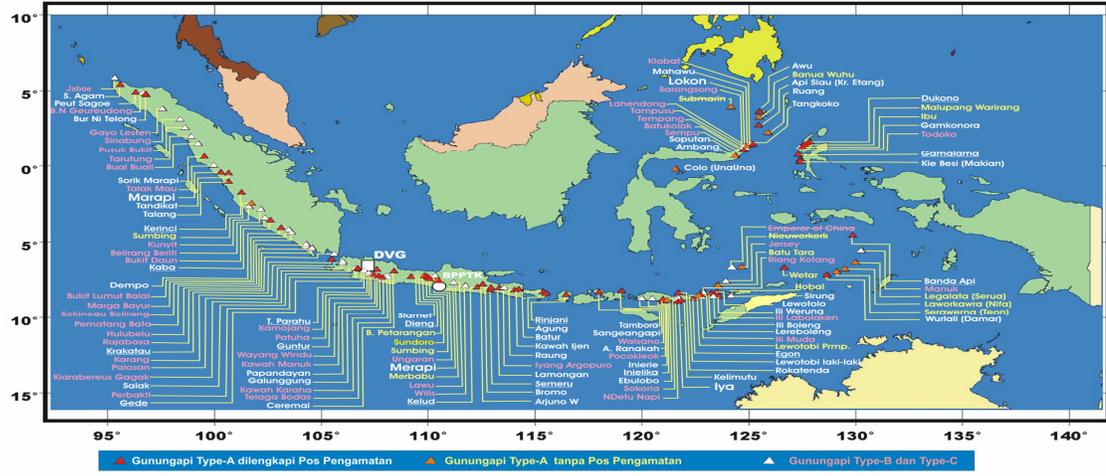
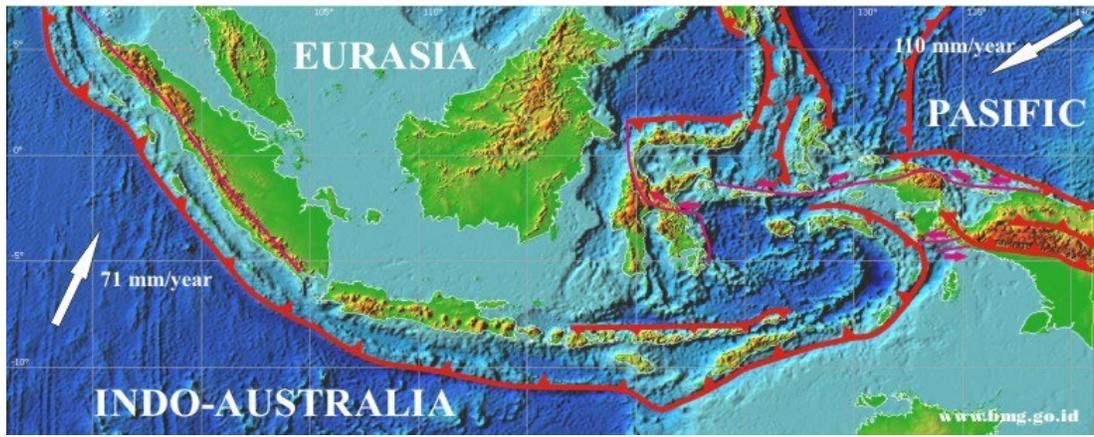




Canadian  
Red Cross  
Croix-Rouge  
canadienne

# Disaster Preparedness Tips

(A guide book for personal safety in the field  
with special reference to Indonesia)



Canadian Red Cross  
Indonesia Mission  
Tsunami Recovery Operations  
Banda Aceh, Indonesia

July 2009

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with special reference to Indonesia)

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July 2009

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# Earthquake

## What is an earthquake?

An earthquake is a sudden tremor or movement of the earth's crust, which originates naturally at or below the surface. Vibrations or shakings in the earth's crust are generally caused by sudden tectonic movements or volcanic eruptions. Earthquakes may also be induced by human activity, such as the removal of materials from the earth's crust or atomic explosions.

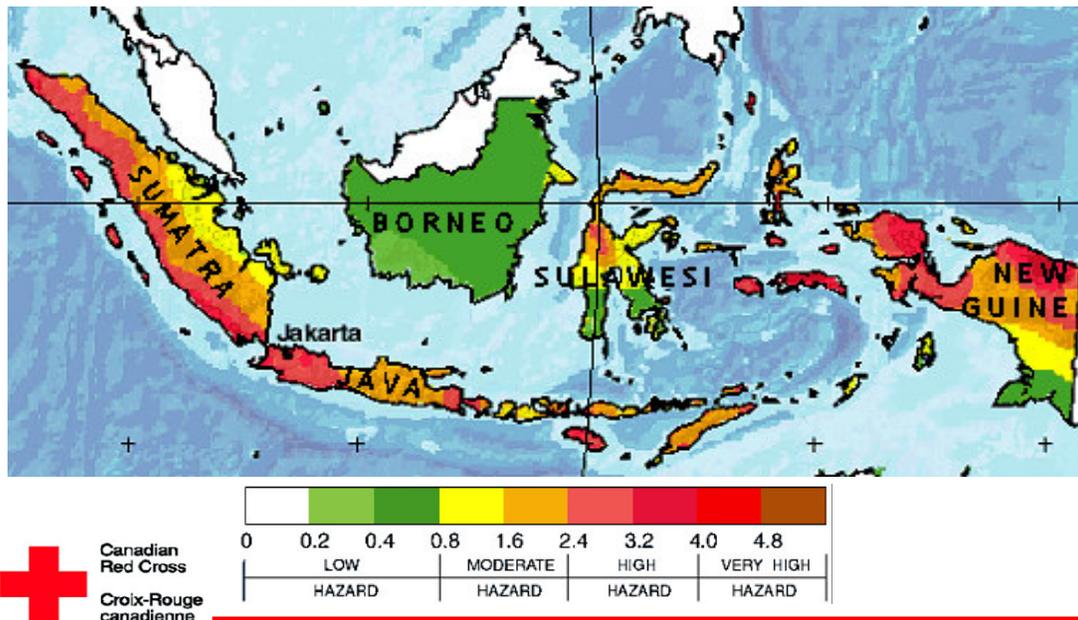
## What causes an earthquake?

