# Animals in Disasters

MODULE A
UNIT 6

## Technological Hazards: Applying the Four Phases

## Overview

This unit deals with technological hazards including hazardous materials spills and radiation hazards. It defines each of these hazards and provides practical information for applying the four phases of emergency management in relation to these hazards. It focuses on protecting animals during such emergencies.

## Objectives

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

- Define technological hazards that threaten the United States
- Protect yourself against technological hazards
- Protect animals against technological hazards
- Apply the four phases of emergency management to technological hazards

## Hazardous materials

Hazardous materials can be released by accident or in disasters. They are dangerous to persons and animals that are exposed and may contaminate the environment and the human food supply. Animals exposed to hazardous materials are a potential threat to humans.

Many farmers are familiar with the appropriate methods for handling commonly used hazardous materials, such as herbicides, pesticides, and fertilizers. The general public needs a better understanding of what hazardous materials are and how to deal with them.

Hazardous chemicals should be dealt with by qualified persons. Depending on the scale of the chemical release, local, State, or Federal offices may become involved in the security and clean-up operations. Often these groups are assisted by industry.

## Mitigation

Hazardous materials are common in many households and animal-care facilities. Compounds such as detergents, cleaning materials, herbicides, and pesticides are potentially dangerous if persons or animals are exposed through incorrect handling or spillage. The following steps will help mitigate a hazardous materials incident.

- Hazardous chemicals should be stored in safe places where children and animals cannot be exposed.
- Storage areas must guard against freezing and overheating of hazardous materials. They should also have separate locks.
- Chemicals should be stored on the floor or lower shelves to prevent falling and spilling. Lips are recommended for all shelving upon which hazardous materials are stored.

## Preparedness

You should identify potential hazards in your immediate environment and learn about proper storage. You should also know what clinical signs these toxins may cause if a person or an animal has been exposed. If you suspect your animal has been exposed, always consult a veterinarian.

You can find out about hazards through legislation called the "Right to Know Act." Your local fire department or emergency management agency can provide you with information on hazardous chemicals in your community. Individuals and animal facilities should have a plan for dealing with hazardous materials on their property.

FEMA may provide resource information and technical and financial assistance to States for developing emergency plans for hazardous materials accidents and other types of emergencies and assist State and local governments in hazardous materials training.

The Environmental Protection Agency (EPA) also conducts technical and environmental training programs related to hazardous materials, and chairs the 14-agency National Response Team (NRT). At the request of community officials, the EPA can provide technical expertise on the full range of environmental contamination issues.

## Response

Unlike many other emergencies in which volunteer help is welcome, in a hazardous materials emergency there is little that untrained members of the public can do. Any information you wish to offer should be given by telephone from a safe distance. Observe all posted exclusion

zones and listen for public announcements on the radio or other local information system.

If a hazardous materials accident occurs during the daytime, animal owners may be at work. The area will be secured and owners should realize that they may not be allowed into the secured areas to retrieve or care for their animals. Emergency services personnel will notify you as to what steps to take. If you are at home during a hazardous materials emergency, it is especially important to bring your animal(s) with you if asked to evacuate, since you may be away for a lengthy period. Alternately, you may be asked to shelter in place. Sheltering in place is required when it would be more harmful for you to evacuate your location than it would be for you to stay.

Owners should not treat animals themselves. The National Animal Poison Control Center in Urbana, Illinois, any college or school of veterinary medicine, State animal disease diagnostic laboratory, and some human poison control centers can provide needed information on how to deal with animal poisonings. There may be a charge for these services.

For animals that graze or live outside, hazardous materials can present additional problems. Animals exposed to low levels of hazardous materials may not appear clinically affected, but their meat, milk and eggs may contain residues that present health risks for humans. Contact a specialist for advice if you think your animal has been exposed. Representatives from the U.S. Department of Agriculture Food Safety and Inspection Service are trained and qualified to deal with these issues. Other sources of information regarding hazardous materials and animals include:

- Federal and State Food and Drug Administration;
- State chemists, whose role includes the safety of animal feeds;
- The National Animal Poison Control Center;
- Colleges and schools of veterinary medicine;
- State disease diagnostic laboratories; and
- Hazardous materials teams in some areas.

## Recovery

A major hazardous materials incident may require response of various levels of government (Federal, State, and local).

