

Disaster Preparedness & First Aid Handbook

Prepared by the Senate Committee on Climate Change in coordination with the Philippine Institute of Volcanology and Seismology (PHIVOLCS), National Disaster Risk Reduction and Management Council (NDRRMC), Department of Education (DepEd), Department of Health (DOH), Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA), Bureau of Fire Protection (BFP), Mines and Geosciences Bureau (MGB) and Vigan City Disaster Risk Reduction and Management Council.

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EARTHQUAKE

WHAT IS AN EARTHQUAKE?

An earthquake is a feeble shaking to violent trembling of the ground produced by the sudden displacement of rocks or rock materials below the earth's surface. Tectonic earthquakes are generated by the sudden displacement along faults in the solid and rigid layer of the earth. Volcanic earthquakes are induced by rising magma beneath active volcanoes. THE PHILIPPINES AS AN EARTHQUAKE- PRONE COUNTRY

The Philippine Archipelago lies between 2 major tectonic plates, the Philippine Sea Plate and the Eurasian Plate. The Philippine Sea Plate is being subducted westward along the Philippine Trench at the eastern side of the Philippines. The Eurasian Plate is being subducted eastward along the Manila Trench, Negros-Sulu Trench and the Cotabato Trench at the

western side of the country except in southern Mindoro and western Panay, where collision takes place. Active faults traverse the archipelago, the longest of which is the Philippine Fault Zone. Subduction of plates along the trenches and movements along active faults are responsible for the present-day high seismicity of the Philippines.

For the last 400 years, the Philippines has been affected by 90 damaging earthquakes. Hence, the likelihood of destructive earthquakes occurring again in the future is indeed very strong. Around 20 earthquakes per day occur in the Philippines, most of which are not felt. About two hundred earthquakes are felt every year.

HAZARDS POSED BY EARTHQUAKES

1. GROUND SHAKING

The destructive effects of earthquakes are due mainly to intense GROUND SHAKING or vibration. Because of severe ground shaking, low and tall buildings, towers, and posts may tilt, split, topple or collapse; road foundations, railroad tracks and bridges may break; water pipes and other utility installations may get dislocated; dams and similar structures may break and cause flooding; and other forms of mass movement may be generated.

2. LIQUEFACTION

LIQUEFACTION is a process where particles of loosely consolidated and water-saturated deposits of fine sand are

rearranged into a more compact state. Water and sediments are squeezed out towards the surface in the form of water and sand fountaining (sand boiling), thus creating a condition resembling 'quick sand'. The consequent loss in volume and underlying support results in subsidence of the ground on top of the liquefying sandy layers and, with it, the sinking and/or tilting of any

structures above it. Liquefaction prone areas may be found in beach zones, sand spits, sand bars, tombolos, wide coastal plains, deltaic plains, floodplains, abandoned river meanders, former lake beds, former or existing marshlands and swamplands, and in areas underlain by sandy lahar deposits.

3. LANDSLIDES

Landslides are a downward movement of slope materials either slowly or quickly. A landslide may be a rock fall, topple, slump, slide or debris flow. Intense ground shaking can trigger a landslide by loosening the cohesion that bonds the slope materials together, thereby making it easier for gravity to pull it downwards. Hilly and mountainous areas, escarpments, steep river banks, sea cliffs, and other steep slopes are prone to landsliding. The main effect of landsliding is burial.

4. GROUND RUPTURE

Many strong earthquakes originate along faults that break the earth's rigid crust. GROUND RUPTURE is a deformation on the ground that marks the intersection of the fault plane with the earth's surface. The most common manifestation is a long fissure extending from a few kilometers to tens of kilometers, although ground rupture may also occur as a series of discontinuous cracks, mounds, or depressions.

The length of ground rupture and the width of the zone of deformation generally increase with the magnitude and type of earthquake.

5. TSUNAMI

Tsunamis are small to giant sea waves mostly generated by submarine earthquakes. Not all submarine earthquakes, however, can cause tsunamis to occur. Tsunamis can only occur when the earthquake is shallow-seated, and strong enough (about Magnitude 7) to displace parts of the seabed and disturb the mass of water over it. Other causes of tsunamis include submarine or coastal landslides, pyroclastic flows, large volume debris avalanches from submarine and partly submerged volcanoes, and caldera collapse.

PHIVOLCS EARTHQUAKE INTENSITY SCALE

Intensity I: Scarcely Perceptible - Perceptible to people under favorable circumstances.

Delicately balanced objects are disturbed slightly. Still water in containers oscillates slowly.

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 one passing of a light truck. Dizziness and nausea are experienced by some people. Hanging objects swing moderately. Still water in containers oscillates moderately.

Intensity IV : Moderately Strong - Felt generally by people indoors and by 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 buildings creak. Standing motor cars may rock slightly. Liquids in containers are slightly disturbed. 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 felt throughout 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 are noticeable.

