CHAPTER 1
REVISION LOG

Rev.	Effective Date	Affected Pages	Revision Description
0	04/30/2009	ALL	Initial Application Submittal.
1	03/31/2010	8-9, 17, 19-29, 41, 43-45, 47, 55, 59, 61	Incorporate RAI responses submitted to the NRC via MFN-09-578 dated 09/04/2009 and MFN-09-801 dated 12/28/2009.
2	06/18/2010	14-18, 22, 26, 30, 22, 34, 38-41, 47, 49, 63	Revised Section 1.2.2.4 regarding nuclear liability insurance. Revised Section 1.1.3.1 regarding the transition period between construction and operations. Incorporated the latest natural phenomena information and updated the figures.
3	12/17/2010	23-25, 29, 32	Incorporate RAI responses from NRC letters dated October 5, 2010 and October 14, 2010. Revised Section 1.2.2.2 to update schedule for operations. Changed name President and CEO. Updated company assets to 2009 information Clarified that insurer determined amount of nuclear liability insurance Revised Section 1.2.5.6 to clarify definition of "basic component". Added description of procedure for inclement weather
4	03/30/2011	39, 48, 49	Changed two erroneous tornado "F3" references to "F2". Added revision number for referenced Reg Guide 1.76. Added revision number for referenced Reg Guide 1.198.
5	08/12/2011	30-32	Revised Section 1.2.5.6 to update the definitions of Basic Component, Critical Characteristics, Dedication Process, Dedicating Entity to be consistent with the GLE QAPD.

Rev.	Effective Date	Affected Pages	Revision Description
		32 38-46	Revised Section 1.2.6 to clarify that the Facility Clearance has been granted to GLE (previously granted to GNFA). Revised portions of Section 1.3 to be consistent with the GLE ISA Summary.

TABLE OF CONTENTS

1. General Information 1-6

1.1 Facility and Process Description 1-6

1.1.1 Facility Location 1-6
1.1.2 Facility Description 1-7

1.1.2.1 GLE Operations Building 1-8
1.1.2.2 UF_6 Cylinder Pads 1-14
1.1.2.3 Other Facility Buildings and Supporting Infrastructure 1-15

1.1.3 Process Description 1-16

1.1.3.1 Process Overview 1-16
1.1.3.2 Process System Descriptions 1-18

1.1.4 Waste Management 1-19

1.1.4.1 Solid Wastes 1-19
1.1.4.2 Liquid Wastes 1-20

1.1.5 Depleted Uranium Management 1-21
1.1.6 Liquid and Air Effluents 1-21

1.1.6.1 Process Wastewaters 1-21
1.1.6.2 Air Effluents 1-22

1.1.7 Raw Materials, By-Products, Wastes, and Finished Products 1-22

1.2 Institutional Information 1-23

1.2.1 Corporate Identity 1-23

1.2.1.1 Applicant Name and Address 1-23
1.2.1.2 Organization and Management of Applicant 1-23
1.2.1.3 Address of Facility and Site Location Description 1-24

1.2.2 Financial Qualifications 1-24

1.2.2.1 Capital Cost Estimate 1-24
1.2.2.2 Funding Commitments 1-25
1.2.2.3 Financial Resources 1-25
1.2.2.4 Liability Insurance 1-26

1.2.3 Type, Quantity, and Form of Licensed Material 1-26
1.2.4 Requested Licenses and Authorized Uses 1-27

1.2.5 Special Authorizations and Exemptions 1-27

1.2.5.1 Authorized Guidelines For Contamination-Free Articles 1-27
1.2.5.2 Exemption to Posting Requirements 1-27
1.2.5.3 Exemption to Decommissioning Funding Requirements ... 1-28
1.2.5.4 Authorization to Use ICRP 68 1-29
1.2.5.5 Authorization to Make Changes to License Commitments 1-30
1.2.5.6 Exemption from 10 CFR 21.3 Definitions 1-30
1.2.5.7 CAAS Exemption on the Cylinder Storage Pads 1-32

1.2.6 Security of Classified Information 1-32

1.3 Site Description 1-33

1.3.1 Site Geography 1-33

1.3.1.1 Site Location Specifics 1-33
1.3.1.2 Features of Potential Impact to Accident Analysis 1-33

1.3.2 Demographics 1-34

1.3.2.1 Latest Census Results 1-34
1.3.2.2 Description, Distance, and Direction to Nearby Population Area 1-35
1.3.2.3 Proximity to Public Facilities 1-35
1.3.2.4 Nearby Industrial Facilities 1-35
1.3.2.5 Land Use within a Five Mile Radius 1-35
1.3.2.6 Land Use Within One Mile of the Facility 1-36
1.3.2.7 Uses of Nearby Bodies of Water 1-36

1.3.3 Meteorology 1-37

1.3.3.1 Primary Wind Directions and Average Wind Speeds 1-37
1.3.3.2 Annual Precipitation – Amounts and Forms 1-37
1.3.3.3 Severe Weather 1-37

1.3.4 Hydrology 1-41

1.3.4.1 Characteristics of Nearby Rivers, Streams, and Other Bodies of Water 1-41
1.3.4.2 Depth to the Groundwater Table 1-42
1.3.4.3 Groundwater Hydrology 1-42
1.3.4.4 Characteristics of the Uppermost Aquifer 1-42
1.3.4.5 Design Basis Flood Events Used for Accident Analysis 1-43

1.3.5 Geology and Seismology 1-43

1.3.5.1 Characteristics of Soil Types and Bedrock 1-44
1.3.5.2 Earthquake Magnitudes and Return Periods 1-45
1.3.5.3 Other Geologic Hazards 1-46

1.4 References 1-47

TABLES

Table 1-1. Typical Types, Sources, Quantities of Solid Wastes Generated by GLE Commercial Facility Operations. 1-51

Table 1-2. Management of Solid Wastes 1-52

Table 1-3. Typical Types, Sources, and Quantities of Wastewater Generated by GLE Commercial Facility Operations. 1-53

Table 1-4. Management of Wastewater Generated by GLE Commercial Facility Operations. 1-54

Table 1-5. Typical GLE Air Emissions. 1-55

Table 1-6. {{{Proprietary Information withheld from disclosure per 10 CFR 2.390}}} 1-56

Table 1-7. Type, Quantity, and Form of Licensed Special Nuclear Material. 1-57

FIGURES

Figure 1-1. Wilmington Site and County Location 1-58

Figure 1-2. Wilmington Site, New Hanover County, and Other Adjacent Counties. 1-59

Figure 1-3. {{{Proprietary Information withheld from disclosure per 10 CFR 2.390}}} 1-60

Figure 1-4. {{{Proprietary Information withheld from disclosure per 10 CFR 2.390}}} 1-61

Figure 1-5. GLE Ownership 1-62

Figure 1-6. Community Characteristics Near the Wilmington Site. 1-63

Figure 1-7. Wind Rose for Wilmington International Airport. 1-64

1. GENERAL INFORMATION

This application requests a license from the U.S. Nuclear Regulatory Commission (NRC) to possess and use source material, special nuclear material (SNM), and byproduct material to construct and operate a commercial uranium enrichment facility. This application is filed by the GE-Hitachi Global Laser Enrichment LLC (GLE). GLE is requesting a license for a period of 40 years.

This chapter provides an overview of the GLE Commercial Facility. The facility enriches uranium for use in the manufacturing of nuclear fuel used in commercial power plants. This chapter provides a description of the facility and enrichment process along with a description of the GLE Site. Institutional information is provided to identify the applicant, describe the applicant's financial qualifications, and describe the proposed licensed activities.

This License Application (LA) is being submitted pursuant to the following:

- Atomic Energy Act of 1954, as amended *(Ref. 1-1)*,
- 10 CFR 70, *Domestic Licensing of Special Nuclear Material (Ref. 1-2)*,
- 10 CFR 40, *Domestic Licensing of Source Material (Ref. 1-3)*, and
- 10 CFR 30, *Rules of General Applicability to Domestic Licensing of Byproduct Material (Ref. 1-4)*.

1.1 FACILITY AND PROCESS DESCRIPTION

This section provides an overview of the GLE Site, the GLE Commercial Facility layout, and a summary of the GLE enrichment process.

1.1.1 Facility Location

The GLE Commercial Facility is located on an existing General Electric Company (GE) industrial site in Wilmington, North Carolina (herein referred to as the Wilmington Site). The Wilmington Site is a 1621-acre tract of land, located west of North Carolina Highway 133 (also known as Castle Hayne Road). The Wilmington Site lies between latitudes (North) 34° 19' 4.0"and 34° 20' 28.9" and longitudes (West) 77° 58' 16.4" and 77° 55' 19.8", and is approximately six (6) miles north of the City of Wilmington in New Hanover County, North Carolina (see Figure 1-1, *Wilmington Site and County Location*, and Figure 1-2, *Wilmington Site, New Hanover County, and Other Adjacent Counties*). The Wilmington Site is also the GLE "controlled area" (or "owner controlled area") for the purpose of meeting the requirements of 10 CFR 70.61(f), *Performance Requirements (Ref. 1-5)*.

The GLE Commercial Facility is located on approximately 100 acres of the Wilmington Site. In addition to the GLE Commercial Facility, the Wilmington Site contains the following GE facilities (see Figure 1-3, *Wilmington Site*):

- Global Nuclear Fuel – Americas, LLC (GNF-A) Fuel Manufacturing Operations (FMO) facility operated under the NRC SNM License-1097 *(Ref. 1-6)*;
- Wilmington Field Service Center (WFSC) in which used reactor control rod drive mechanisms are decontaminated, refurbished, and temporarily stored;
- GE Aircraft Engines (AE) facility which is not involved in nuclear fuel manufacturing operations;
- GE Services Components Operation (SCO) facility in which non-radioactive reactor components are manufactured;
- Fuel Components Operation (FCO) facility in which non-radioactive components for reactor fuel assemblies are manufactured; and
- Miscellaneous administrative and support buildings and site infrastructure, such as roads and parking lots.

To the east of the Wilmington Site border is North Carolina Highway 133 and some commercially and residentially developed properties. Located to the east of North Carolina Highway 133, is a GE-owned 24-acre parcel that is undeveloped, except for a GE employee park and a leased portion of property used as a transportation terminal. To the southwest of the Wilmington Site border is the Northeast Cape Fear River.

The majority of the north, northwest, and south perimeters are undeveloped forestlands. A small segment (approximately 1,000-feet of the north property line) borders the Wooden Shoe residential subdivision. A portion of the south property line is bordered by Interstate Highway 140 (otherwise known as the Wilmington Bypass). Residential properties are located directly south of the Wilmington Bypass.

The surrounding terrain is typical of coastal North Carolina with an elevation averaging less than 40 feet above mean sea level (msl). The terrain is characterized as gently rolling terrain consisting of forest, rivers, creeks, and swamps/marshlands.

1.1.2 Facility Description

The GLE Commercial Facility is shown on Figure 1-4, *GLE Commercial Facility Site Plan*. The GLE Commercial Facility includes the Operations Building where the enrichment processing systems and enrichment processing support systems are contained, several administrative and support buildings, a parking lot, retention basins, uranium hexafluoride (UF_6) cylinder pads, and connecting roadways. A cleared security buffer surrounds the entire GLE Commercial Facility and defines both the Restricted Area and the Protected Area of the facility. The major structures and areas of the facility are described below.

1.1.2.1 GLE Operations Building

The overall layout of the Operations Building is shown in Figure 1-4. The Operations Building includes the following process and support areas:

- Cylinder Shipping and Receiving Area,
- UF_6 Feed and Vaporization Area,
- Product Withdrawal Area,
- Tails Withdrawal Area,
- Cascade/Gas Handling Area,
- Blending Area,
- Sampling Area,
- Radioactive Waste Area,
- Heating, Ventilation, and Air Conditioning (HVAC) Equipment Area,
- Decontamination/Maintenance Area,
- Laboratory Area, and
- Laser Area.

The main process and support areas of the Operations Building and the associated operations are described below.

1.1.2.1.1 Cylinder Shipping and Receiving Area

The Cylinder Shipping and Receiving Area contains the necessary equipment to perform the following functions:

- Receive 30- and 48-inch cylinders from offsite;
- Weigh cylinders and perform other material control and radiological functions during receiving and when preparing for storage or offsite shipment;
- Provide interim storage of cylinders inside the Operations Building;
- Prepare cylinders and transfer them to onsite transfer vehicles (OSTVs) for transfer between the Operations Building and the UF_6 Cylinder Pads;
- Provide interim storage of product, feed, and sample/blend cylinders;

- Prepare cylinders and transfer them to OSTVs for transfer to other process areas within the Operations Building;
- Prepare product cylinders for offsite shipment and intra-site transfer; and
- Prepare 48-inch tails and heel cylinders for offsite shipment.

UF_6 feed is received at the GLE Commercial Facility in American National Standards Institute (ANSI) N14.1-compliant UF_6 cylinders on semi-trailer trucks, typically with one full 48-inch cylinder per shipping trailer. A compliant 48-inch feed cylinder contains a maximum of 12,501 kg of UF_6 *(Ref: 1-7)*.

When UF_6 cylinders are received at the GLE Commercial Facility, the cylinders are inspected, verified, and processed per approved written Operations, Security, and Radiation Protection (RP) procedures. Empty 30- and 48-inch cylinders are also received at the GLE Commercial Facility.

At the Cylinder Shipping and Receiving Area, cylinders are offloaded and transferred to an adjacent weighing and scanning area. After acceptance, feed cylinders are moved to an interim cylinder storage area inside the Cylinder Shipping and Receiving Area. From the interim cylinder storage area, feed cylinders may be moved to a feed station to begin processing, or to the In-Process Pad. An overhead bridge crane and transfer cart are used to handle the UF_6 cylinders.

Source material and SNM are used in this area.

1.1.2.1.2 UF_6 Feed and Vaporization Area

The UF_6 Feed and Vaporization Area contains the necessary equipment to perform the following operations:

- Receive UF_6 feed cylinders from the Cylinder Shipping and Receiving Area;
- Purge the light gases contained within the feed cylinders;
- Capture the light gases for disposal;
- Vaporize the UF_6 contained within the feed cylinders;
- Feed the vaporized UF_6 to the feed header between the Vaporization Area and the Cascade/Gas Handling Area within the Operations Building;
- Maintain design basis UF_6 feed rates to the feed header within the design basis temperature and pressure range; and
- Recover residual UF_6 from the feed cylinders to meet U.S. Department of Transportation (DOT) offsite cylinder shipping requirements for empty cylinders.

The UF_6 Feed and Vaporization Area is divided into feed vaporization chambers (FVCs). Each of the FVCs typically contains: solid feed stations (SFS) to vaporize the UF_6 feed; a cold trap purification station (CTPS) to remove light gases from the feed stream; a low temperature take-off station (LTTS) to remove feed cylinder UF_6 down to heel quantities; and a heated flow control valve box (HFCVB) for each SFS that contains the valves and pipe connections from each SFS.

Source material is used in this area.

1.1.2.1.3 Product Withdrawal Area

The Product Withdrawal Area contains the necessary equipment to perform the following functions:

- Receive empty 48 GLE UF_6 cylinders from interim storage within the Cylinder Shipping and Receipt Area;
- Maintain design basis UF_6 product withdrawal rates from the Cascade main discharge header;
- Separate the light gases from the UF_6 for disposal; and
- Provide filled 48 GLE cylinders with ≤ 8.00 wt% ^{235}U for interim storage and later disposition.

The Product Withdrawal Area contains: volume reducing compressor trains (VRCTs) that move UF_6 product material from the Cascade/Gas Handling System to the product Withdrawal Stations; LTTSs to collect the UF_6 product material; a CTPS to remove non-condensable light gases from the product stream; and a HFCVB for each LTTS that contains the valves and pipe connections from each LTTS.

SNM is used in this area.

1.1.2.1.4 Tail Withdrawal Area

The Tail Withdrawal Area contains the necessary equipment to perform the following functions:

- Receive empty UF_6 cylinders from interim storage within the Cylinder Shipping and Storage Area;
- Maintain design-basis UF_6 tails withdrawal rates from the enrichment system main discharge header;
- Separate the light gases from the UF_6 for disposal; and
- Provide filled UF_6 cylinders with ≤ 0.72 wt% ^{235}U for interim storage and later disposition.

The Tail Withdrawal Area contains: VRCTs that move UF_6 tails from the Cascade/Gas Handling System to the Tail Withdrawal Stations; LTTSs to collect the UF_6 tails material; a CTPS to remove non-condensable light gases from the tails stream; and a HFCVB for each LTTS that contains the valves and pipe connections from each LTTS.

Source material is used in this area.

1.1.2.1.5 Cascade/Gas Handling Area

The Cascade/Gas Handling Area contains the equipment necessary to perform the laser-based enrichment process. The UF_6 gas is exposed to laser-emitted light and two process streams are generated; one enriched in ^{235}U and one depleted in ^{235}U.

Technical details of the GLE laser-based enrichment process are proprietary, subject to export control by U.S. laws and regulations, and in many cases may also fall into the categories of security-related, safeguards, or classified information, access to which is further limited per U.S. laws and regulations.

