Preventing fires in buildings under construction or renovation

Introduction

Fire continues to be a significant cause of loss to buildings under construction or renovation. Simply put, these buildings are just more susceptible to damage by fire, and the magnitude and nature of this susceptibility varies during the course of a project.

Once a fire is allowed to occur, there is uncertainty as to how serious its impact will be. As a project moves towards completion, this uncertainty just gets greater and greater.

Whether it is a new home, a new department store, or a new high rise building there is a very real potential that major portions of the project will need to be razed and replaced if a fire is allowed to start.

Reduce the potential or severity of a fire by applying the new construction fire prevention guidelines contained in this Risktopic.

Discussion

Unlike completed buildings, buildings under construction or renovation may involve a number of conditions that support fire ignition. Once stated, these buildings also offer further conditions that support both fire development and fire spread. For example:

- **Hot work** will be underway with cutting, welding, soldering, brazing, grinding and other similar operations that present open flames, hot slag, and sparks.
- **Combustibles**, including construction materials and waste, are often present in significant concentrations that can readily supply the fuel needed for a fire.

Zurich fire loss experience for construction projects
January 2006 through September 2011

- Number of fire losses: 1,266
- Net incurred claims: $263,000,000
• **Fire protection systems** that are being installed are not typically placed in service until the end of the project. They will not be available to assist in the prompt, automatic control of a fire that may start.

• **Compartmentation and firestopping systems** will be incomplete or unavailable to assist with the control of fire spread.

• **Fire service access** may be hampered by temporary buildings, equipment staging, site work, temporary bracing and other impediments not present with completed buildings.

• **Water supply** availability may be limited and lead to greater manual effort to place hose streams in service to fight a fire.

When a new construction project begins, the potential for fire is often rather low. Earth moving, underground utility installation and foundation work often involve minimal fire exposure to the building or structure to be erected.

However, at some point, combustibles are introduced to a site, and from that point forward the quantities will be in a constant state of change. Permanent fire protection systems are usually not placed into service until a project nears completion. That means that fire extinguishment will rely upon far less effective manual fire protection measures.

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**Construction projects that pose a high fire risk**

Although all construction projects are subject to sustaining losses from fire, projects that are most susceptible to fire losses include:

- High rise buildings (75 feet of higher) – These fires may need to be handled manually as fire service ladder and platform vehicles may not be able to reach the fire.
- High value projects (+$25 million) – With higher values at risk, the fire risk is also higher.
- Wood frame structures - Fires in wood frame structures can spread rapidly due to the structure itself that offers both a high combustible loading and a high continuity of combustibles.

The following are lists of activities, ignitions sources, and ignitable materials that play a role in the increased likelihood of fire at construction sites.

**Fire cause**

Activities that cause fires on construction sites are quite similar to those that affect completed buildings. They include:

- Arson (incendiary or suspicious)
- Hot work and other open flames (embers, burning of waste)
- Electrical distribution
- Smoking
- Cooking

**Fire ignition**

The major sources of ignition for construction site fires include:

- Cutting torches
- Cigarettes
- Open fire
- Matches
Fire fuels

The construction site will contain a variety of combustibles, and the materials more likely to be ignited include:

- Construction materials (expanded plastics insulations, rubber membranes, wood)
- Structural framing materials
- Shoring materials
- Vegetation (grass, trees, and brush)
- Gasoline (in the case of arson)

So, whether it is combustible construction materials, combustible packaging materials, temporary wood bracing and forms, or combustible wastes, all combustibles that arrive on a construction site need to be managed. Controls are needed to:

- Reduce the chance that combustibles will be ignited
- Reduce the potential damage that ignited combustible may cause

Guidance

Implement a fire prevention program for each new construction or renovation project site. The program should incorporate the guidelines of NFPA 241 and this Risktopic.

Site Fire Prevention Management

Designate a person with appropriate knowledge as the Fire Prevention Program Manager for the site in accordance with NFPA 241.

Authorize the Fire Prevention Program Manager to develop and implement a written, comprehensive Site Fire Prevention Program following the provisions of NFPA 241 and this Risktopic.

Provide a team to support the Fire Prevention Program Manager based upon the size and complexity of the project.

Stipulate in contracts that each project subcontractor is to comply with the Site Fire Prevention Program and designate a Fire Prevention Coordinator who will report to the Fire Prevention Program Manager.

