

Unit Ten

Earthquakes / Hazardous Materials

Overview

In this unit you will learn about the effects of earthquakes and how you can protect farms and livestock from them. You will also learn about hazardous material spills and how to limit adverse consequences of this hazard.

Objectives

Upon completion of this unit, you should be able to:

- ➔ Identify the factors that contribute to the damaging effects of earthquakes
- ➔ Identify mitigation measures for earthquakes
- ➔ Describe problems associated with contamination of the food supply
- ➔ Identify procedures that mitigate contamination of the food supply
- ➔ Determine your vulnerability to earthquakes
- ➔ Determine your awareness of the risks of contamination of the food supply

Earthquakes

Major earthquakes have occurred in relatively recent history throughout most of the United States. The most recent and highly popularized incidents include the 1989 Loma Prieta and 1993 Northridge quakes in California.

However, focusing only on California as the state where earthquakes are likely is misleading and could be dangerous. Concern for earthquakes is advised for many parts of the U.S. It is estimated that 109 million people and 4.3 million businesses in 39 states are at risk from earthquakes. There is a 97 percent chance of a major earthquake along the New Madrid fault in the Central U.S. (AK, MO, TN, KY) by the year 2035.

An earthquake is a wave-like movement of the earth's surface. The earth's crust and upper part of the mantle push and move against one another along what are known as fault lines. An earthquake can also be produced by volcanic eruptions.

The impact of an earthquake is measured by its magnitude and intensity. The magnitude measures damage, the intensity measures the amount of energy released.

The Richter scale measures the amount of energy released. A change of one point in the Richter scale represents a difference by a factor of 30 in energy released.

Soil conditions and the extent of shaking contribute to the degree of damage to structures. The extent of shaking that results from an earthquake determines the extent of structural damage. The greatest amount of damage to buildings results from soil liquefaction.

Most injuries to people in earthquakes result from building collapse and falling objects. Secondary injuries result from spillage of hazardous materials, gas escape, and fires.

Following earthquakes there are frequently aftershocks. Although many times aftershocks are of lower energy than the primary earthquake, aftershocks can still cause significant damage and disruption. To minimize losses and damage from aftershocks farmers should heed the warnings of officials and utility companies.

Mitigation for Earthquakes

Because earthquakes cannot be predicted and provide minimal advance warning, the greatest impact on human and animal safety is through mitigation. Mitigation of earthquakes involves safe building construction, upgrading (retrofitting) construction, and creating a safe environment.

Damage to buildings can be reduced if the buildings are firmly anchored to their foundations.

Home, farm, and business owners can purchase earthquake insurance for their home, business, and contents. Renters can also purchase earthquake insurance for their belongings.

Additional information on earthquake-resistant building construction is available in numerous publications. These publications are from the federal and state emergency management agencies and others, and should be consulted for construction standards.

Examples of mitigation of earthquakes include:

Securing objects

- Any objects and tabletop equipment (such as computers or typewriters) that are valuable or heavy should be secured. Fastening materials include Velcro, straps, nuts and bolts, chains, glue, non-drying putty, and micro-crystalline wax.
- Cabinets and shelves should be firmly secured to walls to prevent them from falling. Attach heavy pictures, mirrors, and display units firmly. Secure objects to the struts in the wall, not the plaster board. Strut finders are available at low cost from many hardware stores.
- Cabinets with metal grid doors and shelves with guardrails are the preferred storage containers. All doors on cabinets should have locks or other devices on them that will not open in an earthquake.
- Windows should be constructed of safety glass or covered with Mylar safety film.
- Ceiling fans and heavy equipment should be secured with an extra cable to the joist in the ceiling, so that they do not hit the ground if they fall from the ceiling.
- Avoid storing feed (hay) and straw bales above animals.

Hazardous materials

- Bolt down or reinforce water heaters and other gas appliances. Use flexible gas line and appliance connections wherever possible.
- Know where to turn off the gas supplies to your house or barn.
- Store contents of cabinets and shelves systematically, with heavy items always on the bottom. All containers should have firmly fitting lids on them at all times. Be especially concerned with materials that would be hazardous if spilled.
- Materials such as gasoline, pesticides, and paint thinners should be stored on a low level and away from areas where they might cause significant problems if spilled.

- Materials that would be dangerous if mixed should be stored in separate places. For example, bleach should not be stored close to ammonium-containing materials, such as detergents, or halide-containing materials (e.g., tincture of iodine or Betadine), since toxic gasses are released (ammonia, iodine, and bromine respectively) if they are mixed.
- Maintain “Material Safety Data Sheets” (MSDS) on chemicals regulated by OSHA.
- Keep a first aid kit and eyewash cup near materials that could expose humans to chemicals.

