NFPA 241 - Safeguarding Construction, Alteration, And Demolition Operations

What does this code mean for you?

Learning Objectives

• Define the scope of NFPA 241 and become familiar with how the Standard addresses the following:
  • 1) Processes and Hazards
  • 2) Fire Safety Program
  • 3) Fire Protection During Construction
  • 4) Fire Protection During Demolition
### Fires in Structures Under Construction, Undergoing Major Renovation, or Being Demolished

**2010-2014 Annual Averages**

<table>
<thead>
<tr>
<th>Structure Status</th>
<th>Fires</th>
<th>Civilian Deaths</th>
<th>Civilian Injuries</th>
<th>Direct Property Damage (in Millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under construction</td>
<td>3,750</td>
<td>5</td>
<td>51</td>
<td>$172</td>
</tr>
<tr>
<td>Undergoing major renovation</td>
<td>2,560</td>
<td>4</td>
<td>65</td>
<td>$108</td>
</tr>
<tr>
<td>Being demolished</td>
<td>2,130</td>
<td>4</td>
<td>16</td>
<td>$30</td>
</tr>
</tbody>
</table>

### Fire Statistics

**Fires in Structures Under Construction, Undergoing Major Renovation, or Being Demolished, 2010-2014 Annual Averages**

- **Cooking equipment**: 27% under construction, 9% undergoing renovation, 2% being demolished
- **Heating equipment**: 13% under construction, 15% undergoing renovation, 3% being demolished
- **Intentional**: 13% under construction, 13% undergoing renovation, 42% being demolished
- **Torch, burner or soldering iron**: 6% under construction, 10% undergoing renovation, 12% being demolished
- **Smoking materials**: 5% under construction, 4% undergoing renovation, 2% being demolished
- **Exposure fire**: 3% under construction, 3% undergoing renovation, 2% being demolished

• Engineering or Systems Approach

• Fire Safety Goals:
  ● Life Safety
  ● Property Protection
  ● Continuity of Operations

• Fire safety systems are designed to meet the stated goals.
  ● NFPA 550 – Guide to the Fire Safety Concepts Tree

• Systems Approach

  "OR" Gates
  
  "AND" Gates

NFPA 550 - 2012
• Systems Approach

```
A
B1
B2
B3

B3
B2
B1

OR Gates

A
B1
B2
B3

B3
B2
B1

AND Gates
```

NFPA 550 - 2012

• Fire Safety Objective

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Fire safety objective(s)

Prevent fire ignition
Control heat-energy source(s) Control source-fuel interaction Control fuel

Manage fire impact
Manage fire Manage exposed

= OR gate
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NFPA 550 - 2012
• Prevent Fire Ignition

- Control heat-energy source(s)
- Control rate of heat-energy release
- Control heat-energy transport
- Control heat-energy transfer processes
- Control fuel transport
- Eliminate fuel(s)
- Control fuel ignitability

- Provide separation
- Provide barrier
- Control conduction
- Control convection
- Control radiation
- Provide barrier
- Provide separation
- Control fuel properties
- Control the environment

NFPA 550 - 2012

• Manage Fire

- Control fire by construction
- Control movement of fire
- Control certain fire

- Control fuel properties
- Local fuel quantity
- Control fuel distribution
- Control physical properties of environment
- Control chemical composition of environment

- Suppression
- Suppression

- Automatically suppress fire
- Manually suppress fire
- Detect fire
- Apply extinguishment
- Detect fire
- Communicate signal
- Decide action
- Respond to fire
- Apply extinguishment

- OR gate
- AND gate

NFPA 550 - 2012
• Hot Work
  • Dedicated fire watch
  • Fire watch during and for 2 hours after

• Temporary Heating
  • Installed/used per listing
  • Secured to prevent overturning
  • Equipped with tip-over and overheat cutoffs
  • Dedicated personnel
  • No exposed radiant wire type
• **Smoking**
  • Only permitted in designated areas
  • Prohibited at or near combustible/Flammable Materials
  • Where permitted – safe receptacles provided

**ELECTRONIC CIGARETTES**
Fires have occurred while e-cigarettes were being used, the battery was being charged, or the device was being transported. Battery failures have led to small explosions. Never leave charging e-cigarettes unattended. E-cigarettes should be used with caution.

