Unit

1

INTRODUCTION TO MITIGATION
THE CASE FOR MITIGATION

INTRODUCTION

This unit establishes WHY mitigation must be an essential component of the goals and plans for hazard prone communities. Actual disaster losses are discussed, followed by an opportunity for you to examine the potential for such losses in your own community.

Unit 1 Objectives

1. *Cite examples of the high costs of disasters.*
2. *Define mitigation.*
3. *Provide a rationale for mitigation activities.*
4. *Relate mitigation to the phases of emergency management.*
5. *Describe the hazard analysis process and its relationship to mitigation.*

HIGH COSTS OF DISASTERS

Disasters caused by natural hazards have become increasingly costly, not only for the disaster victims but also for all American taxpayers. From 1989 to 1993, the average annual loss from disasters was $3.3 billion nationally. Over the last four years, that average has increased to $13 billion annually. Since 1975 over 6,000 people have been killed and over 50,000 people injured in natural hazard events.

During the last decade new records were set for the most costly natural disasters in the United States. In 1989, Hurricane Hugo struck the South Carolina coast near Charleston with sustained winds of over 130 mph and a 20-foot storm surge. Hurricane Hugo, exacting losses of $6 billion, also impacted North Carolina, Puerto Rico, and the Virgin Islands. In the same year, the Loma Prieta earthquake, measuring 7.1 on the Richter scale, rocked the San Francisco Bay Area, costing $10 billion. In 1992, Hurricane Andrew struck southern Dade county, Florida, generating high winds and rain over a vast area of the county, and costing $20 billion. Two years later, in 1994, the estimated loss from the Northridge earthquake, which struck the densely populated San Fernando Valley in northern Los Angeles, exceeded $25 billion.

The second most active hurricane season on record in the United States occurred in 1995. Beginning with Hurricane Allison and ending with Hurricane Tanya, there were a total of 19 named storms, 11 reaching hurricane strength. The final toll in the United States was 58 dead and more that $5.2 billion in property losses.

The costs of major disasters to Americans go well beyond those damages that are directly sustained. Recovery from disasters requires resources to be diverted from other important public and private programs, and adversely impacts the productivity of economic systems. The magnitudes of these losses are most appropriately considered at local, rather than national, levels. While direct losses from the Northridge earthquake were only one-half percent of the U.S. Gross National Product (GNP); they represented approximately 3% of the California 1993 Gross State Product (GSP). Direct losses from Hurricane Andrew represented approximately 7% of Florida's GSP.

NATIONAL MITIGATION STRATEGY

As the costs of disasters continue to rise, it becomes more and more evident that pre-disaster steps must be taken to reduce the damage and destruction. This strategy is commonly known as mitigation. Mitigation is defined as *sustained actions taken to reduce or eliminate long-term risk to people and property from hazards and their effects.*

The purpose of mitigation is twofold:

- To protect people and structures; and
- To minimize the costs of disaster response and recovery.

In support of local mitigation action and to address the rising costs associated with natural disasters, the Federal Emergency Management Agency (FEMA) has encouraged the emergency management community to become more proactive in reducing the potential for losses before a disaster occurs.

To assure a national focus on mitigation, FEMA introduced a National Mitigation Strategy in 1995. The strategy promotes the partnership of government and the private sector to ensure safer communities. It encourages all Americans to identify hazards that may affect them or their communities and to take action to reduce risks. The strategy, which was developed with input from State and local officials, as well as individuals and organizations with expertise in mitigation, has two goals:

- To substantially increase public awareness of natural hazard risk so that the public demands safer communities in which to live and work, and

- To significantly reduce the risk of death, injury, economic costs, and destruction of natural and cultural resources that result from natural hazards.

- A growing body of Federal, State, and local-level experience, along with associated research, has demonstrated that mitigation can reduce losses (in terms of life, property, and community resources) from hazard events

DISASTER RESISTANT COMMUNITIES

A concept that supports the National Mitigation Strategy and encourages change in the way America deals with disaster is called Disaster Resistant Communities. The concept has been adopted and refined by FEMA, the Institute of Business and Home Safety, the Central United States Earthquake Consortium (CUSEC), the State of Florida and other States and organizations.