Earthquake Preparedness

Earthquake preparedness focuses on personal safety and acquisition of appropriate reflex behavior. It is recommended that all persons who live in earthquake prone areas learn to:

- DROP (to the floor),
- COVER (under heavy furniture), and
- HOLD (on to the furniture).

Do not house animals underneath things that might fall on them during an earthquake, such as a chimney or a heavy retaining wall.

Stay away from windows.

Prepare and keep available a list of the addresses and phone numbers of:

- Utility companies (electric, gas, water)
- Fire and police departments
- Veterinarians
- Emergency Management Agency
- Local radio stations

After an Earthquake

After an earthquake:

- ➡ Turn off utilities ONLY if there is an obvious problem or when advised to do so. If you turn off any utilities, share this information with others on the farm. Do not turn utilities back on. In many cases only a technician from the utility company is certified to turn utilities (gas) back on.
- ➡ Evaluate sewer lines and report any problems to the local water management agency.
- ➡ Assess animal waste holding areas (dairy and swine lagoons) for integrity and notify local Environmental Health of Water Management Agency if breeched or unstable.
- ➡ Assess integrity of water lines – if well or water main is potentially impacted, notify water management authority and decontaminate drinking water used by humans until advised to do otherwise.
- ➡ Notify local rendering company if animals have died and need removal.
- ➡ Assess if earthquake-associated disruption to roadways will compromise feed delivery to livestock and develop contingency plans.

Impact & Consequences

Earthquakes have many adverse consequences. The following table summarizes some commonly reported problems that occur in earthquakes and the unit where you can learn more about the consequences.

Impact	Consequence	Refer to Unit #
Earthquakes can disrupt telephone services and place a high demand on communication systems	Communications are challenged	5
Earthquakes can disrupt utilities, including water supply, to a community	Infrastructure failure	6
Earthquakes can spark fires	Threat to public and animal safety	7
Earthquakes often render homes of people and housing for animals uninhabitable	Need to evacuate people and animals	8
Earthquakes can destroy enclosures	Displacement of animals	9
Earthquakes frequently cause hazardous materials to spill	Threat to public and animal health	This unit
Earthquakes can cause lagoon walls to fail and the lagoon contents to spill	Adverse effects on the natural environment and wildlife	11
Animals can be killed in earthquakes	Need for carcass disposal	12
Animals can be severely injured in earthquakes	Need for euthanasia	13
Earthquakes can trap animals in collapsed buildings	Threat to the well-being of animals	14
Earthquakes can evoke strong empathies for affected animals	Public concern	15

Hazardous Materials

Hazardous materials spills are perhaps the single most common type of disaster in the U.S. Hazardous material incidents can occur in the home or work place, where they may be limited in scope, but they also occur in public places, such as on highways, train tracks, or at sea.

Following earthquakes, hazardous materials can be knocked over and contaminate the environment (soil, water, air), plants and animals. After the Northridge earthquake, 239 separate hazardous materials incidents occurred.

Right to know laws

In 1986, the United States Congress passed the "Emergency Planning and Community Right to Know Act." This legislation makes it mandatory for communities to establish a Local Emergency Planning Committee (LEPC). Employers are required to work with the LEPC to prepare an emergency plan for possible releases of hazardous substances, and for fixed facilities to cooperate in this planning process.

This legislation also dictates that the emergency response plan, material safety data sheet (MSDS), inventory form, toxic chemical release form, and followup emergency procedures be made publicly available. In many communities, the right-to-know acts have higher standards than the federal law. Local law takes precedence over federal law.

Contamination of the food supply

There are many potentially hazardous chemicals on farms. Examples include pesticides, herbicides, fertilizer, petroleum products, solvents, detergents, and veterinary drugs.

These chemicals must be stored, handled, and disposed of according to strict guidelines. These guidelines are developed to address the following issues:

- ➡ Public health
- ➡ Animal health
- ➡ Safety
- ➡ Documentation
- ➡ Liability

The public health implications include the risk of contaminating the human food supply. In addition, if food animals or their feed or water become contaminated, these contaminants could potentially enter the human food chain.

Case 1: Chlorine gas

What are your concerns?

The following two hypothetical cases are intended to get you to think about protecting the food supply in disasters.

