

EARTHQUAKES: THE HORROR AND THE SCIENCE

Introduction



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Focus

This CBC *News in Review* story focuses on the science of earthquakes. We explore what happened recently in Haiti and Chile and examine the threat they pose to Canada's Pacific coast. We also look at why they occur and what can be done to limit the damage they can cause.

Earthquakes are one of nature's most terrifying and deadly phenomena. The ground beneath one's feet shakes violently while loud grinding noises emerge from below. Buildings sway, crumble, and eventually topple. In coastal areas massive waves known as tsunamis are released, resulting in widespread flooding. Although they generally last for only minutes, to those caught up in their destructive fury the experience can seem to last an eternity.

On January 12, 2010, an earthquake measuring 7.1 on the Richter scale devastated the impoverished Caribbean nation of Haiti, killing an estimated 230 000 people and causing billions of dollars of damage. As a massive international aid effort swung into action to provide much-needed help to quake victims, another even bigger earthquake hit the South American nation of Chile, on February 27. This one, clocking in at 8.8 on the Richter scale, was one of the most powerful earthquakes scientists have ever recorded. It was 500 times more intense than the quake that had struck Haiti the month before. The forces it released were so strong that they permanently shifted the planet's axis, thus shortening the length of a day by 1.2 millionths of a second.

Shortly after these two major quakes hit, other seismic disturbances were also recorded, including a 6.0 magnitude quake in Turkey and less powerful ones in California and Taiwan. With so many

quakes occurring so frequently in different parts of the world, some people began to wonder if the planet was experiencing an unusual set of circumstances. But seismologists—scientists who study earthquakes—were quick to reassure that such events were not unusual.

The high level of destruction and loss of life earthquakes are causing has more to do with what is happening above the ground than forces stirring below it. Because of shifting population patterns, more people are now living in urban areas located above major fault lines—where earthquakes are most likely to strike. Of the world's largest 130 cities with more than one million inhabitants, over half are found in earthquake zones. Many of these are in poor countries with inadequate building codes to minimize earthquake damage and insufficient infrastructure and resources to deal with their devastating after-effects.

The quakes in Haiti and Chile served to redirect Canadians' attention to the country's Pacific coast, especially the B.C. cities of Vancouver and Victoria, which lie above a major fault line. Although this region has been spared a major earthquake for over 300 years, scientists believe it is only a matter of time before the proverbial "big one" hits this region, and many wonder whether enough has been done to prepare for the potentially destructive and deadly consequences that are sure to follow from it.

To Consider

1. Why did the earthquakes in Haiti and Chile in early 2010 attract such international attention?
2. Did you spend much time watching footage of the devastation in Haiti? If so, what struck you about the devastation?
3. Canadians contributed a huge amount of money for Haitian relief following the earthquake. Why do you think Canadians cared enough to give so generously?

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Video Review

Pre-viewing Activity

Before you watch the video, discuss the following questions with a partner or in a small group.

1. What do you know about what causes earthquakes?

2. Why are some parts of the world more prone to earthquakes than others?

3. Why did earthquakes in Haiti and Chile in early 2010 attract so much international attention?

4. Why do you think Canadians were so generous in their response to the earthquake in Haiti?

5. What part of Canada faces the greatest risk of a devastating earthquake occurring in the future? Why?

Viewing Questions

As you watch the video respond to the questions below.

1. Why was the earthquake in Haiti far more deadly and destructive than the one in Chile?

2. What impact did the tsunami have on some communities in Chile?

3. What caused the earthquakes in Haiti and Chile?

4. Why do scientists think that a major earthquake in B.C. is “only a matter of time”?

5. What steps have been taken in B.C. to prepare for an earthquake there?

6. Why do some believe that these measures are not adequate?

7. What can be done on a personal level to prepare oneself and one’s family for an earthquake, using the example of “Lionel” from the video?

8. Why does Canada’s Pacific coast face the threat of a deadly tsunami following an earthquake?

9. From what scientists have learned about the major Asian tsunami of December 26, 2004, how have they revised their predictions about the effects of a similar event occurring in B.C.?

10. What innovations in construction technology have been introduced to make buildings less prone to earthquake damage in Vancouver?

11. Why is it so difficult for scientists to predict where and when an earthquake will strike and how powerful it will be when it does?

12. When and where did the most deadly tsunami strike in Canada?

13. When was the last major earthquake believed to have occurred on the coast of B.C.?

Post-viewing Activity

After you have watched the video, discuss and respond to the following questions. Your teacher may choose to place you in a small group with other students.

