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7.0 FIRE SAFETY

This chapter documents the Eagle Rock Enrichment Facility (EREF) fire safety program. The fire safety program is part of the overall facility safety program and is intended to reduce the risk of fires and explosions at the facility. The facility safety program is described in Chapter 3, Integrated Safety Analysis (ISA) Summary. The fire safety program documents how the facility ensures fire safety.

The EREF fire safety program meets the acceptance criteria in Chapter 7 of NUREG-1520 (NRC, 2002) and is developed, implemented and maintained in accordance with the requirements of 10 CFR 70.62(a) (CFR, 2008a), 10 CFR 70.22 (CFR, 2008b), and 10 CFR 70.65 (CFR, 2008c). In addition, the fire safety program complies with 10 CFR 70.61 (CFR, 2008d), 10 CFR 70.62 (CFR, 2008a), and 10 CFR 70.64 (CFR, 2008e). NUREG/CR-6410 (NRC, 1998), NUREG-1513 (NRC, 2001), NRC Generic Letter 95-01 (NRC, 1995), and NFPA 801 (NFPA, 2008e) were utilized as guidance in developing this chapter.

The comparative differences between the EREF Fire Safety Program and measures prescribed for the National Enrichment Facility are as follows:

- The EREF will have automatic fire sprinkler coverage throughout the process facility structures except in those specific areas where safety analysis shows moderator control requirements take precedence.
- The EREF will provide limited standpipe coverage in the SBM and TSB/OSB to facilitate fire department response.

The basis for providing automatic sprinkler protection in process areas is to meet International Building Code requirements and to conform to recommendations of NFPA 801 to use sprinklers as the preferred type of automatic fire system – to the extent such use is consistent with criticality safety limits. Additionally, the off-site fire department response time to the site is longer than the NEF. Automatic sprinkler protection reduces the need to rely on fire brigade and fire department response and provides defense-in-depth.

Standpipes are being proposed to facilitate deployment of hose streams by the off-site fire department, again consistent with criticality safety limits.

The NEF and EREF also differ due to site characteristics including property boundary, facility layout, variations in building and area names, more exterior cylinder storage pads, different building construction types due to differing building code requirements and natural phenomenon hazard (NPH) parameters, as well as minor differences in UF₆ operations and process layout.

The NEF provided fire-rated enclosures to separate sodium fluoride chemical traps from adjacent spaces and provided gaseous fire suppression systems in these enclosures. The EREF does not have similar provisions. The Separations Building Modules, where the sodium fluoride traps are located, is already classified as an H-4 occupancy under the International Building Code due to the inventory of UF₆. The presence of the sodium fluoride chemical traps does not change this occupancy classification nor increase the fire hazard in the space, therefore, the separating enclosures and fire suppression systems are not required.

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

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(b)	7.4.3.3
Section 7.4 Process Fire Safety	70.64(b) & 70.64(b)	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 site. The objectives of the fire safety program are to prevent fires from starting and to detect, control, and extinguish those fires that do occur. The fire protection organization and fire protection systems at the EREF provide protection against fires and explosions based on the structures, systems, and components (SSC) and defense-in-depth practices described in this chapter. Select fire barriers and administrative controls are considered fire protection items relied on for safety (IROFS).

7.1.1 Fire Protection IROFS

Fire protection items relied on for safety (IROFS) are identified in Section 3.8 of the EREF Integrated Safety Analysis (ISA) Summary.

7.1.2 Management Policy and Direction

AREVA Enrichment Services, LLC (AES) 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 Chapter 11, Management Measures.

The responsibility for fire protection rests with the Environmental Health, Safety & Licensing Manager who reports to the President. The Environmental Health, Safety & Licensing Manager is assisted by the Safety, Security, and Emergency Preparedness Manager whose direct responsibility is to ensure the day-to-day safe operation of the facility in accordance with occupational safety including the fire safety program. The personnel qualification requirements for the Environmental Health, Safety & Licensing Manager and the Safety, Security, and Emergency Preparedness Manager are presented in Chapter 2, Organization and Administration. Fire protection engineering support is provided by the engineering manager. The Safety, Security, and Emergency Preparedness Manager is assisted by fire safety personnel who are trained in the field of fire protection and have practical day-to-day fire safety experience at nuclear facilities. The fire protection staff is responsible for the following:

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

The facility maintains a Safety Review Committee (SRC) that reports to the President. The SRC performs the function of a fire safety review committee. The SRC provides technical and

administrative review and audit of plant operations including facility modifications to ensure that fire safety concerns are addressed.

Engineering review of the fire safety program is accomplished by configuration management and the SRC. Configuration management is discussed in Chapter 11, Management Measures, and the SRC is discussed in Chapter 2, Organization and Administration.

7.1.3 Fire Prevention

Administrative controls are used to maintain the performance of the fire protection systems and delineate 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, in the form of procedures, primarily control the storage and use of combustible materials and the use of ignition sources. These controls include, but are not limited to, the following:

- Governing the handling of transient combustibles in buildings containing IROFS, including work-generated combustibles
- Implementing a permit system to control ignition sources that may be introduced by welding, flame cutting, brazing, or soldering operations
- Ensuring that the use of open flames or combustion-generated smoke for leak testing is not permitted
- Conducting formal periodic fire prevention inspections to (1) ensure that transient combustibles adhere to established limits based on the Fire Hazard Analysis; (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 system inspection, testing, and maintenance procedures.

7.1.4 Inspection, Testing and Maintenance of Fire Protection Systems

An inspection, testing and maintenance program is implemented 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 fire brigade, reporting of fires, and control of penetration seals. The facility's Safety, Security, and Emergency Preparedness Manager has responsibility for fire protection procedures in general; with the facility's maintenance section having responsibility for certain fire protection procedures such as control of repairs to facility penetration seals. Refer to Chapter 11, Management Measures, for additional information on procedures and maintenance activities.

7.1.5 Emergency Organization, Qualifications, Drills and Training

The qualifications, drills and training of the fire brigade members who are part of the Emergency Organization are in accordance with NFPA 600 (NFPA, 2005a). The primary purpose of the Fire Brigade Training Program is to develop a group of facility employees trained in fire

prevention, fire fighting techniques, first aid procedures, and emergency response. They are trained and equipped to function as a team for fighting fires.