Source material and SNM are used in this area.

1.1.2.1.6 Blending Area

The Blending Area contains the necessary equipment to perform the following functions:

- Receive 30- or 48-inch donor cylinders from interim storage within the Cylinder Shipping and Receiving Area;
- Purge the light gases contained within the cylinders;
- Capture the light gases for disposal;
- Vaporize the UF_6 contained within the donor cylinders;
- Feed the vaporized UF_6 to receiver cylinders;
- Recover residual UF_6 from the donor cylinders to meet DOT cylinder shipping requirements for empty cylinders; and
- Provide empty donor cylinders and filled receiver cylinders for interim storage.

The Blending Area contains blending donor stations (which are similar to the SFS) and blending receiver stations (which are similar to the product withdrawal LTTS) described under the Product Withdrawal Area above.

SNM is used in this area.

1.1.2.1.7 Sampling Area

The Sampling Area contains the necessary equipment to perform the following functions:

- Receive filled UF_6 cylinders from interim storage within the Cylinder Shipping and Receipt Area;
- Purge the light gases contained within the cylinders;
- Capture the reactive light gases for disposal and vent the nonreactive light gases;
- Homogenize and sample the UF_6 contained within the cylinders; and
- Maintain design basis UF_6 cylinder rates to support a six (6) million separative work unit (SWU) facility.

The function of the product liquid sampling system is to obtain an assay sample from filled product cylinders. The sample is used to validate the enrichment level of UF_6 in the filled product cylinders before the cylinders are sent to the fuel processor. This is the only system in the GLE Commercial Facility that converts solid UF_6 to liquid UF_6.

The Sampling Area contains: sample containment autoclaves (SCAs) to support liquefaction, sampling, and solidification of UF_6 in the cylinders; CTPS to remove light gases vented from the cylinders being sampled; LTTSs to capture UF_6 vented from the cylinders during sampling; HFCVB for each SCA that contains the valves and pipe connections between units within the sampling area; an autoclave surge tank (AST) that provides UF_6 surge capacity if an autoclave relief device actuates.

Source material and SNM are used in this area.

1.1.2.1.8 Liquid and Solid Radioactive Waste Areas

Quantities of radiologically contaminated, potentially contaminated, and non-contaminated aqueous liquid effluents are generated in a variety of the GLE Commercial Facility operations and processes. Aqueous liquid effluents are collected in tanks located in the Radioactive Liquid Effluent Collection and Treatment Room. The collected effluent is sampled and analyzed to determine if treatment is required before release.

Operation of the GLE Commercial Facility also generates refuse and other hazardous and nonhazardous solid wastes. These wastes may be designated as Resource Conservation and Recovery Act (RCRA) hazardous wastes, low-level radioactive waste (LLRW), high-activity waste, or low-level mixed waste (LLMW). Solid-waste systems are designed to process both wet and dry low-level radioactive solid waste. Solid radioactive waste material is accumulated, monitored for criticality control and other regulatory requirements, stored in temporary accumulation areas, and then transferred to one of the solid-waste storage buildings located on the GLE Site for storage pending eventual offsite shipment/disposition.

1.1.2.1.9 HVAC Equipment Areas

Various ventilation systems are used to condition the environment inside the buildings and areas to meet requirements for personnel, process equipment, and supporting systems and utilities. The HVAC systems also control the room pressure in different areas or zones of the buildings relative to adjacent areas and relative to the outdoors as part of the radioactive or hazardous material containment function.

The ventilation system requirements of each area are dependent on the process performed, and on variables such as the indoor air temperature, relative humidity, relative room pressure, and safety requirements.

Ventilation systems that have the potential to exhaust radioactive or hazardous materials interface with the Monitored Central Exhaust System (MCES). The MCES functions to remove uranium particulates as well as UF_6 and HF gas from process gas streams and room air during normal and abnormal events. The system maintains areas under negative pressure relative to ambient and adjacent areas. This prevents the release of radioactive or hazardous materials, which protects workers and the public. The MCES discharges through a monitored exhaust stack located in the Operations Building.

The ventilation and MCES equipment serving the Operations Building is located in various locations throughout the Operations Building.

1.1.2.1.10 Decontamination/Maintenance Area

The Decontamination/Maintenance Area provides a place for personnel to remove contamination from, and make repairs to, equipment and process components used in UF_6 systems, waste handling systems, and other areas of the facility.

Source material and SNM are contained in this area.

1.1.2.1.11 Laboratory Area

The Laboratory Area is located just north of the Cylinder Shipping and Receiving Area, on the east side of the Operations Building. Within the Laboratory Area there are areas for mass spectroscopy equipment, wet chemistry activities, safety and regulatory testing and analysis, standard analytical laboratory equipment, and fume collection and exhaust hoods.

Source material and SNM are used in this area.

1.1.2.1.12 Laser Area

The Laser Area contains the necessary equipment to operate the laser systems that are part of the GLE laser-based enrichment technology; and produce the specific wavelength of light required to affect the uranium isotope necessary for the enrichment process.

The Laser Area contains: lasers to generate the required wavelength of light needed for the enrichment process, and a laser repair shop located adjacent to the Laser Area to perform maintenance on the laser systems, including calibration, repair, and preventive maintenance.

No source material or SNM is used in this area.

1.1.2.2 UF_6 Cylinder Pads

The UF_6 Cylinder Pads include three outdoor cylinder pads each serving a different function. The three pads are described below. See Figure 1-4 for the location of the UF_6 Cylinder Pads.

1.1.2.2.1 Product Pad

The Product Pad is used to store product in 30-inch cylinders. The Product Pad is approximately 48,000 square feet and constructed similar to the other storage pads to provide for rainwater drainage. Saddles are used to store the cylinders and the cylinders are not typically stacked.

SNM is contained in this area.

1.1.2.2.2 In-Process Pad

The In-Process Pad is used to store feed material, as well as any cylinders containing heels and empty cylinders. It is approximately 130,000 square feet and constructed similar to the other pads to provide for rainwater drainage. Saddles are used to store the cylinders and the cylinders are not typically stacked.

Source material is contained in this area.

1.1.2.2.3 Tails Pad

The Tails Pad is designed to provide storage for 48-inch cylinders containing less than or equal to 0.72 percent weight ^{235}U. The Tails Pad is sized to accommodate the cylinders resulting from ten (10) years of facility operation.

The Tails Pad occupies approximately 465,000 square feet. The pad is sloped to provide drainage to the edges of the pad. The surrounding site is graded to provide collection and drainage of rainwater to an onsite retention basin. The cylinders may be stacked two high and are stored using saddles.

Source material is contained in this area.

1.1.2.3 Other Facility Buildings and Supporting Infrastructure

See Figure 1-4 for the location of the following buildings and supporting infrastructure.

There are three (3) administrative buildings. Two of the administrative buildings primarily contain office space for the GLE support staff and conference rooms. The third administrative building, the Operations Support Center, contains the personnel Entry Control Facility (ECF) and is located at the entrance to the Protected Area. Personnel requiring access to the Protected Area must pass through the ECF. The ECF is designed to facilitate and control the passage of authorized facility personnel and visitors. General parking is located outside of the Protected Area.

Waste storage buildings are used to store solid LLRW. The waste is packaged in transportation containers and surveyed prior to being stored in the warehouse.

An electrical substation and diesel generators provide electrical power to the GLE Commercial Facility. The diesel generators are used during short-term power losses to support an orderly shutdown of the enrichment processes upon loss of power or until normal electrical service is restored. A loss of GLE Site electrical power does not have any public safety implications.

Potable and process water supply lines run to the GLE Commercial Facility from the existing Wilmington Site water supply infrastructure. Sanitary waste, process wastewater, and treated liquid radiological wastewater are routed from the GLE Commercial Facility via underground lines to lift stations. The lift stations deliver the respective wastewaters to the existing Wilmington Site Sanitary Waste Water Treatment Facility (WWTF) and Final Process Lagoon Treatment Facility (FPLTF) through underground pipes.

Two retention basins receive stormwater runoff from the GLE Commercial Facility. The majority of the runoff from the GLE Commercial Facility, including the Operations Building, drains to a collection basin on the Wilmington Site. The remaining runoff, including runoff from the UF_6 Cylinder Pads, drains to a GLE Site retention basin.

There is a water tower, a firewater retention basin, and associated pumps and piping located on the GLE Site. The water in the tower is designated for process water, but has a reserved level for fire fighting. The firewater retention basin and associated diesel powered firewater pumps are designed as a backup source for fire protection systems.

The road leading to the entrance of the GLE Commercial Facility is located off of Castle Hayne Road (see Figure 1-3). There is also a road exiting the GLE Commercial Facility leading to the GNF-A FMO Facility. Both of these roads are located on the Wilmington Site and are maintained by GE.

1.1.3 Process Description

This section provides an overview of the GLE laser-based enrichment process. A more detailed description of the process is provided in the Integrated Safety Analysis (ISA) Summary. The ISA Summary also contains a description of the other systems supporting the GLE Commercial Facility including the utility systems; HVAC systems, process water system, and the various cylinder-handling systems used to move UF_6 cylinders.

1.1.3.1 Process Overview

The GLE Commercial Facility is a uranium enrichment facility that utilizes laser-based enrichment technology. The GLE Commercial Facility is designed to separate a feed stream containing the naturally occurring proportions of uranium isotopes into a product stream (enriched in the ^{235}U isotope) and a tails stream (depleted in the ^{235}U isotope).

The GLE Commercial Facility utilizes industry standard UF_6 containers and processes for material handling aspects of enrichment facility operations similar to those utilized at other uranium enrichment facilities. These similar UF_6 handling processes include the movement of uranium feed stock from its solid UF_6 form in cylinders to gaseous form used in the enrichment cascade via vaporization techniques, the filling of UF_6 cylinders with UF_6 gas condensed into solid UF_6 form after the enrichment process, and the blending of UF_6 gas of different enrichments to create specific desired product enrichments.

The GLE Commercial Facility uses the laser-based enrichment technology within an area of the facility known as the Cascade/Gas Handling Area. The process enriches natural UF_6, containing approximately 0.72 weight percent ^{235}U, to a UF_6 product containing ^{235}U enriched up to 8 weight percent. The nominal capacity of the facility is six (6) million SWU per year.

The uranium enrichment process utilized by the GLE Commercial Facility utilizes lasers tuned to specific frequencies to selectively excite UF_6 gas molecules to enable separation of the ^{235}U isotope in UF_6 feed stock. The result is a UF_6 product stream enriched in the ^{235}U isotope and a UF_6 tails stream in which the fraction of ^{235}U isotope is reduced or depleted. Technical details of the GLE laser-based enrichment technology are proprietary, subject to export controls by U.S. laws and regulations, and in many cases also fall into the categories of security-related, safeguards, or classified information, access to which is further limited per U.S. laws and regulations.

The phases of construction/initial operations include Early Construction, Phase 1 Construction (Initial Construction of one MSWU facility), Phase 2 Construction (Construction and Component Installation to Ramp up to six MSWU), and Full Operations at six MSWU. The facility described in this License Application assumes that the facility is operating at six MSWU. However, the facility will be operating at approximately one MSWU during the first year, two MSWU during the second year, three MSWU during the third year, four MSWU during the fourth year, five MSWU during the fifth year, and six MSWU during the sixth year and every year thereafter. The initial construction plan includes building the Operations Building in its entirety, and equipping it with the necessary equipment to generate one MSWU. During the first year, while the facility is operating at one MSWU, equipment/component installation will be occurring

simultaneously. Similarly, for the second, third, fourth, and fifth years, operations and equipment/component installation will occur simultaneously.

During Early Construction (prior to receipt of an NRC license), the following activities will occur:

- Clearing 100 acres on the GLE Site,
- Site grading and erosion control,
- Installation of stormwater retention system,
- Construction of main access roadways,
- Placement of utilities (electricity, potable water, process water, water for fire suppression, sanitary sewer, natural gas), and
- Construction of parking lots and minor roadways.

During Phase 1 Construction, the following activities will occur:

- Construction of the Operations Building,
- Construction of the UF_6 Cylinder Pads,
- Construction of the guardhouses,
- Construction of ancillary buildings (includes waste storage facilities, vehicle maintenance facilities, warehouses, storage yards, utility buildings, etc.),
- Installation of security systems,
- Construction of the Administrative buildings,
- Installation of the fire protection and other safety systems, and
- Installation of components within Operations Building to support one MSWU production.

{{{Proprietary Information withheld from disclosure per 10 CFR 2.390}}}

During full operations at six MSWU, there is not anticipated to be further facility construction or component installation, with the exception of maintenance and repair activities. Any unanticipated construction/component installation will be evaluated per the 10 CFR 70.72 *Facility Changes and Change Process (Ref. 1-8)* to determine if an amendment to the license is required prior to initiating the activities.

1.1.3.2 Process System Descriptions

The GLE Commercial Facility enrichment process consists of the following four (4) major systems and two enrichment support systems:

Major Enrichment Process Systems

1. UF_6 Feed and Vaporization
2. Cascade/Gas Handling
3. Product Withdrawal
4. Tail Withdrawal

Enrichment Support Systems

1. Blending
2. Sampling

An overview of each process system or support system is provided below.

1.1.3.2.1 UF_6 Feed and Vaporization System

The major function of the UF_6 Feed Vaporization System is to provide a continuous supply of gaseous UF_6 from the feed cylinders to the Cascades. The nominal UF_6 feed flow rate is based on a six (6) million SWU/year facility capacity. Approximately 900 48-inch cylinders are processed annually.

The major equipment used in the UF_6 Feed Vaporization Process are the SFSs. Feed cylinders are loaded into SFSs; vented for removal of light gases, primarily air and hydrogen fluoride, and heated to sublime the UF_6. The light gases and UF_6 gas generated during feed purification are routed to the Feed Purification Subsystem where the UF_6 is de-sublimed. The Feed Purification Subsystem consists of UF_6 cold traps, a vacuum pump/chemical trap set, and a LTTS. The Feed Purification Subsystem removes any light gases such as air and hydrogen fluoride from UF_6 prior to introduction into the Cascade/Gas Handling Area. The UF_6 is captured in UF_6 cold traps and ultimately recycled as feed, while hydrogen fluoride is captured on chemical traps.

1.1.3.2.2 Cascade/Gas Handling System

After purification, UF_6 from the SFS is routed to the Cascade/Gas Handling Area. The gas is exposed to laser-emitted light, and the UF_6 gas is separated into two streams, one enriched in ^{235}U and one depleted in ^{235}U.

1.1.3.2.3 Product Withdrawal System

Enriched UF_6 from the Cascade/Gas Handling Area is de-sublimed in the Product Withdrawal LTTS. Pumps and compressors transport the UF_6 from the Cascade/Gas Handling Area to the Product Withdrawal LTTS. The heat of de-sublimation of the UF_6 is removed by

cooling air routed through the LTTS. Filling of the product cylinders is monitored with a load cell system, and filled cylinders are transferred to the Product Cylinder Sampling System for sampling.

1.1.3.2.4 Tail Withdrawal System

Depleted UF_6 from the Cascade/Gas Handling Area is de-sublimed in the Tail Withdrawal LTTS. Pumps and compressors transport the UF_6 from the Cascade/Gas Handling Area to the Product LTTS. The heat of de-sublimation of the UF_6 is removed by cooling air routed through the LTTS. Filling of the tail cylinders is monitored with a load cell system, and filled cylinders are transferred to the Tails Pad.

1.1.3.2.5 Blending System

The primary function of the Blending System is to blend UF_6 donor cylinders with differing enrichments into a receiver cylinder. The assay in the receiver cylinder is one that meets customer specifications as well as transportation standards.

1.1.3.2.6 Sampling System

UF_6 sampling operations are performed in the Sampling Area. Current American Society for Testing and Materials (ASTM) International standards require that UF_6 samples be taken from homogenized UF_6. Therefore, the design criteria require liquefaction of UF_6 during sampling operations. In addition, sampling of a statistical basis set of feed and tails cylinders is required to support Material Control and Accounting (MC&A) requirements.

Autoclaves with heating and cooling capability are used to liquefy UF_6 in the cylinders, homogenize the liquefied material, obtain a representative sample of the contents of the cylinders, and then solidify the UF_6 in the cylinders before they are removed from the autoclave. The cylinders may be any approved UF_6 cylinder, per ANSI N14.1, *Nuclear Materials – Uranium Hexafluoride – Packaging for Transport (Ref. 1-9)*, which meets nuclear criticality safety (NCS) requirements. The autoclaves are designed to contain a UF_6 release in the autoclave. Electrically heated air is the heating medium and cold air is used for cooling.

1.1.4 Waste Management

1.1.4.1 Solid Wastes

Operation of the GLE Commercial Facility generates refuse and other nonhazardous solid waste, wastes designated as RCRA hazardous wastes, and LLRWs. No high-level radioactive wastes are generated by GLE Commercial Facility operations. GLE does not intend to generate mixed wastes. Low-level waste is expected to be Class A waste. The types, sources, and estimated quantities of solid wastes generated by GLE Commercial Facility operations are summarized in Table 1-1, *Typical Types, Sources, Quantities of Solid Wastes Generated by GLE Commercial Facility Operations*, and Table 1-2, *Management of Solid Wastes*.