Intensity VI:

Very Strong

- Many people are frightened; many run outdoors. Some people lose their balance. Motorists experience a sensation of driving on flat tires. Heavy objects or 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. Limited rockfalls and rolling boulders occur in hilly to mountainous areas and escarpments. 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.

Intensity VIII: Very Destructive

- People are panicky. People find it difficult to stand, even outdoors. Many well-built buildings are considerably damaged. Concrete dikes and foundation 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.

Fissure- 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 sewer pipes are bent, twisted, or broken. Landslides and liquefaction with lateral spreadings and sandboils are widespread. The ground is distorted and undulates. 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 and uprooted.

WHAT TO DO BEFORE, DURING, AND AFTER AN EARTHQUAKE

Before

1. The key to effective disaster prevention is planning.

Determine whether the site is along an active fault and/or prone to liquefaction or landslide which may cause damage to your house or building.

Be sure that proper structural design and engineering practice is followed when constructing a house or building.

Evaluate the structural soundness of buildings and important infrastructure; strengthen or retrofit if found necessary.

Plan ahead with your family in case of an earthquake. Decide on a place to meet in the event that you are separated.

Develop family, workplace and community preparedness and evacuation plans

2. Prepare your place of work and residence for the event.

Strap heavy furniture/cabinets to the wall to prevent sliding or toppling.

Check the stability and secure hanging objects, like ceiling fans and chandeliers, which may break loose and fall during earthquakes.

Heavy materials, breakable items, harmful chemicals, and flammable materials should be stored in the lowermost shelves and secured firmly.

Make it a habit to turn gas tanks off when not in use.

3. Familiarize yourself with your place of work and residence.

Identify relatively strong parts of the building like locations near elevator shafts, near columns and beams, and sturdy tables where you can take refuge during an earthquake.

Learn to use fire extinguishers, first aid kits, alarms, and emergency exits. These should be accessible/conveniently located, and prominently marked.

4. Prepare and maintain an earthquake survival kit consisting of a battery-powered radio, flashlight, first aid kit, potable water, candies, ready-to-eat food, sturdy rope, water-resistant matches, whistle, dust mask, clothes, and blanket.

5. Conduct and participate in regular earthquake drills.

During

1. Stay calm.

2. If you are inside a structurally sound building, stay there.

Protect your body from falling debris by staying in stronger parts of the building like near columns and beams, outside the elevator shaft, or by getting under a sturdy desk or table. Remember Duck, Cover, and Hold (Duck and Cover under a table, Hold on to the legs).

Stay away from glass windows, shelves, cabinets and other heavy objects.

Beware of falling objects. Be alert and keep your eyes open.

3. If you are outside, move to an open area.

Get away from power lines, posts, walls and other structures that may fall or collapse.

Stay away from buildings with glass panes.

If you are on a mountain or near a steep hill slope, move away from steep escarpments which may be affected by landslide.

4. When driving a vehicle, pull to the side of the road and stop. Do not attempt to cross bridges or overpasses, which may have been damaged.

5. If you are near the shore and you feel an earthquake strong enough to make standing difficult, it is always safest to assume that a tsunami might be triggered. Move quickly to higher ground.

After

1. Once the shaking stops, take the fastest and safest way out of the building. Do not rush to the exit. Get out calmly in an orderly manner. Bring your emergency kit. Do not use elevators; use the stairs. Go to an open area or designated evacuation area. Check yourself and others for injuries.

2. Unless you need emergency help:

Do not use your telephone to call relatives and friends. Disaster prevention authorities may need the line for emergency communication. Do not use your car and drive around areas of damage, as rescue and relief operations need the roads for mobility.

3. Help reduce the number of casualties from the earthquake.

Don't enter partially damaged buildings; strong aftershocks may cause these to collapse.

Gather information and disaster prevention instructions from battery-operated radios.

Obeey public safety precaution.

4. Check your surroundings.

Clean up chemical spills, toxic and flammable materials to avoid any chain of unwanted events.

Check for fire and, if any, have it controlled.

Check your water and electrical lines for defects; if any damage is suspected, turn the system off through the main valve or switch.

5. If you must evacuate your residence, leave a message stating where you are going.

What is a tsunami?

A tsunami is a series of small to giant sea waves commonly generated by under-the-sea earthquakes and whose heights may reach more than 5 meters. They are erroneously called tidal waves and are sometimes mistakenly associated with storm surges. Tsunamis can occur when the earth is shallow-seated and strong enough to displace parts of the seabed and disturb the mass of water over it.

Locally-generated tsunamis

The coastal areas in the Philippines, especially those facing the Pacific Ocean, South China Sea, Sulu Sea, and Celebes Sea, can be affected by tsunamis that may be generated by local earthquakes.

In August 17, 1976, a 7.9-magnitude earthquake hit the Moro Gulf and produced tsunamis that devastated the southwest coast of Mindanao and left more than 3,000 people dead, with at least 1,000 people missing. More than 8,000 people were injured and approximately 12,000 families were rendered homeless by more than 5-meter high waves.