An earthquake shakes a rural area of Tennessee. Many houses suffer damage. On a dairy farm, a pipe feeding chlorine into the wash water for the milking parlor breaks and chlorine gas leaks. It is milking time when the break occurs. Twenty cows and three people are in the milking parlor. The chlorine gas diffuses into the dairy parlor. The milkers quickly start coughing, tearing, and gagging. The cows in the parlor become agitated.

What are the immediate concerns?

The first thing is to get people out of harm's way. Only once it is safe for people should the safety of animals be addressed.

One of the milkers releases the cows from their stanchions, while another switches off the vacuum supply to the parlor. The milkers then run to safety. Most of the cows leave the parlor.

One cow becomes distressed and is not able to leave the parlor. She is frightened and the chlorine gas is irritating her.

What would you do?

What are some constraints to saving this cow?

The source of a hazardous chemical release has to be cut off, then further spread should be contained, and finally the chemical should be removed.

In this case, the main supply from the chlorine tank has to be cut off. The chlorine gas has to be dispersed as quickly as possible to prevent ill effects in humans and animals, and because the gas is highly corrosive.

One of the milkers knows where the shut-off valve to the chlorine tank is and turns it off. This stops the flow of chlorine. Then he turns the parlor fans on and most of the gas leaves the parlor. The trapped cow is hosed down with water, but has suffered chlorine burns.

What are the public health concerns?

What implications does the exposure of milking cows and the milking parlor have on the safety of the human food supply?

Direct exposure of the cows to chlorine gas means that the cows have been exposed to a hazardous chemical. In this case, the chemical may enter the cow through the respiratory tract and by penetration of the skin. Other chemicals may enter by ingestion.

In this case, chlorine may affect the milk, but has no lasting effects on meat. Other chemicals could have other effects.

When is it safe again?

How would you determine that the milkers, cows, milk supply and the milking parlor are safe?

Humans exposed to hazardous materials should be seen by a physician and animals by a veterinarian. Many toxic effects are acute, but precautions also need to be taken to minimize long-term consequences. A veterinarian may choose to consult the Food Animal Residue Avoidance Databank (FARAD) (<http://www.farad.org/>).

Professional advice should be sought to determine the safety of the milk for human consumption. The safety of the human food supply should be investigated by representatives of the USDA Food Safety Inspection Service (FSIS), Food and Drug Administration (FDA), and their state equivalents (especially for contaminated milk).

Food products and live animals that are potentially contaminated may need to be held on the facility until safety can be assured.

The safety of the environment can be determined by specialist firms who work under the guidance of the Environmental Protection Agency.

Many food processors test for the presence of contaminants that threaten the safety of the food supply prior to movement for processing and continuously during processing. However, if a chemical contaminant is suspected that is not usually tested, those knowledgeable about the contaminant should advise the processors prior to movement or processing.

Case 2: Feed contamination

An earthquake in California causes damage to the mixing mechanism of a feed mill. As a result of this damage, 20 tons of dairy cattle feed become contaminated with an antibiotic that is not licensed for use in milking cows. In the confusion the contaminated feed was accidentally allowed to leave the mill without assessment.

What are your concerns?

What public and animal health concerns do you think arise when animal feed becomes contaminated with antibiotics?

Dairy farmers were greatly concerned, because they are in violation of food safety regulations, and would not be able to sell milk from cows that had eaten this feed.

What could you do?

How would you know if the feed supply for your animals was contaminated?

Routine quality control testing at the feed mill would have normally detected the error; however, in this case much of the feed had already been distributed by accident. It is of great concern that some feed may have already been given to dairy cows.

Producers and owners should keep detailed records of feed purchases and samples of every feed batch they purchase for three months after that feed has been consumed. These samples can be used, if necessary, for later analysis.

What would you do?

Who should be called to determine the safety of the feed?

Any suspicion of contaminated feed should be investigated by representatives of the FDA or its state equivalent.

Liability lies with the person/company who knowingly or negligently allows contaminated feed to be given to food-producing animals.

Mitigating contamination of the food supply

Exposure of livestock to hazardous materials can present special problems. Animals may ingest, inhale, or otherwise come into contact with hazardous material. Although the animals may not appear clinically affected, their meat, milk, and eggs may contain residues that present a source of exposure for people.

Many farmers are often qualified to handle normal use of hazardous materials on their farms. However, if there is any suspicion of contamination of livestock from hazardous materials, it is essential that livestock producers seek specialist advice. Representatives from the USDA Animal Plant Health and Inspection Service (APHIS) have authority over live animals, the FDA over animal feed and milk, and FSIS over culled livestock going for slaughter. State officials and many processors are also trained and qualified to deal with these issues.

