GLE Environmental Report

Chapter 5 – Mitigation Measures

Revision 0

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Table of Contents

5. Mitigation Measures

Mitigation measures are those actions or processes that would be implemented to avoid or minimize the magnitude of the impact of the Proposed Action on the affected environment, rectify (i.e., repair, rehabilitate, or restore) the affected environment, or compensate for the impact by providing substitute resources or environments (40 Code of Federal Regulations [CFR] 1508.20, *Mitigation*). This chapter of this Environmental Report summarizes the proposed mitigation measures to reduce potential, adverse impacts (see **Chapter 4** of this Report, *Environmental Impacts*) that could result from the construction, operation, and decommissioning of the Proposed GLE Facility. This does not preclude additional mitigation measures that may be implemented by GLE based upon its consultations with regulatory agencies. Residual adverse impacts that would remain after implementation of mitigation measures are anticipated to be SMALL, such that no analyses above and beyond those presented in **Chapter 4** are necessary.

5.1 Land Use

The land use impacts of the Proposed GLE Facility would be SMALL given that the Facility would be constructed and operated on a General Electric Company (GE)–owned land parcel that is currently zoned I-2 and used for Heavy Industrial land use. Measures that have been used in, or could be considered for incorporation into, the Facility layout and design to mitigate land use impacts resulting from the Proposed GLE Facility include the following:

- Selection of a non-wetlands, non-floodplain area for the Proposed GLE Facility at the Wilmington Site
- Use of existing service road routes and utility right-of-ways at the Wilmington Site to the fullest extent practicable for the Proposed GLE Facility to minimize the need for clearing additional wooded areas and additional wetlands crossings at the Wilmington Site
- Use of the existing wastewater treatment and solid waste management infrastructure at the Wilmington Site to the fullest extent practicable for the Proposed GLE Facility to reduce the total area needed for construction and operation of the Facility.

5.2 Transportation

The transportation impacts from construction, operation, and decommissioning of the Proposed GLE Facility would be incremental increases in truck and automobile traffic on major roadways in the vicinity of the Wilmington Site. These increases are expected to have a MODERATE impact on local traffic volumes and patterns on N.C. Highway 133 (NC 133, also known as Castle Hayne Road and, previously, U.S. Highway 117) during construction and operation, but regionally, these impacts to roadways in the vicinity of the Proposed GLE Facility would be SMALL. Examples of measures that would be used, or could be considered, to mitigate the motor vehicle traffic impacts on NC 133 (Castle Hayne Road), U.S. Interstate Highway 140 (I-140), and connecting roadways during the construction, operation, and decommissioning of the Proposed GLE Facility include the following:

- Locating the Proposed GLE Facility near an interstate highway interchange to minimize the distance that truck traffic to and from the Facility must travel on local surface streets and to facilitate GLE employee commuter traffic. This mitigation measure was accomplished through the selection of the Wilmington Site for the Proposed Action.
- Increasing the number of entry gates onto the Wilmington Site property from NC 133 (Castle Hayne Road). This mitigation measure is incorporated into the Proposed GLE Facility design with the addition of a third entrance from NC 133 (Castle Hayne Road) dedicated to only worker

and truck traffic for the Proposed GLE Facility construction, operation, and decommissioning phases.

- Adding roadway improvements (e.g., a turn lane) to NC 133 (Castle Hayne Road) as required by the North Carolina Department of Transportation (NC DOT) for issuance of a driveway permit for connections of the new dedicated Wilmington Site entrance for the Proposed GLE Facility. GLE and NC DOT are evaluating driveway- and roadway-improvement options to minimize impacts from the Proposed Action.
- Scheduling worker shift intervals for Proposed GLE Facility operations so that the shift beginning and end times will be staggered from peak periods of worker-commuting traffic for the existing Wilmington Site facilities and other planned operations at the Wilmington Site.
- Routing truck shipments of radioactive materials per U.S. Department of Transportation hazardous material transport regulations in 49 CFR Part 173 (*Shippers – General Requirements for Shipments and Packagings*) by using a U.S. Interstate Highway System bypass or beltway around a city when available. The Proposed GLE Facility will be located adjacent to an interchange with I-140, which should allow the radioactive materials truck shipments to and from the Facility to bypass traveling on surface roadways in the city of Wilmington area given the likely origins and destinations of these shipments. I-140 connects directly to U.S. Interstate Highway 40, thereby providing continuous interstate highway access from the Proposed GLE Facility to locations throughout the United States.
- Scheduling truck deliveries to, and shipments from, the Proposed GLE Facility for off-peak traffic periods to reduce potential congestion on local roadways during peak worker commuting periods.
- Encouraging carpooling for construction workers and GLE employees commuting to the Proposed GLE Facility.

5.3 Geology and Soils

During construction, a short-term increase in soil erosion would occur. These SMALL impacts would be mitigated by following proper construction best management practices (BMPs) to control soil and sediment erosion, as specified in the *New Hanover County Erosion and Sedimentation Control Ordinance* (New Hanover County, 2007). BMPs could include, but would not be limited to, the following:

- Minimizing the construction footprint to the extent possible
- Engineering design plans that minimize soil disturbance during construction activities
- Using soils from on-site borrow pits, if such additional soil is necessary for construction purposes, that are accessible via existing roadbeds to minimize disturbance to other areas of the Site outside of the GLE Study Area
- Managing construction activities so that only designated areas within the GLE Study Area are disturbed and so that no heavy equipment or construction operations are allowed to affect areas outside of the GLE Study Area unless specifically designated, such as potential use of existing on-site borrow areas
- Using adequate containment methods during excavation and/or similar operations
- Using site-stabilization practices (i.e., placing crushed stone on top of disturbed soil in areas of concentrated runoff)
- Using silt berms, dikes, and sediment fences
- Stabilizing drainage culverts and ditches by lining surface with rock aggregate/rip-rap to reduce flow velocity and prohibit scouring

- Re-using and/or appropriately placing excavated materials to decrease exposed soil piles
- Placing gravel construction pads at the entrances/exits of construction acres.

Additional discussion of erosion and sedimentation control measures is provided in **Section 5.4.2**. After construction is complete, the GLE Facility site would be stabilized with low-maintenance landscaping and pavement.

Geological resources that may exert an impact on the Proposed Action (e.g., potential response of deeper subsurface unconsolidated deposits to regional seismic events) were evaluated in **Section 4.3** of this Report (*Soils and Geological Impacts*). Potential impacts from geological conditions on the Proposed GLE Facility are expected to be SMALL and would be limited within the GLE Study Area. Generally favorable engineering conditions were encountered across the GLE Study Area, with only one localized zone with liquefaction potential that would be mitigated. Because the GLE Study Area is designated as a seismic Site Class C (a classification designating a lower liquefaction potential), and because the GLE Facility site sands have average percent fines of 30% (increasing the resistance to any liquefaction forces), the sands have a low overall potential for soil liquefaction. Control of the low liquefaction potential may be completed through the use of deep foundations or through engineering methods, such as earthquake drains. These structures are injected into the area of potential liquefaction in the subsurface to prevent the build up of pore-water pressure within the zone, which could cause liquefaction during an earthquake event. Other similar engineering methods may be investigated based on the final subsurface investigation and final site design.

5.4 Water Resources

5.4.1 Groundwater

As stated in **Section 4.4** of this Report (*Water Resource Impacts*), no adverse subsidence, groundwater recovery, or groundwater quantity impacts are anticipated during construction, operations, or decommissioning of the Proposed GLE Facility. Impacts to groundwater quality during the construction, operation, and decommissioning phases are anticipated to be SMALL and most likely would be due to the potential for accidental release of hazardous constituents. These impacts would be mitigated through implementation of proper hazardous material and waste-handling procedures and secondary containment, as required by applicable laws and regulations.

Groundwater levels are not anticipated to change significantly in response to the increased pumping required for the Proposed Action. No significant impact on the effectiveness of the existing on-site pumping well system to protect off-site groundwater users from existing on-site impacted groundwater is anticipated. Site-wide groundwater levels would continue to be monitored routinely, and the groundwater monitoring-well and pumping-well networks would continue to be analyzed to confirm that the changes in groundwater levels associated with the Proposed Action are minimal. Unexpected changes would be mitigated by re-adjusting pumping well rates and/or performing well maintenance or rehabilitation procedures, as appropriate, to optimize the effectiveness of the on-site pumping well system.

5.4.2 Surface Waters

Construction of the Proposed GLE Facility would not directly impact any surface waters; however, the installation of the proposed North access road crossing would impact Unnamed Tributary #1 to Prince George Creek and modification of the existing stream crossing of the proposed South access road would impact Unnamed Tributary #1 to Northeast Cape Fear River. Indirect impacts to receiving waters, such as increased sediment and accidental releases to stormwater runoff, could occur during GLE Facility site preparation and construction. These SMALL impacts would be prevented and minimized to the extent possible by following proper construction BMPs, as specified by the *New Hanover County Erosion and*

Sedimentation Control Ordinance (New Hanover County, 2007). Impacts that could not be avoided during site preparation and construction would be minimized using measures such as the following:

- Constructing an access road perpendicular to the stream to minimize the area impacted
- Limiting cut/fill slopes to a horizontal-vertical ratio of three to one or less
- Using silt fencing and covering of soil stockpiles to prevent sediment runoff
- Suspending general construction activities during storms and impending precipitation
- Constructing stream crossings (i.e., installation of culverts) following at least 48 hours of dry weather
- Diverting stream flow during stream crossing construction to minimize excavation in flowing water
- Maintaining construction equipment so that equipment is in good repair and without visible leaks of oil, greases, or hydraulic fluids
- Restoring disturbed areas to original surface elevations where possible.

SMALL impacts to surface waters during Facility operation may potentially occur from constituents in stormwater runoff from the Site, treated process wastewater effluent, and treated sanitary wastewater effluent. All National Pollutant Discharge Elimination System (NPDES) stormwater and wastewater permit requirements would continue to be met. In addition, BMPs would be employed to minimize any impacts to surface waters from the Proposed Action. Mitigation measures to minimize any impacts include, but are not limited to, the following:

- Routing stormwater from the Proposed GLE Facility to a new stormwater wet detention basin, designed in accordance with the North Carolina Department of Environment and Natural Resources (NCDENR) *Stormwater Best Management Practices Manual.*
- Performing on-site treatment of process and sanitary wastewaters to NPDES-permit limits before discharge to receiving waters (see **Section 5.12** for additional information).
- Monitoring and inspecting on-site liquid waste storage tanks and containers on a periodic schedule to detect any leaks or releases to the environment due to equipment malfunctions to ensure that actions according to the Facility's Spill Prevention Control and Countermeasure (SPCC) plan or other appropriate corrective action can be taken promptly.
- Discharging stormwater runoff from the uranium hexafluoride (UF_6) storage pads area to a holding pond for monitoring prior to being discharged to the stormwater wet detention basin.
- Performing periodic visual inspections of the stormwater wet detention basin to verify proper functioning of the basin. Visual inspections would be performed at a frequency that is sufficient to allow for identification of basin high-water-level conditions and for implementation of corrective actions to restore the water level of the associated basin(s) prior to overflowing.
- Ensuring easy access to the stormwater wet detention basin to allow the prompt, systematic sampling of runoff.

Impacts during decommissioning would be mitigated as required by mitigation measures similar to those required for site preparation and construction. In addition, contaminated solutions generated from Proposed GLE Facility decontamination activities would be contained for appropriate treatment, including radioactive-contaminated solutions being pre-treated in the GLE liquid effluent treatment system before being pumped to the existing NPDES-permitted Wilmington Site final process lagoon facility.

5.4.3 Floodplains

Impact to the floodplain boundary from the upgrade of the stream crossing of the exiting service road within the South Road portion of the GLE Study Area over Unnamed Tributary #1 to Northeast Cape Fear River would be SMALL. The upgrade of this crossing would be designed and constructed following the procedures required by the New Hanover County Flood Damage Prevention Ordinance. The new crossing would be designed to meet or exceed current flow capacity; therefore, no rise to the 100-year or 500-year floodwaters would be anticipated. No other direct modification to the boundaries of the floodplains are anticipated during construction, operation, or decommissioning of the Proposed GLE Facility. Minor changes in floodwater volume and flow during extreme storm events are anticipated; however, these impacts would be mitigated by the natural buffering capacity of the Swamp Forest on the border of the Northeast Cape Fear River system into which the stormwater would discharge. No residual effects are expected from these SMALL impacts. In addition, the implementation of a stormwater wet detention basin (see **Section 5.4.2**) and the Wilmington Site stormwater management plan would mitigate a portion of the increased floodwaters from the extreme storm events and all stormwater from smaller storm events on the Site. These measures are discussed in **Section 5.4.2**.

5.4.4 Wetlands

Construction of the Proposed GLE Facility would not directly impact any wetlands, and indirect impacts to wetlands receiving runoff from the GLE Facility site during site preparation, construction, and operation would be SMALL. The proposed North access road would cross two jurisdictional wetland areas and potentially impact two isolated wetlands; however, direct and indirect impacts to these wetlands would be SMALL. No direct impacts would be anticipated to occur to jurisdictional wetland areas located within the South Road portion of the GLE Study Area; however, final impacts would be determined based on the final engineering design, and applicable permits would be obtained prior to site preparation and construction. Indirect impacts to these wetlands would be SMALL. Avoidance and minimization of wetland impacts was considered in establishing the GLE Study Area boundaries. During construction, wetlands impacts that could not be totally avoided would be minimized using the following measures:

- Construction of an access road perpendicular to the wetland to minimize the area impacted
- Limiting cut/fill slopes to a horizontal-vertical ratio of three to one or less
- Avoiding temporary storage of materials in wetlands during construction
- Maintaining the hydrological connectivity of the wetlands to surface waters
- Placing fencing/barriers and using signs around wetland areas
- Using silt fencing and covering soil stockpiles to prevent sediment runoff
- Restoring disturbed areas to original surface elevations
- Re-vegetating disturbed areas with native plant species.

Direct impacts to wetlands that can not be avoided must be compensated for by restoration, creation, enhancement, or preservation of wetlands similar to those impacted. The following compensatory mitigation methods are available in North Carolina: implementation of on-site mitigation, purchase of mitigation credits from a private mitigation bank, or participation in the North Carolina Ecosystem Enhancement Program’s (NCEEP) In-Lieu Fee Program. The first option, on-site mitigation, generally consists of restoration, creation, enhancement, or preservation of wetlands that are similar to those impacted and are located on or near the GLE Facility site. For the second option, mitigation credits may be purchased from banks that have been approved by the interagency Mitigation Bank Review Team. The bank sponsor is responsible for the operation and maintenance of the bank, as well as its long-term management and ecological success. The third option is the In-Lieu Fee Program, which is administered by the NCEEP. The NCEEP was created to provide a stream-lined approach to address compensatory mitigation requirements associated with Section 401 and 404 permits issued by the N.C. Division of Water Quality and U.S. Army Corps of Engineers, respectively. Permittees voluntarily request to participate in the In-Lieu Fee Program. Upon acceptance by the regulatory agencies and the NCEEP, the applicant makes a payment based on the NCEEP's schedule of fees to satisfy the mitigation requirements. The mitigation requirement is then transferred to the NCEEP (NCEEP, 2008; USACE, 2008).

Upon completion of construction of the GLE Facility site, proposed access roads, and stormwater management facilities, the daily operations of the Proposed GLE Facility and the decommissioning of the Facility are not anticipated to result in additional adverse impacts to wetlands.

5.4.5 Water Use

As described in **Section 4.4.5** of this Report (*Water Use*), impacts to the regional groundwater system during the construction, operation, or decommissioning of the Proposed GLE Facility are anticipated to be SMALL. Additionally, no impacts are anticipated to surface water-oriented water users (e.g., fishing, navigation). During construction, water would be provided via tanker truck from off-site potable water sources.

During operation, groundwater levels are not anticipated to change significantly in response to the increased water supply required for the Proposed Action. The existing Wilmington Site groundwater pumping-well system was historically able to provide volumes of water considerably greater than the volumes projected to be required for the Proposed Action without significant adverse impacts. One measure that will significantly mitigate the increased water demand required for the Proposed Action and the other planned new Wilmington Site facilities described in **Section 2.3** of this Report (*Cumulative Effects*) is the planned reuse of the Wilmington Site's treated sanitary wastewater effluent as make-up water in Wilmington Site cooling towers. Because the treated sanitary wastewater effluent has such low hardness, its addition to the Wilmington Site cooling towers increases efficiencies, and each gallon of re-use water introduced into a cooling tower offsets two gallons of process make-up water. Therefore, the volume of treated sanitary wastewater to be re-used as make-up water in cooling towers is anticipated to offset more than the additional volume of groundwater required to meet the process-water demands of the Proposed GLE Facility and the other new Wilmington Site facilities described in **Section 2.3**. In addition, however, techniques to conserve water resources would be implemented when possible to further reduce the impact. Techniques include, but would not be limited to, the following:

- Using low-water-consumption landscaping
- Installing low-flow toilets, sinks, and showers
- Performing localized floor washing using mops and self-contained cleaning machines to reduce water usage compared to conventional washing techniques.

Water use during decommissioning would be significantly lower than water use during the operations phase; therefore, no adverse impacts are anticipated, and additional mitigation would not be required.

During the construction, operation, and decommissioning phases of the Proposed Action, the Wilmington Site pumping well system would continue to be closely maintained and monitored for proper operation and minimal impact to the water resource. Groundwater levels throughout the Site would continue to be measured and analyzed to understand the influence of groundwater withdrawals on groundwater elevations and flow patterns. These activities would continue with a focus on confirming that changes in groundwater levels associated with the Proposed Action are as small as predicted, thus confirming minimal impacts to nearby groundwater users and the long-term sustainability of the groundwater resource. Unexpected changes would be mitigated by re-adjusting pumping well rates and/or performing well maintenance or rehabilitation procedures, as appropriate, to optimize the efficiency of the on-site pumping well system while minimizing off-site water-level declines.

5.5 Ecological Resources

The construction, operation, and decommissioning of the Proposed GLE Facility would result in MODERATE impacts to existing vegetation and local fauna; however, no federally protected species would likely be adversely affected by the Proposed Action. Mitigation measures would be in place to prevent and minimize the potential impacts on ecological resources. In addition to the previously mentioned BMPs and Site stormwater management plan listed in **Section 5.4.2**, potential ecological resources mitigation measures could include, but are not limited to, the following:

- Minimizing the construction footprint to the extent possible.
- Performing surveys of trees greater than 24 inches (61 centimeters [cm]) in diameter before beginning GLE Facility site preparation and construction activities. The impacts to each tree would be mitigated by the planting of one 24-inch (61-cm) diameter tree, two 12-inch (30.5-cm) diameter trees, or three 8-inch (20.3-cm) diameter trees elsewhere on the Wilmington Site.
- Restricting site preparation and the harvesting of trees to periods when the ground is dry.
- If trenches are necessary during construction, ensuring that trenches are closed overnight; trenches that are left open overnight would be inspected and animals removed prior to backfilling. In addition, escape ramps placed at less than 45-degree angles in trenches would provide exit strategies for animals entering the trenches.
- Sodding, seeding, and/or landscaping of disturbed areas of the Proposed GLE Facility in accordance with the Sediment and Erosion Control Permit.
- Installing animal-friendly fencing around the GLE Facility site so that wildlife cannot be injured by or entangled in the site's security fence.

The following existing programs could be expanded to enhance wildlife habitat on the Wilmington Site:

- Planting native plant species (i.e., not invasive species) to re-vegetate disturbed areas and for landscaping of the Site
- Using nectar- and berry-producing plants for landscaping plants
- Conducting site-stabilization practices to reduce the potential for erosion and sedimentation
- Placing bluebird boxes throughout the Site
- Establishing food plots along roadways and under power lines.

In addition to the proposed management practices listed above, recommendations of appropriate State and federal agencies, including the U.S. Fish and Wildlife Service and NCDENR, would be considered.

5.6 Air Quality

The construction, operation, and decommissioning of the Proposed GLE Facility would result in SMALL impacts from air emissions to the atmosphere. The sources, constituents, and quantities of these air emissions released to the atmosphere would vary over the life of the project. Based on results from air dispersion modeling of these emissions, the incremental air quality impacts from the Proposed GLE Facility are predicted to be SMALL and not to substantially change the ambient air quality in the vicinity of the Proposed GLE Facility.

The incorporation of air emissions control systems into the Proposed GLE Facility design and the implementation of planned mitigation measures would reduce the levels of air emissions actually released on-site to the atmosphere during the Proposed GLE Facility construction, operation, and decommissioning phases.

Potential measures that could be used to mitigate fugitive dust emissions during the Proposed GLE Facility construction phase include the following:

- Watering the GLE Facility site and unpaved roads to reduce dust
- Removing dirt from truck tires by driving over a gravel pad prior to leaving the GLE Facility site or unpaved access road to avoid spreading sediments on paved roads
- Covering trucks carrying soil and debris to reduce dust emissions from the back of trucks driving on roadways
- Paving access road and parking lots as soon as practicable.

Air emissions control systems and mitigation measures planned for the Proposed GLE Facility operation phase that would mitigate air emissions to the atmosphere include the following:

- Conducting uranium-enrichment operations inside an enclosed building using a closed-system process with no routine venting of process gases.
- Installing and operating leak-detection monitors for process equipment. In the event a leak is detected due to an equipment component malfunction or other reason, safety interlocks will isolate the section of the process where the leak is detected, limiting the potential quantity of gaseous material that could be released inside the Proposed GLE Facility operations building.
- Maintaining process areas inside the Proposed GLE Facility operations building under continuous negative pressure relative to atmospheric pressure. In the event of a gaseous release in one of these process areas, the negative pressure conditions would prevent outflow of the air from the process areas, effectively containing the released gaseous material to the affected process area.
- Ventilating the Proposed GLE Facility operations building with a high-efficiency, multi-stage air emissions control system. Components of the air emissions control system planned for the Proposed GLE Facility operations building consist of high-efficiency particulate arresting (HEPA) filters for removal of solid particulate matter and then activated carbon beds for adsorption of gases. Exhaust gases from this emission-control system would be vented to the atmosphere through a single stack.
- Implementing a periodic inspection and maintenance program for UF_6 cylinders stored in outdoor areas.
- Burning low-sulfur fuel oil in the auxiliary diesel generators.
- Storing organic solvents, paints, and other volatile organic compound–containing liquids in containers covered with tightly fitting lids.

5.7 Noise

During construction and site preparation, there would be potential for increased noise with MODERATE impacts possible to the closest residents. However, heavy truck and earth-moving equipment usage would be prohibited after twilight and early morning hours. Noise-suppression systems on construction vehicles would be kept in proper operation.

There are various mitigation options that would be considered for application by the contractor. Examples of this mitigation are listed below:

- Equipping construction equipment with the manufacturer's noise-control devices, and maintaining these devices in effective operating condition
- When possible, utilizing quiet equipment or methods to minimize noise emissions during the activity
- For equipment with internal combustion engines, operating equipment at the lowest operating speed to minimize noise emissions, when possible and practical
- Closing engine-housing doors during operation of the equipment to reduce noise emissions from the engine
- Avoiding equipment engine idling
- Utilizing quieter, less-tonal devices that comply with all applicable safety restrictions (e.g., Occupational Safety and Health Administration [OSHA] standards) on back-up alarms for construction equipment.

It may be necessary to implement other noise-mitigation efforts, such as equipment-specific noise control or temporary noise barriers, if adverse impacts are observed as the project progresses.

During operation of the Proposed GLE Facility, most noise would reside inside the Facility due to system operations, and impacts would be SMALL. The buildings housing those operations would absorb the majority of the noise. The expected noise levels during decommissioning would be similar to those during the Proposed GLE Facility operating phase, and therefore, would have a SMALL noise impact. Vegetation (e.g., evergreen tree buffer), site buildings, and other structures would minimize the impact of noise from other equipment located outside of structures on ambient noise levels. Use of a quieter, high-efficiency transformer would be considered to mitigate noise from the proposed electrical substation.

5.8 Historical and Cultural Resources

The construction, operation, and decommissioning of the Proposed GLE Facility would result in SMALL impacts to archaeological site 31NH801, which is located within the South Road portion of the GLE Study Area adjacent to the existing gravel road that runs along the western side of the archeological site. Current design plans for the Proposed Action include paving of the existing gravel road. However, these activities would not involve widening of the road, and archaeological site 31NH801 would not be encroached upon. Protective measures that would be employed during the construction phase of the Proposed Action when this road is paved would include installation of temporary barriers to minimize the possibility of vehicles accidentally leaving the road and disturbing site 31NH801.

The paved road, referred to as the proposed South access road, would connect the Proposed GLE Facility to the existing GNF-A FMO facility, and the Proposed Action would result a slight increase in use of this road. To enable archeological site 31NH801 to remain undisturbed and to help prevent erosion due to wind or rain, the conditions of the bank at the side of the existing gravel road would remain unchanged from its current graded and vegetated state.

5.9 Visual/Scenic Resources

The visual/scenic resource impacts of the Proposed GLE Facility would be SMALL given the design and layout of buildings and other structures, their location in the North-Central Site Sector of the Wilmington Site, the retention of a perimeter tree buffer, and the compatibility of the GLE Study Area with the Site's

Bureau of Land Management (BLM) Visual Resources Management System (VRMS) Management Class IV designation (i.e., scenic-quality rating). Visual/scenic resource impacts resulting from the Proposed GLE Facility would be mitigated by measures that would be incorporated into the final Facility design. These mitigation measures include the following:

- Locating the Proposed GLE Facility in a sector of the Wilmington Site away from Site boundaries bordering existing development along NC 133 (Castle Hayne Road) and I-140, as has been accomplished in formulation of the Proposed Action
- To the fullest width practicable, maintaining the existing tree buffer along the northeast Wilmington Site boundary to limit visibility of the Proposed GLE Facility structures and access road traffic from off-site viewpoints in nearby residential neighborhoods
- Using exterior building colors and landscaping that would soften the visual impact of the Facility.

5.10 Socioeconomic

Overall population, economic, and social adverse impacts from the Proposed GLE Facility are anticipated to be SMALL, even though individual impacts on housing, educational, medical, law enforcement, and fire and rescue services may vary. No socioeconomic mitigation measures are anticipated to be necessary.

5.11 Environmental Justice

The Proposed Action is not expected to result in disproportionately high or adverse impacts on low-income or minority residents; therefore, no environmental justice mitigation measures are anticipated to be necessary.

5.12 Public Health

The potential human health impacts to nearby residents or on-site workers due to exposures from permitted chemical and radiological emissions from the Proposed GLE Facility are anticipated to be SMALL. An essential component of GLE's strategy to avoid human health impacts is to control and minimize potential exposures to workers and the public through BMPs and As Low As Reasonably Achievable (ALARA) practices. Mitigation measures would be in place to minimize the release of non-radiological and radiological effluents, such that their levels would be well below regulatory limits. These mitigation measures include the following:

- Installing a building ventilation system to maintain the majority of the interior of the process building under sub-atmospheric pressure
- Venting exhaust gases from the emission control system to the atmosphere through a single rooftop stack
- Installing alarms in the Emergency Control Center to detect, alarm, [redacted]
- Installing radiation monitors in effluent stacks to detect, alarm, [redacted]

Security-Related Information Withheld Under 10 CFR 2.390

Worker health and safety at the Proposed GLE Facility would be protected by the existing Wilmington Site Nuclear Safety Program and the Industrial Safety Program. These programs comply with all applicable state, U.S. Nuclear Regulatory Commission (NRC; 10 CFR 20, *Standards for Protections Against Radiation*), and OSHA (29 CFR 1910, *Occupational Safety and Health Standards*) requirements. These requirements include the following:

- Compliance with the Site Radiation Protection Program
- Compliance with the SPCC plan
- Compliance with the GLE Environmental, Health, and Safety Program, in accordance with OSHA industrial regulations
- Routine plant radiation and radiological surveying to characterize and minimize potential radiological exposure
- Monitoring of all radiation workers via the use of dosimeters and area air sampling to ensure that radiological doses remain within regulatory limits and ALARA practices
- Conducting operations activities involving hazardous respirable effluents with ventilation control and/or respiratory protection, as required
- Utilizing personal protective equipment based on the nature of the work and chemical and/or radiological hazards present.

5.13 Waste Management

The Proposed GLE Facility would add to the total quantities of wastewaters and solid wastes generated at the Wilmington Site that require subsequent management. The impacts from the management of these wastes would be SMALL to MODERATE.

Waste management impacts resulting from the Proposed GLE Facility would be controlled by implementing a comprehensive program that incorporates the following wastewater and solid waste management impact mitigation measures:

- Minimizing the quantities of waste generated by the Proposed GLE Facility by implementing the waste minimization plan discussed in **Section 4.13.3** of this Report (*Waste Minimization Plan*)
- Performing an integrated safety analysis (ISA) for each on-site waste storage area to identify and prevent accidental releases to the environment
- Monitoring and inspecting on-site liquid waste storage tanks and containers on a periodic schedule to detect leaks or releases to the environment due to equipment malfunctions so that actions identified in the Facility's SPCC plan or other appropriate corrective action can be taken promptly
- Use of the existing Wilmington Site on-site wastewater treatment facilities within the facilities' current regulatory permit limits to avoid the need to add new on-site waste treatment and disposal facilities for the Proposed GLE Facility operations
- Pre-treating radioactive liquid wastewaters in a treatment system planned for the Proposed GLE Facility before the wastewater effluent is pumped to the existing NPDES-permitted Wilmington Site final process lagoon facility for further treatment
- Shipping each waste generated by the Proposed GLE Facility that would require off-site storage, treatment, or disposal to a licensed facility (as appropriate for the waste type) in compliance with U.S. Environmental Protection Agency and NRC requirements
- Conducting on-site treatment of process and sanitary wastewaters to NPDES permit limits before discharge to receiving waters.
- Avoiding and minimizing potential hazardous and radiological waste impacts from the UF_6 storage pads associated with the Proposed Action by the implementation of the following design elements and safety procedures during the operation of the Facility:

- Using a storage array that permits easy visual inspection of UF_6 cylinders, stacked no more than two cylinders high

Security-Related Information Withheld Under 10 CFR 2.390

- [redacted]
- Prior to placing the cylinders on one of the storage pads or transporting them off-site, inspecting the cylinders for external contamination (i.e., a "wipe test")
- Taking steps to ensure that UF_6 cylinders are not equipped with defective valves (identified in NRC Bulletin 2003-03, *Potentially Defective 1-Inch Valves for Uranium Hexafluoride Cylinders*) (NRC, 2003)
- Allowing only designated vehicles with a limited amount of fuels in the storage pads area
- Allowing only trained and qualified personnel to operate vehicles in the storage pads area
- Monitoring the holding pond used to collect stormwater from the cylinder pads.

▪ Inspecting cylinders of UF_6 initially prior to placing a filled cylinder on a storage pad and, thereafter, periodically inspecting for damage or surface coating defects. Inspection criteria would include ensuring the following:

- Lifting points are free from distortion and cracking
- Cylinder skirts and stiffener rings are free from distortion and cracking
- Cylinder surfaces are free from bulges, dents, gouges, cracks, or significant corrosion
- Cylinder valves are fitted with the correct protector and cap
- Cylinder valves are straight and not distorted, two to six threads are visible, and the square head of the valve stem is undamaged
- Cylinder plugs are undamaged and not leaking.

▪ If inspections of a cylinder reveal significant deterioration or other conditions that may affect its safe use, the contents of the cylinder would be transferred to another cylinder and the defective cylinder would be discarded. The cause of any significant deterioration would be investigated, and if necessary, additional inspection of cylinders would be made.