• **Waste Disposal**
  • Removed at end of each day at a minimum
  • Oily rags kept in proper containers

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**Trends in Civilian Deaths in U.S. Smoking Material Home Fires**

Source: The Smoking-Material Problem, John R. Hall, R.H., July 2013
NFPA, 1 Batterymarch Park, Quincy, MA 02169; www.nfpa.org
Fire Analysis & Research Division, anal@nfpa.org
• Waste Disposal – Trash Chutes
  • Develop Trash Chute Safety Plan with AHJ approval
  • Trash Chutes used on exterior of the building
    • Non-combustible construction
    • If Combustible - not less than 1 temporary sprinkler placed in a recess near the top (with a listed guard) and Protected against freezing
Processes and Hazards

- Flammable and Combustible Liquids and Flammable Gases
  - Comply with NFPA 30
  - Storage of Class I and Class II liquids shall not exceed 60 gal. within 50 ft. of structure
  - No open flames near storage area
  - Storage areas posted with “No Smoking” signage

Utilities

- Cooking
  - Cooking equipment properly secured
  - Located in an approved area designated by signs:

  WARNING!
  DESIGNATED COOKING AREA – COOKING OUTSIDE OF A DESIGNATED AREA IS PROHIBITED
• Electrical
  • Must comply with NFPA 70
  • Maintained in safe condition
  • Extension cords free of damage
  • Damaged equipment removed from site
  • Temporary and permanent service equipment disconnecting means – readily accessible to Emergency Responders and properly labeled

• Temporary Lighting
  • Equipped with guards
  • High temperature lighting (i.e. quartz) securely fastened
  • Heavy duty cords
  • Not supported by the cords unless designed for such
  • Removed immediately upon completion of construction
• **Fuel Gas**
  - Installed and tested in accordance with *NFPA 56: Standard for Fire and Explosion Prevention During Cleaning and Purging of Flammable Gas Piping Systems*
  
  • Shall not be used for the cleaning of piping under any circumstance.

• **Fire Safety Program**
  - Develop an overall Construction or Demolition program
  - Program must address:
    - Housekeeping
    - On-Site Security
    - Fire Protection Systems
      - New Construction – Systems installed as construction progresses
      - Demolition – Preservation of existing systems
    - Organization and Training of on-site fire brigade (where applicable)
    - Local Fire department pre-plan
    - Rapid Communication
    - Special Hazards considerations
    - Protection of existing structures from exposure fires
• Key Points
  • Owners responsibility (Owners Document)
  • Pre-fire planning
  • Fire Prevention Program Manager (FPPM)
  • Responsibility

• Owner’s Responsibility for Fire Protection
  • Must designate a person responsible for the fire prevention program
    • Shall have the authority to enforce the provisions of the fire protection standards
    • Shall have knowledge of applicable fire protection standards, systems and inspection procedures
  • Inspection records available for review
Fire Protection

- Fire Prevention Program Manager (FPPM) Responsibilities
  - Responsible for proper training in the use of fire protection equipment
  - Responsible for the presence of adequate numbers and types of fire protection equipment and their maintenance.
  - Responsible for supervising the Hot Work Permit system
  - Responsible for authorizing any impairments to the fire protection, detection or communication systems

Pre-Fire plan
- Develop a pre-fire plan with the local fire department input
- Plan must include provisions for on-site visits by fire agency
- Needs to be a living document that is updated as necessary
• Site Security
  - Guard service provided where required by AHJ
  - Where guard service is provided, Guard shall be trained in all of the following
    - Notification procedures (Fire Department and Management)
    - Function and operation of fire protection equipment
    - Familiarization with any fire hazards
    - Use of construction elevators (where provided)
  - Security fencing shall be provided where required by AHJ
  - Entrances to the structure under construction, alteration or demolition shall be secured where required by AHJ

• Fire Alarm Reporting
  - Readily available public fire alarm box, telephone service to fire emergency center or equal
  - Instructions shall be issued for immediate notification of fire department
  - Numbers conspicuously posted
• Access for Fire-Fighting
  • Command Post
    • Designate a suitable location at the site for a command post
    • Provide building plans, keys, emergency information, communications and any equipment needed
  • Key Box
    • AHJ is permitted to require a key box installed in an accessible location
    • Must be an approved type and contain keys to access as required by AHJ
  • Access Roadways
    • Every building shall be accessible by fire apparatus by means of a roadway having all weather driving surface not less than 20 ft wide and 13 ½ ft vertical clearance
    • Provided at the start of the project
    • Dead ends more than 150 ft must provide turn-around for local apparatus
    • Must extend to within 150 ft of all exterior walls on the 1st floor of the building

• Access for Fire-Fighting
  • Stairs
    • At least one stair must be provided that is usable at all times meeting NFPA 101
    • Must extend upwards as each floor is installed in new construction
    • Must be lighted
    • Must be enclosed where the building exterior walls are in place
    • Must be provided with stair identification
      • Floor level
      • Stair designation
      • Exit path direction
  • Hoists and Elevators
    • Where hoists or elevator provide the only efficient means of transporting equipment to upper floors – must be available to Fire Department when necessary
## Fire Protection

### Access for Fire-Fighting
- **Hydrants**
  - Access from street to hydrants and FDC connections maintained at all times

- **Standpipes**
  - In new buildings, where required, must be maintained in conformity with the progress of the building construction.

