EARTHQUAKES HAPPEN . . .

are you ready?

An earthquake preparedness resource for Grades K–7

Provincial Emergency Program

In using this resource, you may have suggestions to improve the resource, or you may wish to share other innovative ways of incorporating the materials into school curriculum.

The Provincial Emergency Program wants your feedback. We want to ensure the resource continues to meet the needs of BC educators, and toward this end we will review all feedback and incorporate into the original document, where possible, for future printings.

Please send all feedback to:

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National Library of Canada cataloguing in publication data

Main entry under title:

Earthquakes happen— are you ready? [electronic resource] : an earthquake preparedness resource for grades K-7

Co-published by Ministry of Education.
Available through the Internet.
ISBN 0-7726-4899-9

1. Earthquakes - Safety measures - Study and teaching (Elementary) - British Columbia. 2. Emergency management - British Columbia. I. British Columbia. Provincial Emergency Program. II. British Columbia. Ministry of Education.

HV599.E27 2002 372.3'7 C2003-960012-2

Foreword

If you're prepared for an earthquake, you're prepared for any disaster.

Because BC is geographically located in one of Canada's most seismically active earthquake zones, it is important to give our children the awareness and knowledge they need to be prepared for the next major earthquake. The Provincial Emergency Program (PEP) of the Ministry of Public Safety and Solicitor General, in partnership with the Ministry of Education, has prepared this resource for schools to ensure that students and their families have the information they need to be as safe as possible.

Providing useful knowledge and survival tools is much more than holding a "duck, cover, hold" drill or supplying information about the causes of an earthquake—it's about encouraging youth to make emergency preparedness part of their lifestyle so they develop safe life practices that will stay with them forever.

In the past, the Provincial Emergency Program has encouraged principals, educators, and parents to promote emergency preparedness to students by suggesting school activities, providing preparedness materials and providing information about access to the PEP interactive Web site, "Kids' Zone." Our student preparedness outreach initiative is one more tool to educate young people about earthquake safety.

This project is intended to proactively educate BC students on the threat of earthquakes in BC, how to physically and emotionally prepare, how they and their families should respond, and how their community will respond to support them.

The success of the school outreach initiative depends not just on emergency management information, but on the input and involvement of educators, parents, and students. It is imperative that this initiative meet the needs of teachers and students and create a lasting awareness that could save lives.

For the Kids' Zone and additional information on emergency preparedness, visit the PEP Web site (http://www.pep.bc.ca).

Children are our future. By working together to give BC's youth the information they need to be safer in an earthquake or other disaster, and by setting a good example, we—parents, teachers, and governments—are creating a brighter future for all BC youth.

Rich Coleman
Solicitor General

BRITISH COLUMBIA
Ministry of Public Safety and Solicitor General

Christy Clark
Minister of Education

BRITISH COLUMBIA
Ministry of Education

Duck, Cover, and Hold.

Duck under a desk or table. **Cover** as much of your head and torso as possible. **Hold** on to the furniture.

Table of Contents

If you're prepared for an earthquake, you're prepared for any disaster.

This resource is part of a three-phase project intended to proactively educate BC students on the threat of earthquakes in the province. It is designed to prepare students physically and emotionally, teach them how they and their families should respond, and inform them how their community will respond. The objectives of Phase 1 were to:

- identify and acquire samples of emergency/earthquake programs and learning resources in Alaska, Washington, Oregon, California, New Zealand, Quebec, and British Columbia
- interview educators and emergency planners
- evaluate collected programs and learning resources using specific technical and educational criteria
- make recommendations on learning resource development.

Research showed that there are no materials available in any of the preceding jurisdictions that:

- focus on preparing students emotionally for earthquakes
- address BC curricular requirements (e.g., in personal planning/Career and Personal Planning, social studies, science, and other subjects that deal with comparable topics)
- enable students to connect their learning and preparedness to the home and community.

The research also showed that earthquake preparedness learning resources are not widely used in BC schools, although many teachers recognize the need for them. Most of the learning resources developed in and for other jurisdictions are science-based. Emotional issues are rarely and inadequately addressed in existing learning resources. Students need resources that are engaging, interactive, relevant, and appropriate.

As a result of the research, a number of recommendations were proposed and adopted:

- the best BC curriculum match for such materials is Personal Planning K–7 and Career and Personal Planning (CAPP) 8–12; reference should also be made to other curricula (e.g., science)
- the emphasis of resources should be on building on knowledge, skills, and attitudes related to personal preparedness
- because repeat exposure to preparedness issues is the best way to ensure that young people will be able to respond in a healthy and appropriate way, resources should be developed in four clusters—grades 2–3, 5–6, 8–9, and 11–12.

- resources should be in the form of teacher instructional plans that are flexible enough to allow adaptation of the materials to disasters and emergencies in general
- all relevant materials gleaned from the research should be listed in an "Annotated Resources" section of the final learning resource.

Phase 2 involved the creation of draft learning resources for both Grades K–7 and Grades 8–12. Teachers, students, parents, and school administrators were asked to review all materials. The resources were then pilot tested with students and teachers for final input before being produced and distributed.

The completion of **Phase 3** is the production and distribution of learning resource materials to BC schools in the 2002/03 school year.

Acknowledgments

This learning resource is a collaborative effort of many agencies and individuals who shared their expertise and knowledge to develop materials to help BC children become safer.

The following ministries and agencies formed the School Outreach Preparedness Project Working Group:

- Ministry of Education, former Field Services and Curriculum branches (now part of the Standards Department)
- Ministry of Finance, Risk Management Branch
- Ministry of Public Safety and Solicitor General, Provincial Emergency Program (PEP)
- GT Publishing Services Ltd.
- Points of View Research

Special acknowledgement and recognition is given to the following individuals and agencies for their valuable contributions:

- Canadian and American Red Cross
- Focus test participants
- British Columbia Confederation of Parent Advisory Councils (BCCPAC)
- British Columbia Primary Teachers' Association
- British Columbia Principals' and Vice-Principals' Association (BCPVPA)
- British Columbia School Superintendents' Association (BCSSA)
- British Columbia School Trustees' Association (BCSTA)
- British Columbia Teachers' Federation (BCTF)
- Pilot test participants
- US Federal Emergency Management Agency (FEMA)

and other contributors of material.

Particular recognition is also given to the students of St. Joseph's school in Victoria, BC for contributing their "emergency theme" artwork, as well as to the principal and teaching staff who made it possible.

Special thanks and acknowledgement is given to the following sponsors:

- Credit Union Central of British Columbia
- RBC Foundation
- Scotiabank
- Office of Critical Infrastructure Protection and Emergency Preparedness

Their generous financial support provided funds to print and distribute these materials.

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Introduction

"Public apathy about earthquake preparedness remains high. The consistent view of those to whom we spoke was that the public is generally apathetic about the risks of a major earthquake and is therefore not well prepared, despite the myriad of public awareness programs delivered by all levels of government and several private sector organizations."

— 1997/98 Report Earthquake Preparedness Performance Audit, Office of the Auditor General of British Columbia

Despite province-wide efforts to increase public earthquake preparedness, a study cited in the provincial audit found that 52 per cent of British Columbians said they did not have enough information on how to prepare for emergencies. Further, 62 per cent thought they did not have enough information on the natural and human-made risks in their own communities. (*Emergency Preparedness: Canadian Attitudes and Behaviour*, Environics Research Group Ltd., 1995)

While some areas of British Columbia are more susceptible to earthquakes than others, it is important to note that all of BC is considered an earthquake zone. In recent years, earthquakes have been felt in such places as Fort St. John, Dawson Creek, Nelson, and Penticton—areas not traditionally thought of as earthquake prone. Approximately 70 per cent of the total population of BC live in the southwest, the province's most vulnerable earthquake risk area.

Since a major earthquake can occur without warning during school hours, and since schools, as a focal point of any community, play a pivotal role in supporting students, it is critical that students, teachers, administrators, and parents have the information they need to be as prepared as possible.

Many schools already practise earthquake drills. However, school-based earthquake preparedness is more than a matter of regular "duck, cover, hold" earthquake drills. Accordingly, *Earthquakes Happen…Are You Ready?* has been designed to:

- raise awareness of the earthquake hazard in British Columbia
- raise awareness about the importance of personal earthquake preparedness
- provide students and teachers with the relevant information about earthquakes
- encourage students to prepare emotionally as well as physically for the next earthquake

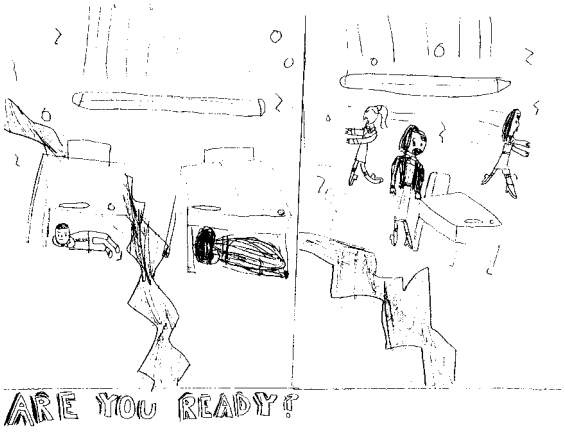
- help students, teachers, administrators, and parents identify potential earthquake hazards and vulnerabilities in the school, home, and community
- encourage students to turn awareness into action by applying their learning in making decisions, thinking critically, and solving problems
- provide earthquake preparedness information that can easily be adapted to many other emergency situations such as floods, severe weather, etc.

All members of the school community have a shared responsibility in maintaining safe schools.

Organization of the Resource

This resource provides the elements of a comprehensive earthquake preparedness learning resource that includes:

- **Instructional Plans** that directly address the BC curriculum. They provide teachers with procedures, resources, and student materials for two grade clusters — Grades 2-3 and Grades 5-6. The lessons address the prescribed learning outcomes for the personal planning curriculum through a study of earthquake preparedness topics.
- **Annotated Resources** of additional materials that educators, parents, and the community may find useful in addressing earthquake preparedness topics.



Using the Instructional Plans

This section of the resource contains two instructional plans for teaching earthquake preparedness in the classroom. The two instructional plans provided here are:

- Grades 2-3: What Happens in an Earthquake? (page 23)
- Grades 5-6: Earthquake Preparations at School and Home (page 35).

Each instructional plan contains instructions for delivering a unit of study related to earthquake preparedness and response. The instructional plans identify the prescribed learning outcomes addressed by the unit, suggested time, materials required, preparation, step-by-step procedural directions, suggested assessment strategies, adaptations, extensions, student handouts, assessment tools, and teacher resources.

These instructional plans are suggestions only, designed to provide guidance for teachers planning instruction to address the topic of earthquake preparedness while meeting the prescribed learning outcomes for personal planning K to 7. Teachers are encouraged to adapt the instructional plans to meet the needs of students and to respond to local requirements. For example, teachers may choose to:

- modify the grade 2-3 instructional plan for use at grade 4
- modify the grade 5-6 instructional plan for use at grade 7
- adjust the instructional plans to address prescribed learning outcomes from other subject areas (see "Cross-Curricular Connections" and "Addressing Additional Curricula" later in this section for more information).

The BC curriculum for personal planning K to 7 has been designed to help students maintain, reinforce, and develop skills, attitudes, and behaviours that can enhance their personal well-being throughout their lives and prepare them to deal with a world of complex, ongoing change. To that end, the instructional plans included in this resource were developed to address the prescribed learning outcomes for the personal planning curriculum through a study of topics related to personal preparedness for earthquakes.

Teachers may choose to deliver the instructional plans as single, continuous units, or may wish to divide the plans into individual activities and content them over the course of several weeks. Teachers may also consider setting a specific time of year to address earthquake preparedness as part of a school-wide approach (e.g., in September as a refresher; in May in conjunction with Emergency Preparedness Week).

In order to prepare students for their own emotional and physiological reactions to an earthquake, it is important that they receive as much information as possible about what an earthquake is *really like*.

Rather than impart such information in passive and non-interactive forms (e.g., lecture, reading), these instructional plans suggest engaging students in a creative reconstruction of what actually happens in the event of an earthquake. To that end, the procedures included in the grade 2-3 and 5-6 instructional plans in particular help students achieve this goal through visualizing:

- the sights, sounds, and physical feeling of an earthquake
- emotions an earthquake can trigger
- the duration of an earthquake (as well as the way that time may stretch during a period of upheaval, intense fear, excitement)
- the sources of danger in an earthquake (e.g., above their heads)
- the safest place to be in an earthquake (e.g., underneath a sturdy piece of furniture).

While it is possible to integrate these instructional plans with pre-existing classroom-based drills, the visualization exercises significantly augment earthquake drills, which focus only on safety procedures and evacuation.

Cross-Curricular Connections

The two instructional plans provided in this resource contain *suggestions* for ways to incorporate earthquake preparedness concepts in the classroom via the curriculum for personal planning. There are, however, many more ways that earthquake preparedness can be taught. The following two scenarios describe possible adaptations of the instructional plans to other subject areas and grades.

Scenario 1: English Language Arts, Grade 1

In this example, a teacher chose to address earthquake preparedness topics through a focus on stories and poems. The teacher began by adapting the grade 2-3 instructional plan, What Happens in an Earthquake? After a discussion of the emotional responses arising from an earthquake or trauma situation, the class read the storybook, *I Promise I'll Find You* by Heather Patricia Ward (Firefly Books). Full text of this book is available online at

www.geocities.com/EnchantedForest/Meadow/2320/promise.html

Since earthquakes and other trauma often commonly cause children to experience fear about separation or loss, the teacher chose this book to illustrate a parent's love for a lost child and a promise to be reunited.

After reading the book as a class, students were given a number of cut-out phrases and words (generated from class discussions of emotional responses), and used these to create their own stories and poems about their emotional responses to hearing the story and discussing trauma situations.

