A Dynamic Risk-Based Framework for Redesigning the Scheduling of Fire Safety Inspections

Fire Chief Len Garis and Dr. Joseph Clare

August 2014

UNIVERSITY OF THE FRASER VALLEY
SCHOOL OF CRIMINOLOGY & CRIMINAL JUSTICE

UNIVERSITY OF THE FRASER VALLEY
CENTRE FOR PUBLIC SAFETY & CRIMINAL JUSTICE RESEARCH

Executive Summary

1. This paper introduces a risk-based, data-driven framework for redesigning fire safety inspections. This framework incorporates information about previous inspections performance, the responsible person in charge of the property, the property use, and the structure type. This alternative method for scheduling fire safety inspections takes into account the likelihood of compliance, thus enabling fire services to target their efforts at the most troublesome/highest risk properties for more frequent inspection, whilst reducing the overall inspection workload and potentially allowing an fire service resources to be redirected to other duties.

2. Fire safety inspections in BC are completed to limit:
    (a) the incidence of fires by rectifying situations posing an increased risk of fires occurring; and
    (b) the risk posed by fires when they occur, by ensuring the appropriate risk-limitation tools are present to maximize life safety and restrict fire spread.

3. The two main reasons for non-compliance with fire safety requirements are:
    (a) the building's responsible person is unaware of the violations, and
    (b) the building's responsible person is aware of the violations, but unconcerned about correcting the situation.

    The first situation can be remedied with education and collaboration, while the second may require a formal process involving a legal response.

4. The previous research examining fire safety inspections in BC has shown:
    (a) the elapsed time since last inspection does not seem to influence fire outcomes with respect to the extent of fire spread and fire related casualty; and
    (b) there is non-random variation in patterns of non-compliance across properties, meaning that:
        (i) the majority of properties that are inspected are compliant;
        (ii) the majority of items that are inspected are compliant; and
        (iii) for those properties that experienced fires, there was greater incidence of non-compliance at the time of the most recent preceding inspection relative to the general patterns of all inspections that are done

5. The data-driven, performance-based framework proposed splits the property characteristics into two measures that operate in parallel: compliance and risk. These metrics can be combined to create a compliance-risk framework that separates all inspectable properties into one of four categories:
    (a) high-risk/low-compliance;
    (b) high-risk/high-compliance;
    (c) low-risk/low-compliance; and
    (d) low-risk/high-compliance.

6. This framework's capacity to discriminate between properties was trialled using Surrey Fire Services data. Of the 12,632 inspectable properties (listed at the time of analysis), this quantitative process classified:
    (a) 6% of properties into the high-risk/low-compliance category;
    (b) 16% of properties into the high-risk/high-compliance category;
    (c) 20% of properties into the low-risk/low-compliance category; and
    (d) 58% of properties into the low-risk/high-compliance category.

7. In comparison, when the same calculations were conducted on the outcomes of fire safety inspections at properties that experienced fires (for the inspection that directly preceded the fires), a very different profile of risk was observed:
    (a) 29% of properties into the high-risk/low-compliance category;
    (b) 9% of properties into the high-risk/high-compliance category;
    (c) 41% of properties into the low-risk/low-compliance category; and
    (d) 21% of properties into the low-risk/high-compliance category.

8. The intent of this data driven categorisation methodology is to ensure fire service inspections resources are being targeted in the most beneficial manner possible. Ideally, this targeted effort would reduce the number of high-risk/low-compliance properties to as close to 0 as possible, as both of these factors could be ameliorated with intensive intervention. By extension, there is also potential to minimize the number of low-risk/low-compliance properties, as this is within the control of the building's responsible person. The timing of the inspections for the other quadrants in the compliance-risk framework could then be based on policy and local demands.

9. This compliance-risk framework does not cover issues associated with:
    (a) the legal implications of implementation;
    (b) the logistics of implementation;
    (c) contingencies for buildings that cannot be accessed
    (d) what to do about 'new' inspectable properties; and; and
    (e) how to bolster and improve the model with additional variables and complexity.

10. With these findings in mind and looking towards the future for fire safety inspections, this forms the bases of one potential approach to developing a data-driven framework for conducting fire safety inspections, based firmly on risk. Should this approach be adopted it would require a trial implementation period followed by a subsequent process and impact evaluation for ongoing performance monitoring. It would also be crucial that the system is treated as dynamic and the calculations are constantly updated based on the most recent data.

11. As with previous work in this area undertaken by these authors, it is important to emphasize and explain this paper *is not* intended to suggest that fire safety inspections should not be done. Instead, the purpose of this research is to build on the previous findings about the non-predictive nature of time since last inspection and the non-random distribution of fire safety inspection non-compliance, to introduce a potential risk-based framework for performance-based fire safety inspection redesign.

Background to Fire Safety Inspections: The Purpose of this Research

This document outlines the first approach to developing a risk-based approach to conducting fire safety inspections in BC municipalities, which builds on previous research into this issue from BC and borrows from the 2005 Alberta approach to Service Delivery Standards produced for the Municipal Based Quality Management Plan[1] (see Appendix, p.19, for a copy of this document).

The previous research that has been undertaken in this area using BC data has shown:

- the elapsed time since last inspection does not seem to influence fire outcomes with respect to the extent of fire spread and fire related casualty [1]; and
- there is non-random variation in patterns of non-compliance across properties, meaning that:
    - the majority of properties that are inspected are compliant;
    - the majority of items that are inspected are compliant; and
    - for those properties that experienced fires, there appears to have been greater incidence of non-compliance at the time of the most recent preceding inspection relative to the general patterns of all inspections that are done [2].

A potential risk-based framework for this redesign, which would incorporate information about previous inspections performance, the responsible person in charge of the property, the property use, and the structure type, is discussed. Should this approach be adopted it would require a trial implementation period followed by a process and impact evaluation as part of ongoing monitoring. This trial implementation and evaluation would be the focus of subsequent research.

Fire Safety Inspections in British Columbia

This section briefly examines:

- the intention underpinning fire safety inspections;
- the transition from *prescriptive* to *performance-based* fire safety codes;
- the relevant codes and legislation that governs fire safety inspections in BC; and
- the broadly defined reasons for non-compliance with fire safety requirements.

The intention underpinning fire safety inspections

Fire safety inspections in BC are completed for two main reasons:

- to limit the incidence of fires by rectifying situations posing an increased risk of fires occurring; and
- to limit the risk posed by fires when they occur, but ensuring the appropriate risk-limitation tools are present to maximize life safety and restrict fire spread.

[1] This document was developed in 2005 by Safety Services, Alberta Municipal Affairs, Public Safety, in response to a request from two Alberta municipalities wishing to develop simple, innovative ways to meet their requirements to inspect properties and manage fire risk with limited, part-time resources. This model was designed to enable local volunteer fire departments to generate inspection frequency scheduling based upon known active and passive fire suppression measures, occupancy type, and inspection history. This document is no longer available from the Safety Services, Alberta Municipal Affairs website and was provided to Surrey Fire Service directly by the Chief Fire Administrator upon request in 2012.

Moving from Prescriptive to Performance-Based Fire Safety Codes

Fire codes are regulations created to promote the safety of the public and reduce the risk of fire exposure, damage, and loss [3, 4]. Fire safety codes are often historical documents that reflect a summation of previously experienced fires and the lessons learned from them [5, 6]. As such, these documents tend to be *prescriptive*, containing guidance resulting from previous experiences in the form of new techniques, practices, and technologies that are introduced to reduce future similar fire safety hazards [5, 7]. A consequence of this process is that fire safety codes become living documents, representing an accumulation of experiences and guidelines, added to after each new threat to fire safety occurs.

Two downsides of this prescriptive approach are:

- fire safety codes are reactive, leading to a repetitive process whereby a major fire occurs and laws are introduced to prevent a re-occurrence; and
- fire safety codes become complex, inflexible, and resistant to alternative solutions to identified problems.