The following table identifies local government responsibilities.

| Agency/Center | Responsibility |
|---|---|
| Local public health department | Safeguards the public when food or water supplies may be affected or when dwellings may become contaminated. |
| A chemist and toxicologist from the local health department | May provide advice on toxicity and personnel protection as well as recommendations to the scene manager regarding actions to reduce public health hazards. |
| Public works department | May assist in containment and cleanup. |

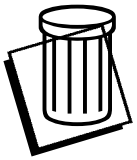
In a major incident, a local government may call on State agencies for resources and knowledge. Such an action could involve a number of State agencies, which include those listed in the following table.

| Agency/Center | Responsibility |
|---|---|
| State Office of Emergency Services | Arranges State and regional mutual aid support and provides liaison with State agencies. |
| State Department of Transportation | Assists and/or provides identification and containment of all materials on State highways and freeways or unincorporated county roadways. |
| State Police or Highway Patrol | Provides general control of the perimeter of the incident (e.g., regulating traffic) and other roles depending on State law and incident requirements. |
| State Department of Fish and Game and regional water quality control boards | Provide recommendations and guidelines when hazardous materials spills are likely to contaminate streams and/or waterways or would otherwise affect wildlife resources. |
| State Occupational Safety and Health Administration (OSHA) personnel | Often possess technical knowledge useful to an incident commander in the areas of exposure, protection and control of hazardous materials. In an incident in which employees have been injured due to exposure, or in a prolonged incident, State OSHA personnel may respond. The State department of health employs health scientists who can help assess the potential human impact of a toxic release. |
| State department of environmental protection | Can predict the environmental impact of actions the incident commander is considering. (For more information about the Incident Command System, see Module B of this course, Unit 5.) |

| | |
|---|---|
| State and local fire marshal | Have specific expertise relating to chemical behavior and fire codes. |
| The U.S. Department of Agriculture Food Safety Inspection Service | The agency that oversees food inspection for human safety, including carcasses that may have been exposed to hazardous materials. |

In the event of an incident, the Federal government can also provide assistance to the local incident commander. The following table identifies Federal government responsibilities.

| Agency/Center | Responsibility |
|---|---|
| National Response Center (NRC) | Staffed by the U.S. Coast Guard, this center operates a 24-hour hotline to communicate notices of major hazardous materials discharges to the appropriate authorities. The NRC can also provide the local government with the expertise and resources of other Federal agencies. |
| Environmental Protection Agency (EPA) | Primarily responsible for hazardous waste site operations, cleanup activities, and environmental impact. |
| Department of Transportation (DOT) | Establishes the nation's overall transportation policy. It bears the primary responsibility for issuing standards and regulations relating to the transportation of hazardous materials from State to State. |
| Department of Energy (DOE) | Primary responsibility in the hazardous materials arena involving radioactive waste generated by the nuclear weapons program or by nuclear reactors that supply energy. |
| Department of Defense (DOD) | Responsible for maintaining personnel, equipment, and other resources for potential use in military conflict. DOD manufactures, stores, and discards the full range of hazardous materials and is also one of the nation's largest shippers of such materials. The DOD can also provide response teams and equipment. |
| OSHA | Responsible for establishing rules and standards to ensure that occupational environments are safe for workers. As part of this function, OSHA regulates employee safety and health at hazardous waste operations, in work environments where hazardous materials are present, or during emergency response to incidents involving hazardous materials. |
| National Agricultural Chemicals Association | Has identified a group of specialists designated as the Pesticides Safety Team. The team provides advice for incidents involving pesticides and will dispatch a response team to the site if one is needed. |
| FEMA | Available to provide additional financial relief in the event of an incident so serious that local and State funds prove inadequate. |



# LEARNING CHECK – WHAT HAVE YOU LEARNED ABOUT HAZARDOUS MATERIALS?

This activity is designed to assess your understanding of the information presented in this unit.
Directions: Answer the questions – use the Answer Key in Unit 10 to check your answers.

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## True or False

1. Animals that have been exposed to hazardous materials present no danger to people.

2. Household compounds like cleaning materials are not considered hazardous materials.

3. There is little that untrained members of the public can do to intervene in a hazardous materials event.

4. If you suspect that your animal has been poisoned, the best resource to contact is a human poison consulting service, they always have information pertaining to humans and animals.

5. Animals that ingest low levels of hazardous materials may not appear clinically affected.

6. Exposure of livestock to hazardous materials may potentially contaminate human food.

7. When hazardous materials releases occur during the day when people are at work, officials are prepared to let owners into secured areas to retrieve their pets.

