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7. FIRE SAFETY

This chapter describes the features that enable an effective Fire Protection Program at the GE-Hitachi Global Laser Enrichment LLC (GLE) Commercial Facility located in Wilmington, North Carolina. The GLE Commercial Facility is located on the Wilmington Site, which also contains the Global Nuclear Fuel-Americas, LLC (GNF-A) Fuel Manufacturing Operations (FMO) facility, as well as other GE-owned facilities. See GLE LA Chapter 1, *General Information*, for a description of the GLE Site and the Wilmington Site.

The fire protection strategy for the GLE Commercial Facility minimizes the risk from potential fires and explosions to protect the health and safety of the workers, the public, and the environment. The Fire Protection Program is developed and implemented in accordance with the following:

- 10 CFR 30.33, *General Requirements for Issuance of Specific Licenses (Ref. 7-1)*;
- 10 CFR 40.32, *General Requirements for Issuance of Specific Licenses (Ref. 7-2)*;
- 10 CFR 70.22, *Contents of Applications (Ref. 7-3)*;
- 10 CFR 70.61, *Performance Requirements (Ref. 7-4)*;
- 10 CFR 70.62, *Safety Program and Integrated Safety Analysis (Ref. 7-5)*;
- 10 CFR 70.64, *Requirements for New Facilities or New Processes at Existing Facilities (Ref. 7-6)*;
- 10 CFR 70.65, *Additional Content of Applications (Ref. 7-7)*;

7.1 FIRE SAFETY MANAGEMENT MEASURES

The GLE Fire Protection Program is based on National Fire Protection Association (NFPA) 801, *Standard for Fire Protection for Facilities Handling Radioactive Materials (Ref. 7-8),* which contains fire safety management measures intended to reduce the risk of fires and explosions at facilities that handle radioactive materials. These management measures are applicable to locations where radioactive materials are stored, handled, or used in quantities, and under conditions, requiring government oversight and/or a license to possess or use these materials.

Fire safety management measures establish fire protection policies and practices for the GLE Commercial Facility. The objective of the Fire Protection Program is to prevent and mitigate fire incidents through education, prevention, controls, detection, and extinguishment.

7.1.1 Fire Protection Items Relied on for Safety

Fire protection Items Relied on for Safety (IROFS) are intended to prevent or mitigate chemical and radiological risks associated with postulated fire events and are defined in the Integrated Safety Analysis (ISA) Summary.

7.1.2 Management Policy and Direction

GLE Management commits to a program that promotes life safety, the conservation of property and essential equipment, and the protection of the environment. GLE maintains fire safety awareness among personnel through general employee training (GET). Training programs are described in GLE LA Section 11.3, *Training and Qualifications*.

The primary responsibility for fire protection resides within the Environmental, Health, and Safety (EHS) Organization. The GLE EHS Manager is assisted by the Industrial Safety Manager, whose direct responsibility is to ensure the day-to-day safe operation of the facility in accordance with occupational safety and health regulations, including the fire safety program. The personnel qualification requirements for the ESH Manager and the Industrial Safety Manager are provided in GLE LA Chapter 2, *Organization and Administration*.

The Facility Safety Review Committee (FSRC) reviews issues affecting the safety of GLE Commercial Facility operations, including fire safety. The FSRC is described in GLE LA Chapter 2.

7.1.3 Fire Protection Program

The GLE Fire Protection Program complies with the criteria in NFPA 801 to ensure fire protection requirements are adequately implemented. The Fire Protection Program implements applicable NFPA and/or other nationally recognized codes and standards to ensure nuclear fire protection requirements are adequately implemented. The Fire Protection Program documents upper level mechanisms by which the GLE Facility Manager achieves and maintains a high degree of fire safety at the GLE Commercial Facility. The GLE Facility Manager ensures the Fire Protection Program is adequately implemented and requirements are provided to GLE personnel. The program is designed to ensure fire safety at the facility as well as to promote protection of life safety, property, essential equipment, the environment and the continuity of operations. The Fire Protection Program is closely integrated within the Design, Operations, and Maintenance Organizations to ensure widespread awareness, while enhancing effective and efficient implementation. The Fire Protection Program is implemented through detailed administrative and implementing procedures. The Fire Protection Program includes the following elements.

7.1.3.1 Management Policy and Direction (Section 7.1.2)

Approved plans and procedures describe the overall management and implementation of the GLE Fire Protection Program. The following ensures fire safety is appropriately incorporated into GLE Operations and that facility modifications are reviewed for fire safety:

- Administrative controls for changes in processes, equipment, or facilities (see GLE LA Section 11.1, *Configuration Management*), and

- Fire protection and management review of planned activities and modifications to ensure building design and operating features are maintained in an analyzed condition.

7.1.3.2 Fire Hazards Analysis (Section 7.2)

A documented Fire Hazards Analysis (FHA) has been initiated, and will be updated as necessary, when significant facility design or operation configuration changes are made, to ensure the fire prevention and fire protection requirements of NFPA 801 have been evaluated.

