

Chapter 9 – Environmental Protection

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9.0 ENVIRONMENTAL PROTECTION

This section documents the potential environmental impacts associated with construction and operation of the Orano Enrichment USA LLC (OE) uranium enrichment facility, hereafter referred to as the “Facility”, and indicates that adverse impacts are small. The Facility will meet the underlying need for additional reliable and economical uranium enrichment capacity in the United States, thereby serving important energy and national security policy objectives. Accordingly, because the impacts of the Facility are minimal and acceptable, and the benefits are desirable, the no-action alternative may be rejected in favor of the proposed action.

9.1 ENVIRONMENTAL REPORT

OE’s prepared Environmental Report (ER) presents the proposed action, purpose of the proposed action, and applicable regulatory requirements in Chapter 1, discusses alternatives in Chapter 2, describes the facility and the affected environment in Chapter 3, and describes potential impacts of the proposed action in Chapter 4. Mitigation measures are described in Chapter 5, environmental measurements and monitoring programs in Chapter 6, a cost-benefit analysis in Chapter 7, and a summary of environmental consequences in Chapter 8. References and Contributors are listed in Chapters 9 and 10, respectively.

9.1.1 Environmental Considerations

OE’s ER adequately addresses the requirements of 10 CFR 51.45(b) as follows.

9.1.1.1 Description of Proposed Action

The proposed action, described in ER Section 1.2 and 2.1.2, is the issuance of an NRC specific license under 10 CFR 30, 10 CFR 40 and 10 CFR 70 to possess and use byproduct material, source material and special nuclear material (SNM) and to construct and operate a uranium enrichment facility in Oak Ridge, Tennessee.

ER Chapter 1 includes the proposed project schedule. Significant characteristics of the facility, including major site features such as Facility design and operating parameters are described in ER Chapter 2 and Chapter 3. A discussion of how the SNM, in this case uranium hexafluoride (UF₆), will be processed to produce enriched uranium-235 (²³⁵U) is described in ER Section 2.1.

9.1.1.2 Purpose of Proposed Action

ER Chapter 1 demonstrates the need for the facility. The demonstration provides the:

- Quantities of SNM used for domestic benefit
- A projection of domestic and foreign requirements for services
- Alternative sources of supply for OE’s proposed services.

ER Chapter 1 and Chapter 2 discuss the effects if the Facility is not constructed, such as the effects to the nation’s energy program.

9.1.1.3 Description of the Affected Environment

Chapter 3 of the ER contains detailed descriptions of the affected environment. The chapter provides a baseline characterization of the site and its environs prior to any disturbances associated with construction or operation of the facility. The following topics and corresponding ER chapter section include:

- Site location (including longitude and latitude) and facility layout (1.0)
- Regional demography (3.10) and land use (3.1)
- Socioeconomic information (3.10)
- Regional historic (3.8), archeological (3.8.), architectural (3.9), scenic (3.9), cultural (3.8), and natural landmarks (3.9)
- Local meteorology and air quality (3.6)
- Local surface water and ground water hydrology (3.4)
- Regional geology and seismology (3.3)
- Local terrestrial and aquatic ecology (3.5)

The baseline descriptions presented are from the most current information available. It was gathered from federal, state, and county sources along with on-site data. Therefore, the information represents both seasonal and long-term environmental trends.

9.1.1.4 Discussion of Considerations

ER Chapter 4 details environmental and socioeconomic effects due to site preparation and facility construction and operation. Chapter 2 describes alternatives to the proposed action, including siting and designs. Chapter 7 provides a discussion of the costs and benefits for each alternative as well as the relationship between short-term use and long-term productivity of the environment, and resources committed. In addition, Chapter 8 provides a summary of environmental consequences from all actions. The associated regulatory criteria and corresponding ER section are as follows:

9.1.1.4.1 Impact of the Proposed Action on the Environment

- Effects of site preparation and construction on land and water use (4.1 and 4.4)
- Effects of facility operation on human population – including consideration of occupation and public radiation exposure – and important biota (4.10 and 4.12)
- Any irreversible commitments of resources because of site preparation and facility construction and operation (4.1, 7.0, and 8.2)
- Environmental effects of the transportation of radioactive materials to and from the site (4.2)
- Environmental effects of accidents (4.12)
- Impacts on air and water quality (4.6 and 4.4)
- Impacts on cultural and historic resources (4.8)

9.1.1.4.2 Adverse Environmental Effects

Refer to Section 9.1.4 below for details on the associated ER chapters and topics.

9.1.1.4.3 Alternatives to the Proposed Action

ER Chapter 2 provides a complete description of alternatives to the proposed action. Included are the no action alternative scenarios as well as the siting criteria and technical design requirements in sufficient detail to allow a fair and reasonable comparison between the alternatives.

9.1.1.4.4 Relationship between Short- and Long-term Productivity

ER Chapter 7 includes the consideration of the short-term uses and productivity of the site during the active life of the facility. No adverse impacts on the long-term productivity of the environment after decommissioning of the facility have been identified. The European experience at the Almelo enrichment plant demonstrates that a centrifuge technology site can be returned to a greenfield site for use without restriction.

9.1.1.4.5 Irreversible and Irrecoverable Commitments of Resources

Irreversible environmental commitments and irretrievable material resources also are included in the cost-benefit analysis in ER Chapter 7. They are part of the capital costs associated with the land and facility and operating and maintenance costs. No significant commitments are involved with the proposed action. The site should be available for unrestricted use following decommissioning. Some components may be reused or sold as scrap during the Facility life or following decommissioning.

9.1.2 Analysis of Effects of Proposed Action and Alternatives

ER Chapter 2 discusses the analysis of effects of the proposed action and alternatives in accordance with 10 CFR 51.45(c). The analysis considers and balances the environmental effects of the proposed action and alternatives available to reduce or avoid both environmental and socioeconomic effects and other benefits of the proposed action.