The teacher then compiled the stories in a class book. Parents were invited to read the stories during a school open house.

This integrated unit was used to help students achieve the following learning outcomes for English Language Arts and Personal Planning:

English Language Arts, Grades K – 1

It is expected that students will:

- demonstrate an understanding that print conveys meaning (Strategies and Skills)
- ask questions as an aid to understanding when reading, listening, or viewing (Strategies and Skills)
- recount what books, stories, or articles are generally about (Comprehension)
- describe the sequence of the main events in a story orally, in writing, or by using pictures (Comprehension)
- identify connections between their thoughts and feelings and their reading, viewing, or listening experiences (Engagement and Personal Response)
- demonstrate a willingness to present relevant ideas in discussions (Composing and Creating)
- identify connections between ideas and information and their own experiences (Composing and Creating)
- demonstrate pride and satisfaction in using language to express their thoughts, ideas, and feelings (Presenting and Valuing)
- demonstrate a willingness to participate in a variety of sharing activities that include the use of pictures, charts, storytelling, songs, lists, menus, and storybooks (Presenting and Valuing)
- demonstrate an awareness of differences in the ways in which people use language in various contexts, including home, the playground, and the school (Building Community)

Personal Planning, Grades K – 1

It is expected that students will:

- identify people and organizations that support children (The Planning Process)
- recognize when a problem exists (The Planning Process)
- relate consequences to actions and decisions (The Planning Process)
- identify and describe a wide range of feelings (Mental Well-Being)
- identify components of a safe and healthy school (Mental Well-Being)
- identify the hazards and use safe behaviours in the home, school, and community (Safety and Injury Prevention)
- demonstrate an ability to access emergency services (Safety and Injury Prevention)

Scenario 2: Science, Grade 7

Science, Grade 7

It is expected that students will:

- investigate how models may be used to think about processes that cannot be observed directly (Applications of Science)
- describe how technology and science are related (Applications of Science)
- identify changes that occur to the Earth's surface due to earthquakes and volcanoes (Earth and Space Science)
- compare and contrast the geological features found on the ocean floor with those on the surface of the continents (Earth and Space Science)

Personal Planning, Grade 7

It is expected that students will:

- describe the immediate and long-term consequences of unsafe behaviours on self and others (Safety and Injury Prevention)
- describe basic first-aid practices in a variety of situations (Safety and Injury Prevention)
- describe the factors that relate to injury prevention (Safety and Injury Prevention)

The teacher began by adapting the grade 5-6 instructional plan, Earthquake Preparations at School and Home. During the discussion of what causes earthquakes, the teacher used models, illustrations, and text resources to teach students about the geological processes related to earthquakes. Students then worked in groups to build their own models of the earth's crust, as well as a working model of a tsunami.

This integrated unit was used to help students achieve the following learning outcomes for Science and Personal Planning:

Addressing Additional Curricula

Some schools may wish to deliver earthquake topics as part of a school-wide, cross-curricular focus for a specified period of time. To that end, teachers may wish to consider additional ways of integrating earthquake preparedness topics in a variety of curricula:

- English—reading stories about earthquakes; writing stories, poems, etc. about earthquakes
- dance, drama, music, visual arts—creating songs, dramas, dances, or images related to earthquakes, earthquake preparedness, and the physical and emotional aftermath of earthquakes
- mathematics—simple word problems using earthquake data and scenarios (e.g., "Each person needs 4 litres of water per day. If there are 5 people in your family, how much water will you need for 3 days?")
- social studies—earthquakes throughout history and their effects on human behaviour.

In addition, the Annotated Resources section of this guide includes a number of teaching and learning resources specifically related to earthquake science topics.

Addressing Sensitive Issues in the Classroom

Discussions of traumatic events such as an earthquake may give rise to a range of anxieties and fears. To help students cope with their responses, and to help ensure their emotional well being, consider the following guidelines.

- Inform students of the objectives of the curriculum in advance before addressing any sensitive issues in the classroom, and provide opportunities for them to share the information with their parents.
- Advise parents in advance about what is happening in the school related to earthquake preparedness. (A sample letter to parents is included here along with an emergency preparedness tip sheet.)
- Be aware of the common emotional responses of children in traumatic situations (refer to the teacher backgrounder: How Children React to Disaster).
- Assure students that fear is a normal and healthy response.
- Focus on actions students can take to help themselves.
- Be quick to dispel students' myths about earthquakes. For example, point out that the earth does not crack and swallow people up. Most buildings do not collapse in an earthquake.
- Discussion of earthquakes and the associated emotions may trigger memories of other traumatic events. Be prepared for such responses and refer students to counsellors as required. In addition, teachers may wish to consult resources such as "When Does the Hurting Stop?" (published as part of *Responding to Critical Incidents: A Resource Guide for Schools*, Ministry of Education, 2001; available online at http://www.bced.gov.bc.ca/specialed/rci/pamph1.htm).
- Inform an administrator or counsellor when a concern arises.

Sample Letter to Parents

Dear parent or guardian:

Next week, your child will be learning about earthquakes. Your child will learn about the possibility of earthquakes in British Columbia and what they can do to be better prepared in a quake.

While many British Columbians assume that earthquakes are a coastal and lower mainland threat, the reality is that an earthquake can be experienced anywhere in the province. BC is one of Canada's most seismically active earthquake zones. In recent years earthquakes have been felt not only on Vancouver Island and in greater Vancouver areas, but in areas such as Nelson, Penticton, Dawson Creek, and Fort St. John.

The class will be working through some scenarios that will help them visualize:

- the sights, sounds, and physical feeling of an earthquake
- emotions an earthquake can trigger
- the duration of an earthquake (as well as the way that time may stretch during a period of upheaval, intense fear, excitement)
- the sources of danger in an earthquake (e.g., items above their heads, breaking windows, etc.)
- the safest place to be in an earthquake (e.g., underneath a sturdy piece of furniture, against an inside wall, etc.).

In most cases, earthquake preparedness lessons support the learning outcomes for the Personal Planning curriculum at the elementary level and for the Career and Personal Planning curriculum at the secondary level. By providing emergency preparedness information to students at several levels of their education, we are encouraging students to make emergency preparedness part of their lifestyle.

Discussions about earthquakes can be very frightening for children. We encourage you to talk to your child about what they are learning in class.

We will be encouraging students to talk to their families about what they can do at home to prepare for an earthquake. Attached are some tips to help you and your family get prepared for any emergency, including an earthquake. You may find these tips helpful as you talk to your child about emergency preparedness.

If you have any concerns about these topics, please contact your child's teacher or principal for further information.

Attachment:

Emergency Preparedness Tips

What to do before a disaster

- ❑ Arrange an out-of-area phone contact for family members to check in with, and plan an alternative family meeting spot if you can't get home.
- ❑ Identify several meeting spots for your family close to where you live, work or play in case you are not all together in an emergency.
- ❑ Practice safety drills in your home so everyone knows how to evacuate safely.
- ❑ Identify an alternate person in the neighbourhood to pick up your children from school in case you can't get there in an emergency situation — tell the school and your children who it is.

Prepare your home

Make your home safer by installing latches on cupboards and securing water tanks, top-heavy furniture, appliances or computers and other items against movement. Don't forget to duplicate or store important documents and essential business records in fireproof/waterproof containers.

Prepare an emergency supply kit

Be prepared to be on your own without help for 72 hours or more. Assemble an emergency kit with a minimum three-day supply of food and water. Store it in a secure place that, ideally, is accessible from outside. Your emergency kit should include:

- ❑ water and water purification tablets (four litres per person per day)
- ❑ food (non-perishable)
- ❑ cooking utensils, including a hand-operated can opener
- ❑ first-aid supplies
- ❑ extra essential medications and glasses, copies of prescriptions and infant supplies
- ❑ personal toiletry items (soap, toothpaste, toilet tissue, etc.)
- ❑ money, including coins
- ❑ battery-operated radio
- ❑ flashlight ("intrinsically safe"/sparkless)
- ❑ extra batteries
- ❑ candles and matches
- ❑ identification
- ❑ shelter — a plastic tarp/small tent, blankets/ sleeping bags or some large orange garbage bags

Protect yourself

During an earthquake, if you are in a building, stay inside and away from windows. Duck, cover, and hold. Duck under a heavy desk or table, cover your head and torso, and hold on to the furniture. If you can't get under something strong, go to an interior wall and sit with your bottom and feet flat on the floor and protect your head.

If you are outside, go to an open area. Stay away from buildings or any structures that could collapse, as well as power lines and dangling electric wires. If you are in a car, stop somewhere clear of overpasses, bridges and power lines. Stay inside your vehicle.

What to do after a disaster

There may be injuries to treat, leaking gas and water to shut off, small fires to put out, debris to clear and other hazards to check for. Be ready with a well-stocked first-aid kit and first-aid training, a wrench, fire extinguisher, work gloves and heavy-duty shoes.

A battery-operated radio will link you to instructions from local government and provincial emergency workers and news in your community.

Hang up any telephone receivers that are off the hook, and use the phone or cell phone only if a life is at stake. Emergency crews will need all available lines.

For more information on emergency preparedness and to play an interactive preparedness game, go to the Provincial Emergency Program (PEP) Web site www.pep.bc.ca and the toll-free PEP messaging line: 1-888-811-6233.

Provincial Emergency Program

The Instructional Plans

Time: 2-3 hours

What Happens in an Earthquake?

Purpose/Overview

IN THIS LESSON, STUDENTS HEAR EARTHQUAKE LEGENDS FROM AROUND THE world. They participate in an "earthquake visualization" activity where they consider the emotions they and others might feel during an earthquake. Students examine the kinds of damage an earthquake can cause in the home, community, and classroom, then use this information to discover "how to be safe" before, during, and after an earthquake (e.g., recognizing and dealing with potential hazards, personal safety responses). Students will also identify emergency response workers and describe their roles.

Prescribed Learning Outcomes

Personal Planning, Grades 2-3

It is expected that students will:

- describe various roles and responsibilities within families (Family Life Education)
- use appropriate vocabulary to express feelings (Mental Well-Being)
- demonstrate behaviours that contribute to a safe and healthy school (Mental Well-Being)
- describe appropriate solutions for hazardous situations in the home, school, and community (Safety and Injury Prevention)
- describe the emergency response systems in the community (Safety and Injury Prevention)
- identify a variety of job and volunteer situations within the community (Career Development)

Social Studies, Grades 2-3

It is expected that students will:

- describe how physical environment influences human activities (Environment)

Materials and Resources

You will need:

- a world map
- a stopwatch or other timer
- drawing and painting materials
- puppets (optional)
- pictures of emergency personnel — fire fighters, doctors, police officers, etc. (optional)

Resources

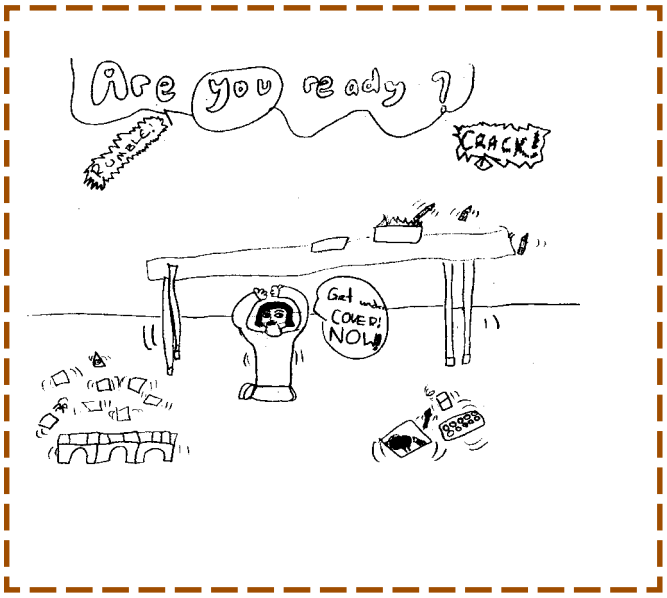
- teacher resources: "Earthquake Legends Around the World" and "When the Ground Shakes"
- student handout: "What I Learned about Earthquakes"
- teacher backgrounders (on pages 47 to 74): "Earthquake Hazards in the Classroom," "How Children Respond to Disaster," and "What Is an Earthquake?"

Preparation

Read the script for the visualization activity (see the teacher resource "When the Ground Shakes"). If you plan to have students create sound effects during the visualization (see procedure step 7), you may want to warn your neighbouring teachers beforehand about the noise.

To be prepared to answer students' questions, read the teacher backgrounder "What Is an Earthquake?" (found later in this resource).

You may wish to prepare larger-print versions of the earthquake legends from the student handout as posters or on index cards.



Procedure

1. Begin by asking students to describe their natural surroundings. You may choose to ask such questions as:
   - What is the land like where we live? Is it flat, or are there mountains? Is it covered with grassy plains, or are there tall trees?
   - Is there water nearby? What kind of water? (If discussing a river, you may want to ask where the water comes from, and where it goes.)
   - What kind of things do you like to do outside? (In discussing this question, help students make connections among natural elements and human activities — e.g., skiing if near mountains, fishing and sailing if near water.)

2. Ask students whether they think their environment has changed over time, or if it has always been the way it is now (e.g., Have the mountains always been just as they are? Have the ocean and rivers always been the same size and shape?). After eliciting some comments, tell them that while it may *seem* like the natural world around us is stable and unmoving, it is really changing all the time. You may want to ask students if they have ever noticed any clues indicating that the nature of the land has changed over time (e.g., seashells dug up in ground far from the ocean).

   Inform students that most changes to the land occur very slowly over long periods of time, so people don't notice them. However, some changes to the land take place very quickly, and can have a huge impact on people's lives. Ask students if they can think of any examples of such changes. Provide hints if necessary until someone mentions earthquakes.

