

High-Intensity Residential Fires Working Group

Final Report

October 31, 2007



CONTENTS

Working Group Mandate	1
Working Group Membership	1
Message from Working Group Co-Chairs	2
Executive Summary – Recommendations	3
High-Intensity Residential Fires in Alberta – Overview and Discussion	6
Definition	6
Data	6
Cause and Location	6
Damage	7
Recent Incidents	8
Contributing Factors	8
Working Group Recommendations	10
1. Public Education and Awareness	10
2. Construction Site Fire Safety and Security	10
3. Construction Codes and Standards	14
4. Fire Investigation and Reporting	20
5. Linking Land-Use Planning and Construction Regulation	23
Conclusion	24
1. Short-Term Implementation	24
2. Medium-Term Implementation	24
3. Long-Term Implementation	25
Appendix A – Reference Document Summary	

WORKING GROUP MANDATE

The *High-Intensity Residential Fires Working Group* was initially established in June 2007 as an internal Government of Alberta committee charged with studying large-loss building fires in Alberta. After a fire at a condominium complex construction site destroyed 18 homes and damaged 76 others in the MacEwan suburb of Edmonton on July 21, 2007, the group was expanded to include municipal fire service personnel and building and fire code officials.

The expanded *High-Intensity Residential Fires Working Group* was given a mandate to review the factors surrounding high-intensity residential fires in Alberta and develop recommendations for the Minister of Municipal Affairs and Housing on ways to reduce the occurrence and severity of these events in the future. The group met seven times between August 3 and October 15, 2007.

WORKING GROUP MEMBERSHIP

Rick McCullough (Co-Chair), Fire Commissioner, Alberta Emergency Management Agency, Alberta Municipal Affairs and Housing

Chris Tye (Co-Chair), Executive Director, Safety Services Branch, Public Safety Division, Alberta Municipal Affairs and Housing

Randy Wolsey, Fire Chief, Edmonton Fire Rescue Services

Ken Block, Deputy Fire Chief, Edmonton Fire Rescue Services

Russell Croome, Fire Prevention Officer, Edmonton Fire Rescue Services

Maurice Otto, Chief Building Inspector, City of Edmonton

Brad Lorne, Deputy Fire Chief, Calgary Fire Department

Wayne Brown, Fire Marshal, Calgary Fire Department

Bruce Schultz, Codes Officer, City of Calgary

John Hillary, Executive Director, Safety Codes Council

Alastair Aikman, Consultant, Aikman Engineering

EX-OFFICIO MEMBERS

Igor Oleszkiewicz, Senior Research Officer, National Research Council Canada

Kevin McEown, Fire Prevention Officer, Saskatchewan Fire Commissioner's Office

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MESSAGE FROM WORKING GROUP CO-CHAIRS

The massive residential fire in the MacEwan suburb of Edmonton on July 21, 2007, had a disastrous impact on the lives of hundreds of area residents and could easily have led to even more tragic consequences. It was therefore with a very clear understanding of the importance of their task that the members of the *High-Intensity Residential Fire Working Group* carried out their efforts on behalf of the Government of Alberta to analyze the causes of high-intensity residential fires and develop recommendations for addressing the problem.

The Working Group's analysis has shown that most high-intensity residential fires in Alberta either involve acts of arson or are the result of accidents caused by residents or workers. So while making code changes to increase fire resistance in new homes can help limit the spread of these fires in the future, it is important to recognize that other preventative measures are needed to help stop them from occurring in the first place.

Public education and awareness campaigns geared around the type of hazards that contribute to the spread of fire in residential areas can help people living in all types of buildings recognize and address those hazards in their homes and communities. By combining that enhanced messaging with the introduction of new measures to increase security and fire safety on construction sites, the Government of Alberta can make effective progress over the long term in addressing the causes of high-intensity residential fires.

The Working Group also believes that Alberta should take a leadership role in addressing this issue from a building code perspective. There is currently a set of proposed code changes under review at the national level that are designed to help limit the spread of fires in residential areas. These changes are being considered for possible inclusion in the 2010 edition of the National Building Code, but the Working Group has reviewed them and believes they should move forward for adoption in Alberta in advance of the national codes process. While we recognize the importance of maintaining consistency with national standards, the high rate of new home construction in Alberta indicates a need to proceed with the revision process as quickly as possible.

These proposed changes recognize that municipal planning bylaws are allowing for increased density in new residential communities, which results in neighbouring homes being located closer to each other than in the past. Although the Working Group agrees that community planning should continue to be a matter for municipal discretion, we also believe that the recommended changes to improve the fire resistance of exterior walls are needed to reduce the potential for building-to-building fire spread where homes are closely spaced.

There is no easy solution for ensuring incidents like the MacEwan fire can never happen again, but the Working Group believes the measures recommended in this report can be effective in reducing the impact that high-intensity residential fires have on Albertans in the future.

Sincerely,

ORIGINAL SIGNED BY

Rick McCullough, Fire Commissioner,
Alberta Emergency Management Agency,
Alberta Municipal Affairs and Housing
Co-Chair, High-Intensity Residential Fires
Working Group

ORIGINAL SIGNED BY

Chris Tye, Executive Director,
Safety Services Branch, Public Safety Division
Alberta Municipal Affairs and Housing
Co-Chair, High-Intensity Residential Fires
Working Group

EXECUTIVE SUMMARY - RECOMMENDATIONS

PUBLIC EDUCATION AND AWARENESS

The most common cause identified for high-intensity residential fires in Alberta that involve occupied buildings is preventable accidents related to smoking, cooking or carelessness. The Working Group recognizes that as residential communities become more densely populated with homes, attention needs to be focused on the fact that being a good neighbour means being a fire safe neighbour.

It is therefore recommended that a communications strategy be implemented to inform the general public about potential fire hazards and arson prevention and to teach them about the safe housekeeping practices that can protect their families and homes from fire spread.

CONSTRUCTION SITE FIRE SAFETY AND SECURITY

National Task Group Recommendations

After arson, the most common cause identified for high-intensity residential fires in Alberta that involve construction sites is preventable accidents related to unsafe or careless worker practices. A task group examining this issue at the national level has developed a set of proposed changes to the National Fire Code designed to increase fire safety at construction sites.

The Working Group feels these changes can be effective in helping to prevent high-intensity residential fires from developing on construction sites, as they contain new or enhanced requirements for:

- improved worker diligence;
- site management and security; and
- the protection of neighbouring, often occupied, homes.

It is therefore recommended that the proposed national task group changes be incorporated into the Alberta Fire Code.

