

The Savannah River Site (SRS) Annual Site Environmental Report is the primary document that the U.S. Department of Energy (DOE) uses to inform the public of environmental performance and conditions at SRS. This report meets the requirements of U.S. Department of Energy (DOE) Order 231.1B, *Environment, Safety, and Health Reporting*. It also is the principal document that demonstrates how the Site complies with the requirements of DOE Order 458.1, *Radiation Protection of the Public and the Environment*.

This document summarizes SRS's environmental information and data to achieve the following:

- Highlight significant Site programs
- Report environmental occurrences and responses
- Describe SRS's compliance with environmental standards and requirements
- Describe SRS's Environmental Management System and sustainability performance
- Provide results of radiological and nonradiological environmental monitoring and the results from monitoring property for release from SRS

Chapter Background

This chapter presents the following:

- A brief history of SRS along with a summary of its current missions
- Highlights of various onsite organizations and their primary responsibilities
- Description of the physical characteristics and attributes of the environment in and around SRS
- SRS's primary mission and annual programmatic updates

1.1 HISTORY

SRS is a DOE site in the western region of South Carolina, along the Savannah River. The Atomic Energy Commission constructed SRS in the early 1950s to produce materials used to create nuclear weapons during the Cold War. Over the next decades, five nuclear reactors produced these materials. The reactors operated until 1988. Several of the support facilities continue to operate. The main activities onsite today involve treating and processing waste, environmental cleanup and remediation, tritium processing, and protecting nuclear material.

1.2 MISSIONS

The SRS mission is to operate safely and efficiently and to protect public health and the environment, while supporting the nation’s nuclear deterrent programs. SRS has three main mission areas:

Environmental Stewardship—SRS is focused on reducing the environmental legacy of nuclear materials and radioactive waste through initiatives such as groundwater restoration, deactivation and decommissioning of excess contaminated facilities, and disposing of radioactive waste.

National Security—SRS is focused on enhancing national security by creating safe, innovative solutions to manage nuclear materials. Activities include surplus nuclear materials disposition, tritium supply management, and maintaining and evaluating the nuclear stockpile.

Clean Energy—SRS is focused on accelerating developing technology to provide sustainable energy through public and private research and development partnerships.

You will find more information on [SRS’s website](#).

1.3 ORGANIZATION

The DOE Environmental Management (DOE-EM) program and the National Nuclear Security Administration (NNSA) oversee the Site missions. These two DOE Program Offices provide direction to the Savannah River Operations Office (DOE-SR). To execute SRS’s missions, two federal agencies, two state universities, and several contractors participate in various supporting roles. Figure 1-1 shows the relationship of these contractors with DOE. You will find a description of each entity on the following pages.

