

**FIRE SAFETY POLICIES OF THE  
MINISTER OF PUBLIC SECURITY**

QUÉBEC

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**Ministère de la Sécurité publique  
Direction de la sécurité incendie**

## **WARNING**

**The present document is published only for administrative purposes.  
To apply and interpret the policies included in this document, you must  
refer to the text published in the *Gazette officielle du Québec*.**

## Foreword

On March 14, 2001, I made public, for the purpose of consultation, the policies for fire safety services that I intend to establish in the near future in each regional community in order to provide a fire safety cover plan.

The Fire Safety Act provides for such a consultation procedure which has allowed the main partners of the ministère de la Sécurité publique to pronounce themselves on the objectives and the parameters that should guide fire safety planning in Québec over the next few years. Generally speaking, the collaborators recognize the value and the relevance of the proposed policies. If some have indicated the importance of being able to adapt its elements to different regional problems, the majority has welcomed the rigour of its information, as well as the necessity of using it as a reference if we wish to improve the level of protection for our fellow citizens against fire and increase the overall effectiveness of our organizations.

I remind you that the content of these policies constitutes the main tool for assessing our fire protection objectives and the actions that the municipal authorities are to decide upon in their fire safety planning. The municipalities that receive a certificate of compliance from the ministère de la Sécurité publique in recognition of their adherence to these policies will be well on the way to receiving a substantial benefit, namely exoneration from responsibility in the event of a lawsuit launched with regard to the work of their fire safety services.

With its new *Fire Safety Act*, Québec has established an original framework for fire safety planning and organization. This framework, unique in North America, is based squarely on the fire safety issues we are faced with today and on related developments which, whether having to do with technology, funding or public organizations, are already influencing our work in fire safety or will do so in the future. I am confident that through their open-mindedness and sense of responsibility, our elected municipal officials and the various municipal and fire safety partners will make full use of this new framework in the serious work they will be doing over the next few months. And as they go about that task, the overriding objective of which is to improve the level of protection of Quebeckers. They can count on the full support of the personnel of the ministère de la Sécurité publique.

Minister of Public Security

Serge Ménard

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## Introduction

- Nature and purpose of the policies:

Section 137 of the *Fire Safety Act* provides for the design of fire safety policies and objectives to guide the municipalities in their work to develop their fire safety cover plans:

“137. The Minister is, more specifically, in charge of determining policies concerning fire prevention, personnel training, emergency response procedures and operations for regional and local authorities.

For that purpose, the Minister shall classify fire risks and list and describe the fire protection objectives and the minimum measures to be considered by regional and local authorities in the establishment of their fire safety cover plans and in their implementation plan.”

The purpose of these ministerial policies is to ensure that the principles and main objectives outlined in the fire safety reform are applied under the corresponding legislative framework in the planning that the municipalities will be undertaking over the coming months. It will thus not be surprising to find that this document refers very often to the ministerial document of June 1999, *Green Light for Fire Safety Reform in Québec*. The first part of this document reviews the problems and issues at the origin of the reform, along with the objectives for dealing with them as proposed by the Government of Québec.

In practice, these policies will serve first as the means enabling the regional authorities to determine the fire protection objectives that they are to incorporate into their fire safety cover plans. In so doing, the policies will facilitate the work carried out by the local municipalities to provide for specific actions that they must take to reach the objectives set at the regional level and to determine the conditions for implementing these actions. It is on the basis of these objectives that the Minister of Public Security will finally assess the extent to which the results of the planning undertaken by the local and regional authorities are in compliance with these policies.

These policies seek in particular to offer a conceptual framework for the fire safety planning process provided for under the new Act. This ministerial document, therefore, presents next the theoretical and methodological underpinnings of fire safety planning. These underpinnings are seen in the main elements of a fire risks management model that has been developed for use by regional and local authorities.

This model will be seen to break with some of the practices of numerous fire prevention organizations, e.g., limiting fire protection actions to response measures or basing fire prevention decisions on strictly circumstantial considerations. The model instead invites the municipal authorities to draw up a portrait of the fire risks in their area and a list of the various means within their reach for choosing the best fire protection measures in accordance with their capacities and the conditions specific to their situation. The model is presented in the second part of this document along with the explanations of its key dimensions. The risks management approach given there will represent, for several municipalities, a wholly new way of planning the various aspects of their fire safety planning. The tone, then, will be to some extent that of a textbook. Mastery of the

different concepts related to the fire risks management model will be seen to be indispensable to a thorough understanding of the proposed policies.

Next come the policies themselves. As the driving force of the fire safety reform since its beginning, they seek a **significant reduction of losses attributable to fire** and an **increased effectiveness of our municipal fire safety organizations**. To each of these policy objectives are tied a number of specific objectives and, in some cases, minimum measures that the municipalities should provide for in their planning.

Achieving the first policy objective, that of reducing fire losses, is based first of all on heightened response effectiveness in terms of current preventive approaches and procedures. Prevention remains the surest means municipalities have for controlling risks and thereby limiting the economic, financial and social costs of fires. The use of preventive measures is all the more appropriate when we realize that the majority of fires in Québec and the loss of lives, injuries and property damage that they entail are due to careless actions which can be effectively dealt with by means of regulations or public education.

Québec's fire record also reflects shortcomings in the organization and use of resources to fight fires, two areas for which the first policy objective has set a certain number of objectives. These objectives are guided by the most widely recognized standards and practices in fire safety and prevention.

The second policy objective consists of increasing the effectiveness of fire safety organizations. As a goal in itself, it brings together the means that should be given preference in order to improve the fire situation in Québec. The related objectives focus steadfastly on establishing structures, measures and actions that will enhance effectiveness in all of its aspects. In so doing, these objectives reflect one of the main thrusts of the *Fire Safety Act*, namely, ensuring that the fire safety planning process makes provision for **optimum** fire protection objectives.

In the same vein, the ministerial policies seek to underscore the interdependence of fire safety and other important municipal activities, such as habitat development, urban planning and legislation, implementation and management of public facilities and infrastructures (in particular, roads and water supply systems) and the organization and delivery of other emergency preparedness services (emergency preparedness, police services, first responder emergency care, etc.). It is to be hoped that greater awareness on the part of the municipalities of the impacts that numerous measures taken in the other spheres of their administration have on the allocation of fire safety resources or on their record of lost lives and property loss will lead them to consider fire risks management as an integral part of their strategic planning and operational management.

While the statement on fire safety policies made by the Minister of Public Safety is provided for under the *Fire Safety Act* and while the present document, following the example of regulatory provisions, is the subject of an article published in the *Gazette officielle du Québec*, it does not technically constitute a regulation made by the Minister of Public Safety or by the Government to be applied when implementing the *Fire Safety Act*. Nevertheless, the policies are no less binding within the context of the planning exercise required from the municipalities, insofar as they refer to the most widely recognized fire safety standards in North America. In fact, they codify the trade practices generally used in this field. Municipalities would be well advised to refer to the stated objectives and suggested measures before considering any other standard that they would judge to be better adapted to their geographical location or organizational situation.



#### - Background

These policies are inspired to a great extent by the work and recommendations of a working group created in 1997 by the ministère de la Sécurité publique. This working group was made up of representatives of the fire safety services chiefs' associations, municipal unions, insurance companies, and government departments and agencies. Its initial mandate was to establish a frame of reference for the organizational planning by municipalities wishing to set up a fire safety service or to strengthen their existing services. This mandate was revised last year to incorporate the spirit and the contents of the new Act.

The reports prepared by the working group brings together the different elements that have to be considered in fire protection planning (region, personnel, equipment, material, etc.), descriptions of fire risks classifications, objectives to be set according to the risks, and measures that could be taken with regard to both prevention and firefighting.

#### - Scope

First published in the *Gazette officielle du Québec* on March 14, 2001, the fire safety policies of the Minister of Public Safety were the subject of a 45-day consultation period for all interested persons. This version takes into account the comments that were received. In accordance with Section 176 of the Act, the Minister has eighteen months, from the date of publication of this final version in the *Gazette officielle du Québec*, to send the notices to the regional authorities that are provided for under article 12 and which oblige each of them to establish a fire safety cover plan.

## 1. The Fire Safety Reform

### 1.1 Review of fire safety problems and issues

The issues raised by the assessment of the fire situation in Québec and the state of the means being used to confront and prevent the problems involved were comprehensively described in the ministerial policy statement of June 1999, which also announced the government's intention to institute a major fire safety reform. For the most part, these issues were covered by the research, experiments and consultations that the ministère de la Sécurité publique carried out in collaboration with its fire prevention partners, in particular since 1995.

The problems to which the new legislative framework intends to provide the first elements of a satisfactory solution were also the subject of numerous presentations and discussions during the months preceding the study of the *Fire Safety Act* as well as for a time following its adoption. That assessment of the fire safety situation has been documented and widely debated and need not be considered in great detail here. It should suffice to review the main points of the challenges facing the municipal authorities:

- The statistics for the number of fires and deaths caused by fire in Québec compare favourably to the statistics of most North American jurisdictions. However, the costs of property loss by fire in Québec are much greater than in most of the other provinces of Canada. Québec is thus deeply concerned by this situation, which translates into significant social and economic costs.
- There is a wide disparity among Québec municipalities with regard to their fire safety organization. Up to a certain point, this disparity reveals a lack of overall cohesion among the municipal governments, that is, they are dealing with the situation on their own. With specific regard to fire safety, this disparity has had the effect of depriving many citizens of an adequate level of protection that they should be afforded by the progress made in recent decades in various areas (prevention, firefighting tactics, emergency communications, etc.).
- In general, the municipal governments do not have a good grasp of their responsibilities in fire safety. For the most part they are unaware of the benefits of prevention and thus do not know about its main methods and practices, notably with regard to regulatory measures. In the same vein, firefighters are poorly prepared to carry out their duties, either because of inadequate training and supervision or because they are poorly equipped.
- This situation goes hand in hand with a level of funding that is generally perceived to be too low. This underfunding prevents many municipalities from meeting their basic obligations, and from dealing with the ever-increasingly urgent need to train their personnel and replace their equipment and fire protection vehicles.
- In this situation, the prospects of development for several municipal fire safety organizations appear to be limited. Yet worthwhile challenges are being offered these organizations, including the opportunity to participate in the implementation of a new emergency preparedness system or the development of first responders services.

- The above-mentioned problems present other impacts which, if not as well known by most, are no less harmful to Québec society. We note first the costs of consumers' insurance premiums, the highest in Canada because of Québec's record of property loss attributable to fire, and the deficiencies in our system preventing us from dealing effectively with that problem. The second impact has to do with the civil liability of the municipalities; they are being taken to court in ever-increasing numbers because of the way their fire safety services are carried out.

## **1.2 Objectives proposed in *Green Light for Fire Safety Reform in Québec* (June 1999)**

It would not be presumptuous to assert that the main objectives proposed by the Government of Québec in its policies made public in June 1999 also won the approval of most of our fire safety organizations as a whole. These objectives consist of the following:

- Significantly reducing, for all areas of Québec, the loss of life and property caused by fire.
- Increasing the effectiveness of public organizations responsible for fire safety by:
  - Optimizing human, material, financial and computer resources.
  - Improving the skills of the various players (firefighters, fire brigade managers, municipal officers, and elected officials).
  - Adopting preventive approaches.
  - Redefining the role of the Government of Québec.

Stemming from these first two objectives is a third objective, which consists in promoting the reduction of the costs incurred by Québec consumers in the form of insurance premiums paid for damage caused by fire.

A number of other more operational objectives were also formulated to help measure the evolution of the situation over time. They include, among other things, a comparison with the performance of fire safety services in all of Canada and a comparison of the situation in neighboring Ontario. These objectives are as follows:

- Gradual achievement, over a period of five years from the implementation of the reform, of a rate of property loss equivalent to the average Canadian rate and within ten years, equivalent to the rate in Ontario.
- The adoption of a specific fire safety planning process by the municipalities.
- The achievement, within the next five years, of a level of qualification of fire safety personnel that is compatible with the fire protection objectives determined for each region.
- The implementation of structures for coordinating, financing and overseeing fire safety.

### 1.3 The new legal framework for fire safety

The *Fire Safety Act* defines the role and responsibilities of all parties in fire prevention: citizens, creators of risks, firefighters, municipalities, insurers and the Government of Québec. It also sets out the actions each party has to take to help improve the fire situation in Québec.

With regard to the municipalities, one of the basic principles of the *Fire Safety Act* consists in assigning responsibilities for each element of fire safety (planning, prevention, emergency response, etc.) to the administrative or operational level the most likely to be able to improve the level of protection of citizens and their property against fire, and to improve the effectiveness of the management of public services.

It is clear that the persons who daily manage the resources directly assigned to firefighting must be as close to the centre of that activity as possible. It is equally clear that a given region can significantly improve the level of protection of its citizens by implementing a systematic risks management approach, by developing a strategic vision of the policies and measures to give precedence to (by focusing more on prevention, for example), and by taking into account of all of its available resources. From these considerations came the idea of a common fire safety planning process undertaken by several municipalities under a single regional body.

In carrying out this process, the municipalities should not base their fire safety decisions solely on financial considerations, nor should they base them solely on the local capacities for dealing with certain situations. The process should instead be based on the risks status for the territory in question and on the level of available resources at the regional level. The primary objective of this process, then, is to reduce the loss of life and property caused by fire.

In this context, the local municipalities maintain sole responsibility for the management of the fire safety resources in their area and in the planning of the firefighting and other services they wish to offer their citizens. They can thus, in accordance with the regional planning objectives, make agreements among themselves to form associations or to pool certain resources.

The regional planning process leads directly to the adoption of a fire safety cover plan. This plan is at one and the same time a risks management and a decision-making instrument for the use of elected municipal officials, and an emergency response-planning instrument for the use of persons in charge of operations. The plan describes the various means for organizing fire safety in the region. It is developed by the regional county municipality (RCM) or by any other agency associated with the RCM under the law, in collaboration with the local governments. The actions that must be taken to achieve the objectives set out in the fire safety cover plan are defined at the local level in an implementation plan that is to be incorporated into the regional plan.

Sections 10 and 11 of the *Fire Safety Act* give the elements that the fire safety cover plan must include. These elements are:

- Inventory, evaluation and classification of the fire risks and, where necessary, the fire hazard reports made under Section 5 of the Act.
- Inventory and evaluation of existing or planned fire protection measures.
- Inventory and evaluation of the human, physical and financial resources allocated to fire safety by the municipal authorities.
- Infrastructures and water sources available for fire safety.

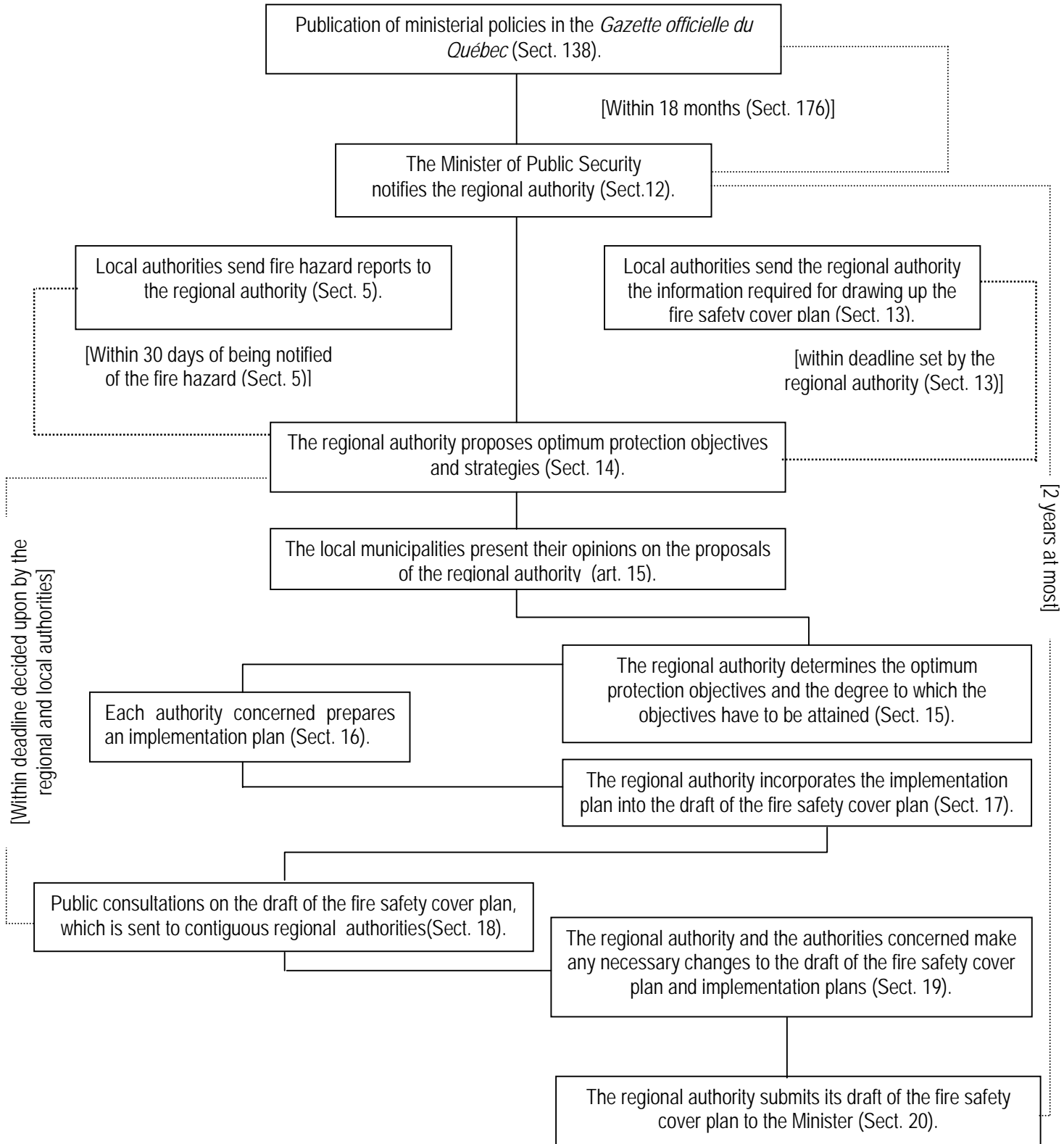
- Analysis of the functional relations among these resources.
- Evaluation of the operational procedures in force in the municipal fire safety services.
- For each class of risks listed or each part of the territory defined in the fire safety cover plan, optimum fire protection objectives.
- The actions to be taken by the municipalities to achieve these objectives.
- The implementation plans of the municipalities concerned.
- Procedure for the periodic assessment of the effectiveness of the actions taken and the degree to which the determined objectives have been attained.
- Similar elements with regard to other emergency situations likely to require the use of the same resources.