Additional Alberta-Specific Recommendations

The Working Group also recommends the development and implementation of:

- ***a model Fire Safety Plan for construction companies and permit issuing authorities to use in establishing plans that will take site security and arson prevention into consideration;***
- ***a system requiring construction companies to appoint a trained “Worksite Fire Safety Officer” responsible for the Fire Safety Plan; and***
- ***an additional communications strategy to provide the construction industry with more information on how to recognize and respond to fire safety hazards.***

CONSTRUCTION CODES AND STANDARDS

National Task Group Recommendations

Study by a national task group has determined that certain construction practices currently permitted under the National Building Code can contribute to the spread of high-intensity residential fires through the use of building materials that aid in fire growth or pathways that facilitate fire spread from one building to another.

The task group has developed a set of changes to the national code that would increase fire resistance requirements for homes that are located close to the property line and decrease the distance at which these increased requirements come into effect. The areas covered by these changes include:

- fire resistance of exterior siding and sheathing materials;
- construction and venting of eave soffits;
- window dimensions and spacing; and
- construction of open projections like balconies and closed projections like chimneys.

The Working Group recommends that Alberta adopt an enhanced version of the proposed code changes being considered nationally.

Additional Alberta-Specific Recommendations

The Working Group also recommends that Alberta plan for and implement changes concerning:

- ***fire detection and spread protection requirements for attached garages;***
- ***non fire-rated floor and roof systems; and***
- ***unsprinklered concealed spaces, balconies and patios.***

National Code Research and Development

In addition, it is recommended that Alberta support changing Canada's national code research and development programs to include a focus on:

- ***developing standards that mitigate against exterior exposure fires; and***
- ***addressing the performance characteristics of exterior materials such as vinyl siding when exposed to heat or fire.***

FIRE INVESTIGATION AND REPORTING

Challenges faced by the Working Group in assembling information for its analysis demonstrated that Alberta needs a new approach to collecting building data that will support better post-fire analysis and lead to improvements in construction codes and standards.

The Working Group recommends the following steps to improve fire investigation and reporting:

- ***collecting more complete building permit data;***
- ***establishing a uniform approach to fire investigation that analyzes how buildings perform under fire conditions; and***
- ***supporting the establishment of a National Fire Advisor Office to co-ordinate the collection of fire incident information nationally and advocate for change.***

LINKING LAND-USE PLANNING AND CONSTRUCTION REGULATION

Many of the high-intensity residential fires in Alberta have developed in newer residential communities. Part of the problem is that some of these newer communities are being designed in ways that present difficulties for emergency crews in gaining access to the area and fighting the fires.

The Working Group therefore recommends that provincial legislation be amended to require that fire and building code officials be engaged as early as possible in the design of new communities, major infill developments or other construction projects.

HIGH-INTENSITY RESIDENTIAL FIRES IN ALBERTA

Overview and Discussion

DEFINITION

High-intensity residential fires (HIRFs) have been defined by the Working Group as fires involving rapid heat release and fire spread beyond the point of origin that usually involve adjacent buildings. These fires also typically include the early exposure of large amounts of combustible materials.

HIRFs can occur in any of the following groupings:

- occupied residential buildings;
- unoccupied residential buildings that are under construction; and
- a mix of occupied and under-construction residential buildings.

DATA

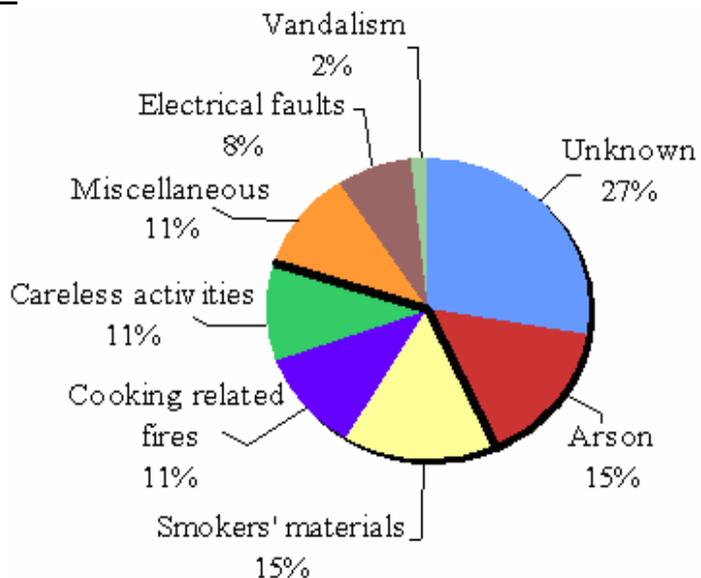
Based on this definition, the Working Group collected the available fire reports from HIRFs that occurred in Edmonton, Calgary, Medicine Hat, Fort McMurray, Airdrie, Camrose and Beaumont from 2000 to 2007 and analyzed the data. The reports indicated there were 86 HIRFs in those municipalities over the specified period, with 65 involving occupied residential buildings and 21 involving residential construction sites.

CAUSE AND LOCATION

The analysis showed that the largest portion of HIRFs in occupied residential buildings was related to accidents involving smoking, cooking or carelessness where cause could be determined.

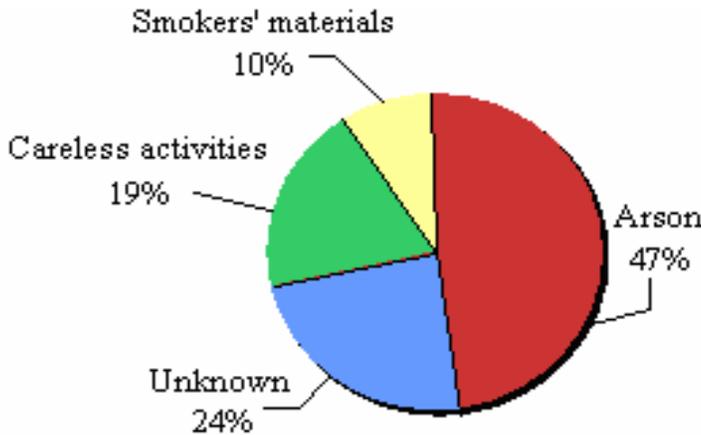
Occupied Residential Buildings:

Total HIRFs	65
Unknown	18
Arson	10
Smoking Materials	10
Cooking	7
Careless Activities	7
Miscellaneous	7
Electrical Faults	5
Vandalism	1



The analysis of residential construction site high-intensity residential fires (HIRFs) showed that by far the most common source of those fires where the cause could be determined was arson.

