



# OFFICE OF THE INSPECTOR GENERAL

U.S. NUCLEAR REGULATORY COMMISSION  
DEFENSE NUCLEAR FACILITIES SAFETY BOARD

## Audit of NRC's Fire Protection Oversight for Operating Reactors

OIG-17-A-10  
April 11, 2017



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**UNITED STATES**  
**NUCLEAR REGULATORY COMMISSION**  
WASHINGTON, D.C. 20555-0001

**OFFICE OF THE  
INSPECTOR GENERAL**

April 11, 2017

**MEMORANDUM TO:** Victor M. McCree  
Executive Director for Operations

**FROM:** Dr. Brett M. Baker */RA/*  
Assistant Inspector General for Audits

**SUBJECT:** AUDIT OF NRC'S FIRE PROTECTION OVERSIGHT FOR  
OPERATING REACTORS (OIG-17-A-10)

Attached is the Office of the Inspector General's (OIG) audit report titled *Audit of NRC's Fire Protection Oversight for Operating Reactors*.

The report presents the results of the subject audit. Following the March 9, 2017, exit conference, agency staff indicated that they had no formal comments for inclusion in this report.

Please provide information on actions taken or planned on each of the recommendations within 30 days of the date of this memorandum. Actions taken or planned are subject to OIG followup as stated in Management Directive 6.1.

We appreciate the cooperation extended to us by members of your staff during the audit. If you have any questions or comments about our report, please contact me at (301) 415-5915 or Paul Rades, Team Leader, at (301) 415-6228.

Attachment: As stated



# Office of the Inspector General

U.S. Nuclear Regulatory Commission  
Defense Nuclear Facilities Safety Board

OIG-17-A-10  
April 11, 2017

## Results in Brief

### Why We Did This Review

On March 22, 1975, a fire at the Browns Ferry nuclear power plant fundamentally changed how the Nuclear Regulatory Commission (NRC) addressed fire protection at nuclear power plants and shaped NRC's fire protection regulatory framework.

Prior to the fire, NRC fire protection regulatory requirements were promulgated through General Design Criteria, *Criterion 3, Fire Protection*. *Criterion 3* prescribed certain fire protection requirements associated with minimizing a fire's effect on equipment important to safety. *Criterion 3* also required that fire protection systems should not impair equipment important to safety.

Accordingly, all nuclear power plant licensees committed to plans outlining each plant's fire protection program, installed fire protection systems, and provided means to assure plants could shutdown safely in the event of a fire.

The audit objective was to assess the consistency of NRC's oversight of fire protection programs at operating nuclear power plants.

### *Audit of NRC's Fire Protection Oversight for Operating Reactors*

#### What We Found

NRC staff have different views on whether they can hold licensees accountable to certain regulatory requirements because the applicability of certain regulatory requirements to individual plants is unclear. As a result, NRC risks inaccurate and inconsistent application of requirements and unreliable oversight.

NRC is also missing opportunities to capture inspection insights from fire protection inspection issues that do not result in findings or violations because NRC does not document inspection issues unless they pertain to findings or violations. As a result, inspectors do not benefit from inspection insights that could enhance future fire protection inspections.

#### What We Recommend

This report makes recommendations to: (1) enhance inspectors' ability to apply appropriate regulatory requirements, licensing basis, and guidance documents to individual plants, and (2) improve communication and knowledge transfer to benefit future inspections.

Agency management stated their general agreement with the findings and recommendations in this report.

