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9. ENVIRONMENTAL PROTECTION

9.1 ENVIRONMENTAL REPORT

GE-Hitachi Global Laser Enrichment LLC (GLE) personnel have prepared an Environmental Report (ER) (Ref. 9-1) which meets the requirements contained in 10 CFR 51, Subpart A, *National Environmental Policy Act—Regulations Implementing Section 102(2)* (Ref. 9-2). In particular, the ER addresses the requirements in 10 CFR 51.45(a)-(e), *Environmental Report* (Ref. 9-3), and follows the general format of NUREG-1748, *Environmental Review Guidance for Licensing Actions Associated with NMSS Programs* (Ref. 9-4). The ER presents the purpose and the applicable regulatory requirements of the GLE Commercial Facility (GLE ER Chapter 1), discusses alternatives (GLE ER Chapter 2), describes the facility and the affected environment (GLE ER Chapter 3), and discusses potential impacts of the proposed action (GLE ER Chapter 4). Mitigation measures are described in GLE ER Chapter 5, environmental measurements and monitoring programs are described in GLE ER Chapter 6, a cost-benefit analysis (CBA) is provided in GLE ER Chapter 7, and a summary of environmental consequences is contained in GLE ER Chapter 8. References are listed in GLE ER Chapters 9 and 10, respectively. Where applicable, this chapter of the license application (LA) refers to the ER in order to address the acceptance criteria contained in NUREG-1520, *Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility* (Ref. 9-5).

9.1.1 Date of Application

As required by 10 CFR 70.21(f), *Filing* (Ref. 9-6), the date of the GLE Commercial Facilities License Application is at least nine months prior to facility construction.

9.1.2 Environmental Considerations

The GLE ER addresses the requirements of 10 CFR 51.45(b) as discussed below.

9.1.2.1 Description of Proposed Action

The proposed action is the issuance of a U.S. Nuclear Regulatory Commission (NRC) specific license under 10 CFR 30, *Rules of General Applicability to Domestic Licensing of Byproduct Material* (Ref. 9-7), 10 CFR 40, *Domestic Licensing of Source Material* (Ref. 9-8), and 10 CFR 70, *Domestic Licensing of Special Nuclear Material* (Ref. 9-9), to possess and use byproduct material, source material, and special nuclear material (SNM); as well as to construct and operate an uranium enrichment facility in New Hanover County, North Carolina. The GLE Commercial Facility will be co-located on the Wilmington Site with the Global Nuclear Fuel – Americas, LLC (GNF-A) Fuel Manufacturing Operations (FMO) facility (License SNM-1097) and several other General Electric (GE)-owned facilities. The enriched uranium produced by the GLE Commercial Facility is intended primarily for use in commercial nuclear power plants.

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A description of the GLE Commercial Facility is contained in ER Chapter 1, *Introduction of the Environmental Report*, and Chapter 3, *Description of Affected Environment*. A complete description of the Wilmington Site, along with specific facility design and operating parameters, are also included. A discussion of the method utilized to process the source material (uranium hexafluoride [UF₆]) to produce uranium enriched in uranium-235 (²³⁵U) is described in ER Section 1.1 (this section also includes the proposed project schedule). Additional information regarding the proposed action, to include significant characteristics of the GLE Commercial Facility, associated outbuildings, and facility design/operating features, is contained in ER Section 2.1.2.1 and the Integrated Safety Analysis (ISA) Summary.

9.1.2.2 Purpose and Need for Proposed Action

The GLE ER Section 1.2, *Purpose and Need for the Proposed Action*, demonstrates the need for an additional uranium enrichment facility in the United States. The proposed action is intended to satisfy the need for an additional reliable and economical domestic source of enriched uranium supply, particularly as existing aging and less efficient production facilities cease operation. By supplying enrichment services to commercial nuclear power plants, the proposed GLE Commercial Facility will support the continued operation of existing nuclear power plants, and the future operation of proposed new plants.

9.1.2.3 Description of Affected Environment

GLE ER Chapter 3 contains a description of the affected environment. The chapter provides a baseline characterization of the GLE Site and its environs prior to any disturbances associated with construction, operation, or decommissioning of the facility. GLE ER Chapter 3 is arranged as follows:

- Regional, local and vicinity land use,
- Transportation,
- Geology and Soils,
- Water Resources,
- Ecological Resources,
- Meteorology, Climatology, and Air Quality,
- Noise,
- Historic and Cultural Resources,
- Visual/Scenic Resources,
- Socioeconomics,
- Public and Occupational Health, and
- Waste Management.

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Each subsection discusses the regional, local, and site conditions as they currently exist in order to establish a baseline. In GLE ER Chapter 4, *Summary of Environmental Impacts*, the baseline is then compared to deviations (impacts) arising from the construction, operation, and decommissioning of the GLE Commercial Facility. The information was gathered from Federal, State, and County sources along with onsite data. The information represents both seasonal and long-term environmental trends.

9.1.2.4 Discussion of Considerations

The following discussion summarizes the information in the GLE ER with respect to the environmental impacts from, and the alternatives to, the GLE Commercial Facility.

9.1.2.4.1 Impact of the Proposed Action on the Environment

In accordance with 10 CFR 51.45(b)(1), GLE ER Chapter 4 discusses the impact of the proposed action on the environment, with the impacts discussed in proportion to significance. Each subsection in GLE ER Chapter 3 has a corresponding section in GLE ER Chapter 4.

9.1.2.4.2 Adverse Environmental Effects

The adverse environmental effects are discussed in each subsection of GLE ER Chapter 4, as well as in GLE ER Chapter 8, *Summary of Environmental Consequences*. These sections satisfy the requirements in 10 CFR 51.45(b)(2). Three areas were identified as having moderate adverse environmental effects requiring mitigation. These include increased traffic on Castle Hayne Road, increased noise on and near the Wilmington Site during construction, and disruption of the wildlife habitat on the Wilmington Site during construction.

GLE ER Chapter 4 has an additional section that discusses Environmental Justice, a Federal policy under which each agency identifies and addresses disproportionately high and adverse human health or environmental effects of agency policies and activities on minority and low-income populations. No disproportionately high and adverse human health or environmental effects were identified.