Residential Construction Sites:



Total HIRFs	21
Arson	10
Unknown	5
Careless Activities	4
Smoking Materials	2

These 21 residential construction site HIRFs began in buildings where the combustible construction materials were not yet protected the way they are in completed buildings. These conditions allow fires to grow very rapidly, which is why HIRFs that begin after-hours at residential construction sites are often already well developed by the time fire crews arrive.

DAMAGE

As a result of their increased severity and scope, HIRFs cause much greater damage than fires that stay confined to one building.

For example, the average amount of damage caused by HIRFs that occurred in Edmonton and Calgary from 2002 to 2006 was almost 11 times higher than the average amount of damage caused by other fires. This means that HIRFs accounted for a much larger portion of the total dollar loss from residential fires in Edmonton and Calgary during that time than the relatively small portion they represented of total fires.

Edmonton and Calgary Fires – 2002-2006

	HIRFs	Other Fires
Number of Fires	33	3,572
Portion of Total Fires	0.9 per cent	99.1 per cent
Losses	\$18,279,540	\$182,764,952
Average Loss per Fire	\$553,925	\$51,166
Portion of Total Losses	9.1 per cent	90.9 per cent

RECENT INCIDENTS

Three other fires that could be classified as high-intensity residential fires (HIRFs) have occurred in Alberta since the July 21, 2007, fire in the MacEwan suburb of Edmonton. However, full reports on them were not available for the Working Group's consideration because the investigations were still ongoing:

- A fire in the 100 block of Royal Elm road in Northwest Calgary on August 15 destroyed three homes and damaged six others.
- A fire in the Cameron Heights neighbourhood of Edmonton on September 7 destroyed three houses and damaged two others.
- Another fire in the MacEwan suburb of Edmonton on September 8 destroyed two homes and damaged two others.

CONTRIBUTING FACTORS

Based on their analysis of the relevant fire incident reports and their experience in the field, the Working Group members have identified the following common factors that contribute to residential fires becoming HIRFs.

Construction Codes and Standards

- The effectiveness of the spatial separation requirements in the national and provincial building codes has been impacted by modern design practices, materials, and by houses being built closer together in Alberta.
- Residential fires are more likely to become HIRFs once they involve the outside of buildings that do not use fire-resistant materials or products to protect combustible substrate materials under combustible exterior cladding.
- While combustible exterior cladding materials are manufactured according to national standards, the testing required by these standards does not subject the materials to the kind of rapid heat gain they are exposed to during large fires. Since the national standards do not consider how materials like vinyl siding perform during HIRFs, there is no clear understanding of how they may contribute to the spread of those fires in residential buildings.

Construction Site Fire Safety and Security

- Fires that originate at construction sites have a greater potential to spread to adjacent occupied or under-construction buildings when fire occurs during the vulnerable period when walls, floors and roofs are framed and before protective sheathing membranes are applied. The large amount of exposed flammable materials on these sites means that fires originating on them are often already burning out of control before fire crews arrive.
- Many builders are unclear about how to apply the fire safety requirements for construction sites listed in the Alberta Fire Code (recently transferred from the Alberta Building Code) and fail to develop, maintain and follow required Fire Safety Plans as a result.

Public Education and Awareness

- Although fire safety information is available in various formats, the public in general does not receive enough information about the steps they can take to reduce the risk of fire in their own homes and help prevent residential fires from spreading in their neighbourhoods.

Fire Investigation and Reporting

- Alberta's current fire incident reporting system collects statistics that capture the overall picture of fire losses in the province, but it is not designed to track specific trends in construction. This makes it difficult for authorities to identify and address any potential issues related to the design, construction or maintenance of specific types of buildings.

Land-Use Planning

- Fire department response time becomes a concern when new subdivisions are developed outside of existing fire station boundaries, before access roads are completed, or when site access is reduced due to construction activity.

Other Factors

- Exterior gas lines for some residential buildings are made of combustible piping that can melt during fires. This can cause the gas to leak, which provides more fuel to fires and makes them more likely to spread.
- Environmental conditions such as high winds that spread flames and deep snowfalls that make roads less accessible for fire crews can also contribute to the spread of high-intensity residential fires.

WORKING GROUP RECOMMENDATIONS

1. Public Education and Awareness

1.1 *Public Information Strategy*

Discussion:

Recent high-intensity residential fires (HIRFs) have raised questions among homeowners, the media, the building construction industry and elected officials about the factors that contribute to these fires, how they can be prevented in the future and what measures are being taken by authorities responsible for public safety.

It is essential that a well thought-out and comprehensive communication plan be developed to give all members of the public the information they need about HIRF hazards and prevention.

1.1.1 Recommendation:

It is recommended that a subcommittee made up of public fire safety education specialists from the Fire Commissioner's Office and the Calgary and Edmonton fire services, in conjunction with the Communications Branch of Alberta Municipal Affairs and Housing and others, develop a comprehensive new HIRF communications strategy with supporting educational materials.

The public education and awareness campaign should include the following elements:

- specific HIRF features in year-round fire safety campaigns designed to educate homeowners about arson prevention and encourage them to exercise safe use and housekeeping practices in relation to barbecues, attached garages, side-yard "storage" and smoking; and
- messages to advise and reassure owners of existing homes, particularly those with exterior vinyl siding that are located in densely populated communities.

2. Construction Site Fire Safety and Security

2.1 *Canadian Commission on Building and Fire Codes Task Group on Fire Safety at Construction and Demolition Sites*

Discussion:

Fire safety provisions at construction and demolition sites, previously located in building codes, have recently been consolidated in the model national and provincial and territorial fire codes.

During the past several years, a number of fires at construction sites have spread beyond the building of origin to pose a serious threat to densely populated urban areas. Notable among these fires are the Waterford condominium fire in Calgary's Erlton community and the MacEwan Green condominium fire in Edmonton. These and other fires originating at construction sites have resulted in significant

losses or damage to community and personal property for those living in adjacent buildings. As a result, the fires called into question the adequacy of the construction site fire safety provisions in the model national and provincial and territorial fire codes.

After these fires were identified as a priority activity by provincial and territorial governments in 2006, the Canadian Commission on Building and Fire Codes (CCBFC) approved the creation of the Task Group on Fire Safety at Construction and Demolition Sites under the Standing Committee on Hazardous Materials and Activities.

The task group and the standing committee have been reviewing requests from the provinces and territories and authorities having jurisdiction, and they have gathered material supporting these requests. The mandate of the task group is to investigate various factors related to this issue.