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## **ABBREVIATIONS AND ACRONYMS**

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BTP	Branch Technical Position
CFR	Code of Federal Regulations
NFPA	National Fire Protection Association
NRC	Nuclear Regulatory Commission
OIG	Office of the Inspector General



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## I. BACKGROUND

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On March 22, 1975, a fire at the Browns Ferry nuclear power plant fundamentally changed how NRC addressed fire protection at nuclear power plants and shaped NRC's fire protection regulatory framework. Prior to the fire, NRC fire protection regulatory requirements were promulgated through *General Design Criteria, Criterion 3, Fire Protection*.<sup>1</sup> *Criterion 3* prescribed certain fire protection requirements associated with minimizing a fire's effect on equipment important to safety, using noncombustible materials, and installing appropriate fire detection and firefighting systems. *Criterion 3* also required that fire protection systems should not impair equipment important to safety. Accordingly, all nuclear power plant licensees committed to plans outlining each plant's fire protection program, installed fire protection systems, and provided means to assure plants could shut down safely in the event of a fire.

### **Operating Nuclear Power Plant Primary Fire Protection Regulatory Requirements**

NRC issued several different fire protection regulatory requirements at different times following the Browns Ferry fire.

#### Branch Technical Positions

Subsequent to *Criterion 3*, NRC developed a series of Branch Technical Positions that established review criteria for proposed fire protection programs.<sup>2</sup> *Branch Technical Position (BTP) APCSB 9.5-1, Guidelines for Fire Protection for Nuclear Power Plants*, dated May 1, 1976, were used for plants that had not applied for an operating license. Appendix A to BTP 9.5-1, *Guidelines for Nuclear Power Plants Docketed Prior to July 1, 1976*, dated August 23, 1976 and February 24, 1977, were used for plants that had applied for licenses before July 1, 1976. NRC issued and revised the BTPs

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<sup>1</sup> General Design Criteria, Criterion 3, "Fire Protection," in Appendix A, "General Design Criteria for Nuclear Power Plants," to 10 CFR Part 50, dated 1971.

<sup>2</sup> A branch technical position related to fire protection provides comprehensive review guidance and sets forth acceptable solutions by NRC staff for nuclear power plant fire protection programs.

multiple times over 26 years to better assure fire safety.

### Safety Evaluation Report

Between 1975 and 1980, licensees submitted fire protection information about their plants to NRC, that was later included as part of a safety evaluation report. The safety evaluation report was typically incorporated into a plant's license. However, not all licensees agreed to modify their plants as described in the safety evaluation reports. Some licensees requested exemptions and proposed alternatives to meeting requirements described in the safety evaluation reports.

### 10 Code of Federal Regulations (CFR) 50.48 and Appendix R

In 1980, NRC promulgated 10 CFR 50.48, *Fire Protection and Appendix R to 10 CFR 50, Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979*, to address fire protection issues. 10 CFR 50.48 required licensees that had not performed safety evaluation report modifications to implement the requirements in Appendix R. Plants licensed before January 1, 1979, had to adhere to certain sections of Appendix R.<sup>3</sup> However, plants licensed after that date were required to adhere to plant-specific fire protection programs approved by NRC.

Throughout the 1980s, licensees submitted fire protection program documentation to NRC for approval. NRC reviewed and approved entire fire protection programs for some plants. For other plants, NRC only approved certain aspects of the programs, such as alternate shutdown procedures. Further, the approvals were site-specific. As a result, some plants licensed after 1979 were only required to meet portions of 10 CFR Part 50 Appendix R, thereby creating a number of NRC-approved fire protection programs and regulatory requirements that varied from plant to plant.

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<sup>3</sup> Plants licensed before January 1, 1979, (also known as Appendix R plants or pre-79 plants) were required to meet 10 CFR Part 50 Appendix R Sections III.G, fire protection of safe shutdown capability; III.J, emergency lighting; and III.O, oil collection system for reactor coolant pump.