The November 15, 1994 Mindoro Earthquake also generated tsunamis that left 78 casualties.

These tsunamis occurred within a very short time, with a first wave reaching the shoreline nearest the epicenter, 2 to 5 minutes after the main earthquake. These tsunamis were both locally-generated. There will not be enough time for warning in case of locally-generated tsunamis.

Far-field tsunamis

Tsunamis may also be generated from distant locations, such as those coming from

other countries bordering the Pacific Ocean like Chile, Alaska in the USA, and Japan (far field tsunamis). The tsunami of May 2, 1960 that was generated by a strong earthquake from Chile killed 61 in Hilo, Hawaii, while 20 people were reportedly killed in the Philippines. Travel times for tsunamis generated in distant locations are longer (1 to 24 hours) and will generally give enough time for warning from the Pacific Tsunami Warning Center (PTWC) and Northwest Pacific Tsunami Advisory Center (NWPTAC).

Natural signs of a local tsunami

1. You would feel the ground or earth shaking (earthquake).
2. Unusual sea level changes occur. There is sudden retreat or rise of sea water.
3. Rumbling sound of approaching waves is audible.

Tsunami Safety and Preparedness

Do not stay in low-lying coastal areas after a strong earthquake. Move to higher grounds immediately.

If unusual sea conditions like rapid lowering of the sea level are observed, immediately move toward high ground.

Never go down to the beach to watch for a tsunami. When you can see the wave, you are too close to escape it.

During the sudden retreat of sea level, interesting sights are often revealed. Fish may be stranded on dry land thereby attracting people to collect them. Sandbars and coral flats may also be exposed.

These scenes tend to attract people to flock to the shoreline, thereby increasing the number of people at risk.

Stay out of danger areas until an all clear bulletin is issued by a competent authority. A tsunami is not a single wave but a series of waves.

VOLCANIC ERUPTION

Why does the Philippines have many volcanoes?

The Philippines sits on a unique tectonic setting ideal to volcano formation. The archipelago is surrounded by subducting plates, as manifested by the trenches that are related to volcano formation.

Classification of volcanoes

1. Active volcanoes

Erupted within historical times (within the last 600 years). Accounts of these eruptions were documented by man;

Erupted within the last 10,000 years based on analyses of datable materials.

2. Potentially active volcanoes

Are morphologically young-looking but with no historical records of eruption.

3. Inactive volcanoes

Have no record of eruptions;

Have a physical form that is being changed by agents of weathering and erosion via the formation of deep and long gullies.

The six most active volcanoes in the Philippines

Volcano
Province
No. of Historical
Last Eruption

Eruptions

Mayon
Albay
49
2009
Taal
Batangas
33
1977
Bulusan
Sorsogon
17
2010-2011
Kanlaon
Negros Oriental
26
2006
Pinatubo
Boundaries
3
1992

of Pampanga,

Tarlac

and Zambales

Hibok-hibok
Camiguin
5
1948
Preparedness Measures

The first step toward safeguarding life, properties, and investments from volcanic hazards is understanding how and why they occur and know what areas are likely to be affected by these.

Comply strictly with PHIVOLCS' prohibition against human settlement in permanent danger zones. Always be on alert and listen to advisories of not venturing into identified restricted areas during volcanic unrest.

Identify, evaluate, and characterize areas vulnerable to hazards and implement appropriate land use plan and zonation.

Heed warnings and evacuation orders in times of volcanic unrest.

What to do before, during and after an ash fall

Before

1. When there is an impending eruption that may cause ashfall, listen to the radio for updates.
2. Prepare a gas mask or clean cloth for covering the nose, candles, matches, flashlights and extra batteries. Put these things in an accessible place.

During

1. Stay calm. Cover your nose and mouth with a damp, clean cloth or gas mask.
2. Listen to the radio for updates or developments regarding the volcanic eruption.
3. Keep your pets in their shelter or inside the house to keep them from inhaling ash.
4. Close all windows and doors of your house.
5. If you are driving a vehicle, pull to the side of the road and stop if there is heavy ashfall.
6. If you are outdoors, look for shelter and wear glasses to protect your eyes. Avoid using contact lenses.

After

1. As soon as the ashfall tapers, scrape off the ashfall that has accumulated on rooftops to prevent the collapse of houses. After removing the ash, clean the roof and gutter with water.
2. Wash all fruits and vegetables thoroughly before eating.
3. Use a vacuum cleaner or shake ash loose from the furniture before dusting them. Cover your nose and mouth while cleaning.
4. To remove ash from glass windows and doors, use a water hose before washing them with soap and lukewarm water.
5. Shake loose ash from plants before watering them.
6. Use powder detergent in washing clothes contaminated with ash.
7. Collect the ashes and put them in an area far from water drainage to avoid clogging.