While the work of the task group is only recently completed and no decisions have been made by the CCBFC, the Working Group believes that sufficient analysis has occurred to show the need for revision to the model National Fire Code (NFC) and to provincial and territorial fire codes in several areas having direct impact on high-intensity residential fires (HIRFs). New or improved requirements being considered would affect:

- protection of existing buildings adjacent to construction, alteration or demolition work;
- improved Fire Safety Plan requirements;
- improved access for emergency personnel to and within buildings under construction or demolition; and
- new requirements for hot application roofing materials, such as bitumen and torch applied membranes.

2.1.1 Recommendation:

It is recommended that the HIRF-related proposed changes to the model NFC developed by the CCBFC task group as described above be adopted in Alberta. Furthermore, it is recommended that these changes be considered for adoption in Alberta prior to any possible inclusion in the model NFC.

2.1.2 Recommendation:

It is recommended that Alberta Municipal Affairs and Housing write to the CCBFC requesting the proposed changes (when final) to the model NFC developed by the CCBFC Task Group on Fire Safety at Construction and Demolition Sites be incorporated into the NFC prior to 2010 as interim code changes.

2.2 ***Additional Recommendations on Fire Safety at Construction and Demolition Sites***

Discussion:

The work of the Canadian Commission of Building and Fire Codes (CCBFC) task group is supported and should contribute significantly to preventing or limiting the effects of construction site fires. However, the Working Group recognizes that new or improved site safety requirements in the Alberta Fire Code (ABC) can only be effective when properly implemented and that such administrative matters are the responsibility of the provinces and territories and not contained in the model National Fire Code.

The Working Group has therefore developed the following recommendations on administrative matters it believes will complement the ABC requirements.

2.2.1 **Recommendation:**

It is recommended that the Fire Commissioner's Office of the Alberta Emergency Management Agency, in partnership with municipalities, develop a model Fire Safety Plan. The model document is to be made available to:

- Safety Codes Council accredited organizations as a planning tool;
- the construction industry to emphasize the importance of developing, implementing and maintaining a planned and documented approach to safety during construction and demolition; and
- the CCBFC with a recommendation that it be used to assist in the development of a model "User's Guide to Fire Safety on Construction and Demolition Sites."

2.2.2 **Recommendation:**

It is recommended that Alberta Municipal Affairs and Housing and the Safety Codes Council require or encourage municipalities to implement the following building and fire permit application procedure improvements:

- All permit application forms should include reference to the need for a Fire Safety Plan. The application form should include a copy of the model Fire Safety Plan or reference to where it is available.
- All completed permit applications submitted for approval should include a permit condition that a Fire Safety Plan be prepared and, where required, submitted to the Fire Safety Codes Officer for review prior to construction.
- Permit categories should include an optional "Hot Works Permit", thereby providing the municipality with the opportunity to separately permit and monitor hot works activities.

2.2.3 **Recommendation:**

It is recommended that the Fire Commissioner's Office of the Alberta Emergency Management Agency encourage municipalities to actively monitor Fire Safety Plans developed by contractors and ensure they pay specific attention to the need for heightened fire safety measures during vulnerable periods when the building under construction presents an increased fire risk to surrounding buildings.

The risk is usually greatest when combustible framing, cladding and other materials are exposed before fire-resistant cladding is installed and before interior fire suppression systems are installed and active.

2.2.4 **Recommendation:**

It is recommended that the Safety Codes Council, through the model Quality Management Plan for accredited municipalities and corporations in the fire discipline, require that every accredited body receive, review and monitor Fire Safety Plans and practices at construction and demolition sites where occupied residential buildings are potentially placed at risk.

2.2.5 **Recommendation:**

It is recommended that Alberta Municipal Affairs and Housing and Employment, Immigration and Industry, Workplace Health and Safety, jointly undertake to establish a worksite safety program that provides for the training and appointment of a "Worksite Fire Safety Officer" responsible for implementing and managing worker education and compliance with safety practices originating in the site Fire Safety Plan.

2.3 ***Contractor Education Strategy***

Discussion:

A number of significant high-intensity fires have occurred at construction sites and some have spread to adjacent occupied residential properties. Arson and lapses in fire-safe construction practices have been the main contributing factors in many of these fires.

An education strategy directed to the various levels of personnel in the construction industry can have a positive influence in reducing the occurrence of these fires.

2.3.1 **Recommendation:**

It is recommended that a generic set of guidelines on the prevention of fires on construction sites be developed for the construction industry and other groups such as building materials suppliers and sub-contractors. These guidelines would be distributed through various means such as trade publications, newsletters and communication media used by their associations.

In addition, the concept of the "Worksite Fire Safety Officer" and compliance with safety practices originating in the site Fire Safety Plan must be emphasized in any communication materials.

3. Construction Codes and Standards

3.1 **Canadian Commission on Building and Fire Codes (CCBFC) Task Group on Spatial Separations**

Discussion:

In the fall of 2006, the CCBFC, Standing Committees on Housing and Small Buildings and on Fire Protection, formed a joint task group. The group was formed to evaluate the current requirements of the 2005 model National Building Code (NBC) with respect to spatial separation between buildings of combustible construction, and to recommend revisions if needed.

Concerns had been raised earlier regarding the vulnerability of buildings adjacent to a building that catches fire. In 2001, following a number of fires in buildings where fire spread to adjacent buildings, the City of Calgary and the Safety Codes Council undertook a joint study of construction materials typically found in exposing building faces. The findings, which identified a potential issue of national scope, were submitted too late in the 2005 code development cycle for review by the appropriate standing committees as the public consultation occurred in 2003. However, the CCBFC agreed that this matter should be considered a priority for the 2010 code development cycle.

The joint task group and the standing committees have been reviewing requests for code changes made by the City of Calgary and others, and the material supporting these requests. The mandate of the joint task group is to investigate various factors related to this issue. While the work is not complete, it has been received by the two parent CCBFC standing committees.

The Working Group believes the work of the joint task group addresses issues directly related to high-intensity residential fires, and that sufficient analysis has occurred to show the need for revision to the model NBC and to provincial and territorial building codes in several areas. New or improved requirements being considered would affect:

- construction related to fire department response time;
- window dimensions and spacing;
- enclosed combustible projections, such as fireplace chases;
- open combustible projections, such as balconies;
- fire-resistance of exterior cladding and substrate materials; and
- construction and venting of eave soffits.

3.1.1 **Recommendation:**

It is recommended that the proposed changes to the model NBC developed by the CCBFC Task Group on Spatial Separations as described above be adopted in Alberta, except as varied in Section 3.2 of these recommendations.

