

Tackling the Construction Fires Crisis (NFPA 241)

National Renewable Energy Laboratory/Golden, CO

August 1, 2023



IT'S A BIG WORLD. LET'S PROTECT IT TOGETHER.®

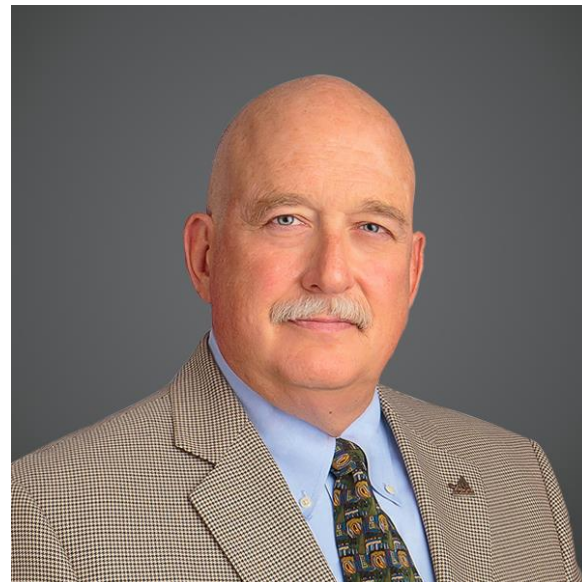
Agenda

- Welcome.
- Introductions
- Background on construction fires
- NFPA 241
- Q&A.
- Conclusion.

Our Presenters

Bruce Campbell, Vice President, DOE Market Leader – Jensen Hughes

Bruce is the current chair of the NFPA 241 technical committee. He also serves on three additional NFPA technical committees. He is a fellow in the Society of Fire Protection Engineers. He has spent his entire 45-year career in the heavy and nuclear industries. Bruce has been involved with several multi-billion-dollar construction projects, as well as one of the largest-ever nuclear D&D projects, which was over \$3 billion and nearly 10 years but completed one year early and under budget. He has helped guide the last two major revisions to NFPA 241, the 2019 and 2022 editions.



Our Presenters

Kevin Carr– NFPA

Kevin Carr is a Senior Fire Protection Specialist at NFPA. He is the staff liaison for NFPA 241, as well as for technical committees that pertain to Aircraft Operations, Building Construction and Life Safety, HVAC, Manufactured Housing, Protection of Records and Remote Inspections. Prior to his work as a staff liaison Kevin held various roles within facilities management, with an emphasis on operations and construction.



Construction Fire Background





Why are buildings under construction vulnerable?

- Incomplete/inactive fire protection systems
- Incomplete passive fire protection
- Different fire loads
- Construction activities
- Less than adequate security
- Lack of a Fire Prevention Plan

The NFPA Fire & Life Safety Ecosystem



www.nfpa.org/ecosystem



Current Events: Construction Fires



Fires in Structures Under Construction by Use

**Table A. Fires in Structures under Construction by Property Use
2016–2020 Annual Averages**

Property Use	Fires	Civilian Injuries	Direct Property Damage
Residential	76%	77%	77%
Mercantile or business	6%	5%	3%
Outside or special property	5%	3%	13%
Storage	4%	2%	1%
Assembly	3%	3%	3%
Health care, detention, correction	2%	7%	2%
Educational	2%	1%	0%

Apartment Building- Las Vegas, NV (RECENT)

- June 20, 2023.
- \$90M project 75% complete, only one structure saved.
- Cause under investigation.
- Fire crews on site for days to maintain coverage at the site.



Photo Credit: Michael Bell

Apartment Building- Charlotte, NC (RECENT)

- May 19, 2023.
- Two deaths, several rescues.
- Cause under investigation, may have been related to a spray-foam insulation trailer.
- Project future remains unclear.



Photo Credit: Charlotte Fire Department

Laboratory Building- Cambridge, MA

- February 5, 2005.
- Underground lab
- After hours, no injuries.
- Cause may have been faulty lightbulb.
- Fire caused \$1 million in damage.