9.1.3 Status of Compliance

ER Section 1.3 summarizes the applicability of environmental regulatory requirements, permits, licenses, or approvals as well as the current status of each on the effective date of the ER.

Many federal laws and regulations apply to the facility during site assessment, construction, and operation. Some of these laws require permits from consultations with, or approvals by, other governing or regulatory agencies. Some apply only during certain phases of facility development, rather than the entire life of the facility. Federal statutes and regulations (non-nuclear) have been reviewed to determine their applicability to the facility site assessment, construction, and operation.

9.1.4 Adverse Information

In accordance with 10 CFR 51.45(e), various sections throughout the ER discuss adverse environmental effects. In particular, Chapter 4 details environmental and socioeconomic effects due to site preparation and facility construction and operation. Chapter 2 compares potential impacts from alternatives. Lastly, Chapter 8 provides a summary of environmental consequences from all actions.

9.2 ENVIRONMENTAL PROTECTION MEASURES

OE is committed to protecting the public, Facility workers, and the environment from the harmful effects of ionizing radiation due to Facility operation. Accordingly, OE is firmly committed to the As Low As Reasonably Achievable (ALARA) philosophy for all operations involving source, byproduct, and special nuclear material. This commitment is reflected in written procedures and instructions for operations involving potential exposures of personnel to radiation (both internal and external hazards) and the facility design. Written procedures for effluent monitoring address the need for periodic (monthly) dose assessment projections to members of the public to ensure that potential radiation exposures are kept ALARA (i.e., not in excess of 0.1 mSv/yr (10 mrem/yr)) in accordance with 10 CFR 20.1101(d).

Parts of OE's environmental protective measures are described in the ER. In particular, Chapter 4 discusses the anticipated results of the radiation protection program with regard to ALARA goals and waste minimization. Chapter 6 discusses the environmental controls and monitoring program.

A description of OE's radiation protection program is included in Chapter 4. Similarly, OE's provisions for a qualified and trained staff, which also is part of the environmental protection measures required, are established by the personnel qualifications of the management and supervisory staff as well as formal training for facility employees, as described in Chapter 2.

9.2.1 Radiation Safety

The four acceptance criteria that describe the facility radiation safety program are as follows:

- Effluent controls to maintain public doses ALARA

The equipment and design features incorporated in the Facility are selected to keep the release of gaseous and liquid effluent contaminants as low as practicable, and within regulatory limits. They are also selected to minimize the use of depletable resources.

Additional information is in Section 4.13 of the ER.

- Waste minimization.

A high priority will be assigned to minimizing the generation of waste through reduction, reuse, or recycling. The Facility incorporates several waste minimization systems in its operational procedures that aim at conserving materials and recycling important compounds.

OE has a program for pollution prevention and waste minimization that includes the following:

- Waste minimization, reduction, reuse, and recycling for the various phases of the Facility construction and operation and decommissioning
- Employee training and education on general environmental activities and hazards regarding the facility, operations and the pollution prevention program
- Responsibilities for pollution prevention and waste minimization

ALARA controls and BMPs will be maintained during facility operation to minimize the generation of radioactive waste as directed in 10 CFR 20.

ER Section 4.12 describes public and occupational health effects from both non-radiological and radiological sources. This section specifically addresses calculated total effective dose equivalent (TEDE) to an average member of critical groups or calculated average annual concentration of

radioactive material in gaseous and liquid effluent to maintain compliance with 10 CFR 20. ER Section 4.13 contains information on facility waste minimization.

License Application Chapter 4 describes:

- Radiological (ALARA) goals for effluent control
- ALARA reviews and reports to management.

9.2.2 Effluent and Environmental Controls and Monitoring

OE will design an environmental monitoring program to provide comprehensive data to monitor the facility's impact on the environment. The preoperational program will focus on collecting data to establish baseline information useful in evaluating potential changes in environmental conditions caused by facility operation. The preoperational program will be initiated at least two years prior to facility operation.

The operational program will monitor to ensure facility emissions are maintained in accordance with ALARA principles and meet the air permit requirements from Tennessee Department of Environment and Conservation (TDEC). Sampling focuses on locations within the site perimeter but may also include distant locations as control sites. Sampling locations have been determined based on NRC guidance found in NUREG-1302 (NRC 1991), meteorological information, and current land use. In conjunction with the existing DOE-Legacy sample monitoring wells already at the site, additional sampling locations may be subject to change as determined from the results of periodic review of land use.

ER Chapter 6 describes the environmental measurement and monitoring programs as they apply to pre-operation (baseline), operation, and decommissioning conditions for both the proposed action and each alternative.

9.2.2.1 Effluent Monitoring

ER Section 6.1 presents information relating to the facility radiological monitoring program. This section describes the location and characteristics of radiation sources and radioactive effluent (Figure 9-1).