TROPICAL CYCLONE

A tropical cyclone or -bagyo? is an intense low-pressure system with minimum sustained winds of 35 kilometers per hour (kph). A yearly average

of 20 tropical cyclones enter the Philippine Area of Responsibility (PAR) and 90% of these affect the country. Hazards due to tropical cyclones are strong winds with heavy rainfall that can cause widespread flooding/flashfloods, storm surges, landslides and mudflows.

Classification of Tropical Cyclones

Tropical cyclones are classified according to their strength and are determined by the speed of the maximum sustained winds near the center.

Tropical depression

-

35 kph to 63 kph

Tropical storm

-

64 kph to 117 kph

Typhoon

-

more than 118 kph

Supertyphoon

-

more than 220 kph

Structure of a Tropical Cyclone

The primary components of a Tropical Cyclone:

A strong tropical cyclone consists of the following:

Eye - is the center of the tropical cyclones and is normally circular in shape with generally cloud-free skies. The wind is light and calm or there are relatively very light winds and no rain. It ranges in size from 10 to 100 kilometers in diameter.

Eye wall- is the ring where very high winds and rains are at the heaviest. The highest winds are on the forward right side of the wall of the storm. If the storm is heading west, the highest winds will be on the northern side of the storm. The heaviest damage occurs when the tropical cyclone's eyewall passes over land.

Rainbands - the spiral rainbands of showers and thunderstorms surround the eye. High wind gusts and heavy downpour often occur in individual rainbands, with relatively calm weather between bands. It covers an area of several square kilometers.

PUBLIC STORM WARNING SIGNALS

Public Storm Warning Signal #1

METEOROLOGICAL CONDITIONS:

A tropical cyclone will affect the locality.

Winds of 30-60 kph may be expected within at least 36 hours or intermittent rains may be expected also within 36 hours. (When the tropical cyclone develops very close to the locality, a shorter lead time of the occurrence of the winds will be specified in the warning bulletin.) IMPACT OF THE WINDS:

Twigs and branches of small trees may be broken.

Some banana plants may be tilted or downed.

Some houses of very light materials (nipa and cogon) may be partially unroofed.

Unless this warning signal is upgraded during the entire existence of the tropical cyclone, only very light or no damage at all may be sustained by the exposed communities.

Rice crop, however, may suffer significant damage when it is in its flowering stage.

PRECAUTIONARY MEASURES:

When the tropical cyclone is strong or is intensifying and moving closer, this signal may be upgraded to the next level.

The waves on coastal waters may gradually develop and become bigger and higher.

The people are advised to listen to the latest severe weather bulletin issued by PAGASA every six hours. In the meantime, business may be carried on as usual except when floods occur.

Disaster preparedness is activated to alert status.

Public Storm Warning Signal #2

METEOROLOGICAL CONDITIONS:

A tropical cyclone will affect the locality.

Winds of greater than 60 kph and up to 100 kph may be expected in at least 24 hours.

IMPACT OF THE WINDS:

Some coconut trees may be tilted with a few others broken.

A few big trees may be uprooted.

Many banana plants may be downed.

Rice and corn may be adversely affected.

A large number of nipa and cogon houses may be partially or totally unroofed.

Some old galvanized iron roofing materials may be peeled off.

In general, the winds may bring light to moderate damage to the exposed communities.

PRECAUTIONARY MEASURES:

The sea and coastal waters are dangerous to small sea crafts.

Special attention should be given to the latest position, the direction and speed of movement, and the intensity of the storm as it may intensify and move toward the locality.

The general public, especially people travelling by sea and air, are cautioned to avoid unnecessary risks.

Outdoor activities of children should be postponed.

Secure properties before the signal is upgraded.

Disaster preparedness agencies/organizations are in action to alert their communities.

Public Storm Warning Signal #3

METEOROLOGICAL CONDITIONS:

A tropical cyclone will affect the locality.

Winds of greater than 100 kph up to 185 kph may be expected in at least 18 hours.

IMPACT OF THE WINDS:

Many coconut trees may be broken or destroyed.

Almost all banana plants may be downed and a large number of trees may be uprooted.

Rice and corn crops may suffer heavy losses.

Majority of all nipa and cogon houses may be unroofed or destroyed and there may be considerable damage to structures of light to medium construction.

There may be widespread disruption of electrical power and communication services.

In general, moderate to heavy damage may be experienced, particularly in the agricultural and industrial sectors.

PRECAUTIONARY MEASURES:

The disturbance is dangerous to the communities threatened/affected.

The sea and coastal waters will be very dangerous to all sea crafts.

Travel is very risky, especially by sea and air.

People are advised to seek shelter in strong buildings, evacuate low-lying areas, and stay away from the coasts and river banks.

Watch out for the passage of the -eye? of the typhoon, indicated by a sudden occurrence of fair weather immediately after very bad weather, with very strong winds coming generally from the north.

