Primer on Natural Disaster Preparedness and Coping Mechanisms

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Preface

Human beings, along with other life forms, have always been subject to environmental stresses over which they have no control. The list of natural hazards and environmental disasters is familiar to all of us— typhoons, floods, earthquakes, volcanic eruptions, droughts, tsunamis, and many others.

But natural hazards need not be natural disasters. Protective preventive action is possible, especially when advance knowledge of the nature and occurrence of such phenomenon is available to the general public.

This primer is limited to three natural hazards— earthquakes, volcanic eruption, and tsunamis. Its goal is toward disaster preparedness and hazard mitigation. Specifically, each topic covers four parts:

A. Basic Understanding about the Phenomenon/Event
B. What To Do Before the Event
C. What To Do During the Event
D. What To Do After the Event

A section "How to Cope with the Traumatic Experience During and After a Disaster," has been added.

There are also activities that will develop thinking skills. These can be integrated in Science, Social Studies and other relevant subjects. This material includes the criteria for integration of natural disaster concepts in the curriculum. Countries which experience similar disasters can readily adapt this material.

Disaster preparedness is a continuous process. It requires concerted efforts. Natural hazards need not become natural disasters if both the general public and the government are well prepared for coping with these.

General Criteria for Integration of Natural Disaster Concepts in the Curriculum

1. Congruence with learning competencies for the subject area

2. Appropriateness to the learners' grade/year level in terms of

    a. vocabulary and readability
    b. diversity of cultural, religious and economic background
    c. gender
    d. text and visuals

3. Organized presentation of ideas in terms of

    a. development of concepts
    b. teaching and learning strategies to meet learners' individual differences

4. Utilization of prior knowledge of learners on a specific disaster

5. Accuracy, relevance and up-to-dateness of information

6. Inclusion of appropriate techniques to reduce the negative effects of the event before, during and after the natural disaster

7. Development of positive values such as

    a. being responsible
    b. taking action collectively
    c. cooperation with other groups in the community

Primer on Earthquake Preparedness and Coping Strategies

This primer will help you in preparing yourself before and during the disaster caused by earthquakes, and how to cope with such a disaster.

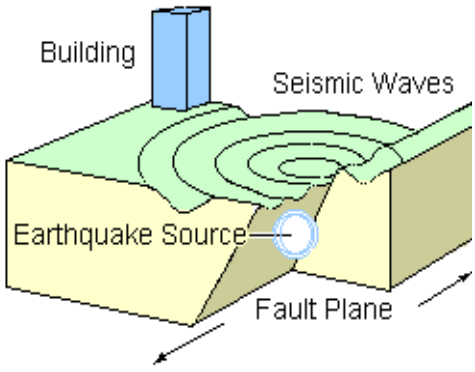
A. Understanding Earthquakes

1. What is an earthquake?

An earthquake is the sudden motion, trembling or shaking of the ground due to the rapid release of energy.

2. What causes earthquakes?

Most earthquakes are due to movement of large slabs of rock called tectonic plates. When the plates slide or move against each other, the plates may be bent or stretched. The bending or stretching stores energy. Sooner or later, the plates break and shift. When the break happens, the stored energy is released in the form of waves, which we feel as earthquake.



The waves spread out from the focus or source of an earthquake in all directions. As the waves travel away from the focus, they grow gradually weaker. So, the ground generally shakes less far away from the focus.

3. Where do earthquakes occur?

Most earthquakes occur along the boundaries of the tectonic plates. If you live close to a plate boundary, you will experience more earthquakes than if you lived far from the boundary. For example, many countries around the Pacific Ocean are often rocked by earthquakes because they are located near the boundary of the Pacific plate.

4. How often do earthquakes occur?

Earthquakes occur everyday. But most are too weak to be felt by humans. More than a million earthquakes occur harmlessly every year. In comparison, damaging earthquakes occur less frequently. The table below shows the frequency of earthquakes worldwide.

Descriptor	Magnitude	Annual average
Great	8 or higher	1[1]
Major	7–7.9	17[2]
Strong	6–6.9	134[2]
Moderate	5–5.9	1,319[2]
Light	4–4.9	c. 13,000
Minor	3–3.9	c. 130,000
Very minor	2–2.9	c. 1,300,000

1. Based on observations since 1900. 2. Based on observations since 1990.
Source: National Earthquake Information Center, U.S. Geological Survey.

5. How are earthquakes measured?

Every time there is an earthquake, we always hear or read the words ***intensity*** and ***magnitude*** in the radio, on television, and in newspapers. Both terms describe the strength of an earthquake.

Intensity is based on the effects a person experiences during an earthquake, and on the damage caused by the earthquake. ***Magnitude*** depends on the energy produced by an earthquake.

Below is the scale used in measuring the intensity of earthquakes in the Philippines. The intensity scale uses Roman numerals to avoid confusing it with the magnitude scale, which uses Hindu-Arabic numerals.

Earthquake Intensity Scale

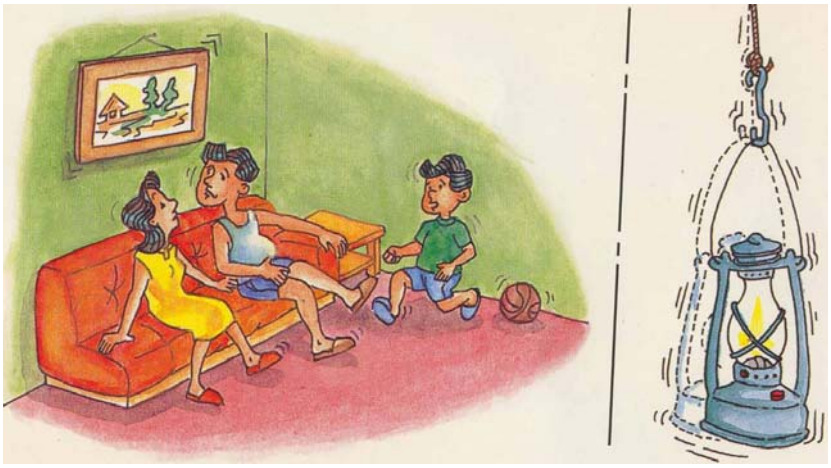
Intensity I. Scarcely Perceptible

- People under favorable circumstances can feel it.
- Delicately balanced objects are disturbed slightly.
- Still water in containers move back and forth (oscillates) slightly.

Intensity II. Slightly Felt

- Felt by few individuals at rest indoors.
- Hanging objects swing slightly.
- Still water in containers oscillates noticeably.