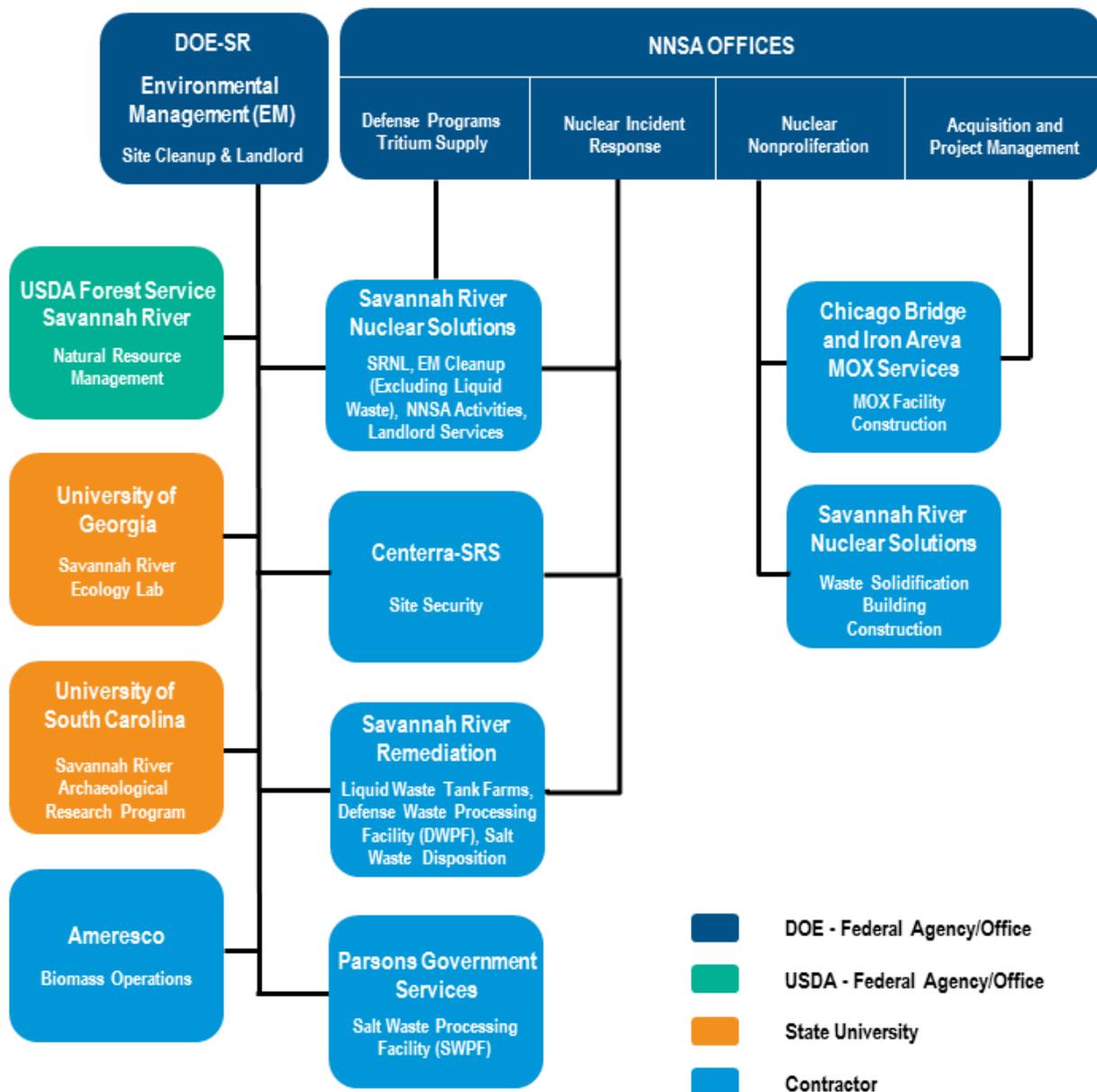


Figure 1-1 SRS Organization



The mission of DOE-EM is to safely clean up the environmental legacy remaining from five decades of developing nuclear weapons and government-sponsored research. DOE-SR is responsible for overseeing EM operations and landlord services supporting all mission areas at SRS. You will find more information on the [DOE-SR website](#).



NNSA is responsible for the defense programs and nuclear nonproliferation elements of the national security mission. NNSA is also responsible for emergency operations related to SRS tritium facility functions and the national Radiological Assistance Program. You will find more information on the [NNSA website](#).



Savannah River Nuclear Solutions, LLC (SRNS), a joint venture of Fluor Corporation, Newport News Nuclear, and Honeywell International, Inc., is the SRS management and operations contractor. SRNS is responsible for nuclear materials facilities, solid waste management facilities, tritium programs, Site infrastructure, and waste site remediation and closure projects. You will find more information on the [SRNS website](#).



Savannah River National Laboratory (SRNL), which SRNS operates, is the only EM-applied research and development laboratory. SRNL creates practical, high-value, cost-effective technological solutions in all three SRS mission areas as well as throughout the DOE complex, with other Federal agencies, and within the private sector. You will find more information on the [SRNL website](#).



Savannah River Remediation LLC (SRR) is responsible for treating and disposing of radioactive liquid waste and operationally closing waste tanks. SRR is composed of a team of companies led by AECOM with partners Bechtel National, CH2M, and BWX Technologies. Critical subcontractors for the contract are AREVA, Atkins, and AECOM Technical Services. You will find more information on the [SRR website](#).