Sections 12 et seq. establish the procedures for developing and adopting the fire safety cover plan by the regional authority and the implementation plans by the local authorities. This procedure is illustrated in Figure 1.

Creating the fire safety cover plan requires more than simply mastering the legislation governing its content and underlying process. The persons creating the plan must be particularly aware of its strategic aspect and how it can be specifically applied in the future. The municipalities are thus to give careful attention to the creation of conditions that will ensure the successful completion of their work on the plan. The fire safety planning process is based primarily on:

- The complete and ongoing participation of the authorities concerned, in political, administrative and operational terms.
- Dynamic, fully thought-out coordination of activities.
- Access to multidisciplinary expertise and competent professional resources.

**Figure 1 Steps for establishing a fire safety cover plan**



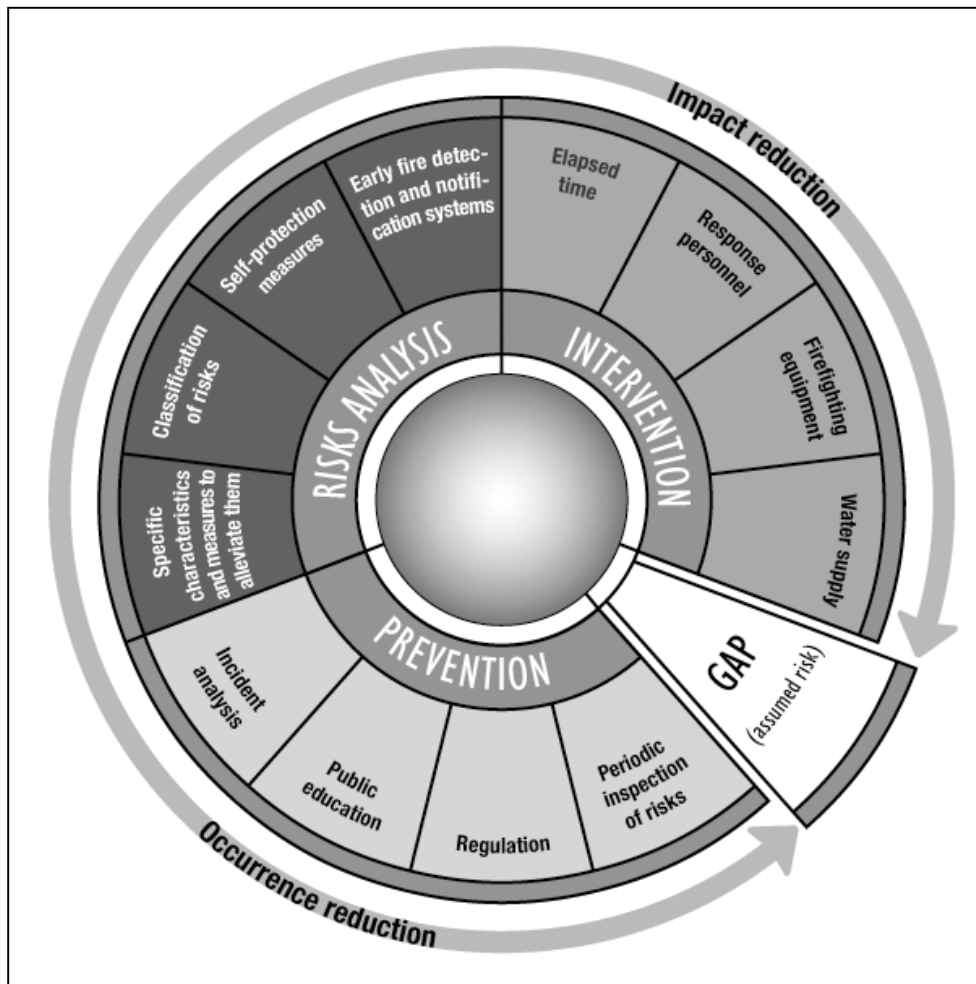
## 2. Methodological Instruments for Effective Fire Risks Management by the Municipalities

### 2.1 Fire risks management model

The planning process for establishing a fire safety cover plan comes within a risks management perspective represented by the model given in Figure 2. This model forms the theoretical basis of the process for creating the fire safety cover plan required of each municipality under the *Fire Safety Act*. The model is based in part on the *Comprehensive Fire Safety Effectiveness Model* developed by Ontario's Office of the Fire Marshall following the Ontario government's adoption of its *Fire Protection and Prevention Act* in 1997. The model given in this document incorporates the specific features of the Québec framework for fire safety management and a number of essential guidelines taken from the most widely recognized standards and practices in fire safety and prevention. It also contains references to the standards developed by the National Fire Protection Association (NFPA), the Canadian Standards Association (CSA), the Underwriters' Laboratories of Canada (ULC) and the Fire Underwriters Survey (FUS).

In essence, the work required of the municipal authorities in the drawing up of their fire safety cover plans consists in an **analysis of the risks** present in their territory to assist in the development of **prevention** measures that will reduce the probability that a fire will occur (**occurrence reduction**) and in planning the **response** measures that will effectively limit the damage of a fire (**impact reduction**). These three dimensions— risks analysis, prevention and response— form the framework which supports all the other elements in the model. It is recognized that some actions involving just one of the three dimensions do not lead to the control of the fire itself and its impact under every circumstance. To counter that situation, these three main dimensions are presented in the model as complementary and interdependent. The establishment of levels of fire protection is thus based on the combined work of several actions.

It will be seen that the purpose of the model is to reduce the fire risks for a given community in terms of occurrence and impacts, leaving a protection gap deemed acceptable to taxpayers in terms of their financial capacity and their tolerance threshold regarding the occurrence of fires and their impacts. The gap between prevention and the actual outbreak of fire can vary in size among the communities, and is determined on the basis of a consideration of all the factors included under each of the three above-mentioned dimensions. This gap is represented in the model as the level of fire risks that remains after the discrepancy between the estimated risks and the concrete or anticipated effects of all the measures deployed to deal with those risks is taken into account. Following a detailed analysis of these factors, each regional authority must determine the risks level it intends to bear for each part of its territory.



**Figure 2** Fire risks management model

Each community has the specific duty to decide on how to combine the various factors in the model and on how much weight to give each one, in terms of the community's situation, such as the size of its territory, the presence of certain risks, its financial or administrative capacity, the difficulty of gaining physical access to some sectors, and any other aspects limiting the effectiveness of its response. Each factor in the model contributes in its own way to the achievement of the fire protection objectives. Some elements dealing with prevention or early fire detection will help reduce the number of fires or victims, while others, by influencing the quality or speed of response, will help reduce material losses.

However theoretical the model is, its use can maximize the effectiveness of the actions taken and the investments made in fire safety. Taking account of each element one by one makes it possible, where necessary, to evaluate or assign a weight to the contributions made by various measures or decisions to the achieving of the objectives set for improving the level of fire protection. As a tool for determining future actions, the model allows decision makers, elected officials and municipal managers to measure



effectiveness or performance of the different options open to them on the basis of different combinations of the factors given in the model.<sup>1</sup>

## 2.2 Risks analysis

Fire safety coverage – and consequently the organization of the various aspects of fire safety – cannot reasonably be expected to be planned for a given territory without prior knowledge of the nature and the level of the risks on that territory. That is why the *Fire Safety Act* makes the “inventory, evaluation and classification of the fire risks on the territory” the primary elements of the fire safety cover plan. Risks analysis contributes more than any other consideration to the objective decisions that are made to determine the level of acceptability of some risks and to the establishment of the measures to be taken to reduce the occurrence or impact of certain kinds of fires. More specifically, risks analysis involves considerations such as:

- 1) Classification of risks
- 2) Specific characteristics of certain risks and the measures taken to alleviate them.
- 3) Self-protection measures and systems
- 4) Measures and systems for early fire detection and notification of fire protection services

Carrying out effective risks management entails the difficult work of deciding what constitutes a “risk.” A definition based on the specific needs of fire security is all the more necessary since the concept of risks applies not just to fire safety but also to such areas as health, public safety, environmental protection, and the financial and insurance sectors.

Risk is most commonly defined as “a more or less foreseeable danger.” Now of course the planning of fire safety prevention measures or emergency response procedures can hardly benefit from such a broad definition; the nature of the danger of fires is, after all, known in advance and the risks involved can, at minimum, be associated with specific sources. Thus, most sectors which have to specify the concept of risk for their strategic or operational planning generally choose a definition incorporating the **probability** that an event will occur and the **severity** of that event’s harmful effects on health, property or the environment.<sup>2</sup> Under such a definition, fire risks become the product of the probability that a fire will start in a given building and the likely consequences of that fire.

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1. Most of the elements of this model are detailed in the main standards covering the organizational and operational planning of municipal fire safety services, namely NFPA standard 1201 *Standard for Developing Fire Protection Services for the Public* and the draft standard NFPA 1710 *Standard for the Organization and Deployment of Fire Suppression, Emergency Medical Operations and Special Operations to the Public by Career Fire Departments* and draft standard NFPA 1720 *Standard for Volunteer Fire Service Deployment*. It would be advisable to consult these documents in order to ensure that all aspects of fire risks management are taken into consideration in this type of planning process. The presentation of these elements inside an integrator model, the processing of each factor and the terms used to designate them can vary from one document to another.

2. Canadian Standards Association, *CAN/CSA-Q634-91 Risk Analysis Requirements and Guidelines*, 1993, 52 pages.

But probability and consequences are abstract risks dimensions that should be made concretely explicit (and ideally, measurable) in terms of real incidents and fully in terms of the purpose that concerns us here, the fire situation in Québec. We should note here that the Minister of Public Security can propose a classification of fire risks under the Fire Safety Act. These classifications are empirical in nature, meaning they are useful to the municipal organizations only to the extent that they refer to tangible situations.

In keeping with a widespread practice in fire safety, this perspective provides for building use to be considered as a base parameter. The most important fire safety organizations in Québec are already using risks classification methods based on the use of every building that presents a fire risks. To that parameter are normally attached criteria concerning the number of possible occupants, number of floors, total area and presence of hazardous materials. Although these methods can give rise to a varying number of risks categories, they have the advantage, in terms of response procedures, of making it possible to estimate the amount of resources (personnel, water supply, response equipment) to be deployed in the event of a fire.

The risks classifications show that the transportation infrastructure, public services, and detached or semi-detached residential buildings (no taller than two stories) constitute low risks, which require minimal deployment of striking power in the event of fire. The intermediate category (moderate risks) includes all residential buildings up to six stories high and all buildings which are used for commercial, industrial or institutional purposes, are no higher than three stories and have a total area of no more than 600 square feet. High-risks buildings are those which generally require a major deployment of human and physical resources to evacuate the occupants in the event of a fire or to contain the dangers of a fire. Buildings in this category are rooming houses, hotels, churches, hospitals, schools and all buildings that are seven stories or more in height. The high-risks category also includes industrial buildings and warehouses that contain hazardous materials.

An analysis of the fires that have occurred in Québec over the past decade confirms the existence of a relatively close relationship among the parameters that are used (along with the risks classes determined by those parameters) and the two basic dimensions of fire risks: probability and consequences. Statistics for the common bungalow will serve to illustrate this relationship. Even though the bungalow is the scene of 68% of fires in Québec because of its widespread presence, the probability that a fire will break out in such a building is still relatively low, indeed, much lower than the probability that a fire will start in an industrial building, for example. Between 1992 and 1999, the fire rate for the residential sector was 3.08 per 1,000 buildings, compared to a fire rate of 15.78 per 1,000 in the commercial sector and 41.68 per 1,000 in the industrial sector (see Table 1). In other words, the fire risks for commercial and industrial buildings are, respectively, five times and thirteen times greater than the fire risks for homes.

The residential sector is far and away the sector for which fire statistics show the greatest loss of lives. Reducing the number of deaths due to fire in that sector depends not primarily on the work of firefighters but rather on prevention measures or early fire detection. The evidence for the relation between building use and the effects of fire is no less convincing with regard to property loss. Between 1992 and 1999, the average amount of property loss due to fire in the residential sector was \$26,224, whereas the average amount of property loss due to fire in commercial buildings and industrial/manufacturing buildings was \$79,268 and \$132,138 respectively. In other words, the losses caused by fire in the commercial and industrial sectors are, respectively, three and five times higher than the losses caused by fire in the residential

sector. These figures are presented in absolute values, that is, per \$1,000 of building value.

**Table 1** Estimation of fire risks according to building use  
(Fires that occurred in Québec between 1992 and 1996)

USE (sector)	FIRES			PROPERTY LOSS			
	Average annual no.	Fire rate /1000 buildings	Relative fire rate	Total losses (in thousands)*	Rate /\$1,000 value**	Average loss (in \$)*	Relative loss rate
Residential	6,560	3.08	1.00	172,019	1.08	26,224	1.00
Services	480	11.66	3.79	31,329	0.88	65,269	2.49
Commercial	709	15.78	5.12	56,201	3.49	79,268	3.02
Industrial	553	41.68	13.53	73,006	5.49	132,138	5.04

\* In constant 1999 dollars.

\*\* Rate adjusted according to the tax-assessed value of buildings, excluding their contents.

### 2.2.1 Proposed classification

On the basis of the above information, the risks classification system being proposed to the local and regional authorities includes only four main elements, which are given in Table 2. The ministère de la Sécurité publique will soon be preparing, for use by municipalities, a more detailed table showing the correlation between each risks class and the basic building use or sub-use categories given in the *Manuel d'évaluation foncière du Québec*. The new table will also show the correlation between the proposed classification and the use categories in Chapter 1 of the *Code de construction du Québec*, which is entitled *Bâtiment*.

Since they are intended to serve first at the regional level— and that for strategic planning, not for operational purposes— these classifications give a summary but reliable overview of the risks present in a given region. The information on which they are based will, in most situations, be sufficient to enable the regional authorities to assess the adequacy of their fire protection measures and resources for responding to the risks levels of different areas in their territory, or the different risks categories for the buildings in those areas. This information will then be used as the basis of the operational planning of the local authorities. This planning will entail the establishment of specific prevention, self-protection and early fire detection measures, as well as emergency response plans for some buildings. Particular attention will have to be given to high-risks buildings. Accordingly, the municipalities may have to specify the nature or the importance of some risks by carrying out a physical inspection of the properties in question.

**Table 2 Fire risks classification**

CLASSIFICATION	DESCRIPTION	Building type
<b>Low risk</b>	<ul style="list-style-type: none"> <li>• Very small, well-spaced buildings</li> <li>• Stand alone residential buildings with 1 or 2 apartments or, 1 or 2 stories</li> </ul>	<ul style="list-style-type: none"> <li>• Sheds, garages</li> <li>• Detached or semi-detached single family homes (with 1 or 2 dwelling units), cottages, mobile homes, rooming houses with fewer than 5 lodgers</li> </ul>
<b>Average risk</b>	<ul style="list-style-type: none"> <li>• Buildings no taller than 3 stories, having a ground floor area of no more than 600 m<sup>2</sup></li> </ul>	<ul style="list-style-type: none"> <li>• 2- to 3-story attached single family homes</li> <li>• Apartment buildings with 8 dwelling units or fewer, rooming houses with 5 to 9 bedrooms</li> <li>• Group F industrial buildings, division 3* (workshops, warehouses, sales rooms, etc.)</li> </ul>
<b>High risk</b>	<ul style="list-style-type: none"> <li>• Buildings having a total area of more than 600 m<sup>2</sup></li> <li>• 4- to 6-story buildings</li> <li>• Buildings in which occupants are able to evacuate in the event of a fire</li> <li>• Buildings without any significant amount of hazardous materials</li> </ul>	<ul style="list-style-type: none"> <li>• Commercial buildings</li> <li>• Office buildings</li> <li>• Apartment buildings with 9 or more dwelling units, rooming houses (10 bedrooms or more), motels</li> <li>• Group F, division 2 industrial buildings (workshops, repair garages, printing shops, service stations, etc.), farm buildings</li> </ul>
<b>Extremely high risk</b>	<ul style="list-style-type: none"> <li>• Buildings taller than 6 stories, or those presenting the possibility of a massive fire outbreak</li> <li>• Buildings whose occupants are not able to evacuate on their own</li> <li>• Buildings for which occupant evacuation is difficult because of the high number of occupants</li> <li>• Buildings where hazardous materials might be found</li> <li>• Buildings for which the impact of a fire is likely to affect the daily life of the community</li> </ul>	<ul style="list-style-type: none"> <li>• Office buildings and adjoining buildings in older neighbourhoods</li> <li>• Hospitals, home care centres, supervised homes, detention centres</li> <li>• Shopping centres with more than 45 stores, hotels, schools, daycare centres, churches</li> <li>• Group F, division 1 industrial buildings (hazardous materials warehouses, paint factories, chemical factories, flour mills, etc.)</li> <li>• Water treatment plants, harbour facilities, gas infrastructures</li> </ul>

\* Classification based on main uses given in the *National Building Code (NBC-1995)*.