GLE Environmental Report

Chapter 6 – Environmental Measurements and Monitoring Programs

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Table of Contents

List of Tables

List of Figures

6. Introduction

In accordance with the Radiation Protection regulations in 10 Code of Federal Regulations (CFR) 20 (*Standards for Protection Against Radiation*), the U.S. Nuclear Regulatory Commission (NRC) requires that licensees perform the measurements and monitoring necessary to demonstrate compliance with these regulations and to demonstrate that the amount of radioactive material present in effluent from the Proposed GLE Facility has been kept As Low As Reasonably Achievable (ALARA). In addition, pursuant to 10 CFR 70.59 (*Effluent monitoring reporting requirements [Domestic Licensing of Special Nuclear Material]*), the NRC requires that licensees submit semiannual reports 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. The NRC has also issued Regulatory Guide 4.15, *Quality Assurance for Radiological Monitoring Programs (Normal Operations) – Effluent Streams and the Environment* (NRC, 1979), and Regulatory Guide 4.16, *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 Plants* (NRC, 1985), which reiterate that concentrations of hazardous materials in effluent must be controlled and that licensees must adhere to the ALARA principle such that there is no undue risk to the public health and safety at or beyond the Wilmington Site boundary.

This chapter describes environmental baseline measurements and subsequent monitoring as applicable to GLE Facility site preparation and construction, operation, and decommissioning of the Proposed GLE Facility. See **Table 6-1** for a summary of the GLE Environmental Monitoring Program. Since the Proposed GLE Facility would be located on the Wilmington Site, the Environmental Monitoring Program was developed considering past experience and data. Where applicable, the existing Global Nuclear Fuel –Americas (GNF-A) Environmental Monitoring Program would be expanded to include the requirements of the GLE Environmental Monitoring Program, as proposed in this chapter. The Expanded Monitoring Program meeting the requirements for both the existing Wilmington Site facilities and the Proposed GLE Facility is referred to below as the Expanded Monitoring Program, and this program would be implemented by the GNF-A and GLE Environment, Health, and Safety (EHS) Functions.

The proposed monitoring program includes monitoring at the points of release from control systems. Airborne emissions would be sampled in the exhaust stacks, liquids would be sampled at the outfalls, and groundwater would be sampled along the perimeter of the Facility. The validity of the source-point monitoring program would be verified by additional measurements performed farther away from the release points, as is currently performed for the GNF-A Environmental Monitoring Program. Trends in the gaseous emissions and liquid effluent monitoring data are reviewed annually by the Wilmington Site Safety Review Committee to evaluate whether changes are needed in systems or practices to achieve ALARA effluent goals.

As has been the case with the existing GNF-A Environmental Monitoring Program, the Expanded Monitoring Program would be revised as appropriate to maintain its effectiveness as changes are noted, such as those related to 1) operations, 2) emergence of newly found information, 3) removal of legacy materials (i.e., calcium fluoride or other materials), and/or 4) regulatory agency permits and other authorizations. Action levels for monitored environmental parameters would be included in documented procedures as appropriate. Such action levels provide guidance to assure compliance within appropriate regulatory limits and would be consulted on an ongoing basis to initiate internal review and adjustments of operations and other procedures.

The field and laboratory analytical procedures for the Expanded Monitoring Program would be the same as those included in GNF-A's existing groundwater monitoring program. The Expanded Monitoring

Program would fall under the oversight of the Wilmington Site quality assurance program; therefore, it would be subject to periodic audits conducted by the quality assurance personnel. Written procedures would 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 Wilmington Site's written procedures would ensure that sampling and measuring equipment, including ancillary equipment such as airflow meters, are properly maintained and calibrated at regular intervals. Moreover, the Expanded Monitoring Program procedures would include functional testing and routine checks to demonstrate that monitoring and measuring instruments are in working condition. Employees involved in implementation of this program would be trained in the program procedures.

The quality control procedures used by the laboratories performing any environmental analyses would be adequate to validate the analytical results. These quality control procedures would include the use of established standards, such as those provided by the National Institute of Standards and Technology, as well as standard analytical procedures, such as those established by the National Environmental Laboratory Accreditation Conference. Monitoring and sampling activities, laboratory analyses, and reporting of Facility-related radioactivity in the environment would be conducted in accordance with industry-accepted and regulatory-approved methodologies.

Monitoring procedures would employ well-known, acceptable analytical methods and instrumentation. The instrument maintenance and calibration program would be appropriate to the given instrumentation, in accordance with manufacturers' recommendations. The EHS Function would ensure that the on-site laboratory and any contractor laboratory used to analyze environmental samples participate in third-party laboratory inter-comparison programs appropriate to the media and analytes being measured. The EHS Function would require that radiological and non-radiological laboratory vendors are certified by either the National Environmental Laboratory Accreditation Program or an equivalent state laboratory accreditation agency for the analytes being tested.

Minimum detectable concentrations (MDCs) are listed in **Table 6-2**. The listed MDCs are typical for the analytical methods employed, as established for the existing Environmental Monitoring Program (GNF-A, 2007).

The action level 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, operation shut down. Action levels are specified in procedures according to the type of samples and the specific analysis.

6.1 Radiological Monitoring

There would not be any radioactive material introduced into the GLE Study Area during construction; therefore, there would not be any monitoring of radioactive materials specifically associated with the Proposed GLE Facility until the Facility begins operations. Operational monitoring is addressed in the subsequent paragraphs. It is anticipated that the Expanded Monitoring Program would remain operational during the majority of the decommissioning phase. As the decommissioning progresses, monitoring points may be phased out as contamination sources are removed. Proposed GLE Facility decommissioning would be performed under the then-current regulations. A comprehensive Decommissioning Plan, including monitoring information, would be prepared and approved by the appropriate regulatory agencies prior to the commencement of decommissioning.

6.1.1 Direct Radiation Monitoring

Personnel dosimetry would be used to evaluate the dose to workers. An estimation of dose provides a means of complying with the North Carolina Regulations For Protection Against Radiation 15A NCAC

11 Section .1600, and the Radiation Protection requirements in 10 CFR 20, including keeping doses ALARA.

Radiation Safety Analyses (RSAs), also referred to as ALARA reviews, would be completed prior to posting the radiation safety requirements for individual work areas. The results from the RSA determine what type of personal protection equipment (PPE) and dosimetry are required for normal operations, maintenance, or other types of work activities. Examples of personnel dosimetry that might be required in specific work areas include film badges, thermoluminescent dosimeters (TLDs), and pocket dosimeters.

Direct radiation monitoring for the cylinder pads and other outdoor storage areas would be accomplished by use of film badges or TLDs. Also, the Radiation Protection Program procedures require periodic surveys to be performed in and around outdoor storage areas to ensure that direct radiation doses are maintained ALARA.

6.1.2 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 would be collected and analyzed so as to be representative of the discharges during production operations. Adequate controls and evaluations would be in place to monitor, assess, and take necessary protective actions that may be needed for circumstances not explicitly treated. The ventilation and exhaust systems are described in **Chapter 4** of this Report (*Environmental Impacts*) and in the GLE Integrated Safety Analysis Summary (to be submitted in September 2008).

The primary source of air emissions from the Proposed GLE Facility would be from the stack on the main process building (see **Figure 6-1**). This stack would be located on the west side of the main process building, about 70 feet (21.3 meters) above ground. The stack would be sampled continuously to measure radioactivity of the exhaust air. The collection filter in the sample system would be removed on a daily schedule during initial operation and analyzed for gross alpha activity. The periodicity of sampling would eventually decrease to weekly if the results are shown to be continually low during normal operations. Air filters with glass-fiber paper (47 mm diameter) would be used. The particulate sampler flow rate would be >30 standard cubic feet per hour (scfph) (> 14 standard liters per minute [sL/m]).

Security-Related Information Withheld Under 10 CFR 2.390

In addition to stack monitoring, air monitoring for radioactive emissions would take place in proximity to the Proposed GLE Facility. A total of 11 active air monitors would be used for analysis of a weekly composite sample for gross alpha activity and concentrations of uranium isotopes. Nine monitors would be placed around the [redacted] Proposed GLE Facility. These locations are shown on **Figure 6-1** and are based on the predominant wind directions. Three of these monitors would be placed [redacted] and would monitor for levels of radioactive material from the storage pads and the stack during periods when the wind is northerly (i.e., wind blowing from the north). Three monitors would be 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 would be placed at the fenceline to the east of the UF_6 storage pads, and two additional monitors would be placed at the fenceline on the western side of the Facility. Additionally, one monitor would be placed on the Wilmington Site property boundary near the point of highest potential impact from the Proposed GLE Facility stack, as predicted by the performance of air dispersion modeling using XOQDOQ (described in **Section 4.6** of this Report, *Air Quality Impacts*). This location would be approximately 0.3 miles (0.5 kilometers [km]) to the northeast of the Proposed GLE Facility stack. The sampling devices and techniques for this monitoring would be the same as described above for the Proposed GLE Facility stack monitoring except that the monitors would operate at an average weekly average flow rate of 150–190 scfph (70– 90 sL/min).

Air monitoring of the ambient levels of radioactive materials in the atmosphere would also be performed. An active air monitor would be placed approximately 0.5 miles (0.8 km) to the west-northwest of the Proposed GLE Facility stack. This location was chosen because it is located in the least-predominant downwind direction from the Proposed GLE Facility. It is also located along an existing access road to minimize environmental impacts associated with accessing the monitoring location. **Figure 6-1** shows the location of the ambient air monitor in relation to the Proposed GLE Facility. The sampling program would include analysis of a weekly composite sample for gross alpha activity and concentrations of uranium isotopes. The sampling devices and techniques for this monitoring would be the same as described above for the Proposed GLE Facility stack monitoring except that the monitors would operate at an average weekly average flow rate of 150–190 scfph (70–90 sL/min).

6.1.3 Wastewater Effluent and Surface Water Monitoring

Radioactive liquid waste treatment in the Proposed GLE Facility would consist of a system to remove uranium and fluoride. Uranium removal would be accomplished through pH adjustment, followed by flocculation and filtration. Fluoride would be removed through the addition of a salt to form a solid fluoride precipitate, followed by either filtration or evaporation. Treated wastewater effluent would be routed to a pump station, which would route the effluent to the existing Wilmington Site final process lagoon facility (see **Figure 3.4-19**) for further treatment. The treated effluent is discharged from this facility to the effluent channel via National Pollutant Discharge Elimination System (NPDES)–permitted Outfall 001. The effluent channel flows to Unnamed Tributary #1 to Northeast Cape Fear River (see **Figure 3.4-19**). The discharges from the GLE liquid effluent treatment system would be controlled to assure that the uranium and fluoride concentrations in the final process lagoon facility 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*) and 10 CFR 20.1302 (*Compliance with dose limits for individual members of the public*), thereby meeting the NRC's unrestricted release limit.

Continuous proportional samples of the treated process wastewater effluent would be collected daily at the outfall (NPDES Outfall 001). The sampling program would include 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 technetium-99.

The Expanded Monitoring Program would maintain the current GNF-A surface water monitoring activities. Gross alpha activity, gross beta activity, and uranium concentrations currently are monitored in the effluent channel; the Northeast Cape Fear River near Castle Hayne, NC (upstream of the Wilmington Site); and the Northeast Cape Fear River at the GE Dock (downstream of the Wilmington Site) (see **Figure 3.4-20**). These grab samples are taken on a monthly basis.

6.1.4 Groundwater Monitoring

The current GNF-A radiological groundwater monitoring program includes analysis of samples from a large number of wells across the Wilmington Site (GNF-A, 2007). Thirteen additional monitoring wells would be constructed around the Proposed GLE Facility, and these wells and the eight existing wells within the GLE Study Area would be added to the sampling protocol as part of the Expanded Monitoring Program. These 21 wells would be positioned in 7 clusters, with 3 wells installed at different depths per cluster. Wells with an A-suffix ID would be the shallowest wells, completed within the Surficial Aquifer at or just below the water table. Wells with B- and C-suffix IDs would be 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 6-2**, are west of the western extent of the less-permeable clay semiconfining layer (see **Section 3.4.1.1.2.2** of this

Report, *Semiconfining Layer*); therefore, the Surficial and Principal aquifers serve hydraulically as one unit across the portion of the GLE Study Area that would be monitored as part of the Proposed Action.

The seven well-cluster locations were selected on the basis of the groundwater flow directions discussed in **Section 3.4.1.1.2**, *Wilmington Site Aquifer and Semiconfining Layer*, and shown on **Figure 6-2**. Existing well-cluster LF-2 is situated near the high point of the groundwater mound mapped within the GLE Study Area. These wells would be positioned near and slightly upgradient of the main GLE operations building, based on the groundwater elevation contours shown on **Figure 6-2**. Should the high point of the groundwater mound shift slightly to the east, the LF-2 well cluster would be directly downgradient of the main GLE operations building, and existing well cluster LF-3 would be positioned to monitor conditions farther downgradient. The remaining five well clusters (proposed new well-clusters GLE-1 through GLE-4, existing wells LF-1A and LF-1B, and proposed new well LF-1C) are positioned as shown on **Figure 6-2** to provide monitoring coverage around the perimeter of the Proposed GLE Facility in the downgradient directions varying clockwise from the north, to the east, and to the southwest.

Initially, samples would be collected quarterly from the 21 proposed GLE monitoring network wells for analysis of uranium. If a validated uranium analytical result exceeds 0.02 mg/L, the subsequent quarterly sample from that well also would be analyzed for gross alpha activity and gross beta activity. The monitoring frequency for each well would be reviewed and potentially adjusted after a sufficient dataset was developed to perform statistically valid trend analyses. The groundwater-sampling procedures established for the existing GNF-A groundwater monitoring program would apply to the Expanded Monitoring Program. These procedures include purging of at least three well volumes before collecting samples using dedicated sampling equipment. Quarterly sampling of the proposed GLE groundwater monitoring network would begin prior to commencement of Proposed GLE Facility operation to further establish baseline groundwater conditions, and the Expanded Monitoring Program would continue throughout the operation and decommissioning phases.

6.1.5 Soil Monitoring

The current GNF-A radiological soil monitoring program includes analysis of samples from a number of locations on and off the Wilmington Site (GNF-A, 2007). Soil samples would continue to be collected on a semi-annual basis from these areas, plus two additional pairs of locations shown on **Figure 6-3** that were established considering the proposed location of the Proposed GLE Facility stack and the prevailing wind directions. The soil-sampling procedures established for the existing GNF-A soil monitoring program would apply to the Expanded Monitoring Program. The soil samples would be collected using decontaminated hand-sampling tools from the upper four inches and would be analyzed for uranium concentrations; the results of this analysis would be used to verify that impacts to the environment as a result of air emissions are SMALL, as discussed in **Section 4.12** of this Report (*Public and Occupational Health Impacts*). Semi-annual sampling of soil at the four proposed additional sampling locations would begin prior to commencement of Proposed GLE Facility operation to establish baseline conditions, and the monitoring program would continue throughout the operation and decommissioning phases. In addition, baseline shallow soil uranium concentrations across the 100-acre (40-hectare [ha]) GLE Facility site would be assessed through implementation of a statistically designed sampling program in advance of GLE Facility site preparation and construction.

6.1.6 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 (GNF-A, 2007). Since the Proposed GLE Facility would be 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 would apply to the Expanded Monitoring Program, and sediment samples would be collected and analyzed annually for uranium.

6.1.7 UF_6 Storage Pad Stormwater Monitoring

Stormwater runoff from the UF_6 storage area first would be routed to a holding pond for monitoring before the stormwater is released to the Proposed GLE Facility stormwater wet detention basin. This stormwater would be analyzed for uranium, gross alpha activity, and gross beta activity.

6.1.8 North Carolina Surveillance Program Description

The North Carolina Division of Radiation Protection Section (NC DRP), a part of the North Carolina Department of Environment and Natural Resources (NCDENR), conducts an area surveillance program (GNF-A, 2007). This program consisting of the following sampling and analysis:

- Low-volume air samplers
- Vegetation
- Sediment
- Soil
- Surface water
- Groundwater.

The samples are grab samples, except for the air samples. The ambient air stations operate continuously, with samples pulled weekly or twice per month. The balance of the program is conducted at frequencies (i.e., quarterly or semi-annually). It is anticipated that the NC DRP would include the Proposed GLE Facility in this program and determine new sampling locations to be added.

6.2 Physiochemical Monitoring

During preparation of the GLE Facility site and construction of the Proposed GLE Facility, worker and public exposure to dust would be monitored in accordance with the Industrial Safety Program. The use of hazardous chemicals during construction would be minimized as much as possible, and PPE would be used when appropriate. In addition, an NPDES General Permit for Construction Stormwater would be in place prior to commencement of any construction activities. The issuance of a NPDES permit for construction activities is tied to submission of an Erosion and Sedimentation Control Plan to the North Carolina Division of Land Resources; this plan would include monitoring requirements that would be implemented throughout site preparation and construction.

During operations, several types of physiochemical (nonradiological) monitoring would be performed to ensure the safety of the workers, public, and environment. Stack monitoring for fluoride would be conducted in accordance with the North Carolina Division of Air Quality (NC DAQ) air quality permit requirements. Treated process and sanitary wastewater effluents and the receiving surface waters would be sampled and monitored to ensure that the levels specified in the NPDES permit are not exceeded. Stormwater runoff would be monitored, as specified in the NPDES permit, to ensure that runoff is appropriately managed. Groundwater quality and levels would be monitored to detect abnormal or adverse conditions (e.g., unanticipated lowering of groundwater levels from increased withdrawals). Ecological monitoring would be performed to ensure that the operation of the Proposed GLE Facility is not adversely affecting the local ecology. Lastly, industrial health and safety monitoring would ensure that noise levels, indoor air quality, and ergonomics are controlled to maintain the health and safety of the workers.

6.2.1 Air Monitoring

In accordance with the NC DAQ air quality permit, the air emission control system stack for the main GLE operations building would be sampled continuously to monitor for any fluoride emissions to the atmosphere. The collection filter in the stack-sampling system would be a filter paper impregnated with calcium carbonate or equivalent. The filter would be removed weekly and analyzed for fluoride content. The quantity of fluoride released from the stack would then be calculated using the analytical results and the weekly exhaust volume of the stack and the associated stack sampler volume (in ratio). The sample analyses will be conducted in conformance with NC DAQ requirements.

6.2.2 Wastewater Effluent, Surface Water, and Stormwater Monitoring

A separate wastewater effluent and surface water monitoring plan for the Proposed GLE Facility would not have to be developed because GLE wastewater effluent discharges would be monitored at existing outfalls in accordance with the existing NPDES permit; therefore, the Expanded Monitoring Program would maintain the current GNF-A surface water monitoring activities and procedures. A Stormwater Permit would be required for the Proposed GLE Facility, and stormwater quality would be monitored from the Proposed GLE Facility stormwater wet detention basin, as required by the permit. Stormwater runoff from the UF_6 storage area first would be routed to a holding pond for monitoring before the stormwater is released to the Proposed GLE Facility stormwater wet detention basin. Surface water quality would continue to be monitored through General Electric Company’s (GE’s) partnership with the Lower Cape Fear River Program (LCFRP). The LCFRP and NCDENR monitor surface water quality on the Northeast Cape Fear River at locations upstream and downstream of the Wilmington Site.

6.2.3 Groundwater Monitoring

The quarterly groundwater monitoring program described in **Section 6.1.4** would also include sampling and analysis for fluoride concentrations and would perform measurements of groundwater pH, temperature, and specific conductance in the field during sampling.

In addition to groundwater sample collection and laboratory analysis, groundwater elevations would be measured from the Proposed GLE Facility monitoring well network as part of each sampling event. On a semi-annual basis, a comprehensive set of groundwater levels would be measured from wells across the entire Wilmington Site. These data would be evaluated to verify that increased groundwater withdrawals would have a SMALL impact on groundwater quality and supply, as discussed in **Section 4.4.1**, *Groundwater Impacts*, and **Section 4.4.5**, *Water Use*, of this Report.

6.3 Ecological Monitoring

The existing Wilmington Site ecological monitoring program consists of implementing a forestry management plan to improve the natural habitat on the Wilmington Site. Implementation of this program also would provide appropriate monitoring and habitat management for the Proposed Action. Program activities include periodic flora and fauna surveys of the land by local biologists to identify potential problems and areas needing improvement. Examples of upcoming activities resulting from the implementation of the survey suggestions include hazard-reduction burns to control the creation of wildfires and the establishment of “no-mow” areas of native grasses and flowers to provide a habitat niche. Monitoring of certain native bird species would occur in partnership with the National Audubon Society.

6.4 Industrial Health and Safety Monitoring

The programs implemented by the Wilmington Site Industrial Health and Safety (IHS) Function would be expanded to include the Proposed Action. The objectives of these programs are to maintain/improve work place safety and to create and maintain employee interest in safety operations. To accomplish these objectives, the IHS Function takes actions to achieve the following:

- Identify/prioritize operational safety concerns
- Establish and recommend a course of action for high-priority concerns or issues
- Maintain a continual awareness of the status of each project and follow up to completion
- Present project identification reviews and closures to area managers
- Inspect/audit shop for compliance to standards (shop areas)
- Plan future activities to generate interest in safety
- Review accidents
- Review safety recommendations from employees
- Plan and conduct safety meetings/reviews
- Promote safety awareness among associates.

The IHS Function prepares and maintains the *Safety, Health, and Fire Protection Manual*. This manual contains information about industrial health and safety policies and procedures and is available both in hard copy and on-line. This manual is broken down into eight sections. The first two sections (Sections A and B) contain general information that includes both administrative information and General Safety Rules that apply to all people who come on the Wilmington Site. The third section, Section C, is the core of the manual. Titled "Safety," Section C contains specific procedures related to specific tasks or equipment. Sections D and E contain rules on health and PPE that are designed to apply in many situations. Section F reviews the fire protection procedures, which provide information and rules that help prevent fires and minimize the danger and damage if a fire does occur. Material-handling information is provided in Section G, which covers moving and storing parts, equipment, and product. Section H provides information on contractor responsibilities, establishing procedures for training, Site access, and contractor safety qualification for work performed on the Wilmington Site. These procedures apply to employees, contractors, and visitors to the Wilmington Site. Many of the procedures contain additional responsibilities for some individuals or groups, or different applicability for certain areas of the Site, but the basic procedures and rules for safety are there to protect everybody on the Wilmington Site. GLE measurements, monitoring activities, and other procedures that would be implemented for compliance with the *Safety, Health, and Fire Protection Manual* are described below.

6.4.1 Indoor Air Quality

The IHS Function has responsibility to ensure that the level of indoor air contaminants within a building do not exceed established exposure limits. IHS would evaluate job functions for potential employee exposures, provide industrial hygiene monitoring, and assist in maintaining air contaminant concentrations below the established exposure limits through the use of ventilation controls, work practices, and PPE.

6.4.2 Noise Monitoring

Prior to operation of new processes, the IHS Function would perform a review of high-noise equipment, processes, and areas to identify potential employee exposures in excess of the action level for noise.

Periodic noise measurements would be taken around the Proposed GLE Facility to ensure that employee noise exposure is limited. Employee noise exposure monitoring that is representative of the job classification would be conducted whenever there is the addition of new equipment; a change to the process operation, equipment, or controls; or when any information indicates that an employee's noise exposure may exceed the action level for noise.

The action level for noise monitoring is the level of noise at which

- An employee must be enrolled in the Hearing Conservation Program and provided audiometric testing;
- Representative noise exposure monitoring is required; and
- Hearing protectors and training on noise hazards must be provided to the employee.

The Occupational Safety and Health Administration (i.e., OSHA) has set the current action level at 85 A-weighted decibels, or dBA, over an 8-hour period. The IHS Function would ensure that representative employee exposure monitoring is conducted; Hearing Conservation Areas (i.e., Greater than or equal to 85 dBA operating noise level – hearing protection required) are posted or properly labeled, training programs are developed, and hearing protection has adequate noise-reduction capabilities.

The existing GNF-A ambient noise monitoring program would continue throughout the construction, operation, and decommissioning phases of the Proposed Action and would be adjusted or expanded as appropriate. In particular, sound levels would be measured at the Wilmington Site property boundary during GLE Facility site preparation and construction activities to ensure that sound levels are lower than the New Hanover County Noise Ordinance (described in **Section 3.7.2.1** of this Report, *New Hanover County*).

6.4.3 Ergonomics

An Ergonomics Program would be implemented to reduce or eliminate musculoskeletal disorders (MSDs) caused by ergonomic stressors while providing for efficient workstations. MSD reduction would be accomplished through identification and correction of ergonomic stressors in the workplace. The Proposed GLE Facility is designed to reduce ergonomic stress on operators. GLE management would ensure that identified ergonomic stressors are evaluated and corrected through work station design improvements, engineering controls, work assignment evaluation and rotation, and administrative controls such as job hazard analyses, work station instruction, or operating procedures. Periodic employee training includes ergonomic stressor awareness and MSD recognition. GLE employees would be encouraged to report suspected MSDs at the earliest development so that prompt action could be taken to evaluate and correct the ergonomics of the workstation.

Tables

Table 6-1. Summary of GLE Environmental Monitoring Program

Medium	Additional Sample Locations[a]	Sample Type	Analyte/Parameter-Frequency[b]
Direct radiation	Personnel dosimetry	▪ Continuous film badges, TLDs, and pocket dosimeters	▪ Gamma and neutron activity
	UF_6 storage pads area and other outdoor storage areas	▪ Continuous film badges or TLDs	▪ Gamma and neutron activity
Air	Main GLE process building stack (see **Figure 6-1**)	▪ Continuous air particulate filter	▪ Gross alpha activity – Weekly ▪ Fluoride – Weekly
	Proposed GLE Facility [redacted], Site boundary point of highest potential impact, and ambient (background) (see **Figure 6-1**)	▪ Continuous air particulate filter	▪ Gross alpha activity – Weekly ▪ Uranium isotopes – Weekly
Surface Water	None in addition to the current effluent channel location at the Site dam and Northeast Cape Fear River locations upstream and downstream of the Site	▪ Grab sample	▪ Gross alpha/beta activities – Monthly ▪ Total uranium – Monthly ▪ LCFRP physical, chemical , and biological monitoring (see **Section 3.4.2** of this Report, *Surface Waters*)
Treated process wastewater effluent	None in addition to the current monitoring at NPDES Outfall 001	▪ Continuous proportional sample of liquid effluent	▪ Total uranium – Daily composite ▪ Gross alpha/beta activities – Weekly composite ▪ Technetium-99 – Quarterly composite ▪ NPDES permit requirements
Treated sanitary wastewater effluent	None in addition to the current monitoring at NPDES Outfall 002	▪ Continuous proportional sample of liquid effluent	▪ NPDES permit requirements
Groundwater	21 monitoring wells (see **Figure 6-2**)	▪ 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	Stormwater wet detention basin	▪ Stormwater grab samples	▪ NPDES permit requirements
	UF_6 storage pads area holding pond	▪ Stormwater grab sample	▪ Gross alpha/beta activities – Before transfer of held water to detention pond ▪ Total uranium – Before transfer of held water to detention pond ▪ Fluoride – Before transfer of held water to detention pond
Soil	4 locations (see **Figure 6-3**)	▪ Shallow soil grab sample	▪ Total uranium – Semi-annual
Sediment	None in addition to current monitoring locations	▪ Sediment grab sample	▪ Total uranium – Semi-annual

[a] Sampling locations for the Proposed Action in addition to locations currently monitored by GNF-A (GNF-A, 2007).
[b] Initial monitoring frequencies may be evaluated and adjusted.
UF_6 = uranium hexafluoride
TLDs = thermoluminescent dosimeters
LCFRP = Lower Cape Fear River Program
NPDES = National Pollutant Discharge Elimination Systems

Table 6-2. Summary of Minimum Detectable Concentrations for Radiological Environmental Monitoring Program

Medium	Analyte	Typical Minimum Detectable Concentration (MDC)
Air (particulate filter) – Stack	Gross alpha activity	1.0 x 10^{-12} microcuries per milliliter (μCi/mL)
Air (particulate filter) – At [redacted], Site boundary point of highest potential impact, and ambient (background)	Gross alpha activity	5.0 x 10^{-16} μCi/mL
	Uranium isotopes	4.0 x 10^{-18} to 5.0 x 10^{-18} uCi/mL (MDC dependent on actual average weekly flow rate, which may vary between 150 to 190 scfph [70 to 90 sL/min])
Surface water	Total uranium	0.02 parts per million (ppm)
	Gross alpha activity	5 picocuries per liter (pCi/L)
	Gross beta activity	20 pCi/L
Treated process wastewater effluent	Total uranium	0.02 ppm
	Gross alpha activity	3.0 x 10^{-8} μCi/mL
	Gross beta activity	5.0 x 10^{-8} μCi/mL
	Technetium-99	2.0 x 10^{-8} μCi/mL
Groundwater	Total uranium	0.02 ppm
	Gross alpha activity	20 pCi/L
	Gross beta activity	5 pCi/L
Stormwater – UF_6 storage pad holding pond	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

Figures

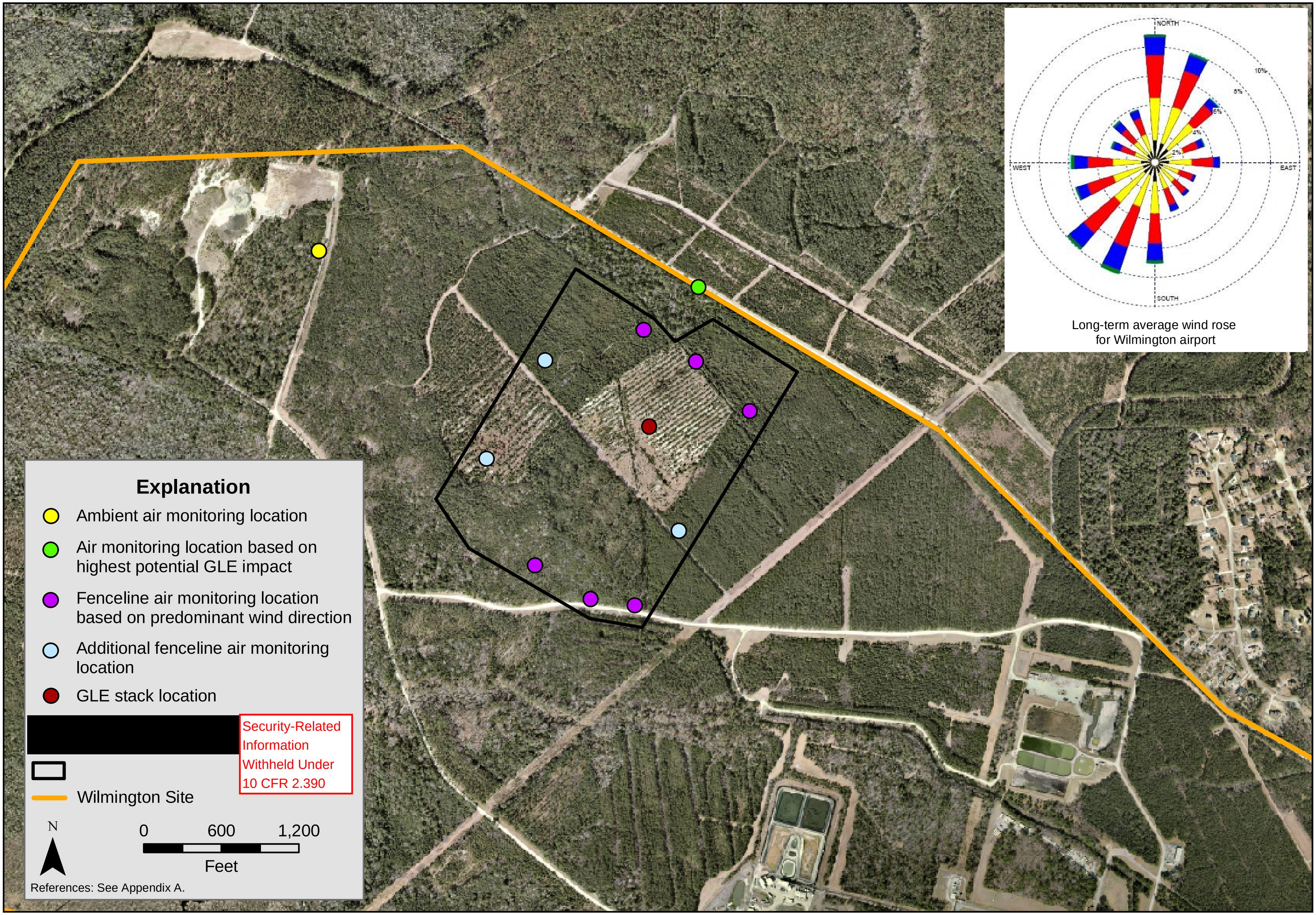

Figure 6-1. GLE air monitoring locations.