PARSONS

Parsons Government Services, Inc. is responsible for designing, constructing, starting up, and operating the Salt Waste Processing Facility (SWPF). When completed, SWPF will separate radioactive salt solutions currently stored in below-ground tanks at SRS. SWPF will transfer separated solutions to the Defense Waste Processing Facility (DWPF) or the Saltstone Facility for more processing. You will find more information on the [Parsons website](#).



Chicago Bridge & Iron Areva MOX Services, LLC is responsible for the designing, constructing, starting up, and operating the Mixed Oxide (MOX) Fuel Fabrication Facility (MFFF). The MFFF will convert plutonium that could be used to make weapons to a form that can be used in a commercial nuclear power plant. You will find more information on the [Chicago Bridge & Iron Areva MOX Services website](#).



Centerra-SRS is responsible for the protective force that focuses on safely ensuring that criminal or terrorist acts do not disrupt the Site and its employees or compromise sensitive information or nuclear materials. You will find more information on the [Centerra website](#).



Ameresco Federal Solutions, Inc. constructed and now operates biomass steam-generating plants in K and L Areas and the steam and electricity cogeneration plant located near F Area. Ameresco currently supplies steam to SRS. You will find more information on the [Ameresco website](#).



The Savannah River Archaeological Research Program (SRARP) is a research unit of the University of South Carolina that provides the technical expertise to manage SRS cultural resources. SRARP responsibilities include identifying, evaluating, and protecting SRS archaeological sites and artifacts, conducting compliance-based research, offering public outreach programs, and preparing documents and reports for state and federal regulators. You will find more information on the [SRARP website](#).



The Savannah River Ecology Laboratory (SREL) is a research unit of the University of Georgia. For more than 65 years, the lab has independently evaluated the environmental risk associated with DOE activities. This mission includes educating graduate and undergraduate students through advanced hands-on research and providing outreach to public schools and communities surrounding the Site. You will find more information on the [SREL website](#).



The U.S. Department of Agriculture (USDA) Forest Service-Savannah River (USFS-SR), under an interagency agreement with DOE-SR, manages SRS's natural resources. These include managing timber; maintaining and improving habitat for threatened, endangered, and sensitive species; maintaining secondary roads and Site boundaries; performing prescribed burns and protecting the Site from wildland fires; and evaluating the effects of its management practices on the environment. You will find more information on the [USFS-SR website](#).

1.4 SITE LOCATION, DEMOGRAPHICS, AND ENVIRONMENT

SRS borders the Savannah River and encompasses about 310 square miles in the South Carolina counties of Aiken, Allendale, and Barnwell. SRS is about 12 miles south of Aiken, South Carolina, and 15 miles southeast of Augusta, Georgia (Figure 1-2). The Savannah River flows along the Site's southwestern border. On Figure 1-2, the capital letters within SRS borders identify operational areas referenced in this report.

Based on the U.S. Census Bureau's 2010 data, the population within a 50-mile radius of the center of SRS is about 781,060 people. This translates to an average population density of about 104 people per square mile outside the SRS boundary, with the largest concentration in the Augusta metropolitan area.

1.4.1 Water Resources

The Savannah River bounds SRS on the southwest for 35 river miles. The upriver boundary of SRS is about 160 river miles from the Atlantic Ocean. The nearest downriver municipal facility that uses the river as a drinking water source (Beaufort-Jasper Water and Sewer Authority's Purrysburg Water Treatment Plant) is about 90 river miles from the Site. Commercial fishermen, sport fishermen, and boaters also use the river. The river is not currently used for any large-scale irrigation projects downriver of the Site.

The groundwater flow system at SRS consists of four major aquifers. Groundwater migrates through the subsurface, eventually either discharging into the Savannah River and its tributaries or migrating vertically downward into the deeper regional flow systems. SRS uses groundwater for both industrial processes and drinking water.

1.4.3 Land and Forest Resources

About 10% of SRS's land is industrial; the remaining 90% consists of natural and managed forests that the USFS-SR plants, maintains, and harvests. SRS consists of four major forests: 1) mixed pine-hardwoods, 2) sandhills pine savanna, 3) bottomland hardwoods, and 4) swamp floodplain forests. These forests, as well as Carolina Bays, are accessible to the public when visiting the Crackerneck Wildlife Management Area and Ecological Reserve near Jackson, South Carolina. More than 345 Carolina Bays exist on SRS. Carolina Bays are relatively shallow depressions that provide important wetland habitat and refuge for many plants and animals. The photograph on the cover of this report is of Rainbow Bay, one of the many Carolina Bays onsite.