7.1.3.3 Fire Prevention Program

The Fire Protection Program includes a documented Fire Prevention Program, implemented by approved written procedures, that describes the following:

- Communication of basic fire safety information for GLE personnel and contractors, including familiarization with procedures for fire prevention, emergency alarm response, and reporting of fires;
- Requirements for conducting documented facility inspections, including provisions for remedial action to correct conditions that increase fire hazards;
- Description of the general housekeeping practices and the control of transient combustibles;
- Control of flammable and combustible liquids, gases, and oxidizers in accordance with the applicable NFPA codes and standards;
- Control of ignition sources, including hot work (grinding, welding, and cutting) in accordance with NFPA 51B, *Standard for Fire Prevention During Welding, Cutting, and Other Hot Work (Ref. 7-9)*;
- Fire reports, including an investigation and a statement regarding the corrective action to be taken in accordance with NFPA 901*, Standard Classifications for Incident Reporting and Fire Protection Data (Ref. 7-10);*
- Fire prevention surveillance in accordance with NFPA 601, *Standard for Security Services in Fire Loss Prevention (Ref. 7-11)*;
- Restriction of smoking to designated areas, and
- Safeguarding construction, demolition, and renovating activities in accordance with the criteria within NFPA 241, *Standard for Safeguarding Construction, Alteration, and Demolition Operations (Ref. 7-12)*.

7.1.3.4 Inspection, Testing, and Maintenance (Section 7.5.6)

Inspection, Testing, and Maintenance (ITM) of fire protection systems is performed using approved written procedures. The results and follow-up actions are recorded and specific acceptance criteria provided for each test. The ITM Program is implemented to ensure fire protection systems and equipment remains operable and functions properly to detect and control fire, when needed.

7.1.3.5 Control of Impairments

Approved written fire protection system impairment procedures are implemented to include:

- Identification, tagging, and tracking of impaired equipment,
- Identification of personnel to be notified, and
- Determination of needed compensatory fire protection and fire prevention measures.

7.1.3.6 Onsite Emergency Response Organizations (Section 7.6.1)

See Section 7.6.1 for a description of the GLE onsite fire emergency response organization (ERO).

7.1.3.7 Offsite Emergency Response Organizations (Section 7.6.2)

See Section 7.6.2 for a description of the GLE offsite fire emergency response organizations.

7.1.3.8 Pre-Incident Planning (Section 7.6.3)

Identification of chemical and radiological risks through development of a FHA that is integrated with the ISA.

7.2 FIRE HAZARDS ANALYSIS

An FHA was performed at the beginning of the facility design process and is revised, as necessary, when significant changes are made to ensure the fire prevention and protection requirements have been evaluated per NFPA 801. The FHA evaluation considers the facility specific design, layout, and anticipated operating needs. Additionally, the FHA considers acceptable means for separation or control of hazards, the control or elimination of ignition sources, and the suppression of fires. The FHA also considers the storage and use of radioactive materials under fire or explosion conditions, which can result in a severe hazard.

The FHA presents a comprehensive, qualitative evaluation of the chemical and radiological releases associated with postulated fire at the GLE Commercial Facility. Based on facility design (construction, fire rated separation [fire barriers], locations of hazardous processes and materials, levels of combustibles, systems response, etc.) and on operations practices, the FHA in concert with the ISA, evaluates credible fire scenarios to establish the radiological and toxic chemical consequences of an unmitigated fire. From these scenarios, the FHA and ISA describe and evaluate preventive and mitigative controls that make up the fire protection IROFS for the GLE Commercial Facility. Evaluation of scenarios for unmitigated fire events includes, as applicable, the building/area construction, fuel loading, process equipment and hazards, possible fire initiators, ventilation system response, propagation potential, and building/area response.

The FHA estimates damage (or thermal insult) to the process and/or monitoring operations, and licensed radiological material. Estimates for potential chemical and radiological releases (consequence analyses) are done outside the FHA, as described in the GLE LA Chapter 3, *Integrated Safety Analysis*. The FHA is reviewed and updated as needed for current conditions and accuracy to ensure effective implementation of the Fire Protection Program is maintained.

7.3 FACILITY DESIGN

7.3.1 Baseline Design Criteria and Defense-In-Depth

The FHA and the ISA demonstrate that the design and construction of the GLE Commercial Facility structures complies with the baseline design criteria of 10 CFR 70.64(a), the defense-in-depth requirements of 10 CFR 70.64(b), and are consistent with the requirements of NFPA 801. The facility design incorporates defense-in-depth concepts such that health and safety are not completely dependent on any single element of the design, construction, maintenance, or operation of the facility.

The GLE Commercial Facility design incorporates limits on areas and equipment subject to contamination for facilities handling radioactive materials. In addition, the design includes facilities, equipment, and utilities intended to facilitate decontamination. The location of the GLE Commercial Facility is such that a fire or explosion event would not affect other important facilities or operations.

