Protection of Adjacent Property During Construction
Buildings > 4 Storeys

Problem Statement

Fires in buildings under construction provide a special risk not only to the structures involved, but to workers, firefighters, the public, and adjacent buildings. The fire experience in Alberta has led to requirements for Adjacent Property Protection (APP) for construction sites under the National Fire Code - 2019 Alberta Edition. The purpose of this code requirement is to limit the risk associated with fire spread from construction sites to exposures, including not just buildings but features such as wildland interface areas. Whilst prevention efforts are intended to reduce the frequency of fire events, APP is fundamentally in place to provide mitigation, or reduce the consequences of fires.

Typical protection for small combustible buildings can be achieved through moderate separation space, physical barriers to heat transfer, products to limit the heat release rate of fires (passive protection), and automatic suppression (active fire protection).

Large combustible construction projects represent a greater risk due to their inherent size, which increases the potential total heat and heat release rate, thereby affecting exposures to a larger degree. The purpose of this guideline is to provide an appropriate performance-based guideline to protect adjacent exposures. As covered in Construction Site Fire Safety: A Guide for Construction of Large Buildings (Canadian Wood Council 2015), this guideline represents a reasonable means to address exposure protection.

Performance-Based Approach

Overview

Preventing fire spread from a construction site is relative to many dynamic factors, including issues such as site planning, and material storage, which for the purpose of this guideline are assumed to meet the best-practice requirements available, as well as regulatory requirements in the National Building Code - 2019 Alberta Edition and National Fire Code - 2019 Alberta Edition. The requirements herein are based on site-specific evaluation.

The primary means of fire spread from a construction site to adjacent exposures is via radiant heat exposure. This is particularly true of tall buildings with combustible exteriors as fire spread may create large radiating surfaces (emitters). As the exterior surface area of an under-construction building increases, it poses a greater risk to exposures (targets) through radiant heat transfer during a fire. Further, the distance between an emitter and a target exponentially affects the rate of heat transfer. The purpose of this approach is to address the size of the emitting surface, relative to the distance between it and potential exposures. The performance based approach takes into account the potential size of a structure fire, the proximity and combustion potential of exposures, as well as a reasonable time for intervention/suppression (such as time to establish a water curtain between the fire and exposures).

Ignition Criteria

Piloted ignition of wood-based materials is generally agreed to occur at radiant heat flux values around 12.5kW/m^2, however this is a conservative value considering that this rate of heat exposure must occur from some duration to initiate combustion. Similarly, non-piloted ignition occurs at heat flux values of about 35 kW/m^2 and up (i.e. auto-ignition of exposed surfaces), again after some term of exposure. This phenomenon is typical to fire spread from construction sites where flame impingement is not necessary to ignite exposures. For the purpose of establishing a performance approach to exposure protection, if intervention can be provided to limit the radiant heat flux to exposures (for example through water curtains) radiant flux on exposures should be no greater than 25 kW/m^2. Lower values are required for instances where intervention is not expected in a reasonable time frame, or where adjacent fuels are not wood-based.

Procedure

For combustible structures exceeding four storeys in height, the following procedure can be applied to establish a low risk to exposures.

1. Conduct an assessment identifying the worst-case fire scenario from the construction site. This would include identifying construction materials and fire protection features relative to the construction process (e.g. staged installation and operation of sprinklers)

2. Identify exposures, including those within and adjacent to the construction site. Note that this evaluation should include all occupied buildings and combustibles exposures, including wildland interface areas.

3. Apply NFPA 80A[1] to determine the required separation distance, or alternatively the allowable percentages of openings on the emitter wall (note that combustible exterior is equivalent to 100% openings). Apply any credits with respect to means of protection as identified from the previous assessment.

4. Note as above, for exposed walls, an **I value of 25kW/m^2** can be used assuming it can be shown that **active protection of exposures is available[2] within 20 minutes of fire initiation**. Ensure that assumptions on detection and response time, accessibility, and available resources (such as water supplies) are substantiated.

5. Atypical and non-cellulose exposures will be required to be evaluated for ignition propensity, and similarly a value for twice the piloted ignition heat flux will be acceptable, provided this value is still less than the non-piloted ignition value.

6. Establish that the provided protection features, separation distance, or exposed openings meet the criteria as above. Note that this may be an iterative process, where the conclusion may be that additional protection features are required.

7. Provide a report to the fire AHJ outlining the process above included with the construction site Fire Safety Plan, for review prior to issuance of a building permit.

There are many measures which can affect the outcome of the NFPA 80A process, including introducing features which incorporate passive or active fire protection, non-combustibility of exterior surfaces, and exterior protection. Many of these are listed in publications from the Canadian Wood Council, as well as in the explanatory material in NFPA 80A. As these sites tend to be very unique with respect to building sitting, and exposure potential, it is important that each site is evaluated independently. For example, a large site in undeveloped green-field areas would require substantially less protection than a site developed in an infill location.

---

1 NFPA 80A Protection of Buildings from Exterior Fire Exposures is based in part on research conducted by the National Research Council as part of the St. Lawrence Burns experiments. This same data was used to create the spatial separation tables utilized in the model National Building Code of Canada, and subsequently the National Fire Code - 2019 Alberta Edition, specifically Fire and the Spatial Separation of Buildings, McGuire, 1966. This process provides an equal level of protection as that inherent within Alberta safety codes. NFPA 80A can be viewed free here: http://www.nfpa.org/codes-and-standards/document-information-pages?mode=code&code=80A

2 Exposure protection must be evaluated for availability of resources (e.g. water supplies) and infrastructure (acceptable access routes).

Revised November 20, 2019.