1. Based on what you have learned from this video, do you think that enough has been done in Canada to prepare for a potential earthquake occurring here? Why or why not?

2. Do you think it is realistic to expect that most people will be as well prepared for an earthquake as "Lionel" and his family? Why or why not?

3. How would you assess the level of preparedness for an earthquake and its likely effects a) in B.C. and b) in the rest of Canada?

4. Would you consider living in an area that was known to be at risk of a major earthquake sometime in the future? Why or why not?

EARTHQUAKES: THE HORROR AND THE SCIENCE

Recent Earthquakes

Did you know . . .

As of April 2010, the Haiti earthquake was believed to have left 230 000 people dead, 1.5 million homeless, and caused damages in the billions of dollars.

Reading Prompt

As you read the following information pause to answer the questions incorporated into the text. The questions will help you to check your understanding of the information.

Two major earthquakes in Haiti and Chile in early 2010 focused international attention on the deadly and destructive power of these forces of nature. Both of these earthquakes resulted in major relief efforts. Canadians donated generously to help those devastated by the Haiti quake in particular, and the federal government committed itself to a long-term program to help rebuild the shattered nation.

Chile also received some international assistance, but the scope of the tragedy was much less severe than in Haiti. The loss of life was far lower, and Chile's government was in a far stronger position to deal with the devastation than Haiti's, which was barely able to provide essential services for the country's desperately poor population even before the earthquake struck.

The Haiti Earthquake and its Aftermath

Note: a more detailed account of the Haiti earthquake and Canada's response to it can be found in the March 2010 issue of *News in Review*.

The earthquake that struck Haiti on January 12, 2010, measured 7.1 on the Richter scale—a significant quake but by no means among the most powerful ever recorded. Yet the damage it caused to this poor Caribbean nation dwarfed the destructive toll of other recent natural disasters, including the massive 8.8 quake that hit Chile just over a month later.

Although many countries, including Canada, quickly responded to the disaster by sending massive amounts

of humanitarian aid, Haiti's poor transportation infrastructure and the heavily damaged roads made it extremely difficult for local and international authorities to deliver it in a timely fashion to those most in need. Because of this delay, many seriously injured people who could otherwise have been saved lost their lives in the days following the earthquake as aid officials, doctors, and nurses stood by in helpless frustration.

As is the case with other huge natural disasters, the earthquake in Haiti resulted in widespread human suffering that was graphically captured on television cameras and broadcast around the world. Responding to such harrowing scenes—including images of young children being operated on for horrific wounds without anaesthetics—many Canadians donated to various humanitarian relief organizations such as the Red Cross, Médecins sans frontières, and World Vision, which were on the ground providing emergency relief to quake victims.

Aid officials were concerned that after a few weeks Haiti would fall out of the news cycle, replaced by some other natural disaster or global conflict that would seize the attention of the world and weaken ongoing relief and recovery efforts. For this reason, they attempted to keep the very serious situation in Haiti before the eyes and conscience of the world and prevent it from becoming yet another example of “yesterday's news.”

This effort appears to have had some success, since major news outlets such

Did you know . . .

Hundreds of prisoners are on the loose in Haiti because the earthquake destroyed the prisons where they were being held.

as the CBC and CNN were continuing to present updates on Haiti many weeks after the disaster occurred. These reports focused on the problems quake survivors were dealing with such as inadequate housing, overcrowding, lack of food and supplies, the onset of the rainy season, and a serious outbreak of crime and violence, particularly directed against women.

They also profiled the relief efforts that the United States and Canada were

continuing to pursue in the country. Prominent individuals such as actor Sean Penn sponsored the construction of a huge tent city for homeless quake victims near Port-au-Prince. In a CNN interview on March 30, 2010, Penn described the project as really nothing more than a huge collection of nylon tarpaulins. But for many Haitians, this would be the only protection they had from torrential rains and other elements.

1. In what ways does television play an important role in disaster relief efforts?
2. To what extent do you believe you are influenced by images you see on television or on the Internet?

A number of political leaders also paid visits to Haiti to boost morale, show their solidarity, and promise that aid would continue to flow to the beleaguered country. They included former U.S. presidents George W. Bush and Bill Clinton, French President Nicolas Sarkozy, the UN Secretary General Ban Ki-moon, and Canada's Stephen Harper and Governor General Michaëlle Jean. Jean's visit was particularly moving because she was born in Haiti, and her hometown of Jacmel was hit very hard by the earthquake.