9.1.2.4.3 Alternatives to the Proposed Action

GLE ER Chapter 2, *Alternatives*, discusses alternatives to the proposed action pursuant to Section 102(2)(E) of the National Environmental Policy Act (NEPA) (*Ref. 9-10*) and 10 CFR 51.45(b)(3). Environmental impacts of the proposal and alternatives, to include the no-action alternative, are presented in comparative form. A discussion of siting and design alternatives is also included.

9.1.2.4.4 Relationship Between Short-Term Uses and Long-Term Productivity

In accordance with 10 CFR 51.45(b)(4), Chapter 8 of the GLE ER discusses the relationship between local short-term uses of the environment and the maintenance and enhancement of long-term productivity from GLE Commercial Facility operation.

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GLE ER Chapter 7, *Cost Benefit Analysis*, contains a CBA that considers short-term and long-term benefits and costs of the GLE Commercial Facility in terms of both economic and environmental impacts. The short-term economic benefits include local jobs created and tax revenues to be generated by the GLE Commercial Facility. Economic costs include costs to GLE associated with site preparation, construction, operation, and decommissioning of the GLE Commercial Facility. The short-term environmental benefits of constructing and operating the GLE Commercial Facility include increased energy security in the United States, and energy generation with fewer emissions of criteria pollutants and carbon. The impacts to the environment which have been categorized as Moderate (sufficient to alter noticeably, but not to destabilize important attributes of a resource) and need mitigation, include increased traffic on Castle Hayne Road, increased noise on and near the Wilmington Site during construction, and disruption of wildlife habitat on the Wilmington Site during construction. No adverse impacts on the long-term productivity of the environment, after decommissioning of the facility, have been identified. GLE intends to decommission the facility for future use without restrictions.

9.1.2.4.5 Irreversible and Irrecoverable Commitments of Resources

In order to satisfy 10 CFR 51.45(b)(5), Chapter 8 of the GLE ER also discusses the irreversible and irretrievable commitments of resources necessary to construct, operate, and decommission the facility. No commitments of environmental resources at or in proximity to the Wilmington Site were identified for the construction, operation, and decommissioning of the GLE Commercial Facility that ultimately could not be restored (that is, become irretrievable) after facility closure and decommissioning for unrestricted use. The only irreversible result from the construction, operation, and decommissioning of the GLE Commercial Facility is land use resources at the offsite land disposal facilities used for the permanent disposal of wastes generated by the construction, operation, and decommissioning of the GLE Commercial Facility.

9.1.3 Analysis of Effects of Proposed Action and Alternatives

The analysis of the effects in regards to the proposed action and alternatives in accordance with 10 CFR 51.45(c) is discussed in the GLE ER Chapter 2. This discussion includes information about the environmental, economic, social, and other benefits and costs associated with the Proposed Action. Chapter 2 also provides an impact summary of the proposed action, to include cumulative effects. GLE ER Chapter 4 contains a description of impacts. GLE ER Chapter 7 discusses the economic and environmental cost and benefits of the Proposed Action.

The analysis presented in GLE ER Chapter 2 considered and balanced the environmental effects of the proposed action, the environmental impacts of alternatives to the proposed action, and alternatives available for reducing or avoiding adverse environmental effects. The analysis considered technology alternatives to the GLE laser-based technology, design alternatives and alternative site locations.

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9.1.4 Status of Compliance

Numerous Federal, State, County, and local government laws and regulations apply to the GLE Commercial Facility during construction, operation, and decommissioning. As required by 10 CFR 51.45(d), GLE ER Section 1.4, *Applicable Regulatory Requirements, Permits, and Required Consultations*, summarizes the applicable environmental regulatory requirements, permits, licenses, or approvals, as well as the current status of each, as of the effective date of the ER.

9.1.5 Adverse Information

In accordance with 10 CFR 51.45(b)(2) and (e), several sections in the GLE ER discuss adverse environmental effects. GLE ER Chapter 2 compares the potential impacts of the GLE Commercial Facility to the alternatives. GLE ER Chapter 4 details environmental and socioeconomic impacts due to site preparation/construction, operation, and decommissioning of the GLE Commercial Facility. GLE ER Chapter 5, *Mitigation Measures*, describes mitigation measures to minimize potential adverse impacts. Finally, GLE ER Chapter 8 provides a summary of the environmental consequences.

The majority of the impacts resulting from GLE Commercial Facility operation have been determined to be **Small** (defined as, environmental impacts from an action are not detectable or so minor they will neither destabilize nor noticeably alter any important attribute of an applicable environmental resource). Four of the impacts were determined to be **Moderate** (defined as, the environmental impacts from an action are sufficient to noticeably alter, but not destabilize, important attributes of a resource). The Moderate impacts are summarized below:

- Additional traffic volume on Castle Hayne Road and an increase in the potential for traffic congestion during peak commuting hours resulting from construction and operation activities,
- Temporarily generated short duration noises resulting from construction equipment, site preparation, and other activities typical of building construction sites,
- Removal of forested biotic communities would noticeably alter the composition of the habitat, but would not destabilize the existence of these communities, and
- Wildlife populations on the Wilmington Site would be altered; however, the existence of these species would not be destabilized.

Each of these impacts are controlled to the greatest extent possible through the use of mitigation measures and best management practices, described in Chapter 5 of the GLE ER.

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9.2 ENVIRONMENTAL PROTECTION MEASURES

GLE maintains an Environmental Protection Program for the GLE Commercial Facility, which builds on the existing Wilmington Site Environmental Protection Program. The primary purpose of the Environmental Protection Program is to ensure exposure of the workers, public, and environment to radioactive materials used in facility operations is kept as low as reasonably achievable (ALARA). This is accomplished through facility design, effluent controls, engineering controls, administrative controls, staff training and qualification, effluent and environmental monitoring, and best management practices. The Environmental Protection Program is consistent with the guidance contained in Regulatory Guide 8.37, *ALARA Levels for Effluents from Materials Facilities (Ref. 9-11)*.

The Environmental Protection Program has required training and qualifications for managers and staff commensurate with the responsibilities of their positions. The qualifications and responsibilities of the manager of the Environmental Protection function are described in GLE LA Chapter 2, *Organization and Administration*.

