1

KNOWING WHAT TO EXPECT

Hazards, Vulnerability, and Disasters

Starting Point

Pretest to assess your knowledge on hazards, vulnerability, and disasters.
Determine where you need to concentrate your effort.

What You'll Learn in This Chapter

- ▲ Differences between accidents, emergencies, and disasters
- ▲ General emergency management responsibilities
- ▲ Types of natural, technological, and anthropogenic hazards
- ▲ The interaction of hazards and vulnerability
- ▲ The nature and impact of disasters
- ▲ The need for response and recovery operations

After Studying This Chapter, You'll Be Able To

- ▲ Understand the diverse sizes and scope of disasters.
- ▲ Differentiate among the diverse hazard categories.
- ▲ Comprehend the relation among hazards, vulnerability, and disasters.
- ▲ Examine the overlap between response and recovery operations.
- ▲ Identify demands to be met in a disaster.

Goals and Outcomes

- ▲ Compare and contrast different disaster magnitudes.
- ▲ Define and use basic disaster and emergency management terminology.
- ▲ Evaluate distinct types of hazards as well as common disaster characteristics.
- ▲ Predict changes resulting from disasters.
- ▲ Evaluate the importance of response and recovery operations.

Disaster Response and Recovery: Strategies and Tactics for Resilience, Second Edition. David A. McEntire.

INTRODUCTION

Welcome to the intriguing disaster discipline and the indispensable response and recovery profession! As a current or future emergency manager, it is crucial that you are aware of the important concepts relating to your vital duties and responsibilities. It is especially imperative that you are able to distinguish among differing disaster magnitudes as well as the factors that lead to and exacerbate these devastating events. For instance, it is vital that you understand natural, technological, and civil/conflict hazards as well as how they interact with the vulnerabilities humans create in society. Comprehending the consequences of disasters and the changes that take place when they occur is likewise necessary if you are to be able to react to them effectively. Being cognizant of the goals pertaining to response and recovery operations will also help you become a successful emergency manager. These topics are addressed in this introductory chapter of ***Disaster Response and Recovery: Strategies and Tactics of Resilience***.

1.1 The Occurrence of Disasters

Everyday people around the world are impacted by events that produce injuries, cause death, destroy personal belongings, and interrupt daily activities. These disturbing experiences are categorized as accidents, crises, emergencies, disasters, calamities, or catastrophes. Such incidents adversely affect individuals, groups, communities, and even nations. Each of these events is similar in that they require action from government officials, businesses, nonprofit organizations, citizens and bystanders, and the victims and survivors themselves. However, these occurrences vary dramatically in terms of magnitude, extent of duration, and scope. For example, a traffic accident can typically be handled within minutes by a few police officers who file reports and a tow truck that removes wreckage. A structural conflagration may require one or two fire departments, but it can displace the resident or family for weeks or months. When a mass shooting occurs, resources are needed to neutralize the threat, investigate the incident, and address the longer-term psychological toll that may possibly result from these intentional acts of violence. Alternatively, an airplane crash may necessitate the participation of firefighters and emergency medical service (EMS) personnel as well as airline officials and government employees such as a coroner or public information officer. If the plane crash does not take everyone's life, the victims and survivors of the ordeal may be injured or permanently disabled and require long-term care. Finally, when a major earthquake or hurricane affects an urban area, many organizations will become involved. Besides first responders, additional personnel will be needed to remove debris, repair utilities, provide relief assistance, and coordinate rebuilding endeavors that could take years. Thus, the impact of a minor accident is both quantitatively and qualitatively different than a major disaster or catastrophe (see Table 1-1) (Quarantelli, 2006). While this book does discuss common emergencies and less frequent catastrophes, it focuses most of its attention on disasters.

Table 1-1: Comparison of Event Magnitude

	Accidents	*Crises*	*Emergencies/ disasters*	*Calamities/ catastrophes*
Injuries	Few	Many	Scores/ hundreds	Thousands/ more
Deaths	Few	Many	Scores/ hundreds	Thousands/ more
Damage	Minor	Moderate	Major	Severe
Disruption	Minor	Moderate	Major	Severe
Geographic impact	Immediate area	Local community	Regional	National/ international
Availability of resources	Abundant	Sufficient	Limited	Scarce
Number of responders	Few	Many	Scores/ hundreds	Thousands/ more
Time to recover	Minutes/ hours/days	Days/weeks	Months/years	Years/decades

1.1.1 Important Concepts

Disasters are defined as deadly, destructive, and disruptive events that occur when a hazard interacts with human vulnerability. Disasters are significant societal events that injure and kill people, damage infrastructure and personal property, and complicate the routine activities people undertake on a daily basis (e.g., bathing, cooking, traveling, going to school, working, etc.).

There are two major types of variables that collide to produce a disaster. A **hazard** is the threat or trigger that initiates a disaster. Hazards include natural, technological, or anthropogenic (human-induced) agents like earthquakes, industrial explosions, and even terrorist attacks that negatively affect people or critical infrastructure. **Vulnerability**, on the other hand, refers to the proneness of people to disasters based on factors such as their geographic location, exposure of property, and level of income or other social variables. The ability of individuals, organizations, and communities to deal with disaster also determines the degree of vulnerability. Vulnerability is therefore closely related to the human element of disasters, while hazards may or may not always have a direct social cause.

While disasters result from the interaction of both hazards and vulnerability, the two concepts have distinct implications for practical application. Because hazards are not always controllable, people and organizations should give extra attention to efforts that reduce their vulnerability to disasters. For this reason, the knowledge and expertise of individuals that are employed in emergency management and

Figure 1-1

Emergency management personnel often attend meetings to discuss important emergency management issues and prepare for future disasters. Michael Rieger/FEMA.

related professions are required to deal effectively with mass emergencies, disasters, calamities, and catastrophes (Figure 1-1).

From an academic standpoint, **emergency management** "is the study of how humans and their institutions deal with hazards, vulnerabilities and the events that result from their interaction" (Jensen, 2013). The emergency management discipline accordingly seeks to advance knowledge about what people and organizations can do to diminish the frequency and impact of disasters. From a practical perspective, **emergency management** "is the managerial function charged with creating the framework within which communities reduce vulnerability to hazards and cope with disasters" (Blanchard et al., 2007, p. 4). This suggests that highly educated and trained individuals have been given the responsibility to advance the goals of emergency management. These professionals are known as emergency managers.

Emergency managers are public servants that help jurisdictions reduce the liabilities and vulnerabilities that lead to disasters. These government employees work closely with many concerned stakeholders and endeavor to build capabilities to deal more effectively with hazards and disasters. Such efforts are commonly described as the disaster life cycle or the four phases of emergency management. This includes mitigation, preparedness, response, and recovery:

▲ **Mitigation** refers to several things, including risk reduction, loss minimization, or the alleviation of potential negative impacts associated with disasters. Careful land-use planning, improvements in building design and construction, and a reliance on insurance are examples of mitigation activities.

- **Preparedness** implies efforts to increase readiness for a disaster. Examples of preparedness initiatives include grant and resource acquisition, planning, training, exercises, and community education.

Mitigation and preparedness should be given the highest priority in the emergency management profession today. For this reason, emergency managers must not be seen solely as an extension of **first responders—**police, fire, and emergency medical personnel. The goals of emergency managers are more proactive and encompassing, even if they do overlap with the objectives and operations of first responders at times.

However, because it is impossible to eliminate all disasters, emergency managers must also be involved in disaster response and recovery operations. **Disaster response** is action "taken immediately before, during, or directly after an emergency occurs, to save lives [and] minimize damage to property" (Godschalk, 1991, p. 136). Examples of disaster response activities include:

- Warning people of severe weather
- Evacuating those considered to be at risk
- Sheltering the affected population

During response, it may also be necessary to provide emergency medical care, relay information to the public, and manage the arrival of donations and volunteers.

Disaster recovery, in contrast, consists of actions "to return vital life support systems to minimum operating standards and long-term activity designed to return life to normal or improved levels" (Godschalk, 1991, p. 136). This incorporates efforts to repair homes damaged by disaster and rebuild community infrastructure such as power lines, roads, and courthouses.

Each of the phases described in Section 1.1.1 is closely related to the others (Neal, 1997). For instance, it is difficult to separate mitigation from preparedness as both are proactive measures to reduce the impact of disaster. Preparedness also has a significant influence upon the success of postdisaster management since it enables a community to anticipate response and recovery needs. In addition, it is difficult to determine when response ends and recovery begins. For instance, are damage assessment and debris removal part of disaster response or disaster recovery operations? Also, during recovery, it is vitally important that steps be taken to prevent future disasters or minimize their potential impact. Instead of simply rebuilding homes that have been damaged by a flood or a tornado, it may be necessary to relocate them to safer areas or implement more stringent construction requirements. For these reasons, the word "phases" may be somewhat misleading. With this in mind, it may be advisable to substitute "phases" with the term "functional areas" or "functional activities." Also, these areas or activities of emergency management do not appear in a neat, linear fashion so it is difficult to separate them conceptually.

It is also imperative that emergency managers are aware of other important concepts related to their profession. New terms have been introduced recently in emergency management due to the rising threat of terrorism and the advent of homeland security. **Homeland security** was initially defined as "a concerted national effort to prevent terrorist attacks within the United States, reduce America's vulnerability to terrorism, and recover from and minimize the damage of attacks that do occur" (Office of Homeland Security, 2002, p. 2). This concept encompasses other important terms such as prevention and protection. **Prevention** refers to actions to stop the occurrence of terrorist attacks. It includes the gathering of intelligence, counterterrorism operations, and border control functions. **Protection**, on the other hand, is more concerned about actions that discourage attacks through increased security measures or efforts to minimize damage if such attacks cannot be prevented in the first place. The reliance on guards, fences, video surveillance, and access control falls into this category.

1.1.2 Preview of Disaster Response and Recovery

As indicated by the title, this book describes strategies and tactics to improve the management of disaster response and recovery operations. This decision is not meant to deny the value of functions relating to mitigation, preparedness, prevention, and protection. It is instead based on the assumption that there is a need for an up-to-date textbook about postdisaster activities. Although there are some great works on this subject already, some may lack current information or approach the material from an academic or practical standpoint only. Also, response and recovery operations have changed significantly over the last decade or two and even more substantially in recent years. The informative research generated by disaster scholars over the years likewise needs to be integrated with the extensive experience of professional emergency managers. Furthermore, there is a dire need to educate government leaders and public servants in order to avert the repetition of mistakes made after Hurricane Katrina and other disasters. Nevertheless, this book may also be of use to corporate personnel or humanitarian workers who are also involved in response and recovery operations.

