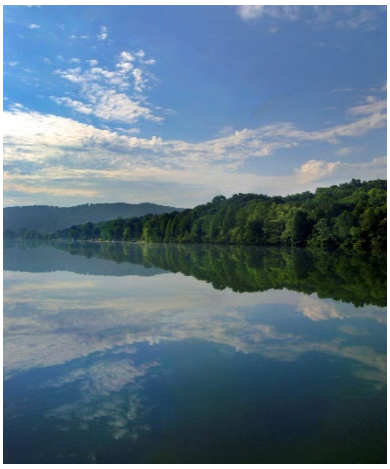

Located on the banks of the Clinch River, the Oak Ridge Reservation comprises three major facilities involved in every mission in the DOE portfolio. DOE is committed to enhancing environmental stewardship and managing the impacts its operations may have on the environment.

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 2020 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; Oak Ridge Associated Universities; and Isotek Systems, LLC.

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. Chapter 5 was 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 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 2020. 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 2020 was estimated to be 0.4 mrem from air pathways, 2 mrem from water pathways (drinking water, fish consumption, swimming, recreation, and other uses), and 0.07 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 natural or 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 2020 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 2020 with applicable regulations for the three major ORR sites is summarized as follows:

- ETTP had no notices of environmental violations or penalties.
- Y-12 had no Clean Air Act permit violations or exceedances. Y-12 did have five National Pollutant Discharge Elimination System (NPDES) permit noncompliances out of approximately 2,600 samples analyzed for the program, resulting in a 99.8% compliance rate.
- 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 2020 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 Systems, LLC; North Wind Solutions, LLC; and UCOR). ORNL had one violation of Tennessee's hazardous waste management regulations and one NPDES permit noncompliance, achieving a compliance rate of more than 99 percent.

Chapter 2 provides a more detailed summary of ORR environmental compliance during 2020. 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 2020.

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 under way at the reservation's three main facilities.

ETTP completed major environmental remediation and facility demolition projects in 2020. The most visible demolition projects were large facilities previously used to test and develop enriched uranium technologies (the K-1200 Centrifuge Complex and the K-1600 Building), the abandoned K-1203 Sewage Treatment Plant, and the K-832 Cooling Water Basin. With major demolition projects complete in 2020, ETTP moved closer to achieving its three end-state goals: a multi-use industrial park, national historic preservation, and conservation and greenspace areas. DOE initiated the transfer of Access Portals 4 and 11, two roadways, the former K-1037 building site, and the former Toxic Substances Control Act Incinerator area for economic development opportunities. DOE also continued to support the proposed general aviation airport project. The K-25 History Center, which features exhibits, audio-visual displays, period artifacts, equipment replicas, and workers' oral histories, opened in February 2020. Finally, potential greenspace initiatives are planned through the transfer of land from DOE to the Tennessee Wildlife Resources Agency for areas less amenable to industrial redevelopment.

Y-12 achievements in 2020 included the recovery of an additional half ton of elemental mercury during the treatment of debris and grit from the Alpha 4 building's column exchange (COLEX) equipment. Construction of the Outfall 200 Mercury Treatment Facility continued, with contractors beginning excavations at the treatment plant site and at the Headworks site, and with installation and operation of a small treatment system to remove mercury from water during this project. Crews also poured concrete pads and began installing rebar for the walls of the treatment facility. Shoring walls and excavations will be completed at the Headworks site in fiscal year (FY) 2021. 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. Preparation for the demolition of the last two buildings in the Y-12 Biology Complex (9207 and 9210) took place throughout 2020, and demolition of Building 9210 commenced on November 16, 2020. Removal of the complex, which once included 11 buildings, will provide approximately 18 acres of land for reuse by Y-12.