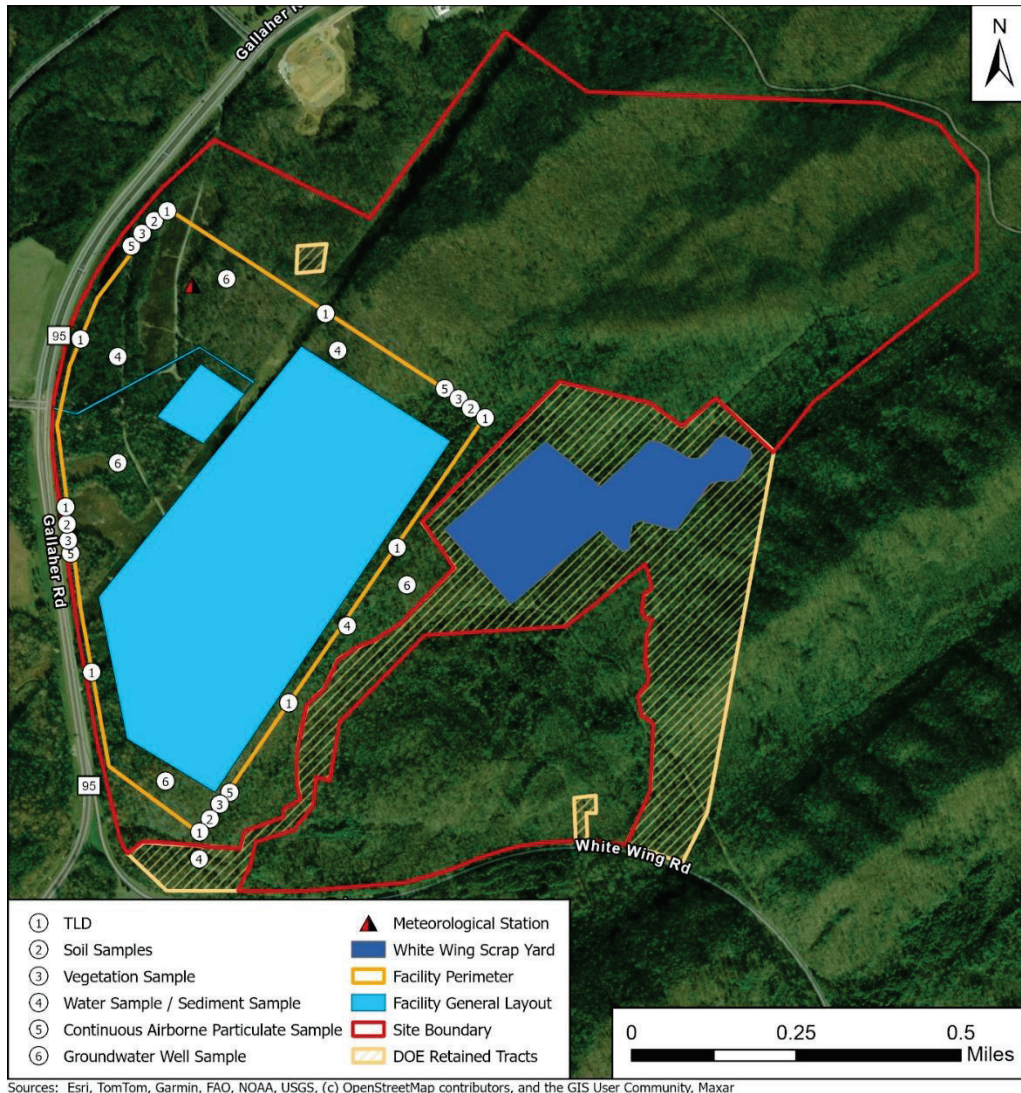


Figure 9-1 Proposed Facility Monitoring Locations

It also describes the various elements of the monitoring program, including:

- Number and location of sample collection points
- Measuring devices used
- Pathway sampled or measured
- Collection frequency and duration
- Method and frequency of analysis, including lower limits of detection.

As a matter of compliance with regulatory requirements, all potentially radioactive effluent from the facility is discharged only through monitored pathways. See ER Section 4.12.3 for a discussion of pathway assessment. The effluent sampling program for the Facility is designed to determine the quantities and concentrations of radionuclides discharged to the environment. The uranium isotopes ^{238}U , ^{236}U , ^{235}U , and ^{234}U are expected to be the prominent radionuclides in the gaseous effluent. The annual uranium source term for routine gaseous effluent releases from the 7.4 million SWU Facility has been conservatively assumed to be less than 592 μCi per year, which

is proportional to the 120 μCi per year source term applied to the 1.5 million SWU Facility described in NUREG-1484 (NRC 1994).

This is a very conservative annual release estimate used for bounding analyses. Additional details regarding source term are provided in ER Section 4.12. Representative samples are collected from each release point of the facility. Effluent data will be maintained, reviewed, and assessed by the Facility's Industrial Safety & Radiation Protection Manager to assure that gaseous effluent discharges comply with regulatory release criteria for uranium. Table 9-1 presents an overview of the effluent sampling program.

The Facility has two main gaseous effluent streams: process related effluents collected by the Gaseous Effluent Vent System (GEVS) and room ventilation effluents collected by the HVAC systems. The GEVS is designed to remove particulates containing uranium and hydrogen fluoride (HF) from process gas streams that may be contaminated. The system uses prefilters and high efficiency particulate air (HEPA) filters, along with potassium hydroxide (KOH)-impregnated activated carbon filters, to capture radioactive particles and absorb HF before the gas is released to the exhaust.

Both the GEVS and HVAC streams are discharged through a common exhaust stack equipped with continuous emission monitoring devices. A list of gaseous effluents and associated annual quantities (estimated) is presented in Section 4.13 of the Environmental Report.

There are no liquid effluent discharges from Facility operations. Radiologically contaminated, potentially contaminated, and non-radiologically contaminated aqueous liquid effluents are generated in various processes throughout the Facility. Most potentially radioactive aqueous effluents originate in the Technical Support Building (TSB), where all aqueous liquid streams are collected in tanks located in the Liquid Effluent Collection and Treatment Room. The collected liquids are sampled and analyzed to determine whether treatment is required prior to atmospheric release by evaporation.

When treatment is necessary, the effluent undergoes filtration and precipitation processes to remove uranium and fluorine. These cycles are repeated as needed until concentrations reach acceptable levels, after which the liquid is transferred to an evaporator for vaporization and final discharge to the TSB GEVS.

Non-contaminated aqueous effluents are also collected and monitored. If they meet all regulatory and administrative criteria, they are evaporated and discharged directly to the atmosphere.

Estimated annual quantities of liquid effluents are provided in Section 4.13 of the Environmental Report.