In order to meet these goals, *Disaster Response and Recovery: Strategies and Tactics of Resilience* will provide a comprehensive discussion about postdisaster management issues and recommendations for their improvement. Chapter 2 will help you as an emergency manager identify the actors involved in response and recovery operations. This includes government officials and agencies as well as corporations, nonprofit organizations, and even ordinary citizens. Chapter 3 discusses human behavior in time of disaster. It dispels widely held myths and illustrates typical social reactions to collective stress. Chapter 4 compares alternative theoretical stances regarding the management of disasters. It acknowledges the strengths and weaknesses of traditional and professional approaches. Chapter 5 covers initial response measures, and it provides ideas on how to protect people through hazard detection, warning, evacuation, and sheltering. Chapter 6 lists steps that can be taken to care for those who have been adversely affected by a disaster. This chapter shares information about search and rescue, emergency medical care, fatality management, and psychological stress. Chapter 7 gives recommendations on how to manage public relations and community resources. In particular, it discusses how you can effectively manage the media, donations, and volunteers after a disaster. The transition from response to recovery is the subject of Chapter 8. It assesses functions such as damage assessment, disaster declarations, and debris removal. In Chapter 9, disaster assistance programs are discussed along with ways to reduce vulnerability. This chapter provides information on recovery and how this functional activity can be linked to mitigation. The challenges of response and recovery are exposed in Chapter 10. It will help you understand difficulties associated with communications, decision making, transportation, politics, special populations, legal issues, and record keeping. Chapter 11 points out tools that can be employed during response and recovery operations. These include technological equipment as well as organizational arrangements (e.g., incident command, emergency operation centers) that will improve coordination. Chapter 12 covers lessons from prior disasters along with new threats and reasons for rising vulnerability. It attempts to help you think critically about the future of emergency management. The final chapter of the book illustrates ways to foster disaster resilience. Chapter 13 discusses various aspects of disaster preparedness in addition to the importance of improvisation, leadership, and professionalism among emergency managers.

Before proceeding with the outlined direction of the book, the remainder of this initial chapter will provide additional information about the types of hazards and how they interact one with another. It also describes the impact of disasters and what you as an emergency manager can expect in their aftermath.

SELF-CHECK

- What types of disruptive events can occur on a daily basis?
- How are they different from one another?
- What is a disaster and what are their causes?
- What is emergency management?
- How is response defined?
- What is recovery?

1.2 Types of Hazards

As an emergency manager who may be involved in disaster response and recovery operations, you must understand the nature of hazards if you are to be successful with your assigned responsibilities. As discussed earlier, a **hazard** is a physical, technological, or anthropogenic agent such as an earthquake, a chemical release, or a violent act. These hazardous events occur in the United States and around the world. Floods, tornadoes, and earthquakes occur, leaving buildings in rubble and other property damage. Vehicles collide due to careless drivers or in conjunction with poor weather conditions. Trains derail due to a mechanical failure of the tracks or human error by the engineer. Petrochemical facilities include large amounts of hazardous materials, sometimes leading to an explosion at the industrial complex. Terrorists detonate improvised explosive devices, producing carnage and fear in their wake. Hazards occur for many different reasons. Some hazards occur naturally in the environment, while others are the result of human activity, neglect of safety precautions, unanticipated mistakes, or malicious intent.

1.2.1 Natural Hazards

Natural hazards are those events originating from the physical environment, typically because of radiation from the sun, heat flow within the earth, or the force of gravity. Natural hazards occur in and across three arenas of action (Mileti, 1999):

- ▲ The atmosphere (the air surrounding the earth that is made up of various gasses)
- ▲ The hydrosphere (the earth's water system)
- ▲ The lithosphere (the earth's crust)

Natural hazards are classified as having atmospheric, geologic, hydrologic, seismic, volcanic, and wildfire origins. There are also other types of natural hazards that will be described in Sections 1.2.2–1.2.7.

1.2.2 Atmospheric Hazards

An **atmospheric hazard** is a hazard agent that is produced in or by the earth's atmosphere. A hurricane is one type of atmospheric hazard (Figure 1-2). Hurricanes begin as tropical depressions in the Atlantic Ocean and form as low-pressure systems due to the warm water that fuels them. When wind speeds top 74 mph, such

Figure 1-2

Hurricane Sandy and struck the northeast destroyed this roller coaster on the boardwalk in Seaside Heights, NJ. Liz Roll/FEMA.

Table 1-2: Saffir–Simpson Hurricane Scale

Category	*Sustained winds*	*Types of damage due to hurricane winds*
1	74–95 mph 64–82 kt 119–153 km/h	**Very dangerous winds will produce some damage:** well-constructed frame homes could have damage to roof, shingles, vinyl siding, and gutters. Large branches of trees will snap and shallowly rooted trees may be toppled. Extensive damage to power lines and poles likely will result in power outages that could last a few to several days
2	96–110 mph 83–95 kt 154–177 km/h	**Extremely dangerous winds will cause extensive damage:** well-constructed frame homes could sustain major roof and siding damage. Many shallowly rooted trees will be snapped or uprooted and block numerous roads. Near-total power loss is expected with outages that could last from several days to weeks
3 (major)	111–129 mph 96–112 kt 178–208 km/h	**Devastating damage will occur:** well-built framed homes may incur major damage or removal of roof decking and gable ends. Many trees will be snapped or uprooted, blocking numerous roads. Electricity and water will be unavailable for several days to weeks after the storm passes
4 (major)	130–156 mph 113–136 kt 209–251 km/h	**Catastrophic damage will occur:** well-built framed homes can sustain severe damage with loss of most of the roof structure and/or some exterior walls. Most trees will be snapped or uprooted and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last weeks to possibly months. Most of the area will be uninhabitable for weeks or months
5 (major)	157 mph or higher 137 kt or higher 252 km/h or higher	**Catastrophic damage will occur:** a high percentage of framed homes will be destroyed, with total roof failure and wall collapse. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months. Most of the area will be uninhabitable for weeks or months

tropical depressions become known hurricanes. In the Indian Ocean, these storm systems are known as cyclones, and in the Pacific Ocean, they are labeled typhoons. The eye or center of these storms is somewhat calm, but it is surrounded by circling cloud bands that produce rain in large amounts. Some hurricanes may have winds in excess of 100 or even 200 mph, and they may produce a storm surge of up to 24 feet. In the Northern Hemisphere, hurricanes rotate in a counterclockwise direction and travel in a west–northwesterly direction. They frequently hit Atlantic states and those along the Gulf Coast. The strength of a hurricane is listed under the Saffir–Simpson scale. The **Saffir–Simpson scale** is a descriptive tool to explain the magnitude of a hurricane in terms of wind and storm surge. It includes five categories. Category 1 is the weakest, while Category 5 is the strongest (see Table 1-2).

This scale estimates potential property damage. Hurricanes reaching Category 3 and higher are considered major hurricanes because of their potential for significant loss of life and damage. Category 1 and 2 storms are still dangerous, however, and require preparatory measures. In the western North Pacific, the term "super typhoon" is used for tropical cyclones with sustained winds exceeding 150 mph.

Florida is one of many states that experiences hurricanes. Hurricane Andrew made landfall on August 24, 1992, and its strong winds devastated the Miami-Dade area. This hurricane produced dozens of deaths and left thousands of people without power and shelter. Weak building codes and poor enforcement resulted in major structural collapses and a debris management nightmare. Hurricane Andrew's impact on Florida was surpassed by four hurricanes and one tropical storm that hit Florida in 2004. This was one of the worst hurricane seasons on record. However, all of these hurricanes combined did not cause as many deaths as a cyclone that hit Bangladesh in 1970. It killed as many as 300,000 people.

A thunderstorm is another atmospheric hazard. Thunderstorms are produced when warm, moist air rises through convection (thermal uplift). They also occur along cold and warm fronts where different air masses collide or when clouds traverse mountain chains (i.e., orographic lifting). When a thunderstorm cell forms (cumulus and cumulonimbus clouds), air rises and then descends quickly leading to rain, sometimes in copious amounts.

FOR EXAMPLE

Hurricane Ike's Impact

In September 2008, Hurricane Ike became the third most costly hurricane in U.S. history. It affected a number of states including Mississippi, Louisiana, and Texas. In terms of impact, damage amounted to over $37 billion and fatalities numbered nearly 200. Obtaining food for those directly affected was a great concern following the disaster. Another major lesson was the need to improve communication and coordination between public agencies so that recovery could proceed smoothly. Even 2 years later, Texas was still working hard to rebuild what was destroyed by Hurricane Ike.

Depending on weather conditions and temperatures, the vertical movement of air also freezes water droplets that fall to the earth as hail. Most hail is small (pea size), but it can be large at times (baseball or even grapefruit size). Hail can damage the roofs of buildings, destroy car windshields, and even kill those that are struck by it. Some of the most costly natural disasters are hailstorms such as the one that hit Fort Worth, Texas, during a 1995 Mayfest celebration. It resulted in at least $1 billion in losses. Over 100 people had to be taken to area hospitals after being struck by softball-sized hailstones.

Thunderstorms also result in downdrafts and straight-line winds (which travel down to the ground and then move horizontally along the earth's surface). Such winds travel quickly and can slam airplanes to the ground and flatten fences and barns. Thunderstorms are common around the world. There are over 16,000 thunderstorms per year in all locations excluding the North and South Poles. In the United States, strong thunderstorms occur frequently along the Gulf Coast or in the Midwestern states. Such storms also generate lightning, which is the emission of electrical bolts from clouds as a result of the interaction of positively and negatively charged fields. Approximately 6000 lightning strikes occur every minute around the world. Lightning often hits buildings, trees, and the ground. Because the temperature of the bolt is extremely hot (perhaps up to 50,000 degrees Celsius), people can be killed. Burns, respiratory failure, and cardiac arrest result from lightning strikes. Forests may also be ignited with fire due to lightning.