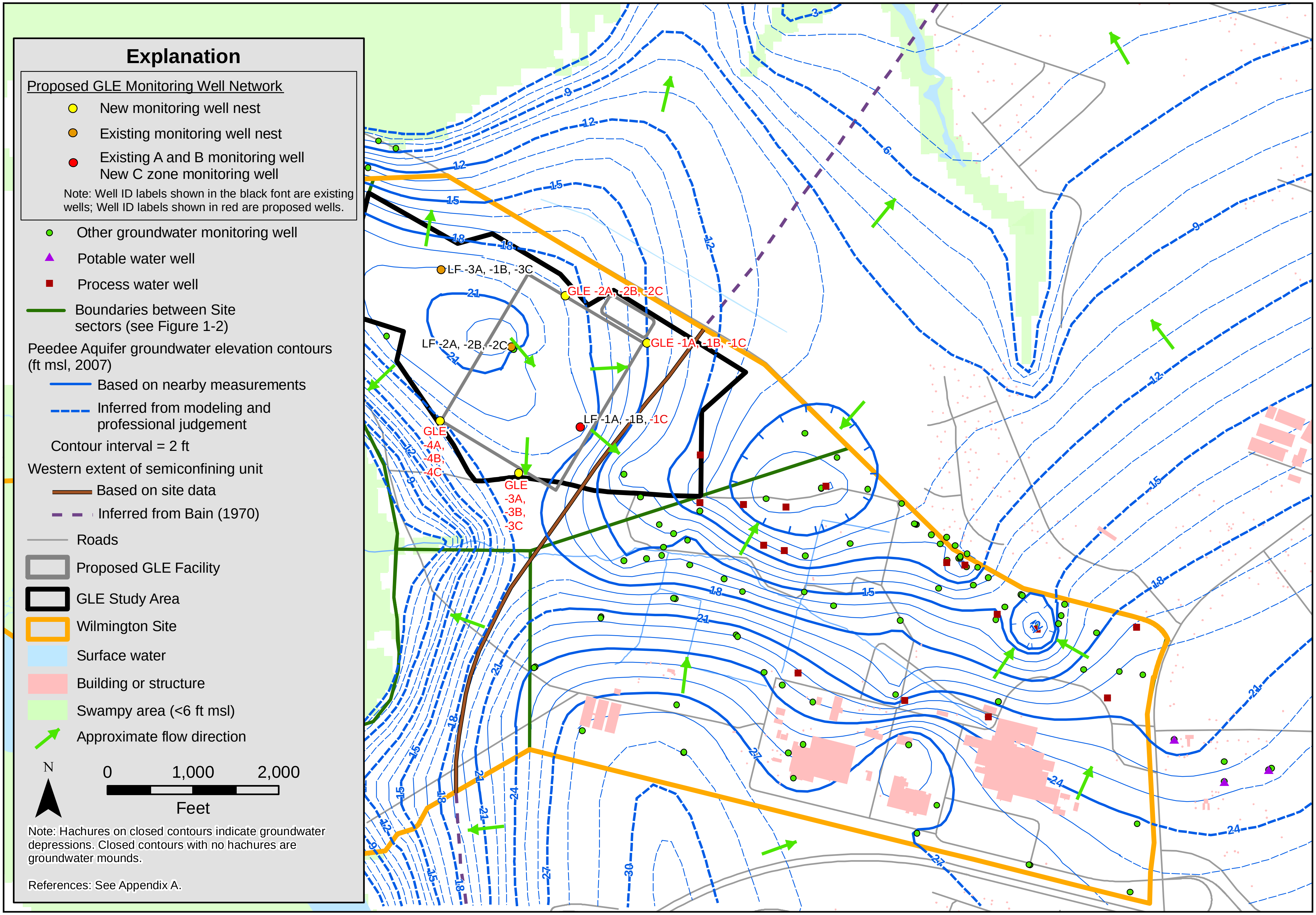

Figure 6-2. GLE groundwater monitoring locations.

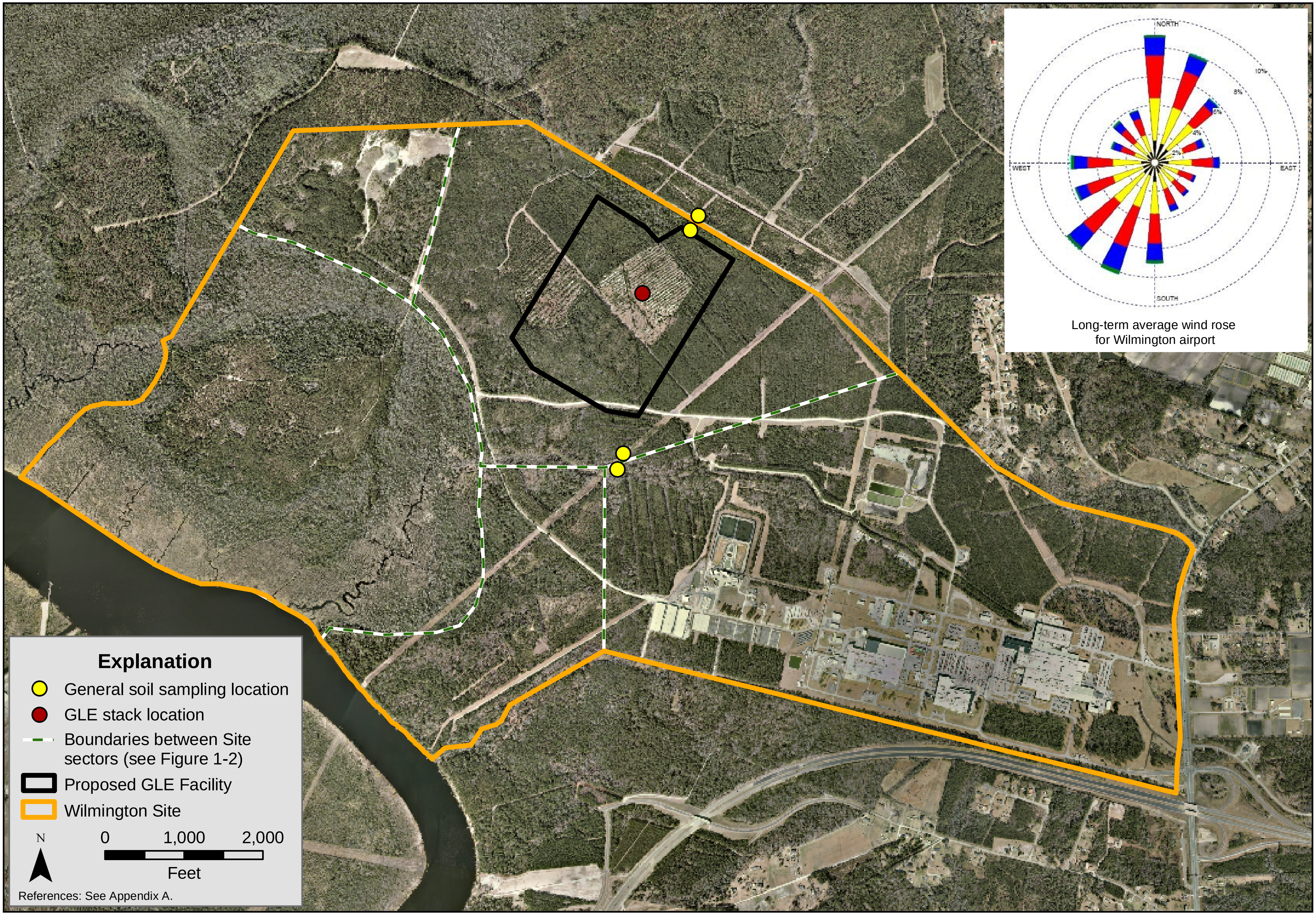

Figure 6-3. GLE soil sampling locations.

GLE Environmental Report

Chapter 7 – Cost-Benefit Analysis

Revision 0

December 2008

Table of Contents

List of Tables

7. Cost-Benefit Analysis

This section examines the benefits and costs of the Proposed Action. The cost-benefit analysis (CBA) attempts to measure the overall impact of the Proposed Action on society's well-being, including both private benefits and costs accruing to the Facility's owners and external benefits and costs experienced by other members of society. Benefits and costs of the Proposed Action result from changes in conditions, relative to baseline conditions. Baseline conditions are defined as conditions expected to exist throughout the lifetime of the Proposed GLE Facility, in the absence of the impacts that would result from the Facility. Where possible, impacts of the Proposed Action have been measured relative to projected baseline conditions. In general, when projections of future conditions are not available, impacts are measured relative to current conditions.

7.1 Introduction to Cost-Benefit Analysis

CBA refers to the calculation of net social benefits arising from a specific project or program. It is a tool used to systematically catalogue, quantify, and value the effect of the project or program on society's well-being. The effect on society's well-being is measured in terms of the project's net benefit, defined as benefits minus costs. Typically, CBA is used to assess the societal impact of public expenditures or regulations; however, it can also be used (as in this situation) when private net benefits (measured by company profits resulting from the project) do not completely capture the total social impact of a project. Impacts (benefits or costs) that accrue to someone other than the Applicant, its customers, and its suppliers are referred to as externalities, comprising external costs and external benefits. In situations where a private project gives rise to externalities, the social net benefits are computed as the sum of private net benefits and external net benefits.

To estimate the private net benefits, projected annual costs are subtracted from projected annual revenues over the lifetime of the project (construction through decommissioning). These totals are then summed, and their present value is computed using two alternative discount rates, as suggested in the Office of Management and Budget (OMB) Circular A-4 (OMB, 2003). These private benefits and costs are described in **Appendix U**, *Private Benefits and Costs of Proposed GLE Facility*.

External benefits and costs are assessed by examining impacts of the Proposed Action that fall outside the company that would own the Facility (i.e., GE-Hitachi Global Laser Enrichment LLC [GLE]), including impacts on the environment and local populations. These impacts are carefully described, and where feasible, quantified, in **Chapter 4** of this Report (*Environmental Impacts*). Where impacts can be quantified, it is sometimes possible to attach a per-unit value to the impact, providing a dollar estimate of the costs and benefits. To estimate total net benefits, total costs are subtracted from total benefits. It should be noted that not all costs and benefits are quantified, and not all the quantified costs and benefits have values associated with them. Quantified and valued externalities are not necessarily the largest or most significant of the external costs and benefits; therefore, it is critical to carefully consider both qualitative and quantitative benefits and costs in evaluating the overall benefits and costs of the Proposed Action.

7.2 No Action Alternative

Under the No Action Alternative, the North-Central Site Sector on which the Proposed GLE Facility would have been built would likely remain undeveloped for the foreseeable future; therefore, there would be no construction impacts in this area of the Site. The existing manufacturing facilities in the Eastern Site Sector (**Figure 1-2**) would continue to operate. The feed material to the Fuel Manufacturing Operations (FMO) facility would continue to be enriched uranium transported to the Site by truck from off-site suppliers. The Advanced Technology Center II (ATC II) complex and Tooling Development Center (see **Section 2.3** of this Report, *Cumulative Effects*) would be constructed as planned. With no changes in land use or activity at the Site resulting from the Proposed GLE Facility, no Facility-related impacts on the company or external impacts on the environment and surrounding communities would be expected. However, not constructing the Proposed GLE Facility would result in foregoing the benefits that the Facility's operation would convey. Over time, if demand for fuel for nuclear power plants grows, there may be increasing shortages of suitable enriched uranium, in part because of the increasing age of the only enrichment facility currently in operation in the United States. Thus, the No Action Alternative has the potential to impose external costs due to increased fuel costs and unreliable supplies.

7.3 Proposed Action Alternative: Environmental Costs

The Proposed Action has the potential to create environmental impacts; the types of impacts examined in detail include impacts on land use, geology, groundwater, surface water, floodplains, wetlands, water use, ecological resources, air quality, public and occupational health, and waste management. The following sections summarize the findings from the environmental impacts analysis, which is discussed in more detail in **Chapter 4** of this Report (*Environmental Impacts*). The following assessment of external benefits and the costs associated with the Proposed Action is organized as follows: for each category, impacts of Site preparation and construction, operation, and decommissioning on affected resources are summarized and any quantitative impact measures are noted. The timing of the projected external benefits and costs is identified.

7.3.1 Land Use Impacts

The Proposed GLE Facility would be built on land already owned by General Electric Company (GE), which is zoned I-2 for Heavy Industrial use and is adjacent to other industrial operations, including a nuclear fuel manufacturing plant. **Figure 1-3** shows the location of the Proposed GLE Facility and the proposed access roads on the Wilmington Site relative to the existing Global Nuclear Fuel–Americas (GNF-A) FMO facility in the Eastern Site Sector, as well as the current land use development in the vicinity of the Site. The proposed project entails construction of a production facility and associated buildings, storage areas, and parking, covering a total of approximately 100 acres (40 hectares [ha]). GLE plans to decommission the Proposed GLE Facility to reduce the level of radioactivity remaining in the Facility to residual levels that are acceptable for release of the Facility for unrestricted use.

7.3.2 Soils and Geology Impacts

Site preparation and construction of the Proposed GLE Facility and the proposed North access road would require clearing and grading of approximately 100 acres (40 ha) of land for the Proposed GLE Facility and approximately 33 acres (13 ha) for constructing the proposed North access road. Located to the east of the 100-acre (40-ha) parcel and within the Main portion of the GLE Study Area would be ancillary structures required for operation of the Proposed GLE Facility that cumulatively would require, approximately, an additional 13 acres (5 ha) to be cleared. Paving of the existing service road within the South Road portion of the GLE Study Area would not involve road widening; therefore, disturbance of additional shallow Site soils is anticipated to be minimal. Terrain changes would be minimal because the area is very gently sloping (gradients less than 2%). Shallow soils would be disturbed for the construction of building footings and for excavation of stormwater detention ponds. The proposed North access road construction would require excavation, backfilling, compaction, grading, and paving. The volumes of soils that would be impacted depend on the Proposed GLE Facility final design and layout. Any shallow soils disturbed or moved during construction would either be reused within the GLE construction site or stockpiled for potential use in other areas of the Wilmington Site. No off-site disposal of soil is expected. Construction potentially could require the placement of foundations into deeper, largely unconsolidated subsurface deposits. Site preparation and construction impacts on soils and geology are expected to be

SMALL. During site preparation, a short-term increase in soil erosion would occur. These SMALL impacts would be mitigated by following proper construction best management practices (BMPs).

Operation of the Facility will cause no additional disturbance to soils. Structure foundations for the Proposed GLE Facility would be designed to meet building codes and to control impacts from seismic events, as well as predicted settlement from building loads. The potential for a seismic event that would induce an impact on Proposed GLE Facility operations is SMALL. The potential of the subsurface materials within the GLE Study Area to liquefy and have an impact on the Facility is also SMALL.

Decommissioning of the Proposed GLE Facility would include removal of any contaminated soil, and soil testing to demonstrate that any residual soil impacts, as compared to the baseline soil-sampling results, meet U.S. Nuclear Regulatory Commission (NRC) and U.S. Environmental Protection Agency (EPA) requirements. Decommissioning would not disturb subsurface soils. Impacts of decommissioning would be SMALL.

7.3.3 Impacts to Water Resources

Construction, operation, and decommissioning of the Proposed GLE Facility have the potential to affect water resources in the vicinity of the Wilmington Site.

7.3.3.1 Groundwater Impacts

During GLE Facility site preparation and construction, sanitary waste at the GLE construction site (i.e., GLE Facility site) would be managed using portable toilets. The water needed for site preparation and construction would be provided by tanker truck from existing water sources, and it would be required that those sources be of potable quality. Therefore, the impact to groundwater quality during site preparation and construction is projected to be SMALL. Water use for Proposed GLE Facility operations would be provided by the existing groundwater supply well system used at the Wilmington Site. Groundwater modeling predicts that the modified pumping rates would change groundwater levels to a small extent within the Peedee Aquifer in the Site vicinity (within approximately 1 to 2 miles; 1.6 to 3.2 kilometers [km]). The groundwater flow patterns would remain largely unchanged, although there would be a small shift in groundwater elevations. There are no known existing off-site groundwater quality issues within or just beyond the catchment area of the Wilmington Site pumping wells; therefore, the small change in groundwater elevations induced by the increased pumping is not anticipated to have any impact on off-site groundwater supply or quality. No significant impact on the effectiveness of the existing on-site pumping well system to protect off-site groundwater users from existing on-site impacted groundwater is anticipated. Decommissioning activities will be designed to prevent any impacts to groundwater quality. Thus, impacts on groundwater quantity and quality resulting from the Proposed GLE Facility are estimated to be SMALL.

7.3.3.2 Surface Water Impacts

The Proposed Action would not require the consumptive use of any surface water, and the construction of the Proposed GLE Facility and the proposed North and South access roads would not cause water quality standards or limits to be exceeded. Impacts to navigation, industrial transport, commercial fishing, or recreation uses would be SMALL. The buildings, parking lots, security buffers, and maintained areas of the Proposed GLE Facility would not require the diversion, fill, or containment of existing surface waters; however, one new stream crossing (Unnamed Tributary #1 to Prince George Creek) and modifications to an existing stream crossing (Unnamed Tributary #1 to Northeast Cape Fear River) would be necessary for the proposed North and South access roads, respectively. To minimize impact to the stream during the development and operation of the access road, the exact location selected for the access road stream crossing would be perpendicular to Unnamed Tributary #1 to Prince George Creek. Installation of the crossing would have a temporary impact on stream flow and bank stability; however, all appropriate precautions would be taken to minimize the intensity and duration of impacts due to the stream crossing development. **Figure 4.4-19** depicts the approximate location of the Proposed GLE Facility and the surface waters of the Wilmington Site. Short-term increase in soil erosion during site preparation would be mitigated by following proper construction BMPs, thus minimizing the potential impact of sediment on surface waterbodies.

The sanitary and process wastewater management practices to be implemented during operation of the Proposed GLE Facility would be in accordance with National Pollutant Discharge Elimination System (NPDES) permit limitations and would not cause water quality standards or limits to be exceeded (see **Section 4.13.2.2.1** of this Report, *Wastewaters [Operation Impacts, Proposed Action]*). Impacts to navigation, industrial transport, commercial fishing, or recreation uses would be SMALL. Surface water runoff quantity would increase due to the conversion of currently forested land into impervious surface and maintained lawn; however, surface water runoff from the Proposed GLE Facility would be routed to a stormwater wet detention basin before discharging to receiving waters, which would serve to regulate stormwater quality and quantity as required by the NPDES stormwater permit. Stormwater runoff collected from the uranium hexafluoride (UF_6) cylinders storage pad would first be routed to a holding basin, where it would be monitored, and then released to the GLE stormwater wet detention basin only if the uranium concentration is below the acceptable level.

With the end of production and the dismantling of the Facility, sanitary and process wastewater effluent discharges would incrementally decrease to zero over the decommissioning phase. Contaminated solutions generated from decontamination activities would be contained for appropriate treatment, including continued operation of the GLE liquid radwaste treatment system to pre-treat radioactive-contaminated solutions before they are pumped to the existing NPDES-permitted Wilmington Site final process lagoon facility. Stormwater runoff would flow to the existing GLE stormwater wet detention basin.

7.3.3.3 Floodplain Impacts

Construction of the Proposed GLE Facility and the proposed North access road would occur outside of the floodplain boundaries. Modifications to the stream crossing for the proposed South access road would occur within the floodplain, but floodwaters would not be impeded during the construction process. The new crossing would have the same or greater flow capacity than that of the existing crossing; therefore, there would be no rise to the 100-year or 500-year floodwaters. Modeled estimates of the floodwater impact of operation of the Proposed Action, relative to undeveloped conditions on the Wilmington Site, range from a 10% increase for a day like that of Hurricane Floyd (similar to a 500-year event), to a 15% increase for a year like 1999, during which such a flood occurs, to a 35% increase for a lower rainfall year. Any such increase would largely be captured by the GLE stormwater wet detention basin, and any increase in floodwaters due to runoff from the Proposed GLE Facility during extreme storm events would be slight and may be mitigated by the natural buffering capacity of the Swamp Forest on the border of the Northeast Cape Fear River system without residual effects. Decommissioning would not change the grading or the impervious surfaces of the Proposed Action. Overall, floodplain impacts would be SMALL.

7.3.3.4 Wetland Impacts

Field surveys were conducted during September 4–7, 2007, to delineate wetlands within the 265-acre (107-ha) GLE Study Area. Wetlands were delineated using the U.S. Army Corps of Engineer's (USACE's) 3-parameter approach (i.e., vegetation, hydrology, soils), as explained in the *Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory, 1987), and the *Jurisdictional Determination Form Instruction Guidebook* (USACE, 2007). The 265-acre (107-ha) GLE Study Area for the Proposed Action was evaluated for the presence of wetlands. No wetlands were found within the

209-acre (85-ha) Main portion of the GLE Study Area. The 56 acres (22 ha) associated with the proposed access roads may impact three jurisdictional wetlands and two isolated wetlands. Up to 0.42 acres (0.17 ha) of jurisdictional wetlands and 0.19 acres (0.08 ha) of isolated wetlands at the Wilmington Site could be impacted by the construction of the proposed North access road. **Table 4.4-7** characterizes the wetlands potentially affected, which are described as Wetlands WA, WB (isolated), WC (headwater), WD (riparian), and WE (riparian/swamp forest). Measures would be taken to avoid impacts to Wetland WE from paving of the proposed South access road and modification to its stream crossing.

In compliance with the National Environmental Policy Act (NEPA), implementation of the Proposed Action would strive first to avoid wetland impacts, then to minimize wetland impacts, and finally to mitigate any remaining impacts. The site for the Proposed GLE Facility was selected to minimize the impacts to wetlands. In addition, existing roads would be used when possible to eliminate new impacts to wetlands. The proposed North access road portion of the GLE Study Area would cross Wetlands WC and WD in a perpendicular manner to minimize wetlands impacts. During the design phase, impacts to wetlands would be further minimized using engineered features, such as reducing cut/fill slopes, avoiding the storage of materials in wetlands during construction, and maintaining the hydrological connectivity of the wetlands. Unavoidable temporary impacts to wetlands could result from site preparation and construction activities due to the removal of vegetation and the temporary storage of construction materials, as well as from potential sediment runoff. The resulting temporary impacts would be mitigated by restoring the disturbed wetlands areas to pre-existing conditions through the planting of vegetation and the removal of excess sediment. During operation, indirect impacts would occur to wetlands that would receive stormwater runoff from the Proposed GLE Facility. Increased runoff could decrease water quality and increase water quantity to these wetlands, thereby altering the species composition or decreasing their ability to function. The proposed North access road would likely bisect a riparian wetland area, thereby interrupting the hydrologic connectivity of that riparian wetland. This disruption could create wetter conditions upstream of the crossing and drier conditions downstream. Decommissioning activities would have no incremental impact on wetlands. In compliance with permit requirements, remaining wetland impacts would be mitigated as required, either through on-site or off-site mitigation, purchase of mitigation credits, or payment in North Carolina Ecosystem Enhancement Program. Overall impacts are projected to be SMALL.

7.3.3.5 Water Use Impacts

As discussed in **Section 4.4.2** of this Report (*Surface Water Impacts*), no adverse impacts to surface water quantity or quality are anticipated. In addition, fishing resources are not expected to be affected (see **Section 4.5** of this Report, *Ecological Resources Impacts*). Thus, no significant impacts are anticipated to surface water-oriented water users (e.g., fishing, navigation).

Water for construction activities would be provided by tanker truck from existing potable water sources. Groundwater use for process and potable water needs during operation was simulated using conservative assumptions and was found to have minimal impacts on groundwater in the Peedee Aquifer. The estimated 75,000 gallons per day (gpd) (283,900 liters per day [lpd]) of process water and 11,000 gpd (41,600 lpd) of potable water required for Proposed GLE Facility operations would be obtained from the existing groundwater pumping-well system at the Wilmington Site. The Proposed GLE Facility process-water demands would be offset by the industrial re-use of treated sanitary wastewater effluent as process water, which was implemented at the Wilmington Site in April 2008. Groundwater modeling predicts that the changes in groundwater withdrawals would not significantly impact neighboring residential wells or groundwater supplies. Decommissioning water use is estimated to be smaller than water use during operation.

7.3.4 Impacts on Ecological Resources

Construction of the Proposed GLE Facility and the proposed North access road would displace some local wildlife populations to nearby habitat in the western portion of the Wilmington Site. No direct impacts to rare or unique habitats or commercially or recreationally valuable species would be expected from site preparation and construction of the Proposed GLE Facility. Human encounters with some wildlife could increase due to disruption of travel corridors and loss of habitat. No direct impacts to rare or unique habitats or commercially or recreationally valuable species would result from construction. Overall, wildlife populations on the Wilmington Site would be altered, but the existence of these species would not be destabilized. Therefore, direct and indirect impacts to wildlife would be MODERATE.

Impacts from the Proposed GLE Facility would occur to approximately 35 acres (14 ha) of Pine Forest community, 46 acres (19 ha) of Pine Plantation community, and 16 acres (6 ha) of Pine-Hardwood Forest community. The remaining 3 acres (1 ha) would be existing disturbed areas. These communities comprise 11% of the existing Pine Forest, 15% of the existing Pine Plantation, and 7% of the existing Pine-Hardwood Forest. Approximately 13 additional acres (5 ha) of Pine Plantation, Pine Forest, and Power Line Corridor communities east of the Proposed GLE Facility and within the GLE Study Area would be replaced with Operational Areas for access driveways, guard houses, a water-storage tank, sanitary and process wastewater life stations, an electric substation, and a stormwater wet detention basin. The removal of forested biotic communities would noticeably alter the composition of habitat, but would not destabilize the existence of these communities; therefore, direct and indirect impacts to existing biotic communities would be MODERATE. Operation of the Proposed GLE Facility would not directly impact additional biotic communities beyond those impacted during the site preparation and construction phase. Fencing around the Proposed GLE Facility could cause additional disruption of wildlife travel corridors. In addition, the Proposed GLE Facility would bisect current biotic communities. Wildlife could develop new travel corridors and use the fence line and new access road as corridors; however, these corridors would increase these animals' vulnerability to predation and decrease the amount of habitat. Wildlife such as deer and turkey could be attracted to forest edges to feed on planted grasses and plants that may grow along the edge. Human encounters with some wildlife could increase due to disruption of travel corridors and loss of habitat. Operation would not noticeably alter the impact to biotic communities or wildlife; therefore, impacts to travel corridors and habitat quality would be SMALL. Although 31 Federal Species of Concern are present in the area or have the potential to use habitat on the Wilmington site, for 27 of these species, the Proposed Action is projected to have no effect; for the other 4 species, the Proposed Action may have an effect, but it is not likely to adversely affect the species. Similarly, of the nine Threatened and Endangered Species for which the Wilmington Site has suitable habitat, the Proposed Action is estimated to have no effect on eight species, and for one, the rough-leaved loosestrife, the Proposed Action may have an effect, but it is not likely to have an adverse effect on this species. Decommissioning activities would minimize impacts to humans and ecological resources. Overall, therefore, the Proposed Action's estimated impact on wildlife and biotic communities is expected to be SMALL to MODERATE.

7.3.5 Air Quality Impacts

Air emissions during site preparation and construction would include an estimated 1,500 pounds/day (680 kilograms [kg]/day) of fugitive dust from heavy equipment working on the site, emissions from the engines of the construction equipment (totaling approximately 270 pounds/day [122 kg/day]), and emissions from vehicles transporting workers and materials to the Site (totaling approximately 170 pounds/day [77 kg/day]). Dust suppression work practices will be used to mitigate the fugitive dust emissions. Modeling predicts that emissions will not substantially change ambient air quality or measurably affect visibility. Air quality impacts during site preparation and construction are estimated to be SMALL. During operations, the Proposed GLE Facility would not be a major source of air emissions projects, as defined by the applicable EPA and North Carolina Division of Air Quality air permitting requirements. The laser uranium-enrichment technology would not emit carbon monoxide (CO), nitrogen oxides (NO_x), volatile organic compounds (VOCs), or sulfur dioxide (SO_2). There is a potential for small gaseous releases associated with operation of the process that could contain uranium isotopes, hydrogen fluoride (HF), and uranyl fluoride (UO_2F_2), which would be contained within the main GLE operations building and routed to a high-efficiency, multi-stage emissions control system. Small amounts of nonradioactive air emissions consisting of CO, NO_x, particulate matter (PM), VOCs, and SO_2 (totaling about 45 tons/year [41 metric tons (mt)/year]) would be released from the auxiliary diesel electric generators to supply electrical power when power from the utility grid is not available, or from building and equipment maintenance activities. An additional 150 pounds/day (68 kg/day) of CO, NO_x, PM, VOCs, and SO_2 emissions would be released from on-site vehicles and from automobiles and trucks travelling to and from the Facility. Ambient air modeling predicts that the air emissions to the atmosphere from operations would not substantially change the ambient air quality in the vicinity of the Proposed GLE Facility. The air emissions are expected to have no measurable impact on regional visibility. Air quality impacts during operations are expected to be SMALL. During decommissioning, emissions could include fugitive dust (mitigated by dust suppression work practices) and CO, NO_x, PM, VOCs, and SO_2 from transportation equipment. Emissions would generally be smaller than emissions during construction and operation. Overall air emissions during decommissioning are estimated to be SMALL.

7.3.6 Noise Impacts

Construction of the Proposed GLE Facility and proposed North access road would temporarily generate short-duration noises resulting from the construction equipment used in road construction, site preparation, and other activities typical of building construction sites. Sound-level modeling predicts that temporary, localized MODERATE noise level impacts would occur for existing residents living in proximity to the northeast Wilmington Site property line as a result of the proposed North access road construction activities and automobile and truck traffic using this road to access the GLE Facility site. Impacts would occur during daytime hours. At locations farther off-site, the noise impacts from construction would be SMALL. Noise impacts during operation of the Proposed Action are expected to be SMALL because most of the equipment used during operations would be located inside the GLE building. Some other exterior equipment, such as transformers, heat pumps, and fans, could potentially generate noise impacts. Use of high-efficiency equipment and/or a noise barrier could be used to mitigate these impacts. Noise impacts during decommissioning are expected to be smaller than during Facility operation, and thus would be SMALL.

7.3.7 Public and Occupational Health Impacts

Air dispersion modeling results are used to estimate exposures at various locations on-site and off-site. During site preparation and construction, fugitive dust emissions are estimated to include both PM_{10} and $PM_{2\ 5}$ particles, but at levels below the PM National Ambient Air Quality Standard (NAAQS) or standard adopted by the State of North Carolina; therefore, no health impacts are expected. Similarly, vehicle emission concentrations were extremely low and were substantially below the applicable air quality standard for individual pollutants. Again, no health impacts are expected. The construction activities themselves may result in an increase in Occupational Safety and Health Administration (OSHA)–recordable injuries relative to the No Action Alternative. Overall, however, site preparation and construction activities are expected to result in SMALL public and occupational health impacts. During the overlap period of final construction activities with start-up of Proposed GLE Facility operations, the presence of up to 1,035 employees at the Facility will again increase the likelihood of occupational accidents and injuries relative to the No Action Alternative. Worker health and safety will be managed according to applicable state, NRC, and OSHA regulations under GNF-A's Nuclear and Industrial safety programs. All non-radiological health impacts to workers or the public are anticipated to be SMALL.