- **First-Aid Fire-fighting Equipment**
  - Must provide portable fire extinguishers in accordance with *NFPA 10, Standard for Portable Fire Extinguishers*

### Means of Egress
- Provide and maintain means of egress in accordance with *NFPA 1, Life Safety Code*

### Safeguarding During Construction and Alterations
- **Scaffolding, Shoring and Forms**
  - Combustible forms/lumber shall be brought to the site only when needed
  - Combustible forms/lumber shall be removed from site as soon as stripping is complete
  - Where combustible forms/lumber are in use, no other combustibles materials may be stored.

- **Construction Material and Equipment Storage**
- **Permanent Heating Equipment**
- **Utilities**
- **Building Separation Walls**
  - Fire Cutoffs
  - Temporary Separation Walls
Fire Protection

• Safeguarding During Construction and Alterations
  • Construction Material and Equipment Storage
    • Temporary storage of equipment to be installed, or excessive combustible construction or packing material shall not be permitted in unprotected areas under construction unless authorized by the AHJ

  • Building Separation Walls
    • Fire Cutoffs
      • Fire walls and exit stairways shall be given priority for installation
      • Fire doors with approved closing device and hardware shall be installed as soon as practical
      • Fire doors once installed shall not be obstructed from closing

• Safeguarding During Construction and Alterations
  • Temporary Separation Walls
    • Occupied portions of the building shall be separated from area under construction, alteration or demolition when operations are considered as having a higher level of hazard than the occupied area.

    • Walls must be 1 hour fire-resistance rated

    • Openings must be protected with 45 min fire protection rating (doors)
    • Walls are not required to be rated where an approved sprinkler system is installed and operational.
• Fire Protection During Construction
  • Water Supply
    • A water supply must be available for fire protection (temporary or permanent) as soon as significant combustibles are present.
    • Where underground mains and hydrants are to be provided, they shall be installed and in service prior to commencing building construction.

• Fire Protection During Construction
  • Sprinkler Protection
    • Where sprinkler protection is to be provided, the installation shall be placed in service as soon as practicable.
    • Where sprinkler protection is required for safety to life, the building shall not be occupied until the system is installed and tested.
    • Allows for floors of a multi-story building to be occupied where:
      • The occupied floors are protected
      • The system is installed such that floors under construction can be isolated
    • Restricts the closing of valves to authorized personnel with notification to designated parties
    • Where frequent operation is happening, all valves shall be inspected at the end of each work shift
• Fire Protection During Construction
  • Standpipes
    • Where permanent installation is a Class II or Class III standpipes, hose and nozzles shall be provided as soon as water supply is available to the standpipe.
    • Where combined systems where hose is not required, temporary hose and nozzles shall be provided.
    • Where required by the AHJ
      • Provide conspicuously marked and readily accessible FDC on the outside of the building at street level with at least one standard hose outlet on each floor
      • Must be securely supported and restrained on alternate floors
      • Hose valves must be kept closed and protected against damage
      • Must use National Standard threads (or local FD requirements where different)
      • Must extend up with each floor and capped at the top
      • Top hose outlet must not be more than one floor below highest forms/staging
      • Must remain in service until permanent standpipe installation is complete

• Safeguarding Roofing Operations
  • Asphalt and Tar Kettles
    • Must be located in a safe place outside of the building
    • Shall not be located on the roof
    • Must have a lid that can be closed by gravity
    • Lid must be close fitting and a minimum of 14 gauge
    • Kettles must be constantly attended when in operation
    • Operator must be within 25 ft and line of sight
    • Cannot block or be within 10 ft of means of egress
• Safeguarding Roofing Operations
  • Single-ply and Torch-Applied Roofing Systems
    • Torches or hot air guns must be used in accordance with manufacturers instructions
    • Shall not be overheated to cause smoking or ignition
    • Use small torches at a safe distance from openings, penetrations and flashing
    • Must be able to visually see flame impingement
  
  • Flame Contact Protection
    • Flame shall not be applied to combustible substrate
    • Base ply is permitted to be glass fiber or organic felts.
    • Flames shall not come in contact with exposed plastic roof cement

• Safeguarding Demolition Operations
  • Special Precautions
  • Temporary Heating Equipment
  • Smoking
  • Demolition using Explosives
  • Utilities
  • Fire Cutoffs
  • Fire Protection
    • Sprinklers
    • Standpipes
• Safeguarding Underground Operations
  • Modifications
  • Tunnels
  • Drainage
  • Fire Safety
  • Means of Egress
  • Security
  • Compartmentation
  • Water Supply
  • Emergency Procedures
  • Fire Detection, Protection and Communications systems

• Safeguarding Construction Operations for Tall Timber Structures