A disaster resistant community employs a long range, community-based approach to mitigation. It promotes significant steps and measures to reduce vulnerability to flooding, earthquakes, hurricanes and other natural hazards. A disaster resistant community has public, private and business sector commitment to mitigation.

A community may be termed “disaster-resistant” when, after a major disaster, it can claim the following.

- Minimal loss of life.

- Limited interruption of public services.

- Timely resumption of business operations.

- Management of the response operation with or without State assistance.

- Recovery to pre-disaster conditions in a timely, pre-planned mode.

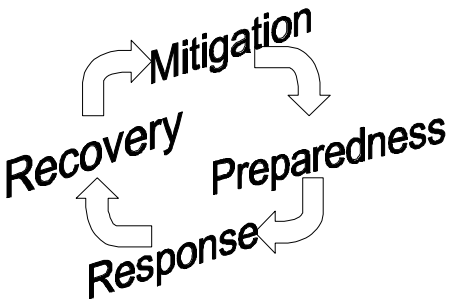
Project Impact

In support of the Disaster Resistant Community concept, FEMA has developed an initiative called Project Impact. Under this initiative, pilot communities are demonstrating the economic benefits of pre-disaster mitigation to States, local communities, businesses and individuals. Project Impact encourages communities to move from the current reliance on response and recovery to an emphasis on mitigation, preparedness and disaster management.

The Director of FEMA reports that communities everywhere are taking the responsibility for alleviating the impact of disasters. The first seven Project Impact communities include Deerfield Beach, Florida; Allegheny County, Maryland; Oakland, California; Pascagoula, Mississippi; Seattle, Washington; Tucker and Randolph Counties, West Virginia; and Wilmington, North Carolina.

A Project Impact Guidebook has been published to help communities protect their residents, organizations, businesses, infrastructure and the stability of the economy as much as possible against the impact of natural disasters before they happen. The Project Impact Guidebook is available from FEMA Publications at 1-800-480-2520.

MITIGATION AND EMERGENCY MANAGEMENT



The many tasks and functions of emergency management may be summarized into a cycle through which communities *prepare* for emergencies and disasters, *respond* to them when they occur, help people and institutions *recover* from them, and *mitigate* their potential effects to reduce the risk of future loss.

Preparedness ensures people are ready for a disaster and respond to it effectively. Preparedness requires figuring out what you'll do if essential services break down, developing a plan for contingencies, and practicing the plan.

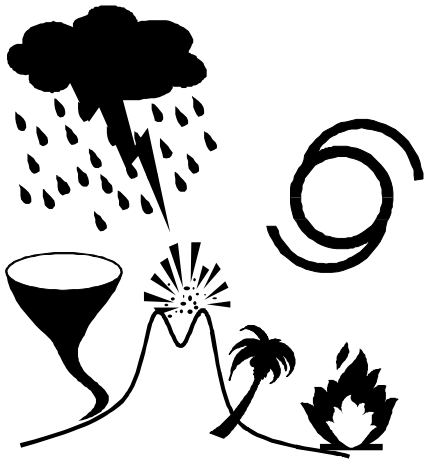
Response begins as soon as a disaster is detected or threatens. It involves search and rescue; mass care, medical services, access control, and bringing damaged services and systems back on line. When State and local governments are overwhelmed by a disaster, they may seek Federal assistance through a Presidential disaster or emergency declaration. Typically, Federal assistance is financial. However, in catastrophic events the Federal government may be asked to mobilize resources from any number of Federal agencies, and to participate in the response.