9.2.1 Radiation Safety

9.2.1.1 Radiological (ALARA) Goals for Effluent Control

Compliance and the ALARA concept are inherent in the GLE Environmental Protection Program in terms of comprehensive monitoring, analysis, and evaluation of air emissions, liquid effluents, and disposition of solid waste. Management controls, quality assurance (QA), and program implementation provide representative measurements of radioactivity in the highest potential exposure pathways, and accuracy verification of the Effluent Monitoring Program of the environmental exposure pathways. Trends are assessed using monitoring results to evaluate the following: (1) facility operations, in terms of “control-at-the-source” of contamination and the containment of radioactivity; (2) the projections of potential dose to offsite populations; and (3) the detection of any unanticipated pathways for the transport of radionuclides within the environment. Monitoring with periodic evaluations is summarized and presented to senior management on an annual basis. The ALARA and Radiation Protection (RP) Programs are described in GLE LA Chapter 4, *Radiation Protection*.

9.2.1.2 Effluent Controls to Maintain Public Doses ALARA

Effluent controls are used to maintain public doses ALARA. Air effluents are filtered through high-efficiency particulate air (HEPA) and/or high-efficiency gas absorption (HEGA) filters prior to release through the Operations Building Stack. GLE LA Section 4.6.1, *Ventilation and Containment*, describes the filtration system used to prevent the release of radioactive air effluents to the environment. The stack is sampled continuously to measure radioactivity of the exhaust air. GLE LA Section 9.2.2.2.2, *Monitoring*, describes the stack sampling and measurements.

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Liquid effluents are treated to remove uranium and fluoride prior to release to the environment. GLE LA Section 9.2.2.2.2 describes the Radioactive Liquid Effluent Treatment System (RLETS). RLETS is sampled throughout the process in order to determine the amount of uranium present in each step of the process. There are administrative controls in place to re-route the effluent through the treatment system if the uranium levels exceed the limit for a step in the process. In addition, tanks and pipes are fitted with automatic leak detection to prevent accidental spills. The final step in the treatment process involves sampling the treated effluent for total uranium and total fluorides prior to release to the GNF-A Final Process Lagoon Treatment Facility (FPLTF).

9.2.1.3 ALARA Reviews and Reports to Management

The Environmental Protection Program is reviewed as part of the annual ALARA review as described in GLE LA Section 4.2.6, *Review of ALARA Program*. This review includes analysis of trends in release concentrations, environmental monitoring data, and radionuclide usage; determines whether operational changes are needed to achieve the ALARA effluent goals; and evaluates designs for system installations or modifications. The results of the ALARA review are reported to senior management, along with recommendations for changes in facilities or procedures that are necessary to achieve ALARA goals.

9.2.1.4 Waste Minimization

The GLE Commercial Facility is designed and operated in accordance with 10 CFR 20.1406, *Minimization of Contamination (Ref. 9-12)*, to minimize contamination, facilitate eventual decommissioning, and minimize to the extent practicable the generation of radioactive waste. GLE LA Section 4.7.8, *Minimization of Contamination*, describes GLE waste minimization practices. The waste minimization practices during design and operation of the GLE Commercial Facility are consistent with the guidance in Regulatory Guide 4.21, *Minimization of Contamination and Radioactive Waste Generation: Life-Cycle Planning (Ref. 9-13)*.

9.2.2 Effluent and Environmental Controls and Monitoring

Effluent and environmental controls and monitors are maintained at and around the GLE Commercial Facility in order to ensure that doses to the workers, the public, and the environment remain ALARA. The Environmental Protection Program is consistent with the guidance contained in Regulatory Guide 4.16, *Monitoring and Reporting Radioactivity in Releases of Radioactive Materials in Liquid and Gaseous Effluents from Nuclear Fuel Processing and Fabrication Plants and Uranium Hexafluoride Production Plants (Ref. 9-14)*.

9.2.2.1 Effluent Monitoring

As described below, liquid, solid, and air effluents are monitored prior to release from the GLE Commercial Facility.

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9.2.2.1.1 Expected Concentrations

The expected concentrations of radioactive materials in airborne and liquid effluents were estimated using conservative assumptions. The concentrations are controlled to be ALARA and below the limits specified in 10 CFR 20, *Standards for Protection Against Radiation* (Ref. 9-15), Appendix B, Table 2.

9.2.2.1.2 Calculation of Total Effective Dose Equivalent

Dose projections to members of the public are performed monthly to ensure the annual dose to members of the public are kept ALARA (that is, does not exceed the regulatory limit of 0.1 mSv/yr [10 mrem/yr]) in accordance with approved written procedures. Compliance with the dose limits to members of the public is demonstrated through either the calculation of the total effective dose to the individual likely to receive the highest dose (as described in 10 CFR 20.1302(b)(1), *Compliance with Dose Limits for Individual Members of the Public* [Ref.9-16]); or through the calculation of annual average concentrations of radioactive material released in gaseous and liquid effluents (as described in 10 CFR 20.1302(b)(2)). The guidance in Regulatory Guide 4.20, *Constraint on Releases of Airborne Radioactive Materials to the Environment for Licensees Other than Power Reactors* (Ref. 9-17), is followed to determine compliance with dose limits to members of the public. Compliance with the dose limits to members of the public is reported to the NRC in the semi-annual effluent report as required by 10 CFR 70.59, *Effluent Monitoring Reporting Requirements* (Ref. 9-18).

If the monthly dose impact assessment indicates a trend in effluent releases, that if not corrected could cause the administrative limit to be exceeded, appropriate corrective action is initiated to reduce the discharges and ensure subsequent releases are in compliance with the annual dose constraint. In addition, an evaluation of the need for increased sampling is performed. Corrective actions may include, for example, source term investigation, HEPA and/or HEGA filter changeout, or operational modifications.

9.2.2.1.3 Effluent Discharge Locations

Figure 9-1, *Air Monitoring Locations*, shows the location of the Operations Building Stack and the air effluent discharge point. Figure 9-2, *Map of Wilmington Site Outfalls, Effluent Channel, and Process Lagoons*, shows the location of the liquid effluent discharges.

9.2.2.1.4 Continuous Sampling Airborne Effluents

The source of air emissions from the GLE Commercial Facility is from the Operations Building Stack (see Figure 9-1). The stack is sampled continuously to measure radioactivity of the exhaust air. The collection filter in the sample system is removed on a daily schedule during initial operation and analyzed for gross alpha activity. The periodicity of sampling will eventually decrease to weekly if the results are shown to be continually low during normal operations.