Tornadoes are another type of atmospheric hazard. Tornadoes are closely associated with thunderstorms. In fact, the name "tornado" stems from the Spanish name for such storms. As warm, moist air collides against cool, dry air, winds may move in a circular or rotating direction. One portion of the rotating air shaft drops, while the other portion moves upward in a vertical manner. When the resulting funnel reaches the ground, it becomes known as a tornado. The speed of winds is the factor used to describe the strength of tornadoes under the Enhanced Fujita Scale. The **Enhanced Fujita Scale** is a scale used to categorize the size of a tornado, including the affiliated wind speed. (see Table 1-3). Small tornadoes (e.g., F0 or F1) are very common but possess slower wind speeds (e.g., 65 mph). Large tornadoes (e.g., F4 or F5) are infrequent, but their wind speed reaches over 200 mph. At such high speeds, windows are broken, roofs are ripped from walls, and even foundations can be sucked from their moorings. Glass, brick, two-by-fours, and even cars become missiles and may penetrate other structures. The large F5 tornado that struck Joplin, Missouri, in May 2011 became the costliest tornado in U.S. history. Damages in this disaster amounted to over $2.5 billion. St. John's Regional Medical Center was one of the larger building structures that received extensive damage. Over 150 people were killed due to this massive tornado.

Tornadoes are very common to the Midwest portion of the United States due to the movement of the jet stream and the collision of air from Canada and the Gulf of Mexico. In fact, 90% of the world's tornadoes take place in the United States (roughly 500–600 per year). Oklahoma has been especially hard hit, as was the case on May 3–5, 1999. Fifty-nine tornadoes were reported in central Oklahoma during this period, and many of them lasted several minutes and traveled great distances. At least 40 people were killed during the outbreak and 675 people were injured. Over 10,000 homes were also damaged or destroyed. Losses were estimated at $1.2 billion. Oklahoma has experienced numerous tornadoes, including three that traveled

Table 1-3: Enhanced Fujita Scale for Tornado Damage

Fujita scale			*Derived EF scale*		*Operational EF scale*	
F number	*Fastest 1/4 mile (mph)*	*3 second gust (mph)*	*EF number*	*3 second gust (mph)*	*EF number*	*3 second gust (mph)*
0	40–72	45–78	0	65–85	**0**	**65–85**
1	73–112	79–117	1	86–109	**1**	**86–110**
2	113–157	118–161	2	110–137	**2**	**111–135**
3	158–207	162–209	3	138–167	**3**	**136–165**
4	208–260	210–261	4	168–199	**4**	**166–200**
5	261–318	262–317	5	200–234	**5**	**Over 200**

Important note about enhanced F-scale winds: The enhanced F scale still is a set of wind estimates (not measurements) based on damage. It uses 3 second gusts estimated at the point of damage and estimates vary with height and exposure. The 3 second gust is not the same wind as in standard surface observations. Standard measurements are taken by weather stations in open exposures.

almost the same paths in the City of Moore in the past 15 years. While the central portion of the country is known as tornado alley, it should be pointed out that these storms have occurred in many locations around the United States.

Winter storms are atmospheric hazards that occur mainly in December, January, and February in the United States. Winter storms include snow, sleet, and ice and are associated with extremely cold temperatures (Figure 1-3). Snowstorms include fluffy flakes of water that has frozen as it falls to the ground. Sleet is sometimes difficult to distinguish from ice storms, although sleet has more water in liquid state than ice storms. In either case, sleet and ice storms will cause very dangerous conditions when they accumulate on the ground. Although winter storms occur most frequently in the northern, central, and western portions of the United States, it is possible for lower states to receive snow periodically. Even ice storms are not excluded from places like Louisiana and Texas.

A very damaging ice storm took place along the U.S.–Canadian border in January 1998. Ice piled up several times higher than prior records, and many power lines and transmission towers collapsed due to the excessive weight of thick ice. The storm revealed just how vulnerable infrastructure can be to the forces of nature. Similar problems occur with excessive snow. On January 28, 1977, Buffalo, New York, received 93 inches of snow. This is an amount greater than the average for that area during the entire year. Snowstorms can turn into blizzards if they are associated high winds. Such storms can leave several inches or feet of snow on the ground, making transportation difficult. When snow falls on steep slopes, the potential for avalanche may result. Avalanches are quick and violent movements of snow down the mountainside. They are common in Washington, Utah, and Colorado. The characteristics of snow, changing temperatures, wind, skiers, and

Figure 1-3

Severe weather can take people by surprise and cause damages to trees, homes, and infrastructure. This rare October 2011 nor-easter storm dumped massive amounts of snow in Connecticut. Darrell Habisch/FEMA.

snowmobiles can trigger avalanches. While snow and avalanches create several challenges, the cold temperatures also produce hypothermia in individuals who are exposed to such weather. In some cases, the heating or lighting of homes during winter storms may lead to fires that cause death and destruction.

A final atmospheric hazard to be discussed here is a heat wave. A heat wave is a prolonged period of high temperatures that may also be coupled with excessive humidity. Heat waves create loss of agricultural crops and also stress humans to the point that they cannot cool their bodies through the normal process of sweating. If relief from the weather or medical care is not given, coma, paralysis, and death will follow. For instance, around 700 deaths (mainly among the elderly) resulted from a prolonged heat wave in Chicago in July 1995. The danger of such events requires constant communication with the public. One of the things that need to be relayed is the **heat index**, which describes the severity of the situation. This index incorporates both temperature and humidity into a scale. It is used by meteorologists to help warn people to stay inside and drink lots of water.

1.2.3 Geological Hazards

Geological hazards are those hazard agents associated with the earth's soil and rock surfaces. Landslides are the most damaging kind of geological hazards. Landslides occur because of a number of variables such as slope angle, moisture content of the soil, and physiology of rock. The presence or absence of

FOR EXAMPLE

Heat Wave in France

In August 2003, France experienced some of the highest minimum and maximum daily temperatures recorded in history. Because many families and physicians had taken time off from work during this typical vacation period, many elderly were left at home or without sufficient care in hospitals and nursing facilities. The lack of air-conditioning units in France combined with temperatures up to 104 degrees Fahrenheit and insufficient fluid intake resulted in the death of as many as 15,000 people. Heat waves such as this one are not always recognized as significant hazards, but their impact can be extensive as France discovered.

vegetation may also be a reason why landslides occur. Landslides may move swiftly and occur without warning or creep at a slow and perhaps unnoticeable pace. Such events are possible in any hilly or mountainous area but are probably most common along the Rocky Mountain region and the Pacific Coast. In 1983, a major landslide blocked a major highway in Thistle, Utah. The sediment and rock created an earthen dam that backed up a river and flooded a city. In 2005, a major portion of the mountain separated in La Conchita, California, and fell to the valley floor below. It buried 15 homes, damaged 16 others, and killed several individuals.

Besides landslides, there are also hazards related to subsidence and expansive soil. Subsidence occurs when the water table or underground rivers erode the soil around them and the earth collapses. This type of sinkhole is common in Florida (Figure 1-4). In August 2013, a sinkhole on Florida's surface swallowed parts of the Summer Bay Resort near Walt Disney World. The sinkhole was about 60 feet wide and 15 feet deep. Fortunately, those vacationing in the area were able to evacuate quickly as the building started to crumble and fall into the sinkhole. Another cause of subsidence is mining for coal and ore or the pumping of groundwater out of a certain geographic area. New Orleans and Mexico City are both sinking due to this latter activity. In contrast to subsidence, expansive soils may actually rise due to the presence of moisture in ground. This hazard is especially prevalent in locations that have clay soils. Although expansive soils are found most often in the south and west, they can be present in many parts of the United States. Expansive soils do not necessarily kill individuals, but they can create a large amount of property damage (especially to the foundations of buildings).

1.2.4 Hydrologic Hazards

Hydrologic hazards are hazard agents that emanate from the earth's water systems. There are four types of hydrologic hazards, one of them being floods. Floods are the most prevalent of any hazard—natural or otherwise. They are also among the most costly. Episodes of flooding occur when there is too much precipitation or where

Figure 1-4

This 45 foot-deep sinkhole formed in Monticello, FL, after Tropical Storm Debby produced excessive rains and flooding. David Fine/FEMA.

there is an inability for soil to absorb water that has fallen to the ground. Flooding can also result from melting snowpack, ice jams, and dam failures. Soil type, topography, and level of development have bearing on flooding. For instance, clay soils are more likely to produce runoff in comparison to sandy soils. Hills, valleys, and the use of cement in highly urbanized areas may also contribute to this type of hazard.

The 1993 great Midwestern flood is the most widespread and costly flood in U.S. history. Months of unusually wet weather and the seasonal snowmelt overwhelmed the Mississippi River Basin with water. Dykes, locks, and dams were eventually filled to capacity, and many of them were breached. The water emitted from broken levees only added to the flooding downstream. Thousands of people had to be evacuated and property losses totaled in the billions of dollars.

FOR EXAMPLE

The Sahel Drought and Famine

From 1961 to 1990, several countries in the Sahel region of Africa experienced a significant decrease in rainfall. This transition zone between the Sahara Desert to the north and the tropical area to the south became even more arid, causing a sharp decline in agricultural production in the area. The large nomadic population, coupled with the overgrazing of animals, could not be sustained by the vegetation of the area. By 1974, over $350 in relief assistance had been provided by the international community. Nonetheless, 5 million head of livestock died due to the drought conditions. The situation was particularly devastating in that an estimated 300,000 people perished from the famine.

Storm surges and coastal erosion may result from hurricanes or other types of phenomena (e.g., low-pressure systems, strong winds, high tides, etc.). A storm surge is a temporary rise in the water level of an ocean or river estuary. Flooding is a product of storm surges, and it can take days and weeks before water recedes after such events. Coastal erosion may also occur as a result of storm surges, and it often damages roads, bridges, dunes, and beaches. Florida is frequently affected by storm surges and coastal erosion associated with hurricanes. Losses can amount to millions of dollars.

Droughts are another kind of hydrologic hazard. Low amounts of rainfall and high evaporation rates due to warm or hot temperatures lead to conditions of drought. Drought can have a major negative impact on agricultural output, thereby contributing to widespread famine. The Great Depression was triggered, in part, by severe drought. However, droughts do not typically result in a shortage of the overall food supply in the United States (although the provision of individual crops may be extremely low). In contrast, famines in other countries can be especially deadly. The lack of adequate food intake has resulted in malnourishment and the spread of fatal diseases in Ethiopia in the 1980s and Niger in the mid-2000s. Dust storms, desertification, and salinization of soil also result from droughts.