Other sources of information are the federal and state Food and Drug Administration and state chemists, whose role includes the safety of animal feeds. Owners should not treat hazmat-contaminated animals themselves.

Most veterinarians can advise on how to treat the clinical aspects of common poisonings. In addition, the ASPCA Animal Poison Control Center (<http://www.asPCA.org/apcc>) in Urbana, Illinois; most colleges and schools of veterinary medicine; state animal disease diagnostic laboratories; and some human poison control centers can provide needed information on how to deal with animal poisonings. In some cases, there may be a charge for these services.

Additional resources on dealing with hazardous materials at local, state, and federal governments are summarized in the Appendix for this unit.

Sources of education

Untrained persons should not work with hazardous materials. Proper training and hazardous materials certification are required to deal with releases and potential contamination of the food supply. If you are concerned about a hazardous materials release, phone 911.

Many local or state Emergency Management Agencies, Environmental Protection Agencies, fire departments, Department of Natural Resources, and Fish and Game Services organize continuing education courses in hazmat incident response.

Assess Your Vulnerability

Earthquakes	
Item	Vulnerability Score
1. Based on your knowledge of local geography, how common are earthquakes in your area? 1 (there have been no earthquakes in the last 100 years)—5 (there has been an earthquake in the last 10 years)	
2. Based on what you have learned about earthquake mitigation, how well prepared are you to minimize the effects of an earthquake (e.g., are your cabinets and shelves secured, do you store heavy objects on lower shelves?) 1 (well prepared)—5 (not well prepared)	
3. What is your vulnerability to earthquakes? Add 1 and 2	Enter this number on page 16-3
Hazardous Materials and Contamination	
Item	Vulnerability Score
1. Based on what you have learned about preventing contamination of the human food supply, how well protected is your farm? 1 (well prepared)—5 (there is a lot of room for improvement)	
2. Are you certified to deal with pesticides, herbicides and other hazardous materials on your farm? 1 (yes, for all of these)—5 (not for any)	
3. How vulnerable is your farm to hazardous materials and feed contamination? Add 1 and 2	Enter this number on page 16-5

**Learning Check**

Directions: Determine if the following statements are true or false based on the material in this unit. When you have finished, check your answers on page 10-16.

1. California is the only state in the country with the risk of severe earthquakes.
True or False?
2. Hazardous materials spills are the most common type of disaster to occur in the United States.
True or False?
3. The Richter scale measures the amount of energy released by an earthquake.
True or False?
4. Most human injuries in earthquakes result from falling objects.
True or False?
5. Hazardous materials are frequently spilled during earthquakes.
True or False?
6. Storing heavy objects and containers with hazardous chemicals on higher shelves is an important mitigation tool for earthquake damage.
True or False?



Learning Check

7. Housing animals so that heavy objects do not fall on them in earthquakes is an important preparedness activity for earthquakes.
True or False?
8. Earthquake insurance is effective mitigation.
True or False?
9. Few farmers are trained and qualified to handle the normal use of most chemicals on their farm.
True or False?
10. When hazardous chemicals are released, their source of release should be cut off.
True or False?
11. Veterinarians should be consulted to deal with the clinical aspects of food animals exposed to hazardous chemicals.
True or False?
12. There are specialized services that can advise on the appropriate treatment of food animals exposed to hazardous chemicals.
True or False?



Learning Check

13. The USDA Food Safety Inspection Service is responsible for overseeing the safety of the U.S. food supply for human consumption.

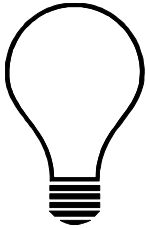
True or False?

14. The Environmental Protection Agency is responsible for overseeing the safety of environment in the U.S.

True or False?

15. The “Right to Know” laws provide emergency management agencies with the power to compile lists of hazardous chemicals at fixed facilities.

True or False?

**Answers**

For every question that you answered incorrectly, review the page listed next to the answer to find out why your answer was incorrect.

1. False10-1
2. True10-6
3. True10-2
4. True10-2
5. True10-3
6. False10-3
7. True10-4
8. True10-2
9. False10-9
10. True10-7
11. True10-10
12. True10-10
13. True10-9
14. True10-8
15. True10-6

Summary

This unit described adverse consequences of earthquakes and how mitigation can reduce their effects. This unit also presented information on hazardous materials and discussed how feed contamination is a potential threat to the food supply after disasters.