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9.2.2.1.5 Sample Collection and Analysis

Based on historical information available from the GNF-A FMO facility on the Wilmington Site, the Environmental Protection Program has established appropriate sample collection and analysis methods and frequencies for the effluent medium and the radionuclide(s) being sampled. Sampling methods ensure that representative samples are obtained using appropriate sampling equipment and sample collection and storage procedures. Monitoring instruments are calibrated at least annually, or more frequently if suggested by the manufacturer.

9.2.2.1.6 Radionuclide-Specific Analysis

Radionuclide-specific analyses are performed on selected composited samples (see Table 9-1, *Summary of the GLE Environmental Monitoring Program*). Monitoring reports in which the quantities of individual radionuclides are estimated on the basis of methods other than direct measurement include an explanation and justification of how the results were obtained.

Radionuclide analyses are performed more frequently than usual as follows: (1) at the beginning of the monitoring program until a predictable and consistent radionuclide composition in effluents is established; (2) whenever there is a significant, unexplained increase in gross radioactivity in effluents; and (3) whenever a process change or other circumstance may cause a significant variation in the radionuclide composition.

9.2.2.1.7 Minimum Detectable Concentrations

Minimum detectable concentrations (MDCs) for both effluent and environmental samples are listed in Table 9-2, *Summary of Minimum Detectable Concentrations for the GLE Environmental Monitoring Program*. The listed MDCs are typical for the analytical methods employed as previously established for the existing Wilmington Site Monitoring Program (see the GNF-A Wilmington Environmental Report Supplement [Ref. 9-19]).

9.2.2.1.8 Laboratory Quality Control

The laboratory quality control procedures are adequate to validate the analytical results. The procedures include the use of established standards such as those provided by the National Institute of Standards and Technology (NIST), as well as standard analytical procedures such as those established by the National Environmental Laboratory Accreditation Conference (NELAC).

9.2.2.1.9 Action Levels

The action level for environmental measurements is the concentration (or mass) of an analyte that indicates that some action needs to be taken, such as an investigation or, if the level is high enough, shut down of operations. Action levels are specified in approved written procedures according to the type of sample and the specific analysis. Such action levels provide guidance in assuring compliance within 10 CFR 20 limits.

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9.2.2.1.10 Federal and State Standards for Discharges

GLE has been issued an air permit from the North Carolina Division of Air Quality (NC DAQ) that contains the regulatory requirements for the emission of fluoride from the Operations Building Stack. The air permit also contains requirements for the operation of the diesel back-up generators.

Stormwater runoff from the GLE Commercial Facility is monitored in accordance with the National Pollutant Discharge Elimination System (NPDES) stormwater management permit issued by the North Carolina Division of Water Quality (NC DWQ).

The GNF-A NPDES industrial wastewater treatment permit regulates the monitoring and sampling for the release of treated process water to the environment because the GLE treated process water is pumped to the FPLTF prior to release to the environment. The composite samples are analyzed for uranium, gross alpha, gross beta, fluoride, ammonia, nitrite, nitrate, copper, nickel, chromium, silver, zinc, total suspended solids, cadmium, lead, nickel, phosphate, and biochemical oxygen demand (BOD) on a prescribed frequency based upon the NPDES permit.

9.2.2.1.11 Leakage Detection Systems

Leak detection systems are operated and maintained in areas where liquid effluents are processed. This includes leak detection on tanks, pipes, sumps, and drains to prevent unplanned releases to groundwater, surface water, and soil. The ISA Summary contains a description of the leak detection systems for the RLETS, Laboratory Area, and the Decontamination/Maintenance Area.

9.2.2.1.12 Releases to Sewer Systems

It is not anticipated that the GLE Commercial Facility will release liquid effluents to the sewer system. Drains from showers and handwash stations in contaminated area change rooms are routed to the RLETS. Sanitary effluents from the GLE Commercial Facility are pumped to the Wilmington Site Sanitary Wastewater Treatment Facility (WWTF).

9.2.2.1.13 Reporting procedures

Reporting procedures comply with the requirements of 10 CFR 70.59 and the guidance specified in Regulatory Guide 4.16. The semi-annual effluent report contains the concentrations of principal radionuclides released to unrestricted areas in liquid and gaseous effluents and includes the MDC for the analysis and the error for each data point.

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9.2.2.1.14 Waste Management procedures

Liquid effluents are treated to remove uranium and fluoride prior to their release to the environment. See GLE LA Section 9.2.2.2.2 for a description of the RLETS. The discharges from the RLETS are monitored and controlled to ensure that the uranium and fluoride concentrations in the FPLTF effluent are in compliance with the concentrations and mass limits stipulated in the NPDES permit, as well as in compliance with 10 CFR 20.1301, *Dose Limits for Individual Members of the Public (Ref. 9-20)*, and 10 CFR 20.1302 thereby meeting the NRC's unrestricted release limit. A description of liquid waste treatment and disposal is provided in the ISA Summary.

Solid waste management facilities, with sufficient capability to enable preparation, packaging, storage, and transfers to licensed disposal sites in accordance with the regulations, are provided and maintained in proper operating condition as required to support the operation of the facility. The ISA Summary contains a description of solid waste processing, packaging, and storage.

9.2.2.2 Environmental Monitoring

9.2.2.2.1 Background and Baseline Measurements

The Wilmington Site Environmental Protection Program has established historical data to provide information about the site environs. Prior to facility operations, soil and groundwater samples were collected from the GLE Commercial Facility location on the Wilmington Site and were analyzed to determine a baseline to be used in evaluating changes in potential environmental conditions caused by facility operation. Air and water samples are collected from remote locations in order to provide background data during operations.

9.2.2.2.2 Monitoring

Direct Radiation Monitoring

Direct radiation monitoring for the UF₆ Cylinder Pads and other outdoor storage areas is accomplished by use of thermo luminescent dosimeters (TLDs). In addition, RP Program procedures require periodic surveys to be performed in and around outdoor storage areas to ensure direct radiation doses are maintained ALARA. Environmental dosimeters are used at the fenceline to measure direct radiation readings.

Air Monitoring

Air emission control systems are designed and operated to assure compliance with regulatory requirements. Operations that could potentially exhaust radioactive materials have air emission controls that are monitored by representative stack sampling to demonstrate compliance with regulations. Samples are collected and analyzed to be representative of the discharges during operations. The ventilation and exhaust systems are described in GLE LA Chapter 4 and in the ISA Summary.

