

March 2014

## CATASTROPHIC EARTHQUAKE PREPAREDNESS

[www.bcauditor.com](http://www.bcauditor.com)



OFFICE OF THE  
**Auditor General**  
of British Columbia



OFFICE OF THE  
**Auditor General**  
of British Columbia

8 Bastion Square  
Victoria, British Columbia  
Canada V8V 1X4  
Telephone: 250-419-6100  
Facsimile: 250-387-1230  
Website: [www.bcauditor.com](http://www.bcauditor.com)

The Honourable Linda Reid  
Speaker of the Legislative Assembly  
Province of British Columbia  
Parliament Buildings  
Victoria, British Columbia  
V8V 1X4

Dear Madame Speaker:

I have the honour to transmit to the Legislative Assembly of British Columbia my *Catastrophic Earthquake Preparedness* report.

We conducted the audit in accordance with Section 11(8) of the *Auditor General Act* and the standards for assurance engagement established by the Canadian Institute of Chartered Accountants.

My Office first looked at this topic 17 years ago in our [Earthquake Preparedness](#) report and arrived at the same conclusion. Progress has been made in some areas over this intervening period, but overall, the province is still at a significant risk if a catastrophic earthquake were to occur today.

One of the main causes for this lack of progress is that preparing for a catastrophic earthquake has not been made a priority. Since my Office's report in 1997, successive governments have decided to allocate scarce public resources to meet more immediate pressing demands, rather than to adequately prepare the province for a catastrophic earthquake that may or may not occur. As a result, Emergency Management BC (EMBC), the government organization tasked with leading the Province's response to a catastrophic earthquake, has not fulfilled this part of its mandate.

We concluded that EMBC cannot demonstrate that it is adequately prepared to manage the effects of a catastrophic earthquake and it is not reporting publicly on the Province's preparedness.

While the recommendations from this audit are directed at EMBC, I urge all readers of this report to look at their own situation and ask themselves whether they are ready and if they have done everything they should to prepare themselves, their families, and their communities for an earthquake.

I would also like to take this opportunity to express my appreciation to EMBC and Ministry of Justice staff for their cooperation during this audit.

Russ Jones, MBA, CA  
Auditor General  
Victoria, British Columbia  
March 2014

# TABLE OF CONTENTS

---

<b>Auditor General’s Comments</b>	4
<b>Executive Summary</b>	6
<b>Summary of Recommendations</b>	8
<b>Response from the Ministry of Justice</b>	9
<b>Detailed Report</b>	12
<i>Background</i>	12
<i>Audit Objectives and Scope</i>	16
<i>Audit Conclusion</i>	17
<i>Key Findings and Recommendations</i>	17
<b>Looking Ahead</b>	34
<b>Appendix A: Types of Earthquakes in the Cascadia Subduction Zone</b>	35
<b>Appendix B: Earthquake statistics</b>	36
<b>Appendix C: Summary of recommendations - OAG’s 1997 report</b>	37
<b>Appendix D: Summary of recommendations - Select Standing Committee on Public Accounts 1999 report</b>	41

**EMERGENCY MANAGEMENT BC (EMBC)** is not adequately prepared for a catastrophic earthquake. This came as a surprise given that my Office first looked at this topic 17 years ago in our *Earthquake Preparedness* report and arrived at the same conclusion. Progress has been made in some areas over this intervening period, but overall, the province is still at a significant risk if a catastrophic earthquake were to occur today.

One of the main causes for this lack of progress is that preparing for a catastrophic earthquake has not been made a priority. Since this Office's report in 1997, successive governments have decided to allocate scarce public resources to meet more immediate pressing demands, rather than to adequately prepare the province for a catastrophic earthquake that may or may not occur. As a result, EMBC, the government organization tasked with leading the Province's response to a catastrophic earthquake, has not fulfilled this part of its mandate.

EMBC staff has demonstrated great dedication in attempting to meet the competing demands of its broad mandate, which includes coordinating government's response to floods, fires, avalanches, and other emergencies throughout the year. In 2013, EMBC responded to approximately 6,000 incidents related to dangerous goods spills, search and rescue events, major floods, fires, landslides, and avalanches. However, given the frequency and demands of these "regular" emergencies, catastrophic earthquake planning has become a lesser priority within EMBC.

While government has stated that it is committed to providing a world-class response to British Columbians, EMBC is still not adequately prepared for a catastrophic earthquake. Furthermore, this lack of preparedness has not been publicly disclosed. Public reporting on EMBC's level of preparedness is necessary to allow individuals, organizations and local and federal governments to make informed decisions on what they need to do to be prepared. Two recent studies have identified that the effects of a catastrophic earthquake in the southwest region of BC could be far more devastating than previously estimated. This makes EMBC's preparedness and public reporting even more important.

Preparing for a catastrophic earthquake is a shared responsibility. Local and federal governments, industry, non-profit organizations, and individuals living in earthquake zones all have important roles and responsibilities and need to be prepared. Given the Province's current level of preparedness, a sustained commitment by all stakeholders is needed if we are going to minimize the loss of life and other devastating impacts expected from a catastrophic earthquake. While



**RUSS JONES, MBA, CA**  
*Auditor General*

## AUDIT TEAM

Malcolm Gaston  
*Deputy Auditor General*

Paul Nyquist  
*Director*

Ardice Todosichuk  
*Manager*

Evan Machin  
*Assistant Manager*

Tanya Wood  
*Analyst*

the recommendations from this audit are directed at EMBC, I urge all readers of this report to look at their own situation and ask themselves whether they are ready and if they have done everything they should to prepare themselves, their families, and their communities for an earthquake.

I would also like to take this opportunity to express my appreciation to EMBC and Ministry of Justice staff for their cooperation during this audit.

A handwritten signature in blue ink that reads "Russ Jones". The signature is written in a cursive style.

Russ Jones, MBA, CA  
Auditor General  
March 2014

**IN RECENT YEARS,** catastrophic earthquakes and tsunamis have occurred in many regions of the world, particularly in the Pacific Rim region wherein British Columbia (BC) lies. The devastating human and economic impacts resulting from these seismic events will require years, and in some cases, decades of recovery.

In BC, the majority of the population resides in an earthquake hazard area. Annually, a few thousand earthquakes occur in and adjacent to BC. According to experts, an earthquake capable of causing structural damage can be expected to occur somewhere in the province about once every 10 years. These earthquakes are large enough to cause significant damage if they occur in a highly populated area.

“Catastrophic” earthquakes are much less frequent, but are capable of resulting in a high number of injuries, casualties, and extensive infrastructure damage. A recent report by the Insurance Bureau of Canada estimates that if such an earthquake were to occur off the densely populated south coast of the province and be followed by a tsunami, damages and losses could amount to nearly \$75 billion. Experts have recently estimated a 12% probability of a catastrophic earthquake affecting BC in the next 50 years.

No jurisdiction in the world can be fully prepared to manage all the effects from a catastrophic earthquake. However, some level of preparedness must be achieved to reasonably protect the population, infrastructure and economy of the province and the country from the predicted impacts of such an event. It takes a conscious decision by government, along with a long-term commitment and the capacity to achieve a predetermined, desired level of preparedness.

The provincial government has charged Emergency Management BC (EMBC), within the Ministry of Justice, with preparing and leading the provincial government’s response to such an event. In 1997, we carried out our first audit on this topic which assessed the degree to which governments in British Columbia were carrying out the four pillar approach to emergency management: mitigation/prevention, preparation, response and recovery. For this current audit, we focused exclusively on EMBC’s preparedness activities and not on other provincial ministries or local governments. We developed our criteria and expectations anticipating that in the intervening 17 years, EMBC had sufficient time to significantly improve its level of preparedness. We also expected EMBC to be reporting to the public and the Legislative Assembly about the state of readiness it has achieved in this time, and the state that it is working towards.

We carried out this audit to answer the following questions:

1. Can EMBC demonstrate that it is prepared to manage the effects of a catastrophic earthquake?
2. Is EMBC publicly reporting on the Province’s preparedness for a catastrophic earthquake?

We concluded that EMBC cannot demonstrate that it is adequately prepared to manage the effects of a catastrophic earthquake and it is not reporting publicly on the Province's preparedness.

Catastrophic earthquake planning has not been made a priority by government or EMBC. Funding the planning work for a catastrophic earthquake that may or may not occur in the short-term competes with funding requests for more immediate needs, such as health care and public education. EMBC's current operating budget for emergency activities is about the same as it was in 2006, despite the increases in BC's population, the near doubling of BC's property values and knowledge of the devastating impact of recent earthquakes in Chile, Japan and New Zealand.

Many of EMBC's deficiencies in its earthquake response capabilities were highlighted in their 2012 response to a potential tsunami in Haida Gwaii. EMBC's internal report on this incident found that EMBC did not have sufficient personnel with the experience, knowledge and training to effectively respond to an earthquake and tsunami event, and their standard operation procedures were inadequate. EMBC is concerned that without additional resources and program enhancements communities will continue to be at risk.

Planning for a catastrophic earthquake is challenging for EMBC staff given the organization's mandate and capacity issues. EMBC's mandate is very broad and day-to-day emergencies such as floods and fires consume the majority of staff time. Furthermore, EMBC is lacking critical positions, such as a logistic planner, which constrains the organization's ability to deliver on its catastrophic earthquake mandate. That said, EMBC could improve its catastrophic earthquake planning by applying a more rigorous management framework to identify and help achieve its desired results.

The Province's response to a catastrophic earthquake will depend largely on the effectiveness of the plans and procedures that EMBC and other stakeholders have in place and how well they are implemented. Our audit identified a number of areas that require attention. We found that EMBC's hazard, risk and vulnerability analysis is not sufficiently detailed or up-to-date and that EMBC's plans and procedures do not consistently reflect best practices. We also found that EMBC's catastrophic earthquake training, exercise and public education programs are inadequate. EMBC's plans and procedures do not clearly describe all the actions that the Minister may need to undertake in a provincial state of emergency. Furthermore, we found that EMBC is not adequately monitoring stakeholder readiness and capacity and is not adequately ensuring that all the various stakeholder plans are integrated into a coordinated provincial response. Finally, we concluded that neither EMBC, nor the ministry it resides within, the Ministry of Justice, report publicly on the state of catastrophic earthquake preparedness in the province.

EMBC is not adequately prepared for a catastrophic earthquake; however, this information has not been made public. As a result, individuals and other key stakeholders do not have sufficient information to understand fully the risks they are facing or to determine the resulting level of preparedness that they must achieve to protect themselves, their families and their communities.

## PROVINCIAL GOVERNMENT RECOMMENDATIONS

### WE RECOMMEND THAT:

- 1** government develop long-term goals for catastrophic earthquake preparedness, including the level of preparedness it expects EMBC to achieve in the next 5, 10 and 15 years.
- 2** government ensures EMBC has the capacity necessary to address identified critical gaps and achieve government's expected level of preparedness.