Assign duties to the Fire Prevention Program Manager to include the following actions:

- Conducting daily Site Fire Prevention Inspections to identify Site Fire Prevention Program infractions
- Recording the findings of Site Fire Prevention Inspections in a Site Fire Prevention Inspection report
- Coordinating with sub-contractor Fire Prevention Coordinators to promptly resolve Site Fire Prevention Program infractions
- Recording the results of actions taken to resolve infractions in the Site Fire Prevention Inspection report
- Delivering Site Fire Prevention Inspection reports to site management on a daily basis

Assign duties to Site Management to include the following actions:

- Reviewing and approving the Site Fire Prevention Program
- Making the Site Fire Prevention Program available to all site workers
- Reviewing daily Site Fire Prevention Inspection reports
- Acting to immediately address:
  - Conditions reported that indicate a disregard or indifference to fire prevention
  - Infractions reported that are not being actively resolved in an acceptable manner
- Filing reports for later review
- Accompanying the Fire Prevention Program Manager on at least a monthly basis to verify Site Fire Prevention Inspections are being conducted in accordance with the Site Fire Prevention Program
Fire Protection Plan

Develop and include a Fire Protection Plan in the Site Fire Prevention Program. Authorize the Fire Prevention Program Manager to conduct a daily site inspection to verify that fire protection equipment is available, accessible, and in service. Authorize the Fire Prevention Program Manager to pursue fire protection deficiencies through the Fire Prevention Coordinators.

Fire protection includes:

- Private fire hydrants
- Standpipe systems (fire hose systems)
- Portable fire extinguishers
- Automatic fire sprinkler systems

Private or public fire hydrants are to be available and in service to protect the site as soon as combustibles are brought on site.

Standpipe systems, where required for the building under construction, are to be provided in a manner that maintains pace with construction. Design and install standpipe systems in accordance with NFPA 14, and maintain the availability of standpipes in accordance with NFPA 241.

Portable fire extinguishers are to be provided and maintained in serviceable condition. Provide extinguishers suitable for all classes of fires present in accordance with NFPA 10.

Automatic fire sprinkler systems, where planned for the completed structure, should be installed and placed in service before commissioning or hot testing operations (e.g. starting up fuel fired equipment) are conducted and as soon as practicable before the building is occupied. In the case of combustible construction, apply the additional special measures outlined below.

### Zurich best practice – Fixed fire protection

When fixed fire protection systems are planned for the completed structure, install and activate the systems before introducing combustibles.

### Combustible construction – Special measures

Expand the Fire Protection Plan to include the following special measures where the project includes combustible construction materials such as wood and plastic. Authorize the Fire Prevention Program Manager to conduct a daily site inspection to verify these special measures are implemented. Authorize the Fire Prevention Program Manager to pursue fire protection deficiencies through the Fire Prevention Coordinators.

- Coordinate the activation of the sprinkler system piping as soon as the framing for each floor is finished
- Chain and lock sprinkler control valves in the open position
- Coordinate the installation of plywood lateral bracing as each floor of the building is completed (eliminates open spaces that allow fire to travel)
- Coordinate additional guard tour activities in any area where hot work was underway in the previous 24-hour period.

### Site access

Develop and include a Site Access Plan in the Site Fire Prevention Program. Authorize the Fire Prevention Program Manager to conduct a daily site access inspection to maintain specified site access through the Fire Prevention Coordinators.
Provide and maintain site access at all time to immediately accommodate the arrival of emergency vehicles to the site, their access to fire protection facilities, and their placement around the buildings or structures under construction.

**Hot work**

Develop and include a Hot Work Procedure in the Site Fire Prevention Program. Authorize the Fire Prevention Program Manager to conduct a daily site hot work inspection to enforce the use of the hot work procedure through the Fire Prevention Coordinators.

Hot work procedures should include:

- Shielding and/or protecting combustibles that cannot be moved more than 35 feet from the work area. Consider floors above and below the work.
- Posting a fire watch
- Providing a portable fire extinguisher dedicated to use by the fire watch.

Although a hot work procedure may be adequate in most situations, the Fire Prevention Program Manager may find that certain exposures require the use of hot work permits, especially when existing building alterations and demolition operations are being performed.

Develop the Hot Work Procedure in accordance with NFPA 51B. Consult the Risktopic “Hot work fire safety” for further guidance.

**Zurich best practice – Hot work permits**

Hot work permits should be used in areas that are not designed and arranged for hot work. The Site Fire Prevention Program should authorize the Fire Prevention Program Manager to designate Hot Work Permit Required areas. These are areas that possess combustible construction features or combustible contents.

**Housekeeping**

Develop and include an Emergency Action Plan in the Site Fire Prevention Program. Authorize the Fire Prevention Program Manager to conduct a daily site housekeeping inspection and enforce housekeeping deficiencies through the Fire Prevention Coordinators.

Remove waste from work areas at least by the end of each shift. NFPA 241 stipulates more frequent removal rates where needed for “safe operations”.

**Combustible materials**

Develop and include guidelines for the management of flammable and combustible materials in the Site Fire Prevention Program. Authorize the Fire Prevention Program Manager to conduct a daily site inspection and enforce storage guideline through the Fire Prevention Coordinators.

