# Construction Site Fire Safety

## A Guide for Construction of Large Buildings

**March 2015**

Canadian Wood Council
Conseil canadien du bois

University of the Fraser Valley
School of Criminology & Criminal Justice

The Canadian Wood Council (CWC) represents the Canadian wood products industry through a national federation of associations. The Mission of the Council is to expand market access and increase demand for Canadian wood products through its work in codes, standards, regulations and education.


## Acknowledgements

The CWC would like to thank all emergency responders who serve Canadians in communities across the country and to dedicate this guide to all those who work tirelessly to reduce the advent and impact of fire.

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## Preparation

This manual was prepared for the CWC by the University of the Fraser Valley in British Columbia, with research and writing by:

- Len Garis, City of Surrey Fire Chief, Adjunct Professor at the School of Criminology and Criminal Justice, University of the Fraser Valley
- Paul Maxim, Professor at Wilfrid Laurier University
- Karin Mark, writer and graphic designer

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### Important Notice

*This information is for general reference and guidance only. The information provided should not be considered exclusive nor inclusive of all information available on the topics presented. While all care has been taken to ensure the accuracy of the information in this publication, the CWC, all persons associated with them and any other contributors do not assume any responsibility for the completeness of the information presented.*

*The contents of this document may not be applicable to all construction sites. Adopted practice should be developed on the basis of a site-specific analysis of fire risk and the applicable regulations.*

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# Introduction

## 1.1 Importance of Construction Fire Safety

Buildings face the greatest risk from fires during the construction phase. In recent years, there have been several examples across Canada of major construction site fires, including those in Calgary, Alberta in March 2015, Kingston, Ontario in December 2013 and Richmond, British Columbia in 2011.

Myriad risks exist at construction sites, including:

- Proximity of combustible materials to ignition sources (e.g. electrical equipment and hot work such as welding);
- Lack of completion of any built-in fire-safety systems such as sprinklers;
- Absence of doors, finished walls and other separations that may slow fire spread; and
- Potential site security issues.

It is estimated that more than 100,000 building projects in Canada each year involve wood-based construction (e.g. wood-frame, post-and-beam, mill or cross-laminated timber).

With this widespread and growing use of wood – due in part to building code changes permitting taller wood buildings – comes the need for a greater focus on construction fire safety. Although research[1] shows that wood buildings are as safe as those built with steel and concrete when effective fire-safety systems are in place, like all buildings, they are more vulnerable to fires when they lack those systems – as is the case during construction.

### Financial Losses

A focus on construction fire safety also makes good business sense. Financial losses can be significant, as fire departments in general take a defensive approach to construction site fires.[2] Because there is typically little to no need for occupant rescue in a building under construction, protecting firefighter safety and preventing fire spread usually are the main focuses.

## 1.2 Scope

The intent of this manual is to reduce the risk of and losses from construction site fires. The manual provides Canadian builders with practical tools and information based on best practice, legislation, regulation and standards from Canada, the United States and Europe. (For more analysis of this topic, please see the research paper *Construction Fire Response: Preventing and Suppressing Fires during Construction of Large Buildings* at www.cwc.ca.)

Regulation related to buildings under construction varies across the country, and the information in this guide may not reflect the local, provincial and national regulation in all areas. It is important to research, understand and comply with all area-specific fire safety regulations before construction and throughout the project. (See the Legislation, Regulation and Other Guidelines section for more information.)

While the focus of this manual is on the design, planning and construction phases for new buildings, the information may also be relevant to projects involving demolition, alteration, renovation, repair and maintenance of existing buildings.

## 1.3 Responsibility for Fire Safety

Fire safety is the responsibility of everyone involved in construction projects, including the construction industry, employers, workers, site visitors, and provincial and local authorities. Each participant has a specific role that, when combined with the efforts of others, can help to reduce the risk of construction site fires.

### Construction Industry

The construction industry has made significant improvements in its efforts to support on-site safety over the years. With the increased focus on construction fire safety, industry associations such as the Canadian Wood Council are stepping forward to provide resources and information to members, designers, builders and regulators.

### Employers

Provincial Occupational Health and Safety regulations require the provision of a safe work environment. To properly implement and evaluate safety at their sites, employers should have a comprehensive policy that covers all levels of the company, from management to labour. Construction companies should emphasize the need for fire safety and create a mindset amongst all employees that fire safety is a top priority.

## Workers

It is critical that workers follow prescribed safety methods of work and demonstrate concern for the health and safety of themselves, fellow employees and others who may be affected by their actions. Workers should:

- Report all potential fire hazards;
- Observe all fire safety rules, procedures and codes of safe practices; and,
- Use, with all reasonable care, the tools, safety equipment and personal protective equipment (PPE) appropriate to the worksite.

## Site Visitors

Individuals visiting jobsites should be required to check in with the site supervisor, who should ensure visitors are made aware of the site safety procedures.

They should also be required to wear appropriate PPE, including, at minimum:

- Hard hat and safety vest;
- Goggles; and
- Appropriate safety shoes or other footwear.

While on the jobsite, visitors should:

- Stay visible;
- Remain alert and aware of their surroundings;
- Never approach equipment unless the operator has acknowledged their presence; and
- Never park vehicles in a way that blocks fire department access.

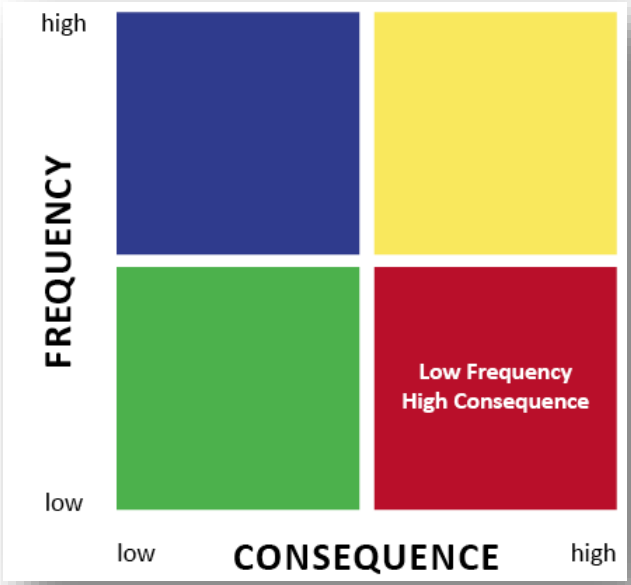
## Authority Having Jurisdiction

**Fire Protection and Construction**
Fire and building regulations are typically enforced at the local government level:

- Building Department: Enforces and oversees building construction in accordance with local bylaws, and provincial legislation and codes.
- Fire Department:
    - Fire Prevention Division: Enforces local fire bylaws and provincial fire codes.
    - Fire Suppression Division: Works with project representatives to develop pre-fire plans and assess water supply, access and exposure protection.

**Health and Safety**
Occupational Health and Safety regulations are enforced by provincial workplace health and safety agencies.

## 1.4 Catastrophic Events




This document was created as a response to try to avert future catastrophic events (e.g. a fire or building collapse), such as those faced by the construction industry over the last decade. As illustrated in the diagram, catastrophic events usually have a low probability of occurring, but high consequences when they do occur. Despite the potential severe consequences, however, human nature is such that routine events are easily accepted but catastrophic events are seldom contemplated and are difficult to accept.

It is important that senior company managers demonstrate leadership in managing the risks associated with catastrophic events. As noted American businessman and humourist Arnold Glasow said, “One of the true tests of leadership is the ability to recognize a problem before it becomes an emergency.”

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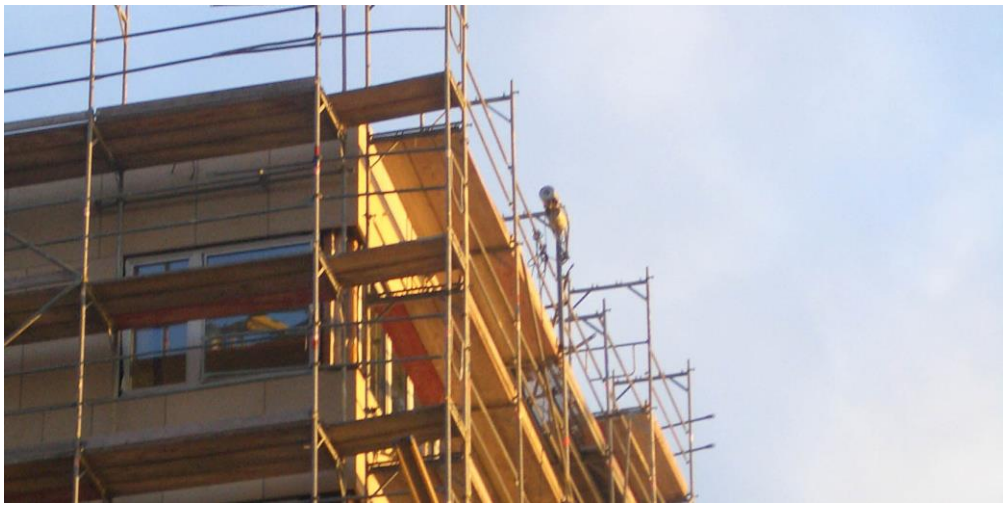

# Legislation, Regulation and Other Guidelines

Construction fire safety in Canada is addressed through a variety of legislation, regulation, standards and guidelines.

## 2.1 Federal

National Model Construction Codes are developed and maintained by the Canadian Commission on Building and Fire Codes (CCBFC), an independent committee established by the National Research Council.

The model codes include the National Building Code, the National Fire Code, the National Plumbing Code and the National Energy Code. Provinces and territories may adopt the codes as their own, either as-is or with amendments.

### National Building Code of Canada (NBCC)

Part 8 of the NBCC 2010 includes construction site regulations.* Provinces and territories that have adopted Part 8 with little or no modification are:

- British Columbia
- Saskatchewan
- Manitoba
- Québec
- New Brunswick
- Newfoundland and Labrador
- Northwest Territories
- Nova Scotia
- Nunavut
- Yukon
- Prince Edward Island

The 2012 Ontario Building Code does not include requirements for fire and life safety at construction sites.