## EMERGENCY MANAGEMENT BC RECOMMENDATIONS

### WE RECOMMEND THAT:

- 3** EMBC develop a strategic plan to meet the Province's long-term goals. The plan should clearly demonstrate how EMBC will evaluate the effectiveness of its activities against its goals.
- 4** EMBC identify, rank and prioritize completion of its own key plans and procedures to ensure it meets its mandate to prepare and respond to a catastrophic earthquake.
- 5** EMBC regularly review its earthquake program to identify significant gaps and risks to a coordinated and integrated response, and develop actions to address them.
- 6** EMBC regularly review and evaluate its stakeholders' emergency plans and procedures to assess stakeholder readiness and capacity.
- 7** EMBC conduct regular catastrophic earthquake exercises with its stakeholders to ensure it can deliver an effective, comprehensive and integrated government-wide response to a catastrophic earthquake.
- 8** EMBC measure the effectiveness of its public preparedness initiatives at regular intervals.
- 9** EMBC report annually to British Columbians on the state of its catastrophic earthquake preparedness. The report should include an assessment of the overall state of earthquake preparedness, risks and capacity, and describe the plans and achievements of the Inter-Agency Emergency Preparedness Council (IEPC).

**THE MINISTRY OF JUSTICE** acknowledges the conscientious and thorough work carried out by the audit team during its review of Emergency Management British Columbia's (EMBC) preparedness for a catastrophic earthquake and would like to acknowledge the efforts of the people, both inside and outside of the ministry, who have been involved with this review.

The Auditor General has recognized that preparing for a catastrophic earthquake is a shared responsibility. EMBC accepts its key role in this regard. Staff are continually working with local governments, regional districts, provincial ministries, Crown agencies, volunteers, non-governmental organizations, the Federal Government, First Nations and governments from other jurisdictions, to ensure that BC is well prepared to respond to a catastrophic event.

The ministry and EMBC accept the Auditor General's findings regarding catastrophic earthquake preparedness.

As a leader in the province's emergency management services, EMBC must balance the need to respond to immediate emergencies, including fire, flooding, avalanches, spills and landslides, with its mandate to ensure preparedness for a catastrophic incident of provincial significance. EMBC responded to approximately 6,000 such emergencies in 2013 alone. These types of events contribute to learning that is applied to EMBC's evolving catastrophic event preparedness.

Immediate actions are being taken to address many of the key issues identified by the audit. Furthermore, a long-term plan for catastrophic earthquake preparedness is being developed that will ultimately address all of the findings contained in this report.

In responding to the audit report, the ministry has grouped some of the related recommendations. The first two recommendations of the Auditor General are directed to the Provincial Government. With respect to these recommendations, Emergency Management BC will work with its colleagues across government to ensure that appropriate actions are taken.

**RECOMMENDATION 1:** *We recommend that the government develop long-term goals for catastrophic earthquake preparedness, including the level of preparedness it expects EMBC to achieve in the next 5, 10, and 15 years.*

EMBC will develop a long-term plan that articulates provincial goals regarding catastrophic earthquake preparedness, and a phased approach for achieving these goals.

**RECOMMENDATION 2:** *We recommend that the government ensures EMBC has the capacity necessary to address identified critical gaps and achieve government's expected level of preparedness.*

EMBC will continue to use its existing resources as efficiently and effectively as possible. At the same time, it will continue to work with partner agencies and stakeholders to promote alignment of efforts. The ministry will embark on a consultative review with other partners to ensure that a more complete understanding of overall stakeholder preparedness is achieved.

**RECOMMENDATION 3:** *We recommend that EMBC develop a strategic plan to meet the Province's long-term goals. The plan should clearly demonstrate how EMBC will evaluate the effectiveness of its activities against its goals.*

**RECOMMENDATION 4:** *We recommend that EMBC identify, rank and prioritize completion of its own key plans and procedures to meet its mandate to prepare and respond to a catastrophic earthquake.*

The spring 2014 update to EMBC's overall strategic plan will identify preparation for catastrophic seismic events as a priority. Further, EMBC's long-term plan for catastrophic earthquake preparedness, will include goals, prioritized activities and an evaluation framework to assess how those goals are being achieved.

**RECOMMENDATION 5:** *We recommend that EMBC regularly review its earthquake program to identify significant gaps and risks to a coordinated and integrated response, and develop actions to address them.*

A key element of EMBC's long-term plan for catastrophic earthquake preparedness will be regular assessment of risks, gaps, and opportunities for program improvement.

**RECOMMENDATION 6:** *We recommend that EMBC regularly review and evaluate its stakeholders' plans and procedures to assess stakeholder readiness and capacity.*

The ministry will formally engage with stakeholders to determine what processes would be most effective to promote mutual awareness and alignment of plans and capacities. This will be part of the ministry's consultative review.

**RECOMMENDATION 7:** *We recommend that EMBC conduct regular catastrophic earthquake exercises with stakeholders to ensure an effective, comprehensive and integrated government-wide response to a catastrophic earthquake.*

The catastrophic earthquake preparedness plan that is referenced in other responses will include regular earthquake exercises with stakeholders. This plan will adopt a measured and progressive approach, characterized by appropriately phased increases in exercise scope and complexity.

**RECOMMENDATION 8:** *We recommend that EMBC measure the effectiveness of public preparedness initiatives at regular intervals.*

EMBC's long-term plan for catastrophic earthquake preparedness will include public education activities and monitoring of these activities. In addition to ongoing public education efforts, a focused campaign will be conducted to bridge gaps in knowledge and encourage behaviour that will improve the province's overall resiliency.

---

**RECOMMENDATION 9:** *We recommend that EMBC report annually to British Columbians on the state of earthquake preparedness including an assessment of the overall state of earthquake preparedness, risk and capacity, and describe the plans and achievements of the Inter-Agency Emergency Preparedness Council (IEPC).*

EMBC's long-term plan for catastrophic earthquake preparedness will include an annual report to British Columbians. This will provide an opportunity to keep emergency preparedness at the forefront of priorities for individuals, families, stakeholders and government partners.

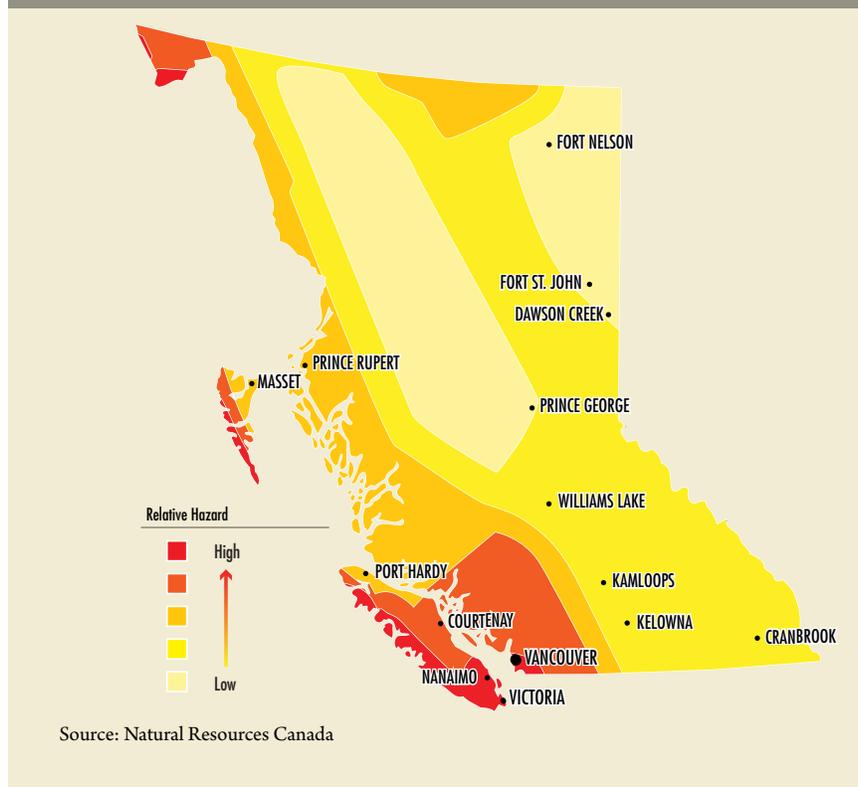
## BACKGROUND

In recent years, destructive earthquakes and tsunamis have occurred in many regions of the world. The devastating human impact and economic loss resulting from these seismic events means years, and in some cases, decades of recovery (see Exhibit 1).

### The majority of BC's population lives in a highly active earthquake zone

Southwestern British Columbia is situated in the Pacific Ring of Fire, an area where some of the world's largest earthquakes occur. Most of the areas at highest risk in the province are also the areas with the highest population density (see Exhibit 2).

Exhibit 2: Earthquake hazard map



Every year, a few thousand earthquakes occur in and adjacent to BC, but most result in little or no damage. According to experts, however, an earthquake capable of causing structural damage can be expected to occur somewhere in the province about once every 10 years.

Exhibit 1: The destructive power of earthquakes



Debris crushed a car outside the Christchurch Catholic Cathedral after a 6.3-magnitude earthquake hit Christchurch, New Zealand, Feb. 22, 2011.

Source: New Zealand Press Association

Catastrophic earthquakes are less frequent but would result in a high number of casualties and evacuees. In this category of earthquake, response capabilities and resources of the local governments will likely be overwhelmed, life saving support from outside the area will be required, and the event would likely have long-term impacts within the incident area as well as, to a lesser extent, on the nation (see Exhibit 3).

**Exhibit 3:** Effects of earthquakes of varying strengths

Category	Effects	Richter Scale
I. Instrumental	Not felt	1-2
II. Just Perceptible	Felt by only a few people on upper floors of tall buildings	3
III. Slight	Felt by people lying down, seated on hard surfaces, or in the upper floors of tall buildings	3.5
IV. Perceptible	Felt indoors by many, by few outside, and windows rattle	4
V. Rather Strong	Generally felt by everyone; sleeping people may be awakened	4.5
VI. Strong	Trees sway, chandeliers swing, bells ring, some damage from falling objects	5
VII. Very Strong	General alarm; walls and plaster crack	5.5
VIII. Destructive	Felt in moving vehicles; chimneys collapse; poorly constructed buildings seriously damaged	6
IX. Ruinous	Some houses collapse; pipes break	6.5
X. Disastrous	Obvious ground cracks; railroad tracks bent; some landslides on steep hills	7
XI. Very Disastrous	Few buildings survive; bridges damaged or destroyed; all services interrupted (electrical, water, sewage, railroad); severe landslides	7.5
XII. Catastrophic	Total destruction; objects thrown into the air; river courses and topography altered	8

Source: SMSTsunamiWarning.com

The strength of an earthquake does not necessarily equate to the corresponding effects shown in Exhibit 3. For example, the 2012 Haida Gwaii earthquake was a magnitude 7.7; yet, there was little damage associated with this earthquake. However, the 2011 earthquake in New Zealand was a magnitude 6.3 and it resulted in 183 deaths and approximately \$35 billion in economic loss due to the close proximity of the earthquake’s epicentre to Christchurch. The damage that occurs is also related to the type of earthquake that can occur. BC’s earthquake profile includes three types of earthquakes: mega-thrust, deep-focus and shallow-focus. Each of these types creates a different pattern of damage (See [Appendix A](#) for more details).

