



Construction Fire Safety Coalition

The U.S. Experience and NFPA 241



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American Wood Council



PROGRAM DESCRIPTION



The presentation will briefly outline the construction fire safety coalition and its purpose. It will discuss the construction site fire problem in the United States. The program will also outline provisions of NFPA 241- *Standard for Safeguarding Construction, Alteration, and Demolition Operations.*



www.constructionfiresafety.org

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Construction Fire Safety Coalition
October 17 at 5:30 PM · 🌐
Let's keep these firefighters in our thoughts and prayers!

BALTIMORESUN.COM
Seven firefighters, two others injured in gas explosion, fire in Northeast Baltimore

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Construction Fire Safety Coalition
October 17 at 10:33 AM · 🌐
Nearly 400 Texas fire marshals attended an October 14 presentation on fire protection during construction at the 20th Annual Texas Fire Marshal's Association annual conference in Austin.
Rob Neale, principal at Integra Code Consultants and Coalition for Construction Fire Safety partner, presented a two-hour seminar promoting the Coalition's message on construction site hazards and mitigation strategies.
Although only a handful of attendees indicated they currently enforce the fire prevention program requirements of the International Fire Code or NFPA 241, following the presentation several indicated they would redouble their efforts to do so.

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Nature of the Problem

U.S. fire departments report the following structure fire averages

- 3,840 under construction
- 2,580 during major renovations

Campbell, Richard, NFPA, *Fires in Structures Under Construction or Renovation*, February 2020



Risk Management

Construction market hammered by rising fire, water damage claims

Claire Wilkinson

June 04, 2019



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Construction companies are stepping up risk management efforts and making greater use of technology in response to a growing number of fire and water damage claims during construction projects, according

to industry sources.

Related Stories



Inland marine premiums double in decade: Best

Most Read in Risk Management

1. 2019 Break Out Awards
2. Damaged Noah's Ark replica awash with insurer resistance
3. AIG promotes McElroy to head North American general insurance
4. Dismissal of suit challenging IRS

Significant Fires During Construction



Bound Brook, NJ January 12, 2020

- Meridia Main
- 174-unit apartment
 - 2 story concrete podium
 - 4 stories wood frame
- 7 alarms
- 70 departments/ 3 Counties
- Destroyed 4 surrounding buildings
- Power cut to downtown for a day
- Commuter rail line shut down
- 100 homes evacuated
- Arson- arrest made



Courtesy NJ.com



Fairfax County, VA: February 8, 2020



Time: Approximately 8am

Location: 2800 block of Poag Street, Penn Daw, Fairfax County, VA

Response: 5 Alarms- Firefighters from Alexandria, Arlington, Fort Belvoir and Prince George's County assisted Fairfax County.

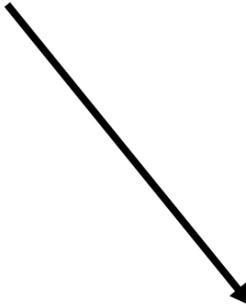
Injuries: One firefighter and one civilian (passerby) were taken for minor injuries

Cause: Cigarette dropped into a combustible garbage chute

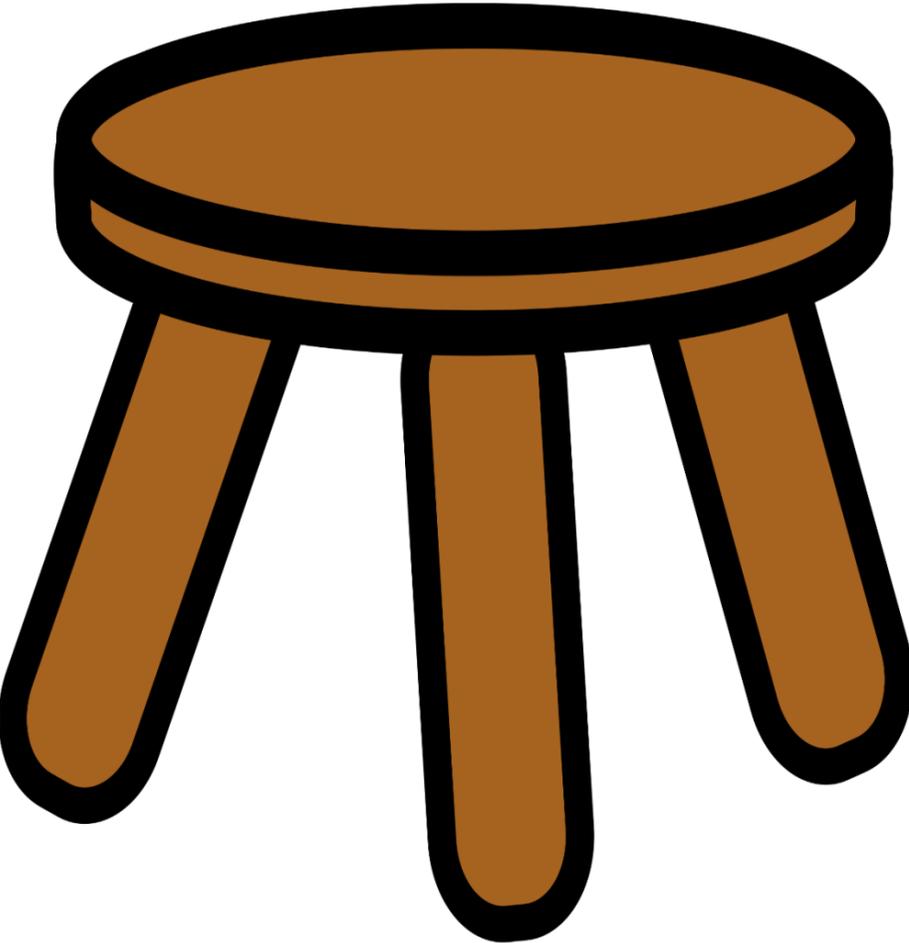
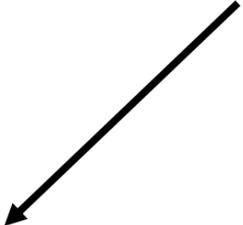