The task of **recovery**, or rebuilding, after a disaster takes years. Services, infrastructure (utilities, communication, and transportation systems), facilities, operations, and the lives and livelihoods of many thousands of people may be affected by a disaster. Local community and State governments do what they can to bring about the recovery. When those resources are expended, Federal loans and grants can help. Funds are used to rebuild homes, businesses and public facilities, to clear debris and repair roads and bridges, and to restore water, sewer and other essential services.

Viewed broadly, the goal of all **mitigation** efforts is risk reduction. The emphasis on *sustained* actions to reduce long-term risk differentiates mitigation from preparedness and response tasks, which are required to survive a disaster safely. Mitigation is an essential component of emergency management. Effective mitigation actions can decrease the impact, the requirements and the expense of a natural hazard event.

HAZARD ANALYSIS PROCESS

Finding out what the hazards are is the first step in any effort to reduce community vulnerability. Hazard analysis involves identifying all of the hazards that potentially threaten a community and analyzing them individually to determine the degree of threat that is posed by each. Hazard analysis determines:



- What hazards can occur.
- How often they are likely to occur.
- How severe the situation is likely to get.
- How these hazards are likely to affect the community.
- How vulnerable the community is to the hazard.

This information is used in the development of both mitigation and emergency plans. It indicates which hazards merit special attention, what actions might be taken to reduce the impact of those hazards, and what resources are likely to be needed.

Hazard analysis requires completion of five steps:

1. Identify the hazards.
2. Profile each hazard.
3. Develop a community profile.

4. Compare and prioritize risk.
5. Create and apply scenarios.

Step 1: Identify Hazards

The first step in hazard analysis is to put together a list of hazards that may occur in the community. A community hazard analysis should consider all types of hazards. Categories of hazards include natural hazards such as storms and seismological events; technological hazards such as nuclear power plants, oil or gas pipelines and other hazardous materials facilities; and civil or political hazards such as a neighborhood that has been the scene of rioting or large demonstrations. Cascading emergencies--situations when one hazard triggers others in a cascading fashion--should be considered. For example, an earthquake that ruptured natural gas pipelines could result in fires and explosions that dramatically escalate the type and magnitude of events.

Information about hazards may be collected from existing analyses and historical data.

Existing Hazard Analysis. If the community has an existing hazard analysis, don't "reinvent the wheel". The best way to begin is by reviewing the existing hazard analysis and identifying any changes that may have occurred since it was developed or last updated. Examples of the kinds of changes within or near the community that could cause hazard analysis information to change over time include:

- New mitigation measures (e.g., a new levee or overflow spillway, new zoning ordinances designed to reduce the amount of damage caused by a specific hazard, or reconstruction of bridges and overpasses).
- The opening or closing of facilities or structures that pose potential secondary hazards (e.g., hazardous materials facilities and transport routes).

When reviewing the hazard analysis, determine three things:

1. Do all of the hazards included in the hazard analysis still pose a threat to the community?
2. Are there hazards that are not included in the existing analysis that pose a potential threat to the community?

3. Does the hazard analysis specifically consider the possibility and impact of cascading hazards?

Historical Data. This list usually is based on historical data about past events. Information about recent or very costly events is generally available from community records. Information about older events may require more research, including information from libraries, oral histories and other government entities.

Step 2: Profile Each Hazard

Develop a hazard profile for each hazard identified in the previous step. (A list of hazard information sources is included in Appendix R of this manual.)

Each profile should include the following information about the hazard:

- Frequency of occurrence—how often it is likely to occur.
- Magnitude and potential intensity—how bad it can get.
- Location—where it is likely to strike.
- Probable spatial extent—how large an area it is likely to affect.
- Duration—how long it can be expected to last.
- Seasonal pattern—the time of year during which it is more likely to occur.
- Speed of onset—how fast it is likely to occur.
- Availability of warnings—how much warning time there is, and whether a warning system exists.

Compare any existing hazard analysis with the hazard profiles. Determine any changes and gaps in the information:

- Are any profiles missing from the hazard analysis?
- Is any type of information generally missing from the hazard profiles?
- Has the relative threat of any hazards changed since the analysis was done? Have priorities changed?