### Alternate Fire Protection Rule 10 CFR 50.48 (c)/National Fire Protection Association Standard 805

In 2004, NRC promulgated 10 CFR 50.48(c), as part of an NRC effort to incorporate risk information into the agency's regulations and enhance safety. 10 CFR 50.48(c) allowed licensees to adopt National Fire Protection Association (NFPA) Standard 805 as the regulatory standard for their plants' fire protection programs. The alternate rule permitted plants to voluntarily transition from previously approved prescriptive fire protection programs to new risk-informed, performance-based requirements under NFPA 805.<sup>4</sup> Not all plants meet the NFPA 805 standard. Therefore, some plants transitioned to the standard, some plants are undergoing a transition process, and other plants have remained under the prescriptive regulatory requirements for their fire protection programs.<sup>5</sup>

### **NRC Fire Protection Oversight Roles and Responsibilities**

NRC staff at headquarters and regions oversee fire protection at operating nuclear power plants. NRC's Fire Protection Branch within the Office of Nuclear Reactor Regulation's Division of Risk Assessment performs safety evaluations associated with fire protection regulations, develops regulations and regulatory guidance, and supports application of the fire protection regulations at the regional level. Additionally, NRC inspectors provide oversight to plant fire protection programs through inspections. Regional inspectors perform in-depth fire protection inspections every 3 years. These inspections include an examination of fire plans, electrical cable separation, operating procedures, and fire procedures to ensure plant personnel can safely shutdown a plant during a fire. Resident inspectors perform quarterly and annual inspections that focus on firefighting capabilities such as fire suppression equipment, fire barriers and fire brigade drills.

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<sup>4</sup> The risk-informed, performance based approach relies on a required outcome rather than prescribing licensees implement a specific process or technique to achieve that outcome. NRC contends this approach allows licensees to focus fire protection activities on the areas of greatest risk.

<sup>5</sup> As of March 2017, 29 plants have either transitioned or are in the process of transitioning to the standard. Other plants remain under the prescriptive fire protection requirements.



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## II. OBJECTIVE

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The audit objective was to assess the consistency of NRC's oversight of fire protection programs at operating nuclear power plants. See Appendix A for information on the audit scope and methodology.

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## III. FINDINGS

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Opportunities exist for NRC to improve the consistency of fire protection oversight by ensuring (1) specific regulatory requirements for individual nuclear plants are clear to cognizant staff, and (2) documentation of inspection insights from discussions of issues that do not result in findings or violations.

### **A. Different Views on Licensee Accountability**

NRC's *Principles of Good Regulation* require regulations to be perceived as reliable and not unjustifiably in a state of transition. NRC also requires regulatory actions to be fully consistent with written regulations. However, NRC staff have different views on whether they can hold licensees accountable to certain regulatory requirements because the applicability of certain regulatory requirements to individual plants is unclear. This could lead to inaccurate and inconsistent application of regulatory requirements which may affect plant safety.

### ***What Is Required***

#### **Regulations Should Be Reliable and Regulatory Actions Should Be Consistent With Regulations**

NRC established its *Principles of Good Regulation* to help it focus on ensuring safety while balancing the interests of NRC's stakeholders including the public and licensees. Through its Principles, NRC has

committed to ensuring that its regulations are perceived as reliable and not unjustifiably in a state of transition. NRC has expressed the requirement that regulatory actions should always be fully consistent with written regulations.

## *What We Found*

### **Different Views on Licensee Accountability to Regulatory Requirements**

NRC staff have different views on whether they can hold licensees accountable to certain regulatory requirements. For example, agency staff have differing views on whether plants are required to protect against or mitigate either single or multiple spurious operations of components, such as valves, as a result of a fire.<sup>6</sup> Some staff asserted they could only hold plant officials responsible for addressing single spurious operations, but not multiple spurious operations as they had done in the past. These staff cited a perceived NRC policy change and did not understand the basis for it. Conversely, other staff expressed confusion when asked about this perceived policy change, and explained they had no difficulty holding plant officials accountable to NRC's requirements. This lack of regulatory reliability was further underscored by licensee staff, who expressed concern to OIG that NRC has not yet clarified its position on this matter, even after licensees have taken voluntary remedial measures recommended by NRC.