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In addition to stack monitoring, air monitoring for radioactive emissions occurs in proximity to the GLE Commercial Facility. A total of eleven (11) active air monitors are used for analysis of a weekly composite sample for gross alpha activity and concentrations of uranium isotopes. Nine monitors are placed around the restricted area fenceline of the GLE Site. These locations are shown on Figure 9-1 and are based on the predominant wind directions. Three of these monitors are placed at the fenceline to the south of the UF₆ Cylinder Pads and monitor for levels of radioactive material from the storage pads and the stack during periods when the wind is northerly (that is, wind blowing from the north). Three monitors are placed on the north and northeastern fenceline to monitor levels of radioactive materials during periods where the wind blows from its predominant southwesterly direction. One additional monitor is placed at the fenceline to the east of the UF₆ Cylinder Pads, and two additional monitors are placed at the fenceline on the western side of the GLE Site. Additionally, one monitor is placed on the Wilmington Site property boundary near the point of highest potential impact from the Operations Building Stack, as predicted by air dispersion modeling performed in the ER Section 4.6, *Air Quality Impacts*, using XOQDOQ. Air monitoring of the ambient levels of radioactive materials in the atmosphere is also performed. An active air monitor is placed approximately 0.5 miles (0.8 km) to the west-northwest of the Operations Building Stack. This location was chosen because it is located in the least-predominant downwind direction from the GLE Commercial Facility. It is also located along an existing access road to minimize environmental impacts associated with accessing the monitoring location. Figure 9-2 shows the location of the ambient air monitor in relation to the GLE Commercial Facility. The sampling program includes analysis of a weekly composite sample for gross alpha activity and concentrations of uranium isotopes.

Wastewater Effluent and Surface Water Monitoring

Radioactive liquid waste treatment in the GLE Commercial Facility consists of a system to remove uranium and fluoride. Uranium removal is accomplished through pH adjustment, followed by flocculation and filtration. Fluoride is removed through the addition of a salt to form a solid fluoride precipitate, followed by either filtration or evaporation. The final step in the treatment process involves sampling the treated effluent for total uranium and total fluorides just prior to release to the GNF-A FPLTF.

Treated effluent is routed to a pump station, which then pumps the effluent to the existing Wilmington Site FPLTF. The treated effluent is discharged from the FPLTF to the effluent channel via NPDES-permitted Outfall 001. The effluent channel flows to the unnamed Tributary No. 1 to the Northeast Cape Fear River. The discharges from the GLE RLETS are controlled to assure that the uranium and fluoride concentrations in the FPLTF effluent are in compliance with the concentrations and mass limits stipulated in the NPDES permit, as well as in compliance with 10 CFR 20.1301 and 20.1302, thereby meeting the NRC's unrestricted release limit. Continuous proportional samples of the treated process wastewater effluent are collected daily at the outfall (NPDES Outfall 001). The sampling program includes analysis of the daily composite samples for uranium content; analysis of a weekly composite of the daily samples for gross alpha activity and gross beta activity; and analysis of quarterly composites (prepared from the weekly composite samples) for ⁹⁹Tc.

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The GLE Monitoring Program includes the current GNF-A surface water monitoring activities. Gross alpha activity, gross beta activity, and uranium concentrations currently are monitored in the effluent channel; Northeast Cape Fear River near Castle Hayne, NC (upstream of the Wilmington Site); and Northeast Cape Fear River at the GE Dock (downstream of the Wilmington Site). These grab samples are taken on a monthly basis.

Groundwater Monitoring

The current GNF-A Radiological Groundwater Monitoring Program includes analysis of samples from a large number of wells across the Wilmington Site (See the GNF-A Wilmington Environmental Report Supplement). Thirteen additional monitoring wells are constructed around the GLE Commercial Facility, and these wells and the eight existing wells within the GLE Commercial Facility are added to the sampling protocol as part of the expanded monitoring program. These 21 wells are positioned in seven clusters, with three wells installed at different depths per cluster. Wells with an A-suffix identification are the shallowest wells, completed within the Surficial Aquifer at or just below the water table. Wells with B- and C-suffix identifications are progressively deeper wells, completed at horizons corresponding to the upper portion of the Principal (Peedee) Aquifer and intermediate depths of the Principal Aquifer, respectively. These well locations, shown on Figure 9-3, *Groundwater Monitoring Locations*, are west of the western extent of the less-permeable clay semiconfining layer (see ER Section 3.4.1.1.2.2, *Semiconfining Layer*); therefore, the Surficial and Principal aquifers serve hydraulically as one unit across the portion of the GLE Site that is monitored.

Initially, samples are collected quarterly from the 21 GLE monitoring network wells for analysis of uranium. If the validated uranium analytical result exceeds 0.02 mg/L, the subsequent quarterly sample from that well is also analyzed for gross alpha activity and gross beta activity. The monitoring frequency for each well is reviewed and potentially adjusted after a sufficient dataset is developed to perform statistically valid trend analyses.

Soil Monitoring

Figure 9-4, *Soil Sampling Locations*, shows the GLE soil sampling locations that were established considering the location of the Operations Building Stack and the prevailing wind directions. The soil-sampling procedures established for the existing GNF-A Soil Monitoring Program apply to the expanded monitoring program. The soil samples are collected using decontaminated hand-sampling tools from the upper four inches and are analyzed for uranium concentrations.

Sediment Monitoring

As part of the existing GNF-A Environmental Monitoring Program, sediment samples are collected semiannually in the effluent channel downstream from the final process basins (See the GNF-A Wilmington Environmental Report Supplement). Since the GLE Commercial Facility is contributing to the flow into these process basins, but not creating any new outfalls, the current sediment sampling locations are sufficient. The sediment sampling procedures established for the existing GNF-A Sediment Monitoring Program will continue, and sediment samples are collected and analyzed annually for uranium.

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Stormwater Monitoring

Stormwater runoff from the GLE Commercial Facility is monitored in accordance with the NPDES permit issued by the NC DWQ.

9.2.2.2.3 Sampling Location, Frequency, and Analysis

Table 9-1 contains a summary of the Environmental Monitoring Program. The table includes the sample medium, sampling location, sample type, sample analyte, and the sample frequency.

9.2.2.2.4 Analytical Methods and Instrumentation

Appropriate sampling and analytical methods were selected based on their sensitivity and reliability to support application of the action levels.

