



Located on the banks of the Clinch River, the Oak Ridge Reservation comprises three major facilities involved in every mission in the DOE portfolio. DOE is committed to enhancing environmental stewardship and managing the impacts its operations may have on the environment.



Executive Summary

Overview

The Oak Ridge Reservation (ORR), located in Roane and Anderson Counties in East Tennessee about 40 km (25 mi) west of Knoxville, is managed by the US Department of Energy (DOE). Today ORR is one of DOE's most complex sites. Established in the early 1940s as part of the Manhattan Project to enrich uranium and pioneer methods for producing and separating plutonium, ORR continued those activities until the mid-1980s. Today ORR comprises three major facilities with thousands of employees performing every mission in the DOE portfolio: energy research, environmental restoration, national security, nuclear fuel supply, reindustrialization, science education, basic and applied research in areas important to US security, and technology transfer. Scientists at the Oak Ridge National Laboratory (ORNL), DOE's largest science and energy laboratory, conduct leading-edge research in advanced materials, neutron scattering, nuclear programs (including isotope production), and high-performance computing. The Y-12 National Security Complex (Y-12 or Y-12 Complex) is vital to maintaining the safety, security, and effectiveness of the US nuclear weapons stockpile and reducing the global threat posed by nuclear proliferation and terrorism. The East Tennessee Technology Park (ETTP), a former uranium enrichment complex, is being transitioned to a clean, revitalized industrial park.

ORR is managed by three DOE Program Secretarial Offices and their management and operating contractors and other prime contractors. This calendar year 2022 Oak Ridge Reservation Annual Site Environmental Report (ASER) contains information furnished to the DOE ORR integrating contractor by other contractors including UT-Battelle, LLC; Consolidated Nuclear Security, LLC; United Cleanup Oak Ridge LLC (UCOR); North Wind Solutions, LLC (NWSol); Oak Ridge Associated Universities; and Isotek Systems, LLC (Isotek). DOE and its contractors at ORR are committed to environmental protection, compliance, and sustainability, which includes the site's utmost efforts to ensure the validity and accuracy of monitoring data.

Executive Summary

Chapter 3 of this report was prepared by UCOR, the lead environmental management contractor for ETTP. Chapter 4 was developed by Consolidated Nuclear Security, LLC, which manages and operates the Y-12 Complex. Chapters 5, 6, and 7 were written by UT-Battelle, LLC, the ORNL management and operating contractor. These contractors are responsible for independently carrying out the various DOE missions at the three major ORR sites. They manage and implement environmental protection programs through environmental management systems that adhere to International Organization for Standardization Standard 14001, Environmental Management Systems. Chapters 3, 4, and 5 include detailed information on each contractor's environmental management systems, which interface with DOE's signature integrated safety management system (ISMS) to provide unified strategies for managing resources. ISMS incorporates safety in all aspects of work and helps ensure safety at all DOE facilities. Safety, as defined in ISMS, encompasses protection of the public, the worker, and the environment, and includes all safety, health, and environmental disciplines: radiation protection, fire protection, nuclear safety, environmental protection, waste management, and environmental management.

DOE operations on ORR have the potential to release various constituents to the environment via atmospheric, surface water, and groundwater pathways. Some of these constituents, such as particles from diesel engines, are common at many types of facilities while others, such as radionuclides, are unique to specialized research and production activities like those conducted on ORR. DOE is committed to enhancing environmental stewardship and managing the impacts its operations may have on the environment. To encourage the public to participate in matters related to ORR's environmental impact on the community, DOE solicits citizens' input on matters of significant public interest through multiple channels. DOE also offers access to information on its Oak Ridge environmental, safety, and health activities.

The ASER is prepared for DOE according to the requirements of DOE Order 231.1B, *Environment, Safety, and Health Reporting*. The ASER includes data on the environmental performance of each of the major DOE ORR contractors and describes significant accomplishments in pollution prevention and sustainability programs that reduce many types of waste and pollutant releases to the environment. DOE has published an annual environmental report with consolidated data on overall ORR performance and status since the mid-1970s. The ASER is a key component of DOE's effort to keep the public informed about environmental conditions across DOE and National Nuclear Security Administration sites.

Impacts

DOE ORR operations resulted in minimal impact to the public and the environment in 2022. Permitted discharges to air and water continued to be well below regulatory standards, and potential radiation doses to the public from activities on the reservation were much less than the 100 mrem standard established for DOE sites in DOE Order 458.1, *Radiation Protection of the Public and the Environment*.

The maximum radiation dose a hypothetical off-site individual could have received from DOE activities on ORR in 2022 was estimated to be 0.2 mrem from air pathways, 0.9 mrem from water pathways (drinking water, fish consumption, swimming, recreation, and other uses), and 2 mrem from consumption of wildlife harvested on ORR. This is about 3 percent of the DOE 100 mrem standard for all pathways and is significantly less than the 300 mrem annual average dose to people in the United States from background radiation.