* The NBCC was under review at the time of publication of this guide; the 2015 version is expected to permit the construction of wood buildings of up to six storeys, from the current four storeys. No changes are proposed for Part 8 of the NBCC 2015.

### National Fire Code of Canada (NFCC)

Section 5.6 of the NFCC covers construction site fire and life safety.* Provinces and territories that have adopted the NFCC with little or no modification are:

| | |
|---|---|
| Saskatchewan | Newfoundland and Labrador |
| Manitoba | Northwest Territories |
| Québec | Nova Scotia |
| New Brunswick | Yukon |

British Columbia and Alberta have province-specific construction and demolition safety sections in their provincial fire codes.

The 2012 Ontario Fire Code does not include requirements for fire and life safety at construction sites. However, the 2014 Ontario Fire Code does cover fire and life safety for demolition (Part 8) and during repairs or renovations (Article 2.6.1.10).

Nunavut and Prince Edward Island have not adopted fire regulations that address fire and life safety at construction sites.

## 2.2 Provincial

Provincial Occupational Health and Safety (OHS) regulations primarily focus on the protection of workers and others present at workplaces. Worker safety at construction sites is commonly addressed through general OHS provisions, although some regulations have additional specific provisions for construction sites, such as in Ontario.

Construction site OHS in Canada is addressed through the following regulations:

- *British Columbia Occupational Health and Safety Regulation*
- *Alberta Occupational Health and Safety Code*
- *Saskatchewan Occupational Health and Safety Regulations*
- *Manitoba Workplace Safety and Health Regulation*
- *Ontario Occupational Health and Safety Regulation, Construction Projects*
- *Québec Act Respecting Occupational Health and Safety*
- *Newfoundland and Labrador Occupational Health and Safety Regulations*
- *Nova Scotia Occupational Safety General Regulations*
- *New Brunswick Workers' Compensation Regulation*
- *Prince Edward Island Occupational Health and Safety Act, General Regulations*
- *Yukon Occupational Health Regulations*
- *Northwest Territories Occupational Health & Safety Regulations*

* The NFCC was under review at the time of publication of this guide; the 2015 version is expected to include additional provisions in Section 5.6 for construction of wood buildings of up to six storeys.

### Hot Work Permits

Hot work requirements vary across Canada. While all jurisdictions require employers to have appropriate safety measures and safe work procedures for hot work, Alberta is the only province where the provincial OHS regulations require hot work permits.

Other jurisdictions have adopted the Canadian Standards Association's W117.2 standard *Safety in Welding, Cutting and Allied Processes* to address hot work safety. (See Other Standards and Codes below for more information.)

Even where hot work permit systems aren't required, they can provide a useful checklist of activities that help ensure the safety of employees and the worksite, as well as compliance with the safe work procedures in your area.

See the Hot Work subsection in the Fire Prevention and Protection Best Practices section of this guide for a hot work permit checklist.

## 2.3 Local Government

Several cities in Canada have published guidance related to construction site fire and life safety, or interpretations of provincial regulations. These documents are primarily intended to supplement, interpret and facilitate compliance with mandatory construction and fire regulations. Topics covered include construction site fire safety plans, protection of adjacent buildings, general construction and demolition site safety, and construction site fencing and barricading.

Prior to starting a construction project, it is advised to check with the local fire department for any area-specific bulletins or guidance.

## 2.4 Company Policy

No employee can be required to work at a jobsite they believe is not safe. All construction companies should have a policy that makes the health and safety of employees the highest priority. Eliminating unsafe working conditions and work practices begins with a company policy that establishes safety rules, policies and procedures that may be grounds for dismissal if not followed.

## 2.5 Other Standards and Codes

### National Fire Protection Association (NFPA)

The NFPA produces standards that serve as the basis for many fire codes and fire prevention practices adopted by the construction industry. Relevant NFPA standards include:

- NFPA 241 *Standard for Safeguarding Construction, Alteration, and Demolition Operations*;
- NFPA 1620 *Standard for Pre-Incident Planning*; and
- NFPA 51B *Fire Prevention in the Use of Cutting and Welding Processes*.

### Canadian Standards Association (CSA)

The CSA Group is accredited in the U.S. and Canada to develop standards in a wide range of subjects related to product safety and performance, process improvement, best practices and safer work environments.

A number of jurisdictions, including BC, Manitoba, New Brunswick, Newfoundland and Nova Scotia, look to the CSA W117.2 standard, entitled *Safety in Welding, Cutting and Allied Processes*, for guidance in hot work safety. The standard can be viewed for free at community.csagroup.org.

### International Code Council (ICC)

The ICC develops model codes and standards used in design, building and compliance processes to construct safe, sustainable, affordable and resilient structures. The ICC produces two documents that are relevant to construction fire safety: the International Building Code and the International Fire Code. Although the codes focus on the United States, both documents provide good practices that are relevant to the construction industry in Canada.

## 2.6 Insurance Industry Perspective

The private property and casualty insurance industry in Canada writes more than $45 billion in premiums and pays out about approximately 60% in claims annually. The industry has had a longstanding concern about large and devastating condominium and apartment fires, and is cautious when dealing with this line of business, particularly for projects under construction.

A focus group of insurance industry representatives was conducted in May 2014 for the development of the *Report on Course of Construction (Fire) Best Practices Guide*[2] for the Canadian Wood Council. Participants had both strong underwriting and loss prevention backgrounds, and included the two largest private property and casualty insurers in Canada. All participants provided Course of Construction (Builder's Risk) insurance coverage.

Construction companies might wish to consider the key concerns of this group, summarized below:

- ☐ The site water supply should be assessed in the planning stages to ensure there is sufficient water to supply the sprinkler system, standpipes and hose, and fire department requirements, both during and after construction.
- ☐ A fire plan for the construction phase should be in place before construction commences and reviewed before construction advances above ground level.
- ☐ The site should be supervised 24/7, with regular tours of the entire jobsite.
- ☐ No smoking should be permitted inside the fenced jobsite perimeter.
- ☐ The standpipes and hose should be installed and activated as the structure is being built (one floor below the floor under construction).
- ☐ Sprinkler systems should be installed and activated floor-by-floor as the structure is being erected (two floors below the floor under construction.)

- Sprinkler systems should be installed as designed (wet or dry), but temporarily used as dry-pipe systems and only converted to wet systems when the risk of freezing is no longer present.
- When hot work is being performed in non-sprinklered areas, staffed and charged fire hoses should be in place. If possible, employ off-duty firefighters to staff the hoses.
- No open-flame heating should be used.
- The erection of fire barriers/separation walls should be prioritized on each floor, and fire doors should be installed as soon as the door's framing is in place. Protocols should ensure the fire doors are then kept closed after normal working hours.
- Firewalls with parapets (or equivalent) that are integral to the approved project design should be installed using a two-storey lag.
- To help reduce the amount of project values susceptible to any fire loss, construction of multiple buildings at the same site should be staged to create a 30-metre firebreak until active fire protection and the noncombustible exterior are installed, before filling in the remaining buildings.
- The insurers preferred the notion of a contractor certification program until wood mid-rise construction becomes more common, and ideally afterwards as well. The certification would apply to all trades working at the site. An audit system to monitor the certification program was also suggested.
- Regular progress reports on construction and loss prevention should be posted to the company website.

An expected consequence of implementing such measures should be cost savings through the ability to obtain the most competitive rates from insurance companies.

## 2.7 Innovation and Alternatives

New and emerging technologies, products and processes are continually being developed to assist in construction site fire safety. While following established best practices, those responsible for construction site fire safety should regularly monitor industry news for innovations in this area.

Construction companies may also need to consider alternative approaches from time to time to address creative building designs brought to them by architects and engineers. An alternative approach should be discussed with local building authorities and should be equivalent, as a minimum, to the code requirements in terms of quality, strength, effectiveness, fire performance, durability and safety.

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# Definitions

**Exposed combustible materials:** Combustible materials that are not protected by fire-resistant coverings (see below).

**Fire-resistant coverings:** Coverings applied to construction elements to increase fire resistance, such as fire-rated gypsum board protecting timber or structural steel.

**Fire-preventative coverings:** Coverings, screens or treatments to combustible materials/construction elements that reduce the risk of ignition. Examples include fire-retardant treatments and noncombustible sheathing.

**Fire Safety Plan (FSP):** A strategy document developed and implemented by the owner of a construction site to address fire prevention, occupant safety, and fire control and extinguishment.

**Fire watch:** Typically consists of a trained person with a fire extinguisher whose sole job during the fire watch period is to guard against any fire ignition as a result of hot work activity.

**Hot work:** Operations including cutting, welding, brazing, soldering, grinding, thermal spraying, thawing pipe, installation of torch-applied roof system or any other similar activity involving an open flame, sparks, friction or other heat or ignition source.

**Hot work area:** The area exposed to sparks, hot slag, radiant heat or convective heat as a result of hot work.

**Hot work equipment:** Electrical or gas welding, soldering or cutting equipment used for hot work.

**Hot work permit:** Permits issued by the responsible person at the facility that permit welding or other hot work to be performed and that outline requirements to meet for the work to be permitted to take place.

**Hot work program:** Allows approved personnel to oversee and issue permits for hot work conducted by their personnel or at their facility. The intent is that trained, on-site, responsible personnel ensure that the required hot work safety measures are taken.

**NFPA Standard:** A standard developed by the National Fire Protection Association (NFPA), an organization that creates and maintains fire protection standards and codes for use and adoption by local governments. Although based in the United States, many NFPA standards and codes are widely adopted for use in Canada.

**Pre-fire or pre-incident plan:** A strategy document and site map indicating all hazards and resource locations related to a property before a fire takes place, to improve the effectiveness of the fire response.

**Personal protective equipment (PPE):** Equipment worn to protect human safety, such as hard hats, safety vests, goggles and appropriate footwear.

**Torch-applied roof system:** Bituminous roofing systems using membranes that are adhered by heating with a torch and melting an asphalt back-coating instead of mopping hot asphalt for adhesion.