## Multiple Choice

8. In your home, chemicals should be stored in which of the following places?
   a. Upper shelves
   b. In the attic
   c. The floor and lower shelves with cabinet locks
   d. In the garage

9. Which of the following agencies safeguards the public when food or water supplies may be affected and when dwellings may be contaminated?
   a. Local public health department
   b. Environmental Protection Agency
   c. Office of Emergency Preparedness
   d. Food and Drug Administration

10. Which of the following agencies has the primary responsibility when hazardous materials accidents involve radioactive waste?
    a. Sheriff's department
    b. Department of Energy
    c. Department of Transportation
    d. Environmental Protection Agency

## Radiation hazards

Contemporary radiation hazards include problems associated with nuclear power plants, nuclear weapons accidents, and the manufacture, transport, and storage of nuclear and other hazardous materials. There is a glossary of radiation terms at the end of this section.

Utility companies in the United States generate about 20 percent of our electricity by nuclear power. Fixed nuclear facilities (power plants, storage facilities, research reactors) are generally safe and constructed to contain any radiological release. However, there is a possibility that an incident could cause a release of radioactive materials. To prepare for this eventuality the Nuclear Regulatory Commission requires that all power plants and State emergency response agencies plan for such problems. The agency must also periodically conduct practice exercises to determine the effectiveness of the plan.

Radiation is any kinetic energy emitted in rays or particles from sources of heat, light, sound, and radioactivity. Mostly, radiation is described as charged particles (ions) in material that it strikes. There are two types of ionizing radiation: those produced from natural origin (including those naturally found in the body) and those produced from natural origin but affected by human activities.

As the radioactive isotope decays it emits a electromagnetic wave or energized particles. The types of radiation are either alpha or beta particles of gamma emissions. The following table identifies each type of emission.

| | |
|---|---|
| Alpha particles | The largest particles with very shallow penetration into a surface. A piece of paper will absorb the radiation. |
| Beta particles | Smaller particles that will penetrate tissue about 2 cm. |
| Gamma rays | Not particles and have no mass. Can penetrate through the body. Similar to X-rays. |

Alpha and beta particles can cause surface skin wounds and internal damage if radioactive compounds that emit these are inhaled or swallowed. Gamma and X-rays can cause whole body damage because of the extent of penetration.

Each isotope has its own specific half-life and most have an affinity for specific tissues. The half-life, or decay of an isotope is the speed at which that isotope reaches one half of its original radioactive strength. For example: the half-life of iodine-131 is eight days. After eight days, it reaches one half of its original radioactivity. In another eight days, the radioactivity is again reduced by one half. The longer the half-life the more persistent the isotope is in the environment.

The following table identifies sources of radioisotopes and their contribution to the human body.

Sources of radioisotopes and contribution to the human body

| Source of Radiation | Percentage |
|---|---|
| Radon | 54 |
| Internal | 11 |
| Medical X-rays | 11 |
| Terrestrial | 8 |
| Cosmic | 8 |
| Nuclear Medicine | 4 |
| Consumer Products | 3 |
| Other | 1 |

Incidents at nuclear power plants are classified into four escalating categories or levels. They are: Unusual Event, Alert, Site Area Emergency, General Emergency.

| | |
|---|---|
| Unusual Event | Any mishap that occurs at the plant. This could be a worker falling off a ladder and breaking a leg. This must be reported to the State emergency response agency because an ambulance sighted at the door of the facility could cause the circulation of false rumors. Unusual events are usually minor mishaps of any kind, not necessarily involving the reactor, with no radiological release requiring offsite response or monitoring. |

| | |
|---|---|
| Alert | There is a reactor accident that involves an actual or potential substantial degradation of the plant safety level. Any releases are expected to be small fractions of the Federal (EPA) protective action guideline exposure levels. Alerts do not represent a threat to the public. |
| Site Area Emergency | A reactor accident that involves actual or likely major failures of plant functions needed for protection of the public. Any releases are not expected to exceed Federal (EPA) protective action guideline exposure levels except near the site boundary. The public will normally be notified and given instructions. |
| General Emergency | A reactor accident that involves actual or imminent substantial care degradation or melting with potential for loss of containment integrity. Releases can be reasonably expected to exceed Federal (EPA) protective action guideline exposure levels offsite for more than the immediate site area. These are incidents that call for immediate protective action. Follow all official instructions. |

Nuclear facilities provide people living nearby (within 10 miles) with written instructions of what to do in all eventualities (what the sirens mean if they go off and where to listen on their radio and television for instructions). If incidents do occur, the following actions are taken.