Environmental Monitoring

Each year extensive environmental monitoring is conducted across ORR. Site-specific environmental protection programs are implemented at ORNL, the Y-12 Complex, and

ETTP. ORR-wide environmental surveillance programs, which include locations and media both on and off the reservation, enhance and supplement data from site-specific efforts. In 2022 many thousands of samples and measurements of air, water, direct radiation, vegetation, fish, and wildlife were collected from across the reservation and analyzed for radioactive and nonradioactive contaminants. Sample media, locations, frequencies, and parameters were selected based on environmental regulations and standards, public and environmental exposure pathways, environmental permits, and measurement capabilities. Chapters 2 through 7 of this report summarize the environmental protection and surveillance programs on ORR. These extensive sampling and monitoring efforts demonstrate DOE's commitment to ensuring safety; protecting human health; complying with regulations, standards, DOE orders, and "as low as reasonably achievable" principles; reducing the risks associated with past, present, and future operations; and improving cost-effectiveness.

Compliance with Environmental Regulations

Federal, state, and local government agencies including the US Environmental Protection Agency and the Tennessee Department of Environment and Conservation monitor ORR for compliance with applicable environmental regulations. These agencies issue permits, review compliance reports, participate in monitoring programs, and inspect facilities and operations. Compliance with environmental regulations and DOE orders ensures ORR activities do not result in adverse impacts to the public or the environment.

Compliance with applicable regulations in 2022 for the three major ORR sites is summarized as follows:

- ETTP had no notices of environmental violations or penalties.
- Y-12 had 100 percent compliance with water quality permit discharge limits for 2022 and

no Clean Air Act violations or exceedances. Personnel from the Tennessee Department of Environment and Conservation Division of Solid Waste Management conducted a Resource Conservation and Recovery Act hazardous waste compliance inspection of Y-12 on February 23, 2022. The inspections covered waste storage areas and reviews of records. Eight issues were identified, including roof leak repairs that were not documented, one container that exceeded 90 days in a storage area, inadequate aisle space in one area, one facility that did not conduct daily inspections when hazardous waste activities occurred for a period of time, and two instances each of containers being inadequately labeled for hazards and improperly closed. Immediate corrective actions were taken where possible. The issues and their causes were reviewed at the time of the incident and all issues were resolved.

- ORNL facilities include those on the Oak Ridge campus as well as off-campus entities such as the National Transportation Research Center and the Carbon Fiber Technology Facility. In 2022 there were no Clean Air Act violations by UT-Battelle, LLC, the ORNL managing contractor, and no Clean Air Act violations or exceedances by the other contractors who conducted activities at ORNL in 2022 (Isotek, NWSol, and UCOR). ORNL wastewater treatment facilities achieved a numeric permit compliance rate of 100 percent in 2022. In October 2022, water from a potable water line break in the 7000 Area was released into White Oak Creek and caused aquatic species mortality (a total of 141 fish, 11 salamanders, and 13 aquatic worms). This incident was reported as a noncompliance with narrative criteria in the National Pollutant Discharge Elimination System permit, which was reissued in December 2022.

Chapter 2 provides a more detailed summary of ORR environmental compliance during 2022. Chapters 3, 4, and 5 further discuss each site's compliance status for the year.

Environmental Management, Pollution Prevention, and Site Sustainability

Numerous environmental management, pollution prevention, and sustainability programs across ORR embody efforts to achieve enduring sustainability in facilities, operations, and organizational culture. The objectives of these programs are to conserve water and energy, minimize waste, and promote energy-efficient buildings, sustainable landscaping, green transportation, and sustainable acquisition. Consequently, these initiatives decrease the life cycle costs of programs and projects while also reducing risks to the environment. As described in Chapters 3, 4, and 5, ORR contractors achieved a high level of excellence in environmental management, pollution prevention, and sustainability programs in 2022.

Environmental Management

Since 1943 ORR has played key roles in America's defense and energy research. However, past waste disposal practices, operational and industrial practices, changing standards, and unintentional releases left some land and facilities contaminated with radioactive elements, mercury, asbestos, polychlorinated biphenyls, and industrial wastes. The DOE Environmental Management program is responsible for cleaning up these sites, and numerous cleanup projects are underway at the reservation's three main facilities.

ETTP completed several soil remedial actions in 2022 that help protect groundwater. Exposure Unit (EU)-25 remedial action centered on the slab, foundation, and underlying soil of the former K-1413 Building, which was constructed in the 1950s and operated until the early 1980s for a range of chemical waste processing activities. This project was completed in 2022 with over 18,000 yd³ of concrete and soil being removed from the site. EU-13 has several excavation areas for ongoing soil remediation at the sites of the former buildings designated as K-413, K-1131, and K-631. This is an area near Poplar Creek that

once housed many of the gaseous diffusion and uranium hexafluoride enrichment support facilities. Remediation was also underway within EU-21, an area that is located in the middle of the K-25 footprint, which is part of the Manhattan Project National Historical Park. Based on results of model calculations, workers are set to excavate 16,000 yd³ of soil to eliminate risks to groundwater.

