
Unit 2: Hazard Vulnerability Analysis and Risk Assessment

Time: 2 3/4 hours

Purpose

The purpose of this unit is to discuss the impacts of hazards on communities and the need to conduct a hazard vulnerability analysis and risk assessment to know what is at stake.

Objectives

Upon completion of this unit participants will be able to:

- 1.** Explain reasons for developing a hazards vulnerability baseline
- 2.** List steps for conducting a hazard vulnerability analysis
- 3.** List types of natural, technological, and man-made hazards that can affect our community and nation
- 4.** Explain how hazards become risks
- 5.** Describe the cascading “ripple” impact of disasters
- 6.** Describe how demographic changes are affecting vulnerability to hazards
- 7.** List examples of key tools and technologies used for vulnerability analysis

Table of Contents

TOPIC	TIME	PAGE
Where Are We in the Planning Process?	2 minutes	2-3
Creating a Baseline of Hazard Vulnerability	10 minutes	2-5
Risk: Identifying its Presence and its Impact	15 minutes	2-12
What Types of Disasters Impact our Communities?	15 minutes	2-17
Cascading Effects of Disasters	15 minutes	2-18
America’s Shifting Face: Vulnerable Populations and our Communities’ Need to Address Them	20 minutes	2-25
Tools and Techniques for Hazards Vulnerability Analysis	20 minutes	2-30
Case Studies: Successful Approaches	20 minutes	2-37
Activity 2-1: Assessing Hazard Vulnerability and Risk Assessment in Your Community	45 minutes	2-39
Summary	3 minutes	2-43
Total Time:	165 minutes	

Instructor Preparation

COURSE MATERIALS	EQUIPMENT
<ul style="list-style-type: none"> ◆ Facilitator Guide ◆ Course Agenda ◆ PowerPoint presentation 	<ul style="list-style-type: none"> ◆ Easel, easel pad, and markers ◆ Overhead projector and projection screen and/or computer display unit and monitor

Where Are We in the Planning Process?

2 minutes

Show Visual 2-1.

Introduce the unit and review the objectives.

Unit 2: Objectives

- ♦ Explain reasons for developing a hazards vulnerability baseline
- ♦ List steps for conducting a hazard vulnerability analysis
- ♦ List types of natural, technological, and man-made hazards that can affect our community and nation

2-1

This unit focuses on the first phase of the disaster-resistant planning process, which is conducting a hazard vulnerability analysis or a hazard identification and risk assessment.

Show Visual 2-2.

Review the objectives.

Unit 2: Objectives

- ♦ Explain how hazards become risks
- ♦ Describe the cascading “ripple” impact of disasters
- ♦ Describe how demographic changes are affecting vulnerability to hazards
- ♦ List examples of key tools and technologies used for vulnerability analysis

2-2

Show Visual 2-3.

Review where we are in the planning process.

Where are we in the planning process?

2-3

Hazard Identification

Hazard identification determines the areas of your community that are affected by disasters, the likelihood of a disaster occurring, and how intense the disaster might be.

“FEMA describes hazard identification as a process of “defining and describing a hazard, including its physical characteristics, magnitude and severity, probability and frequency, causative factors, and locations/areas affected.”

(Schwab et al. 1998)

Creating a Baseline of Hazard Vulnerability

10 minutes

Hazards

Before you show visual, ask participants to name types of disasters in their communities and flip chart responses. (then show Visuals 2-4 and 2-5)

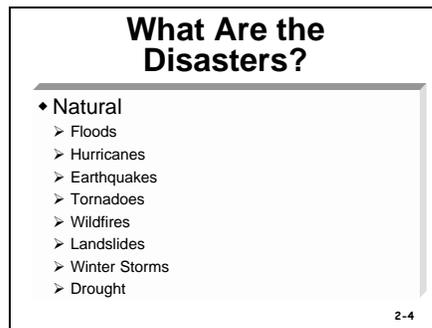
A hazard is a source of potential danger or adverse conditions.

Types of Hazards

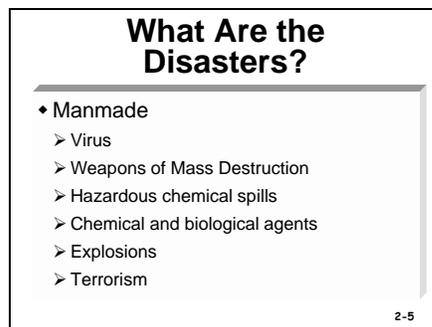
Show Visual 2-4.

Engage participants in a discussion about their experiences with disasters.

Flipchart—add disasters additions.



Show Visual 2-5.