As a results of these limitations, fire services in many developed nations, including Canada, the UK, Japan, and the US, have moved away from prescriptive approaches in recent years [6, 8]. As an alternative, these areas have preferenced *performance-based* codes (also known as *objective codes*) that consider the performance of three entities associated with a fire experience: the fire itself, the structure, and the occupants of the structure [6].[2]

By considering how these entities operate separately and how they interact, solutions to theoretical fire-related problems that may occur in the future can be tested and implemented. This increased flexibility surpasses the capabilities of prescriptive codes, enabling performance-based codes to incorporate alternative solutions to similar problems that emerge over time. Such performance-based codes may contain a quantitative element indicating the degree of risk for a fire to occur, and the corresponding risk of harm should a fire occur, which allows fire services to identify priority public buildings to focus their resources on [7, 9]. The key to making this transition in BC is the capacity to adjust the approach within the confines of existing legislation around fire safety and inspections.

The framework outlined in this report is consistent with this general trend of movement away from predefined schedules towards models based on judgement and analysis.

Fire Safety Codes that Influence the BC Fire Service

There are two main pieces of legislation that influence fire safety inspections conducted by BC Fire Services. At a national level, the National Fire Code of Canada 2010, ensures a consistent standard is applied to fire prevention and safety across the country [10, designed to compliment the 2010 National Building Code of Canada]. On a provincial level, BC operates under the 2012 Building Code [11] and 2012 Fire Code [12]. The national and provincial building codes are enforced during the construction, renovation, and demolition of structures, but once occupancy has occurred, these no longer apply. Post-occupancy, the fire codes are enforced at the municipal government level, meaning that it is incumbent on local fire services to conduct fire-related building inspections. Local fire services are responsible for inspecting properties for compliance with prescribed fire codes, and mandating maintenance should buildings be found to be in violation of those codes. To ensure compliance with these codes, fire safety inspections are undertaken and when infractions are found, inspectors issue an order that requires amendments to be made to bring the building into accordance with the

[2] These three entities align with the systems approach to fire-prevention discussed in the Manitou Inc. (2008) paper entitled, "Surrey Fire Service high-rise fire service study, City of Surrey, British Columbia – Final Report."

prescribed codes. Inspectors are given the authority to inspect and enforce the fire code on behalf of the Fire Commissioner in *Sections 22* and *23* of the *BC Fire Services Act* [12]. Should the owner/operator of a structure fail to comply with a written order there are a range of available legal sanctions that can be pursued. With respect to the frequency of these inspections, it is stipulated within the *BC Fire Services Act*, *Sections 26(1)* and *36(3)*, that, "[a] municipal council must provide for a regular system of inspection" for public buildings (www.bclaws.ca). *Regular* within this context is not expected to bind municipal councils to a specific inspections schedule. Instead, *regular* acts as a guideline within which the frequency of local inspections should be determined, taking into consideration local needs (e.g., ideal level of service and available resources) and the *level of risk* for fire [as per the Interpretive Guide to the BC Fire Services Act, 13].[3]

With respect to *level of risk*, the *Interpretive Guide to the British Columbia Fire Services Act* [13] suggested the establishment of a comparative scale that took into consideration the likelihood that certain fire hazards would be present to a greater degree. While the *Interpretive Guide* provides examples of structures that may be classified as low risk for fire (e.g., art galleries, opera houses, hospitals), medium risk for fire (e.g., schools, psychiatric hospitals, rest homes), and high risk for fire (e.g., restaurants, spray painting operations, apartments), it is important to note that these are simply examples, and do not restrict a particular structure type to a pre-defined level of risk. As such, it is important for fire services in each community to create their own risk categories. This approach is consistent with the targeted prevention campaigns that have been driven by variations in fire risk associated with individual characteristics such as age (under 6 or over 64 years) [14-18] and socio-economic disadvantage [17-21], which were the principles underlying the successful fire reduction campaign undertaken in BC between 2008 and 2012 [22].

Associating risk to different building structures is an essential exercise for fire services to engage in as it may have implications for the frequency and manner by which inspections are conducted. To this end, the *Interpretive Guide to the British Columbia Fire Services Act* [13] classifies buildings into different risk categories with unique standards of inspection frequency. These classifications are based on a national standard, but can be amended locally based on community needs. Occupancies are divided as follows:

- Group A involves structures associated with performance arts, arenas, open air structures, or those not classified elsewhere, such as schools, nightclubs, and restaurants;
- Group B applies to care, treatment, and prison occupancies;
    - B1 is which concerned with detention facilities; and
    - B2 applies to care occupancies;
    - B3 includes facilities where services are provided to support cognitive, physical or behavioural limitations;
- Group C includes residential occupancies, such as hotels and apartments;
- Group D involves other business and personal services, such as office buildings;
- Group E applies to mercantile, such as retail stores; and
- Group F involves industrial structures, such as power plants, service stations, and distilleries.
    - F1 applies to high hazard industrial structures;
    - F2 applies to medium hazard industrial structures; and
    - F3 applies to those with a low hazard

These building risk classifications are still in operation and form the basis of the current schedule for inspection whereby buildings classified as Groups A, B, or C are inspected annually and Groups D, E, and F are inspected

[3] It should be noted that this guide was published in 1992, making it over two decades old, during which time a wide range of factors associated with building design, construction, and risk have changed.

biennially. As is explained, below (Table 2, p.11), the proposed framework incorporates these current attempts to mitigate the risk of fire loss into a model that also evaluates the likelihood of fire safety code compliance. Furthermore, this paper proposes a dynamic process for calculating inspection frequency that moves beyond the current stringent and static frequencies.

Reasons for Non-Compliance and the Use of Sanctions

In broad terms, there are two reasons why inspected buildings are not fully compliant with the fire code. First, the responsible person is unaware of the violations. In such instances, rather than relying solely on fines as a negative consequence of non-compliance, the process should ideally convey to owners/operators a sense of responsibility for complying and encourage them to do so voluntarily through education. With respect to the owners and operators of public buildings, they are essentially taking on the role of the "responsible person" when it comes to providing for the safety of others. However, it is possible that building owners are philosophically in favour of voluntarily meeting all requirements laid out in the fire code but are unaware of all their responsibilities and as such, technically acting non-compliantly. Educating businesses about how to comply and why this matters would likely address this problem in many cases. As such, promoting awareness regarding the regulations associated with things like life safety codes, would be an important component in achieving compliance [23]. Part of this process may involve bi-lateral educational transactions between fire services and owners/operators of public buildings regarding the nature of the regulations and what needs to be done to comply. This type of process would help to identify situations where there is difficulty associated with complying to fire safety regulations, which could lead to revisions of regulations or to injection of resources and support to facilitate voluntary compliance [24]. These types of approaches also provide alternatives to a legal enforcement of code compliance, which can save both fire services and businesses time and money and avoid the use of overly harsh sanctions on businesses that may be willing to comply, but lack the capacity and/or knowledge to do so.

The second main reason that inspected buildings are not fully compliant with the fire code is that the responsible person is aware of the violation(s), but unconcerned about correcting the situation. While many business owners and operators will willingly comply with prescribed safety regulations, particularly when provided with sufficient education to identify and addresses violations when they occur, research suggests that between 10% and 20% of owners will not comply until they have considered the costs and benefits of doing so. This means that, for many of those who are intentionally non-compliant with stated rules and regulations, being caught for those violations will have little effect if there is no penalty [25]. Thus, in relation to compliance with fire safety codes, fire services should not only conduct inspections where they can investigate compliance, but should be able to enforce penalties for an identified failure to comply [23]. Examples of enforcement models that invoke a sliding-scale of punishment are available [25]. When minor violations are detected, a warning is often provided and a re-inspection may be ordered. Should non-compliance be detected during the follow-up inspection, a more formal warning may be taken, and more serious repercussions may result. In some instances, compliance may require a legal response, including fines and/or imprisonment. This approach should only be applied to non-compliance on a case-by-case basis (i.e. not as a mandated, standard course of action), given the significant investment of money and time likely involved.