A sample Hazard Profile Worksheet follows.

HAZARD PROFILE WORKSHEET

HAZARD:

POTENTIAL MAGNITUDE (Percentage of the jurisdiction that can be affected):

- **Catastrophic**: More than 50%
- **Critica**l: 25 to 50%
- **Limited**: 10 to 25%
- **Negligible**: Less than 10%

FREQUENCY OF OCCURRENCE:

- **Highly Likely**: Near 100% probability in next year.
- **Likely**: Between 10 and 100% probability in next year, or at least one chance in 10 years.
- **Possible**: Between 1 and 10% probability in next year, or at least one chance in next 100 years.
- **Unlikely**: Less than 1% probability in next 100 years.

SEASONAL PATTERN:

AREAS LIKELY TO BE AFFECTED MOST (BY SECTOR):

PROBABLE DURATION:

POTENTIAL SPEED OF ONSET
(Probable amount of warning time):

- Minimal (or no) warning.
- 6 to 12 hours warning.
- 12 to 24 hours warning.
- More than 24 hours warning.

EXISTING WARNING SYSTEMS:

COMPLETE VULNERABILITY ANALYSIS:

Step 3: Develop a Community Profile

Combine the hazard-specific information collected during Steps 1 and 2 with information from sector profiles to determine the potential consequences of the hazard.

Sectoring is dividing the community into manageable segments for defining specific types of information: Sector profiles include the following data:

- Geography – features such as mountains, rivers, canyons, coastal areas, fault lines, wildland/urban fire interface (WUFI), etc., that relate to disaster occurrence or response efforts.

- Property - numbers and general characteristics such as land use, types of construction, manufactured homes, building codes, essential facilities and potential secondary hazards such as nuclear power plants or facilities where hazardous materials are manufactured or stored.

- Infrastructure – utilities, communication system, major highway transportation routes including bridges, and mass transit systems.

- Demographics – population size, distribution and concentrations, special populations (e.g. childcare facilities, nursing homes, prisons) and animal populations.

- Response Agencies – information about locations, facilities, services and resources that are needed to plan for response capability.

Develop the community profile by combining each sector profile with hazard-specific information found in the hazard profiles.

Step 4: Compare and Prioritize Risk

After hazard information and community information have been compiled, the next step is to quantify the community's risk so that the planning team can focus on the hazards that present the highest risk to the community. **Risk** is the predicted impact that a hazard would have on people, services, specific facilities and structures in the community. For example, in an earthquake, a specific bridge might be at risk. The predicted impact of an earthquake on that bridge could be collapse, leading to restricted access to a critical facility.

To quantify risk:

- Identify the elements of the community (populations, facilities, and equipment) that are potentially at risk from a specific hazard.
- Assign severity ratings.
- Compile risk data into community risk profiles.

Identifying Elements at Risk. For each hazard, survey risk-related factors in each sector in the community to develop a composite picture of overall risk. These factors include:

- Geographic features such as topography and soil composition.
- Infrastructure lifelines including utilities, communication, and transportation systems.
- Essential facilities such as police and fire departments.
- Special facilities such as schools, nursing homes, and health care facilities.
- Unique, historic or other cultural resources.
- Hazardous materials production/storage/transport.
- Property characteristics such as land use and type of construction.
- Population densities and shifts.
- The availability of response resources.

In identifying and organizing risk factors within the community, it is helpful to have a worksheet to use for all of the hazards to obtain information that is consistent and thus comparable. A sample Risk Assessment Worksheet is located on the next page.

RISK ASSESSMENT WORKSHEET		
Sector	***Essential Facilities at Risk***	
	Population at Risk	
	Infrastructure at Risk	
	Property at Risk	
	Expected Extent of Damage	**Percent of Sector Property**
	Severe	
	Substantial	
	Limited	
	None	

Assigning Severity Ratings. Each applicable hazard is then assigned a severity rating that will quantify, to the degree possible, the damage that can be expected in the community as a result of that hazard. This rating quantifies the expected impact of a specific hazard on people, essential facilities, and property.

