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 2019 *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 Amentum-led partnership with Jacobs; North Wind Solutions, LLC; Oak Ridge Associated Universities; and Isotek Systems, LLC.

DOE's signature integrated safety management system (ISMS), which integrates safety in all aspects of work, 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.

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, manager of 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 each contractor's environmental management systems.

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. 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 multiple communications. DOE also offers the 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 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. The report is written to enhance readability, and references other sections and chapters as well as other reports throughout to avoid redundancy.

Impacts

DOE ORR operations resulted in minimal impact to the public and the environment in 2019. Permitted discharges to air and water continued to be below regulatory standards, and potential radiation doses to the public from activities on the reservation were 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 2019 was estimated to be 0.4 mrem from air pathways, 4 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 6.4 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 2019 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 (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 ORR activities do not adversely impact the public or the environment.

Compliance with applicable regulations during 2019 for the three major ORR sites is summarized as follows:

- ETTP had no notices of environmental violations or penalties.
- Y-12 had no environmental permit violations or exceedances.
- ORNL had two violations of Tennessee's hazardous waste management regulations, an underground storage tank testing violation, and four National Pollutant Discharge Elimination System permit noncompliances.

Chapter 2 provides a detailed summary of ORR environmental compliance during 2019. 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 building efficiency, sustainable landscaping, green transportation, and sustainable acquisition, which in turn decrease the life cycle costs of programs and projects and reduce risks to the environment. While implementing their work in 2019, ORR contractors achieved a high level of excellence in environmental management, pollution prevention, and sustainability programs as described in Chapters 3, 4, and 5.

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 achievements included complete demolition of the K-1037 Building, which once produced barrier material used in the gaseous diffusion process, and demolition of the K-131 and K-631 Poplar Creek Facilities, which were some of the most contaminated facilities remaining at ETTP. K-131 provided purified uranium hexafluoride to the uranium enrichment cascade, and K-631 withdrew gaseous depleted uranium hexafluoride from the cascade, converted it to liquid, and transferred it to transport cylinders. The K-1232 Chemical Recovery Facility, the K-1423 Toll Enrichment Facility (which was used to transfer liquefied uranium hexafluoride), and the K-1414 Garage were also demolished, and the former K-29 uranium enrichment facility foundation slab was removed. Other notable demolitions in the area include a cooling tower, a cooling water pump house, and a test loop facility that was used to evaluate the performance of gaseous diffusion equipment.

Y-12 achievements in 2019 included removing an additional 1.5 tons of elemental mercury from column exchange equipment in the Alpha-4 Building, draining the column exchange process piping, and completing the characterization of 22 tanks. Construction of the Outfall 200 Mercury Treatment Facility continued and secant pile walls were installed near East Fork Poplar Creek. The Mercury Treatment

Facility, when complete, 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. More than 4,000 cubic yards of soil from an oil retention pond was dispositioned. The report *2019 Cleanup Progress: Annual Report to the Oak Ridge Regional Community* (OREM-19-2579) provides a detailed description of each study area and findings from studies performed in fiscal year 2019. Also during fiscal year 2019, the Environmental Management Waste Management Facility received 10,555 waste shipments, totaling 75,074 cubic yards, from ORR cleanup projects.

ORNL achievements in 2019 included completing work on a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) project initiated in 2018 for limited environmental remediation in the 3500 Area of the Central Campus to facilitate future brownfield redevelopment. ORNL also initiated a utilities upgrade project to address the aging utilities that provide electrical service and handle potable water, steam, storm water, and wastewater. Although utilities work is not typically performed under CERCLA, these are large-scale upgrades that may generate significant volumes of soils for disposition. The soils may be contaminated from legacy research and development, and may be remediated as a consequence of the utilities modernization efforts.

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

Environmental Management Waste Management Facility operations collected, analyzed, and disposed of approximately 4.5 million gallons of leachate treated by the Liquid and Gaseous Waste Operations facility, an increase of more than 40 percent over the previous year.