The Three-legged Stool of Effective Firefighting

FD ACCESS



**EARLY
NOTIFICATION**



WATER SUPPLY



Understanding Risks & Hazards

It's no surprise that construction sites can become an unsafe environment

SOURCES OF FUEL



- Combustible refuse and trash
- Building materials
- Flammable gases - e.g., propane
- Flammable liquids
- Packaging materials

SOURCES OF FUEL



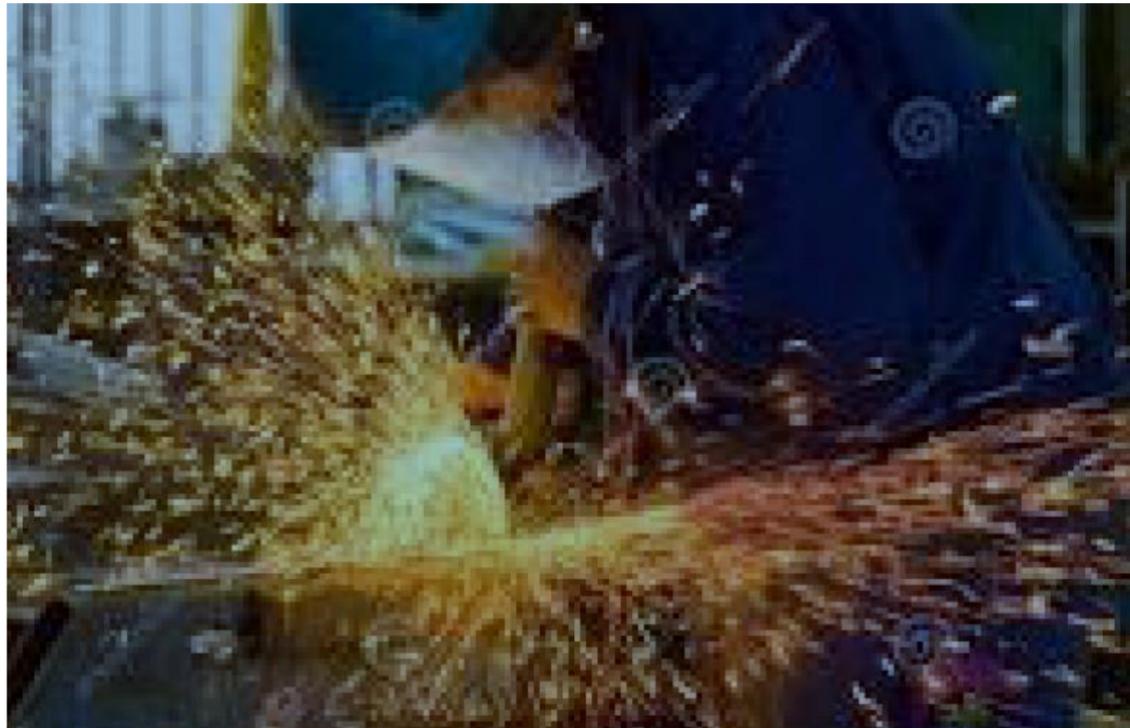
Hilton Towers under construction

No fuel to burn on a Type I building right?

DON'T BE FOOLED



SOURCES OF IGNITION



- Smoking Materials
- Cooking
- Open Flames
- Electrical equipment
- Light fixtures
- Heat and Sparks from grinding and cutting metal
- Arson

SOURCES OF IGNITION



CAUSES OF NEW CONSTRUCTION FIRES



- Cooking Equipment - 22%
- Electrical- 16%
- Heating Equipment- 15%
- Intentionally Set- 11%
- Torch, burner or soldering iron- 7%
- Exposure Fires - 4%
- Smoking- 4%
- Spontaneous Combustion- 4%

Campbell, Richard, NFPA, *Fires in Structures Under Construction or Renovation*, February 2020

CAUSES OF NEW CONSTRUCTION FIRES

- Cooking equipment is the leading cause of fires, but they are usually minor.
- Electrical fires account for 16% of all construction fires but 42% of property damage
- Intentionally set fires make up 11% of construction fires but responsible for 32% of property damage

Campbell, Richard, NFPA, *Fires in Structures Under Construction or Renovation*, February 2020



TIMING OF NEW CONSTRUCTION FIRES

- Occur more frequently in colder months.
- Peak times are between 1600 hrs. and 2000 hrs.
- 12% occur between midnight and 0400 hrs.