Intensity III. Weak

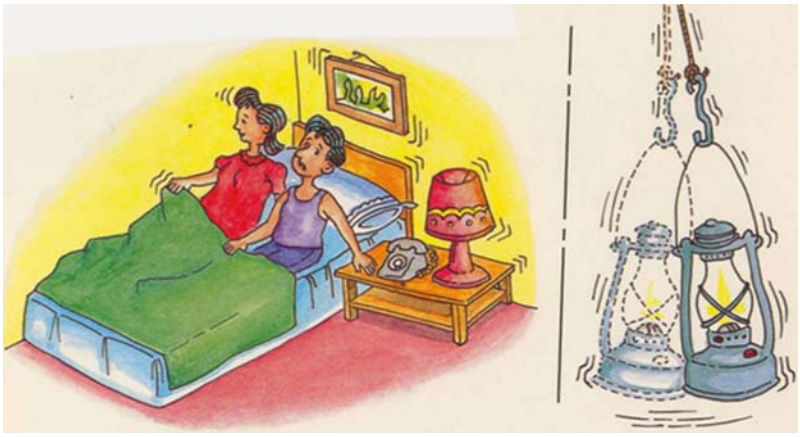


- Felt by many people indoors, especially in upper floors of buildings. Vibration is felt like the passing of a light truck. Some people feel dizzy and nauseated.

- Hanging objects swing moderately.

- Still water in containers oscillates moderately.

Intensity IV. Moderately Strong



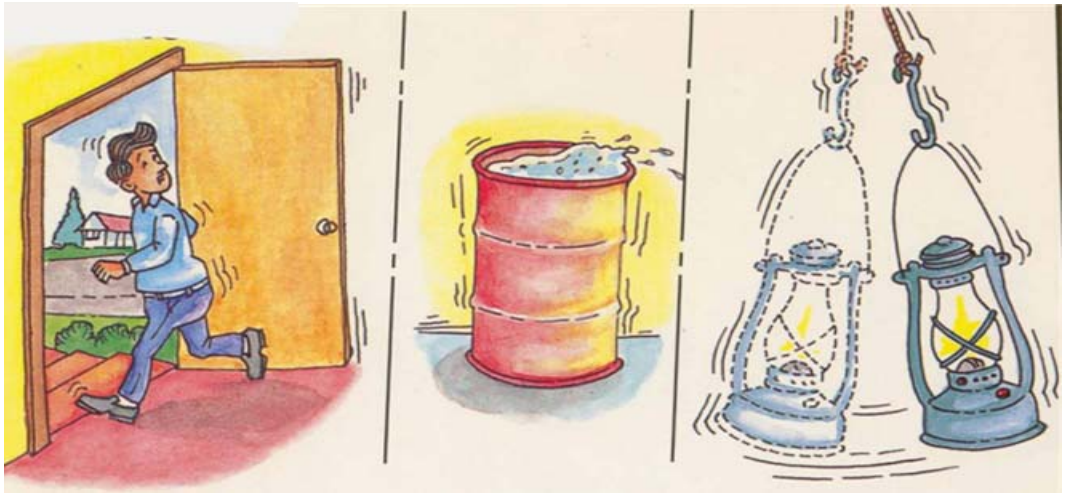
- Felt generally by people indoors and some people outdoors. Light sleepers are awakened. Vibration is felt like the passing of a heavy truck.

- Hanging objects swing considerably. Dinner plates, glasses, windows and doors rattle. Floors and walls of wood-framed building creak. Parked cars may rock slightly.

- Water in containers oscillates strongly.

- Rumbling sound may sometimes be heard.

Intensity V. Strong



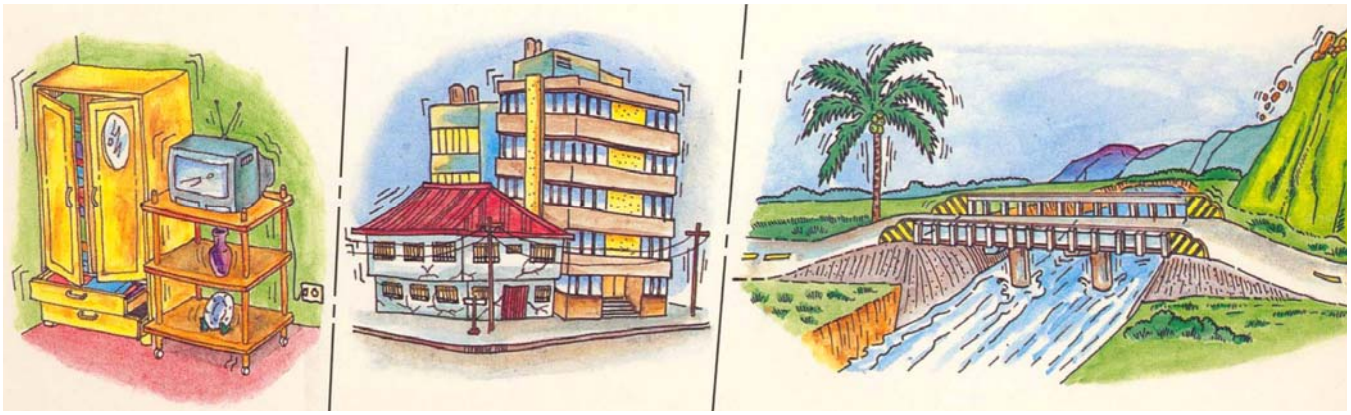
- Generally felt by most people indoors and outdoors. Many sleeping people are awakened. Some are frightened; some run outdoors. Strong shaking and rocking are felt throughout the building.

- Hanging objects swing violently. Dining utensils clatter and clink; some are broken. Small, light and unstable objects may fall or overturn.

- Liquids spill from filled open containers. Standing vehicles rock noticeably.

- Shaking of leaves and twigs of trees is noticeable.