EXAMPLE NATURAL HAZARD	DEFINITIONS
Tropical Cyclone Activity	Low-pressure weather systems, including tropical disturbances, tropical depressions, tropical storms, hurricanes, and typhoons.
Severe Storm Activity	High Surf and other associated effects.
Tsunami	Series of potentially catastrophic ocean waves generated by earthquakes, volcanic eruptions, or landslides beneath the sea.
Earthquakes	Sudden release of stress along a fault, or fracture, in the earth's crust, resulting in the movement of opposing blocks of rock past one another.
Volcanic Activity	Eruption of magma through a vent in the surface of the Earth.
Local Flooding	Water overflowing the artificial or natural boundaries of a stream, river, or other body of water; also ponding of water at or near where the rain is falling or has fallen.
Drought	Period of abnormally dry weather for a region that requires special water conservation or fire mitigation measures.
Wildfires	Uncontrolled/unplanned forest fires and brush fires.
Tornado	Urban/Wildland Interface
Human-caused disasters, including technological disasters	<p>A disaster that humans cause, such as wars, armed conflicts, or civil strife and technological disasters, such as the following:</p> <ul style="list-style-type: none"> ◆ Hazardous materials and explosions ◆ Spills of toxic chemicals, radiological material, biologic material, oil, etc. ◆ WMD – weapons of mass destruction such as missiles, poison gas, bombs ◆ B-NICE the acronym to describe the five classifications of weapons of mass destruction defined in the Biological Weapons Terrorism Act (biological, nuclear, incendiary, chemical, and explosive.) ◆ COBRA – chemical, ordnance, biological, radiological agents ◆ Computer virus such as a 'Trojan horse' program that could compromise your computer security or cell phone viruses that could perpetrate hoaxes that could affect telephone operations or transmit threats and attack targets

Ask participants why it's important to consider the effects of hazards – before disaster happens.

Why Consider the Effects of Hazards – Before a Disaster Happens

- ◆ It costs too much to address the effects of disasters only after they happen.
- ◆ Federal aid after disasters doesn't cover all the costs incurred after a disaster.
- ◆ You can prevent some damage from hazards if you anticipate where and how these natural phenomena occur.

The most meaningful steps in reducing the impacts of hazards are taken at the state and local levels by officials and community members who have a personal stake in the outcome and/or the ability to follow through on a sustained program of planning and implementation.

Hazard Vulnerability Analysis

Define hazard vulnerability analysis.

When you conduct a **hazard vulnerability analysis** you identify, using current knowledge or some degree of existing building stock, those structures and areas that are vulnerable to hazards. In addition, a community growth plan or flat map superimposed on the hazards map will help you identify areas vulnerable to natural hazards. Vulnerability identification determines the facilities at risk and to what degree they might be affected, as well as how they might affect other surrounding structures.

Show Visual 2-6.

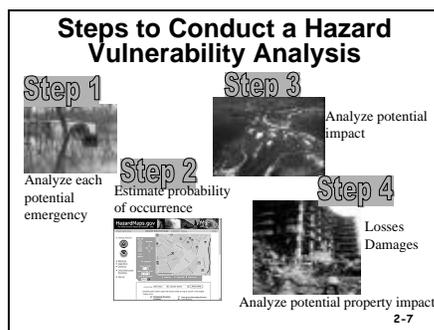
Discuss the potential to project where in the community a disaster is likely to cause the most damage.



Steps to Conduct a Hazard Vulnerability Analysis

Show Visual 2-7.

Briefly review the steps to conduct a hazard vulnerability analysis; cover the details throughout this unit.



Ask participants for quick examples of any of these events that they have been through.

1. Analyze each potential event from beginning to end.

Consider what could happen as a result of:

- ◆ Prohibited access to buildings
- ◆ Loss of electric power
- ◆ Communication lines down
- ◆ Ruptured gas mains
- ◆ Water damage
- ◆ Smoke damage
- ◆ Structural damage
- ◆ Air or water contamination
- ◆ Explosion
- ◆ Building collapse
- ◆ Trapped persons

2. Estimate the probability of the event's occurrence.

3. Analyze the potential human impact of each disaster — the possibility of death or injury.

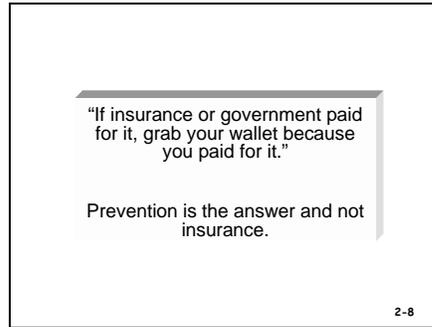
4. Assess the potential property impact for losses and damages (direct and indirect).

Consider the following:

- ◆ cost to replace
- ◆ cost to set up temporary replacement
- ◆ cost to repair

Understand the insurance coverages and implications.

Show Visual 2-8.



"If insurance or government paid for it, grab your wallet because you paid for it."

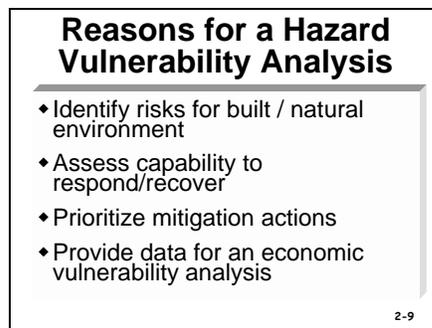
Prevention is the answer and not insurance.

The property casualty insurance industry participates strongly on this issue.

Reasons for a Hazard Vulnerability Analysis and Risk Assessment

Show Visual 2-9.

Review the reasons for conducting a hazard vulnerability analysis.