March 27, 2014 marks the 50th anniversary of the 9.2 magnitude “Great Alaskan Earthquake”, one of the largest earthquakes recorded in recent history. Energy released from an earthquake of this magnitude is equivalent to the explosion of over 1,800 megatons of TNT or over 30,000 combined Hiroshima-Nagasaki atomic bombs (See [Appendix B](#) for other recorded earthquakes).

That 1964 mega-thrust quake triggered a powerful tsunami that resulted in structural damage and human casualties as it travelled down the North American coast and west to Japan. Locally, the tsunami seriously impacted the west coast of Vancouver Island. At least four waves hit Port Alberni, washing away 55 homes and damaging 375 others. Surprisingly, no deaths were reported in BC, but damage in the province was estimated at over \$60 million in current dollars (see Exhibit 4).

Experts estimate there is a 12% probability of a similar catastrophic earthquake and tsunami affecting BC in the next 50 years. A recent report by the Insurance Bureau of Canada estimates that if such an earthquake were to occur off the south coast of the province and be followed by a tsunami, damages and losses could amount to nearly \$75 billion.

As populations and infrastructure continue to grow in these earthquake vulnerable areas of BC, the severity of the economic impacts – in addition to the serious potential for loss of life – will only increase.

## Emergency management is a shared responsibility

Emergency management in BC is a shared responsibility and is founded on an escalating response model (see Exhibit 5).

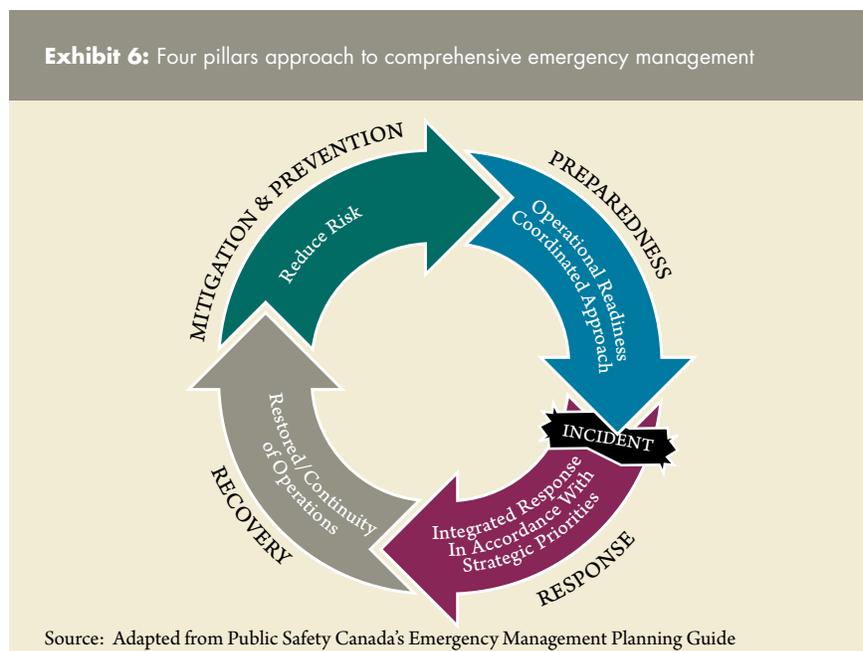
- ◆ At the basic level, individuals are responsible for taking actions to protect themselves.
- ◆ When an emergency extends beyond individual capabilities, local authorities are expected to lead the response, with regional coordination necessary where impacts are multi-jurisdictional.
- ◆ When local authorities are overwhelmed, the provincial government needs to take a strong leadership role to mitigate the effects of the emergency. In this situation, the Province will be responsible for acquiring and deploying the necessary resources to help affected areas and for coordinating and leading a multiple agency response to meet established provincial priorities.
- ◆ Finally, if the provincial government requires resources beyond its own capacity, it can ask the federal government or other jurisdictions for assistance.



## Provincial roles and responsibilities during a catastrophic earthquake

In BC, emergency management is based on four interconnected areas of responsibility (“pillars”)(See Exhibit 6):

1. mitigation and prevention;
2. preparedness;
3. response; and
4. recovery.



The authority and responsibility for three of these areas is established in the *Emergency Program Act* and the *Emergency Program Management Regulation*. The fourth area, mitigation and prevention, is currently not recognized in the Act. The Provincial Emergency Program (PEP) is the agency charged with meeting the requirements set out in the Act and Regulation which includes creating provincial emergency plans and responding to or alleviating the effects of an emergency or disaster.

In 2006, the responsibilities of PEP were folded into Emergency Management BC (EMBC). EMBC is also the coordinating agency for the provincial government’s emergency management activities and includes the duties for the Provincial Emergency Program, the Office of the Fire Commissioner and the Coroners Service. The vision of EMBC is to ensure public safety and save lives through excellence in emergency management leadership.

The diversity of BC’s climate and geography creates a number of natural hazards including earthquakes, blizzards, wildfires, floods and landslides to which EMBC is tasked to respond. In addition, there are a number of human-caused hazards for EMBC to deal with including oil spills, motor vehicle accidents and electrical power outages. To respond to the numerous hazards that BC is subject to, EMBC adopted an “all-hazard” approach to emergency management and developed an *All-Hazard Plan* in 2012. This approach recognizes that most disasters ultimately result in similar impacts and risks that need to be dealt with. This “all-hazard” approach is considered good practice because it allows governments and organizations to efficiently develop a single set of plans and procedures to deal with as many of these common impacts and risks as possible.

## Previous audit work in this area

To date, the provincial government has invested considerable resources in assessing BC's level of preparedness for a catastrophic earthquake, identifying gaps in preparedness, and suggesting areas of improvement.

In an audit of this topic by our Office in 1997, we investigated the level of BC's preparedness for a catastrophic earthquake and what actions were needed to raise the level of preparedness to an adequate standard. In that report, the Auditor General concluded that the provincial government, the Provincial Emergency Program (now EMBC) and local governments were not well prepared for a catastrophic earthquake, and made 60 recommendations (see [Appendix C](#)).

Following that report, the Select Standing Committee on Public Accounts issued its own report in 1999, supporting the Auditor General's 1997 conclusions, and made an additional 28 recommendations (All recommendations have been summarized in [Appendix D](#)).

In 2007, the Province's Internal Audit and Advisory Service evaluated EMBC's emergency management preparedness and response, reaching some similar conclusions to these two earlier public reports and made 13 recommendations.

## AUDIT OBJECTIVES AND SCOPE

We conducted this audit to answer the following questions:

1. Can EMBC demonstrate that it is prepared to manage the effects of a catastrophic earthquake?
2. Is EMBC reporting publicly on the Province's preparedness for a catastrophic earthquake?

As stated earlier and shown in [Exhibit 6](#), emergency management is built on 4 pillars: mitigation and prevention, preparedness, response and recovery. For the purposes of this audit, we focused solely on EMBC's preparedness to plan for an effective response to a catastrophic earthquake. Unlike our 1997 audit which had a much broader scope, mitigation and prevention, response and recovery were out of scope for this audit, and we did not audit other provincial ministries or local governments. However, it is important to note that other stakeholders and the other three pillars are critical and should be part of EMBC's overall strategy.

We developed our criteria and expectations for this audit based on the assumption that in the 17 years since our 1997 audit on this topic, EMBC had sufficient time to significantly improve its level of preparedness. We also expected to find that EMBC has been reporting to the public and the Legislative Assembly about the state of readiness achieved in this time, and the future state of preparedness that it is working towards.

We carried out interviews between March and November 2013, and the audit team reviewed relevant documentation primarily for the years 2008 through 2013.

We conducted the audit in accordance with Section 11(8) of the *Auditor General Act* and the standards for assurance engagement established by the Canadian Institute of Chartered Accountants.

## AUDIT CONCLUSION

We concluded that:

- ◆ EMBC cannot demonstrate that it is adequately prepared to manage the effects of a catastrophic earthquake; and
- ◆ EMBC is not reporting to the public and the Legislative Assembly about how prepared it is for managing the effects of a catastrophic earthquake.

## KEY FINDINGS AND RECOMMENDATIONS

In summarizing our key findings and recommendations below, we also note recommendations that our Office made in 1997 on earthquake preparedness that are still relevant. Our purpose is to show that many of the issues we identified then remain unaddressed.

### **EMBC is not adequately prepared to manage the effects of a catastrophic earthquake**

*Catastrophic earthquake preparedness has not been made a priority*

British Columbia (BC) has never experienced a catastrophic earthquake in a densely populated urban centre and may not for many years. Experts have noted that this has led to public apathy and a lack of urgency for decision makers. Given the human casualties and economic impact suffered from other jurisdictions in recent years (see Exhibit 7), this complacency is worrisome and unwarranted.

Government representatives are elected to make policy decisions and must regularly make choices between which initiatives to fund and which to decline. Funding for a catastrophic earthquake that may or may not occur in the short-term competes with funding requests for more immediate needs, such as health care and public education.

**Exhibit 7:** Earthquake/tsunami impacts

Region	Magnitude	Reported Casualties and Injuries	Estimated Economic Impact (not including impacts to neighboring countries) in Current Dollars
Christchurch, New Zealand (2011)	6.3	185 deaths 1,500-2,000 injuries	\$35 Billion Cdn
Tohoku, Japan (2011)	9.0	15,853 deaths 6,023 injuries	\$200 Billion Cdn
Chile (2010)	8.8	525 deaths	\$15-30 Billion Cdn
Anchorage, Alaska (1964)	9.2	143 deaths	\$2.3 Billion Cdn

Source: Prepared by the Office of the Auditor General of British Columbia

EMBC's operation centre, staffed 24 hours a day seven days a week, receives about 300,000 calls annually. EMBC responded to approximately 6,000 incidents related to dangerous goods spills, search and rescue events, major floods, fires, landslides, and avalanches in 2013. While only a fraction of these emergencies may require an extensive response by EMBC, they consume the majority of staff time. At the same time, EMBC's lack of critical resources such as a logistics planner and its limited funding constrain the organization's abilities.

EMBC's current operating budget for emergency activities is approximately \$6.2 million.<sup>1</sup> This budget is about the same as the budget provided to PEP in 2006, despite a 10% population increase over the same time period, a near doubling of BC's property values, and knowledge of the devastating impacts of recent earthquakes in Chile, Japan, and New Zealand.

EMBC's mandate is very broad and includes emergency coordination and the planning and mitigation of all hazards in BC including catastrophic earthquakes. In the context of this broad mandate and the lack of critical positions and no new funding, EMBC's planning and preparation for a catastrophic earthquake often occurs as a side-of-desk activity.

Many of EMBC's deficiencies in its response capabilities were highlighted following the 7.7 magnitude earthquake that occurred in Haida Gwaii on October 27, 2012. The event triggered a tsunami warning. Fortunately, there was no tsunami, no reported injuries and only limited damage. As per good practices, EMBC drafted an "after action" report of the event that identified shortcomings in the Province's response and actions to address these issues.

In this report, EMBC noted that it did not have sufficient personnel with the experience, knowledge and training to effectively respond to an earthquake and tsunami event and its standard operation procedures were inadequate. EMBC also noted that:

- ◆ some local governments identified that their plans were not adequate;
- ◆ a number of communities lacked information and education on what to do and what local responders should do; and
- ◆ the use of the Provincial Emergency Notification System is cumbersome, resource-consuming and prone to errors.