Campbell, Richard, NFPA, *Fires in Structures Under Construction or Renovation*, February 2020



FIRES OCCURRING DURING MAJOR RENOVATION



- Electrical- 23%
- Heating Equipment- 15%
- Intentionally Set Fires - 12%
- Cooking Equipment - 10%
- Torch, Burner, or Soldering Iron - 9%
- Smoking Materials - 3%
- Exposure Fires - 3%

Campbell, Richard, NFPA, *Fires in Structures Under Construction or Renovation*, February 2020



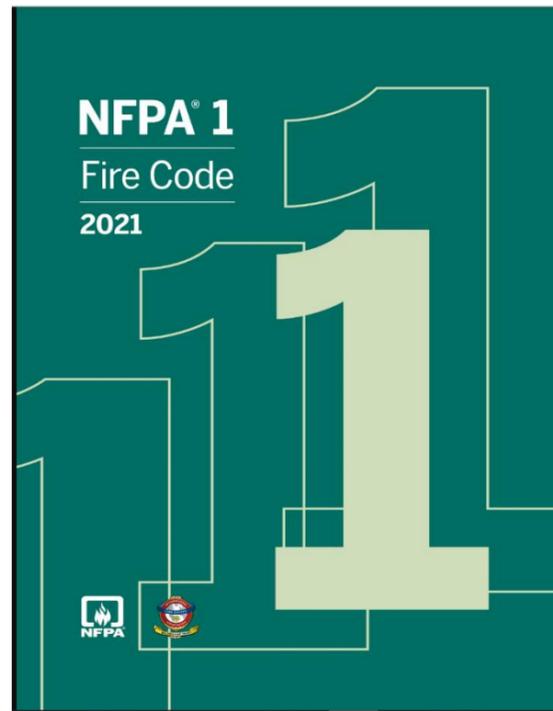
CODES & STANDARDS/ ROLES & RESPONSIBILITIES

...that pertain to safety precautions during construction

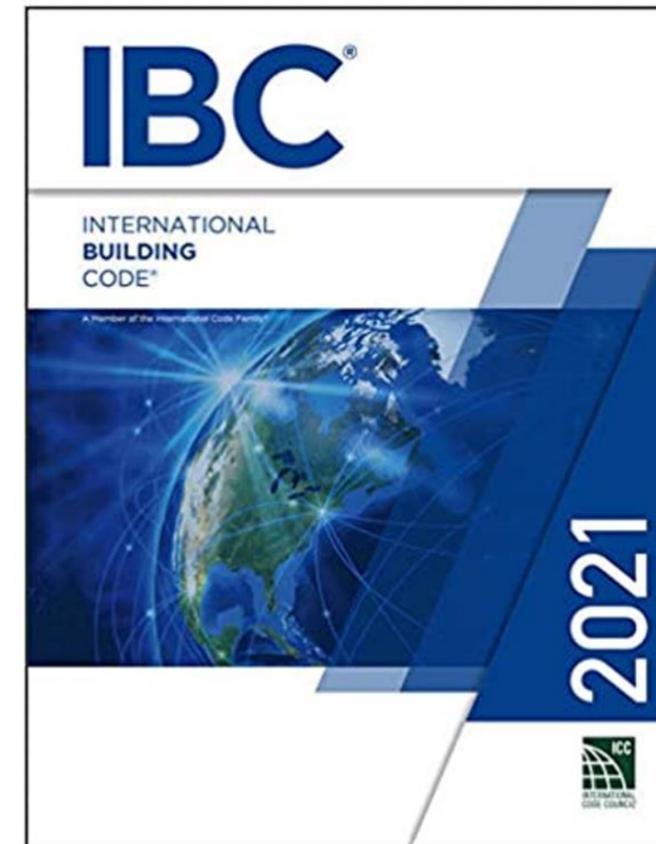
MODEL CODES THAT SAFEGUARD CONSTRUCTION



Chapter 33



Chapter 16



Chapter 33

NFPA 241- DEVELOPMENT

- Work on the subject began in 1930
- The language was adopted by NFPA in 1933
- Complete rewrite by the Committee in 1986
- 1989 edition- complete rewrite on roofing operations
- 2009 edition added 2-hour Firewatch for torch applied roofing systems
- 2013 edition added extra requirements for temporary heating systems