At an international conference held in late March 2010 at the United Nations, over 100 countries pledged to continue providing aid to Haiti. Canada alone intended to contribute an additional \$400-million on top of the amounts the government and private donors had already given. Haiti was requesting a minimum of \$3.8-billion to rebuild its shattered society and economy.

While wealthy donor nations were anxious to help, they wanted to make sure that the money went to those deserving of assistance and not into the pockets of the country's notoriously corrupt political class. To this end, an international commission was established to oversee the distribution of aid money, composed of representatives from donor countries, the Organization of American States, the 15-member bloc of Caribbean nations known as CARICOM, non-governmental organizations, and representatives from Haiti itself.

Former U.S. president Bill Clinton, now the UN's special envoy to Haiti, and Haitian Prime Minister Jean-Max Bellerive will serve as co-chairs of the commission. For his part, Clinton hoped that the billions of dollars in aid would help to create a radically new Haiti, where the presence of so many aid organizations and NGOs would no longer be necessary.

3. Why is it helpful for world leaders to visit countries that have been struck by natural disasters?
4. Why is the Haitian government not solely responsible for the management of aid money flooding to the country? Do you agree with this decision?

Did you know . . .

This was the second time an earthquake had occurred in this particular region of Chile. In 1960, the biggest earthquake in Chile's history struck, killing over 2 000 people.

It could be argued that this ambitious program of post-earthquake relief, which UN Secretary-General Ban Ki-moon characterized as a massive nation-building project, is the least the international community can do for Haiti in its desperate condition. In 1804 this little country became the second independent nation in the Western Hemisphere after having conducted the only successful slave revolt in history. Haitians had decisively repelled the military forces of France and Britain, the two global superpowers of the day.

In return for this remarkable and heroic achievement, Haiti was “rewarded” by being treated as an international pariah state. Haiti was forced to repay its former colonial masters a huge indemnity amounting

to \$50-billion in compensation for their lost “property” (i.e., the slaves). And no foreign government recognized independent Haiti's existence, much less agreed to trade with it, until U.S. President Abraham Lincoln finally extended diplomatic relations in 1862.

On the 200th anniversary of Haitian independence in 2004, President René Préval called on France, Britain, and other European states that had once profited from the human suffering of his people to provide long-overdue financial reparations. At the time, this request was dismissed, and it has now taken a massive earthquake, with huge loss of life and destruction, for it to finally be addressed. For Haiti's people, perhaps this will come as some small consolation after all their pain and loss.

5. Why might it be argued that the massive amount of aid being directed toward Haiti “is the least the international community can do”?

The Chilean Earthquake

Chile is a South American country that is no stranger to earthquakes. But the huge 8.8 magnitude quake that struck in the early morning hours of February 28, 2010, was especially devastating. It occurred when two underwater plates in the earth's crust ruptured along a major fault line. Approximately 436 people were killed, with 90 more still missing one month after the disaster.

Despite the relatively small number of casualties, the earthquake and subsequent tsunami caused major damage to Concepción and other Chilean cities, devastated the fishing industry along the coast, and destroyed a number of homes and businesses. In addition, other vital areas of the nation's economy such

as the copper and wine industries—an important source of export earnings—were believed to have suffered serious damage.

The quake also struck at a particularly inopportune moment in the country's political life. In January 2010, Chileans had elected a new president, who had not yet been sworn in to office when the earthquake occurred. The country's outgoing leader, Michelle Bachelet, toured the areas affected by the disaster and promised immediate aid, while her successor, Sebastián Piñera, criticized her government for what he alleged was its tardy response to the quake. Many ordinary Chileans were frustrated by the fact that their leaders were fighting during a national emergency.

6. In what ways can earthquakes have a devastating impact even if they do not kill thousands of people?

Further Research

A selection of video clips on the two earthquakes can be found at www.cbc.ca/news/

There are approximately 40 000 expatriate Chileans in Canada, concentrated mainly in the Toronto and Montreal areas. This community did its best to maintain communications with friends and relatives in the quake zone and organized aid efforts on their behalf. Many of these people had fled their homeland as political refugees following the 1973 military coup in Chile. Democracy was restored in Chile during the 1990s, but many Chileans chose to stay and make Canada their home.