- The plant notifies the appropriate authorities of the event classification. The lowest classification that applies is designated. As the event continues classifications may change depending on the problem and the actions taken to correct it.
- Depending on the progression of the event emergency management officials will recommend necessary protective action to the public. Public notification is made through sirens and the emergency alert system (EAS) on radio and television.

If radioactive material is released into the environment it forms a plume. The plume cannot be detected by sight or smell and may contain various radioactive isotopes. The direction and speed of the plume depends on weather conditions, especially the wind.

Generally there are two zones of concern: one up to 10 miles from the plant called the plume zone and the other up to 50 miles from the plant called the ingestion pathway zone. (The ingestion pathway zone is named such because radioactive material may be deposited on crops and grasses and contaminate animal or human food.) Action for each zone depends on the direction and speed of the wind. For example, if the wind is going in a westerly direction the recommendations for the west would be different from those made for the east.

Two actions can help protect against radiation exposure:

- Create a distance from the source of radioactivity, and
- Create a barrier to the radioactivity.

The preferred protective action for people is evacuation, but in some limited circumstances sheltering in place may be recommended. Recommendations should be made well in advance of the plume reaching the affected areas. Precautionary actions for livestock typically involve putting animals in corral or under shelter and using protected food and water. Recommendations for livestock are usually made *before a recommendation is made for people*. This protects the people that need to carry out the actions to protect the animals.

The State agriculture department and U.S. Department of Agriculture provide information on the radiation risks to livestock. The emergency management agency should rate the effectiveness of animal shelters in protecting against radioactive penetration in advance of any incident. When animals are sheltered they should be fed only stored covered feed and water that is protected from radioactive fallout.

If animals need to be evacuated along with humans, procedures discussed elsewhere for evacuation should be followed. Routes that are not primary routes for human evacuation efforts should be used to avoid traffic being slowed due to a disabled livestock vehicle.

If animals are left outside and become exposed to radioactive material, a veterinary should evaluate the animals as soon as safety permits. Some forms of external contamination on animals can be washed off. If none of the material has been absorbed, the animal may no longer be contaminated. It is important that a veterinarian check animals for exposure, especially farm animals. No products should be used until appropriate laboratory tests for radioactivity are performed.

The rapid evacuation of people may require that animals are left in barns. Regulatory officials may prohibit entry into the area if it is radioactive. However, short trips may be allowed to care for and milk farm animals. Officials will determine the frequency, duration, and equipment required for these trips. The amount of radiation personnel performing these chores receive will be checked with dosimeters.

## Mitigation

Personal preparation and mitigation for radiological incidents can be improved by ensuring that you have the following:

- Awareness of and familiarity with siren alerts and the emergency alert network;
- Adequate shelter on the premises for animals;
- Protective covers for feed and water resources;
- Knowledge of evacuation sites and routes;
- Knowledge of nearby nuclear facilities, what they do, worst-case scenarios, what a radiation release would contain, and protective measures against these elements.

Many nuclear facility plans do not account for pets and livestock evacuation or on-premise care in the event of radiation release. By working with the facility planners, much can be accomplished in correcting these shortfalls.

## Preparedness

The following actions can be taken to prepare for radiation hazards.

- Those living near a fixed nuclear site should know where the sirens are located and under what circumstances they are activated. The emergency alert system gives specific directions for actions, announcements describing the incident at the nuclear facility, evacuation routes, emergency shelter locations, and other actions to be taken.
- Know where the emergency shelters for your area are located to prevent searching at the time of the incident. (Shelters are also called congregate care centers or mass care centers.) Shelters may not take pets so having a pre-arranged place to take them is important and will reduce concern for animals left in jeopardy.

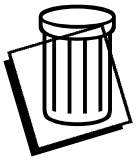
- Prior arrangements for protection or evacuation of horses and other livestock is also important. A barn, thick grove of trees, or trench silo might shelter them against radioactive fallout. Practice will help accustom animals to temporary shelters (many animals resist moving to unfamiliar environments).
- Arrangements with family or friends outside the evacuation area for temporary housing of large animals should be made in advance. Feed and water resources may become critical at the host site without planning.
- Controlling fallout onto water and feed supplies may be difficult. Since most radioactive fallout particles are heavier than water, in bodies of water with little or no turbulence the surface water consumed by animals will be safe to drink within 10 to 14 days. Other water sources such as water troughs can be covered temporarily to protect the water from immediate fallout. Rolls of garden mulch or plastic sheeting can be stored for this purpose.