Unit 2: Hazard Vulnerability Analysis and Risk Assessment

Mapping the hazards that threaten your community allows you to begin a process of identifying the areas that are most at risk and therefore the areas where you may want to concentrate your community risk-mitigation efforts. It also provides an objective basis for your decisions. The more refined your maps of natural and technological hazards can be, the more refined your decisions about those hazards can be. If you know the probabilities of a hazard event in each area, you can apply a “cost-benefit” approach to your decisions. A closer examination of the *costs* and *benefits* of economic disaster planning will be addressed in Unit 4. The analysis and assessment stage begins the process of gathering data upon which informed decisions can be made as to how much your actions will cost and what benefits you hope to gain.

Your community should have an accurate, updated (preferably GIS-based) Hazard and Risk Assessment that will provide a baseline of information on community and business vulnerability, and can be used by leaders to set reasonable performance objectives and priorities for mitigation, response, and recovery from natural hazards.

Risk: Identifying its Presence and its Impact

15 minutes

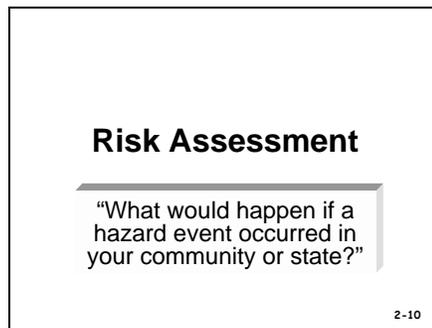
Risk Assessment

Define risk assessment.

Risk is the estimated impact that a hazard would have on people, services, facilities, and structures in the community; the likelihood of a hazard event resulting in an adverse condition that causes injury or damage.

Show Visual 2-10.

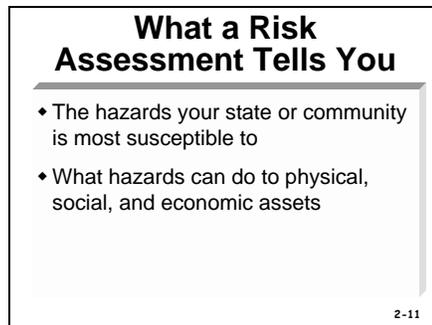
Explain that many sectors have definitions of risk that may vary slightly.



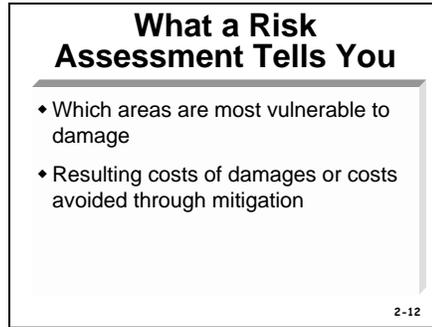
Risk assessment answers the question: *“What would happen if a hazard event occurred in your community, state or region?”*

Show Visual 2-11.

Explain what a risk assessment covers.



Show Visual 2-12.



A risk assessment tells you:

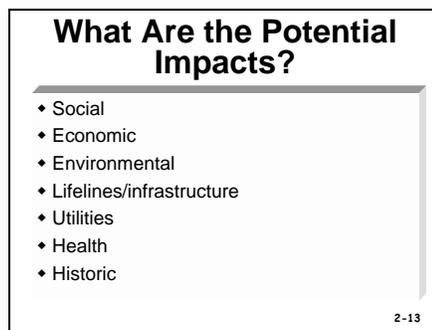
- ◆ The hazards to which your state or community is most susceptible,
- ◆ What these hazards can do to physical, social, and economic assets,
- ◆ Which areas are most vulnerable to damage from these hazards,
- ◆ The resulting costs of damages or costs avoided through future mitigation projects.

Risk assessment is a shared responsibility between states and local communities.

When Hazards Meet Society

Show Visual 2-13.

Lead a discussion about the potential impacts of a disaster.



Show Visual 2-14.

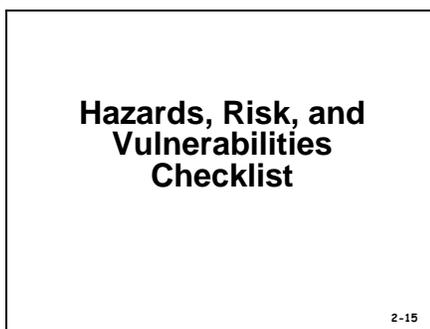


Natural, technological, and human-caused hazards can have a tremendous impact on the community. A hazard event may impact such elements as:

- ◆ Social
- ◆ Economic
- ◆ Environmental
- ◆ Lifelines/infrastructure
- ◆ Utilities
- ◆ Health
- ◆ Historic
- ◆ Life safety and security
- ◆ Non-government property/housing
- ◆ Government facilities and services
- ◆ Educational systems
- ◆ Tourism
- ◆ Migration patterns
- ◆ Psychological

Show Visual 2-15.

Mention the checklist that summarizes key elements in the hazard vulnerability assessment process on pages 2-15 and 2-16. This tool can be used to help do a Hazard Vulnerability Analysis and Risk Assessment in the student's home community.