A sample of severity ratings is included below.

SEVERITY LEVEL	CHARACTERISTICS
Catastrophic	Multiple deaths. Complete shutdown of facilities for 30 days or more. More than 50 percent of property is severely damaged.
Critical	Injuries and/or illnesses result in permanent disability. Complete shutdown of critical facilities for at least 2 weeks. More than 25 percent of property is severely damaged.
Limited	Injuries and/or illnesses do not result in permanent disability. Complete shutdown of critical facilities for more than 1 week. More than 10 percent of property is severely damaged.
Negligible	Injuries and/or illnesses are treatable with first aid. Minor quality of life lost. Shutdown of critical facilities and services for 24 hours or less. Less than 10 percent of property is severely damaged.

Compiling Data into a Community Risk Index. By cross-referencing the compiled hazard and community profile data a risk index can be developed for all hazards. It will include

- Frequency of occurrence.
- Magnitude.
- Speed of onset.
- Community impact (severity rating).
- Special characteristics and planning considerations.

Based on these ratings, a Risk Priority can be assigned to each hazard. Risk priorities may be described using qualitative ratings such as High, Medium and Low.

A sample Risk Index Worksheet is located on the next page.

RISK INDEX WORKSHEET						
Hazard	***Frequency***	***Magnitude***	***Warning Time***	***Severity***	***Special Characteristics and Planning Considerations***	***Risk Priority***
	Highly likely Likely Possible Unlikely	Catastrophic Critical Limited Negligible	Minimal 6 – 12 hours 12 – 24 hours 24+ hours	Catastrophic Critical Limited Negligible		
	Highly likely Likely Possible Unlikely	Catastrophic Critical Limited Negligible	Minimal 6 – 12 hours 12 – 24 hours 24+ hours	Catastrophic Critical Limited Negligible		
	Highly likely Likely Possible Unlikely	Catastrophic Critical Limited Negligible	Minimal 6 – 12 hours 12 – 24 hours 24+ hours	Catastrophic Critical Limited Negligible		
	Highly likely Likely Possible Unlikely	Catastrophic Critical Limited Negligible	Minimal 6 – 12 hours 12 – 24 hours 24+ hours	Catastrophic Critical Limited Negligible		
	Highly likely Likely Possible Unlikely	Catastrophic Critical Limited Negligible	Minimal 6 – 12 hours 12 – 24 hours 24+ hours	Catastrophic Critical Limited Negligible		
	Highly likely Likely Possible Unlikely	Catastrophic Critical Limited Negligible	Minimal 6 – 12 hours 12 – 24 hours 24+ hours	Catastrophic Critical Limited Negligible		

Step 5: Create and Apply Scenarios

The final step in the hazard analysis process is to brainstorm worst case scenarios that will help identify hazard-specific planning and resource requirements. From initial warning, if available, describe the hazard's development and impact on the jurisdiction and its generation of specific consequences. Include:

- Overall impact on the community.
- Impact on specific sectors.
- Consequences (e.g. collapsed buildings, loss of critical services and infrastructure, death, injury, or displacement).
- Needed actions and resources, including mitigation activities.

This activity helps the planning team recognize planning assumptions that should be used in the development of mitigation alternatives.