## Response

If the sirens in the area are activated, listen on radio or television to the designated emergency alert station. Follow the directions closely. If evacuation notices are given it is very important that they are obeyed as soon as possible. The closer the farm is to the incident, the less time is available to shelter without endangering the life of the owner. Follow local instructions as to whether to take your pets with you when you evacuate. Close up the house and leave quickly.

## Recovery

If there is a release of radioactive material, the emergency managers will secure the entire area of possible radiation exposure. Before anyone is permitted to re-enter the area, careful monitoring will assure the safety of residents wanting to return. Re-entry might be permitted under supervision. Animals and feed and water supplies should be checked for radioactivity. Decontamination of any object is difficult and can be hazardous; only people specifically trained in that field should do this.



# LEARNING CHECK – WHAT HAVE YOU LEARNED ABOUT RADIATION HAZARDS?

This activity is designed to assess your understanding of the information presented in this unit.
Directions: Answer the questions – use the Answer Key in Unit 10 to check your answers.

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## True or False

1. The persistence of a radioactive isotope in the environment is measured by its half-life.

2. Two things that can be done to protect people and animals from radiation are creating a distance from the source and creating a barrier to the radioactivity.

3. When evacuation and sheltering are necessary during a radioactive release incident, recommendations are made for people before a similar recommendation for animals.

4. Some forms of external radioactive contamination can be washed off of animals.

5. Having a pre-arranged place to take pets, horses, and livestock will help when an evacuation of a farm or home occurs.

6. If there is a release of radiation and there has been radioactive contamination, the area of contamination will be sealed off by the authorities.

7. Any animal owner can easily decontaminate animals exposed to radioactive materials.

## Multiple Choice

8. Which of the following is NOT a type of radiation?
   a. Alpha particles
   b. Beta particles
   c. Gamma rays
   d. Delta particles

9. Which of the following refers to a reactor accident that involves actual or likely major failures of plant functions needed to protect the public?
   a. Unusual event
   b. Alert
   c. Site area emergency
   d. General emergency

10. Which of the following refers to a reactor accident that involves actual or imminent substantial care degradation or melting with potential for loss of containment integrity?
    a. Unusual event
    b. Alert
    c. Site emergency
    d. General emergency

# GLOSSARY OF RADIATION TERMS

Alpha Particle – Two neutrons and two protons typically arising from the decay of heavy metals such as uranium, plutonium and radium. The large mass and two positive charges result in large direct ionization potential but little ability to penetrate. Alpha particles cannot penetrate through a piece of paper or skin.

Beta Particle – Negatively or positively charged particle emitted from the nucleus as an unstable atom. They can penetrate the skin.

Biological Half-life – The times it takes for the body to reduce the amount by one-half its original amount through elimination.

Electromagnetic Wave – Energy resulting from changing electric and magnetic fields. Long wave lengths are x and gamma rays where the shorter wave lengths are ultraviolet and visible lights and the shortest wave lengths are radar, radio and television.

Fallout – The descent of airborne particulate matter. Although this could refer to soot, dust, etc., it is now generally used in reference to radioactive materials incorporated in particulate matter such as dust and sand as the result of a nuclear detonation or release of radioactive materials from a nuclear power plant.

Gamma rays – A nuclear electromagnetic ray with no mass or charge. Gamma rays can penetrate many centimeters into the tissue.

Ionizing Radiation – Radiation as a result of radioactivity.

Irradiation – The submission of an object to radiation whether it is solar, radioactive or heat.

Neutrons – A man-made nuclear source of nuclear radiation resulting from a fission process. There is no electrical charge and neutrons can travel considerable distance in the air and penetrate the body tissues.

Radioactive Decay (half-life) – The amount of time it takes for an element to reach half of its initial value. The decay rate is the rate of disintegration of a radioactive material.

Radioactivity – The spontaneous disintegration of atoms from an unstable form to a more stable form; the transformation rate of an atom resulting in the emission of radiation in the form of alpha, beta or gamma rays.

Radiation – Kinetic energy being emitted in rays such as heat, light, sound and radioactivity.

Radionuclide – Any radioactive material. Radioisotope should be used in referring to a specific element.

Radiotoxicity – The relative hazards of the various radionuclides and electromagnetic rays and their effect within the body.

X-rays – An artificial source of ionizing radiation. It has the same physical properties of gamma rays but this form of radiation is used in diagnostic and therapeutic applications.

## Summary

In this unit you learned how the four phases of emergency management – mitigation, preparedness, response and recovery – can be applied to the emergency management and response to technological hazards. At each level you were given practical advice to protect yourself and your animals from the dangers that these hazards cause.