Furthermore, it is recommended that these changes be considered for adoption in Alberta prior to any possible inclusion in the model NBC.

3.1.2 **Recommendation:**

It is recommended that Alberta Municipal Affairs and Housing write to the Canadian Commission on Building and Fire Codes (CCBFC) requesting the proposed changes (when final) to the model National Building Code (NBC) developed by the CCBFC joint task group be included in the NBC prior to 2010 as interim changes.

3.2 ***Additional Standards for Spatial Separations***

Discussion:

The work of the CCBFC Joint Task Group on Spatial Separations is largely supported, as it addresses many of the issues arising from the Working Group's review into high-intensity residential fires (HIRFs). However, the CCBFC task group's recommendations are based largely on fire testing and research using test standards developed for fires that originate within an occupied room or suite.

It is not believed that the task group was asked to consider the type of building-to-building fire spread that has occurred with HIRFs. The Working Group's analysis strongly suggests that additional measures in the following areas are needed to further mitigate large property loss fires:

- further increasing the fire-resistance of exterior walls;
- further limiting the potential for fire spread via eave soffits; and
- adopting a "zero lot line" procedure that has been used in some municipalities for many years.

3.2.1 **Recommendation:**

It is recommended that the following additional spatial separation related requirements be adopted in Alberta:

- Walls or parts of walls of houses having a limiting distance of less than 1.5 m that are constructed with a combustible cladding are to incorporate a sheathing membrane that is noncombustible, such as exterior grade gypsum wallboard, or the cladding is to have a fire-resistant coating.
- Walls or parts of walls in buildings other than houses are to be considered as having 100 per cent unprotected openings when they incorporate vinyl siding over combustible sheathing.
- Eaves are not to be located closer than 0.45 m to a property line, or registered limiting distance, and must be non-vented where located between 0.45 m to 1.5 m.
- Soffits in residential occupancies that enclose a common attic or roof space that spans two or more suites are to be protected for a distance of not less than 1.5 m on each side of the party wall or separation wall.
- The concept of "*registered limiting distance*" is to be introduced to allow spatial separation to be determined based on a line mid-way between two buildings as an option to using the property line. This alternate solution would be registered on the land title of the property where the "*registered limiting distance*" is set.

3.3 ***Pre-Engineered Structural Systems***

Discussion:

The Fire Research Program of the National Research Council (NRC's) Institute for Research in Construction has a project underway to study fires in single-family homes. This project was initiated in response to requests from the Canadian Commission on Building and Fire Codes and the Canadian Commission on Construction Materials Evaluation. The primary objective of the research is to develop fire test procedures to determine the potential impact of innovative residential construction products and systems, including pre-engineered structural systems, on the fire safety of occupants. Results from this research should be available by the end of 2007.

The Working Group identified that unprotected pre-engineered structural systems, when exposed to fire, contribute to rapid heat release. The heat release can aid fire growth and spread, resulting in high-intensity residential fires. The Working Group believes action is needed in two areas. First, occupants and emergency responders need to be educated about safety in buildings where these systems exist. Second, the results from the Fire Research Program research need to be reviewed when they become available, and appropriate action needs to be taken as soon as possible.

3.3.1 **Recommendation:**

It is recommended that the Fire Commissioner's Office of the Alberta Emergency Management Agency, in partnership with municipalities, develop a model fire department response protocol that recognizes the unique hazards to occupants and emergency responders related to unprotected pre-engineered structural floor and roof systems in homes and multi-family dwellings.

3.3.2 **Recommendation:**

It is recommended that Alberta Municipal Affairs and Housing and the Safety Codes Council, on release of research data from the NRC's Fire Research Program study of fires in single-family homes, review:

- existing fire incident report data involving homes and multi-family dwellings; and
- the Alberta Building Code (ABC) relating to tested structures.

The review will determine whether the ABC should assign existing fire safety objectives to pre-engineering structural floor and roof systems to increase the time these systems remain viable under fire conditions.

3.4 ***Sprinkler Standards***

Discussion:

The current edition of the ABC requires that every building of residential occupancy greater than three stories in building height be provided with an automatic sprinkler system. Depending on the actual building height, the code prescribes the use of one of two National Fire Protection Association (NFPA) standards; either NFPA 13, "Installation of Sprinkler Systems", or NFPA 13R,

“Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height.” Both standards serve to provide reasonable protection against loss of life and property damage.

While both standards have a similar purpose, National Fire Protection Association (NFPA) 13R permits sprinklers to be omitted in certain areas, such as concealed unprotected roof, attic, crawl spaces and exterior balconies (see also Recommendation 3.6). This could be attributed to several factors, including:

- the standard’s focus on a high level of life safety and a lesser level of property protection;
- a low number of fires and civilian fire deaths and injuries resulting from fires originating in concealed spaces; and
- the standard being based on tests that involve fires originating in an occupied room or suite and focused on preventing fire growth and flashover.

One notable feature of high-intensity residential fires is the tendency for a fire originating in one building to quickly spread to adjacent buildings. This can involve the fire spreading to the exterior cladding of the adjacent building and then traveling vertically and into the attic or roof space by way of the eave soffit vents.

As multi-family residential buildings are typically of combustible construction, fires are extremely difficult to extinguish once they enter an unsprinklered concealed roof or attic space and become established. A similar potential exists for fires starting on the exterior of a building and then spreading vertically.

For residential buildings that are required to be sprinklered, the installation of automatic sprinklers in concealed unprotected roof, attic and crawl spaces and over exterior balconies would greatly improve protection against fire spreading from exterior exposures.

3.4.1 **Recommendation:**

It is recommended that Part 3 of the Alberta Building Code be amended to require that all residential buildings conforming to that part be required to comply with either:

- NFPA 13, “Installation of Sprinkler Systems”, by removing the existing allowance for compliance with NFPA 13R, “Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height”; or
- NFPA 13R, “Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height”, where appropriate, but including the installation of automatic sprinklers in concealed unprotected roof, attic, crawl spaces, exterior balconies, and patios.

3.5 ***Attached Garages***

Discussion:

Subdivisions with single-family homes that incorporate attached front drive two-car garages have become increasingly popular over the past 25 years. This style of home provides homeowners with convenience, security and protection from the elements. It also reduces the demand for on-street parking in communities with homes located on increasingly narrower lots that provide less street parking. In addition, attached garages are often sized so owners can install cabinets and shelving used to store a wide variety of flammable, combustible and toxic products.

This trend has increased home occupants' exposure to fire hazards without a corresponding adjustment in the safety requirements of the model National or Alberta Building Codes.

