U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

The Browns Ferry Nuclear Plant Fire of 1975 Knowledge Management Digest

NUREG/KM-0002
May 2013
Office of Nuclear Regulatory Research

Table of Contents

Introduction 1

Facts about the Browns Ferry Nuclear Plant Fire 2

Impact of the Browns Ferry Nuclear Plant Fire 3

Timeline of the Regulatory Changes in Fire Protection due to the Browns Ferry Nuclear Plant Fire 4

DVD Topics 5

Questions and Answers 6

Note: NUREG/KM-0002 supersedes NUREG/BR-0361

(TVA file photo)

The The three-Unit Browns Nuclear Power Plant, Limestone County, AL, owned and operated by the Tennessee Valley Authority

Introduction

Fire events provide a unique source of historical data, but only when the lessons learned provide advancements in safety. When these lessons are learned but not preserved, they are often repeated.

The purpose of this knowledge management NUREG (NUREG/KM) and DVD is to preserve the history and impact of the fire at the Browns Ferry Nuclear Plant (BFN) on regulations and to educate future generations of safety professionals. This is the second report in the NUREG/KM-Series.

Fire protection in commercial nuclear power plants (NPPs) has been a longstanding challenge since operations began. In the 1960s and 1970s, when most of today's nuclear power reactors were under construction, the U.S. Nuclear Regulatory Commission's (NRC's) predecessor—the Atomic Energy Commission—began adopting rules and regulations to ensure fire safety. The first adopted fire protection regulation was General Design Criterion (GDC) 3, "Fire Protection," as Appendix A, "General Design Criteria for Nuclear Power Plants," of "Title 10 of the Code of Federal Regulations (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities," in February 1971. The GDC 3, in part, states that:

> *Structures, systems, and components important to safety shall be designed and located to minimize, consistent with other safety requirements, the probability and effect of fires and explosions. Noncombustible and heat-resistant materials shall be used wherever practical throughout the unit, particularly in such locations as the containment and control room.*

(TVA file photo)

Aerial view of Browns Ferry Nuclear Plant

During this time, the Institute of Electrical and Electronics Engineers (IEEE) also developed several standards for fire protection safety in the nuclear industry. These first standards were:

- IEEE 279-1971, "Criteria for Protection Systems for Nuclear Power Generating Stations"
- IEEE 383-1974, "IEEE Standard for Type Test of Class 1E Electric Cables, Field Splices, and Connections for Nuclear Power Generating Stations"
- IEEE 384-1974, "IEEE Standard Criteria for Independence of Class 1E Equipment and Circuits"

The NRC issued Regulatory Guide 1.75, "Physical Independence of Electric Systems," in February 1974, and provided the basis for complying with the IEEE 384-1974 standard.

Facts about the Browns Ferry Nuclear Plant Fire

The Energy Reorganization Act of 1974 established the NRC as a regulatory agency. The BFN fire occurred 3 months after the NRC began operations in January 1975.

Picture of Browns Ferry Fire Cable Spreading Room. Note the melted aluminum electrical cable conduit.

- The fire started at BFN on March 22, 1975, by a worker using a lit candle to check for air leaks. This risky action ignited a temporary polyurethane cable penetration seal.
- The fire quickly spread into the polyurethane seal and cables, causing significant damage to the cable spreading room and Unit 1 reactor building.
- The fire at BFN forever changed how the NRC and industry view the threat of fire to safe NPP operations.

Impact of the Browns Ferry Nuclear Plant Fire

The BFN fire prompted a new series of fire protection regulations. The NRC published NUREG-0050, "Recommendations Related to Browns Ferry Fire," in February1976. In response to the recommendations, the NRC developed the Branch Technical Position (BTP) Auxiliary Power Conversion Systems Branch (APCSB) 9.5-1 in May 1976, and its Appendix A, "Guidelines for Fire Protection for Nuclear Power Plants Docketed Prior to July 1, 1976," in February 1977. Appendix A uses the IEEE 383-1974 standard as a basis for flame spread, and to this date it is the electrical cable flame spread standard used in regulations. In November 1980, the NRC published 10 CFR 50.48, "Fire Protection," and Appendix R, "Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979," to 10 CFR Part 50 (effective February 1981).

Picture of TVA Browns Ferry seal penetration tests

The BFN fire was the first major challenge that the newly formed NRC had to face. Today, with a renewed interest in building new nuclear power plants and development of new materials and technology, fire protection continues to face challenges.

Timeline of the Regulatory Changes in Fire Protection due to the BFN Fire

BFN (Source: www.tva.gov)

TMI (Source: NARA)

- May/10/1967: BFN Unit 1 and 2 CP issued
- Jul/31/1968: Unit 3 CP issued
- Aug/1/1974: BFN Unit 1 Comm. Op.
- Aug/2/1974: BFN Unit 2 OL issued
- Mar/22/1975: BFN Fire at Unit 1
- May/1976: NRC publishes BTP 9.5-1
- June/1976: RG 1.120 issued for public comment (withdrawn in 2001)
- Aug/1976: App. A to BTP 9.5-1 is published (revised on Feb/1977)
- Sep/1976: Unit 1 2 restart Comm. Op.
- Mar/1979: TMI NPP accident
- Feb. 1974: Reg. Guide 1.75
- 1975/76: TVA cable fire tests