GLE Commercial Facility operations generate an estimated 380 tons of municipal solid waste (MSW) per year. This waste is collected and placed in roll-off type containers. A

commercial refuse collection service regularly collects the filled containers and transports the waste to a RCRA permitted Subtitle D landfill for disposal.

In addition to MSW, an estimated 107 tons of non-hazardous solid wastes are generated per year as a result of equipment maintenance for GLE Commercial Facility operations. Examples of these wastes are spent coolant and used filter media. These wastes are collected and temporarily stored in containers appropriate for the waste type. Depending on the composition of the non-hazardous waste, these materials are either shipped directly to a permitted RCRA Subpart D landfill for treatment and burial, or routed to other approved facilities for reuse, reclamation, or treatment.

The GLE Commercial Facility generates approximately 12 tons of RCRA hazardous waste per year. This waste is collected, packaged in DOT-approved shipping containers, and temporarily stored onsite for shipment to a RCRA-permitted Subtitle C treatment, storage, and disposal facility.

The sources and typical quantities of LLRW generated by GLE Commercial Facility operations are summarized in Table 1-1. LLRW is collected in containers appropriate for the waste form and shipped by truck to an approved disposal facility as indicated in Table 1-2.

1.1.4.2 Liquid Wastes

The sources and estimated quantities of wastewater generated by GLE Commercial Facility operations are summarized in Table 1-3, *Typical Types, Sources, and Quantities of Wastewater Generated by GLE Commercial Facility Operations*, and Table 1-4, *Management of Wastewater Generated by GLE Commercial Facility Operations*.

The liquid radioactive wastes generated in the Operations Building are collected in closed drain systems that discharge to an accumulator tank. The liquid is treated to remove uranium through precipitation; the liquid is then treated to remove fluoride through evaporation. The resulting solids are dried and disposed of as LLRW.

The treated wastewaters from the Radiological Liquid Effluent Treatment System (RLETS) are discharged to the existing Wilmington Site Sanitary WWTF and FPLTF. The FPLTF receives Wilmington Site process wastewater, including the treated effluent from the GNF-A Radiological Waste Treatment System. The treated effluent from the FPLTF is discharged via National Pollutant Discharge Elimination System (NPDES)-permitted Outfall 001 to the Wilmington Site effluent channel where it is combined with stormwater, discharging groundwater, and treated sanitary wastewater effluent. The effluent channel flows to the unnamed Tributary No. 1 to the Northeast Cape Fear River.

The cooling tower for the GLE Commercial Facility is a closed loop system that does not contact any uranium materials or uranium-contaminated wastewater streams. To minimize the amount of dissolved solids and other impurities in the circulating water, standard operating practice is to regularly remove a portion of the circulating water from the cooling tower loop and discharge the water to an evaporation pond (adding fresh water to the cooling tower loop to make up for corresponding water loss). Approximately 30,000 gallons per day (gpd) is removed and pumped directly to the existing Wilmington Site FPLTF.

Operation of the GLE Commercial Facility generates approximately 10,500 gpd of sanitary waste. The sanitary wastes are collected in a sewer system connected to the existing Wilmington Site Sanitary WWTF. This facility uses an Activated Sludge Aeration Process. The treated effluent from the Wilmington Site Sanitary WWTF is reused as process water.

Stormwater runoff from outdoor impervious surfaces within the GLE Commercial Facility is collected in drainage conduits and channels flowing into retention basins used for collection of runoff. The retention basins are routed to the unnamed Tributary No. 1, which flows into the Northeast Cape Fear River.

1.1.5 Depleted Uranium Management

Depleted uranium (also referred to as UF_6 tails) from GLE Commercial Facility operations is temporarily stored at the GLE Commercial Facility in 48-inch cylinders before being shipped offsite to a depleted uranium conversion facility. There is no onsite disposal of the UF_6 tails at the Wilmington Site. Section 3113 of the United States Enrichment Corporation (USEC) Privatization Act *(Ref. 1-10)* directs the U.S. Department of Energy (DOE) to "accept for disposal" depleted uranium, such as the UF_6 tails generated by the GLE Commercial Facility.

The Tails Pad is designed to provide storage capacity for approximately 9,000 48-inch cylinders, which is equivalent to ten years of facility operation. It is anticipated that DOE will have begun accepting possession of the UF_6 tails before the storage pad capacity is reached. The pad design layout permits double stacking of the 48-inch cylinders and allows the cylinders to be moved with gantry cranes and flatbed trucks. The storage pad occupies approximately 465,000 square feet. To provide stormwater drainage, the pad is sloped at the edges. The terrain surrounding the storage pad is graded to provide collection and drainage of stormwater to a retention basin.

Saddles are used to stack and store the cylinders above the Tails Pad surface. To transfer the UF_6 tails between the Cylinder Shipping and Receiving Area and the Tails Pad, dedicated diesel-powered flatbed trucks are used. At the Tails Pad, a diesel-powered, self-propelled gantry crane is used to unload the cylinder from the flatbed truck, move the cylinder to the appropriate storage location on the pad, and place the cylinder on its pad cradle. Work practices to manage the Tails Pad include periodic inspections and radiological surveys to ensure cylinder integrity. Operators are trained in safe cylinder handling and cylinder maintenance procedures.

1.1.6 Liquid and Air Effluents

1.1.6.1 Process Wastewaters

Uranium enrichment operations performed inside the Operations Building generate process wastewater from decontamination, cleaning wash water, and laboratory wastes. The waste streams contain small concentrations of uranium and are collectively referred herein as liquid radioactive waste. Liquid radioactive waste is treated to remove uranium and fluoride as described in Section 1.1.4, *Waste Management.*

The treated wastewaters from the RLETS are discharged to the existing Wilmington Site FPLTF. This facility currently receives Wilmington Site process wastewater, including the

treated effluent from the GNF-A FMO Facility Radiological Waste Treatment System. The treated effluent from the FPLTF is discharged via NPDES-permitted Outfall 001 to the Wilmington Site effluent channel where it is combined with stormwater, discharging groundwater, and treated sanitary wastewater effluent. The effluent channel flows to the unnamed Tributary No. 1 to the Northeast Cape Fear River. The liquid leaving RLETS is monitored to ensure compliance with the 10 CFR 20, Appendix B, *Annual Limits on Intake (ALIs) and Derived Air Concentrations (DACs) of Radionuclides for Occupational Exposure; Effluent Concentrations; Concentrations for Release to Sewerage (Ref. 1-11),* limit. In addition, the liquid leaving the RLETS system is monitored to ensure compliance with the NDPES permit levels for fluoride, as well as other constituents specified in the permit. Other constituents may include total suspended solids, biological oxygen demand, oil and grease, total nitrogen, dissolved oxygen, and pH.

1.1.6.2 Air Effluents

The laser-based enrichment process is a closed process with no vents needed for routine venting of process gases. Some short-term gaseous releases occur inside the Operations Building during activities associated with operations such as the connection/ disconnection of UF_6 cylinders to process equipment and process equipment maintenance activities. These gaseous releases are routed through the building's ventilation system. The ventilation system air stream passes through a series of emissions-control devices consisting of high-efficiency particulate air (HEPA) filters and high-efficiency gas absorption (HEGA) filters. The exhaust air stream from these emission controls is vented to the atmosphere and monitored at the stack for uranium and fluoride. Table 1-5, *Typical GLE Air Emissions*, shows the typical air effluent concentrations from the Operations Building and the required regulatory limits. GLE shall comply with the requirements in 10 CFR 20, Appendix B, for uranium air effluents, and with the requirements specified in the North Carolina Department of Air Quality permit for monitoring of fluorides (as well as other operational controls/conditions specified in the permit).

1.1.7 Raw Materials, By-Products, Wastes, and Finished Products

The raw materials used in the laser-based enrichment process include UF_6 feed, gases used to support laser operation, oils used to support mechanical operations, process water, and solvents used in cleaning equipment. The by-product of the laser-based enrichment process is depleted uranium tails in the form of solid UF_6. The wastes from the laser-based enrichment process include solid wastes, process wastewaters, and air effluents. Further description of these wastes is contained in Section 1.1.4. The finished product from the laser-based enrichment process is solid UF_6 enriched in ^{235}U. GLE will not use or possess any moderator or reflector with special characteristics, such as beryllium or graphite.

GLE utilizes commercial natural UF_6 feed stock meeting the requirements of ASTM C787-06, *Standard Specification for Uranium Hexafluoride for Enrichment (Ref. 1-12)*. At this time, GLE does not intend to use "reprocessed UF_6" as feed stock, and consistent with ASTM C787-06, GLE requires that suppliers possessing feed cylinders contaminated with reprocessed UF_6 feedstock provide additional evidence of uranium purity that is backed up by statistical sampling of feed stock at GLE. As such, impurities in the feed are expected to be consistent with, or less than, those quantities specified in this standard. GLE shall produce enriched uranium meeting the requirements of ASTM C996-04, *Standard Specification for Uranium Hexafluoride Enriched to Less than 5 % ^{235}U (Ref. 1-13)*, for enriched commercial grade UF_6 and any additional customer specifications.

1.2 INSTITUTIONAL INFORMATION

This section describes the corporate identity, financial qualifications, type of license, and the requested special authorizations and exemptions.

1.2.1 Corporate Identity

The applicant name and address, corporate structure and ownership control, and physical location of the facility are provided below.

1.2.1.1 Applicant Name and Address

This application for an NRC license is filed by GE-Hitachi Global Laser Enrichment LLC. GLE is headquartered in Wilmington, North Carolina.

The full address of the applicant is as follows:

Mailing Address:

Global Laser Enrichment
P.O. Box 780, Wilmington, North Carolina 28402

Physical Address:

Global Laser Enrichment
3901 Castle Hayne Road, Wilmington, North Carolina 28401

1.2.1.2 Organization and Management of Applicant

The corporate ownership structure is shown in Figure 1-5, *GLE Ownership*. GLE is a Delaware limited liability company and currently the only subsidiary of majority owner GE-Hitachi Nuclear Energy Americas LLC (GEH), a global supplier of nuclear energy-related equipment and services, and which is itself a Delaware limited liability company and a wholly-owned subsidiary of GE-Hitachi Nuclear Energy Holdings LLC (Holdings). Holdings, a Delaware limited liability company, is a subsidiary of majority owner GENE Holding LLC (GENE), which is a Delaware limited liability company wholly owned by General Electric Company (GE), a U.S. corporation organized under the laws of the State of New York, and of minority owner Hitachi

America, Ltd., which is a wholly owned subsidiary of Hitachi Ltd., a Japanese corporation. GLE also has two minority owners, Cameco Enrichment Holdings, LLC ("Cameco Enrichment"), with 24% ownership interest in GLE, and GENE, which owns 13.5% of GLE. Cameco Enrichment is a Delaware limited liability company wholly owned by Cameco US Holdings, Inc., a Nevada corporation, which is in turn wholly owned by Cameco Corporation, a Canadian corporation.

In this ownership structure, GE maintains an indirect majority, that is 51% ownership, controlling interest, and no foreign entity has the ability to exercise control over GLE operations and management or has access to, or use rights in, GLE's nonpublic enrichment technology, including classified information. GLE Governing Board resolutions and, as applicable, Governing Board member voting proxies are utilized to assure that only Governing Board members who are U.S. citizens with appropriate U.S. government clearances have access to, or exercise control over activities affecting the protection of, classified information. Foreign ownership, control, and influence (FOCI) information is initially submitted, and periodic updates thereto are provided, to the NRC in accordance with 10 CFR 95, *Facility Security Clearance and Safeguards of National Security Information and Restricted Data (Ref. 1-14).*

The current principal officers of GLE and their citizenship are listed below:

- Chris Monetta, President and Chief Executive Officer — United States
- Craig M. Steven, Chief Financial Officer — United States
- Harold J. Neems, Secretary and General Counsel — United States

GLE's immediate parent, GEH, is the parent company of NRC licensees that are licensed under 10 CFR 50, *Domestic Licensing of Production and Utilization Facilities (Ref. 1-15)*, 10 CFR 70, and 10 CFR 72, *Licensing Requirements for the Independent Storage of Spent Nuclear Fuel, High-Level Radioactive Waste, and Reactor Related Greater Than Class C Waste (Ref. 1-16)*, at facilities in Sunol, California and Morris, Illinois. GLE's affiliate, GNF-A, also a controlled subsidiary of GE, is the current holder of an NRC license under 10 CFR 70 for an existing facility on the Wilmington Site.

1.2.1.3 Address of Facility and Site Location Description

The address of the facility is the same as the physical address of the applicant. A description of the facility site location is provided in Section 1.1.1, Facility Location.

1.2.2 Financial Qualifications

1.2.2.1 Capital Cost Estimate

GLE estimates that the total capital investment required to construct a six million SWU facility is approximately **{{{Proprietary Information withheld from disclosure per 10 CFR 2.390}}}** (in 2009 dollars), excluding capital depreciation, UF_6 tails disposition, decommissioning and any replacement equipment required during the life of the facility. The basis for the cost estimate is provided in Table 1-6, *GLE Commercial Facility Capital Cost Estimate.*

The cost estimate is based on a phased construction approach that is expected to take approximately eight (8) years from the time the license is issued to reach the full six (6) million SWU capacity. The first phase of the GLE Commercial Facility will be a one (1) million SWU facility, followed by incremental addition of 1 million SWU per year, starting one year after the initial 1 million SWU begins operating. GLE is expected to start production on the initial 1 million SWU facility approximately three (3) years from the issuance of the NRC license that GLE is seeking through this application. The ramp u phase (from 1 to 6 million SWU) is expected to leverage efficiencies gained from the initial deployments to expedite the construction process and increase the SWU capacity that can be deployed at one time..

1.2.2.2 Funding Commitments

Construction of the initial 1 million SWU facility shall not commence before funding is fully committed. Of this full funding (equity and/or debt), GLE will have: (1) minimum equity contributions of 30% of project costs from the parents and affiliates of the partners; and (2) firm commitments ensuring funds for the remaining project costs. The construction of the ramp up phase will have the same requirements listed for the first phase, except, that expected profits from sales may be used as a funding source.

GLE shall not proceed with the project unless it has in place long-term conditional enrichment contracts (that is, five (5) years or longer) with price expectations sufficient to cover operating costs (including facility depreciation and decommissioning), with a return on investment.

The foregoing funding commitments, which will be in place prior to GLE Commercial Facility construction and operation, as applicable, are consistent with the license condition approved by the NRC in previous uranium enrichment facility licensing proceedings. See CLI-97-15, 46 NRC 294, 309 (1997) (Claiborne Enrichment Center); CLI-04-3, 59 NRC 10, 23 (2004) (National Enrichment Facility); and CLI-04-30, 60 NRC 426, 437 (2004) (American Centrifuge Plant).

GLE LA Chapter 10, *Decommissioning,* describes how reasonable assurance is provided that funds will be available to decommission the facility as required by 10 CFR 70.22(a)(9), *Contents of Applications (Ref. 1-17)*, 10 CFR 70.25, *Financial Assurance and Recordkeeping for Decommissioning (Ref. 1-18)*, and 10 CFR 40.36, *Financial Assurance and Recordkeeping for Decommissioning (Ref. 1-19)*.

1.2.2.3 Financial Resources

GLE is currently funded by three parent companies, General Electric, Hitachi, and Cameco. The parent organizations have contributed cash and notes to fund the project through the design validation stage of the program and stand committed to provide additional funding pending the successful validation of the design concept. GLE currently expects to fund the construction costs through additional equity contributions provided by the parent companies. However, GLE may explore other funding options including, but not limited to additional equity owners (pending approval of the current parent companies) or long-term debt instruments.

A summary of the parent companies' total assets and net income for 2009 are provided below. All three of the parent organizations are publicly traded and additional information, including annual reports, are available on the companies' respective websites.

For the year ending December 31, 2009, GE had total assets (U.S. Dollars) of $781,818,000,000, with cash assets of $72,260,000,000. GE's net income in 2009 was $10,725,000,000.

For the year ending December 31, 2009, Hitachi had total assets (Japanese Yen) of JPY9,403,709,000,000, with cash assets of JPY807,926,000,000. Hitachi had a net loss in 2009 of JPY787,337,000,000.

For the year ending December 31, 2009, Cameco had total assets (Canadian Dollars) of C$7,342,102,000, with cash assets of C$1,101,229,000. Cameco's net income in 2009 was C$1,099,422,000.

1.2.2.4 Liability Insurance

GLE shall, in accordance with 10 CFR 140.13b, *Amount of Liability Insurance Required for Uranium Enrichment Facilities (Ref. 1-20)*, and prior to and throughout operation of the GLE Commercial Facility, have and maintain nuclear liability insurance in the amount of up to $200 million to cover liability claims arising out of any occurrence within the United States, causing, within or outside the United States, bodily injury, sickness, disease, or death, or loss of or damage to property, or loss of use of property arising out of or resulting from the radioactive, toxic, explosive, or other hazardous properties of chemical compounds containing source material or SNM. The amount of $200 million was determined by the insurer (American Nuclear Insurers).

