Backgrounder: Fire Alarm related 2012 Code changes

(Information obtained from the MMAH Consultation for Potential Changes for the next edition of the Building Code, October – November 2010)

3.2.4.2.(6) - Continuity of Fire Alarm System

The issue of continuity of fire alarm systems in multiple interconnected buildings was raised as a concern. The Code is vague on the requirements for the continuity of a fire alarm system in cases where several buildings were interconnected by walkways. It was clear that when the building was separated by a firewall with openings Sentence 3.2.4.2.(1) requires both sides of the building to be treated as one building in the case of the fire alarm system.

In the case of interconnected walkways identified under Articles 3.2.3.19., 3.2.3.20. and 3.2.6.3., the fire alarm application was not as clear. The Task Group agreed to clarify the requirements for smoke detectors under this application. Further, interconnected walkways permitted in Articles 3.2.3.19. and 3.2.3.20. need not conform to Sentence (1).

3.2.4.6 - Commissioning of Life Safety and Fire Protection Systems

Although the Code requires individual fire protection and life safety components to be commissioned to ensure proper operation there is no specific requirements that require integrated systems to be tested as a whole. This includes systems such as fire alarms connected to, sprinklers, smoke control, ventilations, pressurization, door hold-open devices, elevator recalls, fire shutters etc. The proposal will ensure that life safety and fire protection systems, which are integrated, have been commissioned to operate as intended. All too often one trade will commission a component of the life safety system or fire protection system (e.g. door hold-open device) but where there is reliance on the operation of another system (fire alarm) to ensure the function of this door, there is no requirement that the two systems must be tested as a whole.

3.2.4.8.(1) – Signals to Fire Department

A new requirement inserted due to a new defined use for Group C retirement homes.

3.2.4.9.(2)(b) & (c) – Annunciator and Zone Indication

The Task Group noted that designers often miss the requirement for monitoring of the fire extinguishing system required by NFPA 96. This change will provide clarity of the current requirements for monitoring.

Currently, Clause 3.2.4.10.(2)(e) requires fire detectors in elevator and dumbwaiter shafts, while 3.2.4.11.(e) requires smoke detectors in stair shafts. Clause 3.2.4.8.(2)(c) mandates that only shafts required to be equipped with a smoke detectors have separate zone indication on the annunciator panel and therefore this will apply only to stair shafts. Current code provisions do not required separate zone indication for elevator and dumbwaiter shafts and this can be considered an oversight in the code.

3.2.4.10.(2) – Electrical Supervision

Designers often miss the requirement for monitoring of the standpipe valve required under 3.2.9.5. This change will provide clarity of the current requirements for monitoring of flow or tamper conditions on standpipe systems.

3.2.4.10.(4) – Electrical Supervision

Designers often miss the requirements for supervisory monitoring for such things as control valves, loss of power, phase rotation, etc., which are required to be monitored under NFPA 20, which is referenced by Part 3. A new Sentence (3) should be created to cover electrical supervision signals required by NFPA 20.

3.2.4.10.(5) – Electrical Supervision
Sentence added to require supervisory monitoring of a loss of power to a heat tracing cable for standpipe risers, sprinkler lines as part of a fire suppression system and an exit or means of egress to keep it free of ice and snow

3.2.4.12.(1) and (4) – Smoke and Heat Detectors
There is currently no requirement within the building code to require elevators that experience an alarm condition to recall elevators that are being served by that elevator room. The CSA-B44 standard does require that this detector be located in the elevator machine room. This requirement is often missed by designers and should be mandated through the Building Code.

3.2.4.12.(5), (6) and (7) – Smoke and Heat Detectors
There is currently no requirement to provide occupants of adjoining buildings with notification of possible fire that could impact them by way of the interconnected walkway.

3.2.4.16 – Sprinklers in Lieu of Fire Detectors
Recent editions of NFPA 13 no longer require sprinkler protection in elevator shafts. It has been interpreted by some that since the building is sprinklered, there is no need to install fire detectors in the elevator shaft. This change makes it clear that fire detectors are required in the elevator shafts, regardless of whether the building is sprinklered in accordance with NFPA 13.

3.2.4.20.(1) – Audibility of Alarm Systems
Alert signals by definition are permitted to sound at a supervised location and do not need to be audible throughout the floor area. Removal of the words "throughout the floor area" as applicable to alert signals, clarifies that the alert signal may sound at a designated location: this is the intent of the provision.