Chile is likely to rebound from

its disaster much more rapidly than Haiti. The quake left many regions of the country—such as Santiago, the capital, and Valparaiso, its main port—practically untouched. Chile's solid infrastructure and excellent relationship with international financial bodies will likely be enough to ensure that reconstruction takes place quickly. Thus, although the earthquake that hit Chile was one of the strongest ever recorded, its long-term damage is expected to be far less than that of the Haitian disaster.

Analysis

1. Why do you think the earthquake in Haiti received so much more media attention in Canada and elsewhere than the subsequent quake in Chile?
2. Why is it important for the situation in Haiti following the earthquake to remain a matter of public attention and not fade from view?
3. Why was Chile in a better position to deal with the aftermath of the earthquake that struck it than Haiti was?

EARTHQUAKES: THE HORROR AND THE SCIENCE

The Science of Quakes

Definition

The surface crust of Earth is called the *lithosphere*.

Definition

The place where an earthquake is most intense is known as the *epicentre*.

Pre-reading Activity

With a partner or in a small group discuss and record what you already know about the science of earthquakes. What causes them? How are they recorded and measured? Can they be predicted? You will revisit these notes after you have completed the reading.

Earth is composed of four main layers: an inner core, outer core, mantle, and crust. The crust and the top level of the mantle together comprise a thin skin on Earth's surface. It is this surface area that is divided into a number of sections called tectonic plates that resemble a gigantic jig-saw puzzle. These plates are in constant motion, literally floating above the mantle and core.

Earthquakes occur when two of the many plates, or huge blocks that make up the surface crust, come into contact with each other. The spots where these massive plates slip are faults. Fault lines lie at the edges of two plates that move in opposite directions. These are the locations on the planet where earthquakes are most likely to occur.

When plates come into contact with each other at the fault lines, they sometimes become stuck together because their edges are rough. However, the rest of the plate continues to move. When the two plates have moved far enough in opposite directions, their respective edges become unstuck along one of the fault lines, causing an earthquake to occur.

Why the Ground Trembles

When the plates overcome the friction at the jagged edges of the fault line, energy is released by the force of the moving plates. As soon as this stored-up energy is released it radiates out from the fault in all directions in the form of seismic waves. Just like waves rippling over a

pond, seismic waves shake the ground as they move through it, and when they finally reach the surface, they shake anything standing on it.

There are two types of seismic waves that cause the earth to shake violently: primary waves (P waves), and secondary waves (S waves). P waves are the first to be released during an earthquake, and they travel rapidly in a horizontal direction. When their force reaches the surface, it is felt as a sudden thud or jolt. S waves make themselves known later and trigger the violent side-to-side shaking that is one of the most terrifying aspects of an earthquake. In addition, there are surface waves that radiate in all directions from the epicentre, and these are the last to be felt during an earthquake.

Measuring and Recording Earthquakes

For many centuries people knew very little about the scientific forces that caused earthquakes. In fact, most people attributed them to the actions of spirits or gods. For example, after a devastating earthquake hit Lisbon, the capital of Portugal, on Easter Day 1775, many people believed that the disaster represented God's judgment on the city and its inhabitants and prayed for forgiveness. Now seismologists—the scientists who study earthquakes—know why these massive disturbances occur. Unfortunately, they are not yet able to predict with any degree of accuracy

Did you know . . .

The most powerful earthquake ever recorded, striking Chile in 1960, registered 9.5 on the Richter scale.

exactly when or where they will strike, and how powerful they will be when they do.

Scientists use a device known as a seismograph to record the force of an earthquake. The recording made is called a seismogram. Seismographs have a base that is set firmly in the ground and a heavy weight that hangs freely. When an earthquake occurs, the base of the seismograph shakes, but the hanging weight remains in place because the string or spring from which it is suspended absorbs the motion. The difference in position between the moving base of the seismograph and the motionless weight is what is recorded, indicating how powerful the earthquake has been.

Seismologists use two scales to measure the size, or magnitude, of an earthquake: the well-known Richter scale and the less familiar Mercalli scale. The Richter scale assigns numerical levels of magnitude to earthquakes ranging from 1 to 9—with 9 representing the highest magnitude. The magnitude of an earthquake is determined by the amount of energy it releases, which is indicated by readings on a seismograph.

The Richter scale is logarithmic, meaning that each whole-number increase in magnitude is multiplied by 10. Thus, the seismic waves measured in a level 6 earthquake are 10 times greater than one clocking in at level 5. Most of the thousands of small earthquakes that happen every year register less than 4 on the Richter scale and do not cause any significant damage. For an earthquake to be considered significant, it usually has to register 7 or higher.