Transuranic Waste Processing Center achievements included completing 85 contact-handled transuranic shipments containing 2,739 drums to the Waste Isolation Pilot Plant in Carlsbad, New Mexico. To date, approximately 76 percent of the contact-handled transuranic waste and 56 percent of the remote-handled transuranic waste have been dispositioned at the Waste Isolation Pilot Plant. Key progress for the Sludge Project in 2019 included receiving vendor proposals for the sludge mobilization system, the slurry mixing and characterization tank, and the sludge test area construction. A contract was awarded for testing the mobilization measurements instrumentation.

Pollution Prevention and Sustainability

The three main ORR sites made significant strides in sustainability and pollution prevention in 2019, and highlights are summarized below.

Y-12 has demolished more than 1.6 million gross square feet of excess facilities. More than 72 excess DOE facilities are located on the Y-12 site, with a total of 2.8 million gross square feet. This progress is in line with meeting the DOE site sustainability plan reduction goal of 25 percent by fiscal year 2025. Y-12 also achieved a 66 percent reduction in water use and a 6 percent reduction in energy intensity, and 52.7 percent of non-hazardous waste was diverted from the landfill. Y-12 received renewable energy credits of 7.5 percent. More than 98.8 percent of eligible electronic acquisitions were registered through EPEAT, the Electronic Product Environmental Assessment Tool. Greenhouse gas emissions were reduced by 58 percent compared to the 2008 baseline.

ORNL saw a number of significant achievements in 2019. Operations at the National Transportation Research Center and Carbon Fiber Technology Facility were regulated as conditionally exempt small-quantity generators, meaning that less than 100 kg of hazardous waste was generated per month. No hazardous or mixed wastes were generated, accumulated, or shipped by DOE or UT-Battelle, LLC at the DOE Office of Scientific and Technical Information or the 0800 Area. Closure documentation for DOE Building 1916-T2 was submitted. A new Permit TNHW-178 was issued by TDEC Division of

Solid Waste Management on August 15, 2019. ORNL also implemented 26 new pollution prevention projects and ongoing reuse/recycle projects during 2019, eliminating more than 3 million kg of waste. ORNL achieved a 32 percent decrease in petroleum consumption; an increase, to 46, in the number of alternative use vehicles; and a 66 percent reduction in water use intensity from fiscal years 1985 through 2019, in compliance with the Executive Order 13834 reduction goal of 36 percent by 2025. ORNL has reduced its energy use by 31.6 percent since 2003.

The Office of Environmental Management continued planning for capital asset projects that will further advance ORR cleanup objectives. These include the aforementioned 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 new sludge treatment facility at the Transuranic Waste Processing Center.

UCOR's ORNL Operations and Cleanup Enterprise Installed Process Instrumentation Team was commended for developing a method to reduce the number of required instrument calibrations and consolidating the remaining calibrations, conserving resources and saving $20,000 to $25,000 per year. The ORNL Operations and Cleanup Enterprise Project was recognized for identifying and implementing an innovative approach that recycled ten metal and concrete salt casks rather than disposing of them in a landfill. This resulted in a cost savings of $40,000 and conserved 1,640 cubic feet of valuable landfill space. The General Plant and Capital Projects group was also recognized for implementing a design change that safely reduced the amount of materials used in dewatering boxes during the Zeolite Upgrade Project. This resulted in a $36,000 cost savings and conserved future landfill space.

The Oak Ridge Reservation Landfill (ORRLF) Project was recognized for identifying an opportunity to divert uncontaminated soil from disposal at the landfill and reuse it as landfill cover material, thereby saving $58,160, reducing greenhouse gases, and conserving 1,950 cubic yards of limited landfill space. The ORRLF Project was also recognized for identifying materials from ORRLF Sediment Pond 3 upgrades for reuse at Landfill V, which conserved resources, saved $21,500, and diverted 750 cubic yards of material from landfills.