Photo Credit: Harvard University

Laboratory Building- Newark, DE

- August 9, 2017.
- Renovation work.
- Cause may have been Sawzall igniting material in the ventilation system.
- Fire traveled through ductwork to another floor.
- One firefighter injury reported.



Photo Credit: Josh Shannon

Apartment Building- Buffalo, NY

- March 1, 2023.
- Firefighter LODD.
- Cause under investigation.
- Fire caused \$2.6 million in damage.



Photo Credit: WIVB News

High-Rise Building- Hong Kong

- March 2, 2023.
- 42 story tower fire.
- 2 people injured
- Fire started near top and spread down the building.



Photo Credit: Tyrone Siu/Reuters

Apartment Building- Upland, California

- December 1, 2021.
- 8 buildings destroyed.
- 25 people displaced.
- No official cause reported.



Photo Credit: Fox 11 News

Apartment Building- Seattle, Washington

- April 9, 2021
- 2nd fire in less than a week
- Suspected arson
- Original fire caused \$3 million in damage
- This fire caused an additional \$4000 in damage

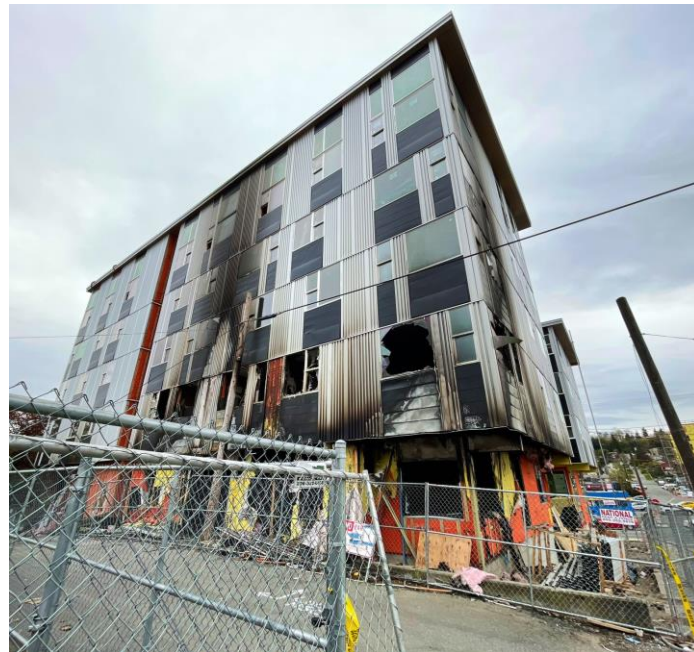


Photo Credit: Komo News

Warehouse Fire- Brownsburg, IN

- March 18, 2022.
- Lack of hydrants.
- Cause may have been hotwork on roof.
- Fire contained to construction materials.



Photo Credit: Chris Anderson

Historic Fire- Notre Dame Cathedral

- April 15, 2019.
- Approximately 850-year-old building.
- Sections of the cathedral were undergoing renovation.
- Multiple fire causes have been suggested.



Photo Credit: Bertrand Guay/Agence France-Presse — Getty Images

Rocky Flats – Building 371

- May 2003
- During D&D of the Facility
 - Cutting up of a glovebox with nibbler
- 12 or more portable extinguishers initially used by workers in bubble suits
- Final extinguishment by FD using 1 ½ inch hose
- Extensive investigation
 - Initial slow
 - DNFSB involved



Photo Credit: Rocky Flats, ES&H



Rocky Flats – Building 991

- February 2004
- During D&D of the Facility
 - Filling a tunnel area with spray-in polyurethane foam
 - Exothermic reaction initiated the fire
- The fill rate (drift) grossly exceeded recommended rate
- Combusted for over a week
- Extensive investigation; immediately
- DNFSB pleased with overall approach to the fire



