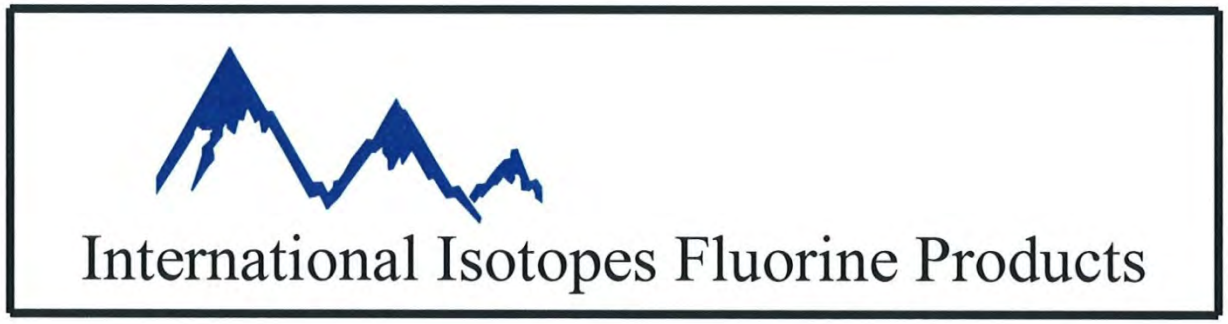

International Isotopes Fluorine Products, Inc. (IIFP)
A Wholly Owned Subsidiary of
International Isotopes, Inc. (INIS)

Fluorine Extraction Process & Depleted Uranium De-conversion (FEP/DUP) Plant

License Application

Chapter 7
Fire Safety

Revision B
November 2, 2011

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7 FIRE SAFETY

International Isotopes Fluorine Products, Inc. (IIFP), a wholly owned subsidiary of International Isotopes, Inc. (INIS), will build and operate a depleted uranium processing facility near Hobbs in Lea County, New Mexico. The IIFP Facility (also referred to as the FEP/DUP Plant) is being licensed under Title 10 Code of Federal Regulations (CFR) Part 40. A description of the planned facility is provided in the IIFP License Application (LA), Revision B Chapter 1 "General Information."

Chapter 7 documents the IIFP Fire Safety Program. Throughout the IIFP LA, the terms fire safety and fire protection are used synonymously. The purpose of the Fire Safety Program is to reduce the risk of fires and explosions at the facility. It also documents how the facility administers fire safety. The IIFP Fire Safety Program meets the acceptance criteria in Chapter 7 of NUREG-1520 U.S. Nuclear Regulatory Commission (NRC)(NRC, 2002) and is developed, implemented and maintained in accordance 10 CFR 70, Subpart H including the requirements of 10 CFR 70.61 (CFR, 2009c), 10 CFR 70.62 (CFR, 2009d), 10 CFR 70.64 (CFR, 2009e) and 10 CFR 70.65 (CFR, 2009f), which bounds any requirements imposed by 10 CFR Part 40 (CFR, 2009a). In addition, the Fire Safety Program complies with 10 CFR 70.22 (CFR, 2009b). NUREG/CR-6410 (NRC, 1998), NUREG-1513 (NRC, 2001) and Generic Letter 95-01 (NRC, 1995) are utilized as guidance in developing this chapter and the Fire Safety Program along with the various National Fire Protection Association (NFPA) standards listed below:

Table 7-1 NFPA Standards

Standard	Title of Standard
NFPA 10-2010	Portable Fire Extinguishers
NFPA 13-2010	Installation of Sprinkler Systems
NFPA 14-2010	Standard for the Installation of Standpipe and Hose Systems
NFPA 15-2007	Standard for Water Spray Fixed Systems for Fire Protection
NFPA 20-2010	Installation of Stationary Pumps for Fire Protection
NFPA 22-2008	Water Tanks for Private Fire Protection
NFPA 24-2010	Installation of Private Fire Service Mains and Their Appurtenances
NFPA 30-2008	Flammable and Combustible Liquids Code
NFPA 45-2011	Fire Protection for Laboratories Using Chemicals
NFPA 54-2011	National Fuel Gas Code
NFPA 55-2010	Storage, Use and Handling of Compressed Gases and Cryogenic Fluids in Portable and Stationary Containers, Cylinders and Tanks
NFPA 70-2011	National Electric Code
NFPA 70E-2009	Standard for Electrical Safety in the Workplace
NFPA 72-2010	National Fire Alarm Code
NFPA 80-2010	Standard for Fire Doors and Other Opening Protectives
NFPA 80A-2007	Recommended Practice for Protection of Buildings from Exterior Fire Exposures
NFPA 85-2011	Boiler and Combustion Systems Hazards Codes
NFPA 90A-2009	Installation of Air-conditioning and Ventilating Systems
NFPA 90B-2009	Installation of Warm Air Heating and Air-conditioning Systems
NFPA 91-2010	Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists and Noncombustible Particulate Solids
NFPA 101-2009	Life Safety Code
NFPA 110-2010	Emergency and Standby Power Systems
NFPA 220-2009	Standard on Types of Building Construction
NFPA 221-2009	Standard for High Challenge Fire Walls, Fire Walls and Fire Barrier Walls
NFPA 251-2006	Standard Methods of Tests of Fire Resistance of Building Construction and Materials
NFPA 430-2004	Storage of Liquid and Solid Oxidizers

Table 7-1 NFPA Standards

Standard	Title of Standard
NFPA 600-2010	Standard on Industrial Fire Brigades
NFPA 780-2011	Standard for the Installation of Lightning Protection Systems
NFPA 801-2008	Standard for Fire Protection for Facilities Handling Radioactive Materials
NFPA 1410-2010	Standard on Training for Initial Emergency Scene Operations

The information provided in this chapter, the corresponding regulatory requirement and the section of NUREG-1520, Chapter 7 (NRC, 2002) containing the NRC acceptance criteria, is presented below:

Table 7-2 NRC Acceptance Criteria

Information Category and Requirement	10 CFR 70 Citation	NUREG-1520 Chapter 7 Reference
Section 7.1 Fire Safety Management Measures	70.62(a), (d) & 70.64(b)	7.4.3.1
Section 7.2 Fire Hazards Analysis	70.61(b), (c) & 70.62(a)&(c)	7.4.3.2
Section 7.3 Facility Design	70.62(a), (c) & 70.64(a)	7.4.3.3
Section 7.4 Process Fire Safety	70.64(a)	7.4.3.4
Section 7.5 Fire Protection and Emergency Response	70.62(a), (c) & 70.64(b)	7.4.3.5

7.1 FIRE SAFETY MANAGEMENT MEASURES

Fire safety management measures establish the fire protection policies for the IIFP Site. The objectives of the IIFP Fire Safety Program are to prevent fires from starting and to detect, control and extinguish those fires that do occur. The fire safety organization and fire protection systems at the IIFP Facility provide protection against fires and explosions based on the structures, systems and components (SSCs) and defense-in-depth practices described in this chapter. Fire barriers, protective measures and administrative controls are considered fire protection Items Relied on for Safety (IROFS) where determined by the Integrated Safety Analysis (ISA) process.