The amounts of nuclear energy liability insurance required may be furnished and maintained in the form of:

- An effective facility form (non-indemnified facility) policy of nuclear energy liability insurance from nuclear facility underwriters;
- Such other type of nuclear energy liability insurance as the NRC may approve; or
- A combination of the foregoing.

GLE will provide proof of insurance to the NRC no later than October 15, 2010.

1.2.3 Type, Quantity, and Form of Licensed Material

GLE proposes to acquire, deliver, receive, possess, produce, use, transfer, and/or store source material and SNM meeting the criteria of SNM of low strategic significance as described in 10 CFR 70.4, *Definitions (Ref. 1-20)*. Details of the SNM are provided in Table 1-7, *Type, Quantity, and Form of Licensed Special Nuclear Material*. It is anticipated that other source and by-product materials will be used for instrument calibration purposes. These materials will be identified during subsequent design phases and the LA will be revised, as necessary.

GLE utilizes commercial natural UF_6 feed stock meeting the requirements of ASTM C787-06. At this time, GLE does not intend to use "reprocessed UF_6" as feed stock, and consistent with ASTM C787-06, GLE shall require that suppliers possessing feed cylinders contaminated with reprocessed UF_6 feed stock provide additional evidence of uranium purity that is backed up by statistical sampling of feed stock at GLE. As such, GLE expects to possess only trace amounts of other radionuclides consistent with the natural decay of uranium.

1.2.4 Requested Licenses and Authorized Uses

GLE is engaged in the production and sale of uranium enrichment services to electric utilities or fuel fabrication facilities for the purpose of manufacturing fuel to be used to produce electricity in commercial nuclear power plants. GLE also may purchase and enrich uranium for direct sale to fuel fabrication facilities. In addition, GLE may provide enrichment services for the U.S. government under certain contractual agreements.

This GLE LA is necessary for licenses issued under 10 CFR 30, 10 CFR 40, and 10 CFR 70 to construct, own, use, and operate facilities described herein as an integral part of the GLE Commercial Facility. This includes licenses for byproduct material, source material, and SNM. The license requested is for a 40 year period. See Section 1.1, *Facility and Process Description*, for a summary description of the GLE activities.

1.2.5 Special Authorizations and Exemptions

1.2.5.1 Authorized Guidelines for Contamination-Free Articles

GLE requests authorization to use the guidelines, contamination, and exposure rate limits developed by the NRC and included as Appendix A of this chapter titled *Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material,* for decontamination and survey of surfaces or premises and equipment prior to abandonment or release for unrestricted use. These guidelines are included as a regulatory acceptance criterion in NUREG-1520, *Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility (Ref. 1-22).*

1.2.5.2 Exemption to Posting Requirements

GLE requests authorization to post areas within Radiological Controlled Areas (RCAs) in which radioactive materials are processed, used, or stored with a sign stating "Every container in this area may contain radioactive material," in lieu of the labeling requirements in 10 CFR 20.1904, *Labeling Requirements (Ref. 1-23).*

The requested exemption is authorized by law because there is no statutory prohibition on the proposed posting of a single sign indicating that every container in the posted area has the potential for internal contamination. Indeed, to reduce unnecessary regulatory burden, the NRC issued a final rule in 2007 that, in part, modified 10 CFR 20.1905, *Exemptions to Labeling Requirements (Ref. 1-24)*, thereby exempting certain containers holding licensed material from the labeling requirements of 10 CFR 20.1904 if certain conditions are met. Although the 2007 rulemaking only applied to facilities licensed under 10 CFR 50 and 10 CFR 52, *Licenses, Certifications, and Approvals for Nuclear Power Plants (Ref. 1-25)*, the rationale underlying the rule supports the exemption request. Exempting GLE from this requirement will reduce licensee administrative and information collection burdens, but serve the same health and safety functions as the current labeling requirements. Therefore, the exemption does not affect the level of protection for either the health and safety of workers and the public or for the environment; nor does it endanger life or property or the common defense and security.

The NRC approved a similar exemption from 10 CFR 20.1904 requested by a prior uranium enrichment facility license applicant. In approving the exemption, the NRC concluded:

"Under 10 CFR 20.2301, the Commission may grant exemptions from the requirements of the regulations, if it determines that the request will be authorized by law and will not result in undue hazard to life or property. Also, 10 CFR 20.1905(c) already exempts containers from 10 CFR 20.1904, if the containers are attended by an individual who takes the precautions necessary to prevent the exposure of individuals in excess of the limits established. The staff agrees that it would be impractical to label each and every container in restricted areas at this facility because of the large number of potential containers. Labeling each container may also reduce radiation safety by desensitizing the worker to radiation warning signs. Since there is no statutory provision prohibiting the granting of this exemption, the staff concludes that the request is authorized by law. Also, the exemption request is consistent with those approved previously at the gaseous diffusion plants and other fuel cycle facilities. Experience at facilities that have received the exemption from the labeling requirement demonstrates that the applicant's request will provide an equivalent amount of safety, and will not result in an undue hazard to individuals. Accordingly, the staff finds that the request will not be an undue hazard to life or property. Therefore, exemption to the requirements of 10 CFR 20.1904 is recommended." (Ref. 1-24)

1.2.5.3 Exemption to Decommissioning Funding Requirements

The following proposed exemption from the requirements of 10 CFR 70.25(e) and 10 CFR 40.36(d) addressing the decommissioning funding requirements is identified in the Decommissioning Funding Plan (DFP) and GLE LA Chapter 10, *Decommissioning*.

10 CFR 70.25(e) and 10 CFR 40.36(d) require, in part, that *"The decommissioning funding plan must also contain a certification by the licensee that financial assurance for decommissioning has been provided in the amount of the cost estimate for decommissioning...".* In accordance with the DFP, GLE will incrementally fund that portion of its total decommissioning costs associated with the disposition of UF_6 tails generated by facility operation. Specifically, GLE will provide financial assurance for the disposition of UF_6 tails based on the expected amount of UF_6 tails to be generated annually, in a forward-looking manner. The NRC has previously approved the same incremental decommissioning financial assurance approach for USEC's American Centrifuge Project (ACP) and Louisiana Energy Services', L.P. (LES) National Enrichment Facility (NEF).

This exemption is justified for the following reasons:

- It is authorized by law because there is no statutory prohibition on incremental funding of decommissioning costs.

- The requested exemption will not endanger life or property or the common defense and security because UF_6 tails are generated incrementally over the life of the plant. GLE will provide financial assurance for UF_6 tails already generated that require disposal and the projected UF_6 tails to be generated in the next year. As such, requiring financial assurance for the disposition of UF_6 tails to be generated over the full licensed operating life of the enrichment facility – at the time of initial license issuance – would impose an unnecessarily large financial burden on the licensee.

- Granting this exemption is in the public interest for the same reasons stated above. Moreover, by eliminating an unnecessarily large financial burden on the licensee, the exemption will facilitate the deployment of an advanced, next-generation enrichment technology in the United States, in furtherance of important national energy objectives.

Finally, providing financial assurance for UF_6 tails disposition on an incremental basis is justified in view of GLE's commitments to: (1) provide full financial assurance for facility decommissioning (assuming a six MSWU facility) at startup (startup refers to when GLE receives licensed material); (2) update its UF_6 tails dispositioning cost estimate annually, on a forward-looking basis, to ensure that the financial assurance reflects the current projected inventory of UF_6 tails at the facility (including any previously-generated tails still requiring disposition); and (3) adjust other decommissioning costs periodically, and no less frequently than every three years. This approach will allow GLE to consider available operating experience and other relevant information, including actual UF_6 tails inventory values and generation rates, and to ensure that sufficient decommissioning financial assurance is available at any point during the licensed operating life of the facility.

1.2.5.4 Authorization to Use ICRP 68

GLE requests authorization to use the derived air concentration (DAC) and annual limit on intake (ALI) values based on dose coefficients published in International Commission on Radiological Protection (ICRP) Publication No. 68, *Dose Coefficients for Intakes of Radionuclides by Workers (Ref. 1-26)*, in lieu of the values in Appendix B of 10 CFR 20, in accordance with approved written procedures.

The ICRP 68 guidance was promulgated after the 10 CFR 20, Appendix B criteria were established, and provides an updated and revised internal dosimetry model. Use of the ICRP 68 models provide more accurate dose estimates than the models used in 10 CFR 20, and allows GLE to implement an appropriate level of internal exposure protection. The NRC has established precedent for this exemption request from 10 CFR 20 in SECY-99-077.

1.2.5.5 Authorization to Make Changes to License Commitments

1.2.5.5.1 Changes Requiring Prior Approval

GLE shall not make changes to the License Application that decreases the effectiveness of commitments, without prior NRC approval. For these changes, GLE will submit to the NRC, for review and approval, an application to amend the license. Such changes shall not be implemented until approval is granted.

1.2.5.5.2 Changes Not Requiring Prior Approval

Upon documented completion of a change request for a facility or process, GLE may make changes in the facility or process as presented in the License Application, or conduct test or activities not presented in the License Application, without prior NRC approval, subject to the following conditions:

1. There is no degradation in the safety commitments in the License; and
2. The change, test, or activity does not conflict with any condition specifically stated in the License Application.

Records of such changes shall be maintained, including technical justification and management approval, in dedicated records to enable NRC inspection upon request at the facility. A report containing a description of each such change, and appropriate revised sections to the License Application, shall be submitted to the NRC within three (3) months of implementing the change.

1.2.5.6 Exemption from 10 CFR 21.3 Definitions

GLE requests authorization to replace the definitions of basic component, commercial-grade items, critical characteristics, dedication, and dedicating entity as they apply to facilities licensed pursuant to 10 CFR 70 with the following:

Basic Component – A structure, system, or component (SSC), or part thereof, designated as an IROFS identified as QL-1 or QL-2, that affects the IROFS function, that is directly procured by the licensee of a facility or activity subject to the regulations in 10 CFR 70 and in which a defect or failure to comply with any applicable regulation in 10 CFR 70, order, or license issued by the U.S. Nuclear Regulatory Commission (NRC) could create a substantial safety hazard (i.e., exceed the performance requirements of 10 CFR 70.61). Basic Components include QL-1 and QL-2 identified IROFS-related design, analysis, inspection, testing, fabrication, replacement of parts, or consulting services that are associated with the component hardware, whether these services are performed by the component supplier or others.

When applied to IROFS identified as QL-NFPA, a basic component is a SSC, or part thereof, that affects the safety function of the IROFS that is directly procured by the licensee or a facility or activity subject to the requirements of the National Fire Protection Administration (NFPA) Code of Record, and in which a defect or failure to comply with requirements of the NFPA Code of Record could create a substantial safety hazard. Basic component includes QL-NFPA identified IROFS-related design, analysis, inspection, testing, fabrication, replacement of parts,

or consulting services that are associated with the component hardware, whether these services are performed by the component supplier or others, to the extent required by the NFPA Code of Record.

Commercial-Grade Item – A SSC, or part thereof, that affects its QL-1 and/or QL-2 identified IROFS function, which is not designed and manufactured as a Basic Component. Commercial-grade items do not include items where the design and manufacturing processes require in-process inspections and verifications to ensure that defect or failures to comply are identified and corrected (i.e., one or more critical characteristics of the item cannot be verified).

When applied to items identified as QL-NFPA (being items in facilities and activities licensed pursuant to 10 CFR 70), commercial grade item means an item that is (1) not subject to design or specification requirements that are unique to facilities or activities; (2) used in applications other than those facilities and activities; and (3) to be ordered from the manufacturer/supplier on the basis of specifications set forth in the manufacture's published product description.

Critical Characteristics – Those important to design, material, and performance characteristics of a commercial-grade item that, once verified, will provide reasonable assurance that the item will perform its intended QL-1 and/or QL-2 identified IROFS function.

When applied to items identified as QL-NFPA, critical characteristics are those important to design, material, and performance characteristics of a commercial grade item that will provide reasonable assurance that the item will perform its intended QL-NFPA identified IROFS function.

Dedication Process – An acceptance process undertaken to provide reasonable assurance that a commercial-grade item to be used as a Basic Component will perform its intended QL-1 and/or QL-2 IROFS function and, in this respect, is deemed equivalent to an item designed and manufactured under QL-1 or QL-2 requirements in accordance with the GLE QAPD. This assurance is achieved by identifying the critical characteristics of the time and verifying their acceptability by inspections, tests, or analyses performed by the purchaser or third-party dedicating entity after delivery, supplemented as necessary by one or more of the following: commercial grade surveys, product inspections or witness at holdpoints at the manufacturer's facility, and analysis of historical records for acceptable performance. In all cases, the dedication process must be conducted in accordance with the applicable provisions of the GLE QAPD. The process is considered complete when the item is designated for use as a basic component applicable to QL-1 and/or QL-2 IROFS.

When applied to items identified as QL-NFPA (being items in facilities and activities licensed pursuant to 10 CFR 70), the dedication process is applied to commercial-grade items to be used as basic components to provide reasonable assurance that they will perform their intended QL-NFPA identified IROFS function and are deemed equivalent to an item designed and manufactured under QL-NFPA requirements in accordance with the GLE QAPD. This assurance is achieved by confirming that the commercial-grade item is manufactured to established, acceptable national codes or standards that include one or more independent product endorsement based on qualification testing or periodic testing of selected characteristics of the item except in cases where such listing/approval is not required by codes and standards. In all cases, the applicable provisions of the GLE QAPD will be used to conduct

the dedication process. The process is considered complete when the commercial-grade item is designated as a basic component.

Dedicating Entity – The organization that performs the dedication process for QL-1 and QL-2 identified IROFS. Dedication may be performed by the manufacturer of the item, a third-party dedicating entity, or the licensee itself. The dedicating entity, pursuant to 10 CFR 21.21(c), *Notification of Failure to Comply or Existence of a Defect and its Evaluation*, is responsible for identifying and evaluating deviations, reporting defects and failure to comply for the dedicated item, and maintaining auditable records of the dedication process. In cases where the Licensee applies the commercial-grade item procurement strategy and performs the dedication process, the licensee would assume full responsibility as the dedicating entity.

When applied to items identified as QL-NFPA (being items in facilities and activities licensed pursuant to 10 CFR 70), the dedicating entity is the licensee. The licensee, pursuant to 10 CFR 21.21(c), is responsible for reporting defects and failure to comply for the dedicated item, maintaining auditable records of the dedication process, and assumes full responsibility as the dedicating entity.

1.2.5.7 CAAS Exemption on the Cylinder Storage Pads

GLE requests exemption from the use of a Criticality Accident Alarm System (CAAS) to cover the UF_6 Cylinder Storage Pads (MPF-106, -107, and -108), Trailer Storage Area, and UF_6 Cylinder Staging Area. The exemption is based on the full discussion presented in GLE LA Section 5.3.5.1 and is summarized as follows:

In the UF_6 Cylinder Storage Yards, most of the storage is provided for source material, not special nuclear material (SNM). Only 30B model cylinder containing SNM at 5 wt% ^{235}U, or less, is stored on the Product Pad. Storage of 30B model cylinders is short term and involves fewer cylinders than Tails or In-Process Storage thus further reducing the total likelihood for mishaps. Installation of CAAS to cover these storage yards will require detection clusters mounted high over the pads and require increased traffic into the storage yards for maintenance, functional testing, and calibration activities. This introduces additional hazards to the worker working at heights and presents an increased cylinder damage hazard from falling items and collapsing lift equipment.

1.2.6 Security of Classified Information

GLE has been granted a facility security clearance, in accordance with 10 CFR 95, in a separate submittal. The use, processing, storage, reproduction, transmission, transportation or handling of classified information necessary to support this license application is currently controlled under the NRC authorized GNF-A facility security clearance at the Secret Restricted Data (SRD) level. As a result, access to restricted data (RD) or national security information (NSI) for the GLE Commercial Facility shall continue to be controlled by GNF-A in accordance with 10 CFR 25, *Access Authorization (Ref. 1-28)*, 10 CFR 95, and any other requirements that the NRC imposes through the issuance of Orders, until such time NRC processes GLE for an approved facility security clearance at the SRD level. Classified information associated with this LA, but not part of the facility security clearance request has been transmitted in a separate submittal.

1.3 SITE DESCRIPTION

This section contains a summary description of the Wilmington Site and surrounding areas. The GLE Environmental Report (ER) *(Ref. 1-29)* contains more detailed information regarding the site and its environs.

1.3.1 Site Geography

This section contains information regarding the site location, including nearby highways, bodies of water, and other geographical features.