Modeling analysis predicts that the impact on public or occupational health from the use, release, and disposal of radiological materials during combined operation of the Proposed GLE Facility with the existing FMO facility would be SMALL. The non-radiological chemicals (e.g., HF) potentially released from the Proposed GLE Facility operation are not persistent and would not accumulate in the environment or cause cumulative health effects. No gaseous criteria pollutants (CO, NO_x, SO_2, VOCs) would be produced by the laser uranium-enrichment technology that would be used for the Proposed GLE Facility operation. The Proposed Action would not significantly affect air quality or potential exposures to gaseous effluents. For airborne releases, off-site concentrations from normal operations of the Proposed GLE Facility are expected to be too low to present problems to public health through inhalation, ingestion, or dermal exposure pathways. Worker exposure to in-facility, non-radiological gaseous effluents would not exceed OSHA's standards for toxic and hazardous substances in accordance with 29 Code of Federal Regulations (CFR) 1920, Subpart Z (*Toxic and Hazardous Substances*). Radiological exposures to workers are limited by standard operating procedures to ensure that they are As Low As Reasonably Achievable (ALARA); the Radiation Protection Group determines appropriate personal protective equipment (PPE) and monitors radiation levels in the work areas and on exiting workers, who are also required to self-monitor prior to exiting.

There are four potential exposure pathways to the general public associated with gaseous effluent: inhalation; immersion in a passing effluent plume; direct radiation due to deposited radioactivity on the ground surface (ground plane exposure); and ingestion of contaminated food products. Inhalation exposures, although very low, are expected to be the predominant exposure pathway at locations near the Wilmington Site. Actual releases from the GLE process are anticipated to be lower than from the FMO facility, which are so low that Alpha radiation exposure levels measured at the Site boundary resulting from the FMO facility are at background levels (GNF-A, 2007). The Proposed GLE Facility is located a roughly equivalent distance to the nearest fenceline as the FMO facility is to its nearest fenceline. The sum of the effluent-related doses and direct dose equivalents provides an estimate of the total effective dose equivalent (TEDE) associated with the combined Wilmington Site operations (Proposed GLE Facility + existing FMO facility). The calculated annual dose equivalents evaluated were the resident nearest to the Proposed GLE Facility and the maximum exposed individual (MEI; located just south of the southern site boundary near the FMO facility, as shown in **Figure 4.12-2**). The MEI is a hypothetical person living at the point of highest projected total uranium concentrations near the Site boundary. Dose equivalents for the MEI and the nearest resident were calculated by pathway for the total body in adults, teens, children, and infants, and are presented in **Tables 4.12-1 and 4.12-2**, respectively. The committed effective dose equivalent (CEDE) for the adult MEI from the combined FMO facility and Proposed GLE Facility emissions was calculated to be 9.2E-6 millisievert (mSv; 9.2E-4 millirem [mrem]) per year. For the adult full-time resident nearest to the Proposed GLE Facility, the CEDE from the combined FMO facility and Proposed GLE Facility emissions was calculated to be 5.6E-6 mSv (5.6E-4 mrem) per year. For the fenceline nearest to the Proposed GLE Facility, the CEDE for an adult from the combined FMO and Proposed GLE Facility emissions was calculated to be 5.3E-6 mSv (5.3E-4 mrem) per year. These doses are well below the EPA 10 mrem per year standard ((40 CFR 190, *Environmental Radiation Protection Requirements for Normal Operations of Activities in the Uranium Fuel Cycle*, *Final Environmental Statement*, *Volume 1*) and the NRC TEDE 100 mrem per year limit (10 CFR 20, *Standards for Protection Against Radiation*). Thus, the public and occupational health impacts of operation of the Proposed GLE Facility are expected to be SMALL. Decommissioning of the Proposed GLE Facility would remove radioactive and hazardous materials from the GLE Facility site, eliminating the potential for future public exposure to these materials. During decommissioning activities, worker radioactive and hazardous material exposures and potential release pathways to public exposure would be controlled and monitored in accordance with GLE internal procedures, any applicable license conditions, and applicable federal and State regulatory requirements. Public and occupational health impacts from decommissioning are also expected to be SMALL.

7.3.8 Wastewater Management Impacts

Construction activities would not generate appreciable process wastewater streams. Construction workers would use portable toilets. During operation, an estimated 5,000 gpd (18,900 lpd) of treated radwaste effluent and an estimated additional 30,000 gpd (113,600 lpd) of cooling tower blowdown would be discharged to the existing Wilmington Site final process lagoon facility for further treatment. An estimated 10,500 gpd (39,700 lpd) of sanitary wastewater from the Facility would be collected in the sewer system connected to the existing activated sludge sanitary wastewater treatment facility on the Wilmington Site. The addition of the estimated quantities of process and sanitary wastewaters from the Proposed GLE Facility to the quantities of similar wastewaters from other existing and planned operations at the Wilmington Site would be within the maximum allowable treatment and discharge limits of the Site's current NPDES permit for discharge to the on-site effluent channel, which flows to the Unnamed Tributary #1 to Northeast Cape Fear River. Further, the qualities of the wastewaters from the Proposed GLE Facility would be similar or better than those currently being received at these facilities for treatment. Therefore, the impacts from managing these additional wastewaters are anticipated to be SMALL. With the end of production and the dismantling of the Facility, sanitary and process wastewater effluent discharges would incrementally decrease to zero over the decommissioning phase. Contaminated solutions generated from decontamination activities would be contained for appropriate treatment, including continued operation of the GLE liquid effluent treatment system to pre-treat radioactive-contaminated solutions before they are pumped to the existing NPDES-permitted Wilmington Site final process lagoon facility.

7.3.9 Solid Waste Management Impacts

Construction of the Proposed GLE Facility would generate solid waste that would be transported off-site and disposed or recycled. Operation of the Proposed GLE Facility would generate an estimated 487 ton/year (449 mt/year) of municipal solid waste and other industrial nonhazardous solid wastes, 12 ton/year (11 mt/year) of wastes designated as Resource Conservation and Recovery Act hazardous wastes, 103 ton/year of combustible (93 mt/year) low-level radioactive waste (LLRW), and 241 tons/year (219 mt/year) of noncombustible LLRW requiring off-site disposal. No high-level radioactive wastes or mixed wastes would be generated by the Proposed GLE Facility operations. The quantities of waste generated by the Proposed GLE Facility would vary depending on the waste type, but would be limited by implementing a waste minimization plan. The combustible and noncombustible LLRW generated by the Proposed GLE Facility operations would be shipped off-site to a licensed facility for recovery, recycling, reuse, or disposal, as appropriate for the specific type of waste. In addition, approximately 12,400 ton/year (11,250 mt/year) of UF_6 tails would be produced by the uranium-enrichment process at full production. UF_6 tails would be temporarily stored at the Proposed GLE Facility before being shipped off-site to a licensed depleted uranium-conversion facility. Impact of treatment and disposal of solid wastes generated by construction, operation, and decommissioning of the Proposed GLE Facility is expected to be SMALL.

7.4 Proposed Action Alternative: Environmental Benefits

7.4.1 Energy Security

Over the next several decades, demand for enriched uranium is projected to grow. Currently, some of the demand for enriched uranium is supplied by foreign sources; increased domestic production of enriched uranium would reduce the possibility that this foreign supply could be vulnerable to either domestic or international political pressure. Recent studies have estimated that that by 2014, U.S. reactors' demand for Separative Work Units (SWU) will exceed projected supply (including approximately 1 million SWU of GLE's output) by almost 5 million SWU (see **Figure 1-13**). Other information provided in **Chapter 1** of this Report (*Introduction*) shows that the SWU shortfall for the world as a whole is similar. Thus, the

Proposed Action's projected 6 million SWU production has the potential to be critical in meeting the nuclear power industry's needs and increasing the nation's energy security. This benefit is potentially LARGE.

7.4.2 Energy Generation with Fewer Emissions of Criteria Pollutants and Carbon

Increased production of enriched uranium from the Proposed GLE Facility would support an increase in electricity production using nuclear technology. Compared to the most likely alternative coal-fired power plants, nuclear electricity generation results in fewer emissions of criteria pollutants, such as NO_x, SO_2, and PM, as well as reduced emissions of carbon. In addition, the laser-enrichment technology being chosen for the Proposed GLE Facility is less energy-intensive than existing technologies; therefore, regional air quality and environmental impacts are further reduced. As stated by NRC's Web site, "Laser enrichment consumes less power, creates less waste, and is more efficient than gaseous diffusion and gas centrifuge enrichment" (NRC, 2008). On a national basis, these environmental benefits are MODERATE.

7.5 Proposed Action Alternative: Socioeconomic Costs and Benefits

In addition to the environmental costs and benefits described above, this Report also examines social and economic impacts and environmental justice, which are important measures of Proposed Action impacts that differ from the environmental costs and benefits listed above. The economic and social impacts of the Proposed Action include both impacts accruing to GLE and impacts accruing to residents of the region. Among the socioeconomic costs and benefits examined are the value of the uranium produced; the jobs and payroll created by the Proposed Action; tax revenues to be generated by the Proposed Action; costs of site preparation and construction; operation and decommissioning of the Proposed GLE Facility; increased traffic congestion caused by the workers commuting to the Facility and trucks transporting raw materials and products to and from the Facility; impacts on historical and cultural resources; impacts on scenic resources; and impacts on social services, such as fire protection, medical care, and schools. The direct costs of constructing, operating, and decommissioning of the Proposed GLE Facility are summarized here and discussed in **Section 4.10**, *Socioeconomic Impacts*, and **Appendix U** in greater detail**.**

7.5.1 Uranium produced

When fully operational, the Proposed GLE Facility will produce 6 million SWU per year, valued at more than $500 million. As noted above, this is potentially a LARGE social benefit because it addresses a projected SWU shortfall in the U.S. nuclear power industry.

7.5.2 Jobs and Payroll

As shown in **Table 4.10-3**, employment at the Proposed GLE Facility would range from 140 to 490 during the 7-year construction period. For the start-up period (first 4 years of operation), there would be approximately 200 start-up employees and 350 operations employees. After that period, there would be 350 employees throughout the operating period of the Facility. Decommissioning would require 200 employees. Although less than 1% of regional baseline employment, this is a SMALL positive impact on the region's economy. Payroll at the Proposed GLE Facility is estimated to range from approximately $11 million during the first year of construction to a high of $69 million in 2013, when there are construction, start-up, and operations workers on-site. During regular operations, annual payroll is estimated to be $32 million.

7.5.3 Tax Receipts

As employment and payroll vary during the construction and start-up periods, sales and income taxes would also vary. During operations, new workers moving into the region would contribute an estimated $747,000 in personal income taxes and sales taxes per year. North Carolina corporate income taxes are estimated to total approximately $1.3 billion over the operating life of the Facility.

7.5.4 Costs of Site Preparation, Construction, Production, and Decommissioning

The costs of site preparation, construction, production, and decommissioning are considered by GLE to be proprietary and are discussed in **Appendix U** (a proprietary document). Although not all these expenditures will be spent in the Wilmington region, the labor costs would be spent within the region, along with a share of the rest. This would be a MODERATE contribution to the region's economy.

7.5.5 Transportation Impacts

The Wilmington Site is located adjacent to the U.S. Interstate Highway 140 (I-140) interchange (Exit 18) with N.C. Highway 133 (NC 133, also known as Castle Hayne Road and, previously, U.S. Highway 117). I-140 connects to U.S. Interstate Highway 40 (I-40) about 3.5 miles (5.6 km) to the east of this interchange, providing continuous interstate highway access from the Wilmington Site to locations throughout the United States. The Site can be accessed from the downtown district of Wilmington and the port area by traveling north on NC 133 (Castle Hayne Road). Existing traffic patterns in the Wilmington Site vicinity are described in **Section 3.2.2** of this Report (*Wilmington Site Transportation Access*).

Under the Proposed Action, automobiles and trucks traveling to and from the Proposed GLE Facility would use existing public roadways. Materials, supplies, and equipment for construction and operation of the Proposed GLE Facility would be delivered to the Wilmington Site by truck. The Proposed Action would result in additional automobile and truck traffic on these local roadways. A new security gate would be constructed to control access to the Proposed GLE Facility. This would increase the number of entry points to the Wilmington Site off of NC 133 (Castle Hayne Road) from two to three entrances. The proposed North access road would be the route used by workers and trucks to access Proposed GLE Facility from NC 133 (Castle Hayne Road; see **Figure 4.1-1**).

Construction of the Proposed GLE Facility is planned to begin in the year 2011 and continue through 2017, although the majority of the construction would be completed by 2013. Construction activities would potentially require an annual labor force of up to 485 workers (see discussion in **Section 4.10.2**, *Proposed Action [Socioeconomic Impacts]*). Recent annual average daily traffic (AADT) counts for NC 133 (Castle Hayne Road) in the vicinity of the Wilmington Site are in the range of 14,000 to 19,000 vehicles per day (see **Section 3.2.2.1**, *Existing Transportation Routes and Traffic Patterns*, and **Figure 3.2-8**). Construction of the Proposed GLE Facility could potentially add up to an estimated 815 average daily vehicle trips (ADT) to the affected segment of NC 133 (Castle Hayne Road) in the vicinity of the Wilmington Site, including both construction workers commuting to the Site and heavy-haul trucks delivering construction materials. Most of this traffic is expected to immediately use I-140, with the remainder of the traffic staying on NC 133 (Castle Hayne Road). The traffic increases associated with construction of the Proposed GLE Facility are temporary (with the most intense activity lasting approximately 3 years), and the construction phase should not adversely impact the existing vehicle capacity of either I-140, NC 133 (Castle Hayne Road), or the connecting roadways. Traffic externalities associated with construction are estimated to be SMALL for the region as a whole, but MODERATE in the segment of NC 133 (Castle Hayne Road) between the Site entrance and the I-140 interchange.

Operations at the Proposed GLE Facility would result in an incremental increase in traffic on major roadways in the vicinity of the Wilmington Site. During initial start-up, operation of the Proposed GLE Facility would add an estimated 1,560 ADT counts; this number would decrease to 740 ADT after the start-up period is completed and remain at that level for the rest of the operation period. Traffic externalities associated with operations are thus estimated to be SMALL for the region as a whole and MODERATE on NC 133 (Castle Hayne Road) in the immediate area of the Site. Operation of the Proposed GLE Facility would increase shipment of radioactive material to and from the Site. Following NRC and U.S. Department of Transportation (DOT) requirements for packaging and transport, trucks would be used to ship UF_6 feed to the Site, UF_6 products to customers, and the UF_6 tails and LLRW to licensed treatment or disposal facilities. The direct connection of I-140 to I-40 provides continuous interstate highway routes from the Proposed GLE Facility to the origination/destination facilities. Radioactive material transport impacts would be SMALL.

Decommissioning employment is estimated to be lower than either construction or operations employment; thus, traffic externalities associated with decommissioning are also projected to be SMALL.

7.5.6 Impacts to Historical and Cultural Resources

Although an archaeological site potentially eligible for listing on the National Register of Historic Places was identified during the assessment of historical and cultural resources on or near the GLE Study Area, the Proposed Action was modified to avoid disturbing the archaeological site (i.e., the existing service road within the South Road portion of the GLE Study Area would be paved, but not widened). Impacts to historical and cultural resources during construction, operation, or decommissioning of the Proposed GLE Facility are expected to be SMALL because no physical changes to the archaeological site are planned.

7.5.7 Visual and Scenic Impacts

During site preparation and construction, some visual impacts may occur due to clearing of portions of the GLE Study Area. Temporary visual impacts may result from the use of construction cranes. Overall, visual impacts during construction are expected to be SMALL. Operation of the Proposed GLE Facility would be compatible with the Wilmington Site's Bureau of Land Management Visual Resources Management System (i.e., BLM VRMS) Management Class IV designation. The visual/scenic resource impacts of Proposed GLE Facility operations at viewpoints outside of the Wilmington Site property boundaries would be mitigated by the design and layout of buildings and other Proposed GLE Facility structures, their location in the North-Central Site Sector of the Wilmington Site, and the retention of a perimeter tree buffer. The 160-foot (49-meter) tower section of the main GLE operation building and the new water tower would be the only structures that are likely to have a visual impact to observers off-site. Given the nature and scale of existing industrial manufacturing operations at the Wilmington Site and in its vicinity, these additional tall structures at the Wilmington Site would be consistent with the visual elements and architectural features already at the Site. The Proposed GLE Facility structures would neither visually impact any known historical, archaeological, or cultural resources on or in the vicinity of the Wilmington Site, nor create visual, audible, or atmospheric elements that are out of character with the Wilmington Site vicinity or alter its existing mixed land use setting. Thus, the visual and scenic impacts of operation of the Proposed GLE Facility are expected to be SMALL. Decommissioning of the Proposed GLE Facility would not result in any additional visual and scenic impacts; thus, the visual and scenic impacts of decommissioning are expected to be SMALL.

7.5.8 Impacts on Regional Services

Because a share of the employees hired by the Proposed GLE Facility would come from outside the region, and because a share of them will bring spouses and children with them, the Proposed Action would increase the demand for public services. Among the types of services demanded are health services, public education, police and fire protection, and housing. The number of new residents in the region is estimated to be, at most, 500 people, which is less than 0.1% of the region's baseline population. Contacts with providers of various types of services and examination of data on such things as unoccupied hospital beds and unoccupied housing for rent or sale reveal that the existing service infrastructure should be able to provide services to the new residents without compromising the quality of service or pushing prices up. The impact on demand for local services is expected to be SMALL.

7.5.9 Environmental Justice

Environmental justice requires that federal policies, projects, and regulated activities not impose disproportionately high and adverse environmental impacts on minorities or low-income people. Examination of the environmental and socioeconomic impacts of the Proposed Action reveal that no group is likely to experience disproportionately high and adverse impacts. Adverse impacts are almost entirely expected to be SMALL. Although there are areas within a 4-mile (6.4-km) radius of the Proposed GLE Facility location that have high percentages of minority population or low-income population, the impacts of the Facility are expected to fall within the Census Block Group (CBG) where the Wilmington Site is located. The area surrounding the Wilmington Site includes a mixture of low-income, middle-income, and affluent residents, as well as minority and non-minority residents. Thus, the Proposed Action is not expected to result in disproportionately high and adverse environmental impacts on low-income or minority residents.

7.6 Summary

Table 7.5-1 presents a summary of the benefits and costs estimated to result from the Proposed Action. The anticipated benefits of the Proposed GLE Facility include socioeconomic benefits and environmental benefits. Profits earned by GLE from Facility operations and additional jobs and spending in the regional economy may be regarded as external financial benefits. Similarly, the additional tax revenues that may be received by federal, State, and local government as a result of the Proposed Action may also be regarded as a socioeconomic benefit. Environmental benefits of the Proposed Action include increased energy security due to increased quantity and reliability of supply for enriched uranium, possible increases in the share of electric power that is generated by nuclear plants, and the use of a less energy-intensive enrichment technology. In addition, the Proposed GLE Facility would provide enriched uranium to fuel existing and potential new U.S. nuclear power plants. Nuclear power plants provide a critical source of base-load electricity without emitting the air pollutants and greenhouse gases associated with combustion-related power generation.

The estimated environmental and socioeconomic costs of the Proposed GLE Facility are generally SMALL, and many of the anticipated external costs may be offset by mitigation measures. These costs include increases in traffic associated with the Wilmington Site, small increases in releases to surface water, small increases in air emissions, and possible impacts, but not adverse impacts, on some Federal Species of Concern.

As noted in the introduction, the overall impact of the Proposed GLE Facility on social welfare includes both the environmental and socioeconomic costs and benefits described here and the private costs and benefits experienced by the Facility owners. **Appendix U** provides additional information about these private benefits and costs.

Considering both private and external benefits and costs, it appears that the Proposed GLE Facility would result in positive net benefits.

Table

Table 7.5-1. Summary of Projected External Benefits and Costs

Cost-Benefit Category	Description	Scale of Impacts
	Benefits	
Energy Security	Increases availability of nuclear fuel, reducing reliance on foreign sources of enriched uranium; establishes an advanced uranium-enrichment technology in the United States.	LARGE
Enriched Uranium Produced	Estimated 6 million Separative Work Units (SWU), helps address projected SWU shortfall in United States after 2014.	LARGE
Reduced Emissions	By allowing increased nuclear power generation, may encourage reduced emissions of criteria pollutants and greenhouse gases by fossil-fuel fired electric utility power plants.	MODERATE
Energy Efficiency	SILEX (Separation of Isotopes by Laser Excitation) technology produces enriched uranium using less electric power than existing uranium enrichment technologies.	MODERATE
Economic Impacts	Employment of up to 1040 during construction and start-up and 350 during operation; increases in regional income due to employee payroll and local GE-Hitachi Global Laser Enrichment LLC (GLE) purchases of goods and services.	MODERATE
Tax Receipts	Sales and income taxes due to GLE and employee spending; corporate income tax on GLE profits.	SMALL
	Costs	
Construction Cost	Proprietary information.	MODERATE
Operating Cost	Proprietary information.	MODERATE
Land Use	Proposed GLE Facility will be built on land already owned by one of the owning companies, already zoned I-2 for Heavy Industrial use, and adjacent to an existing nuclear fuel fabrication plant and other industrial manufacturing operations; no impact on surrounding land uses expected.	SMALL
Transportation	Up to 815 average daily traffic (ADT) counts during construction and 740 to 1,560 ADT during operation. Congestion may occur in the immediate area between Wilmington Site entrances and the U.S. Interstate Highway I-140 (I-140) interchange.	SMALL regionally, MODERATE locally
Water Resources	Groundwater quality for nearby wells unaffected; no significant adverse impacts on nearby wells anticipated from relatively small changes in groundwater withdrawals.	SMALL
	After mitigation, no significant impacts to surface water quality or quantity due to construction of Proposed GLE Facility.	SMALL
	Small increase in surface water runoff and sanitary wastewater discharges during operation.	SMALL
	Short-term increase in soil erosion during GLE Facility site preparation would be mitigated by following proper construction best management practices, thus minimizing the potential impact of sediment on surface waterbodies.	SMALL
	Modification to the stream crossing for the proposed South access road would occur within the floodplain but would not impede floodwaters. Increases in floodwaters due to runoff during extreme storm events will be slight (3% to 5%).	SMALL
	Less than 1 acre of wetlands affected; impacts would be mitigated.	SMALL

(continued)

Table 7.5-1. Summary of Projected External Benefits and Costs (continued)

Benefit-Cost Category	Description	Scale of Impacts
	Costs (continued)	
Soils	Terrain changes induced during site preparation would be minimal because the area is very gently sloping. Shallow soils would be disturbed for the construction of building footings and the excavation of stormwater detention ponds. The construction of the proposed North access road would require excavation, backfilling, compaction, grading, and paving. Shallow soils disturbed during construction would either be reused within the GLE construction site (i.e., GLE Facility site) or stockpiled for potential use in other areas of the Wilmington Site, and no off-site disposal of soil is expected.	SMALL
Air Quality	The construction, operation, and decommissioning of the Proposed GLE Facility would result in SMALL impacts from air emissions to the atmosphere and would not substantially change the ambient air quality in the vicinity of the Proposed GLE Facility.	SMALL
Ecological Resources	Of nine federally-listed Threatened and Endangered Species that are listed as potentially occurring in New Hanover County, only one species may be affected, but would not likely be adversely affected.	SMALL to MODERATE
Social Services	Small increases in regional population will not burden housing, schools, police and fire services, or healthcare.	SMALL
Noise	Except for short duration, temporary construction noise impacts associated with building the proposed North access road portion of the Proposed GLE Facility (MODERATE), noise modeling indicates impacts from construction, operations, and decommissioning will be SMALL	SMALL
Public and Occupational Health	Some increase in work-related injuries due to construction; no adverse health impacts projected for either employees or residents due to radiological or non-radiological releases.	SMALL
Environmental Justice	Environmental impacts are expected to be SMALL and not to fall disproportionately on low-income or minority residents.	SMALL
Wastewater	Process waste and sanitary waste will be treated prior to release to existing effluent channel. Quantities are within maximum allowable under existing National Pollutant Discharge Elimination System (NPDES) permit for the Wilmington Site. Stormwater will be routed to a stormwater wet detention basin prior to release.	SMALL
Solid Waste	Generated municipal, industrial non-hazardous, hazardous, and low-level radioactive waste (LLRW) would be collected and transported off-site for appropriate recycling, treatment, and/or disposal. Uranium hexafluoride (UF_6) tails would be temporarily stored at the Proposed GLE Facility before being shipped to a licensed depleted-uranium conversion facility. The impacts associated resulting from these waste management practices are anticipated to be SMALL to MODERATE.	SMALL to MODERATE

GLE Environmental Report

Chapter 8 – Summary of Environmental Consequences

Revision 0

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Table of Contents

List of Tables

8. Summary of Environmental Consequences

This section summarizes the environmental consequences for the Proposed Action that cannot be avoided and for which no practical means of mitigation are available to completely eliminate the impacts. Identification and description of the environmental impacts for the Proposed Action that would result from the construction, operation, and decommissioning of the Proposed GLE Facility are presented in **Chapter 4** of this Report (*Environmental Impacts*). The mitigation measures that would be incorporated into the Proposed Action to control and minimize potential adverse impacts are summarized in the "Control of Impacts" subsection for each resource category in **Chapter 4** and discussed further in **Chapter 5** of this Report (*Mitigation Measures*).

8.1 Unavoidable Adverse Environmental Impacts

Implementing the Proposed Action would result in some unavoidable adverse impacts on the environment. The types and magnitudes of these impacts would vary during the construction, operation, and decommissioning phases for the Proposed GLE Facility. Environmental impacts from an action that are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of an applicable environmental resource are assigned the significance level of SMALL. When the environmental impacts from an action are sufficient to alter noticeably, but not to destabilize, important attributes of a resource, a significance level of MODERATE is assigned. Environmental impacts that are clearly noticeable and are sufficient to destabilize important attributes of a resource are assigned the significance level of LARGE.

In general, the unavoidable residual adverse impacts for the Proposed Action after implementation of mitigation measures to control and minimize potential adverse impacts would be SMALL, with the exception of MODERATE impacts for transportation; ecological; on-site storage and management of uranium hexafluoride (UF_6) tails; and noise resources on a localized or temporary basis (i.e., at or in the immediate vicinity of the Proposed GLE Facility or only during the construction phase). On a regional basis, the impacts for these resources also would be SMALL. No LARGE adverse environmental impacts are identified for the Proposed Action. The environmental impacts by resource category for the Proposed Action are summarized in **Table 8-1** for each phase of the project life (i.e., GLE Facility site preparation and construction, operation, and decommissioning). The summaries presented in the **Table 8-1** are based on detailed impact discussions and incorporate the impact controls for each resource category presented in the corresponding section in **Chapter 4** of this Report (*Environmental Impacts*), as identified in the table.

8.2 Irreversible and Irretrievable Commitments of Resources

Section 5.8 of NUREG-1748, *Environmental Review Guidance for Licensing Actions Associated with NMSS (Nuclear Material Safety and Safeguards) Programs* (NRC, 2003), defines an "irreversible" commitment and an "irretrievable" commitment as follows:

- *Irreversible* refers to the commitment of environmental resources that cannot be restored
- *Irretrievable* refers to the commitment of material resources that once used cannot be recycled or restored for other uses by practical means.

8.2.1 Irreversible Resource Commitments

No commitments of environmental resources at, or in proximity to, the Wilmington Site were identified for the construction, operation, and decommissioning of the Proposed GLE Facility that ultimately could not be restored after Facility closure and decommissioning of the GLE Facility site for unrestricted use (excluding the material resources discussed in **Section 8.2.2**). Water required for Proposed GLE Facility operations would be obtained from existing Wilmington Site wells. The resulting wastewaters from the Facility's water usage would be treated to meet applicable water quality standards and then discharged back to local receiving surface waters. No solid wastes generated by the Proposed GLE Facility operations would be land-disposed at the Wilmington Site. At the end of the Proposed GLE Facility's operational life, GE-Hitachi Global Laser Enrichment LLC (GLE) is planning to decontaminate and decommission the Facility and restore the GLE Facility site for unrestricted use. This would make the site available for a future alternative land use. Given the Wilmington Site's current land use zoning and the expected land development in its vicinity, the future uses of the GLE Facility site would most likely remain industrial. It is possible that following release of the site for unrestricted use, the GLE structures could be demolished and the land restored to provide a wildlife habitat. Similarly, the limited wetland resources removed by the Proposed Action could be restored. Impacts from paving and minor increased use of an existing gravel road adjacent to a discovered prehistoric archaeological site would be SMALL. No other historically significant archaeological sites were identified within the GLE Study Area. Demolition of the GLE structures during the decommissioning phase would remove the visual/aesthetic impacts created by the structures. The transportation, air quality, noise, and public and occupational health impacts associated with the Proposed GLE Facility operations would cease with the permanent shutdown and decommissioning of the Facility.

The Proposed GLE Facility would require the irreversible commitment of land use resources at those off-site land disposal facilities that would be used for the permanent disposal of the wastes generated by the construction, operation, and decommissioning of the Facility. These wastes include nonhazardous wastes, hazardous wastes, and noncombustible low-level radioactive wastes (LLRW) (see **Section 4.13.2** of this Report, *Proposed Action [Waste Management Impacts]*). In addition, the depleted uranium conversion facilities receiving and processing the UF_6 tails generated by the Proposed GLE Facility would generate wastes ultimately requiring disposal. Wastes from the Proposed GLE Facility would permanently use a portion of the applicable land disposal unit's capacity (e.g., municipal solid waste generated at the Proposed GLE Facility would permanently consume a portion of the New Hanover County landfill's permitted capacity).

8.2.2 Irretrievable Resource Commitments

The construction of the Proposed GLE Facility would require commitments of significant quantities of concrete, steel, nonferrous metals, plastics, and other material resources to the manufacturing of the equipment and the building of the structures required for the operation of the Proposed GLE Facility. The specific types and quantities of these materials would depend on the final Facility design. Upon permanent cessation of Facility operations, certain types of these building materials and used equipment could be recycled after completing decontamination and dismantling of such materials or equipment. The disposal of remaining unusable or contaminated materials or equipment would be an irretrievable commitment of material resources.

The operation of the Proposed GLE Facility would require the mining and refining of uranium ores to supply the UF_6 feed for the uranium-enrichment process. The enriched uranium produced by the Proposed GLE Facility would be used to manufacture the nuclear fuel rods needed to support electrical power production using nuclear technology. Eventually, these rods would be used in the nuclear fuel cycle, and at the end of their use, would need to be disposed as spent fuel. Final disposal of spent fuel would be an irretrievable resource commitment. Also, the depletion of uranium ore deposits to produce the UF_6 feed for Proposed GLE Facility operations would be an irretrievable commitment of material resources.

The uranium-enrichment process and ancillary equipment that would be used for the Proposed GLE Facility are powered by electricity. The electrical power required for Proposed GLE Facility operations would be supplied by the local electric utility company, which produces electricity using fossil-fuel-fired and nuclear power plants to supply power to its grid. At times of electric utility power outages, stand-by power would be provided by the Proposed GLE Facility's on-site diesel electric generators. In addition, diesel fuel and gasoline would be used to operate the motor vehicles used for the Proposed GLE Facility construction, operation, and decommissioning. The electrical energy and fuel consumption for the Proposed GLE Facility would depend on the final Facility design. The consumption of fossil and nuclear fuels to provide the energy to operate the Proposed GLE Facility would be an irretrievable commitment of material resources.

The Proposed GLE Facility construction, operation, and decommissioning would generate a combination of nonhazardous, hazardous, and radioactive waste streams. Those waste materials that could not be recovered or recycled, and, therefore, would need to be disposed (i.e., either by incineration on-site or by burial in an off-site landfill), would represent an irretrievable commitment of material resources. Hazardous and LLRW shipped off-site to a licensed land-disposal facility would permanently remove a portion of land surface area for other land uses by virtue of its disposal at such a facility.