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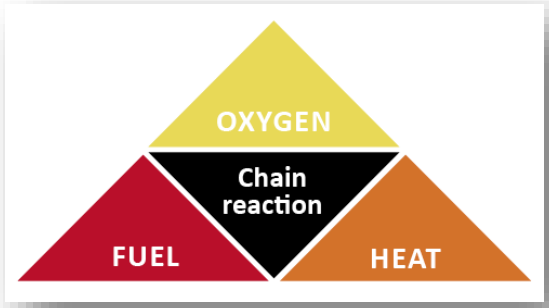
# Fire Basics

## 4.1 Fire Theory




Fuel, heat and oxygen must be present in the right proportions for a fire to occur. This is often described as the “fire triangle.”

The addition of a fourth component, a chemical chain reaction, creates what is called the “fire tetrahedron.” Once a fire has started, the resulting chain reaction sustains the fire until at least one of the elements is removed.

Below are some of the common causes of fires at construction sites.

| OXYGEN | FUEL | HEAT |
|---|---|---|
| • Normal atmosphere is 21% oxygen<br>• Additional oxidizers | • Combustible waste<br>• Building materials<br>• Flammable gases/liquids<br>• Packaging materials | • Smoking materials<br>• Open flames<br>• Electrical equipment<br>• Light fixtures<br>• Grinding/cutting metal |

## 4.2 Heat Transfer

Heat from a fire can be transferred by three methods: radiation, conduction and convection. In a typical building fire, solid and liquid matter are converted to gases by heat, and additional heat (thermal energy) is released as the volatile gases are consumed through the process called burning.

### Radiation

Thermal energy in the form of electromagnetic waves is called radiation. Hot solid, liquid or gaseous materials radiate heat that is absorbed by other materials. Radiation is probably the most typical method of heat transfer from building to building. Radiated heat can result in ignition of surface materials at some distance from the originating fire, causing what is called an exposure fire.

Radiation can also be the main driver of "flashover" in a room or compartment – that is, the transition from localized burning (for example, of a single object) to the burning of all fuel surfaces in a room or compartment. This most often occurs when the heat in a layer of smoke and gases near the ceiling radiates to all other surfaces in the room. When the amount of radiation reaches a critical point, all exposed fuel surfaces ignite.

### Conduction

In conduction**,** heat is transferred molecule to molecule through the length of a solid conductive material, such as metal. The fire may follow the heat, or conducted heat may cause another fire to ignite. Conduction does not typically cause fires to spread *between* buildings, but it can sometimes contribute to spreading a fire *within* a building.

### Convection

Convection is the most typical heat transfer method when it comes to spreading fires within a building. Convection is the transfer of heat from one place to another by the movement of fluids or gases. In the case of a building fire, heat is transferred by the movement of air, including the fire-generated smoke and other gases.

Radiation as well as convection can prevent firefighters from getting close to the seat of a fire.

## 4.3 Fire Types

Fires are classified according to the nature of the material being burned (the fuel), and whether live electrical equipment is present. The primary purpose for classifying fires is to identify the type of material required to extinguish them.

Fire types are grouped below based on fuel sources:

- Class A: Ordinary combustibles such as paper, wood, cloth, etc.
- Class B: Flammable and combustible liquids and gases
- Class C: Electrical fires
- Class D: Combustible metals
- Class K: Flammable cooking oils

## 4.4 Firefighting Methods

The method of fighting a fire depends on the fuel and on the presence of electrical hazards. In general, there are three approaches to putting out a fire:

- Starvation: Cutting off the fuel supply, such as by removing combustible materials;
- Smothering: Separating the fuel from the oxidant, such as by using a fire-retardant blanket to smother flames; and
- Cooling: Lowering the temperature below the material's ignition temperature, such as by applying water.

Fire extinguishers tend to either smother or cool the fire, depending on the type of fire. Small fires can also be smothered by fire blankets or by sand or earth, which are often in good supply at construction sites.

## 4.5 Fire Extinguisher Types

The nature of the fuel source and its reaction to extinguishing agents dictate the type of extinguisher to be used. It is important to understand the different types of extinguishers, because using the wrong agent – such as putting water on a flammable liquid fire or electrical fire – can be highly dangerous and can even help spread the fire.

| Extinguisher Class/Type* | Extinguishing Agent | Extinguishing Method | Remarks |
|---|---|---|---|
| A | Water | Cooling | Lower Temperature |
| | Foam | Smothering | Blanket cuts off air from fuel |
| | ABC dry powder | Smothering | |
| B | ABC dry powder | Smothering | Blanket cuts off air |
| | Foam, $CO_2$, BCF** | Smothering | Possible re-ignition |
| C | ABC dry powder | Smothering | Blanket cuts off air |
| | $CO_2$, BCF** | Smothering | Possible re-ignition |
| | Water fog | Cooling | Special equipment |
| D | Special dry powders or sand | Smothering | Water would produce $H_2$ and an explosion |
| K | Wet chemical | Smothering | Special fire risks based on cooking oils |

** See corresponding fire classes/types listed in Section 4.3 on previous page.*

** BCF - Bromochlorodifluoromethane

## 4.6 Fire Extinguisher Use

1. **Call for help before attempting to extinguish a fire.** The fire may grow much faster than you're capable of dealing with, and if help is on the way, it removes one less concern for you.
   - Call, or have someone else call, 911.
2. Ensure your own safety before trying to extinguish a fire – make sure you have a safe way out. Before using a fire extinguisher, always:
   - Assess the fire size – is it small enough to be put out by an extinguisher?
   - Check that you have the right type of extinguisher for the type of fire (see chart above). For example, never use a water extinguisher on an electrical fire.
   - Ensure you feel confident that you can use the equipment properly.
   - Check to see if the fire extinguisher is charged.
3. Ready the fire extinguisher. Almost all fire extinguishers have a safety pin in the handle. This pin usually looks like a plastic or metal ring, sometimes coloured red, which is held in place by a plastic seal. The seal needs to be broken and the pin pulled.
4. Aim for the base of the fire. Shooting into the flame is a waste of the extinguishing agent, as you're not addressing the source of the flames.
5. Use the PASS method:
   - **PULL** out the safety pin
   - **AIM** at the base of the fire
   - **SQUEEZE** the trigger
   - **SWEEP** the base of the fire

   *Keep in mind:*
   - *Do not let the casing of the extinguisher come into contact with energized electrical equipment.*
   - *If the fire contains loose particles or involves lightweight materials or liquids, be careful not to spread the fire with the blast of the agent from the nozzle.*
   - *A typical fire extinguisher will contain around 10 seconds of extinguishing agent.*
6. If you have successfully put out the fire, tend to the area and make sure not to leave it alone, as it might re-ignite without warning.
7. Replace the used fire extinguisher. The used one is now depleted and will serve no further purpose. Leaving it in place will create a false sense of security.

   **Remember: If you have used an extinguisher, it MUST be recharged.** Also, follow your local fire code requirements for servicing fire extinguishers. Typically, most require annual servicing.

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# Managing Risks

## 5.1 Construction Site Dangers

It is no surprise that a construction site can quickly become a dangerous environment. The presence of hazardous and combustible materials, the use of equipment that generates heat and sparks, lack of completed built-in fire-safety systems or fire separations, and potential security issues are among the hazards.

The leading causes of fire in buildings under construction or demolition are: incendiary or suspicious events, smoking, open flames (e.g. from hot work), embers and heating equipment. Best practices to address the following common hazards can be found in the Fire Prevention and Protection Best Practices section of this guide:

- Waste
- Gases, solvents and many paints and adhesives
- Gas cylinders
- Electrical equipment
- Smoking on site
- Escape routes
- Temporary buildings

Through careful risk assessment, design and planning, hazards can be addressed well before the first shovel goes in the ground.

## 5.2 Fire Prevention Planning

Fire prevention planning, which includes the development of a formal Fire Safety Plan (see next section), should be completed before the project begins.

Steps to ensure success include:

- ☐ Assessing risks by asking questions such as:
    - Where are fires most likely to occur?
    - Are employees properly trained to identify and prevent conditions that may lead to fires, and react appropriately if a fire starts?
    - Are means of egress (exiting) kept clear of obstruction?

- ☐ Identifying and implementing actions to address the risks, such as employee training.
- ☐ Communicating the plan to everyone involved in the worksite (including management, contractors and employees) through written policies and procedures, signage and information/training sessions.
- ☐ Continually evaluating and revising the plan to keep pace with the constant changes at a construction site, including:
    - New contractors or employees;
    - Changes in types and quantities of materials;
    - Changes in water supply; and,
    - Deliveries or completed work that blocks evacuation routes.
- ☐ Maintaining accurate records and keeping them available for inspection by fire authorities.
- ☐ Ongoing training and drilling to keep the information top-of-mind among those at the worksite, and to solicit input for improvements. Tactics can include weekly walk-throughs and "toolbox talks."

## 5.3 Project Staging

Strategic project staging can significantly reduce the fire risk at construction sites. Elements for consideration are as follows.

- ☐ Coordinate the installation of some or all fire protection equipment (such as standpipes, hose stations, sprinkler systems and alarms) in stages to provide active fire detection, control and/or suppression in sync with the development of the structure itself.
- ☐ Prioritize the installation of fire barriers, separation walls and fire doors on each floor, and time them to progress in step with structure development. Fire doors should be installed at the same time as their frames.
- ☐ Fire blocking should be installed immediately where necessary, and smaller openings identified, marked and scheduled for fire stopping as soon as the section is completed.
- ☐ Any noncombustible finishes, both internal and external, should follow in stages as the project progresses.
- ☐ Consider alternate construction materials and methods to reduce fire risks, such as:
    - Using five-ply built-up roof coverings instead of single-ply membrane roofs, to avoid the need for hot work on the roof; and
    - Using panelized wall and floor assemblies constructed off-site, rather than site-built assemblies, to reduce the amount of stored on-site combustibles and construction time.

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# Developing a Fire Safety Plan

Fire safety plans (FSPs) are designed to address typical construction hazards and are usually developed by the site owner/developer or their representative in conjunction with the local fire department. FSPs are required by the National Building Code of Canada and most provincial building or fire codes for construction projects of a certain size or type. Check your locally-applicable building and fire codes for guidance about FSP requirements.

Owners may choose to obtain the services of a fire-safety planning specialist to ensure they develop an adequate plan for their site. This job may also be tasked to a site fire prevention/fire safety manager.

