



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 2023 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); 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.

Chapter 3 of this report was prepared by UCOR, the lead environmental management contractor for ETRP. 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 2023. 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 2023 was estimated to be 0.6 mrem from air pathways, 0.8 mrem from water pathways (drinking water, fish consumption, swimming, recreation, and other uses), and 1 mrem from consumption of wildlife harvested on ORR. This is under 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 2023 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 2023 for the three major ORR sites is summarized as follows:

- ETTP had no notices of environmental violations or penalties.
- Y-12 had nearly 100 percent compliance with water quality permit discharge limits for 2023 and no Clean Air Act violations or

exceedances. Personnel from the Tennessee Department of Environment and Conservation Division of Solid Waste Management performed an unannounced Resource Conservation and Recovery Act hazardous waste compliance inspection of Y-12 from March 6–7, 2023. The inspections covered waste storage areas and records reviews. Two issues were identified: storage of three bags of spent aerosol cans for more than one year and one aerosol can puncturing device that was not closed securely. Immediate corrective actions were taken where possible. The issues and their causes are being reviewed to prevent recurrence.

- 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 2023 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 2023 (Isotek and UCOR). ORNL wastewater treatment facilities achieved a numeric permit compliance rate of 99.9 percent in 2023. One *Escherichia coliform* exceedance occurred in June 2023 at X01 (Sewage Treatment Plant) due to an operational issue with the disinfection system ozone diffuser. The diffuser has since been fixed.

Chapter 2 provides a more detailed summary of ORR environmental compliance during 2023. 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 2023.

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 is positioned for Vision 2024—completion of all soil removal actions—having completed several Exposure Units (EUs) in 2023: EU-16, EU-19, EU-17, and EU-13. In addition, crews have been excavating the final section of contaminated material at EU-21 in the middle of the K-25 footprint, where more than 61,600 yd³ of contaminated soil has been removed since 2021.

Y-12 achievements in 2023 included completing the Alpha-2 (Building 9201-2) deactivation, progress toward completion of the Beta-1 (Building 9204-1) deactivation, and continued construction of the Outfall 200 Mercury Treatment Facility.

Accomplishments in continuing demolition and deactivation were made at ORNL in 2023. These activities included the demolition of the 3005 facility and packaging of the reactor; deactivation of "Isotope Row" (facilities historically used to process radioisotopes) Buildings 3030, 3031, and 3032, with significant progress being made toward deactivation of Buildings 3029, 3118, and

3033; and completed deactivation of the Oak Ridge Graphite Reactor support facility 3003.

The Environmental Management Waste Management Facility received 5,211 waste shipments from ORR cleanup projects in 2023. Environmental Management Waste Management Facility operations also collected, analyzed, and disposed of approximately 3.53 million gallons of leachate treated by the Liquid and Gaseous Waste Operations Facility.

In FY 2023, the Transuranic Waste Processing Center completed contact-handled transuranic waste shipments of 159 m³ to the Waste Isolation Pilot Plant in Carlsbad, New Mexico, 72.5 m³ mixed low-level waste to treatment and disposal, and 1.8 m³ of hazardous waste to treatment and disposal, eliminating 855 containers of the stored inventory.

Pollution Prevention and Sustainability

The three main ORR sites made significant strides in sustainability and pollution prevention in 2023, and highlights are summarized below.

Currently, there are 70 excess facilities at Y-12, with another 59 buildings and trailers to be excessed within the next 10 years. This progress aligns with meeting the DOE planned cleanup scope for Manhattan Project-era buildings at Y-12 that supported uranium enrichment, Beta-1 (9204-01), Alpha-2 (9201-02) and Alpha-4 (9201-04), which are currently undergoing deactivation. Alpha-2 is set for demolition starting in 2024.

In 2023, Y-12 experienced a slight uptick in energy intensity (a little over a half of a percentage above 2022). The upward trend in the site energy intensity figures is largely attributed to the site's teleworking policy expiring after the COVID-19 pandemic and the increase in hired employees.

Y-12 diverted 56.8 percent of municipal and 32 percent of construction and demolition waste from landfill disposal through reuse and recycle in 2023, and certified two buildings as High Performance Sustainable Buildings in FY 2023.

Site Scope 1 (on-site fuel burning) and Scope 2 (purchased electricity) emissions were reduced by 62.6 percent from the FY 2008 baseline.

ORNL implemented 29 ongoing and new pollution prevention projects during 2023, which eliminated more than 11.8 million kg of waste. As of the end of 2023, 80 percent of all ORNL vehicles are alternative fuel vehicles, with 88 percent of all replacements since 2020 being alternative fuel or electric vehicles. Also in 2023, 93 percent of the light-duty vehicles operated on alternative fuels, exceeding DOE fleet management goals. Water use intensity increased by 8.7 percent between 2022 and 2023, due to increased demands for cooling tower makeup water to support growth of high-performance computing systems. Calculated energy use intensity for FY 2023 was 237,514 Btu per gross square foot, a cumulative reduction of 34.7 percent since FY 2003 but an increase of 1.41 percent from FY 2022.

During 2023 at ETTP, the Sustainability Leadership Award-winning projects saved more than 1,325 MT of greenhouse gas emissions, 772,700 lbs of waste from landfills, and treated 16,029,000 gallons of wastewater. In addition to lessening the impact on the environment, these pollution prevention measures also saved approximately \$7.8 million.

OREM continued planning for capital asset projects that will further advance ORR cleanup objectives. These include operation of the Outfall 200 Mercury Treatment Facility at Y-12 by 2025; completion of demolition activities at ORNL's Central Campus, Beta-1 and Alpha-2 by 2027; completion of processing, downblending, and disposing the remaining inventory of ²³³U stored at ORNL by 2028; and construction completion of the first phase of the new Environmental Management Disposal Facility by 2029.