Y-12 achievements in 2022 included progress in constructing the Outfall 200 Mercury Treatment Facility, developing DOE Environmental Management research in new remediation technologies to address mercury releases into the environment from past operations, and contracting for the first mercury remediation technology demonstration. Shoring and major excavations were completed at the headworks site. Crews continued placing concrete pads and walls of the treatment plant. Crews also began erecting structural steel and continued installing underground utilities. The new facility is slated to be operational in 2025. As part of the technology demonstration initiative, an existing ORR facility is being evaluated for the necessary modifications to carry out the proposed demonstration of mercury treatment technologies.

In 2022, UCOR workers finished removing the remaining slabs at the now demolished Biology Complex, readying the land for transfer back to Y-12 for construction of the new Lithium Processing Facility. Crews completed backfilling and seeding the portion of the site where the last two buildings (Buildings 9207 and 9210) once stood. Labs remaining from previous demolition of buildings at the location were removed and their footprints were backfilled and graveled. Between removal of those slabs and the slabs at Buildings 9207 and 9210, more than 6,141 yd³ of waste and debris were removed.

ORNL achievements in 2022 included continuing demolition and deactivation. These activities included the demolition of the Tritium Target Preparation Facility and former Radiological Development Lab's West Cell Bank. Deactivation activities took place at multiple facilities, including the Low Intensity Test Reactor, the Oak Ridge

Research Reactor, and a group of buildings called “Isotope Row” that were constructed in the 1950s and early 1960s to process radioisotopes. Also in 2022, the Oak Ridge Office of Environmental Management (OREM) and its contractor Isotek successfully completed processing and disposing the low-dose inventory of ^{233}U stored at ORNL, ending a 2-year effort that has eliminated a portion of the site’s legacy nuclear material.

The Environmental Management Waste Management Facility received 7,172 waste shipments from ORR cleanup projects in 2022. Environmental Management Waste Management Facility operations also collected, analyzed, and disposed of approximately 3.3 million gallons of leachate treated by the Liquid and Gaseous Waste Operations Facility.

In FY 2022, the Transuranic Waste Processing Center completed contact-handled transuranic waste shipments of 59.3 m³ to the Waste Isolation Pilot Plant in Carlsbad, New Mexico, 58.5 m³ mixed low-level waste to treatment and disposal, and 2.7 m³ of hazardous waste to treatment and disposal, eliminating 475 containers of the stored inventory. Construction of the Sludge Processing Mock Test Facility was completed in June 2022; OREM will now test six critical technology elements to gather the data necessary to complete the final design and construction of the Sludge Processing Facility later this decade to address the site’s 400,000-gallon inventory of transuranic sludge waste.

Pollution Prevention and Sustainability

The three main ORR sites made significant strides in sustainability and pollution prevention in 2022, and highlights are summarized below.

Within the next 10 years, 58 excess facilities at Y-12 and another 60 National Nuclear Security Administration facilities are projected to be taken down. To date, more than 2.8 million gross square feet of excess facilities have been demolished at Y-12. This progress aligns with meeting the DOE site sustainability plan reduction goal of 25 percent by FY 2025.

In 2022, Y-12 experienced a slight uptick in energy intensity (1.1 percent above 2021). The upward trend in the site energy intensity figures is largely attributed to the height of the pandemic occurring during FY 2020 and then having a larger portion of the plant population returning to the site, thus increasing infrastructure use.

Y-12 diverted 55.8 percent of municipal and 7.5 percent of construction and demolition waste from landfill disposal through reuse and recycle in 2022, and 95 percent of eligible electronic acquisitions were registered through EPEAT, the Electronic Product Environmental Assessment Tool. Greenhouse gas emissions were reduced by 1.3 percent from 2021.

ORNL implemented 26 ongoing and new pollution prevention projects during 2022, which eliminated more than 3.6 million kg of waste. As of the end of 2022, 82 percent of all ORNL vehicles are alternative fuel vehicles, with 90 percent of all replacements over the past two fiscal years being alternative fuel or electric vehicles. Also in 2022, 100 percent of the light-duty vehicles operated on alternative fuels, exceeding DOE fleet management goals. Water use intensity increased by 1.7 percent between 2021 and 2022, despite an overall reduction in water consumption. This is because of increased demands for cooling tower makeup water to support growth of high-performance computing systems. Calculated energy use intensity for FY 2022 was 234,194 Btu per gross square foot, a cumulative reduction of 35.6 percent since FY 2003 and a slight increase of 2.8 percent from 2021.

During 2022 at ETTP, more than 226 metric tons of greenhouse gas emissions, 273,490 metric tons of waste, and 282,000 gallons of wastewater generation were avoided as a result of implementation of pollution prevention measures by site projects. In addition to lessening the impact on the environment, these measures also saved more than \$1,600,000.

OREM continued planning for capital asset projects that will further advance ORR cleanup objectives. These include the Outfall 200 Mercury Treatment Facility at Y-12, the new disposal

facility that will accept debris from future cleanup at Y-12 and ORNL, and the sludge treatment facility at the Transuranic Waste Processing Center.