1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980

- Dec/20/1973: BFN Unit 1 OL issued
- Feb/1976: NUREG 0050
- Aug/18/1976: Unit 3 OL issued (Comm. Op. in Mar/1/1977)
- Nov/1980: 10 CFR 50.48 and App. R are added to 10 CFR Part 50 (Pub. Nov/1980; Effective Feb/1981)
- Feb/1971: AEC adds App. A to 10CFR50
- 1974: IEEE 383-1974 and 384-1974
- Sep/1975: Congressional Hearings on BFN Fire
- 1980s Commission Public Meetings and discussions on Fire Protection
- 1974: The Energy Reorganization Act of 1974 establishes the U.S. NRC
- Mar/1/1975: BFN Unit 2 Comm. Op.
- 1971: IEEE 279-1971
- Jan/1975: NRC begins operations
- 1982: Connecticut Light and Power Company vs. U.S. NRC legal challenges

Abbreviations:
BTP - Branch Technical Position
CFR - Code of Federal Regulations
Comm. Op. - Commercial Operation
CP – Construction Permit
IEEE – Institute of Electrical and Electronic Engineers
NARA - National Archives and Records Administration
OL – Operating License
TVA – Tennessee Valley Authority

DVD Topics

To help navigate through the DVD, the outline below provides topics and headings that can be accessed directly. The user may also click the boxes on the Timeline for the documents related to the Browns Ferry Fire.

1. Introduction
2. Historical Documents
    a. 10 CFR Part 50.48 and Appendix R History of Changes
        i. Current Versions of 10 CFR 50.48 and Appendix R
        ii. History of Changes
        iii. *Federal Register* Notices
    b. Secretary of the Commission (SECY) Papers, Legal Challenges, and Congressional Documents
        i. SECY Papers
        ii. Court and Congressional Documents
    c. NRC NUREG (Technical Reports by NRC Staff)
        i. U.S. NRC NUREG on BFN
    d. Reports and Other Related Documents
        i. Non-NRC Reports on BFN
        ii. Journal Articles by the Society of Fire Protection Engineers (SFPE)
    e. Presentations and Multimedia
        i. Video and Photographs of BFN and Seal Penetration Fire Tests
        ii. Office of Nuclear Regulatory Research (RES) Seminar Presentation on BFN Fire; invited speakers David Notley and Robert Ferguson (retired NRC engineers who worked on drafting and issuing Appendix R), June 30, 2008
        iii. RES Seminar Presentation of the 35th Anniversary of the BFN Fire; invited speaker Jack Lewis (former BFN operator on shift the day of the fire and later NRC employee), March 26, 2010
        iv. Technical Training Center (TTC) Interview with Jack Lewis (retired NRC's TTC Instructor, 2005)
        v. Presentations about BFN Fire
    f. NRC Bulletins, Amendments, and Commission Meeting Transcripts
        i. NRC Bulletins
        ii. Amendments to BFN
        iii. Commission Meeting Transcripts

Questions and Answers

This NUREG/KM DVD provides a compilation of information that provides perspective on the BFN fire. Each document type serves a different purpose and answers a different question. Combined, these sources create a well-rounded picture of the event for different types and levels of users. Individually, they paint a detailed picture of certain aspects of the event. The following table asks some questions related to the BFN fire and provides examples of where the user should go in the DVD to find the answers.

QUESTION:	Where to go in the DVD:	Subcategories to go to:
What happened in the BFN fire and what did we learn?	Reports and Other Related Documents	All
	NRC NUREGs	NUREGs
	NRC Bulletins, Amendments, and Commission Meeting Transcripts	Commission Meeting Transcripts
How is this information reported to the public?	Reports and Other Related Documents	Journal Articles
	NRC NUREGs	NUREGs
How did the NRC communicate what actions needed to be taken after this event?	NRC NUREGs	All
	NRC Bulletins, Amendments, and Commission Meeting Transcripts	All
What were the rules and regulations before the BFN fire and how has this fire changed them?	10 CFR 50.48 and Appendix R History of Changes	All
	NRC Bulletins, Amendments, and Commission Meeting Transcripts	Amendments
How does NRC staff inform the Commission of policy and rulemaking matters?	SECY Papers, Legal Challenges, and Congressional Documents	SECY Documents

(continued)

QUESTION:	Where to go in the DVD:	Subcategories to go to:
How does the court uphold or challenge rules set forth by the NRC?	SECY Papers, Legal Challenges, and Congressional Documents	Legal Challenges
How does Congress obtain information, conduct investigations, or oversee the NRC?	SECY Papers, Legal Challenges, and Congressional Documents	Congressional Documents
What do the experts think, and what does a fire like this look like?	Presentations and Multimedia	All
What is the difference between NUREG/BR-0361 and NUREG/KM-0002?	NUREG/KM-0002 supersedes NUREG/BR-0361. It also contains new material such as the 35th Anniversary of the Browns Ferry Fire Seminar and additional historic test photos.	

The Browns Ferry Nuclear Plant Fire of 1975 Knowledge Management Digest

Prepared by:

Felix E. Gonzalez,
David Stroup,
Jessica Kratchman,
Mark Henry Salley

U.S. Nuclear Regulatory Commission
Office of Nuclear Regulatory Research
Fire Research Branch

This DVD was developed using Visual Basic Professional 2008. Make sure you have Windows XP and Visual Basic Framework 3.5 or above for the DVD to work correctly.

NUREG/KM-0002
May 2013