NFPA 241 *(Standard for Safeguarding Construction, Alteration, and Demolition Operations)*

Impacts on Fire Alarm Systems and Installation Contractors

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NFPA 241

AGENDA

- Background on Construction Fires
- NFPA 241 Overview
- Fire Alarm Considerations
- Case Studies
- Questions
CONSTRUCTION FIRE STATISTICS

- NFPA Research Foundation April 2017 Report
  - Fires in Structures Under Construction, Undergoing Major Renovation and Being Demolished
  - Years 2010 through 2014
  - Summarizes
    - Quantities of fires
    - Sources of ignition
    - Monetary damages due to fires
    - # of injuries
    - # of deaths
CONSTRUCTION FIRE STATISTICS

8,500 Fires Per Year

13 Deaths Per Year

132 Injuries Per Year

310 Million Dollars in Losses Per Year
KEY STATISTICS

- 8,500 Construction fires per year (Average of 23 Fires Per Day!)

- Majority of property damage caused by Hot Work (37 Million)
  - Torch, Burner, Soldering Iron etc.

- Majority of injuries caused by heating and cooking equipment followed by hot work
  - Heaters (Permanent or Temporary)
  - Stoves, Ovens, Microwaves etc.

- Majority of deaths caused by fires started by smoking materials
  - Cigarettes, Pipes, Cigars etc.
WHY ARE CONSTRUCTION FIRES UNIQUE?

- Fire protection systems are typically impaired or incomplete during construction
  - Fire Alarm Systems
  - Sprinkler Systems
  - Standpipes
- Higher fire load in/near building
  - Material Storage
  - Waste storage (Dumpsters & Trash Chutes)
- Fire walls incomplete or not constructed yet
  - Fire can Spread Rapidly
WHY ARE CONSTRUCTION FIRES UNIQUE?

 tiềm năng Exposed Combustible Construction
- Wood Frame
- Mill Buildings

High-Risk Construction activities
- Welding
- Cutting
- Pipe Soldering

Security
- Easy to trespass on construction sites
- Intentionally set fires
WHY ARE CONSTRUCTION FIRES UNIQUE?

○ Fire Department Access Challenges
  • Site Access
    – Construction Roads
    – Site Obstructions (Trucks, dumpsters, storage, holes etc.)
  • Building Access
    – Elevators may be unusable
    – Stairs may be incomplete
    – Difficult to navigate floors under construction
NEW CONSTRUCTION V.S. RENOVATION

New Construction

- Built from ground up (including fire protection systems)
- Building Changes in size and shape as time progresses
  - Site access may change
  - FD response may change
  - Availability of stairs and elevators may change
  - Availability of fire protection systems may change
    » Standpipes
    » Sprinklers
    » Fire Alarm
NEW CONSTRUCTION V.S. RENOVATION

Renovations to Existing Buildings

- Benefit of having existing fire protection within building
  - Fire Alarm
  - Sprinkler Systems
  - Standpipes etc.

- Fire Department Response to building likely to remain constant
  - Main Entrance (FACP location)
  - Fire Command Center Location (High-Rise)
  - Elevators and stairs will likely be available
INTRODUCTION

HOW TO ADDRESS THESE CHALLENGES?

CONSTRUCTION FIRE SAFETY PLAN

IN ACCORDANCE WITH NFPA 241
NFPA 241 SUMMARY

- Contains safety and fire protection requirements for construction, renovation and demolition activities
- All of the previously discussed items and more
- Requirement for a Fire Safety Program document to be developed
  - Outline the approach to fire safety throughout the construction project.
  - Identify Fire Prevention Program Managers that shall be held responsible for adhering to NFPA 241/Fire Safety Program policies and procedures
NFPA 241

STANDARD DEVELOPMENT

- 1ST Edition in 1968
- Developed over the years in response to construction fire events
- Current Edition: 2013
- Next Edition: 2018
ADOPTION & ENFORCEMENT

✔ Chapter 16 of NFPA 1 Fire Code
  • “Safeguarding Construction Alteration and Demolition Operations”
  • States that **ALL** structures undergoing construction, alteration or demolition operations **shall** comply with NFPA 241

✔ Chapter 33 of International Building Code
  • “Safeguards During Construction”
  • Scoped to NFPA 241 via IFC references

✔ Chapter 33 of International Fire Code
  • “Fire Safety During Construction & Demolition”
  • NFPA 241 required for items not addressed by chapter 33
ADOPTION & ENFORCEMENT

Underutilized by AHJs

- Many do not realize they can require compliance

Word is spreading and enforcement is increasing among AHJs

- Awareness is spreading across country
- Large recent increase observed in Northeast:
  - New York
  - Massachusetts
SIGNIFICANT REQUIREMENTS

- Fire Safety Program (i.e. NFPA 241 Plan, CFSP)
  - Required in Section 7.1 of NFPA 241
  - Document that outlines all aspects of the fire safety approach for project