Intensity VI. Very Strong

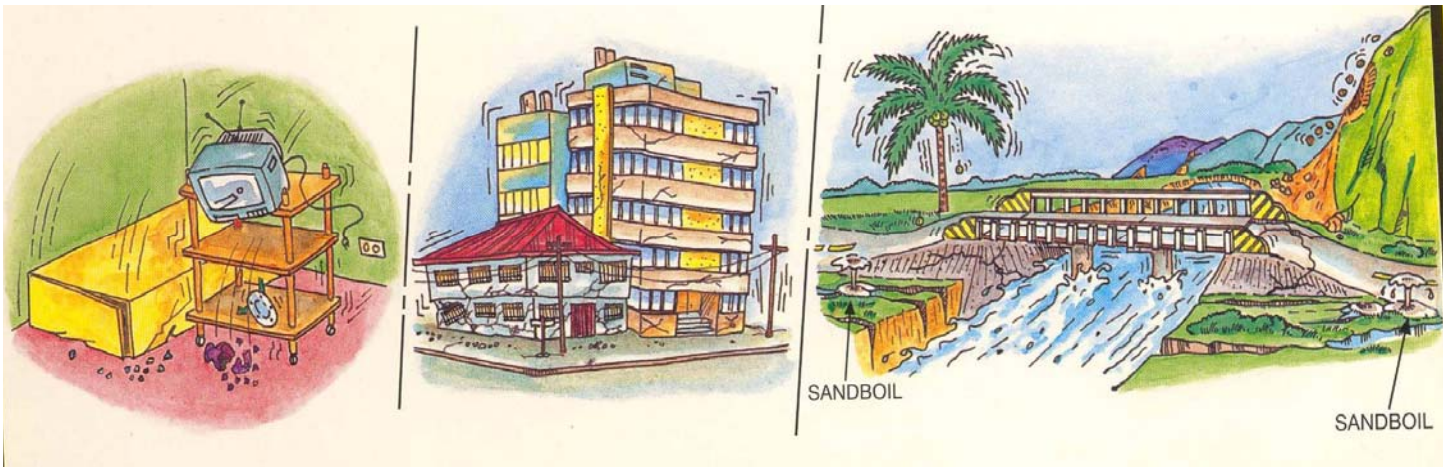


- Many people are frightened; many run outdoors. Some people lose their balance. Motorists feel like driving with flat tires.

- Heavy objects and furniture move or may be shifted. Small church bells may ring. Wall plaster may crack. Very old or poorly-built houses and man-made structures are slightly damaged though well-built structures are not affected.

- Few rocks fall and boulders roll in hilly and mountainous areas. Trees are noticeably shaken.

Intensity VII. Destructive

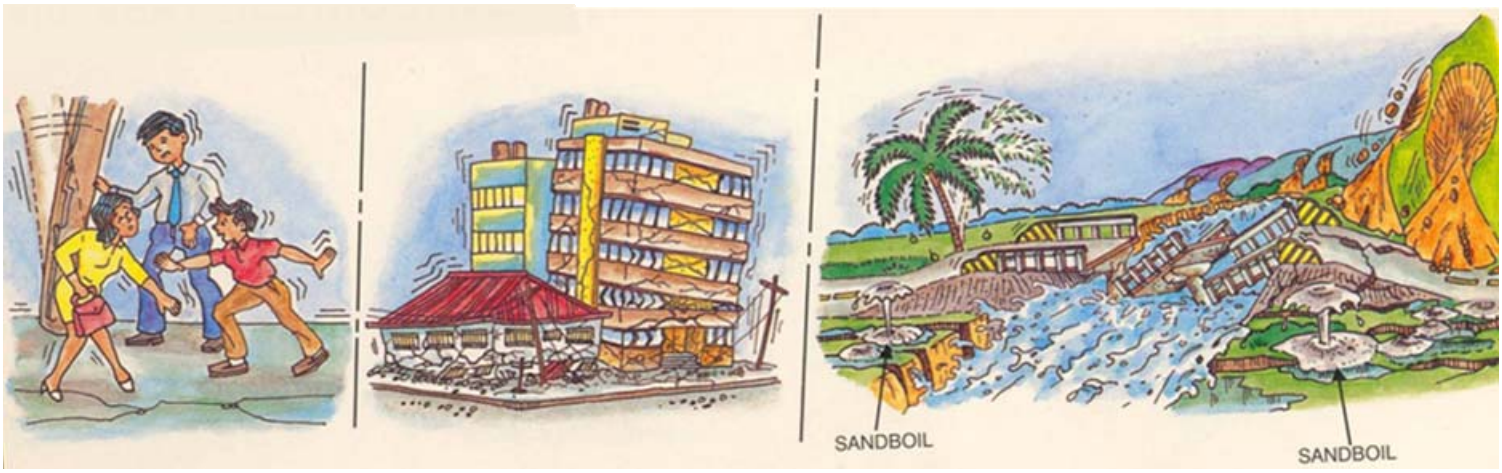


- Most people are frightened and run outdoors. People find it difficult to stand in upper floors.

- Heavy objects and furniture overturn or topple. Big church bells may ring. Old or poorly built structures suffer considerable damage. Some well-built structures are slightly damaged. Some cracks may appear on dikes, fish ponds, road surface, or concrete hollow block walls.

- Limited liquefaction, lateral spreading and landslides are observed, Trees are shaken strongly. (*Liquefaction is a process by which loose saturated sand loses strength during an earthquake and behaves like liquid*.)

Intensity VIII. Very Destructive



- People panic. People find it difficult to stand even outdoors.

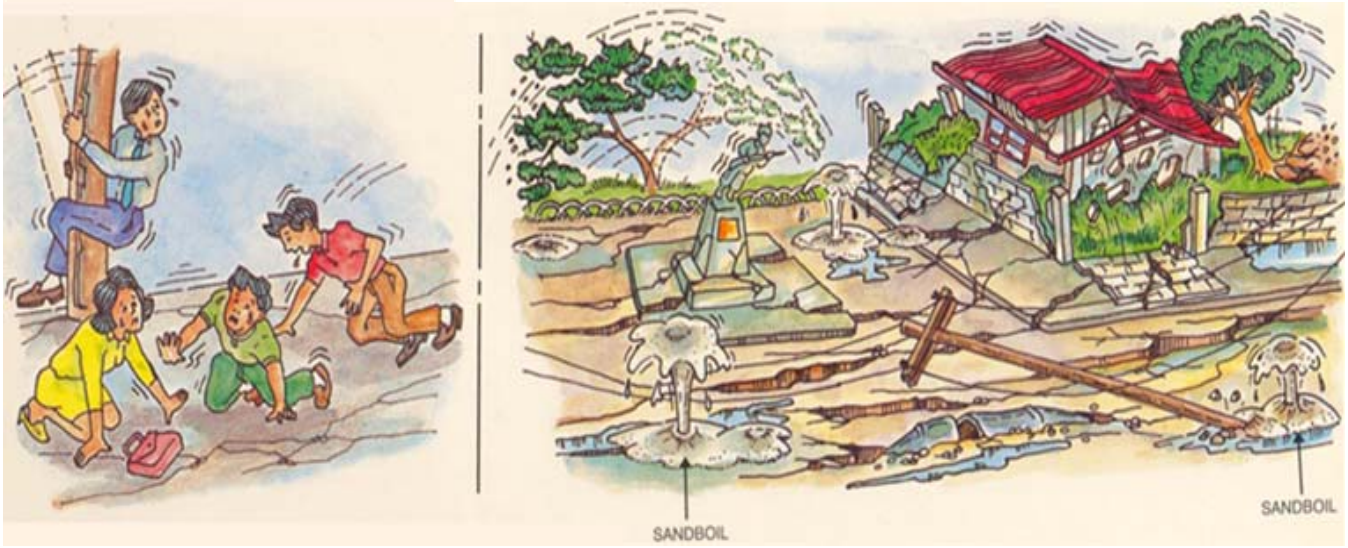
- Many well-built buildings are considerably damaged. Concrete dikes and foundations of bridges are destroyed by ground settling or toppling. Railway tracks are bent or broken.