SUMMARY

- ✓ Disasters caused by natural hazards have become more and more costly.
- ✓ The magnitudes of these losses are greater when considered at local rather than national levels.
- ✓ Mitigation is defined as *sustained actions taken to reduce or eliminate long-term risk to people and property from hazards and their effects.*
- ✓ FEMA has developed a National Mitigation Strategy to strengthen the partnership between government and the private sector to fulfill their responsibilities for ensuring safer communities.
- ✓ To become a Disaster Resistant Community, a jurisdiction must adopt a long range, community-based approach to mitigation that promotes significant steps and measures to reduce vulnerability to natural hazards.
- ✓ Project Impact is a FEMA initiative that designates pilot communities to demonstrate the economic benefits of pre-disaster mitigation.
- ✓ The emergency management cycle describes the process through which emergency managers *prepare* for emergencies and disasters, *respond* to them when they occur, help people and institutions *recover* from them, and *mitigate* their potential effects to reduce the risk of future loss.
- ✓ Mitigation can decrease the impact and therefore the consequences and costs of a natural hazard event.
- ✓ Hazard analysis helps in making decisions about which hazards merit special attention; what actions might be taken to reduce the impact of those hazards, and what resources are likely to be needed.
- ✓ The hazard analysis process involves five primary steps: identify the hazards; profile each hazard; develop a community profile; determine vulnerability; and create and apply scenarios.

MITIGATING YOUR HAZARDS

This exercise provides an opportunity to practice the steps involved in hazard analysis and to become more familiar with the hazards and the vulnerability that exist in your community.

1. List five hazards that exist in your community.

2. For each hazard listed, find out and write down:

HAZARD					
Frequency of Occurrence					
Magnitude					
Location					
Area					
Duration					
Seasonal Pattern					
Speed of Onset					
Availability of Warning					

3. Consider areas of your community.

   For one of the areas, describe the following. (Remember that in a real hazard analysis this must be completed for all sectors of the jurisdiction.)

Geography	
Property	
Infrastructure	
Demographics	
Response Agencies	

4. For the same community sector, complete a Risk Index Worksheet. Remember that this process is completed for the entire community in a real hazard analysis.

• *RISK INDEX WORKSHEET*						
Hazard	***Frequency***	***Magnitude***	***Warning Time***	***Severity***	***Special Characteristics and Planning Considerations***	***Risk Priority***
	Highly likely Likely Possible Unlikely	Catastrophic Critical Limited Negligible	Minimal 6 – 12 hours 12 – 24 hours 24+ hours	Catastrophic Critical Limited Negligible		
	Highly likely Likely Possible Unlikely	Catastrophic Critical Limited Negligible	Minimal 6 – 12 hours 12– 24 hours 24+ hours	Catastrophic Critical Limited Negligible		
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	Highly likely Likely Possible Unlikely	Catastrophic Critical Limited Negligible	Minimal 6 – 12 hours 12– 24 hours 24+ hours	Catastrophic Critical Limited Negligible		
	Highly likely Likely Possible Unlikely	Catastrophic Critical Limited Negligible	Minimal 6 – 12 hours 12– 24 hours 24+ hours	Catastrophic Critical Limited Negligible		

5. Select one of the hazards and develop a scenario that describes the following.

Initial warning	
Overall impact on the community	
Impact on sector described in requirement #3 above.	
Consequences (damage, casualties, loss of services, etc.)	
Needed actions and resources, including mitigation activities	

✓ CHECKING YOUR MEMORY

Circle the correct response. Answers may be found on page A-1.

1. Nationwide, disaster costs annually total
   A) hundreds of thousands of dollars.
   B) millions of dollars.
   C) billions of dollars.

2. "Sustained actions taken to reduce or eliminate long-term risk to people and property from hazards and their effects" defines what component of emergency management?
   A) response.
   B) mitigation.
   C) recovery.

3. Disaster Resistant Communities promote
   A) a long range community based approach to mitigation.
   B) immediate short-term solutions to hazard risk.
   C) Federal solutions to local hazard risk problems.

4. To implement FEMA's National Mitigation Strategy, partnerships must be forged between
   A) Federal and State agencies.
   B) local government and business.
   C) Federal, State and local governments and private sector constituents.

5. The recovery phase of emergency management involves rebuilding efforts that take
   A) years.
   B) weeks.
   C) days.

6. During hazard analysis, the list of hazards is developed from
   A) historical data and community records.
   B) Pre-existing hazard analyses.
   C) Both A and B.

7. The predicted impact that a hazard would have on people, services and property in a community defines
   A) the recovery period.
   B) risk.
   C) loss.