The municipal authorities are to use the above risks classification scheme to identify low-risk buildings. The scheme does, however, give them leeway with regard to the classification of the other risks categories. They can use the suggested criteria to give a weighting to the value of the other elements in their risks analysis. These elements include the specific characteristics of the risks and the existence of measures to be taken to alleviate them, automatic fire protection systems and early fire detection systems. Determining extremely high-risks buildings will clearly require a closer evaluation of the aspects associated with the situation of the occupants or the presence of hazardous materials. For example, any warehouse may be classified as an extremely high risk if it contains highly flammable contents that create firefighting difficulties. The high risks classification is justified here by the need to create an emergency response plan by the fire safety service. In fact, a fire safety organization could decide to consider an entire neighbourhood in this same risk category for reasons associated to the density of occupation or the number of dilapidated buildings in the sector. This neighbourhood would be one level higher than most of the buildings involved if they were taken on an individual basis.

The differentiation of extremely high risks will undoubtedly require a finer appreciation of some of the associated aspects such as the type or state of the occupants of certain buildings or the presence of hazardous materials. For extremely high-risks cases involving the presence of hazardous materials, the municipalities should refer to the criteria given in appropriate government regulations or in the specialized literature on the subject.<sup>3</sup>

Apart from its simplicity, this risks classification system will be of great use to the municipal governments since most of the basic required information is given in their tax assessment databases. Beyond the use<sup>4</sup> of each assessment unit, the property index card provides the value of each building. It thus has information important to fire safety, e.g., kind of heating system and heating fuel, existence and features of fire detection or automatic fire protection systems, etc. The periodic updating of this tax assessment information will ensure the reliability and longevity of the information used for fire safety planning. Lastly, some municipalities that have already begun computerizing their assessments can use the information to map out the risks situation in their territory, thereby facilitating their work to develop the appropriate decision making simulation activities for optimizing their resources.

The proposed classification is intended to allow the municipal authorities to successfully complete their fire safety cover plans, as required by the *Fire Safety Act*. The classification system does not, for now, incorporate the elements subject to declaration under Section 5 of the Act. That is because such declarations will not be defined until after the government has adopted a regulation identifying the activities or goods that present a high or particular fire hazard. Even though knowledge of these elements is not required for the establishment of the fire safety cover plans and the implementation plans, they nevertheless provide municipalities that have information on them with an important tool to enhance their planning. Thus, after the government has adopted a

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3. A list of hazardous materials and their quantity threshold levels for purposes of risks management is given in *Planification des mesures d'urgence pour assurer la sécurité des travailleurs, Guide d'élaboration d'un plan de mesures d'urgence à l'intention de l'industrie*, Québec, Commission de la santé et de la sécurité du travail, 1999.

4. Such being the case, we must however take into account the fact that the use mentioned on the assessment role is *generally the dominant use of each assessment unit while here we must consider the use representing the highest risk category*.

regulation to specify the exact nature of high or particular fire hazards, the municipalities will be able to incorporate declarations for any such hazards into their planning, and to establish specific measures for preventing or dealing adequately with them.

### 2.2.2 Specific characteristics of certain risks and the measures taken to alleviate them

Fire risks cover planning involves more than just classifying fire risks according to the main uses and characteristics of buildings. It also depends on the comprehensive understanding of the environment in which risks are found. The analysis therefore must account for the specific characteristics of certain risks and the effects of measures taken by the various authorities to alleviate them. These authorities share common fire prevention concerns with their fire safety services, or in more general terms, the concern to improve the wellbeing and safety of citizens. These two elements are thus likely to cause variations in the probability of a fire breaking out in a given area or in the extent of the possible impact of such a fire.

#### a) Specific risks characteristics

Specific risks characteristics include:

- Characteristics of neighborhoods
- Public attitude toward fire
- Impact of a fire on a community

#### i) *Characteristics of neighborhoods*

The probability that a fire will occur in a given building varies not only according to the building's characteristics and use considered by themselves but also according to many other factors which, in many cases, cannot be determined by simply knowing those characteristics and use. The building's environment and the general features of the surrounding neighbourhood have an influence on the probability and the possible impact of a fire, and thus on the risks level assigned to the building. Old buildings, for example, present a more complex problem in this regard than do buildings of more recent construction, which are made with fireproof materials or are made according to much more stringent construction or safety standards. The building type, the land occupation density, the distances between buildings, the zoning laws, the source of water supply, and the level of flammability of the buildings in an area are all elements which to one extent or another affect the level of risks for that area.

#### ii) *Public attitude toward fire*

Various surveys and sociological studies show that North Americans are more complacent with regard to fires than are people on other continents. Because they have access to insurance policies, North Americans seem to accept more readily the consequences of fires. Their perceptions do, however, differ according to age group, ethnic origin, and socio-economic situation. That is why the risks analysis must take account, as best it can, of the variables represented by public attitudes toward fires to help the authorities design and set up public fire prevention programs. On a related note, statistics tend to show a relation between economic slowdowns and arson. The authorities should thus be attentive to the conditions and the circumstances that will lead to more cases of arson in their territory.

*iii) Impact of a fire on a community*

With just reason, some communities will want to take full stock of the consequences that fires have for the local or regional economy. Every year in Québec, fire is responsible for dozens of deaths, hundreds of injuries and millions of dollars of property loss. It also leads to many business closures and the loss of innumerable jobs. The lost revenue for the different levels of government is thus extremely high. In this context, we must also keep in mind the psychological effects that the loss of a church, school or factory to fire has on the community.

Following a more positive approach, municipal authorities and regional economic development organizations generally consider an appropriate level of protection against fire as a significant factor when deciding where to locate businesses and even as a condition that attracts investment to certain areas. Besides providing a certain peace of mind to merchants and manufacturers in terms of protecting their assets, good fire safety services often mean important damage insurance savings for them.

b) Measures to alleviate problems

Measures to alleviate problems associated with the present context are as follows:

- Legislation, regulations and safety codes
- Contributions of other municipal services to the reduction of the number or level of fire risks

*i) Legislation, regulations and safety codes*

We will see later that municipalities can use a variety of measures to prevent fires. They can also count on laws, regulations and codes which, designed and adopted by higher levels of government, will have an alleviating effect on the level of fire risks for buildings to which they apply. That is because a significant proportion of the content of these regulations also involves fire safety measures. Such measures can include measures going so far as to require the installation of automatic fire protection systems in public and high-rise buildings.

We must, however, be aware that the requirements contained in these regulations have been designed keeping in mind a specific level of response capacity from public services in the event of fire. The municipal authorities cannot, then, simply depend on these various provisions and of themselves. In fact, it is up to each municipality to define the maximum size of the buildings on its territory in terms of its capacity to respond to an emergency. Therefore, when the size of a building exceeds its capacity to respond, a municipality should provide for fire protection requirements other than those stipulated in the regulations. Under similar circumstances, the installation of sprinklers could be the solution to contemplate. The municipality can also elect to restrict zoning in order to ensure that its capacity to respond corresponds to the risks that are prevalent in each sector of its territory.

*ii) Contribution of other municipal services*

Even though the municipal authorities cannot, strictly speaking, consider services other than fire safety as part of their fire safety planning, their responsibilities,

decision making and actions taken with regard to those other services, often have a direct impact on the level of fire protection in their area.

Appropriate measures taken in areas far removed from fire safety (e.g., urban planning, heritage preservation, etc.) may in themselves alleviate the dangers of fire. They can still promote the effective work of firefighters and thus reduce the losses suffered by citizens or the community. Careful zoning, safe planning of the transportation infrastructure, well-informed economic and urban planning, measures to revitalize older neighbourhoods and restore older houses, grants for demolishing unused buildings, the upgrading of electrical or heating systems—these are all measures that can, over time, help reduce the level of fire risks for a municipality. Such measures taken in the cities of Québec and Montréal during the past twenty years have had conclusive results, namely in terms of the number of fires, the feeling of security among the population or the cost assumed by the community for its protection.

Through their actions, other administrative units or services also participate in this effort. These services include housing services, building inspection services, economic development services, crime prevention and enforcement services, social development services, and sports and recreation services. The actions taken by these services have an impact on the poverty level in the community and on issues that may influence the crime level, e.g., homelessness and street gang activities.

### 2.2.3 Self-protection measures

An accurate assessment of risks levels must take account of automatic fire protection systems, particularly in buildings that present the highest risks level. It must also take account of the measures taken by industries or institutions, such as those involving the organization of fire protection brigades or the running of awareness programs for building occupants.

Fixed fire extinguishing systems are generally found in major buildings (e.g., auditoriums, concert halls, commercial buildings, office buildings, industrial facilities) as well as in some housing complexes. These systems, which include automatic sprinkler systems, serve to start putting out a fire before the firefighters arrive.

Many risks creators, particularly those in the industrial sector, are well aware of the impact that a fire can have on their activities, the environment and the community. They are thus implementing measures to mitigate the effects of a fire or to reduce the need for emergency response services. Industrial or institutional fire brigades are included among these measures, as is the regular holding of disaster simulation exercises, including evacuation of buildings with a high occupant density.

### 2.2.4 Measures and mechanisms for early fire detection and notification of fire safety services

Smoke and fire detection systems complement the work of automatic fire prevention systems by warning a building's occupants to immediately evacuate a building in which a fire has broken out. These systems can be hooked up directly to the municipal fire safety service, thereby allowing the emergency response service to get quickly to the scene of the fire.



The effectiveness with which these systems reduce the impact of a fire for a building and thus the building's risks level is fully acknowledged. That is why certain safety codes now require that they be installed in buildings coming under certain categories. Likewise, several municipalities require the installation and proper maintenance of a smoke detector in every residential building. The fire risks analysis must, however, take full account of the data on the functioning and effectiveness of early detection and notification systems to assess their impact on the level of risks. It is also necessary to be certain of the positive impact these systems have on the response time of firefighters. Without such knowledge, it is impossible to know how effectively these systems serve to alleviate the consequences of a fire.

## 2.3 Prevention

Coming after risks analysis is the second dimension of the fire risks management model, prevention, which brings together factors intended to ensure that a fire does not occur.<sup>5</sup> These factors are:

- 1) Incident evaluation and analysis
- 2) Municipal regulations
- 3) Periodic inspection of risks
- 4) Public education programs and measures

It is difficult to assess the effectiveness of prevention measures since their work to prevent incidents can not easily be accounted for in quantifiable terms. But we could hardly characterize as fortuitous the relation between a marked reduction to the number of accidents over the last 50 years in the Western world and certain developments such as the improvement of building norms and standards, the use of smoke detection systems, greater public awareness, more stringent and more rigorously applied regulations, and better knowledge of the risks present in an area. One of the difficulties involved in recognizing the full value of the contribution made by prevention is that most people still associate it solely with public awareness and education measures, which are often the most visible of all prevention measures. Yet we very likely owe the greater part of the progress made in prevention to the application of more rigorous standards and more relevant regulations as well as to the institution of programs giving more attention to risks inspection.

### 2.3.1 Incident evaluation and analysis

Prevention is based first of all on knowing the probability rate for fires in a given community. But it is also based on an assessment of the incidents that have occurred in

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5. The prevention measures given in the model are intended to reduce the number of fires in Québec. In the strictest sense of their application, their job is to prevent fires from occurring. We know, however, that several fire safety measures will also reduce the impact of a fire. For example, public awareness programs can help citizens develop attitudes reflecting a greater concern to make effective use of preventive measures. Such programs should also make people aware of the need to quickly notify firefighters when a fire breaks out, as well as provide them with information about what exactly to do in the event of a fire. By being properly informed about all of these matters, citizens can help reduce the need for lifesaving operations and help firefighters do their job. Through these actions, then, the public can help reduce the costs of fire in terms of lives, injuries and property loss.

that community. Indeed, it is by acquiring sound knowledge of the conditions responsible for fires that we can develop the most effective measures for eliminating those conditions. Incident evaluation and analysis thus incorporate all actions needed for determining the locations, causes and circumstances of fires. And doing so means putting the main dimensions of the fire risks management model to work. That is, it involves reviewing the events that have required the actions of firefighters (response) as a way of zeroing more precisely in on risks (risks analysis) and better defining the measures that will prevent fires (prevention).

The critical elements of an incident evaluation and analysis program are as follows:

- Criteria for selecting incidents that could be evaluated
- The incident data and information that have been gathered
- The purpose for which the above data and information will be put to use
- The financial and human resources, including training of personnel, that will be made available to the program

Incident analysis should serve as the basis for various preventive measures by steering the actions of public services toward situations presenting the greatest problems or the most disastrous consequences for the community. Yet it is generally the most neglected aspect of fire safety: many municipalities do not even have records on the fires that have occurred in their territory. To remedy the situation, sections 43 to 46 of the *Fire Safety Act* explicitly confer responsibilities for these matters on the directors of the fire safety services in the municipalities. The work of the investigations commissioners has also been redirected for the most part toward prevention objectives to complement the incident analysis duties that are henceforth to be carried out by the fire safety services.

For purposes of application of the Fire Safety Act, incident evaluation can be extended to include periodic checking of the effectiveness of actions described in the municipalities' implementation plans. In fact, doing so is one of the elements in the fire safety cover plan (Sect. 10). Next year, the ministère de la Sécurité publique will be presenting its municipal partners with a series of guidelines for carrying out this and other actions in their fire safety planning.

### 2.3.2 Municipal regulations

Regulatory action is another aspect of fire prevention the value of which municipal governments tend to underestimate and hence ignore. However, the application of proven safety standards is one of the most effective ways to reduce the deaths, injuries and property loss caused by fire. Through the laws governing their actions, the municipal authorities have general powers allowing them to regulate a considerable range of activities having, more or less, to do with fire safety. These activities include the use of gas and electrical systems and appliances; the use of smoke detectors; the use of automatic alarm, sprinkler and extinguishing systems; the construction, operation and maintenance of chimneys and heating equipment; and the accumulation of combustible material, etc.

The reasons most often put forward by the municipalities to explain the little importance they give to regulatory action have to do with the volume and complexity of building regulations as well as the large number of organisms mandated to enforce those regulations. Also, many municipalities find it difficult to recruit specialized personnel or to develop the expertise they need for regulatory enforcement.

In that regard, the Régie du bâtiment du Québec has undertaken major work to consolidate building regulations that will lead eventually to a new sharing of responsibilities between the Government of Québec and the municipalities vis-à-vis the standardization and monitoring of standards. Over the coming years, all laws administered by the Régie will be incorporated into the *Building Act* (R.S.Q., c. B-1.1), which will become the Régie's sole legal framework. The *Building Act* provides for the adoption of a *Building Code* to set standards for the construction of buildings, including their equipment and installations, as well as for the eventual adoption of a safety code having the objective of ensuring public safety in those buildings.

In a development related to this reform, on July 26, 2000, the Conseil des ministres adopted chapter 1 of the Code de construction du Québec which is entitled Bâtiment. At the same time, it adopted a regulation for defining its area of application. This regulation is entitled *Règlement modifiant le Règlement sur l'exemption de l'application de la Loi sur le bâtiment*. Chapter 1 (Bâtiment) came into effect on November 7, 2000. It is made up of the most recent edition of the *National Building Code* (NBC 1995) to which a number of modifications have been made.

Through these changes, the *Building Act* replaces the *Public Buildings Safety Act* with regard to the construction of buildings and the installation of equipment. They permit the adoption of a basic standardized norm governing the quality of construction work and the safety of persons everywhere in Québec. However, the coming into force of the *Building Code* does not prevent the municipalities from regulating the construction of buildings as long as the standards they adopt are superior to the standards of the Code or apply to buildings not covered by the Code. The municipalities' authority to regulate small buildings remains unchanged, but the area of application covered by *Buildings* in the *Building Code* may eventually cover all buildings, including smaller ones.

The *Building Act* includes a mechanism to delegate responsibility to the municipalities for the various activities related to building inspection, demolition orders, adoption of measures different from those called for in the *Building Code*, etc. This mechanism also makes provision for exonerating the authorities concerned of responsibility in their carrying out of these activities. An agreement for delegating these responsibilities may also describe the means for funding the activities that they entail.

### 2.3.3 Periodic inspection of risks

Periodic risks inspection is an essential complement to the regulatory work of municipalities. An appropriate inspection program is also a required counterpart to some public awareness measures, particularly in cases for which it is necessary to ensure the fire safety level of certain household or industrial activities.

A risks inspection program generally includes provisions for each risks category as follows:

- frequency of inspections
- procedures for determining or choosing risks sites for inspection (follow-up on complaints, new construction, major renovations, analysis of fire statistics, etc.)
- type of inspection (routine, joint inspection, smoke detection system, checking for compliance with standards, information for owners or occupants, etc.) and
- inspection methods and objectives

#### 2.3.4 Public education programs and measures

Simply making the public aware of the main causes of fire, including human activity, can be an important means of prevention. That is why a municipal fire prevention program generally includes public awareness initiatives established in accordance with the problems found in the analysis of incidents occurring in a given territory.

