



Paper #3

***Risk Assessment and Management in  
Local Government Emergency Planning***

by

James A. Gordon

## ***Risk Assessment and Management in Local Government Emergency Planning***

Mitigation is the first of the four phases identified under *Comprehensive Emergency Management* (CEM) – the others being preparedness, response and recovery. Mitigation is the process by which the impact of potential emergencies may be reduced, deflected or avoided altogether. It is one of the most critical of the four phases of CEM as it involves recognizing hazards and coming to terms with the potential impact.

Of greatest importance are the steps that can be taken to protect facilities and service delivery functions from disruption. This action must be based on a sound understanding of the issue (the hazard) and balanced against the risk of continuing to do business in an exposed setting. This article will outline the steps necessary to mitigate potential emergencies starting with a proper risk assessment to identify hazards and assess ones vulnerability, managing the risk based on the identified exposure(s), educating those affected by the risk and taking preventative steps to avoid being impacted by the identified hazards.

### **The Concept of Risk**

Risk is a concept that every emergency planner must thoroughly comprehend. While it is important to recognize that no activity can be totally immune from risk as it can never be totally eliminated, it usually can be reduced to an acceptable level. The following statement captures the essential elements in dealing with risk:

- risk is the possibility that harm may occur from an identified hazard;
- risk analysis is the process of evaluating the frequency and consequence of the hazard;
- risk control uses methods of reducing the frequency or consequences of a hazard; and,
- risk management is the ongoing process of daily decision-making given the existence of an identified hazard and that all practical and reasonable measures have been taken to minimize any potential impacts it may have<sup>1</sup>.

Risk is more simply described as frequency multiplied by consequence. In terms of emergency planning, risk is the frequency of an identified hazard facing a community and the consequence that may result. It is this basic concept the emergency planner should keep in the forefront of one's mind as the hazard analysis exercises in the remainder of this article are presented. In some cases hazards can be readily addressed to a point where either the likelihood of occurrence is minimized or the impacts ameliorated to a point which is tolerable. In some cases hazards are of a nature where, for various reasons, they cannot be addressed and represent an ongoing imminent threat to the municipality. This is the nature of risk analysis and management as it applies to the mitigation phase of CEM.

## **Objectives**

Mitigation has four objectives: eliminate the hazard, reduce the risk, reduce the consequences and spreading the risk<sup>11</sup>.

### ***Eliminate Hazards***

Emergency planners often add new sections to existing emergency plans to enable responders to deal with new threats. A better course of action, depending upon the risk and potential impact, would be to eliminate the hazard altogether. Some hazards such as earthquakes and tornadoes cannot be eliminated, however, hazards such as toxic waste depots can be relocated, and transportation of dangerous goods can be re-routed. It may be far more practical and cost efficient to eliminate the hazard rather than plan to deal with its impact.

Thus, the emergency planner may find one's self in a position of trying to influence local authorities to deny approval for, or to relocate, certain hazardous facilities. It is important to not only consider existing hazards but to also anticipate incurring or attracting further hazards. These will include hazardous activities and sites, and their associated by-products.

### ***Reduce Risks***

Eliminating some hazards may be impossible, but it may be possible to reduce the risk of an emergency occurring. For example, it is usually impossible to move an airport or change a flight path, but it is possible to be aware of existing standards and steps being taken to reduce the risk of an aircraft crash. Where standards are not being followed or are inadequate, the emergency planner should take steps to ensure that the community is aware of the situation and be proactive in lobbying for support and change.

While experience with actual emergencies can be the most powerful motivator, in many cases it is only after an emergency in another community or country that people become concerned about their own community. The important concept for the emergency planner to keep in mind is that of anticipation: anticipate the risk, examine the standards for risk reduction, and determine the adequacy of standards and enforcement of those standards.

### ***Reduce Consequences***

If a hazard can not be eliminated, and the risks have been reduced to acceptable levels, there are two steps that can be taken in order to reduce the consequences: mitigate the impact, and prepare a response.