3. Ask students if they know what an earthquake is (see the Teacher Backgrounder: "What is an Earthquake?"). Elicit comments; then have students imagine what people living long ago must have thought when the ground began to shake beneath their feet.

4. Arrange students into small groups of 2-4. Give each group a legend from the Teacher Resource, "Earthquake Legends around the World." Discuss the meaning of *legend* (if necessary). Using a world map, indicate where the different legends come from. Have students read through the legends and discuss them briefly in their groups. (You might wish to circulate and help groups with their reading.) Ask each group to share its legend with the class in the form of a drama, picture, dance, song, etc. When they are finished, ask which legend they found the most interesting and why.

5. Inform students that today we know that earthquakes are not caused by people, animals, or magical beings, but are actually the result of natural forces acting deep inside the planet. Point out that the legends do not represent what the people in these countries believe. Briefly explain the causes of an earthquake by referring to the information provided in the teacher backgrounder: What is an Earthquake?

6. Poll the class to see if anyone has ever experienced an earthquake. If yes, ask: What did it feel like? What did you see? What did it sound like? How long did it last? (You may wish to extend this discussion by focussing on other natural disasters such as floods, tornados, forest fires, etc.)

7. Using the teacher resource, "When the Ground Shakes," conduct a visualization exercise with students. Appoint one person to be the timer for the earthquake, and give him or her the stopwatch (or other timer). You may also want to assign students to create earthquake "special effects" to help the class visualize the experience more clearly. For example, one student could be assigned to flick the lights on and off, while other students could produce sound effects such as windows rattling, books falling, desks thumping, doors slamming, people shouting, car alarms going off, etc. (Alternatively, invite students from another class to perform the sound effects and act as timer so that your all students in your class can experience this part of the activity.)

Before beginning, explain that part way through the visualization they will be asked to practise the duck, cover, and hold procedure. If necessary, review such procedures.

8. Ask students to close their eyes (if they feel comfortable doing so), and to listen as you read the visualization. Once you get to the point where the students should get under their desks, have the timer start the stopwatch and time one full minute. When the "earthquake" is over, have the students count to 60.

9. Debrief the visualization with questions such as the following:

- Did any of the earthquake effects surprise you?
- Did that one minute seem shorter or longer than usual?
- Where did most of the danger come from? (falling objects)
- Why is it important to face away from the window in an earthquake? (avoid breaking glass)
- Why is it important to protect your head and neck? (most vulnerable parts of the body)
- What would you have done differently if you were in the gym? library? bathroom? hall? playground? school bus? (same as in classroom; if no tables or desks to duck under, sit against an inside supporting wall or archway, bottoms and feet flat on floor, cover your head, and stay away from windows and mirrors; if outdoors—stay there unless it is unsafe, move away from buildings, streetlights, and utility wires; crouch and cover in an open space away from trees and playground equipment; on a bus, duck, cover and hold, stay in the bus, and listen to the driver.) What are the dangers in these places? (falling objects, mirrors, broken hot water pipes, trees, playground equipment, electrical lines)
- What would you have done differently if you were at home? in a shopping mall? movie theatre? restaurant? swimming pool? (help students understand that similar principles for earthquake survival can be applied in almost any situation, e.g., duck, cover, and hold; avoid windows and shelves with heavy objects; stay put until it's safe to move; look for an adult to help)
- Why do we count to 60 after the shaking has stopped? (to allow things to finish falling; point out that not all earthquakes in BC las less than one minute — some can last over three minutes).

Make sure that students understand that though an earthquake strikes from below, most of the danger comes from above. Ask students to consider ways in which the

dangers in the visualization could be reduced. Refer to the teacher backgrounder: Earthquake Hazards in the Classroom, for more information.

10. Ask students to pretend that the earthquake in the visualization really happened. What sort of emotions would they now be feeling? Record their answers on the board. Distribute drawing materials, or have students use their reflective journals to record their feelings about the visualization experience. You may wish to have them complete sentence stems such as:

- During an earthquake, I might feel…
- After an earthquake, I might feel…

11. When they are finished, ask them how they could express these feelings to their friends or parents. Assure students that it is normal to feel scared, sad, angry, or even fascinated in an emergency situation. Tell them that communicating strong feelings is sometimes difficult, but is important because it helps other people understand when there is a problem. It can also help a person feel better. You may wish to use puppets to role play a discussion between a child and a parent talking about these feelings. (Refer to the teacher backgrounder, "How Children Respond to Disaster," for more information.)

12. Next, ask students to imagine what sort of damage might happen to the community in an earthquake. Elicit suggestions, correcting any misperceptions that arise (e.g., earthquakes don't cause the ground to open up and swallow people; although some building damage may occur, not all buildings will crumble to the ground). You may want to mention the following:

- parts of some buildings might collapse
- bridges and roads could be damaged
- landslides might occur
- fires might start
- a tsunami (wave) might develop (if you are near the coast)
- people might be injured.

Again, ask students how they would feel about such damage and possible effects on their lives. You may have an opportunity to discuss feelings related to September 11, 2001.

13. Ask students which people in the community are there to help when a disaster such as an earthquake happens. Who helps the injured people? Who puts out the fires? Who gathers the people together and makes sure they are safe? Have students create a list of emergency workers. Such a list could include:

- police officers
- fire fighters
- doctors
- nurses
- teachers, principals, and other school staff
- parents and other family members
- community helpers (e.g., from recreation centres, places of worship)
- other trusted adults.

Point out that, often, it is friends, neighbours, family, and volunteers who respond since it may take some time for fire fighters and other workers to get to the scene. Reinforce that everybody will do the best they can, but in an emergency everyone will be very busy and things will not be perfect.

14. Have students revisit their drawings or journals, and add information about who they could rely on for help in the event of an earthquake. Encourage students to take their drawings home and talk to their parents about what they have discussed in class.

Assessment

Distribute the student handout, "What I Learned about Earthquakes." Read each sentence stem as a class, and ensure students understand them. Have students answer the questions (using words, pictures, or both), and then submit the tool along with their journals or pictures for assessment. Look for evidence that students are able to:

- articulate earthquake hazards
- identify possible emotional responses to an emergency
- display empathy by identifying others' emotional responses
- identify people who can help in an emergency
- reflect what they have learned about earthquake hazards and response.

Adaptations

To facilitate reading of the earthquake legends, pair students in heterogeneous reading partners, or use older students as reading buddies.

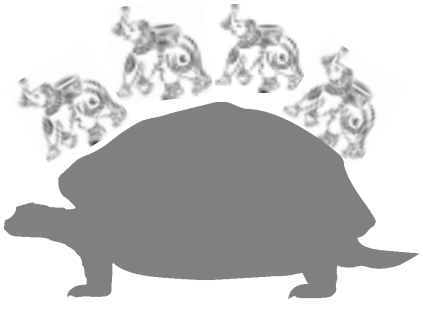
If using this instructional plan with ESL students, take extra time to teach any new vocabulary related to earthquakes. You may also want to spend more time on teaching students how to articulate their emotions by having them write down sentences using the words identified in class discussions. Use key visuals of emergency personnel to help ESL students identify these people and their roles.

If using this instructional plan with special needs students, be sure to adapt teaching of appropriate earthquake response to address their particular needs (e.g., if your class includes students in wheelchairs, do not teach them to duck and cover, but rather remain in their wheelchair, apply the brakes, and protect their head and neck; for students with hearing impairments, use a visual cue to indicate "duck, cover, hold"; ensure teaching assistants are familiar with earthquake response procedures).

Extensions

Have students work in groups to create earthquake dramas. These dramas could demonstrate what to do when an earthquake happens, deal with children trying to express their feelings to parents, or show emergency response workers helping people.

Individual students could illustrate his or her favourite earthquake legend, showing the characters making the earth shake.



"The earth is held up by four elephants that stand on the back of a turtle."

[Teacher Resource]

Earthquake Legends Around the World

East Africa

A giant fish carries a stone on his back. A cow stands on the stone and balances the Earth on one of her horns. When the cow's neck begins to hurt, she tosses the Earth from one horn to the other. This makes the Earth shake.

West Africa

The Earth is held up on one side by a mountain and on the other side by a giant. The giant's wife holds up the sky. When the giant lets go of the Earth to hug his wife, the Earth shakes.

Belgium

When people on Earth are bad, God sends an angel down to strike the air around the Earth. This makes the Earth shake.

Colombia

When the Earth was first made, it sat on three large beams of wood. A god named Chibchacum flooded the land and so he was punished. He has to carry the Earth on his shoulders. This makes him angry and he stamps his feet. This shakes the Earth.

Greece

Strong winds are trapped in caves under the ground. When the winds try to escape from the caves, they make the Earth shake.

India (The Turtle)

The Earth is held up by four elephants that stand on the back of a turtle. The turtle is standing on a big snake. When these animals move, the Earth shakes.

India (Alive! Alive!)

People live inside the Earth. Sometimes they shake the Earth to find out if anyone is still living on the surface. When the Earth shakes, people on the surface shout "Alive! Alive!" so the people inside will know they are there and stop shaking.

Japan

A giant catfish lies curled up under the sea. The islands of Japan are resting on his back. When the catfish moves, the islands shake.

Latvia

A mighty god carries the Earth in his arms as he walks around the heavens. When he is having a bad day, he shakes the Earth.

Mexico

The devil lives inside the Earth. Sometimes he makes big cracks in the ground from the inside. When the devil wants to cause trouble, he uses the cracks to come up to the surface.

Mozambique

The Earth is a living creature and it has the same kinds of problems people have. Sometimes the Earth gets sick with fever and chills, and we can feel it shaking.

New Zealand

Mother Earth has a child inside her named Ru. When baby Ru stretches and kicks, he causes earthquakes.

Scandinavia

The god Loki was being punished for the murder of his brother. He was tied to a rock in a cave under the ground. A cave snake dripped poison on Loki's face. He wiggled to get out of the way. This made the ground above him shake.

Siberia

The Earth sits on a sled driven by a god named Tuli. The dogs that pull the sled have fleas. When they stop to scratch their fleas, the Earth shakes.

North America

Some First Nations legends say that a big earthquake was caused by a war between Thunderbird and Whale. Thunderbird went fishing one day and caught Whale in her claws. When Thunderbird brought Whale back to her nest, they had big fight. Their fighting shook the Earth.

[Teacher Resource]

When the Ground Shakes

"Imagine that you are sitting in class when your desk begins to tremble. You can hear a low, rumbling noise coming from somewhere. It's getting louder. Is it a large truck, or a plane?

• • •

Suddenly the ground starts shaking violently. It feels like you're sitting on a galloping horse. It's hard to stand up. Even staying in your seat is difficult, because your desk is jolting and jumping underneath you. It's almost as if you are riding a bike down a long flight of stairs.

• • •

Someone yells, "It's an earthquake! Duck, cover, and hold!"

[*Students duck, cover, hold, protecting heads and necks facing away from the window, or sit with bottoms and feet flat on the floor with backs against an inside wall, preferably a corner, with knees drawn to chests to protect vital organs and hands and arms covering heads, etc.*]

• • •

[*Give the timer the signal to begin.*]

The ground keeps trembling. The whole building is shaking now. The doors are swinging back and forth on their hinges, banging against the wall. They slam shut. The lights begin to flicker, then go out.

• • •

Notebooks and pencils are falling out of your desk. Hanging plants and lamps are swinging on their hooks. Pictures are banging loudly against the wall. Things are falling from the shelves and bookcases. It's very noisy. One of the windowpanes shatters. The glass comes crashing to the ground.

• • •

Outside, people are shouting and screaming. Car alarms are going off in the distance. There are loud cracks and bangs as parts of outer building and branches of nearby trees fall to the ground.

• • •

[*at end of one minute*]

Suddenly, the shaking ends as quickly as it had begun. All is quiet. The earthquake is over.

• • •

Everyone stays in their safe place, counting out loud to 60, then moves cautiously while looking up to see if anything is going to fall.

• • •

Is everyone all right?"

What I Learned about Earthquakes

When an earthquake happens, I should: _____

_____

_____

_____

_____

It is very important for me to protect my _____

and _____

In an earthquake, most of the danger comes from: _____

_____

An earthquake may make me feel: _____

_____

Some people might feel differently. An earthquake may make someone else feel:

_____

Some people who help me in an emergency are: _____

_____

_____

_____

Time: 3-5 hours

Earthquake Preparation at School and Home

Purpose/Overview

IN THIS LESSON, STUDENTS LEARN TO IDENTIFY EARTHQUAKE HAZARDS IN THE classroom, community, and home. After interviewing their parents to find out about their own family's level of earthquake preparedness, they create an earthquake preparedness proposal suggesting steps to review and further enhance their family's level of emergency earthquake preparedness.

Prescribed Learning Outcomes

Personal Planning, Grade 5

It is expected that students will:

- consistently demonstrate behaviours that contribute to a safe school and community (Mental Well-Being)
- describe the potential for injury in a variety of environments and situations (Safety and Injury Prevention)
- describe how to minimize hazards in a variety of situations (Safety and Injury Prevention)

Personal Planning, Grade 6

It is expected that students will:

- encourage others to contribute to a safe school and community (Mental Well-Being)
- identify basic first-aid skills (Safety and Injury Prevention)
- analyse emergency procedures, in the home, school, and community (Safety and Injury Prevention)

Materials and Resources

You will need:

- stopwatch (or other timer)
- drawing materials (large sheets of drawing paper, pens and pencils, etc.)