## 6.1 Site Fire Safety Manager

A site fire safety manager with adequate training and knowledge should be appointed to manage and enforce the FSP throughout the course of the construction project.

Responsibilities will vary based on site size and complexity, but generally include:

- ☐ Conducting daily inspections to identify fire hazards and security issues, and developing measures to address them.
- ☐ Liaising with the fire department.
- ☐ Ensuring everyone at the site is aware of and understands their responsibilities under the FSP (methods could include signage, training, drills, and stipulations in contracts for subcontractors).
- ☐ Ensuring compliance with the FSP and taking action to address infractions.
- ☐ Carrying out daily inspections of:
    - Evacuation routes, fire safety signage and temporary emergency lighting (where applicable);
    - Installed fire detection and alarm devices;
    - Firefighting equipment/facilities and fire department access; and

- Routing of temporary electrical cables, housekeeping and combustible waste storage.

- ☐ Taking prompt, effective and appropriate action if fires occur, including:
  - Raising the alarm to alert others of the fire;
  - If trained, tackling small fires before they spread;
  - Ensuring all staff, visitors and contractors are evacuated to a place of safety; and
  - If time permits, closing doors and windows as people leave, to slow fire spread.
- ☐ Maintaining accurate records of site inspections, infractions and other documentation related to the FSP for management and fire authorities.
- ☐ Updating evacuation routes and other elements of the plan as necessary as conditions at the site change.

Depending on the size of the project, the site fire safety manager may require support from another designated individual or team.

## 6.2 Plan Components and Implementation

FSPs should be updated after any significant project changes. While plans will vary based on the project size and complexity, at minimum, each FSP should include:

- ☐ The designation and organization of site personnel responsible for fire safety duties;
- ☐ Emergency procedures to be followed in the event of a fire, including sounding the alarm, notifying the fire department, instructing site personnel on the procedures to be followed when the alarm sounds, and firefighting procedures;
- ☐ Measures for controlling fire hazards in and around the building;
- ☐ A maintenance procedure for firefighting facilities;
- ☐ Documents and diagrams showing the type, location and operation of the building's fire emergency systems; and,
- ☐ A list of all emergency response numbers and the names, addresses and telephone numbers of the project's emergency contacts.

### Relevant Activities

Activities that may be critical to the success of a FSP include:

- ☐ Fire safety training, including:
  - Instruction in fire prevention and evacuation procedures for all workers.
  - Adequate training (and retraining) for workers assigned to firefighting duties by a qualified instructor in fire suppression methods, fire prevention, emergency procedures, organization and chain of command, firefighting crew safety and communications.
  - Ensuring all workers assigned to firefighting duties are physically capable of performing the duties safely and effectively.
- ☐ Passive protection, including:
  - Provision on each level of an unobstructed stair discharging to grade level.

- Coordination between the construction of fire compartments and firewalls.
- Management of fuel-fired equipment, including limiting usage and using electrical-powered alternatives when possible.
- Management of temporary heating equipment, such as ensuring all are listed and used in accordance to manufacturer instructions.
- Management of roofing operations involving heat sources and hot work, including having operations conducted by a qualified agency.
- Maintaining a high standard of housekeeping on site.
- Maintaining fire department access to the site.
- Providing a fire separation between occupied areas and areas under construction or demolition.

☐ Fire protection, including:

- An activated (charged) standpipe installed progressively with building construction.
- Where and when practicable, an activated (charged) sprinkler system upon installation of the ceiling membrane. When possible, the system should be activated when construction is not taking place but may be turned off during operating hours.
- Onsite fire protection stations that may include portable fire extinguishers.
- Early installation of fire pumps where required for the fire protection water supply.
- Coordination such that the municipal water supply is available onsite when grade-level construction begins.
- A fire alert warning system.
- Temporary heating equipment that complies with the fire code.

☐ Security and monitoring, including:

- Alert, roving after-hours security personnel.
- A fire watch during hot work operations and for at least 60 minutes afterwards, and again four hours after completion.
- A watch during demolition or construction involving partially occupied buildings.

Additional recommended activities may include:

☐ Installing doors in firewalls and closing them after hours, and putting doors on fusible links during construction.
☐ Providing temporary water-flow alarms on sprinklers.
☐ Providing adequate timing for issuance of the sprinkler permit, given that sprinkler drawings must be reviewed by numerous consultants and accepted by municipal authorities.
☐ Providing sprinkler systems for exposure protection.
☐ Holding a pre-construction meeting between the local fire department and site representatives.
☐ Development of a fire risk assessment for more complex sites that identifies time frames and processes where the risk is greater and extra measures may be required.

Your local fire department may have a checklist to assist with FSP development.

7


# Site Security

Security is required on a construction site for many purposes, including preventing arson, theft and unauthorized entrance.

Security measures may include:

- ☐ Erecting secure fencing, boarding or hoarding at least 1.8 metres in height around the perimeter, with access gates that can be closed and locked.
- ☐ Setting up security access points at site entrances, including entries to the construction zone in occupied buildings.
- ☐ Maintaining strict sign-in/sign-out procedures for anyone gaining access to the site, including visitors, contractors and the permanent workforce (sign-in sheets are also useful for tracking occupants if evacuation is required).
- ☐ Employing 24-hour guards on larger or more hazardous sites, with orders that include recorded rounds, supplemented by intruder alarms.
- ☐ Storing combustible materials and potential ignition sources in secure areas, away from the perimeter and at least 10 metres from the building.
- ☐ Emptying dumpsters regularly and locating them away from buildings, and far enough from the perimeter to prevent deliberate ignition from outside the boundary.
- ☐ Storing expensive equipment and vehicles in a secure area when not in use.
- ☐ Installing security lighting, closed-circuit cameras and intruder alarms.
- ☐ Instituting a rigorous locking-up procedure that includes making sure all gates, doors and equipment are secure, and checking hot work areas for signs of fire.

Site security is everyone's responsibility. Personnel should be advised to:

- ☐ Watch for and report any damage or signs of tampering with perimeter security, lighting or security cameras.
- ☐ Report anyone who does not seem to belong on the site. Security personnel should question any unknown or suspicious individuals.

## 7.1 Security Guards

A security guard service may be required, depending on the size and physical configuration of the site. Orders for the guards should, at minimum, include:

- ☐ Notification procedures that include calling the fire department and management if an event occurs;
- ☐ Knowledge of the building street address;
- ☐ Knowledge of location and use of fire extinguishers and fire control equipment;
- ☐ Familiarization with fire hazards; and
- ☐ Use of the construction elevators, if any on site.

Site security should be issued adequate equipment to enable them to immediately notify the fire department using the emergency phone number if the need arises.

8

# Fire Prevention and Protection Best Practices

Advances are constantly being made in understanding the causes of fires on construction sites, and in methods and technologies to prevent and protect against them. Keeping abreast of such advancements, as well as existing best practices, is helpful when it comes time to develop an effective fire safety plan.

**Click the page numbers to link to the content.**

## 8.1 Electrical Supplies and Equipment

- ☐ All electrical systems and equipment, including temporary installations, should be installed and maintained in accordance with applicable regulations by a qualified technician. Poor installation and maintenance can lead to a buildup of heat or arcing and sparking, all of which have the potential to ignite any nearby combustibles.
- ☐ Electrical equipment, including portable devices and electrical cords, should be regularly maintained and inspected as part of day-to-day routines, and any problems should be reported and fixed immediately.
- ☐ Faulty or damaged equipment should be removed from use immediately, labeled, and either removed from the site or secured to prevent future use.
- ☐ Any equipment that operates at temperatures above 75°C should be securely fastened to prevent hot parts of the equipment from coming in contact with combustible materials.
- ☐ Fragile components, such as temporary lights, should be equipped with guards to prevent accidental damage.
- ☐ Low-voltage equipment should be used when possible.
- ☐ Electrical cabling, especially temporary installations, should be protected against damage from construction activities.
- ☐ Temporary wiring should be removed as soon as it is no longer needed.
- ☐ When using metal halide lights for temporary lighting, only use fixtures equipped with Type O lamps. Any other type of lamp could present a severe fire risk if it fails prematurely. Combustible and flammable materials should not be stored directly below the light fixture in the event of a catastrophic light failure.
- ☐ Special consideration should be given to equipment located near storage of flammable gases or liquids.
- ☐ Where possible, main switches (other than those controlling security and automatic fire detection systems) should be turned off when work ceases, and all equipment unplugged when not in use.

Please see Heating Equipment below for related information.

## 8.2 Emergency Procedures

Please see Evacuation and Egress and Fire Alarm Systems below for related information.

### Preparation

**General**

- ☐ Clear signage should be provided and maintained in prominent positions showing the locations of fire department access routes, escape routes, standpipes, and fire extinguishers provided for use by trained staff. Signs should be reviewed regularly and replaced or repositioned as necessary.
- ☐ Assembly points should be designated in advance and clearly identified.
- ☐ Employers should provide training on emergency procedures, including how to raise the alarm to all workers at the site. Drills should be conducted to test the procedures and ensure workers and supervisors are familiar with their roles and responsibilities.

- ☐ Security personnel should be instructed to open gates or barriers and provide ready access to the fire department in the event of an emergency or an inspection visit.

**Written Procedures**

Written emergency procedures should be displayed in prominent locations and given to all employees and visitors on site.

The procedures should include:

- ☐ Emergency contact details for key personnel who have specific fire or safety roles or responsibilities;
- ☐ Contact details for local emergency services such as police, fire department and poison control;
- ☐ Description of the mechanisms and procedures for alerting people on site about an emergency or possible emergency, such as a siren or bell alarm;
- ☐ Evacuation procedures, including arrangements for assisting any people with hearing, vision or mobility impairments;
- ☐ Map of the site illustrating the location of fire protection equipment, emergency exits and assembly points;
- ☐ Triggers and processes for advising neighbouring businesses/residents about emergencies;
- ☐ A post-incident follow-up process, such as notifying regulatory agencies and organizing trauma counseling or medical treatment; and
- ☐ Procedures for testing the emergency plan, including frequency of testing.