HAZARDS, RISK, AND VULNERABILITIES CHECKLIST

1. Based on history and other sources that define threats, list the hazards and risks that have affected your local community/state/region or that may affect your jurisdiction.
2. List those that may affect the area.
3. Estimate the probability of future occurrences of each incident.
4. Evaluate the possibility of new types of incidents resulting from population changes, new transportation routes and types, and the like.
5. Evaluate combinations of events and the possibility of one event causing another.
6. Develop a jurisdiction-wide map of probable and possible occurrences, including “spillover” events from neighboring jurisdictions. Also, evaluate vulnerability caused by interdependencies between systems such as power, transportation, water treatment, and communications. Specifically assess the vulnerability of key emergency management systems needed to direct, control, and coordinate emergency operations and continue to govern.

HAZARDS, RISK, AND VULNERABILITIES CHECKLIST

7. Assess the potential regional size, shape, and evolution of specific incidents.

8. Assess the potential consequences for your jurisdiction and others resulting from any of the potential incidents.

9. Review the incident analysis at the city and county level to be sure that any local factors affecting probability, severity, ability to respond, or potential consequences are considered.

10. Review the experiences and “lessons learned” from previous incidents.

11. Based on both probabilities of occurrence and severity of consequences, draw up a prioritized list of incidents your jurisdiction must be prepared to handle and the risks they pose.

Source: Federal Emergency Management Agency. EOC's Management and Operations Course, IS 275, July 1995, 3-6.

What Types of Disasters Impact our Communities?

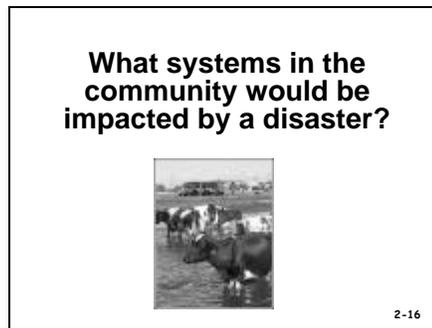
15 minutes

Show Visual 2-16.

Pose the following question to participants:

What systems in your community would be impacted by a disaster?

Write their answers on an easel pad.

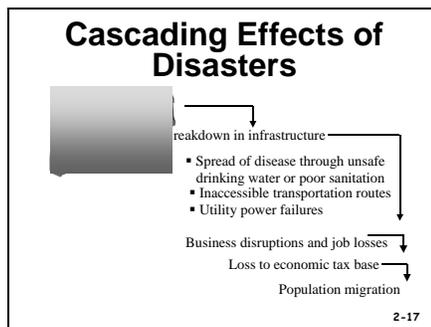


Cascading Effects of Disasters

15 minutes

Show Visual 2-17.

Discuss the cascading effects of disasters.



The combination of natural, technological, and human-caused hazards creates an environment in which effects may be multiplied through cascading effects. For example, an earthquake can lead to a breakdown in infrastructure, resulting in the spread of disease through unsafe drinking water or disruptions in the local economy – due to job losses or business disruptions.

Continue the discussion on the potential impacts, with particular emphasis on the business community.

The economic costs associated with a disaster take many forms, including:

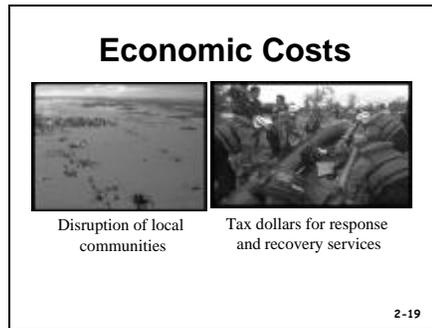
Show Visual 2-18.



Unit 2: Hazard Vulnerability Analysis and Risk Assessment

- ◆ Costs to repair public infrastructure and privately owned buildings,
- ◆ Loss of government and business revenue and agricultural and industrial productivity,

Show Visual 2-19.



- ◆ Disruption of local communities,
- ◆ Tax dollars spent on disaster response and recovery.

Would your business community know what to do if an earthquake, flood, hazardous material spill, or terrorism event happened tomorrow, and could the businesses survive? Damages from disasters always go beyond that of structure and contents. Damages may produce:

- ◆ Rebuilding costs
- ◆ Pressure on credit lines
- ◆ Loss of savings, and out-of-work employees

all of which could threaten the future of businesses. Business operations can be interrupted by direct damages to the business location and equipment, or by failure of critical local infrastructure like electrical power, water supply, and road systems. Often, major transportation and communication lines can be destroyed or temporarily disabled.

At the Federal and State levels, there has been considerable effort to identify hazards such as earthquake, hurricane, and dam failure. Check with these sources, and obtain copies about the government-perceived threats in your community to help you conduct a hazard vulnerability analysis of your business.

Show Visual 2-20.

Provide examples that illustrate cascading effects. Use the Baltimore Tunnel Trail Derailment (visual 2-17) or a recent example.

Ask participants to give examples.

**Train Derailment:
Cascading Effects**

- Baltimore Tunnel
 - CSX freight cars derailed and caught fire
 - Hazardous materials released
 - Black smoke and fumes throughout downtown area
 - All roads to city closed
 - Cancellation of 2 Baltimore Orioles baseball games
 - No evacuations – but residents remained inside
 - Disruption in Internet services throughout N.E. U.S.
 - Call centers and phone centers disrupted

2-20

Show Visual 2-21.

Give the Nevada Industrial Explosion example or a recent example.