1.3.1.1 Site Location Specifics

The GLE Commercial Facility is located on an existing industrial site in Wilmington, North Carolina. The existing Wilmington Site is situated on a 1621-acre tract of land, located west of North Carolina Highway 133 (also known as Castle Hayne Road). The Wilmington Site lies between latitudes (North) 34° 19' 4.0"and 34° 20' 28.9" and longitudes (West) 77° 58' 16.4" and 77° 55' 19.8", and is approximately six (6) miles north of the City of Wilmington in New Hanover County, North Carolina (see Figure 1-1 and Figure 1-2). For further information, see Section 1.1.1.

The southeastern corner of the Wilmington Site is adjacent to the interchange of Interstate 140 with Castle Hayne Road. Current access to and from the Wilmington Site by trucks and other vehicle traffic is from Castle Hayne Road. Northbound Castle Hayne Road from the Interstate 140 interchange bordering the Wilmington Site is a four-lane road that continues for approximately one-half mile before narrowing to two lanes. The Wilmington Metropolitan Planning Organization designated Castle Hayne Road as an urban principal arterial south of Interstate 140 and as an urban minor arterial north of the Interstate 140 interchange.

1.3.1.2 Features of Potential Impact to Accident Analysis

The surrounding terrain is typical for coastal North Carolina. The terrain has an average elevation of less than 40 feet above msl and is characterized by gently rolling land, with rivers, creeks, swamps, and marshlands. Approximately 182 acres of the southwest portion of the Wilmington Site are classified as swamp forest. There are no mountain ranges nearby. The terrain of the GLE Site is very gently sloping (gradients less than 2 percent) with little relief; therefore, landslides are not credible events. There is no volcanic or glacial activity in the region or vicinity of the Wilmington Site.

The elevation of the GLE Site is above the 500-year coastal still water flood elevation (coastal still water elevations factor in potential impacts from storm surge, including tidal and wind setup effects). The GLE Commercial Facility is located outside both the 100- and 500-year flood plains and there are no dams in the vicinity that could contribute to a rapid flood event. The site may be subject to a probable maximum probable flood event resulting from combined river flooding of the Cape Fear and Northeast Cape Fear Rivers. This type of event would be very slow moving thus allowing ample warning for safe shutdown. GLE will have procedures for determining what actions to take in the event of inclement weather (i.e., whether to shut down operations). Additionally, the design of systems and components within the facility are evaluated for the flooding to ensure any accidents that could result in high consequencesare "Highly

Unlikely", and any accidents that could result in intermediate consequences are "Unlikely", thus meeting the performance requirements in 10 CFR 70.61.

Due to the curvature of the coastline in the area, the ocean lies approximately 10 miles east and 26.4 miles south of the Wilmington Site. The Federal Emergency Management Agency defines the geographic threshold for concern regarding a tsunami as one (1) mile inland from the coast with an elevation of 25 feet above msl. Given the distance of the Wilmington Site from the ocean, there are no direct threat effects of a potential tsunami. Because of the distance of the Wilmington Site upstream from the Atlantic Ocean (approximately 23 river miles) and the height of the GLE Site above the 500-year floodplain, the indirect effects of flooding from a tidal bore in the Northeast Cape Fear River induced by a tsunami are minimal.

The Mid-Atlantic Coastal Plain province counties in North Carolina are in a low potential zone for the presence of radon gas relative to other regions in the state.

Soil samples collected at the GLE Site typically do not have high amounts of natural organic material. In addition, no peat deposits that could be a potential source of methane gas have been identified at the GLE Site. There are no municipal landfills on or in the immediate vicinity of the Wilmington Site that could generate methane gas; therefore, methane gas buildup beneath the Wilmington Site is not credible.

The projected lowering of the potentiometric surface at the GLE Site, as a result of the groundwater withdrawals from the aquifer on and in the vicinity of the Wilmington Site, is minimal, and no greater than the historical seasonal fluctuations observed in groundwater levels. In addition, the absence of a thick or regionally continuous confining bed at the GLE Site further minimizes the potential for subsidence as a result of lowered groundwater levels; therefore, subsidence due to dewatering is not credible. Likewise, there are no active mines adjacent to the Wilmington Site or known economic deposits of minerals, stone, or fuel materials that could cause subsidence at the GLE Site.

1.3.2 Demographics

This section provides the current census results (calendar year [CY] 2000) for the area surrounding the Wilmington Site, to include specific information about populations, public facilities, and industrial facilities. Land use and nearby bodies of water are also described.

1.3.2.1 Latest Census Results

According to the U.S. Census Bureau's 2000 Decennial Census *(Ref. 1-30)*, a total of 321 census blocks fall within a five-mile radius of the Wilmington Site. The majority of these census blocks (261) is within New Hanover County and includes 12,997 persons and 4,953 households. A total of 57 Pender County census blocks are within the five-mile radius, with a combined population of 3,305 persons and 1,274 households. An examination of census block data from CY 2000 reveals a total of three census blocks in Brunswick County with some portion of the total area inside the five-mile radius. The total population of these three (3) census blocks is 36 persons in 17 households. Blocks with any portion of their area inside the five-mile radius were included in this population count. (See GLE ER Section 3.10.1 for additional information.)

1.3.2.2 Description, Distance, and Direction to Nearby Population Area

The region around the site is lightly settled with large areas of heavily timbered tracts of land. Farms, single-family dwellings, and light commercial activities are located along North Carolina Highway 133. In the eastern and southern vicinities of the Wilmington Site, residential uses are dominant due to the presence of the Wrightsboro (south), Skippers Corner (east), and Castle Hayne (northeast) communities. Wrightsboro has a population of approximately 4500, Skippers Corner has a population of approximately 1200, and Castle Hayne has a population of approximately 1100. (See GLE ER Section 3.1 for additional information.)

1.3.2.3 Proximity to Public Facilities

Figure 1-6, *Community Characteristics Near the Wilmington Site*, shows the location of schools and parks with respect to the five-mile Wilmington Site radius. There are a total of 90 public and private elementary, middle, and high schools in the three-county region. In addition to these primary and secondary schools, colleges such as the University of North Carolina at Wilmington (UNCW), Brunswick Community College, and Cape Fear Community College are located in the region. Out of the 90 schools in the region, one is within a four-mile radius of the GLE Site (Wrightsboro Elementary) and 21 schools are within an eight-mile radius of the GLE Site. The nearest hospital, New Hanover Regional Medical Center, is approximately six (6) miles from the Wilmington Site.

No state or federal parks are located within five (5) miles of the Wilmington Site. There are 18 parks, three trails, and three gardens maintained by New Hanover County. Four of the parks are located within a five-mile radius of the Wilmington Site.

1.3.2.4 Nearby Industrial Facilities

The Northeast Cape Fear River borders the Wilmington Site to the west, and industrial land uses are dominant on the opposite (west) side of the river. The BASF Corporation, Elementis Chromium Facilities, and the L.V. Sutton coal-fired power plant operated by Progress Energy are examples of industrial operations located in this area. The industrial area sits between the Northeast Cape Fear River and the main branch of the Cape Fear River.

1.3.2.5 Land Use within a Five Mile Radius

The land use in the vicinity of the Wilmington Site is discussed below and generally covers the five-mile radius around the Wilmington Site. The Wilmington Site is a 1,621-acre parcel, owned by the GE, located west of Castle Hayne Road (otherwise known as North Carolina Highway 133). The property is currently zoned I-2, which is described in the New Hanover County zoning code as intended for heavy industrial uses. No portion of the property is currently used for agricultural purposes.

Immediately north of the Wilmington Site is a large parcel of approximately 4,069 acres owned by Hilton Properties. The current zoning designation for this property is Rural Agricultural, which is designed for low-density residential development with an emphasis on farming and open-space preservation. This parcel is locally known as the Sledge Forest and is currently used for timber management and as a private hunting area. Access to the Sledge Forest is provided via a private, unpaved road that intersects with Castle Hayne Road and closely follows the northern property line of the Wilmington Site.

The Northeast Cape Fear River borders the Wilmington Site to the west, and industrial land uses are dominant on the opposite (west) side of the river. The BASF Corporation, Elementis Chromium facilities, and the L.V. Sutton coal-fired power plant operated by Progress Energy are examples of industrial operations located in this area. The industrial area sits between the Northeast Cape Fear River and the main branch of the Cape Fear River. In the eastern and southern vicinities of the Wilmington Site, residential uses are dominant due to the presence of the Wrightsboro (south), Skippers Corner (east), and Castle Hayne (northeast) communities.

Three (3) public schools are located within five (5) miles of the Wilmington Site: Wrightsboro Elementary School, Emma B. Trask Middle School, and Emsley A. Laney High School. Trask Middle School also serves as an emergency shelter for New Hanover County.

The Wilmington International Airport (ILM) is located approximately five (5) miles south-southeast from the Wilmington Site. The New Hanover County Landfill is located approximately four (4) miles southwest of the Wilmington Site.

1.3.2.6 Land Use Within One Mile of the Facility

As described above, the Wilmington Site is bordered on the north by the Sledge Forest and on the west by the Northeast Cape Fear River. Castle Hayne Road borders the eastern portion of the site. Further north along Castle Hayne Road, are four (4) mobile homes located on the opposite side of the street from the Wilmington Site. Adjacent to the site on the northeast side is the Wooden Shoe residential subdivision. Located adjacent to the Wilmington Site's eastern boundary across Castle Hayne Road, are the North Carolina State University Horticultural Crops Research Station, a truck parking lot, and a small recreational park for use by Wilmington Site employees (owned by GE). Directly south of the site is the Interstate 140, and beyond the interstate is a small residential area.

1.3.2.7 Uses of Nearby Bodies of Water

A portion of the Wilmington Site borders the Northeast Cape Fear River. Both commercial and recreational fishing occur on the Northeast Cape Fear River. Commercial fishing is more prevalent downstream of the Wilmington Site and in the Cape Fear River Estuary.

1.3.3 Meteorology

1.3.3.1 Primary Wind Directions and Average Wind Speeds

On an annual basis, the wind direction (direction from where the wind is blowing) at Wilmington International Airport is predominantly southwesterly *(Ref. 1-31)*; thus, reflecting the general synoptic scale wind pattern. In contrast, the predominant wind direction during the fall and winter is often northerly, due largely to the influence of invading polar air masses and changes in global circulation *(Ref. 1-31; Ref. 1-32)*. Figure 1-7, *Wind Rose for Wilmington International Airport*, shows the overall wind rose for Wilmington International Airport. The annual prevailing wind speed at the airport is 10.4 mph (9 knots) *(Ref. 1-31)*.

1.3.3.2 Annual Precipitation – Amounts and Forms

The mean annual precipitation in eastern North Carolina is heaviest in the southeast corner of the state and steadily decreases toward the north and west. The higher precipitation amounts are due to higher levels of moisture provided by the Atlantic Ocean. The area along the North Carolina coast experiences afternoon showers and thunderstorms often during the summer months. These storms form along a sea breeze front as it moves inland from the coast. The mean annual precipitation for the area around the GLE Commercial Facility is approximately 55.0 inches/year according to the 1948 to 1995 dataset *(Ref. 1-31)* and 57.1 inches/year according to the 1971 to 2000 dataset *(Ref. 1-33)*.

Due to the moderate climate, Wilmington receives very little snowfall, except on rare occasions. On average, only about 2.1 inches of snowfall occurs annually. December and January are expected to receive the most average snowfall, at 0.6 inches *(Ref. 1-33)*. Wilmington also receives only a small amount of sleet. The mean recurrence interval for measurable sleet in Wilmington, North Carolina, is approximately 4.6 years, or an annual probability about 22 percent. Sleet greater than 0.25 inches has a mean recurrence interval of only once every 46 years, or an annual probability of about 2 percent *(Ref. 1-34)*. Freezing rain usually poses a higher risk to power systems and trees than sleet. Freezing rain does not occur often in Wilmington, although it occurs more often than sleet *(Ref. 1-34)*. Measurable accumulations occur in Wilmington with a mean recurrence interval of about 1.5 years, or an annual probability of 67 percent. More significant accumulations of less than 0.25 inches occur with a mean recurrence interval of 7.7 years, or an annual probability of 13 percent. Accumulations of less than 0.5 inches, which are very likely to affect power lines and trees, are expected to occur in Wilmington at a mean recurrence interval of 46 years, or an annual probability of 2 percent.

1.3.3.3 Severe Weather

1.3.3.3.1 Extreme Temperature

The highest recorded temperature at Wilmington International Airport for the period of record is 104.0°F, which occurred during June 1952 *(Ref. 1-33)*. The lowest recorded temperature of 0.0°F occurred in December 1989 *(Ref. 1-33)*. This shows that the maximum annual temperature range at the Wilmington Site is about 104.0°F.

1.3.3.3.2 Extreme Precipitation

Tropical storms and hurricanes occur in and around the southeastern United States, making Wilmington prone to high amounts of rainfall over a short time period. The highest recorded 24-hour rainfall amount of 13.38 inches at Wilmington International Airport occurred during September 1999 due to the effects of Hurricane Floyd making landfall on the North Carolina Coast *(Ref. 1-33)*. Rainfall totals recorded for the 49 year period starting in 1949 and ending in 2000, published by the NOAA, were reviewed. The heaviest rainfall amounts normally occur during the month of September with an average monthly total rainfall of 173 mm (6.79 in) which is the equivalent of a daily rainfall average of 5.8 mm (0.23 in) per day. The Extreme Environmental Rainfall is equivalent to the 24-hour all season extreme local precipitation (based on point precipitation frequency estimates from NOAA Atlas 14 for Wilmington, North Carolina, and is estimated to be 109 mm (4.29 in). The 24-hour rainfall estimate accounts for the peak 1-hour extreme local precipitation estimate of 49 mm (1.91 in). The maximum one time extreme rainfall event recorded for a 24 hour period was a value of 340 mm (13.38 in) (rainfall event resulting from Hurricane Floyd making landfall on the eastern coast on September 15, 1999).

The largest snow accumulation in the Wilmington, North Carolina Area was 38.9 cm (15.3 in) from December 22 to December 24, 1989. The amount of snowfall in a 24 hour period equaled the maximum amount of 13 inches. The roof loading from the maximum amount of snow in a 24 hour period or the largest snow accumulation are 17 and 20 psf, respectively, per the information in ASCE 7-05.

ASCE 7-05 provides a methodology for estimating mean recurrence periods for snowfalls beyond those presented in this document. Using this methodology, the 1×10^{-5} snowfall is estimated to be about 17 to 25 psf. Based on the above the Design Basis Snow (DBS) is defined as 25 psf.

The roofs of the proposed facility are currently designed with a live load capacity of 30 psf. The roof design does not include any parapets so that there will be no drift snow loads over the majority of the roof. The exception to this is where the roof elevations change. Adjacent to locations where a lower roof abuts to walls for higher roof areas there is the potential for snow drifts to form. Following the guidelines in ASCE 7-05, the highest drift snow load is approximately 85 psf above the normal snow load of 10 psf, which exceeds the live load roof capacity. The additional drift snow load would be present for approximately 20 feet from the wall of the higher roof areas of the facility. For the roof decking in this area the snow drift load could cause the decking to first sag and eventually fail, allowing snow and water to enter the building. The main roof supports (e.g., steel girders and beams) are not expected to be overloaded because of the failure of the weaker roof decking, thus their failure is not postulated. Therefore, a complete roof failure due to any load, including snow drift loads, is determined to be "Highly Unlikely."

1.3.3.3.3 Extreme Winds

Extreme winds may occur at Wilmington International Airport due to localized events, such as thunderstorm downdrafts, microbursts, or tornadoes. In addition, the airport lies in a particularly vulnerable location for hurricane-force winds. As of 1995, the highest wind gust measured at the airport was approximately 78 mph (68 knots) *(Ref. 1-31)*; however, since that time, Wilmington has experienced Hurricanes Fran (1996), Floyd (1999), and Charley (2004).

Hurricane Fran had a peak gust of approximately 86 mph (75 knots) measured at the Wilmington International Airport. Hurricane Floyd similarly caused a wind gust of approximately 86 mph (75 knots) at the airport *(Ref. 1-37)*. Hurricane Charley had somewhat lower wind gusts of approximately 74 mph (64 knots) at the airport *(Ref. 1-38)*. The likelihood and consequences of design basis wind velocities are discussed further in Section 1.3.3.3.7.

1.3.3.3.4 Thunderstorms

Rainfall in the region during the summer months comes primarily from thunderstorms. These storms occur on approximately 33 percent of days during June through August in the vicinity of the Wilmington Site and are scattered and uneven in coverage *(Ref. 1-31)*. Although the inland advance of the sea breeze front often causes summer thunderstorms, other primary causes of thunderstorms in the Wilmington area are tropical storms or hurricanes approaching from the south and southeast, and large-scale synoptic fronts approaching from the north and west. The latter two causes of thunderstorms also increase the chance of severe weather. For example, hail is observed in the Wilmington area on an average of about once per year *(Ref. 1-31)* and is most likely to be associated with synoptic frontal thunderstorms. Severe thunderstorms may produce damaging straight-line winds greater than 57 mph (50 knots). According to the National Severe Storms Laboratory (NSSL) *(Ref. 1-39)*, the area surrounding the Wilmington Site experiences approximately four days per year of damaging thunderstorm winds or winds less than 57 mph (50 knots) due to a thunderstorm.