AHJ RESPONSIBILITIES

Team providing local government representation

1. Building Department – provides enforcement and oversight of building construction process in accordance with state and local statutes
2. Fire Prevention Bureau – enforces adopted Fire Code provisions
3. Fire Suppression Division – develops
 - pre-fire plan, tactics, strategy, access, water supply, and exposures



BUILDING INSPECTORS

Traditional Role:

- Reviews approved plans
- Ensures that the construction matches the plans
- Applies Building code & trade codes
- Views the fire code and fire safety the responsibility of the fire inspector



FIRE INSPECTOR

Traditional Role:

- Inspects finished buildings
- Fire code is a “maintenance” code
- Rarely on construction sites
- Views the building inspector as responsible for code enforcement on construction sites



RESPONSIBILITY GAP

Both sides retreat into these traditional roles:

- Not out of bad motives
- Culture they were hired and trained into

Bad habits and unsafe practices exist between these traditional roles

- Staffing is also an issue



NFPA – FIRE SAFETY PROGRAM

*"A **fire safety program** shall be included in **all construction, alteration, or demolition contracts**, and the right of the owner to administer and enforce this program shall be established, even if the building is entirely under the jurisdiction of the contractor."* NFPA 241 Sec. 1.3.4

- The **owner must designate** a person who shall be **responsible for the fire prevention program** and **authorize them to enforce** its provisions. NFPA 241 Sec. 7.2



PROGRAM MANAGER RESPONSIBILITIES

NFPA 241 sec. 7.2.4

- Proper training in the use of fire protection equipment
- Development of pre-fire plan with local FD
- Responsible for presence of adequate fire protection devices
- Supervision of the permitting of hot work
- Weekly self inspection program
- Authorize planned impairments
- Responsible for the guard service





FIRE SAFETY PROGRAM

Construction Site Safety Plans

FIRE SAFETY PROGRAM

All the following should be addressed in a fire safety program

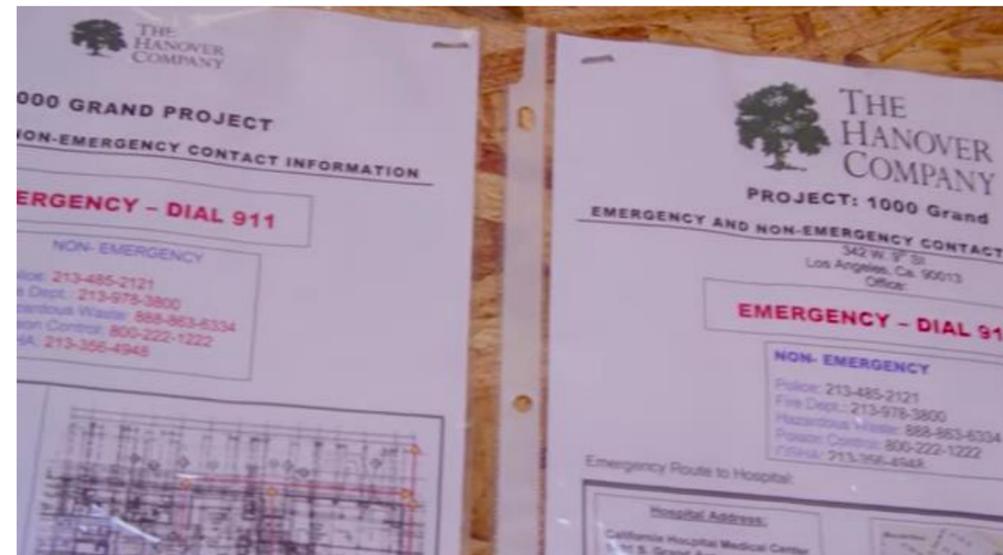
- Good housekeeping
- On-site security
- Fire protection systems: installation as construction progresses and preservation of existing systems during demolition
- Training of employees
- Development of a pre-fire plan w/ local fire department
- Rapid communication
- Consider special hazards
- Protection of existing structures from exposure to fire