The Richter scale provides a rough idea of the power of a particular earthquake, but does not indicate the degree of destruction a particular quake may have caused. For example, the Haiti earthquake of January 12, 2010,

registered 7.1, whereas the Chilean quake a month later was a far more powerful event that registered 8.8. However, the Haiti quake caused far greater loss of life and destruction than was the case in Chile. This is where the Mercalli scale is useful. Its ratings, using Roman numerals, are based on the amount of damage caused by a particular quake and can only be assigned once observers have been able to enter the earthquake zone and assess the destruction that has occurred. Thus, a category XII earthquake, the most serious on the Mercalli scale, would be one where almost all buildings have been destroyed, the ground is cracked, and other related natural disasters such as tsunamis or landslides have also occurred.

Predicting Earthquakes

Every day, seismologists monitor earth tremors worldwide with increasingly sophisticated instruments. The state of their knowledge today is far greater than it was when the science was born in the 19th century. However, scientists are not yet able to predict when earthquakes will occur, even in areas lying on a fault line that is prone to them. The initial seismic waves picked up at monitoring stations are early-warning indicators that a powerful earthquake may be about to occur, but this will only give at most a few minutes of warning.

Seismologists can make educated guesses that earthquakes are likely to happen in areas located along major fault lines, such as the Pacific coast of Canada and the U.S. Based on their research into past tremors, they are also able to predict when the next big event may occur, but these predictions are extremely vague and may only deal in decades rather than specific years or months. However, predictions regarding aftershocks that take place after a major tremor has

occurred are far more exact because they are based on aftershock patterns from previous disturbances in the same area. Recent research has also pointed to a possible connection between shifting electromagnetic fields and earthquakes, and perhaps that gas seepage and the tilting of the ground may be early warning signs of earthquakes.

Earthquake Preparation

If earthquakes cannot be predicted or prevented, then perhaps the most practical approach is to prepare for them in an attempt to minimize the damage they may cause when they do strike. In wealthy countries, steps have been taken to implement strict building codes and construction methods that can make buildings less prone to collapse during earthquakes.

Such procedures certainly limited the damage to large structures in Chile during the February 2010 earthquake. But in very poor countries such as Haiti, these measures are practically non-existent. This can result in widespread devastation as poorly constructed homes and other buildings collapse quickly, burying their inhabitants inside them.

Some countries have introduced educational programs to raise public awareness about earthquakes and provide detailed information about how citizens can prepare for them and what they can do should one occur. Beyond that, there is very little that can be done to predict or control these violent and terrifying natural phenomena.

Follow-up

1. Update the notes you made in the Pre-reading Activity with new information you learned in this section. Were you already an earthquake expert or did you learn new information?
2. Why do you think people once gave supernatural explanations for earthquakes? How has science broadened our knowledge of these phenomena?
3. Do you think that the growth of major urban areas lying in earthquake zones, such as Los Angeles and Vancouver, should be limited to minimize the damage from a future quake? Why or why not?
4. Do you think that science will one day be able to predict earthquakes with any degree of precision? Why or why not?

EARTHQUAKES: THE HORROR AND THE SCIENCE

The Threat to British Columbia

Quote

"We will have a devastating earthquake. We've had them in the past, and we undoubtedly will have them again in the future." — Gary Rogers, Pacific Geo-Science Centre (CBC *News in Review*, April 2010)

Further Research

Visit the Web site of an earthquake-related Canadian government agency at <http://earthquakescanada.nrcan.gc.ca>.

A major fault line is located off the Pacific coast of Canada, where the Juan de Fuca plate comes into contact with the much larger North American plate. For this reason, the western coastal region of British Columbia is the number-one zone of risk in Canada for a massive earthquake.

The earthquakes in Haiti and Chile have increased concerns in Canada's most western province about the expected onset of the "big one."

According to earthquake scientist John Cassidy, massive earthquakes measuring magnitude 9 on the Richter scale can be expected to strike the region roughly once every 500 years. But the interval between such cataclysms can lie anywhere between 250 and 850 years, making predictions very spotty at best.

The last big earthquake to strike the B.C. coast occurred on January 26, 1700, with its epicentre only 100 kilometres from today's city of Vancouver. This was long before European settlement of the region, and the only accounts of the event are orally transmitted stories and legends passed on from generation to generation by members of local native bands. We also know from records taken at the time that this massive quake triggered a giant tsunami, a wall of water that travelled across the Pacific, hitting the coast of Japan about 10 hours after the tremor, causing considerable destruction there.