The Fire Brigade Training Program provides entrance and educational requirements for fire brigade candidates as well as the medical- and job-related physical requirements. The Fire Brigade Training Program provides for initial training of all new fire brigade members, semi-annual classroom training and drills, annual practical training, and leadership training for fire brigade leaders.

The EREF Emergency Plan also discusses the use of offsite 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.

The pre-fire plans include the location of fire protection equipment, approach paths for fire response, potential hazards in the area, 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

A Fire Hazards Analysis (FHA) has been conducted evaluating fires at the facility which, if uncontrolled, could cause a release of UF₆ in quantity and form that may result in an intermediate or high consequence, as defined in 10 CFR 70.61 (CFR, 2008d). UF₆ is present in sufficient quantity for this to occur in the following areas: Separations Building Modules (SBM), Cylinder Receipt and Shipping Building (CRSB), UF₆ Handling Areas, Technical Support Building (TSB), Blending, Sampling and Preparation Building (BSPB), Trailer Parking, Full Product Cylinder Storage Pad, Full Tails Cylinder Storage Pads, and the Full Feed Cylinder Storage Pads.

The FHA develops bounding credible fire scenarios and then assesses the consequences of unmitigated fire.

The FHA for the facility consists of the following:

- A description of the facility's use and function
- The boundaries of fire areas
- The specific fire hazards and potential fire scenarios within the fire areas
- The methods of consequence analysis
- The occupancy and construction requirements
- Life safety requirements
- IROFS required for postulated fire scenarios within the fire area
- Methodology for evaluating the impact of fire on IROFS
- The facility response to fires
- Defense or mitigation strategy for overall facility protection.

The results of the FHA are utilized in the Integrated Safety Analysis (ISA) to identify possible fire initiators and accident sequences leading to radiological or toxic chemical consequences resulting from fire interaction on UF₆ or UF₆ byproducts.

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

7.3 FACILITY DESIGN

The design of the facility incorporates the following:

- Limits on areas and equipment subject to contamination
- Design of facilities, equipment, and utilities to facilitate decontamination.

7.3.1 Building Construction

The facility consists of several different process-related buildings and functional areas:

Separations Building Modules (SBMs) which include the following areas:

- Cascade Halls
- Process Service Corridor
- Link Corridor
- Electrical and Mechanical Equipment Rooms
- UF₆ Handling Area
- Cylinder Receipt and Shipping Building (CRSB)
- Blending, Sampling, and Preparation Building (BSPB)
- Centrifuge Assembly Building (CAB)
- Full Feed, Full Product, Full Tails, and Empty Cylinder Storage Pads
- Technical Support Building (TSB)
- Operation Support Building (OSB)

There are also numerous utility support and non-process structures and areas including:

- Electrical Services Building (ESB)
- Electrical Services Building for the Centrifuge Assembly Building
- Mechanical Services Buildings (MSBs)
- Visitor Center
- Guard House
- Administration Building
- Security and Secure Administration Building
- Long and Short-Term Warehouses
- Electrical Switchyard
- Domestic Sanitary Sewage Treatment Plant
- Fire, Process, and Domestic Water Tanks and Pump Buildings
- Fuel Oil Storage Tanks
- Liquid Nitrogen (N₂) Package

- Gasoline and Diesel Fueling Station

The SBMs, UF₆ Handling Area, BSPB, TSB, and OSB are protected steel frame buildings with insulated metal panel exterior walls. Structural elements of these buildings are protected structural steel columns and trusses with built-up composite roofing on metal deck. Select interior walls are concrete or masonry as required by code or to support equipment loads. These process buildings all share at least one wall. Accordingly, to meet building code allowable area requirements, these are classified as Type IB in accordance with the IBC (ICC, 2006). This is equivalent to Type II, 222 construction per NFPA 220 (NFPA, 2006c).

The CRSB is separated from the other process buildings and will also be a protected steel frame building with insulated metal panel exterior walls and protected columns and trusses with built-up composite roofing on metal deck meeting Type IB construction requirements.

The CAB will be an unprotected steel frame building with insulated metal panel exterior walls and with built-up composite roofing on metal deck. This construction is classified as non-combustible Type IIB in accordance with the International Building Code (IBC) (ICC, 2006). This is equivalent to Type II, 000 construction per NFPA 220 (NFPA, 2006c). The CAB shares a portion of one wall with the SBMs. The separating construction at this interface will be fire-rated as required to separate the CAB from the adjoining process structures.

The remaining utility and non-process related structures including the Visitor Center, Security Buildings, Administration Building, Warehouses, Electrical and Mechanical Services Buildings, a Sanitary Sewage Treatment Plant, Gasoline and Diesel Fueling Station are all independent from the main plant process buildings. These structures will be unprotected steel frame buildings with insulated metal panel exterior meeting Type IIB construction.

All of the cylinder storage pads are open lay-down areas each consisting of a concrete pad with a dedicated collection and drainage system. Concrete saddles are used for fixed location storage of cylinders. Other stillages or stops may be used for interim storage or to secure cylinders temporarily during movement. There are no structures over any of the cylinder storage pads.

7.3.2 Fire Area Determination and Fire Barriers

The facility is subdivided into fire areas by barriers with fire resistance as required by the IBC (ICC, 2006), as required for specific hazards (e.g., National Electrical Code, NFPA 70 (NFPA, 2008c) requirements for transformer vaults), or as determined necessary by the FHA to ensure licensed material safety consistent with the ISA. The design and construction of fire barrier walls is in accordance with NFPA 221 (NFPA, 2006d). These fire areas are provided to limit the spread of fire, protect personnel and limit the consequential damage to the facility. Fire barriers for the main process structures are shown in Figures 7.3-1 through 7.3-8. The fire resistance rating of fire barrier assemblies is determined through testing in accordance with NFPA 251 (NFPA, 2006e). Openings in fire barriers are protected consistent with the designated fire resistance rating of the barrier. Penetration seals provided for electrical and mechanical openings are listed to meet the guidance of ASTM E-814-02 (ASTM, 2002) or UL 1479 (UL, 2003). Penetration openings for ventilation systems are protected by fire dampers having a rating matched to that of the barrier per code. Door openings in fire rated barriers are protected with fire rated doors, frames and hardware in accordance with NFPA 80 (NFPA, 2007g).