FIRE SAFETY PLAN

NFPA 241 Chapter 7

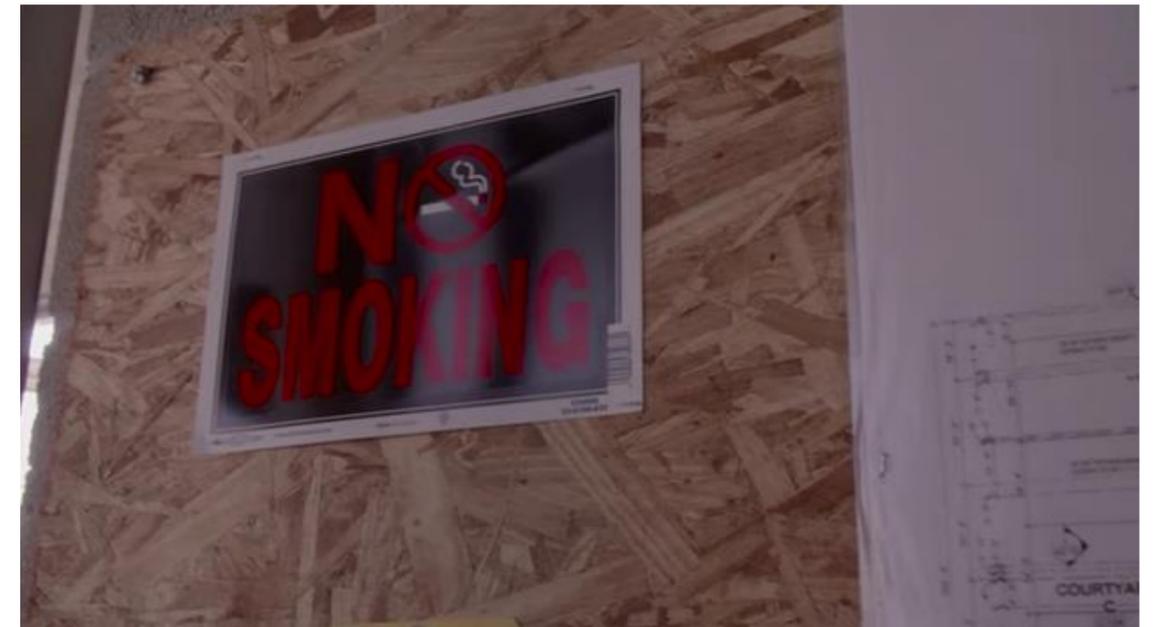
Fire prevention plan (FPP) should include

- Organizational structure and responsibilities for fire safety
- Name and contact phone number of person(s) responsible for FPP compliance
- Arrangements for recording fire safety training given to site personnel and visitors, including required actions in case of fire
- Risk assessments and FPE reports requiring specific fire safety measures
- Fire safety requirements in compliance with applicable fire and building codes
- Procedures for emergency notification, evacuation and/or relocation of all persons in the building under construction which are aligned with site emergency notification plan



FIRE SAFETY PLAN: CONTINUED

- Fire prevention measures
 - security requirements
 - control of ignition sources
- Procedures for Hot Work permit operations, cutting and welding
- Electrical supplies and equipment
- Compliance with 'smoking' policies
- Plant equipment and vehicles
- Prohibition of open fires
- Control/reduction of combustibile materials
- Control flammable liquids and gases
- Proper storage and disposal of waste materials
- Fire department access, facilities and coordination
- Evacuation plan and procedures



FIRE SAFETY PLAN: CONTINUED

- Fire protection provisions
 - portable fire extinguishers
 - standpipes
 - hydrants, hose reels and water supplies
 - automatic fire sprinklers*
 - automatic fire detection and alarm systems*
 - temporary emergency lighting*
- Separation from adjacent buildings and other hazards
- Special provisions if work is being carried out in occupied buildings
- Urban wildland interface clearance requirements, if appropriate

*These items can only be evaluated during the final stage of construction





KEY NFPA 241 CODE REQUIREMENTS

...regarding site security, housekeeping, hot work, equipment fueling, smoking, food preparation and other hazardous activities on construction sites

SITE SECURITY

- Guard service shall be provided when required by the AHJ
 - **New provision: Combustible construction exposed during construction more than 40ft above grade plane-guard service required (2019)**
- Security fences shall be provided where required by the AHJ
- Entrances to the structure under construction must be secured



SITE SECURITY

- Site security plan, based on security assessment, should include:
 - Personal observations
 - Logbooks
 - Video technology
 - Scheduled patrol routes
 - Proper notification procedures
- The guard service must be trained in the following
 - Notification procedure
 - Function & operation of fire protection equipment
 - Familiarization of fire hazards
 - Use of construction elevator



SITE SECURITY

THEY ALWAYS PUT-UP FENCES AFTER THE FIRE!



HOUSEKEEPING

- Housekeeping “rules” not the same as housekeeping “activity”
- Can quickly deteriorate from lack of action
- Supervisors need to enforce consistently and act when it is violated
- NFPA 241 deals with waste disposal in Section 5.4



HOUSEKEEPING

- Clear premises of all refuse and process waste
- Remove waste, scrap and debris daily
- Keep all building site areas free of accumulated packing materials (e.g. pallets, paper, etc.)
- Provide appropriate metal bins (or dumpsters with lids) for combustible waste disposal such as oil rags
 - Empty these containers at the end of every shift
 - Take contents off-site



HOUSEKEEPING

- Storage places accessible to firefighters
- Clear spaces around stored materials and provide adequate gangways between them
- If a sprinkler system is installed, all material stacks should not impede effective sprinkler operations
- Open-topped dumpsters containing combustible materials should be emptied or moved to at least 35 ft from combustible structures at the end of each work shift. (A.5.4.1)

