Conception of Fire Protection

**Purpose of NPP Fire Protection**
- Nuclear Safety
- Radioactive Release
- Life Safety
- Plant Damage/Business Interruption

**Defense-in-Depth Philosophy for Fire Protection**
- Multiple independent & redundant layers of defense
- PREVENTION: Prevent fires from starting
- SUPPRESSION: Rapidly detect, effectively control, and promptly extinguish those fires that do occur.
- MITIGATION: Protect structure, system, and components important to safety so that a fire that is not promptly extinguished by suppression activities will not prevent the safe shutdown of facility.
- Design fire protection system such that their failure or inadvertent operation does not adversely impact the ability of SSCs to perform their safety functions.

---

Background

**Fire Protection Regulation for NPP in Korea**

HAN Yu Lee
Hanul Unit 1,2 of Korea Hydro & Nuclear Co., Ltd, Republic of Korea

**Summary**

Purpose of NPP fire protection at NPP in Korea is to minimize both probability of occurrence and consequence of fire. To meet this objective, operating plants are designed to provide reasonable assurance through defense in depth. The ultimate goal is nuclear safety and radioactive release to be minimized in event of a fire. The Korean regulatory framework for nuclear plants is based on number for US regulations and supporting guidelines. In accordance with Korea nuclear regulation Atomic Energy include fire protection program to protect structure, system and component important to safety. It also states about requirement for Fire Hazard Analysis and fire prevention, fire detection system and suppression, building design and etc.

---

**Fire Protection Regulation for NPP in US**

**Federal Regulation**

- Operated before 1979. 1. 1
- Operated after 1979. 1. 1
- PRESENT

- 10CFR 50.48(b) (1980. 10)
- 10CFR 50.48(a) (1980. 10)
- 10CFR 50 App.A GDC 3(1971. 2)
- 10CFR 50 App.A GDC 3(1980. 10)
- 10CFR 50 App.R GDC 3(1971. 2)
- 10CFR 50 App.R GDC 3(1980. 10)
- 10CFR 50.48(c) (2004. 7)

**Guidelines**

- BTP APCSB 9.5-1 (1975. 5)
- BTP CMEB 9.5-4 (1981. 7)
- BTP SLPB 9.5-1 (2003. 12)
- R.G. 1.189 (2001. 4)
- R.G. 1.205 (2006. 3)

**Industrial Standards**

- NFPA 803 (1978)
- NFPA 805 (2001. 1)
- NFPA 804 (1995. 8)
- NFPA 804 (1995. 8)
Fire protection Regulation for NPP in Korea

**Domestic Law**
- Nuclear Safety and Security Commission (NSSC)
- The Building Law

**International Law**
- National Emergency Management (NEMA)
- The Building Law
- NFPA RCC-I

Fire Protection Programs (FPP) in KHNP

**Organization, Staffing Responsibilities**
- Describe the organizational structure and responsibilities for its establishment and implementation
- Program management
- Fire protection staffing and qualification
- Engineering and modification
- Inspection, testing and maintenance of fire protection SSCs
- Fire prevention, emergency response

**Fire Protection Training And Qualification**
- Training and Experience in fire protection and in nuclear plant safety
- Fire brigade training and Qualification
- General employee training
- Appropriate action to take upon discovering a fire, etc.
- Watch training

**Fire Hazard Analysis**
- Perform to demonstrate that the plant will maintain the ability to perform safe-shutdown functions and minimize radioactive materials
- Release to the environment in the event of a fire
- Consider potential in situ and transient fire hazards
- Determine the effects of a fire to safely shutdown
- Specify measures for fire prevention, fire detection, fire suppression, and fire containment for each fire area containing SSCs important to safety

**Safe Shutdown Analysis**
- Identify safe shutdown components
- Circuits
- Demonstrate capability of safe shutdown

Approach for fire safety

**Deterministic Fire Protection**
- Ensuring system needed shut down
- System-based tool for considering fire
  (Rather than today's more detailed component based information)
- 10CFR50.48(b) Appendix R of 10CFR 50
- REG guide1.189

**Deterministic Post Fire Safe Shutdown Over View**
- NEI00-01 Guidance for Post-Fire Safe Shutdown Circuit Analysis
- Figure 1-2 Deterministic Post-fire Safe Shutdown Overview

Risk-informed performance-based fire protection
- Risk Insights
  Rely on required outcome
  (rather than a specific process or technique to achieve outcome)
- 10CFR50.48(c)
- NFPA850
- REG guide1.205
- Approval: Shearon Harris Plant in North Carolina, in June 2010
- Oconee plant in South Carolina, in Dec, 2010

Fire Modeling
- Hand Calculations
- Two-Zone Models
- CFD

- $T_f - T_a = 6.85 \left( \frac{Q}{A_{th} \cdot \Delta T} \right)^{0.15}$
- McCohey, Quembre, noncondens (K04)
- COAST: NIST
- EDF: NIST