7.3.3 Electrical Installation

All electrical systems at the facility are installed in accordance with NFPA 70 (NFPA, 2008c). Switchgear, motor control centers, panel boards, variable frequency drives, uninterruptible power supply systems and control panels are mounted in metallic enclosures and contain limited amounts of combustible material. Cable trays and conduits are metallic and the cables in cable trays are flame retardant and tested in accordance with the guidance of ANSI/IEEE 383 (ANSI / IEEE, 1974), IEEE 1202 (IEEE, 1991), UL 1277 (UL, 2001), or ICEA T-29-520 (ICEA, 1986).

Lighting fixtures are constructed of non-combustible materials and their ballasts are electronic and contain only an insignificant amount of combustible material.

All indoor transformers are dry type. Outdoor oil filled transformers are located in the local utilities substation yard which is located on the western portion of the property with adequate spatial separation from facility buildings so as not to present an exposure fire hazard.

An auxiliary power system is provided to supply power for temporary lighting, ventilation and radiation-monitoring equipment where potential radiation hazard exists.

Electrical conduits leading to or from areas with uranic material are sealed internally to prevent the spread of radioactive materials. Only utilities required for operation within areas having uranic material enter into these areas.

7.3.4 Life Safety

The buildings are provided with means of egress, illumination, and protection in accordance with the IBC (ICC, 2006) and NFPA 101 (NFPA, 2006b). Barriers with fire resistance ratings consistent with IBC (ICC, 2006), NFPA 101 (NFPA, 2006b), or the FHA are provided to prevent unacceptable fire propagation from impacting personnel egress.

All of the buildings are provided with emergency lighting for the illumination of the primary exit paths and in critical operations areas where personnel may need to operate valves, dampers and other controls in an emergency. Emergency lighting is considered as a critical load. All critical loads are fed from uninterruptible power supplies (UPSs) which are connected to the essential load motor control centers (MCCs). The UPSs receive power input from two incoming power sources, four diesel powered electric generators and stationary batteries. All power inputs to the UPS transfer automatically to another source if the first source fails. Thus, loads connected to the UPS are unaffected by offsite power and standby generator failure. See ISA Summary Section 3.5.2, Electrical System, for additional details on the UPS and Electrical System.

Marking of means of egress, including illuminated exit signs, are provided in accordance with NFPA 101 (NFPA, 2006b) and Chapter 10 of the IBC (ICC, 2006).

7.3.5 Ventilation

The building heating, ventilating and air conditioning (HVAC) system provides the primary form of ventilation employed at the facility. The HVAC system is designed to maintain room temperature and the specific environmental conditions associated with processes within a particular area.

The ventilation system is not engineered for smoke control. It is designed to shutdown in the event of a fire. Ductwork, accessories and support systems are designed and tested in

accordance with NFPA 801 (NFPA, 2008e), NFPA 90A (NFPA, 2002), NFPA 90B (NFPA, 2006a), and NFPA 91 (NFPA, 2004b). Flexible air duct couplings in ventilation and filter systems are noncombustible. Air entry filters are UL Class I.

The power supply and controls for mechanical ventilation systems are located outside the fire area served.

The process facilities are also provided with process-related ventilation systems specific to the support of UF₆ operations. These systems are the Gaseous Effluent Ventilation Systems (GEVS) which are provided for the SBMs (SBM GEVS also exhausts systems in the BSPB), the TSB, and the CAB Centrifuge Test and Post-Mortem rooms. These systems provide local exhaust when routine operations and maintenance activities are performed that involve opening a process system.

There are also select facility HVAC systems which perform a confinement ventilation function to effectively reduce the potential chronic exposure of workers by ensuring that areas that may contain dispersible radioactive materials during normal operations remain at a lower pressure than that of adjoining areas of the facility. The TSB HVAC system is designed to provide negative pressure for the following TSB areas: Decontamination Workshop, Chemical Trap Workshop, Mobile Unit Disassembly/Reassembly Workshop, Valve Dismantling Workshop, and the Maintenance Facility. Both the Ventilated Room in the BPSB and the Centrifuge Post Mortem and Test Area Rooms in the CAB are provided with dedicated HVAC systems that provide confinement ventilation for those spaces.

Ventilation ductwork from areas containing radioactive materials that pass through non-radioactive areas are constructed of non-combustible material and are protected from possible exposure to fire by materials having an appropriate fire resistance rating.

High efficiency particulate air (HEPA) filtration systems are utilized in both the GEVS systems and those HVAC systems which perform a confinement ventilation function. This includes the SBMs, TSB, and CAB Centrifuge Test and Post-Mortem Facilities GEVS systems, the TSB HVAC system that serves the negative pressure rooms described above, as well as the Ventilated Room HVAC system and the CAB Centrifuge Test and Post-Mortem Facilities HVAC system. HEPA filters are UL 586 (UL, 1996)(UL Class I), which are non-combustible. In all ventilation systems, the HEPA filters are enclosed in ductwork. The HEPA filtration systems are analyzed in the FHA. They are designed to shutdown in the event of a fire.

Smoke control is accomplished by the Fire Brigade and off-site Fire Department utilizing portable smoke removal equipment.

The various facility ventilation systems are described in ISA Section 3.5.1, Building Ventilation and the GEVS systems are described in ISA Sections 3.4.9 and 3.4.10.

7.3.6 Drainage

Water that may discharge from the fire water supply or suppression systems or from fire fighting activities could be contaminated with radioactive materials. Discharged water will be contained, stored, sampled, and treated if necessary (i.e., if the water is discharged in an area containing radiological materials). This also applies to areas used for chemical storage to ensure that other hazardous materials are not discharged inappropriately. Wall and floor interfaces will be made watertight. Provisions will be made at all pertinent door openings to prevent fire protection water from migrating outside of the contained area. If there is a possibility that the water could be contaminated with fissile uranium compounds, the containment methodology will be designed to be safe with respect to criticality. The drainage system design and associated

containment configuration will be addressed during the detailed design phase and the Safety Analysis Report will be revised, as appropriate. Water runoff from the Full Tails Cylinder, Full Feed Cylinder, Full Product Cylinder and Empty Cylinder Storage Pads will be collected in the Cylinder Storage Pads Stormwater Retention Basins. Liquid effluent monitoring associated with the Cylinder Storage Pads Stormwater Retention Basins is discussed in the Environmental Report.