1.2.5 Seismic and Volcanic Hazards

Seismic hazards are hazard agents produced by the movement of tectonic plates that float on magma. Earthquakes are seismic hazards occurring along fault lines where landmasses move apart, collide, or slide against each other laterally. Earthquakes produce waves that travel in and on top of the earth. These waves emanate from the geographic origin of the earthquake, known as a focal point. The location on the earth's crust directly above the focal point is the epicenter. Earthquake intensity is measured with the **Richter scale**, a measurement of the registered shaking amplitudes. In contrast, the **Mercalli scale** is used to describe the physical observation of damages that result from the movement of the earth's crust (e.g., broken windows, cracked walls, falling pictures, etc.).

Earthquakes occur in every part of the world, although their probability is highest in places such as the ring of fire (around the Pacific Rim). In the United States, there are major fault lines in California, Utah, Illinois, and South Carolina and in New England. Earthquakes have likewise taken place along the New Madrid fault (stretching from Arkansas to Missouri and Tennessee) and have changed the course of the Mississippi River in the past. Additional destructive slips in this area are projected to occur in the future. Earthquake faults along the Pacific Coast are very active and have destroyed gas and water lines, roads and bridges, and homes and other structures. The 1989 Loma Prieta and 1994 Northridge earthquakes killed scores of individuals. Tens of thousands and even hundreds of thousands have perished in earthquakes in Mexico City, Russia, India, Iran, and Haiti. Building codes have historically been weak in these countries, resulting in additional building collapses when earthquakes occur and the crushing of their inhabitants. In 2013, the Sichuan province in China was the epicenter of a major earthquake. The movement of tectonic plates coupled with poor construction took 200 people's lives.

Tsunamis may be associated with underwater landslides and asteroids that impact the oceans, but they result most often from earthquake hazards. If fault lines slip under the ocean, the accompanying seismic waves displace water, which races vertically and horizontally away from the focal point. When these waves reach land, they become amplified on the surface. The resulting harbor waves may appear in a series of waves that may travel hundreds of feet to a few miles inland. These waves move rapidly (as fast as 500 mph) and may reach one or two stories in height. They level many of the buildings and much of infrastructure that lies in their path.

Tsunamis result in drowning and may sweep their victims out to sea as they recede. Hawaii and the northwestern coast of the United States are prone to tsunamis. One tsunami struck Hilo, Hawaii, in 1946 and another affected Alaska in 1964. Several deaths resulted in each event. The most powerful tsunami in history occurred on January 4, 2005. The Sumatra earthquake registered over 7.0 on the Richter scale; it sent powerful tsunami waves to over 12 countries surrounding the Indian Ocean. Over 300,000 people died from this tragic event. Another major tsunami occurred after an earthquake struck Japan in 2011. The tsunami that was generated had waves reaching over a 100 feet in some locations. The Tohoku earthquake and tsunami also damaged the Fukushima nuclear power plant and caused the release of radioactive material into the air. Almost 16,000 people were killed as a result of these combined hazards. This event illustrates how complex some disasters can be.

Volcanic activity is another type of natural hazard and it is closely related to earthquakes and the movement of magma within the earth's crust. Magma may bubble up through fissures in the earth surface, creating a cone with a reservoir of lava. These mountainous craters may vent superheated gasses and emit lava flows down the side of the cone. Volcanic eruptions can be particularly deadly, as was the case with Mt. St. Helens in 1980 (Figure 1-5). A bulge developed over time on the north face of Mt. St. Helens and eventually the growing pressure gave way in a violent explosion. Tons and tons of soil, lava, and mud were sent down the side of the mountain and into the valley and rivers below. Fifty-seven people were killed in the incident, being vaporized immediately, buried under volcanic debris, or drowned in lahars (violent mudflows). Volcanic ash also rained down on communities around the volcano and even in nearby states. This made some vehicles inoperable and caused a cleanup nightmare. In addition, the logging industry in this area was severely disrupted for a period of time due to the Mt. St. Helens eruption. In the United States, volcanic activity is present mainly in the Northwest and Hawaii.

FOR EXAMPLE

Nevado Del Ruiz

In November 1985, the 17,716 feet Nevado del Ruiz volcano in Western Columbia erupted, emitting an ash cloud that rose over 45,000 feet in the air. Superheated lava poured out of the crater, melting the snowcapped volcanic cone. The ash, lava, and water turned into a river of mud (known as a lahar) that raced down the mountainside toward the valley floor. This liquid avalanche was as high as 50 feet and moved up to 30 mph. It buried the city of Armero. Buildings were demolished and carried down the river channel or covered with tons of volcanic debris. When all was said and done, at least 20,000 were dead or missing. This volcanic hazard triggered one of the worst disasters in Columbia's history.

Figure 1-5

This picture of Mt. St. Helens on May 18, 1980, illustrates the significant risk posed by volcanic eruptions. NOAA News Photo.

1.2.6 Wildfire Hazards

Wildfires are hazards that result from lightning strikes and they can quickly envelop hundreds of acres of forest and brush. However, humans may also play a role in the ignition of wildfires due to carelessness with matches, cigarettes, grills, and campfires. High temperatures, drought conditions, low humidity in the air, and strong winds can cause wildfires to spread rapidly. This has been the case in major forest fires in Yellowstone National Park and in numerous other forested areas around the country. Increasingly, such wildfires threaten people's settlements due to the urban–wildland interface. For instance, in October 2007, wildfires in Southern California were extremely devastating. Some of the fires were started by power lines that were damaged due to strong Santa Ana winds or by a truck that overturned (causing sparks). Others were ignited by an arsonist and a boy who was playing with matches. The extreme fire conditions at this particular time of year resulted in over 500,000 acres being scorched in counties from as far north as Santa Barbara all the way down to San Diego. The fires destroyed over 1,500 homes and required the evacuation of up to 950,000 people. In addition, over 12,000 people had to be sheltered at Qualcomm Stadium. Many roads had to be closed as a result of the fast-moving flames, and responders from CAL FIRE, the National Guard, and even Canada were called in to extinguish the fires. Both ground and air crews were needed to get the fires under control by November 6. Fortunately, on other occasions, wildfires fires may die out as a result of topographic conditions (e.g., a gulch or river), weather changes (e.g., rain), and the lack of fuel (e.g., scarcity of trees and undergrowth).

1.2.7 Biological Hazards

Biological hazards are agents that spread disease or are otherwise poisonous. Such hazards pose a grave threat to humankind, and millions of people have died by coming into contact with them. Biological hazards may be broken down into two categories: pathogens and toxins. **Pathogens** are organisms that spread disease and may include anthrax, smallpox, plague, hemorrhagic fever, and rickettsiae. **Toxins** are poisons created by plants and animals. Ricin and botulism are examples of such toxins. Toxins are not likely to kill many people at a time. However, pathogens are far more devastating. For instance, the 1918 Spanish influenza pandemic killed more people in the United States than had died in combat in World War I. When famines occur and people are malnourished, disease epidemics are especially likely. In recent years, there have been growing agricultural and public health concerns related to hoof and mouth disease, hantavirus, SARS, and West Nile virus. The avian "bird" flu has also been a serious concern in Asia, Europe, and Africa. These biological hazards have created many worries for public health officials, particularly in light of our highly transient populations and the ease of modern travel around the world. Much more needs to be done to prepare for biological hazards.

SELF-CHECK

- What is a natural hazard?
- What are the types of natural hazards?
- Are atmospheric and hydrological hazards related?
- How is a geological hazard different from a seismic hazard?
- What are the effects of biological hazards?

1.3 Technological Hazards

Technological hazards are hazard agents related to industry, nuclear materials, the built environment, computers, and transportation systems. These hazards abound in our modern, industrial world, and they range from hazardous materials releases and environmental degradation to structural failures and beyond.

1.3.1 Industrial Hazards

Industrial hazards are hazard agents produced by the extraction, creation, distribution, storage, use, and disposal of chemicals. Chlorine, benzene, insecticides, plastics, fuel, and other materials are released into the atmosphere when regulations are ignored, employees are untrained or careless, and equipment fails. Such materials in solid, liquid, or gas state may be toxic, flammable, explosive, or corrosive. They may react in very complex ways depending on temperature and the presence of water, oxygen, or other chemicals. The release of methyl isocyanate (MIC) in Bhopal, India, from the Union Carbide Company is regarded to be the most deadly industrial accidents in history. While the cause of this event has been under intense debate, it is believed that poor maintenance resulted in an accidental chemical release. Forty-five tons of gas was emitted into the city, killing anywhere between 2,500 and 10,000 people. While there is continued disagreement about the extent of fatalities and the cause of this hazard, the event had a profound impact on hazardous materials regulations in the United States and elsewhere. Unfortunately, industrial hazards continue to occur around the world. On October 4, 2010, a dike surrounding a sludge reservoir at the Hungarian Aluminum Production and Sales facility broke and released 1 million cubic meters of alkaline water and red sludge. It traveled down a creek and settled in three communities. The noxious flood killed 10 people, injured 286, and affected 358 homes (Ministry of the Interior, 2011). In 2013, a major industrial accident occurred in Texas (Figure 1-6). A stockpile of ammonium nitrate at the West Fertilizer Company exploded and killed 15 people, including many volunteer firefighters. Damage from the blast destroyed a school, a nursing home, and numerous homes and businesses in a 37-block area. The event prompted an investigation by the Chemical Safety Board and underscores the importance of land-use planning and emergency preparedness. Unfortunately,

Figure 1-6

The April 20, 2013, West Texas fertilizer plant explosion produced major damages, including to this apartment complex. Earl Armstrong/FEMA.

such events may not only result from mistakes; some may be intentional. There is always a potential that industrial hazards could be triggered by terrorists seeking to cause death and destruction.

1.3.2 Environmental Hazards

Careless industrial activity may have other negative effects. Pollution, degradation, and overuse of natural resources are types of ecological or environmental hazards. **Environmental hazards** are agents (such as pollution) that result in the degradation of our physical surroundings and pose a risk to people's health and well-being. Pollution involves the emission of wastes in the physical environment. This may include the distribution of solid, liquid, and gas wastes into landfills, rivers, and the atmosphere. Such activities harm the soil, contaminate water supplies, and poison the air. Pollution can also hinder farming and lead to health problems. It has also been suggested that the emission of pollutants into the atmosphere may add to global warming, although it should be noted that there is political controversy about the causes and consequences of climate change. In spite of this debate, alterations in climate would logically affect weather patterns and the nature of storms. For instance, flooding could become more severe and locations that had sufficient water in the past may later find themselves amid drought.

