* In response to guidance documents and new ground water quality standards issued by the New Jersey Department of Environmental Protection (NJDEP) in 2019, PPPL reviewed the historical use of PFAS-containing products and firefighting foam. This review included chemical purchase records, NEPA reviews and interviews with longtime PPPL employees including firefighters. The review documented the storage, but not the use of PFAS-based firefighting foam at PPPL. Based on the information gathered during this review, the Licensed Site Remediation Professional (LSRP) responsible for PPPL's environmental remediation program determined that sampling for PFAS was not required. The LSRP reported in PPPL's biennial certification of PPPL's Ground Water Remedial Action Permit that PFAS are not potential contaminants of concern and do not require further remedial under the NJDEP Site Remediation Regulations. In October 2021, PPPL completed a survey documenting the current and/or historical production, storage, and/or use of PFAS chemicals which was required by NJDEP of all discharge permittees.

Key Takeaways

- Drinking water at PPPL is provided by a public utility (New Jersey American Water).
- PPPL has no history of AFFF use and has no fire suppression systems using PFAS-based foam.
- The state of New Jersey has not required PFAS sampling at PPPL to date.
- PPPL has not sampled environmental media for PFAS.

SLAC NATIONAL ACCELERATOR LABORATORY

Site Description: The SLAC National Accelerator Laboratory (SLAC) is located in Menlo Park, CA. The DOE Office of Science is active onsite with research and development activities. While DOE-EM previously had onsite presence, there are no longer any DOE-EM funded programs ongoing at SLAC. Stanford University owns the land, leases it to DOE, and acts as the M&O contractor.

Assessment Summary

Key findings from the PFAS survey and follow-up correspondence are as follows:

- *Current/Historical Activities:* PFAS had been previously used in the Babar Detector Facility, which operated from 1999 to 2008, primarily for detector cooling purposes. SLAC is currently looking into this past usage to determine whether further investigation is warranted. SLAC confirmed PFAS use in fire suppressant foams and in metal plating facility operations did not occur.
- *PFAS Inventory:* Based on recent chemical inventory records, current PFAS chemical use at SLAC is very limited, mostly in the form of small quantity sealants and adhesives.
- *PFAS Occurrence in the Environment and Potential Exposure Pathways:* SLAC does not collect samples for or monitor for PFAS. Groundwater underlying SLAC is non-potable with no beneficial uses, due to low yield and high naturally occurring dissolved solids. SLAC receives its drinking water from a regional PWS. The PWS has sampled for certain PFAS and no PFAS have been detected.
- *Sampling Protocols:* SLAC's monitoring equipment does not contain PFAS (e.g., Teflon®).
- *Stakeholders:* SLAC has not been contacted by regulatory agencies or stakeholders regarding PFAS. SLAC (Stanford University and DOE) are under a Clean-up and Abatement Order issued by the California Regional Water Quality Control Board (Water Board). At a routine monthly meeting with the Water Board a question about potential use of PFAS in the Plating Shop was asked. Subsequent research indicated no use in the Plating Shop and the subject was closed.

Key Takeaways
• Drinking water at SLAC is supplied by a regional PWS. • PFAS were not and are not being used in any common activities associated with PFAS (e.g., fire training, metal plating). Use in less common activities such as the Babar Detector are currently being researched and evaluated. • SLAC has not sampled for PFAS as there have been no known releases of PFAS to soil, sediment, surface water, or groundwater. • SLAC has not been contacted by regulatory agencies or stakeholders regarding PFAS.

THOMAS JEFFERSON NATIONAL ACCELERATOR FACILITY

Site Description: TJNAF, located in Newport News, Virginia, conducts basic research of the atom's nucleus using the laboratory's unique particle accelerator and laser. The DOE has a presence onsite through the Thomas Jefferson Site Office. The M&O contractor for the TJNAF is Jefferson Science Associates.

Assessment Summary

Key findings from the PFAS survey and follow-up correspondence are as follows:

- *Current/Historical Activities:* While the TJNAF does not currently have active fire training onsite, there is a Memorandum of Understanding (MOU) between the TJNAF and the Newport News Fire Department (NNFD). A recent request was made by the TJNAF for the NNFD to revise the existing MOU to include the requirements for mandatory reporting of

any use or discharge of AFFF by the NNFD in the event of a fire response action onsite. This MOU update request is currently being considered by the NNFD.

- *PFAS Inventory:* Existing TJNAF onsite inventory does not have more than 100 pounds of any one PFAS. However, onsite inventory includes some products with very small amounts of PFAS-containing chemicals that include: R134a refrigerant that contains 1,1,1,2-tetrafluoroethane; R410a refrigerant that contains pentafluoroethane; EnsolveNext degreaser that contains perfluoroisobutyl methyl ether; and HFE-7100 engineered fluid that contains perfluorobutyl methyl ether and perfluoroisobutyl methyl ether.
- *PFAS Occurrence in the Environment and Potential Exposure Pathways:* TJNAF does not collect environmental samples for or monitor for PFAS. TJNAF receives its drinking water from a municipal PWS. The PWS has sampled for certain PFAS and no PFAS have been detected.
- *Sampling Protocols:* TJNAF sampling protocols avoid sampling supplies that contain PFAS.
- *Stakeholders:* Jefferson Science Associates has had brief conversations with the Virginia Department of Environmental Quality Virginia Pollutant Discharge Elimination System (VPDES) point of contact in reference to PFAS. The DEQ VPDES point of contact mentioned that there are currently no PFAS monitoring requirements for TJNAF but any new regulatory requirements would be issued through the existing VPDES permit monitoring criteria.

Key Takeaways
• Drinking water at TJNAF is supplied by a municipal PWS. • TJNAF does not have any onsite fire training activities but has an existing MOU with the NNFD; the request has been made with the NNFD to revise the MOU to include mandatory reporting of any use or discharge of AFFF during a fire response action onsite. • PFAS was not used in the past and currently no activities on site used PFAS. Since no PFAS was used on site and drinking water is supplied by a public utility, no sampling has occurred for the presences of PFAS.