7.3.7 Lightning Protection

Lightning protection for the facility is in accordance with NFPA 780 (NFPA, 2008d).

7.3.8 Criticality Concerns

Criticality controls will be provided by employing the basic principals of criticality safety. The premise of nuclear criticality prevention is that at least two, unlikely, independent, and concurrent changes in process conditions must occur before a criticality accident is possible. This double contingency principal is described in ANSI/ANS-8.1-1998 (ANSI, 1998). Controls or systems of controls are used to limit process variables in order to maintain safe operating conditions.

Moderation control is applied for criticality safety of UF₆ at the EREF. Automatic sprinkler systems will be provided in all process-related structures where required by the FHA. These systems are designed consistent with moderator control limitations to satisfy criticality safety criteria. The EREF FHA contains a methodology for the comparative evaluation of fire risk versus criticality risk for areas where moderator control is required. The methodology consists of decision-making hierarchy which systematically evaluates: 1) in-situ combustible quantities/configuration, 2) presence of transient combustibles, 3) presence of ignition sources, 4) presence of fissile materials, their quantity and configuration, 5) potential for water ingress in fissile containers, 6) potential to impact critically safe attributes (geometry, shapes, arrays, etc.), 7) reflection from external water spray, and 8) barriers that prevent inadvertent moderator introduction including their resilience under applicable design basis events. The completed analyses will be reviewed and approved by a criticality safety engineer.

Where double contingency principle cannot be satisfied (e.g., where fire might initiate a sprinkler activation concurrent with causing a leak in an enriched UF₆ vacuum piping system) or water is otherwise determined unacceptable by analysis, automatic sprinkler protection will be omitted or limited in coverage to ensure criticality safety is maintained or alternate fire protection measures will be taken. Figure 7.5-2 identifies those structures where sprinklers are proposed and moderator control is required. Nuclear Criticality Safety Analyses (NCSAs) will be performed to determine the specific moderator control attributes and sprinkler limitations.

With respect to fire hose streams, procedures and training for both onsite fire brigade and offsite fire department emphasize the need for moderator control in these areas. A criticality safety officer will be present anytime fire hose streams are to be deployed in a moderator control area. See Section 7.5 for additional information.

Fire protection concerns are also addressed in the moderation control areas by the fire protection program. The program includes administrative controls which limit the transient and in situ combustibles, controls ignition sources in these areas, and isolates these areas from other areas of the plant with appropriately rated fire barriers to preclude fire propagation to or from these areas. There are automatic detection and manual alarm systems located in these areas to ensure prompt response. Those elements of the fire protection program that are

credited fire protection IROFS are detailed in Chapter 3 of the Integrated Safety Analysis Summary.

See Chapter 5, Nuclear Criticality Safety, for additional discussion on criticality control.

7.3.9 Hydrogen Control

Hydrogen is used as an analytical gas in laboratories. In order to prevent the possibility of fire or explosion in the laboratory areas where hydrogen might accumulate will be protected by one or a combination of following features:

- Hydrogen piping will be provided with excess flow control.
- Hydrogen supply will be isolated by emergency shutoff valves interlocked with hydrogen detection in the area(s) served by the hydrogen piping.
- Natural or mechanical ventilation will be provided to ensure that hydrogen concentrations do not exceed 25% of the lower explosive limit. If mechanical ventilation is provided, it will be continuous or will be interlocked to start upon the detection of hydrogen in the area. Mechanical ventilation will also be provided with airflow sensors to sound an alarm if the fan becomes inoperative.

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 will be protected by a design which incorporates the following measures, as necessary, that are identified in NFPA 70E (NFPA, 2004a) and/or ANSI-C2, National Electrical Safety Code (ANSI/IEEE, 2007).

- Natural or mechanical ventilation will be provided to ensure that hydrogen concentrations do not exceed 25% of the lower explosive limit. If mechanical ventilation is provided, it will be continuous or will be interlocked to start upon the detection of hydrogen in the area. Mechanical ventilation will also be provided with airflow sensors to sound an alarm if the fan becomes inoperative.

7.3.10 Diesel Fuel Oil and Gasoline Storage

Diesel fuel oil is stored in exterior aboveground tanks to supply the facility standby diesel generators. These tanks will be provided with suitable separation, spill containment, and other protection features as required for “aboveground storage tanks” as defined in NFPA 30 (NFPA, 2008b).

Both gasoline and diesel fuel oil are stored adjacent to the Gasoline and Diesel Fueling Station (GDFS). These tanks will be provided with suitable separation, spill containment, and other protection features as required for “protected, aboveground storage tanks” as defined in NFPA 30.

GDFS operations and fuel dispensing will be in accordance with requirements of NFPA 30A (NFPA, 2008g). Fuel dispensing will be done using approved, automated dispensing equipment.

The storage tanks are located over 50 m (164 ft) from the nearest building housing UF₆, over 50 m (164 ft) from cylinder trailer delivery routes, and over 150 m (492 ft) from exterior pathways where UF₆ cylinders are handled in other than interstate transport configuration. The tanks will be diked or otherwise protected to ensure spills are contained in a manner that does not threaten process structures or cylinder transport routes.

7.3.11 Environmental Concerns

Radiological and chemical monitoring and sampling will be performed as specified in EREF Environmental Report, Chapter 6, Environmental Measurements and Monitoring Programs, on the contaminated and potentially contaminated facility liquid effluent discharge including water used for fire fighting purposes. Surface water runoff will be diverted into water collection basins. Water runoff from the Full Tails Cylinder, Full Feed Cylinder, Full Product Cylinder and Empty Cylinder Storage Pads will be collected in the Cylinder Storage Pads Stormwater Retention Basins. Water runoff from the remaining portions of the site will be collected in the Site Stormwater Detention Basin.

7.3.12 Physical Security Concerns

In no cases will security requirements prevent safe means of egress as required by the NFPA 101 (NFPA, 2006b) and the IBC (ICC, 2006).