1.3.3.3.5 Lightning

Another hazard of thunderstorms is lightning, which can strike miles from a thunderstorm and often occurs without warning. Besides the obvious danger to personnel working outside, lightning can disrupt electrical circuits and cause fires. The region surrounding the Wilmington Site has experienced a lightning flash density ranging from 4 to 8 flashes/km^2/year over the period from 1996 through 2000.

1.3.3.3.6 Tornados

Fifteen (15) tornadoes are known to have touched down in New Hanover County, North Carolina, between 1950 and 2008, including waterspouts in the sound and on the Atlantic Ocean. The strongest of tornado to hit near New Hanover County occurred on June 13, 1962 (in neighboring Brunswick County) and measured F2 on the Fujita scale (meaning it was capable of producing considerable damage). Wind speeds associated with an F2 tornado are between 113 and 157 miles per hour (mph) for the fastest quadrant values. An F2 tornado can have 3-second gust wind speeds from 110 to 137 mph on the Enhanced Fujia Scale.

Based on evaluation of data from the National Severe Storms Laboratory *(Ref. 1-39)*, a tornado would be expected to occur within 25 miles of the Wilmington Site on 0.4 to 0.6 days per year. The ocean covers a significant portion of the area within 25 miles of the Wilmington Site; therefore, some of these tornadoes could occur as waterspouts. From a probabilistic perspective, tornado design basis guidance indicates that tornadoes in the Wilmington area would be expected to have up to 230-mph maximum winds at an exceedance probability of 10^{-7} per year *(Ref. 1-40)*. This change in expected intensity would not be abrupt, but due to the coarse nature of the grid cells used in Regulatory Guide 1.76, *Design-Basis Tornado and Tornado Missiles for Nuclear Power Plants (Ref. 1-41)*, to calculate the intensity regions, there

is a sharp demarcation between regions. Nevertheless, using this approach, the likelihood of a tornado of this magnitude is "Highly Unlikely".

Because there is no record of an F4 or F5 tornado in NC, and none of the tornadoes in the Wilmington area were stronger than a F1 tornado, from a deterministic perspective, a conservative tornado for the GLE site would be a F2tornado (118 to 161 mph 3-second gust speed equivalent). NUREG/CR-4461, *Tornado Climatology of the Contiguous United States (Ref. 1-42),* indicates that the tornado wind speed with an annual probability of 10^{-5} is 140 mph (3-second gust speed) for the region (Region II) in which the GLE site is located. In accordance with the performance requirements of 10 CFR 70.61 in Subpart H a tornado with an annual probability of 10^{-5} can be considered as a "Highly Unlikely" event. Since the 140 mph tornado wind speed compares with the wind speeds associated with the deterministic F2 tornado for the site, the deterministic tornado wind speed for the site is 140 mph (3-second gust speed). This magnitude wind is bounded by the wind speed identified for hurricanes as described below.

1.3.3.3.7 Tropical Storms and Hurricanes

The area of New Hanover County along the coast could expect the following return periods for each category of hurricanes that have been in the indicated categories at some point along their track, passing within approximately 86 miles (75 nautical miles):

- Category 1, 6 to 10 years;
- Category 2, 23 to 30 years;
- Category 3, 33 to 44 years;
- Category 4, 79 to 120 years; and
- Category 5, 191 to 250 years (*Ref. 1-40*).

Because winds are stronger on the right side of the storm's eye, causing more wind damage and higher storm surges, the greatest meteorological threat to New Hanover County comes from hurricanes that strike land in the approximate area between the South Carolina border and the outlet of the Cape Fear River. In addition, the strongest bands of rain occur in front of a hurricane as it approaches, resulting in a great deal of heavy, flooding rain in New Hanover County when a storm approaches this area of coastline. Between 1954 and 2004, three hurricanes, ranging from Category 1 through Category 3, made landfall in the area. Two of the hurricanes, Hurricanes Hazel (1954) and Fran (1996), were Category 3 storms that made landfall with winds between 111 to 130 mph. Note that the indicated return periods are not an indication that a specific area would experience the wind speeds of the indicated category of hurricane. It indicates that at some point along the track of a hurricane that was at the indicted category the track may pass within the indicated distance from the coast.

The most severe documented wind for the area in proximity to the proposed site was 98 miles per hour (on the conservative assumption that the wind speed reported was a one minute average value, this equates to a 3-second gust wind speed of 107 mph). The highest recorded wind speeds were experienced as a result of a hurricane (Hazel, 1954). The most severe wind speed in the area is below the Category 3 hurricane range (lowest wind speed in Category 3 is 111 mph for the one minute average that equates to a 122 mph 3-second gust wind speed). Thus, for the area in proximity to the proposed site no hurricane winds associated with Category 3 strength events have occurred (the occurrence of hurricane Category 3 wind speeds in the area in proximity to the proposed site is considered to be the "Unlikely" event). Distinct from "Unlikely" events, a Category 4 hurricane, represented as an event with 3-second gust wind speeds of 157.5 mph, was selected as the deterministically identified "Highly Unlikely" DBW event. This is based on objective criteria, supported by the historical data.

According to the examination of NOAA storm surge data *(Ref. 1-44)*, most portions of the Wilmington Site at an elevation of 25 feet above msl, including the GLE Commercial Facility would not be directly affected by the highest storm surge. This is further supported by the storm surge potential from hurricanes being estimated at 21.94 feet as presented in Regulatory Guide 1.59, *Design Basis Floods for Nuclear Power Plants (Ref. 1-45)*.

1.3.3.3.8 Floods

The GLE Site does not fall within 100-year or 500-year floodplains *(Ref. 1-46)*; however, some of the low-lying areas on the Wilmington Site contain swamp forest that borders the Northeast Cape Fear River. Much of this swamp forest is in the floodplain and may flood upstream during extreme rain events. As a result, the GLE site may be subject to a maximum probable flood event as discussed in Section 1.3.1.2.

1.3.4 Hydrology

The section contains descriptions of nearby water bodies, groundwater on and near the Wilmington Site, and design basis flood events.

1.3.4.1 Characteristics of Nearby Rivers, Streams, and Other Bodies of Water

Bodies of water in the vicinity of the Wilmington Site are the Northeast Cape Fear River (which borders the Wilmington Site to the west) and its associated tributaries and creeks. The Northeast Cape Fear River is a blackwater river with relatively low levels of dissolved oxygen and higher turbidity than the Cape Fear River. The Northeast Cape Fear River and its tributaries have a naturally low pH and are classified as swamp water by the North Carolina Department of Environment and Natural Resources Division of Water Quality. At the Wilmington Site, the river is tidally influenced. Salinity concentrations vary with the rate of freshwater input and the amount of tidal exchange.

On the Wilmington Site, there are three (3) streams that provide habitat to aquatic wildlife. Two of the streams, unnamed Tributaries No. 1 and No. 2 (located in the Swamp Forest community in the Western Site Sector), drain to the Northeast Cape Fear River. The remaining stream is located on the Eastern Site Sector and drains northward to Prince George Creek. The first two are unnamed tributaries to the Northeast Cape Fear River and are classified as freshwater streams, but their lower reaches are tidally influenced by the river. The third stream, the unnamed tributary to Prince George Creek, is a freshwater stream and is not tidally influenced within the Wilmington Site. All streams are capable of accommodating the aquatic species associated with the neighboring Northeast Cape Fear River. However, the tidal variations in dissolved oxygen and salinity may affect the suitability of the habitat for some species.

In addition, there are three (3) small ephemeral ponds in the Western Site Sector and North-Central Site Sector, along with wetland areas throughout the Site that provide habitat. These areas provide a water source for wildlife found on the Wilmington Site.

1.3.4.2 Depth to the Groundwater Table

On the Wilmington Site, the water table is generally located near the land surface averaging approximately nine (9) feet below ground surface (bgs) with a range from 0 to 20 feet bgs.

1.3.4.3 Groundwater Hydrology

The Wilmington Site is within the North Carolina Coastal Plain physiographic province, which extends from the Piedmont eastward to the North Carolina coast. The coastal aquifer system is an eastward-dipping and eastward-thickening wedge of depositional sediments and sedimentary rock underlain by a crystalline, eroded surface of igneous and metamorphic rock (Precambrian or Early Paleozoic age). Six (6) regional aquifers are present in the region surrounding the Wilmington Site, including the Surficial Aquifer, Castle Hayne Aquifer, Peedee Aquifer, Black Creek Aquifer, and the Upper and Lower Cape Fear Aquifers. The aquifers are water-yielding formations that are more permeable than the finer-grained formations (confining units) that are typically above and/or beneath these coastal aquifers. In most areas, a less-permeable confining unit, with the exception of the Surficial Aquifer, overlies each aquifer that is under water-table conditions. The aquifers and confining units consist of sands, conglomerates, silts, clays, shell hash, and fossiliferous limestones deposited in nearshore and deltaic to offshore marine environments *(Ref. 1-47)*.

1.3.4.4 Characteristics of the Uppermost Aquifer

The Surficial Aquifer includes undifferentiated, stratified sediments. These sediments typically include terraced and barrier beach deposits, fossil sand dunes, and stream channel deposits. The sediment texture varies from medium- to fine-grained sands to silts and clays. This aquifer is recharged directly by rainfall, and the water table is generally located relatively near the land surface (approximately averaging nine (9) feet bgs with a range from 0 to 20 feet bgs). The hydraulic conductivity of the Surficial Aquifer has been estimated to be approximately 130 feet/day.

The Surficial Aquifer discharges into streams, drainage canals/ditches, and the low-lying swampy areas on the Wilmington Site. In addition, the Surficial Aquifer recharges groundwater into the underlying Peedee Aquifer (referred to as the Principal Aquifer). Due to yield limitations, water supply from the Surficial Aquifer is primarily restricted to domestic use.

The Wilmington Site wells produce from the Peedee Aquifer, which is the principal aquifer under the site. Groundwater is used at the existing Wilmington Site for industrial process water and drinking water. The average annual withdrawal is approximately 1.0 million gpd. Water levels measured in wells that tap the Peedee Aquifer at the Wilmington Site were evaluated in terms of the long-term sustainability of the water resource. The water levels in the aquifer do not show a long-term downward trend. A review of potential future changes to the withdrawal rates indicate that the existing water use and future estimates (approximately 10 percent increase) do not exceed the sustainable yield of the aquifer in this area (See GLE ER). The hydraulic conductivity of the Peedee Aquifer has been estimated to be approximately 38 feet/day.

1.3.4.5 Design Basis Flood Events Used for Accident Analysis

The topography of the Wilmington Site and the general area is level terrain; therefore, water accumulation (flooding) is expected to be a slow event providing ample warning to Operations personnel. GLE CF processes would be safely shut down prior to any potential threat of flooding. In addition, there are no dams on the Northeast Cape Fear River, but there are several dams upstream on the Cape Fear River. The closest dams and locks on the Cape Fear River are approximately 30, 50, and 70 miles upstream of where the Northeast Cape Fear River comes into the Cape Fear River. Seismic induced failures of these dams and locks could cause flooding at the GLE site due to the general area being an estuary and in general about the same elevation. The lower Cape Fear River estuary has a tidal reach extending all the way up to the first dam and lock. Due to the level terrain the flood potential due to upstream dam and lock failures (e.g., due to seismic activity) would not likely result in a higher level of flooding than the design basis event form probable maximum flood from rainfall on the watershed.

The nearest river to the GLE site is the Northeast Cape Fear River. The Northeast Cape Fear River watershed covers 1750 square miles. Six miles south of the site, the Northeast Cape Fear River joins the Cape Fear River. The Cape Fear River has a watershed of 9149 square miles. The Design Basis Flood at the site is based on evaluating flooding on the Northeast Cape Fear River and also by evaluating flooding on the Cape Fear River. Flooding on the Cape Fear River has the potential for causing flooding on the Northeast Cape River since the site is only six miles from where the two rivers join together. These conditions were shown to have the highest flood potential, and are used as the "Highly Unlikely" flood event, and could result in about 3 feet of flooding in the facility structures.

1.3.5 Geology and Seismology

This section describes the geology and seismology at the Wilmington Site, including soil characteristics, earthquake magnitudes and return periods, and other geologic hazards.

1.3.5.1 *Characteristics of Soil Types and Bedrock*

Generally flat topography characterizes most of the Wilmington Site's physiography; however, the GLE Site is positioned on a topographic high compared to the adjacent land in that area of the Wilmington Site. The ground surface begins to gently roll into small low hills in the Northwestern Wilmington Site Sector, suggesting the presence of possible sand dune or remnant terrace deposits from shoreline migration in the recent geologic past. The Northeast Cape Fear River and its floodplain are the most prominent physiographic features bordering the Western and Northwestern Wilmington Site sectors. High bluffs and extensive estuarine areas along this reach of the river help protect the GLE Site from flooding events. The area west of the river channel scar, which is clearly visible in aerial images, marks an ancient flow boundary of the Northeast Cape Fear River. The abandoned part of the channel is today an estuarine area of low topographic relief bordering the current river's edge.

Surficial sedimentary deposits at the Wilmington Site are interpreted to be mostly a result of deposition in the geologic past associated with the ancient Northeast Cape Fear River system. These surficial deposits overlie the Peedee Formation at the Site and are largely undifferentiated and unconsolidated alluvial sands, clayey sands, and clays. Some of these deposits are previously deposited marine sediments that were reworked and re-deposited by alluvial processes.

The sedimentary sequence in the GLE Site is comprised of 10 to 30 feet of thin layers of silty fine sands, silty fine clayey sands, fine sandy silts, and fine sandy clays that overlie the Peedee Formation. Surficial sands are present in the area with an apparent average thickness of less than 5 feet. Thicker surficial sand deposits of approximately 10 feet thick are present in some areas. Surficial sediments in the uppermost 4 to 10 feet of this sector range from dark brown and black sand with some organic material to gray and tan fine- to medium-grained sand with minimal gravel. Beneath these sands, a dark gray, very silty and clayey fine sand is present in some locations.

At the base of the surficial deposits in many locations on the Wilmington Site lies a substantial marine clay layer considered to be part of the Peedee Formation. The Peedee Clay layer is encountered at a typical depth range of 20 to 30 feet. Hydraulically, the Peedee Clay forms an important semi-confining unit overlying the Peedee Aquifer, which is the source of process water for the existing Wilmington Site. The presence of glauconite throughout the Peedee Clay and the absence of reworked sediments more characteristic of shallower alluvial deposits suggest the Peedee Clay is of marine origin; therefore, this marine clay layer is stratigraphically considered part of the Peedee Formation. The Peedee Clay varies in both thickness and distribution across the Site.

Field observations of samples collected during investigations of the GLE Site indicate that the consistency of the Peedee Clay is generally firm, but can be softer if located near the ground surface. In general, this clay layer contains more silt than sand and is easily distinguished from other surficial alluvial clays present in some areas of the GLE Site by the uniform presence of glauconite and the Peedee Clay's characteristic gray to dark gray color.

The potential for differential settlement, or the difference in settlement across a foundation, was considered when preparing facility and roadway engineering designs. No soil types on the GLE Site pose any construction concerns.

Previous geotechnical investigations on the Wilmington Site found that soil conditions required the use of a specialized structural in-ground support system. A geotechnical design investigation to determine the structural in-ground support system necessary to support the estimated heavy loading will be completed prior to commencement of construction. The geotechnical design investigation will be performed using the applicable regulatory guidance in Regulatory Guide 1.132, *Site Investigations for Foundations of Nuclear Power Plants (Ref. 1-48)*.

1.3.5.2 Earthquake Magnitudes and Return Periods

Earthquake epicenters in the southeastern United States generally extend in a northeasterly orientation along the axis of the Appalachian Mountain range. In North Carolina, the vast majority of seismic activity is concentrated in the western mountainous regions, where sutures and faults are predominantly associated with North American collisional tectonics. There are clusters of events scattered throughout South Carolina, and a few isolated occurrences of singular events along the coast. A small number of events are recorded along the Mid-Atlantic Coastal Plain physiographic province. In summary, seismicity levels are low outside of the Charleston region and the mountains to the west. In the Wilmington Site region, seismicity levels are relatively low.

Using 12,899 events published by the Virginia Tech Seismological Observatory, with augmented catalogs extracted from the Advanced National Seismic System (ANSS) for more recent events, 896 unique earthquakes were located within a 200-mile radius of the Wilmington Site between 1698 and 2007. The earliest instrument-based event locations were recorded in 1925; however, reliable, spatially diverse networks did not accumulate earthquake locations and magnitudes until the early 1970s.

Prior to 1924, there are no events whose horizontal location error is less than 12.4 miles and not until 1965 was the network large enough to provide constraints to locate events with a 2.5-mile error. The median horizontal error for events in the 200-mile radius is 51.6 miles, with an inter-quartile distance (spread) of 51 miles. Prior to 1973, there were no estimates of uncertainty for hypocenter depths. After installation of seismic arrays, event-depth uncertainty varies from 0 to 62 miles, with a median of 0.9 miles and an inter-quartile spread of 1.7 miles.