- Fire Prevention Program Managers
  - Person(s) designated as responsible for site compliance with NFPA 241 and the Fire Safety Program
CONSTRUCTION FIRE SAFETY PLAN

 websocket


- Good housekeeping
  - Site cleanup procedures
  - Material storage locations

- On-site security
  - Site control
  - Site access
  - Site lockdown
  - AHJ allowed to require guard service
Existing system preservation

- Existing sprinkler protection should remain active where possible
  - Scheduled impairments and then returned to service
- Existing fire alarm detection and notification shall remain active where possible
  - Scheduled impairments and then returned to service
  - Possibly change smoke detectors to heat detectors for duration of construction
CONSTRUCTION FIRE SAFETY PLAN

- **On-site fire brigade**
  - Outline site response to fire events
    - Attempt to extinguish with extinguishers or evacuate?
    - Notification of FD, GC, Site Contractors, Owner etc.

- **Pre-fire plan with the local fire department**
  - Fire department access to site and building
  - Procedures for meeting/escorting fire department
  - FDC locations
  - Standpipe locations
  - Stair availability and locations
  - Elevator availability/location
CONSTRUCTION FIRE SAFETY PLAN

🔗 Rapid communication
• How are events communicated throughout the site
  – Radios
  – Cell Phones
  – Intercoms
  – Fire Alarm System

🔗 Special Hazards
• Documentation of any hazards specifically related to previous or adjacent occupancies
  – Flammable/combustible liquids
  – Construction that requires unique demolition
    » Cutting (torch)
CONSTRUCTION FIRE SAFETY PLAN

○ Exposure Protection
  • Separation distances for site trailers, sheds, storage etc.
  • Means of separation between occupied areas and renovation areas
    – 1 HR Construction Required or Sprinklers

NFPA 241
CONSTRUCTION FIRE SAFETY PLAN

 Activate Fire Protection as it is installed

• This is oftentimes not considered or enforced
  – Systems installed and turned off until final inspection date
    » Fire alarm
    » Sprinkler

• Standpipes shall be active or temporary standpipes installed throughout construction (NFPA 241 requirements)

• Sprinkler system installation should be coordinated activated prior to final inspection
  – Will provide protection during construction even if it hasn’t been approved or may need to be adjusted.
  – Better than no protection!
CONSTRUCTION FIRE SAFETY PLAN

 millennials
• Fire alarm system installation should be coordinated and placed in service prior to final inspection
  – Means of notification required throughout construction areas (NFPA 241 requirement)
  – Temporary system may be desired if new system cannot be installed as construction progresses
  – Once installed, system should be on even if pending acceptance
SUPPORT FOR EARLY SYSTEM ACTIVATION

- **Notification**
  - Workers
  - Other occupants
  - Fire Department

- **Detection**
  - Sprinkler supervision
  - Manual pull stations
  - Detectors where construction environment is suitable
    - Example: System could be live with detectors bagged until area is cleaned

- **Sprinklers**
  - Serve as heat detection
  - Property protection throughout the building
EARLY ACTIVATION CHALLENGES

AHJ approval

- Phased activation approach review with AHJ
  - Many see benefit to system activation ASAP
  - Some hesitant prior to their final approval
    » Activation could involve activating system prior to being connected to city supervision after final acceptance

Site Conditions & Timelines

- Smoke detectors should not be installed where construction dust is present (detectors removed or bagged)
- Typically easier to be phased on a floor by floor basis
  - after disruptive/dirty work is complete
TEMPORARY FIRE ALARM SYSTEMS

- Not specifically required to be implemented in all scenarios
- Typically in new construction or large renovations
- Temp systems could be:
  - Stand-alone
    - Wireless systems increasingly popular
    - Removed at end of construction and re-used
  - Temporary wiring and devices connected to existing wired system
    - Linear heat detection is common
    - Removed at end of construction when new FA work is compete
FIRE ALARM CONSIDERATIONS

FIRE ALARM SYSTEM REPLACEMENTS

- Existing FA system should always stay online for duration of project unless:
  - Temp FA system installed
  - Firewatch implemented
- This allows building to be protected while new system is installed.
- Cutover procedure required near completion
  - Sprinkler supervisory devices
  - Control functions
    - Elevators
    - Smoke Control
    - Door holders
    - HVAC
IMPAIRMENTS

Specific impairment plans should be developed for each type of impairment

- Reviewed with building owner & General Contractor
  - In charge of coordinating all impairments as the FPPMs
- Reviewed with AHJ
- Used as part of impairment permit
FIRE ALARM CONSIDERATIONS

IMPAIRMENTS

Ο No sprinkler impairments on adjacent floors
  • May require short FA impairment for drain down/fill

Ο No simultaneous FA impairments on same floor as FP
IMPAIRMENTS

- Keep existing FA system active as much as possible
  - Do not bypass notification
  - Do not bypass active sprinkler zones
  - Do not bypass fire pump
    - Sprinkler contractor should turn pump back on if shut off for zone drain down
FIRE ALARM CONSIDERATIONS

IMPAIRMENTS

◆ Bag smoke detectors
  • In addition to by-passing point in FACU
  • Bagging permit typically required
  • Beware of detectors associated with output functions
    – Elevators
    – Smoke Control
    – Stair & Elevator Pressurization
    – Pre-Action Sprinkler Systems
CONTROL FUNCTION IMPAIRMENTS

Smoke detectors for:
- Elevator Recall
- Smoke Control
- Stair/Elevator Pressurization
- Etc.