A public awareness program normally includes information on the following elements:

- purpose and objectives of the program
- persons targeted by the program
- content of the message (the main thrust of the information to be given)
- the human and financial resources that will be used to design and implement the measures provided for under the program
- the parameters describing how the program will be delivered (partnership, length of program, how often it is offered, etc.) and
- the means for assessing the effectiveness of the message delivered to the people targeted by the program

### 2.4 Intervention

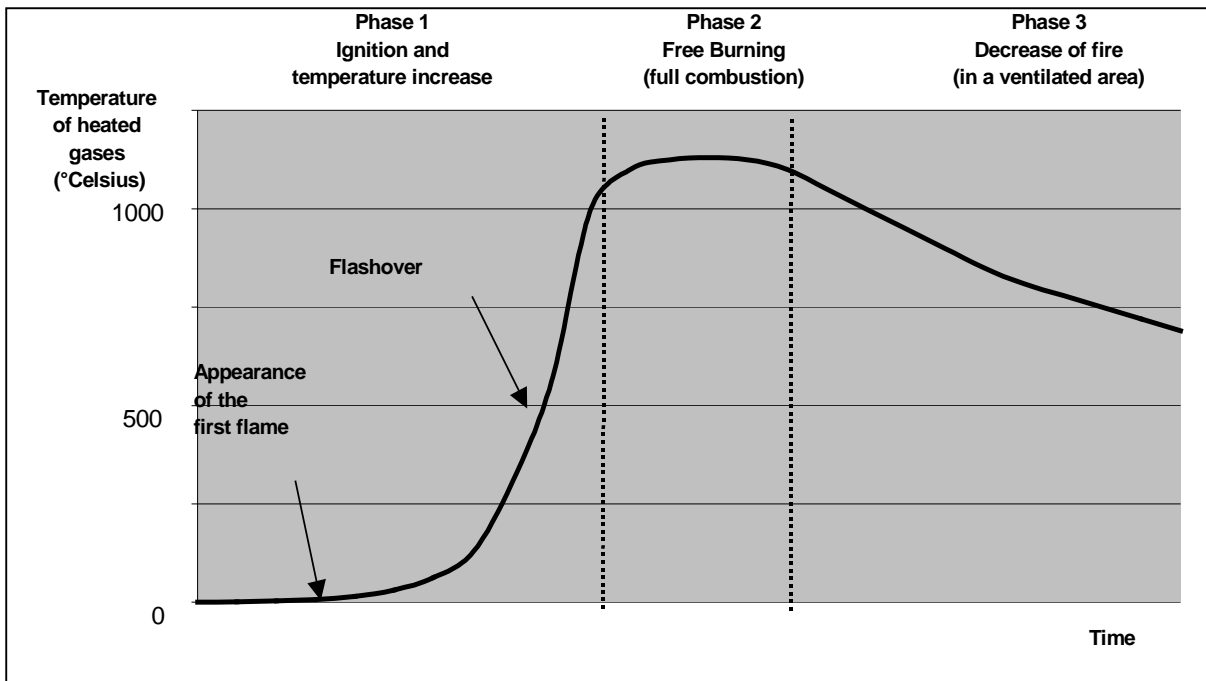
The third dimension of the risks management model usually combines the commonly best known elements of fire safety or, at the very least, the most visible aspects, perhaps because they are after the risks, that is when fire breaks out. Therefore, the purpose of taking these elements into account in a double perspective of risks management and fire safety planning consists of a response making it possible to limit the impact of a fire. These elements are as follows:

- 1) the elapsed time;
- 2) the response personnel;
- 3) the required water flow; and
- 4) firefighting equipment, especially those used for pumping and carrying water.

#### 2.4.1 The notion of flashover

In order to understand how interdependent these different aspects are, one must master the notion "flashover point". As a matter of fact, this phenomenon marks a critical step in the evolution of any building fire since it determines both the chances of the survival of its occupants and the amount of resources (and more specifically the water flow) to be used in order to control the progression of the fire and eventually to extinguish it. The flashover point directly depends on the duration of the contact between flames and combustible materials, and on the fire load density of these materials. Despite the fact that a fire safety service has no control over this aspect and on the period between the beginning of the combustion process and the time when the fire alarm is being pulled, the tactical purpose of any intervention will consist in applying the extinguishing agent before the fire reaches that point.

The notion of flashover is based on the fact that, generally speaking, fire always progresses the same way even if fire propagation magnitude and speed depend to a large extent on the flammability of building materials, contents and design of the building. Figure 3 shows the three phases of a typical fire.



**Figure 3** Main phases of fire progression

These three phases are:

- 1) The superheating, ignition and expansion phase that begins with an abnormal increase in temperature at a specific point until the first flame appears; the quickness of this abnormal increase in temperature can vary and take from a few seconds to several hours. Afterwards, the room temperature increases quickly until the flashover point. During that time, the fire is limited to the room where it originated;
- 2) Free burning, that follows the flashover, when all combustible materials in the room are burning and flames seem to take up the whole room volume. The fire spreads to the structural elements, destroying doors, walls and other combustible obstacles;
- 3) Decrease of fire, which appears as the combustible elements consume themselves, thus reducing the quantity of heat released. In a confined location, the fire can be incandescent (smoldering fire) due to the lack of oxygen and present all the conditions favourable to an explosion.

Thus, when superheating occurs, the temperature increases more or less rapidly until the first flame appears. During this period which can last between a few seconds and several hours, materials are being distilled and smoke appears. It is during this interval that early

fire detection or automatic fire protection systems can significantly contribute to reducing possible losses, the combustion phenomenon not usually having had the time at this stage to cause considerable damage.

When an object fires up, it starts burning the same way as if it were in free air. However, after a short while, fire locations begins to affect fire growth. Smoke given off by the burning object rises to the ceiling as hot gases; this layer covers the ceiling and the upper part of room walls. The heat resulting from all heated sections is then transmitted through thermal radiation to other objects in the room and this can increase the combustion speed of the burning object and the speed of the flame spreading on its surface.

At that stage, fire can die if the object is completely burnt before others ignite or if the oxygen feed is not enough to maintain combustion. Otherwise, other combustible products keep on heating up until they reach their respective ignition temperature. Flames then suddenly spread to all combustible materials within the room. The temperature increases from 500°C (932°F) to 1000°C (1832°F) within a fraction of a second. This brutal propagation of a fire is called "flashover" and marks the beginning of the second phase shown in figure 3.

The flashover is therefore a critical step of fire evolution for two reasons. Firstly, beyond that point, people imprisoned in this specific area have almost no chance of surviving. Secondly, flashover causes a sudden acceleration of the combustion rate and a larger amount of water then becomes necessary in order to control this fire. In fact, once this is over, emergency services will most likely find themselves in a precarious situation in the case of a larger building where they would have to limit themselves to preventing and controlling fire progression and then face a total loss if additional resources or relief personnel are not dispatched in a number large enough to control this fire.

According to an analysis<sup>6</sup> performed in the United States on close to 500 building fires, it was observed that in a typical fire scenario, the flashover of a room almost always occurs within ten minutes following the occurrence of a flame. Also, a single-family house usually becomes engulfed by flames within five to twenty minutes following flashover of one of its rooms.

Based on these elements, the conclusion regarding response to a fire is obvious: a fire safety service with very little time to limit losses must inevitably strive to arrive at the scene of a fire before the flashover point, i.e. before ten minutes, since the number of firefighters and the water volume needed to suppress fire greatly increase after this time.

After taking the elapsed time into consideration, the rescue and firefighting personnel, water flow required to put out the fire and pumping equipment, together with water transportation are the elements of the striking force that must be used to fight a fire.

#### 2.4.2 Elapsed time

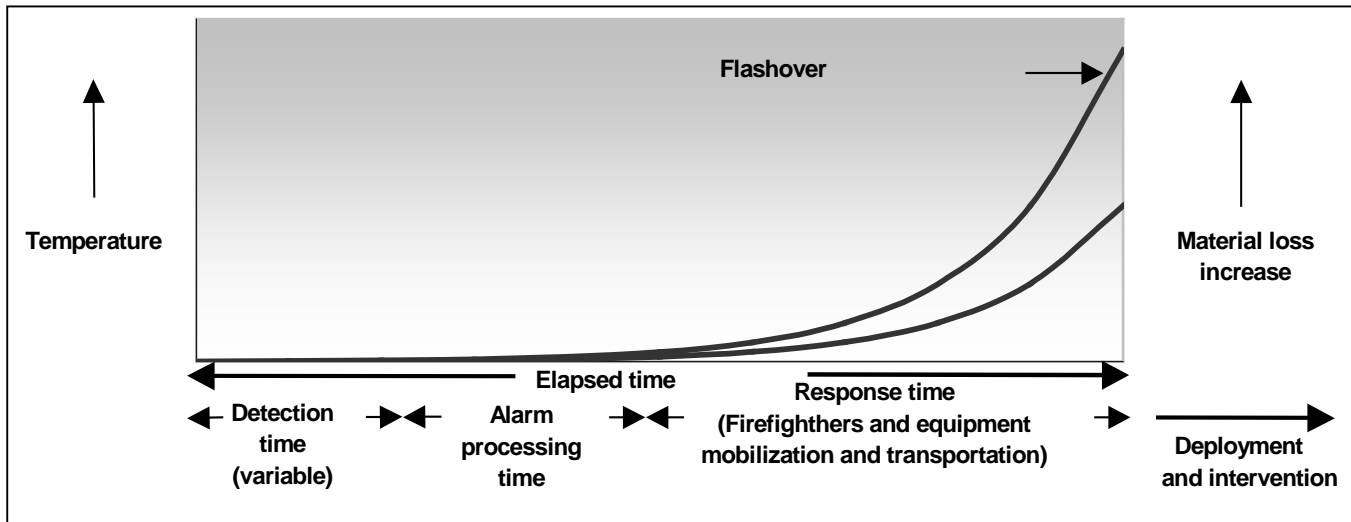
The elapsed time is defined as the duration between ignition and the moment when firefighters apply the extinguishing agent. This time can be divided in three phases as shown in figure 4.

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6. COLEMAN, Ronny J. *Residential Sprinkler Systems*, Quincy, National Fire Protection Association, 1991, p. 68-69.

The first phase is the detection time; this occurs before the fire safety service is called. It is, of course, variable and unless the burning building has detection equipment connected to an emergency central station, it is usually beyond the control of public services. This is when a smoke alarm plays an important role; mainly to allow the occupants of a burning building to evacuate the premises and alert the firefighters. When there are no occupants in a building, the alarm connected to an emergency central station will immediately send the alert allowing rescue services to mobilize more quickly. Therefore, we should promote the installation of such equipment in buildings located beyond the response radius deemed acceptable by the fire safety services.

The second phase is the time needed to process the alarm and route it to a fire safety service. Although the fire safety service is not always responsible for this period, its duration can be controlled by imposing requirements to call centers; NFPA standard 1221 *Installation, Maintenance, and Use of Emergency Services Communications Systems* is the main reference in this field for rescue organizations in North America.



**Figure 4** Fire progression and sequence of events

The third phase is the elapsed time as such and it takes place in two steps:

- firefighters mobilization time that depends, among others, on their status (whether full or part time or volunteer);
- travelling time between the fire hall and the scene of the fire which obviously depends on the distance to cover, but which can also vary according to hindrances to travel, road conditions, traffic density, etc.

Since the objective usually consists of dispatching emergency aid to the scene of the fire before the flashover, the elapsed time should not usually exceed the left portion of the curve shown in figure 3. Although these delays are not part of the elapsed time as such, we must also consider the time needed for deploying firefighters and equipment at the scene of the fire, a delay that can be more or less important depending on the ease of access to the burning property or location, on the availability of water close to the location, etc.

### 2.4.3 Response personnel

The response personnel refers to the number, preparedness and organization of the work to be done by firefighters and members of the fire safety service on the fire scene. Each of these items involves a certain number of factors that must be taken into account when planning an intervention.

#### a) Number of responders

When considering the number of firefighters to be deployed on a fire location, the following aspects must be taken into account:

- minimum number of firefighters needed to fight a fire within a building;
- minimum number of firefighters needed to provide an adequate striking force;
- use of reinforcement or relief personnel;
- number of firefighters needed in a service in order to dispatch a minimum for intervention at all times.

#### i) *Minimum number of firefighters needed to fight a fire within a building*

The success of a fire suppression operation depends to a large extent on the capacity of the fire safety service to quickly start its intervention. In that sense, a rapid attack inside a building is a must. However, one should attempt such an attack only if a minimum number of responders can be gathered in order to safely perform this task.

NFPA standard 1500 *Standard on Fire Department Occupational Safety and Health Program* clearly states that at least four firefighters are required to lead an internal attack and rescue operation. This recommendation is repeated in draft standard 1710 *Standard for the Organization and Deployment of Fire Suppression, Emergency Medical Operations and Special Operations to the Public by Career Fire Departments* and in draft standard 1720 *Standard for Volunteer Fire Service Deployment*<sup>7</sup>. A decision rendered on December 5, 1996 by the review board of the Commission de la santé et de la sécurité du travail has confirmed that it is appropriate to maintain this standard even if it is not adopted through a regulation.

In order to ensure the safety of the response personnel as well as to guarantee the success of the operation as a whole, nothing should be attempted inside a burning building before the first four firefighters arrive on the scene. This rule can be broken only in a few special circumstances, for example, when a victim has fallen close to an exit or when fire is limited to a location that definitely poses no threat to firefighters.

#### ii) *The minimum number of firefighters needed to provide an adequate striking force*

As far as the minimum number of firefighters needed to provide an adequate striking force is concerned, it can be determined from the list of critical tasks that must usually be performed at the scene of the fire. According to draft

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7. These two standards were approved by the NFPA Technical Committee on May 16, 2001. The final text of each of these standards must however be revised and receive the approval of the Standards Committee of the organization during the course of July 2001, before being subject to release.



standard 1710, of the Ontario model<sup>8</sup> and on the Table on effective intervention developed by the Fire Underwriters Survey (FUSI)<sup>9</sup> and reflecting the actual practices of the main fire safety organizations in Canada and the United States, appendix 1 shows us, based on actions required to perform rescues and to extinguish fire, an example of a work process that anticipates the number of personnel that is usually considered as being optimum for an intervention in a low-risk building.

It should be noted that this number of personnel is based on the number of firefighting interventions in areas served by a water network where water does not have to be transported. Additional personnel should usually be provided to operate each water tank truck or other equipment used in rural areas to pump water from a supply source other than waterworks and to deliver it to the site of the fire.

*iii) Use of reinforcement or relief personnel*

When determining the number of personnel, one must take into account the eventual need for reinforcement in case of subsequent alarms, or for relief personnel. Based on the delays that this implies, one must not wait until a second alarm or count on resources offered by city aid in order to ensure the required number of firefighters in order to deploy the above-mentioned striking force.

The requisition of additional resources from the same fire safety service or from that of a neighboring municipality requires that the conditions for redeployment of resources in such case be planned in advance in order to ensure an adequate coverage of the whole territory. In such a context, it goes without saying that the prompt mutual assistance provided for in article 33 of the *Fire Safety Act* can only be considered accessible in exceptional situations which should not have been anticipated in the regional planning process.

*iv) The number of firefighters needed in a service in order to dispatch at all times a minimum number for intervention*

It is possible to dispatch a minimum number of firefighters in order to provide an adequate striking force with a given risks level only provided one can count on an available pool of firefighters whose travelling time to the scene of the fire will correspond to the expected elapsed time. In the case of services consisting of full-time personnel, this implies the maintenance of a sufficient workforce in the fire hall. In the case of services that can count only on volunteer or part-time firefighters, relying on a given ratio of presumably available people out of a total number of personnel can lead to random results in some parts of the territory or during some periods of the year. It is better to make schedules based on the availability of each member at different times of the day in order to be capable of mobilizing the minimum number of people required at all time and in all concerned geographic locations.

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8. Office of the Fire Marshall of Ontario, *Fire Ground Staffing and Delivery Systems Within A Comprehensive Fire Safety Effectiveness Model*, Ministry of the Solicitor General and Correctional Services, 1993, 49 pages.

9. Service d'inspection des assureurs incendie, *Évaluation de la protection du public contre l'incendie*, Groupement technique des assureurs inc., 1987.

b) Preparation of responders

The efficiency of an intervention is conditioned to a large extent by the level of preparedness of the personnel called out to fight a fire. This level of preparedness can be based on firefighter education, on the training given on a regular basis to fire safety service members and on the existence and update of response plans within the organization.

i) *Firefighter education*

Any fire department should have an education and training program adapted to the kind of operations performed by its members irrespective of their frequency since the risks for the health and security of firefighters are substantially identical, regardless of the municipal context in which they have to work. Moreover, the Act Respecting Occupational Health and Safety stipulates that an employer must ensure appropriate education, training and supervision in order to provide the worker with the ability and knowledge necessary to carry out his work safely.

Recently hired full-time personnel must comply with the requirements of the *Regulation respecting the training of members of fire departments*. According to this regulation, a full-time firefighter must have successfully completed the training program certified by the vocational studies diploma titled *Fire Safety Intervention*. Other requirements apply to prevention technicians, officers and managers of city brigades when hired on a full-time basis.

Despite the absence of requirements governing volunteer or part-time firefighters, it is strongly recommended that these firefighters take the training offered in Québec in the order proposed in table 3. Established in the same spirit as the Act Respecting Occupational Health and Safety, namely for the purpose of developing the special qualifications in individuals who have a direct relationship with their work context, fire safety training program modules do indeed correspond to the different categories of tasks that can be entrusted to firefighters within the framework of firefighting interventions. The training recommended for part-time officers corresponds to the *Managing the Intervention* profile of the *Fire Safety Manager*.