EMBC included strategies to improve its performance based on its current capacity. It also identified that risks to communities would continue without additional resources and program enhancements.

Although government officials continue to state that catastrophic earthquake preparedness is a priority, government has not provided clear direction regarding the degree of preparedness it is committed to attain or what level of risk is acceptable. In our view, given the scope of preparation that will be required to adequately prepare BC for a catastrophic earthquake, government should be planning for 5, 10 and 15 years rather than the typical 1 to 3 year plans.

[Audit 1997 – Recommendation 2 – The provincial government should develop long-term goals for earthquake preparedness.]

1 The Province also contributes approximately \$14 million dollars to a joint federal and provincial initiative to fund infrastructure projects that will provide flood protection to communities across BC.

[Audit 1997 – Recommendation 6 – The provincial government should provide the Provincial Emergency Program with a reasonable level of resources to meet the government’s expectations.]

**RECOMMENDATION 1:** *We recommend that government develop long-term goals for catastrophic earthquake preparedness, including the level of provincial preparedness it expects EMBC to achieve in the next 5, 10 and 15 years.*

**RECOMMENDATION 2:** *We recommend that government ensures EMBC has the capacity necessary to address identified critical gaps and achieve government’s expected level of preparedness.*

*EMBC has not implemented a managing-for-results framework in preparing for a catastrophic earthquake*

As was evidenced in Japan in 2011, no government can be completely ready to respond to a catastrophic earthquake (see Exhibit 8). However, we expected EMBC to have a system in place to track and demonstrate how it is improving the Province’s level of preparedness.

Managing-for-results provides an organization’s leadership with tools to measure its success and identify areas for improvement so goals can be achieved. The general principles of this framework are part of the planning requirements under the Province’s *Core Policy and Procedures Manual*. The managing-for-results framework is valuable because it embodies the old adage that “what gets measured gets done.”

**Exhibit 8:** Being totally prepared is not possible

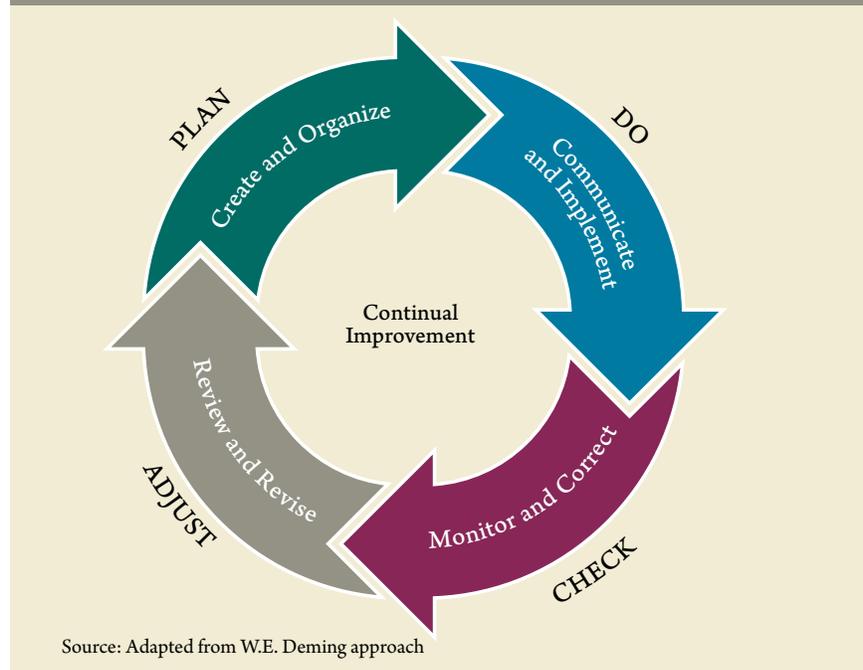


Despite Japan’s investment of billions of dollars in earthquake and tsunami mitigation, preparedness, response and recovery, the scale of destruction during the March 11, 2011 tsunami quickly overwhelmed authorities.

Source: BBC News

The managing-for-results framework can be conceptualized as a simple four-step process known as Plan-Do-Check-Adjust (PDCA) (see Exhibit 9). These steps are the foundation for International Organization for Standardization (ISO) 9000. The ISO 9000 family of standards represents an international consensus on good management practices.

**Exhibit 9:** The Plan-Do-Check-Adjust (PDCA) model that underpins the managing-for-results approach



We expected EMBC management, using this four-step process, to have undertaken the following key initiatives:

**PLAN:** Establish the objectives and processes necessary to deliver results in preparing for a catastrophic earthquake. Establish key performance indicators and targets to evaluate success.

**DO:** Implement the plan and collect information on performance.

**CHECK:** Evaluate results and identify areas for improvements.

**ADJUST:** Revise work plans as necessary throughout the year to ensure results are being achieved. Annually review overall performance and adjust objectives, strategies, key performance indicators and work plans as needed for the following year.

We found that EMBC has made progress in some areas; however, overall EMBC is not applying a rigorous managing-for-results framework and has gaps in the following areas:

**PLAN:** A goal in *EMBC's 2012–2015 Strategic Plan* is to “enhance BC’s ability to manage large scale and catastrophic events.” Five objectives for achieving this goal have been identified (see Exhibit 10).

**Exhibit 10:** Extract from *EMBC Strategic Plan 2012–2015*

*Goal 4 - Enhance British Columbia’s ability to manage large scale and catastrophic events*

- ◆ Align EMBC staff resources to support major event response and recovery capacity
- ◆ Build and support local, provincial, national and international liaison agreements and networks
- ◆ Build public/private sector agreements and partnerships
- ◆ Monitor stakeholder readiness and capacity
- ◆ Coordinate provincial support to local authorities and First Nations engaged in emergency management

Source: *EMBC's Strategic Plan 2012–2015*

We found that EMBC could not demonstrate that these objectives were based on a systematic assessment of areas of highest risk or significant gaps in its program.

In addition, EMBC does not have a catastrophic earthquake work plan that defines the strategies for how these objectives will be realized, nor have they identified key performance indicators and related annual targets to measure its progress.

**DO:** Although EMBC does not have a catastrophic earthquake annual work plan, the agency has undertaken actions to improve the Province’s preparedness for a catastrophic earthquake. However, we found that implementation of these actions has often had to be secondary to other operational activities, so progress has been slow.

**CHECK:** Because of the absence of key performance indicators and associated annual targets for improving EMBC’s preparedness for a catastrophic earthquake, the agency is not objectively evaluating whether its actions are improving its preparedness. We did find, however, that EMBC recently created status reports for its top three priority projects. These reports could be expanded so EMBC can monitor its progress once it determines the key outcomes that it is working to achieve.

**ADJUST:** EMBC does not regularly evaluate the effectiveness of its earthquake preparedness activities and adjust its programs, plans and procedures. However, we did note that the agency adjusted some of its plans and procedures in response to recent evaluations. Notably, EMBC identified opportunities for improvements after attending a large-scale earthquake exercise in Washington State, and in relation to the tsunami threat following the 2012 Haida Gwaii earthquake.

**RECOMMENDATION 3:** *We recommend that EMBC develop a strategic plan to meet the Province’s long-term goals. The plan should clearly demonstrate how EMBC will evaluate the effectiveness of its activities against its goals.*

## *Gaps exist in EMBC's preparedness*

The Province's response to a catastrophic earthquake will depend largely on the effectiveness of the plans and procedures that EMBC and other stakeholders have in place and how well they are implemented. We, therefore, expected that EMBC's plans and procedures:

1. are based on a detailed hazard risk and vulnerability analysis;
2. are reflective of best practices;
3. include the actions that the Minister may undertake in a state of emergency;
4. include the review of ministry and local government plans and procedures to ensure they are integrated and coordinated;
5. include monitoring of key stakeholders readiness and capacity to carry out their plans;
6. include catastrophic earthquake training and exercises; and
7. include maintaining an effective public education program.

Following are our findings for each of the above seven areas.

### **1. EMBC's hazard, risk and vulnerability analysis is not sufficiently detailed and not up-to-date**

We expected EMBC to have developed a detailed hazard risk and vulnerability analysis (HRVA) based on a scenario of a catastrophic earthquake that would then be used to guide the development of its response plans and procedures. An HRVA is a critical part of every emergency program. An HRVA assists emergency managers in prioritizing their mitigation and planning efforts, and in determining where to focus their resources during the initial response to a catastrophic earthquake.

Consistent with the requirements of the Emergency Program Management Regulation and international good practice, EMBC is required to prepare and update annually an HRVA that identifies potential emergencies and disasters, and to assess the potential impact of these events on people and property. EMBC's own guidance states that an HRVA should be completed before a strategic plan or an emergency response plan is written, as an HRVA guides response actions. However, EMBC's HRVA, developed in 1997, has not been updated since this time and is general in its content. It was anticipated in our 1997 report that this general HRVA would be developed into an area-specific HRVA that would model, in detail, the hazards, risks and potential impacts of a catastrophic earthquake on the BC population, tourists, critical facilities, disaster routes and industry. EMBC has made little progress in this area. However, EMBC recently applied for funding from the federal government to work on the development of a model that could identify regions of high seismic risk and highest potential losses. The proposed project will require a more comprehensive and centralized inventory and mapping of the province's critical infrastructure than is currently available.

[Audit 1997 – Recommendation 4 – Provincial Emergency Program should work with regional and local governments to refine the development of specific, regional earthquake planning scenarios.]

[Audit 1997 – Recommendation 16 – The provincial government should develop an inventory of key provincial infrastructure.]

## 2. EMBC's plans and procedures do not consistently reflect best practices

We expected EMBC's catastrophic earthquake plans and procedures to reflect best practices; however, we found deficiencies in several areas.

- ◆ **Comprehensive Emergency Management Plan** – Consistent with international good practices, EMBC is developing a *Comprehensive Emergency Management Plan* which consists of an *All-Hazard Plan*; support appendices; and hazard-specific appendices. However, while EMBC has recently completed the *All-Hazard Plan*, it has not developed a hazard-specific appendix for a catastrophic earthquake or key support appendices related to issues that would arise following such an earthquake (for example, the need for mass evacuation and shelter, critical infrastructure, and food and water). A timetable has not been set for completing these documents.
- ◆ **BC Emergency Response Management System (BCERMS)** – EMBC has successfully developed and implemented the BCERMS. This system, based on best practices, provides a standardized process for organizing and managing a response to any emergency or disaster in BC.
- ◆ **Earthquake Response Plan** – Building on the BCERMS model, EMBC developed a draft *Earthquake Response Plan* in 2008 which describes a general operational concept for a provincial response to a damaging earthquake. However, we found that this plan does not meet EMBC's own good practice expectations. The plan does not:
  - identify vulnerable geographic locations, populations and facilities/infrastructure;
  - specify public warning/information requirements;
  - identify special resource requirements and procedures for locating resources; and
  - refer to other emergency-related plans.

Furthermore, the plan includes the assumptions that all BC residents in earthquake-prone areas of the province know what to do in an earthquake – for example, that all families have emergency kits, family reunification plans, and the ability to sustain themselves for a period of time until help is available. The plan also assumes that local governments have adequate plans and will survive to coordinate their own local response and recovery efforts. We noted that EMBC has not confirmed that these assumptions are realistic. Recent studies indicate that a majority of the population in BC's earthquake hazard area do not know how to prepare their homes and themselves for a catastrophic earthquake.