Short Impairment
- Bag detector for short duration then remove immediately
  - Minimizes duration
- Examples include:
  - Short cutting operation near elevator lobby
  - Vacuuming debris near stair landing
  - Loading construction debris into elevator
CONTROL FUNCTION IMPAIRMENTS

 Longer Impairment (multiple days)
  • Change detector type
    – Rate of rise detectors better than fixed temperature
      » Earlier activation to simulate early activation of smoke detector
    – Multicriteria detector
      » More resistant to nuisance alarms
      » May need to discard device after use if installed in dirty environment
  • Examples include:
    – Regular short duration impairments
    – Reconstruction of an elevator lobby
    – Demolition of entire floor of building
DEUTSCHE BANK FIRE NYC - 2007

- High Rise Building
  - 41 Stories
- NYC Adjacent to Ground 0
- Dismantling after 9/11
  - Asbestos Abatement
  - Clearing 9/11 debris
- 7 Alarm Fire
  - 87 Response Units
  - 475 Firefighters
- 17th floor origin
- Cause: Smoking
DEUTSCHE BANK FIRE NYC - 2007

- 115 Firefighter Injuries
- 2 Firefighter Deaths
DEUTSCHE BANK FIRE NYC - 2007

- Standpipes were removed from building
  - Hoisted hose lines to 17th floor
- Sprinkler systems were inactive
- Delayed notification of fire department by construction personnel
- Blocked stairwells
- Unique conditions due to:
  - Asbestos Abatement
  - Deconstruction Activities
- No NFPA 241 Plan
DEUTSCHE BANK FIRE NYC - 2007

Center For Disease Control & Prevention (CDC) Report – 2010

Recommendations:
  • Enforce NFPA 241 Procedures for all Construction and Demolition Activities
    – Would have addressed:
      » Blocked Stairwells
      » Combustible Debris
      » Sprinkler System Operation
      » Standpipe Operation
CONSTRUCTION FIRE CASE STUDIES

WALTHAM MA APARTMENT COMPLEX - 2017

- Apartment Complex (5 Buildings)
- 246 Units
- Wood Construction
- 10 Alarm Fire
- Cause: Arson
CONSTRUCTION FIRE CASE STUDIES

WALTHAM MA APARTMENT COMPLEX - 2017

- Only 4 Firefighter Injuries
- No Deaths
CONSTRUCTION FIRE CASE STUDIES

WALTHAM MA APARTMENT COMPLEX - 2017

- Sprinkler systems were incomplete and not in service
- Fire alarms were incomplete and not in service
- No NFPA 241 Plan
CONSTRUCTION FIRE CASE STUDIES

WEYMOUTH MA APARTMENTS - 2017

- Apartment building
- 50 Units
- 4 Stories
- Wood Construction
- 4 Alarm Fire
- Cause: Unknown
CONSTRUCTION FIRE CASE STUDIES

WEYMOUTH MA APARTMENTS - 2017

- No Injuries
- No Deaths
Sprinkler systems were incomplete and not in service

Fire alarms were incomplete and not in service

Final inspection planned for 4 weeks after fire occurred

Challenging Water supply
  • Had to run hose across nearby train tracks

NFPA 241 Plan unknown
  • Could have included
    – sprinkler activation
    – Fire department water supply (pre-fire plan)
DORCHESTER MA APARTMENTS - 2017

- Apartment building
- 83 Units
- 6 Stories
- Wood Construction
- 6 Alarm Fire
- Cause: Generator
CONSTRUCTION FIRE CASE STUDIES

DORCHESTER MA APARTMENTS - 2017

- 1 Injury
- No Deaths
Sprinkler systems were incomplete and not in service
Fire alarms were incomplete and not in service
Final inspection planned for next day
Delayed notification to FD
No NFPA 241 Plan
LESSONS LEARNED

❖ Trends:
  • Wood frame construction
  • Sprinklers & FA present but disconnected or turned off

❖ NFPA 241
  • May have reduced damage/injuries
    − Coordinated an approach to turn on sprinklers & fire alarm systems prior to final inspection
    − Coordinated pre-fire plan with FD
      » Water supply locations
      » Determine best approach to fight a fire before responding to an event
    − Improved communication procedure for notifying FD
      » Fire alarm system notification
        • Municipal
        • Local
QUESTIONS?

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