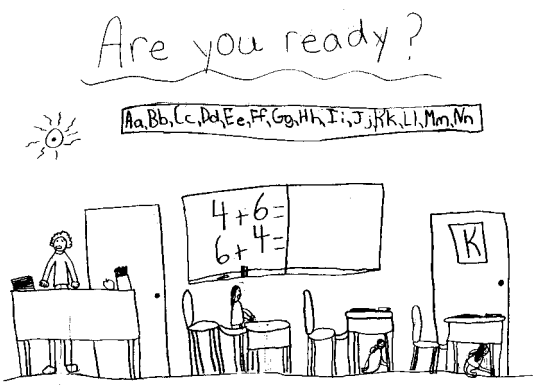
Resources

- teacher resource: "Visualizing an Earthquake"
- student handouts: "Earthquake Hazards in the Home," "Hazard-Proof Your Home," "Interview Questions," "How Prepared Am I?"
- teacher backgrounders (on pages 47 to 66): "Earthquake Hazards in the Classroom," "How Children Respond to Disaster," "Earthquake Preparedness," "What Is an Earthquake?" "Earthquake Glossary," and "Emergency Supply Kit"

Preparation

Read and familiarize yourself with the script for the visualization activity (see the teacher resource, "Visualizing an Earthquake"). To be prepared to answer students' questions, read the teacher backgrounder, "What Is an Earthquake? "(found later in this resource).

If you are unable to facilitate a demonstration of basic first aid skills, contact a guest for this part of the instructional plan.



Procedure

1. Begin by asking students if they have ever been in an earthquake. Have those who answer yes explain what happened during the earthquake, what they thought, and what it felt like. (You may wish to extend this discussion by focussing on other natural disasters such as floods, tornados, forest fires, etc.)

2. Ask students if they know what causes earthquakes to happen. Elicit comments, then fill in their knowledge gaps with some brief direct instruction. Refer to the teacher backgrounder, "What is an Earthquake?" for information on the geological processes that cause earthquakes.

3. Have students consider what would happen if an earthquake were to occur when they were sitting in the classroom. Elicit comments on how they think the earthquake would feel and sound like, and what sort of damage it might cause to the objects in the classroom.

4. Using the teacher resource, Visualizing an Earthquake, conduct a visualization exercise with the students. Appoint one person to be the timer for the earthquake, and give him or her the stopwatch. Alternatively, invite a student or teacher from another class to act as timer so that all students in your class can experience the visualization.

   Before beginning, remind students of what to expect in a visualization exercise. In addition, explain that part way through the visualization they will be asked to practise the duck, cover, and hold procedure. If necessary, review such procedures.

5. Ask students to close their eyes (if they feel comfortable doing so), and to listen as you read the visualization. Once you get to the point where the students should get under their desks, have the timer start the stopwatch and time one full minute.

6. Debrief the visualization with questions such as the following:
   - How did it make you feel?
   - Were there any earthquake effects described that surprised you?
   - Did that one minute seem shorter or longer than usual?
   - What classroom items became potential dangers?
   - If an earthquake really were to happen, what sort of decisions would you have to make very quickly?
   - What might happen to people who aren't properly protected from the hazards identified? What sort of injuries might they suffer? What different first-aid skills and materials would be useful in treating such injuries? If someone is seriously injured, what should you do?

   Discuss and demonstrate simple first aid procedures for dealing with minor injuries (e.g., applying pressure to stop bleeding of minor cuts). Discuss the importance of knowing which injuries students can deal with, and which ones they need help to treat.

7. Allow time for students to use their journals or to talk with a partner about the visualization experience. Debrief as necessary (refer to the teacher backgrounder, "How Children Respond to Disaster," for more information).

8. Inform students that although earthquakes happen underground, many of the dangers we face in an earthquake are overhead. Anything that is not securely fastened may fall. That is why it's so important to get under a heavy piece of furniture like a desk, so we can be protected from falling objects. It is also important to face away from the windows, as they can sometimes shatter inward when an earthquake occurs.

Ask students to look around at the classroom again and try to identify as many possible earthquake hazards as they can. You may want to refer to the teacher backgrounder, Earthquake Hazards in the Classroom, for more information. Have students consider how these hazards can cause injury, and what might be done to reduce their potential danger.

9. Arrange students in small working groups of 3-4, and distribute large sheets of paper and drawing materials to each group. Ask the groups to consider potential hazards in other public places they visit in their daily lives. You may want to assign specific places to each group (e.g., the shopping mall, movie theatre, skating rink, restaurant, public park), or you may want to have them choose their own. In their groups, students should discuss what types of hazards might exist in such a place. They should then draw a picture of the setting that includes all of these different hazards. The picture should also include one or two safe areas where a person would be protected from the identified hazards.

10. When each group has finished its drawing, have them exchange their picture with another group. They should then try to identify all potential hazards in the picture they've been given, as well as the safe places in the setting. If time is available, have the groups continue exchanging their pictures until all groups have examined all of each other's drawings.

Conduct a brief class discussion on the different hazards identified in each of the settings drawn. Were there any hazards that were not included in the picture or identified by the observing groups? Where were the safe areas in each picture?

11. Distribute the handout, Earthquake Hazards in the Home. Go over the handout as a class, and inform them that they will be expected to examine their homes for possible hazards and complete the checklist as homework.

12. When students have finished their homework, conduct a brief class discussion on the subject of home hazards. Go over the checklist, and ask students which of the listed hazards was most common in their home. Next, ask them to come up with ideas on how they could work to diminish the danger of those hazards. After students have discussed some solutions, distribute the handout, Hazard-Proof Your Home, and allow time for them to read it.

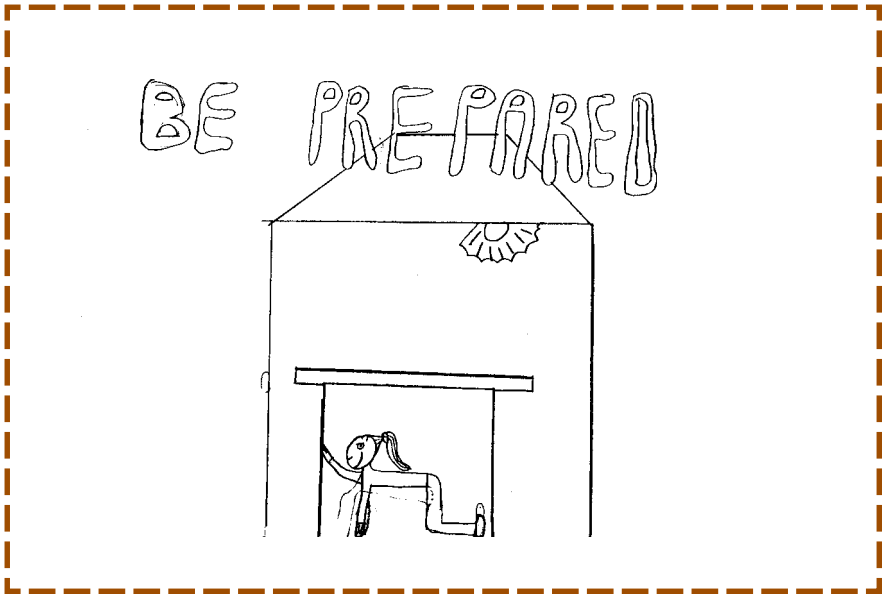
13. Ask the students if they know whether or not their family has an earthquake emergency plan. Inform them that they will be expected to interview a parent or guardian on the subject of earthquakes and emergency preparedness. As a class, brainstorm a list of interview questions and write them on the board. Alternatively, distribute the student handout, "Interview Questions." When finished, instruct students to write down the questions and take them home to ask their parent or guardian.

14. Next class, conduct a discussion on the results of the interviews. How prepared would the students say their families are to deal with an earthquake?

15. Write the headings "Before an Earthquake," "During an Earthquake," and "After an Earthquake" on the overhead or chalkboard. Ask students to suggest what they and their families can do at each stage. Use the teacher backgrounder: Earthquakes Preparedness, to suggest additional responses.

16. Have students create an Earthquake Preparedness Proposal based on the results of the interview and the information discussed. This proposal could include some or all of the following:

- an assessment of the hazards
- an analysis of what has been done already and what needs to be done
- a schedule for family meetings to introduce and/or review earthquake emergency procedures
- suggestions on how to earthquake-proof the home, based on what hazards the students identified when completing the "Earthquake Hazards in the Home" handout
- fill-in-the-blanks handouts for all family members with spaces for family contact information and diagrams indicating where the family should meet in the event of an earthquake
- fill-in-the-blanks handouts for responsibilities each family member could assume before and after an earthquake (e.g., who should replace water, food every six months)
- large, easy-to-read signs identifying the breaker panel, gas, and water switches
- floor plans for each room of the house that identify both safe and dangerous places to be when an earthquake hits, and evacuation routes and exits.



Assessment

When students have finished their proposals, distribute the student handout, "How Prepared Am I?" Have them complete the self-assessment before submitting their group pictures, homework, and earthquake preparedness proposals for assessment. Assess their work, looking for evidence that they are able to:

- identify earthquake hazards in a variety of home, school, and community settings
- identify ways to minimize or avoid earthquake hazards
- identify possible emotional responses to an emergency situation
- encourage others to contribute to a safe school and community (Personal Development: Mental Well-Being)
- identify basic first-aid skills (Personal Development: Safety and Injury Prevention)
- analyse emergency procedures, in the home, school, and community (Personal Development: Safety and Injury Prevention)

Adaptations

If using this instructional plan with ESL students, take extra time to teach the students any new vocabulary related to earthquakes. You may also want to spend more time on teaching students how to articulate their emotions by having them write down sentences using the words in class discussions.

If using this instructional plan with special needs students, be sure to adapt teaching of appropriate earthquake response to address their particular needs (e.g., if your class includes students in wheelchairs, do not teach them to duck and cover, but rather remain in their wheelchair, apply the brakes, and protect their head and neck; for students with hearing impairments, use a visual cue to indicate "duck, cover, hold"; ensure teaching assistants are familiar with earthquake response procedures).

Extensions

- Have groups prepare a drama, dance sequence, song, or poem about how to respond if an earthquake occurs while they are in a public place (e.g., swimming pool, restaurant, shopping centre, movie theatre).
- Have students do a follow-up review later in the year to see how much they remember of earthquake hazards and to consider what steps their families have taken to preparefor the possibility of an earthquake.
- Have students apply their earthquake preparedness knowledge to other emergencies or disasters that they might encounter in their lives (e.g., fire, flooding, hurricane). As a class, discuss how preparedness techniques would differ from situation to situation.
- Share with students information from the teacher backgrounder, "Emergency Supply Kit." Students could include such information in their earthquake preparedness proposals. Encourage them to share their proposals with their families when finished.
- Have students compile a school bulletin board of earthquake preparedness information.

[Teacher Resource]

Visualizing an Earthquake

"Imagine that you are sitting in class, working on an assignment, when you notice that your desk is trembling slightly. You wonder what's causing that strange shaking.

You can hear a low, rumbling noise coming from somewhere. It's getting louder. Is it a large truck, or maybe a plane?

Suddenly there is an incredible jolt, as if the entire school had been lifted a few centimetres off the ground and then comes crashing down. It feels like you're on the back of a galloping horse. It's hard to stand up. Even staying in your seat is difficult, because your desk is shaking and jumping underneath you. It's almost as if you are riding a bike down a long flight of stairs.

You hear someone yell, 'It's an earthquake! Duck, cover, and hold!'

[*Students duck, cover, hold, protecting heads and necks facing away from the window, or sit with bottoms and feet flat on the floor with backs against an inside wall, preferably a corner, with knees drawn to chests to protect vital organs and hands and arms covering heads, etc.*]

[*Give the timer the signal to begin.*]

The whole building is shaking violently. The doors are swinging back and forth on their hinges, banging against the wall. They slam shut. The lights begin to flicker, and then go out.

Notebooks and pencils are falling out of your desk. Hanging plants and lamps are swinging on their hooks. Pictures are banging loudly against the wall. Things are falling from the shelves and bookcases. Those that are breakable smash loudly as they hit the floor. It's very noisy. Some of the windowpanes start to shatter. The glass comes crashing to the ground.

Outside, people are shouting and screaming. Car alarms are going off in the distance. There are loud cracks and bangs as parts of outer building and branches of nearby trees fall to the ground.

Suddenly, the shaking ends as quickly as it had begun. Things get quieter, but you can still hear many sounds, such as the car alarms and dial tones from receivers that have fallen off their hooks. The earthquake is over.

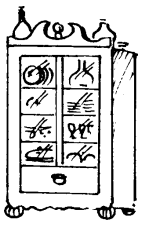
Everyone stays in their safe place, counting out loud to 60, then moves cautiously while looking up to see if anything is going to fall.

Is everyone all right?"

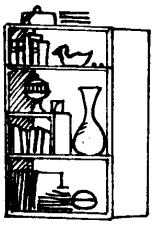
Earthquake Hazards in the Home

Take the time to go through the rooms in your home to identify the possible earthquake safety hazards.

- china cabinet

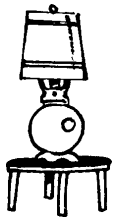


- tall knick-knack shelves

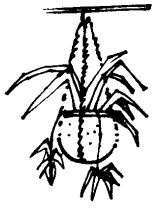


- bookcases

- tall, heavy table lamp



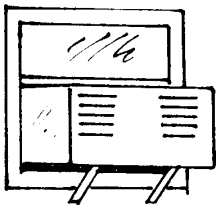
- hanging plant



- mirror on wall

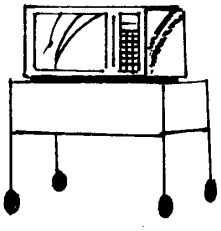
- heavy objects on wall shelves

- window air conditioner



- hanging lamp or chandelier

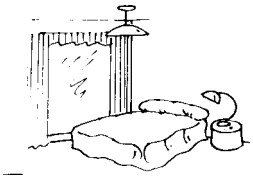
- unsecured TV, computer, stereo, CD stacks



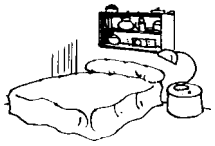
Earthquake Hazards in the Home

Take the time to go through the rooms in your home to identify the possible earthquake safety hazards.