1. **Tectonic movement**- earthquake can be triggered by tectonic activity along the plate boundaries and fault. An earthquake of 9.3 magnitude at the west coast of northern Sumatra on 26 December 2004, was caused by the thrust –faulting on the interface of the India and the Burma plates.
2. **Volcanic eruptions**- earthquake can be linked to an explosive volcanic eruption. In 1833 an earthquake generated by the eruption of the Krakatau Volcano at the straight of Sunda between Java and Sumatra Islands triggered at least three tsunami waves that killed 36,000 people.
3. **Human activities**- Earthquake can be generated by human activities. Shock waves caused by the French nuclear tests generated some tremors in the past.

## Effects of earthquakes

1. Destruction of buildings, infrastructures
2. Human casualties
3. Can generate tsunami

Seismic hazard map of Indonesia



## How are earthquakes measured?

There are two different ways of measuring earthquakes:

1. Magnitude (Richter scale)
2. Intensity (Modified Mercalli Intensity scale)

A rough estimation of the damage based on the experiences, however it largely depends on the nature of buildings and the location:

### Less than 3.5

Generally not felt, but recorded.

### 3.5-5.4

Often felt, but rarely causes damage.

### Under 6.0

At most slight damage to well-designed buildings. Can cause major damage to poorly constructed buildings over small regions.

### 6.1-6.9

Can be destructive in areas up to about 100 kilometers across where people live.

### 7.0-7.9

Major earthquake. Can cause serious damage over larger areas.

**8 or greater**

Great earthquake. Can cause serious damage in areas several hundred kilometers across.

Modified Mercalli Intensity Index

Scale	Effects/Specifications
Scale I	Not felt by people; Detected only by seismographs
Scale II	Perceived by people resting on high floors of buildings;
Scale III	Slightly perceived outside, like a small truck passing. Hanging objects sway.
Scale IV	Noisy like a heavy truck passing; Crockery, windows and doors vibrate and move.
Scale V	Clearly perceived outside buildings. People wake up. Small objects on shelves and tables are displaced and can fall. Open doors and windows swing to and fro. Small landslides occur on steep hills.
Scale VI	Perceived by everyone; Frightened people run outside; Lightweight furniture moves.
Scale VII	Difficult for people to remain standing. Perceived by people driving vehicles
Scale VIII	Fright and panic even in people driving vehicles. Heavy furniture can fall. Partial collapse of masonry buildings without columns and with low wall density. Fissures in reinforced masonry.
Scale IX	Widespread panic; even animals are frightened and "cry out"
Scale X	Widespread destruction of buildings
Scale XI	Severe damage even to earthquake resistant buildings; catastrophe
Scale XII	Total damage; The intensity is so high that changes are produced in the landscape, with great horizontal or vertical displaced.

**1. How do I protect myself in an earthquake?**

**Things to do before an earthquake occurs**

- At home, talk about earthquakes or possible disasters. Make sure every colleague/family member knows how to respond in case of an earthquake.
- Know the safe spots in each room (under a sturdy table or desks, against the interior wall or a column, or under door frame etc.)
- Identify the safest and nearest place from your house.
- Practice DROP, COVER and HOLD in each safe spot. Drop under a sturdy table or desk, hold on to its leg, and protect your eyes by pressing your face against your arms. Practicing will make these actions an automatic response. When there is an emergency, many people hesitate, forgetting what they are supposed to do. Responding quickly and automatically will help to protect you from injury.
- Know the danger spots- near windows, mirrors, hanging objects, tall unsecured furniture, and shelves holding heavy objects.
- Locate safe places outdoors- In an open, away from buildings, trees, telephone and electric post and lines and overpasses.
- Locate gas, water, and electricity installations, and periodically check that they are in good condition. Use accessories with flexible connections, and make sure you know how to disconnect them.
- Identify exits and alternative exits- always know all the possible ways to leave your house and work place in emergency situations. Practice getting out of your home or building, check and see if the planned exits are clear of obstacles.
- Keep in a handy place: emergency telephone numbers, first aid box, a portable radio, and torch with batteries.
- Always carry your I.D.
- Know the location of shut off valves for water, gas and electricity. Learn how to operate those valves.
- Learn first aid.

- Develop an emergency communication plan- in case family members are not together during the earthquake, that is, when adults are at work and children are at school.
- Make the home a safe place by doing the following:
  - Secure heavy furnishing such as cup boards and book cases against walls to prevent them from falling over and injuring persons.
  - Keep large, heavy objects and breakables on lower shelves to prevent you from serious injuries caused by falling objects.
  - Store all flammables or hazardous liquids outside the house, in their proper containers, away from structures since earthquakes may trigger fires or explosions within the building.
  - Hang heavy items such as pictures and mirrors away from beds, couches, and anywhere people sit.
  - Pull down and close shutters or draw curtains, as protection from flying glass, especially for windows that are near the bed in the event of an earthquake occurring at night and people are asleep.
- Ensure that a stock of appropriate supply is kept: food and drinking water, first aid kit and essential medicine, flash light with extra batteries, portable radio with extra batteries. Radio will be the best source of information following the earthquake especially when the electricity power is out.

### **Things to do during an earthquake**

- Stay calm. If you are indoors, stay indoors. If you are outdoors, stay outdoors. Many injuries occur as people enter or leave buildings.
- If you are inside, move away from windows, doors, tall cabinets, breakables or heavy objects that could fall. Take cover under a desk or sturdy table and hold on or stay against an interior wall or column. Remember that most fatal injuries are head wounds, therefore, DROP, COVER and HOLD.
- If you must leave a building, do so in an orderly manner. Rushing to get out can result in injuries. Do not use the elevator. As a precaution against possible fires, use the stairs.
- If you are outdoors, move to a clear area away from the trees, signs, buildings, electrical wires and poles. DROP and COVER your head until the shaking stops.