For example, if it is impossible to re-route dangerous goods transportation, it may be possible to move critical facilities which are adjacent to the route. This applies both in an injury reduction sense, in that the siting of institutions next to hazardous facilities or routes should be minimized, and in a physical infrastructure sense by being aware of where roads, rail, pipelines and bulk storage converge. The emergency planner should be aware of both potential emergency sources, such as the storage and use of chlorine gas for example, and the siting of new health facilities or schools so that infrastructure required in an emergency response does not become part of the problem.

Plans to respond to such contingencies are then in order and are developed in the preparedness phase of CEM.

### ***Spread Risks***

"Spreading the risk" is an expression usually associated with the insurance industry. Indeed, it may be time for a municipality to work with its insurers to investigate the costs and benefits of retrofitting facilities and infrastructure for earthquakes, flood-proofing and extreme weather, and the effect this would have on the financial stability of the municipality before and after an emergency.

Another approach is to play an active role in planning processes. This applies both proactively, with the emergency planner involved in general municipal planning to identify potentially disastrous situations, and retroactively, as part of public hearings and investigations after an emergency, especially if it is human-caused, when the combination of circumstances is reviewed and the emergency planner may have input to avoid future emergencies.

Community awareness and education are important components in mitigation. When possible, this message should be taken to the public. This however moves emergency planning into the political arena, pushing emergency planners into what, for many, may be an uncomfortable but necessary situation. But for emergency management to be taken seriously, both as a profession and a responsibility, emergency planners must take a more proactive role.

### **Risk Assessment**

A comprehensive risk assessment is fundamental to mitigation and reflects the duality of municipal emergency planning. Not only must the hazards be identified that will impact upon the facilities, service delivery and staff of a municipality, but the impact on the community in general must also be anticipated in order to assess the potential evacuees and casualties that may be generated through various types of emergency. Hence, there is a need to identify the potential hazards facing the community in general, and a need to assess the vulnerability to these hazards by anticipating the type and extent of the impact.

### ***Hazard Identification***

A hazard is considered to be anything which either threatens the residents of a community or the things that they value. In the context of a municipality, a hazard is anything which threatens its facilities, service delivery function, staff, or has the potential to generate a large number of evacuees and casualties.

A basic aspect of emergency planning is to complete a thorough hazard assessment. This may allow the elimination or mitigation of existing hazards, thus possibly avoiding the need to develop response plans to deal with them. Based upon this assessment of the hazards facing a community, the remainder of the emergency plan will specifically identify certain response tactics or retain sufficient flexibility to adapt to a wide variety of hazards.

### **Internal Hazards**

The logical first step in hazard identification is to identify those within the community, jurisdiction or service delivery area. Most hazards fall into two categories: natural hazards, such

as earthquakes, forest fires and windstorms; and technological hazards, such as aircraft crashes, toxic chemical spills and widespread power outages.

While these examples represent the full range of potential internal hazards facing a community, the inclusion of some or all of these will eventually depend upon the budget, information and time available. However, an *all hazards* approach is highly recommended at this stage. Do not discount certain considerations simply because they have not happened or the likelihood is extremely rare: emergencies are extraordinary situations brought on by extraordinary circumstances.

Experts in meteorology, fire fighting, engineering and environmental chemistry should be consulted for guidance on the frequency and severity of certain kinds of events. This should be in addition to local historians or long time residents who may have useful anecdotal information. Where a lack of information or historic record presents itself, the emergency planner may have to develop some possible scenarios to fully develop the possible events and necessary reactions.

The more thought put into this step of the planning process, the more flexible, and hence durable, will be the overall plan. This will eliminate any second-guessing of the emergency plan's ability to deal with potentially any hazard when those extraordinary situations arise.

#### External Hazards

It is foolish for an emergency planner to constrain one's analysis, planning and preparedness to a specific jurisdiction without considering the hazards and planning endeavours of adjacent jurisdictions.