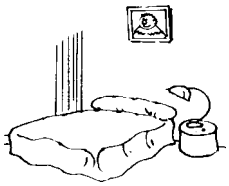
- bed by big window



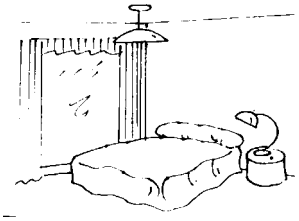
- heavy objects on shelves above bed



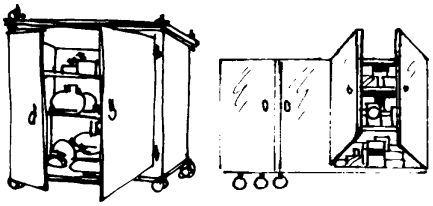
- heavy picture above bed



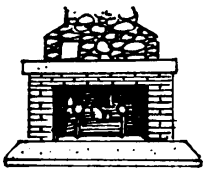
- hanging light above bed



- cabinet doors not fastened, medicine cabinet doors not fastened

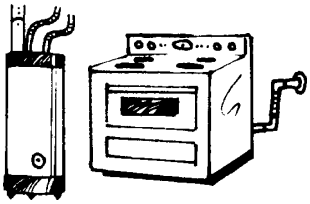


- fireplace bricks

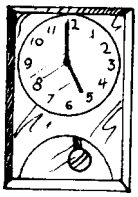


- chimney

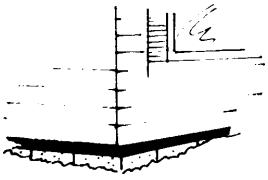
- unsecured appliances such as water heater, dryer, fridge, stove (especially if gas-powered)



- heavy wall clock



- house not bolted to foundation



Hazard-Proof Your Home

These are some of the things your family can do to reduce potential earthquake hazards in your home:

- ❑ Move beds away from large windows and out from underneath hanging lights.
- ❑ Make sure beds are away from heavy mirrors, large pictures, bookcases, or shelves.
- ❑ Instead of using heavy lamps on bed tables, use light, non-breakable lamps.
- ❑ Remove all heavy or breakable objects from high shelves.
- ❑ Do not hang plants that are in heavy or breakable pots. Put them in light, non-breakable pots before hanging them.
- ❑ Used closed hooks for all hanging plants, lamps, and other suspended objects, and make sure all hooks for hanging objects are securely attached to studs.
- ❑ Use earthquake-proof picture hooks to secure all heavy wall hangings such as mirrors and pictures to walls.
- ❑ Secure all cabinets with strong latches that will not open during an earthquake (magnetic latches usually aren't strong enough).
- ❑ Remove all glass bottles from bathroom medicine cabinets and put them in drawers or in a cabinet that is strongly latched.
- ❑ Make sure there are no glass containers around the bathtub.
- ❑ Move all flammable materials away from any heat sources.
- ❑ Move heavy objects away from exit routes.
- ❑ Secure all wheeled objects so they cannot roll.
- ❑ Make sure all tall, heavy furniture is firmly attached with studs to the nearest wall.
- ❑ Make sure that your gas lines are attached with flexible connectors to appliances such as stoves, water heaters, and dryers with flexible connectors.
- ❑ Make sure all heavy appliances such as water heaters, refrigerators, and stoves are securely attached to wall studs or the floor, and that air conditioners are well braced.
- ❑ Secure all roof tiles.
- ❑ Put plywood sheeting in the attic around the chimney to prevent bricks from falling through to the living quarters, and make sure the outside chimney is securely braced to the buildings.
- ❑ Make sure your house is firmly bolted to the foundation.
- ❑ Remove dead or diseased branches from trees in your yard.

Interview Questions

Have you ever been in an earthquake? If yes, what was it like?

What do you think the chances are of an earthquake happening here?

If an earthquake happens here, what do you think the chances are of people being injured or killed?

If an earthquake happens here, what do you think the chances are of our home being seriously damaged?

How earthquake-proof do you think our home is?

Do we have a family plan for what to do in case of an earthquake? If yes, what is it?

Do we have an out-of-town family contact to use in case of emergencies? If so, who is it? What's that person's phone number?

Do we have an emergency safety kit? If yes, what's in it?

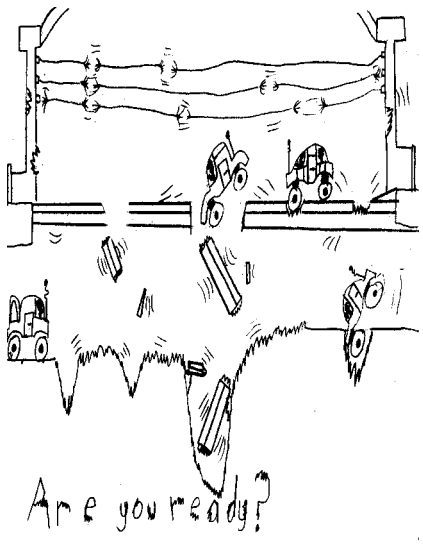
Are our water, gas, and electricity main switches clearly labelled so that everyone in the family knows where they are and how to turn them off?

Would you be willing to have a family meeting to discuss what we should do and who we should call in case of an earthquake?

How Prepared Am I?

What I learned	Associated Activity	Self-assessment	Teacher assessment
I know how to make quick, informed decisions regarding my safety in case of emergency	• *earthquake visualization* • *class discussion* • *group picture analysis* • *home hazard identification* • *earthquake preparedness proposal*		
I know how to identify earthquake risks in my classroom	• *earthquake visualization* • *class discussion*		
I know how to identify earthquake risks in my home	• *home hazard identification*		
I know how to identify earthquake risks in my community	• *group picture analysis*		
I know how to identify safe places to be if an earthquake happens	• *earthquake visualization* • *class discussion* • *group picture analysis* • *home hazard identification* • *earthquake preparedness proposal*		
I know how and where to "duck, cover, and hold" to protect myself if an earthquake happens	• *earthquake visualization* • *class discussion* • *group picture analysis* • *earthquake preparedness proposal*		
I can identify first aid skills that would be useful to help people injured in an earthquake	• *earthquake visualization* • *class discussion* • *first aid demonstration*		
I know how to reduce the risks of possible earthquake hazards in my classroom and home	• *earthquake visualization* • *class discussion* • *home hazard identification* • *earthquake preparedness proposal*		
My earthquake proposal includes a step-by-step plan that would increase my family's level of earthquake preparedness	• *earthquake preparedness proposal*		
My earthquake preparedness proposal suggests useful ways my family members can contribute to our household safety	• *earthquake preparedness proposal*		

Teacher Backgrounders

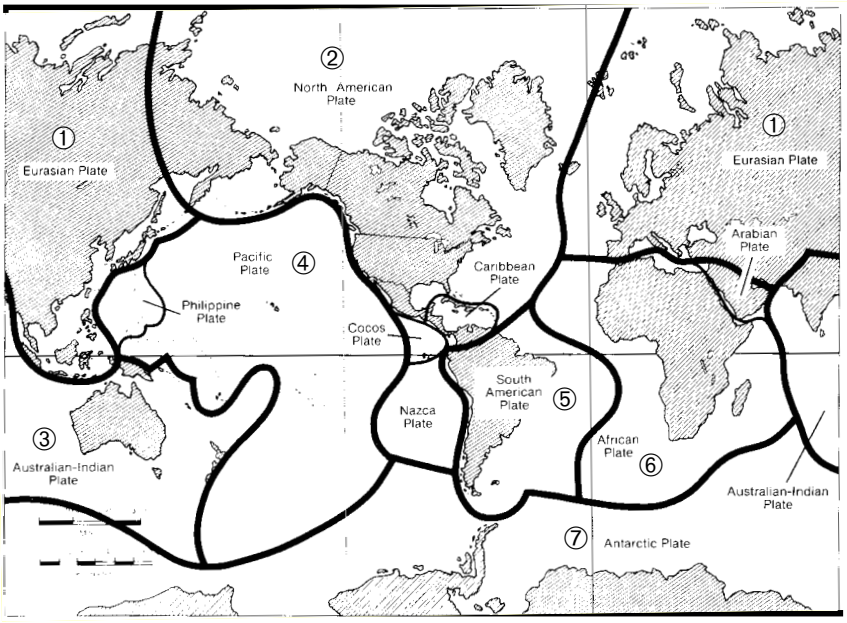


What is an Earthquake?

AN EARTHQUAKE IS A SUDDEN, SOMETIMES violent, shaking of the ground caused by the sudden release of stored energy within the Earth's crust. Earthquakes are natural events, like snowstorms or tornadoes. Although the destruction they may cause can be terrifying and devastating, they are an essential part of the geologic process that constantly shapes the surface of our planet.

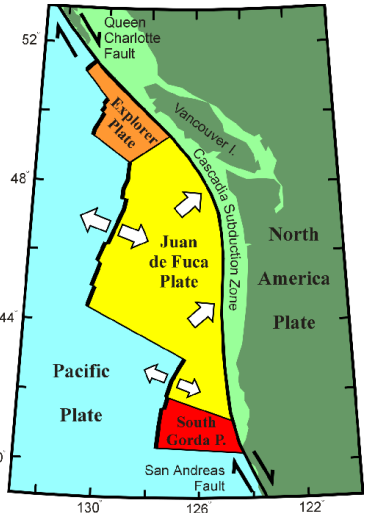
What Causes Earthquakes?

Although the Earth feels solid and unmoving to us, that isn't really the case. The planet surface is actually made up of seven large, and several smaller, crustal plates moving in continual motion over the planet's molten core.



Earth's crust consists of seven major crustal plates and several minor plates. — Adapted from original by US Federal Emergency Management Agency (FEMA)

Compressional forces continually create stress on the rock within and between each of these plates. When the rock can no longer withstand this stress they suddenly break or slide creating what we feel as an earthquake.



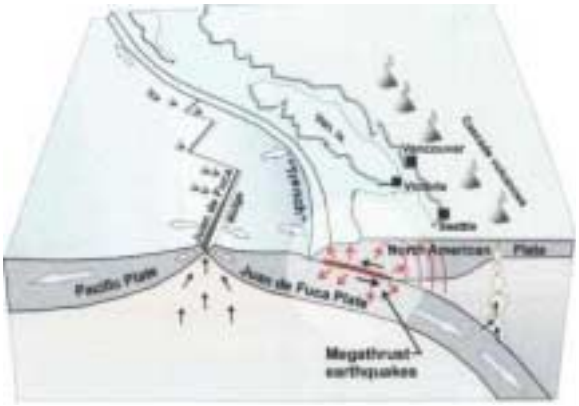
Tectonic Plates of the West Coast of Canada —National Resources Canada, Geological Survey of Canada

All of British Columbia is on the North America Plate. Note also the interaction of the Pacific Plate off the coast of BC and two smaller plates, the Juan de Fuca Plate and the Explorer Plate.

Approximately 90 per cent of the world's earthquakes occur along the margins of these tectonic plates, where one of three boundary conditions exist:

- **Divergent boundaries** occur between plates moving away from each other. Examples of a divergent boundary are seen off the west coast of Vancouver Island between the Pacific Plate and both the Juan de Fuca and Explorer Plates where an underwater mountain range is slowly being built by upwelling magma.

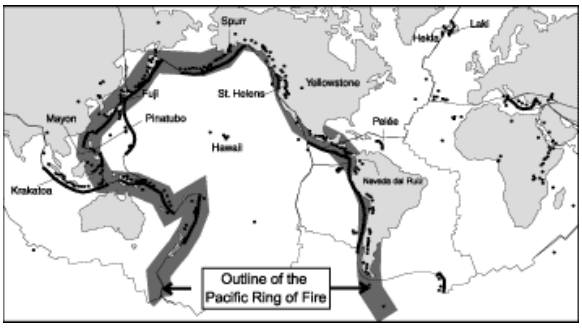
- **Transform (or Strike-Slip) boundaries** exist where tectonic plates slide horizontally past each other, neither creating nor destroying crust. Transform boundaries are commonly marked by shallow earthquakes. North of Vancouver Island, the Queen Charlotte Fault is a good example of a transform fault and is, in fact, the northern extension of the San Andreas Fault in California.
- **Convergent (or Subduction) boundaries** are boundaries where plates slowly come together and one plate is driven (or subducted) below the other. In British Columbia, the Cascadia Subduction Zone is one of the world's best examples of this type of boundary. Along this margin, the subducting Juan de Fuca and Explorer plates compress the North America Plate creating a bulge along its western margin.



Cascadia Subduction Zone (CSZ) illustrating how the Juan de Fuca Plate subducts below the North America Plate. — Natural Resources Canada

The "Pacific Ring of Fire," a band of intense earthquake activity circling the Pacific Ocean, and including Canada's west coast, is one of the most seismically active areas in the world, clearly delineating the active plate margins.

Earthquakes occur from the deformation of outer, brittle portions of these tectonic plates. Due to the heating and cooling of the rock below these plates, the resulting convection causes the adjacently



The "Pacific Ring of Fire," shown here, is defined by the region of high earthquake activity around the margin of the Pacific Tectonic Plate. — Natural Resources Canada, Geological Survey of Canada

overlying plates to move, and, under great stresses, deform. The rates of plate movements range from about 2 to 12 centimetres per year and stress can build up within deforming plates or between "locked" plate margins. If the accumulated stress exceeds the strength of the rocks, they can break suddenly, releasing the stored energy as an earthquake.

Earthquakes can take place at the surface of the Earth and at some depth within it. The *hypocentre* of an earthquake is usually somewhere between the surface and 100 km in depth, but it can occur as deep as 720 km below the surface. The *epicentre* of an earthquake is the point on the earth's surface directly above the hypocentre.