- Tombstones may be displaced, twisted or overturned. Utility posts, towers and monuments may tilt or topple. Water and sewer pipes may be bent, twisted or broken.

- Liquefaction and lateral spreading cause man-made structures to sink, tilt or topple. Numerous landslides and rockfalls occur in mountainous and hilly areas. Boulders are thrown out from their positions particularly near the epicenter. Fissures and fault rupture

may be observed, trees are violently shaken. Water splashes or slops over dikes or banks of rivers.

Intensity IX. Devastating



- People are forcibly thrown to the ground. Many cry and shake with fear.

- Most buildings are totally damaged. Bridges and elevated concrete structures are toppled or destroyed.

- Numerous utility posts, towers and monuments are tilted, toppled or broken. Water and sewer pipes are bent, twisted or broken.

- Landslides and liquefaction with lateral spreading and sand boils are widespread. The ground is distorted. Trees are shaken very violently with some toppled or broken. Boulders are commonly thrown out. River water splashes violently or slops over dikes and banks.

Intensity X. Completely Devastating

- Practically all man-made structures are destroyed.

- Massive landslides and liquefaction, large-scale subsidence and uplifting of land forms and many ground fissures are observed. Changes in river courses and destructive seiches in large lakes occur. Many trees are toppled, broken or uprooted.

To determine the strength and location of earthquakes, scientists use a recording instrument known as a seismograph. A seismograph is equipped with sensors called seismometers that can detect ground motions caused by seismic waves. Some seismometers are capable of detecting ground motion as small as 1 billionth of a meter, or about 40 billionth of an inch.

A seismograph produces wavy lines that reflect the size of seismic waves passing beneath it. The record of the wave, called a seismogram, is imprinted on paper, film, or recording tape or is stored and displayed by computers.

6. How is the magnitude of an earthquake expressed?

The magnitude of an earthquake is expressed using the Richter scale. It was developed in 1935 by United States seismologist Charles F. Richter. The magnitude is a measure of the energy released in an earthquake. It is determined by studying the height of waves recorded in seismograms.

Every increase of one number in magnitude means the energy released is 32 times greater. For example, an earthquake of magnitude 7.0 releases 32 times as much energy as an earthquake measuring 6.0. To give you an idea of the magnitude scale, a quake greater than 7.0 may destroy many buildings.

7. How is the epicenter of an earthquake located?

Scientists locate the epicenter by noting how long it takes for the seismic waves to arrive at different seismograph stations. From the arrival time, seismologists can calculate how far the source of the earthquake is from each station.

A circle is drawn around each station using the calculated distance as the radius. Given three stations, the minimum number needed, there will be three circles. The intersection of the three circles is the epicenter of the earthquake.

8. Can we predict earthquakes?

Earthquakes happen suddenly. Scientists have no way of knowing exactly when or where the next one will hit. But scientists can make fairly accurate long-term predictions of where earthquakes will occur. They know, for example, that about 80 percent of the world's major earthquakes take place along a belt encircling the Pacific Ocean. This belt is called the *Ring of Fire* because it has many volcanoes, earthquakes, and other geologic activity.

Scientists are working to make accurate forecasts on when earthquakes will strike. Geologists closely monitor certain fault zones where quakes are

expected. Along these fault zones, they can sometimes detect small quakes, the tilting of rock, and other events that might signal a large earthquake is about to occur.

9. Do animals sense earthquakes?

For centuries, many people have believed that animals can predict earthquakes. There were reports that dogs howl in the night mysteriously, caged birds become restless, and nervous cats hide. But what animals sense, if they feel anything at all, is not known yet. There were a few studies on animal prediction but there was nothing concrete that came out of these. More research is still needed to determine the connection between animal behavior and earthquakes.

B. What to Do Before an Earthquake

In the House

- Cabinets, refrigerators and other heavy furniture should be properly secured on the wall or house posts.
- Fix portions of the house that are termite-infested.
- The roof and ceiling, if possible, should be made from light materials.
- Always prepare emergency kits.
- Learn how to apply first-aid.
- Know where the main switch is located.
- Don't place heavy objects in high places.
- Know how to contact each other during emergency (meeting place and time).

In School

- Encourage the administration of the school to have an earthquake awareness program, to show what to do and how to prevent further damage in case there is earthquake. One example is having earthquake drills.

- Conduct an earthquake drill, following do's and don'ts:

Because earthquakes can happen anytime, you should act immediately once there is ground shaking. Earthquake drills are very important to help you react immediately and properly. During an earthquake drill, you should be able to follow your teacher's command. You will:

1. Immediately TAKE COVER under desks, tables, or in a strong doorway. TURN AWAY from windows, shelves, and heavy objects and furniture that may fall.

2. Stay under shelter until shaking stops.

3. Be silent and listen to instructions.

4. Leave the building quickly, calmly and orderly only after ground shaking stops.

5. Go to the designated open-space assembly area outside the school building.

C. What To Do During an Earthquake

1. Don't Panic! Stay inside the house or building, don't go out. The best thing to do is to protect yourself from falling debris by hiding under a strong table or structure. Stay away from glass windows for they might break and cut you.

2. Stay indoors until the shaking stops and you're sure it's safe to exit.

3. If you are outside, stay outside. Proceed to an open place away from falling electric wires, trees or walls. Drop to the ground until the shaking stops.

4. Don't turn on the gas tank in case of a leak.

5. Use the stairs instead of the elevator.

6. If you are inside a car, avoid passing on an overpass or bridge. They may be damaged by the quake and collapse. Keep the car on a safe open place while waiting for help to come. Be careful of overhead hazards such as power lines or falling building debris. Stay inside the car until the shaking stops.

7. If you live near the sea, remember that an earthquake can cause a tsunami, evacuate right away to a higher place.

8. If you are inside a crowded building like a movie house, don't race out. Don't panic and avoid falling objects.

9. If you have pets, don't try to hold your pet during a quake. Animals instinctively want to hide when their safety is threatened. If you get in their way, even the nicest pets may hurt you.