Besides, when a municipality asks its service to assume other responsibilities in addition to its firefighting functions, such as air-sea search or freeing individuals (using the "jaws of life") from automotive vehicles at the scenes of road accidents, it should make sure that its personnel is adequately trained for the tasks that they perform.

**Table 3**

**Recommended training<sup>10</sup> for volunteer firefighters and the order in which courses should be taken**

TASKS	TRAINING MODULES								
	(1) OCCUPATIONAL HEALTH AND SAFETY <small>(before starting employment)</small>	(2) CONCEPTS IN FIRE SUPPRESSION	(3) SELF-CONTAINED BREATHING APPARATUS	(4) CONCEPTS RELATED TO BUILDINGS	(5) FIREFIGHTING EQUIPMENT	(6) FIREFIGHTING EQUIPMENT FOR USE WITH WATER	(7) VENTILATION TECHNIQUES	(8) EMERGENCY PROCEDURES IN LOW-RISE BUILDINGS	(9) EMERGENCIES INVOLVING HAZARDOUS MATERIALS
Being at the scene of a fire and assisting participants in support tasks	X								
Supporting outside firefighting activities: • Firefighting vehicle operations <i>(excluding elevation devices)</i>	X				X	X			
During an attack inside any type of low-rise building: • Trained firefighter <i>(first person on the fire scene)</i> • Apprentice firefighter accompanied by a trained and experienced firefighter	X X	X X	X X	X X	X X	X X	X X	X X	
Intervention involving hazardous materials	X	X	X		X	X	X	X	X
During any other type of intervention: • Firefighter accompanied by a trained and experienced firefighter	X								

10. Based on the currently available program that leads to a vocational diploma in *Fire Safety Intervention*

## ii) Training

Fire safety interventions require from each individual proficiency and special skills, and the whole group must comply with high standards in terms of coordination. As a result, the municipal service must ensure the constancy of these conditions by providing regular training for its personnel.

NFPA standard 1500 *Standard on Fire Department Occupational Safety and Health Program* defines the frequency of these training sessions. In particular, it states in chapter 3 that a training program that consists of one drill per month is the minimum for the personnel of a fire safety service that can be called to fight a structural fire. However, additional hours are recommended when a municipality owns special equipment or when it offers specialized services. A training program should take into account the risks particular to each area by planning simulation exercises based on the response plans designed for buildings that are likely to present difficulties for firefighters. Training sessions dealing with cases that involve buildings that are left to burn should be largely based on the clauses of NFPA standard 1403 *Standard on Live Fire Training Evolutions*.

## iii) Response plans

In the case of buildings involving risks of conflagration or requiring special intervention measures, the purpose of response plans is to plan strategies to avoid having to improvise at the scene of a fire. These plans contain information on the fire load density of buildings, construction details, the risks related with their use and the number of people that may be present based on the time of the day and on the time of the year. Therefore, response plans make up one of the most important source of information for the officer who analyzes the situation in case of a fire. The procedure to be followed to elaborate a response plan is described in NFPA standard 1620 *Pre-Incident Planning*.

## c) Work organization

Work organization at the fire scene is the last factor related to response personnel efficiency. It refers to the command function within the context of firefighting interventions, to the guidelines and procedures governing the performance of operations and to the measures and conditions surrounding firefighter safety.

In order to safely manage an intervention, one must rely on a clearly defined command system that applies to all types of situations. This system makes it possible to define a structure and to coordinate a plan to manage emergency operations. NFPA standard 1561 *Fire Department Incident Management System* is a very useful reference on this subject.

Fire safety services can also use the *Guide des opérations à l'intention des services de sécurité incendie*, recently published under the guidance of the ministère de la Sécurité publique. Based on a document written by the fire department in Montreal, this book is adapted to most fire safety services in Quebec. It is in many ways a good practice guide that combines under one cover all the elements essential to adequately prepare and plan interventions by a fire service. Its use should make possible the following:

- to standardize the way to provide firefighting services;
- to plan the routing of resources based on the characteristics of the area, buildings and available resources;

- to enable resource sharing between fire services;
- to identify the risks related with each type of intervention, the means to control them and the tactics to be implemented; and
- to determine the needs in personnel training.

The *Guide des opérations à l'intention des services de sécurité incendie* is not intended to replace education for firefighters or service managers, but it can certainly be a good starting point to improve the expertise of personnel. NFPA standard 1201 *Standard for Developing Fire Protection Services for the Public*, also provides other elements that could be used to organize fire safety services.

As far as firefighter safety is concerned, it is essential to know that according to the Act Respecting Occupational Health and Safety (R.S.Q., c. S-2.1), each employer and his workers must search for and apply the means to improve occupational health and safety conditions. This act also mentions some of the tools needed to do so. The first one, a prevention program, is a must for all fire safety services. It consists of planning and carrying out activities aimed at eliminating or controlling dangers with which workers are confronted. Therefore, a municipality can, by resorting to such a program, develop an intervention material and equipment procurement program that complies with safety standards. To that end, it could be useful to refer to NFPA standard 1500 *Standard on Fire Department Occupational Safety and Health Program*.

#### 2.4.4 Water supply

Water availability and the reliability of supply have a direct influence on the effectiveness of the intervention. The water flow required to extinguish a fire depends on the type of building on fire. For that purpose, several formulas make it possible to evaluate the required flow. It is therefore important for the fire safety service to have a good knowledge of the water supply network and its capacity in the different parts of its area. An updated map of the waterworks showing the location and diameter of its piping should remain available at all times in the fire hall and in each vehicle. It is also essential for the municipality to have a maintenance and verification program for its network. In addition, all hydrants should be numbered and identified with a color code referring to its available flow. NFPA standard 291 *Recommended Practice for Fire Flow Testing and Marking of Hydrants* can be used as a reference.

When the water network cannot meet requirements or does not serve the whole territory, it becomes necessary to create water supplies to replenish water tank trucks. These water supplies must be accessible at all times and located within reasonable distance from the risks to be covered in order to provide an adequate water flow. NFPA standard 1142 *Standard on Water Supplies for Suburban and Rural Fire Fighting* recommends different methods to increase the efficiency of interventions in areas without water distribution facilities.

#### 2.4.5 Firefighting equipment

The level of effectiveness of firefighting interventions finally depends on the type and condition of the different equipment used by firefighters. A fire safety service must have at its disposal the required vehicles and accessories and make sure that they are manufactured, used and maintained in accordance with standard specifications. Appendix 1 shows a list of the major standard specifications that apply to this chapter.

Special attention must be paid to intervention, pumping and water transportation vehicles, especially in light of the fact that the municipality classification system used to determine fire insurance prices is subject to rather strict standards in that respect. As a rule, the Insurance Advisory Association (IAA) recommends that a first response vehicle be less than 15 years old, then used as a reserve vehicle for five more years. Once this 20-year utilization period is over, the vehicle must preferably be put in storage. Based on the financial burden that buying such a vehicle represents for some municipalities, the IAO has reduced its requirements for municipalities whose vehicles are likely to be less used, namely those with less than 5,000 inhabitants. The IAO now accepts that these municipalities use a first response pumper that is more than fifteen years old, as long as it successfully undergoes yearly pump and on-road vehicle performance tests as provided for in standard ULC-S515 *Standard for Automobile Fire Fighting Apparatus*.

### 3. Proposed Objectives

Now that the fire risks management model has been established, the objectives proposed by the Minister of Public Security for the establishment, by regional authorities, of a fire safety cover plan, can be grouped under one or the other of the two main orientations that are the basis of the fire safety reform. Remember that these orientations consist of the following:

- reducing human and property losses attributable to fire in all Québec regions;
- increasing the efficiency of the organizations responsible for fire safety.

These two orientations respectively control five objectives that more specifically relate to the prevention and intervention aspects of fire safety service operations while the other three refer to the municipal organization of this sector of activity. In a way, each of these two orientations constitutes a whole. Therefore, if it becomes impossible to reach one of the objectives in a given area, the efforts spent on trying to reach the other objectives should still allow this first area to contribute to the generally agreed upon orientation. Following the intent of the fire risks management model, intervention weaknesses that are noted in a sector should, for example, be compensated by early fire detection measures and alarm transmission to the fire safety service or, when unable to mobilize sufficient rescue personnel within a reasonable time limit, by preventive measures that will result in limiting the frequency of having to resort to these resources.

#### 3.1 To reduce losses resulting from fire

##### 3.1.1 Objective No. 1

**Considering the tested effectiveness of preventive measures in the fight against fires, municipalities must, based on methods and approaches that are preventive, give priority to protecting both citizens and man-made heritage against fire.**

Prevention, under the various forms put forward in the risks management model, groups together the only approaches that can assure the definite attainment of the objective that is sought when one talks about fire safety, the absence of fire. Despite the difficulty in evaluating precisely the effects of preventive measures, there is no doubt that these measures constitute effective ways of reducing the number of fires and therefore reducing injuries, property damages and the loss of life. Over the last 40 years, the success of preventive measures is demonstrated by a decrease in the leading losses due to fire. Suffice it to say that, at the beginning of the 1970s, Québec found unacceptable an annual average of 179 deaths attributable to fire, compared to an average of 77 deaths in the 1990s. Remember that between these two dates, namely in the 1980s, we witnessed the widespread marketing of the smoke detector and the adoption, by government authorities and by several municipalities, of standards and regulations requiring its installation in apartment buildings. Therefore, there is no reason why these types of measures, to which we owe this reduction in the death toll, cannot also contribute to an equally significant decrease in property loss, an area in which Québec still has much to do.

The increasing popularity of preventive approaches is not a phenomenon that is unique to the firefighting field. In several spheres of human activity, the effects of prevention are evident, as are the advantages of investing in measures that anticipate problems rather than trying to solve them after the fact, as they happen to arise. This is a question of

effectiveness initially, but the question of financial cost also arises: we estimate, in effect, that the indirect losses ensuing from fire represent up to ten times that of direct damage. We know that one out of three businesses will definitively cease operating or will not reopen its business at the same location after having been the victim of a major fire. In municipalities under 5,000 inhabitants, often centred on one industry, one out of two businesses will suffer this fate. Furthermore, the businesses and industries having been subjected to fire generally have a much higher rate of bankruptcy in the years following the fire than the recognized average in their field of activity.

Although our modern societies tend to acknowledge the advantages and the results of preventive approaches, they do not in fact value them. For example, we can observe a lack of understanding on the part of municipal administrators and elected representatives regarding possible actions and practices in connection with fire prevention. These actions and practices are often limited to basic public awareness measures and are usually centred on the annual fire prevention week. The only people they ask to participate are the members of the fire safety service, who operate closely with their clientele, who, like children, are easy to reach or who accept without question messages about fire prevention. These events are rarely based on an analysis of incidents that occurred in the community or rarely call on the other human or physical resources of the municipality. Judged complex or too restrictive for landowners, the approach prescribed by regulations, in particular, continues to be disregarded in a number of municipalities that do not have sufficient administrative resources to apply the clauses of the *Code de construction du Québec*, National Building Code (NBC) or National Fire Code (NFC).

Nevertheless, recent data from the Québec Fire Statistics Report show that a large part of our problems in this field can be solved through preventive steps<sup>11</sup>. Since negligent or careless behaviour still accounts for 45% of the fires that occur in Québec and for 60% of the ensuing deaths, there is definitely room for public education campaigns. However, these campaigns must be well oriented: for example, in spite of the success of smoke detectors, we must not accept the fact that the majority of deaths attributable to fire occur in the absence of such a device or because the smoke alarm is out of order. Once the origin of a deadly fire is known, half of the time it is found to be in an area used for sleeping or for preparing and cooking food. Moreover, mechanical and electrical defects are still the cause of 25% of our fires and of 33% of the ensuing property loss that almost always occurs in the industrial sector.

In this context, the objective stated above should make obligatory the wider involvement of municipal governments in the fields of activity associated with fire prevention: evaluation and analysis of occurrences, regulation, periodic inspection of hazards, and public education initiatives. This involvement should go hand in hand with a greater sense of responsibility awareness by the public when faced with the phenomenon of fire, and, more particularly, by risks generators in situations of higher risks management.

Such an orientation essentially respects the spirit of the modifications recently made to the *Building Act*, that institutes a better distribution of responsibility amongst the participants who are in a position to act on the quality of construction and on the safety of people. Besides the fact that this Act invites the municipalities to take on the assigned functions of monitoring the application of standards inside all buildings so as to develop or maintain the expertise that will allow them to subsequently extend these functions to

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11. The following data are taken from the document *La sécurité incendie au Québec, Quelques chiffres, Édition 2000*, published by the ministère de la Sécurité publique. Unless otherwise stated, they all cover the period from 1992 -1999.



small buildings, it also aims to make designers, contractors, owners and occupants more responsible in terms of safety requirements.

In concrete terms, this objective implies that each regional authority will, within its fire safety cover plan, make provision for the design and implementation, by the local authorities, of a fire prevention activity plan for its respective territory. This plan will include no less than the following elements:

- an evaluation and incident analysis program;
- an evaluation and, if needed, a program that aims to update the various clauses of the municipal regulation dealing with fire safety, including the list of measures to take in order to ensure their implementation;
- a program for installing and checking that smoke detectors work;
- a periodic inspection program for high risks;
- a public awareness activity program.

Each one of these programs should state its pursued goals and objectives; the risks or as the case may be, the targeted public; a summary description of the main components; the frequency of its activities; the methods used, the form used to implement measures and evaluate results as well as the human, physical and financial resources assigned to the planning and accomplishment of the projected activities.

Regarding regulation, while waiting for the clauses currently being formulated at the *Régie du bâtiment du Québec* to be applied to all buildings, municipalities will make sure that they have a construction regulation that is based on Chapter 1 (*Bâtiment*) of the *Code de construction du Québec* for the building categories that are not currently covered by Québec legislation. As regards the adoption of their prevention program, it should be based on the *National Fire Code*.

On the subject of awareness, municipalities can take advantage of activities and tools already available in Québec. In addition to the guidance provided annually by the ministère de la Sécurité publique for organizing the fire prevention campaign, which occurs during the month of October, the municipal fire safety services can in particular acquire and use programs like “Protect Yourself From Fire” or “I’m Safe! I’m Happy!”, developed respectively by the American National Fire Protection Association (NFPA) and Bic Corporation, and available under the auspices of private sector sponsors.

Finally, it makes sense that fire prevention planning, much like certain intervention procedures used in a fire safety service, should be based directly on the results obtained from the evaluation process and incident analysis. This way, municipalities could eventually be induced to adopt a specific regulation in order to control certain properties or activities that present a high or special fire hazard. They could also design and implement an inspection program for the properties involved or focus their public awareness measures on particular groups, depending on local problems. Thus, intervention weaknesses that cannot be rectified in a given geographic sector or on the territory of an entire municipality should logically translate into increased prevention efforts.

### 3.1.2 Objective No. 2

**Taking into account existing resources on a regional scale, design fire safety services, plan the organization and the provision of rescue services and anticipate intervention procedures so as to target, in the face of low-risk situations located inside the town urbanization boundaries defined on the development plan, the deployment of a strike force that makes an effective intervention possible.**

The explanations relating to the critical character of the flashover point in the progression of a fire leads to a definite understanding of the importance, for an entire rescue organization, of being able to deploy a sufficient strike force to the scene of a fire within a set time limit. This is a condition essential both to the effectiveness of the interventions and to the safety of the persons involved, including the firefighters.

The strike force is composed of personnel assigned to rescue and firefighting operations, and of the water flow necessary to extinguish the fire as well as of the firefighting equipment, more specifically the pumping equipment and if needed, the equipment used to transport water. Table 5 summarizes these parameters by individually indicating the levels widely recognised in the fire safety community based on whether we wish, in the case of a low-risk building, to reach one of the following objectives:

- rescue the people inside the burning building;
- confine the fire to room of origin;
- confine the fire to floor of origin.

**Table 4** Deployment of response resources according to the response time for a low-risk building

RESPONSE TIME	RESPONSE RESOURCES
<b>Under 5 minutes</b>	Response time favouring the effectiveness of the intervention
<b>Between 5 and 10 minutes</b>	Response time favouring the effectiveness of the intervention
<b>Between 10 and 15 minutes</b>	Response time compatible with an effective intervention
<b>Over 15 minutes</b>	Response time prejudicial to the effectiveness of the intervention

The data contained in this table must be interpreted in the light of explanations presented in Section 2.4.2 with respect to the elapsed time and, more particularly, with respect to the time period that can elapse between the moment when the fire starts and the moment when the alarm is sounded. It goes without saying that reaching one of the above-mentioned objectives will depend, chiefly, on the duration of this period. But, in general, in circumstances presenting similar conditions and where the value of this factor is constant, we can expect that the elapsed time indicated will lead to the expected

results. In this way, an intervention combining the minimal resources mentioned in the table and carried out according to the response time favouring (F) its effectiveness, should allow, if this is the case, the rescue of persons trapped inside the burning building. An effective intervention, one that respects the parameters of “C”, makes it possible, in theory, to contain the fire inside the original room. An intervention carried out within a response time prejudicial (P) to its effectiveness does not ordinarily make it possible to hope to contain the fire inside the original site.

Subject to the following considerations regarding elapsed time and response personnel, this objective requires each municipality to plan, insofar as the availability of regional resources permits, the organization of fire emergency operations in order to assure, within ten minutes of the alarm sounding at its fire safety service, the deployment of ten firefighters and the delivery of the necessary water to any site which poses a fire risks and which is located inside the town urbanization boundaries defined in the development plan of the regional community.