The Physical Security Plan (PSP) addresses the establishment of permanent and temporary Controlled Areas. The PSP identifies the ingress and egress methodology during both normal and emergency conditions. This includes emergency response personnel both onsite and offsite. Two means of access to the site are provided, one via one of the two controlled gates continuously manned by Security and the other via designated emergency access gates (i.e., crash gates). Refer to the PSP for additional details.

7.3.13 Baseline Design and Defense-in-Depth

The FHA and the ISA demonstrate that the design and construction of the facility complies with the baseline design criteria (BDC) of 10 CFR 70.64(a) (CFR, 2008e), the defense-in-depth requirements of 10 CFR 70.64(b) (CFR, 2008e) and are consistent with the guidance provided in NFPA 801 (NFPA, 2008e). The design provides for adequate protection against fire and explosion by incorporating defense-in-depth concepts such that health and safety are not wholly dependent on any single element of the design, construction, maintenance or operation of the facility. This is accomplished by achieving a balance between preventing fires from starting, quickly detecting, controlling and promptly extinguishing those fires that do occur and protecting structures, systems and components such that a fire that is not promptly extinguished or suppressed will not lead to an unacceptable consequence.

7.4 PROCESS FIRE SAFETY

Chapter 6, Chemical Process Safety, 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 only process chemical of concern is uranium hexafluoride (UF_6). UF_6 is not flammable and does not disassociate to flammable constituents under conditions at which it will be handled at the EREF. The two byproducts in the event of a UF_6 release are hydrogen fluoride (HF) and uranyl fluoride (UO_2F_2) and neither presents a process fire safety hazard. The Integrated Safety Analysis Summary has analyzed the hazards associated with the processes performed at the facility. The analysis did identify select individual process fire safety hazards. The heater/chiller units for the heating and chilling of UF_6 cold traps contain a combustible silicone oil-based heat transfer media. These chillers contain a limited volume of oil and are operated at high temperature limits below the oil flash point. Safety features were applied to ensure that these units will not fail in a condition that would result in fire exposure to local UF_6 containing components.

There are other process components (e.g., pumps, fans, centrifuge drives, etc.) powered by electrical motors and/or that have lubricant systems that could fail and result in a local fire. None of these other failures were found to exacerbate fire impact to process components beyond being an initiator for a general area fire. Accordingly, they were evaluated in the area by area analysis in the FHA. Refer to Chapter 3 of the Integrated Safety Analysis Summary and Chapter 6, Chemical Process Safety for additional information.

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 systems consist of a dedicated fire water supply and distribution system, automatic 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/fire brigade response and pre-fire plans.

7.5.1.1 Fire Water Supply and Distribution System

A single Fire Water Supply System provides storage and distribution of water to fire protection features and systems that protect the entire facility as shown in Figures 7.5-1 Sheets 1 and 2, Exterior Fire Protection System Overall Site Plan, and Figure 7.5-2, Sprinkler System Coverage.

7.5.1.1.1 System Description

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 (NFPA, 2007b). The fire protection water supply consists of two 757,082 L (200,000 gal) (minimum) water storage tanks designed and constructed in accordance with NFPA 22 (NFPA, 2008a). The tanks are used for both fire protection water supply and process water supply. A reserve quantity of 681,374 L (180,000 gal) is maintained in the bottom of each tank for fire protection purposes. The elevation of the suction line for the process water pump is above the level of the required fire protection water supply in each tank. Thus the process water pump cannot pump water required for fire protection purposes. The fire protection water supply in each tank is sized for the maximum anticipated water supply needed to control and extinguish the design basis fire at the facility. Two, 5678 l/min at 10.35 bar (1500 gpm at 150 psi) horizontal, centrifugal, fire pumps designed and installed in accordance with NFPA 20 (NFPA, 2007d) are provided. For redundancy the capacity of the fire protection water supply is designed to ensure 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 pumps. The maximum demand anticipated based on a design basis fire is 5678 l/min (1500 gpm) based on 3785 l/min (1000 gpm) flowing from a building sprinkler system plus 1892 l/min (500 gpm) for hose streams for a duration of two hours. The tanks are arranged so that one will be available for suction at all times.

Fill and make up water for the storage tanks are from the well water supply on-site which is capable of filling the fire protection water inventory in a single storage tank in an 8-hour period.

The fire water supply system distribution piping for the plant is designed and installed in accordance with NFPA 24 (NFPA, 2007e). 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 per the Fire Hazard Analysis and NFPA 801 (NFPA, 2008e). Through appropriate valve alignment, either fire pump can take suction from either storage tank and discharge through either leg of the underground piping loop. The system piping is sized so that the largest sprinkler system demand in a process structure (including hose stream allowance) is

met with the hydraulically shortest flow path assumed to be out of service. Sectional control 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 (NFPA, 2008e). Exterior fire hydrants, equipped with separate shut-off valves on the branch connection, are provided at intervals to ensure complete coverage of all facility structures, including the Full Tails Cylinder, Full Feed Cylinder, Full Product Cylinder, and Empty Cylinder Storage Pads Cylinder Storage Pads.

The fire pumps are separated from each other by fire-rated barrier construction. One fire pump is electric-motor driven and one is diesel engine-driven to avoid common mode failure (e.g., bad fuel). The electric fire pump is powered from a normal (non-diesel backed) power supply. A dedicated diesel fuel tank is provided in or adjacent to the fire pump building for the diesel-engine driven pump and is sized to provide a minimum eight hour supply of fuel in accordance with NFPA 20 (NFPA, 2007d). The diesel fuel tank will have suitable spill containment.

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. Use of start delay timers prevents simultaneous start of both pumps. Both pumps are maintained in the automatic start condition at all times, except during periods of maintenance and testing. Each fire pump controller interfaces with the site-wide fire alarm system, which is monitored and annunciated in the Control Room, for all alarm and trouble conditions required by NFPA 20 (NFPA, 2007d). Remote manual fire pump start switches are provided in the Control Room. Once activated, the fire pumps can only be shut-off at the pump controller location. Pumps, suction and discharge piping and valves are provided and arranged in accordance with NFPA 20 (NFPA, 2007d). The Fire Pump Building is provided with automatic sprinkler protection.