Additionally, some inspectors told OIG they could not hold licensees accountable for a requirement to notify NRC of fire protection program changes that could be "adverse to safe shutdown" because NRC does not explicitly define what constitutes "adverse to safe shutdown." Some headquarters managers acknowledged the lack of a definition, but noted they were unfamiliar with the challenge faced by inspectors.<sup>7</sup>

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<sup>6</sup> Electrical cable fires can sometimes result in electrical circuit failures. These fire-induced circuit failures can sometimes cause electrically controlled components such as pumps and valves to turn on and off or open and close when they should not.

<sup>7</sup> NRC management maintains that staff can properly identify licensee activities or changes that adversely affect safe shutdown by following several steps and guidelines for determining whether a licensee is maintaining "sufficient safety margins." One set of guidelines includes a comparison of the activity or change to codes and standards, and their alternatives, to safety analysis acceptance criteria in a plant's licensing basis.

Lastly, NRC held a licensee accountable for new regulatory requirements when the licensee had not fully completed modifications and procedural changes during the transition to NFPA 805. Some inspectors contended the plant should be inspected according to all of the new requirements even though the plant had not implemented all of the NFPA 805 changes. Licensee staff contended the scope of the inspection should be limited since the plant was in the NFPA 805 transition period.

### *Why This Occurred*

#### **Applicability of Regulatory Requirements to Individual Plants Is Unclear**

NRC staff have different views on licensee accountability to regulatory requirements because the applicability of specific regulatory requirements to individual plants is unclear. Fire protection regulatory requirements are made up of multiple safety evaluation reports, letters between NRC and licensees, and license amendments that reflect plant design changes that occur over time. NRC staff responsible for fire protection oversight have to determine which regulatory requirements apply to each individual plant based upon its unique and evolving licensing basis.

### *Why This Is Important*

#### **Inaccurate and Inconsistent Application of Regulatory Requirements Could Affect Plant Safety**

Differing views on the application of regulatory requirements could lead to inaccurate and inconsistent application of requirements and unreliable oversight. Additionally, staff time spent ascertaining which regulatory requirements apply to specific plants can detract from time spent on direct inspection work. Together, these factors increase the risk of fire protection oversight lapses that could compromise plant safety. By clarifying applicability of various fire protection regulatory requirements for individual plants, NRC could strengthen safety oversight and promote

public confidence in the agency's stated commitment to regulatory clarity, reliability, and efficiency.

### **Recommendation**

OIG recommends that the Executive Director for Operations

1. Identify and implement best practices to enhance inspectors' ability to apply the appropriate regulatory requirements, licensing basis, and guidance documents to individual plants.

## **B. Missed Opportunities for Documenting Inspection Insights**

Federal Government and internal agency guidance requires NRC to use quality information to achieve program objectives and commit to making decisions based on the best available knowledge from research and operational experience. However, NRC is missing opportunities to capture inspection insights from fire protection inspection issues that do not result in findings or violations. This occurs because NRC does not document inspection issues unless they are associated with findings or violations. As a result, fire protection inspectors do not benefit from inspection insights and emerging trends that can enhance future inspections.

### ***What Is Required***

#### **Oversight Should Be Based on Quality Information, Best Available Knowledge, and Operational Experience**

Federal internal control standards require NRC to use quality information to achieve program objectives. Additionally, NRC has committed through its *Principles of Good Regulation* to making decisions based on the best available knowledge from research and operational experience.

## *What We Found*

### **Missed Opportunities for Documenting Inspection Insights**

NRC is missing opportunities to capture inspection insights from fire protection inspection issues that do not result in findings or violations. Potential findings or violations identified by inspectors are sometimes resolved through discussions with licensees and NRC headquarters staff to clarify plant-specific requirements, and how conditions observed by inspectors relate to those requirements. For example, OIG observed inspectors and licensee staff spend several hours discussing whether the plant being inspected had to meet the same requirements as other plants for multiple spurious operations, fire dampers, and emergency lighting battery tests.

