10.11 FIRE PROTECTION

The fire protection program is based on the NRC requirements and guidelines, Nuclear Electric Insurance Limited (NEIL) Property Loss Prevention Standards and related industry standards. With regard to NRC criteria, the fire protection program meets the requirements of 10 CFR 50.48(c), which endorses, with exceptions, the National Fire Protection Association's (NFPA) 805, "Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants – 2001 Edition." BFN has further used the guidance of NEI 04-02, "Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program under 10 CFR 50.48(c)" as endorsed by Regulatory Guide 1.205, "Risk-Informed, Performance Fire Protection for Existing Light-Water Nuclear Power Plants."

Adoption of NFPA 805, "Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants", 2001 Edition in accordance with 10 CFR 50.48(c) serves as the method of satisfying 10 CFR 50.48(a) and General Design Criterion 3. Prior to adoption of NFPA 805, General Design Criterion 3, "Fire Protection" of Appendix A, "General Design Criteria for Nuclear Power Plants," to 10 CFR Part 50, "Licensing of Production and Utilization Facilities," was followed in the design of safety and non-safety related structures, systems, and components, as required by 10 CFR 50.48(a).

NFPA 805 does not supersede the requirements of GDC 3, 10 CFR 50.48(a), or 10 CFR 50.48(f). Those regulatory requirements continue to apply. However, under NFPA 805, the means by which GDC 3 or 10 CFR 50.48(a) requirements are met may be different than under 10 CFR 50.48(b). Specifically, whereas GDC 3 refers to SSCs important to safety, NFPA 805 identifies fire protection systems and features required to meet the Chapter 1 performance criteria through the methodology in Chapter 4 of NFPA 805. Also, under NFPA 805, the 10 CFR 50.48(a)(2)(iii) requirement to limit fire damage to SSCs important to safety so that the capability to safely shut down the plant is satisfied by meeting the performance criteria in Section 1.5.1 of NFPA 805.

A Safety Evaluation was issued on October 28, 2015, by the NRC, that transitioned the existing fire protection program to a risk-informed, performance-based program based on NFPA 805, in accordance with 10 CFR 50.48(c).

10.11.1 Design Basis Summary

10.11.1.1 Defense-in-Depth

The fire protection program is focused on protecting the safety of the public, the environment, and plant personnel from a plant fire and its potential effect on safe reactor operations. The fire protection program is based on the concept of defense-

in-depth. Defense-in-depth shall be achieved when an adequate balance of each of the following elements is provided:

(1) Preventing fires from starting;
(2) Rapidly detecting fires and controlling and extinguishing promptly those fires that do occur, thereby limiting fire damage; and
(3) Providing an adequate level of fire protection for structures, systems, and components important to safety, so that a fire that is not promptly extinguished will not prevent essential plant safety functions from being performed.

10.11.1.2 NFPA 805 Performance Criteria

The design basis for the fire protection program is based on the following nuclear safety and radiological release performance criteria contained in Section 1.5 of NFPA 805:

- Nuclear Safety Performance Criteria. Fire protection features shall be capable of providing reasonable assurance that, in the event of a fire, the plant is not placed in an unrecoverable condition. To demonstrate this, the following performance criteria shall be met.

  (a) Reactivity Control. Reactivity control shall be capable of inserting negative reactivity to achieve and maintain subcritical conditions. Negative reactivity inserting shall occur rapidly enough such that fuel design limits are not exceeded.

  (b) Inventory and Pressure Control. With fuel in the reactor vessel, head on and tensioned, inventory and pressure control shall be capable of maintaining or rapidly restoring reactor water level above top of active fuel such that fuel clad damage as a result of a fire is prevented.

  (c) Decay Heat Removal. Decay heat removal shall be capable of removing sufficient heat from the reactor core or spent fuel such that fuel is maintained in a safe and stable condition.