As the situation currently stands in BC there are additional complications associated with ensuring compliance with the fire codes and for enforcing breaches of the standards. Three reasons for this are:

1. There is currently generally no requirement under BC municipal bylaws to demonstrate that a minimum standard of fire safety has been achieved prior to obtaining a business licence (assuming that a business licence has been obtained);[4]
2. There is ambiguity surrounding who has the responsibility to address building fire safety violations: e.g., it not always clear who is responsible when the owner and occupier are separate people; and
3. There is ambiguity surrounding the definition of compliance, as it is uncertain if this requires 100% pass rate for items at inspection, or if there room for discretion provided the most crucial fire detection and suppression items are present and functioning.

Previous Key Findings from BC Analysis

Two recent pieces of research using BC data have bought into question the current approaches to (a) managing the timing of inspections, and (b) the current practice of treating all buildings within a risk category as the same. The basic overview of these findings is discussed, below.

First, analysis was undertaken into the relationship between the elapsed time since last inspection and its influence on fire outcomes with respect to the extent of fire spread and fire related casualty [1]. Based on the most recent five years of fire incident data reports submitted to the BC Office of the Fire Commissioner for which the date of last inspection was captured (1999-2003),[5] the following major findings emerged:

- the majority of fires (74%), injuries (81%), and deaths (74%) occurred within 1 year of the most recent inspection;
- the frequency of fires, injuries, and deaths declined as the duration between inspection and fire event increased, up until the inspection was over 36 months prior to the fire; and
- there was no meaningful distinction between the duration since the last inspection and:
    - the frequency of fires at residential and non-residential properties; and
    - the extent of fire spread;

Second, previous research [2] has demonstrated that inspection non-compliance is non-random for properties and items, and there is a link between experiencing a fire and elevated non-compliance at the most recent inspection preceding the fire event. The main findings can be summarised as follows:

- there is a non-random non-compliance of properties at the most recent round of fire safety inspections, with 74% of properties found to be fully compliant;
- there is a non-random failure of fire safety inspection items at the most recent round of inspections:
    - 95% of items inspected were fully compliant; and
    - properties that had at least one non-compliant inspection item were likely to have had 25% non-compliance.
- prior to experiencing fires, the most recent round of inspections produced very different failure patterns than the 'norm' for all properties.
    - 62% of the properties that experienced fires were non-compliant at the most recent inspection that preceded the fire. This was 2.4 times more frequent than the 26% of properties that were non-compliant at the most recent round of inspections;

[4] Some municipal fire departments do conduct business license inspections to ensure that the basic fire safety requirements are met prior to a business opening.

[5] It was unknown what the overall inspection frequency for all properties in this sample was, which made it somewhat difficult to interpret whether time since last inspection had any impact on frequency of fire.

- 70% of the properties that experienced fires were scheduled for annual inspections;
- 21% of the items inspected at properties that experienced fires were non-compliant at the most recent inspection that preceded the fire. This was 4.0 times greater than the 5% of items that were non-compliant at the most recent round of inspections; and
- Properties that experienced fires and had at least one non-compliant inspection item were likely to have 40% non-compliance. This was 1.6 times greater than the results from the most recent round of inspections.

These findings demonstrate the motivation for moving from prescriptive fire safety codes towards performance-based codes (as discussed, above). As a conclusion of both of these pieces of work [1, 2], the authors suggested that it may be possible to redesign the fire safety inspection process to acknowledge a broader set of risk factors, informed by the non-predictive nature of time since last inspection and the variation within risk categories. The next section of this paper outlines an example of a framework that was designed to try an operationalise some of these types of issues

The Municipal Risk Based Fire Quality Management Plan and Variations in Risk

The Alberta Service Delivery Standards establishes "responsibilities and minimum performance criteria for providing compliance monitoring services under the Safety Codes Act (SCA) including" (see Appendix, p.19, and Footnote 1, p.1):

(a) permit issuance (fireworks);
(b) code advice;
(c) plans examinations;
(d) site inspections;
(e) site investigations;
(f) variances;
(g) orders;
(h) verification of compliance;
(i) identification and follow-up of deficiencies and unsafe conditions;
(j) collection and remittance of Safety Codes Council (SCC) fees; and
(k) maintaining files and records.

These service delivery standards were produced for the Municipal Based Quality Management Plan (QMP) and were intended to ensure compliance monitoring for the administration of the Alberta Safety Codes Act and the Alberta Fire Code, as well as the investigation and reporting of fires. According to the QMP, inspections would be administered in accordance with a frequency schedule based on a risk assessment rating, with each inspectable property scored according to the framework outlined in Table 1, below. This framework could be altered according to the specific Municipality's conditions and priorities. The outcome of this process was to classify buildings into an inspection frequency category based on risk score:

- inspect every year – scores less than 0;
- inspect every two years – scores between 0 and 10;
- inspect every three years – scores between 11[6] and 20; and
- inspect every four years – scores over 20.

[6] The Alberta documentation indicates this range was 10 to 20, but to have exclusive categories this would need to be 11.

TABLE 1. AN EXAMPLE OF THE INSPECTABLE PROPERTY RISK ASSESSMENT RATING PROVIDED IN APPENDIX A OF THE SERVICE DELIVERY STANDARDS OF THE MUNICIPAL RISK BASED FIRE QMP

Inspectable property risk assessment rating example	Score if 'Yes'
Does the premises have an automatic sprinkler system?	5
Does the premises have a fire alarm system?	3
Does the alarm system automatically contact the emergency services?	2
Does the premises have on-site maintenance staff?	1
Is the owner/operator of the premises a government body?	1
Is the premises staffed 24 hours a day?	2
Are occupants under the care of staff 24 hours a day?	3
Is the staff/resident (patient) ratio at night 1:12 or better?	4
Is the staff/resident (patient) ratio at night 1:6 or better?	5
Does the premises provide self-inspections every 6 months?	4
Does the premises provide self-inspections every 12 months?	2
Are fire drills conducted every two months on average?	1
Was the premises built since 1974?	1
Was the premises built since 1985?	2
Was the premises built since 1990?	3
Was the premises built since 1997?	4
Is there 3m from this structure to the next on one side?	1
Is there 3m from this structure to the next on both sides?	1
Is there 3m from this structure to the one behind?	1
Is there one fire hydrant within 90m of this structure?	1
Are there two fire hydrants within 90m of this structure?	2
Is the premises within 5 miles of the nearest fire hall?	3
Does the owner/manager life on site?	2
Do occupants regularly sleep on the premises?	−5
Do occupants have mobility problems?	−5
Is this a licensed premises?	−5
Is smoking allowed on the premises?	−5
Were there any deficiencies noted on the last inspection report?	−5
Is the structure(s) within 10m of treed/brush area?	−5
Does the structure have wooded shakes/shingles for roofing/siding?	−5
Has the structure followed FireSmart guidelines?	−5

Adapting a Risk-Based Approach: the Distinction between Compliance and Risk

This Alberta QMP model is uni-dimensional and collapses a range of constructs into a single measure. An alternative to this approach splits the property characteristics into two measures that operate in parallel: compliance and risk.

Compliance

As indicated, above, within a BC context there is ambiguity surrounding the definition of compliance. It is uncertain if this requires 100%pass rate for items at inspection, or if there room for discretion provided the most crucial fire detection and suppression items are present and functioning. The current process that is implemented by the Surrey Fire Service allows for some discretion with respect to the need for re-inspection,

as a function of inspection failure on specific items.[7] Based on existing practice re-inspections are not conducted for:

- fire hydrant service failures;
- exit light functionality;
- extinguisher failures, such as not serviced, missing, or not mounted; and
- emergency lighting that was not fully functioning.[8]

Although the justification for this distinction has resulted from ad-hoc approaches to managing risk associated with specific types of item failures, the decisions have not been driven by analysis of data on inspections failure.