3.2.4.22.(3) – Smoke Alarms
Statistics have shown that next to kitchen fires, fires originating in sleeping rooms within dwelling units account for the second highest causes of fire deaths in homes. (Refer to NFPA 13D Table A1.2B statistics.) With the current code requirement for smoke alarms to be located in corridors outside the sleeping rooms, this has caused a delay in notifying occupants in the sleeping rooms of a fire especially if the fire originates within that room with the door closed.

This is for two reasons; the audibility levels within the sleeping room may be reduced due to the closed door, and secondly the smoke travel from the sleeping room to the detector (if door is closed) will be impeded thus delaying activation and early notification of occupants.
Smoke alarms located within the corridor will be still be required as they are better capable of detecting a fire originating outside of the room

3.2.4.22.(5), (6), (7), and Appendix Note – Smoke Alarms
There are no requirements for supplemental power supply for smoke alarms in buildings addressed under Part 3. As a result of the extended power outages that occurred in Ontario 2003, concern was expressed over the lack of Code provisions requiring a secondary power supply to smoke alarms installed in residential occupancies. The risk of fire increases during power outages as building occupants rely more on candles for light, and portable exposed-flame appliances for cooking and heating.

In Nova Scotia, deaths occurred during an extended blackout in newer dwelling units, which were equipped with hardwired smoke alarms disabled by the power outage.

Proposed new Sentence (6) recognizes certain smoke alarms with sounder base installations (essentially an independent smoke detector functioning as a smoke alarm) that may be the choice of installation in

some hotels, motels and dormitories. These detectors, although functioning remotely in the individual suites, would be connected to a fire alarm panel thus providing additional supervision of the detectors in the individual rooms. These devices would be required to follow the inspection frequencies of CAN/ULC-S536, "Inspection and Testing of Fire Alarm Systems," as per the Fire Code.

Including battery back-up capability in smoke alarms will reduce the probability of undetected fires. While people may generally rely on the hard-wired power supply, cautions are generally announced when there are power outages. Reminders in those announcements to check smoke alarm batteries would further reduce the likelihood of fire deaths and property loss. 120 volt AC smoke alarms with battery back-up are readily available in the market place from many manufacturers. These units are readily interchangeable with the standard 120 volt AC units without battery back-up and do not require rewiring in order to be utilized. In addition, their usage would not require any wording change or other considerations in their use relative to Section 32 of the Canadian Electrical Code. The basic standard units provide battery back up power for months. Therefore the technology to meet the new objective of proposed Clause (5)(c) is easily met. The permission in Sentence (6) is directed at hotels, motels and dormitories residential occupancies (persons generally vacate these facilities when there are extended power outages). Although it is recognized that the fire alarm panel will not meet the "less than 7 days in the normal condition, followed by 4 minutes of alarm" back-up power supply requirement, it has many additional benefits to alarms required under Sentence (1), such as:

- the smoke alarms connected to a fire alarm panel have the advantage of being supervised;
- this type of smoke alarm system would have to meet annual inspection requirements;
- the alarm system has the advantage of being monitored and maintained;
- it has the advantage of being addressable;
- it has the advantage of remaining installed and operative vs a battery-operated unit, which could have its power source and/or unit removed or made inoperative;
- there would not be any additional cost associated with this proposal as this is seen as an option to the required battery backup, and if this option were chosen, they would not have to meet the additional battery requirements (possibly a cost savings).

3.2.4.22.(10) & (11) – Smoke Alarms

Smoke alarms that do not have a manually operated silencing device incorporated within the circuitry are prone to tampering and disconnection due to false alarms or annoyance.
It is difficult to provide the manually operated silencing device on smoke detectors and making this a requirement would be very onerous and possibly costly.
Requiring the manually operated silencing switch on the circuitry of the smoke alarm will minimize potential tampering with the smoke alarm.

3.2.4.22.(12) – Smoke Alarms

Anecdotal evidence as well as studies have demonstrated that possibly as little as 6% of children aged 6 to 15 awoke reliably to the standard high-pitch beeping alarm signal. Installed in the hallway, the signal is usually received at around 60 dBA at the pillow. When the sound level is increased to 89 dBA at the pillow, by placing the sounder above the bed, 50% of the children awoke and only 29% of those 6-10 years old. The Australian team decided to test alternative signals; the child's mother's voice, an actor's voice, a low-pitch T-3 signal and the standard Australian high-pitch alarm. All the signals were tested at night in the child's home at 89 dBA. Results show that the mother's voice was the best signal to awake the child, then the actor's voice and the low pitch T-3 alarm. The standard alarm performed the worst with 27% of the children not awaken after 60 seconds.