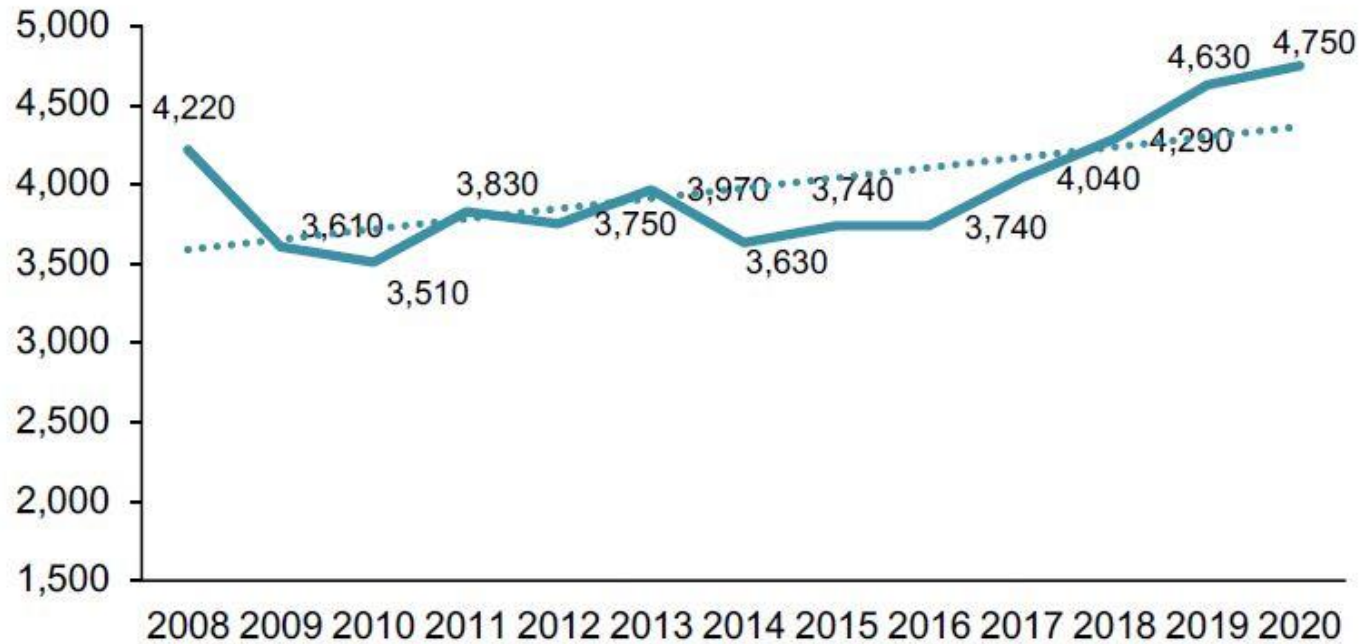
The Numbers: Data on Construction Fires



www.nfpa.org/constructionfiresafety

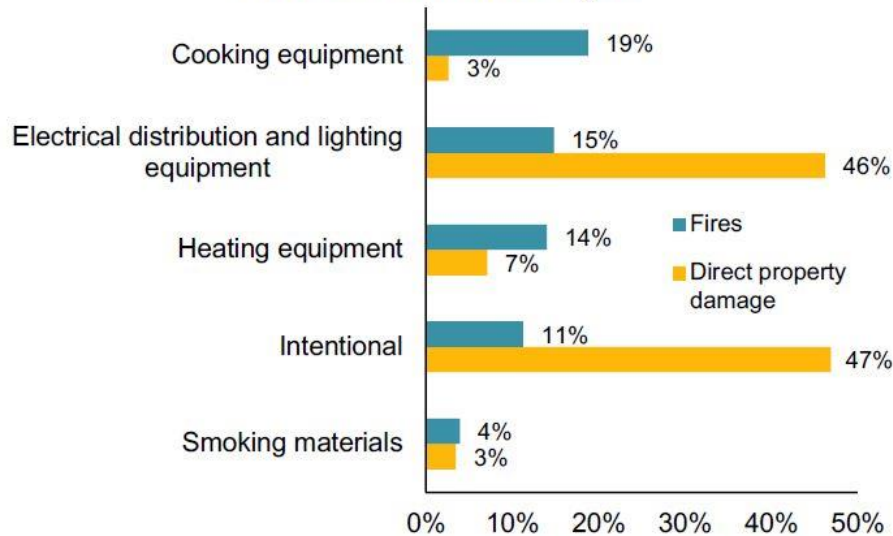
The Numbers: Data on Construction Fires

Figure 1. Fires in Structures under Construction, 2008–2020.



Fires in Structures Under Construction by Cause