When the -eye? of the typhoon hits the community, do not venture away from a safe shelter, because after one to two hours the worst weather will resume with very strong winds coming from the south.

Classes in all levels should be suspended and children should stay in the safety of strong buildings.

Disaster preparedness and response agencies/organizations are in action with appropriate response to actual emergency. Public Storm Warning Signal #4

METEOROLOGICAL CONDITIONS:

A very intense typhoon will affect the locality.

Very strong winds of more than 185 kph may be expected in at least 12 hours.

IMPACT OF THE WINDS:

Coconut plantations may suffer extensive damage.

Many large trees may be uprooted.

Rice and corn plantations may suffer severe losses.

Most residential and institutional buildings of mixed construction may be severely damaged.

Electrical power distribution and communication services may be severely disrupted.

Damage to affected communities may be very heavy. PRECAUTIONARY MEASURES:

The situation is potentially very destructive to the community.

All travel and outdoor activities should be cancelled.

Evacuation to safer shelters should have been completed since it may be too late in this situation.

With PSWS #4, the locality is very likely to be hit directly by the eye of the typhoon. As the eye of the typhoon approaches, the weather will continuously worsen with the winds increasing to their strongest, coming generally from the north. Then, a sudden improvement of the weather with light winds (a lull) will be experienced. This means that the eye of the typhoon is over the locality. This improved weather may last for one to two hours depending on the diameter of the eye and the speed of movement. As the eye moves out of the locality, the worst weather experienced before the lull

will suddenly commence. Thereafter, very strong winds will come generally from the south.

The disaster management councils concerned and other disaster response organizations are now fully responding to emergencies and in full readiness to immediately respond to a possible calamity.

What to do in case of typhoons

Stay indoors and keep calm.

Monitor TV and radio reports.

Secure your home.

Trim trees near dwellings.

Keep roads clear for emergency vehicles.

Go to the nearest designated evacuation center if your house is in a flood-prone area.

Have a flashlight and radio handy, with fresh batteries.

Stock up on food, potable water, kerosene, batteries, and first-aid supplies.

In case of flooding, turn off the main sources of electricity, gas and water in your home.

Stack furniture above the expected flood level. Keep appliances, valuables, chemicals, toxic substances, and garbage beyond the reach of floodwaters.

Avoid low-lying areas, riverbanks, creeks and coastal areas, slopes, cliffs, and foothills. Rain can trigger landslides, rockslides or mudslides.

Avoid wading through flooded areas. Do not attempt to cross flowing streams.

Do not operate any electrical equipment during a flood.

Do not use gas or electrical appliances that have been flooded.

Flood

FLOOD is due to water overflowing from streams and other bodies of water, as well as by the accumulation of rainwater by drainage. Floods can cause severe damages to lives and properties.

Flood/Flooding/Inundation - is a great flow of water that rises and spreads over the land when a volume of water from lakes/streams/rivers exceeds its carrying capacity and escapes from its usual boundaries.
Types of Floods

Flooding can be classified based on the following criteria:

Based on location or place of occurrence

- River flooding is caused by the overflowing of

the river when run-off exceeds the capacity of the channels and flooding the adjacent low-lying areas called the floodplain. This may last a few hours or many days depending on the intensity, amount and the distribution of the rainfall.

- Coastal flooding may occur due to storm surges, high tide and tsunamis (waves produced by earthquakes/volcanoes at sea). Storm surge occurs when strong onshore winds push the water inland and cause a rise in sea level, and flooding the low-lying coastal areas. Worst cases could occur when it coincides with the occurrence of high tide.

- Urban flooding occurs in an area where roads are usually paved. During rainy episodes, water cannot infiltrate the ground and is normally retained in the surface. This type of flooding is often associated with the limited capacity of the sewerage system to drain the heavy rains that are falling.

Based on duration of occurrence

- Flash Flooding is caused by a very short period of unusually heavy rainfall or cloudburst over a relatively small drainage area. Flash floods carry highly destructive flood waves and are most common in mountainous areas or in steep places that have streams flowing through narrow canyons.

- Sheet Flooding is caused by comparatively shallow water flowing over a wide area and is very common in floodplains that are normally flat. Sheet flooding may also result when water from a river channel with insufficient carrying capacity over-tops its bank, inundating the adjacent areas.

Causes of Flooding

Floods are due to the complex combination of weather, climatic and human activities:

1. Heavy, continuous rain that does not cease, or ceases only briefly.
2. Meandering river system
3. Heavy siltation of the river system which could decrease the carrying capacity of the river
4. Dam spilling/over-topping of dikes and levees
5. Unusually high coastal and estuarine waters due to storm surges
6. Damming - Sudden discharge of floodwater with accompanying debris materials, including trees, rocks, soil, etc.
7. To a certain extent, astronomically influenced phenomena such as high tides coinciding with the occurrence of heavy rainfall

Aggravating factor:

- Presence of informal settlers
- Increasing population
- Increasing level of urbanization

- Altering the ecological system in a river basin, which could have an impact on the hydrology of the watershed

- Denudation of forest and watershed areas

If it has been raining hard for several hours, or steadily raining for several days, be alert to the possibility of a flood. Floods happen as the

ground becomes saturated.

