

Earthquakes, unlike hurricanes and some other natural hazards, earthquakes strike suddenly and without warning. Nevertheless, if your business is located in a region at risk for earthquakes there are many things that can be done to reduce the chances that those who work in or visit the premises will be injured, that property there will be damaged or that your day-to-day operations will be unduly disrupted by an earthquake. These activities all fall under the concept of *preparedness* because to be effective, they must be done *before* earthquakes occur.

Preparing for earthquakes involves (1) learning what employers and employees should do before, during and after earthquakes, and (2) doing or preparing to do those things now, before the next quake. Workplace preparedness requires the participation of owners, managers and employees, as well as those who design, build, regulate and maintain buildings used as workplaces.

All 50 states and 5 U.S. territories are at some risk for earthquakes. Earthquakes can happen at any time of the year.

Know the Risks

An **earthquake** is the sudden, rapid shaking of the earth, caused by the breaking and shifting of subterranean rock as it releases strain that has accumulated over a long time, initial mild shaking may strengthen and become extremely violent within seconds. Additional earthquakes, called **aftershocks**, may occur for hours or even months. Most are smaller than the initial earthquake, but larger magnitude aftershocks also occur.

Larger earthquakes may cause deaths, injuries and extensive property damage. Most casualties and injuries during an earthquake occur when people fall while trying to walk or run during the shaking; when they are hit by falling, flying or sliding household items or non-structural debris; and/or when they are struck or trapped by collapsing walls or other parts of a building. Transportation, power, water, gas and other services may be disrupted. In some areas, shaking can cause **liquefaction** - - when the ground acts more like a liquid. When this happens the ground can no longer support the weight of a building. In coastal areas, earthquakes under the sea floor can cause tsunamis.

Things NOT to do during an EQ:

- DO NOT turn on the gas again if you turned it off; let the gas company do it.
- DO NOT use matches, lighters, camp stoves or barbecues, electrical equipment, appliances UNTIL you are sure there are no gas leaks. They may create a spark that could ignite leaking gas and cause an explosion and fire.
- DO NOT use your telephone, EXCEPT for a medical or fire emergency. You could tie up the lines needed for emergency response. If the phone doesn't work send someone for help.

- DO NOT expect firefighters, police or paramedics to help you. They may not be available.

Why should people in the eastern US be concerned about earthquakes?

- **Severe earthquakes have occurred in the East:**
 - In November of 1755, an earthquake with an estimated magnitude of 6.0 and a maximum intensity of VIII occurred about 50 miles northeast of Boston, Massachusetts. Boston was heavily damaged. Other strong earthquakes recorded in the continental US were centered in southeastern Missouri near the border with Arkansas, Kentucky and Tennessee. In the winter of 1811-1812, a series of three powerful earthquakes of magnitudes about 7.0 to 7.8 and hundreds of aftershocks occurred near New Madrid, Missouri. These shocks were so strong that observers reported that the land distorted into visible rolling waves. They changed the course of the Mississippi River, created a vast area of ground deformation and liquefaction features; and they were felt widely along the east coast of the U.S. 800 to 1000 miles away. Because the surrounding area was mostly undeveloped at the time, few deaths were reported and these events stirred relatively little attention then. In August of 1886, a strong earthquake occurred in Charleston, South Carolina. Magnitude is estimated at 6.8 to 7.2. Much of the city of Charleston was damaged or destroyed. Earthquakes in the East are not confined to these areas; they have been recorded in every State east of the Mississippi. Damaging earthquakes have occurred historically in nearly every eastern State.
- **Earthquakes of the same magnitude affect larger areas in the East than in the West:**
 - The size of the geographic area affected by ground shaking depends on the magnitude of the earthquake and the rate at which the amplitudes of body and surface seismic waves decrease as distance from the causative fault increases. Comparison of the areas affected by the same Modified Mercalli intensity of ground shaking in the 1906 San Francisco, California, the 1971 San Fernando, California, the 1811-12 New Madrid, Missouri, and the 1886 Charleston, South Carolina, earthquakes shows that a given intensity of ground shaking extends over a much larger area in the Eastern United States. Ground shaking affects a larger area because amplitudes of seismic waves decrease more slowly in the east than in the west as distance from the causative fault increases.

Can we cause earthquakes?

- Earthquakes induced by human activity have been documented at many locations in the United States and in many other countries around the world. Earthquakes can be induced by a wide range of causes including impoundment of reservoirs, surface and underground mining, withdrawal of fluids and gas from the subsurface, and injection of fluids into underground

formations. While most induced earthquakes are small and present little hazard, larger and potentially damaging manmade earthquakes have occurred in the past.

- The hazard posed by manmade earthquakes can be mitigated by minimizing or in some cases stopping the activity that is causing the earthquakes to occur. For example, earthquakes linked to wastewater disposal in deep wells in Colorado, Ohio and Arkansas stopped occurring after injection was halted.

Is there any way to prevent earthquakes?

- We cannot prevent natural earthquakes from occurring but we can significantly mitigate their effects by identifying hazards, building safer structures, and providing education on earthquake safety. By preparing for natural earthquakes we can also reduce the risk from human induced earthquakes.