7.1.1 Fire Safety (Protection) IROFS

Fire protection IROFS are designed to prevent or mitigate chemical and radiological risks associated with postulated fire events. The IROFS related to fire safety are identified and defined in the IIFP ISA Summary, Revision B.

7.1.2 Management Policy and Direction

IIFP is committed to ensuring that the IROFS, as identified in the ISA Summary, are available and reliable and that the facility maintains fire safety awareness among employees, controls transient ignition sources and combustibles and maintains a readiness to extinguish or limit the consequences of fire. The facility maintains fire safety awareness among employees through its General Employee Training

Program. The training program is described in the IIFP LA, Revision B Chapter 11 "Management Measures."

The responsibility for fire protection rests with the Environmental, Safety and Health (ESH) Manager who reports directly to the Chief Operations Officer (COO) of the IIFP Facility. The ESH Manager is assisted by a Fire Protection Lead on fire protection engineering matters and is supported in the day-to-day maintenance of fire protection items by personnel who are trained in fire protection.

Engineering support is provided by the Engineering Manager. The personnel qualification requirements for the ESH Manager, Engineering Manager and the Fire Protection Lead are presented in the LA, Revision B Chapter 2, "Organization and Administration." The Fire Protection Lead assigned to oversee the IIFP Fire Safety Program is trained in the field of fire protection and has practical day-to-day fire safety experience at a nuclear, radiological or chemical facility. The Fire Protection Lead is responsible for the following:

- Fire Safety Program and procedural requirements
- Fire safety considerations
- Maintenance, surveillance and quality of the facility fire protection features
- Review of design changes as they relate to fire safety
- Documentation and record keeping as they relate to fire safety
- Fire prevention activities (i.e., administrative controls and training)
- Organization and training of the IIFP Fire Brigade
- Pre-fire planning

Engineering review of the IIFP Fire Safety Program is accomplished using applicable management measures, including configuration management (CM), as discussed in LA, Revision B Chapter 11.

7.1.3 Fire Prevention

Administrative controls are used to maintain the performance of the fire protection systems and to assign and define the responsibilities of personnel with respect to fire safety. The primary fire safety administrative controls are those that relate to fire prevention. These fire prevention controls are implemented by using procedures and primarily control the storage and use of combustible materials and the use of ignition sources. The controls include, but are not limited to, the following:

- Limiting the use of combustible materials in construction of the buildings at the facility

- Controlling the handling of transient combustibles in buildings containing IROFS including work-generated combustibles

- Implementing a "hot work" permit system to control ignition sources that may be introduced by welding, flame cutting, brazing or soldering operations

- Conducting formal periodic fire prevention inspections to: 1) ensure that transient combustibles adhere to established limits based on the Fire Hazard Analysis (FHA), 2) ensure the availability and acceptable condition of fire protection systems/equipment, fire stops, penetration seals and fire-retardant coatings and 3) ensure that prompt and effective corrective actions are taken to correct conditions adverse to fire protection and preclude their recurrence

- Performing periodic housekeeping inspections

- Implementing a permit system to control the disarming of fire detection or fire suppression systems, including appropriate compensatory measures

- Implementing fire protection systems inspection, testing and maintenance procedures

7.1.4 Inspection, Testing and Maintenance of Fire Protection Systems

Inspection, testing and maintenance are implemented through procedures to ensure that fire protection systems and equipment remain operable and function properly when needed to detect and suppress fire. Fire protection procedures are written to address such topics as training of the IIFP Fire Brigade, reporting of fires and control of penetration seals. The facility ESH organization has responsibility for fire protection procedures in general with the facility's Plant Engineering and Maintenance organization having responsibility for certain fire protection procedures such as control of repairs to facility penetration seals. Further information about management measures for procedures and maintenance is provided in LA, Revision B Chapter 11.

7.1.5 Emergency Organization Qualifications, Drills and Training

The IIFP Fire Brigade is comprised of facility employees who have normal job responsibilities and also serve in a dual role on the Fire Brigade. The Fire Brigade is an incipient fire brigade as classified under NFPA 600-2010 and is organized, operated and trained accordingly. The function of the Fire Brigade is discussed in Section 7.5.2.1 “Fire Brigade.” The IIFP Facility Emergency Management Plan (EMP), Revision B also discusses the use of off-site emergency organizations, drills and training.

7.1.6 Pre-Fire Plans

Detailed pre-fire plans will be developed for use by the Facility Fire Brigade and the off-site emergency services organizations that respond to IIFP incidents. The pre-fire plans include the facility layout, access, contents, construction materials, hazards, hazardous materials, types and locations of fire protection systems, location of fire protection equipment, power supply and ventilation isolation means, important plant equipment in the area and other information considered necessary by fire emergency response personnel.

7.2 FIRE HAZARDS ANALYSIS

An initial Fire Hazards Analysis has been developed for the facility including the fire areas and fire zones which, if uncontrolled, could release depleted uranium hexafluoride (DUF_6) or chemicals affecting licensed materials. DUF_6 is present in the DUF_6 Autoclave Building and the associated outside cylinder staging area, the depleted uranium tetrafluoride (DUF_4) Process Building and the cylinder storage pads.

The FHA has been developed in accordance with NFPA 801-2008. It presents the bounding credible fire scenarios and then assesses the consequences of unmitigated fire. The results of the FHA are utilized in the ISA to identify possible fire initiators and accident sequences leading to radiological consequences or chemical consequences resulting from chemical releases affecting licensed materials.

The FHA for the facility consists of the following:

- A description of the facility's use and function
- The specific fire hazards and potential fire scenarios within the fire areas and fire zones
- The methods of consequence analysis
- Description of the facility occupancy and construction requirements
- Life safety requirements
- The boundaries and barriers of the fire areas and fire zones
- The facility response to the postulated fires
- Defense or mitigation strategy for overall facility protection

In addition to building and process-related fire scenarios, the FHA also addressed small, mid-sized and large vehicle fires, including the DUF_6 cylinder hauler. DUF_6 cylinders that are received at the IIFP Facility are unloaded from the transport truck using the cylinder hauling equipment (cylinder hauler) outside the fenced Restricted Area of the Full DUF_6 Cylinder Storage Pad. Cylinders that are typically transported to (full) and from (empty) the DUF_6 Autoclave Building outside staging area and within the IIFP Site are unloaded, loaded and moved using the same cylinder hauler that is used within the storage pad areas. Cylinders that are emptied are moved to the Empty DUF_6 Cylinder Storage Pad and stored until approved for loading and shipping back to the customer. The cylinder hauling equipment design meets the same standard as that used safely in the uranium hexafluoride (UF_6) industry by The U.S. Department of Energy (DOE) and others. The cylinder hauler leaves the cylinder storage pads if there is a need for refueling. In the event of an out-of-fuel situation, a maximum quantity of five (5) gallons of fuel may be brought into the staging pads and hand dispensed into the hauler in accordance with written procedures.

