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). 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 2018 *Oak Ridge Reservation Annual Site Environmental Report* (ASER) contains detailed and complex information furnished to the DOE ORR integrating contractor by other contractors including UT-Battelle, LLC; Consolidated Nuclear Security, LLC; UCOR, an AECOM-led partnership with Jacobs; North Wind Solutions, LLC; Oak Ridge Associated Universities; and Isotek Systems, LLC.

Safety is of paramount importance at all DOE facilities, and DOE's signature integrated safety management system (ISMS) integrates safety in all aspects of work at its 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.

Three key chapters of this report were prepared for DOE in strict accordance with applicable federal, state, and local regulations. Chapter 3 was written 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; and Chapter 5 was written by UT-Battelle, LLC, which manages ORNL. These contractors are also responsible for independently carrying out the various DOE missions at the three major ORR facilities. They manage and implement environmental protection programs through environmental management systems that adhere to International Organization for Standardization standard 14001, *Environmental Management Systems*, and are integrated with ISMS to provide unified strategies for managing resources. Chapters 3, 4, and 5 include detailed information on the contractors' environmental management systems.

DOE operations on ORR have the potential to release a variety of 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. Any releases are highly

regulated and carefully monitored. DOE is committed to enhancing environmental stewardship and managing the impacts its operations may have on the environment. It encourages the public to participate in matters related to ORR's environmental impact on the community by soliciting citizens' input on matters of significant public interest through various communications. DOE also offers public 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 all 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. The report is written to enhance readability, and it references other sections and chapters as well as other reports throughout to avoid redundancy.

2018 Impacts

In 2018, DOE ORR operations resulted in minimal impact to the public and the environment. Permitted discharges to air and water were well below regulatory standards, and potential radiation doses to the public from activities on the reservation were significantly 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 2018 was estimated to be 0.2 mrem from air pathways, 0.2 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 natural or background radiation.

Environmental Monitoring

Each year extensive environmental monitoring is conducted across ORR. Site-specific environmental protection programs are carried out 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 2018, thousands of samples and measurements of air, water, direct radiation, vegetation, fish, and wildlife collected from across the reservation were analyzed for both radioactive and nonradioactive contaminants. Sample media, locations, frequencies, and parameters were selected based on environmental regulations and standards, public and environmental exposure pathways, public concerns, 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 (EPA) and the Tennessee Department of Environment and Conservation (TDEC) 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 activities do not adversely impact the public or the environment.

Compliance with applicable regulations during 2018 for the three major ORR sites is summarized as follows:

- Y-12 had three environmental violations in 2018.
- ETTP had no environmental violations, issues, or findings in 2018.
- ORNL had no environmental violations, issues, or findings in 2018.

Chapter 2 provides a detailed summary of ORR environmental compliance during 2018. Chapters 3, 4, and 5 discuss each site's compliance status for the year.

Cleanup, Pollution Prevention, and Site Sustainability

Numerous cleanup, pollution prevention, and sustainability programs across ORR embody efforts to achieve enduring sustainability in facilities, operations, and organizational culture. These programs promote energy and water conservation, building efficiency, sustainable landscaping, green transportation, sustainable acquisition, and waste minimization, which in turn decrease the life cycle costs of programs and projects and reduce risks to the environment. While implementing their work in 2018, ORR contractors achieved a high level of excellence in pollution prevention and sustainability programs as described in Chapters 3, 4, and 5.

Cleanup Operations in 2018

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 have left 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 achievements included completing the demolition of ETTP's Central Neutralization Facility, which once treated the site's industrial wastewater. Demolition of ETTP's K-633 Test Loop Facility, one of several radiologically contaminated facilities in ETTP's Poplar Creek area, was also completed during 2018. Deactivation of Building K-1037 and the K-1200 Centrifuge Complex continued to prepare these structures for safe demolition in the next couple of years.