### During emergencies

- ☐ Employees discovering a fire should sound the fire alarm and notify all employees in the immediate vicinity, as well as surrounding areas that may be threatened by the fire.
- ☐ Employees should then immediately notify the fire department of the fire.
- ☐ The supervisor or designated individual should also be notified of the fire immediately.
- ☐ Employees discovering a fire should, if possible, quickly and carefully remove anyone who is injured or in immediate danger.
- ☐ If the area or material involved in the fire is small, properly trained employees may attempt to extinguish the fire using approved fire suppression equipment.
- ☐ If the fire appears to be too large, involves a toxic substance, or is electrical-based, employees should leave the area immediately and notify their supervisor.

## 8.3 Equipment and Vehicles

- ☐ No vehicles should be parked inside of buildings unless fire-detection systems are installed and monitored.
- ☐ No mobile construction equipment should be stored inside of buildings without first making sure the equipment has cooled down and there are no leaks in the fuel or hydraulic systems.

- ☐ Equipment and vehicles should be located so their exhausts discharge as far as possible away from combustible materials (not less than 500 mm).
- ☐ Combustible materials should be prevented from coming into contact with, or being close to, hot surfaces such as flues and exhaust pipes.
- ☐ Fuel storage and service areas should not be located within structures under construction, alteration or demolition.
- ☐ Policies for the refueling of tools and equipment should require that the appliance be cool before refilling.
- ☐ Where appropriate, sand trays should be provided to absorb drips of fuel or lubricant. The trays should be changed at regular intervals.
- ☐ As a general rule, long-term parking of vehicles should not be permitted within 10 metres of a building under construction, and, if possible, a separate parking lot should be available for workers' vehicles.

## 8.4 Evacuation and Egress

### Preparation

- ☐ Adequate paths of travel to exits and evacuation routes should be provided at all times, taking into account the number of people, activities being undertaken, and occupant capabilities. Routes should also be designated through large open-plan areas.
- ☐ Two ways out should be provided whenever possible, particularly if working at height or below ground level.
- ☐ Multi-storey projects that have progressed to 10 metres or more above ground level should have permanent or temporary stairs to the ground that are accessible from each working level.
- ☐ Signage showing the fastest way out should be clearly visible, and should be regularly monitored and relocated as necessary as construction progresses and conditions change.
- ☐ Regular checks should be undertaken to ensure exits and evacuation routes are kept clear of obstructions and provided with clear signage. These checks should be undertaken daily or weekly, depending on the risks associated with the site.
- ☐ Combustible materials and liquids should never be stored in an evacuation route.
- ☐ Building exits should never be blocked or locked while people are in the buildings.
- ☐ Staff should be advised to make themselves aware of escape routes and that routes could change without notice.

### During emergencies

- ☐ An assembly site away from the premises should be designated in advance and communicated to everyone on the site. If acetylene cylinders are stored on site, the assembly site should be at least 200 metres away from the location of the cylinders.

- Once a fire alarm has been raised, the fire department should be contacted and all occupants should evacuate the building and/or worksite and make their way to the assembly site, ensuring that fire service access points are not obstructed.
- If the building fills with smoke, occupants should stay low and follow the wall, if possible, as they exit.
- A designated person should confirm that all occupants have been accounted for (using documentation such as sign-in sheets, employee lists and work schedules), and provide the information to the fire department. It is important that the fire department know if anyone may be in the building, so a system to track site occupants at all times is critical.

### Temporary Exiting

- Existing exits should not be impaired or impeded by new construction. In the event that temporary exiting is required, blocked exits should be minimized.
- Temporary floor signs should be provided in any stairwell connecting three or more floors, indicating the floor number, roof access and direction to exits.
- If the building is over one storey in height, at least one stairwell should be provided that is in usable condition at all times.
- A stairwell should be extended upward as each floor is installed with new construction.

## 8.5 Fire Alarm Systems – Temporary

It is everybody's responsibility to immediately raise the alarm in cases of fire or other emergency on a site.

Where the installation of permanent automatic detection and alarm systems is not practical during construction, a temporary means of fire warning should be established to allow staff to raise an alarm across the site if a fire is detected, and to alert the fire department.

Manual devices (such as hand-crank alarms and air horns) may be utilized, provided that:

- They are distinctive and clearly audible above background noises in all areas;
- All staff and inducted visitors are trained/instructed so that they can recognize the fire/emergency alarm and understand what action to take; and
- The devices are distributed throughout the site, and staff are aware of their locations and trained in their use.

Telephone systems can be used to alert the fire department, provided the emergency procedures adequately specify responsibilities for alerting the fire department, and emergency numbers are prominently displayed along with the site address.

Emergency phones, when provided, should be located at strategic points and clearly identified.

## 8.6 Fire Extinguishers

See the Fire Basics section for information about fire extinguisher types and use.

- ☐ Extinguishers should be installed in unobstructed and easily accessible locations in accordance with NFPA 10 *Standard for Fire Extinguishers*. They should be installed on each storey, adjacent to each required exit, temporary exit or stairway, and near areas where combustibles are stored and hot work is carried out.
- ☐ At least one Class A, B and C fire extinguisher of the appropriate size should be provided at all times.
- ☐ Ride-on mechanically-propelled equipment should carry an appropriate fire extinguisher when possible.
- ☐ Employees should be made familiar with the location of all fire extinguishers on site.
- ☐ Extinguishers should be provided for fire watch personnel while hot work is being undertaken, and at any other locations identified through risk assessments or required as part of a standard safe work method.
- ☐ Fire extinguishers should be maintained and regularly inspected, and staff should be trained in the use of manual firefighting equipment.
- ☐ As construction progresses, the adequacy of portable firefighting equipment should be reviewed as part of the periodic site fire assessment.

## 8.7 Fires – Open and Waste Fires

- ☐ Open fires, including the burning of waste materials, should be prohibited on the construction site. Combustible waste materials should be regularly removed from the site rather than burned.
- ☐ Use of warming devices, such as heating drums, should be located outside of any structure. If they are intended to be used, a risk assessment should first be undertaken.

## 8.8 Fire Protection Systems

When the following fire protection systems are to be installed in the completed building, the project should be planned to bring them into operation as early as possible during the course of construction.

### Automatic Fire Sprinkler and Other Suppression Systems

- ☐ When possible, automatic fire sprinkler systems should be progressively brought into service on each floor as construction takes place.
- ☐ Early installation is particularly important when the building design relies on a sprinkler system to supplement fire separations (e.g. waiving requirements for spandrels or reducing fire-resistance levels) or to control fire spread when combustible materials are exposed during construction.

- ☐ Progressive installation may not be practical in colder regions during the winter, due to the lack of insulation or heating in the unfinished buildings.
- ☐ There is potential for damage to sprinklers from nearby construction tasks when installation is performed before the building is completed, so special care and/or replacement of damaged components may be necessary.

### Automatic Fire Detection and Alarm Systems

- ☐ When possible, fire detection and alarm systems should be brought into service progressively on each floor as construction takes place.
- ☐ There is potential for damage to these systems from nearby construction tasks when installation is performed before the building is completed, so special care and/or replacement of damaged components may be necessary.

### Fire Compartment Boundaries

Fire compartment boundaries include fire doors, penetration seals and general protection of other openings.

- ☐ Fire compartment boundaries should be completed progressively throughout the project to minimize fire spread.
- ☐ Where the provision of fire compartments is critical to fire safety during construction, temporary coverings of openings should be provided while ensuring exit paths are not compromised.

### Other Forms of Fire Protection

- ☐ Fire stairs with fire-resistant walls.
- ☐ Planned firefighting shafts.
- ☐ Fire-protective materials applied to structural steel.
- ☐ Fire-preventative coverings, such as fire blankets, used over combustible construction.

## 8.9 Food Preparation

- ☐ Food preparation that involves the use of open flames should be prohibited.
- ☐ Areas should be designated where meals can be warmed using a microwave or other forms of non-flame-producing heat.
- ☐ Cooking appliances should be properly installed, with adequate ventilation provided.

## 8.10 Flammable and Combustible Building Materials

- ☐ Deliveries of wood framing and other combustible materials should be planned to minimize the time they are stored on site.
- ☐ Combustible building materials and scrap lumber should be stored in a secure area at least 22 metres away from any buildings or partially constructed buildings, or any area where hot work is undertaken.
- ☐ When not in use, mops used to spread bitumen for hot surface applications should be stored in a safe location at a safe distance away from buildings.

- ☐ If there is no alternative to storing combustible building materials within or close to a building under construction, the storage area should:
    - Have controlled access;
    - Not be in an area where hot work is being carried out;
    - Be in either an area covered by the site fire-detection system or included in the route of regular fire checks;
    - Have firefighting equipment close by; and
    - Be protected from ignition sources where practical by fire-preventative covers.

## 8.11 Flammable and Combustible Liquids and Gases

The storage and use of flammable liquids and gases require specific safety measures that address the risks of use in confined spaces and potential explosions, in addition to normal fire risks. Refer to the applicable federal or provincial legislation.

This category includes common fuels (e.g. gasoline and liquid propane gas) and acetylene used for cutting purposes. Typical requirements are found in various NFPA standards.

Some of the main fire prevention methods are as follows:

- ☐ Gas-line purging requirements:
    - Gas lines should be purged to the outdoors.
    - Gas lines should be continuously monitored to the point of discharge. If done indoors, a combustible gas detector should be used to monitor the point of discharge.
    - Ignition sources should be kept at least three metres away from the point of discharge.
    - The discharge point should be at least three metres from openings and eight metres from any intakes.
    - Any non-purging employees should be evacuated.
    - Purging should be stopped when 90 per cent gas volume is reached.
- ☐ Workers should be instructed and trained in the storage and handling of flammable and combustible liquids and gases.
- ☐ Storage of flammable liquids and gases should be limited to a day's supply.
- ☐ When not in use, flammable liquids and gases should be stored in closed, clearly labeled containers/cylinders compliant with NFPA standards, in a secure area – preferably an open compound at least 10 metres from permanent and temporary buildings and 20 metres from structures fabricated predominantly with combustible materials.
- ☐ In enclosed settings, care should be taken to avoid buildup of explosive fumes.
- ☐ Automatic flammable-gas detection equipment should be considered for enclosed storage areas.
- ☐ All electrical fittings in storage areas, such as lights and switches, should be suitable for an environment where a flammable or explosive atmosphere may be present.