- If you are in a vehicle, stop and remain inside until the shaking stops. Avoid buildings, overpasses, bridges, power lines and roads beside ravines and cliffs in which landslides may occur. Be cautious of possible road damage while you proceed.
- If you are in a building; once earthquake is over, leave the building. Remember: do not shout, do not run, and do not push.

**Avoid unstable items and buildings.** Injuries and deaths during earthquakes are caused by falling objects and collapsing structures, and are largely avoidable. Take extra care in your home to ensure minimal damage or injury.

**Secure heavy items.** Since falling objects pose the greatest danger during an earthquake, all tall or heavy furniture should be secured to the wall to prevent it from toppling over. TVs, stereos, heavy paintings, pots and plants should be tied down or placed on safety mantles. Remove all heavy items from the tops of shelves and cupboards.

**Be fire aware.** Ensuing fires after an earthquake can cause havoc. Make sure you know where to switch off the gas supply to your apartment or building. Know the emergency exits in your building and make sure they are not obstructed in any way. Keep a regularly maintained fire extinguisher nearby and learn how to use it. Most fires start small and can be extinguished easily with quick action.

**Prepare an escape bag.** Include in it a radio, flashlights, spare batteries, solid fuel for a cooker, candles, money and ID documents. Stock up at least 3 days of water and food. Keep an extra rotating supply of your prescription medications in the bag.

**Protect your most vulnerable areas.** In the event of an earthquake, take all measures necessary to protect your head and neck, the most vulnerable parts of your body.

**Assume the "earthquake position".** If you are indoors, drop down to the floor in the "earthquake position". Make yourself small, with your knees on the floor, and your head tucked down toward the floor. Take cover under a sturdy desk or table. Place one hand on a leg of the table (to keep it from shifting away from you) and one hand over the back of your neck. Alternatively get down low next to a solid sofa or armchair and cover your head and neck with a pillow. Stay clear of windows, fireplaces, wood stoves, and heavy furniture or appliances that may fall over. Stay inside to avoid being injured by falling glass or building parts.

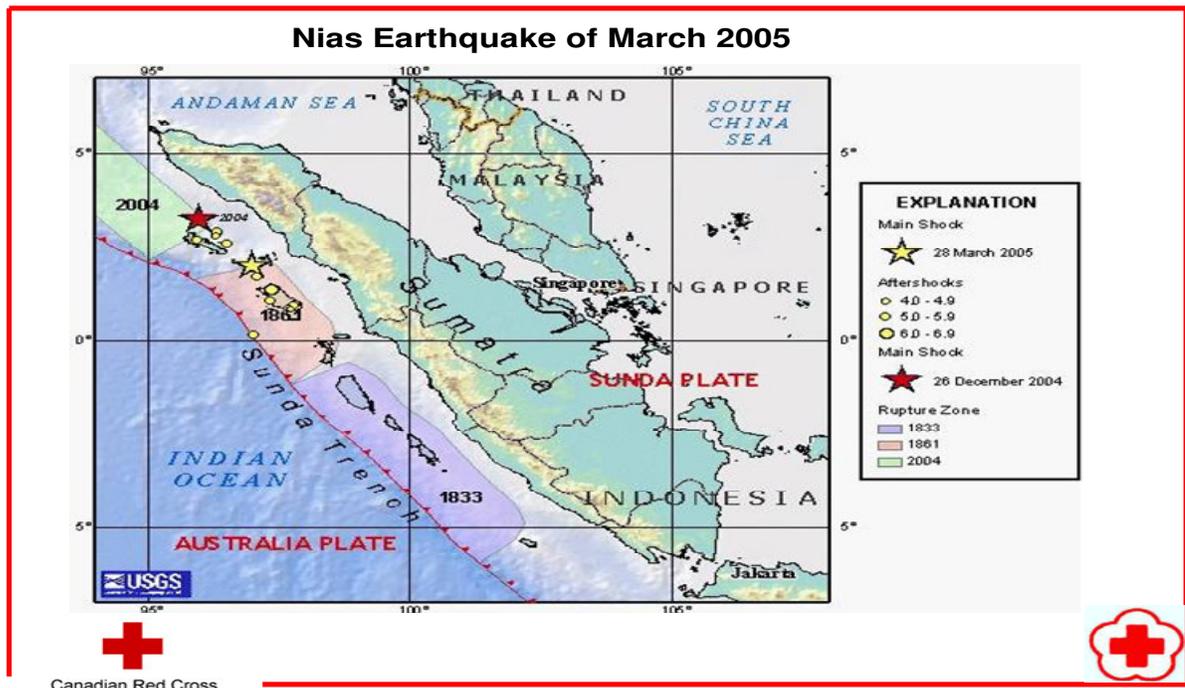
**Keep children and pets safe.** If you have children or pets, do everything possible to get them under the table with you. Make sure as much of their bodies are protected as possible.

**Have shoes handy.** To avoid stepping on broken glass and other objects, keep a pair of shoes and flashlight in a plastic bag tied to a foot of your bed so you don't need to grope in the dark.

**Take precautions wherever you happen to be.**

If you are in a crowded area, take cover where you are. If you are outside, get into the open, away from buildings and power lines. If you are at the beach, move quickly to higher ground or several hundred yards inland. If you are driving, stop if it is safe, but stay inside your car. Stay away from bridges, overpasses and tunnels. Move your car as far out of the normal traffic pattern as possible. If possible, avoid stopping under trees, light posts, power lines, or signs.

**Try to remain calm.** Wait for the earthquake to stop before moving from your spot.



**Earthquake zones**

Certain areas of the world are more prone to earthquakes than others. The main areas are: the Pacific coast of North and South America; Japan; southeast Asia; Indonesia; the east coast of China; Central Asia; and a band which stretches across the Mediterranean from Italy to Iran.

But there is nowhere in the world that is entirely safe.

# Tsunami

## What is a tsunami?

*Tsunami* is a Japanese word which means "harbor wave". Represented by two characters, "tsu" (harbor) and "nami" (wave), it is referred to as a giant waves which attack coastlines resulting to damage to property and loss of life.