This is an important consideration for municipalities as emergencies occurring in a neighbouring municipality, even if not affecting this municipality directly, may have a significant impact on local resources if expertise and equipment need to be seconded or evacuees need shelter. Mutual aid agreements, common in the police and fire services, may need to be negotiated between a municipality and one or all of its neighbours. If a particular jurisdiction is highly susceptible to large-scale incidents, such as the one which contains a regional airport, it is advisable to coordinate plans for this eventuality.

#### Hazard Inventory

Most emergency plans include some form of hazard description. The simplest form is a list of hazards that local experience and local experts suggest may occur. This method may be faulty as the less frequently or randomly occurring phenomena may not be represented. In keeping with the concept of an all hazards approach, a comprehensive as possible list of hazards should be articulated. The following figure presents a checklist of hazards which may be considered in your community or jurisdiction.

## Inventory of Community Emergency Probability<sup>iii</sup>

Rate the probability of the following events occurring in your community over the next decade according to the following scale:

- 0 - not applicable to my community
- 1 - not probable
- 2 - low probability
- 3 - moderate probability
- 4 - high probability
- 5 - nearly certain

|             |  |
|-------------|--|
| 0 1 2 3 4 5 | AVALANCHE                                  |
| 0 1 2 3 4 5 | BLIZZARD OR MASSIVE SNOWSTORM              |
| 0 1 2 3 4 5 | BOMB THREATS                               |
| 0 1 2 3 4 5 | ACTUAL BOMBING                             |
| 0 1 2 3 4 5 | CHEMICAL CONTAMINATION OR SPILL            |
| 0 1 2 3 4 5 | CIVIL DISOBEDIENCE OR RIOT                 |
| 0 1 2 3 4 5 | DAM RUPTURE                                |
| 0 1 2 3 4 5 | DROUGHT                                    |
| 0 1 2 3 4 5 | EARTHQUAKE                                 |
| 0 1 2 3 4 5 | ELECTRIC POWER BLACKOUT                    |
| 0 1 2 3 4 5 | EPIDEMIC                                   |
| 0 1 2 3 4 5 | MAJOR STRUCTURE FIRE                       |
| 0 1 2 3 4 5 | FLASH FLOOD                                |
| 0 1 2 3 4 5 | FOREST OR BRUSH FIRE                       |
| 0 1 2 3 4 5 | FREEZING ICE STORM                         |
| 0 1 2 3 4 5 | HOSTAGE INCIDENT                           |
| 0 1 2 3 4 5 | HURRICANE FORCE WINDS LOST PERSONS         |
| 0 1 2 3 4 5 | MAJOR FROST AND FREEZE                     |
| 0 1 2 3 4 5 | MAJOR GAS MAIN BREAK                       |
| 0 1 2 3 4 5 | MAJOR HAIL STORM                           |
| 0 1 2 3 4 5 | MAJOR INDUSTRIAL ACCIDENT                  |
| 0 1 2 3 4 5 | MAJOR INFRASTRUCTURE FAILURE OR DISRUPTION |
| 0 1 2 3 4 5 | MAJOR ROAD ACCIDENT                        |
| 0 1 2 3 4 5 | MAJOR SMOG EPISODE                         |
| 0 1 2 3 4 5 | MAJOR WATER MAIN BREAK                     |
| 0 1 2 3 4 5 | MINE EMERGENCY                             |
| 0 1 2 3 4 5 | MUD OR LANDSLIDE OIL SPILL                 |
| 0 1 2 3 4 5 | PIPELINE EXPLOSION                         |
| 0 1 2 3 4 5 | PLANE CRASH IN THE COMMUNITY               |
| 0 1 2 3 4 5 | RADIOLOGICAL ACCIDENT                      |
| 0 1 2 3 4 5 | RIVER FLOOD                                |
| 0 1 2 3 4 5 | SEVERE FOG EPISODE                         |
| 0 1 2 3 4 5 | SHIP EMERGENCY IN HARBOUR OR NEARBY COAST  |
| 0 1 2 3 4 5 | SMALL BOAT LOST OR ACCIDENT                |
| 0 1 2 3 4 5 | SUDDEN WASTE DISPOSAL PROBLEM              |
| 0 1 2 3 4 5 | RAILWAY ACCIDENT                           |
| 0 1 2 3 4 5 | TORNADO                                    |