Variations in the types of risk

The current inspections process utilised by Surrey Fire Services does not exploit a risk-assessment distinction that has been incorporated into areas such as forensic mental health, child protection, and offender recidivism management: the distinction between static and dynamic indicators of risk. In these contexts, *static risk factors* are those factors that have been demonstrated to relate risk potential. Translating this to a fire context, these risk factors would by the essentially non-changeable aspects of the property that influence fire likelihood, such as construction material, zoning density, and geographic location in the city. In contrast, *dynamic risk factors* are those factors that have a demonstrated association with risk, but are amenable to alteration. Within a fire context, these would refer to the types of risk factors that can alter over time and can be influenced by inspection and improved safety practices (the Three 'E's). Examples of this could include the level of diligence demonstrated by the responsible person (possibly captured in proxy by the prior compliance history at the property), recent compliance history, building use, and so on. Meaningful variations in the risks posed by any structure are going to be identified by considering static and dynamic risk factors in parallel.

A compliance-risk framework

To operationalize these concepts, dynamic risk factors and compliance performance need to be monitored in an ongoing, consistent manner. In conjunction with the static risk posed by the building, the outcomes of this ongoing assessment should drive the frequency of building inspections. Building on the Alberta model, one approach to achieve this would be to use a scoring process to identify different levels of risk, based on the available information on these two metrics:

(1) high-risk/low-compliance;
(2) high-risk/high-compliance;
(3) low-risk/low-compliance; and
(4) low-risk/high-compliance (as displayed in Figure 1, below).

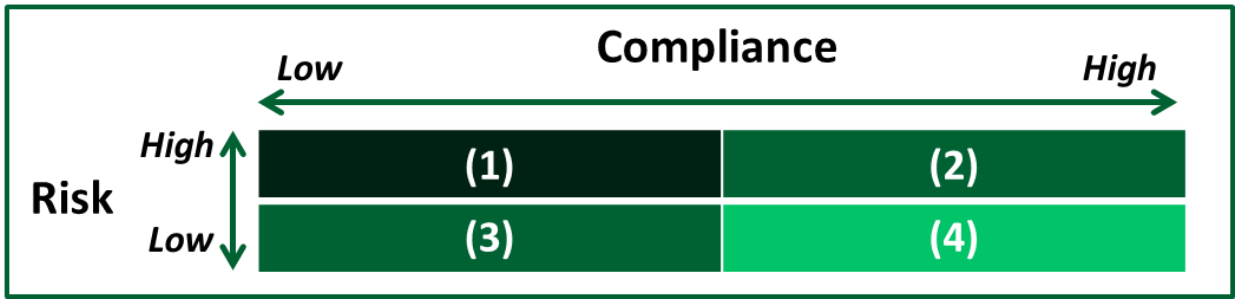
Implementation of this approach in an iterative manner within a Municipality will enable discrimination between properties in a meaningful, consistent, replicable manner.

---

[7] Pre-16 August, 2011, properties were only invoiced if there were still non-compliance issues after the re-inspection. The original inspection has always been (and continues to be) free. This is regardless of the size of the workload involved with completing the initial inspection. Post-16 August, 2011, properties that require a re-inspection are all invoiced (flat fee of $111.40, plus HST). Again, this cost is a flat rate, regardless of the work involved with undertaking the re-inspection, or as a result of the nature of the initial failure to comply.

[8] As of 16 August, 2011, this issue now requires re-inspection.

FIGURE 1. THE 2 × 2 MATRIX CAPTURING THE RELATIONSHIP BETWEEN COMPLIANCE AND RISK FOR INSPECTABLE PROPERTIES



The Compliance-Risk Approach – Surrey, BC, as a Case Study

Using Available Data to Approximate Risk and Compliance

One crucial component of this compliance-risk approach is to construct the metrics based on available data within the Municipality's data systems. Table 2 displays one example of a potential scoring of the risk metric components chosen from the Surrey Fire Services data set.

According to this example, the overall risk score for each property was then computed by summing across these components. The possible range for this scale was +7 (highest risk) through to −5 (lowest risk). As an example for this calculation, if a property was classified as Group C, was built in 1978, and has a sprinkler system, the risk score would = 5 + 2 +(−3) = 4. It would be possible to adjust the individual weights used here and also to introduce other risk factors, depending on the priorities and objectives of the Municipality.

TABLE 2. COMPONENTS OF THE RISK METRIC CHOSEN FROM THE SURREY DATA SYSTEM

Risk metric components	Score
Is the building classified as Group A ('A', 'A1', 'A2', 'A3', 'A4')	2
Is the building classified as 'B1' (detention facility)?	5
Is the building classified as 'B2' (care occupancies)?	5
Is the building classified as 'C' (residential occupancy, meaning people sleep there)	5
Is the building classified as 'F1' (high-hazard industrial)	5
Is the building classified as 'F2' (medium-hazard industrial)	3
Is the building classified as 'F3' (low-hazard industrial)	1
Was the building built prior to 1995?	2
Was the building built in 1995 or more recently?	−2
Does the building have a sprinkler system?	−3

Table 3 shows and example of the scoring of the compliance metric components chosen from the Surrey data system. According to this framework, the overall compliance score for each property was computed by multiplying the most recent inspection result score by the score for the number of items inspected at the property, producing a possible range for the compliance score from +20 (fully compliant and a large number of inspection items) through to −20 (fully non-compliant and a large number of inspections items). As an example for this calculation, if a property had 45% of the items inspected were non-compliant and there were a total of 12 items inspected, the compliance score would = −2 × 3 = −6. Once again, depending on the department's

particular priorities and considerations, it would be possible to add components to this compliance framework (e.g., specific item failures considered to be crucial to life-safety could be added with a negative value).

TABLE 3. COMPONENTS OF THE COMPLIANCE METRIC CHOSEN FROM THE SURREY DATA SYSTEM

Compliance metric components		Score
Most recent inspection result	Were 100% of the items compliant at last inspection?	5
	Were less than 25% of the items non-compliant at the last inspection?	−1
	Were between 25% of items and less than 50% of items non-compliant at the last inspection?	−2
	Were between 50% of items and less than 75% of items non-compliant at the last inspection?	−3
	Were between 75% of items and less than 100% of items non-compliant at the last inspection?	−4
	Were 100% of the items non-compliant at the last inspection?	−5
Number of items inspected at the property	Was there 1 item inspected at the property?	1
	Was there between 1 item and 9 items inspected at the property?	2
	Was there between 10 items and 19 items inspected at the property?	3
	Was there 20 or more items inspected at the property?	4

Preliminary Capacity for these Scales to Discriminate between Inspectable Properties

Using the example scales presented in Table 2 and Table 3, a preliminary attempt was made to discriminate the inspectable properties in Surrey according to risk and compliance. The data set being used here matches the one used in the previous research, "The non-random nature of fire safety inspection compliance: a platform for predicting fire risk" [2]. The results of using the risk and compliance metrics to capture all of the properties in the Surrey data set are displayed in Table 4. In this table, compliance scores ranged from to −15 to +20 and risk scores ranged from −5 to +7. The values within the table indicate the number of properties that produced each combination of risk and compliance. For example, 6 properties from the full set of 12, 632 properties had a compliance score of −4 and a risk score of +7 (circled in Table 4 as an example for readers).