Table 9-1 Effluent Monitoring Program

Sample Location	Sample Type	Analysis / Frequency
Buildings GEVS exhaust vents	Continuous particulate filter HF scrubbing sparger	Fluorine concentration-Weekly Gross alpha/beta-Weekly Isotopic analysis ³ -Quarterly composite
Process Areas ¹	Local area continuous air particulate filter ²	Gross alpha/beta-Weekly Isotopic analysis ³ -Quarterly composite
Non-Process Areas ¹	Local area continuous air particulate filter ²	Gross alpha/beta-Quarterly composite

Notes:

1. A "Process Area" is any area of the facility where UF₆ process flow between feed, product, or tails cylinders occurs, including areas where cylinders containing UF₆ are opened for testing, inspection, or sampling. A "Non-Process Area" is any other area where UF₆ is present only in fully contained form.
 - These will generally be collected with continuous air monitors, as required to complement the effluent monitoring program.
2. Isotopic analysis for Uranium if gross alpha and gross beta activities indicate that an individual radionuclide could be present in a concentration greater than 10 percent of the concentrations specified in Table 2 of Appendix B to 10 CFR Part 20.

9.2.2.1.1 Expected Concentrations

Pursuant to 10 CFR 20, surveys necessary to demonstrate compliance with these regulations and to demonstrate that the amount of radioactive material present in effluent from the facility has been kept ALARA are required. In addition, the NRC has issued Regulatory Guide 4.15 (NRC 2007) and Regulatory Guide 4.16 (NRC 2010) that reiterate that concentrations of hazardous materials in effluent must be controlled and that licensees must adhere to the ALARA principal such that there is no undue risk to the public health and safety at or beyond the site boundary.

As noted in ER Section 6.1.1, discharge of gaseous effluent has the highest possibility of the potential pathways, of introducing facility-related uranium into the environment. However, the radioactive materials in gaseous effluents from the Facility are expected to be very low concentrations of uranium because of process and effluent controls. Under routine operating conditions, radioactive material in effluents discharged from the facility will comply with regulatory release criteria.

9.2.2.1.2 Calculation of Total Effective Dose Equivalent

Based on recorded Facility effluent data, dose projections to members of the public will be performed as required to ensure that the annual dose to members of the public does not exceed the ALARA constraint of 0.1 mSv/yr (10 mrem/yr) from air emissions and radioactive materials. Compliance is demonstrated through effluent and environmental sampling data. Compliance with 10 CFR 20.1301 will be demonstrated using a calculation of the TEDE to the individual who is likely to receive the highest dose in accordance with 10 CFR 20.1302(b)(1). Pursuant to 10 CFR 70, semiannual reports will be submitted, specifying the quantities of the principal radionuclides released to unrestricted areas and other information needed to estimate the annual radiation dose to the public from effluent discharges. If the monthly dose impact assessment indicates a trend in effluent releases that, if not corrected, could cause the ALARA constraint to be exceeded, appropriate corrective action will be initiated to reduce the discharges to assure that subsequent releases will be in compliance with the annual dose constraint. In addition, an evaluation of the need for increased sampling will be performed.

9.2.2.1.3 Effluent Discharge Locations and Sampling

Effluents will be sampled as indicated in Table 9-1, which presents an overview of the effluent sampling program. For gaseous effluents, continuous air sampler filters are analyzed for gross alpha and gross betas required. The filters are composited as required and an isotopic analysis is performed if a specified gross alpha or gross beta action level is exceeded (as specified in Table 9-1). Table 9-2 summarizes detection requirements for gaseous and liquid effluent sample analyses. Sampling of liquid effluent discharges to the detention and retention basins are described below in Section 9.2.2.2.

Table 9-2 Required Lower Limit of Detection for Effluent Sample Analysis

Effluent Type	Nuclide	MDC in Bq/mL ($\mu\text{Ci/mL}$)
Gaseous ¹	Isotopic U	5.6×10^{-9} (1.5×10^{-13})
Gaseous ¹	Gross Alpha	5.6×10^{-9} (1.5×10^{-13})
Liquid ²	Isotopic U	5.6×10^{-4} (1.5×10^{-8})

Notes:

1. These MDCs are 5% of the limits in 10 CFR 20 Appendix B, Table 2 Effluent Concentrations (retention Class D for Air)
2. This MDC is 5% of limit in 10 CFR 20 Appendix B, Table 2, Col. 2 (Water) value for retention Class D.

The guidance in NUREG-1302 (NRC 1991) and Regulatory Guide 4.16 (NRC 2010) were followed for determining sample locations, analyses, frequencies, durations, and lower limits of detection.

Lastly, Chapter 6 of the ER justifies the choice of sample locations, analyses, frequencies, durations, and lower limits of detection.

9.2.2.2 Environmental Monitoring

As described in ER Chapter 6, an environmental monitoring program is to be implemented to measure non-radiological chemical impacts upon the natural environment.

The environmental monitoring program relies on the data acquisition from the radiological and physiochemical monitoring programs to detect and contain any potentially adverse releases from the Facility to the environment.

Sampling locations are determined based on meteorological information and current land use. The sampling locations may be subject to change as determined from the results of any observed changes in land use.

The range of chemical surveillance incorporated into all the planned monitoring programs are designed to be sufficient to predict any relevant chemical interactions in the environment related to Facility operations.

Environmental monitoring program activities would include periodic flora and fauna surveys of the land to identify potential problems and areas needing improvement

The Radiological Environmental Monitoring Program (REMP) at the Facility is a major part of the effluent compliance program. It provides a supplementary check of containment and effluent controls, establishes a process for collecting data for assessing radiological impacts on the environs and estimating the potential impacts on the public, and supports the demonstration of

compliance with applicable radiation protection standards and guidelines. The REMP includes the collection of data during pre-operational years to establish baseline radiological information that will be used in determining and evaluating impacts from operations at the Facility on the local environment (Table 9-3). The REMP will be prior to Facility operations in order to develop a sufficient baseline. The early initiation of the REMP provides assurance that a sufficient environmental baseline has been established for the Facility before the arrival of the first uranium hexafluoride shipment.

A map of ecological sample locations is shown in Figure 9-2.