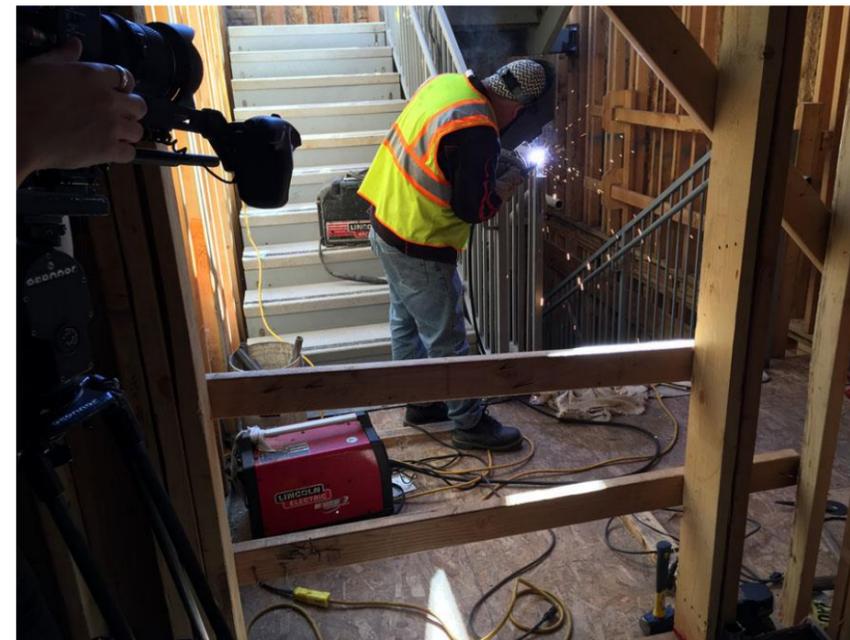


HOT WORK

Hot Work should be closely controlled

Implement a permit system including

- Requirements for written permission (a permit) prior to commencement of hot works
- Hot works permits must be specific to a location, activity and work period and must not provide blanket coverage for more than one location activity or work period



HOT WORK

Other management practices to reduce ignition potential

- Reinforce accountability and ensure constant fire mitigation measures
- Combustible materials at least 35 feet away from Hot Work area
 - If they cannot be moved, cover area with a fire-resistant blanket
 - Sweep floors in these areas of all combustible waste and debris
- Cover all floor and wall openings within 35 feet of a hot work area to prevent hot sparks from entering walls or falling to a lower level
- Hot Works should never be conducted in the presence of flammable gases, vapors, liquids, or dust



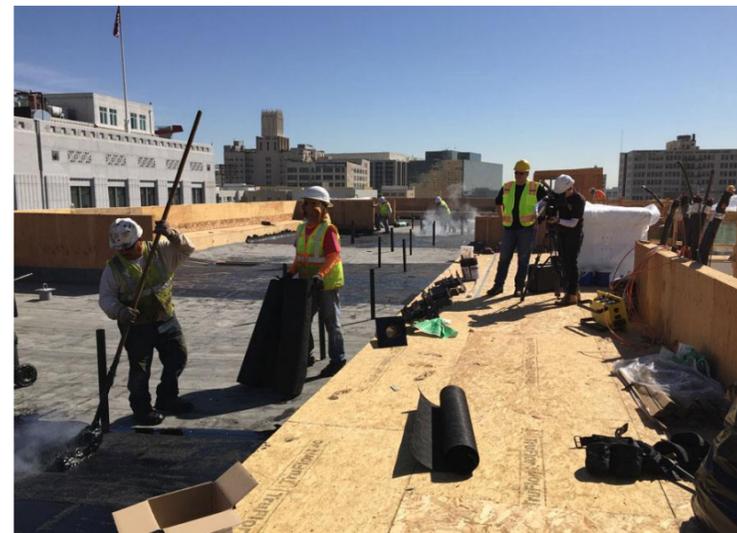
HOT WORK

- Provide appropriate fire extinguishers that are properly sized, fully charged, and ready for operation
- Keep evacuation paths clear
- Assign a suitably trained and equipped person to fire watch during hot works until released by the PAI
- PAI to inspect hot works areas at day's end
 - Also by security staff, if reasonably practicable and safe to access the area
- Provide means for communicating an alarm in accordance with Emergency Action Plan



FIRE WATCH: NFPA 51B 4.4

- Shall be trained to recognize the inherent hazards of the work site and hot work operations
- Fire watch shall be assigned no other duties
- Has the authority to stop hot work operations if unsafe conditions develop.
- A fire watch shall be posted for the duration of the hot work
- A fire watch shall be maintained for 1 hour after completion of hot work operations. Longer for torch applied roofs.



ELECTRICAL- BRANCH CIRCUITS

- Branch circuits shall originate in an approved power outlet or panelboard.
- All conductors shall be protected by overcurrent devices
- Runs of open conductors shall be located where the conductors are not subject to physical damage, and the conductors shall be fastened at intervals not exceeding (10 ft).
- Electrical devices shall be maintained in a safe condition.
- Extension cords shall be maintained free from damage.
- Damaged equipment and cords shall be removed from service until rendered safe.