A tsunami is a series of ocean waves, generated from large, shallow earthquakes with the epicenter or fault line located near or on the ocean floor. Tsunami waves have long periods and wavelengths. In the deep ocean they may reach only a few meters in height above the water surface, hence passengers aboard boats far from the seashore may never feel an approaching tsunami. As waves enter shallow waters, the heights increase drastically resulting in a sudden increase in sea level thereby flooding low-lying coastal areas.

## What causes a tsunami?

Earthquakes that cause displacement of the seafloor generate most tsunamis, but, as we shall see, a volcanic activity and a landslide occurring above or below the sea surface, underwater, and meteorite impacts can generate a tsunami.

## History of Tsunami in West coast of Indonesia

### History of Tsunami in Aceh and Western Coast of Sumatra, Indonesia

Location	Date	Magnitude	Damage/Loss
Central part of Western Sumatra	10 February 1797	8	More than 300 fatalities
South western Sumatra	24 November 1833	8.8-9.2	Flooded all the southern part of west Sumatra
Central Sumatra and Nias	5 January 1843	7.2	Many fatalities
Western coast of Sumatra	16 February 1861	8.2	Several thousands fatalities
Kradatau	27 August 1883	Volcano-caused	Over 36000 deaths
Banda Aceh	1941	-	-
Aceh and Nias island (Indian ocean tsunami)	26 December 2004	9-9.3	More than 270,000 (in Indonesia, India, Sri Lanka, Thailand, Maldives etc)



## 2. How do I protect myself in a Tsunami?

### What to do Before and During a Tsunami

The following are guidelines for what you should do if a tsunami is likely in your area:

- **Turn on your radio** to learn if there is a tsunami warning if an earthquake occurs and you are in a coastal area.
- **Move inland to higher ground** immediately and stay there.
- **Stay away from the beach.** Never go down to the beach to watch a tsunami come in. If you can see the wave you are too close to escape it.
  - **CAUTION - If there is noticeable recession in water away from the shoreline this is nature's tsunami warning and it should be heeded.** You should move away immediately.

### What to Do After a Tsunami

The following are guidelines for the period following a tsunami:

- **Stay away from flooded and damaged areas** until officials say it is safe to return.
- **Stay away from debris in the water;** it may pose a safety hazard to boats and people.
- **Save yourself - not your possessions**

# Flood

## What is a flood?

Floods occur when large amount of water overflows over dry land. They may result from prolonged or very heavy rainfall, severe thunderstorms, monsoon rains, or tropical cyclones. People, who live near rivers, or in low-lying coastal areas, live with the greatest threat of floods.

## Common types of flooding

1. Slow onset floods
2. Rapid onset floods
3. Flash floods

## Flood warnings

Usually, a reasonable warning period is possible except in case of flash floods. Common terms used by the meteorological department to describe the warnings for flooding are as:

1. **Minor flooding:** Causes inconvenience, closing small roads and low-level bridges.
2. **Moderate Flooding:** Low-lying areas inundated, requiring removal of stock, equipment and evacuation of isolated homes. Main road and rail bridges may be covered.
3. **Major flooding:** Higher areas inundated, towns and properties isolated, and extensive damage.
4. **Local flooding:** Intense rainfall, some high run-off, but usually no flooding in main streams;
5. **Significant river rises:** This warning is issued if it is not certain that the initial flood levels will be exceeded in the main streams. It makes people aware that appreciable rises are expected.

**Flood in Nias (Dec 07)**



Canadian Red Cross

**Flooding in Nias (Dec 07)**



Canadian Red Cross

### 3. How do I protect myself in a flood?

#### Before a Flood

To prepare for a flood, you should:

- Know your local flood history.
- Find out from local government agencies or experts at what river height you are unsafe.
- Avoid building in a floodplain unless you elevate and reinforce your home.
- Find out the evacuation route.
  
- Elevate the furnace, water heater, and electric panel if susceptible to flooding.
- Install "check valves" in sewer traps to prevent flood water from backing up into the drains of your home.
- Construct barriers (levees, beams, floodwalls) to stop floodwater from entering the building.
- Seal walls in basements with waterproofing compounds to avoid seepage.

#### During a Flood

If a flood is likely in your area, you should:

- Listen to the radio or television for information.
- Be aware that flash flooding can occur. If there is any possibility of a flash flood, move immediately to higher ground. Do not wait for instructions to move.
- Be aware of streams, drainage channels, canyons, and other areas known to flood suddenly. Flash floods can occur in these areas with or without such typical warnings as rain clouds or heavy rain.

If you must prepare to evacuate, you should do the following:

- Secure your home. If you have time, bring in outdoor furniture. Move essential items to an upper floor.

- Turn off utilities at the main switches or valves if instructed to do so. Disconnect electrical appliances. Do not touch electrical equipment if you are wet or standing in water.

If you have to leave your home, remember these evacuation tips:

- Do not walk through moving water. Six inches of moving water can make you fall. If you have to walk in water, walk where the water is not moving. Use a **stick** to check the firmness of the ground in front of you.
- Do not drive into flooded areas. If floodwaters rise around your car, abandon the car and move to higher ground if you can do so safely. You and the vehicle can be quickly swept away.