D. What To Do After an Earthquake

1. Inspect yourself for cuts, wounds, or fractures and those around you. Apply first aid if necessary. Do not move seriously injured persons unless they are in immediate danger of further injury.

2. Remember to help your neighbors who may need special assistance--infants, the elderly, and people with disabilities.

3. Inspect the water sewerage system, electrical lines and gas for leak. If there is damage, close it right away.

4. Wear shoes or boots. There might be broken glasses or sharp objects on the ground that can cut you.

5. Be careful with broken electric wires. Report them right away to proper authorities.

6. Avoid places near the sea. There might be a tsunami after the earthquake.

7. Use the telephone only in case of an emergency.

8. Listen to a battery-operated radio or television for the latest emergency information.

9. Be prepared for aftershocks. Stay away from damaged buildings because it may eventually collapse.

10. Follow the emergency plan in your community.

11. If you want to leave your place, leave a message of your whereabouts. Bring emergency materials.

You might not be able to avoid getting a scratch or a bump during an earthquake but if you follow all the reminders and tips given, you can possibly save your life.

Activities

Activity 1. Earthquake History of Your Country

Through this activity, you will be able to recognize patterns in the global distribution of earthquakes and volcanoes. You will also be able to interpret maps and assess the likelihood of future earthquakes in your place or country.

Major Earthquakes in _____ *(write your country here)*			
Year	Nearest city: Epicenter	Richter magnitude	Number of deaths, etc.

Estimate the cost for the damage caused by the strongest earthquake in your country.

Activity 2: Lessening earthquake damage
(Do you know the ways to reduce the damage caused by earthquakes?)

Assign earthquake intensity based on observed effects. Examine the damage and effect of the recent earthquake (intensity and magnitude and damage (how many people died and how many building damaged, etc.). Assess the local risk when the big earthquake hits your place (risk assessment).

Understanding and applying what you have learned:

1. In a major earthquake, where in your school and in your housing area would you be safest? What places are at greatest risk from the effects of an earthquake? Explain why you selected these places?

2. If you live in an earthquake-prone area, your school may have regular earthquake drills. If your school has a regular drill, examine the drill and evaluate its appropriateness. If your school has no earthquake drill plan, describe how you would develop a plan for your school.

3. Think about the following questions:
   a. Where will students go when the shaking stops?
   b. How will this be performed?

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Primer on Volcanic Eruption Preparedness and Coping Strategies

In general, when preparing for the possible occurrence of any natural disaster, the first step is to understand the nature of the natural disaster. This primer will help you in preparing yourselves before and during the disaster caused by the volcanic eruption, and how to cope with the disaster caused by the volcanic eruption.

A. Understanding Volcanoes

1. What are Volcanoes?

Volcanoes vary in shapes and sizes. Volcanoes destroy, and volcanoes also create new beautiful landscapes.

A volcano is a mountain built up by melted (molten) rocks and ashes found below the surface of the earth. It opens downwards. When pressure builds up gases, molten rocks (called magma) come out through the opening (hole/vents). Bubbles of gas appear from the rocks fill the air while the rocks flow as lava. Below is Mt Mayon, in the Philippines, an active volcano with a perfect cone.

All volcanic eruptions are not alike. Some eruptions are quiet, with lava slowly oozing from a vent. Other eruptions are very violent, with lava and other materials being thrown up hundreds of kilometers into the air. Gases from within the earth's interior mix with huge quantities of dust and ash and rise into the air as great dark clouds that can be seen from many kilometers away. An erupting volcano can trigger tsunamis, flashfloods, earthquakes, mudflows and rockfalls.

2. What are the types of volcanoes?

Volcanoes are given specific names depending on their form and shape. Their form is determined by the ingredients of the erupting magma. Their shapes are determined by how explosive is their eruption and the amount of water in the magma.

Stratovolcanoes and shield volcanoes are the largest types of volcanoes, but have different shapes because of the differences in their magma. Shield volcanoes and stratovolcanoes erupt many times over thousands of years whereas cinder cones which are smaller volcanoes with different shapes usually have a short life, erupting only once. These are classified into three categories.

Ist category: Composite or Stratovolcano

The shape in Figure 1 shows a composite cone: one that most people associate with volcanoes. It is a steep, high mountain made of layers viscous lava and pyroclastic materials. They erupt every 100 to 1000 years. They are also called stratovolcanoes. Some of these volcanoes are Mt. Krakatoa, East of Java, Mt. Mayon in the Philippines, and Mt. Fuji in Japan.

Figure 1

Mt. Mayon

Mt. Fuji

Krakatoa

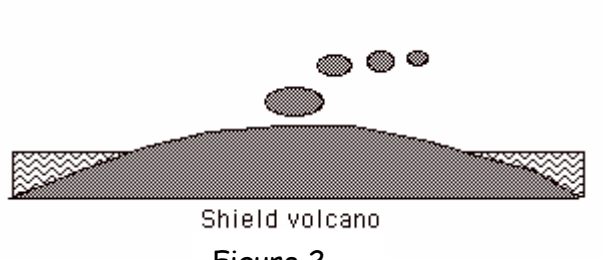

Figure 2

2nd Category: Shield Volcano

The shape in Figure 2 shows a shield volcano. It has very low slopes as the lava flows for miles. These volcanoes may be 100 km across Mauna Loa in Hawaii, for example, has a slope less than 2 degrees on the flanks. Hawaii is made of five shield volcanoes. Kilauea is the most active at present. This type of volcano is nonexplosive and the least dangerous type of eruption since people rarely get killed by them.

Mauna Loa, Hawaii

3rd Category: Cinder Cones

Cinder cones are the simplest type of volcano. They are built from particles of lava ejected from a single vent. As the gas-charged lava is blown violently into the air, it breaks into small fragments that solidify and fall as *cinders* around the vent to form a circular or oval cone as in Figure 3. Most cinder cones rarely rise more than a thousand feet or so above their surroundings. The Paricutin volcano in Mexico is a cinder cone rising approximately 1,200 ft above the surrounding plane.

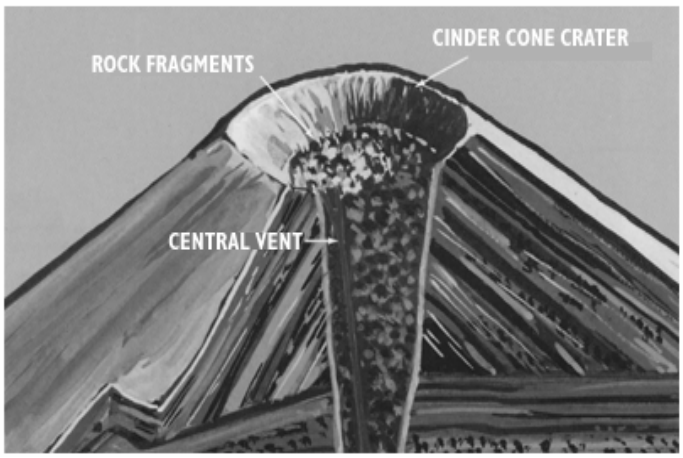

Figure 3

Paricutin Volcano, Mexico

3. What kinds of volcanic hazards could take place?

- ***Discharge of big rocks (boulders)***. People who live or work very close to the volcano are in danger of being hit by rocks that come out of the volcano.