9.2.2.2.5 Action Levels

The action level for environmental measurements (effluent and other measurements) is the concentration (or mass) of an analyte that indicates some action needs to be taken, such as an investigation or, if the level is high enough, shut down of operations. Action levels are specified in approved written procedures according to the type of sample and the specific analysis. Such action levels provide guidance in assuring compliance within 10 CFR 20 limits.

9.2.2.2.6 Minimum Detectable Concentration

MDCs for both effluent and environmental samples are listed in Table 9-2. The listed MDCs are typical for the analytical methods employed, as established for the existing Wilmington Site Monitoring Program (see the GNF-A Wilmington Environmental Report Supplement).

9.2.2.2.7 Data Analysis

As specified in approved written procedures, data analysis methods and criteria used in evaluating and reporting the environmental sampling results are appropriate and indicate when an action level is being approached in time to take corrective actions.

9.2.2.2.8 Federal, State and Local requirements

The Federal, State, and local requirements for environmental monitoring are followed in accordance with the licenses and permits described in GLE LA Section 9.2.2.1, *Effluent Monitoring*.

9.2.2.2.9 Impacts Assessment

Data from the Environmental Monitoring Program can be used to assess impacts to the environment from potential radioactive and nonradioactive releases.

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9.2.3 Integrated Safety Analysis

The GLE Project has established and maintains a safety program demonstrating compliance with the performance requirements of 10 CFR 70.61, *Performance Requirements (Ref. 9-21)*. The safety program utilizes approved written procedures for performing an ISA that contains the appropriate level of detail for the complexity of each process. The program applies graded management measures commensurate with the reduction of the risk attributable to the item.

GLE has prepared an ISA in accordance with 10 CFR 70.60, *Applicability (Ref. 9-22)*, which includes the evaluation of high and intermediate consequence events involving releases of radioactive material to the environment. The ISA process is described in GLE LA Chapter 3, *Integrated Safety Analysis*.

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9.3 REFERENCES

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- 9-4. NUREG-1748, *Environmental Review Guidance for Licensing Actions Associated with NMSS Programs*, U.S. Nuclear Regulatory Commission, August 2003.
- 9-5. NUREG-1520, *Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility*, U.S. Nuclear Regulatory Commission, March 2002.
- 9-6. 10 CFR 70.21, *Filing*, U.S. Nuclear Regulatory Commission, 2008.
- 9-7. 10 CFR 30, *Rules of General Applicability to Domestic Licensing of Byproduct Material*, U.S. Nuclear Regulatory Commission, 2008.
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- 9-10. National Environmental Policy Act of 1969, as amended.
- 9-11. Regulatory Guide 8.37, *ALARA Levels for Effluents from Materials Facilities*, U.S. Nuclear Regulatory Commission, July 1993.
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- 9-13. Regulatory Guide 4.21, *Minimization of Contamination and Radioactive Waste Generation: Life-Cycle Planning*, U.S. Nuclear Regulatory Commission, June 2008.
- 9-14. Regulatory Guide 4.16, *Monitoring and Reporting Radioactivity in Releases of Radioactive Materials in Liquid and Gaseous Effluents from Nuclear Fuel Processing and Fabrication Plants and Uranium Hexafluoride Production Plants*, U.S. Nuclear Regulatory Commission, Revision 1, December 1985.
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- 9-16. 10 CFR 20.1302, *Compliance with Dose Limits for Individual Members of the Public*, U.S. Nuclear Regulatory Commission, 2008.

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- 9-17. Regulatory Guide 4.20, *Constraint on Releases of Airborne Radioactive Materials to the Environment for Licensees Other than Power Reactors*, U.S. Nuclear Regulatory Commission, December 1996.
- 9-18. 10 CFR 70.59, *Effluent Monitoring Reporting Requirements*, U.S. Nuclear Regulatory Commission, 2008.
- 9-19. GNF-A Wilmington Environmental Report Supplement, *Site Environmental Report Supplement for the Period 1995-2005*, Global Nuclear Fuel-Americas, LLC, March 2007.
- 9-20. 10 CFR 20.1301, *Dose Limits for Individual Members of the Public*, U.S. Nuclear Regulatory Commission, 2008.
- 9-21. 10 CFR 70.61, *Performance Requirements*, U.S. Nuclear Regulatory Commission, 2008.
- 9-22. 10 CFR 70.60, *Applicability*, U.S. Nuclear Regulatory Commission, 2008.

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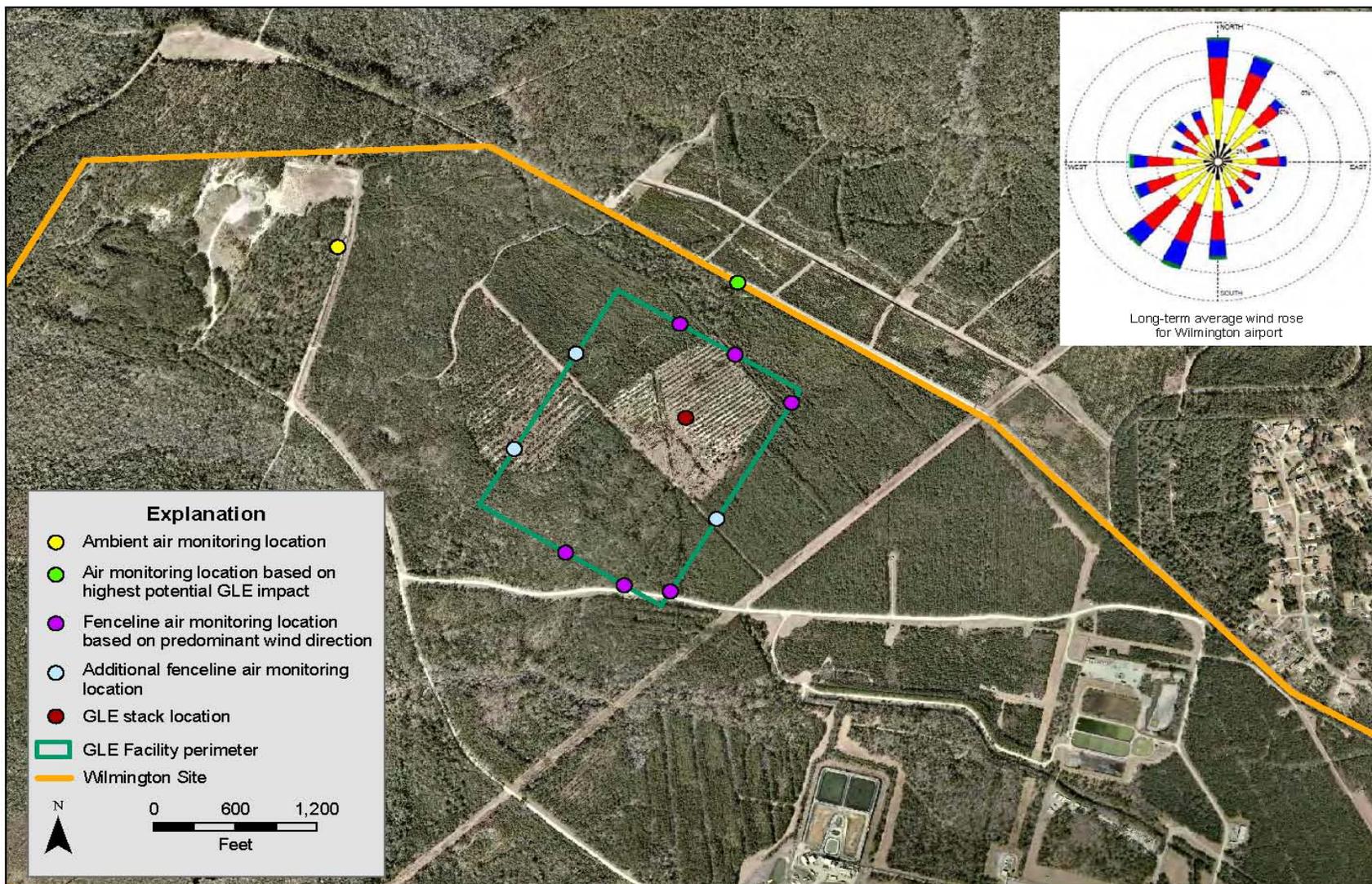
Table 9-1. Summary of GLE Environmental Monitoring Program.