## *Why This Occurred*

### **No Documentation of Discussions, Issues, and Insights That Do Not Result In Findings or Violations**

NRC does not document inspection discussions, issues, and insights unless they are associated with findings or violations. Rather, NRC staff are only required to document significant information pertaining to findings and violations.

## *Why This Is Important*

### **Inspectors Do Not Benefit From Inspection Insights**

Because NRC does not document inspection issues unless they pertain to findings or violations, inspectors do not benefit from inspection insights that could enhance future fire protection inspections. Lacking such information, inspectors risk repeating work on issues that were resolved in previous inspections. During one triennial fire inspection observed by OIG, inspectors conceded they could spend several hours unnecessarily duplicating undocumented work from previous inspections, and contended

that this happens routinely. Duplicative efforts detract from time and effort that could be spent more effectively addressing unexamined or unresolved safety issues. However, improved access to inspection insights could help future fire inspection teams plan and conduct their work more efficiently and effectively.

**Recommendation**

OIG recommends that the Executive Director for Operations

2. Identify and reinforce tools and methods available for identifying and communicating issues suitable for knowledge transfer to improve future inspections.



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## **IV. CONSOLIDATED LIST OF RECOMMENDATIONS**

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OIG recommends that the Executive Director for Operations

1. Identify and implement best practices to enhance inspectors' ability to apply the appropriate regulatory requirements, licensing basis, and guidance documents to individual plants.
2. Identify and reinforce tools and methods available for identifying and communicating issues suitable for knowledge transfer to improve future inspections.

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## **V. AGENCY COMMENTS**

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An exit conference was held with the agency on March 9, 2017. After reviewing a discussion draft, agency management provided comments that have been incorporated into this report, as appropriate. As a result, agency management stated their agreement with the findings and recommendations in this report and opted not to provide formal comments for inclusion in this report.

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## OBJECTIVE, SCOPE, AND METHODOLOGY

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### Objective

The audit objective was to assess the consistency of NRC's oversight of fire protection programs at operating nuclear power plants.

### Scope

The audit focused on assessing NRC's fire protection oversight for operating nuclear power plants. We conducted this performance audit from September 2016 through January 2017 at NRC headquarters in Rockville, Maryland, and observed three triennial fire protection inspections at operating nuclear power plants in three of NRC's four regions. Internal controls related to the audit objective were reviewed and analyzed. Throughout the audit, auditors were aware of the possibility of fraud, waste, and abuse in the program.

### Methodology

OIG reviewed relevant criteria for this audit, including Government Accountability Office's *Standards for Internal Control in the Federal Government*, Appendix A to Part 50 - *General Design Criteria for Nuclear Power Plants*, 10 CFR 50.48 *Fire Protection*, Appendix R to 10 CFR Part 50, National Fire Protection Association 805, and *NRC's Principles of Good Regulation*.

To understand how NRC staff and managers oversee fire protection programs at operating nuclear power plants, OIG reviewed additional sources such as inspection procedures, regulatory guides, industry guidance, and industry concerns.

OIG interviewed NRC staff and management from the Office of Nuclear Reactor Regulation, Office of Nuclear Regulatory Research, and all regional offices. OIG also interviewed external stakeholders and licensee personnel, and observed three triennial fire protection inspections at

operating nuclear power plants in three of NRC's four regions.

We conducted this performance audit in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

The audit was conducted by Paul Rades, Team Leader; Levar Cole, Audit Manager; Jenny Cheung, Auditor; and John Thorp, Senior Technical Advisor.

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## TO REPORT FRAUD, WASTE, OR ABUSE

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## COMMENTS AND SUGGESTIONS

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If you wish to provide comments on this report, please email OIG using this [link](#).

In addition, if you have suggestions for future OIG audits, please provide them using this [link](#).