A jockey pump is provided in the Fire Pump Building to maintain pressure in the fire protection system during normal operation.

7.5.1.1.2 System Interfaces

The Fire Water Supply System interfaces with the site well water supply that supplies fill and make up water to the fire water supply storage tanks.

7.5.1.1.3 Safety Considerations

Failure of the Fire Water Supply System will not endanger public health and safety. The system is designed to assure water supply to automatic fire protection systems, standpipe systems and to 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 failure, electrical or mechanical.

7.5.1.2 Standpipe and Hose Systems

As required by the FHA, standpipe systems and interior fire hose stations are provided and installed in accordance with NFPA 14 (NFPA, 2007c) in the following locations:

- Class I standpipe systems for fire brigade and the offsite fire department use are provided in the stairwells of the Process Service Corridor of the SBMs and the stairwells in TSB and OSB.

The systems are designed to provide a minimum flow recommended by NFPA 14 (NFPA, 2007c) for class I standpipe systems. The standpipe risers are separated from the building sprinkler system risers. The separation ensures that a single impairment will not disable both the sprinklers and the hose systems. Standpipes will be routed in a manner and suitably designed against NPH criteria to ensure their failure will not result in flooding of areas containing enriched uranium above a critical mass.

The remaining structures and areas of the site are two stories or less in height and are reachable by fire hose extended from the outside fire hydrants or fire apparatus.

In addition to fixed standpipes, the EREF will be provided with fire hose on mobile apparatus and/or at strategic locations throughout the facility. The amount of hose provided will be sufficient to ensure that all points within the facility will be able to be reached by at least two 38 mm (1½-in) diameter attack hose lines and one 64 mm (2½-in) diameter backup hose line consistent with NFPA 1410 (NFPA, 2005b). These lines are intended for use by the offsite fire response agencies in the event of a structural fire. Hydraulic margin for these hose lines will be sufficient to ensure minimum nozzle pressures of 4.5 bar (65 psig) for attack hose line(s) and 6.9 bar (100 psig) for the backup hose line.

7.5.1.3 Portable Extinguishers

Portable fire extinguishers are installed throughout all buildings in accordance with NFPA 10 (NFPA, 2007a). Multi-purpose extinguishers are provided in general areas 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 (NFPA, 2007a). Specialized extinguishers are located in areas requiring protection of particular hazards. Supplemental fire extinguishers will be provided in water exclusion areas. In areas where water discharge is prohibited due to moderator control constraints, the preferred fire extinguisher agent is carbon dioxide due to its suitability for use on electrical equipment and lack of hydrogenous moderator.

7.5.1.4 Automatic Suppression Systems

Fire sprinkler systems are engineered to protect specific hazards in accordance with parameters established by the FHA. NFPA 801 (NFPA, 2008e) requires that fire sprinkler systems be provided for the nuclear related process areas of the facility except where determined unnecessary or inappropriate by the FHA. For the EREF, there are areas where sprinklers may be omitted or only provide partial coverage due to the need to mitigate the risk of criticality. In these cases, other controls to mitigate the impact of fire will be provided as required. The EREF FHA contains a methodology for comparative evaluation of fire risk and criticality risk. This methodology will be applied during detailed design to determine where sprinkler coverage should be limited or omitted and what other controls (i.e., alternate suppression, limitations on combustibles, etc.) should be applied.

The areas proposed for sprinkler system coverage are shown in Figure 7.5-2, Sprinkler System Coverage including notation of structures/areas where moderator control concerns may limit sprinkler application or coverage.

Automatic preaction sprinkler systems designed and tested in accordance with NFPA 13 (NFPA, 2007b) are provided in following buildings, subject to moderator control restrictions:

- Process Service Corridor in the Separations Building Module

- UF₆ Handling Area
- Technical Support Building
- Blending, Sampling and Preparation Building

Automatic wet pipe sprinkler systems, designed and tested in accordance with NFPA 13 (NFPA, 2007b) are provided in the following buildings:

- Administration Building
- Security and Secure Administration Building
- Long Term Warehouse
- Fire Pump Building
- Centrifuge Assembly Building
- Operation Support Building
- Short Term Warehouse

Water flow detection is provided to alarm and annunciate all sprinkler system actuations. Sprinkler system control valves are monitored under a periodic inspection program and their proper positioning is supervised in accordance with NFPA 801 (NFPA, 2008e) to ensure the systems remain operable.

7.5.1.5 Fire Detection Systems

Facility structures are provided with automatic fire detection installed in accordance with NFPA 72 (NFPA, 2007f) as required by the FHA or in accordance with the IBC (ICC, 2006). Automatic smoke, heat, or fire detectors are installed as appropriate to the hazard in all process structures as required by the FHA or in accordance with IBC (ICC, 2006) for early detection of fire conditions and/or to actuate preaction sprinkler valves to charge sprinkler piping in the protected areas.

All structures protected by wet-pipe sprinkler systems will have sprinkler water flow and other system conditions monitored and alarmed in accordance with NFPA 72 (NFPA, 2007f).

7.5.1.6 Manual Alarm Systems

All facility structures are provided with manual fire alarm pull stations installed in accordance with NFPA 72, (NFPA, 2007f), NFPA 101 [Life Safety Code] (NFPA, 2006b); and as required by the FHA.

7.5.1.7 Fire Alarm System

Each building of the facility is monitored by a local fire alarm control panel (LFACP) installed in accordance with NFPA 72 (NFPA, 2007f). Each panel has a dual power supply, consisting of normal building power and backup power by either 24-hour battery or the facility UPS. The method of backup power will be determined in final design. Activation of a fire detector, manual pull station or water flow device results in an audible and visual alarm at the building control panel and the main fire alarm control panel.

The main fire alarm control panel (MFACP), located in the Control Room, is a listed, microprocessor-based addressable console connected via data highway to each individual

LFACP. The MFACP has dual power supplies, consisting of normal building power and backup power by either 24-hour battery or the facility UPS. The method of backup power will be determined in final design. The MFACP monitors all functions associated with the individual building alarm panels and the fire pump controllers. All fire alarms, suppression system actuation alarms, supervisory alarms, and trouble alarms are audibly and visually annunciated by the MFACP and automatically recorded via printout. Failure of the MFACP will not result in failure of any building's LFACP and its associated local control functions (e.g., releasing or local alarming).