ELECTRICAL- LIGHTING

- Temporary lights shall be equipped with guards
- Temporary lights shall be equipped with heavy-duty electrical cords with connections and insulation maintained in safe condition.
- Temporary lights shall not be suspended by their electrical cords
- Splices shall have insulation equivalent to that of the cable.
- Temporary wiring and lights shall be removed immediately upon the completion of the construction

ELECTRICAL- COMMON VIOLATIONS

Open Splices and bad wiring



BEST PRACTICES - SMOKING

5.3.1* Smoking shall be prohibited at or in the vicinity of hazardous operations or combustible/flammable materials, and "No Smoking" signs shall be posted in these areas.

5.3.2 Smoking shall be permitted only in designated areas.

5.3.3 Where smoking is permitted, safe receptacles for smoking materials shall be provided.



BEST PRACTICES - COOKING

- Cooking equipment shall be placed and used in such a manner so that it is secured against overturning or displacement.
- Cooking shall only be located in approved cooking areas that are designated by approved signs, which state the following:
 - **WARNING!**
DESIGNATED COOKING AREA — COOKING OUTSIDE OF A DESIGNATED COOKING AREA IS PROHIBITED
- Cooking outside of approved cooking areas shall be prohibited.



BEST PRACTICES - HEATING EQUIPMENT

- Locate temporary areas to protect against weather outside of any structure
- Conduct refueling of heating devices outside and safely
- Maintain separation distance from combustible materials
- Require personnel to be in attendance when the heater is running
- Restrain device to minimize risk of knock-over or incorrect location
- Inspect regularly



BEST PRACTICES – PASSIVE SYSTEMS

- Early installation of permanent or temporary fire compartments can limit fire spread
- Address protection of door openings, windows, shafts and service penetrations
- Provide temporary fire alarm system and modified evacuation procedures to address expected fire spread rate
- Provide separation distances or fire barriers between adjacent buildings appropriate to the fire hazard



BEST PRACTICES - FLAMMABLE LIQUIDS

- Train workers in storage and handling of dangerous goods
- Keep storage of flammable liquids and gases to a day's supply
- Provide clear signage identifying materials being stored and prohibiting smoking, open flame, hot works, and use of cell phones



BEST PRACTICES - GARBAGE CHUTES

- Construct chutes of noncombustible materials and locate outside building envelope
- Minimize accumulation of combustible materials close to the chute
- Change-out dumpsters frequently to prevent chute clogging
- Protect combustible trash chute interior by a temporary automatic sprinkler within a recess near chute top*

*Can be connected by a firehose or commercial rubber hose not less than 3/4" diameter



BUILT-IN FIRE PROTECTION FEATURES

The following components and systems are not considered to be effective in minimizing the risks until they are complete:

- Fire stairs, including fire-resistant walls
- Fire-protective materials to structural steel
- Automatic fire sprinkler systems and other automatic suppression systems
- Fire compartment boundaries, including fire doors, penetration seals, and general protection of other openings



FIREFIGHTING ACCESS: COMMAND POST- NFPA 241§7.5.1

New Provision!

- A suitable location at the site shall be designated as a command post and provided with plans, emergency information, keys, communications, and equipment, as needed.
- The person in charge of fire protection shall respond to the location command post whenever fire occurs.



FIREFIGHTING ACCESS: KEY BOX NFPA 241 § 7.5.2

New Provision!

- Where access to or within a structure or an area is unduly difficult because of secured openings or where immediate access is necessary for life-saving or fire-fighting purposes, the authority having jurisdiction shall be permitted to require a key box to be installed in an accessible location.
- The key box shall be an approved type and shall contain keys to gain access as required by the authority having jurisdiction.



FIREFIGHTING ACCESS: EXTERIOR

- Every building must be accessible by a road with an all-weather driving surface of at least 20' of unobstructed width
- The required width of access roadways shall not be obstructed in any manner, including obstruction by parked vehicles.
- Dead-end roads more than 150' must include a turnaround
- Access road(s) must be within 150' of all exterior 1st floor walls



FIREFIGHTING ACCESS: STAIRS

- Provide at least one useable stairway at all times
- Extended upward as each floor is completed
- Stairways must be lighted
- Enclose stairways once exterior walls are complete
- Provide identification signs to include floor level, stair designation, and exit path direction



FIREFIGHTING ACCESS: HYDRANTS

- Free access from the street to fire hydrants and to outside connections for standpipes, sprinklers, or other fire extinguishing equipment, whether permanent or temporary, shall be provided and maintained at all times.
- Protective pedestrian walkways shall not be constructed so that they impede access to hydrants.
- No material or construction shall interfere with access to hydrants, siamese connections, or fire extinguishing equipment.