Combustibles are prohibited within the staging pads and for a clear area at least twenty-five (25) feet from the staging pads with the exception of the cylinder hauler components and fluids. The primary combustible fuel source within the cylinder staging pads is the cylinder hauler vehicle. The IIFP cylinder hauler is physically limited in fuel capacity to less than seventy-four (74) gallons. Diesel fuel has a flash point near 110°F, which categorizes the fuel as a Class II combustible liquid. The auto-ignition temperature of the diesel fuel is approximately 450^{o}F.

IIFP evaluated a postulated "pool fire" where all of the contents of a full diesel fuel tank are spilled under or around the cylinder, the spill puddles into a pool and is ignited. No credit in the evaluation is taken for sloping or drainage of the spill or for fire-fighting response both of which are actually provided for the IIFP Facility. The response time and limits on the depth of the fuel pool may present unacceptable consequences and risks involving type 48-X or 48-Y UF_6 cylinder rupture for a scenario that is not mitigated and assumes a spill and pool of greater than seventy-four (74) gallons of diesel fuel. The type 48-G cylinder is discussed later.

For evaluating risk of a fuel pool fire, IIFP used the results of NRC analysis for a "UF_6 Storage Area Fire" provided in NUREG-1491 (NRC, 1994). In the NRC analysis, it was determined that it would take twenty (20) minutes for a hydrocarbon pool fire with a temperature of 1500^{o}F to cause rupture of a UF_6 cylinder. It was further conservatively calculated that is would require seventy-four (74) gallons of fuel for the fire to burn for twenty (20) minutes. The NRC staff calculated about twenty (20) minutes of burn time for conservative assumptions of fuel pooling (NRC, 2005).

Based on the results described in NUREG-1491, the postulated fire scenario (which is based on the engineered control seventy-four (74) gallon tank physical limit for the cylinder hauler fuel quantity) is insufficient to cause cylinder rupture. However, the NUREG-1491 scenario is based on models that evaluated the thick wall UF_6 cylinder design.

IIFP will receive type 48-Y, 48-X and 48-G cylinders from customers for heating, feeding and processing the DUF_6 contents. After examination of the fire modeling studies that are known to have been done on these type cylinders, IIFP has determined there are several uncertainties that preclude the use of pool fire burn time and cylinder rupture times to accurately make a risk-based decision relative to the type 48-G cylinder. Instead, IIFP has added a fire suppression system and a double-layered (containment) safety diesel fuel cell tank to the cylinder hauler.

The risk evaluation for the ISA accident sequence 101.13, "Cylinder hauler fuel fire in the solid DUF_6 cylinder storage area," considers the above added safety design features. The risk evaluation summary is shown in the IIFP ISA Summary Tables 3-7, 4-2, 4-3, 6-1 and 6-2. The use of IROFS DUF-47 (the safety double layered diesel fuel cell tank) and DUF-48 (the cylinder hauler fire suppression equipment) results in a "highly unlikely" failure index. This satisfies the NUREG-1520 risk performance criteria for any consequence level; therefore, the risk index for accident 101.13 is satisfied for all 14-ton cylinder models that have been authorized by the NRC.

The FHA is reviewed and updated as necessary to incorporate significant changes and modifications to the facility, its processes or combustible inventories. FHA changes or modifications are controlled by CM as discussed in LA, Revision B Chapter 11 to ensure that the information and analysis presented in the FHA are consistent with the current state of the facility.

7.3 FACILITY DESIGN

The design of the facility and the individual buildings incorporate the following:

- Utilization of non-combustible construction as much as practicable
- Class I roof decking on all process buildings
- Automatic sprinkler protection for all buildings
- Minimization of the number of buildings and areas containing uranium
- Design of facilities, equipment and utilities to facilitate decontamination

7.3.1 Building and Cylinder Pad Construction

The facility consists of several different buildings and functional areas:

- DUF_6 Autoclave Building
- DUF_4 Process Building
- Decontamination Building
- DUF_4 Container Storage Building
- DUF_4 Container Staging Building
- Fluorine Extraction Process (FEP) Building
- FEP Oxide Staging Building
- FEP Product Gas Storage and Packaging Building
- Anhydrous Hydrogen Fluoride (AHF) Staging Containment Building
- Fluoride Products Trailer Loading Building

- Maintenance & Stores Building
- Environmental Protection Process (EPP) Building
- Material Warehouse
- Utilities Building
- Main Switchgear Building
- Fire Pump House
- Water Treatment Building
- Process Offices and Lab
- Administrative Building
- Guard House

All buildings are designed and constructed to meet applicable codes as shown in Table 7-3.
All buildings contain automatic sprinkler protection per NFPA 13-2010 and the New Mexico Commercial Building Code (NMCBC-2009).

Table 7-3 Building Conformance to Applicable Codes

BUILDING	**CODE CONSTRUCTION CONFORMANCE**			
(Areas where uranium is processed are shown in BOLD print)	**NMCBC CLASS**	**NMCBC TYPE**	**NFPA 13**	**NFPA 101**
DUF_6 Autoclave Building	H4	IIB	ORD HAZ-GP2	SPECIAL PURPOSE IND
DUF_4 Process Building	H4	IIB	ORD HAZ-GP2	SPECIAL PURPOSE IND
Decontamination Building	H4	IIB	ORD HAZ-GP2	SPECIAL PURPOSE IND
FEP Process Building (SiF_4 and BF_3)	H4	IIB	ORD HAZ-GP2	SPECIAL PURPOSE IND
FEP Oxide Staging Building	H4	IIB	ORD HAZ-GP2	SPECIAL PURPOSE IND
DUF_4 Container Storage Building	H4	IIB	ORD HAZ-GP2	SPECIAL PURPOSE IND
DUF_4 Container Staging Building	H4	IIB	ORD HAZ-GP2	SPECIAL PURPOSE IND
FEP Product Gas Storage & Packaging Building	H4	IIB	ORD HAZ-GP2	INDUSTRIAL
AHF Staging Containment Building	H4	IB	ORD HAZ-GP2	STORAGE
Fluoride Products Trailer Loading Building	H4	IB	ORD HAZ-GP2	STORAGE
Maintenance & Stores	F1/S2	IIIB	ORD HAZ-GP2	STORAGE – MIXED
EPP Building	H4	IIB	ORD HAZ-GP2	STORAGE
Utilities Building	F1	IIB	ORD HAZ GP2	INDUSTRIAL
Material Warehouse	S2	IIB	ORD HAZ GP2	STORAGE
Main Switchgear Building	F2	IIB	NOT SPKLR	INDUSTRIAL
Fire Pump House	F1	IIB	ORD HAZ GP2	INDUSTRIAL
Water Treatment Building	F1	IIB	ORD HAZ GP2	INDUSTRIAL
Process Offices	B	IIIB	LGT HAZ	BUSINESS – MIXED
Laboratory **(small uranium samples handled)**	B	IIIB	ORD HAZ GP2	INDUSTRIAL MIXED
Administrative Building	B	IIIB	LGT HAZ	BUSINESS
Guard House	B	IIIB	LGT HAZ	BUSINESS

Refer to Figure 1-5 and Table 1-2 in LA, Revision B Chapter 1 “General Information” for locations of and building descriptions on the 40-acre. A larger and more legible engineering drawing, 100-C-0001 Revision F, has been provided to NRC as part of the IIFP LA Engineering Drawing Package.