1.4.4 Animal and Plant Life

SRS is home to many species of plants and animals, including:

- Approximately 1,500 species of plants
- More than 100 species of reptiles and amphibians
- Approximately 50 species of mammals
- Nearly 100 species of fish
- Nearly 600 species of aquatic insects

SRS also provides habitat for more than 250 species of birds. Additionally, the Site provides habitat for protected species including the wood stork, the red-cockaded woodpecker, the pondberry, the gopher tortoise, and the smooth purple coneflower (all federally listed as threatened or endangered species). There are at least 40 plant species onsite that are of state or regional concern.

1.5 DOE-EM PRIMARY SITE ACTIVITIES

1.5.1 Nuclear Materials Stabilization

In the past, the mission of the F- and H-Areas separations facilities was to process special nuclear materials and spent fuel from Site reactors to produce materials for nuclear weapons and isotopes for both medical and National Aeronautics and Space Administration applications. Central to these separations facilities were the canyons, where the radionuclides were chemically separated from nuclear fuels. The end of the Cold War in 1991 shifted that mission to stabilizing nuclear materials and providing safe interim storage or disposal. F Canyon completed its production mission in 2002 and was deactivated in 2006.

Since 2003, H Canyon has recovered and disposed of highly enriched uranium from various spent and unirradiated nuclear fuels as well as from uranium-bearing materials from sites across the DOE complex. In H Canyon, a separations process purifies the highly enriched uranium and then dilutes it into a low-enriched uranium product using natural uranium. The low-enriched product is shipped offsite and used to



SRS Employee Monitoring Operations at H Canyon

manufacture commercial reactor fuel. H Canyon also dissolves plutonium materials into a solution that is converted into a purified oxide product. You will find more information on [H-Area Nuclear Materials Disposition](#) on SRS's website.

1.5.2 Nuclear Materials Consolidation and Storage

The K-Area Complex is DOE's only special interim nuclear materials storage facility designated to safely store plutonium. The principal operations building formerly housed K Reactor, which produced nuclear materials to support the United States for nearly four decades during the Cold War. DOE has revitalized this safe and robust structure to store nuclear materials. The stored materials have various proposed disposition paths including the Waste Isolation Pilot Plant (WIPP) in Carlsbad, New Mexico; DWPF; H-Area facilities; and the Mixed Oxide (MOX) Fuel Fabrication Facility.

SRS handles and provides interim storage of our nation's surplus plutonium and other special nuclear materials, fulfilling the United States' commitment to international nonproliferation in a safe and environmentally sound manner.

You will find more information on [Nuclear Materials Management](#) on SRS's website.

1.5.3 Spent Nuclear Fuel Storage

SRS supports the DOE National Security mission by safely receiving and storing spent fuel elements from foreign and domestic research reactors, pending disposition. Currently, SRS stores spent nuclear fuel at the L-Area Complex. You will find more information in the [L-Area Complex](#) fact sheet on SRS's website.

1.5.4 Waste Management

SRS manages radiological and nonradiological waste created by previous operations, as well as newly generated waste created by ongoing Site operations.

1.5.4.1 Radioactive Liquid Waste Management

Processing nuclear materials for national defense, research, and medical programs generates radioactive liquid waste. SRS safely stores approximately 35 million gallons of radioactive liquid waste underground in waste tanks located in the F- and H-Area Tank Farms. SRS waste tanks safely stored radioactive liquid waste for decades. Closing the liquid waste storage tanks is a high priority for DOE-EM. In order to do this, SRS must first remove the waste from the tanks and then process and treat the waste before disposing of it. In 2016, SRS closed Tank 12H, the eighth of 51 storage tanks.