The GLE Commercial Facility buildings and supporting infrastructure are described in GLE LA Chapter 1, *General Information*. Additional design details are provided in the GLE ISA Summary. GLE Commercial Facility support buildings that may contain special nuclear material (SNM) or source material are constructed to meet applicable requirements of the International Building Code (IBC)-2006 *(Ref. 7-13)* and the general fire-related design criteria discussed in this section. The Operations Building is the primary structure where the enrichment processing systems and enrichment processing support systems are contained. The fire-related design criteria for the Operations Building are described in the following sections.

7.3.2 Operations Building Construction

The Operations Building is constructed of noncombustible materials meeting the requirements of Type IA or IB construction as described in Chapter 6 of IBC-2006. The Operations Building is a mixed occupancy of Factory Industrial (F-1) and High Hazard (H-3) as classified by Chapter 3 of IBC-2006. The Operations Building is also designed to limit the potential for contamination and to facilitate decontamination. See GLE LA Chapter 4, *Radiation Protection*, for additional information regarding radiological controls.

Type IA construction requires structural frame and the exterior and interior bearing wall elements to meet the requirement of 3-hour fire-rated construction. Type IB construction requires the structural frame and the exterior and interior bearing walls to meet the requirements of 2-hour fire-rated construction. These construction features meet the requirements of NFPA 801, Section 5.5, for fire resistant or noncombustible construction (typically Type I or Type II as defined in NFPA 220, *Standard on Types of Building Construction (Ref. 7-14)*.

7.3.2.1 Interior Surface

The interior surface is designed to meet the requirements of NFPA 801, Section 5.8.1 and 5.8.2. The interior surface finish of walls and ceilings in process and storage areas are Class A in accordance with NFPA 255, *Standard Method of Test of Surface Burning Characteristics of Building Materials (Ref. 7-15)*. The floor finish is Class I in accordance with NFPA 253, *Standard Method of Test for Critical Radiant Flux for Floor Covering Systems Using a Radiant Heat Energy Source (Ref. 7-16)*. Exit enclosures (egress corridors and exit paths) meet the requirements of NFPA 101®, *Life Safety Code® (Ref. 7-17)*, Section 40.3.3, Class A or B for walls and ceilings and not less than Class II for floors.

7.3.2.2 Storage

Chemicals, materials, and supplies are stored, to the extent practical, in separate storerooms located in areas where no work with radioactive materials is conducted. Only those quantities of chemicals, materials, and supplies needed for immediate or continuous use are present.

7.3.3 Fire Area Separation

The Operations Building is subdivided into separate fire areas, as determined by the FHA, for the purposes of limiting the spread of fire, protecting facility personnel, and limiting consequential damage to the facility. The subdivided design approach provides passive fire protection features, while minimizing:

- The spread of potential contamination,
- Equipment damage and loss,
- Clean-up cost and time,
- Operational down time, and
- Damage to one-of-a-kind types of equipment.

The fire area separation approach employs fire barriers, with fire resistance commensurate with the potential fire severity, between the major process areas (such as, Laser Area) with further subdivision provided, as practicable, to minimize fire areas within the process areas.

Fire rated barriers meet the minimum requirements of the IBC-2006, Chapter 7, *Fire Resistance Rated Construction.* Openings and penetrations within the envelope of each fire area are sealed with protective assemblies (penetration firestop systems, fire dampers, fire/smoke dampers, etc.) consistent with the designated fire rating in accordance with NFPA 221, *Standard for High Challenge Fire Walls, Fire Walls, and Fire Barrier Walls (Ref. 7-18)*. Door openings are protected with fire rated doors, frames, and hardware in accordance with NFPA 80, *Fire Door Openings and Other Opening Protectives (Ref. 7-19)*. Fire dampers are provided where ventilation ductwork penetrates fire rated barriers in accordance with NFPA 90A, *Installation of Air-Conditioning and Ventilating Systems (Ref. 7-20)*.

7.3.4 Power Supply and Distribution Systems

Electrical systems are designed in accordance with NFPA 70®, *National Electrical Code® (Ref. 7-21)*. Switchgear, motor control centers, panel boards, uninterruptible power supply systems, and control panels are mounted in metallic enclosures and contain only small amounts of combustible material. Cable trays and conduits are metallic and the cables in cable trays meet the requirements of UL 1277, *Electrical Power and Control Tray Cables with Optional-Fiber Members (Ref. 7-22)*. Less hazardous dielectric fluids are used, where practicable, in place of hydrocarbon-based insulating oils for transformers and capacitors located inside buildings, or in any location where an exposure hazard to important facilities is posed.

The lights, ventilation, and operation of the majority of the equipment are dependent upon a reliable source of electrical power. Transformers, switches, and control panels are located so that maintenance work can be done without direct exposure to process conditions.