7.3.2 Fire Area Determination and Fire Barriers

The facility buildings are subdivided into fire areas by barriers with fire resistance commensurate with the potential fire severity in accordance with the NMCBC-2009. The design and construction of fire barrier walls is in accordance with NFPA 221-2009. These fire areas are provided to limit the spread of fire, protect personnel and limit the consequential damage to the facility.

The fire resistance rating of fire barrier assemblies is determined through testing in accordance with NFPA 251-2006. Openings in fire barriers are protected consistent with the designated fire resistance ratings of the barriers they penetrate.

Penetration seals between the AHF Staging Containment Building and the Fluoride Products Trailer Loading Building and between the DUF_4 Process Building and the DUF_6 Autoclave Building are provided for electrical and mechanical openings and are listed to meet the guidance of American Society of Testing and Materials, ASTM-814 (ASTM, 2008) or Underwriters Laboratories, UL 1479, (UL, 2006). Penetration openings for ventilation systems are protected by fire dampers having a rating equivalent to that of the barrier. Door openings in fire rated barriers are protected with listed fire rated doors, frames and hardware in accordance with NFPA 80-2010.

7.3.3 Electrical Installation

All electrical systems at the facility are installed in accordance with the New Mexico Electric Code (NMEC-2009, based on the National Electric Code, NFPA 70-2011). Switchgear, motor control centers, panel boards, variable frequency drives, uninterruptible power supply systems and control panels are mounted in metallic enclosures and contain only small amounts of combustible materials.

Cable trays and conduits are metallic and the cables in cable trays are flame retardant and tested in accordance with the guidance provided in American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE) 383-2003, IEEE 1202-2006, UL 1277-2010 or Insulated Cable Engineers Association (ICEA) T-29-520-1986.

Lighting fixtures are constructed of non-combustible materials. Lighting ballasts contain only an insignificant amount of combustible material. Incandescent, fluorescent and metal halide fixtures are used.

All indoor and outdoor distribution transformers are dry type. The size and placement of the primary outdoor oil-filled power transformers is yet to be determined, but their location does not offer an exposure to plant facilities. An auxiliary power system is provided to supply power for temporary lighting, ventilation and system monitoring equipment where a potential hazard exists.

7.3.4 Life Safety

The buildings are provided with means of egress, illumination and protection in accordance with the NMCBC, 2009. Barriers with fire resistance ratings consistent with the NMCBC, 2009 and the FHA are provided to prevent unacceptable fire propagation.

All of the buildings are provided with emergency lighting for the illumination of the primary exit paths and the essential operations areas where personnel are required to operate valves, dampers and other controls in an emergency. All emergency lighting fixtures are provided with self-contained

battery/charging systems in accordance with NMCBC, 2009, and NFPA 101-2009 and are fed from the emergency power system backed up by the diesel powered electrical generator.

All critical loads are fed from the uninterruptible power supply (UPS) that is fed from the emergency power system backed up by the diesel powered electrical generator.

Marking of means of egress, including illuminated exit signs are provided with self-contained battery/charging systems in accordance with NMCBC-2009 and NFPA 101-2009 and are fed from the emergency power system backed up by the diesel powered electrical generator.

7.3.5 Ventilation

Ventilation for the DUF_4 and FEP Process Buildings is provided with roof mounted exhaust fans and wall mounted intake louvers. Steam is used as the main heat source for the process building environment. Process Control Room areas are heated, ventilated and cooled by electrical heat pump units with electric auxiliary heat. The Control Room heating, ventilation and air conditioning (HVAC) units create positive pressure in each of the Control Rooms with alarms to indicate loss of pressure. Process equipment areas are open and of large volumes, so steam heating is practical. Cooling of other process and storage areas is provided with wall mounted exhaust fans and intake louvers. The ventilation and HVAC systems meet NFPA 90A, "Installation of Air-conditioning and Ventilating Systems" and NFPA 90B, "Installation of Warm Air Heating and Air-conditioning Systems."

The ventilation systems are not engineered for smoke control, but are designed to shut down in the event of a fire. Smoke control is provided by an off-site Fire Department utilizing portable smoke removal equipment.

7.3.6 Drainage

Buildings, building aprons and process area outdoor pads, where chemicals or licensed materials are stored or processed, have curbs and/or dikes to prevent drainage of contaminated liquids outside the spill controlled areas. Water from activation of the sprinkler system or from fire fighting activities could contain contaminated materials or flammable and combustible liquids. During the initial period of sprinkler activation or generation of fire water in an area, the water collects in the spill controlled area and is handled and treated as any other type of spillage or liquid. Areas that have dikes for non-uranium hazardous chemical or oil spill control are equipped with pumps that can be activated automatically or manually to pump spilled liquids or water to the EPP for treatment. Areas where licensed materials are processed or stored that have curbing and/or dikes are not automatically pumped to the EPP. If fire water accumulates in those areas in excess of the holding capacity, the water may be pumped to another licensed material curb/dike area to holding tanks in the Decontamination Building or to the large Hydrogen Fluoride (HF) Recycle Tank where it can be sampled to determine its proper disposition. Portable pumps are also available for emergency pumping of liquids to other holding areas, tanks or treatment if necessary. If the volume of the fire water reaches a level that exceeds the respective spill control area, it is pumped to other outside spill control areas not directly affected by the fire response. If the water drains and enters the plant storm sewer drain system, it then flows to the Storm Water Retention/Evaporation Basin where it is sampled to determine proper disposal. In the event of a fire in the cylinder storage pad areas, it is unlikely the fire water will become contaminated. Water runoff from the Full Cylinder Storage Pad is collected in the Full DUF_6 Cylinder Pad Storm Water Retention Basin. Water runoff from the Empty DUF_6 Cylinder Storage Pad is also collected in a Storm Water Retention Basin. Liquid effluent monitoring associated with the Storm Water Retention Basins is discussed in Revision B of the IIFP Environmental Report.

7.3.7 Lightning Protection

The potential for lightning strikes to the building is considered possible; therefore, a lightning protection system will be installed on all process buildings per NFPA 780-2011 "Standard for the Installation of Lightning Protection Systems." The lightning protection system will consist of air terminals, interconnecting grounding cable, down-comer grounding cable, ground rods and required connectors.