ORNL achievements in 2020 included the characterization and deactivation of former reactors and isotope production facilities as well as remediation to support future brownfield redevelopment. Workers used a 175-ton crane to install a protective tent at Building 3026, the Radioisotope Development Lab, to protect nearby research facilities while the final two hot cells from the building are demolished. Characterization and deactivation also continued in former reactors and isotope production facilities, including Buildings 3005, 3010, 3042, 3009, 3010, 3010-A, 3080, 3083, and 3107, and in 11 other facilities in the Isotope Row area that supported and produced radioisotopes. Actions included asbestos abatement, removal of combustible materials, and isolation of electrical and mechanical utilities at the facilities. On June 3, 2020, ORNL received final approval for the phased construction completion report that details Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) environmental remediation activities at the 3500 Area of the Central Campus. This area is slated for brownfield reuse after final waste disposition was completed in September 2019.

The Environmental Management Waste Management Facility (EMWMF) received 12,271 waste shipments, totaling 129,038 cubic yards, from ORR cleanup projects in FY 2020. EMWMF operations also collected, analyzed, and disposed of approximately 4.3 million gallons of leachate treated by the Liquid and Gaseous Waste Operations facility.

In FY 2020, the Transuranic Waste Processing Center completed nine contact-handled transuranic shipments containing 378 drums to the Waste Isolation Pilot Plant in Carlsbad, New Mexico. To date, approximately 78 percent of the contact-handled transuranic waste and 63 percent of the remote-handled transuranic waste have been dispositioned at the Waste Isolation Pilot Plant. Construction began on the Sludge Processing Mock Test Facility, which will play a vital role in maturing technologies needed to begin processing Oak Ridge's 500,000-gallon inventory of transuranic waste.

In the fall of 2019, Isotek Systems, LLC began processing uranium-233 material inside glove boxes in Building 2026 to produce a solidified, low-level waste form acceptable for disposal.

Pollution Prevention and Sustainability

The three main ORR sites made significant strides in sustainability and pollution prevention in 2020, and highlights are summarized below.

Within the next 10 years, 83 excess facilities at Y-12 and another 55 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 is in line with meeting the DOE site sustainability plan reduction goal of 25 percent by fiscal year 2025. In 2020, Y-12 also achieved a 12 percent reduction in water use and a 10 percent reduction in energy intensity, and 46.7 percent of municipal and 46.9 percent of construction and demolition waste was diverted from landfills. More than 98.7 percent of eligible electronic acquisitions were registered through EPEAT, the Electronic Product Environmental Assessment Tool. Greenhouse gas emissions were reduced by 23 percent compared to the 2008 baseline.

ORNL implemented 24 new pollution prevention projects and ongoing reuse and recycle projects during 2020, eliminating more than 3 million kg of waste. With the addition of 100 new sustainable vehicles, approximately 90 percent of ORNL's 467-vehicle fleet is compliant with alternative fuel vehicle criteria. In 2020, one hundred percent of light-duty vehicles operated on alternative fuels, exceeding DOE fleet management goals. Total annual water use at ORNL has been reduced by 27.2 percent since FY 2007, although water consumption at ORNL is expected to rise to support additional high-performance computing and Spallation Neutron Source activities. Calculated energy use intensity for FY 2020 was 237,298 Btu per gross square foot, a cumulative reduction of 34.8 percent since FY 2003 and a reduction of 1.36 percent since FY 2019.

The ETTP decommissioning and demolition project was recognized for recycling 178,150 lb of scrap metal from deactivation work that met CERCLA qualification. This effort saved 203,499 kWh of energy, 17,400 gal of water, and 54 metric tons in greenhouse gas emissions while preserving valuable landfill space. ETTP decommissioning and demolition operations were also recognized for repurposing excavation spoils material from the ED-19 utility upgrade project as backfill at the K-832-H Basin, which avoided 730 cubic yards of waste, reduced 2.59 metric tons of greenhouse gas emissions, and saved over $70,000.

The Office of Environmental Management 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.

The Oak Ridge National Laboratory Operations and Cleanup Enterprise project was recognized for recharacterizing radioactively contaminated equipment as CERCLA-compliant waste in order to dispose of it locally, which avoided 59 metric tons of greenhouse gas emissions and saved the project $245,000 in container, shipping, and disposal fees.