- ☐ All sources or potential sources of ignition should be eliminated or controlled where an explosive atmosphere exists or is likely to exist.
- ☐ Flammable liquids and gases should be stored separately from materials that could intensify the fire or present a toxic hazard, such as oxygen, acetylene and chlorine.
- ☐ Flammable liquids, compressed gases and/or liquid propane gas should not be stored together.
- ☐ Empty and full gas cylinders should be separated, and empty cylinders marked to allow staff and firefighters to identify them easily.
- ☐ Clear signage should be provided identifying the materials being stored and prohibiting smoking, open flame, hot work and the use of mobile phones in and around the storage area.
- ☐ The use of acetylene should be minimized and spare cylinders should not be kept on site. As soon as the work is completed, acetylene cylinders should be returned to the storage area.
- ☐ Leaks or spills should be dealt with promptly and safely.
- ☐ Flammable liquids should never be used when there are open flames or sources of ignition nearby. For example, fuel tanks of heating devices should never be refilled while the device is in operation or is hot enough to ignite the liquid.
- ☐ Propane cylinders should not be placed closer than three metres to a source of ignition unless they are part of hand-held equipment, part of a lead pot used in plumbing or electrical work, part of a propane-powered or propane-heated vehicle, or are protected by a barrier, wall or other separation.
- ☐ The accumulation of static charge during the transfer of flammable or explosive substances from one container to another should be prevented by electrically bonding the containers.
- ☐ Liquids should only be used for their intended purposes. For example, gasoline should not be used to start a fire or used as a cleaning agent.
- ☐ Proximity to flammable liquids and gases should be considered in hot-work risk assessments.

## 8.12 Flammable and Combustible Materials – Other

During construction, combustible materials may be temporarily in place or exposed in locations such as the façade or as parts of wall or ceiling linings. These include:

- ☐ Shade cloths, tarps and other covering around scaffolding, separating work areas, and around the site perimeter;
- ☐ Scaffolding components;
- ☐ Combustible façade materials, including insulation;
- ☐ Piping, wiring, and other service elements; and,
- ☐ Wood framing members and sheathing.

Additional precautions may be required during the construction phase if a risk assessment determines the volume of exposed combustible materials is significant. The risk assessment should consider the proximity of the incomplete building to surrounding buildings, as well as fire safety within the site.

Mitigation measures to consider include:

- ☐ Shade cloths, tarps and other temporary coverings should be fabricated from noncombustible materials or fire-retardant materials when possible, and should be securely fastened to prevent contact with heaters or other ignition sources.
- ☐ For buildings of four or more storeys, if the incomplete, exposed façade is combustible, or if the building is predominantly of combustible construction, consider one or more of the following controls:
    - Exposed combustible construction materials could be progressively clad with the coverings required by the final design (e.g. interior gypsum board, gypsum sheathing, and exterior cladding) so that there are only two storeys below the current construction level with significant exposed combustible materials.
    - If an automatic sprinkler system is to be provided, it could be progressively commissioned so that there are only two unprotected storeys with significant combustible materials below the current construction level.
    - Early installation of permanent or temporary fire compartments can limit fire spread in the event of an uncontrolled fire. Protection of door openings, windows, shafts and service penetrations needs to be addressed.
    - A temporary fire alarm system could be provided and evacuation procedures modified to address the expected rate of fire spread.
    - Separation distances or fire barriers may be needed between adjacent buildings and the building under construction, as appropriate to the fire hazard.

## 8.13 Heating Equipment

- ☐ Any heating equipment should, as a minimum, comply with provincial and local regulations and be installed, used and maintained in accordance with the manufacturer's instructions.
- ☐ Heating equipment should not be used in close proximity to combustible materials.
- ☐ Personnel should always be required to be in attendance when the heater is running.
- ☐ The heating device should be restrained to minimize the risk of it being knocked over or being incorrectly located.
- ☐ Heating equipment should be regularly inspected.
- ☐ Heaters should not be covered with wet or damp clothing. Coat stands and drying racks should be fixed in place a safe distance from heaters.
- ☐ Paraffin or gas heaters should be avoided where possible.
- ☐ Where possible, a system planned so that heating equipment remains outside the building(s) under construction should be considered.
- ☐ Heaters used in temporary buildings should have enclosed elements, be fixed in position (preferably above floor level), be thermostatically controlled, and be maintained in sound condition.

Please see Electrical Supplies and Equipment above for related information.

## 8.14 Higher-risk Sites

Additional measures are warranted for construction of tall buildings where the upper storey is above the reach of external firefighting equipment, or buildings of predominantly combustible construction that have four or more storeys or a floor area of more than 2,500 square metres.

### All Tall Buildings

- ☐ A wet standpipe riser should be provided, fed by duplicate pumps.
- ☐ Fire doors with self-closers should be fitted to protect the escape stairs and, where possible, access to any shaft in which a crane is located.
- ☐ The building should be horizontally compartmented at intervals not exceeding 10 storeys, to prevent the spread of smoke and flames. This should be done at the earliest opportunity after construction of each of the relevant floors, using temporary fire-stopping materials with at least one-hour fire resistance, until the permanent fire-stopping arrangements can be put in place.

### Large or Tall Building Sites with Combustible Construction

- ☐ The building should be compartmented at the earliest stage possible. For example, fire-resistant sheathing required by the final building design should be fixed in place as soon after the erection of each storey as is practicable.
- ☐ To retard the spread of fire up a building through unstopped ducts and shafts, consideration should be given to installing temporary fire-retardant boarding as work progresses.
- ☐ Permanent fire-resisting doors, panels and fire stopping should be installed as early as possible.
- ☐ The proximity of the incomplete structure to the site boundary and surrounding buildings should be considered during the fire risk assessment.
- ☐ Serious consideration should be given to mitigating fire damage by facing exposed wood construction and combustible insulation with noncombustible or limited-combustible materials at the earliest opportunity. The use of such materials may be extended to protect windows and door openings not required as means of escape.
- ☐ Consideration should be given during the fire safety planning process to evacuation routes for site personnel, including crane operators.
- ☐ Even when the perimeter of the site is secure, access to the building under construction should be denied when work is not in progress.
- ☐ When multiple large structures constructed predominantly of combustible materials are being built close to each other, the hazards of fire spread from one to another should be considered and minimized as part of the fire risk assessment.

## 8.15 Housekeeping

‘Housekeeping’ involves keeping the worksite tidy and safe, ensuring combustible materials are stored in safe designated areas, as well as spotting hazards and taking action against them.

Housekeeping is an important fire-prevention practice, but it can quickly deteriorate as a result of lack of action from supervisors. Housekeeping needs to be enforced consistently and action taken when rules are violated.

Proper housekeeping includes:

- ☐ Keeping the premises clear of all kinds of refuse and process waste.
- ☐ Ensuring waste and excess debris or scrap is swept up and removed from the premises at least daily.
- ☐ Ensuring all areas in and around the building site are kept free from accumulated packing materials, such as empty wooden crates, straw, plastic products, paper, etc.
- ☐ Ensuring appropriate metal bins (or dumpsters with lids for some items) are provided for disposal of combustible waste materials such oily rags;
- ☐ Keeping storage areas accessible to firefighters.
- ☐ Clearing spaces around stacks of stored materials and ensuring adequate gangways are present between them.
- ☐ If a sprinkler system is installed, arranging all stacks of material to ensure they do not impede the effective operation of sprinklers.
- ☐ Locating dumpsters at least 15 metres away from the building (the farther away, the better). If a dumpster is located within the footprint of the building, then an on-site guard should be assigned or hired to monitor it.

## 8.16 Hot Work

Hot work – work that generates open flames, heat and/or sparks – is a common cause of fires on construction sites. Hot work operations may include cutting, welding, brazing, soldering, grinding, thermal spraying, thawing of pipe, and installation of torch-applied roof systems.

When possible, activities involving hot work should be minimized or conducted off-site in a dedicated hot-work shop.

When hot work on site is required, site managers are responsible for ensuring adequate control and procedures are in place before work begins. A risk assessment should be conducted that considers alternatives to hot work, the risk of fire ignition, who will be in danger, and the possibility of fire spread.

### Training

- ☐ Anyone performing hot work should be trained in proper equipment operation, handling and storage of welding materials, compressed gas safety, chemical hazards, and working procedures.
- ☐ Additional training may also be required in the proper selection and use of specialized personal protective equipment.
- ☐ Training in confined space entry is necessary before any hot work is performed in a confined space area.
- ☐ Anyone performing hot work should be trained in emergency procedures such as how to raise the alarm, call the fire department, and safely evacuate the area in the event of fire.

## Hot Work Permits

A hot work permit system is a useful fire-prevention tool even in jurisdictions where they are not required, as they:

- ☐ Provide a checklist of activities that protect employee and site safety;
- ☐ Help ensure compliance with safe work procedures; and
- ☐ Ensure accountability that fire prevention measures are being considered at all times.

Permits should be specific to the location, activity and work period, and should not provide blanket coverage.

A permit checklist may include the following measures:

- ☐ Written permission should be obtained prior to starting any hot work activity.
- ☐ All potential hazards should be described and accounted for.
- ☐ Hot work equipment should be regularly inspected and tested to ensure it can be operated safely (e.g. power source, welding leads, torches, etc.).
- ☐ Combustible materials and liquids should be at least 10 metres away from the hot work area. If they cannot be moved, they should be protected with fire blankets, guards or metal shields.
- ☐ Floors in hot work areas should be swept clean of all combustible materials and debris.
- ☐ Combustible floors and flooring (e.g. wood or carpeting) should be wet down and covered with damp sand or fire blankets.
- ☐ Burning, welding or cutting should not take place where there is danger of extreme heat coming in contact with a concrete surface, unless the surface is protected from the heat source.
- ☐ All openings in floors and walls within 10 metres of a hot work area should be covered to prevent hot sparks from entering, or falling to a lower level.
- ☐ If there is a danger of heat transfer to other areas (e.g. through metal beams, bolts or pipes), those areas should also be cleared of combustible materials.
- ☐ When working on walls or ceilings, combustible materials should be moved away from the other side of the wall.
- ☐ Bitumen kettles should not be located on roofs, and should be provided with a close-fitting metal cover. They should be under constant supervision when in operation.
- ☐ Tar pots that are in use should not be placed within three metres of an entrance or exit of a building or structure.
- ☐ Welding or cutting torches should not be laid down until the gases have been completely shut off.
- ☐ Hot work should never be conducted in the presence of flammable or explosive gases, vapours, liquids, substances or dust.
- ☐ Welding or cutting of metal that has been cleaned with a flammable or combustible liquid should not be permitted until the metal has dried.
- ☐ Hot work should not be permitted on containers or piping that contained a flammable substance until they are purged using an effective method.