7.3.5 Life Safety

In accordance with IBC-2006, the Operations Building is classified as mixed occupancy, Factory Industrial (F-1) and High Hazard 3 (H-3). In accordance with NFPA 101®, the facility is classified as a Special Purpose Industrial Occupancy, with a hazard classification of ordinary hazard. Life safety features (such as, occupancy separation, means of egress, illumination, and exit marking and signage, etc.) meet the requirements of NFPA 101® and IBC-2006. Rated fire barriers in accordance with NFPA 101® and the FHA are provided to prevent unacceptable fire propagation.

7.3.6 Ventilation, Containment, and Filtration Systems

The need for effective ventilation both during and immediately following an emergency such as a fire is of considerable importance. The design of the ventilation, confinement, and filtration systems is intended to provide effective ventilation both during and immediately following an emergency such as a fire, and is in accordance with applicable NFPA and/or nationally recognized codes and standards. Where shutdown of the ventilation system is not appropriate, fire/smoke dampers are not required for ventilation duct penetrations. When fire/smoke dampers are not used, an alternative means of protecting against fire propagation is provided.

Ductwork, accessories, and support systems are designed and tested in accordance with, as applicable, NFPA 801, NFPA 90A, NFPA 90B, *Installation of Warm Air Heating and Air-Conditioning Systems (Ref. 7-23)*, and NFPA 91, *Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Noncombustible Particulate Solids (Ref. 7-24)*. Flexible air duct couplings in ventilation and filter systems are noncombustible. Ductwork from areas containing radioactive materials, passing through non-radioactive areas, are noncombustible construction and are protected from possible exposure fires by materials having a fire resistance rating as determined by IBC-2006, NFPA, and/or other nationally recognized codes and standards. Air entry filters are approved filter media that produce a minimum amount of smoke (UL Class I) when subjected to heat.

The Monitored Central Exhaust System (MCES) is designed to automatically balance and maintain negative pressure from areas of lesser potential contamination to areas of higher potential contamination. Ventilation systems serving normally non-contaminated areas exhaust a percentage of the handled air to the atmosphere. The heating, ventilation, and air conditioning (HVAC)/MCES, serving potentially contaminated areas, exhaust 100% of the handled air to the environment through filtered exhaust paths. In addition to removing uranium particulates from room air, the MCES is designed to remove uranium hexafluoride (UF_6) and hydrogen fluoride (HF) from process gas streams and room air during normal and abnormal operating conditions.

High-efficiency particulate air (HEPA) and/or high-efficiency gas absorption (HEGA) filtration systems are utilized in various areas as part of the confinement function of the HVAC system.

Smoke control systems are designed in accordance with IBC-2006, NFPA, and/or other nationally recognized codes and standards. Smoke control is also accomplished by the onsite ERO and the offsite responding fire departments utilizing portable smoke removal equipment.

7.3.7 Facility Control, Computer, and Telecommunication Rooms

Facility control, computer, and telecommunications rooms meet the applicable requirements of NFPA 75, *Standard for the Protection of Information Technology Equipment (Ref. 7-25),* and/or other nationally recognized codes and standards.

7.3.8 Drainage and Control of Contaminated Runoff

Water that may discharge from the Firewater System or from firefighting activities (water runoff) that could be contaminated with radioactive materials is confined in accordance with NFPA 801, Section 5.10, stored, sampled, and treated if necessary. Water runoff from the UF_6 Cylinder Pads is collected in the Retention Basin. Liquid effluent monitoring associated with the Retention Basin is discussed in GLE Environmental Report (ER) Chapter 6, *Environmental Measurements and Monitoring Programs*. Drainage or confinement of firewater within the facility is provided and accomplished by one or more of the following methods:

- Floor drains,
- Floor trenches,
- Open doorways or other wall openings,
- Curbs for confining or directing drainage,
- Equipment pedestals, and
- Pits, sumps, and sump pumps.

7.3.9 Water Control (Moderation) Consideration

Within the GLE Commercial Facility, there are process areas where water is undesirable due to nuclear criticality safety (NCS) concerns. Redundant fire protection features are provided to ensure effective mitigation, including automatic detection, fire barriers, ignition controls, combustible loading controls, and emergency response activities. When called upon, the ERO and/or responding offsite fire departments typically extinguish fire in these areas with the use of portable and wheeled dry chemical fire extinguishers. In the unlikely event extinguishers cannot control or extinguish the fire, the Emergency Command Center (ECC) and the onsite and offsite EROs act appropriately. The pre-incident plans (see Section 7.6.3, *Pre-Incident Planning*) for fires and explosions include firefighting guidance governing restrictions on the use of water in certain areas of the facility.

7.3.10 Lightning Protection

The lightning protection system is in accordance with applicable portions of NFPA 780, *Standard for the Installation of Lightning Protection Systems (Ref. 7-26),* and/or other nationally recognized codes and standards.