7.3.8 Criticality

Criticality is not a concern for this facility. DUF_6 cylinders are inspected upon arrival and are accepted only when determined to contain non-fissile (non-enriched) material (See Revision B Chapter 5 "Nuclear Criticality Safety" of the IIFP LA).

7.3.9 Hydrogen Control

Hydrogen is utilized as a raw material reactant within the DUF_4 Building where it is injected into the reaction vessel mixing head and mixes with the DUF_6 to carry out the de-conversion process.

Hydrogen is produced in a packaged generation unit located outside and remotely from buildings and process equipment. Piping remains external to the DUF_4 Process Building for as much of the run-length as possible with only the shortest length necessary entering the DUF_4 reaction vessel area. Internal piping is protected from mechanical damage such as by-mobile cranes or vehicles. Hydrogen is produced at a rate of approximately 6-10 lbs per hour and is temporarily stored in an external storage tank of approximately 5-7 cubic feet capacity adjacent to the hydrogen generator. The hydrogen is dispensed into the piping system at an estimated pressure of 10-15 psig. A more detailed description of the hydrogen supply system is provided in the ISA Summary, Revision B Section 3.1.

The Process Hazard Analysis (PHA) and ISA evaluated the hydrogen control scenario and determined controls required for an acceptable risk. In order to prevent fire or explosion in the areas where hydrogen might accumulate, the areas are protected the following features:

- Hydrogen piping is provided with excess flow control valves.

- Hydrogen supply for the DUF_6 to DUF_4 de-conversion process is isolated by emergency shutoff valves interlocked with detectors in the enclosed building area served by the hydrogen piping and at the hydrogen generation source.

- Mechanical ventilation is provided to ensure that hydrogen concentrations do not exceed 25% of the lower explosive limit. Ventilation is interlocked to start upon the detection of hydrogen in the area. Mechanical ventilation is equipped with airflow sensors that sound an alarm if one of the exhaust fans becomes inoperative. Additionally, the DUF_4 Process Building is not a leak-tight enclosure, and the potential for accumulation of very light weight hydrogen gas is lessened unless relatively large leaks and flows rates are incurred.

- Hydrogen may also be generated at battery charging stations in the facility. In order to prevent the possibility of explosion or fire, areas where hydrogen might accumulate are protected by a design which incorporates the measures, as necessary, that are identified in NFPA 70E-2009 and/or ANSI C2-2007.

7.3.10 Environmental Concerns

There is no normal process water discharge from the facility. Sanitary water (estimated at approximately 3000-4000 gallons per day average) is tertiary treated and then used on-site for landscape or tree watering or is evaporated. Storm water runoff drains to the Storm Water Retention/Evaporation Basin for evaporation and/or sampling and approved discharge in accordance with the State of New Mexico Ground Water Discharge Permit. The potential effects to the environment of water resulting from fire fighting are mitigated by the drainage control and disposal discussed in Section 7.3.6 above.
Radiological and chemical monitoring and sampling are performed as specified in IIFP ER, Revision B Chapter 6 "Environmental Measurements and Monitoring Programs" on potentially contaminated facility liquid effluent discharges including water used for firefighting purposes.

7.3.11 Physical Security Concerns

In no case will security requirements prevent safe means of egress, as required by NFPA 101 and the NMCBC-2009. The IIFP Security Plan (SP) addresses the establishment of permanent and temporary Controlled Areas. The SP identifies the ingress and egress methodology during both normal and emergency conditions. This includes emergency response activities for both on-site and off-site personnel.

7.3.12 Baseline Design Criteria and Defense-In-Depth

The FHA and the ISA demonstrate that the design and construction of the facility comply with the baseline design criteria (BDC) of 10 CFR 70.64 (CFR, 2011e), the defense-in-depth requirements of 10 CFR 70.64 (CFR, 2011e) and that they are consistent with the guidance provided in NFPA 80-2010. The design provides for adequate protection against fire and explosion. This design achieves a balance between preventing fires from starting, quickly detecting fires, controlling and promptly extinguishing those fires that do occur, and protecting structures, systems and components so that a fire that is not promptly extinguished or suppressed will not lead to an unacceptable consequence.

The ISA Summary, Revision B describes the basis for providing successive levels of protection using IROFS such that health and safety of employees and the public is ensured within the acceptable risks determined by the ISA structured risk analyses. Additionally, in most parts of the processes, safety is further assured by added measures through implementation of designed operational control features that are not IROFS but do apply the defense-in-depth engineering design philosophy. Descriptions of some of the more significant added measures are summarized in the ISA Summary, Revision B Section 3.1.

7.4 PROCESS FIRE SAFETY

IIFP LA, Revision B Chapter 6 describes the chemical classification process, the hazards of chemicals, chemical process interactions affecting licensed material and/or hazardous chemicals produced from licensed material, the methodology for evaluating hazardous chemical consequences and chemical safety assurance. The ISA evaluates the hazards associated with the processes used at the facility. The ISA, in concert with the FHA, identifies processes that represent a process fire safety hazard to the facility. A listing of the major chemicals and the estimated typical range of inventories are provided in the IIFP LA, Revision B Table 1-1.

The IIFP DUF_6 cylinder storage pads are characterized as having minimal fire hazards owing to the absence of structures and the restricted storage of combustible materials. Non-combustible concrete cylinder saddles are used to support the cylinders. With the exception of the cylinder hauler, no other fuel burning vehicles are permitted within the perimeters of the storage pads. A fire involving the cylinder

hauler is a credible scenario affecting a DUF_6 cylinder and is addressed by the ISA and the resulting IROFS for ensuring an acceptable risk.

A fire hazard associated with hydrogen filled equipment and piping, if unmitigated, (See Section 7.3.9) is the most likely credible scenario leading to significant impact to buildings or equipment. It is addressed by the ISA to ensure an acceptable risk.

7.5 FIRE PROTECTION AND EMERGENCY RESPONSE

This section documents the fire protection systems and fire emergency response organizations provided for the facility.

7.5.1 Fire Protection System

The facility Fire Protection System consists of a dedicated fire water supply and distribution system, automatic sprinkler suppression systems, standpipe and hose systems, portable fire extinguishers, fire detection and alarm systems, fire pump control systems, valve position supervision, system maintenance and testing, fire prevention program, fire department response and pre-fire plans. See Figure 7-2 for the "Exterior Fire Protection Overall Site Plan." The Figure 7-2 shown is for illustration purposes. A larger and more legible engineering drawing, 100-C-0002 Revision D, has been provided to NRC as part of the IIFP LA Engineering Drawing Package.