**Figure 2. Fires in Structures under Construction by Leading Cause
2016–2020 Annual Averages.**



Fires by Month and Time of Day

Figure 3. Fires in Structures under Construction by Month
2016–2020 Annual Averages.

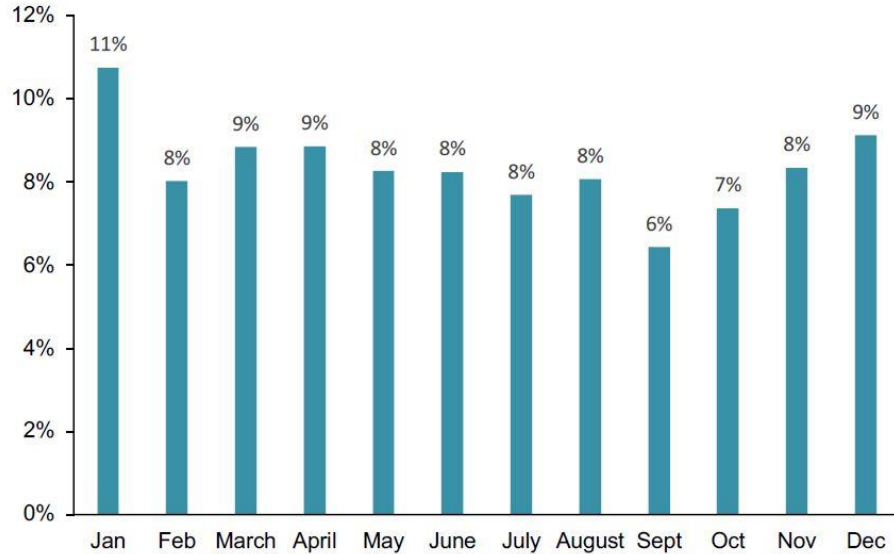
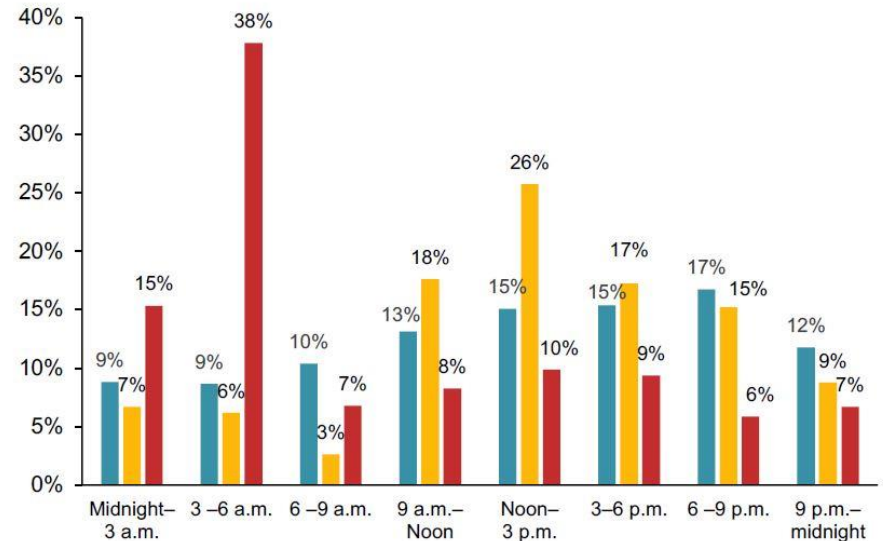
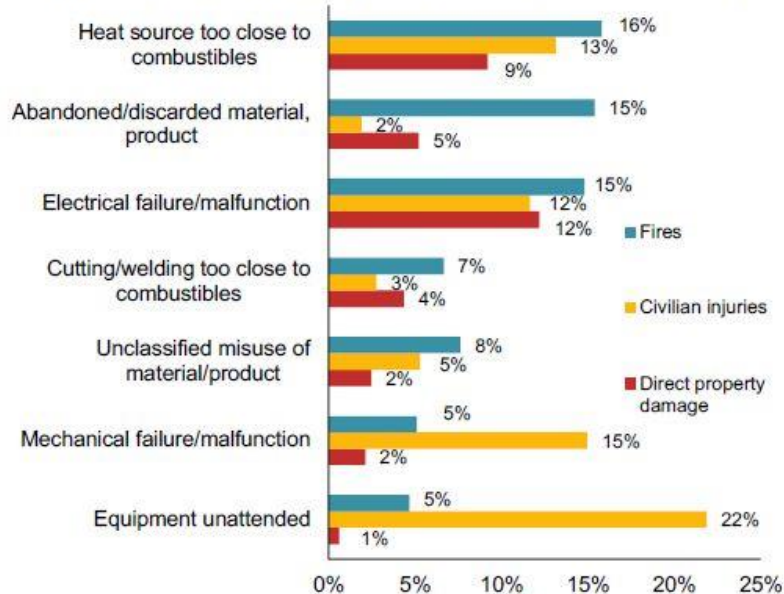