There are many other forms of degradation. One of the most salient environmental concerns is over fracking, which is a process of drilling into the earth and injecting a mixture of water, salt, sand, and other elements to obtain natural gas. While the search for cleaner fossil fuels is warranted, some believe chemicals injected into the soil may contaminate groundwater. Other types of environmental hazards include desertification and the salinization of the soil, which may accompany overfarming. This type of environmental hazard limits the production of agricultural goods and could lead to widespread famines in the future. While the depletion of natural resources is not always considered a primary issue for emergency management, the depletion of oil, gas, and coal would limit the heating of homes during the winter or the use of air conditioning during summer. This could put many lives in jeopardy, especially if renewable resources do not replace the fossil fuels we rely on currently.

1.3.3 Nuclear Hazards

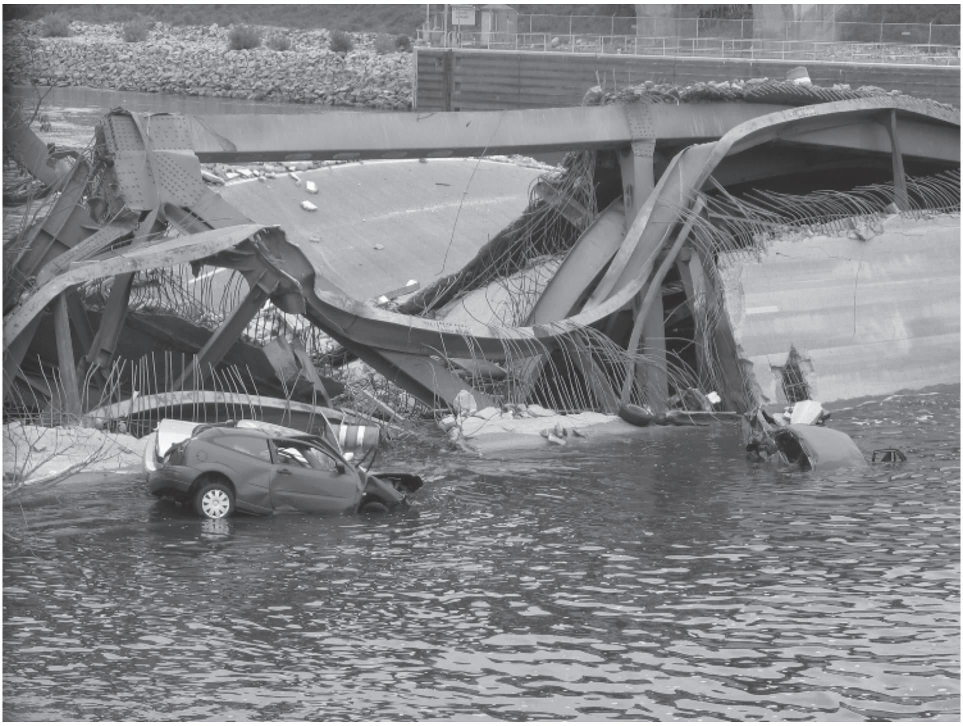
A **nuclear hazard** results from the presence and potential threat of radioactive material. Nuclear power plants provide electricity for communities, businesses, and individual citizens. Although these facilities produce nuclear wastes that must be disposed of, they pollute less than the power plants running off of coal. Although nuclear hazards are rare, they can be extremely disruptive. Nuclear power plants create health risks because radiation can injure or kill people if it is accidentally released into the environment. This potential was witnessed in 1979 at the Three Mile Island nuclear power plant in Harrisburg, Pennsylvania. Because of a leak in the equipment that purifies water entering the turbines, a backup system should have been activated. Unfortunately, an employee had shut this secondary system off during maintenance, which caused the system to overheat. A warning light did not illuminate as it should have and radioactive material was released into the containment building. In time, an employee noticed what was taking place and was able to close a valve to reverse the unfolding chain of events. No one was killed in the incident. However, the public became alarmed at the lack of information during the warning and evacuation process. This was not the case at the Chernobyl reactor in the former Soviet Union. After similar mistakes and mechanical failures, many of those responding to the hazard died and thousands had to be evacuated. Nearby areas are still somewhat dangerous today, and cancer has affected those that failed to leave as requested by the government.

1.3.4 Structural Collapse Hazards

The collapse of structures is another potentially deadly hazard. **Structural collapses** are hazards that occur when gravity and poor engineering interact and result in the failure of buildings, roads, or other construction projects. These collapses may include the breaking of dams and dykes or the crashing down of buildings. There have been numerous dam failures throughout the history of the United States, including those in Johnstown, Pennsylvania (1889); Buffalo Creek, West Virginia (1972); and Teton, Idaho (1976). The failure of dikes and retaining devices has also occurred in the 1993 Midwest floods and after Hurricane Katrina in New Orleans. Thousands of lives and large amounts of infrastructure have been lost due to such hazards.

Structural failures are not limited to water retaining devices alone however. Buildings, bridges, and parking garages have also suffered from improper use, poor engineering, and inadequate construction. One of the most notable structural hazards was the 1981 Hyatt Skywalk collapse. While a dance was being held in the hotel atrium, the suspended walkway broke loose due to the dynamic load of those dancing on it. The walkway fell to the floor and on top of those dancing below. The event killed over 100 people, injured twice that amount, and posed

Figure 1-7



The aftermath of the I-35W bridge collapse is seen in this picture from Minneapolis, MN. Todd Swain/FEMA.

extreme difficulties for those involved in search and rescue activities. Another structural failure occurred in August 2007 over the Mississippi River near Minneapolis. During rush hour traffic, the I-35W bridge suddenly gave way due to what is speculated as a design flaw. The bridge and cars plummeted to the river below. Nearly 150 people were injured and 13 were killed. In May 2013, a parking structure that was under construction collapsed at Montgomery Mall in Maryland. This event left one person dead and another injured. Structural failures are often fatal, and they are very costly too (Figure 1-7).

1.3.5 Computer Hazards

Advanced technology increases productivity and provides many other benefits to societies. However, modern computers have posed a technological hazard in the past and will continue to do so in the future. A **computer hazard** is a disruptive hazard associated with computer hardware and software. One example is the threat associated with Y2K. The system of recording dates created fears that anything run by computers would fail. This included potential nightmare scenarios relating to plane flight programs, public utility systems, and communications media. After conscientious efforts to change how dates were recorded in computer coding and prepare for any eventuality, the arrival of the new millennium came and went without any substantial disturbance. There have been several situations, however, where computers have been affected by freezing temperatures, floods, and fires. Such hazards shut down or disrupt power grids, traffic signals, communications capabilities, and online banking records. What is more, there is always a chance that a hacker will enter a supposedly secure website to steal information or cause mayhem. Businesses have had corporate information stolen and the Department of Defense firewalls have been breached. Hackers can therefore shut down or manipulate computer systems. For instance, people in other countries have interfered with 911 communication centers in the United States. Because of the knowledge and skills of today's hackers, cyberterrorism is a growing concern for the government and businesses alike.

1.3.6 Transportation Hazards

Because of the ease of moving people, goods, and services around the world, we are faced with several transportation hazards. A **transportation hazard** is an accident that occurs on roads or railways, at sea, or in the air. Such incidents may result from adverse meteorological circumstances, human error, or mechanical failure. For example, there may be mass vehicle accidents owing to fog or wet and wintery weather. At other times, tired or careless drivers may overturn their tankers, which carry hazardous materials and force the evacuation of neighborhoods and portions of cities. Train derailments are also common and may result from reckless young drivers trying to beat the safety gates, animals grazing on the tracks, and the expansion or contraction of rails due to heat and freezing temperatures. In July 2013, the conductor of a train in Spain was talking on a cell phone and failed to slow down as necessary for an approaching curve. The wreck claimed the lives of 79 people. Train derailments can also emit hazardous materials into the environment and create a cleanup nightmare for rail companies and surrounding communities.

Instances of cruise ships and ferries sinking, vessels crashing into docks, or oil tankers hitting jagged rocks and puncturing their hulls are transportation hazards that have occurred in the past and in more recent years too. Almost everyone is aware of the sinking of the Titanic, which killed over 1500 people in 1912. The event illustrated the impact of careless navigation, the danger posed by icebergs, and the need for sufficient lifeboats on ships. Unfortunately, there have been many other examples of shipping accidents at sea. In January of 2012, the captain of the Costa Concordia deviated from the designated route in the Mediterranean Sea and struck rocks. The Italian cruise liner sunk and 32 people died as a result. The sinking of ferries is also common in places like India or the Philippines, where they are often overloaded with people and supplies. On other occasions, captains have lost control of ships in harbors in New York and Canada. One of the most notorious incidents was the 2003 Staten Island Ferry crash. The vessel ran into a concrete pier, killing 11 people and injuring over 70. In some cases, extreme environmental damage may result from shipping accidents. The most notable transportation-related oil spill in U.S. history occurred on March 24, 1989, in Prince William Sound, Alaska. When the Exxon Valdez ran aground, more than 240,000 barrels of oil were deposited into the seawater, polluting the beach and killing thousands of animals.

FOR EXAMPLE

Ferry Sinking in Bangladesh

In July 2003, a ferry traveling to the southeast from the capital of Dhaka sank. The vessel encountered turbulent waters where two rivers merge. The boat, carrying between 500 and 800 people, capsized and quickly took on water. About half of those on the ship were rescued by fishermen or managed to swim to shore about 75 yards away. The overcrowded ferry and strong currents produced one of the deadliest transportation disasters in Bangladesh ever.

Wreckage from the Asiana Airlines Boeing 777 that crashed on July 6, 2013 while landing at San Francisco International Airport.

Airplane crashes are surprisingly less frequent than most other types of transportation accidents, but they may happen when pilots overshoot runways, when wind shear occurs, when runways are icy or wet, and when planes are not meticulously engineered and maintained. Plane crashes can be particularly devastating. In many cases, all passengers onboard will be killed. In November 2001, an Airbus A300-600 broke apart over Queens, New York, due to problems associated with the stress placed on the vertical stabilizer. Each of the 260 passengers and crewmembers died, and much of the fuselage landed in a neighborhood, which only added to the adverse consequences. In other cases, passengers may be fortunate to survive plane crashes. A Boeing 777 originating from South Korea crashed on July 6, 2013, at the San Francisco International Airport when it hit the seawall just short of the runway. The pilot was not sufficiently trained on the aircraft he was flying, and the guidance system was disabled at the airport at the time. While there were only 3 fatalities, nearly 200 people were injured. It is certainly amazing the outcome was not more severe.