TABLE 4. MATRIX FORMED BY THE INTERACTION OF RISK AND COMPLIANCE SCORES FOR ALL PROPERTIES, SURREY DATASET (N = 12,632 PROPERTIES)

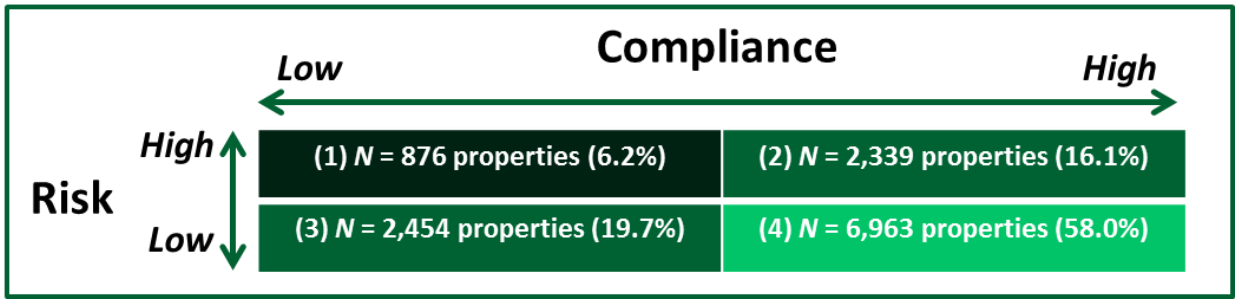
Risk score	Compliance score														
	−15	−12	−10	−9	−8	−6	−5	−4	−3	−2	5	10	15	20	Total
7	–	–	–	–	–	4	–	(6)	8	–	–	2	15	4	**39**
5	–	–	–	–	–	1	2	1	5	5	1	37	22	1	**75**
4	–	–	–	–	12	11	1	24	23		2	4	46	23	**146**
3	–	–	2	–	3	28	12	16	83	12	12	232	171	9	**580**
2	–	–	–	–	1	2	2	4	11	9	4	31	39	3	**106**
1	–	–	5	4	9	77	63	97	237	96	199	619	775	88	**2,269**
0	–	–	1	3	39	47	13	143	170	11	34	65	418	127	**1,071**
−1	–	–	2	1	–	14	10	16	31	6	28	104	110	17	**339**
−2	1	2	14	2	18	119	101	218	509	175	462	1,305	1,587	300	**4,813**
−3	–	–	–	2	21	8	1	56	50	3	16	47	142	78	**424**
−4	–	–	1	–	1	5	4	3	22	1	7	22	58	13	**137**
−5	–	–	5		8	46	25	102	373	51	272	502	1,082	167	**2,633**
Total	**1**	**2**	**30**	**12**	**112**	**362**	**234**	**686**	**1,522**	**369**	**1,037**	**2,970**	**4,465**	**830**	

In relating these values back to the compliance-risk framework displayed in Figure 1, above, the following scores were used to identify the four quadrants (with the broken dividing lines in Table 4 showing how the individual properties were divided up into the frequencies and percentages listed in Figure 2):

(1) Risk ≥ 1 and Compliance < 0;
(2) Risk ≥ 1 and Compliance ≥ 0;
(3) Risk < 1 and Compliance < 0;
(4) Risk < 1 and Compliance ≥ 0.

This translates into the division of the numbers of properties as demonstrated in Figure 2:

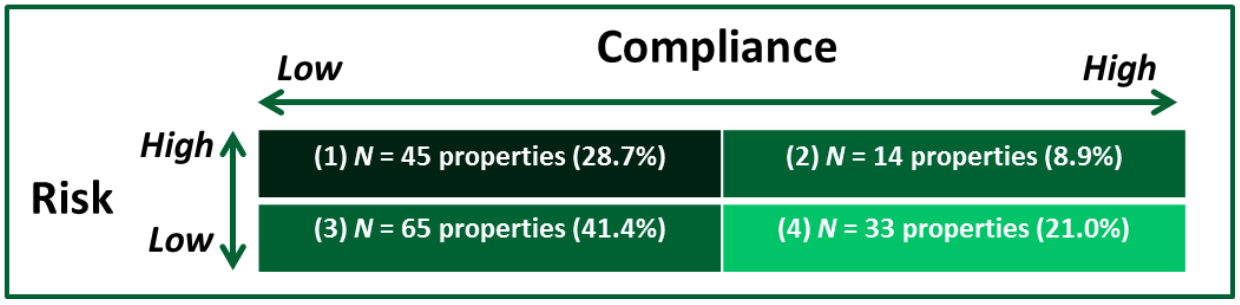
FIGURE 2. THE DIVISION OF PROPERTIES (COUNT AND %) INTO THE 2 × 2 MATRIX CAPTURING THE RELATIONSHIP BETWEEN COMPLIANCE AND RISK FOR INSPECTABLE PROPERTIES (N = 12,632 PROPERTIES)



Testing the Compliance-Risk Framework on Inspections that Preceded Fires

As discussed previously, analysis of the most recent fire safety inspections prior to fires that occurred at 157 inspectable properties in Surrey revealed that these properties were more likely to have been non-compliant and that a much greater percentage of the items inspected at these properties were likely to be non-compliant. To further examine the potential for the compliance-risk framework to discriminate properties in a meaningful way, the calculations based on the weights displayed in Table 2 and Table 3 were re-run on the most recent inspections prior to the fires that occurred. The division of properties that resulted can be seen in Figure 3.

FIGURE 3. THE DIVISION OF PROPERTIES (COUNT AND %) INTO THE 2 × 2 MATRIX FOR INSPECTABLE PROPERTIES DIRECTLY PRIOR TO A FIRE OCCURRING (N = 157 PROPERTIES)



Thus, using the same scoring process in both cases, relative to the full sample of inspectable properties in Surrey (Figure 2), the inspections that directly preceded the fires at these inspectable properties were classified into Quadrant 1 (high-risk/low-compliance) 4.6 times more often (29% for properties that had fires compared to 6% overall) and into Quadrant 3 (low-risk/low-compliance) 2.1 times more often (41% for properties that had fires compared to 20% overall).

In contrast, relative to the full sample of inspectable properties in the City (Figure 2), the inspections that directly preceded the fires were less likely to result in properties being classified into Quadrant 2 (high-risk/high-compliance) and Quadrant 4 (low-risk/high-compliance). The whole sample of properties were classified into Quadrant 2 1.8 times more often than properties that experienced fires (16% vs. 9%, respectively). In addition, the whole sample of properties were classified into Quadrant 4 2.8 times more often than properties that experienced fires (58% vs. 21%).[9]

Hypothetical Impact on Inspection Practices for Surrey Fire Services

This section provides a hypothetical impact of this compliance-risk model on the inspection practices of the Surrey Fire Services. Unlike the data presented earlier, the modelling within this section is based on the number 2014 of inspectable properties in Surrey during the first half of 2014. The following assumptions underpin the data presented in this section:

- there are 13,692 inspectable properties in the City;
- 2,641 (19%) of these are in a risk category that means they are currently inspected annually and 11,051 are in a risk category that means they are currently inspected biennially;
- the relative percentages displayed in Figure 2 capture the distribution of properties under the compliance-risk classification framework;
- the relative inspection frequencies for the four quadrants of the compliance-risk framework would be:
  (a) 2 per year for high-risk/low-compliance;
  (b) 0.5 per year (1 every 2 years) for high-risk/high-compliance;
  (c) 1 per year for low-risk/low-compliance; and
  (d) 0.25 per year (1 every 4 years) for low-risk/high-compliance.
- the inspection failure rate is 26%, spread evenly across all property types (from [2] as discussed on p.7); and
- each property that requires a reinspection is only reinspected once.

Under the current regime (annual and biennial inspections with 26% inspection failure), the current annual inspections workload for Surrey Fire Service is 10,291 inspections, with the details displayed in Table 5.

TABLE 5. ESTIMATED ANNUAL INSPECTION WORKLOAD BASED ON THE CURRENT INSPECTION PRACTICES (N = 13,692 PROPERTIES)

Classification	# properties	Annual inspection frequency	Annual first inspection	Annual reinspection	Total inspections
Annual	2,641	1	2,641	687	3,328
Biennial	11,051	0.5	5,526	1,437	6,963
Total	**13,692**		**8,167**	**2,124**	**10,291**

[9] All of these comparisons between the percentages in Figure 2 and Figure 3 were statistically significant using *Z*-tests for proportions.

Under the assumptions of the compliance-risk framework (with the relative property classification specified in Figure 2) the annual inspection workload would reduce by 8% to 9,428 inspections, as specified in Table 6.