There are no significant geological features in the Wilmington region that would produce a major earthquake. The IBC has identified this area as Zone 1 and considers seismic events of minor magnitude (Mercalli VI, Richter 5.5 – 6.0).

The Charleston, South Carolina earthquake of 1886 was felt in Wilmington, producing modified Mercalli intensities of V – VI, which is considered as light to moderate shaking effects. Since then there have been nine recorded seismological events in the Wilmington Area, all of which have been minor in nature, producing effects no greater than Mercalli IV. The earthquake epicenters in the southeastern United States generally extend in a northeasterly orientation along the axis of the Appalachian Mountain range. In North Carolina, the vast majority of seismic activity is concentrated in the western mountainous regions, where sutures and faults are predominantly associated with North American collisional tectonics. There are clusters of events scattered throughout South Carolina, and a few isolated occurrences of singular events along the coast. A small number of events are recorded along the Mid-Atlantic Coastal Plain physiographic province.

As fully described in the ISA Summary, GLE will use a performance goal of 1×10^{-4}/year for "Highly Unlikely" seismic event.

1.3.5.3 Other Geologic Hazards

As described in Section 1.3.1.2, other geologic hazards are not present at the Wilmington Site. There are no mountain ranges nearby. The terrain of the GLE Site is very gently sloping (gradients less than two percent) with little relief; therefore, landslides are not credible events. There is no volcanic or glacial activity in the region or vicinity of the Wilmington Site.

Soil samples collected at the Wilmington Site typically do not have high amounts of natural organic material. In addition, no peat deposits that could be a potential source of methane gas have been identified within the GLE Site.

The projected lowering of the potentiometric surface in the GLE Site as a result of the groundwater withdrawals from the aquifer on and in the vicinity of the Wilmington Site is minimal, and no greater than the historical seasonal fluctuations have been observed in groundwater levels. In addition, the absence of a thick or regionally continuous confining bed on the GLE Site further minimizes the potential for subsidence as a result of lowered groundwater levels; therefore, subsidence due to dewatering is not credible.

There are no active mines adjacent to the Wilmington Site or known economic deposits of minerals, stone, or fuel materials that could cause subsidence at the GLE Site.

Using the soil information from the geotechnical design investigation mentioned in Section 1.3.5.1, the following activities will be conducted:

- The assessment of liquefaction potential of subsurface soils will be completed using the applicable guidance contained in Regulatory Guide 1.198, *Procedures and Criteria for Assessing Seismic Soil Liquefaction as Nuclear Power Plant Sites (Ref. 1-50).* The Ground Motion Response Spectra used for the liquefaction analysis will be based on guidance contained in the *International Building Code (Ref. 1-51).*

- Allowable bearing pressures for shallow and deep foundations will be evaluated using established geotechnical engineering methods. Methods anticipated for use include those contained in the following publications: NAVFAC DM 7, *Naval Facilities Engineering Command Design Manual (Ref. 1-52)*; *Foundation Engineering Handbook (Ref. 1-53)*; *Foundation Analysis and Design (Ref. 1-54)*; and FHWA-IF-99-025, *Drilled Shafts: Construction Procedures and Design Methods (Ref. 1-55).*

The evaluation of total and differential settlement for structure foundations will be completed using established geotechnical engineering methods. Methods anticipated for use include those contained in the following publications: NAVFAC DM 7, Foundation Engineering Handbook; and Foundation Analysis and Design.

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Table 1-1. Typical Types, Sources, Quantities of Solid Wastes Generated by GLE Commercial Facility Operations.

Waste Type	Waste Source	Estimated Average Annual Quantity Generated
Municipal Solid Waste (MSW)	General worker operations, maintenance, and administrative activities not involving the handling of or exposure to uranium	380 ton/yr
Nonhazardous Industrial Wastes	Nonhazardous wastes from equipment cleaning and maintenance activities (for example, used coolant, nonhazardous caustic, and filter media) that are recyclable or not accepted by MSW landfill	107 ton/yr
Resources Conservation and Recovery Act (RCRA) hazardous waste	Wastes designated as RCRA hazardous wastes from equipment and maintenance activities (for example, used cleaning solvents and used solvent-contaminated rags)	12 ton/yr
Low-Level Radioactive Waste (LLRW)	Laboratory waste from UF_6 feed sampling and analysis	97 lb/yr
	Combustible, uranium-contaminated used items (for example, worker personal protection equipment, swipes, step-off pads)	92 ton/yr
	Noncombustible, uranium-contaminated, used items (for example, spent filters from HVAC systems, liquid radiological waste treatment system, and area monitors) and corrective maintenance items (defective pigtails, valves, and other safety equipment that needs replacement)	863 yd^3/yr
	Liquid radiological waste treatment system filtrate/sludge	670 lb/yr

Table 1-2. Management of Solid Wastes.

Solid Waste Source	Onsite Waste Management	Offsite Waste Treatment/Disposal
Municipal solid waste (MSW)	Collected and temporarily stored in roll-off containers	Filled roll-off containers transported by commercial refuse collection service to an approved disposal site
Non-hazardous wastes from operations equipment cleaning and maintenance activities that are recyclable or not accepted by MSW landfill	Collected and temporarily stored in containers	Filled containers transported by truck to an approved disposal site[a]
Wastes designated as Resource Conservation and Recovery Act (RCRA) hazardous wastes	Collected and temporarily stored in containers	Filled containers transported by truck to an approved disposal site[b]
Laboratory waste from UF_6 feed sampling and analysis	Collected and temporarily stored in containers	Either transported by truck to an approved disposal site or transported to an approved uranium recovery vendor.
Combustible used or spent uranium-contaminated materials	Collected and temporarily stored in containers	Either transported by truck to an approved disposal site or transported to an approved uranium recovery vendor.
Noncombustible used or spent uranium-contaminated materials	Collected and temporarily stored in boxes	Filled boxes transported by truck to an approved disposal site[c]
Liquid Radiological Waste Treatment System filtrate/sludge	Collected and temporarily stored in metal cans	Filled cans transported by truck to an approved disposal site

[a] Licensed RCRA Subpart D landfill.

[b] Licensed RCRA Subpart C Treatment, Storage, and Disposal Facility (TSDF).

[c] Licensed Low-Level Radioactive Waste Disposal Facility.

Table 1-3. Typical Types, Sources, and Quantities of Wastewater Generated by GLE Commercial Facility Operations.

Wastewater Type	Wastewater Source	Typical Average Daily Quantity Generated
Process liquid radiological waste	Wastewaters from the Operations Building Decontamination/Maintenance Area; process area floor drains, sinks, sumps, and mop water; Laboratory Area floor drains, sinks, sumps, and mop water; change room showers and sink; and aqueous process liquids that have the potential to contain uranium	5,000 gpd
Cooling tower blowdown	Operations Building HVAC cooling tower	30,000 gpd
Sanitary Waste	Sanitary waste from building areas used by GLE personnel (for example, restrooms and break rooms)	10,500 gpd
Stormwater	Stormwater runoff from impervious surfaces (for example, building roofs, parking lots, service roads, outdoor storage pads, and other maintained areas)	Variable depending on local precipitation

Table 1-4. Management of Wastewater Generated by GLE Commercial Facility Operations.

Wastewater Type	Onsite Waste Management	Offsite Waste Treatment/Disposal
Process liquid radiological waste	Wastewaters collected in closed drain system connected to Radiological Liquid Waste Treatment System (RLETS). Treated radiological waste effluent discharged to existing Wilmington Site process wastewater aeration basin and Final Process Lagoon Treatment Facility (FPLTF)	Treated effluent from the Wilmington Site FPLTF is discharged at NPDES-permitted Outfall 001 to the onsite effluent channel
Cooling tower blowdown	Blowdown pumped from cooling tower to existing Wilmington Site FPLTF	Treated effluent from the Wilmington Site FPLTF discharged at NPDES-permitted Outfall 001 to the onsite effluent channel
Sanitary Waste	Sanitary waste collected in sewer system connected to existing Wilmington Site Sanitary Wastewater Treatment Plant. Waste stream treated by activated sludge aeration process.	Treated effluent from the Wilmington Site Sanitary Wastewater Treatment Plant is discharged at NPDES-permitted Outfall 002 to the onsite effluent channel
Stormwater	Stormwater runoff collected in drainage conduits and channels flowing to onsite retention basins.	Stormwater from onsite retention basins is discharged per requirements of NPDES stormwater permit.

Table 1-5. Typical GLE Air Emissions.

Constituent	Amount	Regulatory Limit
Uranium	$8x10^{-15}$ µCi/mL [a]	$3x10^{-12}$ µCi/mL [b]
Hydrogen Fluoride	< 0.50 lb/day	~0.50 lb/day [c]

a. Per Global Laser Enrichment Environmental Report, December 2008.

b Per 10 CFR 20, Appendix B.

c Best estimate provided as the actual limit is specified on the North Carolina Department of Environment and Natural Resources air permit to be issued prior to operations.

Table 1-6. {{{Proprietary Information withheld from disclosure per 10 CFR 2.390}}}

Table 1-7. Type, Quantity, and Form of Licensed Special Nuclear Material.

Source and/or Special Nuclear Material	Physical and Chemical Form	Maximum Amount to be Possessed at any One Time
Uranium (natural and depleted) and daughter products	Physical: solid, liquid, and gas Chemical: UF_6, UF_4, UO_2F_2, oxides and other compounds	140,000,000 kg
Uranium enriched in isotope ^{235}U up to 8 percent by weight and uranium daughter products	Physical: solid, liquid, and gas Chemical: UF_6, UF_4, UO_2F_2, oxides and other compounds	2,600,000 kg
^{99}Tc, transuranic isotopes and other contamination	Any	Amount that exists as contamination as a consequence of historical feed of recycled uranium at other facilities.

Figure 1-1. Wilmington Site and County Location.

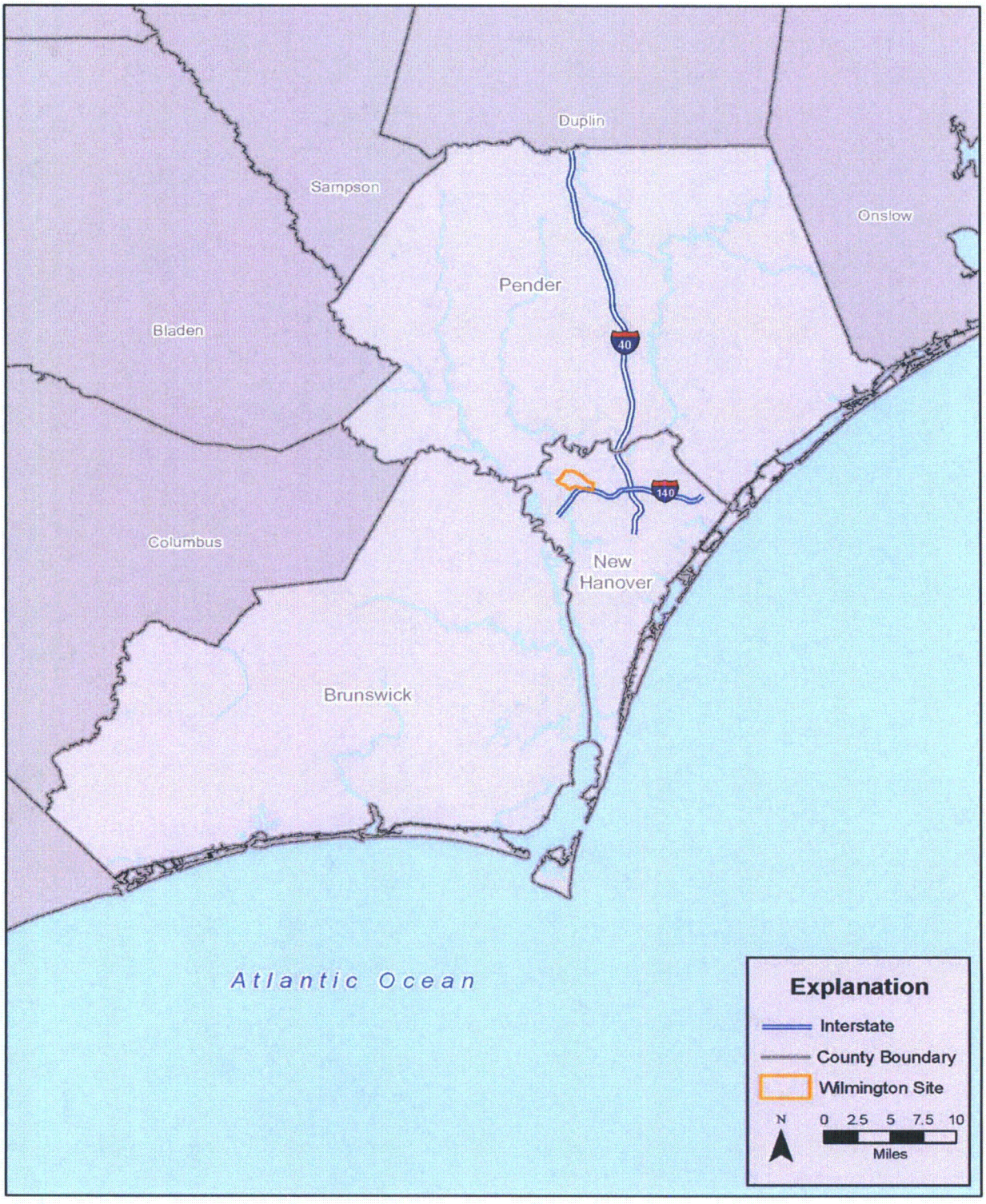


Figure 1-2. Wilmington Site, New Hanover County, and Other Adjacent Counties.