What are seismic waves?

Energy is released during an earthquake in several forms: as movement along the fault, as heat, as sound and as *seismic waves* that radiate out from the source, or hypocentre, causing the ground to shake, sometimes hundreds of kilometres away. These waves radiate from an earthquake's hypocentre in concentric spheres much like waves ripple outward from where a stone is thrown into a pond. Seismic waves are recorded and measured by sensitive scientific instruments called seismographs.

Although seismologists recognize several different types of waves, most people are interested in only two types: Primary waves (compression waves) and Secondary waves (shear waves). Within the earth, these two waves travel at different speeds and their respective speeds vary depending on a number of factors including the type and density of the material they are passing through. P waves are faster (6 to 13 kilometres per second). In comparison, S waves are slower (3.5 to 7.5 kilometres per second).

Knowing these two waves travel at different speeds is very useful. Just as light and sound travel at different speeds and we use this to gauge how far away a lightening storm is, we can gauge how far away an earthquake is by measuring the length of time between the arrival of the P and S waves. In fact, seismologists use this calculation to triangulate the location of an earthquake's hypocentre.

How are earthquakes measured?

Scientists measure two things following an earthquake: Magnitude and Intensity. Magnitude measures the amount of energy released at the hypocentre. Intensity measures the energy felt at any one particular location on the earth's surface. Therefore, while there is only one magnitude value for each earthquake, there are several intensity values recorded around the earthquake's epicentre.

Although there are several different ways of measuring magnitude (e.g., Moment Magnitude, Surface Wave Magnitude, Body Wave Magnitude, Local Magnitude), a standardized logarithmic scale (1-~10) is used to indicate the relative strength of the earthquake. Because the scale is logarithmic, each single point increase in the scale represents a tenfold increase in magnitude. So a magnitude 7.0 earthquake is 10 times greater than a magnitude 6.0.

Generally, the further you are from the hypocentre of the earthquake, the less you feel the effects of the earthquake (i.e., the intensity decreases). This is not always the case as local ground conditions can actually amplify seismic waves.

The Modified Mercalli Intensity (MMI) scale rates the effects felt on a descriptive, 12-increment scale. Intensity values are generally largest close to the epicentre of the earthquake, and will generally decrease with increasing distance from the epicentre.

Magnitude	Relative Strength	Typical Intensity (MMI) at Epicentre	No. recorded globally/year
> 8.0	Great	> IX	1
7.0 – 7.9	Major	> VIII	18
6.0 – 6.9	Strong	VII - IX	120
5.0 – 5.9	Moderate	VI – VII	800
4.0 – 4.9	Light	IV - V	6 200
3.0 – 3.9	Minor	II - III	49 000
2.0 – 2.9	Very Minor	I	365 000
1.0 – 1.9	Very Minor	I	2 920 000

Why does British Columbia experience so many earthquakes?

Because of its proximity to major plate boundaries, British Columbia alone experiences over half of Canada's earthquakes every year. The largest earthquake recorded (during historic times) in Canada was a magnitude 8.1 earthquake that struck just off BC's Queen Charlotte Islands on August 22, 1949. This earthquake ruptured a 500-km-long segment of the Queen Charlotte fault and was felt over almost all of the province, and as far north as the Yukon Territory and as far south as Oregon State.

Over 800 earthquakes occur throughout BC each year. Most of these earthquakes, though, are too small to be felt. The most seismic of these regions is off the west coast of Vancouver Island. More than 100 earthquakes with a magnitude of 5 or greater have occurred here in the past 70 years.

There are four types of earthquakes that we are exposed to in BC:

- shallow intra-plate earthquakes in the North America Plate on which all of BC is situated. These earthquakes are the result of the tremendous stress that deforms and eventually breaks rock within the western margin of this plate.

Modified Mercali Intensity Scale

Intensity	Characteristic Effects
I	Not felt by people, only detected by seismographs.
II	Felt only by a few people at rest, especially on upper floors of buildings. Delicately suspended objects may sway.
III	Felt noticeably indoors; like the vibrations due to a passing truck. Standing motor cars may rock slightly.
IV	Felt indoors by many people, outdoors by few. Dishes, windows, doors rattle. May awaken some sleepers. Standing cars rocked noticeably.
V	Felt by nearly everyone, many awakened. Some dishes and windows broken; occasional cracked plaster; unstable objects overturned. Some disturbance of trees, poles and other tall objects.
VI	Felt by all; many frightened and run outdoors. Some heavy furniture moved; some falling plaster or damaged chimneys. Damage slight.
VII	General alarm; people run outside. Walls crack; chimneys fall. Considerable damage in poorly designed structures. Noticed by persons in moving vehicles.
VIII	Considerable damage in ordinary substantial buildings with partial collapse. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned. Changes in well water. Car drivers seriously disturbed.
IX	Considerable damage with partial collapse of substantial buildings. Buildings moved off foundation; ground cracks conspicuous. Underground pipes broken.
X	Ground cracks badly; landslides on river banks and steep slopes; rails bent; many buildings destroyed.
XI	Broad fissures in ground; major landslides and earth slumps; floods. Few buildings remain standing bridges destroyed; nearly all services (railways, underground pipes, cables) out of action.
XII	Total destruction. Ground rises and falls in waves; lines of sight and level distorted. Objects thrown into the air.

- shallow to deep intra-plate earthquakes off-shore in the subducting Juan de Fuca Plate—these earthquakes are the result of the stresses and deformation taking place within these oceanic crustal plates as they plunge below the North America Plate.
- shallow to deep subduction earthquakes off-shore along the Cascadia subduction fault—these earthquakes, sometimes called megathrust earthquakes, are the result of the locked subducting plate margin suddenly unlocking and the North America Plate sliding up over the subducting plates (megathrust earthquake are the world's largest earthquakes).
- shallow to deep transform or strike-slip earthquakes off the northern coast of BC.

The last Cascadia earthquake is estimated to have exceeded magnitude 9. A megathrust earthquake in Chile in 1960 was magnitude 9.5, and one in Alaska in 1964 was magnitude 9.2.

What happens in an earthquake?

You may feel little tremors, glasses and china may start to rattle, and often a low rumbling sound is associated with these tremors. The arrival of the first earthquake waves (P waves) often feels like a big truck going by. This is the time to find a safe spot, before the arrival of the S waves. The S waves and other similar waves are typically what cause most of the violent shaking. This shaking is characterized by rapid side to side shaking, as well as rolling and pitching ground, which can make it hard to walk. The amount of time between the arrival of the two types of waves depends on how close you are to the hypocentre. If the earthquake is hundreds of kilometres away, you will likely have plenty of time to find a safe place before the arrival of the S waves.

Following the initial earthquake, aftershocks occur; these are completely normal. Often, the sudden break or slip triggering the initial earthquake transfers a tremendous amount of stress to neighbouring rock. This rock then may break or slip under the new stress and may, in turn, transfer this stress further on. A sort of earthquake "chain reaction" can ensue until a new equilibrium is reached. Typically, these aftershocks are smaller than the original earthquake, but occasionally can be as large or larger than the initial earthquake. The number of aftershocks generally increases with the size of the earthquake, and may number in the tens or even hundreds.

What are the effects of earthquakes?

Most earthquakes are so mild that people barely feel them. In fact, there are about 1500 small earthquakes a year in Canada alone. However, depending on how deep the quake occurs below the surface and how forcefully the pent-up stress of the rocks is released, an earthquake can be very powerful and cause a lot of damage.

Niigata, Japan, June 16, 1964 Earthquake. Liquefaction undermines otherwise structurally sound buildings.
— Earthquake Engineering Research Center, University of California, Berkeley

When earthquake vibrations travel through soil with a high water content, the soil may take on the properties of a semi-liquid, similar to quicksand or pudding. This is called *soil liquefaction.* If the water table is near the ground surface, this tends to have the effect of liquefying the surface sediments. Buildings, bridges, towers and other structures on ground that liquefies during an earthquake may topple

over or sink into the earth. *Sand boils* or *sand volcanoes* are another common result of seismic waves moving through unconsolidated terrain. In these situations, groundwater bubbles up to the surface following the path of least resistance, carrying with it sand from below.

In addition, earthquakes can cause landslides, rockslides, or rockfalls, especially on steep slopes with soft sediment or sparse vegetation. On snow-covered slopes, an earthquake may trigger an avalanche.

Rockfalls and rockslides are potential secondary impacts of earthquakes. — Provincial Emergency Program, Government of BC

Avalanches are often triggered by winter earthquakes. — Provincial Emergency Program, Government of BC

When quakes occur near the coastal areas, there is also the possibility that a *tsunami* (seismic sea waves) will form. The thrusting motion of a megathrust earthquake causes large vertical movement on the sea floor and this displaces a large volume of water that travels away from the undersea motion as a tsunami. In bays or lakes, a similar, smaller phenomenon is the *seiche*, a large wave caused by water sloshing back and forth.

Damage caused by tsunami in Port Alberni, 1964. The power of a tsunami is exemplified as automobile replaces home in this central Vancouver Island community. —Provincial Emergency Program, Government of BC

As devastating as earthquakes can be, it is important to remember that they usually last for less than a minute. The chances of being killed or injured in an earthquake are actually very low.

The greatest risks of personal or property damage during the actual shaking are due to falling items and broken glass. Several secondary effects pose substantial risk and include:

- fires—during a large-scale event, the problem of multiple simultaneous ignitions may be compounded by broken water lines
- floods—flooding may occur not only due to broken water lines, but also due to dam and dike breaches as well as tsunamis

- chemical spills—industrial spills (tankers and railcars), school chemistry labs, home chemical spills
- power supply—including downed lines and arcing transformers in the short term, and heating and power problems over the longer term
- sewer lines—health/sanitation hazard
- gas supply—fire and explosive hazard initially, heating problems over the longer term
- water supply—limits fire response capabilities and drinking water supply (potential health issues)
- phone lines—both cellular and land-based phone systems are prone to inoperability due to either infrastructure damage and/or system overload
- infrastructure damage—first responder and primary care facilities may be damaged; transportation arteries may be damaged or destroyed (e.g., bridges, roads, tunnels, ports, airports).

The more you prepare yourself for the possibility of an earthquake (e.g., by creating an emergency supply kit; having a family, school, and office emergency response plan; hazard-proofing your home, office, school), the smaller the chance of injury or damage.

Earthquake Glossary

Aftershock: Aftershocks are typically smaller earthquakes following a larger earthquake. They occur in the same general area as the larger earthquake and are the result of the transfer of stress from the larger earthquake hypocentre to adjacent areas. Depending on a number of factors, tens or even hundreds of aftershocks may follow a single large earthquake. Generally aftershocks diminish in magnitude and frequency over time.

Cascadia Subduction Zone: The Cascadia Subduction Zone is the area off the west coast of North America in which eastward moving tectonic plates are subducting beneath the North America Plate. This zone extends from northern California to just west of northern Vancouver Island and is bounded by two transform faults—the San Andreas and the Queen Charlotte Faults.

Convergent (or Subduction) Boundary: Convergent boundaries describes a form of plate tectonic margin in which adjacent crustal plates are moving towards one another and in which one plate is forced (or subducted) beneath the other. An excellent example of such plate activity is found off the southwest coast of British Columbia in an area named the Cascadia Subduction Zone.

Crust: The earth's crust is the thin skin of rock making up the terrestrial and submarine surface of the planet. This "skin of rock," however, is not static. It is actually made up of seven major plates and several minor plates moving in constant motion over the earth's molten core.

Crustal Plate: See *Plate*.

Debris Flows: Debris flows are a form of landslide in which unconsolidated material and vegetation fail and move downslope en masse with a relatively high water content level.

Divergent (or Spreading) Boundaries: Divergent boundaries describe a form of plate tectonic margin in which adjacent crustal plates are moving away from one another. Off the southwest coast of British Columbia, the boundary between the Pacific Plate and Juan de Fuca Plate is a local example of a divergent boundary.

Earthquake: An earthquake is a sudden, sometimes violent, shaking of the ground caused by the passage of seismic waves generated cracking, faulting, and movement of rock within the earth's crust.

Earthquake Hazards: Earthquake hazards are potentially damaging, naturally occurring geomorphic events that occur as a result of an earthquake. These events include surface faulting, landslides, slumps, rockfall, avalanches, debris flows, liquefaction, sand boils, and flooding due to tsunamis or river avulsions.

Earthquake-induced Hazards: Earthquake-induced hazards are potentially damaging, non-geologic or human-made threats resulting from earthquake hazards. Examples of these hazards include chemical spills, downed power lines, fires, breached dams, broken water and sewer mains, toppled furniture and equipment, and falling lighting.

Epicentre: An earthquake's epicentre is the point on the earth's surface directly above the hypocentre of an earthquake.

Explorer Plate: The Explorer Plate is a small tectonic plate located off the west coast of Vancouver Island between the Pacific and North America Plates. Its western margin is a divergent or spreading boundary, and its eastern margin is a convergent or subducting boundary.

Hypocentre: The hypocentre of an earthquake is the point in the earth's crust at which the rock actually fails, creating the earthquake. An earthquake's hypocentre may be at the earth's surface or several tens of kilometres down.

Intensity: Intensity is a measure of ground shaking obtained through damage reports to structures and reports as to what was felt at any one location.

Juan de Fuca Plate: The Juan de Fuca Plate is a small tectonic plate off the west coast of Vancouver Island and is located between the Pacific and North America Plates. Its western margin is a divergent or spreading boundary, and its eastern margin is a convergent or subducting boundary.

Lateral Spreading: Lateral spreading describes "cracking" of the earth's surface as a result of tensional forces across the ground surface.

Landslides: A landslide is a geomorphic event in which a mass of unconsolidated sediment fails and collapses under the force of gravity.