### 3. EMBC's plans and procedures do not articulate clearly the actions that the Minister may undertake in a provincial state of emergency

We expected EMBC's plans and procedures to include the actions that the Minister of Justice can take in a provincial state of emergency.

A catastrophic earthquake resulting in significant structural damage and human casualties will most likely require the declaration of a provincial state of emergency. Section 10 of the *Emergency Program Act* sets out the extraordinary powers available to the Minister following such a declaration.

Those powers include:

- ◆ control or prohibition of travel;
- ◆ demolition of structures;
- ◆ restoration of essential facilities;
- ◆ distribution of essential supplies;
- ◆ mass evacuation and shelter;
- ◆ price setting; and
- ◆ rationing of supplies for the duration of the state of emergency.

EMBC is responsible for emergency management under the Act, so it has an important role in supporting the Minister's enactment of these powers. Because an immediate emergency response is critical to minimizing loss and damage from a catastrophic earthquake, it is essential that EMBC has necessary information and defined procedures in place to empower the Minister to make fully informed decisions and execute his/her powers in a timely manner.

We found, however, that EMBC has not compiled the necessary information and procedures to address all the powers granted to the Minister under a provincial state of emergency. This creates the risk that the personal, structural and financial losses following a catastrophic earthquake could be greater than necessary due to a delay in implementation of these powers.

**RECOMMENDATION 4:** *We recommend that EMBC identify, rank and prioritize completion of its own key plans and procedures to ensure it meets its mandate to prepare and respond to a catastrophic earthquake.*

## 4. EMBC has not adequately ensured plans and procedures of other stakeholders would result in an integrated and coordinated response

One of EMBC’s primary objectives in preparing for a catastrophic earthquake is to ensure that the Province undertakes a coordinated and integrated response to the event. This objective reflects one of the basic principles of emergency management: coherency of action (see Exhibit 11). Taking this approach means EMBC would help coordinate and lead government and non-government agency assistance with local, provincial and even national resources to ensure provincial priorities are achieved and communities in need receive the help that they require as quickly as possible.

### Exhibit 11: Principle 5 - coherency of action

Emergency management requires collaboration, coordination and integration by all partners in order to most effectively apply emergency management resources and execute activities. Coherency of action relies on clear roles, responsibilities, authorities and capacities of all partners.

Source: Principles of Emergency Management, EMBC Reference Manual

For this approach to work properly, the response efforts and plans of all these different stakeholders must be integrated and coordinated. However, we found that EMBC does not systematically review these plans and procedures and, therefore, cannot ensure that they are integrated and coordinated.

### 4.1 Local authorities’ plans are not reviewed by EMBC to ensure integration and coordination

EMBC’s legislation and regulation define a number of mandatory and discretionary powers and duties of the Minister. The mandatory actions state that the Minister “must” do something; the discretionary actions state that the minister “may” do something. In either case, the legislation empowers the Minister to do whatever is necessary to prevent, respond to or alleviate the effects of a catastrophic earthquake.

Under the Act, the Minister may promote the development of integrated plans and “require local authorities ... to prepare, in cooperation with designated ministries, integrated plans and programs, satisfactory to the Minister, to deal with emergencies.” We found that EMBC has not exercised this power to ensure that local government plans are coordinated and integrated with other local authority plans and the Province’s plans.

Integration between local authorities and with other provincial government plans is necessary for an effective government response to a wide-scale disaster. Without integration and coordination, critical rescue and response efforts could be delayed and ineffective. Such a situation was apparent in the independent review by the Attorney General following the 1996 blizzard on Vancouver Island and the Lower Mainland. The review found that there was no coordinated approach to clearing major transportation arteries. Some major roads were plowed up to the municipal border, but remained impassable beyond that.

One method to address integration and coordination across multiple local authorities is regional coordination. Our Office's 1997 report on earthquake preparedness and the Attorney General's report on the 1996 blizzard both recommended that regional coordination be strengthened.

[Audit 1997 – Recommendation 2 – The earthquake preparedness program should provide an integrated and cohesive approach to earthquake preparedness that supersedes the assignment of specific jurisdictional responsibilities.]

In April 2009, the Ministry of Public Safety and the Solicitor General entered into a partnership with the Greater Vancouver Regional District (Metro Vancouver) to form the Integrated Partnership for Regional Emergency Management (IPREM). IPREM's objective is to improve regional emergency management in the Metro Vancouver region. This has been an important step in establishing the formal commitments and structures necessary to ensure that provincial and local authority plans are integrated and coordinated in Metro Vancouver. IPREM could become a model for cooperation between local governments elsewhere in the province. To date, this model has not been extended outside of Metro Vancouver.

We have been advised that IPREM is about to release its first product: the Regional Disaster Debris Management Plan; however, a number of deliverables still need to be completed for IPREM to achieve its vision of a disaster resilient region with a coordinated emergency management strategy.

[Audit 1997 – Recommendation 9 – The provincial government should strengthen regional emergency planning and coordination.]

#### 4.2 Provincial ministries and Crown corporations' plans are not reviewed by EMBC to ensure integration and coordination

Under the Emergency Program Management Regulation, ministers and Crown corporations are required to maintain emergency plans and procedures, and to ensure that these are coordinated and consistent with the emergency plans and procedures of every other minister. To help facilitate this coordination, the Emergency Program Management Regulation established the Inter-Agency Emergency Preparedness Council (IEPC), with representatives from each key ministry and co-chaired by EMBC. The regulation specifies that the IEPC must provide each minister with "the assistance necessary to ensure that the minister's emergency plans and procedures are coordinated and consistent with the plans and procedures of all other ministers and with the government's overall emergency preparedness strategies."

Given this requirement, we expected either the IEPC, or EMBC, to be systemically reviewing ministry and Crown corporation plans periodically to ensure they are integrated and consistent with the plans and procedures of all other ministries and with the Province's overall plans and strategies. This review would help ensure that ministry plans are integrated and coordinated. We found no such systematic reviews by either IEPC or EMBC.

[Audit 1997 – Recommendation 8 – Deputy Minister and Crown corporations' chief executives should take steps to increase the profile and effectiveness of the IEPC.]

**RECOMMENDATION 5:** *We recommend that EMBC regularly review its earthquake program to identify significant gaps and risks to a coordinated and integrated response, and develop actions to address them.*

## 5. EMBC is not adequately monitoring stakeholder readiness and capacity

We expected EMBC to be monitoring the response readiness of all its major stakeholders and their capacity to carry out necessary activities in the event of a catastrophic earthquake.

Plans and procedures are effective only if everyone knows what to do, and there are enough people and resources to fully execute the plans.

Following a catastrophic earthquake, EMBC will need to coordinate the efforts of a vast number of different players including: local authorities (defined under the Act as being municipalities and their municipal councils; regional districts and their boards; and national park superintendants); provincial ministries and Crown corporations; the Temporary Emergency Assignment Management System (TEAMS) personnel; and the federal government. Key to EMBC's coordination will be a realistic understanding of these organizations' readiness and capacity before such an event. The importance of this is reflected in one of the objectives in EMBC's Strategic Plan: "monitor stakeholder readiness and capacity" ([See Exhibit 10](#)).

Overall, we found that EMBC is not adequately monitoring the readiness and capacity of its key stakeholders which include local authorities, provincial ministries, Crown corporations, TEAMS volunteers, First Nations, and the federal government.

### 5.1 *Local authorities' plans and capacity to carry out their plans are not adequately reviewed by EMBC*

The *Emergency Program Act* and accompanying Local Authority Emergency Management Regulation set out the responsibility of local authorities to prepare a local emergency plan, provide details about the broad content of that plan, and make clear the expectation that the plan will be periodically reviewed and updated. EMBC has the authority under the Act and this regulation to review and evaluate: local emergency plans, local government's capacity to carry out this plan, and its training and exercise programs. We found that EMBC is not doing this. The lack of such review and evaluation exposes the province to the risk that provincial emergency plans may be founded on unrealistic assumptions of local government capacity and that, overall, the province may not have the resources it expects to be available to respond to and mitigate the effects of a catastrophic earthquake. As a result, residents of some communities could be put at increased risk following a catastrophic event.

[Audit 1997 – Recommendation 27 – The provincial government should play a stronger role in ... monitoring to ensure that all municipalities plan to a certain standard.]

### 5.2 *Provincial ministries and Crown corporations' plans and procedures and business continuity plans are not being adequately monitored*

We found weaknesses in the monitoring of this stakeholder group in two main areas: plans and procedures and business continuity planning.

## Plans and procedures

Under the Emergency Program Management Regulation, each minister must develop emergency plans and procedures in the event of an emergency or disaster. As noted above, we expected that these plans and procedures would be integrated and coordinated. Furthermore, we expected that EMBC would be reviewing them to ensure that ministries and Crown corporations have achieved a required state of readiness and have the capacity necessary to implement their plans in a catastrophic earthquake.

Because EMBC is not conducting a systematic review of these plans, we concluded that there is a risk that ministry’s and Crown corporations’ planned responses to a catastrophic earthquake may not be meeting a necessary standard, and that they may not have the capacity to carry out their plans. This concern was raised in BC’s Legislature during discussions of BC Hydro’s December 2012 internal audit report where legislators noted that: “BC Hydro is not adequately prepared to react, respond, and recover from a widespread catastrophic event such as an earthquake.”

[Audit 1997 – Recommendation 23 – The provincial government should take a stronger, more proactive role than it is now doing to ensure that supporting ministries keep their earthquake preparedness plans current.]

## Business continuity planning

EMBC’s *All-Hazard Plan* states that “provincial ministries will mobilize to deliver emergency and critical services during emergencies and disasters. The ability of ministries to carry out their critical services is enhanced by the creation and maintenance of business continuity plans.” Government’s *Core Policy and Procedures Manual* places importance on ensuring ministries can carry out their services (see Exhibit 12).

We expected EMBC to be monitoring and reporting on ministry business continuity plans, identifying deficiencies, and working with ministries to address any issues in a remediation plan. Instead, we found that EMBC only requires government corporations, that are considered critical, to prepare a self-assessment of their business continuity plans and does not verify the accuracy of statements in these documents. Furthermore, EMBC is not publicly reporting on the state of ministry business continuity plans.

### Exhibit 12: Extract from the *Core Policy and Procedures Manual*

The Ministry of Finance’s *Core Policy and Procedures Manual* states that ministries shall: report the status of ministry-wide business continuity to EMBC semi-annually and on an ad-hoc basis, as requested; conduct a risk assessment to identify and analyze threats to ministry business and services and submit them to EMBC; and complete a Business Impact Analysis for each business unit or program area utilizing EMBC templates.

Areas identified by ministries or EMBC as deficient or non-compliant will require the development of a remediation plan identifying the actions, target dates and individuals responsible. The progress of the plan will be monitored until the required actions are complete.

Source: Province of British Columbia, Ministry of Finance

[Audit 1997 - Recommendation 38 –The provincial government should... assign responsibility for maintaining a business continuation planning program and establish accountability for success; monitor the status of such planning; and audit ministry planning programs.]