Table: Percentage of children who awoke within different times (summary of p. 285)

Signal	0 - 30 seconds	31 - 60 seconds	Over 60 seconds
Mother's voice	79%	21%	0
Actor's voice	71%	29%	0
Low pitch T-3	67%	33%	0
Standard Alarm	67%	6%	27%

Ball, Michelle, Bruck, Dorothy, 2004, The Effect of Alcohol upon Response to Fire Alarm Signals in Sleeping Young Adults, Proceedings of the 3rd International Symposium on Human Behaviour in Fire, Belfast, Northern Ireland, Interscience Communications, pp. 291-302.

During the same period, the Australian team went on to study another group at risk. They state "alcohol ingestion greatly increases fire fatality risk across all age groups. In a study of residential fire deaths in Japan, Sekizawa reports that 53.1% of all fatalities were asleep and or drunk, and that over 65% of victims aged between 6 and 64 were under the influence of alcohol. Other studies conducted across several continents have reported similar findings. The combination of smoking and drinking seems to particularly elevate risk due to an increased opportunity for fire ignition. In fact, the majority of smoking related fire fatalities show some direct connection with alcohol consumption" (p. 291).

For this study, subjects aged 18 to 25 years old were recruited, they were self-reported deep sleeping persons without hearing difficulties or sleep disorders. They were tested in their own home over 3 nights one week apart. They consumed alcohol to reach a measured blood alcohol content (BAC) of 0.05, 0.08 and they were also tested sober. Three sounds were tested: a recorded female voice, the standard high frequency beeping alarm and the low frequency T-3. Sounds were commenced at 35 dBA and increased every 30 seconds by a 5 dBA increment to a maximum level of 95 dBA. The results show that the response to both the female voice and the T3 were very similar and both aroused individuals at sounds intensity lower than the standard alarm when sober. There was a substantial increase in sound level required to awake subjects when alcohol was administered. In fact at BAC 0.05, 33% did not awake to any signal and at BAC 0.08, 66% did not awake to any signal: this means that people under the effect of alcohol at levels accepted by law to drive a car would not awake to a fire alarm!
In their last study, not yet published, but presented at the NFPA Congress on June 3, 2007, the latest.

Research conducted by Dorothy Bruck and her team from the School of Psychology, Victoria University, Australia. The reference of the paper or report, from which this information is extracted, is found at the start of each section.
Bruck, Dorothy, Reid, Sharnie, Kouzma Jefoon, Ball, Michelle, 2004, The Effectiveness of Different Alarms in Waking Sleeping Children, Proceedings of the 3rd International Symposium on Human Behaviour in Fire, Belfast, Northern Ireland, Interscience Communications, pp. 279-289.
Ball, Michelle, Bruck, Dorothy, 2004, The Effect of Alcohol upon Response to Fire Alarm Signals in Sleeping Young Adults, Proceedings of the 3rd International Symposium on Human Behaviour in Fire, Belfast, Northern Ireland, Interscience Communications, pp. 291-302.
Bruck, Dorothy; Thomas, Ian; Kritikos, Ada, 2006, Investigation of auditory arousal with different alarm signals in sleeping older adults, Report to the Fire Protection Research Foundation for the 2005-2006 US Fire Administration
Grant. http://www.nfpa.org/assets/files//PDF/Research/Investigation_of_Auditory_Arousal.pdf

3.2.4.23 – Voice Communication Systems

Currently there is no requirement in the Building Code to provide a voice communication system in a building falling outside the scope of Subsection 3.2.6. [Though the Code permits relief from certain provisions where a voice communication system is installed - refer to 3.3.2.4.(14)(f)].

As an example in the case of the larger mercantile occupancies contain bulk and rack storage with a variety of products including expanded plastics, flammable and combustible liquids, and oxidizers. Studies of past fires in similar facilities have revealed rapid fire and smoke development. It has been noted that at times these stores may contain upward of 1 000 customers, therefore it is essential to provide an appropriate communication system during a fire alarm.

Based on recommendations of occupant behavior studies conducted and researched by Dr. Guylene Proulx at NRC, in conjunction with site visits to various large mercantile stores, it was concluded that an effective and reliable voice communication system was deemed to be a crucial element in relaying information to the patrons and staff.

GENERAL OBSERVATIONS ON HUMAN BEHAVIOR IN FIRE (presented by Dr. Guylene Proulx)(relevant statements extracted)
1. Studies reveal that the early stages of a fire are characterized by ambiguous information and the occupants difficulties in coping are due to the problems of understanding what is going on and of making allowances for the rapid changes in the situation.
2. Initial response to fire cues are usually characterized by denial which means a delay in response from the occupants who tend to ignore the situation and carry on their activities.
3. In addition to design consideration should be given to the improvement of fire alarm comprehension and associated training procedures. Alarms that give information, rather than just loud signals, have great potential for reducing delays in evacuation..