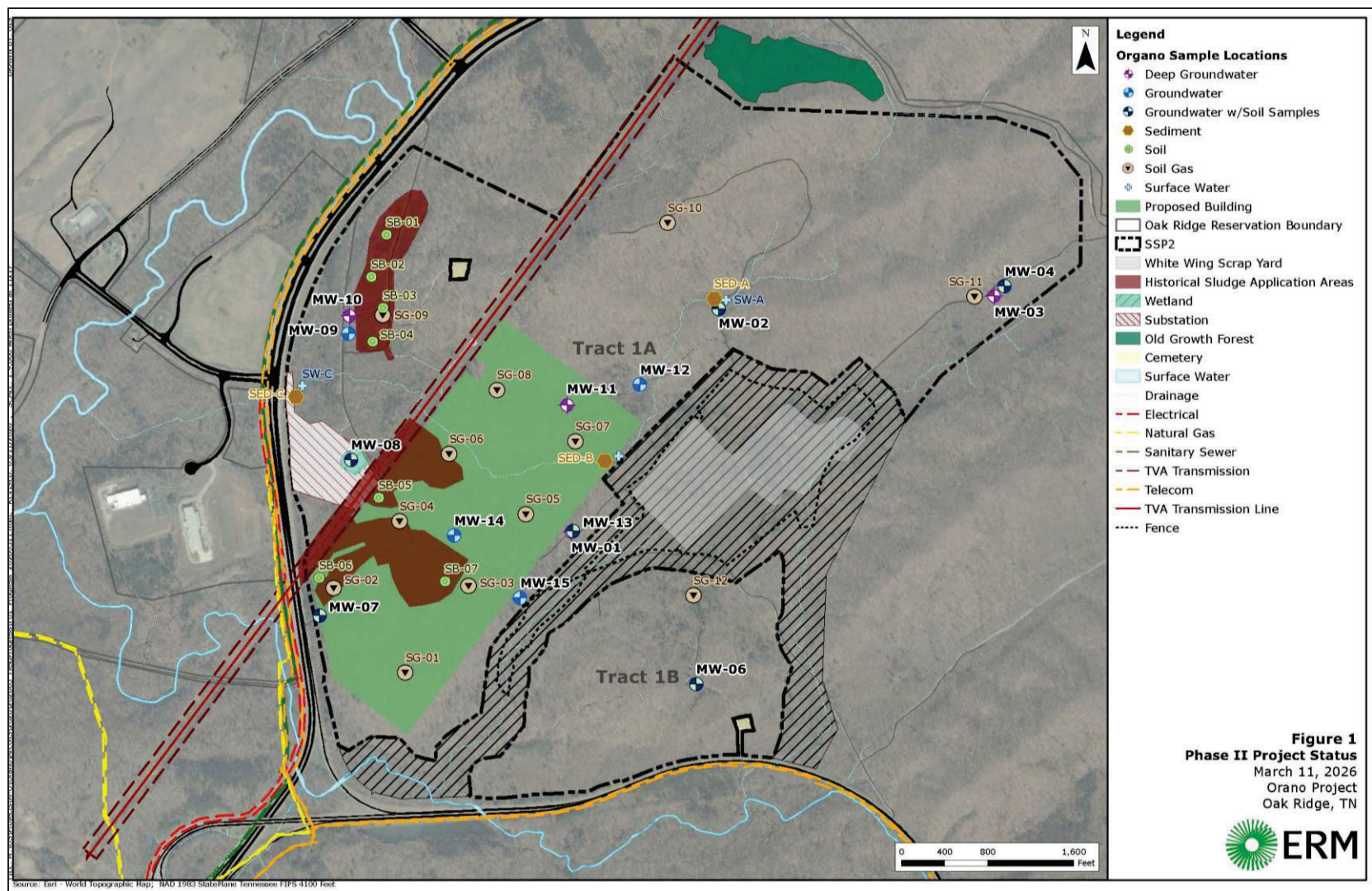


Figure 9-2 Ecological Sampling Locations

Table 9-3 Preoperational Radiological Environmental Monitoring Program

Sample Type	Location	Minimum Number of Sample Locations	Sampling and Collection Frequency	Type of Analysis
Continuous Airborne Particulate	Note 4	4	Continuous operation of air sampler with sample collection as required by dust loading but at least biweekly. Quarterly composite samples by location.	Gross beta/gross alpha analysis each filter change. Quarterly isotopic analysis on composite sample.
Vegetation	Note 4	5	1 to 2-kg (2.2 to 4.4-lb) samples collected semiannually	Isotopic analysis ¹
		5	Quarterly if present (i.e., during growing seasons); one sample at each location	Fluoride uptake
Groundwater	Note 4	4	4-L (1.06-gal) samples collected semiannually	Isotopic analysis ¹
Basins	Note 2	1 from each of 2 basins ² Discharge points to the basins ²	4-L (1.06-gal) water sample/1 to 2-kg (2.2 to 4.4-lb) sediment sample collected quarterly Quarterly for one sediment sample at each location	Isotopic analysis ¹ Fluoride uptake
Soil	Note 4	4	1 to 2-kg (2.2 to 4.4-lb) samples collected semiannually	Isotopic analysis ¹
			Quarterly, near vegetation sample locations; one sample at each location	Fluoride uptake
Domestic Sanitary Sewage Treatment Plant ³	Note 3	Note 3	Note 3	Note 3
TLD	Note 4	9	Quarterly	Gamma and neutron dose equivalent

Notes:

1. Isotopic analysis for Uranium.
2. Site Stormwater Detention Basins and Cylinder Storage Pads Stormwater Retention Basins.
3. Sanitary wastewater from the DSSTP is not expected to be contaminated with licensed material. Therefore, OE does not sample or analyze the untreated sewage
4. See legend of Figure 9-1 and Figure 9-2 where each sample type will be collected.

A minimum detectable concentration (MDC) of at least 1.5×10^{-13} $\mu\text{Ci/mL}$ is a program requirement (NRC 2015) for all analyses performed on gaseous effluent samples. That MDC value represents 5% of the limit for any applicable uranium isotope (Class D). Liquid samples are analyzed to an MDC equivalent to 5% or less of the appropriate 10 CFR 20 Appendix B, Table 2, Col. 1 (ambient air) value. The MDCs for gross alpha (assumed to be uranium) in various environmental media are shown in Table 9-4.