7.5.1.1 Fire Water Supply and Distribution System

System Description

Automatic sprinkler system coverage is provided for all buildings on-site. Automatic sprinkler design is per NFPA 13-2010, "Standard for the Installation of Sprinkler Systems." The sprinkler systems are not yet designed; however, the minimum design for any of the process buildings is based on the classification of Ordinary, Group 2 for chemical plants with a minimum design density of 0.2 gallons per minute per square foot (gpm/ft^2) over the hydraulically most remote area of 1,500 square feet. A minimum hose stream requirement of 250 gpm for both inside and outside hose streams is provided. The minimum supply duration for sprinklers and hose stream operation is 90 (ninety) minutes. The office areas are considered to be Light Hazard. The design density in those areas is $0.1gpm/ft^2$ over the hydraulically most remote 1500 ft^2.

A reliable fire protection water supply and distribution system of adequate flow, pressure and duration is provided based on the characteristics of the site and the FHA. The fire protection water supply and distribution system is based on the largest fixed fire suppression system demand, including a hose stream allowance, in accordance with NFPA 13-2010. The minimum fire water flow required to be available per Appendix B of the International Fire Code is 1,500 gpm at 20 psi for a minimum duration of 2 (two) hours and a minimum of 180,000 gallons in storage. Redundant (100,000-gallon minimum) fire water storage tanks designed and constructed in accordance with NFPA 22-2008 are provided. Separate storage tanks are used for the fire protection water supply and the sanitary water supply.

Two (2) fire water booster pumps are provided for the facility. The primary booster pump is driven by an electric motor fed from the facility electrical system and the emergency backup booster pump is diesel driven. Each booster pump, capable of delivering 600 gpm at approximately 100 psi, is a horizontal, centrifugal pump designed and installed in accordance with NFPA 20-2010.

For redundancy, the capacity of the fire protection water supply ensures that 100% of the required flow rate and pressure are available in the event of failure of one of the water storage tanks or fire water pumps.

The maximum demand anticipated is based on the maximum combined sprinkler and hose stream demand and duration determined in accordance with NFPA 13-2010.The tanks are arranged so that one tank will be on stream at all times.

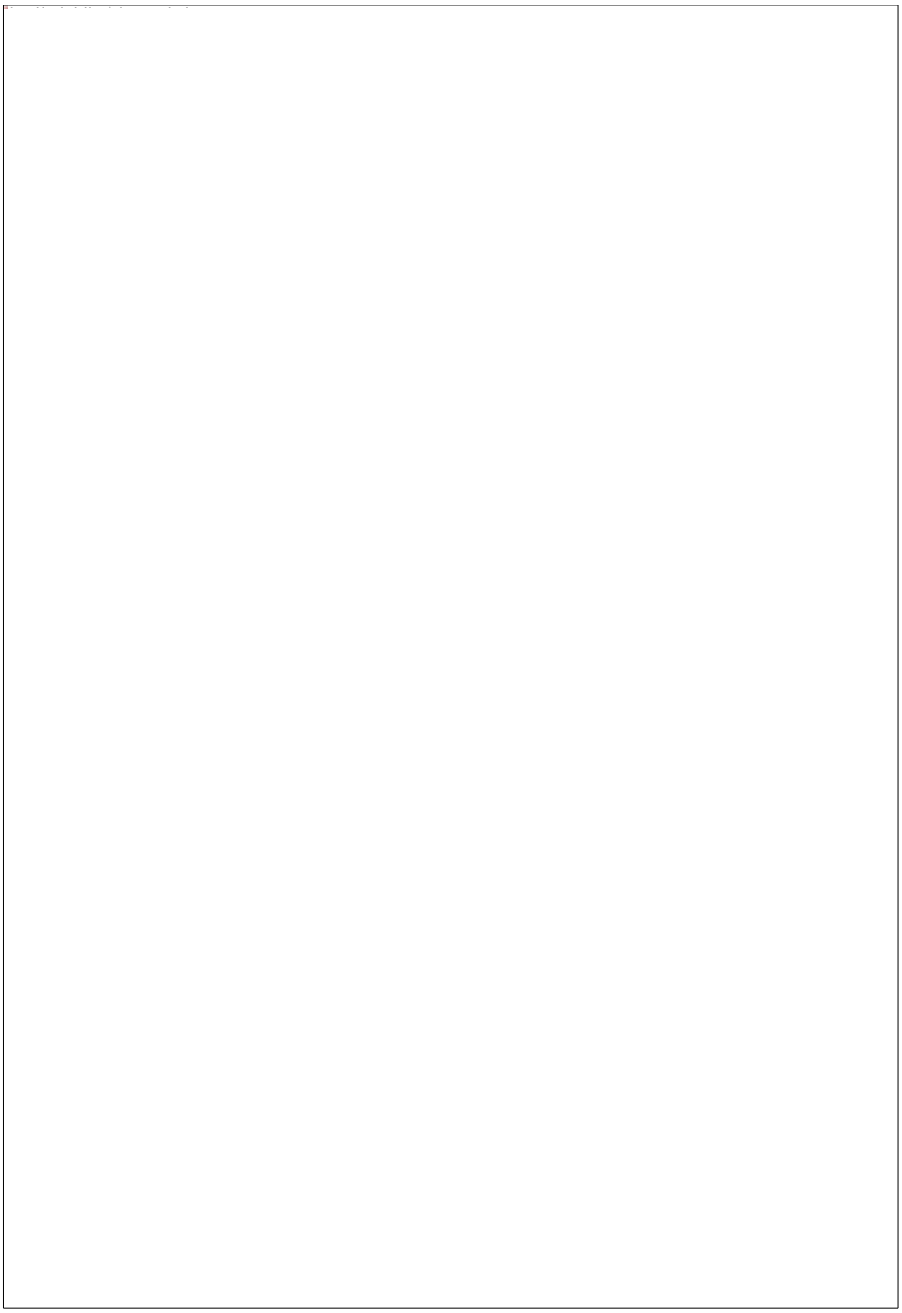

Figure 7-1 Redacted - Exterior Fire Protection Overall Site Plan

The fire water service main for the plant is designed and installed in accordance with NFPA 24-2010. The source of fire water supply, which is isolated from the sanitary water system, is a 6-inch underground circulating water main designed in accordance with NFPA 24-2010, "Standard for the Installation of Private Fire Service Mains and Their Appurtenances."

The fire water system maintains approximately 65 psig static pressure at the base of the risers inside the buildings. The underground water mains that feed the sprinkler systems and fire hydrants are constructed of 6 inch PVC pipe that is UL listed and/or Factory Mutual (FM) approved for fire main use. The fire protection water supply and distribution system design is based on the largest fixed fire suppression system demand, including a hose stream allowance, in accordance with NFPA 13-2010.

The distribution system, including piping associated with the fire pumps, is looped and arranged so that a single pipe break or valve failure will not totally impair the system as required by the Fire Hazard Analysis and NFPA 801. Through appropriate valve alignment, either fire pump can take suction from the storage tank(s) and discharge through either leg of the underground piping loop. The system piping is sized so that the largest sprinkler system demand (including hose stream allowance) is met with the hydraulically shortest flow path assumed to be out of service.