  (d) Vital Auxiliaries. Vital auxiliaries shall be capable of providing the necessary auxiliary support equipment and systems to assure that the systems required under (a), (b), (c), and (e) are capable of performing their required nuclear safety function.

  (e) Process Monitoring. Process monitoring shall be capable of providing the necessary indication to assure the criteria addressed in (a) through (d) have

been achieved and are being maintained.

- Radioactive Release Performance Criteria. Radiation release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) shall be as low as reasonably achievable and shall not exceed applicable 10 CFR, Part 20, Limits.

Chapter 2 of NFPA 805 establishes the process for demonstrating compliance with NFPA 805.

Chapter 3 of NFPA 805 contains the fundamental elements of the fire protection program and specifies the minimum design requirements for fire protection systems and features.

Chapter 4 of NFPA 805 establishes the methodology to determine the fire protection systems and features required to achieve the nuclear safety performance criteria outlined above. The methodology shall be permitted to be either deterministic or performance-based. Deterministic requirements shall be "deemed to satisfy" the performance criteria, defense-in-depth, and safety margin and require no further engineering analysis. Once a determination has been made that a fire protection system or feature is required to achieve the nuclear safety performance criteria of Section 1.5, its design and qualification shall meet the applicable requirement of Chapter 3.

10.11.1.3 Codes of Record

The codes, standards and guidelines used for the design and installation of plant fire protection systems are as follows: (for specific applications and evaluations of codes refer to the Fire Protection Report)

a) American National Standards Institute (ANSI)
b) American Society for Testing Materials (ASTM)
c) Factory Mutual (FM) Research Fire Protection Equipment Approval Guide
d) Institute of Electrical and Electronic Engineers (IEEE)
    - IEEE 383 – 1974, Standard for Type Test of Class 1E Electric Cables, Field Splices, and Connections for Nuclear Power Generating Stations
    - IEEE 384 – 1974, Criteria for Separation of Class 1E Equipment
    - IEEE 634 – 1978, Standard Cable Penetration Fire Stop Qualification Test
e) National Fire Protection Association (NFPA)
    - NFPA 10 – 1967 Ed., Installation of Portable Fire Extinguishers
    - NFPA 12 – 1966 Ed., Carbon Dioxide Extinguishing Systems
    - NFPA 13 – 1985 Ed., Standard for the Installation of Sprinkler Systems (Control Bay and Intake Pumping Station)

- NFPA 13 – 1987 Ed., Standard for the Installation of Sprinkler Systems (Unit 2 Reactor Building and Units 1, 2, 3 Battery and Battery Board Rooms)
- NFPA 13 – 1991 Ed., Standard for the Installation of Sprinkler Systems (Unit 3 Reactor Building, Units 2 & 3 HPCI Rooms, and Cable Spreading Rooms A & B)
- NFPA 13 – 2002 Ed., Standard for the Installation of Sprinkler Systems (Unit 1 Reactor Building and Unit 1 HPCI Room)
- NFPA 14 – 1986 Ed., Standpipe and Hose Systems
- NFPA 15 – 1985 Ed., Standard for Water Spray Fixed Systems for Fire Protection
- NFPA 15 – 2001 Ed., Standard for Water Spray Fixed Systems for Fire Protection
- NFPA 20 – 1987 Ed., Standard for the Installation of Stationary Pumps for Fire Protection
- NFPA 20 – 1999 Ed., Standard for the Installation of Stationary Pumps for Fire Protection
- NFPA 22 – 1971 Ed., Standard for Water Tanks for Private Fire Protection
- NFPA 24 – 1984 Ed., Standard for the Installation of Private Fire Service Mains
- NFPA 30 – 1969 Ed., Flammable and Combustible Liquids Code
- NFPA 50A – 1984 Ed., Standard for Gaseous Hydrogen at Consumer Sites
- NFPA 72 – 1990 Ed., Standard for the Installation, Maintenance, and Use of Protective Signaling Systems
- NFPA 72 – 2002 Ed., Standard for the Installation, Maintenance, and Use of Protective Signaling Systems
- NFPA 80 – 1986 Ed., Standard for Fire Doors and Fire Windows
- NFPA 80 – 1992 Ed., Standard for Fire Doors and Fire Windows
- NFPA 90A – 1989 Ed., Standard for Installation of Air Conditioning and Ventilating Systems
- NFPA 600 – 2000 Ed., Standard on Industrial Fire Brigades
- NFPA 805 – 2001 Ed., Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants

