



Emergency Preparedness: Earthquakes

Earthquakes are sudden slips along a geological fault and the resulting ground shaking and radiated seismic energy caused by the slip or by volcanic activity or other sudden stress changes in the earth.

- Earthquakes strike suddenly without warning at any time of the year, day or night.
- Smaller earthquakes (aftershocks) often follow the main quake.
- The U.S. Geological Survey estimates that several million earthquakes occur in the world annually.
- All 50 states and all U.S. territories are vulnerable to earthquakes.
- California experiences the most frequent damaging earthquakes; however, Alaska experiences the greatest number of large earthquakes, mostly in uninhabited areas.
- Annual damages amount to more than \$200 billion in the U.S.
- Ground shaking can collapse buildings and bridges, and disrupt gas, electric and phone service.
- The largest U.S. earthquakes were along the New Madrid fault, based in Missouri. The 1811-1812 three-month series of quakes included three larger than 8.0 on the Richter scale felt over the entire eastern U.S.
- Where earthquakes have occurred before, they will happen again.

Earthquake Hazards: Secondary or cascading effects associated with earthquakes may affect people.

- Ground shaking is the movement of the earth's surface from earthquakes or explosions.
- Landslides are the movement of surface material down a slope.
- Surface faulting is displacement that reaches the earth's surface during slip along a fault.

- A tsunami is a sea wave of local or distant origin that results from large-scale seafloor displacements associated with large earthquakes, major submarine slides or exploding volcanic islands. The 2004 Indian Ocean earthquake spawned the largest tsunami on record.
- A seiche is the slosh of a closed body of water from earthquake shaking.
- Fire may be caused by the violent disruptions to electrical, natural gas and gasoline lines. The 1906 San Francisco earthquake spawned three days of structure fire throughout the city.

Earthquake Risk is the probable building damage and number of people that are expected to be hurt or killed if an earthquake on a particular fault occurs.

Earthquake Severity is expressed in terms of both intensity and magnitude. However, the two terms are quite different and are often confused.

- Intensity is based on the observed effects of ground shaking on people, buildings and natural features.
 - Modified Mercalli Intensity Scale measures intensity values on 12 levels: I to XII.
 - Lower numbers are based on what people felt and higher numbers on observed structural damage.
- Magnitude is related to the amount of seismic energy released at the hypocenter of the earthquake.
 - The Richter scale measures magnitude values with whole numbers and decimal fractions on 10 levels.
 - Lower numbers (less than 2.0 to 5.9) create micro to moderate effects, and higher numbers (6.0 to 10.0+) create strong to epic effects.
 - Valdivia, Chile (1960) – largest recorded earthquake in the world measured at 9.5

- Anchorage, Alaska (1964) – largest recorded earthquake in U.S. measured at 9.2, caused more than \$1 billion of damage and spawned a devastating tsunami
- Indian Ocean (2004) – measured at 9.1 and caused a catastrophic tsunami
- Great San Francisco Earthquake (1906) – measured at 8.3
- Pacific Ocean off the coast of Japan (2011) – fourth largest earthquake recorded at 9.0; spawned a tsunami that killed thousands of people in northeastern Japan and caused damage to nuclear reactors
- Earthquake of magnitude 10.0+ has never been recorded

Be Prepared: *Before the Quake*

Take Protective Measures: Secure your property to minimize damage.

- Earthquake (seismic) retrofit your home to increase resilience to quakes.
- Secure your home with foundation straps and clips.
- Secure items that may be shaken out of place: bookcases, appliances, water heater, heavy furniture.
- Install automatic shut-off valves on utilities, especially natural gas.

Develop Emergency Plans: Early preparation saves lives and prevents fear and panic. Plans should be easily accessible, practiced regularly, and shared with friends or extended family members. If you live along a coast, include a tsunami evacuation plan. Conduct practice drills with your family or employees.

Create Emergency Supply Kits: Families, schools and workplaces should have supply kits. At home, include supplies for all family members and pets for three days, making certain that the kit is portable in case of evacuation. Kits should include:

- Food and water
- Medicines, first-aid kit, copies of prescriptions, toiletries
- Important documents, personal identification, copies of insurance
- Cash or travelers checks
- Other essential supplies that your family may need: flashlights, extra batteries, blankets, seasonal clothing, a battery-operated or crank radio, a weather radio, cell phones and chargers

During the Quake: *Take Action*

- *If indoors:* Take cover under a sturdy desk or table, or against an interior wall. Use a doorway only if you know it is a bearing wall. Avoid windows, hanging objects, fireplaces and unsecured furniture. Crouch and cover your head with your arms. Do not use elevators.
- *If in bed:* Stay in bed, and protect your head with a pillow.
- *If outdoors:* Move to open areas, away from trees or tall buildings. Avoid windows and outside walls.
- *If in a vehicle:* Stop as quickly as possible, but avoid stopping by large buildings, trees or overpasses. Proceed cautiously, watching for road and bridge damage.
- *If trapped:* Do not light a match, move or kick up dust. Cover your mouth with a handkerchief or clothing. Tap on a pipe or wall so rescuers can locate you; use a whistle if it's available. Shout only as a last resort since shouting can cause you to inhale dust

After the Quake: *Be Cautious*

- Turn on a radio for reports.
- Open cabinets cautiously.
- Check for gas and water leaks, and broken electrical and sewer lines.
- Check for cracks and damage in your home.
- Keep streets clear for emergency vehicles. Do not drive your vehicle.
- Be prepared for aftershocks.
- Leave a note for family and friends if you evacuate.
- Stay calm, and lend a helping hand to others.

Information Sources:

www.eden.lsu.edu; www.fema.gov; www.ready.gov;
www.earthquake.usgs.gov; www.redcross.org

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