7.3.11 Wildland Fire Protection

Wildland fire protection was assessed in the FHA in accordance with applicable portions of NFPA 1143, *Standard for Wildland Fire Management (Ref. 7-27)* and NFPA 1144, *Standard for Reducing Structure Ignition Hazards from Wildfire (Ref. 7-28)*. The FHA determined the wildland fire threat for the GLE Site is a moderate hazard. Current configurations do not require additional fire protection measures.

7.3.12 Physical Security Concerns

As described in Section 7.3.5, *Life Safety*, the design of buildings and facilities provides for safe egress in case of fire, chemical events, or other emergencies. Security requirements will not prevent safe means of emergency egress as required by the NFPA 101® and IBC-2006. The GLE Physical Security Plan (PSP) addresses the establishment of permanent and temporary Controlled Access Areas. The PSP and Radiological Contingency and Emergency Plan (RC&EP) identify the ingress and egress methodology during both normal and emergency conditions, respectively. This includes emergency response personnel both onsite and offsite.

7.4 PROCESS FIRE SAFETY

GLE has addressed process fire safety through the facility design and operations. Fire hazards are identified and addressed through the ISA and the FHA. The ISA uses the information identified in the FHA and considers the potential accident scenarios and establishes the IROFS necessary to ensure the health and safety of GLE personnel and the public. The GLE Commercial Facility is designed in accordance with IBC-2006, NFPA, and other nationally recognized codes and standards. The GLE Commercial Facility hazardous areas are identified as part of the pre-incident plans (otherwise known as pre-fire plans) as discussed in Section 7.6.3, *Pre-Incident Planning*. The ISA methodology is discussed in GLE LA Chapter 3. The ISA Summary provides details of the ISA, including fire hazards and associated IROFS.

The following discussion describes the principle process fire hazards associated with the laser-based enrichment technology.

7.4.1 Principal Hazardous Materials

The major process material of concern is UF_6. UF_6 is not flammable or combustible; however; UF_6 is not compatible with organics and can react with non-fomblin lubricating oils at high temperatures. The two byproducts resulting from a UF_6 release (in the presence of moist air) are HF gas and uranyl fluoride (UO_2F_2). Neither byproduct presents a process fire safety hazard.

Although UF_6 is not considered a fire hazard, exposure of UF_6 cylinders to heat and/or fire does create the potential for loss of cylinder integrity and an associated UF_6 release hazard. The potential failure of UF_6 cylinders due to exposure to fire is evaluated in the FHA.

7.4.2 Principal Fire Hazards

7.4.2.1 Lasers

Laser-based enrichment technology, which is utilized in the GLE uranium enrichment process, presents two potential fire hazards of concern: hydrogen and oil. The Laser Area does not contain radioactive material.

[Proprietary Information withheld from disclosure per 10 CFR 2.390]

Areas where hydrogen is present are designed to meet Class I, Division 2 hazardous locations in accordance with NFPA 70®, Article 500, *Hazardous Locations*.

Laser operations and equipment meet the requirements of NFPA 115, *Standard for Laser Fire Protection (Ref. 7-32)*.

7.4.2.2 Flammable/Explosion Hazards

Process equipment subject to fire or explosion hazards is evaluated in the ISA and FHA. IROFS have been established to prevent or mitigate fire hazards, as may be required by 10 CFR 70.61. In addition to IROFS, the following features, attributes, and controls are in place to prevent a large fire or explosion that could result in a UF_6 release:

- Fire Protection Program;
- Automatic sprinkler systems;
- Automatic smoke, chemical, and fire detection;
- Compartmentalization with fire barriers;
- Emergency response operations;
- Nitrogen inerting of select equipment;

- Natural or mechanical ventilation or other controls provided to ensure that flammable concentrations do not exceed 25 percent of the LEL.
- Fire rated boundaries;
- Structural steel fire proofing;
- Ignition sources are minimized;
- Robust and/or qualified UF_6 cylinder construction;
- Noncombustible construction; and
- HVAC system response.

The GLE Commercial Facility may generate hydrogen at battery-charging stations throughout the facility. Hydrogen controls in battery-charging stations are provided. Specifically, natural or mechanical ventilation or other controls are provided to ensure that hydrogen concentrations do not exceed 25 percent of the LEL.

7.4.2.3 Combustible Liquid Hazards

Combustible liquids are utilized as a cooling medium in process equipment. The following features ensure this specific fire hazard is prevented or mitigated:

- Fire Protection Program,
- Combustible liquid containment,
- Automatic sprinkler systems,
- Automatic smoke or heat detection system,
- Fire barriers,
- Emergency response operations, and
- Use of high flashpoint combustible liquids.

7.5 FIRE PROTECTION SYSTEMS

7.5.1 Firewater Supply System

The existing Wilmington Site firewater supply and distribution system consists of a 300,000 gal (100,000 devoted to fire) Water Storage Tank and Water Reservoir (~675,000 gal) which distributes water throughout an underground 10-inch looped gridded firewater distribution system, supplying water to existing facilities and hydrants, via 1,500 gpm electric and diesel fire pumps.