Medium	Sample Locations	Sample Type	Analyte/Parameter Frequency
Direct Radiation	Fenceline	TLDs and environmental dosimeters	Gamma and neutron activity
	Outdoor storage areas	TLDs and environmental dosimeters	Gamma and neutron activity
Air	GLE operations building stack	Continuous air particulate filter	Gross alpha activity – Weekly Gross beta activity – Weekly Fluoride – Weekly
	GLE facility perimeter, site boundary point of highest potential impact, and background	Continuous air particulate filter	Gross alpha activity – Weekly Gross beta activity - Weekly
Surface water	Site dam	Grab sample	Gross alpha/beta activities – Monthly Total uranium – Monthly
Treated process wastewater effluent	NPDES outfall 001	Continuous proportional sample of liquid effluent	Total uranium – Daily composite Gross alpha/beta activities – Weekly composite ⁹⁹ Tc – 6-month composite NPDES permit requirements
Groundwater	21 monitoring wells	Grab sample after typical 3-well purge	Total uranium – Quarterly Gross alpha/beta activities – Only if total uranium concentration in previous sample >0.02 mg/L Fluoride – Quarterly
Stormwater	Detention ponds	Grab sample	NPDES permit requirements
Soil	See Figure 9-4	Shallow soil grab sample	Total uranium – semi-annual
Sediment	Above site dam	Sediment grab sample	Total uranium - annual

**Table 9-2. Summary of Minimum Detectable Concentrations for the
GLE Environmental Monitoring Program.**

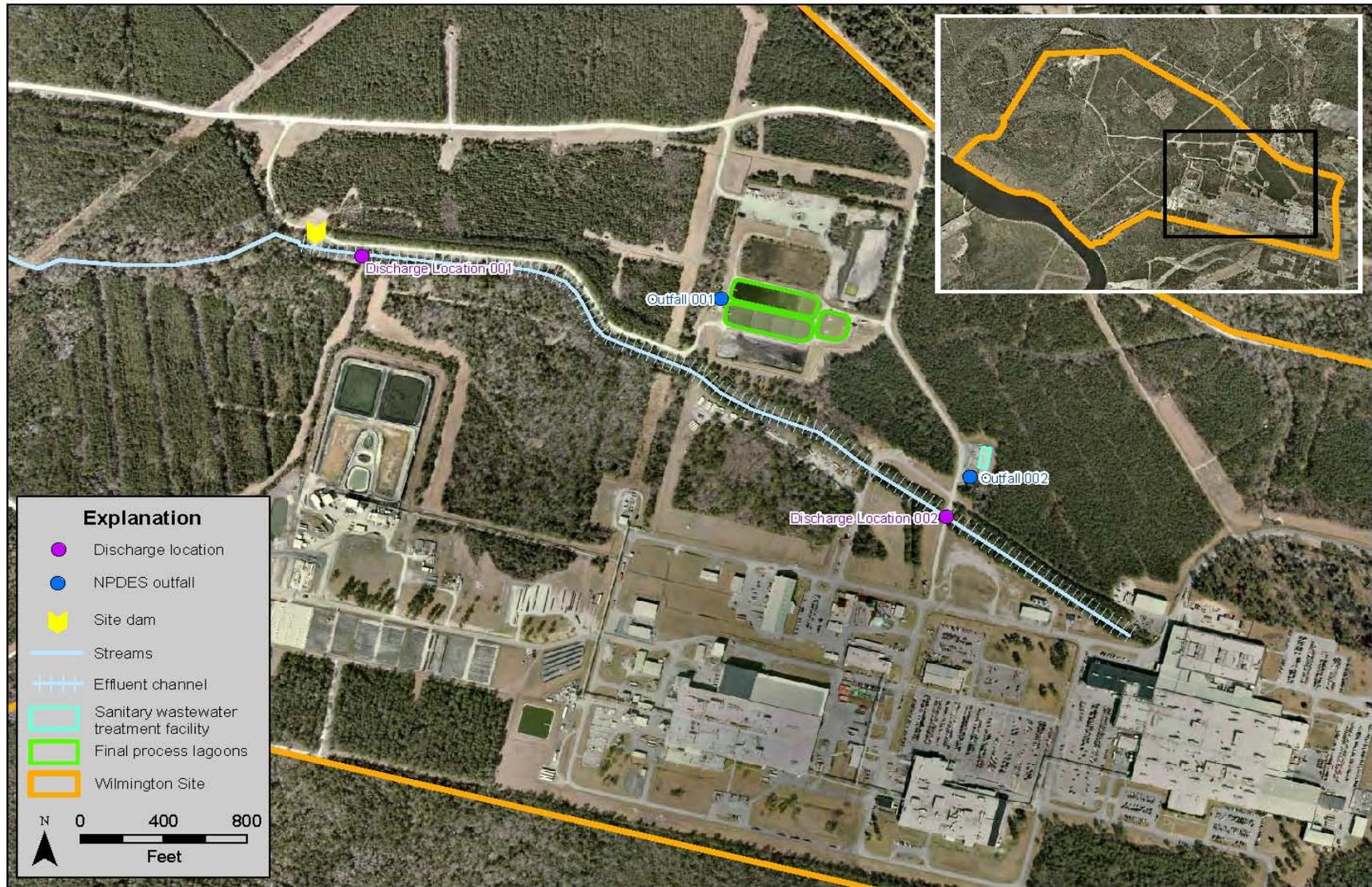
Medium	Gross Alpha Activity	Typical Minimum Detectable Concentrations for Radiological Environmental Monitoring Program
Air (particulate filter) - Stack	Gross beta activity	20 picocuries per liter (pCi/L)
	Gross alpha activity	1.0×10^{-12} microcuries per milliliter ($\mu\text{Ci/mL}$)
Air (particulate filter) – At access area fence line, Site boundary point of highest potential impact, and ambient (background)	Gross alpha activity	1.0×10^{-12} $\mu\text{Ci/mL}$
	Gross beta activity	20 pCi/L
Surface Water	Total uranium	0.02 parts per million (ppm)
	Gross alpha activity	5 pCi/L
	Gross beta activity	20 pCi/L
Treated process wastewater effluent	Total uranium	0.02 ppm
	Gross alpha activity	3.0×10^{-8} $\mu\text{Ci/mL}$
	Gross beta activity	5.0×10^{-8} $\mu\text{Ci/mL}$
	^{99}Tc	20 pCi/L
Groundwater	Total uranium	0.02 ppm
	Gross alpha activity	20 pCi/L
	Gross beta activity	5 pCi/L
Soil	Total uranium	0.02 ppm
Sediment	Total uranium	0.02 ppm