Pre-Flood Preparation

- Avoid building your house on the floodplains and riversides.

- Keep drainage areas free from debris accumulation.

- Ensure that drainage facilities are functioning properly.

- Plant trees and protect the forests, especially in the mountains, to diminish floods.

- Protect the rivers. Do not throw garbage because it will make them shallow, destroying their draining capabilities.

- Do not connect septic tanks to the drainage canals and rivers.

- Periodic desilting, dredging, widening and deepening of riverbeds must be conducted.

Before the Flood

- Be informed of the daily weather conditions and forecasts from PAGASA.

- Be aware of how often and to what extent your location is likely to be flooded.

- Know the flood warning system and evacuation plan of your community and make sure your family knows them.

- Identify an evacuation area for the family and livestock.

- Assign specific tasks and responsibilities to family members

according to an evacuation plan.

- Keep a stock of food, which requires no or little cooking and refrigeration, good for at least three days.

- Keep a battery-operated radio and flashlight, cell phones, emergency cooking equipment, candles, matches, and a first aid kit handy in case of emergency.

- Securely anchor weak houses.

When Warned of Flood

- Watch for rapidly rising flood waters.

- Listen to your radio for emergency and possible evacuation orders or instructions.

- Store drinking water in containers as water service may be interrupted.

- Move household belongings to upper levels.

- Transfer livestock to higher ground.

- If advised to evacuate, do so. Don't panic. Move to a safe area before access is cut off by floodwaters.

- Turn off the main electricity switch and gas valve. Disconnect electrical appliances. Do not touch electrical equipment if you are wet or standing in water. Lock your house before evacuating.

During the Flood

- Stay indoors.

- Do not attempt to cross rivers or flowing streams where water is above the knee.

- Do not go swimming or boating in swollen rivers.

- Do not drive through flooded areas or streets. Avoid needless trips.

- Stay away from downed power lines.

- Be alert for gas leaks. Use a flashlight to inspect for damage.

- Report flooded areas to the Local Disaster Risk Reduction and Management Councils.

After the Flood

- Re-enter your house with caution using a flashlight, not lanterns or torches. Flammables and dangerous animals like snakes may be inside.

- Be alert for fire hazards like broken electric wires.

Do not eat food and drink water until they have been checked for contamination.

Report broken utility lines (electricity, water, gas and telephone) to appropriate agencies/authorities.

Do not turn on the main switch or use appliances and other equipment until they have been checked by a competent electrician.

Consult health authorities for immunization requirements.

Do not go sight-seeing in disaster areas. Your presence might hamper rescue and other emergency operations.

Storm Surge

A STORM SURGE is a sudden rise in sea level above normal, causing big waves as a tropical cyclone approaches the coast. The highest water level rise or the peak of a storm surge usually happens on the same time there is a passage of a typhoon across a coastline. The wall of water can engulf low-lying coastal communities and can also bring destruction to natural and man-made structures, especially if this coincides with the occurrence of high tide.

The stronger the tropical cyclone, the lower the atmospheric pressure; the shallower the coast, the higher the surge will be. A storm surge can sweep the coastline, and can extend several kilometers inland.

What to do

Make plans for evacuating members of your family and yourself to higher ground before a storm surge takes place.

Stay off the beach when a weather disturbance is approaching or exists in your community.

Listen to the PAGASA Public Forecast/Warnings that are aired regularly. The storm surge warning is incorporated in the Domestic Bulletins and reads like this: Residents along low-lying coastal areas are advised to seek higher ground and to take the necessary precautions against flooding due to big waves from the sea.

As soon as possible, evacuate to higher ground and stay away from beaches when a typhoon approaches your community.

Thunderstorm

A THUNDERSTORM is a violent local atmospheric disturbance accompanied by lightning, thunder, and heavy rain, often with strong gusts of wind and sometimes by hail. The typical thunderstorm is 5 kilometers in diameter and lasts an average of 30 minutes, but the more severe ones may last much longer. When compared with tropical cyclones, thunderstorms affect relatively small areas but all thunderstorms are dangerous.

Hazards associated with thunderstorms

1. Lightning

Lightning is a visible electrical discharge due to high

voltage differences that build up within the cloud, or between the rain cloud and the ground below.

The temperature of a lightning bolt is five times hotter than the surface of the sun. The sudden lightning creates sound waves in the air that we hear as thunder. Lightning can cause death and injuries and can

spark fires.

2. Heavy Rainfall

Excessive rains can produce flashfloods/floods that can transform small creeks into raging floodwaters, sweeping over structures along their path.