8.3 Short-Term and Long-Term Impacts

Section 5.8 of NUREG-1748 (NRC, 2003) defines a short-term period and a long-term period as follows:

- *Short-term* represents the period from start of construction to the end of the Proposed Action, including prompt decommissioning
- *Long-term* represents the period extending beyond the end of the Proposed Action.

The short-term environmental impacts for the Proposed GLE Facility are the impacts summarized in **Table 8-1**. Long-term environmental impacts identified for the Proposed GLE Facility are related to land use beyond the permanent closure of the Proposed GLE Facility. As discussed in **Section 8.2.1**, although the future land use of the area on which the Proposed GLE Facility would be located is expected to be unrestricted, the actual long-term use of the land would likely remain an industrial use. Similarly, wastes generated by the Proposed GLE Facility and sent off-site for land disposal would remove land from future alternative uses.

8.4 Short-Term Uses of the Environment and Maintenance and Enhancement of Long-Term Productivity

Consistent with the definitions established in Section 5.8 of NUREG-1748 (NRC, 2003), the terms "short-term uses" and "long-term productivity" are defined as follows:

- *Short-term uses* generally affect the present quality of life for the public (i.e., the planned license period for the Proposed GLE Facility)
- *Long-term productivity* affects the quality of life for future generations based on environmental sustainability (i.e., the period after license termination for the Proposed GLE Facility).

The construction, operation, and decommissioning of the Proposed GLE Facility would require short-term uses of environmental resources that would have a SMALL impact on the quality of life for the public. Impacts on the public from the short-term use of these environmental resources for the Proposed Action would be controlled and minimized to the extent practicable with the implementation of mitigation measures and good resource management practices.

The Proposed GLE Facility would be constructed on land already owned by General Electric Company (GE) and currently not accessible by the public. No identified cultural or historical resources would be impacted by the Proposed Action. The Proposed GLE Facility would create no visual/resource impacts that are out of character with the Wilmington Site vicinity, or alter its existing mixed land use setting. Potential impacts from geological conditions on the Proposed GLE Facility are expected to be SMALL and mitigated through engineering controls.

The Proposed Action would result in SMALL direct impacts on stream channels by creating a crossing for the proposed North access road and modifying an existing crossing to be used for the proposed South access road. Water-quality impacts from construction and operation of the Proposed Action would be SMALL due to the use of best management practices (BMPs) and standard waste treatment operations. The Proposed Action does not use surface water as a source of water. Any impacts from the Proposed Action on groundwater quality are anticipated to be SMALL. Groundwater levels are not anticipated to change significantly in response to changes in pumping required for the Proposed Action; therefore, water consumption by the Proposed GLE Facility would not notably impact the supply of water to other users in the area. Upgrade of the existing stream crossing for the proposed South access road would occur within the floodplain boundary, but no other topographic impacts to floodplains are anticipated. Minor changes in floodwater volume and flow during extreme storm events are anticipated, and these SMALL impacts would be mitigated by natural systems. The main 100-acre (40-hectare) area of the Proposed GLE Facility would not directly impact any wetlands. The proposed North access road would cross two jurisdictional wetland areas and potentially impact two isolated wetlands. The existing gravel service road that would be upgraded to serve as the proposed South access road crosses and abuts another jurisdictional wetland; however, this wetland would not be directly impacted from the modifications to the existing roadway. Direct and indirect impacts to these wetlands would be SMALL and mitigated to the extent practicable and as required by regulations.

Construction and operation of the Proposed GLE Facility and proposed North and South access roads would displace some local wildlife populations to nearby habitat in the western portion of the Wilmington Site and disrupt wildlife travel corridors. Human encounters with some wildlife could increase due to disruption of travel corridors and loss of habitat. No direct impacts to rare or unique habitats or commercially or recreationally valuable species would result from the Proposed Action. The removal of forested biotic communities would noticeably alter the composition of habitat, but would not destabilize the existence of these communities. Overall, wildlife populations on the Wilmington Site would be altered, but the existence of these species would not be destabilized. Therefore, direct and indirect impacts to ecological resources from the Proposed Action would be MODERATE.

Workers at the Proposed GLE Facility would use appropriate safety equipment and procedures to limit to acceptable levels any radiation and chemical exposure that would occur during certain material-handling and maintenance activities required for operation of the uranium-enrichment process. During construction, operation, and decommissioning of the Proposed GLE Facility, air emissions control systems, monitoring programs, and BMPs would be used to limit the amounts of air pollutants released to the atmosphere so as to not significantly affect the ambient air concentration levels to which the public is exposed. Wastewaters generated by the Proposed GLE Facility operations would be treated on-site to meet National Pollutant Discharge Elimination System (NPDES)–permit requirements before being discharged to receiving waterbodies used by the public. Solid wastes would be managed on-site in accordance with good waste storage and handling practices and shipped for recycling, re-use, or final treatment or disposal at licensed facilities appropriate for the waste type.

Overall population, economic, and social adverse impacts from the Proposed GLE Facility are anticipated to be SMALL. The numbers of workers required for construction, operation, and decommissioning of the Proposed GLE Facility are expected not to significantly affect housing, educational, medical, law enforcement, and fire services in the region. The Proposed Action is not expected to result in disproportionately adverse impacts on low-income or minority residents.

Motor vehicle traffic generated by the construction and operation of the Proposed GLE Facility could increase local traffic congestion during certain times of the day on roadways in the vicinity of U.S. Interstate Highway 140 and NC Highway I33 (also known as Castle Hayne Road) interchange, creating MODERATE impacts, but overall transportation impacts would be SMALL on a regional basis. Existing residents living adjacent to the northeastern Wilmington Site property boundary near the proposed North access road could be exposed to temporary MODERATE noise impacts for short durations during initial site preparation and construction activities for the Proposed GLE Facility. Because most noise-generating sources associated with operation of the Proposed GLE Facility would be located inside structures, noise impacts for the remainder of the operating life of the Proposed GLE Facility would be SMALL.

The construction, operation, and decommissioning of the Proposed GLE Facility would permanently consume materials and energy resources that would no longer be available for use by future generations. Upon the permanent closure of the Proposed GLE Facility, GLE would decontaminate and decommission the buildings and equipment and restore the land for unrestricted use. This would make the GLE Facility site available for a future alternative land use.

The construction and operation of the Proposed GLE Facility would require the short-term commitment of resources and would permanently commit certain resources (e.g., land, uranium ore, energy, construction materials) to the Facility's construction and operation. The short-term use of such resources would result in the long-term socioeconomic benefits to the local area and the region through continued (and incremental) employment and expenditures as described in **Section 4.10.2** of this Report, *Proposed Action (Socioeconomic Impacts)*. Long-term productivity would be facilitated by investment in dependent businesses in the local area and region and would provide further socioeconomic benefits to the local area and the region.

Table

Table 8-1. Summary of Unavoidable Short-Term Adverse Environmental Impacts for Proposed Action

Resource Category	Unavoidable Short-Term Adverse Environmental Impacts		
	Site Preparation and Construction	**Operation**	**Decommissioning**
Land Use (see **Section 4.1**)	**SMALL** – Approximately 100 acres (40 hectares [ha]) of land within the Wilmington Site, which currently is owned by General Electric Company (GE), would be used for the construction of the main GLE operations building and other Facility-support structures. Located to the east of this 100-acre (40-ha) parcel and within the Main portion of the GLE Study Area would be ancillary structures required for operation of the Proposed GLE Facility that cumulatively would require, approximately, an additional 13 acres (5 ha) to be cleared. No additional land outside of the Wilmington Site would need to be acquired for the project.	**SMALL** – The selected land parcel for the Proposed GLE Facility would be located within the Wilmington Site, which currently is zoned I-2 by New Hanover County for Heavy Industrial land use and already serves as a site for nuclear fuel manufacturing and other industrial manufacturing operations.	**SMALL** – Upon permanent cessation of operations, the Proposed GLE Facility will be decommissioned to reduce the level of radioactivity remaining in the Facility to residual levels acceptable for release of the Facility for unrestricted use.

(continued)

Resource Category	Unavoidable Short-Term Adverse Environmental Impacts		
	Site Preparation and Construction	**Operation**	**Decommissioning**
Transportation (see **Section 4.2**)	**SMALL to MODERATE** – An estimated 815 average daily trips (ADT) would occur during the site preparation and construction phase. Construction materials would be shipped to the site by trucks. Adding 815 ADTs to the current annual ADT levels for the affected segments of N.C. Highway 133 (NC 133. also known as Castle Hayne Road) would significantly add to the traffic volumes on the road and increase the potential for traffic congestion during peak commuting hours; therefore, the transportation impacts on a local basis during construction would be MODERATE. The proximity of the Proposed GLE Facility to the NC 133/U.S. Interstate Highway 140 (I-140) interchange and direct connection of I-140 to U.S. Interstate Highway 40 (I-40) would allow truck shipments and workers commuting to and from the GLE construction site (i.e., GLE Facility site) to bypass traveling on surface roadways in the surrounding communities; therefore, the transportation impacts for the Proposed GLE Facility on a regional basis would be SMALL.	**SMALL to MODERATE** – An estimated 1,560 ADT would occur during initial start-up due to this period having the largest on-site work force. Once the start-up phase is completed, the traffic impact is projected to decrease to 740 ADT for the remainder of planned operating life. These traffic volumes are similar to those during construction, so impacts on a local basis during operation locally would be MODERATE and regionally would be SMALL. Operations would increase radioactive material truck shipments to and from the Wilmington Site. Following U.S. Nuclear Regulatory Commission (NRC) and U.S. Department of Transportation (DOT) requirements for packaging and transport, trucks would be used to ship uranium hexafluoride (UF_6) feed to the Site, UF_6 products to customers, and UF_6 tails and low-level radioactive wastes (LLRW) to licensed treatment or disposal facilities. I-140's direct connection to I-40 provides continuous interstate highway routes from the Proposed GLE Facility to the origination/destination facilities. Radioactive material transport impacts would be SMALL.	**SMALL –** The number of daily vehicle trips would decrease during the decommissioning activities to an estimated 105 ADT. Truck transport from the Site would be used for shipping the decontamination and demolition wastes to licensed disposal or recycling/re-use facilities. Given the significant reduction in the number of on-site workers, the level of expected truck traffic, the relatively short duration of many of the decommissioning activities, and the future roadway system improvements likely to have been made in the area by the date that the Proposed GLE Facility permanently ceases production, the transportation impacts during decommissioning would be SMALL.

(continued)

Table 8-1. Summary of Unavoidable Short-Term Adverse Environmental Impacts for Proposed Action (continued)

Resource Category	Unavoidable Short-Term Adverse Environmental Impacts		
	Site Preparation and Construction	**Operation**	**Decommissioning**
Soils (see **Section 4.3.1**)	**SMALL** – Site preparation and construction of the Proposed GLE Facility and the proposed North access road would require clearing and grading of approximately 146 acres (59 ha) of land. Terrain changes would be minimal because the area is very gently sloping (gradients less than 2%). Shallow soils would be disturbed for building footings and excavation of stormwater detention ponds. North access road construction would require excavation, backfilling, compaction, grading, and paving. The volumes of soils that would be impacted depend on the Proposed GLE Facility final design and layout. Any shallow soils disturbed or moved during construction would either be re-used within the GLE construction site or stockpiled for potential use in other areas of the Wilmington Site. No off-site disposal of soil is expected.	**SMALL** – Operation of the Proposed GLE Facility would not involve additional soil disturbances beyond that required for site preparation and construction. Additional areas susceptible to soil erosion and dust generation would not be created.	**SMALL** – Decommissioning activities would include removal of any contaminated soil and soil testing to demonstrate that any residual soil impacts, as compared to the baseline soil-sampling results, meet U.S. Nuclear Regulatory Commission (NRC) and U.S. Environmental Protection Agency (EPA) requirements.
Geology (see **Section 4.3.2**)	**SMALL** – Construction potentially could require the placement of foundations into deeper, largely unconsolidated subsurface deposits. These geological conditions, however, would not create significant impacts on site preparation and construction of the Proposed GLE Facility, and the SMALL impacts would be mitigated through engineering controls.	**SMALL** – Structure foundations for the Proposed GLE Facility would be designed to meet building codes and to control impacts from seismic events, as well as predicted settlement from building loads. The potential for a seismic event that would induce an impact on Proposed GLE Facility operations is SMALL. The potential of the subsurface materials within the GLE Study Area to liquefy and have an impact on the operations is also SMALL.	**SMALL** – Decommissioning activities are expected to involve removal of aboveground equipment and possibly structures, and would not impact subsurface soils.

(continued)

Table 8-1. Summary of Unavoidable Short-Term Adverse Environmental Impacts for Proposed Action (continued)

Resource Category	Unavoidable Short-Term Adverse Environmental Impacts		
	Site Preparation and Construction	**Operation**	**Decommissioning**
Groundwater (see **Section 4.4.1**)	**SMALL** – Sanitary waste at the GLE construction site would be managed using portable toilets. The water needed for site preparation and construction would be provided by tanker truck from existing water sources, and it would be required that those sources be of potable quality. Therefore, there would be no anticipated impact to groundwater quality during site preparation and construction.	**SMALL** – Water use for Proposed GLE Facility operations would be provided by the existing groundwater supply well system used at the Wilmington Site. Groundwater modeling predicts that the modified pumping rates would change groundwater levels to a small extent within the Peedee Aquifer in the Site vicinity, and the groundwater flow patterns would remain largely unchanged. There are no known existing off-site groundwater quality issues within or just beyond the catchment area of the Wilmington Site pumping wells. Therefore, the small change in groundwater elevations induced by the increased pumping is not anticipated to have any impact on off-site groundwater supply or quality. No significant impact on the effectiveness of the existing on-site pumping well system to protect off-site groundwater users from existing on-site impacted groundwater is anticipated.	**SMALL** – Procedures, methods, and protocol used for decontamination and decommissioning activities would be designed to prevent impacts to groundwater quality.

(continued)

Table 8-1. Summary of Unavoidable Short-Term Adverse Environmental Impacts for Proposed Action (continued)

Resource Category	Unavoidable Short-Term Adverse Environmental Impacts		
	Site Preparation and Construction	**Operation**	**Decommissioning**
Surface waters (see **Section 4.4.2**) Note: See the *Wastewater Management Resource Category* section of this table for additional details.	**SMALL** –Construction and/or modification of stream crossings for the proposed North and South access roads would result in SMALL direct impacts on up to 392 feet (ft; 119 meters [m]) of stream channel. There would be no direct impacts to surface waters from construction of the Proposed GLE Facility. The impacts from any soil erosion on surface waterbodies from construction of the proposed North and South access roads and the Proposed GLE Facility are anticipated to be SMALL due to the use of best management erosion control practices, and this construction would not cause water quality standards or limits to be exceeded. Impacts to navigation, industrial transport, commercial fishing, or recreation uses would be SMALL.	**SMALL** – The wastewater management practices that would be used during operation of the Proposed GLE Facility would not cause surface water quality standards or limits to be exceeded (see *Wastewater Management Resource Category*). Surface water runoff from the Proposed GLE Facility would be routed to a stormwater wet detention basin before discharging to receiving waters, which would serve to regulate stormwater quality and quantity as required by the National Pollutant Discharge Elimination System (NPDES) stormwater permit. Stormwater runoff from the UF_6 storage area would be routed to a holding pond for monitoring before the stormwater would be released to the stormwater wet detention basin. Impacts to navigation, industrial transport, commercial fishing, or recreation uses would be SMALL	**SMALL** – With the cessation of production and the decommissioning of the Facility, sanitary and process wastewater effluent discharges would incrementally decrease to zero over the decommissioning phase. Stormwater runoff would continue to flow to the existing stormwater wet detention basin. Contaminated solutions generated from decontamination activities would be contained for appropriate treatment, including continued operation of the GLE liquid radwaste treatment system to pre-treat radioactive-contaminated solutions before they are pumped to the existing NPDES-permitted Wilmington Site final process lagoon facility.
Floodplain (see **Section 4.4.3**)	**SMALL** –Upgrade of the existing stream crossing for the proposed South access road would occur within the floodplain boundary, but the new crossing would be designed to meet or exceed current flow capacity. Therefore, impacts to the floodplain would be SMALL. Construction of the Proposed GLE Facility and proposed North access road would occur outside of the floodplain boundaries.	**SMALL** –Any increase in floodwaters due to stormwater runoff from the Proposed GLE Facility and access roads would be SMALL and likely mitigated by the natural buffering capacity of the Swamp Forest of the Western Site Sector on the border of the Northeast Cape Fear River system.	**SMALL** – No change in grading or impervious areas on the Wilmington Site is expected to result from decommissioning activities.

(continued)

Table 8-1. Summary of Unavoidable Short-Term Adverse Environmental Impacts for Proposed Action (continued)

Resource Category	Unavoidable Short-Term Adverse Environmental Impacts		
	Site Preparation and Construction	**Operation**	**Decommissioning**
Wetlands (see **Section 4.4.4)**	**SMALL** – The main 100-acre (40-ha) area of the Proposed GLE Facility would not directly impact any wetlands. Up to 0.42 acres of jurisdictional wetlands and 0.19 acres of isolated wetlands at the Wilmington Site would be removed by the construction of the proposed North access road, and no direct impacts would be anticipated from the modifications of the proposed South access road. Unavoidable temporary impacts to wetlands could result from site preparation and construction activities due to the removal of vegetation, temporary storage of construction materials, and potential sediment runoff. The resulting temporary impacts would be mitigated by restoring the disturbed wetlands areas to pre-existing conditions through the planting of vegetation and removal of excess sediment.	**SMALL** – Indirect impacts would occur to wetlands that would receive stormwater runoff from the Proposed GLE Facility and its roadways. Increased runoff could decrease water quality and increase water quantity to these wetlands, thereby altering the species composition or decreasing their ability to function. The proposed North access road would likely bisect a riparian wetland area, thereby interrupting the hydrologic connectivity of that riparian wetland. This disruption could create wetter conditions upstream of the crossing and drier conditions downstream. Modification of the proposed South access road would not impact adjacent wetlands during the operation phase.	**SMALL** – Decommissioning activities would occur within the areas previously disturbed for Proposed GLE Facility construction and operation; therefore, no further impacts to wetlands would occur.
Water Use (see **Section 4.4.5**)	**SMALL** – Water for construction activities would be provided by tanker truck from existing potable water sources.	**SMALL** – The additional process and potable water required for Proposed GLE Facility operations would be obtained from existing wells at the Willington Site. Groundwater modeling predicts that the increased groundwater withdrawals would not significantly impact neighboring residential wells or groundwater supplies. The existing Wilmington Site groundwater pumping-well system was historically able to provide volumes of water that are significantly greater than the volumes projected to be required without significant adverse impacts.	**SMALL** – Water use by decommissioning activities would be expected to require similar or smaller quantities than the amount needed during the operation phase.

(continued)

Table 8-1. Summary of Unavoidable Short-Term Adverse Environmental Impacts for Proposed Action (continued)

Resource Category	Unavoidable Short-Term Adverse Environmental Impacts		
	Site Preparation and Construction	**Operation**	**Decommissioning**
Ecological (see **Section 4.5**)	**MODERATE** – Construction of the Proposed GLE Facility and proposed North and South access roads would displace some local wildlife populations to nearby habitat in the western portion of the Wilmington Site. Human encounters with some wildlife could increase due to disruption of travel corridors and loss of habitat. No direct impacts to rare or unique habitats or commercially or recreationally valuable species would result from construction. Overall, wildlife populations on the Wilmington Site would be altered, but the existence of these species would not be destabilized. Therefore, direct and indirect impacts to wildlife would be MODERATE. The majority of the vegetation that would be disturbed by construction was planted or regenerated after clear-cutting of the area occurred in the early 1990s. Longleaf and loblolly pines are the dominant tree species. The removal of forested biotic communities would noticeably alter the composition of habitat, but would not destabilize the existence of these communities; therefore, direct and indirect impacts to existing biotic communities would be MODERATE.	**SMALL** – Operation of the Proposed GLE Facility would not directly impact additional biotic communities beyond those impacted during the site preparation and construction phase. Fencing around the Proposed GLE Facility could cause additional disruption of wildlife travel corridors. In addition, the Proposed GLE Facility would bisect current biotic communities. Wildlife could develop new travel corridors and use the fenceline and new access road as corridors; however, these corridors would increase these animals' vulnerability to predation and decrease the amount of habitat. Wildlife such as deer and turkey could be attracted to forest edges to feed on planted grasses and plants that may grow along the edge. Human encounters with some wildlife could increase due to disruption of travel corridors and loss of habitat. Impacts from noise, height of the Facility, and emissions would be SMALL. Operation would not significantly alter the impact to biotic communities or wildlife beyond those impacts during construction; therefore, impacts to travel corridors and habitat quality would be SMALL	**SMALL** – Decommissioning activities would occur within the area used for operations. Landscape areas and maintained lawn areas established at the completion of the construction phase could be impacted during the decommissioning process. Disturbed areas would be re-planted in accordance with the regulations at the time of decommissioning. Impacts from possible radiological exposure would be similar to or less than exposure during the operation phase. Decommissioning would be conducted in accordance with NRC and EPA regulations, thereby minimizing impacts to humans and, as a result, also afford protection to ecological resources. Overall impacts to wildlife and biotic communities from decommissioning would be SMALL.

(continued)

Table 8-1. Summary of Unavoidable Short-Term Adverse Environmental Impacts for Proposed Action (continued)

Resource Category	Unavoidable Short-Term Adverse Environmental Impacts		
	Site Preparation and Construction	**Operation**	**Decommissioning**
Air Quality (see **Section 4.6**)	**SMALL** –Site preparation activities, proposed North access road construction, and other construction activities would create temporary localized fugitive dust emissions. Dust-suppression work practices would be used to mitigate these fugitive dust emissions. Carbon monoxide (CO), nitrogen oxides (NO_x), particulate matter (PM), sulfur dioxide (SO_2), and volatile organic compound (VOC) emissions would be released from on-site heavy construction equipment and from automobiles and trucks travelling to and from the GLE construction site. Ambient air modeling predicts that the fugitive dust and other air emissions to the atmosphere from the construction activities would not substantially change the ambient air quality in the vicinity of the Proposed GLE Facility. The air emissions are expected to have no measurable impact on regional visibility.	**SMALL** – The Proposed GLE Facility would not be a major source of air emissions as defined by the applicable EPA and North Carolina Division of Air Quality (NC DAQ) air permitting requirements. The laser uranium enrichment technology would not emit CO, NO_x, SO_2, or VOCs. There is a potential that Proposed GLE Facility operations could result in small releases of hydrogen fluoride (HF) and PM, consisting of uranium isotopes and uranyl fluoride (UO_2F_2). Any such releases would be contained within the main GLE operations building and routed to a high-efficiency, multi-stage emissions-control system. Small amounts of nonradioactive air emissions consisting of CO, NO_x, PM, SO_2 and VOCs would be released from the intermittent use of auxiliary diesel electric generators to supply electrical power when power from the utility grid is not available. Other small miscellaneous air emissions sources would be associated with building and equipment maintenance activities. Additional CO, NO_x, PM, SO_2, and VOC emissions would be released from on-site vehicles and from automobiles and trucks travelling to and from the Facility. Ambient air modeling predicts that the air emissions to the atmosphere from operations would not substantially change the ambient air quality in the vicinity of the Proposed GLE Facility. The air emissions are expected to have no measurable impact on regional visibility.	**SMALL** –During any demolition activities required for decommissioning, localized fugitive dust emissions could occur for relatively short durations. Dust-suppression work practices would be used to mitigate these fugitive dust emissions. CO, NO_x, PM, SO_2, and VOC emissions would be released from on-site construction equipment and from automobiles and trucks travelling to and from the site. The number of vehicles and the duration that the vehicles are on-site would be less than occurred during the construction phase. Therefore, it is expected that the air emissions to the atmosphere from Proposed GLE Facility decommissioning would not substantially change the ambient air quality in the vicinity of the Proposed GLE Facility. The air emissions are expected to have no measurable impact on regional visibility.

(continued)

Table 8-1. Summary of Unavoidable Short-Term Adverse Environmental Impacts for Proposed Action (continued)

Resource Category	Unavoidable Short-Term Adverse Environmental Impacts		
	Site Preparation and Construction	**Operation**	**Decommissioning**
Noise (see **Section 4.7**)	**SMALL to MODERATE** –Construction of the Proposed GLE Facility and proposed access roads would temporarily generate short duration noises resulting from construction equipment, site preparation, and other activities typical of building construction sites. Sound-level modeling predicts that temporary localized MODERATE noise level impacts would occur for existing residents living in proximity to the northeast Wilmington Site property line. These impacts would result from proposed North access road construction activities and automobile and truck traffic using this road to access the GLE construction site. At locations farther off-site, the noise impacts for the Proposed GLE Facility would be SMALL.	**SMALL** – Most equipment that would be used for the Proposed GLE Facility operations would primarily be housed within the main GLE operations building, with limited rooftop equipment planned. Other ancillary exterior equipment, such as heat pumps, pumps, and transformers, would be potential noises sources. Vehicular traffic noise along the proposed North access road would be generated by automobile and trucks using the road. Sound-level modeling predicts that the sound levels at nearby residential subdivisions from the operation of equipment and vehicle traffic associated with Proposed GLE Facility operations would be below the applicable New Hanover County Noise Ordinance and EPA sound-level limits.	**SMALL** – Noise-generating decommissioning activities would include dismantling of Facility equipment and trucks hauling the equipment and other materials off-site. Any demolition required for decommissioning would produce temporary noise levels similar to those produced by heavy construction equipment used for site preparation. As a result, the majority of the noise impacting the community would be temporary and predominated by truck and vehicle traffic noise along the North access road. The expected noise levels would be similar to those during the Proposed GLE Facility operation phase, and therefore, would have a SMALL noise impact.
Historical and Cultural (see **Section 4.8**)	**SMALL** –Two archaeological sites were identified within the GLE Study Area. One of the sites was determined not to be historically significant. The second site, located on the edge of a bluff overlooking the Northeast Cape Fear River, was determined to be a prehistoric archaeological site dating to the Middle Woodland period. This archaeological site would not be disturbed by the paving of an existing nearby gravel service road or other activities required for the construction of the Proposed GLE Facility.	**SMALL** – Impacts from minor increased use of an existing service road adjacent to an identified prehistoric archaeological site would be SMALL. To enable the identified prehistoric archeological site to remain undisturbed and to help prevent erosion due to wind or rain, the conditions of the bank at the side of the existing gravel road would remain unchanged from its current graded and vegetated state.	**SMALL** – The identified prehistoric archaeological site would not be disturbed by the activities required for the decommissioning of the Proposed GLE Facility.

(continued)

Table 8-1. Summary of Unavoidable Short-Term Adverse Environmental Impacts for Proposed Action (continued)

Resource Category	Unavoidable Short-Term Adverse Environmental Impacts		
	Site Preparation and Construction	**Operation**	**Decommissioning**
Visual/Scenic (see **Section 4.9**)	**SMALL** – The construction of the Proposed GLE Facility would require clearing of vegetation from areas in the interior of the Wilmington Site; however, the amount of trees and vegetation cleared would be limited, to the extent practicable, to the land area needed for the Proposed GLE Facility's operational, security, and utility requirements. Temporary visual intrusions into the landscape may result from the use of construction cranes at the GLE construction site for erecting building structures and installing equipment. No other visual/scenic resource impacts are expected to result from the activities performed for site preparation and construction of the Proposed GLE Facility.	**SMALL** – The Proposed GLE Facility would be compatible with the Wilmington Site's Bureau of Land Management Visual Resources Management System (i.e., BLM VRMS) Management Class IV designation. The visual/scenic resource impacts of Proposed GLE Facility operations at viewpoints outside of the Wilmington Site property boundaries would be mitigated by the design and layout of buildings and other Proposed GLE Facility structures, their location in the North-Central Site Sector of the Wilmington Site, and the retention of a perimeter tree buffer. The 160-ft (49-m) tower section of the main GLE operation building and new water tower would be the only structures that are likely to have a visual impact to observers at some off-site viewpoints. Given the nature and scale of existing industrial manufacturing operations at the Wilmington Site and in its vicinity, adding these two additional tall structures to the Wilmington Site would not be out of character with the visual elements and architectural features already at the Site. The Proposed GLE Facility structures would neither visually impact any known historical, archaeological, or cultural resources on or in the vicinity of the Wilmington Site, nor create visual, audible or atmospheric elements that are out of character with the Wilmington Site vicinity, or alter its existing mixed land use setting.	**SMALL** – Decommissioning activities would involve removal and decontamination of the process equipment and materials from building interiors and from outdoor storage areas. Some of the structures, including the main GLE operations building, access roads, and utility lines built for the Proposed GLE Facility, would remain in place after closure. No additional changes to the visual/scenic resources impacts are expected due to the decommissioning of the Proposed GLE Facility.

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Table 8-1. Summary of Unavoidable Short-Term Adverse Environmental Impacts for Proposed Action (continued)

Resource Category	Unavoidable Short-Term Adverse Environmental Impacts		
	Site Preparation and Construction	**Operation**	**Decommissioning**
Socioeconomic (see **Section 4.10**)	**SMALL** – The annual construction labor force needed for the Proposed GLE Facility would peak at approximately 490 workers. The impact of these workers on social resources and services would depend on how many workers are hired from within the region. If most of the construction workers are obtained from within the region, then social services such as law enforcement and education would experience little increase in demand and, therefore, create no adverse impacts. A large influx of construction workers from outside the region could potentially temporarily affect housing, educational, medical, law enforcement, and fire services. An analysis based on the estimated number of construction workers required for site preparation and construction shows that, overall, the socioeconomic impact of the site preparation and construction activities associated with the Proposed GLE Facility is anticipated to be SMALL.	**SMALL** – Approximately 350 permanent workers would be needed for operation of the Proposed GLE Facility following start-up. Depending on the number of these workers relocating from other regions, operation of the Proposed GLE Facility could affect housing, educational, medical, law enforcement, and fire services. An analysis based on the estimated number of new workers required for startup and operation shows that, overall, the socioeconomic impact of operation of the Proposed GLE Facility is anticipated to be SMALL.	**SMALL** – Approximately 50 workers would be needed for decommissioning activities. Decommissioning of the Proposed GLE Facility would not occur until the permanent cessation of operations and thereby would provide community leaders and planners time to prepare for its potential impacts. It also would be completed within a relatively short amount of time (~2 years). As a result, supporting this activity would not require a permanent adjustment in social infrastructure, such as building new hospitals or schools. The analysis of the social impacts of construction and operation suggest that regional housing, education, and medical services would not be adversely impacted by other large, temporary increases in population. The social impact of decommissioning of the Proposed GLE Facility, therefore, would be SMALL.

(continued)

Table 8-1. Summary of Unavoidable Short-Term Adverse Environmental Impacts for Proposed Action (continued)

Resource Category	Unavoidable Short-Term Adverse Environmental Impacts		
	Site Preparation and Construction	**Operation**	**Decommissioning**
Environmental Justice (see **Section 4.11**)	**SMALL** – Residential neighborhoods near the Wilmington Site include a mix of minority and non-minority residents, as well as a mix of residents having low incomes and residents having incomes above the low-income or poverty threshold. Because the greatest impact from activities associated with the Proposed GLE Facility is not expected to extend beyond the immediate vicinity of the Wilmington Site, site preparation and construction would not result in any disproportionately adverse impacts on low-income or minority residents.	**SMALL** –The greatest impact from Proposed GLE Facility operations would occur in areas with a mix of ethnicities and income levels. Proposed GLE Facility operation would not result in any disproportionately adverse impacts on low-income or minority residents.	**SMALL** – Decommissioning of the Proposed GLE Facility would not result in any disproportionately adverse impacts on low-income or minority residents.
Public and Occupational Health (see **Section 4.12**)	**SMALL** – No radioactive materials would be on-site during the site preparation and construction. During the site preparation and construction phase, worker activities and exposures to hazardous materials would be controlled and monitored according to Occupational Safety and Health Administration (OSHA) and applicable State of North Carolina requirements governing construction activities at construction sites.	**SMALL** –Modeling analysis predicts that the impact on public or occupational health from the use, release, and treatment of radiological materials during combined operation of the Proposed GLE Facility with the existing FMO facility would be SMALL. The non-radiological chemicals (e.g., HF) potentially released from the Proposed GLE Facility operation are not persistent and would not accumulate in the environment or cause cumulative health effects. Any non-radiological impacts to worker or public health would be SMALL and would be managed by a combination of process controls, best management practices (BMPs) and As Low As Reasonably Achievable (ALARA) practices, and monitoring programs.	**SMALL** – Decommissioning of the Proposed GLE Facility would remove radioactive and hazardous materials from the GLE Facility site, eliminating the potential for future public exposure to these materials. During decommissioning activities, worker radioactive and hazardous material exposures and potential release pathways to public exposure would be controlled and monitored in accordance with GEH internal procedures, any applicable license conditions, and federal and State regulatory requirements applicable at the time of decommissioning.