**Nevada Industrial
Explosion**

- EDA funded \$1.5 million public works project –to build infrastructure improvements for industrial site –
 - New marshmallow factory built at industrial site
 - Explosion of PEPCON rocket fuel destroyed the company, most of industrial park – damages exceeded \$74 million
 - Employees at Kidd & Company factor received checks – for a 1 ½ yrs – business insurance policy

2-21

CASCADING EFFECTS OF DISASTERS: WHERE'S YOUR BACK-UP INFRASTRUCTURE— THE BALTIMORE TUNNEL TRAIN DERAILMENT

On Wednesday July 18, 2001, 11 cars of a CSX transportation freight train consisting of 3 locomotives and 60 cars derailed and caught fire in a tunnel beneath downtown Baltimore and burned for several days. The derailment occurred in the single-track Howard Street tunnel, a tunnel that exits near the Camden Yards Baseball Stadium. A tanker railcar transporting approximately 26,000 gallons of liquid tripropylene was ruptured in the derailment and caught fire. The train was also carrying a number of other hazardous materials including hydrochloric acid, a substance that can cause skin and eye irritation and breathing problems.

The train fire sent black smoke and fumes across the Baltimore downtown area, and at one point, all roads leading into the city were closed. The smoke continued to affect the city a day later, forcing cancellation of the July 18 and 19 Baltimore Orioles baseball games at the nearby Camden Yards Stadium. Although there were no evacuations, residents were asked to remain indoors.



Smoke coming from tunnel entrance

A burst water main in the tunnel flooded local streets. Fiber optic cables that ran through the tunnel were severed, resulting in major disruption in Internet services for the Northeastern United States. The back-up fiber-optic cables were located on the opposite side of the tunnel from the main cables and were also destroyed by the fire, water and wreckage. In all, the accident cut three major fiber-optic lines for the East Coast: WorldCom Inc.'s UUNet, Metromedia Fiber Network and PSINet Inc. Telephone service to western Maryland was also affected by the train wreck.

"That tunnel is basically the I-95 of the East Coast for fiber," said John Grundey, president of LAI Construction Services Inc. of White Marsh, which built a fiber-optic line detour around the break. "It was a once-in-a-lifetime place for vulnerability."

**CASCADING EFFECTS OF DISASTERS: WHERE'S YOUR BACK-UP INFRASTRUCTURE—
THE BALTIMORE TUNNEL TRAIN DERAILMENT**

Epilogue: The Baltimore tunnel fire not only had an impact on the rail, local residents and businesses, but cable cuts also affected cable service throughout the country. Communications companies had to reroute data to other cables causing major delays. A call center in Cumberland, Maryland that handles campground reservations for the Michigan Department of Natural Resources was knocked off line. Seventy-five miles away, Citicorp's call center in Hagerstown, Maryland lost two-thirds of its phone service for customers to call about information regarding credit card applications and bills.

“The disruption should alert companies whose lifeblood is telecommunication services to the importance of redundancy,” said Harvey Jacobs, a Washington, D.C., attorney who specializes in Internet-related legal issues. “Companies need at least two providers for their Web hosting and telecom services despite the higher costs involved. Then, when a disruption like the Baltimore tunnel fire occurs, a company can avoid going out of business, even temporarily,” Jacobs said.

Bibliography

CNN.com, 2001. “Baltimore roads reopened after train fire.” In July 19, 2001 CNN.com. <http://www.cnn.com/2001/US/07/19/derailed.train/index.html>

Associated Press, 2001. “Baltimore tunnel fire burns Internet users nationwide.” In July 20, 2001 Florida Today. <http://www.flatoday.com/news/tech/stories/2001/jul/tt072001a.htm>

BBC News Online, 2001. “Baltimore toxic scare bates.” In July 22, 2001 BBC News <http://news.bbc.co.uk/1/hi/world/americas/1451068.stm>

Roberto Borea/Associated Press, 2001. “Train derailment in Baltimore reveals a fragile Net backbone” by “C. Benjamin Ford and Neil Adler, Staff Writers in The Gazette Business. <http://www.jacobs&associates-internet-law-firm.com>

HAZARDOUS MATERIALS - WHO'S YOUR NEIGHBOR? 1988 HENDERSON, NEVADA INDUSTRIAL EXPLOSION

On August 20, 1986, the Economic Development Administration (EDA), a bureau of the U.S. Department of Commerce, awarded a \$1.5 million public works grant to Clark County, Nevada. The purpose of the award was to construct road and utility infrastructure improvements necessary to expand a county-owned industrial site in the community of Henderson, Nevada. The improvements provided capacity for Kidd and Company to build its new marshmallow factory. In addition to directly creating new jobs, the project promised to help stabilize the surrounding agricultural areas that would furnish the raw materials for the marshmallow manufacturing process. In all respects, the project exemplified EDA's job creation and economic stabilization goals.

The industrial park had only one other tenant at the time; Pacific Engineering and Production Company (PEPCON). PEPCON was one of only two U.S. producers (both located in Henderson) of ammonium perchlorate, an oxidizer supplied to Morton Thiokol for its solid fuel rocket motors supporting the nation's military and space exploration programs.

That's right—a marshmallow company next door to a rocket fuel plant! Remember "Murphy's Law"—the one about anything that can go wrong probably will?