Rationale for expanding the use of voice communication systems is simply that voice communication systems do aid in evacuation; people do not vacate when there is just an alarm, generally they require instructions.

This proposal addresses only the voice communication aspect of Clause 3.2.4.22.(1)(b) and was not intended to require two-way communication in non 3.2.6. buildings. The following occupancy types, based on the list in Appendix A-3.1.2.1.(1) of the Building Code: malls, convention centres, cinemas, nursing homes, any assembly, schools, big box, casinos, airports, train stations would benefit from voice communication system. Conditions that would trigger the need for a voice communication system such as occupant load, requirements for a fire alarm system, building area, height, combustible load, and controlled egress were also considered.
In all cases a fire alarm system would be required under Subsection 3.2.4. In many cases the decision to require a voice communication system was established based on specific occupancy classifications due to the nature of activity, and the occupants general unfamiliarity with the premises.
In the case of Group B-1 it was felt that there was control of the occupants and they could not leave unless aided or escorted by staff so voice communication system would not be practical in this occupancy.
In the case of F-1 it was felt that occupants generally have a very good understanding of the processes their surroundings, and facility in which they work. They would also be in the best position to judge when an emergency was taking place and take appropriate measures.

To address and identified potential weakness in the requirements for voice communications in these stores. The type of system that would be installed, would typically be a single channel, all call voice system, with the speakers being used to transmit alarm signals as well as voice. With the voice system as part of the fire alarm system, this would include all the side benefits of emergency back up power, regular

testing, electrical supervision of devices, silencing of the signals when announcements are being made, etc.
The TG discussed many issues and came to the following conclusions:
1. It was agreed that the requirement for intelligibility of the voice message is essential and this would have to be included in the requirements for voice communication system. (This will be prepared under a separate change.) It was noted that very often, inadequate number of speakers are installed in buildings resulting in poor communication capabilities.
2. It was agreed that voice communication system would be required not a paging system. It was felt that this would be more reliable because it is subject to maintenance and inspection. It was also agreed that this requirement for a voice communication system should not trigger the need for a fire alarm system and that is why the phrase "where a fire alarm system is required by 3.2.4." has been added.
3. It was agreed that a similar provision for voice communication system be included in Part 9, as the same risk exists as identified in the Part 3 submission. It was however noted that this may not have much of an impact to Part 9 buildings due to the conditions that trigger the need for a voice communication.

3.2.4.23.(1)(a) – Voice Communication Systems
Clause (a) appeared to be restrictive of new technologies that could be utilized to meet the intent of the 2-way communication.

3.2.6.7.(2).(j) & (l) – Central Alarm and Control Facility
To clarify that 2 way communication is required with every elevator car.

Designers often miss the requirement for monitoring of the standpipe valve required under 3.2.9.5. (To be relocated to 3.2.4.9-2011) This change will provide clarity of the current requirements for monitoring of flow or tamper conditions on standpipe systems.

3.2.6.8 – Voice Communication System
The words "or systems" have been removed. This is deemed as an editorial clarification as a building is only permitted to have one fire alarm system.

Clause (c) was added to clarify the requirements for a Group C Retirement Home.

3.2.7.10 – Protection of Electrical Conductors
The current requirements for the protection of electrical conductors are vague, and there are no standards referenced to meet the one-hour protection requirement.

There is now a ULC standard for evaluation of circuit integrity.
The Task Group on Electrical Conductors concluded that the application of the one-hour electrical conductor protection would be limited to high-rise buildings in addition to contained use areas, and areas of refuge as well as fire pump conductors. It was deemed that these identified areas were a higher risk category due to higher occupant load, and increased evacuation times, so emergency response times may be longer. The areas of refuge in hospitals are expected to operate longer in fire conditions and the occupants may not necessarily be able to evacuate. Within contained use areas the occupants do not have full control to evacuate on their own so there is a delay factor.

It was noted that the CAN/ULC-S524, "Installation of Fire Alarm Systems" standard will pick up many of the areas of higher risk not within the high-rise category.
The addition of fire pumps was not seen as a technical change as the NFPA 20 standard (currently referenced) already requires this protection: this is merely a reminder to the users. Removing the downstream requirements of protection was seen as an economical approach. The protection will be up to the distribution panel. It is assumed that occupants will have evacuated the floor of emergency before the

conductors have been rendered inoperative. In addition, devices such as smoke alarms, heat detectors, emergency lighting units are not tested for continued operation under fire conditions.