(continued)

Table 8-1. Summary of Unavoidable Short-Term Adverse Environmental Impacts for Proposed Action (continued)

Resource Category	Unavoidable Short-Term Adverse Environmental Impacts		
	Site Preparation and Construction	**Operation**	**Decommissioning**
Wastewater Management (see **Section 4.13.1**)	**SMALL** – Construction activities would not generate appreciable process wastewater streams. Construction workers would use portable toilets. Stormwater runoff would be contained using BMPs for soil erosion control at construction sites as prescribed in the Erosion and Sedimentation Control Plan required for the NPDES construction permit.	**SMALL** – Proposed GLE Facility operations would generate an estimated 5,000 gallons per day (gpd; 18927 liters per day [lpd]) of process liquid radwaste that would be collected in a closed drain system connected to a liquid effluent treatment system. Treated radwaste effluent and an estimated additional 30,000 gpd (113,562 lpd) of cooling tower blowdown would be discharged to the existing Wilmington Site final process lagoon facility. An estimated 10,500 gpd (39,747 lpd) of sanitary wastewater from the Facility would be collected in sewer system connected to the existing Wilmington Site activated sludge sanitary wastewater treatment plant. The addition of the estimated quantities of process and sanitary wastewaters from the Proposed GLE Facility to the quantities of similar wastewaters from other existing and planned operations at the Wilmington Site would be within the maximum allowable limit allowed under the Site's current NPDES permit for discharge to the on-site effluent channel, which flows to Unnamed Tributary #1 to Northeast Cape Fear River. Surface water runoff from the Proposed GLE Facility would be routed to a stormwater wet detention basin before discharging to receiving waters, which would serve to regulate stormwater quality and quantity as required by the NPDES stormwater permit. Stormwater runoff collected from the UF_6 cylinders storage pad would be first routed to a holding basin, where it would be monitored and released to the GLE stormwater wet detention basin only if the uranium concentration is below the acceptable level.	**SMALL** – With the permanent cessation of operations and resulting reduction in the number of on-site workers, sanitary and process wastewater quantities generated by the Proposed GLE Facility would decrease to eventually zero by the end of the decommissioning phase. Radioactive-contaminated solutions generated from Proposed GLE Facility decontamination activities would be treated in the existing GLE liquid effluent treatment system before the system was dismantled. Stormwater runoff would continue to be routed from the Proposed GLE Facility's stormwater drainage system to the GLE stormwater wet detention basin during the decommissioning phase and after closure.

(continued)

Table 8-1. Summary of Unavoidable Short-Term Adverse Environmental Impacts for Proposed Action (continued)

Resource Category	Unavoidable Short-Term Adverse Environmental Impacts		
	Site Preparation and Construction	**Operation**	**Decommissioning**
Solid Waste Management (see **Section 4.13.2**)	**SMALL** – Construction of the Proposed GLE Facility would generate solid waste materials that would need to be collected and transported off-site for recycling or disposal. It is expected that predominately refuse and construction debris typical of industrial construction projects would be generated during the construction phase. No radioactive wastes would be generated during the initial construction phase. Good work practices for construction site waste management would be used to collect and sort the wastes for recycling or disposal at a licensed off-site facility appropriate for the waste type. Hazardous waste generated throughout the construction phase would be temporarily stored on-site, and then shipped to an off-site facility appropriate for the waste types in accordance with established recycling and hazardous waste management programs.	**SMALL to MODERATE** – Operation of the Proposed GLE Facility would generate an estimated 487 tons/year (442 metric tons (mt)/year) of municipal solid waste (MSW) and other industrial nonhazardous solid wastes, 12 tons/year (11 mt/year) of wastes designated as Resource Conservation and Recovery Act (RCRA) hazardous wastes, and approximately 345 ton/year (313 mt/year) of LLRW. No high-level radioactive wastes or mixed wastes would be generated by the Proposed GLE Facility operations. The quantities of waste generated by the Proposed GLE Facility would vary depending on the waste type, but would be limited by implementing a waste minimization plan. The MSW, industrial non-hazardous, RCRA hazardous waste, and LLRW generated on-site during Proposed GLE Facility operation would be collected and shipped off-site for recycling, treatment, and/or disposal at the appropriate, licensed facility. In addition, approximately 12,400 ton/yr (11,249 mt/year) of UF_6 tails would be generated by the uranium-enrichment process at full production. The UF_6 tails would be temporarily stored at the Proposed GLE Facility before being shipped to a licensed depleted-uranium conversion facility. The impacts from on-site UF_6 tails cylinders storage during normal conditions would be SMALL and, in the event of an accident, the impacts would be SMALL to MODERATE, depending on the type and magnitude of the incident. It is expected that the impacts of off-site conversion of the UF_6 tails generated by the Proposed GLE Facility to depleted uranium oxide at a licensed depleted-uranium conversion facility, as well as the ultimate disposal of this material at a licensed LLRW disposal facility, would be SMALL.	**SMALL** – Solid wastes would be generated by activities required for the decontamination and removal of process equipment from inside of buildings. Decontaminated, used equipment would be shipped off-site to salvage or disposal facilities, as appropriate to the equipment type. For any structures demolished as part of the decommissioning activities, the demolition material would be shipped off-site. Radioactive-contaminated equipment and materials removed during decommissioning would be shipped to a licensed treatment or disposal facility (as appropriate for the material type) or disposed of in a manner authorized by the NRC. Similarly, hazardous waste materials removed during decommissioning would be shipped to a RCRA-permitted Subtitle C treatment, storage, and disposal facility (i.e., TSDF) or an appropriate, licensed recovery facility.

GLE Environmental Report

Chapter 9 – References

Revision 0

December 2008

Table of Contents

9. References

Chapter 1.0 Introduction

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GLE Environmental Report

Chapter 10 – List of Preparers

Revision 0

December 2008

Table of Contents

List of Tables

10. List of Preparers

Table 10-1 lists the individuals who contributed to the preparation of the Environmental Report and their affiliation. The Report was primarily prepared for GE-Hitachi Global Laser Enrichment LLC (GLE) by staff at RTI International (RTI), and included technical input from consultants and subcontractors to RTI.

The list of contributors is organized into three sections:

1. RTI staff
2. GLE staff
3. Technical consultants to RTI
4. Subcontractors to RTI.

The contributor's name, academic credentials, and years of experience are provided in **Table 10-1**. The type of contribution that each person made for the 11 chapters of the Environmental Report is noted by the following:

A **Author.** Qualified professional staff who contributed as primary or secondary author to the Report chapters or subsections.

E **Editorial.** RTI professional staff who provided editorial, document preparation, or graphical support.

L **Lead.** RTI professional staff assigned to lead a chapter or subsection of the Report to help facilitate involvement of authors and incorporation of reviewer's comments.

QA **Quality Assurance.** RTI professional staff who contributed to the overall quality review of the project.

R **Reviewer.** RTI professional staff included in one or more of several tiers of technical review of a chapter or subsection (ranging from specific subject matter expertise to senior technical reviewers with a broader perspective).

T **Technical.** Professional staff who made specific technical contributions to sections of the Report or the associated analyses, modeling, or database support. RTI staff such as Geographic Information System (GIS) analysts who contributed to maps and figures used throughout the report.

Principal individuals responsible for the environmental assessment that led to the development of this Report (i.e., authors/reviewers) are denoted with an asterisk in **Table 10.1-1**. RTI professional staff who had minimal input on the project, and administrative or overhead personnel, are not listed in **Table 10-1**.

Table

Table 10-1. Contributors to Environmental Report for GLE

Contributors, Credentials, and Education	Environmental Report by Chapter and Contribution Breakdown A=Author E=Editorial L=Lead QA=Quality Assurance R=Reviewer T=Technical											
	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	General Project Role
1. RTI International Staff												
Joseph Alexander, P.G. (Project Director)* M.S., Geology (concentration in Hydrogeology/Engineering Geology), Northern Arizona University B.S., Geology, East Carolina University Years of Experience: 34	R	R	R	R	R	R	R	R		R	R	L T
Justine Allpress (GIS Specialist) B.S., Applied Geography, East Carolina University Continuing Education: Work toward M.A. in Geography, University of North Carolina at Charlotte Years of Experience: 10												T
Paul Andrews (Research Environmental Scientist)* B.S., Meteorology, The Pennsylvania State University Years of Experience: 15		T	A	A	A	T		A	A		A	
Mary Barber (Senior Environmental Research Scientist) Ph.D., Ecology and Evolutionary Biology, Johns Hopkins University B.A., Biology, Vassar College Years of Experience: 24			R	R								
Susan Beck (Document Preparation Specialist) B.A., English (magna cum laude), West Virginia University Years of Experience: 30												E

(continued)

* Principal individuals responsible for the environmental assessment that led to the development of this Report.

Table 10-1. Contributors to Environmental Report for GLE (continued)

Contributors, Credentials, and Education	Environmental Report by Section and Contribution Breakdown A=Author E=Editorial L=Lead QA=Quality Assurance R=Reviewer T=Technical											
	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	General Project Role
Jo Ellen Brandmeyer (Research Environmental Engineer) Ph.D., Environmental Sciences and Engineering (Air Quality Modeling), University of North Carolina at Chapel Hill M.S., Environmental Engineering (Air Pollution Control), University of Tennessee at Knoxville B.S., Chemical Engineering, University of Missouri at Rolla Years of Experience: 24		R		R T								
William Cooter (Research Environmental Scientist) Ph.D., Economic Climatology, University of Oklahoma M.S., Environmental Science, University of Oklahoma B.S., Mathematics, University of Oklahoma Years of Experience: 35			R T	R								
Michele Cutrofello (Environmental Engineer)* M.S., Environmental and Water Resources Engineering, Tufts University B.S., Environmental Engineering (summa cum laude), Tufts University Years of Experience: 5		T	A	A	A			A	A		A	
Dana Doucet (Project Coordinator) B.S., Business Management, University of Phoenix Certificate in Project Management, University of Phoenix Years of Experience: 5										L		

(continued)

* Principal individuals responsible for the environmental assessment that led to the development of this Report.

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	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	General Project Role
Cary Eaton (Senior Research Chemist and Program Manager) Ph.D., Organic and Analytical Chemistry, North Carolina State University M.S., Analytical Chemistry, University of South Carolina B.S., Chemistry, Davidson College Years of Experience: 42												QA
Kibri Everett (Environmental Scientist) M.S., Earth Science (GIS Concentration), North Carolina Central University B.S., Environmental Technology, North Carolina State University Years of Experience: 2												T
Scott Guthrie (Research Geologist)* B.S., Geology, Marshall University Certificate in Groundwater Resources Planning, J. Sargeant Reynolds Community College Years of Experience: 22		T	R T	R T		T						T
Kathy Heller (Senior Economist)* Completed formal coursework for Ph.D. in Economics, University of North Carolina at Chapel Hill. M.S., Economics, University of North Carolina at Chapel Hill B.A., Economics, The College of William and Mary Years of Experience: 25		T	A R	A R	A		A L	A	A		A	
Andrew Helminger (Environmental Scientist) M.E.M., Duke University, Environmental Management B.A., St. Olaf College, Biology/Environmental Studies Years of Experience: 13			A						A		A	

(continued)

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Beatrix Jackson (Environmental Scientist)* M.S., Geology, Rhine-Westphalian University of Technology of Aachen, Germany B.S., Geology, Rhine-Westphalian University of Technology of Aachen, Germany Years of Experience: 15	A T	A T				A L T		A	A		A	
Carolyn Keith (Research Geologist) M.S., Geology, University of North Carolina at Wilmington B.S., Geology, University of North Carolina at Wilmington B.A., History and English, Women's College of the University of North Carolina Years of Experience: 13			T									T
James Kessler (Geologist)* M.S., Geology (emphasis in Hydrogeology), Northern Arizona University B.S., Geological Sciences, University of Oregon Years of Experience: 10			A	A	A			A	A		A	
Sarah LaRocca (Environmental Scientist) B.S., Environmental Science, University of North Carolina at Chapel Hill Years of Experience: 2		A T	T	T								
Michael Laney (Research Environmental Scientist) M.S.P.H., Environmental Protection, University of North Carolina at Chapel Hill B.S.P., Environmental Health, East Carolina University Years of Experience: 32			R	R								

(continued)

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	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	General Project Role
Sam Leaman (Senior Research Policy Analyst) M.R.P., Regional Planning (Economics emphasis), University of North Carolina at Chapel Hill Rockefeller Fellow, Harvard University, Academic Year B.A., Political Science and Economics, Wake Forest University Years of Experience: 25			R T	R T								
Jennifer Lloyd (Research Programmer/Analyst) B.S., Applied Mathematics, concentration in Computer Science, North Carolina State University Years of Experience: 15												T
Michael Lowry (Research Hydrogeologist)* M.S., Environmental Sciences and Engineering, University of North Carolina at Chapel Hill B.A., Interdisciplinary Studies (Math, Physics, and Geology), University of North Carolina at Chapel Hill Years of Experience: 15			A	A	A	T		A	A		A	
Carol Mansfield, Senior Economist Ph.D., Economics, University of Maryland B.A., Economics, Yale University Years of Experience: 18							R T					

(continued)

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Anthony Marimpietri (Senior Research Director) M.R.P., Regional Planning (Concentration in Environmental Systems Analysis and Environmental Economics), University of North Carolina at Chapel Hill M.S., Environmental Engineering, Drexel University B.S., Mechanical Engineering, Lafayette College Years of Experience: 38	R	R T		R								T
Richard Marinshaw, P.E. (Research Environmental Engineer) M.S., Environmental Engineering, University of North Carolina at Chapel Hill B.S., Civil Engineering, University of Maryland Years of Experience: 30			R	R								
Kimberly Matthews (Research Environmental Scientist)* M.S., Natural Resources, North Carolina State University B.A., Biology, Wittenberg University Years of Experience: 10		T	A R	A R	A L	A T		A	A		A	T
Roy Neulicht, QEP (Senior Research Engineer) B.S., Chemical Engineering, North Carolina State University Years of Experience: 34			R	R								
Maggie O'Neil (Environmental Scientist) M.S., Forest Resources, The Pennsylvania State University B.S., Environmental Biology, St. Lawrence University Years of Experience: 3		T	T									T

(continued)

* Principal individuals responsible for the environmental assessment that led to the development of this Report.

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	Environmental Report by Section and Contribution Breakdown A=Author E=Editorial L=Lead QA=Quality Assurance R=Reviewer T=Technical											
Alton Peters (Research Environmental Engineer) B.S., Civil Engineering, Mississippi State University M.S., Environmental Sciences and Engineering, University of North Carolina at Chapel Hill Years of Experience: 12			T									T
Paul Peterson, P.E. (Senior Research Environmental Engineer)* M.S., Mechanical Engineering, University of California at Irvine B.S., Biological Sciences, University of California at Irvine B.S., Civil and Environmental Engineering, University of California at Irvine Years of Experience: 27		T	A R T	A R T	A T	A T		A L	A		A	
Sunil Rao (Environmental Engineer)* M.S., Civil Engineering, North Carolina State University B.S., Civil Engineering, BVM College of Engineering, India Years of Experience: 4		A T										
Jay Rineer, P.E. (Research GIS Specialist) M.S., Environmental Engineering, Virginia Polytechnic Institute and State University B.S., Civil Engineering, Virginia Polytechnic Institute and State University Years of Experience: 10			R	R								
Cynthia Salmons (Research Environmental Scientist) M.S.P.H., Environmental Chemistry, University of North Carolina at Chapel Hill B.S., Chemistry, Duke University, Durham, NC Total Years of Experience: 24												QA

(continued)

* Principal individuals responsible for the environmental assessment that led to the development of this Report.

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Jenn Schimek (Environmental Scientist) B.S., Biology, University of Texas at Austin Years of Experience: 3		T	A T	A T	A T	A T		A	A		A	
Julie Shogren (Editor/Writer) B.A., Communications, University of Kentucky Years of Experience: 14									L			E
Emaly Simone (Research Environmental Scientist)* B.S., Geology, University of North Carolina at Chapel Hill Years of Experience: 7			L R	L R					R	A L	L R	R T
Andrew Stahl, P.G. (Senior Research Hydrogeologist)* M.S., Geology (hydrogeology emphasis), Pennsylvania State University B.S., Geology, State University of New York at Binghamton Years of Experience: 23	R	R	R	R	R	R	R	R		R	R	L QA T
Robert Truesdale (Director, Water Resources Systems) M.S., Geological Sciences, University of Maine A.B., Geology, Duke University Years of Experience: 25				R								
Mark Turner (Staff Director) B.S., Chemical Engineering, North Carolina State University B.S., Chemistry, University of North Carolina at Chapel Hill Years of Experience: 23		T	A R	A R	T			T				
Constance Wall (Research Environmental Scientist QA Specialist) B.S., Chemistry, North Carolina Central University Years of Experience: 29												QA

(continued)

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Keith Weitz (Environmental Scientist) M.E.M., Environmental Management, Duke University School of the Environment B.A., Economics and Business Administration, Augustana College Years of Experience: 15			R	R								
Amy Wesley-Snider (Environmental Scientist) B.S., Environmental Science, St. Bonaventure University Years of Experience: 6			T						T			QA T
Susan Wolf (Research Environmental Scientist)* M.S.P.H., Environmental Sciences and Engineering, School of Public Health, University of North Carolina at Chapel Hill Thesis in preparation B.A., Biology and Geography, University of Delaware Years of Experience: 15			A	A		A			A			
Dallas Wood (Research Associate)* B.S., Economics, North Carolina State University Years of Experience: 3		T	A T	A T	T		A T		A		A	
2. GLE Staff												
Julie A. Olivier* Completed formal coursework for Ph.D. in Environmental Systems Engineering, Clemson University M.S., Environmental Science and Engineering, Virginia Polytechnic Institute and State University B.S., Chemistry, University of New Orleans Years of Experience: 12	A R	R	R	A R	R	R	R	R	R	R	R	R

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	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	General Project Role
3. Technical Consultants to RTI												
David Dumond* Ph.D., Botany, North Carolina State University M.S., Botany, North Carolina State University B.A., Botany, North Carolina State University Years of Experience: 38			R T	R T	T							
Stephen Johnston Ph.D., Economics, North Carolina State University B.S., Nuclear Engineering, North Carolina State University Years of Experience: 42	A R T	A R T	R	R			R				A	T
Jonathan Lees (University of North Carolina at Chapel Hill)* Ph.D., Geophysics, University of Washington – Seattle B.Sc., Physics, University of Illinois – Urbana B.Sc., Mathematics, University of Illinois – Urbana Years of Experience: 29		T	A									
Bev Wilson (University of North Carolina at Chapel Hill)* Doctoral Student, University North Carolina at Chapel Hill M.R.P., Regional Planning, University North Carolina at Chapel Hill B.A., Political Science and Economics, Duke University Years of Experience: 4			A	A				A	A		A	
4. Subcontractors to RTI												
Jeff Fullerton (Acentech)* M.S., Mechanical Engineering, Bucknell University Years of Experience: 11			A	A	T	T		A	A		A	

(continued)

* Principal individuals responsible for the environmental assessment that led to the development of this Report.

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	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	General Project Role
Roberto Gomez (Acentech) B.A., Economics, University of Massachusetts Years of Experience: 5			T	T								
Jonah Sacks (Acentech) M.S., Architectural Acoustics, Rensselaer Polytechnic Institute Years of Experience: 4			T	T								
Matt Postlewaite (Environmental Services, Inc.) B.A., Anthropology, University of Central Florida Years of Experience: 8			T	T								
Terri Russ (Environmental Services, Inc.) M.A., Anthropology, East Carolina University B.A., Anthropology, University of North Carolina at Chapel Hill Years of Experience: 13			T	T								
Scott Siebel (Environmental Services, Inc.) * M.S., Archaeomaterials, The University of Sheffield B.A., Archaeological Studies, The University of Texas at Austin Years of Experience: 12			A T	A T	T			T	A		A	
Ed Hearn, P.E. (Geotechnologies, Inc.) M.S., Soil Mechanics, University of California B.S., Civil Engineering, Georgia Institute of Technology Years of Experience: 35			R	R	T							

(continued)

* Principal individuals responsible for the environmental assessment that led to the development of this Report.

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Phil Lambe, P.E. (Geotechnologies, Inc.)* Sc.D., Soils Mechanics, MIT M.S., Soils Mechanics, MIT B.S., Civil Engineering, MIT Years of Experience: 24			A T	A T	T				A		A	
Kenneth Weeden (KWA Planning & Associates) M.R.P., Regional Planning, University of North Carolina at Chapel Hill B.A., Journalism and Sociology, University of Mississippi Years of Experience: 33			R	R								

[*] Principal individuals responsible for the environmental assessment that led to the development of this Report.

GLE Environmental Report

Chapter 11 – Glossary

Revision 0

December 2008

Table of Contents

11. Glossary

0.2% annual chance flood (or flow) – Also known as the 500-year flood; refers to the flood elevation for a given area that has a 0.2% chance of being equaled or exceeded each year (FEMA, 2007a).

1% annual chance flood (or flow) – Also known as the 100-year flood; refers to the flood elevation (for a given area) that has a 1% chance of being equaled or exceeded each year. Thus, the 100-year flood could occur more than once in a relatively short period of time. The 100-year flood, which is the standard used by most federal and state agencies, is used by the National Flood Insurance Program as the standard for floodplain management and to determine the need for flood insurance (FEMA, 2006a).

100-year flood – Refers to a flood elevation (for a given area) that has a 1% chance of being equaled or exceeded each year. Thus, the 100-year flood could occur more than once in a relatively short period of time. The 100-year flood, which is the standard used by most federal and state agencies, is used by the National Flood Insurance Program as the standard for floodplain management and to determine the need for flood insurance. The term 100-year flood is synonymous with the 1% annual chance flood (FEMA, 2006a).

500-year flood – Refers to the flood elevation for a given area that has a 0.2% chance of being equaled or exceeded each year. This term is synonymous with the 0.2% annual chance flood (FEMA, 2007a).

a – A constant in the b-Value calculation; describes the seismic activity (log number of events with M=0).

A horizon – Horizons are the distinctive layers that make up a soil profile and aid in the understanding how the soil was formed. Most soils have three or more horizons. The A horizon, which falls below or (in cultivated soils) makes up the surface layer, is composed of a mixture of mostly mineral and organic matter. This layer is a source of plant nutrients and contains the majority of plant roots.

AADT (average annual daily traffic) – The total volume of vehicle traffic in both directions of a highway or road for a year divided by 365 days.

Active (Continental Margin) – A tectonic boundary where two plates are moving toward each other.

Aeromagnetic data – Data obtained from magnetometer recordings of variations in the intensity of the ambient magnetic field, measured from an aircraft.

AE/SCO – Aircraft Engines and Services Components Operations on the Wilmington Site, operated by GE Aviation.

Air mass – A region of atmosphere that is relatively homogeneous in temperature and moisture.

Air stagnation – A meteorological state characterized by poor ventilation due to light or calm winds and the presence of an inversion, which is favorable to an air pollution episode.

Air submersion dose – The dose resulting from external exposure to airborne concentrations.

ALARA (As Low As Reasonably Achievable) – Making every reasonable effort to maintain exposures to radiation as far below the dose limits as is practical and consistent with the purpose for which the activity is undertaken, taking into account the state of technology, the economics of improvements in relation to the state of technology, the economics of improvements in relation to the benefits to public health and safety, and other societal and socioeconomic considerations, as well as in relation to utilization of radiation and radioactive materials in the public interest.

Alluvium – Clay, silt, sand, gravel, or similar unconsolidated detrital material, deposited during comparatively recent geologic time by a stream or other body of running water.

Alpha radiation – Radiation emitted when heavy, unstable nuclides (e.g., uranium, radium, radon, thorium) undergo decay. The alpha particle is a helium nucleus consisting of two protons and two neutrons. Most alpha radiation is not able to penetrate human skin, but can be harmful if alpha-emitting materials are inhaled or swallowed.

Alternative site – A ranked site, other than the proposed site, that was evaluated in the fine-screening step.

Ambient Sound Level – A sound level that represents the background noise from community or environmental sound sources.

Amplification – The process by which soils and sediments near the surface modify ground shaking during earthquakes by reducing the velocity of earthquake waves and increasing their amplitude.

Anadromous – Fish that mainly inhabit salt water, but migrate to fresh water to reproduce.

Analysis (MCDA) – MCDA is a family of mathematically based methods and procedures that provide a comprehensive and rational framework for structuring both tangible and intangible elements of a complex decision problem, for representing and quantifying its elements, for relating those elements to overall goals, and for evaluating alternative solutions.

Anemometer – A rotating instrument used for measuring wind speed, consisting of concave wind-catching cups on top of a pole.

Anticline – A configuration of folded, stratified rocks in which rocks dip in two directions away from a crest.

Aquifer – A subsurface rock or sediment formation that is porous and permeable. To be an aquifer, it must have these traits to a high enough degree that it stores and transmits useful quantities of water.

Area of Environmental Concern – Designated by the North Carolina Coastal Resources Commission within 20 North Carolina counties as areas of natural importance that may be easily destroyed by erosion or floodwater or that may have environmental, social, economic, or aesthetic values to the state.

Area of Potential Effect (APE) – Referred to herein as the GLE Study Area.

Attenuation – A sound-level reduction.

Atterberg limit – A set of parameters for fine-grained silt/clay soils that determine the relative activity of the soils and their relationship to moisture content. The liquid limit, plastic limit, and shrinkage limits define the relative points at which soils transition between the liquid and plastic, plastic and semisolid, and semisolid and solid states, respectively. The parameters are measured in a laboratory test performed according to ASTM D-4318 (ASTM, 2005).

Automated Surface Observing System (ASOS) – Unmanned weather instrumentation and sensors that automatically collect weather observations.

A-Weighting – A series of filters applied to an unfiltered (or Flat) sound level. The A-Weighting is used to generate a single number sound level that is intended to be representative of human response to sound.

Background radiation – Radiation from cosmic sources; naturally occurring radioactive material, including radon (except as a decay product of source or special nuclear material); and global fallout as it exists in the environment from the testing of nuclear explosive devices or from past nuclear accidents that contribute to background radiation and are not under the control of the licensee. "*Background radiation*" does not include radiation from source, by-product, or special nuclear materials regulated by the U.S. Nuclear Regulatory Commission.

Barrier Island – A low, sandy island near and parallel to the shore on a gently sloping offshore bottom.

Base flood elevation – The flood event for a given area that has a 1% chance of being equaled or exceeded in any given year (also known as the 100-year flood). Base Flood Elevations (BFEs) are shown on Flood Insurance Rate Maps (FIRMs) and on the flood profiles. The BFE is the regulatory requirement for the elevation or floodproofing of structures. The relationship between the BFE and a structure's elevation determines the flood insurance premium (FEMA, 2005).

Basement rock – The crust of the Earth, usually igneous or metamorphic, below sedimentary deposits.

Bearing conditions – The capability of soils underlying shallow foundations to support structural loads without excessive settlement.

Beta radiation – A light, short-range particle (an ejected electron) emitted during the radioactive decay of many beta-active, unstable nuclides. Examples of pure beta-emitters are the radionuclides strontium-90 and tritium. Beta radiation is moderately penetrating and can penetrate human skin to the germinal layer (where new skin cells are produced). Beta-emitting contaminants may be harmful if ingested or inhaled.

Bh horizon – The horizon most widely used to classify soil types through its morphology. In some soils, the B horizon is created only from the weathering of the underlying rock, whereas in other soils, this weathering is supplemented by the translocation of materials from overlying horizons. The subscript "h" indicates that humus has translocated into the horizon.

Biomicrudite – A variable proportion of skeletal debris and carbonate mud with fragments that are more than one millimeter in diameter.

Biotic community – A group of organisms living and interacting within the same habitat.

Blowdown – The portion of the circulating water flow in a cooling tower that is removed in order to maintain the amount of dissolved solids and other impurities in the remaining circulating water at acceptable levels.

Body wave – A seismic wave that travels deep within the structure of the earth.

Body-wave magnitude – The magnitude of an earthquake determined by measuring the maximum amplitude of the P-wave, or primary waves, on a seismogram of the event. P-waves are compressional waves that have the highest velocity of all waves generated by earthquakes.

Bog – A type of wetland characterized by acidic water and accumulation of sphagnum moss; precipitation driven.

Brackish – Mixed fresh and salt water.

Breakbulk cargo – Non-containerized general cargo (e.g., iron, steel, machinery, linerboard, woodpulp) stored in boxes, bales, pallets, or other units to be loaded onto or discharged from ships or other forms of transportation (AAPA, 2008).

Bryophytic vegetation – A non-vascular, terrestrial, moss-like plant.

Bryozoan – Any sessile marine or freshwater animal of the phylum Bryozoa, forming branching, encrusting, or gelatinous moss-like colonies of many small polyps.

Bulk cargo – Loose cargo (dry or liquid; e.g., grain, coal, oil) that is loaded, shoveled, scooped, forked, mechanically conveyed, or pumped in volume directly into a ship's hold (AAPA, 2008).

b-Value – The value commonly used to describe the relative occurrence of large and small events (a high *b* value indicates a larger proportion of small earthquakes, and vice versa).

Calcar – A project of cartilage of the ankle of a bat covered with a membrane that forms a pouch to catch and hold insects.

Calcarenite – A limestone consisting of predominantly (more than 50%) recycled calcite particles of sand size; a consolidated calcareous sand; and calcareous sandstone.

Calcareous – Term used to describe a substance that contains calcium carbonate. When applied to a rock name, it implies that as much as 50% of the rock is calcium carbonate.

Calibrator – A device that produces a specific sound level, which can be used to calibrate sound-level meters.

Candidate sites – The universe of potential sites that offer the benefits of facilitating material transport to comply with safety and security requirements while optimizing material transport costs.

Canopy – The uppermost vegetative layer, generally formed by stands of trees.

Capable Fault – As defined in 10 CFR 100, Appendix A, *Seismic and Geologic Siting Criteria for Nuclear Power Plants* (NRC, 1997) "a fault that has exhibited one or more of the following characteristics: 1) movement at or near the ground surface at least once within the past 35,000 years or movement of a recurring nature within the past 500,000 years; 2) macro-seismicity instrumentally determined with records of sufficient precision to demonstrate a direct relationship with the fault; and 3) a structural relationship to a capable fault according to characteristics (1) or (2) of this paragraph such that movement on one could be reasonably expected to be accompanied by movement on the other." It also states that, notwithstanding the foregoing paragraphs, structural association of a fault with geologic structural features that are geologically old (at least pre-Quaternary), such as many of those found in the Eastern region of the United States, shall, in the absence of conflicting evidence, demonstrate that the fault is not a capable fault within this definition.

Carcinogen – A chemical or radiation that is capable of inducing cancer.

Cenozoic – An era of geologic time, from the beginning of the Tertiary period to the present; considered to have begun about 65 million years ago.