Figure 4. Fires in Structures under Construction by Time of Day
2016–2020 Annual Averages.



Factors Contributing to Ignition

**Figure 6. Fires in Structures under Construction
by Factors Contributing to Ignition, 2016–2020 Annual Averages.**

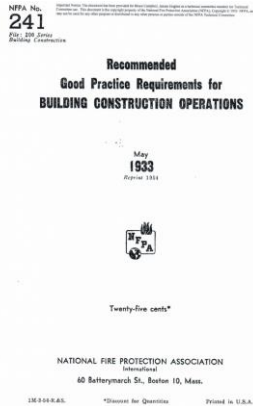


NFPA 241: Through the Years

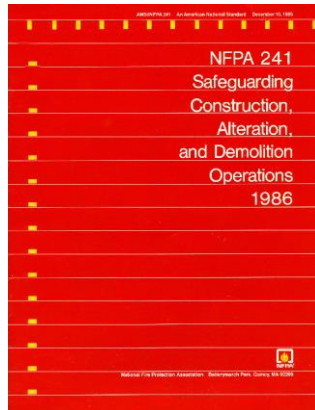
2019

2022

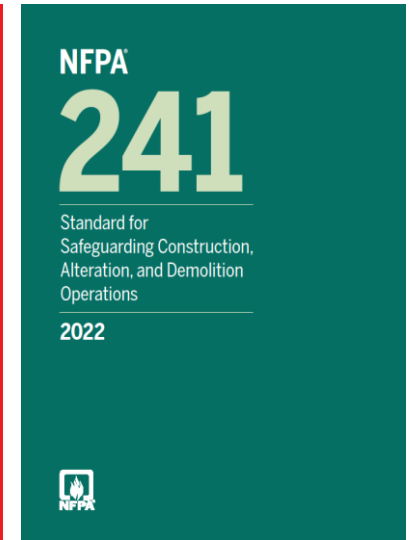
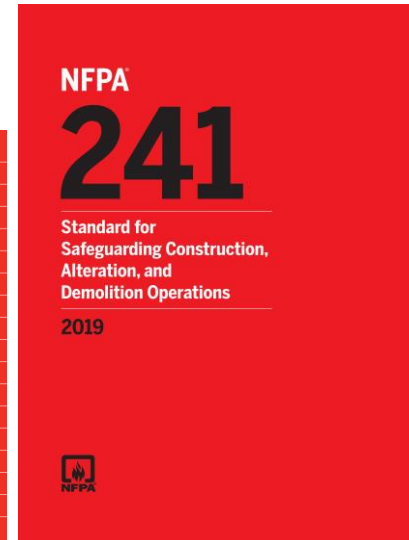
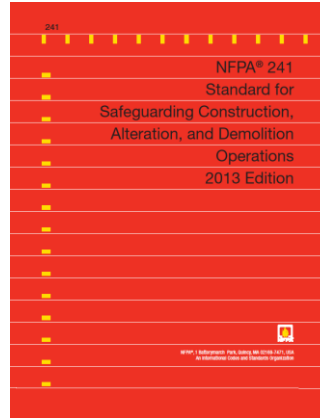
1933



1986

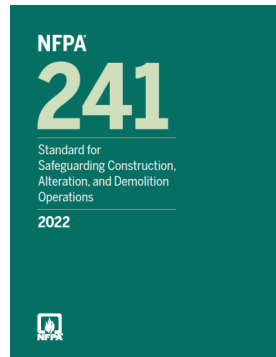


2013



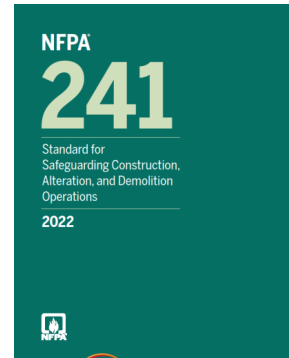
Reorganization

- > Chapter 1 – Administration
- > Chapter 2 – Referenced Publications
- > Chapter 3 – Definitions
- > Chapter 4 – General Requirements
- > Chapter 5 – Temporary Construction, Equipment, and Storage
- > Chapter 6 – Utilities
- > Chapter 7 – Processes and Hazards
- > Chapter 8 – Safeguarding Construction and Alteration Operations
- > Chapter 9 – Safeguarding Demolition Operations