The rescue of persons inside a burning building should not, in itself, be attempted before having at least four firefighters at the scene of the fire with the appropriate equipment and a water supply allowing a flow of 1,150 litres per minute, and all this, ideally, within five minutes of the alarm sounding at the fire safety service. This is illustrated in the central column of Table 5. Given the assumed progression of the fire after a ten-minute delay, any intervention of this nature that cannot be supported by a complete strike force is likely to spread resulting in high losses. This is the practice recommended at NFPA standard 1500, *Standard Relative to a Workplace Health and Safety Program in Fire Services*<sup>12</sup>.

**Table 5** Deployment of response resources according to the response time for an inside fire attack in a low-risk building

RESPONSE TIME	RESPONSE RESOURCES
<b>Under 5 minutes</b>	Response time favouring the effectiveness of the intervention
<b>Between 5 and 10 minutes</b>	Response time compatible with an effective intervention
<b>Between 10 and 15 minutes</b>	Response time prejudicial to the effectiveness of the intervention
<b>Over 15 minutes</b>	Response time prejudicial to the effectiveness of the intervention

The town urbanization boundaries are, as you know, the portion of the territory where the essential urban activities are centred and where the land is usually more densely

12. Unless otherwise indicated, the standards mentioned in this document are only used for reference purposes. Since they reflect the most widely recognised practices in the fire safety field, the municipalities and the fire emergency services would be well advised to consult them when planning or organising their operations. However, they are not bound to respect each and every one of their clauses.

populated than other parts of the territory. The urbanization boundaries also limit the sectors where the municipal authorities have agreed to extend the future development of the town. They usually draw the line between the rural area, where inhabitants are more dispersed, and the urban area. Also connected to town urbanization boundaries are the phenomena of the concentration of activities, of real estate development growth, and a multiplicity of functions, which all represent, more or less, a relation with one or another of the aspects of fire risks management or the optimisation of municipal resources and equipment in this field. It could appear quite logical, for example, to want to assure a minimum protection against fires in areas where more of the population, real estate wealth and major production services and activities can be found. Even so, a municipal government does not reap all the benefits from its investments in water supply infrastructures if it is not able to dispatch, in the sectors served, other firefighting resources that will assure a higher level of protection compared to the other parts of the territory.

An objective that favours a fixed level of fire protection within the urban boundaries is in keeping with the orientations that the government has already formulated in terms of land-use planning<sup>13</sup>. Notably, these orientations invited municipal authorities to practice a form of urbanization management that is concerned with the improvement of the quality of life and the development of services for persons living in urbanized areas through the maintenance and improvement of equipment and shared services as well as a plan to consolidate the location of equipment and the infrastructure.

While being to some degree selective, the coverage of fire risks throughout the different sectors of the municipality, and the reference to town urbanization boundaries must not be perceived as exclusive, or even restrictive, in relation to the territory that will be provided with fire protection. On the one hand, it is not because a fire safety service sets the goal to improve the efficiency of its interventions in a given area that it will neglect the other areas of the municipality. On the contrary, it would appear fair to assume that a significant improvement of interventions within town urbanization boundaries would at the same time lead to an increase in the efficiency of interventions for the remainder of the territory. On the other hand, the deployment, outside of the urbanization boundaries, of an appropriate strike force within an elapsed time exceeding fifteen minutes must not be inevitably considered as ineffective or useless. In fact, it is understood that certain privately installed protection and early fire detection measures as well as the automatic alarm connected to public services can contribute to limiting the spread of fire or significantly reducing the period preceding the mobilization of resources. As a result, the municipalities must specify in their planning documents the strike force they intend to deploy in low-risk situations, and the elapsed time to do so in the different locations of their territory and not only within their urbanization boundaries. In accordance with the intent of objectives 2 and 3, we must expect this strike force to take on optimal characteristics, i.e. that it must be put together after all the resources available throughout the region have been considered.

Owing to its numerous aspects, this objective is the one that presents the highest level of involvement on the part of municipalities and fire safety organizations in terms of the planning they must do. Regionally, its consideration is likely to generate discussion and require decisions from municipal authorities on the entire set of factors that influence the effectiveness of fire safety interventions, perhaps even on a few of the aspects

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13. Government of Québec, *Les orientations du gouvernement en matière d'aménagement du territoire*, 1994, p. 6-40.

associated to risks analysis. In certain cases, this could event lead to the revision of town urbanization boundaries so they reflect, more faithfully, the actual state of the environment or take into account the real potential of the municipality for development.

Nonetheless, such an objective must not be seen as impossible to reach. On the one hand, the data available on the interventions carried out by fire safety services between 1992 and 1999 reveal that, in 73% of the cases, firefighters reached the site of the fire while it was still limited to the original room. In an indeterminate proportion of situations, however, the strike force necessary to enter a building to fight a fire or the resources needed to implement an effective strategy were not available at the time (which, incidentally, can partly explain the significant property loss resulting from these fires). However, this proportion of 73 % leads us to believe that, in most environments, the optimization of resources and the improvement of various factors when combined in an effective intervention (alarm, mobilization, water supply, etc.) will contribute to mobilizing this strike force within the hoped for time.

On the other hand, we must consider that this is an objective to be reached in most situations presenting normal conditions whether in terms of climate, topography or access to the location of the fire, range of the fire or even the availability of response resources. Within this context and in accordance with the provision contained to this effect in NFPA draft standard 1710, the deployment, in 90% of the cases, of a strike force allowing for an effective intervention could, in hindsight, be considered acceptable.

Finally, it could already be taken for granted that this objective will not be reached by certain emergency response organizations. This could be the case for municipalities that are isolated geographically and whose demographics and organizational or administrative resources are not sufficient to justify keeping an autonomous fire safety organization. It could also be the case for cities with more than 50,000 inhabitants, that are asked to, as we will see, to deploy a strike force that is more compatible with the resources that it has at its disposal, within a time limit generally assuring an effective intervention. While some organizations could have difficulty in gathering the necessary resources in certain parts of the territory, others will have some trouble in assuring the response time that makes the required effectiveness possible.

At the very least, the requirement that this objective represents for municipalities is to take part in an exercise that will allow them, by setting aside administrative urbanization boundaries, to take into account the existing resources in their region in order to establish an optimum level of protection to be offered to their population. In doing so, they will be able to measure the gap that separates them from reaching the proposed objective and to establish conditions that could be implemented, notably as part of prevention, in order to increase their level of protection.

#### a) Response time

Response time represents the time between the moment the alarm is sounded at the fire safety service and the moment the complete strike force arrives on the scene of a fire<sup>14</sup>. It

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14. This suggests that a fire safety service cannot usually allow itself to wait, before sending the necessary resources, for the fire to be confirmed by one of its members sent out to scout the scene. However, even if it can effectively reduce the number of trips due to false alarms, this way of proceeding is highly incompatible with the effective mobilization of its strike force in all other cases, which are not false alarms and which are usually the case. Moreover, it has never been able to present a real solution to the problem of false alarms.

is widely recognised in the fire safety community, that a response time less than ten minutes favours the effectiveness of an intervention. Therefore, the proposed objective asks municipalities to consider the organizational and operational procedures that, when combined, make possible the achievement of this time limit throughout the major part of their territory.

More particularly, the best organized fire safety services, namely those having a number of interventions that usually necessitate the use of full-time personnel, cannot easily avoid this requirement. The analysis of the annual average of fires that occurred between 1992 and 1999, based on municipal demographics, shows that, at a certain level, in this case being 50,000 inhabitants, the cities are faced with a volume and a frequency of events that amply justify the proposed deployment. The high density of population in the central neighbourhoods of these municipalities also requires an early response from fire safety services, so as to limit the risks of conflagration. That is why municipalities with over 50,000 inhabitants should structure their fire safety services, plan the organization and provision of emergency services and anticipate intervention procedures in order to target, in low-risk situations located within their town urbanization boundaries, the arrival of a strike force at the scene of the fire within a time limit that does not exceed ten minutes.

Given the scattered effect that characterises rural housing and a great part of urban residential housing in municipalities with smaller population, a response time of fifteen minutes can, in these areas, be considered acceptable for the coverage of low-risk situations located within the town urbanization boundaries. In municipalities of under 50,000 inhabitants, the deployment of an appropriate strike force within such a time limit remains compatible with an effective intervention, while making an objective analysis of the level of resources that these organizations can mobilize and the limitations to which they are subjected. It was stated earlier that a low-risk residence can burst into flames within a time limit varying between five and twenty minutes following the flashover of one of its rooms, namely after a period of fifteen to thirty minutes after the appearance of the first flame. Other things being equal, the arrival of the firefighters on the site of the fire within fifteen minutes of an alarm would therefore offer, in many cases, the possibility of containing the fire inside the room of origin.

A response time exceeding fifteen minutes definitely reduces the effectiveness of the intervention by the firefighters. Under such circumstances, they are often constrained to use defensive strategies that are intended to limit the losses to flaming building in order to prevent the fire from spreading. If we disregard the rescue of persons, which always constitutes the priority in rescue operations, the minimal objective of any intervention should be to save the building within which the fire originated.

Municipal authorities would be well advised, if they wish to reach this objective, to give serious consideration to the system used to receive and transmit the alarm to the fire safety service (9-1-1 call centres). It would enable the rescue organization to exercise a form of control over one part of the elapsed time that does not usually fall inside its scope but never ceases to have an impact on the deployment of resources. The time used to process and send the alarm to the fire safety service is in fact located on the portion of the fire progression curve that is the most influential both in terms of the number of resources that will need to be deployed and the extent of the losses that will eventually be found unacceptable. In a certain sense, each minute saved during this time period enables the emergency services to widen their radius of action on the field and moreover improve their chances of arriving at the scene of the fire before the flashover.

This aspect of mobilizing emergency resources was recently analyzed by the National Committee for the revision of first responder emergency services<sup>15</sup>. Pointing out that 9-1-1 services are essential to the first responder emergency response chain, the committee specified that 85 % of the Québec population is covered by such a system, even if the coverage only represents 35 % of the territory. However, it deplors what many stakeholders in the fire safety field have already observed, namely difficulties in understanding and integrating the mutual roles played by the various participants as well as a nearly systematic absence of memorandums of understanding between 9-1-1 centres and emergency service call coordination centres. In this context, the committee recommends that the processing method and the protocol of call transfers from 9-1-1 centres to the health service communication centres be uniform and respect the norms and standards established by the *ministère de la Santé et des Services sociaux*.

A first step in the right direction, particularly for municipal organizations offering first responders services, would be to ensure that the systems used to receive and transmit the alarm to the fire safety service respect the most important requirements provided for in NFPA standard 1221 *Installation, Maintenance and Use of Emergency Services Communications Systems*. Municipalities using private dispatch services or 9-1-1 centres should therefore include the provisions of this standard in the contractual clauses binding them to their service providers. Aside from the implied alignment of equipment and procedures, the respect of these standards is conducive to having rescue organizations and citizens in general benefit from the most recent technological advances in the field of communications, which can significantly improve the effectiveness and the speed of the interventions. This should also contribute to standardizing call transfer protocols between 9-1-1 emergency centres and the participants involved in the fire safety, police and health services.

#### b) Response personnel

The results from the analysis of critical tasks to be accomplished at the scene of a fire establish the minimum number of resources necessary to carry out rescue and firefighting operations in a low-risk building at ten, based on the previously proposed classification. Therefore, the objective of any fire safety service should, from the viewpoint of an effective intervention, consist of assembling this number of firefighters within the previously mentioned time limit.

However, we will agree that this objective can be more easily attained by municipalities that have a team that is, at least in part, composed of full-time firefighters. Besides accelerating the dispatch of resources to the scene of a fire, the maintenance of personnel at the fire station makes possible the mobilization of a larger number of resources and the redeployment of teams, if needed, to the rest of the territory. For the same reasons expressed previously, municipalities with over 50,000 inhabitants should provide for the deployment of at least ten firefighters for any fire occurring in a low-risk building.

While they should also strive for this objective by establishing intervention procedures, everywhere that it is possible, that call for ten response personnel at the time of the initial alert, it is likely that municipalities who depend upon volunteer firefighters could experience some difficulty in mobilizing such a strike force. In these cases, the minimum

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15. Comité national sur la révision des services préhospitaliers d'urgence, *Urgences préhospitalières*, December 2000.

number of firefighters should be established at eight in order to provide an effective intervention. Let us state that this number of response personnel applies to an intervention that uses a water supply system that can provide sufficient water flow. Therefore it does not account for the transport of water, in rural areas, by tanker or by relay pumping. In contrast, certain situations do not generally call for this number of firefighters. This is the case with fires that do not directly affect a building, like vehicle, grass or garbage fires, for which a smaller number of firefighters can be envisaged to carry out the operational procedures of the fire safety services.

Let us also add that rescue planning under the heading of response personnel must consider the probability of having to face extreme conditions or a fire whose intensity or duration would have already reached the flashover point at the time of arrival at the scene. Establishing the above-mentioned strike force must leave sufficient flexibility to the fire safety service to be able to respond to a request for additional resources during subsequent alarms, or to respond to a second fire somewhere else on its territory. If needed, they can ask for mutual assistance from another municipality.

Finally, establishing the essential number of firefighters, in order to provide an effective intervention inevitably implies that each of the response personnel possesses the qualifications necessary to perform the tasks that will eventually be required. Owing to the application, since September 17, 1998, of the *Regulation respecting the training of members of fire departments*, municipalities hiring new firefighters on a full-time basis must require them to have a vocational studies diploma that provides the qualifications enabling them to perform the majority of tasks at the scene of a fire. In the absence of similar requirements in the case of volunteer or part-time firefighters, fire safety services should ensure that their firefighters have acquired the qualifications needed to fulfil the role they are asked to play in accordance with the contents of Table 3.

#### c) Water supply

In accordance with what was previously stated in the section on intervention, the four firefighters needed to enter a building to fight a fire must be able to count on a water flow of at least 1,150 l/min to feed an attack line and a protection line (allowing for the respective application of 400 l/min and 750 l/min, if needed). The team composing the complete strike force needs a minimum water quantity of 1,500 l/min.

However, we must specify that it is only after the officer in charge of fire safety operations has done his reconnaissance that he decides to enter the burning building in order to proceed to the search and rescue of persons by using protection lines. When the fire is still in its growth phase, the officer in charge can also decide to extinguish it by using the available quantity of water.

In urban areas, water flow should last at least 30 minutes. In rural and suburban areas, NFPA standard 1142, *Standard on Water Supplies for Suburban and Rural Fire Fighting*, suggests a minimum of 15,000 litres for low-risk buildings.

It should be noted that the water flow stipulated does not provide a sufficient water supply to effectively extinguish fire in all buildings presenting higher risks. To ensure an adequate intervention, the water flow calculation methods suggested by the Insurer's Advisory Organization or NFPA standard 1142 can be used. It is important to regularly check the water supply system by performing hydraulic tests at various points in the system in order to ensure that the infrastructures are able to supply the quantity of water that is necessary for interventions. Also, in sectors that are not serviced by a water



supply system, it is advisable to locate the water supply points that will make it possible to assure an appropriate supply during any intervention.

d) Firefighting equipment

To provide the quantity of water previously mentioned, a fire safety service must have at least one pumper that is in accordance with manufacturing standard ULC-S515 *Standard for Automobile Fire Fighting Apparatus*. In sectors that are not serviced by waterworks, the fire safety service must also count on one pumper and at least one water tanker that comply with the same standard. A maintenance and checking program for vehicles and accessories should be implemented in order to ensure their reliability, while being influenced by the clauses provided for in the standards listed at Annex 2; mainly by standard NFPA 1915 *Standard for Apparatus Preventive Maintenance Program*.

3.1.3 Objective No. 3

**Taking into account existing resources, design fire safety services, plan the organization and the provision of rescue services and anticipate the intervention procedures so as to target, in the case of other risks categories, the deployment of an optimal strike force.**

If, in Québec as in other parts of North America, major fire safety services apply relatively uniform standards and procedures during low-risk interventions, their approaches, from time to time, present notable disparities with regard to dispatching response resources to higher-risks buildings. This is due to two factors: the observable differences in the risks classification systems currently used by these organizations and the preferred ways of managing these types of risks in various environments. Analysis shows that it is quite difficult to single out the standards that best reflect the methods to be used even though the circumstances are the same.

Within this context, it is likely not possible, nor even timely, to propose to municipal fire safety services the attainment of predetermined objectives with respect to other risks categories. We must understand that in planning their interventions for the low-risk situations surveyed on their territory, a majority of these organizations will become more familiar, within the next few years, with an approach that is entirely unknown to them at this time. While benefiting from the improvements that result from this planning, municipalities must, however, at the very least, focus on the deployment of an optimal strike force in the case of fires presenting average, high or very high risks. The optimal character of the strike force implies taking into account all resources available regionally and their mobilization in accordance with parameters presented earlier, should the case arise.

In other words, this objective requires the municipalities to determine, for each risks category involved, the minimum strike force that they are able to deploy and the response time that they can reach in an ordinary situation, i.e., in the majority of cases with normal conditions. Establishing this strike force should, as much as possible, be based on the most widely recognised standards, so as to favour effective interventions without compromising the people at risk, including the firefighters. We recommend consulting the Table on effective intervention proposed by the Insurers' Advisory Organization that suggests the levels of resources to deploy according to different risk categories. In general, it appears justifiable to expect that the resources dispatched to the scene of a fire would be more substantial if the risk is higher, the tasks being more

numerous or more complex and the difficulties associated to the intervention requiring a certain level of expertise or specialized equipment (e.g.: elevating device). As with the preceding objective, careful attention must be paid to buildings located within the town urbanization boundaries, mainly because of the dangers of conflagration in these locations and their associated risks.