- ***Pyroclastic flows.*** . Pyroclastic flows may be as hot as 700 degrees C and can travel up to 100 meters per second. These consist of rock fragments and hot gases that flow down the valleys at very fast and dangerous speeds.

- ***Volcanic ashes***. Ashes could get into ones eyes that can cause irritation, and inhaled, one may get respiratory problems. These are rock materials that have been broken into tiny pieces. If seen under the microscope, sharp corners and edges could be observed.

- ***Poisonous gases***. Some of the gases that come out of a volcano may be toxic. These gases usually accumulate in valleys where they can be shielded from the blowing wind.

- ***Lava***. Flowing lava is almost impossible to stop. It will bury anything it encounters in its path. You may think that lava is on fire but it is not. Lava glows because it is very hot and in liquid form. The fire that appears to be with the lava is actually from the materials that came into contact with the hot lava.

- ***Lahars***. Lahars come from the volcanic ash and other fragments that are lying on the slopes of the volcano. During heavy rains, the volcanic deposits are carried down the slopes by water as lahars. Many people think that lahars come directly from the eruption of the volcano. They do not.

- ***Giant sea waves or tsunamis***. Tsunami may be generated when a volcano that is located near or in a body of water erupts. Tsunamis are not caused by the tides. It may be produced by any volcanic activity that pushes or displaces the water. People who live along coastal areas are particularly at risk during a tsunami.

- ***Earthquakes***. They can trigger landslides along the slopes of the volcano and in surrounding areas thus cause damage to people, animals, and crops.

B. What To Do Before a Volcanic Eruption

- Be aware of the different places that will be affected by the volcanic eruption.

- Take hold of the maps that gives information about danger zones around active volcanoes.

- Be aware of the different reminders and instructions about the dangers posed by an erupting volcano.

- See to it that a means of transportation that you can use to get out of the area is available.

- Make sure that there is a First Aid Kit in your home.

1. **What are the signs that a volcano is going to erupt?**

   - Frequent earthquake occurring around the volcano;
   - Swelling in certain portions of the volcano;
   - Big cracks are forming;
   - The temperature around the volcano is increasing;
   - The temperature in bodies of water like lakes, and hot springs is increasing;
   - The bodies of water are becoming acidic;
   - Plants around the volcano are drying up.

2. **What do you do when you observe these signs?**

   - ***Leave the Permanent Danger Zone immediately.*** Avoid all places indicated in the hazard map as dangerous.
   - ***Stay away from low-lying areas.*** These are places where avalanches, lava flows, and lahars are likely to pass.
   - ***Transfer immediately to a safer place.*** You should do this particularly if you suffer from a respiratory disease like asthma Cover your nose with a wet piece of cloth to avoid inhaling volcanic ash.
   - ***Evacuate to higher grounds.*** If you live along the coast, you must evacuate to higher grounds inland particularly when you see the sea rapidly retreating from the shore. This is a sign that a tsunami is approaching. Stay away from the coast until the authorities say it is safe.
   - ***Always be on the alert for warnings***. Some government agencies in charge of monitoring the volcanic activity issue

warnings thru the radio or television. Be on the alert for these warning.

- ***Keep necessary items in your home***. Keep dust masks, enough non-perishable food and water for at least 3 days, first aid kit, battery-operated radio with extra batteries, candles and/or flashlights, extra wood if you are using wood stove, cleaning supplies (broom, rags, dust pans, etc..)

C. What To Do During a Volcanic Eruption

1. Where to go?

- ***Stay inside the house or evacuation center***. Do this unless you have a very important matter to attend to. Be careful, alert, and calm if you need to travel.

2. What to do to save yourself?

- ***Always be on the alert for warnings***. Some government agencies in charge of monitoring the volcanic activity issue warnings thru the radio or television. Be on the alert for these warnings.

Indoor

- Stay indoors to minimize exposure -- especially if you have respiratory ailments.

- In ashy areas, use dust masks and eye protection. If you don't have a dust mask, use a wet handkerchief.

- Close doors and windows. Place damp towels at door thresholds and other draft sources; tape drafty windows.

- Dampen ash in yard and streets to prevent it from being blown up.

- Put stoppers in the tops of your drainpipes (at the gutters).

- Cover electronic devices (radio, TV, computers, cameras, etc..) with cloth or plastic.

- Since most roofs cannot support more than four inches of wet ash, do not let ash accumulate on roofs. Wear your dust mask and use precaution on ladders and roofs.

- Brush, shake and pre-soak ashy clothing before washing.

- If there is ash in your water, let it settle and then use the clear water. Better still, filter the water.

- You may eat vegetables from the garden, but wash them first.

- Use battery operated radio to receive information.

Outdoor

- Seek cover immediately. Cover your nose with a wet piece of cloth to avoid inhaling the ash.

- Remove outdoor clothing before entering a building.

D. What To Do After a Volcanic Eruption

- You can go back to your house when the authorities e.g., authorized persons from the Disaster Agency have declared it is safe to do so.

- A thick layer of ash is heavy, especially when wet. If you have it on your roof, ask an experienced person to remove it right away. It may cause the roof to cave in.

- Be careful to not wash ash into drainpipes, sewers, storm drains, etc.

- Avoid doing activities that blow up ash.
- Keep the cover of electronic devices until the surrounding is free of ash

- Seek advice from public officials regarding disposal of volcanic ash in your community.

- Wet ash can be slippery. Use caution when climbing on ladders and roofs.

- Assist parents, brothers, and sisters in cleanup.

- Remember to help others who may require special assistance – infants, elderly, and people with disabilities.

- Be on the lookout for further lahar events. The presence of lahars do not stop with the volcanic eruption. Many years after the eruption, lahars will flow down the streams, brought down by heavy rains. You have to be especially alert during typhoon season. You have to vacate the place immediately if a storm is coming or will pass by the place within 24 hours.

Activities

Activity 1.