FIREFIGHTING ACCESS: STANDPIPES (WHERE REQUIRED)

- Maintain in conformity with building progress and ready for use
- Install at least one standpipe, prior to construction exceeding 40', within one floor of the highest point of construction
- Must be conspicuously marked and readily accessible FDC
- One hose outlet on each floor
- A water supply providing a minimum flow of 500 gallons per minute provided (IFC)



FIREFIGHTING ACCESS: WATER SUPPLY (NFPA 241)

- Fire protection water supply (temporary or permanent) shall be available as soon as significant combustible material is present - NFPA 241 Section 8.7.2.1
- Where underground water main or hydrants are to be provided, they shall be installed, completed, and in service prior to start of construction





NEW CONSTRUCTION SAFETY CODE PROVISIONS NFPA 2019 EDITION

The 2019 edition includes not only a number of clarifications but an introduction of new requirements. A special provision is added to the application section that allows the authority having jurisdiction to implement portions of the standard as appropriate.

NEW CONSTRUCTION SAFETY CODE PROVISIONS NFPA 241 2019 EDITION

- **Adds Definitions**
- **Electrical Service Disconnecting Means**
- **Guard Service Requirement**
- **Command Post and Key Box Requirement**
- **Tall Mass Timber Building Construction Requirements**



DEFINITIONS: NFPA 241 2019 EDITION

- **Cross Laminated Timber (CLT):** A prefabricated engineered wood product consisting of not less than three layers of solid-sawn or structural composite lumber where the adjacent layers are cross-laminated and bonded with structural adhesives.
- **Critical Heat Flux (CHF).** The minimum heat flux at or below which there is no ignition
- **Facility Fire Brigade.** An organized group of employees at a facility who are knowledgeable, trained, and skilled in at least basic fire-fighting operations, and whose full-time occupation might or might not be the provision of fire suppression and related activities for their employer.



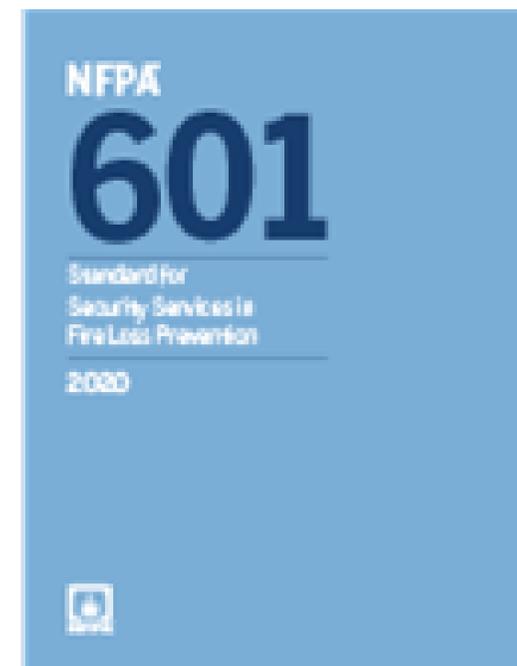
ELECTRICAL SERVICE DISCONNECTING MEANS: NFPA 241 2019 EDITION

6.1.1.4 *During construction or demolition activities, all temporary and permanent service equipment disconnecting means shall be readily accessible to emergency service personnel and shall be labeled as to which equipment is controlled by such disconnects.*



GUARD SERVICE REQUIREMENT NFPA 241 2019 EDITION

7.2.5.1* *Guard service shall be provided where required by the authority having jurisdiction. Where required, buildings with combustible construction exposed during construction more than 40 ft above grade plane shall be provided with guard service when there are no crews on-site*



COMMAND POST AND KEY BOX REQUIREMENT NFPA 241 2019 EDITION

7.5.1 Command Post. 7.5.1.1 A suitable location at the site shall be designated as a command post and provided with plans, emergency information, keys, communications, and equipment, as needed.

7.5.1.2 The person in charge of fire protection shall respond to the location command whenever fire occurs.

7.5.2 Key Box. 7.5.2.1 Where access to or within a structure or an area is unduly difficult because of secured openings or where immediate access is necessary for life-saving or fire-fighting purposes, the authority having jurisdiction shall be permitted to require a key box to be installed in an accessible location.



TALL MASS TIMBER BUILDING CONSTRUCTION REQUIREMENTS NFPA 241 2019 EDITION

12.2* Roofing Operations. The requirements of Chapter 9 shall apply for roofing operations, except that torch-applied roofing systems shall be prohibited.

12.3* Fire Exposure Analysis. Before construction begins, a study shall be conducted by a fire protection program manager to assure that the sequencing of passive and active fire protection installations, combined with the separation provided between other structures on the same or adjacent lots, is adequate to prevent fire spread to the exposed structures.

12.3.2 Construction shall comply with the requirements established by the fire exposure analysis.



TALL MASS TIMBER BUILDING CONSTRUCTION REQUIREMENTS: NFPA 241 2019 EDITION

12.5.1* Guard service trained in accordance with 7.2.5.2 or other methods acceptable to the AHJ shall be required at all times that combustible construction has exceeded three stories and workers are not on the site.

12.5.2 Minimum 6 ft (1.8 m) high security fences shall be provided around the entire exterior of the construction site.



FIRST ARRIVING UNITS



8 MINUTES LATER





AMERICAN WOOD COUNCIL

This concludes The American Institute of Architects