Statistics for the 10-year period covering 1996 to 2005 show that, of fires involving attached garages, 170 (54 per cent) spread beyond the garage and resulted in \$26.4 million in property loss. This represents 88 per cent of the total property losses for all fires that originated in attached garages.

Recent fire incidents show that fires originating in attached garages can eventually spread to adjacent closely spaced properties and cause high-intensity residential fires. The Working Group believes that simple preventative measures to alert occupants and provide protection against fire spread should be implemented.

3.5.1 **Recommendation:**

It is recommended the Alberta Building Code be amended to require that:

- every attached residential garage serving a single dwelling unit have one layer of 12.7 mm gypsum wallboard, or similar performing membrane, on all wall and ceiling/roof surfaces; and
- a heat detector be permanently connected to the smoke alarms in the dwelling unit.

3.6 ***Exterior Balconies***

Discussion:

Two factors that are considered to be significantly affecting the growing number of fires originating on balconies are outdoor cigarette smoking and the popularity of barbecuing.

Those who smoke are now more commonly doing so outside. Statistics for the 10-year period covering 1996 to 2005 show that, of the 567 fires originating on an exterior balcony, 248 (44 per cent) were attributed to smokers' materials and resulted in \$14.7 million worth of property loss. A significant number of these fires involved cigarettes or matches improperly discarded into planters containing combustible materials such as peat moss.

In response to the unacceptable risk and high number of reported fires, the Alberta Fire Code 1992 prohibited solid-fuel fire (i.e. briquettes) style barbecues from balconies of buildings containing more than two dwelling units. However, other types of barbecues are still permitted. While some building owners prohibit barbecues, many others continue to allow tenants to use propane barbecues and some newer buildings provide service for natural gas fired barbecues.

The popularity of exterior balconies as a place to smoke or barbecue, combined with combustible furnishing, propane, increased use of combustible cladding such as vinyl siding and lack of balcony sprinkler protection, has contributed to the potential for high-intensity residential fires (HIRFs).

Fire statistics confirm that when fires start on a balcony and spread beyond the balcony of origin, they have resulted in significant property loss. Statistics for the same 10-year period, 1995 to 2006, show that of the 567 fires originating on an exterior balcony, 218 (38 per cent) spread beyond the balcony of origin and resulted in \$26.6 million worth of property loss. This is 90 per cent of the total property loss for all fires that originated on a balcony.

The Working Group believes that simple preventative measures that serve to limit fire spread can help prevent this type of fire from extending beyond the balcony of origin to become an HIRF.

3.6.1 **Recommendation:**

It is recommended that the Alberta Building Code be amended to require that exterior balconies and patios be provided with sprinkler protection in every multifamily residential building where dwelling units are located above other dwelling units and a sprinkler system is installed.

Where the building does not have a sprinkler system, it is recommended that balconies and patios have wall and ceiling membranes incorporate a noncombustible exterior finish or a fire-resistant substrate membrane such as exterior grade gypsum wallboard.

3.7 **Code Development System**

Discussion:

The National Research Council (NRC's) Institute for Research in Construction is a world-class research and model construction code development organization. The NRC publishes model codes and progeny documents that are adopted in almost every province and territory and impact every Canadian wherever they live, work or play.

While the primary objectives vary from model code to model code, objectives addressing safety and property protection are high on the list of importance. Scientific research assesses how individual materials and assemblies of materials perform under test conditions that typically simulate fires originating in an occupied interior space. Research and testing does not normally involve fires that originate or have become established on the exterior of a building or within an unoccupied space, such as a roof, attic or crawl space.

Alberta's recent experience with high-intensity residential fires has indicated a need to suggest the following in relation to combustible exterior cladding systems:

- Researchers and code developers should take into consideration fires that originate outside of the building.
- The scope of material manufacturing standards should be reviewed and adjusted to more thoroughly consider the performance characteristics of combustible exterior cladding and substrate materials when they are exposed to fire.

3.7.1 **Recommendation:**

It is recommended that Alberta Municipal Affairs and Housing request that the Canadian Commission on Building and Fire Codes (CCBFC) and the National Research Council's Institute for Research in Construction implement the following changes to Canada's national code research and development programs:

- Undertake research activities and have CCBFC standing committees consider the effects of exterior exposure fires spreading via the exterior of residential buildings across exterior surfaces and into roof and attic spaces.
- Work with Canada's national materials standards writing and testing organizations to examine and modify manufacturing and testing standards for combustible cladding and substrate materials, such as vinyl siding and oriented strand board (OSB), used singularly and in combination when exposed to fire.

3.7.2 **Recommendation:**

It is recommended that Alberta Municipal Affairs and Housing and the Safety Codes Council forward approved changes specific to the Alberta Building Code and the Alberta Fire Code resulting from this report to the CCBFC with a recommendation that they be considered for inclusion in the model National Codes of Canada.

4. **Fire Investigation and Reporting**

4.1 ***Provincial Fire Incident Reporting System***

Discussion:

The Fire Incident Reporting System at the Fire Commissioner's Office of the Alberta Emergency Management Agency provides a common set of definitions and terminology for reporting fire incident and other fire loss data, together with a method for systematic data collection, quality control, processing, analysis, and the dissemination of findings in a variety of formats to serve both internal and external client needs.

The system is based on a standard reporting format adopted across Canada and provides a dependable body of facts essential for carrying out initiatives to reduce both the frequency and severity of fires in the province.

The standard fire incident report provides a classification of property, a description of the specific structure prior to an incident, a description of the ignition sequence, the conditions found upon arrival, what action was taken, and fire growth and smoke spread.

There are also variables for describing injuries or fatalities to civilians and firefighters, the extent of the damage, the weather parameters and the resources used to control the incident.

Analysis of fire data supports many functions, such as:

- describing a community's fire problem;
- supporting code refinements;
- developing and evaluating public fire education programs;
- conducting research on fire causes and trends;
- planning future fire protection needs; and
- developing training for emergency responders.

Although fire statistics can support code refinements, no incident database can address all the subtleties of the code's impact. Some jurisdictions supplement their fire incident reporting systems with special fire investigation reports and data-collection tools that help detect previously unrecognized or emerging fire hazards. Similar supplemental data gathering mechanisms are needed in Alberta.

A review of fire investigation reports on high-intensity residential fires revealed a lack of consistent and systematic documentation of fires and the need for development of a standardized fire investigation report.