SELF-CHECK

- What is a technological hazard?
- What are the types of technological hazards?
- Why do technological hazards occur?
- How does industry and commerce influence hazards?
- What can be done to better prevent or deal with technological disasters?

1.4 Civil/Conflict Hazards

There are several types of **civil/conflict hazards**. Mass shootings, panic behavior, riots, terrorism, and war fall into this category. Each will be discussed in the following.

1.4.1 Mass Shootings

Mass shootings are one example of civil/conflict hazards. Unfortunately, it appears that these events have become more common in past years. The list of shootings at schools and other locations since the late 1990s is disturbing:

- Pearl, Mississippi (1997)—3 killed
- Paducah, Kentucky (1997)—3 killed
- Jonesborough, Arkansas (1998)—5 killed
- Springfield, Oregon (1998)—5 killed
- Conyers, Georgia (1999)—4 wounded
- Atlanta, Georgia (1999)—9 killed
- Pelham, Alabama (1999)—3 killed

Other events have been especially devastating. On April 20, 1999, two disgruntled students entered Columbine High School in Jefferson County, Colorado. Besides detonating several bombs in and around this educational facility, the students fired into the crowded cafeteria and library areas. By the time the perpetrators committed suicide, 12 students and 1 teacher were killed and 24

FOR EXAMPLE

Recent Mass Shootings

On December 14, 2012, a horrific school shooting took place in Connecticut at Sandy Hook Elementary. Twenty children and six adults were murdered by a 20-year-old gunman. Those that survived the mass shooting and some emergency personnel that rushed to the scene to help have had an extremely difficult time coping with this traumatic event. On July 20, 2012, a similar crisis occurred inside a movie theater in Aurora, Colorado. A gunman used multiple weapons of weapons to attack his victims, ultimately killing 12 people and wounding over 50 others. On September 16, 2013, a man who was discharged from the military entered a Navy facility at a Washington Navy Yard. He opened fire, killing 12 and injuring several others. Each of these events has prompted additional discussion about gun control and mental health issues. They have also created a need for better prepared police officers, emergency medical technicians, and emergency management offices.

others were injured. The incident prompted a national review of how to respond to mass shootings, and the lessons gleaned have had a major impact on law enforcement policies and procedures. On September 15, 1999, a gunman walked into youth rally and discharged to weapons into the congregation at a church in Fort Worth, Texas. Seven people were killed. Numerous others were injured and had to be quickly taken to area hospitals. In October of 2002, there were several sniper shootings that occurred over a period of several weeks at numerous locations in Maryland, Virginia, and Washington, DC. One man and one minor were responsible for killing 10 people and injuring 3 others. These serial murderers prompted a massive investigation and illustrated the difficulty of capturing those involved in such episodes of violence.

1.4.2 Panic Flight

Panic flight, or the fleeing of many individuals from what appears to be imminent harm, is extremely rare. However, it has led to major emergencies under certain situations. Panic flight is most likely to occur when large crowds gather at concerts, sporting venues, and other large public gatherings. An example took place on February 20, 2003, in West Warwick, Rhode Island. The rock band Great White was performing at a nightclub. The road manager used pyrotechnics inside the building, causing the ceiling to catch on fire. As the fire spread quickly, the occupants headed for the doors. Because most people exited the same way they entered the building, a bottleneck ensued and many were trampled or became stuck. Around 100 people died in the blaze and over 187 were injured. The fire led to a drawn-out debate about who was legally liable. Was it the fault of the city inspectors, the building owner, or band manager? The tragedy also prompted a review of fire exits and sprinkler systems around the nation. Such events have occurred in countries around the world. In 2005, 841 people were killed and another 323 were injured while attending a religious gathering at a mosque in Baghdad.

FOR EXAMPLE

The Kiss Nightclub Fire

In January 2013, flames ignited the Kiss nightclub in Santa Maria, Brazil, after band members lit a flare on stage. In an effort to escape the fire, a human stampede resulted. More than 200 people were unable to evacuate and died as a result of smoke inhalation. Another 150 were injured due to the rush of people trying to leave the burning nightclub. This fire was one of the worst emergencies in Brazil's history. It illustrated the dangers of panic flight, overcapacity in the nightclub, and insufficient signage for emergency exits.

Someone reported the presence of a suicide bomber, and people began to evacuate the building and area. Hundreds of people stampeded toward a bridge, which broke and fell into the Tigris River. Many people were killed or injured as a result. Panic flight does not occur very often, but it can turn deadly as these cases suggest.

1.4.3 Riots

Riots are another type of civil/conflict hazards. **Riots** are large disturbances where people engage in antisocial behavior. This conduct includes rock throwing, looting, tipping over vehicles, starting fires, and attacking law enforcement personnel. Social protesters and their opponents sometimes spark riots (perhaps because of political or economic circumstances). They can also result from racial tensions or cultural conflict. Other factors, such as the loss of a team in the Super Bowl, may also trigger riots. Whatever the cause, these events can disrupt business activities and hurt the economy. They may also produce a large number of injuries and even death.

There have been several notable riots in the United States, including the Watts Riot in Los Angeles in 1965. This episode began when an officer pulled over an African-American man who was alleged to have been driving erratically. In another racially charged situation, four police officers appeared to have used excessive force against Rodney King in Sylmar, California. The incident was caught on tape, but the police officers were not convicted of any crime. Many people believed that the police beating was unnecessary and brutal. Others believed the legal system was biased when the verdict was made public. On April 29, 1992, scores of people took to the streets to illustrate their dismay. Fifty people were killed, hundreds were injured, and thousands were arrested. Damage was in the millions of dollars. Another riot occurred in Seattle in 1999 when environmentalists and others protested the policies of the World Trade Organization. During a 4-day period, people marched, broke windows, disabled busses, and heckled police. Law enforcement agencies in Seattle were not fully prepared. They were caught off guard by the demonstration that turned violent. This was not the case after the George Zimmerman trial in 2013. The police in Florida and around the nation prepared for potential riots due to the death of a young black man, and fortunately, the resulting protests were limited in number and were generally peaceful.

1.4.4 Terrorism

Terrorism has been one of the most deadly civil/conflict hazards throughout history, and it has become even more pronounced in the past few years. **Terrorism** is the threat or use of violence to intimidate someone or a government. The perpetrators usually have ideological motives and a political objective to reach. For instance, terrorists engage in this behavior to seek independence, promote their religion, protest abortions, or protect the environment. Terrorists have used guns, arson, bombings, and other measures to kill and disrupt the activities of others. Their attacks have occurred around the world. Suicide bombings are common in the Middle East, particularly in Israel. Other major attacks have occurred in Spain, Germany, Russia, the United Kingdom, Iraq, Afghanistan, and Kenya.

The worst case of terrorism in the United States was on September 11, 2001. Islamic extremists hijacked four planes and used them as missiles against buildings symbolic of U.S. political, military, and economic interests. The World Trade Centers were the main targets of the planes. The towers collapsed after the ignited jet fuel weakened the structure. Thousands of people died and several buildings in New York were turned into a pile of broken glass, twisted metal, and other dangerous and unhealthy debris. The Pentagon was also struck during the attack, but few people died in this building than in the World Trade Centers in New York. One plane was crashed in Pennsylvania, and it is assumed that this aircraft was headed to the White House or Capitol Hill.

Terrorists are also seeking other novel ways to attack their enemies, including through the use of weapons of mass destruction (e.g., nerve, blister, blood, and choking and incapacitating agents). Shortly after 9/11, for example, envelopes containing anthrax were sent via mail to the headquarters of a newspaper in Florida and to Congressional leaders in Washington, DC. This attack disabled the postal service for days and killed a handful of people. In April 2013, a woman from East Texas sent an envelope containing ricin to President Obama. The individuals involved in these incidents were identified. The first person committed suicide and the other has been imprisoned for her actions.

FOR EXAMPLE

Manchester Bombing

In June 1996, terrorists parked a vehicle near a major intersection in the commercial district of Manchester, England. A local television station received word that a bomb would be detonated. A bomb squad was brought in, but team was not able to dismantle the explosives. However, the city was able to evacuate 80,000 people from the area. No one died in the attack, but it did injure over 200 people who were cut by glass, impaled by objects, or otherwise affected by the blast. Several buildings were damaged or destroyed, and many businesses and apartment dwellers lost office space or residences. This intentional disaster cost millions of dollars in direct and indirect losses. It prompted a major emergency response and criminal investigation.

A significant terrorist attack involved the use of sarin gas by the Aum Shinrikyo cult in Japan. This event, which occurred in a subway, killed several people. It also created massive medical care needs—whether real or imagined—for thousands of others. It illustrated the grave potential of biological, chemical, and nuclear weapons. The rising threat of terrorism has prompted a significant reorganization of the U.S. government and the establishment of the Department of Homeland Security. Billions of dollars have been poured into first responder training and public health preparedness measures as a result.

1.4.5 War

Conflict has occurred throughout history between different tribes, ethnic groups, and nation-states. With the advent of modern weaponry, however, the stakes of fighting have become much higher. Millions of people are killed when negotiations break down and violence ensues. Cities have also been leveled. Such was the case in World War II when London, Dresden, Hiroshima, and Nagasaki were bombed with conventional or nuclear explosives. Shortly thereafter and during the Cold War, the fear of a nuclear attack from the Soviet Union prompted the United States to invest heavily in civil defense initiatives. The goal was to prepare for such an attack, stockpile supplies, and evacuate and shelter citizens if required. Perhaps there is less interstate conflict today as compared to the past, but there are certainly notable exceptions. For instance, the United States intervened in Iraq to push back Saddam Hussein, and it also deposed the Taliban in Afghanistan. However, there is also the potential for major conflict in the Middle East due to ongoing tensions between Israel and its enemies or Iran and the United States. What is more, there has been a great deal of intrastate fighting as in places such as Somalia, Yugoslavia, Rwanda, Libya, and Syria. These internal civil wars are known as "complex emergencies." They typically involve ethnic cleansing, a failed government, and economic turmoil that are sometimes combined with natural and environmental disasters and especially famines. Those responding to such events have been targeted by the warring factions. For example, relief workers in Iraq have been kidnapped and killed by the belligerent parties.

SELF-CHECK

- What is a civil/conflict hazard?
- What are the types of civil/conflict hazards?
- What is the role of humans in civil/conflict hazards?
- How is each type of civil/conflict hazard related to the other? Are they different? If so, how?