### **Driving Flood Facts**

The following are important points to remember when driving in flood conditions:

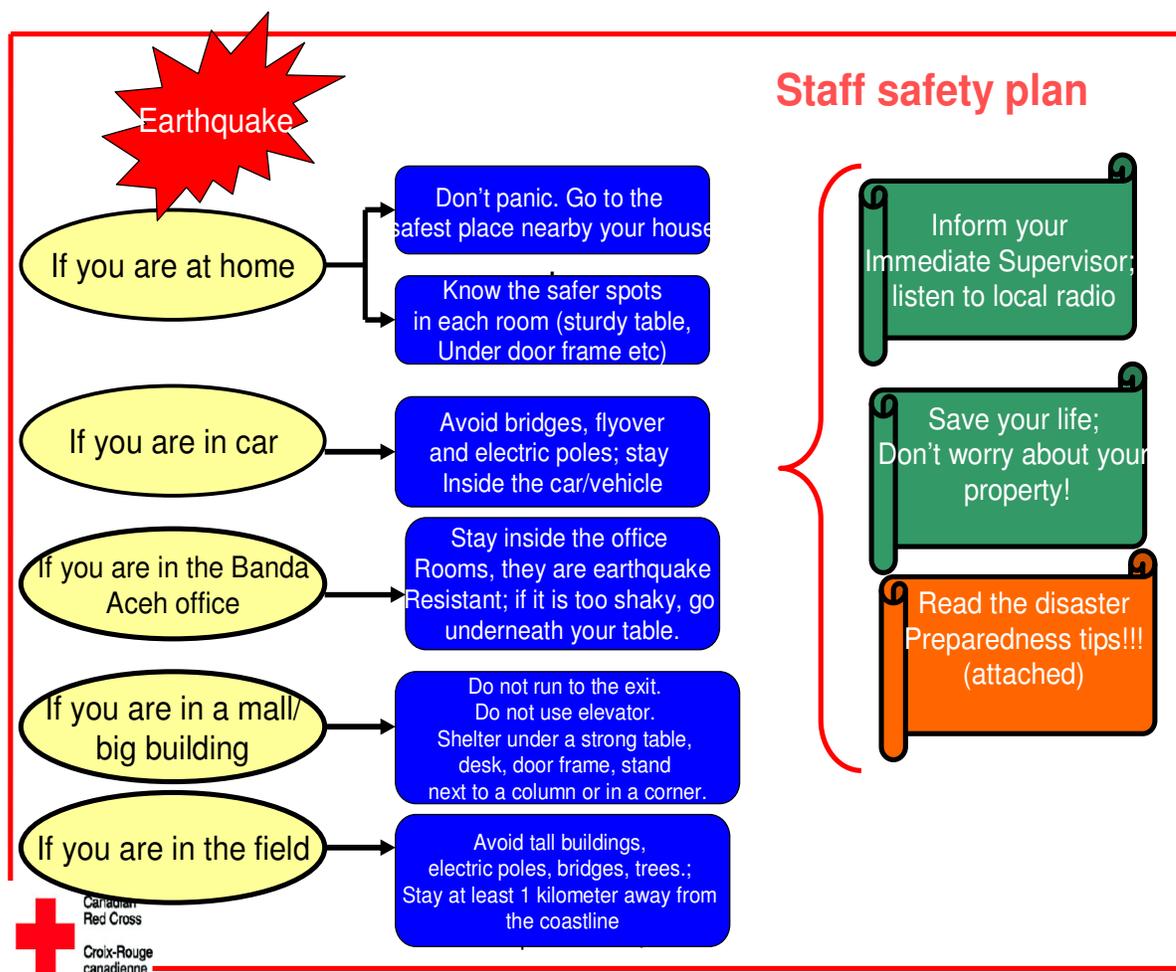
- Six inches of water will reach the bottom of most passenger cars causing loss of control and possible stalling.
- A foot of water will float many vehicles.
- Two feet of rushing water can carry away most vehicles including pick-ups.

### **After a Flood**

The following are guidelines for the period following a flood:

- Listen for news reports to learn whether the community's water supply is safe to drink.
- Avoid floodwaters; water may be contaminated by oil, gasoline, or raw sewage. Water may also be electrically charged from underground or downed power lines.
- Avoid moving water.
- Be aware of areas where floodwaters have receded. Roads may have weakened and could collapse under the weight of a car.
- Stay away from downed power lines, and report them to the power company.

- Return home only when authorities indicate it is safe.
- Stay out of any building if it is surrounded by floodwaters.
- Use extreme caution when entering buildings; there may be hidden damage, particularly in foundations.
- Service damaged septic tanks, cesspools, pits, and leaching systems as soon as possible. Damaged sewage systems are serious health hazards.
- Clean and disinfect everything that got wet. Mud left from floodwater can contain sewage and chemicals.



# Volcano

## What is a volcano?

A volcano is an opening, or rupture, in a planet's surface or crust, which allows hot, molten rock, ash, and gases to escape from below the surface. Volcanic activity involving the extrusion of rock tends to form mountains or features like mountains over a period of time. The word *volcano* is derived from Italian *vulcano*, after Vulcan, the Roman god of fire.

## How is the volcano formed?

The glowing magma of Earth's mantle pushes up towards the surface, searching for ways to escape through cracks in the Earth's crust. It does not always get through. If the crust is too dense, the magma stops and flows back, until, with the gasses of the magma, it stays trapped. In time it succeeds in escaping- then, it explodes like a cork from a bottle. A volcano is 'born'. This erupts magma into the air in the form of molten lava, gas, ash and solid fragments.

## How safe are volcanoes?

Volcanoes are much safer than other natural events such as earthquakes, floods, and hurricanes. However, volcanic eruptions can hurl hot rocks for at least 30 km. Floods, airborne ash, or noxious fumes can spread 160 km or more. If you live or work near a known volcano, active or dormant, be ready to evacuate at a moment's notice. Stay out of the area. A lateral blast of a volcano can travel many km from the mountain. Trying to watch an erupting volcano is a deadly idea.

- Be prepared for these disasters that can be spawned by volcanoes: earthquakes, flash floods, landslides and mudflows, thunderstorms, tsunamis.
- Evacuation: Although it may seem safe to stay at home or in the office and wait out an eruption, doing so could be very dangerous. The rock debris from a volcano can break windows and set buildings on fire. Leave the area before the disaster begins.

## Risk Zones around an active volcano

### **1. Extreme Risk Zone** (0 to 100 m)

This is the area within tens of metres of an active vent. This is the death zone. Only to be approached under extreme circumstances with a good reason to be there. This location is subject to intra crater earthquakes, extreme temperatures, choking and toxic gases, falling projectiles, and unstable terrain. An eruption may give 30 seconds warning at most. This region is incompatible with life. You will be killed if you stay there long enough. It is suggested that you stay away from this zone.