Valves are arranged to provide adequate sectional control of the fire main loop to minimize protection impairments. All fire protection water system control valves are monitored under a periodic inspection program, and their proper positioning is supervised in accordance with NFPA 801-2008. Exterior fire hydrants, equipped with separate shut-off valves on the branch connections, are provided at intervals to ensure complete coverage of all facility structures including the Full DUF_6 Cylinder Storage Pad.

The primary fire water booster pump and the emergency back-up diesel fire water booster pump are separated from each other by two-hour fire-rated barrier construction. Each pump is equipped with a dedicated listed controller. The pumps are arranged for automatic start functions upon a drop in the system water pressure as detected by pressure switches contained within the pump controllers. The start pressure logic prevents simultaneous operation of both pumps. Each fire water pump controller interfaces with the site-wide protective signaling system for all alarm and trouble conditions recommended by NFPA 20-2010. Fire water pump controllers are monitored and annunciated at the central alarm panel in the DUF_4 Process Building Control Room and the Shift Superintendent's work area. Once activated, the pumps can only be turned off at the pump controller location. Pumps, suction and discharge piping and valves are provided and arranged in accordance with the recommendations of NFPA 20-2010. A dedicated diesel fuel tank is provided for the diesel driven fire pump. The tank is located in the Fire Pump House and is sized to provide a minimum eight-hour supply of fuel in accordance with the recommendations of NFPA 20-2010. A jockey pump is provided in the Fire Pump House to maintain pressure in the fire protection system during normal operation. The Fire Pump House is provided with automatic sprinkler protection.

System Interfaces

The fire protection water supply system does not interface with the sanitary, cooling or process water supply systems. Independent pumps supply water to the fire water supply storage tanks. Consequently, the fire water supply is independent of the other water supply systems.

Safety Considerations

The system is designed to assure water supply to automatic fire protection systems, standpipe systems and fire hydrants located around the facility. This is accomplished by providing redundant water storage tanks and redundant fire pumps which are not subject to a common electrical or mechanical failure.

7.5.1.2 Standpipe and Hose Systems

As required by the FHA, Class I and Class II standpipe systems and interior fire hose stations are provided and installed in accordance with NFPA 14-2010 in the multi-story process buildings.

The standpipe systems are designed in accordance with NFPA 14-2010 and are separated from the building sprinkler systems either by check valves or separate piping. Connections are provided to allow pressurizing each standpipe or sprinkler system or both, independently, from nearby fire hydrants. The separation ensures that a single impairment does not disable both the sprinklers and standpipe system.

In addition to fixed standpipes and fire hose stations, the IIFP Facility is provided with fire hoses on mobile apparatus and/or at strategic locations throughout the facility. The amount of hose provided is sufficient to ensure that all points within the facility are reached by at least two 64 mm (2½-inch) diameter backup hoses consistent with NFPA 1410-2010. These hoses are intended for use by the IIFP Fire Brigade in the event of a structural fire. Hydraulic margin for these hose lines is sufficient to ensure minimum nozzle pressures of 4.5 bar (65 psig) for attack hoses and 6.9 bar (100 psig) for backup hose lines.

7.5.1.3 Portable Extinguishers

Portable fire extinguishers are installed throughout all buildings in accordance with NFPA 10-2010. Multi-purpose extinguishers are provided for Class A, B or C fires. The portable fire extinguishers are spaced within the travel distance limitation and provide the area coverage specified in NFPA 10-2010. Specialized extinguishers are located in areas requiring protection for particular hazards.

7.5.1.4 Automatic Suppression Systems

Wet pipe sprinkler systems are engineered to protect specific hazards in accordance with parameters established by the FHA. Water flow detectors are provided to alarm and annunciate sprinkler system actuation. Sprinkler system control valves are monitored under a periodic inspection program, and their proper positioning is supervised in accordance with NFPA 801-2008 to ensure all systems remain operable.

Automatic wet pipe sprinkler systems that have been designed and tested in accordance with NFPA 13-2010 are provided in all buildings.

7.5.1.5 Fire Detection Systems

All facility structures are provided with automatic fire and smoke detectors installed in accordance with NFPA 72-2010, International Fire Code (IFC-2009), NMCBC-2009 and as required by the FHA.

7.5.1.6 Manual Alarm Systems

All facility structures are provided with manual fire alarm pull stations in accordance with the 2009, NFPA 72-2010, IFC-2009 and as required by the FHA.

7.5.1.7 Fire Alarm System

The fire alarm system is a positive, non-interfering successive, municipal type matrix that operates with a single break or ground to the wiring. The fire alarm system meets the requirements of NFPA 72-2010, "National Fire Alarm Code." The fire alarm system consists of a central fully addressable, microprocessor-based fire alarm panel, located in the DUF_4 Process Building Control Room, a local fully addressable fire alarm panel located in each building on site, heat detectors, smoke detectors and manual pull stations where required. Each fire alarm panel is furnished with a battery backup and charger as required by NFPA 72-2010 and is fed from the emergency power system backed up by the diesel generator. The central alarm panel monitors all functions associated with the individual building alarm panels and the fire pump controllers. All alarm and trouble functions are audibly and visually annunciated by the central alarm panel and automatically recorded via printout. Failure of the central alarm panel does not result in failure of any building fire alarm control panel functions.

Sprinkler system and hose station water flow devices and fire water pump controllers are monitored by the fire alarm system. Each device is removable from service for maintenance or trouble shooting without disabling the entire system.

Features to avoid detector false alarms are also incorporated into the design. Activation of a fire detector, smoke detector, manual pull station or water flow device results in an audible and visual alarm at the individual building control panel and at the central alarm panel.

The following conditions are monitored by the central alarm console through the fire water pump controllers:

- Pump running
- Pump failure to start
- Pump controller in "off" or "manual" position
- Battery failure
- Diesel over-speed
- Diesel high engine jacket coolant temperature
- Diesel low oil pressure
- Battery charger failure

Both fire water pumps are maintained in the automatic start condition at all times except during periods of maintenance and testing. Remote manual start switches are provided in the control room adjacent to the alarm console. Pumps are arranged for manual shut-off at the controllers only.

All fire protection water system control valves are monitored under a periodic inspection program, and their proper positioning is supervised in accordance with NFPA 801-2008.

7.5.2 Fire Emergency Response

The following sections address the IIFP fire emergency response.

7.5.2.1 Fire Brigade

The IIFP Fire Brigade is an incipient fire brigade as classified under NFPA 600-2010 and its members are not required to wear thermal protective clothing nor self-contained breathing apparatus (SCBA) during firefighting. The intent of the Facility Fire Brigade is to be able to handle all minor fires and to be a first response effort to supplement the local fire department for major fires at the facility. The IIFP Fire Brigade members are trained and equipped to respond to fire emergencies and contain fire damage until off-site help from a neighboring Fire Department arrives. The IIFP Fire Brigade response includes the use of hand held portable and wheeled fire extinguishers as well as hoses to fight interior/exterior incipient fires and to fight larger exterior fires in a defensive mode (e.g., vehicle fires).