Liquefaction: Liquefaction is a temporary process that causes soil and sand to behave like a dense fluid rather than a wet solid mass during an earthquake. It is best exemplified by the effect of standing on wet sand at low tide, moving your feet, and slowly sinking into the sand.

Magnitude: Magnitude is a measure of earthquake size and is recorded on a logarithmic (base 10) scale. Most people feel a magnitude 5.0 earthquake. The largest earthquake recorded was a magnitude 9.5 in Chile (1960).

Means of Egress: A means of egress is a continuous path of travel provided for the escape of persons from any point in a building to a safe open area outside the building with access to a public thoroughfare.

Megathrust (or Subduction) Earthquake: A megathrust earthquake is an inter-plate earthquakes resulting from failure along a subducting plate margin.

Mitigation: Mitigation referst to action taken prior to the occurrence of an earthquake to minimize losses (injury, life, property, or economic).

Modified Mercalli Intensity (MMI) Scale: The MMI scale is a globally standardised 12-point scale for assessing intensity. Expressed in roman numerals, it ranges between intensity level "I"—only felt by seismographs, to intensity level "XII"—complete destruction of structures.

Non-structural Hazard: Non-structural hazards are building contents or elements, not part of the load carrying structure, that could fail causing life or property damage.

Non-structural Mitigation: Non-structural mitigation focusses on the contents and/or elements of a building that are not part of the building structure.

North America Plate: The North America Plate is one of the seven major tectonic plates that make up the earth's crust. Extending from the west coast of North America to the middle of the Atlantic Ocean, all of British Columbia lies along the western margin of this westwardly moving plate.

Pacific Plate: The Pacific Plate is one of the seven major tectonic plates that make up the earth's crust. Underlying most of the Pacific Ocean, the northeastwardly moving Pacific Plate is forms transform boundaries with the North America Plate.

Pacific Ring of Fire: The Pacific Ring of Fire is a zone or band of intense earthquake activity that circles the Pacific Ocean. It is one of the most seismically active areas of the world and clearly delineates the active plate margins around the Pacific.

Plate (Tectonic Plate/ Crustal Plate): A techtonic or crustal plate is a large, relatively rigid segment of the earth's lithosphere that moves in relation to other plates over the earth's molten interior.

Primary Wave (P wave): P waves are the fastest moving seismic wave and propagate through a series of compressions and dilations.

Rockslide: A rockslide is geomorphic event in which a mass of rock fails and collapses under the force of gravity.

Sand Boil (or Sand Volcano): A sand boil is a localized, small-scale geomorphic feature characterized by a low (less than 1 m) mound of sand with a central vent. These features result from shaken sediments settling and the underlying ground water being forced to the surface.

Secondary Wave (S wave): S waves are the second fastest form of seismic wave and propagate with a wave form transverse to the direction of travel. S-waves do not travel through liquids.

Seiche: A seiche is an oscillationsof water (standing waves) in a bay or lake.

Seismic Wave: Seismic waves are energy waves moving through the earth. They are usually generated by earthquakes or explosions and can have a number of forms: Primary waves, Secondary waves, Rayleigh waves, and Love waves.

Structural Hazard: Structural hazards are load carrying elements of a building that could be damaged or fail during or following an earthquake, causing life or property damage.

Structural Mitigation: Structural mitigation focusses on the building components that resist gravity, wind, seismic, and other loads. They include beams, columns, braces, floor and roof slabs, foundations, and load-bearing walls.

Subduction: Subduction is the geologic process in which the edge of one tectonic plate dips and descends beneath the edge of another.

Tectonic Plate: See *Plate*.

Transform (or Strike-Slip) Boundary: Transform, or strike-slip, boundaries describe a form of plate tectonic margin in which adjacent plates are sliding past one another. The San Andreas Fault is a good example of a transform boundary.

Tsunami: A tsunami is a series of abnormally large waves that can be initiated by submarine earthquakes, coastal or submarine landslides, submarine volcanic eruptions, or large meteor impacts.

How Children Respond to Disaster

A child's sense of security depends on the regularity of daily routine. When some thing happens to disrupt this regularity, children may suffer anxiety and fear. It is important to address these feelings and help children resolve them. How adults help children deal with their emotions in the wake of a disaster may determine how well the child will recover from the experience.

When an earthquake strikes, it is natural to experience feelings of intense distress. If you are with children, keep in mind that they will look to you for guidance and support. Your fear will be seen as proof that the danger is real. Try to put your own fear into words. By articulating your own emotions, you will encourage the children to do the same.

In the aftermath of an earthquake, a child is most afraid of:

- abandonment, being separated from her or his family
- injury or death
- another quake occurring
- being left alone.

These feelings may trouble the child long after earthquake has passed. Do not dismiss the child's fear or anxiety. These feelings are real. Even if the danger has passed, the child may still experience intense fear.

Signs of Emotional Distress

Emotional response to a disaster can take many different forms. Like adults, children may experience anger, fatigue, hyperactivity, sleeplessness, nightmares, depression, inability to concentrate, or a loss of appetite. They may develop an excessive fear of the dark, cry more often, or exhibit signs of constant worry. Look for these signals, and foster an atmosphere of open communication in which children feel free to express their fears. Remember that it may be very difficult for them to put their feelings into words. Be patient, provide opportunities for them to communicate their feelings in other ways (e.g., drawing, play-acting).

Communication

Communication is the most effective way for the children to resolve their feelings. **Listen** to what they are saying, and alleviate their fears by explaining as much as you can about the nature of the disaster. The more they know, the more reassured they will be and the better prepared to deal with the event.

Fear of Abandonment

Since one of the main fears to plague children after disaster hits is the fear of being abandoned, it is imperative that you not leave a child alone. If they are left by themselves, children will be much more likely to develop clinging behaviour that may persist for a long time.

Involving Children

One of the best ways to help children manage their feelings in the wake of an earthquake is to involve them in the recovery process as much as possible. Include them in the clean-up activities. Give them real tasks to do. This will help them combat feelings of helplessness and enable them to regain a sense of control over their own lives.

Earthquake Hazards in the Classroom

Even the safest-looking rooms may have items that in the event of an earthquake may pose a significant threat to the people within. It's a good idea to examine your classroom for possible earthquake hazards. Students can be included in this activity, so they can learn to identify potential dangers in their own homes.

Look closely around the classroom, and ask yourself these questions:

- Are all free-standing cabinets, bookcases, and shelves firmly secured to a structural support?
- Have all heavy objects been removed from upper shelves, especially those above the students' desks?
- Are all items mounted on the wall secured to prevent them from flying free or breaking windows in the event of an earthquake?
- Are seating areas located away from the windows so that students are protected from breaking glass?
- Are all hanging plants in lightweight, unbreakable pots, and fastened to closed hooks?
- If you have a television or computer in your classroom, is it securely fastened to a solid platform or securely attached to a rolling cart with wheels that lock? Are VCRs, projectors, and screens secured?
- If you have a piano in your classroom, is it secured against rolling during an earthquake?
- If you have an aquarium or other potentially hazardous display, is it located away from the seating areas?
- Are all hazardous materials (e.g., cleaning fluids, chemicals used in science experiments) firmly secured to minimize the chance of bottles breaking and leaking?
- Are light fixtures firmly fastened to the ceiling? Do hanging fixtures have safety chains?
- In the library, are student seating areas located away from book shelves?
- In the gym, is heavy equipment stored securely?
- In kitchens and science labs, are gas shut-off valves easily accessible? Are appliances connected to gas source using flexible hoses?
- Are all exits clear and unobstructed?

Earthquake Preparedness

Advance planning greatly improves the chances of survival after an earthquake or other disaster. The following are some strategies for preparing for and recovering from an earthquake.

Getting Prepared

These are some of the steps families can take to make sure that they're prepared in the event of an earthquake:

- Identify possible earthquake hazards in your home. Do what you can to reduce the threat of these hazards.
- Prepare an emergency supply kit for your family with enough food and water to last at least three days. In addition, each member of the family should have a pair of sturdy shoes and a flashlight under or near their bed.
- Hold a family meeting and create an emergency action plan. Practise this plan, and review it a few times a year so that everyone can remember what to do if an earthquake ever hits.
- Choose two meeting places for everyone to memorize:
  - one right outside your home, in case a fire breaks out
  - one outside your neighbourhood, in case it is impossible to return home (e.g., your neighbourhood has been evacuated).
- Choose an out-of-area family contact. Make sure that everyone in the family memorizes the contact's full name and phone number. When an earthquake hits, it is usually easier to make a long-distance call, as local phone lines get tied up quickly.
- Locate safe spots and danger zones in each room of your home.
- Identify safe exit routes from each room in your home.
- If you live in a house:
  - label breaker panel, gas valve, and main water valves with large, easy-to-read signs
  - ensure everyone in your family knows where and how to shut off the water, electricity, and gas supply.
- If you live in an apartment:
  - make sure everyone in your family knows where the emergency exit is (remember to use the stairs, not the elevator)
  - determine who is responsible for turning off gas mains (e.g., building manager)
  - show them where the fire alarm is, and explain when and how to use it.
- Make sure appliances and shelves are firmly fastened to the wallsor floor, and that gas servicing to appliances uses flexible hoses. Place large or heavy objects on lower shelves. Brace high and top-heavy objects. Store bottled foods, glass, china, and other breakables on low shelves or in cabinets that can fasten shut.
- Know where and how to shut off all utilities, and keep a wrench handy to shut off valves.
- Take a first aid course.

When the Ground Moves

It's important to take quick action to be safe when the ground first starts to shake. Don't wait until you're certain an earthquake is actually occurring.

- **Duck, cover, and hold**. At the first sign of ground shaking, duck under a desk or table, cover head and torso, and hold on to the legs of the table or desk. It is very important to make

sure your head and neck are protected. If a desk is not available, sit on the floor with your back toward an inside wall, knees up to your chest, elbows on your knees, and hands over your head. Alternatively, adopt the same posture in an archway or doorway (if a doorway, prop a book in the door to keep it from swinging). Make sure you're away from windows and outside walls.

- Stay away from the kitchen. The kitchen is the highest hazard area in the home. There may be moving appliances and flying dishes. There may be gas or water pipes leaking. This may lead to fire or flooding.
- In a high-rise building: Stay in the building on the same floor. An evacuation may not be necessary. Do not use elevators.
- If outdoors: Stay there unless it is unsafe. Move away from buildings, trees, streetlights, and utility wires.
- If you are in a vehicle, pull over to the side of the road (to keep the road clear for emergency vehicles), and stop as quickly as safety permits. Stay in the vehicle. Avoid bridges, overpasses, tunnels, and underpasses; avoid stopping near or under buildings, trees, or utility wires.

When the Shaking Stops

- Remain calm, assess the situation, and determine a course of action.
- Stay in your safe place, and count to 60. When you move from your safe place, move cautiously, looking up and around for potential hazards.
- Check yourself and those around you for injuries.
- If you live near coastal waters, be aware that the earthquake may have caused a tsunami. Evacuate to higher ground immediately and stay there until you are told it is safe to return.
- If the electricity is out, use flashlights or battery-powered lanterns. Do **not** use candles, matches, or open flames indoors because of the possibility of gas leaks. Likewise, flashlights should be "intrinsically safe" (sparkless).
- If you smell gas or hear a hissing or blowing sound, open a window and leave the building immediately and call the gas company. If possible, shut off the main gas valve outside.
- If there is electrical damage, switch off the power at the main control panel.
- If water pipes are damaged, shut off the water supply at the main valve.
- Wear sturdy shoes in areas covered with fallen debris and broken glass.
- Check your home for structural damage.
- Clean up spilled medicines, bleaches, gasoline, and other flammable liquids.
- Do not flush toilets until you know that sewage lines have not been damaged.
- Open cabinets cautiously. Beware of objects that can fall off shelves.
- Use the phone (including cell phones) only to report a life-threatening emergency. Hang up phones that were shaken off their hooks to keep the lines clear.
- Listen to news reports for the latest emergency information.
- Stay away from damaged areas, unless the relevant authorities have specifically requested your assistance.
- Earthquakes are usually followed by smaller tremors, or aftershocks. Be prepared for these.

Emergency Supply Kit

One of the best things your family can do to prepare for an earthquake is put together an emergency supply kit and store it in an easily accessible place in your home. Your kit should include the items your family will most likely need in the event of an evacuation. These should be stored in an easy-to-carry container such as a large covered plastic garbage pail, a backpack, or a duffel bag. It's also a good idea to keep a smaller emergency kit in the family vehicle and at your workplace.

If you have infants, disabled members of the household, and/or pets, you will also need to include any special supplies and equipment they will need.

Water

Store four litres of water per person per day, and have a minimum three-day supply on hand. In addition, include purifying agents in your kit, such as iodine tablets, bleach, etc.

Store your water in thoroughly washed plastic, fibreglass, or enamel-lined metal containers. Never use a container that has held toxic substances! Plastic containers, such as soft drink bottles or bulk water containers, are the best. You can also purchase food-grade plastic buckets or drums. Make sure to change your water every few months, so that it stays fresh.

Food

Store at least a three-day supply of non-perishable food for each person. Choose items that require no refrigeration, cooking, or preparation. Select food items that are compact and easy to carry. Be sure to rotate the food supply every six months to keep it fresh.

- ready-to-eat canned meats, fruits and vegetables
- soups—bouillon cubes or dried soups in a cup
- milk—powdered or canned
- stress foods—sugar cookies, hard candy
- juices—canned, crystallized, or juice boxes
- protein foods such as smoked or dried meats, beef jerky, or soy jerky
- high-energy foods—peanut butter, nuts, trail mix, etc.