We also found significant gaps in EMBC’s own business continuity plan. For example, although Kamloops has been identified as an alternative site for the Provincial Emergency Coordination Centre (PECC), in the event that its locations on Vancouver Island are affected, the transfer of the PECC responsibilities and staffing to the alternative site has not been tested. In addition, EMBC is not reviewing and updating its own business continuity plan annually, as required by the *Core Policy and Procedures Manual*.

[Audit 1997 - Recommendation 26 –The provincial government should take steps to identify, equip and test an alternate site for its Provincial Emergency Coordination Centre.]

### 5.3 Temporary Emergency Assignment Management System may not be sufficient to staff EMBC’s response centres

Temporary Emergency Assignment Management System (TEAMS) is a staffing system that maintains a resource pool of highly skilled provincial employees from various ministries in BC, who train regularly and have the appropriate skills and experience to manage provincial emergency operations centres. These volunteers are a critical resource for EMBC to ensure it has the capacity to adequately staff its response centres. However, EMBC has noted a decline in the availability of trained experienced TEAMS members and has been challenged to find an adequate number of TEAMS personnel to deploy during emergencies.

### 5.4 The federal government’s capacity creates challenges

During the audit, we identified three major challenges in the Province’s coordination and integration with the federal government:

1. funding;
2. logistics; and
3. responsibility to First Nations.

#### **Funding**

The Government of British Columbia and the Government of Canada signed a *Memorandum of Understanding* (MOU) on emergency preparedness in 1988. The MOU includes a cost sharing agreement in support of a Joint Emergency Preparedness Program (JEPP) for developing and maintaining emergency plans. Under the JEPP program, local authorities were eligible to apply for federal funding to help enhance their emergency preparedness and response capacity. In March 2013, the federal government eliminated JEPP funding. EMBC has noted that the loss of JEPP funding will likely impact the ability of local authorities to purchase equipment, and conduct training and exercises for emergency preparedness. Although the Ministry of Justice formally expressed its concern to the federal government about this cut, federal funding for the program has not been reinstated. As noted above, any loss of capacity and capability by local authorities could impact local governments’ and EMBC’s response to a catastrophic earthquake.

## Logistics

In the aftermath of a catastrophic earthquake, it is expected that the provincial government will need to call on the federal government for assistance. One of the primary resources that the federal government can deploy is the Canadian Armed Forces. The Canadian Armed Forces brings expertise in logistics management and the movement of food, water and medical equipment. Significant readily available military resources exist in BC, but even these will likely be overwhelmed initially in a catastrophic earthquake. The Canadian Armed Forces have told EMBC that it could take several days before they could support the affected area. EMBC has not yet been able to mitigate this risk, especially in ensuring there is an effective flow of essential goods and supplies to affected communities.

Developing private partnerships for supply chain management could be one answer for overcoming this issue. EMBC has stated that development of these partnerships is a high priority, but none have been established to date. EMBC is working with the Red Cross to develop a plan for the timely and effective deployment of the Red Cross's national and international resources into BC following a catastrophic earthquake. Even after these planning details are finalized, current logistics challenges will still need to be addressed.

## Responsibility to First Nations

We also noted an inconsistency in the roles and responsibilities of the provincial and federal governments in terms of providing First Nations assistance in the event of a catastrophic earthquake. EMBC's 1998 draft earthquake response plan identifies that assistance for First Nations will be federally provided by Indian and Northern Affairs Canada. However, a 1993 letter of understanding between the provincial and federal governments states, "When immediate action is required to preserve life or property on Indian Reserves and when local bands so request, the Provincial Emergency Program (now EMBC) will assist, support or arrange for such required emergency measures."

EMBC has advised our Office that it does not have the dedicated capacity to assist First Nations during a catastrophic earthquake. Further discussions with the federal government will be necessary to resolve this issue.

[Audit 1997 - Recommendation 28 –The provincial government should review on a regular basis the status of the National Earthquake Support Plan. As well, the Canada-BC Memorandum of Understanding on Emergency Preparedness should be reviewed and, where appropriate, updated.]

**RECOMMENDATION 6:** *We recommend that EMBC regularly review and evaluate its stakeholders' emergency plans and procedures to assess stakeholder readiness and capacity.*

## 6. Earthquake response training and exercising is inadequate

We expected EMBC’s plans and procedures to include a robust training and disaster response exercise program. These activities are valuable in preparing emergency managers and stakeholders to respond successfully following a catastrophic earthquake.

Currently, EMBC provides emergency management training for volunteers and local governments through the Justice Institute of British Columbia. However, we found that this training does not specifically cover a catastrophic earthquake scenario and is dependent on discretionary funding which can affect its ability to be delivered consistently.

Although EMBC has carried out some disaster exercises, we found that these only tested a limited range of roles and responsibilities and did not include a scenario where a provincial state of emergency is declared. Also, it is unclear whether these exercises are working towards an overall objective to ensure EMBC could coordinate an integrated and effective response.

[Audit 1997 – Recommendation 32 – The provincial government should provide more exercises at the province-wide and regional level to ensure that the liaison between emergency response efforts of different levels of government work effectively.]

**RECOMMENDATION 7:** *We recommend that EMBC conduct regular catastrophic earthquake exercises with its stakeholders to ensure it can deliver an effective, comprehensive and integrated government-wide response to a catastrophic earthquake.*

## 7. EMBC’s education program is not adequate to prepare the public for a catastrophic earthquake

We expected EMBC’s plans and procedures to include an effective public education program. One of the goals of EMBC’s Strategic Plan is “increased safety and resilience for individuals and communities.” An objective associated with this goal is delivering an effective public education program. Good practice dictates that public education is an important aspect of mitigating the impacts of a catastrophic event. For each person who is prepared and knowledgeable about what to do in an earthquake, there is one less person who may need basic assistance after the event. This means that limited government resources can then be stretched further.

We found that EMBC has only a limited public education program where one of its initiatives is assisting with an annual earthquake drill (“ShakeOut”) where participants “Drop, Cover and Hold On.” EMBC has also worked with some coastal communities on tsunami readiness. While EMBC does track information on the number of annual participants in the “ShakeOut” initiative, it does not track the effectiveness of its public education programs (i.e., whether families have emergency kits, reunification plans and the ability to sustain themselves for a period following a catastrophic earthquake as assumed in the Province’s 2008 draft earthquake response plan).

A recent survey by the British Columbia Automobile Association indicated that while 75% of respondents noted that they would expect their home could be damaged by an earthquake, only 35% knew how to “drop, cover and hold on” if an earthquake were to hit. The survey raises concerns that EMBC’s assumptions of the level of individual and family preparedness may be flawed.

**RECOMMENDATION 8:** *We recommend that EMBC measure the effectiveness of its public preparedness initiatives at regular intervals.*

## **EMBC is not reporting to the public and the Legislative Assembly about how prepared it is for a catastrophic earthquake**

As we noted earlier, EMBC's plans and strategies are based on a model where preparing for and responding to a catastrophic earthquake require individuals, industry and not-for-profit organizations and local, provincial and federal governments to work together to address the challenges faced by everyone in the affected area.

Embedded in this "community response" model are important assumptions of what roles, responsibilities, and level of preparedness exist before and after a catastrophic earthquake.

These assumptions must be realistic and all stakeholders must understand and agree to comply with them for this model to function effectively. Stakeholders have different levels of resources and risk acceptance, so it is essential that each stakeholder understand the actual level of preparedness achieved by all the others and what that means for him/her.

Provincial spending on catastrophic earthquake preparedness is ultimately a policy decision made by government, after it has weighed the competing needs and priorities of its constituents. As a result, it is essential that government is open about its state of catastrophic earthquake readiness if the public is to hold government accountable for its policy decisions.

Our 1997 audit reached similar conclusions about the value of public reporting on the Province's state of catastrophic earthquake preparedness, noting that "the general public needs to appreciate the extent of their vulnerability if they are to be convinced to support public mitigation efforts and develop personal strategies for earthquake preparedness." The report went on to recommend that the Provincial Emergency Program (PEP) report annually on the state of earthquake preparedness. This recommendation was endorsed by the Select Standing Committee on Public Accounts in its 1999 report.

We therefore expected to find that EMBC is:

- ♦ tracking the public's actual level of catastrophic earthquake preparedness as part of the agency's evaluation of the effectiveness of its public education efforts; and
- ♦ reporting publicly its own level of preparedness as part of its efforts to be transparent and accountable to the public.

We found that neither EMBC, nor the ministry it operates within (Ministry of Justice), publicly reports on the state of catastrophic earthquake preparedness in the province.

The Ministry of Justice included performance indicators in its *2012 Annual Service Plan* that reflected a narrow aspect of the Province's catastrophic earthquake preparedness – "Performance Measure 17: The percentage of critical Temporary Emergency Assignment Management System (TEAMS) positions filled by qualified government employees." This measure was subsequently dropped from the planned performance measure listing for the *2013/14–2015/16 Service Plan* under the rationale that it was not an outcome-based measure. The current service plan includes the performance measure "Timeliness of Disaster Financial Assistance private sector claim adjudication."

In our view, neither of these indicators provide key stakeholders or the public with sufficient information to understand fully how well prepared the province is for a catastrophic earthquake, the risks that they are facing, or the level of preparedness that they must achieve to protect themselves, their families and their communities.

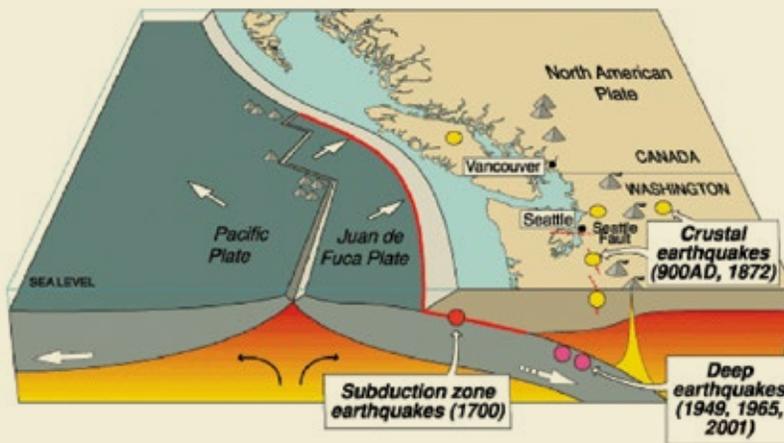
Government's preparedness includes an understanding of how well all ministries are prepared to respond to a catastrophic earthquake. The Emergency Program Management Regulation specifically sets out that the Inter-Agency Emergency Preparedness Council (IEPC) facilitates the coordination of ministry plans and procedures. This role is critical to support EMBC's mandate. With such an important role in ensuring that emergency preparedness is coordinated and integrated across ministries, it was recommended in our 1997 audit that the IEPC report annually on its plans and achievements. However, this recommendation has never been implemented.

[Audit 1997 – Recommendation 6 – The provincial government should report annually on the state of earthquake preparedness in British Columbia. The report should include an assessment of the overall state of earthquake preparedness, a report on plans and achievements of the Inter-Agency Emergency Preparedness Council, and accountability information regarding Provincial Emergency Program's own performance in relation to its annual objectives.]