UNESCO	Volcanic Eruption
	Purpose To understand how the viscosity of the magma affects the way a volcano erupts
Key Words magma viscous eruption volcano lava **Materials** 2 clear bottles 2 – 100 mL graduated cylinder water corn syrup marking pen 2 pc drinking straw	**Procedure** 1. Pour 100 mL of water into a bottle labeled A. Water is used to represent the runny magma. 2. Pour 100 mL of corn syrup into another bottle labeled B. Corn syrup is used to represent the stickier, thicker magma. 3. Place a straw in each bottle, and slowly blow bubbles. **Q1.** ***Discuss the difference between the bubbles in each liquid and the difficulty you had producing them.*** 4. Keep blowing until each liquid is bubbling. **Q2.** ***Discuss the difference between the bubbles in each liquid.*** **Q3.** ***Which one of these liquids would produce a more violent volcanic eruption?*** 5. You can find additional information in the online lesson Volcanic Cones and Eruptions (http://volcano.und.nodak.edu/vwdocs/vwlessons/lessons/Cones/Cones1.html)

Activity 2. Where are the volcanoes?

Find active volcanoes on a map and the latitude and longitude of a volcano nearest your place. This can be linked to a lesson on maps in geography.

Activity 3. Volcanoes and the Atmosphere

Understand that volcanoes emit gases such water vapor, carbon dioxide, and sulfur dioxide (chemical experiment; chemistry; chemical reaction in nature).

Experiment 1: iron powder and sulfur (related with our life: making cairo)
Experiment 2: decomposition of sodium hydrogen carbonate

Activity 4. Volcanoes in Asian Country

Below is a list of volcanoes in the Philippines, the number of eruptions of each and the year of last eruption. Order or sequence the eruption: from the most recent eruption to earliest eruption.

Name of Volcano		No. of eruption	Year of last Eruption	Location
1.	Mayon	45	1993	Albay
2.	Taal	33	1977	Batangas
3.	Kanlaon	25	1996	Negros Or.
4.	Bulusan	13	1994	Sorsogon
5.	Ragang	9	1915	Cotabato
6.	Smith	8	1924	Babuyan Is.
7.	Hibok-hibok	6	1953	Camiguin
8.	Didicas	5	1978	Babuyan Is Group
9.	Babuyan Claro	1	1913	Babuyan Is.
10.	Caminguin de Babuyanes	1	1957	Babuyan Is. Group
11.	Cagua	1	1860	Cagayan
12.	Banahaw	1	1780	Lucena City
13.	Calayo	1	1886	Bukidnon
14.	Iraya	?	1464	Batanes
15.	Pinatubo	1	1991	Zambales

16.	Iriga	?	1641	Camarines Sur
17.	Biliran	?	1939	Leyte
18.	Bud dajo	?	1897	Jolo Island
19.	Matutum	?	1911	Cotabato
20.	Kalatungan	?	------	Bukidnon
21.	Makaturing	?	------	Lanao
22.	Parker	?	------	South Cotabato

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Primer on Tsunami Preparedness and Coping Strategies

This primer will help you in preparing yourself before and during the disaster caused by tsunami, and how to cope with such a disaster.

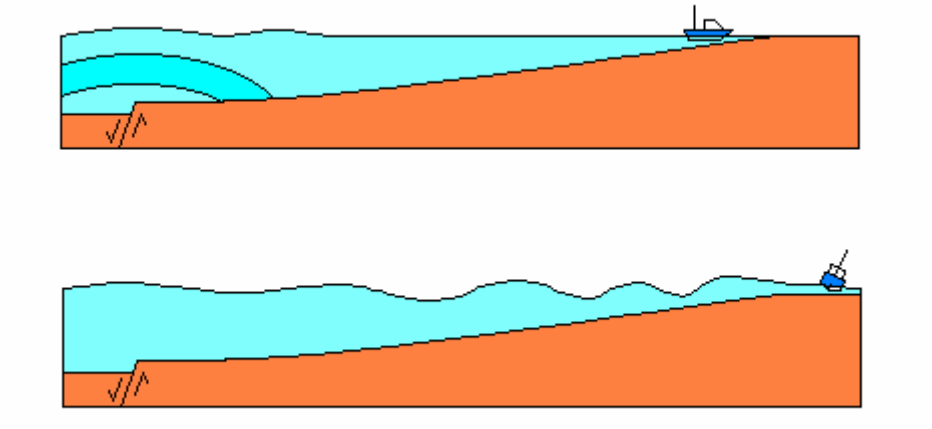
A. Understanding Tsunamis

1. What are tsunamis?

Tsunamis are waves that are produced when water in the sea is suddenly moved or displaced. The cause of movement is oftentimes a large earthquake that takes place underwater.

2. How does an earthquake cause tsunamis?

A tsunami is generated when a big mass of water is suddenly moved. This may happen when the seafloor itself moves. The seafloor may jerk upward or downward. The sudden movement produces an earthquake. It also moves the water mass above the seafloor, creating tsunami waves that travel rapidly away.



3. Are there other causes of tsunamis?

Yes. A tsunami may also be generated if a volcano erupts under shallow waters. The force of the eruption will push the water above it, creating tsunami waves. Big landslides that take place underwater or by the coast can also form tsunamis. A large meteorite falling from outer space may also produce tsunamis, but this is rare.

4. How big are tsunami waves?

The size of tsunami waves depends on the depth of the water. Out in the deep sea, they are rather low, usually less than a meter high. This means they look like ordinary waves and they usually pass unnoticed by people on ships. But when tsunamis reach shallower waters, they may rise up to 30 meters, roughly the height of a 10-story building.

5. How fast are tsunami waves?

In the deep sea, the waves may be as fast as a jet plane, travelling 900 km in an hour. But when the waves reach the shallow waters near land, they slow down. For example, at a water depth of 15 meters, the speed would be about 45 km/hr. But a wave moving at that speed would still be too fast to run away from.

6. What happens when tsunamis encounter land?

Each wave slows down and grows into a towering wall of water. The wave pushes forward with the weight of the ocean behind it. Houses and buildings collapse, roads are washed away, people and animals are snatched out to sea, and everything not strongly anchored to the ground are swept away. In addition, the flood waters uproot trees, bust water pipes, and contaminate water wells.

Gleebruk Village, Indonesia before and after the December 2004 tsunami

Photos courtesy of DigitalGlobe

7. Which places are prone to tsunamis?

All coastal areas may be hit by tsunamis, even those thousands of kilometers away from the source. That's because tsunamis can start off from one side of the ocean and travel all the way to the other side. But the areas around the Pacific Ocean are especially prone to tsunamis because of the large earthquakes that happen there.

8. What are the signs that a tsunami is coming?

The sea rapidly retreats and the sea bottom is exposed for hundreds of meters. When you see this, you must leave the place immediately. You only have a few minutes to escape before the destructive tsunamis arrive.