Much like low-risk situations, it is also agreed that emergency services can be faced with extreme conditions or with fires whose density or duration could have already reached the flashover point when the response personnel reach the scene of the fire. Therefore, municipalities must plan the mutual assistance procedures applicable under similar circumstances.

The fact that it is important for municipalities to plan higher-risks interventions need not be explained. However, to the considerations previously raised in relation to the impact of fires, suffice it to add the fact that in over 80% of major fires, i.e., those having caused for over \$250,000 in damages, that occurred in Québec between 1992 and 1999, the flames had already spread to the outside of the original room when the firefighters arrived at the site. In spite of their relatively low number, these events have therefore been the cause of more than one quarter of the losses sustained to buildings recorded in Québec

Finally, this objective demands the production of specific intervention plans for higher risks buildings so as to increase the effectiveness of the intervention by firefighters in the event of fire and, as a result, to reduce the consequences of such an event. Since devising these plans requires a relatively high level of knowledge of the risks and the properties at stake, municipal programming activities could limit themselves to setting a schedule with annual objectives to be achieved in term of pre-incident planning by specifying, when applicable, which buildings should come first. The content of these plans should be in accordance with the main standards used in the fire safety field, contained in NFPA standard 1620 *Pre-Incident Planning*.

#### 3.1.4 Objective no 4

##### **Fill any eventual shortfall in terms of firefighting through adapted self-protection measures.**

Based on the classification of risks as proposed above, the last two objectives encompass all the aspects related to firefighting operations by furthering the design and implementation of an optimum response by municipal services when an intervention becomes necessary. Hence, although very efficient, municipal resources can remain well below the means that are usually required to ensure a minimum protection against fire and especially in the case of high risks hard to locate or those that are difficult to access. As a result, in such situations, fire safety planning must provide for measures adapted to self-protection by seeking, whenever possible, an active collaboration from concerned risks generators. These measures can consist in installing fixed extinguishing systems as well as fire detection devices and automatic alarm transmission mechanisms to alert the municipal fire safety service. Appendix 3 lists the main standards related to manufacturing, installing and maintaining these types of devices. The municipalities can even promote the setup of private fire brigades or have permanent recourse to fire prevention technicians in certain businesses or institutions located on their territory.

Building Code provisions and a number of municipal regulations already impose the obligation for some types of buildings to install fixed extinguishing systems or early fire detection mechanisms. Besides, the contribution of such systems to the effectiveness of

the intervention by safety services has already been pointed out. However, it should be noted that it is only recently that these building regulations have been applied in a number of locations or for some types of buildings, and for this reason, many of the buildings built during the last few years, namely in sectors such as trade and industry, do not meet these new requirements. In this situation, therefore, the risks analysis process must result in the identification of measures which, by delaying fire progression or ensuring an early response by public safety services, would be more likely to increase the efficiency of the intervention. If most of these measures are usually taken by building owners, or on a less frequent basis initiated, by occupants, municipalities can play a leadership role in promoting them. The City of Québec, for example, has already implemented programs to extend the installation of sprinklers in residential buildings in its historical sector and in locations located far from fire stations.

However, in terms of intervention, the installation of automatic water sprinklers or of a standpipe system in buildings means that there are specific features that those in charge of fire safety services must know about. The latter will find it beneficial to refer to NFPA standard 13E *Recommended Practice for Fire Department Operations in Properties Protected by Sprinkler and Standpipe Systems* regarding the main procedures to be followed in such cases.

In more general terms, when doing urban planning, municipalities should consider the sites on their territory that are fire risks. Establishing installations that have the potential of conflagration, beyond those areas served by appropriate road or water supply infrastructures, merit special attention both in terms of serving the population as a whole and the feasibility for different public services to provide adequate services. This is why all concerned municipal services (urban planning, housing, economic development, public works, fire safety) should refer to NFPA standard 1141 *Standard for Fire Protection in Planned Building Groups* in order to plan the development of inaccessible sectors within deadlines allowing for an efficient response in case of fire.

### 3.1.5 Objective no 5

**In the case of other risks of disaster that can require the use of fire safety resources, plan emergency response procedures and provide for intervention procedures allowing the deployment of an optimum strike force taking into account the resources available within the region.**

According to article 11 of the *Fire Safety Act*, the fire safety cover plan can include, for other risks of disaster that can require the use of the same resources, planning procedures that are similar to those used for fire safety. However, the addition of these procedures to the overall scheme obliges parties only if decided upon by relevant authorities and provided it is expressly stated. If applicable, article 47 specifies that the municipality that has created the fire safety services, and each of its members will not be liable for any damage that might result from their intervention during a disaster requiring their participation. For example, a municipality can, at its discretion, indicate in its regional plan that its unit responsible for fire safety is also authorized to use jaws of life within a given area. If it does so and specifies the nature and scope of the service it offers, it can benefit, with regard to whatever actions it or its personnel might have to take, from an immunity similar to the one that applies to its fire safety activities.

Objectives proposed so far consist of defining the immunity granted to municipal authorities in the field of fire safety. By reminding us of the most basic rules regarding the organization and operations in this sector, they are indeed inviting municipalities to refer to them when determining the level of services that they wish to offer to their population and when implementing measures in that sense. When these rules are not already covered by standards recognized by most stakeholders in the field of fire safety, municipalities must themselves define the criteria that they will follow as they ensure fire protection on their territory.

Like fire safety interventions, it seems logical that the liability release applicable to other risks of disaster be strictly beneficial to municipalities having tried to plan their organization in that respect by determining the level of services which they intend to implement. To that purpose, the idea of a "striking force" related to the intervention as used in the field of fire safety can very well be adapted and municipalities must therefore determine, for each of the other emergency services in which their firemen can take part, the level of resources that must be deployed and the deployment time that corresponds to an efficient intervention.

Some precisions become essential in this perspective. First of all, we understand that by demanding the deployment of an optimum strike force, this objective implies that all municipal resources available in the region be taken into account.

Local and regional authorities, who will then include in their plan information regarding other risks of disaster, should use parameters such as the response time, the number and qualifications of stakeholders, as well as the equipment required according to circumstances and indicate, for each type of disaster and for each sector of the territory, the level of resources which they intend to mobilize. For guidance in this regard, they can refer to recognized standards provided that they exist. For your information, appendix 2 contains a list of standards applicable to firefighting personnel, to the training of stakeholders, to the preparation and performance of operations, and to the material that is essential in cases requiring a more frequent use of fire safety resources.

Finally, it is advisable to limit intended events to those situations that lie within the competence of fire safety services. Conditions for interventions by firefighters in case of major disasters requiring the implication of emergency preparedness, for example, should not be included in the fire safety cover plan. The responsibility for planning and coordinating operations, the conditions for resorting to firefighter intervention and the liability system applicable in such circumstances are beyond the competence of municipal fire safety services and are the subject of specific legislative or normative clauses. Therefore, fire safety services should only consider those incidents that fall within the responsibilities explicitly granted to them within the emergency preparedness organization of their territory. Besides, a bill on civil protection is now under study<sup>16</sup>; and it will cover, provided that it is adopted, organizational and operational planning in this field.

Based on these comments, the following events could be included in a fire safety cover plan implemented by regional authorities and in the implementation plans of local municipalities:

- a) Firefighting
  - Fighting road vehicle fires
  - Fighting grass and forest fires

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16. *Emergency Preparedness Bill 173*

- Fighting fires involving hazardous materials
  - Fighting electrical distribution station fires
  - Fighting underground fires
  - Fighting railroad vehicle fires
  - Fighting fires in aircraft
  - Fighting marine fires
- b) Rescue
- Extrication of vehicle accident victims
  - High altitude rescue: mountains, bridges, structures, buildings, pits, etc.
  - Water rescue: drowning, flooding, ice rescues, etc.
  - Confined space rescue
  - Rescue of suicidal people
  - Freeing of trapped victims
  - Freeing of imprisoned people without any risks to their physical safety (e.g.: elevator)
  - Search for people lost in the forest
- c) Emergency intervention
- Emergency intervention in case of a leak or spill of hazardous materials:
    - Detection of hazardous materials
    - Establishment of a safety perimeter
    - Performance of manoeuvres
  - Emergency intervention during flooding or other natural disasters
  - Emergency intervention in case of bomb threat
  - Emergency intervention in case of the risks of a building collapsing
  - Assistance to public services: police, ambulance, public works
- d) First aid
- Basic medical assistance
  - Advanced medical assistance with defibrillation, first responder services
- e) Protection and clearing
- Protection of goods or of disaster sites
  - Clearing of debris
  - High-risks work or event supervision

### **3.2 For more responsible and more efficient municipal organizations in matters regarding public security**

#### 3.2.1 Objective no 6

##### **Maximizing the use of resources assigned to fire safety**

Like several other similar exercises performed during the last thirty years, the Commission nationale sur les finances et la fiscalité locale (*Pacte 2000*) recently put the accent on the different effects of the fragmentation of municipalities in Québec: multiple stakeholders, sometimes inefficient land splitting, deficient planning and lack of a strategic vision, sterile competition, low productivity and high costs of some services for taxpayers, tax disparities, limited administrative and operational capacity of some

municipalities, effects of certain excesses, etc. Given this situation, the Government of Québec revealed in the year 2000 its orientations in terms of municipal reorganization. Since then, it has begun to implement some of its proposals by grouping municipalities in a few metropolitan areas and by entrusting mandataries with the task of producing an analysis of the situation and a statement of recommendations in several other cases.

Given the organizational issues raised by the Fire Statistics Report, the reform of this field of activities is an important part of the overall orientation that consists of reviewing the structures and procedures of municipalities in order to maximize the use of resources, to increase their efficiency and to reduce costs for citizens. This is why, incidentally, the objectives proposed so far demand that municipalities take into account all the regionally available resources for the purpose of increasing the overall protection of the population against fire. However, even if the Québec Fire Statistics Report were not what it is, an objective consisting in optimizing resource allocation in that field should still be stated as such. As a matter of fact, beyond the reduction of human and material losses that will undoubtedly result from the implementation of more efficient organizations and procedures, several reasons justify the effort to rationalize the use of the human, financial and material resources dedicated to fire safety.

In terms of human resources, the upgrade of qualifications for a high proportion of the volunteer or part-time manpower will sometimes attract the attention of municipal authorities. Meanwhile, due to an increasing demographic decline, some municipalities in peripheral areas already find it difficult to recruit candidates who would become firefighters. Maintaining adequate and qualified personnel in these areas can only be possible in several cases through the merging of services or, at the very least, by entering into intermunicipal agreements regarding the provision of some services. Contrary to the belief of several elected municipal officials, to the effect that these intermunicipal mergings have a negative influence on the motivation of fire safety service members and hinder the recruiting of personnel, experience shows in several areas that, in so doing, the status of the volunteer firefighter is given more status, both by the increased training possibilities and the affiliation to an organization that is more professional, better equipped and more effective.

The situation with regard to material resources is hardly any different. During the last twenty years, municipalities have delayed their purchase of response equipment and vehicles. As a result, several of them are now forced to contemplate major investments in order to acquire costly equipment, the utilization rate of that is, individually speaking, rather low. Some of them might also want their population to benefit from technological advances, which can substantially contribute to increasing the efficiency of emergency services in a field such as telecommunications.

Obligations imposed upon municipal governments in terms of fire safety lead us to believe in several respects in the existence of a critical mass of resources that many of them obviously do not have at the time being. The fact is that 291 out of the 961 municipal fire safety services surveyed in 1999 had less than twenty firefighters and 36 of them had less than ten firefighters. Therefore, when dispatching an adequate strike force to a fire requiring, as we saw earlier, the mobilization of eight to ten firefighters, the chances of meeting this objective for an organization with less than twenty members are naturally highly limited. In another respect, we note that some 600 municipalities with a population of less than 1,000 inhabitants invested the average amount of \$13,835 in fire safety during the fiscal year 1998, but this certainly does not allow them to maintain an adequate level of protection or a decent quality of human or material resources.

In concrete terms, regional authorities responsible for planning fire safety are being asked to disregard, to some extent, the borders of local municipalities in order to design methods of providing service and intervention taking into account, first and foremost, the risks to be covered rather than the unit or service that will provide such coverage. The purpose here is for municipalities to adapt their actual methods and rescue organizations and to review their procedures in order to heighten the level of protection of a greater number of citizens at a reduced cost while benefiting whenever possible from economies of scale and productivity gains. Priority must be given to formulas that will help reinforce the administrative and operational capacity of concerned organizations and that will ensure maximum equity among taxpayers and municipalities thus avoiding a situation in which only a few groups bear the financial burden for services used by the whole population.

Beyond an optimum allocation of resources in the region, this objective can also mean the allocation of personnel and resources to other purposes capable of improving the level of protection of the population, whether dealing with fire or other situations that can pose a threat to emergency preparedness.

We must specially strive to achieve a greater contribution from firefighters in the field of fire prevention, especially when they are full-time employees. Beyond the already proven benefit for a municipality to give priority to prevention, the involvement of firefighters in the implementation of public awareness measures makes it possible to promote a stimulating approach that uses the sense of responsibility and the social awareness of citizens rather than resorting essentially to regulatory actions which are, by definition, less popular within the population. Besides, firefighters, especially those who are full-time, are often the best-prepared and most credible people to inspect buildings, whether for the purpose of informing owners and occupants or evaluating compliance with the different safety regulations.

In the same vein, some municipalities are interested in developing first responder services within their fire safety brigade. Firefighters have received professional training and they often have personal skills making them fit to help victims of accidents in any circumstance whatsoever. Besides, when performing their duties, they have access to the instrumentation and technical means that are great help to them when giving emergency prehospital care. However, despite encouraging a diversified use of resources affected to fire safety by municipalities, the implementation of first responder services must be contemplated with great caution in order not to jeopardize the main operations of the organizations involved. The report from the National Emergency Prehospital Service Review Committee concerning the implementation of first responder services by municipalities was recently submitted to the Government of Québec; it could therefore announce within the next few months the orientations that it intends to promote with regard to this issue.

In line with an item raised by some of the preceding objectives when discussing the level of protection to be offered within town urbanization boundaries, maximizing the use of municipal resources in terms of fire safety finally involves urban planning and development and the management of some public infrastructures. When municipalities better understand fire risks and when they become more aware of the level of protection that can be provided in the different areas of their territory, they will accept to base their development efforts in locations served by the appropriate road and water supply infrastructures most capable of providing them with an adequate coverage of fire-related risks. Similarly, can we expect that other municipal services capable of contributing to fire prevention or protection will become aware of their responsibilities in this regard?

### 3.2.2 Objective no 7

**At the supramunicipal level, give priority to the use of regional county municipalities (MRCs) to organize or manage some functions in the field of fire safety.**

Some of the findings made by the Commission nationale sur les finances et la fiscalité locale have led the government to choose the supramunicipal level in order to carry out certain responsibilities or to organize certain functions. This is a matter of administrative efficiency while also being a preoccupation leading to the improvement of the living standard of citizens and providing for a more reasonable distribution of the tax burden among taxpayers. If the need for reinforced supramunicipal structures to deal with the issues of all municipalities of a territory was especially urgent in the Montréal and Québec regions, it is also urgent in other Québec areas with respect to some responsibilities that local municipalities have difficulty assuming fully or efficiently.

In a field related with fire safety, remember that the Scientific and Technical Commission responsible for analyzing events related to the ice storm that took place between January 5 to 9, 1998 (Nicolet Commission) regretted the limited operational capacity of several municipalities and recommended the creation of a supramunicipal level to organize some functions in the field of emergency preparedness. Besides, it has already been stated in this document that deficiencies could be noticed in several locations regarding prevention or the search for the causes and circumstances surrounding fires. Deficiencies also persist at several levels in terms of organizing and managing rescue interventions, and this, even after making intermunicipal agreements providing for the delegation of authority, the supply of services or mutual assistance. These agreements usually imply nothing more than a bilateral coordination between a centre that is better organized and some satellite municipalities, for example, and they do not necessarily account for all the critical aspects in the deployment of intervention resources.

Now that these facts have been recognized, what functions could be favourably performed at the supralocal level and what should this level be? The most influential principle in that respect should be the assignment of a responsibility to the administrative or operational level that is most capable of assuming it while ensuring both efficiency and effectiveness in the area of public management.<sup>17</sup>

From then on, do we have to contemplate more specialized services or those requiring a particular expertise or sophisticated equipment? We should think specifically of the design and application of special regulations, the use, in some areas, of fire prevention technicians, the development of expertise with regard to investigating the causes and circumstances of fires, the implementation of specialized rescue units (nautical brigade, rescue squad in confined space, etc.), and even the management and development of human resources in the field of fire safety.

Functions such as strategic planning, coordination and communication that, by definition, transcend local organizations also stand out. The assignment of planning-related responsibilities to regional authorities in accordance with the Fire Safety Act follows this logic. Similarly, it is rather hard to imagine how a two or more of organizations can be entrusted with emergency communications within a given region without somewhat

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17. Efficiency refers to a function or service assumed by the level capable of ensuring production at the least cost. Efficiency is typical of services most capable of meeting the expectations and needs of the population in quantity and in quality.



sacrificing efficiency in terms of rescue interventions or productivity. Therefore, the hope is that the elaboration of a fire safety cover plan will make it possible in each case to implement more appropriate coordination structures.