- ☐ Appropriate fire extinguishers should be on hand, fully charged and operable.
- ☐ Evacuation paths should be kept clear.
- ☐ There should be a means for communicating an alarm in the hot work area.
- ☐ A suitably trained and equipped person should be assigned to fire watch during the hot work and stay on watch until released by the individual in charge. Hot work areas should be monitored for at least an hour after the work is completed, and checked again four hours later.
- ☐ In premises with heat or smoke detectors, only those adjacent to the hot work area should be disabled, and should be reactivated immediately afterwards.
- ☐ After hot work is completed, hot waste materials should be removed and disposed of safely, and all equipment, including gas cylinders, should be removed to a secure area. (If bitumen or tar boilers are involved, only the gas cylinders need to be removed.)
- ☐ Hot work areas should be inspected at the end of the day by the authorizing individual, and by security staff (if on site and it is reasonably practicable and safe to access the area).

Please see Personal Protective Equipment for Hot Work below for related information.

## 8.17 Hose Stations and Hose Reels

- ☐ All hose stations and hose reels required by code for the completed building should be progressively installed on all levels of a building under construction as early as possible, and unobstructed access maintained. As well, they should be made fully operational as soon as possible.
- ☐ Hose stations should be installed for use both inside and outside the building.
- ☐ Any required booster connections should be installed as early as possible.

## 8.18 Personal Protective Equipment for Hot Work

Personal protective equipment (PPE) guards employees against injury (which can be fatal) and will vary depending on the type of construction activity.

The information in this section is specific to hot work. For other construction work, please refer to and follow the PPE practices and guidelines applicable to your region and type of activity.

### Clothing and Equipment

- ☐ Protective clothing and equipment should be suitable for the type of work to be performed, kept in good repair, and kept free of oil and grease.
- ☐ Sleeves should be kept buttoned at the wrist and collars should be kept buttoned.
- ☐ Fire-resistant gauntlet gloves, aprons of leather or asbestos, and other appropriate PPE should be used as protection against radiated heat or sparks.

- ☐ Front pockets on overalls and aprons, and cuffs on pants, should be eliminated.
- ☐ Capes or shoulder covers made of leather or other flame- and heat-resistant material should be worn during overhead welding or cutting operations.
- ☐ Leather skullcaps can be worn under helmets to provide protection against head burns.
- ☐ When working in a confined space or an overhead location, earplugs should be worn or the ears covered with wire screen protectors.
- ☐ Hard hats or other types of head protectors should be used where there is exposure to falling objects or debris.
- ☐ Low-cut shoes should not be worn unless the ankles are covered with protective leggings.
- ☐ Employees required to wear respirators should keep them clean and sterilized after each use. When not in use, the equipment should be stored in closed containers.
- ☐ The airline to supplied-air respirators should be provided with a filter that will remove pipe scale, water, oil, mist, and noxious vapours. The respirator should also be equipped with a pressure-reducing valve to prevent the supplied-air pressure from exceeding 25 psi.
- ☐ Insulating mats of sufficient size should be used when the worker is sitting on the same metal that is being welded.
- ☐ Rubber gloves should be worn under welding gloves when welding in wet or damp locations.
- ☐ After a welding job is completed, the material should be marked “HOT” in chalk, or a warning sign posted to caution other employees.

### Eye Protection

- ☐ Goggles, helmets, hand shields, or other suitable eye protection with the proper lens shade for the work at hand should be worn during all welding or cutting operations.
- ☐ Goggles, helmets, and hand shields should be checked frequently. Equipment with light leaks should not be worn, as radiation burns can result. Cracked, broken, or loose filter plates should be replaced immediately.
- ☐ Protective-coloured flash goggles with side shields should be worn under a hood for protection against harmful rays, flying chips, and sparks when an arc is struck prematurely before the helmet is lowered. The lenses should be No. 1 or No. 3 shade. Inert gas metal-arc welding by nearby welders requires goggles under the helmet with lens shade.
- ☐ When arc-welding operations are performed in an area that is not enclosed or isolated, other persons near the welding area (generally within 23 metres of the arc) should wear appropriate goggles.
- ☐ Flash shields should be carried on portable welding carts as standard equipment and should be used when necessary.

Please see Hot Work above for related information.

## 8.19 Protection of Adjacent Buildings

Protection of adjacent buildings and facilities that would be exposed to a fire originating at the construction site should be assessed. Methods and materials used to protect adjacent buildings and facilities may include active or passive systems, such as:

- ☐ spatial separation,
- ☐ water curtains,
- ☐ fire-resistant construction methods and materials (such as gypsum sheathing), or
- ☐ temporary fire barriers, such as fire tarpaulins.

The occupancy type of any adjacent building also should be considered during the development of the fire safety plan.

## 8.20 Smoking

Smoking materials are a significant ignition source for fires on construction sites. All employees and site visitors should be fully informed of site smoking restrictions, and an emphasis placed on the fire safety reason for such restrictions.

- ☐ Smoking restrictions should be applied throughout a construction site because hazardous materials, such as flammable liquids and gases, may be used in open as well as enclosed areas.
- ☐ If designated smoking areas are to be provided on or adjacent to a construction site, a specific risk assessment should be undertaken before it is allowed.
- ☐ Smoking restriction zones should be clearly identified, signposted and strictly enforced.
- ☐ Smoking areas should be constructed of noncombustible materials and be separated from buildings by at least six metres (or more if determined necessary by a risk assessment). Combustible curtains, canopies and drapes should not be used to protect smokers from the elements.
- ☐ The immediate area should be kept clear of combustible materials, including windblown debris and vegetation.
- ☐ Safe receptacles for smoking materials should be provided, such as suitable metal ashtrays and a separate metal garbage can with a fitted metal lid.
- ☐ Smoking areas should be provided with a suitable fire extinguisher.
- ☐ The risk of smoking materials being discarded around the perimeter of the site should be considered and, if the risk is significant, precautions should be implemented.

## 8.21 Standpipe Risers

- ☐ Standpipe risers with fire department connections should be installed progressively as construction is undertaken, and unobstructed access maintained.
- ☐ When a standpipe system is to be installed progressively in unoccupied portions of a building under construction, a permanent or temporary standpipe system is permitted. The standpipe system should have:

- Conspicuously marked and readily accessible fire department connections on the outside of the building at street level;
- At least one hose outlet at each floor;
- Pipe size, hose valves and water supply conforming to local bylaws and codes;
- At minimum, secure supports and restraints on alternate floors;
- At least one hose valve for attaching fire department hose at each intermediate landing or floor level in the exit stairway; and
- Valves that are kept closed and protected from mechanical damage at all times.

- ☐ A standpipe system introduced progressively should be installed so that it is no more than one level below the highest forms, staging, and similar combustible construction materials at all times.
- ☐ A temporary standpipe system should remain in service until the installation of the permanent standpipe system is complete.
- ☐ If a building equipped with a standpipe system is being deconstructed or demolished floor by floor, the system and all fire department connections and valves should be maintained in operable condition at all times on all storeys, except for the storey located immediately below the one being deconstructed or demolished.

Please see Hose Stations and Hose Reels above for related information.

## 8.22 Temporary Buildings

- ☐ Temporary offices, sheds and construction shanties should be located separately from other storage facilities having combustible construction or contents.
- ☐ Temporary buildings should be located as far as possible away from the building under construction or other occupied buildings – at least 10 metres, and 20 metres for combustible construction.
- ☐ A risk assessment should be conducted to determine fire precautions within temporary buildings and accommodation, including temporary fixed fire protection systems, portable firefighting equipment, and alarm systems.
- ☐ Temporary structures located inside any building should be of noncombustible construction or protected by automatic sprinklers.
- ☐ Temporary structures that are located outside should be separated by a minimum of 10 metres and not closely clustered.
- ☐ When floors of temporary buildings are raised above ground level, the space beneath should be closed to prevent the accumulation of trash, while still allowing for under-floor ventilation. No combustible materials should be stored under the building.
- ☐ Temporary buildings where cooking takes place (including the use of toasters) should have automatic fire detection installed.
- ☐ Temporary accommodation should not be provided in structures under construction composed predominantly of combustible materials.

## 8.23 Waste

- ☐ Waste is both a fire and trip hazard and should be disposed of as soon as possible. A clean floor policy creates a cleaner and safer environment.
- ☐ Dust and debris should be removed from the building and its immediate vicinity at the end of each shift or as soon as possible.
- ☐ Scrap lumber and other combustible waste should be stored as far from buildings as possible.
- ☐ Dumpsters should be located away from buildings (e.g. 15 metres) and far enough from the perimeter to prevent deliberate ignition from outside the boundary. If a dumpster must be located within the footprint of the building, an on-site guard service should be assigned or hired to monitor it.
- ☐ Waste materials susceptible to spontaneous ignition, such as oily rags and other materials contaminated by flammable liquids, should be stored in clearly labeled noncombustible containers and removed from the site at the end of each work shift.
- ☐ Waste or other material should not be permitted to fall freely from one storey to another.
- ☐ Waste should be placed in a container that is designed to ensure the deposited materials cannot escape, and that is secure and not accessible to the public.
- ☐ Unless specific items of vegetation are to be retained, all dry/dead vegetation should be removed from larger sites for a distance of 18 metres from buildings and structures under construction.
- ☐ If waste chutes are used, whenever possible they should be constructed of noncombustible materials and be located outside the building envelope.
- ☐ The accumulation of combustible materials close to waste chutes should be minimized as far as possible. Dumpsters at the bottom of chutes need to be changed out frequently to prevent chutes from becoming clogged with debris.