3. Tornado/Waterspout

The more severe hazard brought about by a thunderstorm is a tornado/waterspout. The amount of destruction depends largely on the strength of the wind. Most injuries and deaths result from flying debris.

4. Hail

Hailstones are ice crystals falling from a thunderstorm cloud. Since the air temperature in the country is normally high, hailstones that reach the ground are usually the size of a grain of corn, which is seldom of sufficient size to cause damage to properties. However, hail can destroy crops.

What are the signs of an impending thunderstorm?

- Towering cumulonimbus clouds
- Darkening skies
- Flashes of lightning and gusty winds
- Sound of thunder

Who are at risk from a thunderstorm?

People who are outdoors (especially under or near tall trees, in isolated sheds or near hilltops) are at risk from lightning. Also in danger are people in automobiles when flash flooding occurs near them.

How to prevent damages due to lightning

If you are outdoors, seek shelter from lightning. Go inside the house, enclosed car or large building, if you can.

If you can't find shelter, avoid the solitary tree or the tallest objects in the area. Lightning tends to strike tall objects.

Stay away from anything that conducts electricity.

Don't use any plug-in electrical appliances such as tele- phones, computers, or television sets.

Stay in your automobile if you are travelling.

When outside, don't use metal objects.

Get out of water; it conducts electricity.

When you feel an electrical charge-your hair stands on end or your skin tingles-lightning may be about to strike you. Don't drop to the ground. Sit down instead, but with only your feet touching the ground and positioned apart from each other while you cover your head with your hands or hold your knees.

Remember, if you can hear thunder, you are close enough to be struck by lightning!

Tornado

A TORNADO is described as a violently rotating column of air extending from a thunderstorm to the ground. Tornadoes come in many sizes but are typically in the form of a visible condensation funnel whose narrow end touches the earth and is often encircled by a cloud of debris.

A tornado acts like a giant vacuum cleaner, sucking and carrying objects-such as trees, structures, or debris-along on its path and jumping across the ground in a narrow

erratic movement.

It can strike any time of the day but does so more frequently in the afternoon-when the temperature is at its highest-and in the evening. It may also develop

when there are tropical cyclones.

Much of the damage comes from its extreme winds. Wind speeds are estimated to exceed 450 km/hr and may last for a few minutes. Whenever a tornado strikes, it may leave marks of destruction. Tornadoes are often obscured by rain or dust.

There have been reported occurrences of -buhawi,? the local term for tornado, in the Philippines. One occurred in San Miguel, Bulacan, and damaged at least 30 houses in 2007.

Signs of an impending tornado

A funnel-shaped column appears from the base of a cumulonimbus cloud.

The weather feels warm, humid, uncomfortable and calm.

Lightning flashes and thunder cracks.

A tornado reaching the ground produces a roaring or buzz-ing sound.

What is a waterspout?

A tornado that occurs or moves over a body of water is called a waterspout. On the average, a waterspout is less intense and less violent, but the larger ones can completely destroy a small sea craft.

Cases of waterspout coming ashore with the intensity of a tornado have been reported. In December 1979, one struck Gingoog City in Misamis Oriental, and rendered 10,000 families homeless.

How can I keep myself safe?

If at work, home or in school, keep calm, take cover in any interior hallway, the lowest place in a building, or under sturdy furniture-and brace yourself. Stay away from windows.

Secure outdoor objects (like garbage cans, garden tools, toys, signs, garden sets) if time permits, to prevent them from becoming missiles during the tornado's passage.

Lie down in any depression or crawl into culverts when a tornado is about to strike as it is considerably better than remaining upright.

If driving a vehicle, stop and abandon it and seek shelter outside in the nearest depression, ditch or ravine (but be aware of flash flooding).

Tornadoes are generally short-lived. They come and go quickly. There may not be time for a warning.

Be alert for the sudden appearance of violent winds, rain, hail or a funnel-shaped cloud in your locality.

Landslide

A LANDSLIDE is the downward and outward movement of slope materials composed of rocks and/or soil. This event is generally triggered by prolonged heavy rainfall or by earthquakes. A

number of factors contribute to the occurrence of landslides. These include the high degree of weathering and fracturing of rocks, steep configuration of slope, deforestation, and the overloading of slope surfaces following the construction of

heavy structures.

What to do before:

Coordinate with the Mines and Geosciences Bureau (MGB) regarding the landslide susceptibility of the area concerned.

Consult a professional for advice on engineering measures

most appropriate for the site for landslide mitigation or prevention.

Reinforce the foundation and walls of structures when needed.

Develop a land use plan, ensuring that site developments are compatible with the conditions and limitations of the natural environment

Promote public awareness and involvement on landslide mitigation.

Develop a community preparedness and evacuation plan.

Maintain a list of contact numbers during emergencies.

What to do during:

Evacuate the community immediately if warned of an impending landslide

Get out of the house/building as soon as possible when rumbling sounds are heard from upstream or when trembling of the ground is felt. Run across a slope, not downwards.