Census block – The smallest geographic unit used by the U.S. Census Bureau for tabulation of 100% data (data collected from all houses, rather than a sample of houses). Several Census blocks make up Census Block Groups, which can be combined to create census tracts.

Channel sands – A sand or sandstone deposited in a stream bed or other channel eroded into the underlying rocks.

Class Y – Refers to the retention time of radioactive material in the pulmonary region of the lung. The classification of Y applies to a range of clearance half-times of greater than 100 days.

Clean Water Act (CWA) – Federal act that regulates discharges of pollutants into the waters of the United States (33 U.S.C. 1251 et seq.).

Coastal Area Management Act (CAMA) – Article passed by the General Assembly of North Carolina in 1974 to enable the state and local governments to maintain the environmental health of North Carolina coastal ecosystems cooperatively (N.C.G.S. 113A-129.2).

Coastal stillwater elevations – Elevations that factor in the potential impacts from storm surge, including tidal and wind setup effects (FEMA and State of North Carolina, 2006a).

Coastal Zone Management Act (CZMA) – Law passed by Congress in 1972 to enable states to maintain the environmental health of coastal ecosystems (16 U.S.C. 1451 et seq.).

Coda-wave magnitude – After the initial burst of energy in a seismic signal, the signal gradually returns to the background level experienced prior to the earthquake. This tapering off of the seismic energy is the coda. The length of the coda is proportional to the size of the earthquake and is used to determine a quick estimate of magnitude.

Colluvial – Loose earth material that has accumulated at the base of a hill, through the action of gravity, as piles of talus, avalanche debris, and sheets of detritus moved by soil creep or frost action.

Committed dose equivalent (CDE) – The dose equivalent to organs or tissues of reference that will be received from an intake of radioactive material by an individual during the 50-year period following the intake.

Committed effective dose equivalent (CEDE) – The sum of the products of the weighting factors applicable to each of the body organs or tissues that are irradiated and the committed dose equivalent to these organs or tissues.

Compression wave velocity – The velocity of seismic waves transmitted through the ground by particles vibrating parallel to direction of wave travel.

Concentration – The amount of matter contained within a unit volume. Concentration is often expressed in micrograms per cubic meter of air by the AERMOD dispersion model.

Confined aquifer – An aquifer bounded above and below by impermeable beds, or by beds of distinctively lower permeability than that of the aquifer itself, allowing the groundwater to be under pressure; an aquifer containing confined water.

Confining unit – A body of impermeable or distinctly less-permeable material that is stratigraphically adjacent to one or more aquifers.

Conformably – Pertaining to an unbroken sequence of strata or beds, characteristic of uninterrupted deposition.

Conglomerates – Coarse-grained cemented sedimentary rocks consisting of rounded or subangular fragments set in fine-grained sands or silts.

Consumptive use – Water use where the water is withdrawn from the source and not returned.

Contact (geologic) – A plane or irregular surface between two types or ages of rock.

Convection – The process of transferring heat upwards in the atmosphere by the rising of warm air. The results of convection are sometimes showers and thunderstorms.

Cosmogenic – Produced by the action of rays that come from outer space.

Cretaceous – A period of the Mesozoic era, from 140 million to 65 million years ago.

Criteria Air Pollutant – The 1990 amendments to the Clean Air Act required the U.S. Environmental Protection Agency (EPA) to set National Ambient Air Quality Standards (NAAQS) for certain pollutants known to be hazardous to human health. EPA has identified and set standards to protect human health and welfare for the following six pollutants: sulfur dioxide, particulate matter, nitrogen dioxides, carbon monoxide, ozone, volatile organic compounds, and lead. The term “criteria pollutants” derives from the requirement that EPA must describe the characteristics and potential health and welfare effects of these pollutants. NAAQS are set or revised on the basis of these criteria.

Criteria cluster – Top level in the criteria hierarchy and tree; describes major criteria categories.

Criteria hierarchy – A series of ordered groupings of criteria in a decision tree–like system. Groupings consist of criteria within the same subject matter.

Criteria tree – Graphical representation of the criteria hierarchy.

Criterion – A parameter that is a measurable characteristic and is used to compare sites using site-specific data.

Cross section – A graph or drawing that shows features transected by a given plane.

Cross-bedding – A type of stratigraphic bedding appearing commonly in sandy deposits; the strata, essentially intraformational, dip in the direction of the current flow.

Crystalline – An igneous or metamorphic rock consisting wholly of crystals or fragments.

Cultural resource – Locations or objects that retain evidence of historic or cultural activities that are 50 years of age or older.

Curie – The basic unit used to describe the intensity of radioactivity in material. One curie equals the quantity of radioactive material in which there are 37 billion (3.7×10^{10}) nuclear transformations (i.e., disintegrations) per second, which is approximately the activity of 1 gram of radium.

Day-night Average Sound Level (L_{DN}) – A sound level that represents the average sound level during daytime hours and nighttime hours, with the nighttime hours having a 10 dB increase to represent the higher sensitivity of humans at those hours.

Daytime hours – Hours between 7:00 a.m. and 10:00 p.m.

Debitage – The lithic debris resulting from the manufacture or refurbishment of a lithic tool.

Decay product – A new nuclide formed as a result of radioactive decay. A nuclide resulting from the radioactive transformation of a radionuclide, formed either directly or as the result of successive transformations in a radioactive series. A decay product (daughter product or progeny) may be either radioactive or stable.

Decibels – A logarithmic ratio of a sound pressure level over a reference pressure level of 20 μPa.

Deciduous – Trees, shrubs, or vines that shed their leaves, typically in autumn, and lie dormant during the winter months.

Deltaic – Sedimentary deposits laid down in a delta and characterized by a mixture of sand, clay, brackish-water organisms, and organic matter.

Depth-Duration-Frequency table – A table that relates a storm depth (inches of precipitation) to its duration (minutes or hours) to its frequency of recurrence (5-, 10-, 25-, 50-, 100-, or 500-year storm).

Design basis earthquake event – The earthquake specified by the International Building Code for use in structural design. The safety systems at a site must be designed to remain functional both during and after the event, thus assuring the ability to shut down and maintain a safe configuration.

Designated use – The targeted use of a waterbody as determined by the water quality standard (e.g., water supply, primary recreation, wildlife).

Dewater – In the context of waste management, the process of natural, chemical, or mechanical removal of water from a sludge, thereby reducing it to a damp solid with the lowest level of moisture attainable.

Dewpoint – Temperature to which air must be cooled at constant pressure for condensation to occur. This is the temperature at which the air would become saturated and dew would form.

Dilution factor – A multiplier used to approximate the decrease in concentration between the source and the receptor.

Dip – The angle that a structural surface, such as a bedding or fault plane, makes with the horizontal, measured perpendicular to the strike of the structure and in the vertical plane.

Direct effects – Those effects that could damage or destroy the physical integrity of a significant cultural resource.

DNA (Deoxyribonucleic acid) – The human material that carries the genetic information in the cell and that is capable of self-replication and synthesis of RNA (ribonucleic acid). DNA consists of two long chains of nucleotides twisted into a double helix and joined by hydrogen bonds between the complementary bases adenine and thymine or cytosine and guanine. The sequence of nucleotides determines individual hereditary characteristics.

Dolotomized – The process by which limestone is wholly or partly converted to dolomite rock or dolomitic limestone by the replacement of the original calcium carbonate (calcite) by magnesium carbonate (mineral dolomite).

Dose equivalent – The product of the absorbed dose in tissue, the quality factor, and all other necessary modifying factors at the location of interest (units are rem or seiVert).

Downdraft – Downward-moving air inside a thunderstorm caused by the density of cooler air.

Drainage area – The entire land area contributing surface drainage to a specific point (15A NCAC 02B .0202).

Drawdown – The distance by which the level of a water source is lowered by the withdrawal of water.

Dry Conversion Process (DCP) – A chemical reaction between vaporized uranium hexafluoride and superheated steam, followed by a pyrohydrolysis and reduction in a hydrogen atmosphere, to produce uranium dioxide.

Dry deposition – The process by which particulate matter in an emitted plume settles to the ground due to the effects of gravity. Dry deposition of gas occurs as well, but is caused by molecular and chemical effects.

Eastern Site Sector – As shown on **Figure 1-2**, the sector covering the eastern portion of the Wilmington Site; contains the existing Wilmington Site facilities.

Echinoid – An echinoderm of the class Echinoidea, which includes the sand dollars and sea urchins.

Ecoregion – A classification of land based on similar climate, vegetation, and topography.

Ecotone – Transitional areas between adjacent biotic communities.

Effluent – A liquid discharged as waste, such as contaminated water from a facility.

Effluent channel – A discernable confined and discrete conveyance that is used for transporting treated wastewater to a receiving stream (15A NCAC 02B .0202).

Emissions – Gases, particles, or liquids released into the atmosphere from smokestacks, other vents, and surface areas of commercial or industrial facilities.

Endangered – Any native or once-native species of wild animal whose continued existence as a viable component of the state's fauna is determined by the North Carolina Wildlife Resources Commission to be in jeopardy, or any species of wild animal determined to be an "endangered species" pursuant to the Endangered Species Act (N.C.G.S.A. § 113-331 - 377).

Endangered Species Act – The Endangered Species Act of 1973, Public Law 93-205 (87 Stat. 884), as it may be subsequently amended.

Endemic- Native to or confined to a particular geographic area.

Energy Equivalent Sound Level (L_{EQ}) – A sound level that represents the average energy level of the measurement period.

Environmental Impacts – Standard of significance established by NRC in NUREG-1748, p. 4-14:

- SMALL: The environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.
- MODERATE: The environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.
- LARGE: The environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

Environmental sound monitor – A measurement device that includes a microphone and data recorder to log the numerical values of environmental sound levels over time. The data-logging component of the monitor is packaged into a weatherproof box to protect it from the elements, whereas the microphone is routed via a cable to a tripod.

Eocene – An epoch of the Tertiary period, occurring from 55 to 40 million years ago and characterized by the advent of the modern mammalian orders.

Ephemeral – A feature that carries only stormwater in direct response to precipitation, with water flowing only during and shortly after large precipitation events. An ephemeral stream typically lacks the biological, hydrological, and physical characteristics commonly associated with the continuous or intermittent conveyance of water (15A NCAC 02B .0259).

Epicenter – The point on the Earth's surface directly above the source of an earthquake.

Erosion factor Kf – Indicates the erodibility of the fine-earth fraction, or the material less than 2 millimeters in size. The estimates are based primarily on the percentage of silt, sand, and organic matter and on the soil structure and permeability.

Erosion factor Kw – Indicates the erodibility of the whole soil. The estimates are based primarily on the percentage of silt, sand, and organic matter and on the soil structure and permeability. The estimates are modified by the presence of rock fragments.

Erosion factor T – An estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year and is based on depth of soil to bedrock and the type of bedrock. General association is made with textural soil groupings defined by the U.S. Department of Agriculture as more vulnerable to wind erosion and is also used in calculating the Wind Erosion Equation.

Erosion potential – The likelihood of movement of soil due to runoff.

Escarpment – A long, nearly continuous cliff or relatively steep slope facing in one general direction, breaking the continuity of the land by separating two level or gently sloping surfaces, and produced by erosion or faulting.

Estuarine –Areas where freshwater sources (e.g., rivers, streams) meet saltwater environments (e.g., oceans). Natural environments associated with estuaries such as wetlands often have the ability to buffer large volumes of water that result from flood conditions.

Eustatic – Pertaining to worldwide changes of sea level that affect all the oceans.

Evergreen – Trees, shrubs, or vines that retain their leaves throughout the winter.

Existing Wilmington Site facilities – Current operations at the Wilmington Site, includes the Fuel Manufacturing Operation, Aircraft Engines and Services Components Operations, and other current manufacturing, waste treatment, technical support, and administration structures and operations.

Externality – An impact of a production or consumption decision that falls on individuals who are not part of the production or consumption decision and who have no ability to control the outcome. Externalities may be external costs (negative impacts) or external benefits (positive impacts).

Eye wall – The area of towering thunderstorms and strong winds that surrounds the eye, or calm center, of a hurricane.

Facies – A map-able, areally restricted part of a lithostratigraphic body, differing in lithology or fossil content from other beds deposited at the same time and in lithologic continuity.

Factor of safety (FS) – In terms of liquefaction potential, the FS has been defined as FS = CSRliq/CSReq, where CSReq is the cyclic stress ratio generated by the anticipated earthquake ground motions at the site, and CSRliq is the cyclic stress ratio required to generate liquefaction (Seed and Idriss, 1982).

Fall Line – A linear boundary between descent from an upland to a lowland, as at the edge of a plateau; specifically, the Fall Line marking the boundary between the ancient, resistant crystalline rocks of the Piedmont physiographic province and the younger, softer sediments of the Atlantic Coastal Plain physiographic province in the eastern United States.

Faults – A fracture or fracture zone in rock along which movement has occurred.

Federal Species of Concern – Species about which there are some concerns regarding its status and threats, but for which insufficient information is available to indicate a need to list the species under the Endangered Species Act (69 FR 19975; April 15, 2004).

Feldspar sands – Sands containing minerals of the feldspar group, which are the most widespread of any mineral group and consist of alkali feldspar, plagioclase, and celsian minerals.

Fenceline – The property boundary of the Wilmington Site.

Flood Insurance Rate Maps (FIRMs) –Flood hazard maps that show the areas in a community that are subject to flooding and the risk associated with these flood hazards; published by the Federal Emergency Management Agency (FEMA) under the administration of the National Flood Insurance Program, One of the areas shown on the FIRM is a Special Flood Hazard Area (SFHA). The SFHA is the area that has a 1% or greater chance of flooding in any given year; this area is also referred to by some as the 1% annual chance floodplain, base floodplain, or the 100-year floodplain. The flood hazard and risk information presented on the FIRMs is the result of engineering studies that are performed by engineering companies, other federal agencies, or communities, which are reviewed for compliance with FEMA guidelines and approved by FEMA (FEMA, 2007b).

Flood Insurance Study (FIS) – A book that contains information regarding flooding in a community and is developed in conjunction with the Flood Insurance Rate Maps (FIRMs). The FIS, also known as a flood elevation study, frequently contains a narrative of the flood history of a community and discusses the engineering methods used to develop FIRMs. The FIS also contains flood profiles for studied flooding sources and can be used to determine Base Flood Elevations for some areas (FEMA, 2006b).

Flooding – The inundation of land areas by water.

Flooding frequency – The annual probability of a flood event expressed as a class (e.g., high, medium, low) for each soil association unit.

Floodplain – The relatively flat area surrounding a river that is prone to occasional or periodic flooding.

Fluvial – a) Of or pertaining to a river or rivers. b) Existing, growing, or living in or about a stream or river. c) Produced by the action of a stream or river; e.g., sand and gravel deposits.

Flux – The mass of material transferred to a given area of the ground, as in the dry or wet deposition process. The units are mass per unit area per unit time (e.g., g/m^2-s).

FMO – Fuel Manufacturing Operation **f**acility currently operated by GNF-A at the Wilmington Site.

Formation (geologic) – A persistent body of igneous, sedimentary, or metamorphic rock, having easily recognizable boundaries that can be traced in the field without recourse to detailed paleontologic or petrologic analysis and that is large enough to be represented on a geologic map as a practical or convenient unit for mapping and description; the basic cartographic unit in geologic mapping.

Fossiliferous – Containing fossils.

Frequency – The rate at which a sound pressure fluctuates, stated in Hertz (Hz).

Front – The boundary between differing air masses.

Frostpoint – The temperature to which air must be cooled at constant pressure for frost to form. This is the sub-freezing equivalent of dewpoint.

Fugitive dust – Particulates that are suspended in the atmosphere due to activities on the ground, such as grading, digging, wind erosion, plowing, or driving on unpaved surfaces.

Fujita Scale – A scale created by Tetsuya Fujita used to describe the intensity of tornadoes, which is based on damage to man-made structures and vegetation.

Gamma radiation – High-energy, short-wavelength, electromagnetic radiation emitted from the nucleus. Gamma radiation frequently accompanies alpha and beta emissions and always accompanies fission. Gamma rays are very penetrating and are best stopped or shielded by dense materials, such as lead or depleted uranium. Gamma rays are similar to x-rays.

Gaussian plume dispersion model – A computer model used for calculating the dispersion and deposition of pollutants. This type of model assumes that emissions are normally distributed (i.e., have a Gaussian distribution) through a cross-section of the plume along the plume's centerline.

GE – General Electric Company, owner of the Wilmington Site property.

Gigawatt – A measurement of the generating capacity of power plants (1,000 Megawatt).

Glauconitic – Pertaining to a dull-green granular member of the silicate mica group and found in marine sedimentary rocks from the Cambrian to the present. Glauconitic sands contain a sufficient number of grains of glauconite to impart a marked greenish color to the sediment.

GLE – GE-Hitachi Global Laser Enrichment LLC, the applicant for a license to construct and operate the Proposed GLE Facility.

GLE facility operations – The actual operation of the as-built facilities within the 100-acre (40 ha) area (same area as the Proposed GLE Facility).

GLE Facility site – The 100-acre (40-ha) area (same area as the Proposed GLE Facility) used in the context of construction activities such as clearing, grading, excavation, and foundation work by heavy equipment. Also known as the GLE construction site.

GLE Study Area – As shown on **Figure 1-3**, the 265-acre (107-ha) area on the Wilmington Site evaluated for the Environmental Report. Includes the anticipated footprint of the Proposed GLE Facility (100 acres [40 ha]), the area around the Facility for potential future expansion, the locations of the proposed North and South access roads, and a 200-ft (61-m) corridor along the locations of the proposed roads.

GNF-A – Global Nuclear Fuel–Americas; owner/operator of the Fuel Manufacturing Operation facility at the Wilmington Site.

Grading – A progressive change in particle size from top to bottom in a rock layer. Most common is a sequence with coarse grains at the bottom and fining upwards, which is typically caused by a declining current velocity within the depositional environment.

Gravity data – Data obtained from measuring the Earth's gravity field.

Groundwater elevation mound – An area with relatively higher groundwater elevations, possibly due to greater recharge rates or groundwater-flow boundaries. Groundwater generally flows in a radially outward direction from a groundwater mound.

GWe (Gigawatt electrical) – A measurement of the rate of energy output of a nuclear power plant (1 GWe equals 1 billion watts of electricity).

Hazardous Air Pollutant (HAP) – Air pollutants listed in Section 112(b)(1) of the Clean Air Act that are not subject to National Ambient Air Quality Standards, but that may present a threat of adverse human health effects or adverse environmental effects.

Hazardous Waste – A solid waste, or a combination of solid wastes, that is defined under the Resource Conservation and Recovery Act (RCRA) (42 U.S.C. Section 6903, *Definitions*) to be hazardous because of its quantity, concentration, or physical, chemical, or infectious characteristics that may (i) cause, or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness; or (ii) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed (40 CFR 261.3).

Herbaceous – Non-woody vegetation.

Herpetofauna – Any or all species of amphibians and reptiles.

Holocene – An epoch of the Quaternary period, from the end of the Pleistocene, approximately 10,000 years ago, to the present time; also known as the Recent period.

Hydraulic conductivity – A measure of the permeability of a porous medium or the relative ability of groundwater to flow through the system.

Hydrogeologic – Dealing with subsurface waters and with related geologic aspects of surface waters.

Hydrology – The study of how water occurs in the atmosphere, on the ground, and below the ground surface.

Igneous rock – A rock or mineral that solidified from molten or partly molten material, such as magma.

Indirect effects – Those effects that would not directly destroy the physical integrity of a significant cultural resource, but would either adversely affect an element or elements that contribute to the significance of the resource or would increase the risk of destruction by outside action.

Induration – The hardening of a rock or rock material by heat, pressure, or the introduction of cementing material; especially the process by which relatively consolidated rock is made harder or more compact.

Intercalated – Refers to layered material that exists or is introduced between layers of a different character; especially refers to relatively thin strata of one kind of material that alternates with thicker strata of some other kind, such as beds of shale intercalated in a body of sandstone.

Intermittent – A feature that contains water for only part of the year, typically during winter and spring, when the aquatic bed is below the water table. An intermittent stream often lacks the biological and hydrological characteristics commonly associated with the conveyance of water (15A NCAC 02B .0259).

Inter-quartile distance or spread – A statistical term defined as the difference between the 75th percentile (often called [Q3]) minus the 25th percentile (Q1).

Invertebrate – Any animal lacking a vertebral column.

Ionizing radiation – Any radiation capable of displacing electrons out of atoms and producing ions. Some examples are alpha, beta, gamma, x-rays, neutrons, and ultraviolet light.

Iron oxide minerals – Typically, the oxide minerals of hematite and magnitite.

Isotope – A form of an element that differs from the normal form of the element by atomic mass due to a differing number of neutrons in the nucleus of the atom.

Jet Stream – A fast-moving band of strong winds in the mid latitudes that occurs in the upper portion of the troposphere (lower layer of the atmosphere). The jet stream's position provides an indication as to the separation of air masses, such as polar and tropical.

Kaolinitic clay – A clay with a high-alumina clay mineral that does not appreciably expand under varying water content and does not exchange iron or magnesium.

Karst – A type of topography that is formed on limestone, gypsum, and other rocks by dissolution and that is characterized by sinkholes, caves, and underground drainage.

Laminae – The thinnest recognizable layers in a sedimentary rock.

Laminated beds – Beds of sediment that can be split into thin layers.

Land cover – Material found covering the surface of the earth; may originate from natural or anthropogenic sources.

Letter of map change (LOMC) – A letter that reflects an official revision to an effective National Flood Insurance Program map. An LOMC is issued in place of the physical revision and republication of the effective map (FEMA, 2006c).

Lifecycle phase – The lifecycle phases identified for this project are pre-construction, construction, operation-production, and decommissioning.

Lignitic – Containing lignite, a brownish-black coal in which the alteration of vegetal material has proceeded further than in peat, but not so far as subbituminous coal.

Lime – Calcium oxide, CaO; specifically quicklime and hydraulic lime. The term is used loosely for calcium hydroxide (as in hydrated lime) and incorrectly for calcium carbonate (as in agricultural lime).

Limestone – Sedimentary rock composed largely of mineral calcite ($CaCO_3$) formed by either organic or inorganic processes.

Lineament – A straight topographic feature of regional extent that is thought to represent a crustal structure such as an underlying fault.

Liquefaction – A phenomenon in which the strength and stiffness of a soil is reduced by earthquake shaking. Liquefaction occurs in saturated soils, i.e., soils in which the space between individual particles is completely filled with water. Liquefaction of soils near the ground surface could result in a bearing capacity failure of foundations. If the soils are deep, then liquefaction is unlikely to cause failure, but could result in significant settlements from the dissipation of earthquake-induced pore pressures.

Liquid limit – The moisture content at the transition from plastic to liquid state. The liquid limit provides a measure of the moisture content of a soil based on its performance during a standard laboratory test. It is one of the Atterberg limits measured on fine-grained soils.

Lithic – A cultural artifact made of stone.

Lithologic – The character of a rock described in terms of its structure, color, mineral composition, grain size, and arrangement of its component parts; all those visible features that in the aggregate impart individuality to the rock.

Load shedding – Electrical-load control program used by electric utilities to reduce the total system-wide electrical load during periods of peak demand by temporarily shutting down power to certain industrial and large commercial customers under pre-arranged agreements.

Loam – A rich, friable soil containing a relatively equal mixture of sand and silt and a somewhat smaller proportion of clay.

Logs (well/ boring) – The record of, or the process of recording, events or the type and characteristics of the rock penetrated in drilling a borehole, as evidenced by the cuttings, core recovered, or information obtained from electric, sonic, or radioactivity devices.

Love wave – A type of surface wave that moves a surface particle horizontally from side to side; the fastest type of surface wave.

Low-Level Radioactive Waste (LLRW) – Materials that have become contaminated with radioactive material or have become radioactive through exposure to neutron radiation. This waste typically consists of contaminated protective shoe covers and clothing, wiping rags, mops, filters, reactor water treatment residues, equipments and tools, luminous dials, medical tubes, swabs, injection needles, syringes, and laboratory animal carcasses and tissues.

M – Magnitude of earthquakes in the b-Value calculation.

Magnitude – A measure of earthquake strength based upon the amount of ground motion experienced and corrected for the distance between the observation point and the epicenter.

Main portion of the GLE Study Area – As shown on **Figure 1-3**, the 209-acre (85-ha) area of the GLE Study Area evaluated for the placement of the Proposed GLE Facility and areas around the Facility for potential future facility expansion. Excludes the North and South Road portions of the GLE Study Area.

Major Source – Term used to determine the applicability of permitting regulations to specific sources. What constitutes a major source varies according to what type of permit is involved, the pollutant(s) being emitted, and the attainment designation of the area where the source is located. In general, a source is major if its emissions exceed certain thresholds that are defined in terms of tons per year. For example, under title V of the Clean Air Act, a major source is any source that emits or has the potential to emit 100 tons per year or more of any criteria air pollutant or any source that emits or has the potential to emit 10 tons per year or more of any hazardous air pollutant (HAP), or 25 tons per year or more of a mixture of HAPs.

Make-up water – As part of industrial cooling towers, where fresh cooling water is continuously circulated through heat exchangers, the partial loss of evaporated water that is replaced by fresh cooling water is referred to as “make-up” water. Because make-up water usually contains carbonates and other dissolved salts, a portion of the circulating water is also continuously discarded as "blowdown" water to prevent the excessive build-up of salts in the circulating water.

Map Unit – Maps representing a collection of soils and used in both the STATSGO and SSURGO databases. The individual soils in the collection may be similar to each other, or may be very different from each other. In some cases, the collection includes non-soil areas such as bedrock, gravel pits, or water. The individual soils or non-soil areas in the collection are referred to as Components (i.e., soil types) of the Map Unit. Each Map Unit is uniquely identified by a Map Unit ID and a Map Unit Symbol.

Marl – A friable, earthy deposit consisting of clay and calcium carbonate.

Maximum Exposed Individual (MEI) – A hypothetical person living at the point of highest projected constituent concentrations near the property boundary. The MEI is the location assessed to have the greatest potential off-site impact, regardless of whether an individual currently occupies the location or is likely in the future to occupy the location.

Meander – One of a series of regular, freely developing sinuous curves, bends, or loops in the course of a stream; produced by a mature stream swinging from side to side as it flows across its floodplain or shifts its course laterally toward the convex side of an original curve.

Megatons-to-Megawatts Program – A United States-Russia nonproliferation agreement of 1993 to convert highly enriched uranium (HEU) taken from dismantled Russian nuclear warheads into low-enriched uranium (LEU) used to fabricate fuel for U.S. nuclear power plants.

Mesic – Relating or adapted to a moderately moist habitat.

Mesozoic – An era of geologic time, from the end of the Paleozoic era to the beginning of the Cenozoic era, or from about 225 million years to about 65 million years ago.

Metamorphic rock – Rock derived from pre-existing rocks by mineralogical, chemical, and or structural changes in response to changes in temperature, pressure, shear stress, and chemical environment, generally at depth in the Earth's crust.

Micaceous – Consisting of or containing mica; a group of phyllosilicate minerals.

Micritic – Refers to a limestone consisting dominantly of a micrite matrix.

Microburst – An intense downburst of cool air from a thunderstorm that causes localized (within 2.5 miles [4 km]), damaging, straight-line winds when it reaches the ground and is forced to flow horizontally. Microbursts are caused by rain evaporating inside the thunderstorm, and thereby cooling the air, which becomes dense and quickly sinks.

Microphone – A very sensitive device used to convert sound-pressure levels into electrical signals that can be recorded by an environmental noise monitor.

Middle Woodland period – A prehistoric cultural period dating from approximately 200 BC – 1000 AD in the southern Coastal Plain of North Carolina.

Miocene – An epoch of the later Tertiary period, after the Oligocene and before the Pliocene.

Mixed Waste – A type of waste that contains both hazardous and radioactive source, special nuclear, or by-product material, as defined by the Atomic Energy Act.

Mixing Height – The height above the surface of the earth through which relatively vigorous vertical mixing occurs. This is an important parameter in determining the vertical spread of a chemical plume in the atmosphere.

Moldic – A rock characteristic that results from the removal, usually by solution, of an individual constituent of a rock, such as a shell.

Mollusk – Any invertebrate of the phylum Mollusca, typically having a calcareous shell of one, two, or more pieces that wholly or partly enclose the soft, unsegmented body of the creature; includes chitons, snails, bivalves, squids, and octopuses.

MSA (Metropolitan Statistical Area) – A geographic entity that is defined by the U.S. Office of Management and Budget (OMB) for use by federal statistical agencies in collecting, tabulating, and publishing federal statistics. Each MSA consists of one or more counties and includes the counties containing the core urban area, as well as any adjacent counties that have a high degree of social and economic integration (as measured by commuting to work) with the urban core.

Multi-family development – A land parcel that contains three or more dwelling units on a lot in common ownership, such as apartment buildings, condominiums, or mobile home parks.

Municipal Solid Waste (MSW) – Discarded durable goods, non-durable goods, paper, cardboard, containers and packaging, plastics, metals, food wastes, yard trimmings, and miscellaneous inorganic wastes.

Municipality – A political unit, such as a city, town, or village, incorporated for local self-government.

Megawatt (MW) – A measurement of the generating capacity of power plants.

MWe (**Megawatt electrical**) – A measurement of the rate of energy output of a nuclear power plant (1 MWe equals 1 million watts of electricity).

N – Expected *cumulative* annual number of earthquakes in the b-Value calculation.

National Ambient Air Quality Standards (NAAQS) – Air quality standards that EPA is required to promulgate under the Clean Air Act Amendments of 1990 for criteria pollutants (i.e., not toxic pollutants) considered harmful to human health and the environment. These standards apply to carbon monoxide, lead, nitrogen dioxide, $PM_{2\ 5}$, ozone, and sulfur oxides.

National Cooperative Soil Survey Program – An effort of federal and state agencies, universities, and professional societies to deliver science-based soil information.

National Emissions Standards for Hazardous Air Pollutants (NESHAP) – Emission standards applicable nationwide that are established by the U.S. Environmental Protection Agency for hazardous air pollutants.

National Land Cover Dataset (NLCD) – National dataset that depicts land cover based on categories, including open water, perennial ice/snow, open space developed, low intensity developed, medium intensity developed, high intensity developed, barren land, deciduous forest, evergreen forest, mixed forest, scrub/shrub, grassland/herbaceous, pasture/hay, cultivated crops, woody wetlands, and emergent herbaceous wetlands.

National Pollutant Discharge Elimination System (NPDES) – EPA surface water quality program authorized by Congress as part of the 1987 Clean Water Act to control the discharge of pollutants to waters of the United States (40 CFR 122.2).

National soil classification system – The nationally recognized methods for identifying soils across the United States and its territories based on taxonomic classification, with supporting information such as detailed soil profile description, location of the typical soil profile, range in characteristics, competing series, geographic setting, geographically associated soils, drainage and permeability, use and vegetation, distribution and extent, series established, remarks, and additional data.

Natural Resources Conservation Service – An organization within the U.S. Department of Agriculture aimed at helping America's private land owners and managers conserve their soil, water, and other natural resources.

Nighttime Hours – Hours between 10:00 p.m. and 7:00 a.m.

Non-attainment Area – An area in which the maximum allowable air concentration of a given pollutant has been reached; therefore, additional releases of the pollutant are not permitted.

Non-consumptive use – Water use where the water is withdrawn from the source and returned.

Normalized Concentration (χ/Q) – Air concentration output from an air dispersion model that was executed for an emission rate of 1 unit of a substance. In the example of radioactive emissions, the unit emission rate (Q) is 1Ci/sec. χ/Q is then the concentration in Ci/m^3 over 1 Ci/sec. Therefore, the normalized concentration has units of sec/m^3. To compute concentration, multiply the normalized concentration by the actual emission rate.

North access road – A proposed access road to the Proposed GLE Facility from N.C. Highway 133 (Castle Hayne Road) that would be built within the North Road portion of GLE Study Area, in part using existing on-site service road routes.