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# Working with the Fire Department

## 9.1 Pre-fire or Pre-incident Plans

Pre-fire or pre-incident planning with the local fire department is a critical step, to be taken before any substantial development of a construction site. Pre-incident plans, which focus on information required for emergency responses, are commonly required for construction projects in addition to fire safety plans.

NFPA 1620 *Standard for Pre-Incident Planning* is the common standard used for these plans. Check with your local fire department to confirm the requirements in your area.

A pre-incident plan typically includes information, site plans and drawings that illustrate:

- ☐ Fire department access points to the site;
- ☐ Locations of fire extinguishers and initial attack equipment;
- ☐ Any special provisions for firefighting activities;
- ☐ The disposition of all built-in fire protection systems;
- ☐ Emergency escape routes and stairs;
- ☐ Available water supplies and positions of hydrants and hose reels that are operative;
- ☐ Any other operative fire safety systems that have been provided;
- ☐ Locations of assembly points and registers of persons currently on the site; and,
- ☐ Details of temporary accommodation and storage areas, including location for storage of hazardous items such as flammable liquids and gas cylinders.

The fire department should also be made aware of any alternative solutions that could affect firefighting operations, and any changes to the pre-incident plan that may occur as construction progresses.

## 9.2 Notification Process

If an emergency occurs, it is essential that emergency responders are properly notified and dispatched to the scene immediately. All people at a construction site should be made aware that it is everyone's responsibility to take action if an emergency occurs, including raising the alarm and contacting the fire department.

Procedures for notifying emergency responders should be well documented and readily available to all employees and site visitors.

The training should include:

- ☐ What to do when you discover an emergency;
- ☐ How to raise the alarm and what should happen next;
- ☐ What should be done upon hearing a fire alarm sound;
- ☐ The procedures for alerting jobsite personnel and visitors, and directing them to evacuate if needed;
- ☐ The specific arrangements and methods for notifying the fire department;
- ☐ The reporting of incidents, especially any near-misses; and,
- ☐ Policies and procedures to interface with responding units.

Documentation of a supervisor's investigation or report on each incident should also be filed for all events.

## 9.3 Incident Command System

Fire departments use an Incident Command System (ICS) to manage their response. An ICS provides a structured approach to all elements of a response – including command structure, personnel, policies, procedures, facilities and equipment – with the aim of improving the effectiveness of the response.

While aspects may vary for different departments, an ICS uses a "first-on-scene" structure, in which the first responder to a scene becomes the Incident Commander and remains in charge until one of the following occurs: the incident is resolved, a more qualified responder arrives and receives command, or the Incident Commander appoints his/her own replacement.

The person who reports an emergency at a construction site may have information that will be valuable to the Incident Commander. Development of the site's fire safety plan should include procedures on how to interact with the Incident Commander to pass along information.

## 9.4 Water Supply

- ☐ A water-supply analysis should be conducted prior to the development of the project to ensure adequate and reliable water supplies are available for both firefighting operations and on-site fire protection systems.
- ☐ Water mains/connections that will feed hydrants, sprinklers and hoses should be installed, tested and brought into service prior to the introduction of any combustible elements to the site.

- ☐ If insufficient public hydrants are available, yard hydrants should be installed.
- ☐ Public water supplies – including public hydrants, tested and verified – should be in place before breaking ground. The same applies to yard hydrants provided in lieu of public hydrants.
- ☐ When the site is remote and an adequate and reliable public water supply is not available, an alternative means of providing the water supply should be established, or means should be found to reduce the fire risk.

## 9.5 Fire Department Access

- ☐ Clear, marked and unobstructed fire department access to the site and buildings should be provided at all times, and the fire department notified immediately of any changes or restrictions to the access points.
- ☐ At fenced sites, provisions should be made to provide access to fire department equipment and crews when required.
- ☐ Unobstructed access should also be maintained to fire hydrants, portable extinguishers, and fire department connections for standpipe and sprinkler systems.
- ☐ A means should be provided to allow firefighters to perform their duties on all levels of the building. This includes making provision for the use of elevators, hoists and lifts to assist firefighting crews to reach all levels of the building.
- ☐ Significant changes to the access to the site should be discussed with the fire department before being implemented.

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# Construction Zones within Occupied Buildings

Renovation and maintenance activities are often undertaken after buildings have received their certificate of occupancy and are occupied. This presents a number of challenges to fire and life safety, and may also be subject to additional regulations. Check the codes and bylaws for your area.

The principal contractor should take the lead in preparing a site fire safety plan, but the construction crew employer and the building owner should be involved in developing a plan that addresses all stages of the construction/renovation/maintenance project.

Common issues to be addressed include:

- ☐ Isolation of existing fire protection systems in occupied areas and the construction/renovation/maintenance zone;
- ☐ Verification of alarm system performance after adjustments and reprogramming;
- ☐ Fire and smoke separation of the construction zone from occupied areas;
- ☐ Security to prevent unauthorized access to work areas;
- ☐ Blocking of evacuation paths from occupied parts of the building;
- ☐ Disturbance of service penetrations through existing fire separations;
- ☐ Modification of the performance of smoke management systems and firefighting equipment;
- ☐ Monitoring of the construction/renovation/maintenance zone for fires; and
- ☐ Emergency notification for both the construction/renovation/maintenance zone and occupied portion of the building.

A joint fire safety committee should be established to create, validate and implement an emergency plan and procedures for the facility and construction zones for the duration of the project. Responsibilities for the committee members should be clearly defined.

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# References

Significant portions of the information in this manual were adapted from the American Wood Council technical design guides entitled *Basic Fire Precautions During Construction of Large Buildings* and *Hot Work During Construction of Large Buildings*.

## 11.1 Numbered References

[1] Garis, L. and Clare, J., *Fire Outcomes in Residential Fires by General Construction Type: A Retrospective Analysis in British Columbia* (2014), Centre for Public Safety and Criminal Justice Research, School of Criminology and Criminal Justice, University of the Fraser Valley.

[2] *Report on Course of Construction (Fire) Best Practices Guide* (July 2014), Technical Risk Services for the Canadian Wood Council.

## 11.2 Other Sources of Information

*Comparison of the Canadian Construction Site Fire Safety Regulations/Guidelines* (September 2014), Sereca Fire Consulting for the Canadian Wood Council.

*Fire Safety on Construction Sites* (DVD: 2011), Fire Protection Association of the United Kingdom.

*European Guideline: Fire Prevention on Construction Sites* (2012), Confederation of Fire Protection Associations in Europe.

*Construction Fire Safety Plan Bulletin* (2013), City of Surrey, British Columbia.

*Fire Protection: Implement a Hot Work Permit Program* (September 11, 2013), OHS Insider (ohsinsider.com).

Drysdale, D., *An Introduction to Fire Dynamics* (2000), 2nd Edition, John Wiley & Sons, Toronto.

*Get to Know Your Personal Safety Equipment* (January/February 2001), Worksafe Magazine, WorkSafe BC.

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# Appendix A

## Knowledge, Skills and Abilities Checklist – Construction Fires

To be confident in construction site fire safety, individuals should have or acquire the knowledge and skills to:

- ☐ Properly supervise fire safety activities during construction and demolition;
- ☐ Evaluate local building and fire code provisions;
- ☐ Ensure compliance with Occupational Health and Safety regulations;
- ☐ Utilize the provisions of NFPA Standard 241 *Standard for Safeguarding Construction, Alteration, and Demolition Operations*;
- ☐ Develop and implement a pre-fire plan in accordance with NFPA 1620 *Standard for Pre-Incident Planning*;
- ☐ Evaluate and properly utilize standpipes, automatic sprinkler systems, fire alarm systems and portable fire extinguishers;
- ☐ Conduct a fire inspection program in an onsite scenario;
- ☐ Perform oversight for security and guard services;
- ☐ Conduct the training of subordinate personnel in the use of all fire protection equipment;
- ☐ Be able to evaluate the operational status of fire protection equipment that has been approved for the specific site;
- ☐ Supervise hot work operations, including follow-up on permit processes;
- ☐ Evaluate, access and remedy any impairment to any fire protection system required by the code;
- ☐ Understand how to protect essential equipment that may be exposed to potential damage;
- ☐ Provide emergency information to the local fire department, including interface with the Incident Commander and use of pre-fire information; and,
- ☐ Evaluate any issue associated with access or water supply that would limit the local jurisdictions' ability to combat fires onsite.

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# Appendix B

## Knowledge, Skills and Abilities Checklist – Hot Work

To be confident in construction site hot work, individuals should have or acquire the knowledge and skills to:

- ☐ Comply with NFPA Standard 51B *Fire Prevention in the Use of Cutting and Welding Processes*;
- ☐ Comply with NFPA 241 *Standard for Safeguarding Construction, Alteration, and Demolition Operation*s;
- ☐ Properly utilize temporary heating equipment, including compliance with applicable codes and use of oil-fired-heaters and liquid propane gas heaters (both refueling and installation);
- ☐ Take precautions against fire ignition, including demonstrating an understanding of basic fire behaviour, fire ignition sources, and fire-spread characteristics in buildings under construction;
- ☐ Understand the roles and responsibilities of an individual conducting the fire watch;
- ☐ Safely use, inspect and operate fire extinguishers;
- ☐ Ensure that the water supply for fire protection meets the minimum requirements onsite when hot work is performed.
- ☐ Identify the function of automatic sprinkler systems and the issues associated with temporary shutdowns and operation of valves;
- ☐ Understand the relationship between internal combustion equipment and potential fire causes;
- ☐ Conduct safe roofing operations;
- ☐ Store and safely use flammable and combustible liquids and gases;
- ☐ Store and safely use explosive materials;
- ☐ Properly notify the fire department of an emergency in progress; and,
- ☐ Interface with the first responders on the scene.

Canadian Wood Council
Conseil canadien du bois

99 Bank Street, Suite 400
Ottawa, Ontario K1P 6B9
Canada
Phone: (613) 747-5544
Fax: (613) 747-6264
**www.cwc.ca**