The fire water supply system for the GLE Commercial Facility is installed, in accordance with NFPA 801, Section 6.2., with fire pumps arrangement and installation meeting the requirements of NFPA 20, *Installation of Stationary Pumps for Fire Protection (Ref. 7-33)*. The system is designed to supply the largest single automatic sprinkler system plus a 250 gpm hose stream allowance. The system is sized for an Ordinary Hazard, Group 2, sprinkler system. Therefore, the required water flow for sprinklers is 940 gpm at a residual pressure of 20 psi at the system riser. The firewater distribution system is a looped system with cross connections into the various buildings to prevent a single piping component failure from disabling significant portions of the system. The International Fire Code (IFC)-2006 *(Ref. 7-34)*, Table B105.1, for Type I buildings of greater than 295,900 sq ft, requires a minimum firewater flow of 6,000 gpm for four hours. However, IFC-2006, Section B105, exception permits a flow reduction of up to 75% if the building is sprinklered throughout. The GLE Commercial Facility is in excess of 1,200,000 sq ft (including the upper elevations) and is provided with automatic fire suppression throughout except as indicated in the FHA. Therefore, the minimum firewater flow required is 1,500 gpm for four hours (360,000 gal).

For reliability, firewater is supplied from two independent supplies, each with adequate capacity to provide continuous water supply at the above flow rate for a minimum duration of four hours. The firewater distribution piping and supplies will be designed to IBC-2006 seismic requirements.

7.5.2 Fire Detection and Alarm Systems

Automatic fire detection is provided for fire areas in accordance with the requirements of IBC-2006, Section 907; NFPA 101®, Section 40.3.4.1; and NFPA 801, Section 6.8. The type of detection provided is based on the fire hazards present and the need for early warning or very early warning detection as determined by analysis. The fire alarm system is designed and installed per the requirements of NFPA 72®, *National Fire Alarm Code® (Ref. 7-35)*.

Manual pull stations are located at exits and throughout the facility to allow occupants to initiate an alarm. Area detection is provided as well as detection for automatic closing doors, fire/smoke damper operation, and air handler shutdown. Suppression system activation is also monitored by the fire alarm system.

Fire/smoke dampers located in supply air ducts are activated by smoke or heat. Smoke detectors are provided in the supply and return of air handling units. Individual air handlers are shut down by the fire alarm system when local duct detectors are in alarm. Fire/smoke dampers located in exhaust ducts at fire barriers are activated by heat detection. Exhaust fans are not shut down by the fire alarm system.

Audible and visible appliances provide occupant notification. The fire alarm system communicates with a 24-hour seven day a week ECC. Remote annunciation of alarms is provided at building entry points and control room.

7.5.3 Automatic Suppression Systems

Automatic sprinkler protection is required in designated areas of the facility to control fires in accordance with IBC-2006, NFPA 13, Section 4.1, and NFPA 801, Section 6.1.2. An Ordinary Hazard, Group 2, system is installed with a design density of 0.15 gpm per square foot (ft^2) over the most hydraulically remote 4,000 ft^2 area.

Automatic sprinkler protection may be omitted from a room or space where sprinklers are considered undesirable because of the nature of the contents in accordance with IBC-2006, Section 903.3.1.1.1. See Section 7.3.9, *Water Control (Moderation) Consideration,* for additional information.

In those areas where automatic sprinkler systems are not provided, alternative fire protection is considered. Alternatives may include an automatic clean agent extinguishing system in accordance with NFPA 2001, *Clean Agent Fire Extinguishing Systems (Ref. 7-36),* or an automatic detection system(s) coupled with manual use of a standpipe system. The omission of automatic sprinklers from any area is subject to approval by the Authority Having Jurisdiction.

7.5.4 Standpipes

Standpipe systems installed in accordance with NFPA 14, *Standard for the Installation of Standpipe and Hose Systems (Ref. 7-37)*, are provided in each required exit stairway as required by IBC-2006. Hose connections are located at each intermediate landing as specified by NFPA 14, Section 7.3.

7.5.5 Portable Extinguishers

Fire extinguishers are provided throughout the facility in accordance with NFPA 10, *Portable Fire Extinguishers (Ref. 7-38),* as required by NFPA 801. In areas where water control is considered, carbon dioxide and dry chemicals are provided so that an uncontrolled moderator source is not created.

7.5.6 Inspection, Testing, and Maintenance of Fire Protection Systems

Fire protection systems and features are inspected and tested in accordance with the requirements in NFPA 25, *Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems (Ref. 7-39),* and other applicable NFPA codes and standards.