4.1.1 **Recommendation:**

It is recommended that the following actions be taken to improve monitoring of fires in Alberta to address emerging fire problems before they can have a significant impact:

- The Fire Commissioner's Office of the Alberta Emergency Management Agency should implement new data gathering mechanisms to supplement the current standard fire incident reports and gather additional in-depth information on fires of interest. These mechanisms can take the form of:
 - reports from the multidisciplinary Significant Incident Investigation Team, which is currently being established;
 - establishing communication channels between the fire service and the Fire Commissioner's Office to capture and record critical information on emerging fire trends anywhere in the province so timely action can be taken to investigate, research and address such issues before they cause significant losses; or
 - the creation and promotion of a standardized fire investigation report form that can provide useful information for fire research and other purposes.

- Building permit data collection fields should be created to populate the Safety Code Council's provincial permit repository database. This would create a more useful record of the building design, materials, etc., to meet data needs for research on building construction materials in relation to potential future fire problems.

4.2 ***National Fire Advisor***

Discussion:

At present, reliable fire statistics that show Canada's fire issues are not being collected. The fire investigation data does not reflect the relationship between building materials and their performance under a fire condition and this data does not reflect the significance of close proximity buildings and the hazard imposed by radiant heat and other by-products of fire.

A new Office of the National Fire Advisor would be able to analyze and act on comprehensive national fire data as one way to enhance fire protection, detection, prevention and suppression by the fire service and improve awareness about the issues affecting first responder's health, safety and effectiveness.

The creation of an Office of the National Fire Advisor is seen by the Canadian Association of Fire Chiefs as the most important action the federal government can take to improve the level of fire protection for Canadians. The Federation of Canadian Municipalities also supports a resolution that requests support from the Members of Parliament for the creation of an Office of the National Fire Advisor located within Public Safety Canada.

The creation of an Office of the National Fire Advisor would do the following to better serve the public's fire safety and emergency needs:

- Serve as a national link for provinces and territories, thus providing leadership and co-ordination to the provincial Fire Marshals/Commissioners. There is currently no requirement for the collection of fire statistics or fire data nationally. The Office of the National Fire Advisor could require that all provinces and territories report fire investigation statistics in a timely and standardized manner to develop and disseminate comprehensive fire statistics for Canada and ensure effective interpretation of evolving fire trends.
- Ensure the information gathered is relevant to the fire issues and risks revealed by fire trend interpretation. The fire investigation data collected would reflect the changes in technology for building construction materials, construction methods and the use of the building, which would help support code change proposals designed to reduce life and property losses.
- Ensure national co-ordination and liaising with other federal departments and agencies, including the military, for emergency preparedness of the community and for training and integration of equipment for improved emergency response to regional, national and international emergencies.

- Co-ordinate national training in prevention and education to consistently promote and support initiatives by local and regional fire departments. There would be a strategy for fire prevention on a national level in public education and fire service training to better prepare the public through awareness campaigns.

4.2.1 **Recommendation:**

It is recommended that Alberta Municipal Affairs and Housing send Public Safety Canada a letter supporting the creation of an Office of the National Fire Advisor under the Emergency Management Branch, Public Safety Canada. Furthermore, it is recommended that the letter indicate a willingness to assist the newly created office in achieving its mandate.

5. **Linking Land-Use Planning and Construction Regulation**

5.1 Discussion:

Some municipalities appear to be approving new developments, particularly on the periphery of existing built-up areas, without paying adequate attention to some Alberta Building Code and Alberta Fire Code requirements, such as limiting distances, roadway design, and fire department access. This can lead to a municipal fire department having to respond to a fire emergency at a remote construction site or a newly occupied subdivision where access is restricted or hindered because of unfinished, restricted, or poorly designed roadways or sites being blocked by construction activity.

Recent experience has highlighted the need for greater co-operation and co-ordination between municipal authorities and private development companies at all stages of a project, from concept to completion and occupancy.

5.1.1 **Recommendation:**

It is recommended that Alberta Municipal Affairs and Housing amend the *Municipal Government Act* and the *Safety Codes Act* to create mandatory linkage requiring that municipal planners and private developers engage building and fire officials in the approval of new subdivisions and major developments.

CONCLUSION

One of the most important responsibilities of any government is to protect the safety of its citizens, and recent incidents have shown that high-intensity residential fires have become a safety issue for Albertans. The *High-Intensity Residential Fires Working Group* therefore faced an important challenge in developing practical recommendations that the Government of Alberta can implement to effectively address the issue.

Some of the recommendations in this report can be acted on relatively quickly, while others will take longer to implement.

SHORT-TERM IMPLEMENTATION

The Working Group believes that the Government of Alberta can act quickly to begin the process of moving the Alberta Fire Code and Alberta Building Code changes recommended in this report forward for adoption. The Working Group recognizes, however, that public and industry consultations need to be conducted and that a cost-benefit analysis should be completed.

Other areas where the Working Group recommendations can be implemented in the short-term include:

- recommending to the Canadian Commission on Building and Fire Codes that the code changes recommended in this report be incorporated into the national model codes as interim changes;
- developing and implementing communications strategies for the public on high-intensity residential fire prevention and for the construction industry on how to recognize and respond to fire safety hazards;
- developing and promoting model Fire Safety Plans and special fire department response protocols in partnership with municipalities; and
- supporting the creation of a National Fire Advisor Office within the federal government.

MEDIUM-TERM IMPLEMENTATION

The Working Group's recommendations in the following areas would require a period of planning work prior to implementation:

- developing enhancements to Alberta's building and fire permit application procedures and fire statistics monitoring/information system;
- working with the federal government to implement changes to Canada's national code research and development programs;
- potentially developing Alberta Building Code fire safety objectives for pre-engineering structural floor and roof systems; and
- establishing procedures to monitor Fire Safety Plans as part of municipal Quality Management Plans.

LONG-TERM IMPLEMENTATION

Two of the recommendations in this report represent new concepts that would require a longer period of development and planning before they would be practical for implementation:

- amending Alberta legislation to establish formal links between land-use planning and building and fire code requirements; and
- establishing a Worksite Fire Safety Officer system.