All fire pump alarm and trouble conditions are monitored by the MFACP through the fire pump controllers and annunciated in accordance with NFPA 20 (NFPA, 2007d).

7.5.2 Fire Emergency Response

7.5.2.1 Fire Brigade

The facility maintains a fire brigade made up of employees trained in fire prevention, fire fighting techniques, first aid procedures, emergency response, and criticality safety. The fire brigade is organized, operated, trained and equipped in accordance with NFPA 600 (NFPA, 2005a). The criticality safety training addresses water moderation, water reflection, product cylinder safety by moderation control, and water flooding. The fire brigade is considered an incipient fire brigade as classified under NFPA 600, e.g., not required to wear thermal protective clothing nor self-contained breathing apparatus during firefighting. The intent of the facility fire brigade is to respond and control minor fires and provide first response and supplement the offsite fire department for any major fire at the plant. The fire brigade members are trained and equipped to respond to all fire emergencies and take first response actions until the offsite fire department arrives. First response firefighting by the brigade includes using hand portable or wheeled fire extinguishers and advancing hoselines to fight interior/exterior incipient fires and to fight larger exterior fires in a defensive mode (e.g., vehicle fires). Fire brigade members will not perform firefighting where conditions warrant structural firefighting gear.

When the local fire department arrives onsite, the local fire department assumes control and is responsible for all fire fighting activities. The plant fire brigade, working with the plant's Emergency Operations Center, will coordinate offsite fire department activities to ensure moderator control and criticality safety. The fire brigade is staffed so that there are a minimum of five fire brigade members available per shift. The fire brigade includes a safety officer who is responsible to ensure that moderator control and criticality safety are maintained during firefighting activities.

Periodic training is provided to offsite assistance organization personnel in the facility emergency planning procedures. Facility emergency response personnel meet at least annually with each offsite assistance group to accomplish training and review items of mutual interest including relevant changes to the program. This training includes facility tours, information concerning facility access control (normal and emergency), potential accident scenarios, emergency action levels, notification procedures, exposure guidelines, personnel monitoring devices, communications, contamination control, moderator control issues, and the offsite assistance organization role in responding to an emergency at the facility, as appropriate.

7.5.2.2 Offsite Organizations

AES will use the services of local offsite fire departments to supplement the capability of the facility Fire Brigade. The primary agency that will be available for this response is the City of

Idaho Falls, Idaho Fire Department. This agency is a signatory to the Bonneville County Mutual Aid agreement and can request assistance from other signatory agencies including adjacent municipal fire departments and the fire/emergency response services of the US Department of Energy's Idaho National Laboratory as warranted. A letter has been received from the Bonneville County Fire Protection District #1 (which includes response by the Idaho Falls Fire Department) including a commitment to fire protection and emergency response to the EREF. The training and conduct of emergency drills is discussed in the EREF Emergency Plan.

AES has performed a baseline needs assessment evaluating the response to fires and related emergencies to confirm adequacy of the response considering both facility resources and response of the primary response agencies. This assessment identified that adequate response is available.

The Idaho Falls Fire Department is comprised of a roster of approximately 100 paid personnel – 24 response personnel per shift staffing five fire stations in a three-shift rotation. The department has five front-line engine companies (pumpers) and five in reserve, one 30 m (100 ft) telescoping platform, one heavy rescue truck and four light duty rescue/wildland trucks, three water tenders [6813 L (1800 gal), 11,356 L (3000 gal), and 12,114 L (3200 gallon)] tankers, one hazmat response vehicle, several command vehicles and ten ambulances equipped to provide advanced level life support. Six ambulances are staffed per shift with four in reserve.

All emergency response personnel are required to be a minimum Firefighter Level I and EMT – Basic per Idaho standard. Shift assigned ambulance personnel are qualified as Intensive Care Paramedics per Idaho standards.

The estimated response time to the EREF for a basic life support ambulance is 26 minutes with a second ambulance available within an additional one to three minutes. EREF personnel will be trained and equipped to provide first aid and circulatory/respiratory support in the interim (e.g., provide CPR, apply automatic external defibrillation, and administer oxygen). The estimated response time to EREF for a structural fire engine and full structural crew is 28 minutes with a second engine company within an additional one to three minutes. The initial response for a structural first alarm would be three engines, a rescue truck, an ambulance, and a staff officer. In the event of a fire, the EREF fire brigade will respond and the Idaho Falls Fire Department will be notified to respond. If the fire is incipient, the EREF fire brigade will fight the fire utilizing hand portable/wheeled fire extinguishers and/or 38 mm (1½-in) hose lines. If a structural response becomes necessary, 38 mm (1½-in) and/or 64 mm (2½-in) hose lines from facility standpipes or hydrants to the nearest points to the fire will be extended by the EREF fire brigade, where it can be done safely. The latter activity will minimize deployment time for the offsite responders upon their arrival. Given the presence of automatic fire sprinklers in the process areas and other occupied facility structures, it is unlikely that a rapid structural response for fire suppression or occupant rescue would be required.

To ensure that application of water or other firefighting activities are consistent with moderator concerns for criticality safety, the EREF fire brigade safety officer is trained and equipped to don structural firefighting gear and will accompany offsite responders to the firefighting location. A minimum of two individuals qualified to serve as the EREF fire brigade safety officer will be onsite during plant operation.

In order to respond to airborne release emergencies or other chemical incidents, EREF will also maintain hazardous material response capability. This is further described in SAR Section 6.4.8, Emergency Planning.

Through a combination of onsite capability, offsite responders, or through contract arrangements, AES will ensure that capabilities are in place to respond to other events such as

confined space rescue, trench rescue, high angle rescue, and other technical emergencies as required. The EREF fire brigade/emergency response team equipment will be inventoried, inspected and tested in accordance with recognized standards. Final needs for these response areas and response equipment will be reassessed after detailed facility design to ensure adequate response capabilities are in place and training completed prior to any construction activities.