Table 9-4 Required MDC for Environmental Sample Analysis

Medium	Analysis	MDC Bq/mL or g ($\mu\text{Ci/mL}$ or g)
Ambient Air ¹	Gross Alpha	2.2×10^{-9} (6.0×10^{-14})
Vegetation	Isotopic U	1.9×10^{-4} (5.0×10^{-9})
Soil/Sediment	Isotopic U	1.1×10^{-2} (3.0×10^{-7})
Groundwater ²	Isotopic U	2.2×10^{-4} (6.0×10^{-9})

Notes:

1. MDCs are 2% or less of the limits in 10 CFR 20 Appendix B, Table 2 Effluent Concentrations (retention Class D for ambient air).
2. MDCs are 2% or less of the limits in 10 CFR 20 Appendix B, Table 2 Effluent Concentrations (retention Class D for water).

9.2.2.3 Data Analysis

Written procedures will be in place to ensure the collection of representative samples, use of appropriate sampling methods and equipment, proper locations for sampling points, and proper handling, storage, transport, and analyses of effluent samples. In addition, the Facility's written procedures also ensure that sampling and measuring equipment, including ancillary equipment such as airflow meters, are properly maintained and calibrated at regular intervals. Sampling equipment (pumps, pressure gages, and air flow calibrators) will be calibrated by qualified individuals. Sampling equipment and lines will be inspected for defects, obstructions, and cleanliness. Calibration intervals will be developed based on applicable industry standards.

9.2.2.4 Laboratory Quality Control

All environmental samples will be analyzed by an accredited offsite laboratory. Monitoring and sampling activities, laboratory analyses, and reporting of Facility-related radioactivity in the environment will be conducted in accordance with industry-accepted and regulatory-approved methodologies.

9.2.2.5 Action Levels

Administrative action levels are established for effluent samples and monitoring instrumentation as an additional step in the effluent control process. All action levels are sufficiently low so as to permit implementation of corrective actions before regulatory limits are exceeded.

As noted in ER Chapter 6, administrative action levels are established for effluent samples and monitoring instrumentation as an additional step in the effluent control process. All action levels are sufficiently low so as to permit implementation of corrective actions before regulatory limits are exceeded. Effluent samples that exceed the action level are cause for an investigation into the source of elevated radioactivity. Administrative action levels will be implemented prior to Facility operation to ensure that chemical discharges remains below the limits specified in the Facility discharge permits.

9.2.2.6 Federal and State Standards for Discharges

ER Section 1.3 describes all applicable federal and Tennessee state standards for discharges, as well as required permits issued by local, state, and Federal governments.

9.2.2.7 Reporting

Radiological reporting procedures will comply with the requirements of 10 CFR 70.59 and the guidance specified in Regulatory Guide 4.16 (NRC 2010). Reports of the concentrations of principal radionuclides released to unrestricted areas in effluents will be provided and will include the MDC for the analysis and the error for each data point. Each year, the Facility will submit a summary report of the environmental sampling program to the NRC, including all associated data as required by 10 CFR 70. The report will include the types, numbers, and frequencies of environmental measurements and the identities and activity concentrations of facility-related radionuclides found in environmental samples, in addition to the MDC for the analyses and the error associated with each data point.

9.2.3 Waste Management

The Facility's waste management program encompasses the control, handling, and disposition of licensed radioactive and mixed wastes in accordance with 10 CFR Part 20, applicable NRC license conditions, and all relevant federal, state, and local environmental requirements. Waste streams are segregated, characterized, and managed to ensure safe operations and regulatory compliance.

The principal waste types generated at the Facility include:

- Solid radioactive waste, consisting primarily of filters and media from chemical traps and personal protective equipment used in controlled areas. Uranium contamination is typically present as uranyl fluoride or other uranium compounds formed through UF_6 hydrolysis.
- Solid non-radioactive waste, including general industrial refuse and non-contaminated maintenance materials generated outside controlled areas.
- Liquid radioactive waste, originating from decontamination solutions used to clean UF_6 handling systems. These liquids may contain dissolved uranium compounds and are collected, characterized, and transferred for appropriate treatment or disposal.
- Liquid non-radioactive waste, including sanitary wastewater and non-contact cooling water. These streams are segregated from process systems and do not contain licensed material.
- Gaseous waste, consisting of ventilation exhaust from controlled areas and process off-gas streams. Under abnormal conditions, these gases may contain trace quantities of uranium particulates or HF, but they are routed through engineered controls such as cold traps, chemical traps, scrubbers, and HEPA filtration systems.

9.2.3.1 Radioactive Waste Management Program

The Facility will implement a Radioactive Waste Management Program (RWMP) under the Facility's Radiation Protection Program described in Chapter 4, to ensure that the handling and transfer of radioactive waste are conducted in a manner protective of the environment and in full compliance with 10 CFR 20.2006, 10 CFR 20.2108, and applicable DOT requirements. The RWMP will ensure that radioactive waste is properly characterized, classified, packaged, documented, and transferred for disposal in a manner that minimizes environmental impact and prevents unauthorized releases of radioactive material.

The Radiation Protection Manager has overall responsibility for ensuring RWMP compliance. The Waste Management Supervisor manages daily implementation. Quality Assurance conducts periodic reviews to verify documentation accuracy and procedural adherence.

Waste characterization activities identify radionuclide content, activity, physical and chemical form, and hazardous constituents. Waste is classified in accordance with regulatory definitions for low-level radioactive waste. These steps support environmental protection by ensuring that waste is routed to properly licensed disposal sites.

As required by 10 CFR 20.2006, all shipments will be accompanied by a complete and accurate Uniform Low-Level Radioactive Waste Manifest. Supporting documents include container inventories, radiological survey data, and DOT shipping papers. These controls ensure that waste is managed and transported in a manner protective of the environment.