In 1925, Sam Ulmer, a native elder from the Klallam tribe in Washington State, told an anthropologist interviewing him that his people's legends told of the rivers becoming salt, the valleys filling with water, and the weather becoming so cold that many died. According to Louis Clamhouse, who wrote an account of the

1700 earthquake based on local Pachema stories from Vancouver Island, a huge wave smashed into the beach, destroying everything in its way.

In addition to the massive 1700 event, more recent earthquakes in British Columbia include:

- December 9, 1918: A magnitude 6.9 earthquake caused minor damage on Vancouver Island.
- May 26, 1929: A magnitude 7 quake south of the Queen Charlotte Islands caused minor damage.
- June 23, 1946: A magnitude 7.3 quake, the largest ever recorded in Vancouver Island, caused considerable damage in the communities of Port Alberni, Comox, and Powell River. One person drowned when his boat capsized.
- August 22, 1949: Canada's second-largest earthquake, measuring 8.1, toppled cows on the Queen Charlotte Islands, bounced cars in Terrace, and caused buildings to sway in Prince Rupert, but resulted in no fatalities.
- June 24, 1970: A magnitude 7.4 quake hit south of the Queen Charlotte Islands but caused no deaths or serious damage in this sparsely populated area.

If a major quake and tsunami were to hit the British Columbia coast today, the potential destruction and loss of life would be significant because the area is densely populated.

Even a less powerful tremor, such as the 7.1 magnitude earthquake that devastated Haiti, could cause significant damage to Vancouver and its surrounding vicinity. Because the area is such an active earthquake zone, smaller events are perhaps more likely to occur than the much-dreaded "big one." However Cassidy does not think this is necessarily

a good thing because “a magnitude 7 that is close to you, within 20 to 40 km, can be more damaging than a magnitude 9 that is 100 km away” (“Haiti a tragic reminder earthquakes expected closer to home,” *Saanich News*, January 25, 2010).

Cassidy and other experts who have assessed the state of B.C.’s earthquake preparedness are convinced that even in the event of a “big one,” the death toll and damage would not be anywhere near the devastation that struck Haiti. This is in large part because the quality of construction in the province is much better than that in Haiti. As well, B.C. has developed a detailed earthquake emergency plan.

But there is a real danger of a major

earthquake and a potentially devastating tsunami taking place at some point during the lifetimes of people living in this area now. Such a one-two punch—should it happen—is expected to result in the worst natural disaster Canada has ever experienced, and the cost in lives and property damage could possibly be immense. Officials at the provincial and municipal levels in B.C. seek to reassure local residents, and Canadians living in other regions as well, that the preparations they have made will keep the death toll and destruction to a minimum. But there are still many unanswered questions regarding just how ready the province and the country are for the “big one”—when and if it does take place.

Analysis

1. How aware are Canadians across the country about the potential for a devastating earthquake occurring along the country’s Pacific coast? Why don’t we hear more about this threat?
2. Would the information you learned in this feature affect your decision about moving to, or remaining in, British Columbia? Explain.

EARTHQUAKES: THE HORROR AND THE SCIENCE

Activity: Planning for a Disaster

While earthquakes could potentially strike anywhere in Canada, and small tremors have been felt in practically every region of the country, the coastal area of British Columbia is by far the most earthquake-prone zone in the country. It is along the fault line between the Juan de Fuca and North American plates, and this is where most experts believe the next “big one” will eventually occur.

In order to prepare for such a catastrophe authorities at all three levels of government—federal, provincial, and municipal—have developed various earthquake-preparedness plans. These plans inform local residents about potential dangers, adopt preventative measures to limit anticipated damage, and establish emergency procedures that can be speedily implemented after a major earthquake strikes.

Your task is to develop a detailed earthquake preparedness plan for British Columbia. You may wish to form groups to research and develop the details of this plan, choosing three of the following aspects of the plan to work on:

- Building codes and restrictions — making buildings more resistant to earthquake damage
- Family earthquake protection plans
- Education programs to inform people about the danger of earthquakes and steps to be taken should one occur
- Early warning measures — like tsunami sirens
- Emergency response expectations after an earthquake strikes — including federal, provincial, and municipal government expectations

A good source of information about the current state of earthquake readiness in Canada can be found at the Earthquakes Canada Web site:
<http://earthquakescanada.nrcan.gc.ca/index-eng.php>.

Information about how to prepare for earthquakes can also be found in this month’s *CBC News in Review* video.