### **2. High Risk Zone** (100 m to 300 m)

This is the area on the edge of the crater. In an eruption you are in danger. You will only have a 50:50 chance of survival here in a larger than normal eruption. Limit time in this region. This is usually the closest you should approach an active volcano under ideal conditions. Don't even think of getting this close to volcanoes like Sakura-jima (Japan), Anak Krakatau (Indonesia).



(The Mount Bromo volcano on the island Java of Indonesia. Photo by Jan-Pieter Nap taken on July 11 2004)

### **3. Medium Risk Zone.** (300 m to 3 km)

At any time bombs can be expelled to this distance. Think twice before sleeping here. Spending hours in this zone may be OK but keep a careful watch on activity

#### 4. Low Risk Zone (3 km to 10 km)

There is a low risk of injury from an eruption in this zone. Bombs may fall in this zone during a large eruption. In July 2000 Copahue Volcano (Chile) expelled bombs to 9 km. Lahars or large pyroclastic flows may travel this far down valleys, otherwise it is usually safe.

#### 5. Safe Zone for Habitation (Beyond 10 km)

Only a very large eruption will affect this area. Lahars are capable of traveling over 10 km down the side of volcanoes. The great lahars of Nevado del Ruiz volcano (Colombia 1985) traveled 100 km and destroyed the town of Armero 73 km from the source. This accident was correctly forecast and the tragedy was a human made disaster.



#### When you are in the house

Before

1. Avoid areas downwind of the volcano
2. You want to get to high ground away from the eruption
3. Get a pair of goggles

During

1. Close all windows, doors and dampers
2. Put all equipment and machinery inside a garage or barn.

After

1. Clear roofs of ash fall (ash fall is very heavy and can cause buildings to collapse).

### **When you are in the field**

Before

1. Avoid areas downwind of the volcano

During

1. If caught in a rock fall, roll into a ball to protect head
2. Avoid low-lying area where poisonous gases can collect and flash floods can be most dangerous
3. If caught near a stream, beware of mud flows.
4. If possible, shelter indoors

### **In vehicle**

During

1. Keep car or truck engines off
2. Avoid driving in heavy ash fall (driving will stir up more ash that can clog engines and stall vehicles)

### **Protect yourself:**

1. Wear long sleeved shirts and pants.
2. Use goggles to protect eyes.
3. Use a dust-mask or hold a damp cloth over face to help breathing.
4. Keep skin covered to avoid irritation or burns
5. Stay away from volcanic ash fall, cover your mouth and nose.

## **Safety recommendations when visiting an active Volcano**

### **Pre-Planning**

#### **1. Read about past eruptions**

Volcanic eruptions can repeat themselves. What the volcano has done in the past is what it is capable of doing in the future. While volcanoes are inherently unpredictable, studies of past eruptions at a particular volcano will give an indication of what is possible.

#### **2. Read about past accidents**

Analyze what went wrong in past accidents. The Bulletin of the Global Volcanism Network (Smithsonian Institute) has the best monthly volcanic activity reports including accident reports. Two accidents have happened on

field trips associated with International Volcanology conferences (Galeras in 1993 and Semeru 2000). Many scientists are inexperienced when it comes to climbing volcanoes. Theoretical knowledge is no replacement for field experience.

### **3. Observe the volcano for at least 24 hours before getting close to the danger zone**

Record the number of explosions per hour and know what the volcano is doing. Sometimes a two to three day observation period is required before approaching the summit area. Simply arriving at the volcano and climbing straight to the summit is asking for trouble!

### **4. Know the current volcano warning level**

How does this compare to the "normal" state of volcanic activity. Volcano warning levels may be expressed in different forms. Warning levels may mean different things on different volcanoes. Learn what the current activity level means for the particular volcano you are visiting. Remember, most volcanoes are not monitored by scientists so don't rely on the authorities knowing the danger level. Absence of evidence is not evidence of absence. If there is no current eruption warning, it does not necessarily mean the volcano is safe!

### **5. Be self sufficient**

Do not expect other people to come into the danger zone and rescue you. Don't expect people to risk their life to get you out of danger.

### **6. Take all precautions in PREVENTING an accident**

Be very conservative in your actions. Don't assume the volcano is safe if everything looks quiet. It may be the "calm before the storm". A blocked vent can be quiet but the pressure can be building to a large eruption.

### **7. Obey local authorities**

Don't enter any area on the volcano if the local authorities prohibit it.

## **Precautions in the Danger Zone**

### **1. Wear the correct equipment at all times**

Wear a helmet and take a gas mask. If your helmet is not strapped on at all times it is useless. Even effusive volcanoes like Kilauea may send dangerous projectiles into the air from lava sea-water interactions and methane explosions. Unstable ground can result in falls and head injuries.

### **2. Beware of many sources of danger on a volcano**

Extreme heat, cold, windstorms, heavy rain/ acid rainfall, lightning, altitude sickness, blizzards, getting lost, volcanic activity, unstable terrain, dangerous plants, animals, and insects. Volcanoes generate their own weather which can

be severe and different from that only a few km away. Localized wind storms may reach 150 km/hr without warning. Cooling lava flows may still be deadly, when rain falling on the hot surface may displace breathable air after it flashes to steam (people died from the effect at Nyiragongo eruption in 2002).

### **3. Survey the ground on approach to the crater.**

Look for evidence of recent ejecta. If you can see recent bombs on the ground then you can be hit. Limit your time in that area. It is preferable you relocate to a safer zone. Some vents eject projectiles in a particular direction. Don't stay in the firing line. Recent bombs are black and stand out from the brown colour of older lava.

### **4. Watch out for rock falls and avalanches when climbing the crater.**

Falling rocks and unstable ground pose one of the most immediate hazards when climbing a volcano. Don't kick rocks down the slope and try to limit your impact on the unstable terrain. Watch out for other climbers above and below you. The crater edge may be overhanging. Know where you are walking at all times. Be careful of new ground slumping or cracking.

### **5. Beware of Hazardous Gases.**

Hazardous gases emitted by volcanoes include carbon dioxide, sulfur dioxide, hydrogen sulfide, radon, hydrogen chloride, hydrofluoric acid, and sulfuric acid. Gases can be toxic directly or displace oxygen from the environment leading to anoxia. Never enter a depression near active fumaroles, especially on a day without wind. Toxic gases can pool in the depression leading to a dangerous situation.