Before shipment, the RWMP will require confirmation that the receiving facility holds a valid NRC or Agreement State license authorizing acceptance of the waste type and quantity. Shipments are not authorized until verification is complete and all environmental and regulatory checks have been satisfied.

Any discrepancies identified by a receiving site are promptly evaluated, documented, and corrected. Records required under 10 CFR 20.2108 are retained for the prescribed duration to support environmental compliance reviews.

9.2.3.2 Waste Disposal

OE will dispose of licensed radioactive material only by methods authorized under 10 CFR 20.2001 or specifically approved in the OE NRC license. OE will comply with 10 CFR 20.2002 and will not use any disposal method requiring separate NRC approval, including alternative disposal procedures, unless prior NRC authorization is obtained.

All radioactive and mixed wastes generated at the Facility will be packaged in NRC-approved containers and transferred exclusively to off-site licensed disposal facilities identified in Table 4-5 of the OE Environmental Report for Radwaste Disposal. The specific disposal facility will be selected on a commercial and operational basis at the time of shipment.

OE will not dispose of licensed radioactive material by decay-in-storage, and no request for NRC approval of decay-in-storage disposal will be submitted.

OE will conduct no on-site disposal of radioactive waste via sanitary sewage or incineration, consistent with 10 CFR Part 20, Subpart K. Accordingly, OE does not intend to request NRC approval for:

- Disposal of radioactive waste into sanitary sewage under 10 CFR 20.2003,
- Disposal of radioactive waste by incineration under 10 CFR 20.2004.

The Facility will not generate, process, or manage any of the waste types described in 10 CFR 20.2005 or any byproduct material regulated under 10 CFR 20.2008. Therefore, OE will not use the disposal provisions of these sections and does not intend to request NRC approval for any disposal activities under 10 CFR 20.2005 or 10 CFR 20.2008.

OE will ensure that all waste management and disposal activities comply with 10 CFR 20.2007, including adherence to all applicable federal, state, and local environmental and public health protection regulations. All transfers of radioactive wastes for disposal will be made only to entities that are specifically authorized to receive such material under a license issued by the NRC or an Agreement State. Prior to each transfer, OE will verify the receiving facility's authorization and ensure that the transfer is conducted in accordance with all applicable requirements of 10 CFR Part 20, Subpart K. Documentation of authorization and transfer conditions will be maintained as part of the facility's radioactive waste management program.

Prior to shipment, each waste container will undergo a radiological survey to verify compliance with all applicable safety, contamination-control, and labeling requirements. OE will implement controls to ensure that occupational and public exposures remain within the limits of 10 CFR Part 20 and to prevent the spread of contamination. All packages will comply with the public dose limits specified in 10 CFR 20.1301, and all associated records will be maintained in accordance with 10 CFR 20.2108.

9.2.3.3 Waste Discharge Points

Based on the Facility design and operational controls, no environmental discharge points exist for licensed radioactive material or hazardous UF₆-related chemicals during normal operations. All potential discharge pathways are engineered for containment, monitoring, and mitigation to ensure compliance with the public dose limits established in 10 CFR 20.1301.

UF₆ process systems are fully enclosed and maintained under negative pressure with continuous monitoring. Any UF₆ or HF generated through incidental hydrolysis is captured by cold traps, chemical traps, scrubbers, or filtration systems.

Ventilation exhaust is released through monitored stacks to verify that uranium concentrations remain below detection limits during normal operations. These exhaust points are not considered radioactive discharge points under normal operating conditions.

Sanitary wastewater and non-contact cooling water are discharged to a permitted municipal treatment facility under applicable state requirements.

A full description of waste impacts is provided in Section 4.13 of the Environmental Report (OE 2026).

9.2.3.4 Waste Minimization

A high priority will be assigned to minimizing the generation of waste through reduction, reuse, or recycling. The equipment and design features incorporated in the Facility are selected to keep the release of gaseous and liquid effluent contaminants as low as practicable, and within regulatory limits. They are also selected to minimize the use of depletable resources.

The Facility design serves to minimize the use of depletable resources. Water is the primary depletable resource used at the Facility. Electric power usage also depletes fuel sources used in the production of the power.

During operation, a non-hazardous materials waste recycling plan will be implemented. The recycling plan will start with the performance of a waste assessment to identify waste reduction opportunities and to determine which materials will be recycled.

The Facility will develop and maintain a Spill Prevention, Control, and Countermeasure (SPCC) Plan to ensure compliance with regulatory requirements in the event of unplanned oil spills. The purpose of the SPCC Plan is to identify administrative and engineering countermeasures to reduce the potential for the occurrence of spills, reduce the risk of injury to personnel if a spill occurs, mitigate impacts of potential releases of oil to the environment and provide procedures and guidance to ensure the Facility response to spills and subsequent reporting are complete and in compliance with federal and state standards. The SPCC Plan will be developed in accordance with the requirements of 40 CFR 112.

ALARA controls will be maintained during facility operation to minimize the generation of radioactive waste as directed in 10 CFR 20.

9.2.4 Integrated Safety Analysis

OE has prepared an Integrated Safety Analysis (ISA) in accordance with 10 CFR 70.60. The ISA:

- Provides a complete list of the accident sequences that if uncontrolled could result in radiological and non-radiological releases to the environment with intermediate or high consequences.
- Provides reasonable estimates for the likelihood and consequences of each accident identified.
- Applies acceptable methods to estimate environmental effects that may result from accidental releases.
- Identifies adequate engineering and/or administrative controls for each accident sequence of environmental significance
- Assures adequate levels are afforded so those items relied on for safety (IROFS) will satisfactorily perform their safety functions.

The ISA demonstrates that the facility and its operations have adequate engineering and/or administrative controls in place to prevent or mitigate high and intermediate consequences from the accident sequences identified and analyzed. Corresponding management measures are described in Chapter 11.