TABLE 6. ESTIMATED ANNUAL INSPECTION WORKLOAD BASED ON THE COMPLIANCE-RISK FRAMEWORK WITH NO CHANGE IN CURRENT RISK LEVELS (N = 13,692 PROPERTIES)

Classification	# properties	Annual inspection frequency	Annual first inspection	Reinspections	Total inspections
High-risk/low-compliance	849	2	1,698	441	2,139
High-risk/high-compliance	2204	0.5	1,102	287	1,389
Low-risk/low-compliance	2697	1	2,697	701	3,398
Low-risk/high-compliance	7942	0.25	1,986	516	2,502
Total	**13692**		**7,483**	**1,945**	**9,428**

If, with targeted effort, the number of high-risk/low-compliance properties was able to be reduced by 50%, the annual inspection workload would reduce by 16% relative to the current levels, as displayed in Table 7.

TABLE 7. ESTIMATED ANNUAL INSPECTION WORKLOAD BASED ON THE COMPLIANCE-RISK FRAMEWORK WITH A 50% REDUCTION HIGH-RISK/LOW-COMPLIANCE (N = 13,692 PROPERTIES)

Classification	# properties	Annual inspection frequency	Annual first inspection	Reinspections	Total inspections
High-risk/low-compliance	424	2	848	220	1,068
High-risk/high-compliance	2630	0.5	1,315	342	1,657
Low-risk/low-compliance	2697	1	2,697	701	3,398
Low-risk/high-compliance	7941	0.25	1,985	516	2,501
Total	**13,692**		**6,845**	**1,779**	**8,624**

As suggested previously, these figures are entirely dependent on the specified assumptions and should be interpreted with caution.

Summary and Conclusions

Results Recap and Overview

It is clear from previous research that the timing of fire safety inspections is non-predictive of fire risk. It is also clear that there is a non-random variation for non-compliance of properties that undergo fire safety inspections. This pattern also extends to indicate that the most recent round of inspections that preceded fires produced very different failure patterns from the 'norm' for all properties. These findings lend themselves well to the development of a compliance-risk framework for attributing a risk value to each inspectable property in the City of Surrey. This risk value is based on data-driven metrics that are influenced by the risk (static and dynamic posed by the building) and the compliance (as indicated at the most recent inspection), which can vary over time as a function of the interaction between the building occupants, the building responsible person, the fire service, and the demands and objectives of the Municipality.

Working through some examples of the application of this compliance-risk framework, the current research has demonstrated that that the full set of inspectable properties can be separated into meaningful categories that represent the interaction between risk and compliance, whereby roughly 6% of properties fall into Quadrant 1 (high-risk/low-compliance), in greatest need of fire service intervention, and 58% fall into Quadrant 4 (low-risk/high-compliance), which potentially needs the least frequent external auditing and intervention.

The intent of this process is to ensure fire service inspections resources are being targeted in the most beneficial manner possible. Ideally, this targeted effort would be to attempt to reduce the number of properties in Quadrant 1 (high-risk/low-compliance) to as close to 0 as possible, as both of these factors could be ameliorated with intensive intervention. There is also potential to minimize the number of properties that fall into Quadrant 3 (low-risk/low-compliance), as this situation is within the control of the building's responsible person. The timing of the inspections for the other Quadrants would then be based on policy and local demands.

Unresolved issues that would require operational decision-making prior to implementation

This framework does not address a number of issues that would require operational decision-making prior to the implementation of this type of inspection regime. These include:

1. The issue of how to legally implement this type of approach. The direct application of this would need to be assessed within the legal framework and actuarial thresholds as established by the Municipality responsible for the fire inspection service.

2. The logistics of implementation would need to be managed taking into account the unique context provided by each fire department across each Municipality.

3. Contingencies would need to be developed for buildings that the fire safety inspectors are unable to gain entry to. The specific procedure surrounding properties that could not be accessed would have to be determined by the responsible authority in each area.

4. There needs to be a defined process for defining the risk level for new properties that require inspection.

5. There is potential to bolster the information available for this process over time to collect additional discriminating variables in a systematic, consistent manner. This model represents a best-available, jumping-off point for the risk-based process, rather than a definitive, final model. As it stands, there is currently no calculation involving potential harm in the event of a fire (beyond the building classification grouping) included in this model. This is something that would need additional work to be able to quantify and incorporate into a modelling process. The logic displayed here would be suitable to include this variable though, if that was considered a priority by the local Municipality.

Conclusions: Looking to the Future

With these findings in mind and looking towards the future for fire safety inspections, this forms the bases of one potential approach to developing a data-driven framework for scheduling fire safety inspections, based firmly on risk. Should this approach be adopted it would require a trial implementation period followed by a subsequent process and impact evaluation for ongoing performance monitoring. This trial implementation and evaluation would be the focus of subsequent research. If implemented, it is fundamentally important that these processes are monitored and evaluated in an ongoing manner. Continual analysis of where the risk is within the community will help prioritize action and help provide insight into the longitudinal effectiveness of these

efforts. On a fundamental level, evaluation of activity should focus on whether the proposed strategies have been initiated and delivered successfully (process evaluation), and the impact of these activities on the overall problem should be measured (impact evaluation). It is also crucial that the system is treated as dynamic and the calculations are constantly updating based on the most recent data.

This amended strategy would incorporate the *Three E's* of injury prevention [26]: environment (product design or modification), enforcement (of legislation and policies), and education. In addition to being prescriptive and missing the issues associated with dynamic risk and the ill-defined concept of 'compliance' (with relevance to enforcement and the environment), the current process also overlooks the education component of this process.

References

[1] L. Garis and J. Clare, *Examining "regular" fire-safety inspections: the missing relationship between timing of inspection and fire outcome*, 2012, Centre for Public Safety and Criminal Justice Research, School of Criminology and Criminal Justice, University of the Fraser Valley.

[2] L. Garis and J. Clare, *The non-random nature of fire safety inspection compliance: a platform for predicting fire risk*, 2013, Centre for Public Safety and Criminal Justice Research, School of Criminology and Criminal Justice, University of the Fraser Valley.

[3] W.K. Chow and G.C.H. Lui, *A proposed fire safety ranking system for karaoke establishments and its comparison with the NFPA fire safety evaluation system* Building and Environment, 2002. **37**: p. 647-656.

[4] P.A. Croce, et al., *The international forum of fire reserach directors: a position paper on performance-based design for fire code applications.* Fire Safety Journal, 2008. **43**: p. 234-236.

[5] G. Deakin, *Fire safety standards - help or hindrance.* Fire Safety Journal, 1999. **32**: p. 103-118.

[6] R.M. Tavares, *An analysis of the fire safety codes in* Fire Safety Journal, 2009. **44**: p. 749-755.

[7] A. Wolski, N.A. Dembsey, and B.J. Meacham, *Accommodating perceptions of risk in performance-based building fire safety code development.* Fire Safety Journal, 2000. **34**: p. 297-309.

[8] J. Santos-Reyes and A.N. Beard, *A systemic approach to fire safety management.* Fire Safety Journal, 2001. **36**: p. 359-390.

[9] P.G. Holborn, et al., *Fires in workplace premises: risk data.* Fire Safety Journal, 2002. **37**: p. 303-327.

[10] National Research Council Canada, *National Fire Code of Canada, 2010*, 2010, National Research Council of Canada. p. 343.

[11] Ministry of Public Safety and Solicitor General, *2012 BC Building Code*, 2012, Office of the Fire Commissioner, Ministry of Public Safety and Solicitor General, British Columbia.

[12] Ministry of Public Safety and Solicitor General, *2012 BC Fire Code*, 2012, Office of the Fire Commissioner, Ministry of Public Safety and Solicitor General, British Columbia.

[13] Office of the Fire Commissioner, *Interpretive guide: criteria for determining frequency of inspections, Subject Fire Services Act - Sections 26(1) & 38(3)*, 1992, Ministry of Municipal Affairs, Recreation and Housing, Province of British Columbia.

[14] C. Jennings, *Urban residential fires: an empirical analysis of building stock and socioeconomic characteristics for Memphis, Tennessee*, in *Faculty of the Graduate School of Cornell University*1996, Cornell University. p. 307.