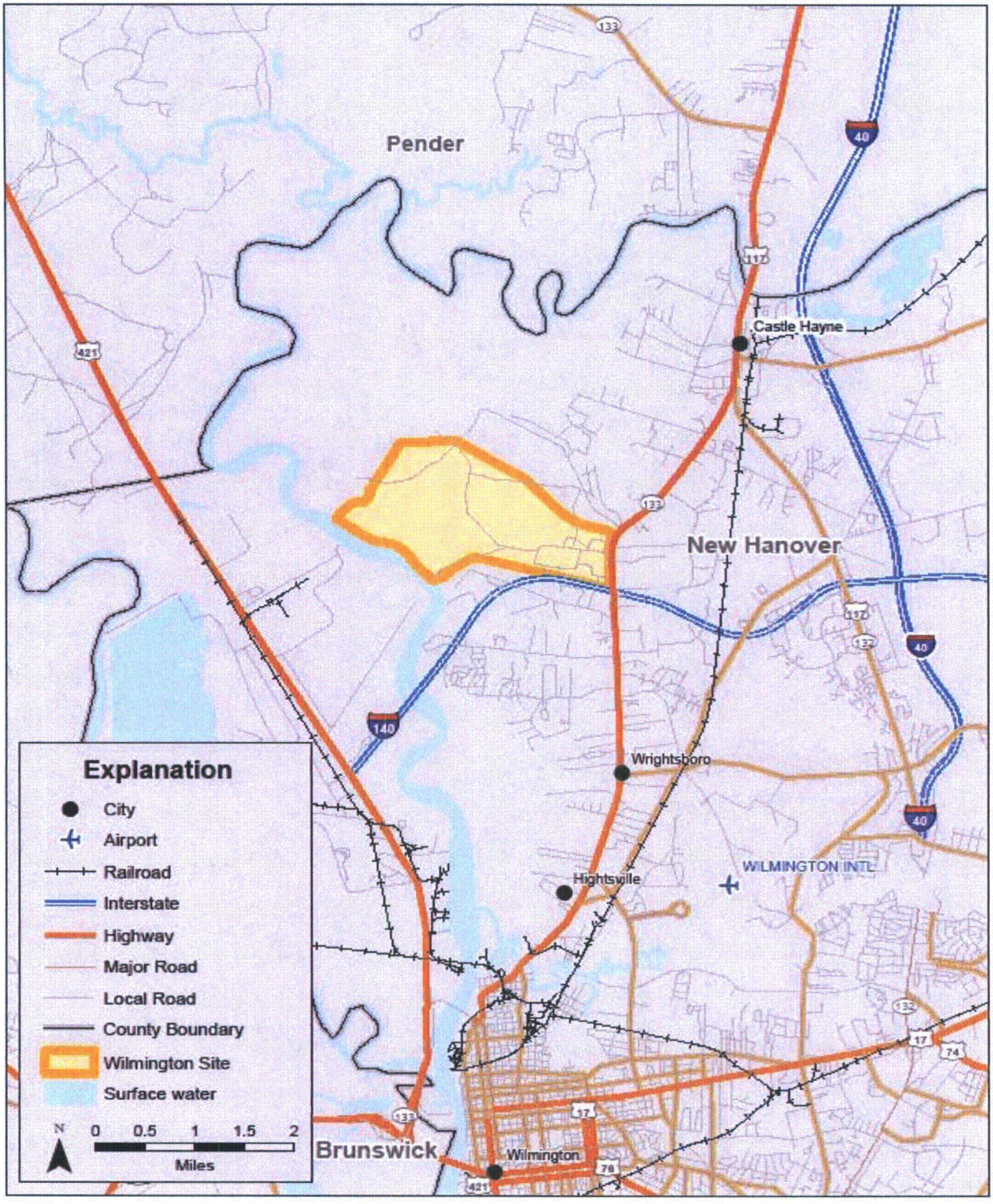
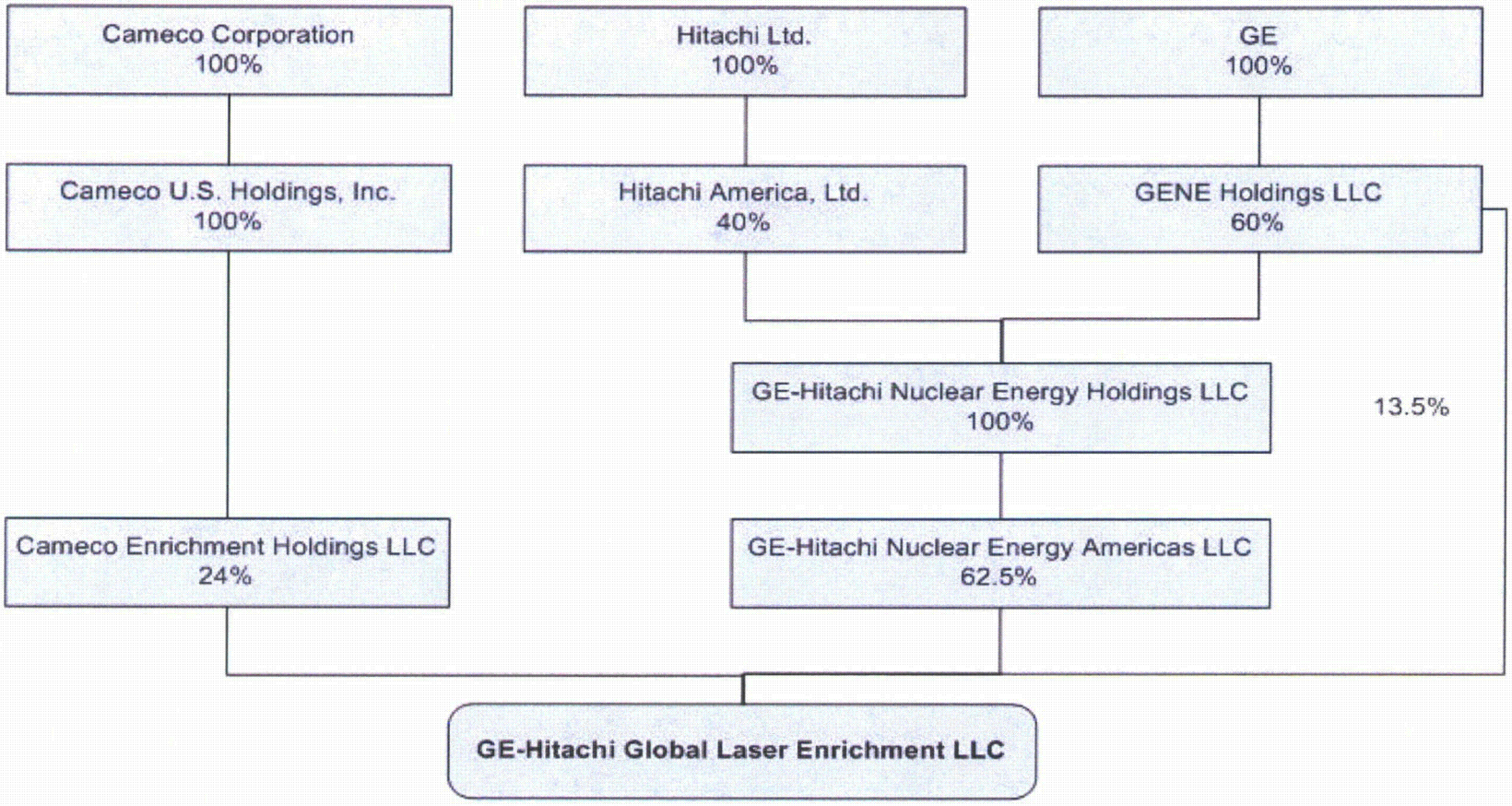


Figure 1-3. {{{Proprietary Information withheld from disclosure per 10 CFR 2.390}}}

Figure 1-4. {{{Proprietary Information withheld from disclosure per 10 CFR 2.390}}}

Figure 1-5. GLE Ownership.



GE Indirect Membership Interest:	51%	(60% x 62.5% + 13.5%)
Hitachi, Ltd. Indirect Membership Interest:	25%	(40% x 62.5%)
Cameco Corporation Indirect Membership Interest:	24%	

Figure 1-6. Community Characteristics Near the Wilmington Site.

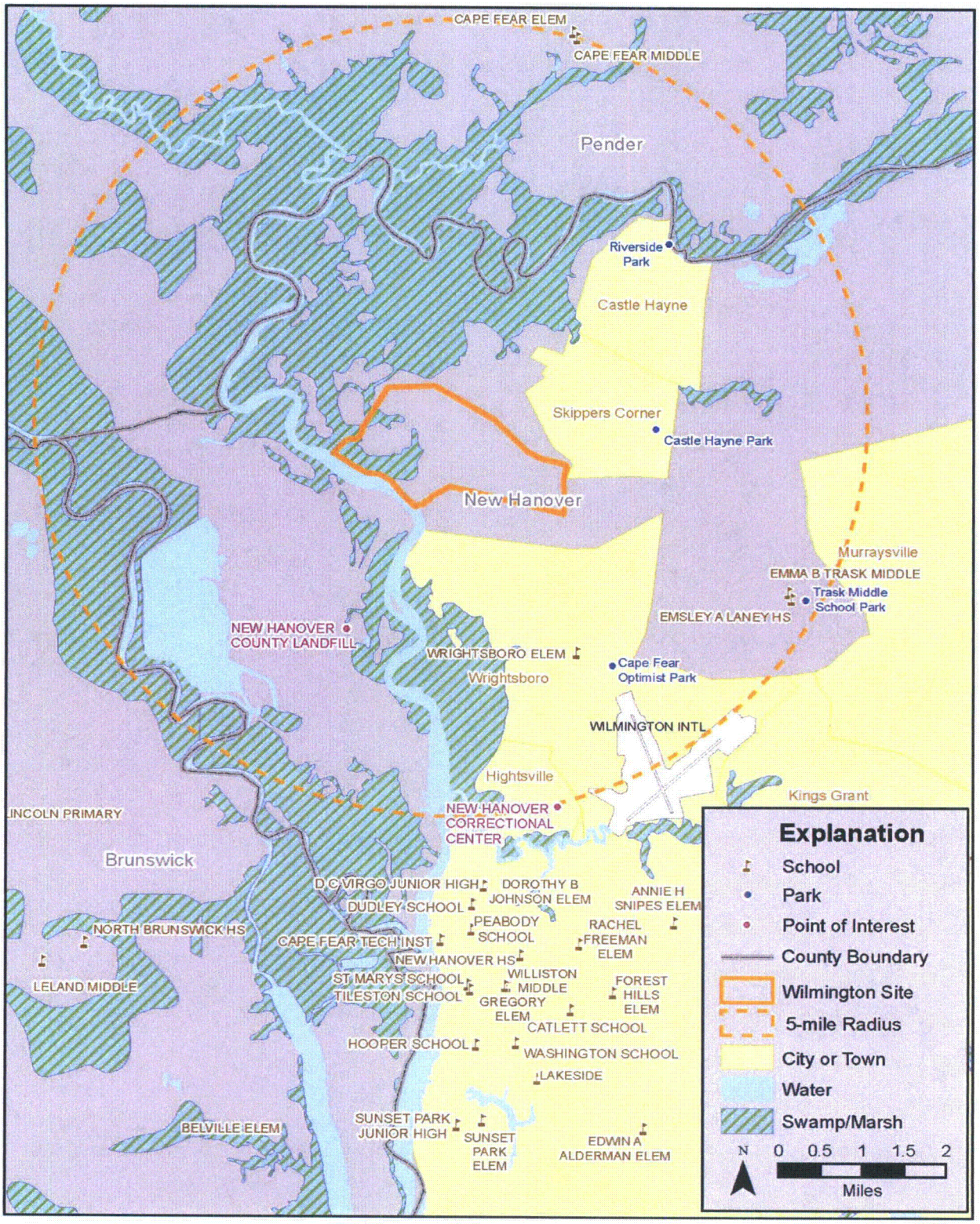
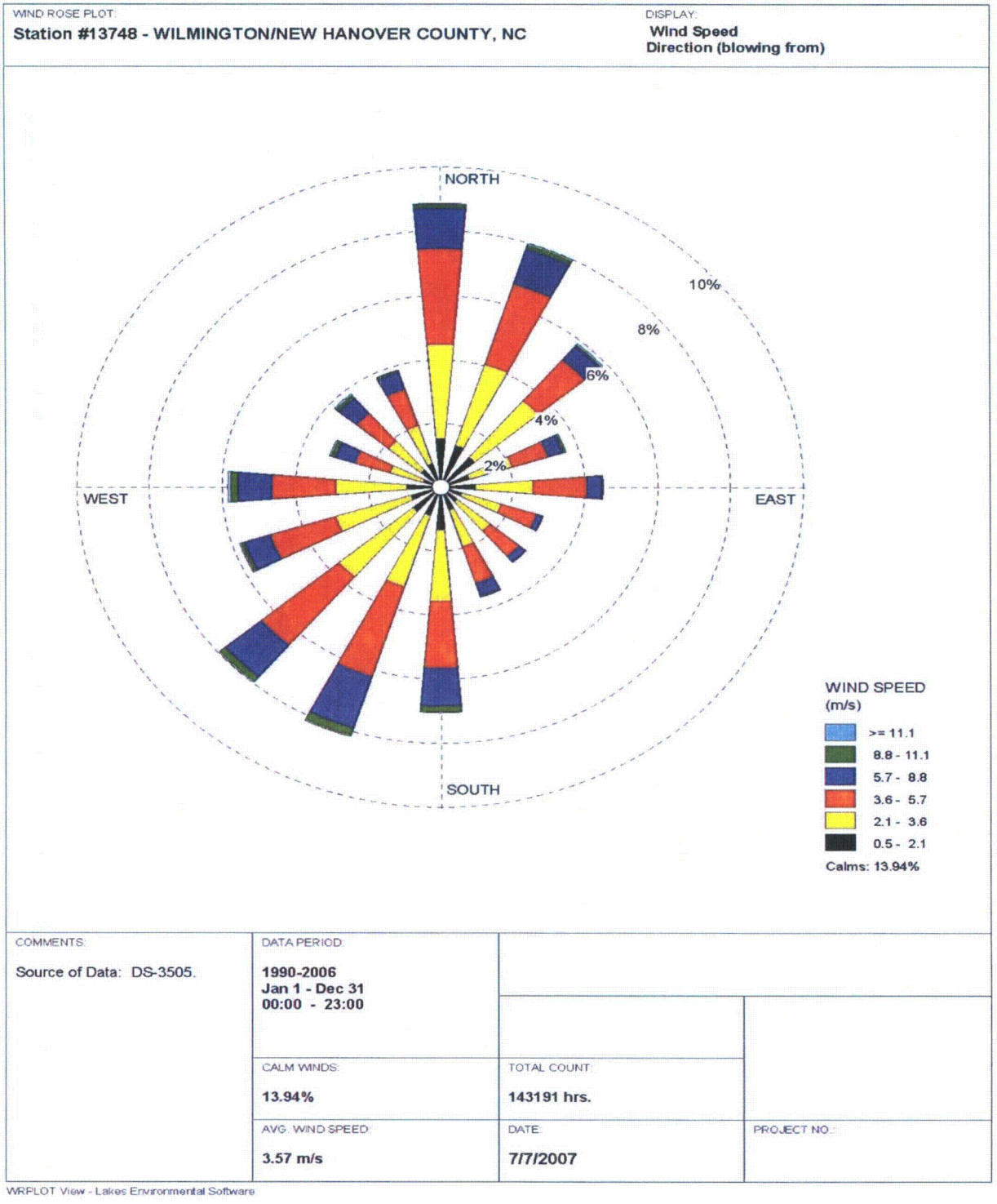


Figure 1-7. Wind Rose for Wilmington International Airport.



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APPENDIX A -

GUIDELINES FOR DECONTAMINATION OF FACILITIES AND EQUIPMENT PRIOR TO RELEASE FOR UNRESTRICTED USE OR TERMINATION OF LICENSES FOR BYPRODUCT, SOURCE, OR SPECIAL NUCLEAR MATERIAL

U.S. Nuclear Regulatory Commission
Division of Fuel Cycle Safety
and Safeguards
Washington, DC 20555
April 1993

APPENDIX A

The instructions in this guide, in conjunction with Table 1, specify the radionuclides and radiation exposure rate limits which should be used in decontamination and survey of surfaces or premises and equipment prior to abandonment or release for unrestricted use. The limits in Table 1 do not apply to premises, equipment, or scrap containing induced radioactivity for which the radiological considerations pertinent to their use may be different. The release of such facilities or items from regulatory control is considered on a case-by-case basis.

1. The licensee shall make a reasonable effort to eliminate residual contamination.

2. Radioactivity on equipment or surfaces shall not be covered by paint, plating, or other covering material unless contamination levels, as determined by a survey and documented, are below the limits specified in Table 1 prior to the application of the covering. A reasonable effort must be made to minimize the contamination prior to use of any covering.

3. The radioactivity on the interior surfaces of pipes, drain lines, or ductwork shall be determined by making measurements at all traps, and other appropriate access points, provided that contamination at these locations is likely to be representative of contamination on the interior of the pipes, drain lines, or ductwork. Surfaces of premises, equipment, or scrap which are likely to be contaminated but are of such size, construction, or location as to make the surface inaccessible for purposes of measurement shall be presumed to be contaminated in excess of the limits.

4. Upon request, the Commission may authorize a licensee to relinquish possession or control of premises, equipment, or scrap having surfaces contaminated with materials in excess of the limits specified. This may include, but would not be limited to, special circumstances such as razing of buildings, transfer of premises to another organization continuing work with radioactive materials, or conversion of facilities to a long-term storage or standby status. Such requests must:

    a. Provide detailed, specific information describing the premises, equipment or scrap, radioactive contaminants, and the nature, extent, and degree of residual surface contamination.

    b. Provide a detailed health and safety analysis which reflects that the residual amounts of materials on surface areas, together with other considerations such as prospective use of the premises, equipment, or scrap, are unlikely to result in an unreasonable risk to the health and safety of the public.

5. Prior to release of premises for unrestricted use, the licensee shall make a comprehensive radiation survey which establishes that contamination is within the limits specified in Table 1. A copy of the survey report shall be filed with the Division of Fuel Cycle Safety and Safeguards, U. S. Nuclear Regulatory Commission, Washington, DC 20555, and also the Administrator of the NRC Regional Office having jurisdiction. The report should be filed at least 30 days prior to the planned date of abandonment. The survey report shall:

   a. Identify the premises.

   b. Show that reasonable effort has been made to eliminate residual contamination.

   c. Describe the scope of the survey and general procedures followed.

   d. State the findings of the survey in units specified in the instruction.

   Following review of the report, the NRC will consider visiting the facilities to confirm the survey.

APPENDIX A

TABLE 1
ACCEPTABLE SURFACE CONTAMINATION LEVELS

NUCLIDES[a]	AVERAGE[bcf]	MAXIMUM[bdf]	REMOVABLE[bef]
U-nat, U-235, U-238, and associated decay products	5,000 dpm α/ 100 cm^2	15,000 dpm α/ 100 cm^2	1,000 dpm α/ 100 cm^2
Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I-129	100 dpm/100 cm^2	300 dpm/100 cm^2	20 dpm/100 cm^2
Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	1000 dpm/100 cm^2	3000 dpm/100 cm^2	200 dpm/100 cm^2
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above.	5,000 dpm βγ/ 100 cm^2	15,000 dpm βγ/ 100 cm^2	1,000 dpm βγ/ 100 cm^2

[a]Where surface contamination by both alpha- and beta-gamma-emitting nuclides exists, the limits established for alpha- and beta-gamma-emitting nuclides should apply independently.

[b]As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

[c]Measurements of average contaminant should not be averaged over more than 1 square meter. For objects of less surface area, the average should be derived for each such object.

[d]The maximum contamination level applies to an area of not more than 100 cm^2.

[e]The amount of removable radioactive material per 100 cm2 of surface area should be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of less surface area is determined, the pertinent levels should be reduced proportionally and the entire surface should be wiped.

[f]The average and maximum radiation levels associated with surface contamination resulting from beta-gamma emitters should not exceed 0.2 mrad/hr at 1 cm and 1.0 mrad/hr at 1 cm, respectively, measured through not more than 7 milligrams per square centimeter of total absorber.