|             |                                     |
|-------------|-------------------------------------|
| 0 1 2 3 4 5 | TSUNAMI                             |
| 0 1 2 3 4 5 | VOLCANIC ERUPTION OR FALLOUT        |
| 0 1 2 3 4 5 | WATER POLLUTION                     |
| 0 1 2 3 4 5 | • WATERSHED                         |
| 0 1 2 3 4 5 | • WELL CONTAMINATION                |
| 0 1 2 3 4 5 | • OTHER GROUND WATER SOURCES        |
| 0 1 2 3 4 5 | • BACK-UP OF SEWAGE TREATMENT PLANT |
| 0 1 2 3 4 5 | WATER SHORTAGE                      |
| 0 1 2 3 4 5 | OTHER                               |

This list is not inclusive of all possible emergencies but is meant to serve as a first step in identifying community threats.

### ***Vulnerability Analysis***

Vulnerability analysis is an assessment of the impact that given hazards may have not only on your community, but on your emergency response system as well. Each hazard has a particular type of impact on a community and the response mechanisms. For example, floods limit mobility while windstorms render communication systems inoperable and chemical-leaks can produce mass casualties. Not only must a municipality be aware of how each hazard will impact their facilities, service delivery and staff, but also the potential for generating casualties from the emergency and the constraints placed on responders due to the nature of the event.

### **Impact Assessment**

Understanding the potential hazards and associated risks in a community is important and to determine the priorities in addressing these hazards it is necessary to consider the possible impact of each.

There are four types of impacts: social, environmental, economic and political<sup>iv</sup>. Social impacts are factors such as the numbers of deaths and injuries resulting from a particular hazard. Other social impacts to be considered are the loss of existing housing, disruption of education and the loss of critical facilities and irreplaceable or difficult to replace equipment. Environmental impacts include the effect of a hazard on air and water quality. The effect on existing wildlife and vegetation also warrant consideration. Economic impacts would include structural and non-structural damage, loss of infrastructure, loss of transportation centres, and the temporary loss of jobs. Political impact is reflected by public perception of blame, or the degree to which local officials are held responsible for the occurrence and response to the emergency.

In addition to these *types* of impacts, the emergency planner must consider the components, or *systems*, the impacts bear upon and possibly alter. These are: regulatory, human, building and business<sup>v</sup>. The nature of the regulatory environment, either within the municipality or from outside bodies, may change in the aftermath of an emergency. This is particularly true in hospital and public health areas where more stringent measures may be necessary in such conditions. Also, senior levels of government may become involved if a significant event has occurred.

The human environment will certainly have changed after such an event. Contrary to popular perception, widespread panic is not common after major emergencies. Rather, the reality will be

people in shock and concerned for their families. It may be difficult to have people on the job focus on their duties or to have people report to work if the event occurred while they were at home. In addition, in the case of a significant event, the apparently insurmountable job of cleaning up and carrying on with business may affect the performance of administrative staff. Critical Incident Stress Debriefings (CISD) will most likely be necessary in major events and need to be anticipated.

The physical infrastructure of the work environment may be impacted and necessitate a change of venue. Alternate locations and proper seismic evaluations must be part of a comprehensive plan.

Finally, the business environment will be impacted. In local government, this equates to overburdened resources. This will involve a crisis management team practiced in this type of management. This activity may detract from other routine but necessary business functions of the municipality.

#### Ethnic and Cultural Considerations

Many recent immigrants may have difficulty understanding the commonly spoken language of the community and have trouble assimilating pre-emergency education efforts, understanding orders to evacuate, following emergency procedures and seeking appropriate medical aid. In addition, they may not understand or assimilate hazard information and emergency preparedness material.