### **6. Can you directly see the vent?**

If you can directly see the vent then the projectiles have a direct line of sight to you. Rocks and lava can be ejected at 200 m per second, sometimes even supersonic. You might be hit before you even hear the explosion. Lateral projectiles are some of the most dangerous and can be lethal in even a minor eruption.

### **7. Beware of periods of low activity.**

Quiet periods at a volcano may lure you into a false sense of security, and make you go closer than you would otherwise. Beware of a quiet volcano!

### **8. Limit your time in the danger zone.**

The closer you go to the vent, the greater the risks. In zone 1 (see above) even a minor eruption can be fatal. The risks multiply exponentially in this zone. Spend only minutes in this zone, if you need to be there at all. There is really no reason to be in zone 1 of a volcano. The scientists at Galeras made the fatal error of staying 4 hours in this area! Remember you will be killed here if you stay long enough. It is like sleeping on a freeway. Eventually something will hit you if

you stay long enough. Some scientists enter the danger zone immediately after a large eruption because they believe the magma column may be lowered for a while.

**9. Exit the danger zone well before sunset.**

Start the climb early and exit by midday. If something goes wrong then rescue will be almost impossible at night. If you survive the accident then you may die of exposure during the cold night at altitude.

**10. Observe from a safe location.**

Stay up wind and away from the direction of travel of projectiles. Have an evacuation plan with 2 exits. Mentally rehearse your escape plan continuously while in the danger zone. Vent migration may make a previously safe area off limits. Take time to study the volcano topography before going too close.

**11. If caught in an eruption near the crater take cover.**

You have a 50% chance of survival if you are caught in an eruption. Hiding behind boulders or in a depression will shield you from lateral projectiles. Watch for vertical projectiles.

**12. Visibility may suddenly reduce to almost zero without warning.**

This can be due to fog, cloud, rain, volcanic fumes or nightfall. Be sure you can deal with these situations. Most people would have severe problems walking out of an area under these conditions. A familiar location will become a nightmare under limited visibility. If you find yourself in very low visibility then you may just have to sit and wait until conditions improve.

**13. Leave the area if it becomes dangerous.**

There is no point having a safety plan if it is ignored. Two scientists were killed on Guagua Pichincha Volcano in 1993 when they remained in the crater despite getting a radio warning of possible eruption 85 minutes earlier.

**14. Do not approach lava flowing through vegetation.**

Underground explosions occur in front of lava flowing over burning vegetation. Plants burn without oxygen as they are covered by lava, creating methane gas. The gas fills underground lava tubes. When the methane ignites, the ground explodes up to 100 meters in front of the advancing lava flow. Rocks and debris blast in all directions.

**15. Look for warning signs of an eruption.**

Explosive activity may be preceded by earthquakes or rock falls. You may only have 30 seconds warning but this may give you time to take cover or evasive action.

## **16. Watch out for Heavy Rain.**

Heavy rain can cause flash flooding and lahars.

A decision to climb an erupting volcano should be based on a risk-benefit analysis. To see an eruption is one of the greatest sights in nature but the challenge must be accepted with common sense and knowledge of the risks.

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## Some disaster related terminologies

**Capacity** - is a combination of all the strengths, resources, skills, knowledge and abilities available within a community, society or organization that can reduce the level of risk, or the effects of a disaster. Access, leadership, infrastructures, time, commitment, resources

**Disaster**- a serious disruption of the functioning of a community or a society causing widespread human, material, economic and environmental losses which exceed the ability of the affected community or society to cope using its own resources.

**Earthquake** - an earthquake is a sudden tremor or movement of the earth's crust, which originates naturally at or below the surface. Vibrations or shakings in the earth's crust are generally caused by sudden tectonic movements or volcanic eruptions.

**Flood** – Floods occur when large amount of water overflows over dry land. They may result from prolonged or very heavy rainfall, severe thunderstorms, monsoon rains, or tropical cyclones. People, who live near rivers, or in low-lying coastal areas, live with the greatest threat of floods.

**Hazard**- an event, happening or human activity which has the chance for causing risk and danger to life or damage to properties and the environment.

**Lahar** is an Indonesian word describing **mudflows** and **debris flows** that originate from the slopes of a volcano. Both types of flows contain a high concentration of rock debris to give them the internal strength necessary to transport huge boulders as well as buildings and bridges and to exert extremely high impact forces against objects in their paths.

**Risk**- is the expected losses (lives lost, person injured, damage to property and disruption of economic activity or livelihood) caused by a particular phenomenon.

$$R = H * V / C$$

**Tsunami** - is a Japanese word which means "harbor wave". Represented by two characters, "tsu" (harbor) and "nami" (wave), it is referred to as a giant waves which attack coastlines resulting to damage to property and loss of life.

A tsunami is a series of ocean waves, generated from large, shallow earthquakes with the epicenter or fault line located near or on the ocean floor.

**Vulnerability** - Inability of individuals, households and community to prepare for and respond to hazards. The degree of loss to a given element at risk. It is expressed on a scale of 0 (no damage) to 1 (total loss).

**Volcano** - a volcano is an opening, or rupture, in a planet's surface or crust, which allows hot, molten rock, ash, and gases to escape from below the surface. The word *volcano* is derived from Italian *vulcano*, after Vulcan, the Roman god of fire.

**Volcanology** is the study of volcanoes. The role of volcanology is to gain an understanding of how volcanoes work, to further scientific knowledge, provide eruption hazard assessment, monitoring, and crisis management. One of the most important roles of volcanology is to foresee hazardous events, and save lives when an eruption occurs.

Annex 2.  
**Volcanoes of Indonesia**

Indonesia is located at the junction of four tectonic plates, Australian, Philippine, Eurasia and Pacific.

Indonesia has more active volcanoes than any other country. It contains some of the world's most famous volcanoes, Krakatau (Krakatoa), Tambora, and Merapi.