1.5 The Complexity and Impact of Disasters

Although it is useful to classify hazards in order to understand their unique features, it is also important for you to recognize that hazards are not mutually exclusive. In other words, each hazard may interact with others in convoluted and perhaps even unpredictable ways. Also, human vulnerability tends to complicate and exacerbate the impact of triggering agents. The examples are numerous:

- An earthquake may break a dam, cause a building collapse, and produce landslides.
- Degradation of the environment (e.g., deforestation) could exacerbate flash flooding and mudslides that are related to severe storms.
- Flooding and poor health conditions could lead to the spread of certain communicable diseases.
- Computer mishaps or cyberterrorism might lead to hazardous materials releases or infrastructure failures.

FOR EXAMPLE

Hurricane Katrina

Hurricane Katrina will long be remembered as a complex disaster. In September 2005, Hurricane Katrina—a category four storm—slammed into the coast of Louisiana, Mississippi, and Alabama. Each of these states suffered severe losses. However, it was New Orleans that gained national and international attention. The winds of the hurricane damaged structures in the "Big Easy" and affected power and phone service. Nevertheless, the storm surge and heavy rains were most problematic. Lake Pontchartrain rose to historic levels and the levees set up to keep the waters from inundating the below-sea-level community were breached. New Orleans was flooded. Water, sewer, and gas lines were broken. The contents of numerous petroleum and hazardous chemical tanks were released. Homes and businesses were under water. Making matters worse, antisocial behaviors including looting and fights were reported around the city. The local, state, and federal response was slow and inadequate. The reaction was also hampered further when criminals began firing weapons at rescue helicopters and relief workers. Many evacuees sought shelter in the superdome where supplies were inadequate and conditions were filthy. Behavior was beginning to turn violent among some disaster victims about the time federal aid arrived at the superdome. The delivery of assistance was delayed because flooding severely affected the transportation system. Public health workers feared an outbreak of disease due to the squalid living conditions and requested an evacuation of the city. Katrina involved natural, environmental, biological, technological, and civil hazards. It was complicated by poor planning before the hurricane and insufficient communication during response and recovery operations (Figure 1-8).

Figure 1-8

This picture of boats impacting infrastructure illustrates why Hurricane Katrina was one of the most complex disasters to affect the United States. Robert Kaufmann/FEMA.

- ▲ A train derailment could result in the spill of dangerous chemicals and harm the natural habitat.
- ▲ Those participating in riots often set fire to nearby structures, which may trigger panic flight behavior.
- ▲ The failure of individuals and organizations to adequately plan and prepare for disasters often complicates response and recovery operations and aggravates disaster impacts.

As an emergency manager, you must appreciate the complex nature of hazards and vulnerability as it can have serious impact upon response and recovery operations. In most cases, you will be responding to multiple hazards and vulnerabilities in any given disaster. This creates serious challenges that you must be ready to deal with at a moment's notice.

1.5.1 The Nature of Disasters

As mentioned earlier, when a hazard or multiple hazards interact with humans and the vulnerability they create, disasters occur. People may be injured or killed as a result of these destructive events, and the impact is significant. From 2001 to 2012, natural disasters killed 1.9 million people worldwide and affected another 2.9 billion (UNISDR, 2013). Deaths are also significant in the United States. For instance, "it is estimated that natural hazards killed over 24,000 people between January 1, 1975 and December 31, 1994" (Mileti, 1999, p. 66). These statistics were collected from fires, flooding, or other hazards, although these numbers do not include the toll of disease outbreaks, which are also substantial. The number of injuries from disasters should not be overlooked either, as it averages about 100 per week in the United States (Mileti, 1999, p. 66). Such injuries may include superficial cuts from flying glass in a tornado or serious internal wounds due to the collapse of a building after an earthquake.

Property is likewise damaged or destroyed in disasters, costing billions of dollars each year. Homes and belongings can be covered by landslides, fishing vessels are sunk in hurricanes, and businesses are flattened by strong winds. Furniture, clothing, televisions, and cars are ruined in disasters. Losses average about $1 billion per week in the United States, and these figures are rising exponentially each decade (Mileti, 1999, p. 66). Hazardous materials spills, nuclear accidents, and other events can likewise degrade the natural environment, thereby affecting the health and well-being of people beyond the current generation.

Disasters also disrupt individuals and society as a whole. Routine activities such as cooking, sleeping, and bathing may be hindered due to the damages of one's appliances, bed, or home. Jobs are also lost, business transactions are prohibited, and traffic is snarled when hazards impact corporations and transportation systems. Disasters are also accompanied by building collapses, road closures, and downed power and phone lines. The infrastructure is often severely impacted. Simple tasks such as mailing a letter or having your trash hauled away cannot be performed because the government is also adversely affected. Disasters, including terrorist attacks, cause economic decline and can sometimes jeopardize mental health. Disasters of all types have even led to political turmoil at times and have changed the direction of policy in the United States (e.g., the creation of the Department of Homeland Security after 9/11). There is no doubt that disasters have a bearing upon taxes, insurance rates, and many other aspects of our lives.

1.5.2 Changes Associated with Disasters

During the immediate emergency period of a disaster, several significant changes occur that complicate the job of an emergency manager. Dynes et al. (1972), three well-known disaster scholars, have identified six of them:

1. **Uncertainty**. In the immediate aftermath of disaster, there is a lack of information about what has happened, why it occurred, the number of injured or dead, the extent of the devastation, and what should be done to deal with these problems.
2. **Urgency**. Seeing needs arise, most citizens and leaders desire to act quickly to issue warnings, treat injuries, and clear roads of debris as quickly as possible.
3. **Emergency consensus**. Individuals, groups, businesses, government departments, and political leaders generally work together (at least in the immediate aftermath of a disaster) to overcome problems.

4. **Expansion of citizen role**. People are not only more willing to cooperate in a disaster, but they are also likely to be involved in searching for neighbors trapped under debris, transporting the wounded to hospitals, and providing relief supplies to charitable organizations.
5. **De-emphasis of contractual relationships**. Because victims' needs must be met as soon as possible, written agreements are not relied upon. Verbal arrangements are made instead. Accounts and debts are settled when the situation calms down. It is also likely that supplies will be donated with no thought of reimbursement.
6. **Convergence**. People and material resources will flow to the scene of a disaster. This may include evacuees returning to the location and those wanting information about victims. It may also include volunteers, reporters, and researchers, people wanting to take advantage of the situation, groups cheering on the emergency workers, and others mourning those who have died in the event (Kendra and Wachtendorf, 2003c).

These changes can have a dramatic impact on those involved in the management of disasters. Decision making becomes difficult and postdisaster operations are stressful. Poor communications in disasters complicate the sharing of information. Many agencies and volunteers help to get things done quickly, but the arrival of too many organizations and donations can add to the overwhelming nature of disaster. Resources may be available, but they may not be shipped or tracked in an effective manner. Later on, blame may be placed on those considered to be at fault. Disagreements might arise about recovery policies, particularly in regard to disaster assistance and rebuilding priorities. Some of the changes that take place after a disaster have positive features while others are negative. In most cases, the changes resulting from disasters will provide benefits and drawbacks for those working in emergency management and related professions. For instance, more political and financial support may be given to emergency management after a disaster. However, disasters may require long hours for those working in this important endeavor.

1.5.3 The Need for Response and Recovery Operations

Besides understanding the consequences of disasters, you must be aware of the goals of response and recovery operations if you are to be an efficacious emergency manager. Such objectives include protecting lives, limiting property loss, and overcoming the disruption that disasters cause. There are other aspirations that must be considered as well. For instance, you must ensure care for special populations such as those in nursing homes. You must work to coordinate the efforts of all types of disaster participants, regardless if they are affiliated with the government or not. Another desire is to reduce further deterioration of the environment when a disaster occurs and rebuild with future hazards in mind. You may rely on both predetermined organizational arrangements and technology to complete these responsibilities. In most disasters, multiple activities will require your active attention and flexibility. Resources should be tracked to help cover expenses. Extreme care should be taken to avoid possible lawsuits. It will be important to record what has transpired so you can learn from your successes and shortcomings.

Your job during response and recovery operations is therefore extremely challenging. There are many demands that have to be addressed, and two of them have been identified by Ronald Perry (1991, p. 201):

- **Agent-generated demands** are the needs made evident by the hazard (e.g., problems resulting from the disaster agent itself). These demands appear immediately as the disaster unfolds, and some examples include sandbags to fight flooding, shelters to care for those made homeless, and the restoration of electricity owing to power outages.
- **Response-generated demands** are the needs that are made evident as individuals, organizations, and communities attempt to meet agent-generated demands. They are visible as people and agencies try to deal with the impact of flooding, earthquakes, and other hazards.

Acquiring sandbags, finding suitable shelter sites, and obtaining portable generators or electricians are examples of response-generated demands. Response-generated demands thus deal with the logistical issues pertaining to the reaction of people and organizations to agent-generated demands (Figure 1-9).

In addition to these demands, you should recognize that there will be other expectations placed upon you after a disaster:

- **Normalcy-generated demands** are the pressures to quickly get things back to predisaster conditions. Returning people to their homes and restarting business activity are types of normalcy-generated demands.

Figure 1-9

The damage of electricity infrastructure (an agent-generated demand) in Crystal Beach, TX, after Hurricane Ike created the need to replace power poles (a response-generated demand). Greg Henshall/FEMA.

- **Mitigation-generated demands** are the desires to prevent a recurrence of the disaster. Creating more stringent building codes and relocating residences to less-hazardous areas are examples of mitigation-generated demands.
- **Preparedness-generated demands** are expectations that the mistakes made evident in response and recovery operations will not be repeated in the future. Improvements in planning, training, exercises, and the allocation of additional resources fall into this category.

All of these disaster-related demands create priority problems for emergency managers. Normalcy-generated demands sometimes run in opposition to the mitigation- and preparedness-generated demands. As an example, people want to return to their homes even when it would be best to remove them permanently from the floodplain. Government officials may also desire to give attention to rebuilding schools rather than invest in emergency management personnel or planning activities. In spite of these conflicts, you must take advantage of the increased public concern disasters provide to promote change during response and recovery. All of these goals and functional activities are directed toward the goal of disaster resilience. **Resilience** may be described as the ability to react effectively and efficiently in time of disaster. It is the overarching goal of the remainder of this book.