10.11.2 System Description

10.11.2.1 Required Systems

Nuclear Safety Capability Systems, Equipment, and Cables

Section 2.4.2 of NFPA 805 defines the methodology for performing the nuclear safety capability assessment. The systems, equipment and cables required for the nuclear safety capability assessment are contained in TVA calculation EDQ099920110010, NFPA 805 – Nuclear Safety Capability Analysis.

Fire Protection Systems and Features

Chapter 3 of NFPA 805 contains the fundamental elements of the fire protection program and specifies the minimum design requirements for fire protection systems and features. Compliance with Chapter 3 is documented in the Fire Protection Report.

Chapter 4 of NFPA 805 establishes the methodology and criteria to determine the fire protection systems and features required to achieve the nuclear safety performance criteria of Section 1.5 of NFPA 805. These fire protection systems and features shall meet the applicable requirements of NFPA 805 Chapter 3. These fire protection systems and features are documented in the Fire Protection Report.

Radioactive Release

Structures, systems, and components relied upon to meet the radioactive release criteria are documented in the Fire Protection Report.

10.11.2.2 Definition of “Power Block” Structures

Where used in NFPA 805 Chapter 3 the terms “Power Block” and “Plant” refer to structures that have equipment required for nuclear plant operations. For the purposes of establishing the structures included in the fire protection program in accordance with 10 CFR 50.48(c) and NFPA 805, the plant structures listed in Table 10.11-1 are considered to be part of the ‘Power Block’.

10.11.3 Safety Evaluation

The Fire Protection Report documents the achievement of the nuclear safety and radioactive release performance criteria of NFPA 805 as required by 10 CFR 50.48(c). This document fulfills the requirements of Section 2.7.1.2 “Fire Protection Program Design Basis Document” of NFPA 805. The document contains the following:

- Identification of significant fire hazards in the fire area. This is based on NFPA 805 approach to analyze the plant from an ignition source and fuel package perspective.
- Summary of the Nuclear Safety Capability Assessment (at power and non-power) compliance strategies.
  - Deterministic compliance strategies

  - Performance-based compliance strategies (including defense-in-depth and safety margin)
- Summary of the Non-Power Operations Modes compliance strategies.
- Summary of the Radioactive Release compliance strategies.
- Summary of the Fire Probabilistic Risk Assessments.
- Key analysis assumptions to be included in the NFPA 805 monitoring program.

10.11.4 Fire Protection Program Documentation, Configuration Control and Quality Assurance

In accordance with Chapter 3 of NFPA 805 a fire protection plan documented in FPDP-6 defines the management policy and program direction and defines the responsibilities of those individuals responsible for the plan's implementation. TVA procedure FPDP-6:

- Designates the senior management position with immediate authority and responsibility for the fire protection program.
- Designates a position responsible for the daily administration and coordination of the fire protection program and its implementation.
- Defines the fire protection interfaces with other organizations and assigns responsibilities for the coordination of activities.
- Identifies the appropriate authority having jurisdiction for the various areas of the fire protection program.
- Identifies the procedures established for the implementation of the fire protection program, including the post-transition change process and the fire protection monitoring program.
- Identifies the qualifications required for various fire protection program personnel.
- Identifies the quality requirements of Chapter 2 of NFPA 805.

Detailed compliance with the programmatic requirements of Chapter 3 of NFPA 805 are contained in the Fire Protection Report**.**