Ethnic minorities are often unaware of programs for financial, emotional and medical assistance following an emergency. The inability of minorities to get aid means there is a longer period of economic recovery and that may mean a long-term decline in the quality of life. Those persons with the highest damage report high loss levels, and they receive the most aid, but those with the littlest to lose and, thus, the lowest financial losses are often the most in need.

Given the added risks that are associated with belonging to an ethnic or cultural minority, it is important that emergency planners work with ethnic groups in their communities to ensure the adequate provision of basic humanitarian services following an emergency.

#### Risk Management

Risk management is the corollary of risk assessment. Whereas risk assessment is the identification of hazards and their potential impact on a community, risk management is the weighing of the probabilities of an activity or activities leading to a consequence which has a negative impact on a community. In other words, it is the balance of continuing to do business "as is" versus taking potentially costly and inconvenient steps to mitigate a hazard.

The formally defined purpose of risk management is "to provide a systematic tool for anticipating potential losses to an organization, and for selecting the most effective means of reducing losses.<sup>vi</sup>" In its broadest sense, risk management deals with four types of losses<sup>vii</sup>:



- Personnel Losses - loss of the services of key people due to sickness, injury or death. Personnel losses affect the efficiency of your operation, especially where you count on someone who has unique skills or knowledge to help you meet your objectives.
- Property Losses - any tangible property, such as equipment, supplies or facilities belonging to an organization that is lost due to accidental events. Property losses may involve theft, physical damage from carelessness or a natural or human-caused emergency.
- Expenses - additional costs incurred due to an accident such as supplementary staff, additional supplies or transportation costs. These losses account for extra expenses that would not have arisen without the emergency.
- Liability Losses - this category includes the personnel, property or expense losses of others outside the organization due to the alleged wrongful acts of an organization's agents. Any expenses incurred to defend or administer a claim are liability losses.

Therefore, the most commonly articulated objectives of risk management are:

- to ensure personnel safety;
- to reduce losses of supplies and facilities;
- to reduce negligence by staff; and
- to minimize public risk.

These objectives should be kept in mind during mitigation activities, and risk management activities in particular. These may help guide what hazards must be mitigated and which can be "risk managed." Once again, the emergency planner must not forget the duality of this function as not only is the protection of facilities, staff and service delivery important, but also preventing the exposure of the general public to an unacceptable risk is equally important.

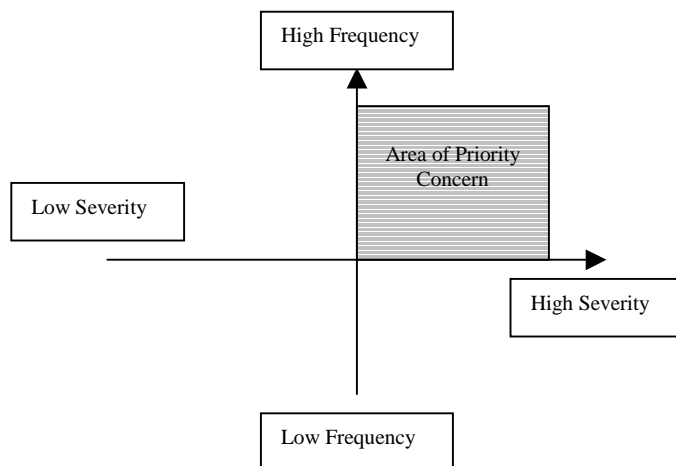
Five simple principles of risk management will help make this aspect of mitigation easier to integrate<sup>viii</sup>. These are: be professional, be thorough, be prepared, keep a record and talk with people. Acting in an appropriate and competent manner, being thorough in your task, preparing for questioning and criticism, maintaining accurate records of activities and decisions, and talking with people to share your concern over minimizing exposure to risks will assist in making risk management an effective part of emergency mitigation.