- > Chapter 10 – Safeguarding Roofing Operations
- > Chapter 11 – Safeguarding Underground Operations
- > Chapter 12 – Safeguarding Construction Operations for Tall Mass Timber Wood Structures
- > Chapter 13 – Safeguarding Construction Operations for Large Wood Frame Structures
- > Annex A – Explanatory Material
- > Annex B – Informational References



NFPA 241: Fire Prevention Program Manager (Partial List)

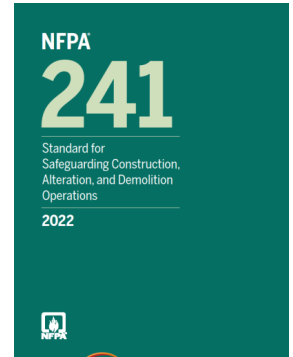
- Owner must designate
- Authority to enforce the fire prevention program
- Must have knowledge of standards
- Responsible for guard service
- Provides training on protection equipment
- Must conduct daily inspections
- Ensures presence/adequacy of devices
- Authorizes impairments
- Responsible for the development of pre-incident plan



NFPA 241: Fire Prevention Program

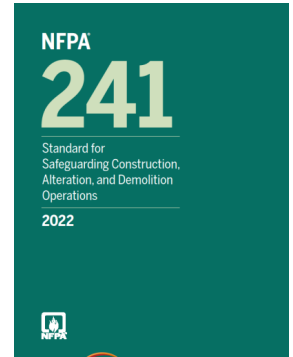
4.2.1

An overall project-specific Fire Prevention Program shall be developed.