North American Vertical Datum (NAVD) – NAVD 88 is a fixed datum derived from a simultaneous, least squares, minimum constraint adjustment of Canadian/Mexican/United States leveling observations. Local mean sea level observed at Father Point/Rimouski, Canada, was held fixed as the single initial constraint. NAVD 88 replaces NGVD 29 as the national standard geodetic reference for heights. According to benchmark data for the Wilmington/Cape Fear area published by the National Oceanic and Atmospheric Administration, the difference between ft NAVD and ft msl is very small. For example, 9.30 ft NAVD (the 500-year floodplain boundary) is equivalent to 9.33 ft msl. Therefore, for the purposes of this report, ft NAVD and ft msl are used interchangeably (NOAA, 2003).

North-Central Site Sector – As shown on **Figure 1-2**, the sector covering the north-central portion of the Wilmington Site; contains the Main portion of the GLE Study Area.

North Road portion of GLE Study Area – A 200-ft wide corridor (the 33 acres [13 ha] shown in **Figure 1-3**) across the Eastern Site Sector that contains the proposed location of the North access road.

Northwestern Site Sector – As shown on **Figure 1-2**, the sector covering the northwestern corner of the Wilmington Site.

Nuclide – A species of atom characterized by the constitution of its nucleus. The nuclear constitution is specified by the number of protons, number of neutrons, and energy content or, alternatively, by the atomic number, mass number, and atomic mass.

N-value – The result of a standard penetration test (SPT) performed according to ASTM D-1586 (ASTM, 1999). The N-value measured as the number of blows to drive the SPT sampler the final 12 inches of the 18 inches it is driven. This value is used to estimate soil properties by empirical correlations for use in geotechnical analyses.

Obviously superior site – A site that is environmentally preferable to the proposed site and that, after consideration of all relevant costs and benefits, is obviously superior to the proposed site.

Official Soil Series Descriptions (OSD) – A national collection of more than 20,000 detailed soil series descriptions, covering the United States, Territories, Commonwealths, and Island Nations served by the U.S Department of Agriculture National Resources Conservation Service.

Off-site – Area outside the property boundary (or outside the fenceline) of a facility.

On-site – Area inside the property boundary (or inside the fenceline) of a facility.

Oxbow – A U-shaped bend in a river or stream that may or may not be cut off from the mainstem.

Paleocene – Noting or pertaining to an epoch of the Tertiary period, from 65 to 55 million years ago, and characterized by a proliferation of mammals.

Parcel – A piece of land that can be owned, sold, and developed.

Passive (Continental Margin) – A tectonic boundary where two plates are moving away from each other and new crust is forming from magma that rises to the Earth's surface between the two plates.

Peak Daily Runoff Volume – The highest runoff volume occurring on a single day during a storm event that lasts multiple days (e.g., a hurricane or nor'easter).

Peak ground acceleration – The maximum acceleration experienced by the particle on the ground during the course of the earthquake motion.

Peak Horizontal Ground Acceleration (PHGA) – The maximum horizontal acceleration at the ground surface at a site during the design earthquake.

Peak storm event – An extreme storm event that is predicted to occur only once a century (or longer) based on the magnitude of precipitation falling during a certain period of time. For this analysis, storms predicted to occur once every 100 or 500 years are considered peak storm events.

Peat – Partially reduced plant or wood material containing approximately 60% carbon and 30% oxygen.

Pedestrian inspection – The process of walking over an area with the goal of identifying whether or not cultural materials or architectural debris are observable on the ground surface. Such an inspection can either be systematic or random, depending on project goals and/or field conditions. Systematic pedestrian inspection typically involves one or more individuals walking along evenly spaced transects aligned either to cardinal directions or landform shape.

Pelage – The hair, fur, or wool that covers the animal.

Percent g – G is the force of gravity (an acceleration of 9.78 m/s^2). When there is an earthquake, the forces caused by the shaking can be measured as a percentage of the force of gravity, or percent g.

Perennial – A feature that contains water year round during a year of normal rainfall, with the aquatic bed located below the water table for most of the year. A perennial stream exhibits the typical biological, hydrological, and physical characteristics commonly associated with the continuous conveyance of water (15A NCAC 01C .0101).

Permeability – The ability of a porous rock, sediment, or soil to transmit fluids.

Phosphorite – A sedimentary component composed of laminae, pellets, oolites, nodules, shell and bone fragments.

Photon energy – Light consists of particles, or quanta, called photons, each with an energy of the Planck's constant times its frequency. The Planck constant was developed by Max Planck. It is a physical constant that is used to describe the sizes of quanta (indivisible entities of a quantity).

Physiographic province – A region where all parts are similar in geologic structure and with a unified geomorphic history; a region whose pattern of relief features or landforms differs significantly from that of adjacent regions.

Physiography – The science of physical geography; (formerly) geomorphology.

Piedmont – A plateau extending from New Jersey to Alabama and lying east of the Appalachian Mountains.

Pile – A foundation structural element installed to transfer structural load from the ground surface to a greater depth, where soils are stronger, by the combination of friction along the pile sides and bearing below the pile tip. Piles can be installed by driving with a hammer (driven pile) or by drilling into place and pouring concrete to fill the hole (auger cast pile).

Plastic limit – The moisture content of a soil at the transition from semisolid to plastic state.

Plasticity index – The difference between the liquid limit and the plastic limit measured for a fine-grained soil sample. The plasticity of soil is caused by the adsorbed water that surrounds the clay particles. The type of clay material and their proportional amounts in a soil will affect the liquid and plastic limits.

Plate (Tectonic) – The two sub-layers of the earth's crust (lithosphere) that move, float, and sometimes fracture; the interaction of these layers causes continental drift, earthquakes, volcanoes, mountains, and oceanic trenches.

Pleistocene – Noting or pertaining to the epoch forming the earlier half of the Quaternary period, beginning about 1.75 million years ago and ending 11,500 years ago, characterized by widespread glacial ice and the advent of modern humans (AGI, 2008).

Pliocene – Noting or pertaining to an epoch of the Tertiary period, occurring from 5 to 1.75 million years ago and characterized by the increased size and numbers of mammals, by the growth of mountains, and by global climatic cooling (AGI, 2008).

Plio-Pleistocene – A generalized period of geologic time that straddles the chronostratigraphic boundary (approximately 1.8 million years ago) between the Pliocene and Pleistocene epochs. This period occurs sometime after the beginning (approximately 5 million years ago) of the Pliocene epoch (last epoch of the Tertiary period) and extends for some unspecified period of time into the more recent Pleistocene epoch (first epoch of the Quaternary period ending approximately 11.5 thousand years ago) (AGI, 2008).

PM_{10} – Particulate matter with aerodynamic diameter of 10 µm or less. PM_{10} includes $PM_{2\ 5}$.

$PM_{2\ 5}$ – Particulate matter with aerodynamic diameter of 2.5 µm or less. Since it is very small, $PM_{2\ 5}$ is important because it can be inhaled deep into the lungs.

Pocosin – A wetland formed in an upland depression from the accumulation of organic sediments and that is dominated by evergreen shrub vegetation.

Polar Front – The boundary of colder polar air and warmer tropical air that is found at the earth's surface.

Potable water – Water that is safe for human consumption.

Potentiometric surface – The level to which the groundwater would rise in a well if unaffected by friction with the surrounding rocks and sediments under unconfined conditions — includes the pressure and elevation head.

Precambrian – All geologic time and its corresponding rocks before the beginning of the Paleozoic era, equal to about 90% of geologic time. The Precambrian ended 570 million years ago, during which the Earth's crust formed and life first appeared in the seas.

Preferred site – The site that emerges from the site selection process, after the qualitative cost-benefit analysis, to determine if there is an “obviously superior” site to the proposed site.

Primary road – A main road intended for travel by the public between important destinations, such as cities**.**

Primordial radionuclides – Radionuclides left over from when the earth and the universe were created.

Proctor maximum dry density (MDD) – The peak point on the curve of soil dry density versus moisture content measured in laboratory test performed according to ASTM D-698.

Progeny – The decay product or products resulting after a radioactive decay or a series of radioactive decays. The progeny can also be radioactive, and the chain continues until a stable nuclide is formed.

Proofroll – An evaluation of subgrade soil conditions by driving a loaded, rubber-tired dump truck over an area and having an engineer observe the action of the wheels on the subgrade soils to evaluate their condition and to recommend required repairs.

Proposed GLE Facility – 100 acres (40 ha) of the main portion of the GLE Study Area where the GLE Facility is proposed to be built.

Proposed site – A desirable location where the applicant would like to place the facility for business and other considerations.

Provenience – The physical location of an object in relation to a known datum.

P-wave – A body-wave that is the fastest wave, and therefore, the first to arrive at a given location. The P-wave, or compressional wave, alternately compresses and expands material in the same direction it is traveling.

Pyrite – A commonly cubical and striated iron sulfate mineral that is the most widespread and abundant of the sulfide minerals.

Pyrite – A sulfide mineral, such as iron sulfide (FeS_2).

Quartz – A silicate mineral (i.e., SiO_2) composed exclusively of silicon-oxygen tetrahedra, with all oxygens joined in a three-dimensional network.

Quaternary – Noting or pertaining to the present period of Earth’s history, forming the latter part of the Cenozoic era, originating about 2 million years ago and including the Recent and Pleistocene epochs.

Radiation – Refers to the process of emitting energy in the form of rays or particles that are released by disintegrating atoms. The U.S. Nuclear Regulatory Commission is responsible for regulating and licensing the use and possession of certain radioactive materials and the resulting radiation from byproduct and special nuclear materials.

Radioactivity – A property possessed by some elements, such as uranium, whereby alpha, beta, or gamma rays are spontaneously emitted.

Radionuclide – A radioactive atomic nuclide, which is an atomic nucleus specified by atomic weight, atomic number, and energy state.

Rare – Species listed as threatened, endangered, or other special concern by the state or federal government.

Rayleigh wave – A type of surface wave that moves a surface particle in a circle or ellipse.

Receptor – In air dispersion modeling, refers to a location for which concentration and deposition values will be calculated by the model.

Recharge – The downward vertical flow of groundwater to an aquifer. Recharge may be from seepage through the unsaturated zone (for unconfined aquifers) or downward flow from overlying layers (for confined aquifers).

Region – Refers to the geographic area surrounding the Wilmington Site; limited to areas at the county level or greater (geographic area that is larger than vicinity, below). For example, the map area shown in **Figure 1-1** may be considered a region that includes the Wilmington Site, but this term is used differently in various sections of the Environmental Report, and section-specific descriptions are included in the Report for clarification.

Region (socioeconomic) – The relevant region is limited to that area necessary to include social and economic base data for 1) the county in which the Proposed GLE Facility would be located; and 2) those specific portions of surrounding counties and urbanized areas from which the construction/refurbishment work force would be principally drawn, or that would receive stresses to community services by a change of residence of construction/refurbishment/decommissioning workers. Other social and economic impacts can generally be presumed to fall within the same area covered by this definition of the region. For this study, the socioeconomic region is defined as Brunswick, Pender, and New Hanover counties in North Carolina.

Regression – A retreat of the sea from land areas.

Relative Deposition Rate (D/Q) – Deposition output from an air dispersion model that was executed for an emission rate of 1 unit of a substance. In the example of radioactive emissions, the unit emission rate (Q) is 1Ci/sec. D/Q is then the deposition rate in Ci/m^2-s over 1 Ci/sec; therefore, the relative deposition rate has units of 1/m^2. To compute an actual deposition rate, multiply the relative deposition rate by the actual emission rate.

Relief – A term used loosely for the physical shape, configuration, or general unevenness of a part of the Earth's surface, considered with reference to variations of height and slope or to irregularities of the land surface; the elevations or differences in elevation, considered collectively, of a land surface.

Rem – Special unit of any of the quantities expressed as dose equivalent equal to the absorbed dose in rads (rad is the special unit of absorbed dose) multiplied by the quality factor (10 CFR 20.1004).

Resonance – The wavelength light produced by the laser system required to facilitate the uranium isotope separation process.

Response Spectrum – A means by which to represent a seismic action. A response spectrum implies the calculation of structural response as opposed to a using ground acceleration or velocity time-history, which must be used to calculate structural response. Using a response spectrum as the basis for calculating seismic loads requires only calculation of action effects (Tomaževič, 1999). A design-response spectrum is determined by procedure described in NCBC section 1615.1.4 to provide the basis for a structural engineer to select earthquake load for use in design.

Revised Universal Soil Loss Equation (RUSLE) – Mathematical equation that incorporates erosion, topography, and land cover factors to estimate the magnitude of terrestrial soils lost.

Riparian – The land adjacent to the banks or the banks of any river or stream.

Riparian area – An area that is adjacent to a body of water (15A NCAC 02B .0202).

Rosatom (Rosatom Nuclear Energy State Corporation) – Rosatom is a State Corporation in Russia and the regulatory body of the Russian nuclear complex; comparable in function to the U.S. Nuclear Regulatory Commission.

Russian "Suspension Agreement" – A program under which Russia is allowed to sell uranium in the United States.

Sanitary waste – Liquid or solid wastes originating solely from humans and human activities, such as wastes collected from toilets, showers, wash basins, sinks used for cleaning domestic areas, sinks used for food preparation, clothes-washing operations, and sinks or washing machines where food and beverage serving dishes, glasses, and utensils are cleaned.

Savanna – An ecological community that is dominated by scattered trees and large areas of grasses.

Screening – A systematic process of evaluating criteria in increasing levels of detail to distinguish characteristics of a choice; also referred to as screening step.. Used in the site-selection process to eliminate a site after it fails to meet certain criteria. Depending on the level of scrutiny, screening is expressed at initial, coarse, or fine screening.

Secondary road – A road supplementing a main road, usually wide enough and suitable for two-way, all-weather traffic at moderate or slow speeds.

Sedimentary – Formed by the deposition of sediment or pertaining to the process of sedimentation. Sedimentary rock results from the consolidation and cementation of loose sediment that has accumulated in layers.

Seismic array – A set of seismographs distributed over an area of the Earth's surface at spacing narrow enough so that signal waveform may be correlated between adjacent seismometers.

Seismic potential – Possibility of earthquakes or ground shaking in general.

Seismic refraction survey – Method of subsurface exploration where seismic waves triggered at ground surface and arrival times for waves are measured at points spaced along the ground surface with varying distance from seismic source. The refracted wave changes directions at contacts between two materials of different seismic velocity and travels a longer distance than direct surface wave.

Seismic site classification – Classification of a soil profile defined, by NCBC Table 1615.1.1, developed to evaluate the anticipated amplification of earthquake motions from bedrock up to the ground surface. Classifications range from site class A (hard rock) to site class F (soft soil with anticipated instability).

Seismicity – Measure of frequency and magnitudes of earthquakes in a given area.

Semiconfining layer – A lower-permeability layer between two or more permeable water-bearing units that restricts vertical flow between the units. A semiconfining layer is relatively more permeable than a confining layer.

Semi-permanent – In meteorology, refers to an atmospheric feature, such as a high, which persists for long periods of time and can be expected to occur regularly.

Sepal – An outer leaf or petal segment of a flower or flower bud.

Separative Work Units (SWU) – Units of measurement of the effort needed to separate uranium-235 (^{235}U) from uranium-238 (^{238}U). SWUs are computed using a standard formula derived from the physics of uranium enrichment. For example, for 220 pounds (100 kilograms [kg])) of natural uranium (comprised of approximately 99.3% ^{238}U and 0.7% ^{235}U) in the feed material, it takes about 60 SWU to produce 22 pounds (10 kg) of uranium enriched in ^{235}U content to 4.5%. It takes approximately 100,000 SWU of uranium enriched to 4.5% ^{235}U to fuel a typical 1,000-megawatt commercial light-water nuclear reactor for a year.

Serotinous – A seed-bearing case that requires heat or fire to release the seed.

Shear wave velocity – The velocity of seismic waves transmitted through the ground by particles vibrating perpendicular to the direction of wave travel.

Shell hash – A sediment layer of fragmented shells and marine detritus.

Sherd – A fragment of a ceramic vessel.

Shovel testing – The controlled excavation of 30-cm diameter holes and the screening of the removed sediment for the presence or absence of cultural material. This testing is typically conducted on a grid aligned to cardinal directions or landform shape.

SieVert (sV) – As defined by the International System of Units, the unit of radiation dose equivalent, equal to 1 joule of energy per kilogram of absorbing tissue. The sieVert replaces the rem (1 sV = 100 rem).

Significantly Rare – Limited – As defined in NCNHP, 2007: “The range of the significantly rare species is limited to North Carolina and adjacent states (endemic or near endemic). These are species which may have 20–50 populations in North Carolina, but fewer than 50 populations rangewide. The preponderance of their distribution is in North Carolina and their fate depends largely on conservation. Also included are some species with 20–100 populations in North Carolina, if they also have only 50–100 populations rangewide and declining.”

Significantly Rare – Throughout – As defined in NCNHP, 2007 “These significantly rare species are rare throughout their ranges (fewer than 100 populations total).”

Siliceous – Containing free silica or, in the case of volcanic glass, silica in the norm.

Silviculture – The management of forests for timber production; forestry.

Single-family development – Land parcels with single-family, detached, small-lot single-family, or two-family residential uses.

Sinkhole – Depression in surface of the ground caused by the collapse of the roof over a solution cavern.

Slope gradient – The difference in elevation between two points, expressed as a percentage of the distance between those points.

Special Nuclear Material (SNM) – Nuclear material (e.g., plutonium, uranium-233, or uranium) enriched in the isotopes uranium-233 (^{233}U) or uranium-235 (^{235}U).

Soil association unit – A landscape or soil grouping that has a distinctive proportional pattern of soils; it normally consists of one or more major soils and at least one minor soil, and is named for the major soil(s).

Soil compressibility – Property used to describe the amount that soils will compress under an applied load.

Soil Survey Geographic (SSURGO) Database – The most detailed level of soil mapping done by the National Resources Conservation Service. Field-mapping methods using national standards were used to construct the soil maps in the SSURGO database (NRCS, 2006a), with scales generally ranging from 1:12,000 to 1:63,360. SSURGO digitizing duplicates the original soil survey maps. This level of mapping is designed for use by landowners, townships, and county natural resource planning and management. SSURGO data are available for selected counties and areas throughout the United States and its territories. SSURGO is linked to a National Soil Information System (NASIS) attribute database. The NASIS database gives the proportionate extent of the component soils and their properties for each map unit. The SSURGO map units consist of 1 to 3 components each. The map extent for a SSURGO dataset is a soil survey area, which may consist of a county, multiple counties, or parts of multiple counties (NRCS, 2006a).

Solum – The upper portion of the soil profile in which soil formation occurs (i.e., topsoil is produced).

South access road – A proposed access road for direct transport (i.e., avoiding public roads) between the Proposed GLE Facility and GNF-A's Fuel Manufacturing Operation facility that would be constructed within the South Road portion of GLE Study Area by paving an existing on-site service road.

South Road portion of GLE Study Area – A 200-ft wide corridor (the 23 acres [9 ha] shown in **Figure 1-3**) that contains the proposed location of the South access road.

South-Central Site Sector – As shown on **Figure 1-2**, the sector covering the south-central portion of the Wilmington Site.

Special Concern – Any species of wild animal native or once-native to North Carolina that is determined by the Wildlife Resources Commission to require monitoring, but which may be taken under regulations adopted under the provisions of this Article (Article 25 of Chapter 113 of the General Statutes, 1987).

Spectral acceleration – Approximately what is experienced by a building, as modeled by a particle mass on a mass-less vertical rod having the same natural period of vibration as the building.

Spoil – Soil that has been excavated and moved from its original location, as in sediment removed from ditches.

Stability – A property of the atmosphere that suppresses mixing. The main parameter determining stability is the vertical temperature profile of the atmosphere.

Stability Class – A letter code indicating the degree of atmospheric stability. Stability Class A refers to the most unstable atmospheric conditions, with strong mixing, and Stability Class F refers to the most stable atmospheric conditions, with little mixing. Stability Class D is considered stable.

Standard penetration test (SPT) – An in-situ soil test used to characterize geotechnical aspects of a soil, such as approximate soil strength parameters and relative density of granular deposits. Penetration test performed at selected depths in a soil test boring by driving a split-barrel sampler a distance of 18 inches using a 140-pound hammer dropping a distance of 30 inches. Procedure described in ASTM D-1586 (ASTM, 1999).

Storm surge – Water that is pushed toward the shore by the force of the winds swirling around the storm. This advancing surge combines with the normal tides to create the hurricane storm tide, which can increase the mean water level to heights impacting roads, homes, and other critical infrastructure. In addition, wind-driven waves are superimposed on the storm tide. This rise in water level can cause severe flooding in coastal areas, particularly when the storm tide coincides with the normal high tides (FEMA, 2006d).

Stormwater – The flow of water that results from precipitation and that occurs immediately following rainfall or as a result of snowmelt.

Strata – Plural for stratum; a bed or layer of sedimentary rock having approximately the same composition throughout.

Stratified deposits – Sediments deposited in layers, commonly due to differences in texture, hardness, cohesion or cemetation, color, internal structure, and mineralogic or lithologic composition.

Stratigraphy – The science of rock strata; concerned not only with the original succession and age relations of rock strata, but also with their form, distribution, lithologic composition, fossil content, and geophysical and geochemical properties.

Strike – Direction of line formed by intersection of a rock surface with a horizontal plane.

Structural fill – Soil considered suitable for placement and compaction in areas where structures will be constructed.

Structure (geological) – Attitudes of deformed masses of rock.

Subcanopy – The vegetative layer beneath the treetops, but above ground-layer plants, generally consisting of smaller trees, large bushes and woody vines; understory.

Subsidence – The lowering of the Earth’s surface, caused by such factors as compaction, a decrease in groundwater levels, or the pumping of oil.

Surface water – All waters collected above ground level, including rivers, lakes, streams, ponds, and wetlands.

Surface-wave magnitude – The magnitude of an earthquake determined from surface waves on a seismogram from a teleseismic earthquake (one located more than 20° away). Surface waves are seismic waves that travel over the surface of the Earth versus than those that travel through the Earth, such as P-waves and S-waves. M_S magnitudes are measured from surface waves that have a period of about 20 seconds.

Surficial aquifer – Water-borne unconsolidated and residual deposits occurring on or near the Earth's surface, generally unstratified and representing the most recent of geologic deposits.

Suture – A major fault zone through a mountain range.

S-wave – A body-wave that is slower than the P-wave and arrives next, shaking the ground up and down and back and forth perpendicular to the direction it is traveling.

Syncline – A configuration of folded, stratified rocks in which rocks dip downward from opposite directions to come together in a trough.

Synoptic – In meteorology, the large-scale weather pattern, including the large-scale highs, lows, and fronts that are depicted on a typical national weather map.

Tectonics – A branch of geology dealing with the broad architecture of the outer part of the Earth; i.e., the regional assembling of structural or deformational features, a study of their mutual relations, origin, and historical evolution.

Terrace – Nearly level surface, relatively narrow, bordering a stream or body of water and terminating in a steep bank. Commonly, term is modified to indicate origin, as in stream terrace and wave-cut terrace.

Terraced deposits – Wave-cut deposits exposed by uplift or by the lowering of sea level, commonly occurring along the margin and above the level of a body of water and marking a former water level.

Tertiary – The first period of the Cenozoic era (after the Cretaceous period of the Mesozoic era and before the Quaternary period), thought to have covered the span of time between 65 million years and 3 to 2 million years ago. The Tertiary period is divided into five epochs: the Paleocene, Eocene, Oligocene, Miocene, and Pliocene.

Threatened – Any native or once-native species of wild animal that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range, or one that is designated as a threatened species pursuant to the Endangered Species Act (N.C.G.S.A. § 113-331 - 377).

Title V – Title V of the 1990 Clean Air Act Amendments requires all major sources and some minor sources of air pollution to obtain an operating permit. A title V permit grants a source permission to operate. The permit includes all air pollution requirements that apply to the source, including emission limits and monitoring, record keeping, and reporting requirements. It also requires that the source report its compliance status with respect to permit conditions to the permitting authority.

Topographic – The representation of a land surface, including its relief and the position of its natural and man-made features.

Topography – The shape of Earth's surface or the geometry of landforms in a geographic area.

Topsoil – The fertile, surface portion of a soil; usually dark colored and rich in organic material.

Total Effective Dose Equivalent (TEDE) – The sum of the deep-dose equivalent (for external exposures) and the committed effective dose equivalent (for internal exposures) (DDE + CEDE = TEDE).

Toxic Air Pollutant (TAP) – Any of the carcinogens, chronic toxicants, acute systemic toxicants, or acute irritants listed under State of North Carolina Administrative Code, Title 15A, Subchapter 2D, Section 1100.

Transgression – An advance of the sea over land areas; possible causes include a rise in sea level or subsidence.

Transmissivity – A measure of the permeability of a porous medium that reflects the aquifer thickness. Transmissivity thus reflects the overall water-bearing potential of a porous medium.

Travel corridor – Pathways that animals use to travel from one location to another to acquire resources.

Tributary – A stream that supplies water to a larger stream.

Trough-of-depression – The zone of lowered groundwater elevations within the influence of multiple pumping wells. The generally circular zone of lowered groundwater elevations around a single pumping well is a cone of depression. Thus, a trough of depression includes several overlapping cones of depression.

Type 0 Waste – A mixture of highly combustible waste, such as paper, cardboard, cartons, wood boxes, and combustible floor sweepings, from commercial and industrial activities. The mixtures may contain up to 10% by weight of plastic bags, coated paper, laminated paper, treated corrugated cardboard, oily rags, and plastic or rubber scraps.

U.S. General Soil Map (STATSGO) – The U.S. General Soil Map (NRCS, 2006b) consists of general soil association units at the 1:250,000-scale. It was developed by the National Cooperative Soil Survey and supersedes the State Soil Geographic dataset published in 1994. It consists of a broad-based inventory of soils and non-soil areas that occur in a repeatable pattern on the landscape and that can be cartographically shown at the scale mapped. The Digital General Soil Map of the United States was designed primarily for regional, multi-county, river basin, state, and multi-state resource planning, management, and monitoring. Data are not detailed enough to make interpretations at a county level. The approximate minimum area delineated is 1,544 acres (625 ha), which is represented on a 1:250,000-scale map by an area approximately 1 cm by 1 cm (0.4 inch by 0.4 inch).

UF_6 – Uranium hexafluoride; a conversion product of U_3O_8, also known as “yellow cake,” which is produced by mining and milling uranium ore. The UF_6 is then enriched before being made into nuclear fuel.

UF_6 feed – Natural uranium in the form of uranium hexafluoride (UF_6) suitable for enrichment.

UF_6 product – Uranium hexafluoride (UF_6) that contains a higher concentration of the U^{235} isotope as a result of the enrichment process.

UF_6 tails – Uranium hexafluoride (UF_6) that contains a lower concentration of the U^{235} isotope as a result of the enrichment process. Also known as depleted uranium.

Ultimate skin friction capacity – The maximum available resistance resulting from friction between the vertical surfaces of a pile and the surrounding soil.

Ultimate total capacity – The maximum available compression resistance resulting from the combination of ultimate skin friction capacity and the ultimate bottom (tip) resistance resulting from the normal force between the pile tip and the underlying soil.

Unconfined aquifer – An aquifer that is not confined by a less-permeable confining unit. An aquifer where the water table elevation represents the hydraulic potential.

Unconformably – Indicates discontinuity of any type in a stratigraphic sequence.

Unconsolidated Deposits – Geologic deposits that are loose and unstratified.

Understory – Any vegetation that grows beneath the canopy layer; sub-canopy.

Undifferentiated deposits – Geologic deposits that have not been mapped in detail and are typically a complex mixture of units with different geologic history.

Unified Soil Classification –A soil-classification system used in engineering and geology disciplines to describe the texture and grain size of a soil. The classification system can be applied to most unconsolidated materials and is represented by a two-letter symbol; see **Appendix H** (ASTM, 1985).

Unincorporated area – An area that is not located within the jurisdiction of any local government. Such unincorporated areas are governed and taxed by county-level government.

Unit emission rate – An assumption made in the air dispersion modeling process that the emission consists of 1 g/sec for point sources or 1 g/m^2/sec for area sources. The results can be multiplied by the actual emission rates of various constituents to produce actual concentration and deposition estimates. Unit emission rates are used to avoid running an air dispersion model for each different emission rate being emitted.

Unitized concentration – Concentration values produced by running an air dispersion model using a unit emission rate. These may be multiplied by the actual emission rates of each constituent to produce actual concentration estimates.

Uplift (geologic) – A structurally high area in the crust, produced by positive movements that raise or upthrust the rocks, as in a dome or arch.

Uplift capacity – The maximum available tension resistance of a pile resulting from the combination of the ultimate skin friction capacity and the pile weight.

Vicinity – Refers to a geographic area close to the Wilmington Site; usually describes features within 1 to 2 miles of the Site, but may extend to a specific radius that is less than countywide (smaller geographic area than “region”).

Viewshed – The area on the ground that is visible from a specific location.

Void – A general term for pore space or other openings in rock. In addition to pore space, the term includes vesicles, solution cavities, or any primary or secondary openings. Also, a portion of a borehole from which the core could not be recovered.

Vs30 – The shear-wave velocity averaged over the top 100 ft (30 m) for a firm-rock site condition, which is measured at 760 m/s.

Water quality standards – Water quality goals for specific waterbodies that are adopted by states and approved by EPA to comply with the Clean Water Act.

Water table – The top of an unconfined aquifer, below which the aquifer is saturated.

Waters of the United States (or jurisdictional waters) – All waters that are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters that are subject to the ebb and flow of the tide (33 CFR 328.3). Includes lakes, rivers, streams, and wetlands.

Western Site Sector – As shown on **Figure 1-2**, the sector covering the western portion of the Wilmington Site and includes the floodplain of the Northeast Cape Fear River.

Wet deposition – Process by which particulate matter or gasses are transferred by precipitation from an emitted plume and deposited on the ground. Wet deposition may be calculated with or without plume depletion.

Wet Detention Basin – A wet detention basin is a stormwater management facility that includes a permanent pool of water for removing pollutants and additional capacity above the permanent pool for detaining stormwater runoff (NCDENR, 2007).

Wetlands – Areas that are inundated or saturated by surface waters or groundwater at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions (33 CFR 328.3).

Whorl(s) – Three or more leaves or branches in a circle about a common axis.

Wilmington Site – The entire 1,621-acre (656-ha) parcel of land west of Castle Hayne Road (N.C. Highway 133) owned by GE (New Hanover County Tax Department parcel ID R01700-001-001-000; 3901 Castle Hayne Road). This term, as used in this Report, does not include other parcels east of Castle Hayne Road owned by GE.

Wind Rose – A plot of wind direction and speed showing the distribution of directions that the wind blows from at a measurement site. The proportion of the time that a wind blows from any given direction is indicated by the length of the “petal” on the wind rose.

Wind Speed – The speed of air movement measured for a set height above ground level (agl) at a meteorological observing site. This height may vary depending on the location. Typically, anemometers at National Weather Service stations are placed at 32 ft 10 inches (10 m) agl; however, some are still found at 20 ft (6 m) agl.

Windscreen – A foam device inserted over a microphone to reduce the exposure of the microphone to winds that might create increased sound levels.

Xeric – Relating or adapted to an extremely dry habitat

Zone AE –A classification used by FEMA to denote areas on a Flood Insurance Rate Map where base flood elevations have been determined. The base flood is the flood having a 1% chance of being equaled or exceeded in any given year. This is the regulatory standard also referred to as the 100-year flood. The base flood is the national standard used by the National Flood Insurance Program and all federal agencies for the purposes of requiring the purchase of flood insurance and regulating new development (FEMA, 2007c).

Zoning – A designation and reservation under a master plan of land use for light and heavy industry, dwellings, offices, and other buildings; use is enforced by restrictions on types of buildings in each zone.