When the local off-site Fire Department arrives at the IIFP Site, the Fire Department personnel assume control and responsibility for the fire fighting activities. The transition of fire fighting control to the off-site Fire Department is coordinated through the on-shift incident commander or emergency director (See the IIFP EMP, Revision B for the incident commander and the emergency director descriptions and responsibilities). Smoke control is accomplished by the off-site Fire Department utilizing portable smoke removal equipment.

Periodic training is provided to off-site assistance organization personnel in the facility emergency planning procedures. Facility emergency response personnel meet at least every two (2) years with each off-site assistance group to accomplish training and review items of mutual interest including relevant changes to the EMP and Fire Safety Program. This training includes facility tours, information concerning facility access control (normal and emergency), potential accident scenarios, emergency action levels, notification procedures, exposure guidelines, personal monitoring devices, communications, contamination control, and the off-site assistance organization role in responding to an emergency at the IIFP Facility, as appropriate.

7.5.2.2 Off-Site Organizations

IIFP will use the services of local, off-site Fire Departments to supplement the capability of the Facility Fire Brigade. The two primary agencies available for this response are the City of Eunice, New Mexico Fire and Rescue Agency and the City of Hobbs, New Mexico Fire Department. Both of these agencies are signatories to the Lea County, New Mexico Mutual Aid Agreement and can request additional mutual aid from any of several county fire departments/fire districts.

The Hobbs Fire Department is the primary response agency and is comprised of a roster of approximately seventy (70) paid personnel, staffing three (3) fire stations in a three-shift rotation. The Department has structural engines, a ladder truck, a heavy rescue truck, grass fire trucks, a water tanker, several command vehicles and ambulances, each equipped to provide advanced level life support. Firefighters are trained to Firefighter Level I and Emergency Medical Technician (EMT) – Basic as a minimum per New Mexico standards. Shift assigned ambulance personnel are EMT – Paramedics per New Mexico standards.

Eunice Fire and Rescue is the secondary response agency and is comprised of a roster of approximately twenty (20) volunteers. Eunice has structural fire engines, grass fire trucks, a water tanker, command vehicles and ambulances, each equipped to provide intermediate level life support. Firefighters are trained, as a minimum, to Firefighter Level I and ambulance personnel are trained, as a minimum, to

EMT – Basic per New Mexico standards. In the event of a fire, the IIFP Fire Brigade responds and the Hobbs Fire Department and Eunice Fire and Rescue Department are notified to respond. If the fire is incipient, the IIFP Fire Brigade fights the fire utilizing hand portable/wheeled fire extinguishers and/or 38 mm (1½-in) hose lines. The estimated response time to the facility has not been verified at this time, but response times from the Hobbs and Eunice Fire Departments are estimated at less than 15 minutes and from 20 to 30 minutes, respectively. Response times will be confirmed in signed Memorandums of Understanding (MOU) with these organizations.

Through a combination of on-site capability, off-site responders and contract arrangements, the EMP and implementing procedures ensure that capabilities are in place to respond to other events, such as hazardous material releases, confined space rescue, trench rescue, high angle rescue and other technical emergencies. The IIFP Fire Brigade and Emergency Response Team equipment is inventoried, inspected and tested in accordance with recognized standards. These response areas and response equipment will be reassessed after detailed facility design is completed to ensure adequate response capabilities are in place and applicable training is completed. Additional reassessments will be conducted to ensure the response capabilities are in place prior to startup operations.

Emergency and fire response actions at the IIFP Facility are addressed in the EMP. The Emergency Management Plan identifies outside response organizations that are expected to respond to emergencies at the facility per MOUs. The EMP also conforms with and addresses the acceptance criteria specified in Chapter 8 of NUREG-1520, “Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility,” (NRC, 2010). The IIFP EMP, Revision B is submitted to the NRC under a transmittal letter separate from the LA (See the IIFP LA, Revision B Chapter 8 “Emergency Management”).

REFERENCES

ASTM, 2011 American Society for Testing and Materials, ASTM E-814-11a. "Standard Test Method for Fire Tests of Through-Penetration Fire Stops," 2011.

CFR, 2011a Title 10, Code of Federal Regulations, Part 40, "Domestic Licensing Of Source Material," 2011.

CFR, 2011b Title 10, Code of Federal Regulations, Section 70.22 "Contents of Applications,"-2011.

CFR, 2011c Title 10, Code of Federal Regulations, Section 70.61 "Performance Requirements," 2011.

CFR, 2011d Title 10, CFR Code of Federal Regulations, Section 70.62 "Safety Program and Integrated Safety Analysis," 2011.

CFR, 2011e Title 10, Code of Federal Regulations, Section 70.64 "Requirements for New Facilities or New Processes at Existing Facilities," 2011.

CFR, 2011f Title 10, Code of Federal Regulations, Section 70.65 "Additional Content of Applications," 2011.

ICC, 2009 ICC International Fire Code® (IFC), 2009.

NFPA, 2008a "SFPE Handbook of Fire Protection Engineering," 2008 Edition National Fire Protection Association, Quincy, MA, 2008.

NFPA, 2008b Fire Protection Handbook, 2008 Edition, National Fire Protection Association, Quincy, MA, 2008. NMCBC, 2009 Title 14, New Mexico Commercial Building Code, Chapter 7, Part 2, 2009 New Mexico Commercial Building Code, 2009.

UL, 2011 Underwriters Laboratories, UL 1479, "Fire Tests of Through-Penetration Firestops," 2011.

NRC, 1977 U.S. Nuclear Regulatory Commission, Generic Letter 77-02, "Fire Protection Functional Responsibilities, Administrative Control and Quality Assurance," 1977.

NRC, 1994 U.S. Nuclear Regulatory Commission, NUREG 1491, "UF6 Storage Area Fire" Washington, D.C., 1994.

NRC, 1995 U.S. Nuclear Regulatory Commission, Generic Letter 95-01, "NRC Staff Technical Position on Fire Protection for Fuel Cycle Facilities," 1995.

NRC, 1998 U.S. Nuclear Regulatory Commission, NUREG/CR-6410 "Nuclear Fuel Cycle Facility Accident Analysis Handbook," 1998.

NRC, 2001 U.S. Nuclear Regulatory Commission, NUREG-1513 "Integrated Safety Analysis Guidance Document," 2001.

NRC, 2010 U.S. Nuclear Regulatory Commission NUREG-1520, “Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility,” 2010.

NRC, 2005 U.S. Nuclear Regulatory Commission, NUREG-1827, “Safety Evaluation Report for the National Enrichment Facility in Lea County, New Mexico, Louisiana Energy Services,” Washington, D.C., 2005.

NFPA, National Fire Protection Association, Various Standards as shown in Table 7-1, “National Fire Protection Association,” Quincy, MA.