Y-12 achievements in 2018 included characterization of nine facilities in the Y-12 Biology Complex. In 2018, 3.1 tons of elemental mercury were removed from column exchange equipment in the Alpha-4 Building, and 9,477 feet of process piping, 22 tanks, and four heat exchangers were tapped, drained, and deactivated. Twenty-one of the aforementioned tanks were demolished and removed from the site for disposal. Ground was broken in 2018 for the Outfall 200 Mercury Treatment Facility. This 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. Early site preparation will ensure construction begins in 2019. Buildings 9743-2 and 9770-2 were demolished during 2018. Mobilization began in 2018 for the demolition of the remaining buildings in the Biology Complex.

At ORNL, achievements included removal of combustible material and asbestos from Building 7500, also known as the Homogeneous Reactor Experiment. Cleanup achievements also included characterization

and disposal of 74 waste items that were added to the Molten Salt Reactor Experiment's waste handling plan in 2014, and workers completed the successful Reactive Gas Removal System pumpdown of fuel drain tanks and a fuel flush tank. Significant progress was made in fiscal year 2018 to advance the design and safety basis document package for the uranium-233 processing phase in support of the DOE review and approval process. ORNL's Liquid and Gaseous Waste Operations received several important upgrades during fiscal year 2018 as a follow-up to an engineering evaluation and extended life study issued in 2016.

Environmental Management Waste Management Facility operations collected, analyzed, and disposed of approximately 3.19 million gallons of leachate treated by the Liquid and Gaseous Waste Operations facility. Characterization for the proposed Environmental Management and Disposal Facility began in February 2018 with the installation of 16 water sampling wells.

Transuranic Waste Processing Center achievements included completion of 56 contact-handled transuranic shipments to the Waste Isolation Pilot Plant (WIPP). To date, approximately 72 percent of the contact-handled transuranic waste and 46 percent of the remote-handled transuranic waste have been dispositioned at WIPP. Key progress for the Sludge Project in 2018 included receiving vendor proposals for the sludge mobilization system, the slurry mixing and characterization tank, and the sludge test area construction. The contract for testing the mobilization measurements instrumentation was also awarded.

Pollution Prevention and Sustainability in 2018

The three main ORR sites made significant strides in sustainability and pollution prevention in 2018, and highlights are summarized below.

- Y-12 achieved a 9.0 percent reduction in energy use intensity from the fiscal year 2015 baseline, in line with meeting the DOE site sustainability plan reduction goal of 25 percent by fiscal year 2025, and also achieved a 66 percent reduction in water use. Greenhouse gas emissions were reduced by 55 percent during 2018, and 91.5 percent of construction and demolition materials were diverted from the landfill.
- ORNL implemented 25 new pollution prevention projects and ongoing reuse/recycle projects during 2018, eliminating more than 4 million kg of waste. ORNL also achieved a 61 percent reduction in water use intensity from fiscal years 1985 through 2018, in compliance with the Executive Order 13693 reduction goal of 36 percent by 2025; a 32 percent decrease in petroleum consumption; and an increase, to 25, in the number of alternative use vehicles. ORNL has seen a cumulative reduction of 31.6 percent in energy used since 2003.
- ETTP carbon dioxide emissions have surpassed the targeted 40 percent reduction outlined in Executive Order 13693. The total reduction of greenhouse gas emissions to date, starting with the 2008 baseline year, is 58.6 percent. In 2018, ETTP received an exceptional electronics stewardship award from the Green Electronics Council for the use of Electronic Product Environmental Assessment Tool (EPEAT) methods. Other significant 2018 accomplishments at ETTP included diversion of approximately 156 tons of rubble through reuse, saving approximately 1,100 cubic yards of landfill space; recognition of the K-1401 Treatability Study Team for optimizing waste disposition efforts, saving $9.4 million; and the reuse of a contaminated manipulator from Building 3028, which saved $75,000.

The Office of Environmental Management also continued planning for capital asset projects that will further advance ORR cleanup objectives. These include the aforementioned mercury treatment facility at Y-12, the new disposal facility that will accept debris from future cleanup at Y-12 and ORNL, and the new sludge treatment facility at the Transuranic Waste Processing Center.