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**Figure 7.3-1, Separations Building Module/UF₆ Handling Area Basement Fire Barriers
contains Security-Related Information
Withheld from Disclosure under 10 CFR 2.390**

**Figure 7.3-2, Separations Building Module/UF₆ Handling Area First Floor Fire Barriers
contains Security-Related Information
Withheld from Disclosure under 10 CFR 2.390**

**Figure 7.3-3, Separations Building Module/UF₆ Handling Area Second Floor Fire Barriers
contains Security-Related Information
Withheld from Disclosure under 10 CFR 2.390**

**Figure 7.3-4, Separations Building Module/UF₆ Handling Area Roof Fire Barriers
contains Security-Related Information
Withheld from Disclosure under 10 CFR 2.390**

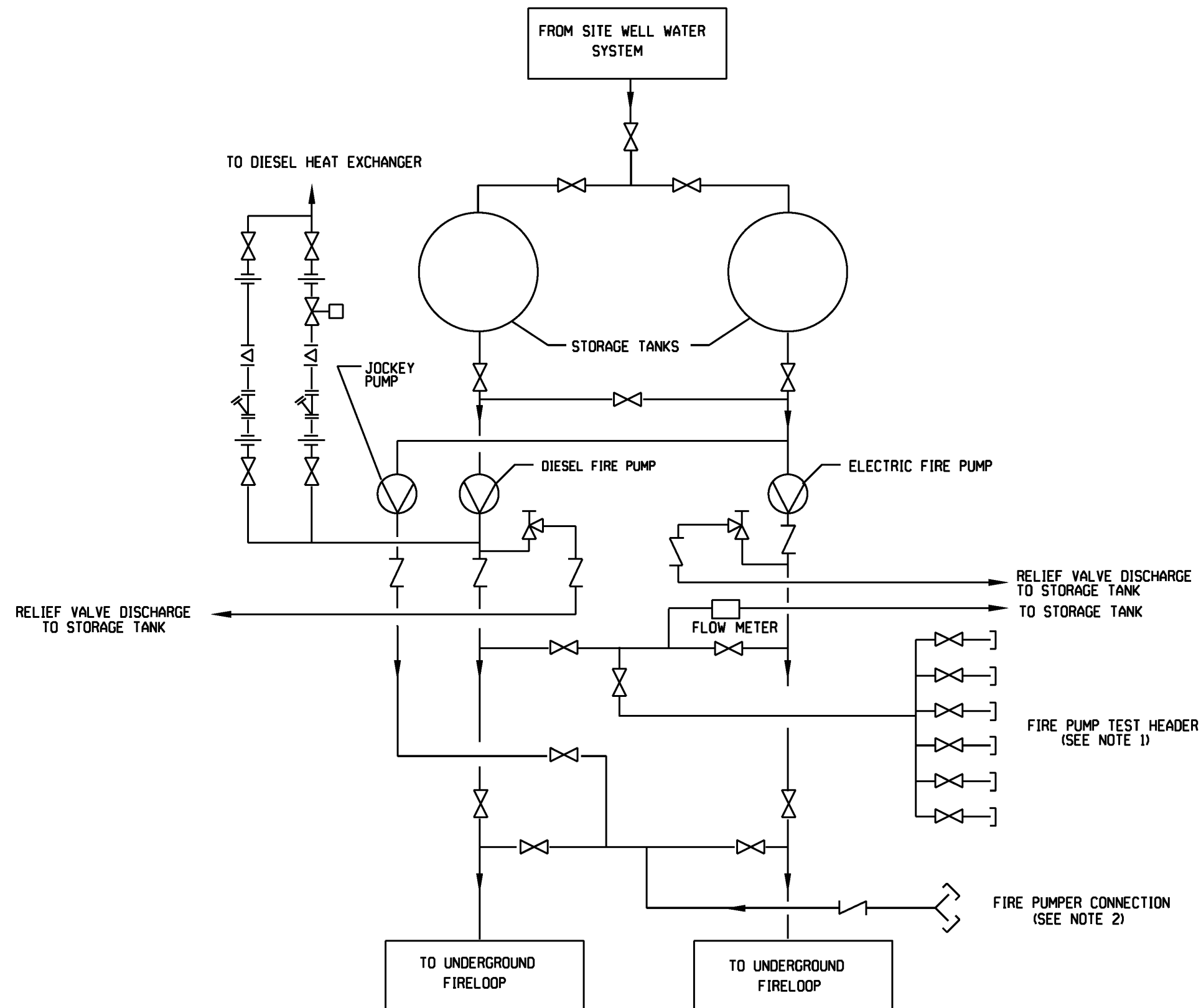
**Figure 7.3-5, Blending, Sampling and Preparation Building Fire Barriers
contains Security-Related Information
Withheld from Disclosure under 10 CFR 2.390**

**Figure 7.3-6, Technical Support/Operation Support Building First Floor Fire Barriers
contains Security-Related Information
Withheld from Disclosure under 10 CFR 2.390**

**Figure 7.3-7, Technical Support/Operation Support Building Second Floor Fire Barriers
contains Security-Related Information
Withheld from Disclosure under 10 CFR 2.390**

**Figure 7.3-8, Technical Support/Operation Support Building Third Floor Fire Barriers
contains Security-Related Information
Withheld from Disclosure under 10 CFR 2.390**

**Figure 7.5-1 (Sheet 1 of 2), Exterior Fire Protection System Overall Site Plan
contains Security-Related Information Withheld from Disclosure under 10 CFR 2.390**



NOTES

1. SIX 85 MM (2½IN.) HOSE CONNECTIONS FOR FIRE PUMP DISCHARGE TEST.
2. STANDARD FIRE DEPARTMENT CONNECTION WITH TWO HOSE INLETS WITH PLUGS AND CHAIN.

FIRE PROTECTION - LEGEND

	VALVE
	CHECK VALVE
	RELIEF VALVE
	STRAINER
	REGULATOR VALVE
	SOLENOID VALVE
	UNION
	FLOW DIRECTION

FIGURE 7.5-1 **Rev. 2**
 EXTERIOR FIRE PROTECTION
 SYSTEM OVERALL SITE PLAN
 SHEET 2 OF 2
EAGLE ROCK ENRICHMENT FACILITY
SAFETY ANALYSIS REPORT

**Figure 7.5-2, Sprinkler System Coverage, contains Security-Related Information
Withheld from Disclosure under 10 CFR 2.390**