Figure 9-1. Air Monitoring Locations.



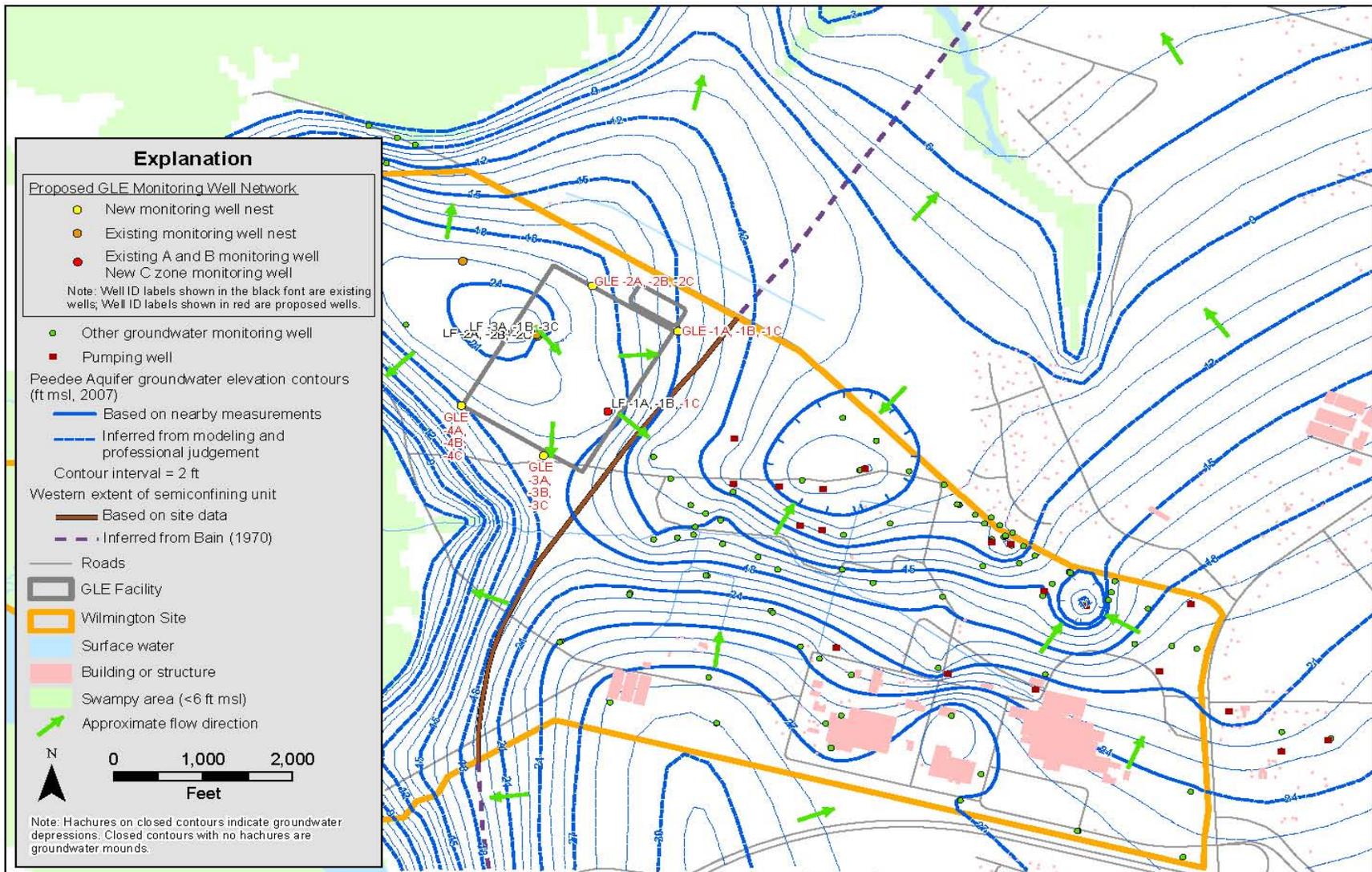
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Figure 9-2. Map of Wilmington Site Outfalls, Effluent Channel, and Process Lagoons.



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Figure 9-3. Groundwater Monitoring Locations.



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Figure 9-4. Soil Sampling Locations.



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