The EDA project was officially completed on April 13, 1988. Just twenty-five days later, the PEPCON rocket fuel plant blew up killing two and injuring 300. The horrendous blast consumed 9 million pounds of rocket fuel and was felt up to 70 miles away.

The explosion literally vaporized the PEPCON plant, destroyed the economic development marshmallow company success story next door, most of the industrial park, and blew cars off a highway a half-mile away. Damage to the PEPCON plant and surrounding community exceeded \$74 million. It was said that one could detect the scent of toasted marshmallow halfway across the neighboring state of Utah.



Photo of Kidd Marshmallow Plant to the right of the vaporized PEPCON plant.

**HAZARDOUS MATERIALS - WHO'S YOUR NEIGHBOR?
1988 HENDERSON, NEVADA INDUSTRIAL EXPLOSION**

All of Kidd's employees survived—which is amazing considering the blast registered 3.5 on the Richter scale. For the next year and a half, while the marshmallow factory was being rebuilt, all Kidd employees received their regular paychecks (thanks to a well-planned business insurance policy).

Epilogue: The incident caused Henderson and Nevada state officials to undertake a vigorous examination of the merits of separating heavy industry from its populated areas. The other ammonium perchlorate manufacturing operation in Henderson was soon moved to a remote site surrounded by a 9000-acre buffer.

A new rocket fuel plant to replace the blown-up Henderson facility was subsequently built in an isolated area about 14 miles outside of Cedar City, Utah, but this time with a substantial no-build buffer around it. On July 30, 1997, the new Cedar City facility suffered its own explosion and fire, killing one and injuring four.

Bibliography

Woodbury, Chuck, 2002. "Marshmallow Factory Tour is Sweet Deal." In Out West, an on-line newspaper about the West.

<http://www.outwestnewspaper.com/marshmallow.html>

Vogel, Ed, 1998. "Could It Happen Again?" in the May 3, 1998 Los Vegas Review-Journal. http://www.lvrj.com/lvrj_home/1998/May-03-Sun-1998/news/7426853.html

Bates, Warren, 1998. "Shattered Windows, Lives" in the May 3, 1998 Los Vegas Review-Journal. http://www.lvrj.com/lvrj_home/1998/May-03-Sun-1998/news/7426849.html

Rogers, Keith, 1998. "Remnants of Explosion Linger" in the May 3, 1998 Los Vegas Review-Journal. http://www.lvrj.com/lvrj_home/1998/May-03-Sun-1998/news/7426852.html

Macy, Robert, 1997. "Same Company involved in Utah, Las Vegas Blasts" in the July 30, 1997 Las Vegas Sun. <http://www.lasvegassun.com/sunbin/stories/>

Associated Press, 1997. "One Killed, Three Injured in southern Utah Plant Explosion" in the July 30, 1997 Las Vegas Sun.

<http://www.lasvegassun.com/sunbin/stories/>

Las Vegas Review Journal, 1998. "The Day Southern Nevada Shook" in the May 3, 1998 Los Vegas Review-Journal. http://www.lvrj.com/lvrj_home/1998/May-03-Sun-1998/news/7426880.html

America's Shifting Face: Vulnerable Populations and our Communities' Need to Address Them

20 minutes

Include opportunities for dialogue and table discussions to encourage participants to actively think about the socio-economic demographics of their region or community – how it has changed, who is living there, and why it's important to address these issues. Focus the discussion on the following areas:

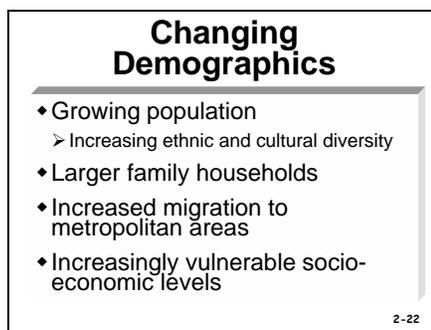
- ♦ Community, cultural, and ethnic makeup and changes
- ♦ Examples where these issues have impacted their economic development or emergency manager practices or disaster experiences
- ♦ Other experiences or situations

Mention that this area is one of the hottest areas of research, practice and policy both here and internationally in the emergency manager and land use planning professions. Mention that at the state and local level, very little time is spent really trying to understand how these issues impact the professions.

Changing Demographics in the United States

Show Visual 2-22.

Highlight issues related to the changing demographics in the U.S and its impact on disaster resistance.



ASK

What population changes have occurred in your community?

Population Growth

Our population in the United States is rapidly growing in size and in cultural and ethnic diversity. John Levy identified escalating population growth as the biggest issue facing U.S. planners over the next half century (APA magazine, 8/2001). The U.S. Census Bureau estimates an increase of 128 million people to our current population by 2050.

