

Executive Summary

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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, operating, and support contractors. This calendar year 2021 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; UCOR, an Amentum-led partnership with Jacobs; North Wind Solutions, LLC (North Wind); Oak Ridge Associated Universities; and 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 managing 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 all of 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 2021. 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 2021 was estimated to be 0.5 mrem from air pathways, 7 mrem from water pathways (drinking water, fish consumption, swimming, recreation, and other uses), and 0.2 mrem from consumption of wildlife harvested on ORR. This is about 8 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, are carried out to enhance and supplement data from site-specific efforts. In 2021 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 in 2021 with applicable regulations for the three major ORR sites is summarized as follows:

- ETTP had no notices of environmental violations or penalties.
- Y-12 was issued a Notice a Violation for three fish kills caused by chlorinated water

discharges, two oily sheens caused by construction activities and CERCLA remediation activities, and a cloudy discharge also caused by CERCLA remediation activities.

- 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 2021 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 conduct activities at ORNL (Isotek, North Wind, and UCOR). There was one violation of Tennessee's hazardous waste management regulations at ORNL and two National Pollutant Discharge Elimination System permit noncompliances, resulting in an ORNL National Pollutant Discharge Elimination System permit compliance rate of greater than 99 percent. Chapter 2 provides a more detailed summary of ORR environmental compliance during 2021. 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. These programs conserve water and energy, minimize waste, and promote energy-efficient buildings, sustainable landscaping, green transportation, and sustainable acquisition. In turn, 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 2021.

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.

After completing all the major facility demolition projects in 2020, ETTP focused on the removal of building slabs, environmental remediation, and repurposing of real estate in 2021. The 235,000-square-foot concrete slab that formed the foundation of the former Centrifuge Complex was the largest of the concrete slabs removed. The area was backfilled with more than 30,000 cubic yards of clean soil, and the site was restored to a grassy field. The Old Powerhouse area in the extreme western side of ETTP, having undergone previous remediation in 2007, was recontoured in 2021 using 76,000 cubic yards of backfill and 27,000 cubic yards of topsoil. This project redirected water to nearby wetlands, and resulted in a swath of land with a clean soil cover that has been proposed for future recreational development. In 2021, DOE continued to support the proposed general aviation airport project. Design of the K-25 Viewing Platform began along with other associated site improvements on the K-25 Preservation Footprint. Work also continued on the transfer of additional areas of ETTP. The transfer of Access Portals 4 and 11 to the Community Reuse Organization of East Tennessee (CROET) was completed, as well as CROET's sale of the former K-31/K-33 area to Kairos Power. A new End State and Closure Plan was developed in 2021 to address the remaining scope of work and future land transfers, as ETTP moves closer to achieving the three end-state goals of a multiuse industrial park, national historic preservation, and conservation/greenspace areas.

Y-12 achievements in 2021 included demolition of the last two facilities in the former Y-12 Biology

Complex, planning for the Lithium Processing Facility (LPF), ongoing construction of the Outfall 200 treatment facility, and deactivation activities. Removal of Buildings 9207 and 9210, the final two structures remaining from the original 11-building Biology Complex, provided approximately 18 acres of land for reuse by Y-12, including space for the construction of the proposed LPF. DOE published the *Environmental Assessment for the Lithium Processing Facility at the Y-12 National Security Complex, Oak Ridge, Tennessee*, and the *Finding of No Significant Impact for the Environmental Assessment for the Lithium Processing Facility at the Y-12 National Security Complex, Oak Ridge, Tennessee* for construction of the LPF in March 2021 (DOE/EA-2145). Construction of the Outfall 200 Mercury Treatment Facility also continued in 2021, with the installation of shoring walls at the Headworks site and construction of the treatment plant walls. The entire facility will be capable of treating 3,000 gallons of water per minute and will include a 2-million-gallon storage tank to handle storm water peak flow conditions. Deactivation activities in 2021 included the column exchange (COLEX) structures on the east end of the 500,000-square-foot Alpha 4 Building (9102-4), capturing another 1.25 tons of mercury from cleanup in those pipes and tanks during deactivation completion. Ongoing deactivation is occurring at several Y-12 facilities in preparation for eventual demolition, including Alpha 2 (Building 9201-2) and Beta 1 (Building 9204-1).

ORNL achievements in 2021 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 2021, the Oak Ridge Office of Environmental Management (OREM) and its contractor Isotek successfully completed processing and disposing the low-dose inventory of uranium (U)-233 stored at ORNL, ending a two-year effort that has

eliminated a portion of the site's legacy nuclear material.

The Environmental Management Waste Management Facility (EMWMF) received 83,568 cubic yards from ORR cleanup projects in 2021. EMWMF operations also collected, analyzed, and disposed of approximately 3.52 million gallons of leachate treated by the Liquid and Gaseous Waste Operations Facility.

In FY 2021, the Transuranic Waste Processing Center (TWPC) completed contact-handled transuranic waste shipments of 159 cubic meters accounting for 756 containers to the Waste Isolation Pilot Plant in Carlsbad, New Mexico. Comprehensively, the TWPC has completed processing of 98 percent and shipment of 78 percent of the ORR Site Treatment Plan contact- and remote-handled transuranic waste life cycle legacy inventory. Construction on the Sludge Processing Mock Test Facility is underway, which will play a vital role in maturing technologies needed to begin processing Oak Ridge's 500,000-gallon inventory of transuranic sludge waste.

Pollution Prevention and Sustainability

The three main ORR sites made significant strides in sustainability and pollution prevention in 2021, and highlights are summarized below.

Within the next 10 years, 53 excess facilities at Y-12 and another 42 National Nuclear Security Administration facilities are projected to be taken down. To date, Y-12 has demolished more than 2.8 million gross square feet of excess facilities. This progress aligns with meeting the DOE site sustainability plan reduction goal of 25 percent by fiscal year 2025.

In 2021, Y-12 experienced a slight uptick in water use and energy intensity (0.5 percent and 5.4 percent above 2020, respectively). This was due to the plant population returning to the site after the pandemic occurring in 2020 and the corresponding increase in the use of infrastructure to support the work force and project requirements.

Y-12 diverted 50 percent of municipal and 65 percent of construction and demolition waste from landfill disposal through reuse and recycle in 2021, and more than 95 percent of eligible electronic acquisitions were registered through EPEAT, the Electronic Product Environmental Assessment Tool. Greenhouse gas emissions were reduced by 5 percent from 2020.

There were 24 new and ongoing reuse and recycle projects implemented at ORNL during 2021, which eliminated more than 2.3 million kg of waste. As of the end of 2021, ORNL has replaced 308 vehicles in the 467-vehicle fleet with newer models. The new vehicles are more fuel-efficient; 90 percent are alternative-fuel vehicles or gas hybrids. Also in 2021, 100 percent of the light-duty vehicles operated on alternative fuels, exceeding DOE fleet management goals. Even though water use has increased in recent years to support enhanced research facilities, total annual water use at ORNL has decreased by 23.2 percent since FY 2007. Calculated energy use intensity for FY 2021 was 240,885 Btu per gross square foot, a cumulative reduction of 33.8 percent since FY 2003 and a slight increase of 4.5 percent from 2020.

During 2021 at ETTP, more than 58 metric tons of greenhouse gas emissions, 8,600 cubic yards of waste, and an estimated 49,259 work hours were saved; 24,870,000 gallons of wastewater generation were avoided; and more than 33,000 miles of travel were eliminated as a result of implementation of pollution prevention measures by the projects. In addition to lessening the impact on the environment, these measures also saved more than \$5,000,000.

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.