APPENDIX A

ALBERTA MUNICIPAL AFFAIRS AND HOUSING ALBERTA EMERGENCY MANAGEMENT AGENCY

HIGH-INTENSITY RESIDENTIAL FIRE WORKING GROUP

Reference Document Summary

No.	TITLE	AUTHOR	DATE
1.	Terms of Reference for High-Intensity Residential Fires Working Group	Alberta Municipal Affairs and Housing (MAH)	August 15, 2007
2.	Residential Fire Losses in Alberta, 2001 – 2005	Fire Commissioner's Office, MAH(FCO)	Unknown
3.	Residential Buildings Under Construction Fire Losses in Alberta, 2001 – 2005	FCO	Unknown
4.	List of High Intensity Residential Fires (2002 – 2007)	FCO	Unknown
5.	Limits on unprotected or glazed openings in exposing building faces at short limiting distances: Review of issues and Recommendations for revision of the National Building Code	Igor Oleszkiewicz, Canadian Codes Centre, Institute for Research in Construction/National Research Council (IRC/NRC)	May 2007
6.	Photographs showing Edmonton (2) and Camrose fires involving multiple single family-homes	Unknown	June, 2007
7.	Experimental Study of Spatial Separation for the City of Calgary and the Safety Codes Council	Fire Risk Management Program, IRC/NRC	December 14, 2007
8.	Fire Safety for Infill Construction Sites – Final Report	Ken Richardson Fire Technologies Inc.	February 16, 2007
9.	Code Change Requests to the NBCC on Building to Building Fire Spread	City of Calgary	March 2007
10.	Construction of Exposing Building Faces in Buildings of Combustible Construction	City of Calgary	January 14, 2003
11.	High-Intensity Fires – Summary of Incidents	Unknown	August 15, 2007
12.	Edmonton High-Intensity Fires – Summary Information from Investigation Reports – Buildings Under Construction	FCO	Unknown
13.	Edmonton High-Intensity Fires – Summary Information from Investigation Reports – Occupied Buildings	FCO	Unknown
14.	Calgary High-Intensity Fires – Summary Information from Investigation Reports – Buildings Under Construction	FCO	Unknown
15.	Calgary High-Intensity Fires – Summary	Fire Commissioner's	Unknown

No.	TITLE	AUTHOR	DATE
	Information from Investigation Reports – Occupied Buildings	Office (FCO)	
16.	CCBFC Task Group on Fire Safety at Construction and Demolition Sites (draft proposed changes)	Canadian Codes Centre, Institute for Research in Construction/National Research Council (IRC/NRC)	February 16 to March 26, 2007 (last modified)
17.	CCBFC Task Group on Spatial Separation (list of proposed NBC changes)	Canadian Codes Centre, IRC/NRC	May 8 to 25, 2007 (last modified)
18.	Vinyl Siding Installation Manual	Vinyl Siding Institute	Copyright 2004
19.	Research Highlight – Relationship Between Moisture Content and Mechanical Properties of Gypsum Sheathing	Canada Mortgage and Housing Corporation	February 2007
20.	One City’s Case for Residential Sprinkler Systems	National Fire Protection Association Journal	July/August 1997
21.	CCBFC Task Group on Fire Safety at Construction and Demolition Sites (proposed changes)	Canadian Codes Centre, IRC/NRC	June 26 to July 10, 2007 (last modified)
22.	NFC 2005, Section 5.6. Reflecting Submitted Proposed Changes	Canadian Codes Centre, IRC/NRC	Based on previous document.
23.	Working Group Report, Changes to Building Code Related to Fire Behaviour	David Price, City of Calgary	August 28, 2007
24.	One and Two Family Dwelling and Apartment Fire Losses in Edmonton and Calgary	FCO	Unknown
25.	High-Intensity Residential Fires Working Group, Interim Ministerial Progress Report – September 1, 2007	Alberta Municipal Affairs and Housing	September 1, 2007
26.	Minutes of the Fifth Meeting of the Joint Fire Protection and Housing and Small Buildings Task Group on Spatial Separation	Canadian Codes Centre, IRC/NRC	June 21, 2007
27.	Pine Knoll Townhome Fire, Raleigh, North Carolina	Schirmer Engineering, Charlotte, North Carolina	August, 2007
28.	Edmonton Building Permits 2001 – 2006	City of Edmonton	Unknown
29.	Residential Building Construction in Calgary 2000 – 2007	City of Calgary	Unknown
30.	One and Two Family Dwelling and Apartment Fire Losses in Alberta 2001 – 2005 (Various Criteria)	FCO	Unknown
31.	Residential Buildings Under Construction Fire Losses in Alberta 2001 – 2005	FCO	Unknown
32.	All Residential Fire Losses in Alberta 2001 – 2005	FCO	Unknown
33.	National Fire Advisor Support Paper	Edmonton Fire Rescue Services	Unknown

No.	TITLE	AUTHOR	DATE
34.	CCBFC Task Group on Fire Safety at Construction and Demolition Sites (final proposed changes).Version Section_5.6_ReflectingPCs_V3-Edited.doc	Canadian Codes Centre, Unknown Institute for Research in Construction/National Research Council (IRC/NRC)	
35.	Incident Report – Fire at 11 Tuscany Vista Road NW, Calgary	City of Calgary	April 25, 2006
36.	Incident Report – Fire at 302 Rockyspring Circle NW, Calgary	City of Calgary	March 14, 2006
37.	Alberta Housing Industry Technical Committee letter to NBC Joint Task Group on Spatial Separation	Gord Bontje, Chair, Alberta Housing Industry Technical Committee	October 5, 2007
38.	Fires in Residential Buildings in Calgary, Edmonton, and Medicine Hat	Alastair Aikman, Consultant, Aikman Engineering	Unknown
39.	Proposal to Increase Minimum Limiting Distance Requiring Exposing Building Face Protection to <1.5 m from Current <1.2 m in the Alberta Building Code 2006	City of Calgary	October 15, 2006
40.	Technical Standards and Specification Manual for Gas Distribution Systems	Alberta Agriculture and Food	September 2005
41.	Review of Vinyl Siding	Alastair Aikman, Consultant, Aikman Engineering	Unknown
42.	Fires in Attached Residential Garages, 1996-2005	Fire Commissioner's Office, Alberta Municipal Affairs and Housing (FCO)	Unknown
43.	Exterior Balcony Fires, 1996-2005	FCO	Unknown
44.	More Fire Protection Needed in Garages: Report into deadly Winnipeg Blaze (CBC news report)	Canadian Broadcasting Corporation News	October 18, 2007
45.	High-Intensity Residential Fires – An Overview	Alastair Aikman, Consultant, Aikman Engineering	October 2007
46.	Fires at Residential Construction Sites and Fires Involving Occupied Residential Buildings (statistics)	Alastair Aikman, Consultant, Aikman Engineering	Unknown
47.	High Intensity Fires – Summary of Incidents	Alastair Aikman, Consultant, Aikman Engineering	Various

This summary includes both published documents and working papers from various sources. All documents are considered confidential except where they are already publicly available.