9.3 PHYSIOCHEMICAL MONITORING

Facility environmental monitoring policies and procedures shall be developed in accordance with current approved federal, state, and local requirements. Sampling instrumentation used in the collection of environmental monitoring data by Facility or third-party personnel will be selected and procured to ensure reliability and accuracy. Instrumentation will take into consideration field and climate conditions. A monitoring instrument maintenance and calibration program will ensure documented compliance with manufacturer recommendations. Third-party and Facility environmental personnel will adhere to documentation and analysis protocols to ensure the quality and reliability of compliance reporting data generated via OE approved third-party laboratory inter-comparison programs. Monitoring protocols will be appropriate to the media and parameters being measured.

Environmental and radiological samples are to be collected in accordance with the Facility procedures and policies. Sample locations and frequencies are identified in agency-issued permits and appropriate regulatory standards. Samples will be shipped off-site for analysis to a licensed analytical laboratory under chain of custody for testing using appropriate analytical methodologies. Analytical parameters for testing are developed to reflect the reporting goals of all site permits issued by federal, state, and local regulatory agencies. Third-party contractors or laboratories shall meet Facility requirements for the complaint and timely documentation and reporting of analytical data metrics supporting Facility activities, including:

- Sampling for chemical and radiological contamination in process effluents
- Chemical or radiological characterization of process and construction solid waste streams
- Chemical or radiological characterization of liquid process waste streams
- Routine stormwater, groundwater, soils, and air monitoring sampling in support of routine or event-based compliance reporting

Third-party support may be used for additional monitoring for occupational exposures may be performed by approved offsite analytical laboratories or industrial hygiene professionals may be contracted to perform bioassay analyses.

All waste liquids, solids and gases from enrichment-related processes and decontamination operations will be analyzed and/or monitored for chemical and radiological contamination to determine safe disposal methods and/or further treatment requirements.

See Environmental Report Chapter 6 for a description of the physiochemical monitoring program. Below are the physiochemical sampling information (Table 9-5) and Stormwater Monitoring (Table 9-6) information tables.

Table 9-5 Physiochemical Sampling

Media	Number of Locations	Monitoring Frequency	Sample Type	Analysis ¹
Groundwater	3 deep wells (59.5' – 139' bgs) 10 shallow gw wells (12' – 20' bgs)	Semiannually, in accordance with regulatory requirements	Grab	VOCs, SVOCs, PFAS, PCBs, Metals
Soil ² /sediment	Soil sample locations to be developed in accordance with regulatory requirements and final Facility design	Quarterly, in accordance with regulatory requirements	Direct push sampling Grab	VOCs, SVOCs, PFAS, PCBs, Metals
Surface water	Sample locations are developed in accordance with regulatory and permit requirements.	Quarterly, in accordance with regulatory and permit requirements	Grab	VOCs, SVOCs, PFAS, PCBs, Metals
Stormwater ²	Sample locations to be determined by regulatory permit (i.e., SPCC, SWPPP) requirements	In accordance with permits and regulatory requirements	Grab, Composite	See Table 9-6
Vegetation ²	5 sample locations	Quarterly or in accordance with regulatory and permit requirements	Grab	Isotopic analysis Fluoride uptake

Notes:

¹ Environmental screening criteria for all media are developed to reflect current regulatory and permitted values

² Environmental monitoring locations and screening criteria are developed to meet appropriate regulatory detection limits and permitted values and are identified in Figure 9-1

Table 9-6 Stormwater Monitorings ¹

Monitored Parameter	Monitoring Frequency	Sample Type
Oil and Grease	In accordance with permit and regulatory requirements	Grab/Composite
Total Suspended Solids (TSS)	In accordance with permit and regulatory requirements	Grab/Composite
Polycyclic Aromatic Hydrocarbons (PAHs)	In accordance with permit and regulatory requirements	Grab/Composite
VOCs/SVOCS	In accordance with permit and regulatory requirements	Grab/Composite
Total Phosphorus	In accordance with permit and regulatory requirements	Grab/Composite
Total Ammonia	In accordance with permit and regulatory requirements	Grab/Composite
Radionuclides	In accordance with permit and regulatory requirements	Grab/Composite
Total Nitrates/Nitrites	In accordance with permit and regulatory requirements	Grab/Composite
Metals	In accordance with permit and regulatory requirements	Grab/Composite

Notes:

¹ Site Stormwater monitoring locations, Cylinder Storage Pads Stormwater Retention Basins and any temporary basin(s) used during construction.

² Environmental screening criteria for all media are developed to reflect current regulatory and permitted values

9.4 REFERENCES

- NRC. 1994. "Final Environmental Impact Statement for the Construction and Operation of Claiborne Enrichment Center, Homer, Louisiana." *U.S. Nuclear Regulatory Commission* NUREG-1484 (Volume 1).
- NRC. 2010. "Monitoring and Reporting Radioactivity in Releases of Radioactive Materials in Liquid and Gaseous Effluent from Nuclear Fuel Processing and Fabrication Plants and Uranium Hexafluoride Production Plan." *U.S. Nuclear Regulatory Commission* Regulatory Guide 4.16 (Revision 2).
- NRC. 1991. "Off-site Dose Calculation Manual Guidance: Standard Radiological Effluent Controls for Boiling Water Reactors." *U.S. Nuclear Regulatory Commission* NUREG-1302.
- NRC. 2007. "Quality Assurance for Radiological Monitoring Programs (Normal Operations) – Effluent Streams and the Environment." *U.S. Nuclear Regulatory Commission* Regulatory Guide 4.15 (Revision 2).
- NRC. 2015. "Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility." *U.S. Nuclear Regulatory Commission* NUREG-1520 (Revision 2).
- OE. 2026. *Orano Enrichment USA LLC Enrichment Facility Environmental Report*. Environmental Report, Orano Enrichment USA LLC, U.S. Nuclear Regulatory Commission. <https://www.nrc.gov/docs/ML2603/ML26030A236.html>.