[15] J.C. LeBlanc, et al., *Home safety measures and the risk of unintentional injury among young children: a multicentre case-control study.* Canadian Medical Association Journal, 2006. **175**(8): p. 883-887.

[16] S.J. Scholer, et al., *Predictors of mortality from fires in young children.* Pediatrics, 1998. **101**(5): p. 1-5.

[17] U.S. Fire Administration, *Socioeconomic factors and the incidence of fire*, 1997, Federal Emergency Management Agency, United States Fire Administration, National Fire Data Center. p. 35.

[18] U.S. Fire Administration, *Fire risk*, in *Topical Fire Research Series*2004, National Fire Data Center. p. 7.

[19] C. Jennings, *Socioeconomic characteristics and their relationship to fire incidence: a review of the literature.* Fire Technology, 1999. **35**(1): p. 7-34.

[20] P. Schaenman, et al., *Proving Public Fire Education Works*1990, Arlington, Virginia: TriData Corporation.

[21] K.N. Shaw, et al., *Correlates of reported smoke detector usage in an inner-city population: participants in a smoke detector give-away program.* American Journal of Public Health, 1988. **78**(6): p. 650-653.
[22] J. Clare, et al., *Reduced frequency and severity of residential fires following delivery of fire prevention education by on-duty fire fighters: cluster randomised controlled study.* Journal of Safety Research, 2012. **43**: p. 123-128.
[23] R. Van den Bergh and L. Visscher, *Optimal enforcement of safety law - Rotterdam Institute of Law and Economics (RILE) Working Paper Series, No.2008/04*, 2008, Rotterdam Institute of Law and Economics (RILE), Erasmus University Rotterdam. p. 27.
[24] R.J. Burby, P.J. May, and R.C. Paterson, *Improving compliance with regulations: choices and outcomes for local government.* Journal of the American Planning Association, 1998. **64**(3): p. 324-334.
[25] G. Suurmond, *Compliance to fire safety regulation: the effects of the enforcement strategy - Department of Economics Reserach Memorandum 2007.03*, 2007, Faculty of Law, Department of Economics, University of Leiden, The Netherlands: Leiden.
[26] S.P. Baker, *Injury Control*, in *Preventive Medicine and Public Health*, R. M.J., K.F. Maxcy, and P.E. Sartwell, Editors. 1973, Appleton-Century-Crofts: New York.

Author Biographical Information and Acknowledgements

Len Garis is the Fire Chief for the City of Surrey, B.C. and is an Adjunct Professor in the School of Criminology and Criminal Justice at the University of the Fraser Valley and a member of the Institute of Canadian Urban Research Studies, Simon Fraser University. Contact him at Len.Garis@ufv.ca.

Dr Joseph Clare, was the strategic planning analyst for the Surrey Fire Service (BC) between 2010 and 2013, and is also an Honorary Research Fellow with the Crime Research Centre, University of Western Australia, and a member of the Institute of Canadian Urban Research Studies, Simon Fraser University. Contact him at joe.clare@uwa.edu.au.

Special thanks to Amanda McCormick, Dr Darryl Plecas, and Dr Charles Jennings for contributions to earlier versions of this work.

Appendix

As detailed in Footnote 1 (p.1), this document was developed in 2005 by Safety Services, Alberta Municipal Affairs, Public Safety, in response to a request from two Alberta municipalities wishing to develop simple, innovative ways to meet their requirements to inspect properties and manage fire risk with limited, part-time resources. This model was designed to enable local volunteer fire departments to generate inspection frequency scheduling based upon known active and passive fire suppression measures, occupancy type and inspection history. This document is no longer available from the Safety Services, Alberta Municipal Affairs website and was provided to Surrey Fire Service directly by the Chief Fire Administrator upon request in 2012.

Schedule B

Service Delivery Standards

Version: Municipal Risk Based Fire QMP
Date: March 9, 2005

SERVICE DELIVERY STANDARDS
TABLE OF CONTENTS

Page

SCOPE OF SERVICES

This Service Delivery Standards document establishes responsibilities and minimum performance criteria for providing compliance monitoring services under the Safety Codes Act (SCA) including:

- permit issuance (fireworks)
- code advice,
- plans examinations,
- site inspections,
- site investigations,
- variances,
- orders,
- verification of compliance,
- identification and follow-up of deficiencies and unsafe conditions,
- collection and remittance of Safety Codes Council (SCC) fees, and
- maintaining files and records.

SECTION 1: PERFORMANCE

The Municipality will:

- perform the services in an effective and timely manner,
- endeavour to work co-operatively with the owner and/or the owner's representative(s) to achieve compliance with the SCA and applicable Regulation(s), and
- perform the services with impartiality and integrity, and in a professional and ethical manner.

SECTION 2: PERSONNEL

The Municipality will:

- employ persons knowledgeable about the applicable codes, standards and regulations, relative to the services it provides,
- employ Fire Safety Codes Officers (SCOs) who are certified and designated at an appropriate level to provide compliance monitoring relative to services the Municipality provide, and
- maintain a registry of all SCOs they employ, and their level(s) of Certification, and Designation of Powers.

SECTION 3: QUALITY MANAGEMENT PLAN TRAINING

The Municipality will:

- train its SCOs and other involved staff in the requirements of this QMP, and
- maintain the training records on the employee's file.

SECTION 4: RECORDS

The Municipality will maintain a file system for all the records associated with performing the services including:

- permits (fireworks)
- plans, specifications, and other related documents,
- plans review reports,
- inspection reports,
- verifications of compliance,
- variances,
- orders and other means of enforcement, and
- related correspondence and/or other relevant information.

SECTION 5: SAFETY CODES COUNCIL OPERATING FEES

The Municipality will collect the SCC operating fee for each permit issued (fireworks) under the Safety Codes Act, and remit those fees to the SCC in the manner and form prescribed by the SCC.

SECTION 6: ORDERS

The Municipality will employ appropriately certified Fire SCOs who may issue orders in accordance with Part 5 of the SCA.

SECTION 7: VARIANCES

The Municipality will employ appropriately certified Fire SCOs who may issue variances in accordance with the appropriate sections of the SCA and SCC policy.

SECTION 8: COMPLIANCE MONITORING

General

The Municipality will monitor compliance, as outlined in the appendices to this QMP, through a program of permit issuance (fireworks), plans examination (when applicable), regular site inspection, and follow-up inspections or verification of compliance (when applicable), using appropriately certified and designated Fire SCOs to provide compliance monitoring in accordance with the SCA and associated codes and standards.

Permits

The Municipality will collect all information required by the SCC to be collected as part of each fireworks permit application.

The Municipality may issue permits for fireworks under the Alberta Fire Code that include:

- name of the issuing Municipality,
- permit number,
- date of issue,
- applicant's name, address, and phone number,
- landowner's name, address, and phone number,
- location by legal description, civic address, and municipality,
- description of the activity,
- permit conditions,
- issuer's name, signature, and designation number, and
- a Freedom of Information and Protection of Privacy Act (FOIPP) statement that meets the requirements of FOIPP as per the following example:

"The personal information provided as part of this application is collected under the Safety Codes Act, the Municipal Government Act and the Freedom of Information and Protection of Privacy Act (RSA 2000). The information is required and will be used for issuing permits, safety codes compliance verification and monitoring. The name of the permit holder and the nature of the permit is available to the public upon request. If you have any questions about the collection or use of the personal information provided, please contact the Municipality of Crowsnest Pass at (403) 562-8833".

Site Inspections

A Fire SCO will inspect:

- to determine if a building, structure or place complies with the SCA, the Alberta Fire Code and referenced codes and standards,
- within the time frames outlined in the inspection frequency sections of this QMP,
- in a timely fashion (endeavour to inspect within 2 working days and will not exceed 5 working days, when contacted for any required inspection), and
- all buildings, equipment and installations in place at the time of the inspection.