About 76 volcanoes in Indonesia have erupted in historical times.

<b>Sumatra</b>	<b>West Java</b>	<b>Bali</b>	<b>Banda Sea</b>
<ul style="list-style-type: none"> <li>• <u>Pulau Weh</u></li> <li>• <u>Seulawah Agam</u></li> <li>• <u>Peuet Sague</u></li> <li>• <u>Geureudong</u></li> <li>• <u>Kembar</u></li> <li>• <u>Sibayak</u></li> <li>• <u>Sinabung</u></li> <li>• <u>Toba</u></li> <li>• <u>Imun</u></li> <li>• <u>Helatoba-Tarutung</u></li> <li>• <u>Sibualbuali</u></li> <li>• <u>Lubukraya</u></li> <li>• <u>Sorik Marapi</u></li> <li>• <u>Talakamau</u></li> <li>• <u>Sarik-Gajah</u></li> <li>• <u>Marapi</u></li> <li>• <u>Tandikat</u></li> <li>• <u>Talang</u></li> <li>• <u>Kerinci</u></li> <li>• <u>Hutapanjang</u></li> <li>• <u>Sumbing</u></li> <li>• <u>Kunyit</u></li> <li>• <u>Pendan</u></li> <li>• <u>Belirang-Beriti</u></li> <li>• <u>Kaba</u></li> <li>• <u>Dempo</u></li> <li>• <u>Patah</u></li> </ul>	<ul style="list-style-type: none"> <li>• <u>Krakatau</u></li> <li>• <u>Danau</u></li> <li>• <u>Karang</u></li> <li>• <u>Kiaraberes-Gagak</u></li> <li>• <u>Perbakti</u></li> <li>• <u>Salak</u></li> <li>• <u>Gede</u></li> <li>• <u>Patuha</u></li> <li>• <u>Wayang-Windu</u></li> <li>• <u>Malabar</u></li> <li>• <u>Tangkuban Parahu</u></li> <li>• <u>Papandayan</u></li> <li>• <u>Kawah Kamojang</u></li> <li>• <u>Guntur</u></li> <li>• <u>Tampomas</u></li> <li>• <u>Galunggung</u></li> <li>• <u>Talagabodas</u></li> <li>• <u>Karaha</u></li> <li>• <u>Cereme</u></li> </ul> <p style="text-align: center;"><b>Central Java</b></p> <ul style="list-style-type: none"> <li>• <u>Slamet</u></li> <li>• <u>Dieng</u></li> <li>• <u>Sundoro</u></li> <li>• <u>Sumbing</u></li> </ul>	<ul style="list-style-type: none"> <li>• <u>Batur</u></li> <li>• <u>Bratan</u></li> <li>• <u>Agung</u></li> </ul> <p style="text-align: center;"><b>Lombok</b></p> <ul style="list-style-type: none"> <li>• <u>Rinjani</u></li> </ul> <p style="text-align: center;"><b>Sumbawa</b></p> <ul style="list-style-type: none"> <li>• <u>Tambora</u></li> </ul> <p style="text-align: center;"><b>Flores</b></p> <ul style="list-style-type: none"> <li>• <u>Wai Sano</u></li> <li>• <u>Poco Leok</u></li> <li>• <u>Ranakah</u></li> <li>• <u>Inierie</u></li> <li>• <u>Inielika</u></li> <li>• <u>Ebulobo</u></li> <li>• <u>Iya</u></li> <li>• <u>Sukaria</u></li> <li>• <u>Ndete</u></li> <li>• <u>Napu</u></li> <li>• <u>Kelimutu</u></li> <li>• <u>Egon</u></li> <li>• <u>Ilimuda</u></li> <li>• <u>Lewotobi</u></li> <li>• <u>Leroboleng</u></li> <li>• <u>Riang</u></li> </ul>	<ul style="list-style-type: none"> <li>• <u>Emperor of China</u></li> <li>• <u>Nieuwerkerk</u></li> <li>• <u>Gunung Api</u></li> <li>• <u>Wurlali</u></li> <li>• <u>Teon</u></li> <li>• <u>Nila</u></li> <li>• <u>Serua</u></li> <li>• <u>Manuk</u></li> <li>• <u>Banda Api</u></li> </ul> <p style="text-align: center;"><b>Sangihe Islands</b></p> <ul style="list-style-type: none"> <li>• <u>Ruang</u></li> <li>• <u>Karangetang</u></li> <li>• <u>Banua Wuhu</u></li> <li>• <u>Awu</u></li> <li>• <u>Unnamed</u></li> </ul> <p style="text-align: center;"><b>Halmahera</b></p> <ul style="list-style-type: none"> <li>• <u>Tarakan</u></li> <li>• <u>Dukono</u></li> <li>• <u>Tobaru</u></li> <li>• <u>Ibu</u></li> <li>• <u>Gamkonora</u></li> <li>• <u>Todoko-Ranu</u></li> <li>• <u>Jailolo</u></li> </ul>

- Bukit Lumut
- Balai
- Besar
- Ranau
- Sekincau
- Belirang
- Suoh
- Hulubelu
- Rajabasa

- Ungaran
- Telomoyo
- Merbabu
- Merapi
- Lawu
- Wilis

### **East Java**

### **Sulawesi**

- Una Una
- Ambang
- Soputan
- Sempu
- Tondano
- Lokon-  
Empung
- Mahawu
- Klabat
- Tongkoko

- Kelut
- Kawi-Butak
- Arjuno-  
Welirang
- Penanggungan
- Malang Plain
- Semeru
- Bromo
- Lamongan
- Lurus
- Iyang-  
Argapura
- Raung
- Ijen
- Baluran
- Lusi Mud  
volcano

### Kotang

### **Lesser Sunda**

- Paluweh
- Sangeang  
Api
- Gilbanta
- Batu Tara
- Sirung
- Iliboleng
- Lewotolo
- Ilibabalekan
- Iliwerung

- Hiri
- Gamalama
- Tidore
- Mare
- Motir
- Makian
- Tigalalu
- Amasing
- Bibinoi

### **Papua**

No Volcanoes

- Umsini