Demographic Changes

As a country we are becoming an increasingly global community. Many who live and work here are from other countries. These multi-cultural changes reflect differing psychology, lifestyle choices and logistical and communication needs. Examples of recent demographic shifts that impact disaster vulnerability are:

- ◆ Larger family households
- ◆ Increased migration to metropolitan areas
- ◆ Increasingly vulnerable socio-economic levels

Impact on Disaster Resistance

These population changes signal a need to constantly update our understanding of the needs of our community and think “out of the box” regarding its risk reduction and economic growth. Our nation’s rich diversity requires a much broader approach to defining “community,” engaging its members, and taking the needed steps to change disaster risk behavior. Critical considerations in our planning approaches should always include:

- ◆ Economic conditions
- ◆ Cultural diversity
- ◆ Social issues

One of the most striking examples of this demographic change is California. The percentage of population growth in CA due to foreign born/international migration since 1990 is over 68 percent. A January 2001 report released by the Center for Immigration Studies, based on a 2000 Population Survey, put the foreign-born share of the state’s population at over 25 percent.

Vulnerable Populations

Defining Vulnerability

Show Visual 2-23.

Define vulnerable populations.

Vulnerable Populations

- ◆ Inability to gain access, synthesize, and use hazard reduction information
- ◆ Inability to take steps to
 - reduce vulnerability
 - take protective steps during or after an event
- ◆ Incapable of absorbing effects of disaster

2-23

Many of our community's most vulnerable populations are often those most at risk, and those most deeply affected by disaster.

While vulnerability can be described in many ways, consider the following three descriptions:

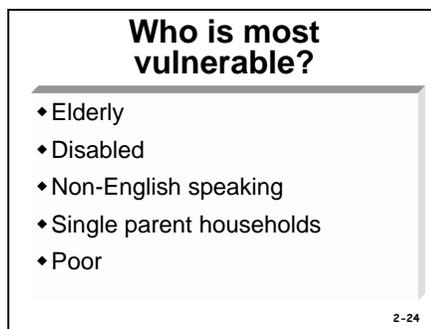
- ◆ Inability to gain *access, synthesize and use* hazard reduction information to protect lives, homes and businesses.
- ◆ Inability to take *steps* to reduce vulnerability to hazards before an event, or take protective steps during or after an event.
- ◆ Incapable of *absorbing* the effects of a disaster in the long term.

Who Is Most Vulnerable?

Show Visual 2-24.

ASK

Who are the most vulnerable populations in your community?



Every community has its own set of circumstances that impacts and sometimes defines those most vulnerable. Five individuals groups often most vulnerable are:

- ◆ Elderly
- ◆ Disabled (physical or mental impairments that limit one or more of the major life activities)
- ◆ Non-English speaking (speaks languages other than English in household)
- ◆ Single parent households
- ◆ Poor

Unit 2: Hazard Vulnerability Analysis and Risk Assessment

Consider the following U.S. Census statistics taken from the U.S. Census during years in the late 1990s through 2000:

- ◆ Elderly – 55.1 million aged 55 and older (excluding those in prisons or institutions)
- ◆ Disabled – 54 million; one in five
- ◆ Non-English – nearly 50 million; over 17%
- ◆ Single parent – 11 million; 10.6 % of all households
- ◆ Poor – 12.6% of total population (average over 3 year period between '97 – '99)

Examples: Actions Regarding Earthquakes and At-Risk Populations

- ◆ The Missouri Seismic Advisory Board was successful in applying pressure to ensure that the construction of a new state prison met seismic codes.
- ◆ The California Seismic Safety Commission, through the California Earthquake Loss Reduction Program, develops a plan every five years to guide state seismic policy. The most recently revised draft plan includes an element that specifically addresses the at-risk population.

Discuss what makes these and other groups vulnerable.

“The disaster field has long acknowledged that natural disasters are ‘social’ events, having their foundations in the social structure, and recently the dialogue surrounding the vulnerability of racial, ethnic communities in the U.S. has increased.”
(Fotherfill, Darlington, Maestas 1999)

Tools and Techniques for Hazards Vulnerability Analysis

20 minutes

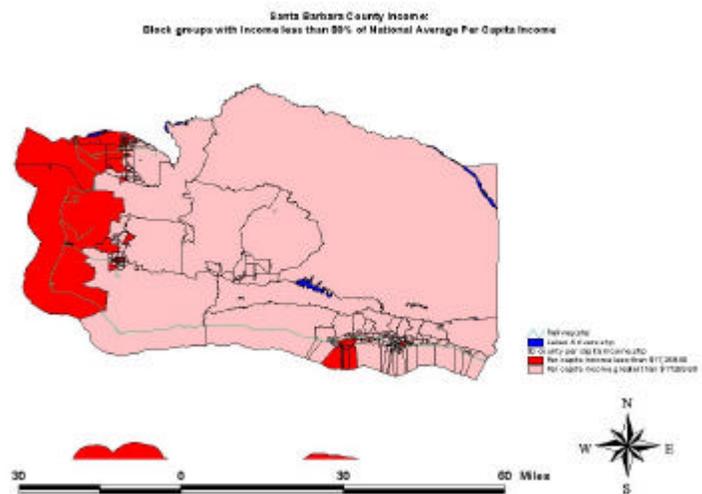
ASK

What tools and techniques are you currently using in your communities?