Guidelines should include:

- Locating temporary structures with combustible construction or occupancy at least 50 feet from the building or structure under construction
- Storing combustible construction materials and wastes at least 50 feet from the building or structure under construction
- Storing quantities of Class I flammable liquids and Class II combustible liquids that exceed 60 gallons at least 50 feet from the building or structure under construction
- Using listed safety containers to transport flammable and combustible liquids on the site
- Using listed safety containers to store oily rags awaiting use, cleaning, or disposal
Smoking

Develop and include guidelines for a “No Smoking” program in the Site Fire Prevention Program. Authorize the Fire Prevention Program Manager to conduct a daily site inspection, post and maintain “No Smoking” signs in accordance with the “No Smoking” program, and pursue infraction of the “No Smoking” program through the Fire Prevention Coordinators.

Where it is not practicable to ban smoking from an entire construction site, limit smoking to designated areas in accordance with NFPA 241. Arrange designated smoking areas as follows:

- Use noncombustible construction for any enclosure or seating
- Provide adequate separation from combustibles
- Post signs to indicate smoking is permitted
- Provide marking of the designated smoking area boundary
- Provide adequate receptacles for the collection of discarded smoking materials

Post “No Smoking” signs in all areas where smoking is not permitted such as:

- Enclosed buildings
- Buildings or structures under construction where combustible construction or contents are present
- Storage areas where combustible materials are present
- Areas where oil, gasoline, propane or other flammable or combustible liquids or gases are stored, handled, or used

Temporary heating equipment

Develop and include guidelines for the control of portable and temporary heaters in the Site Fire Prevention Program. Authorize the Fire Prevention Program Manager to conduct a daily site inspection, and pursue infraction of the program through the Fire Prevention Coordinators.

Guidelines should address actions that include:

- Selecting equipment that is listed for the intended purpose
- Locating equipment in accordance with its listing and manufacturer’s instructions to maintain adequate clearance to combustibles
- Securing equipment in its use location
- Fueling equipment outside of the building or structure under construction
- Maintaining equipment by trained personnel
- Instructing workers on these guidelines
- Instructing workers to monitor this equipment throughout each shift for appropriate use and application

Emergency action plan

Develop and include an Emergency Action Plan in the Site Fire Prevention Program. The plan should addresses actions to take should a fire occur and include:

- Worker training incorporating content such as:
  - Identification of unfriendly fires
  - Report fires and other emergencies
  - Fire evacuation procedures
- Emergency site contact point
  - Central point of contact for reporting all emergencies
  - Available at all time work is underway
- Emergency contact information
  - List of critical telephone numbers specific to the site
Emergency response team
- Select staff to support the responding emergency services
- Assign duties such as:
  - Meeting emergency responders at the site entrance
  - Directing emergency responders to the emergency location on site
  - Verifying fire protection systems are in service and available
  - Shutting off electric power
  - Shutting off fuels

Fire service visits
Develop a plan to engage the local public fire service as part of the Site Fire Prevention Program. Facilitate the fire service becoming familiar with the nature, scope and size of the project as well as the site Emergency Action Plan.

Before the project begins, meet with the fire service to describe the location and arrangement of the site, the types and nature of fire hazards to be present on the site during the course of the project, and protection features planned for the site. Protection features should include:

- Access to the site
- Access to the buildings or structures
- Location of private fire hydrants
- Locations of planned risers serving sprinklers and hose connections
- Location of fire department connections for planned fire systems

During the course of the project, invite the fire service to visit on a monthly basis to maintain familiarity with the site.

Site security
Develop and include a Security Plan in the Site Fire Prevention Program. Provide passive, manual, and active security features for the site. The type and extent of features should be based upon the conditions on site.

Security features to consider include:

- Passive
  - Perimeter fencing
  - Site lighting
- Manual
  - Guard service during and after work hours
  - Hourly, recorded guard tours
  - Monitored closed circuit television system
- Automatic
  - Intrusion alarms including door contacts, infrared beams, motion detectors, and glass break detectors

Guards should be provided as soon as significant values are present on the site. Assign the Fire Prevention Program Manager to be responsible for the guard service in accordance with NFPA 241. Guards should remain on site until the following conditions exist:

- Planned automatic fire sprinkler systems are in service
- Complete electronic fire alarm system is in service
- Complete electronic intrusion alarm system is in service
• All combustibles or high valued equipment is secured inside the building or structure

Conclusion

A comprehensive Site Fire Prevention Program under the direction of a knowledgeable and competent Fire Prevention Program Manager authorized to implement and enforce the program will provide a framework for significantly reducing the likelihood of a fire on the construction site.

The presence of a well defined Emergency Action Plan, staff trained and prepared to implement the plan, and a responding local public fire service familiar with the site will greatly improve the potential for reducing the impact of any fire that may occur.

References


Related Risk topics

• Hot work fire safety, Zurich Services Corporation.
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