Stay away from the path of landslide debris, or seek refuge behind a sturdy tree or structure.

What to do after:

Ask proper authorities to thoroughly examine damaged structures and utilities before using these.

Stay away from the landslide area. There may be danger of additional landslides.

Check with caution injured and trapped persons within the landslide area. Direct rescuers to their locations.

Listen to local radio or television stations for the latest emergency information.

Seek the advice of an expert for evaluating landslide hazards or designing corrective techniques to reduce landslide risk.

Extreme Climatic Variability

CLIMATE change is the direct impact of global warming with observed increase in global mean temperatures. These rising temperatures will cause

changes in weather patterns that may result to increased frequency and intensity of extreme weather events such as droughts and floods affecting the most vulnerable areas of the country and the whole region as well. Longer drought periods and more intense rainfall will greatly affect water resources. Other impacts include an increasing number of intense tropical cyclones, storm surges, killer heat waves and the emergence of more weather-related diseases, massive species extinction, ecosystem collapse, agricultural failure due to changes in rainfall patterns, higher temperature and saltwater intrusion, and rising sea levels which will eventually inundate coastal towns and cities around the world.

Periodical Phenomenon of Climatic Variability

An extreme climate event associated with the El Nino Southern Oscillation (ENSO) influences the climate variability of the country. It is a global phenomenon that occurs in the equatorial Pacific Ocean, affecting the normal rainfall pattern of the different regions of the world, but impacts differ. ENSO has two phases: the warm phase referred to as El Nino and the cold phase referred to as La Nina.

La Nina is characterized by unusually cold surface ocean temperatures in the equatorial Pacific Ocean, as compared to El Nino, which is characterized by unusually warm surface ocean temperatures. The system may be described generally by an irregular cycle of alternating periods of warm (El Nino) and cold (La Nina) conditions, with a transition period (Neutral condition) between them. El Nino and La Nina occur on average of every 3 to 5 years. Generally, the impact of El Nino in the country is drier than normal rainfall condition, which

sometimes leads to drought, and La Nina to be associated with wetter than normal condition, causing devastating floods and landslides.

Heat Waves

Heat Waves occur when the daily maximum temperature of more than five consecutive days exceeds the average maximum temperature by 5-degree Celcius, the normal period

being 1961-1990 (World Meteorological Organization).

Heat can kill by pushing the human body temperature beyond its limits. Elderly people, young children, and those who are sick or overweight are more likely to become victims

of extreme heat. Men sweat more than women so they are more susceptible to heat illness and become more quickly dehydrated. Excessive heat that lasts for more than two days significantly increases heat-related illnesses. People living in urban areas may be at greater risk from the effects of a prolonged heat wave than people living in rural regions.

What to do before:

- Plan changes in your daily activities to avoid strenuous work during the warmest part of the day.

- Consult a physician when affected by extreme heat.

- Undergo training on first aid.

- Interview local physicians and paramedics about the dangers of sunburn, heat exhaustion, heat stroke, and other possible conditions caused by excessive heat.

What to do during:

- Wear loose-fitting, lightweight, light-colored clothing that will cover as much skin as possible.

- Protect your face and head by wearing a wide-brimmed hat.

- Drink plenty of water even if you do not feel thirsty to prevent dehydration.

- Avoid drinks with alcohol or caffeine, which can also cause dehydration.

- Take frequent breaks if you must work outdoors.

- Use a buddy system when working in extreme heat.

- Eat frequent small meals for easy digestion.

- Use salt tablets or table salt because it retains fluids.

Human-Induced Hazards

Structure Collapse

Structure collapse is often caused by engineering failures such as the under-designing of structural components, by corrosion attack, and by an aerodynamic resonance in structures.

What to do before:

- Conduct a general check on the condition of all houses and buildings

- Repair or rehabilitate structures to put them in good condition.

- Adopt the existing warning system for a building certified as unsafe for occupancy.

- Cordon off and mark buildings found unsafe with -off- limits?.

What to do during:

Vacate the house/building immediately.

Apply first aid, and in cases of injuries or casualties, bring the victims to the nearest hospital for medical treatment. What to do after:

Secure the area.

Evaluate and assess the damaged structure through the assistance of engineers.

Recommend for approval the demolition of condemned buildings, subject to recommendation by proper authorities. Fire

Fire is composed of three elements-heat, fuel, and oxygen, which when combined, will result in a chemical reaction called burning. The leading cause of death in a fire, by a three-to-one ratio over burns, is asphyxiation (choking sensation). Inhaling carbon monoxide can cause loss of consciousness or death within minutes. The heat from a hostile fire exceeds anything to which a person is normally exposed. A fully developed room fire has temperatures over 1, 100 degrees Fahrenheit.

Fire generates a black, impenetrable smoke that blocks vision and stings the eyes. It is impossible to navigate through such smoke, so fire drill participants should practice evacuating houses/ buildings by at least two routes.