



Fact Sheet

United States Nuclear Regulatory Commission
Office of Public Affairs
Washington DC 20555
Telephone: 301/415-8200 E-mail: opa@nrc.gov

Nuclear Power Plant Fire Protection

Background

A fire at the Browns Ferry Nuclear Power Plant, on March 22, 1975, was a pivotal event that brought fundamental change to fire protection and its regulation in the U.S. nuclear power industry. The fire started when plant workers in the cable spreading room used a candle to test for air leakage through a non-fire-rated (i.e. polyurethane foam) penetration seal that led to the reactor building. The fire ignited both the seal material and the electrical cables that passed through it, and burned for almost 7 hours before it was extinguished. More than 1600 cables were affected and, of those, 628 were important to safety.

The fire damaged electrical power, plant control systems, and instrumentation cables that impaired the functioning of both the normal and standby reactor cooling systems, and affected the plant monitoring capability for the operators. Given the loss of many safety systems, the plant operators had to perform emergency repairs in order to restore the plant's systems needed to place the reactor in a safe shutdown condition.

The investigations that followed the Browns Ferry fire identified significant deficiencies, both in the design of fire protection features at nuclear power plants and in the plant procedures for responding to a fire event. The investigators concluded that the occupant safety and property protection concerns of fire insurance companies did not sufficiently encompass nuclear safety issues, especially in terms of the potential for fire damage to cause the failure of redundant divisions of systems and components important for safe reactor shutdown. Following the Browns Ferry fire the Commission revised its fire protection regulations to address the identified deficiencies related to the nuclear safety issues.

Discussion

Today the fire protection programs at U.S. nuclear power plants have the primary goals of minimizing both the probability of occurrence, and consequences of fire. To meet these goals, the fire protection programs for operating nuclear power plants are designed to provide reasonable assurance that a fire will not prevent the performance of necessary safe shutdown functions and

will not significantly increase the risk of radioactive releases to the environment. The primary fire protection program objectives for operating reactors are to:

- Prevent fires from starting,
- Detect, rapidly control, and promptly extinguish those fires that do occur, and
- Protect structures, systems, and components important to safety so that a fire that is not promptly extinguished will not prevent the safe shutdown of the plant.

The fire protection program objectives at plants that have permanently ceased operations are to:

- Reasonably prevent fires from occurring,
- Rapidly detect, control and extinguish those fires that do occur that could result in a radiological hazard, and
- Ensure that the risk of fire-induced radiological hazards to the public, environment and plant personnel is minimized.

Current Status

The NRC staff continues to monitor individual licensee actions to address plant-specific fire protection technical issues through its reactor oversight program, and to work with the nuclear industry representatives to resolve generic fire protection concerns. The generic fire protection concerns that the staff is currently addressing include:

- Risk-informing circuit failure inspections; and
- Performance of fire barriers that protect cables and equipment for safely shutting down the reactor.

The NRC is pursuing a rulemaking to permit the use of feasible operator actions, meeting certain acceptance criteria, in lieu of installed fire protection systems or features to safely shut down the reactor following a fire.

The NRC is also pursuing a rulemaking to endorse National Fire Protection Association (NFPA) Standard 805, "Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants" as a risk-informed, performance-based voluntary alternative to the current fire protection requirements for existing plants.

The NRC is revising its significance determination process that is used to evaluate the significance of findings related to fire protection.

NRC Generic Communications on Fire Protection

The following Information Notices (IN) have been issued recently to inform plant owners of fire protection problems or developments that could affect their plant.

IN 2002-01, "Metalclad Switchgear Failures and Consequent Losses of Offsite Power," Jan. 8, 2002.

IN 2002-04, "Wire Degradation at Breaker Cubicle Door Hinges," January 10, 2002.

IN 2002-07, "Use of Sodium Hypochlorite for Cleaning Diesel Fuel Oil Supply Tanks,"
January 28, 2002.

IN 2002-15, "Hydrogen Combustion Events in Foreign BWR Piping," April 12, 2002.

IN 2002-24, "Potential Problems With Heat Collectors on Fire Protection Sprinklers,"
July 19, 2002.

IN 2002-27, "Recent Fires at Commercial Nuclear Power Plants in the United States,"
September 20, 2002.

IN 2003-08, "Potential Flooding Through Unsealed Concrete Floor Cracks," June 25, 2003.

IN 2003-19, "Unanalyzed Condition of Reactor Coolant Pump Seal Leakoff Line During
Postulated Fire Scenarios or Station Blackout," October 6, 2003.

NRC Regulations and Guidelines

The NRC's regulations and supporting guidelines for nuclear plant fire protection include, but are not limited to: Title 10 of the Code of Federal Regulations (10 CFR)–Part 50 Appendix A General Design Criterion 3, Part 30.48, and Part 50 Appendix R; regulatory guides 1.189 and 1.191; generic communications (e.g., Generic Letters, Bulletins, Regulatory Information Summaries and Information Notices); NUREG reports; Standard Review Plant (NUREG-0800) and associated Branch Technical Positions; and industry standards.

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