**RECOMMENDATION 9:** *We recommend that EMBC report annually to British Columbians on the state of its catastrophic earthquake preparedness. The report should include an assessment of the overall state of earthquake preparedness, risks and capacity, and describe the plans and achievements of the Inter-Agency Emergency Preparedness Council (IEPC).*

**AS THIS AUDIT ONLY** looked at one of the four pillars (preparedness) of emergency management, future work by our Office may include the other three pillars: mitigation and prevention, response and recovery. All four pillars are critical to ensuring the Province can manage the effects of a catastrophic earthquake. For example, while planning for a response is challenging, it is finite. Post disaster recovery often takes years, even decades. Appropriate recovery planning can improve resiliency by reducing recovery time and economic losses.

**Exhibit A1:** Types of earthquakes in the Cascadia subduction zone



Source: United States Geological Survey

Source	Affected Area	Max. Size	Recurrence
● Subduction Zone	WWA, OR, CA	M 9	500-600 yr
● Deep Juan de Fuca plate	WWA, OR	M 7+	30-50 yr
● Crustal faults	WA, OR, CA	M 7+	Hundreds of yrs

In BC, a **mega-thrust earthquake** (“the big one”) could occur offshore when one piece of the earth’s crust (oceanic plate) is pushing beneath another (continental plate). Stress builds and eventually the two pieces slip rapidly, generating earthquakes as large as magnitude 9.

Quickly following an earthquake like this in British Columbia, a destructive tsunami – a series of waves up to 10 metres high – will hit the coast while also travelling across the Pacific Ocean toward Alaska, Hawaii and Asia. There would be widespread damage, including thousands of injuries and fatalities and the destruction of hundreds of buildings. Aftershocks up to magnitude 7 could occur, causing even greater damage.

This type of quake occurs, on average, every 500 to 600 years, but the intervals between events have been as short as short as 100 to 300 years. The last major mega thrust quake occurred in 1700 and was approximately a magnitude 9. Scientists have estimated that there is about a 12% chance of a similar magnitude quake in the next 50 years.

Notable mega-thrust earthquakes: Alaska, 1964, M 9.2; Indonesia, 2004, M 9.1-9.3; Chile, 2010, M 8.8; Japan, 2011, M 9.0

**Deep-focus earthquakes** occur on faults at depths of 48-60kilometres in this region.

Because the faults break so deeply, the wave energy spreads over a much larger area than from a shallow-focus quake. Strong shaking generally lasts a few seconds to a minute, but can be longer. Few if any aftershocks occur.

After a deep earthquake in this region, the heaviest damage will be likely concentrated on Vancouver Island and along the Strait of Georgia. No tsunami is expected.

These earthquakes strike, on average, every 30 years, with the latest in 1949, 1965 and 2001. The probability of a deep earthquake causing considerable damage of a magnitude 6.5 or greater is around 12% in the next 50 years.

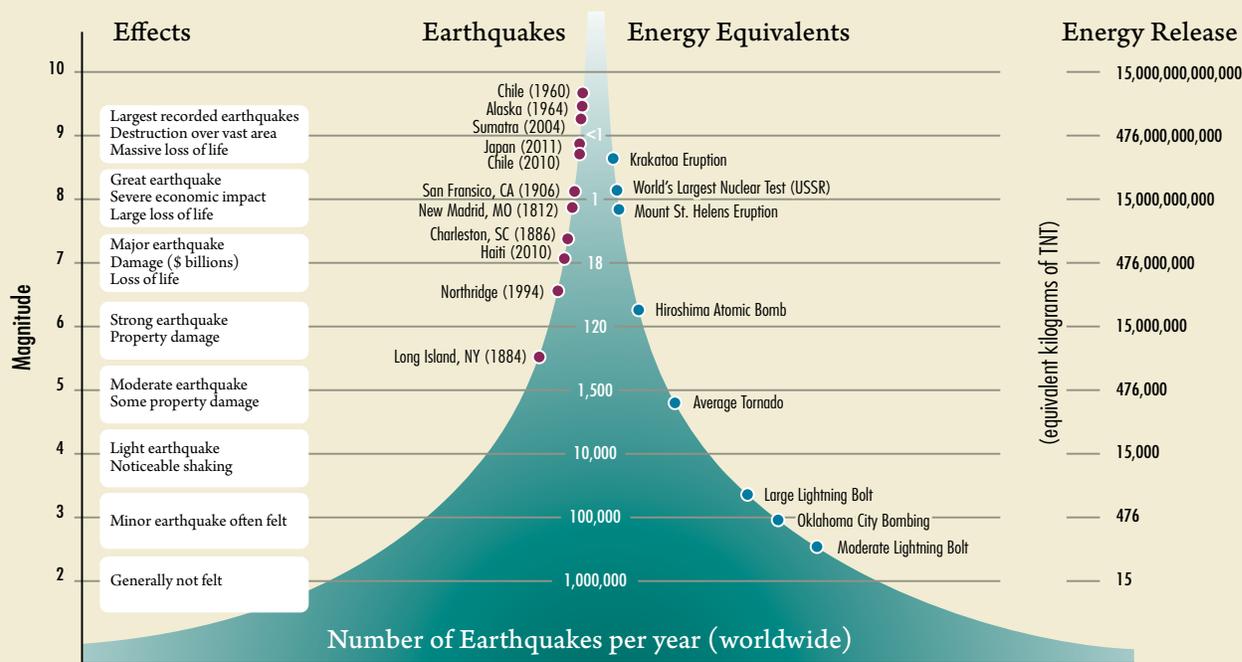
Notable deep-focus earthquakes: Haida Gwaii, 1949, M 8.1; Nisqually, Washington, 2001, M 6.8

**Shallow-focus earthquakes** occur within the earth’s crust along fractures, generally at depths less than 35 kilometres. This class affects a smaller area than a deep earthquake of the same magnitude, but the shaking is usually more intense and aftershocks more numerous. Tsunamis are unlikely, but could occur if a shallow earthquake occurred under the Strait of Georgia.

Because of the abundance of shallow faults in this region, small earthquakes of this type are recorded every day, and damaging quakes occur every few decades. The probability of a shallow crustal earthquake causing considerable damage in British Columbia has been estimated at approximately 12% in the next 50 years. To better understand these quakes, more information is needed about where the active faults are.

Notable shallow-focus earthquakes: Vancouver Island, 1946, M 7.3

Exhibit B1: Earthquake statistics



Source: Adapted from Incorporated Research Institutions for Seismology

The left side of the figure above describes the effects of an earthquake by magnitude. The larger the number, the bigger the earthquake. Significant earthquakes are noted on the left side of the shaded tower. The shaded area indicates how many earthquakes of each magnitude occur every year. The events on the right side of the tower show equivalent energy release.

Summary of recommendations	
Recommendation #	Recommendation Description
1*	The provincial government should establish a Seismic Safety Commission.
2*	The provincial government should develop long-term goals for earthquake preparedness.
3*	The provincial government should provide more focus to its earthquake preparedness program.
4*	The provincial Emergency Program (PEP), regional, and local governments should extend the development of earthquake planning scenarios.
5*	The provincial government should reposition the Provincial Emergency Program.
6*	The provincial government should increase funding for the Provincial Emergency Program.
7*	The provincial Emergency Program should report annually on the state of earthquake preparedness in British Columbia.
8*	The provincial government should raise the profile of the Inter-Agency Emergency Preparedness Council (IEPC).
9	The provincial government should strengthen regional emergency planning and coordination.
10*	The provincial government should ensure that the seismic elements of the Provincial Building Code are applied to all provincial buildings.
11*	The provincial government should maintain an advisory capability to help municipalities work with the Provincial Building Code.
12	The provincial government should determine the role that insurance should play in mitigation, and define the most appropriate regime through which it can be offered to the public.
13	The provincial government should continue discussions with the insurance industry and, where appropriate, the federal government, with a view to reaching agreement on how best to create an environment for an affordable insurance regime within the industry's capacity.
14*	Provincial Emergency Program (PEP) should measure the extent of public preparedness. (This should be done now, to help decide how and where to focus public awareness activities and to provide a baseline for future measurement and, at regular intervals in the future, to help assess the effectiveness of the initiatives.)
15*	PEP should work with key stakeholders (such as Emergency Preparedness Canada, provincial government agencies, local governments, utilities and private sector organizations) to develop and implement a coordinated public awareness communication strategy.

\* This OAG audit recommendation was endorsed in the Select Standing Committee on Public Accounts' 1999 Earthquake Preparedness in British Columbia report.

Recommendation #	Recommendation Description
16*	PEP should, in conjunction with the development of earthquake planning scenarios (see Recommendation 2), develop an inventory of key provincial infrastructure. Based on the detailed vulnerability analysis the planning scenarios would provide, options for dealing with areas of vulnerability should be considered, the cost of upgrading estimated, and programs proposed to carry out the upgrades on a priority basis over, for example, the next 20 years.
17*	The Ministry of Health and PEP should give immediate attention to reviewing and, where appropriate, strengthening the ability of the health system to respond to a major earthquake.
18*	All ministries assigned key support functions should complete, without delay, plans detailing how they will carry out their assigned responsibilities after a major earthquake.
19*	The Ministry of Environment, Lands and Parks should develop a response plan, test it and train staff accordingly, in order to be able to meet its responsibilities under the provincial earthquake response plan.
20*	PEP should update the <i>British Columbia Earthquake Plan</i> to reflect the current situation, and take steps to have the Emergency Program Management Regulation amended as necessary.
21*	PEP should develop a new communication strategy to ensure that the provincial response plan is known and understood by local authorities and response agencies.
22*	PEP should take a stronger, more proactive role than it is now doing, to ensure that supporting ministries keep their earthquake preparedness plans current.
23*	PEP should continue to work with Emergency Preparedness Canada at the national level to develop further heavy urban search and rescue capability.
24*	PEP should take a leadership role with respect to the development of systems standards, protocols, guidelines and coordination for resource management.
25*	PEP should identify a number of potential Provincial Field Response Centre sites at strategic locations throughout the province, test them for suitability, and communicate the details to those agencies likely to be involved in the response efforts.
26*	PEP should take steps to identify, equip and test an alternative site for its Provincial Emergency Coordination Centre.
27*	PEP should play a stronger role in providing to local governments advice and assistance regarding response planning, and in monitoring to ensure that all municipalities plan to a certain standard.
28*	PEP should review on a regular basis with Emergency Preparedness Canada the status of the <i>National Earthquake Support Plan</i> . As well, the <i>Canada-British Columbia Memorandum of Understanding on Emergency Preparedness</i> should be reviewed and, where appropriate, updated.
29*	PEP should continue to work with its counterparts in Alberta to ensure that the <i>Alberta Support Plan</i> is operational for a real event.
30*	PEP should remain in contact with the Canadian Armed Forces to ensure that it has current information about the resources and capabilities available, and disseminate this information to municipalities.
31*	PEP should discuss with Emergency Preparedness Canada the possibility of conducting regular exercises around the <i>National Earthquake Support Plan</i> and its relationship to British Columbia's plans.