L-Area Complex



Saltstone Disposal Units—with Newly Constructed SDU-6 in Center of Photo (Large Disc-Shaped Object)

SRS uses cylindrical tanks, known as Saltstone Disposal Units (SDUs) to dispose of the low-activity liquid waste. In 2016, SRS constructed SDU-6, a new design for the cylindrical SDUs, and processed and disposed of more than 1.5 million gallons of waste through the Saltstone facilities.

SRS uses DWPF to process high-activity waste from the Tank Farms. Since DWPF began operating in March 1996, it has produced more than 15.8 million pounds of glass, immobilizing 59.9 million curies of radioactivity and pouring more than 4,000 canisters. In FY 2016, DWPF produced 136 canisters with approximately 490,000 pounds of glass, immobilizing approximately 2.6 million curies of radioactivity.

You will find more information in the [Radioactive Liquid Waste: Operational Tank Closure](#) and [Liquid Waste Facilities](#) fact sheets on SRS's website.

1.5.4.2 Solid Waste Management

Solid wastes managed at SRS include the following types:

- Low-level radioactive solid waste, including ordinary items contaminated with small amounts of radioactive material
- Transuranic (TRU) waste, which contains alpha-emitting isotopes with an atomic number greater than that of uranium (92)
- Hazardous waste (nonradiological), which is any toxic, corrosive, reactive, or ignitable material that could affect human health or the environment
- Mixed waste, which contains both hazardous and radioactive components
- Sanitary waste, which like ordinary municipal waste, is neither radioactive nor hazardous

All low-level radioactive and hazardous wastes that SRS generates are treated, stored, and disposed of to meet environmental and regulatory requirements. The Site also emphasizes minimizing waste and recycling as a way to reduce the volume of waste that SRS must manage.

SRS packages TRU waste and transports it in Department of Transportation (DOT)-approved containers to WIPP for disposal. WIPP is the underground repository for DOE's TRU waste. SRS began shipping TRU waste to WIPP in May 2001. SRS has made more than 1,650 shipments to WIPP through 2014. In 2016, the Site began removing waste from TRU Pad 2. All remaining legacy TRU waste is packaged and ready for SRS to ship to WIPP. SRS did not make any TRU shipments in 2016 because WIPP was not accepting any shipments.

DOE conducts annual reviews to ensure that Site operations are within DOE's performance standards. The annual reviews for the E-Area Low-Level Waste Facility Performance Assessment (PA) and the Saltstone Disposal Facility PA, showed that operations in FY 2016 were within the performance standards DOE Orders establish and that the public and the environment were protected.

You will find more information on the [Solid Waste Management](#) page on SRS's website.

1.5.5 Waste Site Remediation and Closure

Past operations at SRS have released hazardous and radioactive substances to soil, which subsequently have ended up in the groundwater. Area Completion Projects is responsible for and focuses on reducing the footprint of legacy waste at SRS's contaminated waste sites and obsolete facilities. Area Completion Projects cleans up contamination in the environment by treating or immobilizing the source of the contamination, mitigating transport through soil and groundwater, and slowing the movement of contamination that has already migrated from the source. Cleanup includes capping inactive waste sites, installing and operating efficient groundwater treatment units, and using natural remedies, such as bioremediation (using naturally occurring microbes).



Construction of the Multi-Layer Protective Landfill Cover at the D-Area Ash Basin

In 2016, SRS continued a five-year project to restore 90 acres located near the former coal-fired power plant in D Area. SRS constructed the multilayer protective landfill cover for the second of the three basins. You will find additional information on the activities in Chapter 3, *Compliance Summary*. The restoration included removing ash that had been deposited over decades and constructing an engineered cover system. The result was two highly engineered grassy hills. You will find more information on the [Area Completion Projects](#) page on SRS's website.

1.5.6 Environmental Monitoring

SRS has an extensive environmental monitoring program that has been in place since 1951, prior to the start of Site operations. In the 1950s, onsite environmental monitoring program data were reported in Site documents. Beginning in 1959, SRS made offsite environmental surveillance data available to the public. SRS reported onsite and offsite environmental monitoring separately until 1985, when it merged data from both programs into one publicly available document, the *U.S. Department of Energy Savannah River Plant Environmental Report for 1985*.