The Municipality may, at their discretion, extend the time frame for a required site inspection(s) by documenting in the file:

- the reason for the extension, and
- the new time frame or date for conducting the inspection(s).

A Fire SCO will, for each inspection required by this QMP, complete an inspection report noting:

- permit number and file number (if applicable),
- Municipality name,
- date,
- Owner name, address, and phone number,
- Contractor name, address, and phone number (if applicable),
- legal description, address (if applicable), and municipality,
- building, structure, place, equipment or installation being inspected,
- a description of the nature of the occupancy at the time of inspection,
- all observed deficiencies (any condition where the building, structure, place, equipment or installation is incomplete, or does not comply with the SCA or an associated code or regulation and in the opinion of the Fire SCO is not an unsafe condition),
- all observed unsafe conditions (any condition that, in the opinion of a Fire SCO, could result in property loss, injury, or death, and is not a situation of imminent serious danger),
- all observed situations of imminent serious danger and the action taken by the Fire SCO to remove or reduce the danger, and
- name, signature, and designation number of the Fire SCO conducting the inspection.

The Municipality will, for each required inspection:

- provide copies of Inspection Reports to the permit applicant (when applicable), occupant, owner, and the Municipality's file; and, if requested, to the project consultant, Architect, or Consulting Engineers, and
- follow-up on noted deficiencies or unsafe conditions through re-inspection(s) (at the discretion of the Fire SCO verification of compliance may be accepted as follow-up).

Verification of Compliance

A Fire SCO may, at their discretion, accept a verification of compliance (reasonable assurance provided from a third party that a building, structure, place, equipment or installation work complies):

- as follow-up to deficiencies or unsafe conditions noted on a site inspection, or
- in lieu of a site inspection when permitted in this QMP.

A Fire SCO, when accepting a verification of compliance, will document the information to the permit file including:

< identification of the document as a verification of compliance,
< permit number (when applicable),
< name and title of the person who provided the verification of compliance and how it was provided (i.e. written assurance, verbal assurance, site visit by designate, etc.),
< date accepted by the Fire SCO, and
< signature and designation number of the Fire SCO.

No-Entry Policy

When a Fire SCO is unable to gain entry to a site for a required inspection, the Fire SCO will leave a notification on-site in a visible location, or forward notification to the Owner and permit applicant (when applicable), advising of the inspection attempt and requesting that the Fire SCO be contacted to arrange for the site inspection.

If the Fire SCO does not receive a response within 30 days of notification, the Municipality will mail the Owner and permit applicant (when applicable), a second notification requesting that the Fire SCO be contacted within 30 days to arrange for a site inspection.

If the Fire SCO is not contacted within 30 days of the second notification, the Fire SCO will discuss with the respective Municipality's CAO other forms of action which can be undertaken to ensure compliance with the SCA.

APPENDIX A: FIRE DISCIPLINE – Delivery Standards

Compliance monitoring in the fire discipline will consist of:

- administration of the Safety Codes Act and the Alberta Fire Code, and
- investigation and reporting of fires.

Compliance monitoring will consist of reasonable inspections of buildings, structures and places to check for compliance with the Alberta Fire Code. These inspections may be required as noted in the Inspection Program and Frequency Schedule or as the result of a request, complaint or emergency condition at the discretion of the Fire SCO.

Inspections will be administered in accordance with the Inspection Program and Frequency Schedule (attached) and will include the preparation and distribution of site inspection reports. At the discretion of the Fire Safety Codes Officer, verification of compliance may be acceptable as proof of correction to a noted deficiency.

Summary records will be maintained which contain the following minimum information:

Maintenance Inspections	New Work Inspections	Investigations
file number, site address, name of Safety Codes Officer doing the work, comments, date of inspection, assurance of compliance with corrective items, and date of site completion/sign off.	file number, site address, site description, date of plans examination, name of Safety Codes Officer doing the work, date of permit issuance, comments, value of construction, building permit #, date of inspection, assurance of compliance with corrective items, and date of site completion/sign off.	file number, location of fire, date of fire, date of investigation, building / property use, cause of fire, origin of fire, value of loss, name of Safety Codes Officer conducting the investigation, comments, and date of completion/sign off.

Investigations will be conducted to determine the cause and origin of fires where a death, injury, or property loss occurs, the results of which will be reported to the Fire Commissioner in accordance with the Administrative Items Regulation. A Fire Safety Codes Officer may arrange for any additional municipal, law enforcement, agency, or other resources as required to assist in an investigation. In the event of a fire resulting in a death or serious injury, or where arson is suspected, the investigation will include immediate notification of the provincial Fire Commissioner. It is also recognized by the Municipality that investigations of fires or explosions that result in serious injury, death, suspected incendiary activity or complicated loss, may involve representatives or agents of the provincial Fire Commissioner.

Inspection Program and Frequency Schedule

The Municipality will develop an inventory of all inspectable property (All buildings, structures and places except farms, ranches, single family residential occupancies, duplexes and semi-detached row housing and associated outbuildings. Farm/Ranch operations that cater to the general public including Bed & Breakfasts and Country Vacation operations will be inspectable property). Each inspectable property will then be scored using the attached questionnaire.

The Municipality will then implement an inspection program, which bases the frequency of inspection on the score each premises received in the questionnaire. Once a score is determined the suggested Inspection frequency for each premises will be:

Less than 0	=	Inspect every year
0 to 10	=	Inspect every two years
10 to 20	=	Inspection every three years
20+	=	Inspect every four years

Note: Where a question asks about the presence of a system it is assumed that the system is maintained according to Code. If such maintenance is not occurring then the answer should be "NO".

The questionnaire is subject to change by the Municipality in consultation with their Safety Codes Officers to reflect changing conditions and priorities. Such changes will be forwarded to the Safety Codes Council as amendments to this QMP upon approval by the Municipality in the form of a resolution.

Inspectable Property Risk Assessment Rating – Municipality of Crowsnest Pass

#	Question	Yes	Score
1.	Does the premises have an automatic sprinkler system?	5	
2.	Does the premises have a fire alarm system?	3	
3.	Does the alarm system automatically contact the emergency services?	2	
4.	Does the premises have on site maintenance staff?	1	
5.	Is the owner/operator of the premises a government body? (Federal/Provincial/Municipal)	1	
6.	Is the premises staffed 24 hours a day?	2	
7.	Are occupants under the care of staff 24 hours a day?	3	
8.	Is the staff/resident(patient) ratio at night 1:12 or better?	4	
9.	Is the staff/resident(patient) ratio at night 1:6 or better?	5	
10.	Does the premises provide self inspections every 6 months?	4	
11.	Does the premises provide self inspections every 12 months?	2	
12.	Are fire drills conducted every two months on average?	1	
13.	Was the premises built since 1974?	1	
14.	Was the premises built since 1985?	2	
15.	Was the premises built since 1990?	3	
16.	Was the premises built since 1997?	4	
17.	Is there 3m. from this structure to the next on one side?	1	
18.	Is there 3m from this structure to the next on both sides?	1	
19.	Is there 3m from this structure to the one behind?	1	
20.	Is there one fire hydrant within 90m of this structure?	1	
21.	Are there two fire hydrants within 90m of this structure?	2	
22.	Is the premises within 5 miles of the nearest fire hall?	3	

Inspectable Property Risk Assessment Rating – Crowsnest Pass (Page 2)

23.	Does the owner/manager live on site?	2	
24.	Do occupants regularly sleep on the premises?	-5	
25.	Do occupants have mobility problems?	-5	
26.	Is this a licensed premises?	-5	
27.	Is smoking allowed on the premises?	-5	
28.	Were there any deficiencies noted on the last inspection report?	-5	
29.	Is the structure(s) within 10 metres of treed/brush area?	-5	
30.	If yes in # 29 does the structure have wooden shakes/shingles for roofing or siding material ?	-5	
31.	Is yes in #29 has the structure followed FireSmart Guidelines?	+5	

Date Scored:		Total Score:	
Frequency Indicated:		Scored By:	
Last Inspection:		Next Inspection:	