The five steps in risk management are identifying exposures, examining risk management techniques, selecting a technique, implementation and monitoring<sup>ix</sup>.

### ***Identify Exposures***

An exposure is a threat, such as the hazards identified in an earlier stage of the planning process. In addition, it can include liability exposure arising from statutory obligations and other acts such as the Workplace Hazardous Materials Information System (WHMIS). The actions required under this step are largely done in the earlier Hazard Identification section of Risk Assessment.

## Priority Area for Risk Management Action<sup>x</sup>



This figure shows where the greatest concern should be placed based on the frequency and severity of exposures (hazards).

### ***Examine Risk Management Techniques***

There are two general approaches to manage risk: focus on control measures to minimize potential losses, known as *risk control*; and *risk financing* which accepts the exposure and pays for actual losses after the event by either retention, where the organization assumes financial responsibility, or through commercial insurance. Clearly, risk control is the most responsible option for a public body such as a municipality.

Risk control techniques attempt to reduce the probability and consequences of accidental losses. There are five common risk control techniques: exposure avoidance, loss prevention, loss reduction, segregation of exposures and contractual transfer.

#### Exposure Avoidance

The best way to reduce exposure to risk is to stop the risky activity. This would entail stopping certain activities altogether and implies an option for discretionary activities. This is not an option for mandated functions.

From a facilities perspective, siting of proposed facilities should be given careful thought to ensure risks to the building and staff are eliminated. From a public health perspective, certain post-emergency epidemiological concerns may be eliminated by taking proactive steps to eliminate certain contributing factors. The objective is to reduce the probability of risk to zero.

#### Loss Prevention

Loss prevention also attempts to reduce the probability of risk but not as ambitiously as exposure avoidance. Loss prevention focuses on reducing the loss frequency and not the severity. Minimizing the number of times a risky activity is undertaken, or the exposure of facilities, staff or service delivery functions to a risk, will reduce the probability of a loss occurring.

### Loss Reduction

Loss reduction focuses on the severity of the impact when loss prevention has failed. This would involve well thought out plans for moving to alternate locations should a facility be impacted by an emergency, the off-site storage of back-up records, or mutual aid plans for calling on neighbouring municipalities. Real reduction of the impact depends upon such ameliorating actions taking place almost automatically after an event.

### Segregation of Exposures

Segregation of exposures naturally follows from loss reduction with two options: segregate supplies, service delivery function or management operations to a number of locations to minimize the probability of one event at one facility from becoming a catastrophe; or duplication of supplies and service delivery capability.

Segregation would imply a certain degree of inefficiency in an organization and travel time and cost, whereas duplication implies an added expense in duplicate material and time in cross-training staff.

### Contractual Transfers

This technique involves transferring some or all of one's function to a contractor who accepts the risk exposure. Clearly, this is not an option for a municipality for the majority of its mandated functions. However, it is something that should be specifically articulated in routine contracts involving some risk exposure such as gas and hazardous chemical delivery and hazardous material disposal.

### ***Select Best Techniques***

Selecting the apparent best risk management alternative means selecting the most workable techniques based on four criteria: technical feasibility, financial constraints, legal requirements, and humanitarian considerations.

Technical feasibility simply involves matching the technical needs of facilities, management or the planning process to the method and outcome of a particular technique. Financial constraints are perhaps the most significant in their impact on the choice of technique. Implementation and management of the techniques must be financially feasible but consideration must also be given to the long-term financial perspective. Cost-benefits studies may be undertaken to assess all aspects of a chosen technique. Legal criteria are important to municipalities to ensure that all aspects of their mandate are met and that all operations are within statutory parameters. Finally, humanitarian concerns address the human factor in risk control: the saving of lives is fundamental to risk control, mitigation and emergency planning.