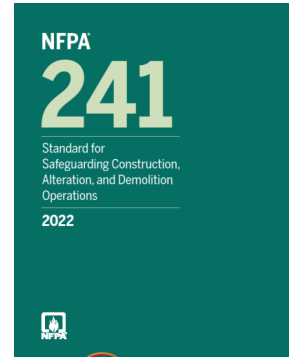
NFPA 241: Fire Prevention Program

- Pre incident plan
- Emergency contacts
- Site emergency communication procedures
- Site personnel
- Signage
- Hot work operations
- **Fire protection systems**
- Emergency incident location



NFPA 241: Fire Prevention Program

- Good housekeeping
- Waste disposal
- Security
- Special hazards
- Protection of existing structures
- Documentation
- Life safety plan
- Temporary utilities



NFPA 241: Fire Prevention Program

The Fire Prevention Program can also include other items:

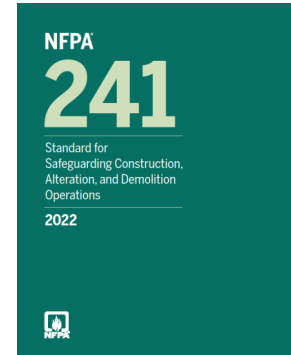
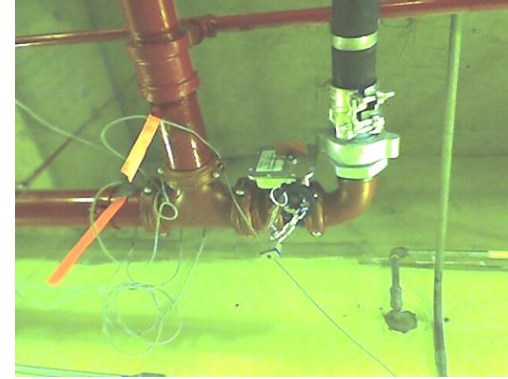
4.3.2.2*

Measures used to place permanent fire protection systems temporarily in service during construction shall be as follows:

- (1) In conformance with the Fire Prevention Program
- (2) Evaluated based on the type and status of the system
- (3) Evaluated based on the conditions of the building construction

4.3.2.3

Systems temporarily placed in service during construction **shall not be required** to comply with NFPA Standards.



NFPA 241: Enforcement

The AHJ has a critical role in ensuring safety on a construction site.

1.6 Enforcement.

1.6.1

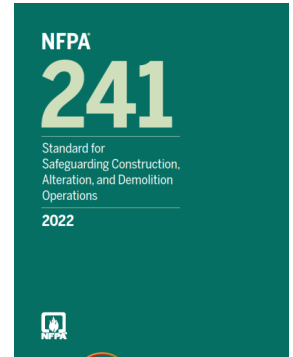
This standard shall be administered and enforced by the authority having jurisdiction (AHJ) designated by the governing authority.

1.6.2

The AHJ shall determine whether the provisions of this standard have been met.

1.6.3*

The AHJ shall be permitted to accept partial requirements of this standard.





Resources: Fire Safety on Construction Sites

- Research papers, video and fact sheets - nfpa.org/ConstructionFireSafety
- Training courses -
 - Fire Prevention Program Manager Training
 - nfpa.org/FPPMDemo
 - Construction Site Fire Safety Fundamentals Training
 - nfpa.org/ConstructionSafetyFundamentalsDemo
 - NFPA 51B, *Hot Work Safety*
 - nfpa.org/HotWorkDemo
- Jensen Hughes resources -
 - <https://www.jensenhughes.com/media-center>
 - <https://www.jensenhughes.com/insights/the-importance-of-nfpa-241-standard-for-safeguarding-construction-alteration-and-demolition-operations-in-healthcare-facilities>

Thank You

Q&A

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Note: All images are attributed as shown, or from either NFPA or Getty Images.



Courtesy of Michael Bedard