First Aid Kit

- sterile adhesive bandages in assorted shapes and sizes
- sterile gauze pads, rolls
- adhesive tape
- tensor bandages
- scissors, tweezers, needle, safety razor blade, medicine dropper
- bar of soap
- moistened towelettes
- antiseptic
- non-breakable thermometer
- petroleum jelly or other lubricant
- assorted sizes of safety pins
- latex or rubber gloves
- eye wash
- pain relievers
- antacid
- vitamins
- laxative
- anti-diarrhea medication
- activated charcoal (to absorb poisons)
- emetic (to induce vomiting)

Tools and Miscellaneous Supplies

- sturdy shoes and at least one complete change of clothes for each family member
- flashlight and extra batteries (flashlight should be "intrinsically safe" or sparkless)
- battery-operated radio and extra batteries
- cash or traveller's cheques (including small change)
- fire extinguisher, small canister, ABC type
- pliers, screwdriver, shut-off wrench for gas and water
- compass
- aluminum foil
- signal flare
- needles, thread
- cups, plates, and utensils (plastic is lightest)
- manual can opener, utility knife
- tent or tarp, plastic sheeting
- bedding (sleeping bags, blankets, etc.)
- tape, rope
- matches in a waterproof container
- paper, pencil
- whistle
- dust mask and work gloves

Special Items

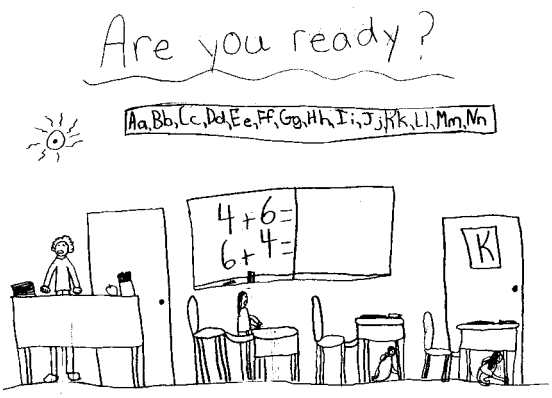
- baby supplies (formula, powdered milk, bottles, diapers)
- prescription drugs (e.g., heart and high blood pressure medications, insulin)
- contact lenses and supplies, extra prescription eyeglasses
- feminine sanitary supplies
- personal toiletries (toothbrush, toothpaste, etc.)
- entertainment (books, games, toys, etc. for both children and adults)

Important Family Documents

Keep copies of these in a waterproof, fireproof portable container:

- will, insurance policies, contracts, deeds, stocks, and bonds
- family records (birth, marriage, death certificates)
- passports, social insurance cards, immunization records
- bank account numbers, credit card account numbers and companies
- inventory of valuable household goods, important telephone numbers

Annotated Resources



Instructional-Based Resources

Title	Source	Date	Grade	Comments
It Can Happen, Be Ready	*Canadian Red Cross*	*1997*	**2**	• *natural disaster preparedness and response in general — very little specific to earthquakes* • *multimedia: facilitator's guide (lesson plan based), student guide (background information and exercises), poster set* • *also available in French*
Facing the Unexpected, Be Aware	*Canadian Red Cross*	*1997*	**5**	• *natural disaster preparedness and response in general — very little specific to earthquakes* • *multimedia: facilitator's guide (lesson plan based), student guide (background information and exercises), video* • *also available in French*
Emergency!	*Office of Critical Infrastructure Protection and Emergency Preparedness* *(formerly Emergency Preparedness Canada)*	*1990*	**7-10**	• *preparedness and response for a variety of emergencies* • *video + teacher's manual with lesson plans, teacher background, resource list* • *also available in French*
Masters of Disaster	*American Red Cross*	*2000*	**K-8**	• *three separate resources for three grade clusters (K-2, 3-5, and 6-8)* • *general emergency preparedness, hurricanes, floods, tornados, lightning, earthquakes* • *multimedia: lesson plans, with handouts, stickers, posters, video, printable paper, CD-ROM* • *emphasis on science, some PP content*
Earthquake II: You Can Survive	*American Red Cross*	*1992*	**2-4**	• *earthquake preparedness and response* • *video + discussion guide* • *mostly PP content*
Be Ready 1-2-3	*American Red Cross*	*1991*	**K-3**	• *emergency preparedness and response, specifically fires, storms, and earthquakes* • *facilitator's guide (lesson plan based), student guide (the Be Ready Book)* • *also available online at http://www.redcross.org/pubs/dspubs/tchrschl.html* • *also available (online) in Spanish and Vietnamese*

Instructional-Based Resources (cont'd)

Title	Source	Date	Grade	Comments
Tremor Troop: Earth Quakes	*Federal Emergency Management Agency (FEMA)*	*1992*	**K-6**	• *what causes earthquakes, preparedness and response* • *lesson plans, teacher background, and handouts* • *emphasizes science connection*
Seismic Sleuths	*FEMA*	*1992*	**7-12**	• *what causes earthquakes, seismology, preparedness and response* • *comprehensive lesson plans* • *emphasizes science connection* • *more appropriate for 10-12 than 7-9*
Earthquake Safety: Activities for Children	*FEMA*	*1990*	**K-6**	• *earthquake preparedness and response* • *lesson plans, teacher background, and handouts* • *essentially an older version of the Tremor Troops resource, focussing solely on preparedness and response (rather than science)*
Adventures of the Disaster Dudes	*FEMA/American Red Cross*	*unknown*	**4-6**	• *preparedness and response for various disasters* • *video + presenter's guide* • *mostly PP content*
Tsunami Curriculum: Move to High Ground	*Washington Military Department*	*unknown*	**K-6**	• *four multi-activity units, teacher background, handouts* • *multiple curriculum connections: English, math, science, social studies, fine arts* • *emphasis on tsunami, but with some additional earthquake information*
Oregon Earthquake and Tsunami Curriculum	*Oregon Department of Geology and Mineral Industries*	*1998*	**K-10**	• *three separate resources for three grade clusters (K-3, 4-6, and 7-10)* • *lesson plan based, including some handouts, teacher background; also includes resource lists and school procedures* • *science, math, and PP/CAPP connections*

Policies and Procedures

Title	Source	Date	Comments
School Earthquake Safety Guidebook	*BC Ministry of Education*	**1989**	• *guidelines for school/district earthquake preparedness and response plans* • *available online at http://www.pep.bc.ca/hazard_preparedness/earthquake_preparedness.html*
Responding to Critical Incidents: A Resource Guide for Schools	*BC Ministry of Education*	**2001**	• *designed to assist schools in developing protocol for responding to "critical incidents"; principles can easily be applied to earthquakes and other natural disasters* • *available online at http://www.bced.gov.bc.ca/specialed/rci/welcome.htm*
Emergency Preparedness Program	*School District 43 (Coquitlam)*	**2001**	• *emergency preparedness and response* • *procedures manual* • *available online at http://www.sd43.bc.ca/newsd43/general%5Finfo/publications/emergency%5Fprep%5Fprogram/eppmanual.htm*
Emergency Management for North Shore Schools	*School District 44 and 45 (North and West Vancouver)*	**2000**	• *emergency preparedness and response* • *collection of information sheets on "emergency preparedness planning"*
Guidebook for Developing a School Earthquake Safety Program	*FEMA*	**1990**	• *developing a school/district earthquake procedure* • *procedures manual* • *also available online at http://www.fema.gov/mit/schfac.htm*
Seismic Considerations—Elementary and Secondary Schools	*FEMA*	**1990**	• *earthquake-proofing school buildings — both at design stage and via retrofitting*
Los Angeles Unified School District policy package	*Los Angeles Unified School District*	**unknown**	• *comprehensive policy and procedures for emergencies/disasters (including bomb threats, shootings, riots, etc. as well as earthquakes)* • *video, training materials, procedures manual*
Arkansas School Earthquake Preparedness Guidebook	*State of Arkansas*	**1993**	• *emergency preparedness and response* • *procedures manual* • *full text available online at http://quake.ualr.edu/schools/guide/*
Claremont Unified School District Emergency Preparedness Plan	*State of California*	**1998**	• *emergency preparedness and response* • *procedures manual* • *full text available online at http://www.cusd.claremont.edu/par/epp/index.html*

Resources for Parents, Families, and the Community

Title	Source	Date	Comments
Prepare Now for an Earthquake in BC	*Inter-Agency Emergency Preparedness Council*	**unknown**	• *earthquake preparedness and response* • *focus on home and family* • *also available online at http://www.pep.bc.ca/hazard_preparedness/prepare_now/prepare.html*
Earthquake Survival Guide	*Ministry of Public Safety and Solicitor General*	**1998**	• *earthquake preparedness and response-- "pocket-sized" guide* • *also available online at http://www.pep.bc.ca/hazard_preparedness/earthquake_preparedness.html*
Quakesafe	*Canadian Red Cross*	**1994**	• *earthquake preparedness and response at home* • *for parents, with suggested discussion points for children* • *video (8:30)*
Be Prepared Not Scared	*Canadian Red Cross*	**1999**	• *general, yet comprehensive, advice aimed at families/adults for preparing for an emergency* • *pamphlet* • *joint production of Emergency Preparedness Canada, Home Depot, and the Red Cross* • *full version also available online at http://www.epc-pcc.gc.ca/publicinfo/self_help_ad/self_help/self_bepre.html*
Earthquake: Being Prepared at Home and School	*Neal Goldin Productions*	**1991**	• *what happens in an earthquake; earthquake preparedness and response* • *video (11:30)* • *formerly a provincially "recommended" video for PP K-7*
On Shaky Ground	*BCTV*	**1996**	• *what happens during/after an earthquake; strategies for coping* • *video (47:27)* • *done in the format of a simulated news broadcast after a 7.5 has hit Vancouver — "live" pictures of various rescue/aftermath scenarios, plus interviews with emergency response personnel*
Shake Down: Now is the Time to Get Prepared	*BC Gas*	**2001**	• *earthquake-proofing in relation to natural gas* • *online resource — available at http://www.bcgas.com/home/eme_after.html*

Resources for Parents, Families, and Communities (cont'd)

Title	Source	Date	Comments
Earthquake ABC: A Child's View of Earthquake Facts and Feelings	*Sirius Productions*	**1994**	• *children's feelings about earthquakes* • *alphabet book (e.g., A is for Aftershock) with pictures and text by children, teacher guide, and parent guide* • *available online at http://home.earthlink.net/~torg/*
Be Ready 1-2-3	*American Red Cross*	**1991**	• *emergency preparedness and response, specifically fires, storms, and earthquakes* • *facilitator's guide (lesson plan based), student guide (the Be Ready Book) for children approximately 5-10 yrs old* • *designed to be taught by any "instructor," not just classroom teachers (e.g., parents, high school students)* • *available online at http://www.redcross.org/pubs/dspubs/tchrschl.html* • *also available (online) in Spanish and Vietnamese*
Disaster Preparedness Coloring Book	*American Red Cross*	**1993**	• *general emergency preparedness, plus specific info for earthquakes, tornados, fire, thunderstorms, etc.* • *designed to be worked on with children and parents together (e.g., includes discussion points for parents)*

Web Sites

Title	Comments
Provincial Emergency Program (PEP)	• *http://www.pep.bc.ca/* • *BC-specific* • *includes:* – *specific information related to earthquakes (earthquake preparedness and response; seismology info)-- http://www.pep.bc.ca/hazard_preparedness/earthquake_preparedness.html* – *specific information related to tsunami http://www.pep.bc.ca/hazard_preparedness/tsunami_preparedness.html* – *kids zone http://www.pep.bc.ca/kids/submenu_kids.html*
Federal Emergency Management Agency (FEMA)	• *http://www.fema.gov/* • *general disaster preparedness and response* • *many resources available online free for downloading, including:* – *Helping Children Cope with Disaster* – *Your Family Disaster Plan* – *Emergency Food and Water Supplies* – *Coping With Stress Caused by Natural Disasters* • *includes "FEMA for Kids"--activities and resources for children, plus parent and educator support (http://www.fema.gov/kids/)*
Office of Critical Infrastructure Protection and Emergency Preparedness *(formerly Emergency Preparedness Canada)*	• *http://www.ocipep-bpiepc.gc.ca* • *various resources and fact sheets on emergency preparedness, what the federal government does in emergencies*
Canadian Red Cross	• *http://www.redcross.ca/index_english.html* • *overview of what the Canadian Red Cross does; contact information for local chapters*
American Red Cross	• *http://www.redcross.org* • *information about the services they provide* • *some resources available online*

Contact Information

PEP—Provincial Emergency Program
455 Boleskine Road
Victoria, BC V8Z 1E7
Tel: (250) 952-4913
Fax: (250) 952-4888
(Mailing Address: PO Box 9201 Stn Prov Govt, Victoria, V8W 9J1)
www.pep.bc.ca
PEP also has 6 regional offices—check the Web site for details.

Justice Institute of BC (JIBC)
The Justice Institute does not publish any of the resources cited here, but does have many of materials available through its library. Resources may be borrowed directly or through an inter-library loan via your public or school library.

715 McBride Boulevard
New Westminster, BC V3L 5T4
Phone: (604) 528-5599
Fax: (604) 528-5593
Email: library@jibc.bc.ca
www.jibc.bc.ca/about/f-library.html

FEMA— Federal Emergency Management Agency
500 C Street, SW
Washington, DC 20472
Phone: (202) 566-1600
www.fema.org

Northwest regional center (serving: Alaska, Idaho, Oregon, Washington)
Federal Emergency Management Agency
Federal Regional Center
130 228th Street, SW
Bothell, WA 98021-9796
Tel: 425-487-4600
Fax: 425-487-4622

Canadian Red Cross
National Office
170 Metcalfe St.
Ottawa, Ontario K2P 2P2
Tel: (613)740-1900
Fax: (613)740-1911
feedback@redcross.ca
www.redcross.ca/index_english.html

American Red Cross
P.O. Box 37243
Washington, DC 20013
www.redcross.org/pubs/

Notes