\* This OAG audit recommendation was endorsed in the Select Standing Committee on Public Accounts' 1999 Earthquake Preparedness in British Columbia report.

Recommendation #	Recommendation Description
32*	PEP should develop provincial initiatives to encourage municipalities to test key components of their individual plans sufficiently, and to provide more exercises at the province-wide and regional levels to ensure that the liaison between the emergency response efforts of different levels of government works effectively.
33*	PEP should prepare a matrix of emergency planning and response positions at both provincial and local government levels, and identify the appropriate training regime needed for each position.
34*	PEP should obtain from provincial and local government agencies, at least annually, information about the training they have provided to emergency planning and response personnel.
35*	PEP should develop a clear and practical plan setting out roles, responsibilities and processes for carrying out initial damage assessment immediately following a major earthquake, and communicate the plan to all who will have a role in damage assessment.
36*	PEP should develop a coordinated plan for upgrading the Province's communication equipment to a more reliable system, and update, finalize and distribute its communications plan.
37*	PEP should develop and issue a current emergency public information plan as soon as possible, and test the plan on a regular basis.
38*	The provincial government should implement the recommendations made by the Risk Management Branch regarding business continuation planning. These recommendations include: assigning responsibility for maintaining a business continuation planning program and establishing accountability for success; monitoring the status of such planning; and auditing ministry planning programs. Also recommended was that the Risk Management Branch act in a training and coordinating role and provide status reports to the Deputy Ministers' Council.
39	The provincial government should give serious consideration to how best to coordinate the roles of the Risk Management Branch and PEP, as this area of emergency preparedness is closely related to the other aspects of preparedness for which PEP is responsible.
40*	The provincial government should discuss with the federal government options for dealing with the financial ramifications of a catastrophic disaster. In addition, it should develop its own options paper on ways of dealing with and mitigating its own financial liabilities in the event of a major earthquake.
41*	Ministries and Crown corporations should give immediate attention to completing business continuation plans.
42*	PEP should establish and provide to local governments guidelines for the development of business continuation plans.
43*	PEP should pursue the recommendations made in an interim report of the Joint Emergency Liaison Committee regarding structural assessment. These recommendations include: assigning volunteer engineers to pre-designated fire halls; providing accessible storage of necessary equipment and supplies at pre-designated fire halls; identifying volunteer engineers and registering them with PEP; having PEP coordinate the registration of all types of volunteers prior to a disaster; and having PEP develop an education strategy for professionals and the public to inform them about building inspection and posting.
44*	PEP should advise local governments as to the steps they should take to develop sound plans to inspect and post buildings after an earthquake (helpful in this regard—particularly in establishing priorities for post-earthquake inspections—will be the inventories of hazardous buildings and critical response facilities suggested in Recommendations 50 and 51.)

\* This OAG audit recommendation was endorsed in the Select Standing Committee on Public Accounts' 1999 Earthquake Preparedness in British Columbia report.

Recommendation #	Recommendation Description
45*	PEP should, working in conjunction with local governments, ensure that plans are developed to inspect all key infrastructures (whether it is owned provincially or locally).
46*	PEP should establish and provide to local governments guidelines for dealing with debris removal.
47*	PEP should establish and provide to local governments guidelines for planning for reconstruction.
48	Local governments should take steps to apply the seismic elements of the building code to all new critical response facilities.
49*	Local governments should, in conjunction with the development of earthquake planning scenarios (see Recommendation 4), develop an inventory of key infrastructure. Based on the detailed vulnerability analysis the planning scenarios would provide, options for dealing with areas of vulnerability should be considered, the cost of upgrading estimated, and programs proposed to carry out the upgrades on a priority basis over, for example, the next 20 years.
50*	Local governments should develop programs to identify and inventory hazardous buildings and to upgrade the seismic robustness of buildings based on the relative magnitude of risk to the public.
51*	Local governments should assess all critical response facilities, estimate the cost of upgrading them to a standard that would ensure their operability in a post-earthquake situation, and establish priorities for upgrading.
52*	Local governments should ensure they have current, complete earthquake preparedness plans, prepared in accordance with guidelines issued by PEP.
53*	Local governments should develop schedules for testing their plans and ensuring that recommendations arising from the tests are dealt with.
54*	Local governments should develop plans for carrying out initial damage assessment immediately following a major earthquake, and ensure the plans are consistent with the provincial plan.
55*	Local governments should continue to test their ability to communicate with each other and, where significant problems are identified, take steps to correct the problems.
56*	Local governments should develop emergency public information plans, and test them on a regular basis.
57*	Local governments should give immediate attention to completing business continuation plans.
58*	Local governments should, working in conjunction with PEP, ensure that plans are developed to inspect all key infrastructures (whether it is owned provincially or locally).
59*	Local governments should develop plans for debris removal.
60*	Local governments should establish strategies for long-term reconstruction.

\* This OAG audit recommendation was endorsed in the Select Standing Committee on Public Accounts' 1999 Earthquake Preparedness in British Columbia report.

The following recommendations were made by the Select Standing Committee on Public Accounts in addition to the recommendations that they endorsed which can be found in [Appendix C](#).

## Summary of recommendations

Recommendation #	Recommendation Description
1.2	Your committee recommends that the PEP, in developing a coordinated public awareness communication strategy, take advantage of marketing expertise and work closely with local governments, neighbourhood programs and non-profit agencies.
1.3	Your committee recommends the provincial government encourage the incorporation of earthquake preparedness issues and emergency first aid certificate programs into school curricula throughout British Columbia.
3.2	Your committee recommends that the provincial government work with local governments to ensure that micro zonation mapping is completed in high-hazard areas of British Columbia.
4.2	Your committee recommends that the Provincial Emergency Program finalize its B.C. Earthquake Strategy by March 31, 2000, and provide public access to the strategy by making it available on the Internet.
5.1	Your committee encourages the provincial government to consider repositioning the PEP within the Premier's Office in order to raise its profile and increase its effectiveness.
5.2	Your committee recommends that the annual report by PEP include, but not be limited to a discussion of the following topics: the progress of earthquake planning and preparedness in provincial ministries and Crown corporations; federal-provincial coordination of earthquake planning and preparedness measures; the work and progress of Treasury Board (Capital Division) with respect to seismic upgrading of provincial infrastructure.
6.2	Your committee recommends that the IEPC work with non-government emergency response organizations to achieve better coordination of response efforts.
8.1	Your committee recommends that the provincial government, in consultation with the general insurance industry and other stakeholders, determine the type of regime that would best ensure affordable earthquake insurance continues to be available, to compensate British Columbia policyholders who suffer earthquake related loss to their property and/or its contents, and encourage the adoption by those policyholders.
8.2	Your committee recommends that the provincial government, in consultation with the general insurance industry and other stakeholders, clarify the issues with respect to scope of insurance coverage for damages resulting from earthquakes, and in particular with respect to fire damage following earthquake.
8.3	Your committee recommends that the provincial government require insurers to take appropriate steps to draw to policyholders' attention, on the face of insurance policies, the scope of coverage available with respect to damages resulting from earthquake.

Recommendation #	Recommendation Description
9.2	Your committee recognizes the work of Treasury Board (Capital Division) in evaluating, costing and prioritizing seismic upgrading of British Columbia’s infrastructure. Your committee encourages the provincial government to make the seismic upgrading of provincial infrastructure a priority in British Columbia and, in doing so, to recognize its moral and legal responsibility for the safety of the province’s school children.
9.3	Your committee recommends that seismic upgrading projects in schools include a consideration of non-structural damage mitigation measures, such as seismic restraint systems.
9.4	Your committee recommends that the provincial government ensure that all buildings that are designated as emergency centres meet current seismic standards.
10.1	Your committee recommends that the provincial government encourage and promote tie-down programs for gas appliances and mobile homes, and examine the feasibility of mandating tie-downs in the applicable codes.
10.2	Your committee recommends that the provincial government encourage and promote public education with respect to earthquake-related natural gas hazards.
12.2	Your committee recommends that the provincial government encourage earthquake response planning and testing in all British Columbia schools, and consider providing funding assistance for emergency supplies in all schools.
12.3	Your committee notes the steps taken by the Ministry of Health to review and strengthen the ability of the health system to respond to a major earthquake, and encourages the ministry to continue its efforts in this regard and in particular, to consider the adequacy of British Columbia’s ambulance services capacity.
12.4	Your committee recommends that the provincial government encourage local government initiatives, as well as cooperation between industry and governments, with respect to hazardous material planning.
12.5	Your committee recommends that the provincial and local government take steps to ensure adequate consideration is given to women’s services in earthquake response planning.
13.1	Your committee recommends that the provincial government recognize the important role neighbourhood programs have to play in earthquake preparedness planning and response, and take steps to promote the development of more such programs in British Columbia.
14.2	Your committee encourages the PEP to complete its upgrading and updating efforts as soon as possible, and to ensure these plans are updated on a regular basis. Your committee also encourages local governments to implement the Auditor General’s recommendations with respect to emergency communications and public information plans.
15.2	Your committee acknowledges the Provincial Emergency Program’s efforts in coordinating the “Thunderbird 4 – Cascadia Response” exercise in March 1999, and recommends that the provincial government encourage more joint earthquake response exercises by the Provincial Emergency Program, Emergency Preparedness Canada and the Canadian Armed Forces, including regular exercises around the National Earthquake Support Plan and its relationship to British Columbia’s plans.

Recommendation #	Recommendation Description
15.4	Your committee recommends that future testing of earthquake response plans involve participation by urban search and rescue teams.
16.2	Your committee recommends that the provincial government review relevant legislation and policies to ensure that there are no legislative, regulatory or other impediments to the provision of adequate emergency training and certification to enable emergency medical assistants to provide effective assistance in the event of a major earthquake.
18.2	Your committee recommends PEP work cooperatively with local governments to develop guidelines for local government business continuation plans.
19.2	Your committee recommends that the provincial government educate British Columbians about the fact that public funds will generally not be available to compensate for losses to private property resulting from earthquake, and that public funds will only be available to restore and replace public infrastructure.
20.1	Your committee recommends that the provincial government, in particular the Provincial Emergency Program, move with dispatch in developing strategies to address the recommendations contained in this report.
20.2	Your committee recommends that representatives of the Provincial Emergency Program re-attend before the committee no later than December 31, 1999, in order to provide information regarding progress made in implementing the recommendations contained in this report.



OFFICE OF THE  
**Auditor General**  
of British Columbia

**Location:**

8 Bastion Square  
Victoria, British Columbia  
V8V 1X4

**Office Hours:**

Monday to Friday  
8:30 am – 4:30 pm

**Telephone:** 250-419-6100

Toll free through Enquiry BC at: 1-800-663-7867  
In Vancouver dial 604-660-2421

**Fax:** 250-387-1230

**Email:** [bcauditor@bcauditor.com](mailto:bcauditor@bcauditor.com)

**Website:**

This report and others are available at our website, which also contains further information about the office: [www.bcauditor.com](http://www.bcauditor.com)

**Reproducing:**

Information presented here is the intellectual property of the Auditor General of British Columbia and is copyright protected in right of the Crown. We invite readers to reproduce any material, asking only that they credit our Office with authorship when any information, results or recommendations are used.