SRS continues to conduct an extensive environmental monitoring program to determine impacts, if any, from SRS to the surrounding communities and the environment, both on and offsite. In addition to the onsite environmental monitoring the Site conducts, SRS also monitors a 2,000-square-mile area beyond the Site boundary. This area includes neighboring cities, towns, and counties in South Carolina and Georgia. SRS collects thousands of samples of air, rainwater, surface water, drinking water, groundwater, food products, wildlife, soil, sediment, and vegetation. These samples are checked for radionuclides, metals, and other chemicals that could be in the environment because of activities at SRS.

The Site's radioactive discharges to air and water were well below regulatory standards. However, SCDHEC gave SRS one Notice of Violation under the National Pollutant Discharge Elimination System (NPDES) program associated with nonradiological surface water discharges for total suspended solids, which had minimal impact on the environment. You will find additional detail on the Notice of Violation in Chapter 3, *Compliance Summary*. Chapter 4, *Nonradiological Environmental Monitoring Program*, contains more information on the surface-water sampling to support the NPDES program.

The potential radiation doses to the public from SRS operations were well below the DOE public dose limit. Chapter 6, *Radiological Dose Assessment*, contains more information on the public dose limit. You will find overview information on monitoring and radiation dose in the [Environmental Monitoring](#) fact sheet on SRS's website.

1.6 NNSA PRIMARY SITE ACTIVITIES

NNSA operates tritium facilities at SRS to supply and process tritium, a radioactive form of hydrogen gas that is a vital component of nuclear weapons. SRS also plays a critical role in NNSA's nonproliferation missions, helping the United States meet its commitments to security and disposing of plutonium and uranium.

1.6.1 Tritium Processing

SRS has the nation's only facility for extracting, recycling, purifying, and reloading tritium. SRS replenishes tritium by recycling tritium from existing warheads and by extracting tritium from target rods irradiated in nuclear reactors that the Tennessee Valley Authority operates. SRS purifies recycled and extracted gases to produce tritium suitable for use. SRS tritium facilities are part of the NNSA's Defense Program at SRS. You will find more information on [Defense Programs](#) on SRS's website.

1.6.2 Nuclear Nonproliferation

When construction is complete, the Mixed Oxide (MOX) Fuel Fabrication Facility (MFFF) will convert surplus weapons-grade plutonium to a form compatible with generating electricity in commercial nuclear power reactors. The plutonium in the MOX fuel cannot be used for nuclear weapons. You will find more information on the [Chicago Bridge & Iron Areva MOX Services](#) website.



Tritium Facility



MFFF Facility under Construction

1.7 SPECIAL ENVIRONMENTAL STUDIES

SRS provides a unique setting for environmental research with 90% of SRS being in a natural state. Several organizations at SRS—the University of Georgia Savannah River Ecology Laboratory (SREL), U.S. Forest Service-Savannah River (USFS-SR), Savannah River Archeological Research Program (SRARP), and Savannah River National Laboratory (SRNL)—conduct research to support a better understanding of human impact on both plants and animals.

More than 30 species of frogs, toads, and salamanders use the more than 400 isolated wetlands on SRS as breeding areas. SRS wetlands come in many shapes, sizes, and most importantly for amphibians, the normal length of time they hold water. Researchers at SREL have studied isolated wetland ecosystems for almost five decades, including amphibian studies beginning in 1978 at Rainbow Bay, which is featured on the cover of this year’s Annual Site Environmental Report. The Guinness World Records recognizes the SREL amphibian study at Rainbow Bay as the longest-running amphibian study in the world. SREL has recorded 9 species of salamanders, 3 toad species, and 14 frog species at Rainbow Bay during the 39-year study. Dramatic changes have occurred over time in which species produce offspring successfully because the wetland in recent years generally fills with rain later and holds water for less time than it did in the early years of the study.

[SREL](#), [USFS-SR](#), and [SRARP](#) summarized the environmental studies and research they have conducted on SRS in 2016. These summary reports are on the SRS 2016 Annual Environmental Report webpage. These reports present and discuss environmental studies and research that occurred during the reporting year and directly affected environmental sampling or dose calculations. Special environmental studies and research directly impacting the environmental monitoring program and dose calculations are presented and discussed in their respective chapters.