Kalutara Beach, Sri Lanka

Photos courtesy of DigitalGlobe

If you feel an earthquake while at the coast, treat it as another warning sign. Although not all earthquakes cause tsunamis, it is wise not to ignore them. Tsunamis caused by a local earthquake arrive quickly and the authorities might fail to warn the public on time.

9. What do you do when you see the signs?

Climb immediately to higher ground. Stay there until the authorities say it is safe. Do not be impatient to return home. The first waves are not always the biggest nor the most dangerous. Also remember that the gap between waves can be as long as an hour. There have been reports of people who were killed because they have mistaken a long time gap as the end of the tsunami attack.

10. Do animals sense a tsunami is coming?

According to some witnesses, they saw some animals acting strangely before the tsunami attacks in December 2004. Similar stories about odd animal behavior before earthquakes have been going around for a long time now. Some people think animals can sense signs of danger that humans cannot. But at the moment, no one has proven the connection between animal behavior and impending disasters.

11. Where did the term tsunami come from?

Tsunami is a Japanese word that means harbor wave (*tsu*, harbor, and *nami*, wave). It was coined by Japanese fishermen who returned from fishing to find the harbor in ruins, even though they did not see any large waves out at sea.

The term tidal waves has become a popular sustitute for tsunamis. This is probably because a tsunami can look like the tide rushing in. But the term is not accurate because a tsunami is not produced by tidal action.

B. What To Do Before a Tsunami

On December 26, 2004, the world was stunned by the news. A great earthquake in the Indian Ocean generated tsunamis that struck the coasts of surrounding countries. Hundreds of thousands of people were drowned in the rampaging waters. The damage to property was enormous. It was one of the biggest natural disasters in recent times.

If you were one of the people by the coast that day, would you have known what to do? Read and learn. The life you save may be your own.

1. Find out if you live in a Tsunami Danger Zone. Get information from the nearest disaster management agency. Those who live within a kilometer from the shore at elevations lower than 15 meters are especially at risk.

2. Choose a safe place to run to. Make sure every family member knows how to get there by different routes. The evacuation site must be higher than 15 meters and, if possible, away from the coast.

3. Train all family members to be alert for the following tsunami warning signs:

    - strong rumbling of the ground
    - earthquake
    - sudden rise or fall of water by the shore

4. Assemble an emergency kit that includes the following:

    - flashlight
    - battery-operated radio
    - extra batteries
    - first aid kit
    - food and water
    - medicine
    - money

5. Store enough drinking water that can last for several days. The tsunami will spoil all open water sources, and rescuers bringing clean water may take some time to arrive.

6. Family members should be able to contact each other in case some get separated during a tsunami. It is helpful to have a relative or friend who everyone can call, preferably someone who lives in a different area.

7. Visit the local disaster management agency now and then to update yourself about tsunamis. Share the latest information with your family.

C. What To Do During a Tsunami

1. Run to your chosen evacuation site as soon as you hear the official warning signal, or notice the tsunami warning signs.

2. Do not go to the beach to look at the exposed seafloor. Stay away from all coastal areas. Even shorelines not facing the source of the tsunami may be affected. Tsunamis can bend around landmasses.

3. Stay in the evacuation site and listen to the radio for the latest news. Return home only when the authorities say it is safe. Tsunamis can last for hours. Succeeding waves may be bigger, and more dangerous because of the numerous floating debris.

D. What To Do After a Tsunami

1. Help those who need special assistance such as children, old or sick people, pregnant women, and people with disabilities.

2. Give first aid to people with slight injuries. But do not move people who are seriously injured unless it is dangerous to keep them where they are. Moving people with a broken neck or back may paralyze them for life. Call for professional help.

3. Inspect your house for damage. Look out for broken electric wires, you may step on a live one. Close the main valves if you find leaking gas tanks or pipes. Use a flashlight to light your way. Do not use kerosene lamps, candles, or matches.

4. Do not drink water from open wells. The water will certainly be contaminated. Do not eat food that came into contact with the flood waters.

5. Keep yourself informed. Watch out for announcements from the authorities. Listen to radio broadcasts.

Activities

Activity 1.

Observe the coastline that is nearest to your community.

1. Describe the coastline. Is it rugged, hilly, gently-sloping or flat?

2. Using a topographic map with a scale of 1:10 000, locate where the houses are, and find out how high the ground is above sea level. Record the elevation in meters.

3. In Indonesia, the tsunami wave was 10m high. Using the topographic map, locate the places in the coastal area that would be affected by a 10m-high tsunami.

Activity 2.

Form a group with your classmates and plan out a tsunami drill.

Activity 3.

If a tsunami hits your area, what kind of volunteer work can you do with your classmates?

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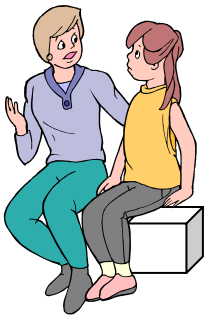
How to Cope with the Traumatic Experience During and After a Disaster

1. How do you help yourself feel better during and after a natural disaster?

After experiencing a disaster, it is very common, and quite normal for people to experience a different emotions, thoughts, and physical reactions. These responses may appear immediately after the disaster or some time later. They may last for a few days, a few weeks and sometimes even longer. Don't worry— these are very normal reactions to very abnormal situations. Although your life may not be exactly as it was before the disaster, you can recover and feel better after some time.



- Talk openly with your parents and friends about your feelings— afraid, frightened, confused, nervous, angry or worried.
- Do some kind of regular physical activities, like walking, gardening, or swimming, and others.
- Try to keep your sleep schedule as normal as possible.
- Eat well balanced and regular meals. Do not eat a lot of high-fat or sugary foods, or miss meals.
- Do not use alcohol or drugs to feel good.
- Give yourself time to relax.
- Try to do normal daily routines as much as possible.

2. How can you help others feel better?

- Let your friend know you are sorry about what happened and you want to understand and help.

- Listen carefully, patiently, and often. Remember that everyone behaves differently after a natural disaster.

- Understand your friend if he/she expresses anger or criticism.

- Do not force your friend to talk if he/she does not always feel like talking.

3. How can teachers and other adults help children cope with natural disaster?

- Teach what hazards are present in your community and how to prepare for each.

- Use the information about natural disasters in other subject area like science, math, social studies, and language arts.

- Let children talk about the disaster and let them ask questions as much as they want. Share your feelings too.

- Use art, music, and photography to help children express their emotions.

- Hug and touch children often. Frequently reassure children that all of them are safe.

- Allow children to feel sorry about their lost treasures, like a toy, a book, a lost home.

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