SELF-CHECK

- Do hazards interact with each other?
- What do we call hazards that occur in conjunction with other hazards?
- How are disasters different from hazards?
- What changes occur in society after a disaster?
- Why are response and recovery operations needed?
- What demands do emergency managers face after a disaster?

SUMMARY

As an emergency manager, you should be aware of important concepts such as hazards, vulnerability disasters, emergency management, disaster response and recovery, and resilience. You must understand what types of hazards may occur including their natural, technological, and civil/conflict variants. It is also imperative that you comprehend how hazards interact with each other and vulnerability and how a myriad of variables may determine the impact of disasters. Successful emergency managers should know what changes to expect when a disaster occurs. They must effectively meet the demands that confront them and deal with the aftermath of a disaster in a successful manner.

KEY TERMS

Agent-generated demands	The needs made evident by the hazard (e.g., problems resulting from the disaster agent itself).
Atmospheric hazards	A hazard agent that is produced in or by the earth's atmosphere.
Biological hazards	Agents that spread disease or are otherwise poisonous.
Civil/conflict hazards	Violent events that have the potential to produce mass casualties.
Compound hazards	Multiple hazards that react to each other in chaotic fashion.
Computer hazards	A disruptive hazard associated with computer hardware and software.
Disasters	Deadly, destructive, and disruptive events that occur when a hazard (or multiple hazards) interacts with human vulnerability.
Emergency management	From an academic standpoint, "the study of how humans and their institutions deal with hazards, vulnerabilities and the events that result from their interaction." From a practical perspective, "the managerial function charged with creating the framework within which communities reduce vulnerability to hazards and cope with disasters."
Emergency managers	Public servants that help jurisdictions reduce the liabilities that lead to disasters. They also help built community disaster capabilities.
Enhanced Fujita Scale	A scale used to categorize the size of a tornado, including the affiliated wind speed.
Environmental hazards	Agents that involve the degradation of the environment, such as pollution, that pose a risk to people's health and well-being.
First responders	Public safety personnel such as police, firefighters, and emergency medical technicians.
Geological hazards	Hazard agents associated with the earth's soil and rock.
Hazard	A physical, technological, or intentional agent such as an earthquake, industrial explosion, or terrorist bombing.
Heat index	Incorporates both temperature and humidity into a scale to help warn people to stay inside and drink lots of water.

Homeland security	"A concerted national effort to prevent terrorist attacks within the United States, reduce America's vulnerability to terrorism, and recover from and minimize the damage of attacks that do occur."
Hydrologic hazards	Hazard agents that occur with the earth's water systems.
Industrial hazards	Hazards produced by the extraction, creation, distribution, storage, use, and disposal of chemicals.
Mercalli scale	A scale used to describe the physical observation of damages that result from the movement of the earth's crust (e.g., broken windows, cracked walls, falling pictures, etc.)
Mitigation	Risk reduction, loss minimization, or the alleviation of potential negative impacts associated with disasters.
Mitigation-generated demands	The desire to learn from the disaster and avoid making similar mistakes in the future.
Na-tech hazards	A combination of natural–technological hazards.
Natural hazards	Those events originating from the physical environment, typically because of radiation from the sun, heat flow within the earth, or the force of gravity.
Normalcy-generated demands	The pressures to get things back to predisaster conditions.
Nuclear hazards	A hazard resulting from the presence of radioactive material.
Pathogens	Organisms that spread disease and may include anthrax, smallpox, plague, hemorrhagic fever, and rickettsiae.
Preparedness	Efforts to increase readiness for disaster response and recovery operations.
Preparedness-generated demands	Expectations that the mistakes made evident in response and recovery will not be repeated in the future. Improvements in planning and the allocation of additional resources fall into this category.
Prevention	Refers to actions to stop the occurrence of terrorist attacks and includes the gathering of intelligence, counterterrorism operations, and border control functions.
Protection	Refers to actions that discourage attacks through increased security measures or efforts

	to minimize damage if such attacks cannot be prevented in the first place. The reliance on guards, fences, video surveillance, and access control falls into this category.
Recovery	Activity to return the affected community to predisaster or, preferably, improved conditions.
Richter scale	A measurement of the registered shaking amplitudes of an earthquake.
Resilience	The ability to react effectively and efficiently in time of disaster.
Response	Activity in the immediate aftermath of a disaster to protect life and property.
Response-generated demands	The needs that are made evident as individuals, organizations, and communities attempt to meet agent-generated demands.
Riots	Large disturbances where people engage in antisocial behavior.
Saffir–Simpson scale I	A descriptive tool to explain the magnitude of a hurricane in terms of wind and storm surge.
Seismic hazards	Hazard agents produced by the movement of tectonic plates that float on magma.
Structural collapse hazards	Hazards that occur when gravity and poor engineering result in the failure of buildings, roads, or other construction projects.
Technological hazards	Hazard agents related to industry, structures, hazardous materials, computers, and transportation systems.
Terrorism	The threat or use of violence to intimidate someone or a government.
Toxins	Poisons created by plants and animals.
Transportation hazards	An accident that occurs in the air, on roads or railways, or at sea.
Vulnerability	Proneness to disasters or the inability of individuals, organizations, and communities to prevent them or deal with them effectively.
Wildfire hazards	Hazards that result from lightning strikes, which can quickly envelop hundreds of acres of forest and brush.

ASSESS YOUR UNDERSTANDING

Posttest to evaluate your knowledge on hazards and disasters.
Measure your learning by comparing pretest and posttest results.

Summary Questions

1. A crisis is a much bigger problem than a catastrophe. True or false?
2. A disaster occurs when a hazard interacts with human vulnerability. True or false?
3. Emergency management is a profession that attempts to reduce the probability of disasters and be prepared to respond and recover effectively if they cannot be prevented. True or false?
4. There is no relation or overlap between response and recovery operations. True or false?
5. An earthquake is an example of a geological hazard. True or false?
6. Mass shootings and riots are civil/conflict hazards. True or false?
7. Disasters are not characterized by the disruption they cause to people's daily, routine activities. True or false?
8. A normalcy-generated demand is a desire to prevent the recurrence of a disaster. True or false?
9. Resilience is concerned about the effectiveness of emergency management, but not the efficiency of response and recovery operations. True or false?
10. A disaster is:
    - **(a)** Smaller than an accident
    - **(b)** Smaller than a crisis
    - **(c)** Larger than an emergency
    - **(d)** Larger than a calamity
    - **(e)** Larger than a catastrophe
11. A winter storm is an example of:
    - **(a)** A natural hazard
    - **(b)** A technological hazard
    - **(c)** A civil/conflict hazard
    - **(d)** All of the above
    - **(e)** None of the above
12. Tornadoes may be classified as:
    - **(a)** An atmospheric hazard
    - **(b)** A hydrologic hazard
    - **(c)** A biological hazard
    - **(d)** A civil/conflict hazard
    - **(e)** None of the above

13. Disasters are complex because:
    - **(a)** One hazard may trigger another hazard.
    - **(b)** A hazard interacts with human vulnerability.
    - **(c)** Low preparedness levels may exacerbate impact.
    - **(d)** Answers a and b.
    - **(e)** Answers a, b, and c.
14. Uncertainty:
    - **(a)** Is defined as an urgent situation
    - **(b)** Results from an expansion of the citizen role
    - **(c)** Is associated with a lack of information
    - **(d)** Is equated to a de-emphasis of contractual relationships
    - **(e)** Answers a and b

Review Questions

1. Explain the difference between an accident and a catastrophe.
2. Define the term disaster and note its relation to hazards and vulnerability.
3. What is an emergency manager and what does he or she do?
4. What are the four phases or functional areas of emergency management? How do these relate to homeland security?
5. List the major categories of hazards.
6. Provide one or two examples of hazards under each category identified in question 5.
7. What are the major changes an emergency manager can expect after a disaster?
8. What are the goals of disaster response and recovery?
9. What is an agent-generated demand?
10. What is a response-generated demand?
11. What is a normalcy-generated demand?
12. What is a mitigation-generated demand?
13. What is a preparedness-generated demand?
14. What is resilience?

Applying This Chapter

1. After responding to a major apartment fire in Boise, Idaho, you become aware of the fact that a sprinkler system would have prevented much of the damage. How can you link recovery activities to the goals of mitigation?
2. Suppose you are expecting the arrival of a hurricane in Charleston, South Carolina. What hazards might be present along the coast, and how would they interact with each other? Give two examples.

3. A terrorist has just blown up a courthouse in Seattle, Washington. What changes might occur when this takes place? What can you as an emergency manager do to effectively deal with the unique challenges associated with such a disaster?
4. The mayor and city manager in Birmingham, Alabama, are questioning you about the value of your position in the government. Explain what types of disasters could occur in your city and justify the need for response and recovery operations.
5. A flood has destroyed many homes and businesses in Greenville, Mississippi. How can you help your community recovery from disaster while also promoting the necessary changes to prevent a recurrence in the future?
6. As an emergency manager, you are frequently invited to speak to various organizations in your community. While discussing the goals of response and recovery to a group of Boy Scouts, one of those in attendance asks, “What is resilience?” How would you define it to the young man and explain why it is necessary to pursue after disaster strikes?

YOU TRY IT

How Can I Get Information About Hazards?

Answer the following questions by providing a list of organizations and their contact information. If you wanted information about hurricanes, who could you contact? If you needed details about the impacts of earthquakes, who could assist you? If you need to learn more about volcanic hazards, what government agency could assist you? If you needed to understand tornadoes better, who could answer your questions? What if you needed to better comprehend hazardous materials incidents? Who could provide such information? What about terrorism? Who could help you understand terrorist behavior better?

What Would I Do?

Suppose your community was affected by a tornado. What are the possible consequences of this hazard if it interacts with human vulnerability? What would you need to do to respond? What considerations should be taken into account for recovery?

The Interaction of Hazards

You are the emergency manager for New Orleans. Hurricane Katrina has just struck your community. What are the hazards? Are the hazards related? If so, how? What are the implications of compound or na-tech hazards?

Disasters and Change

Disasters result in a great deal of change. What are some of the changes you can expect? Are these good or bad? How would they impact your job as an emergency manager? Why is it important to be aware of them?

Meeting Demands

What are the agent-generated demands, response-generated demands, normalcy-generated demands, mitigation-generated demands, and preparedness-generated demands? Make a list of the demands placed on you and categorize them. How do these impact your job as an emergency manager? Do they present difficulties for you? How could you overcome them?