### ***Implement the Selected Technique(s)***

Risk control techniques must be implemented to be effective. There are two dimensions to such implementation: technical and managerial. Technical considerations are the most significant and include input from a wide variety of technical experts, such as architects, engineers, geologists, medical doctors and public health professionals. Management considerations provide for the implementation strategies and foster the cultural change within the organization to enable successful transition.

### ***Monitor and Revise Approach***

The word "apparent" was used in the section on selecting the "apparent" best alternative technique. This is because one cannot be certain of the choice made unless monitoring of the selected criteria occurs.

Ongoing monitoring to observe the correct fit of the chosen technique and the success of the implementation is important to achieving the goal of successful risk control. It should not be assumed that once implemented, the risk control technique looks after itself. Risk control is dynamic as is the operating environment of the organization. Changes to the program may have to be made which might even include adopting a new control technique. In this way, the risk management program will remain current and relevant to the organization.

### **Risk Communication**

Risk assessment and risk management activities must be communicated to staff and the public. Efforts made in education and prevention may ease the subsequent CEM tasks of preparedness, response and recovery.

### ***Education***

The emergency planner should now have an understanding that communication of hazards and the education of staff, management and the public is an important element in hazard mitigation. The sharing of information is the least costly and the most effective form of emergency mitigation. Such simple actions may help save lives by preparing both municipal staff and the public for potential emergencies.

Two main elements emerge under education which, again, reflect the duality of the municipality's function: apprise staff of likely scenarios, the steps taken to mitigate those hazards and how to survive the eventuality of an emergency; and educate the public about likely hazards and the public health threats in the post-event period, including the availability of health care facilities, and what they can do to avoid becoming a victim, such as treating water and having personal/family emergency kits available. Taking the message to these target groups in a proactive fashion will help make the jobs of responding and recovering from an emergency a much easier.

### ***Prevention***

Prevention has been alluded to in earlier sections of this article, namely as risk control techniques: exposure avoidance and loss prevention. It is worth briefly reiterating as a principle at the close of a discussion on mitigation.

If a potential emergency can be avoided altogether or the exposure to being impacted by a possible emergency can be reduced, time invested in these activities will be seldom wasted. Any effort at prevention becomes magnified in the chain of events which lead up to an emergency. The lives saved and liability litigation which is avoided may save an organization from possible dire consequences in the future. The same logic applies to costs of preventative actions. Cost incurred in moving facilities, where possible, or retrofitting buildings and infrastructure will prevent interruption of critical service delivery relied upon in the response and recovery phases during and after an emergency. Also, contributing to moving a hazard or applying pressure to

local officials to not locate hazards near critical infrastructure are important elements of prevention.

Risk must be anticipated and existing standards for risk reduction must be examined. The adequacy of these standards and their enforcement must be thoroughly assessed. Where such standards are lacking within the municipality, it behooves the emergency planner to take corrective action and institute standards. Such standards must be simple and achievable.

Where possible, the emergency planner should be actively involved in prevention measures. Such activities have proven extremely productive in other areas such as fire services and transportation safety. Prevention activities will make the three remaining phases of CEM, preparedness, response and recovery, that much easier if all possible action has been taken to avoid unnecessary risk.

---

<sup>i</sup> Modified from the Major Industrial Accidents Council of Canada Basic Risk Assessment Course 1996, pp. 32-33.

<sup>ii</sup> Laughy, L. 1990. A Planner's Handbook for Emergency Preparedness. Vancouver: UBC Centre for Human Settlements.

<sup>iii</sup> Modified from B.C. Provincial Emergency Program original source.

<sup>iv</sup> Laughy, *supra*.

<sup>v</sup> Perry, L.G. 1994. *Preparing for an Emergency: A Step-by-Step Approach*. Disaster Recovery Journal. Oct/Nov/Dec.

<sup>vi</sup> British Columbia Ministry of Forests. 1990. S-411 Risk Management.

<sup>vii</sup> *ibid.*

<sup>viii</sup> *ibid.*

<sup>ix</sup> *ibid.*

<sup>x</sup> *ibid.*