Testing, inspection, and maintenance are documented by means of approved written procedures, with the results and follow-up actions recorded, and specific acceptance criteria provided for each test. Routine inspection and testing of the Fire Protection System are conducted by GLE personnel and/or contract personnel under GLE direction. Responsibility for maintenance, operation, and engineering of the Fire Protection System and equipment is specified in approved written procedures. The fire protection equipment is maintained as part of the formal, planned preventative maintenance program at the GLE Commercial Facility.

7.6 FIRE EMERGENCY RESPONSE READINESS

7.6.1 Onsite Emergency Response Organization

NFPA 801, Section 4.7, requires a fire emergency organization that meets the requirements of either an on-site industrial fire brigade (NFPA 600, *Standard on Industrial Fire Brigades [Ref. 7-40]*), or a Fire Department (NFPA 1500, *Fire Department Occupational Safety and Health Program [Ref. 7-41]*). Due to the facility's remote location and the lack of sufficient local fire department staff capabilities relative to fire involving nuclear materials, the GLE Commercial Facility provides for a fully staffed onsite fire brigade that is trained for interior structure fire fighting. The size and complexity of the fire emergency organization is based on the size of the facility, presence of fire hazards, and the availability of offsite fire fighting response capability. Documented training and drills are conducted to demonstrate proficiency. Appropriate equipment, including portable communications, lighting, thermal protective clothing, and protective equipment is available in sufficient quantities and sizes to fit each fire brigade member expected to enter the hot and warm zones.

The Wilmington Site ERO is comprised of two teams that provide emergency response support. These two teams include the ERO, which is responsible for fire suppression and hazardous material control activities and the Emergency Medical Technicians (EMTs), which are responsible for emergency medical services. In addition, the ERO provides support services for bomb threat searches, severe weather preparedness, emergency preparedness, confined space evaluations, hazard prevention and elimination, community service and education, and offsite mutual aid assistance. Currently, the ERO is trained and qualified (as a minimum) to fight incipient stage fires.

The New Hanover County Department of Fire Services will be notified when:

- A fire is beyond the incipient stage; or
- The scope of a fire exceeds the capabilities of onsite resources.

7.6.2 Offsite Emergency Response Organizations

Per the GLE RC&EP, response agreements are in place to request emergency offsite assistance when needed. Most responding organizations are located in close proximity to the Wilmington Site. Current response agreements in place include Castle Hayne Volunteer Fire Rescue, which in-turn could call in additional mutual aid departments listed below:

- Wrightsboro Volunteer Fire and Rescue,
- Ogden Volunteer Fire and Rescue,
- New Hanover County Fire and Rescue,
- Federal Point Volunteer Fire and Rescue,
- Myrtle Grove Volunteer Fire and Rescue,

- City of Wilmington Fire Department, and

- New Hanover County Forestry Service.

The EROs listed above provide fire suppression, rescue (including confined space), and hazardous materials response support activities. The organizations listed below provide the services indicated.

- New Hanover Sheriff's Office provides law enforcement, crowd, and traffic control,

- New Hanover County Department of Emergency Management provides coordination of mass casualty, communications, radiological detection, and multi-agency coordination activities, and

- New Hanover Regional Medical Center and New Hanover Regional Emergency Medical Services provide medical treatment and transport to the hospital (including treatment and transport of radiologically contaminated personnel).

7.6.3 Pre-Incident Planning

NFPA 801, Section 4.8.1 requires written pre-fire plans (also known as pre-incident plans). Pre-fire plans are developed with the assistance of the facility fire emergency organization. NFPA 801, Section A.4.8.1, specifies the minimum content of pre-fire plants as follows:

- Fire and chemical hazards in area,

- Radiation hazards,

- Egress access,

- Emergency lighting,

- Fire protection systems/equipment in area,

- Special fire-fighting instructions (water controlled [moderation] consideration areas, lasers),

- Ventilation systems/airflow path,

- Utilities, and

- Special considerations on adjoining areas.

Pre-fire plans are developed in accordance with NFPA 801 and NFPA 1620, *Recommended Practice for Pre-Incident Planning (Ref. 7-42)*. Once developed, these plans are provided to the onsite and offsite EROs.

7.6.4 Emergency Response Personnel Training and Qualification

Onsite ERO members are required to complete initial training to become ERO members and continuing education classes to maintain ERO membership. The primary purpose of the onsite ERO is to provide quick response personnel who are familiar with the GLE Commercial Facility and the Wilmington Site, and trained in firefighting techniques, first aid procedures, and emergency response to mitigate emergency incidents.

7.6.5 Fire Drills

ERO training requirements and drill frequencies necessary to demonstrate proficiency are implemented in accordance with the RC&EP. Drills are critiqued and documented as outlined in the RC&EP.

7.6.6 Fire Investigations and Fire Reports

A Fire Prevention Program is implemented to include fire reports (including an investigation and a statement on the corrective action to be taken).

7.7 REFERENCES

7-1 10 CFR 30.33, *General Requirements for Issuance of Specific Licenses*, U.S. Nuclear Regulatory Commission, 2008.