Finally, more local operations include those presenting interesting opportunities to make economies of scale. Within the framework of a regional county municipality, an intermunicipal management board or *ad hoc* structures, several areas have already taken part in group purchasing operations in order to acquire fire safety equipment, material or miscellaneous supplies. Some municipalities, in collaboration with certain school boards, have also joined in order to have access to the services of certified instructors to the purpose of organizing training activities for fire safety service members.

Regarding the supramunicipal level that must be chosen to perform such functions, this objective definitely favours regional county municipalities. This takes into account the fact that, as supramunicipal structures, regional county municipalities have already existed for twenty years and they can thus capitalize on well-established traditions of political consensus. At the technical level, several of them can actually count on qualified professional resources which give them access to a multidisciplinary expertise connected to the different fields of municipal activity or with other preoccupations typical of their environment. The organization of services at this level is often the best proof of equity for taxpayers within a given region, and this, in terms of the quality of offered services and in terms of the distribution of financial charges that will undoubtedly ensue. This option relieves local organizations from all the red tape associated with managing several intermunicipal agreements. Finally, since they usually represent a critical mass that cannot be reached separately by several locations, the regional county municipality territory or population often offers the conditions that are most liable to develop and maintain higher-level skills in the field of managing municipal affairs.

However, as we understand, this objective especially aims at being consistent with the provisions of the Fire Safety Act according to which regional authorities are responsible for planning fire safety. As a matter of fact, it is legitimate to believe that the risks analysis, fire safety resource census and setting of protection objectives for a regional territory will lead, on that same basis, to opportunities for pooling one's resources. Provided that the development of a professional and well-equipped fire safety organization might represent a common issue for all municipalities of a given region, resorting to the regional county municipality to implement such an organization should therefore be considered as a preferred option.

For lack of the creation of a unique fire safety service under the responsibility of the regional county municipality, the latter should be used to perform its specific responsibilities anywhere the cost/benefit ratio appears beneficial for local administrations. While several municipalities in Québec cannot yet count on, for example, the service of a prevention technician due to their limited financial capacity or because their limited needs do not justify hiring a full-time person, there is good reason for benefiting from this line of thought and for contemplating the possibility of developing this kind of expertise within the regional county municipality. The same idea applies to the purchase of state-of-the-art equipment or to the development of other specialized functions such as training fire safety service members, some prevention activities or investigative work related to the causes and circumstances of fires.

Based on the importance of this aspect with respect to fire safety interventions (and eventually to interventions by other rescue organizations and first responder services),

concerned organizations will need to at least analyze the opportunity to implement an integrated emergency communication and resource allocation system.

### 3.2.3 Objective no 8

**Plan fire safety with the intention of adapting resources and organizations to other structures dedicated to public safety, whether in the field of emergency preparedness, rescue organization, emergency prehospital services or police services.**

Insofar as the last two objectives will become a reality, it will then be appropriate to make sure that fire safety organization in the area is harmoniously blended with other public safety-related functions. Fire safety planning should of course be used to implement different partnerships between the stakeholders of the same area and based on purposes such as fire prevention, the identification of fire causes and circumstances, the performance of investigations on suspicious fires, the delivery of rescue services, the planning and organization of certain emergency measures, etc.

Since fire safety services in a number of areas are combining the first, and may be the only resources mobilizable in case of a disaster, this combining becomes especially necessary in terms of emergency measure planning and deployment mechanisms. Now under study at the National Assembly, Bill 173 titled *Civil Protection Act* provides for a division of responsibilities between local municipalities and regional authorities, a division that resembles in all respects which apply to fire safety responsibilities. If this bill is adopted, municipalities will also have to perform an emergency preparedness organization planning.

It has also been stated that municipalities are increasingly under pressure to get involved in the organization of emergency prehospital services on their territory. The report from the Comité national sur les soins préhospitaliers d'urgence recommends the implementation in all Québec regions of a chain of intervention with lots of place for first responder services, the operation of which should be outsourced to municipalities. Given the nature and financing methods of first responders, the territorial jurisdiction of government partners combined with their implementation and supervision and, in a more general terms, the complexity of issues raised by their organization, there is an increasingly visible interest in having recourse to the regional level to implement such services.

Finally, some fire safety functions are paying close attention to the competence of police forces, namely when the safety of burning premises must be ensured or when the source of the fire has to be determined, as well as the possible causes and the circumstances of such a disaster. Since expertise in that respect is often shared between fire safety services and police forces depending on the organizations and the people involved, there is, except for legal provisions related to deadly or criminal fires, no standard procedures regarding their respective allocation. It therefore appears preferable for administrations in this situation to implement coordination mechanisms in order to ensure a high-quality delivery of service in all circumstances or to avoid eventual jurisdiction conflicts. All this should be very easy since municipalities are also responsible for organizing police services and regional county municipalities have been involved during the last few years in decisions regarding police services on their territory.

Incidentally, on this same topic, the recent ministerial consultation document regarding police organization in Québec and titled, *Vers une nouvelle carte policière*, proposes a

larger role for the public safety committees of regional county municipalities in order to provide them with responsibilities on any matter regarding public safety. It goes without saying that the new responsibilities entrusted to regional county municipalities regarding fire safety, and eventually emergency preparedness, are giving this perspective all its meaning, because, provided that municipal representatives are in agreement, these structures can impose themselves in situations such as regional public forums to debate any public safety-related matter.

## Conclusion

Based on Québec fire statistics, the different stakeholders in this area decided a few years ago that the institutions, the organization and the operation in this field of activity needed to be reformed. Since then, they were able to recognize the appropriateness of the plan of action proposed by the government and to vote upon the feasibility of measures aiming at implementing the orientations that they contained. Several partners representing municipalities, insurers or fire safety services even took part in the design and development of these measures.

The adoption, by the government, of the Fire Safety Act marked the first significant step towards the implementation of this reform. Planning efforts to be made soon by municipalities in all Québec regions obviously represent a much more crucial step. As a matter of fact, consolidating the results of the Québec fire statistics will depend in several respects on the depth and quality of the reflection to be done by municipal representatives during the next few months and on their degree of professionalism. Let us hope that the present orientations will make this reflection easier. They will soon be followed by support documents for the different stakeholders, whether elected officials or civil servants, who will be taking part in the fire safety planning process, namely regional county municipalities (MRCs), local municipalities, fire safety service directors and members, etc. The ministère de la Sécurité publique also intends to support regional bodies in performing these new responsibilities.

However, given the scope of this whole task, one must remain realistic regarding the results that can be expected from the first generation of fire safety coverage plans. Objectively, these plans will not make it possible to do all that must be done in order to improve the fire situation in Québec. However, there is no doubt that the following exercises will allow us to benefit from the themes and results of this first planning session by taking advantage of the most worthwhile experiments with regard to fire risks management or of the most profitable ones in terms of improving the efficiency of organizations.

**APPENDIX 1**  
**THE MINIMUM NUMBER OF PERSONNEL AND THE OPERATIONS NECESSARY**  
**TO CARRY OUT RESCUE AND TO FIGHT A FIRE**  
**IN A LOW-RISK BUILDING**

STAGES	ACTIVITIES	NUMBER OF FIREFIGHTERS	FIREFIGHTER NUMBER	CUMULATIVE NUMBER	OBJECTIVE
<b>Initial stages<sup>1</sup></b>	Incident command <sup>2</sup>	1	1	1	Analyze situation
	Pumper operation	1	2	2	Establish water supply
	Search and rescue (Primary search / Attack)	2	3 and 4	4	Rescue people in danger / Quick attack
	Use of necessary equipment and accessories	2	5 and 6	6	Ventilate the building
	Establish an attack line <sup>3</sup>	2	7 and 8	8	Confine fire to room of origin – Protect rescue and attack team
	Establish a protection line/ Rapid intervention crew (RIC)	2	9 and 10	10	Assist teams in dangerous zone

1. Section 6-4.4.1 of standard NFPA 1500 *Standard on Fire Department Occupational Safety and Health Program* stipulates that the initial stages of an incident include the tasks performed by the first group that arrives on the premises, with only one team working in the hazardous area.
2. Section 6-4.4.2 of this same standard stipulates that one standby member is allowed to assume other responsibilities outside the hazardous area, in this case the apparatus operator, the incident commander, the technician or the aide.  
  
Section 6-4.4.4 stipulates that at the initial stages of the incident, when only one team is working in the hazardous area, one assisting member is allowed to assist or rescue members of his team, provided that leaving his task does not jeopardize the health and safety of the team.
3. Section 6-4.4.4 of standard NFPA 1500 stipulates that when a second team is assigned to the hazardous area, the incident is no longer considered to be in the initial stages, and at least one rapid intervention crew (RIC) becomes necessary.

**APPENDIX 2**  
**MAIN STANDARDS RELATED TO MANUFACTURING, USING OR MAINTAINING**  
**FIREFIGHTING APPARATUS, EQUIPMENT AND ACCESSORIES<sup>1</sup>**

EQUIPMENT	STANDARD
Intervention vehicles	CAN/ULC-S515-1988, <i>Standard for Automobile Firefighting Apparatus</i> CAN/ULC-S523-1991, <i>Light Attack Fire Fighting Apparatus (Mini Pumper)</i> CAN/ORD-C822.13, <i>Maintenance Testing of Fire Department Pumpers</i> NFPA 1901, <i>Standard for Automotive Fire Apparatus</i> NFPA 1911, <i>Standard for Service Tests of Fire Pump Systems on Fire Apparatus</i> NFPA 1915, <i>Standard for Fire Apparatus Preventive Maintenance Program</i>
Portable or aerial ladder and elevating platform	CAN/ULC-S515-1988, <i>Standard for Automobile Firefighting Apparatus</i> NFPA 1914, <i>Standard for testing Fire Department Aerial Devices</i> NFPA 1932, <i>Standard on Use, Maintenance and Service Testing of Fire Department Ground Ladders</i>
Hoses	NFPA 1961, <i>Standard for Fire Hose</i> NFPA 1962, <i>Standard for the Care, Use and Service Testing of Fire Hose, Including Couplings and Nozzles</i>
Protective clothing and equipment	NQ 1923-030 (M3 1994-12-05), <i>Lutte contre les incendies de bâtiment- Vêtements de protection</i> CAN/CGSB-155.1-98, <i>Firefighters' Protective Clothing for Protection Against Heat and Flame</i> NFPA 1971, <i>Standard on Protective Ensemble for Structural Fire Fighting</i> NFPA 1851, <i>Standard on Selection, Care and Maintenance of Structural Fire Fighting Protective Ensembles</i>
	BNQ 1923-410-M95, <i>Fire Fighting – Protective Helmets</i>
	BNQ 1923-500 (M3 1994-03-17), <i>Protective boots used to fight building fires</i>
	BNQ 1923-750 (1984-07-25), <i>Protective gloves used to fight building fires</i>
Breathing apparatus	CAN/CSA-Z94.4-F93 (C1997), <i>Choice, maintenance and use of respirators</i> CAN/CSA-Z180.1-00, <i>Air comprimé respirable et systèmes connexes</i> NFPA 1981, <i>Standard on Open-Circuit self-contained Breathing Apparatus for Fire Service</i>
Emergency communications	NFPA 1221, <i>Installation, Maintenance and Use of Emergency Services Communications Systems</i>
Personal alarm	NFPA 1982, <i>Standard on Personal Alert Safety Systems (PASS)</i>
Hazardous material protective clothing	NFPA 1991, <i>Standard on Vapor-Protective Ensembles for Hazardous Material Emergencies</i> NFPA 1992, <i>Standard on Liquid Splash-Protective Clothing for Hazardous Materials Emergencies</i>
Portable extinguishers	NFPA 10, <i>Standard for Portable Fire Extinguishers</i>

1. As mentioned previously, these standards are only presented as a guide. The municipalities or fire safety services are only obliged to satisfy the requirements that they stipulate if these requirements are explicitly mentioned in a rule or legislation which applies to them.

**APPENDIX 3**

**MAIN STANDARDS RELATED TO MANUFACTURING, INSTALLING AND  
MAINTAINING SELF-PROTECTION EQUIPMENT AND THE MECHANISMS FOR FIRE  
DETECTION AND NOTIFICATION SYSTEMS**

<b>EQUIPMENT</b>	<b>STANDARD</b>
<b>Sprinklers</b>	<p>NFPA 13, <i>Standard for the Installation of Water-Based Automatic Extinction Systems</i>                      NFPA 13D, <i>Standard for the Installation of Water-Based Automatic Extinction Systems in Single Family Residences, Duplexes and Mobile Homes</i>                      NFPA 13R, <i>Standard for the Installation of Water-Based Automatic Extinction Systems in Apartment Buildings with Four or More Stories</i>                      NFPA 25, <i>Standard for the Inspection, Testing and Maintenance of Water-Based Fire Protection Systems</i></p>
<b>Detection and alarm systems</b>	<p>NFPA 72, <i>National Fire Alarm Code</i>                      CAN/ULC-S524, <i>Standard for the Installation of Fire Alarm Systems</i>                      CAN/ULC-S531, <i>Standard for Smoke Detectors</i>                      CAN/ULC-S536, <i>Standard for the Inspection and Testing of Fire Alarm Systems</i>                      CAN/ULC-S552, <i>Standard Governing the Maintenance and Testing of Smoke Detectors</i>                      CAN/ULC-S553, <i>Standard Governing the Installation of Smoke Detectors</i>                      ULC/ORD-C693, <i>Central Station Fire Protective Signalling Systems and Services</i></p>
<b>Carbon monoxide detectors</b>	<p>CAN/CGA-6.19, <i>Standard for Residential Carbon Monoxide Detectors</i>                      UL 2034, <i>Single and Multiple Station Carbene Monoxide Detectors</i></p>
<b>Portable extinguishers</b>	<p>NFPA 10, <i>Standard for Portable Extinguishers</i></p>
<b>Industrial brigades</b>	<p>NFPA 600, <i>Standard on Industrial Fire Brigades</i></p>

**APPENDIX 4**  
**STANDARDS APPLICABLE TO MUNICIPAL FIRE SAFETY SERVICES**  
**FOR SOME TYPES OF INTERVENTION**

<b>TYPE OF RESPONSE</b>	<b>PERSONNEL</b>	<b>TRAINING</b>	<b>OPERATIONAL PROCEDURES</b>	<b>MATERIAL AND EQUIPMENT</b>
<b>Incident involving hazardous materials</b>	- NFPA 1500	- NFPA 472 - NFPA 1006 - First level of the firefighter training program - Module 22 of the firefighter training program	- NFPA 471 - NFPA 1221 - NFPA 1500 - NFPA 1670 - Emergency Measure Guide (Canutec)	- NFPA 471 - NFPA 1981 - CAN/CSA-Z94.4 - CAN/CSA-Z180.1 - NFPA 1982 - NFPA 1991 - NFPA 1992
<b>Extrication from motor vehicles</b>	- NFPA 1500	- NFPA 472 - NFPA 1006 - Modules 1, 2, 3, 5, 6,7, 8 and 9 of first level and modules 11 and 24 of the firefighter training program	- NFPA 1221 - NFPA 1500 - NFPA 1670	- NFPA 1670 - NFPA 1971 - NFPA 1981 - NFPA 1982 - NFPA 1936 - BNQ 1923-030 - BNQ 1923-410 - BNQ 1923-500 - BNQ 1923-750 - CAN/CSA-Z-94.4 - CAN/CSA-Z180.1
<b>Rescue in a confined space</b>	- NFPA 1500	- NFPA 472 - NFPA 1006 - Modules 1, 2, 3, 5, 6,7, 8 and 9 of first level and modules 11 and 21 of the firefighter training program	- NFPA 1221 - NFPA 1500 - NFPA 1670	- NFPA 1981 - NFPA 1982 - NFPA 1983 - CAN/CSA-Z94.4 - CAN/CSA-Z180.1



#### APPENDIX 4 (continued)

BNQ 1923-030	<i>Structural Firefighting – Protective Garments</i>
BNQ 1923-410	<i>Firefighting – Protective Helmets</i>
BNQ 1923-500	<i>Protective Boots Used to Fight Building Fires</i>
BNQ 1923-750	<i>Protective Gloves Used to Fight Building Fires</i>
CAN/CSA-Z94.4	<i>Choice, Maintenance and Operation of Breathing Apparatuses</i>
CAN/CSA-Z180.1	<i>Air comprimé respirable: production et distribution</i>
NFPA 471	<i>Responding to Hazardous Materials Incidents</i>
NFPA 472	<i>Standard for Professional Competence of Responders to Hazardous Materials Incidents, 1997 Edition</i>
NFPA 1006	<i>Rescue Technician Professional Qualifications</i>
NFPA 1221	<i>Installation, Maintenance and Use of Emergency Services Communications Systems</i>
NFPA 1500	<i>Standard on Fire Department Occupational Safety and Health Program</i>
NFPA 1670	<i>Operations and Training for Technical Rescue Incidents</i>
NFPA 1936	<i>Standard on Power Rescue Tool Systems</i>
NFPA 1971	<i>Standard on Protective Ensemble for Structural Fire Fighting</i>
NFPA 1981	<i>Standard on Open-Circuit Self-Contained Breathing Apparatus for Fire Fighters</i>
NFPA 1982	<i>Standard on Personal Alert Safety System (PASS) for Fire Fighters</i>
NFPA 1983	<i>Standard for Fire Service Life Safety Ropes and System Components</i>
NFPA 1991	<i>Standard on Vapor-Protective Suits for Hazardous Chemical Emergencies</i>
NFPA 1992	<i>Standard on Liquid Splash-Protective Suits for Hazardous Chemical Emergencies</i>