7-2 10 CFR 40.32, *General Requirements for Issuance of Specific Licenses*, U.S. Nuclear Regulatory Commission, 2008.

7-3 10 CFR 70.22, *Contents of Applications*, U.S. Nuclear Regulatory Commission, 2008.

7-4 10 CFR 70.61, *Performance Requirements*, U.S. Nuclear Regulatory Commission, 2008.

7-5 10 CFR 70.62, *Safety Program and Integrated Safety Analysis*, U.S. Nuclear Regulatory Commission, 2008.

7-6 10 CFR 70.64, *Requirements for New Facilities or New Processes at Existing Facilities*, U.S. Nuclear Regulatory Commission, 2008.

7-7 10 CFR 70.65, *Additional Content of Applications*, U.S. Nuclear Regulatory Commission, 2008.

7-8 NFPA 801, *Standard for Fire Protection for Facilities Handling Radioactive Materials*, National Fire Protection Association, 2008.

7-9 NFPA 51B; *Standard for Fire Prevention During Welding, Cutting, and Other Hot Work,* National Fire Protection Association, 2009.

7-10 NFPA 901, *Standard Classifications for Incident Reporting and Fire Protection Data,* National Fire Protection Association, 2006.

7-11 NFPA 601, *Standard for Security Services in Fire Loss Prevention,* National Fire Protection Association, 2005.

7-12 NFPA 241, *Standard for Safeguarding Construction, Alteration, and Demolition Operations*, 2004.

7-13 2006 International Building Code (IBC), International Code Council, March 2006.

7-14 NPFA 220, *Standard on Types of Building Construction*, National Fire Protection Association, 2009.

7-15 NFPA 255, *Standard Method of Test of Surface Burning Characteristics of Building Materials,* National Fire Protection Association, 2006.

7-16 NFPA 253, *Standard Method of Test for Critical Radiant Flux for Floor Covering Systems Using a Radiant Heat Energy Source,* National Fire Protection Association, 2006.

7-17 NFPA 101®, *Life Safety Code®*, National Fire Protection Association, 2009.

7-18 NFPA 221, *Standard for High Challenge Fire Walls, Fire Walls, and Fire Barrier Walls*, National Fire Protection Association, 2009.

7-19 NFPA 80, *Fire Door Openings and Other Opening Protectives,* National Fire Protection Association, 200

7-20 NFPA 90A, *Installation of Air Conditioning and Ventilating Systems*, National Fire Protection Association, 2009.

7-21 NFPA 70®, *National Electrical Code®*, National Fire Protection Association, 2008.

7-22 UL 1277, *Electrical Power and Control Tray Cables with Optional-Fiber Members*, Underwriters Laboratory, November 2001.

7-23 NFPA 90B, *Installation of Warm Air Heating and Air-Conditioning Systems*, National Fire Protection Association, 2009.

7-24 NFPA 91, *Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Noncombustible Particulate Solids*, National Fire Protection Association, 2004.

7-25 NFPA 75, *Standard for the Protection of Information Technology Equipment*, National Fire Protection Association, 2009.

7-26 NFPA 780, *Standard for the Installation of Lightning Protection Systems*, National Fire Protection Association, 2008.

7-27 NFPA 1143, *Standard for Wildland Fire Management*, National Fire Protection Association, 2009.

7-28 NFPA 1144, *Standard for Reducing Structure Ignition Hazards from Wildfire,* National Fire Protection Association, 2008

7-29 NFPA 30, *Flammable and Combustible Liquids Code,* National Fire Protection Association, 2008

7-30 NFPA 704, *Standard System for the Identification of the Hazards of Materials for Emergency Response*, National Fire Protection Association, 2007

7-31 NFPA 69, *Standard on Explosion Prevention Systems*, National Fire Protection Association, 2008.

7-32 NFPA 115, *Standard for Laser Fire Protection*, National Fire Protection Association, 2008.

7-33 NFPA 20, *Installation of Stationary Pumps for Fire Protection*, National Fire Protection Association, 2007.

7-34 IFC-2006, International Fire Code, 2006

7-35 NFPA 72®, *National Fire Alarm Code®,* National Fire Protection Association, 2007.

7-36 NFPA 2001, *Clean Agent Fire Extinguishing Systems*, National Fire Protection Association, 2008.

7-37 NFPA 14, *Standard for the Installation of Standpipe and Hose Systems*, National Fire Protection Association, 2007.

7-38 NFPA 10, *Portable Fire Extinguishers*, National Fire Protection Association, 2007.

7-39 NFPA 25, *Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*, National Fire Protection Association, 2008.

7-40 NFPA 600, *Standard on Industrial Fire Brigades*, National Fire Protection Association, 2005.

7-41 NFPA 1500, *Fire Department Occupational Safety and Health Program*, National Fire Protection Association, 1500.

7-42 NFPA 1620, *Recommended Practice for Pre-Incident Planning*, National Fire Protection Association, 2003.