Geographic Information Systems (GIS)

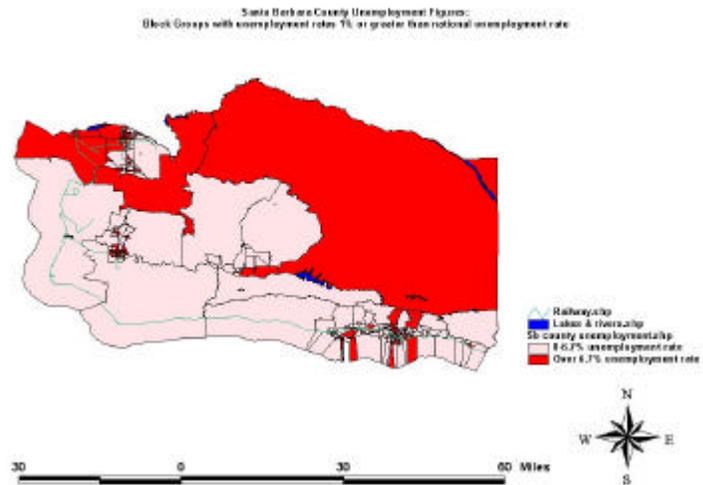
Show Visual 2-25.

Briefly describe some of the capabilities of GIS.



Show Visual 2-26.

Continue your discussion of GIS capabilities, emphasizing its usefulness and you can use it to build on to get a basic outline of the community.



GIS is a computer-based tool for mapping and analyzing physical elements and events that occur on earth. GIS is a database that relates detailed information directly to a geographical area for mapping and analysis purposes.

GIS allows users to overlay different kinds of data to determine relationships among them.

Maps produced with GIS can help to explain hazard events, predict outcomes, visualize scenarios, and plan strategies.

GIS can help map hazard areas and present hazard identification information, allowing you to compare these areas with existing land uses.

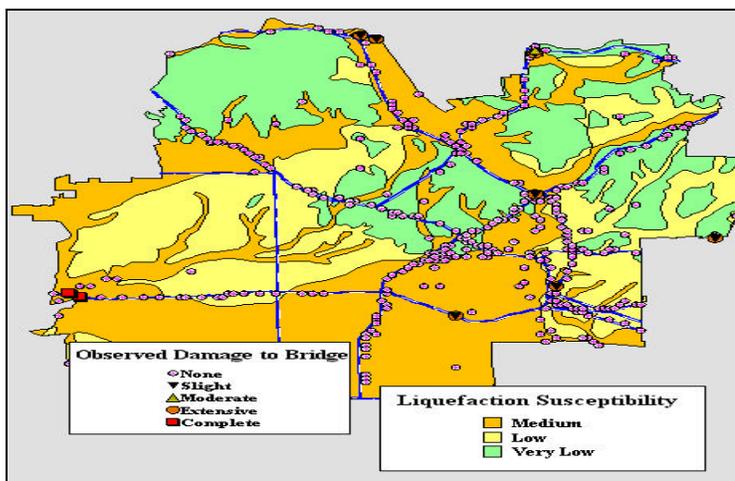
Modeling Programs

Hazards U.S. (HAZUS)

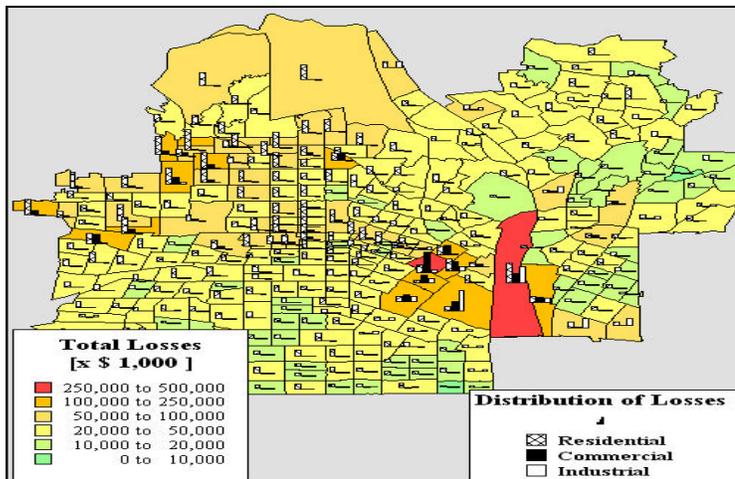
Show Visual 2-27.

Explain the purpose of HAZUS.

An example of one program is HAZUS, there are others also.



Show Visual 2-28.



HAZUS is a standardized, nationally applicable earthquake loss estimation methodology that uses PC-based GIS software.

The HAZUS loss estimation methodology is a software program that uses mathematical formulas and information about building stock, local geology and the location and size of potential earthquakes, economic data, and other information to estimate losses from a potential earthquake.

Unit 2: Hazard Vulnerability Analysis and Risk Assessment

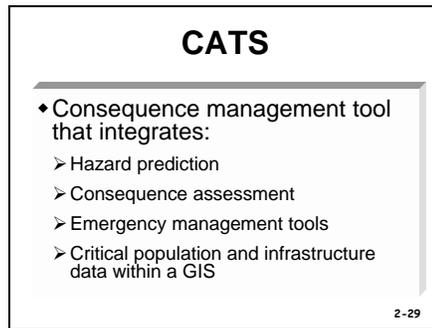
Default data contained in HAZUS includes:

- ◆ Demographic data (population, age, ethnicity, and income)
- ◆ General building stock (square footage of occupancy classes for each census tract)
- ◆ Medical care facilities
- ◆ Emergency response facilities (fire, police, emergency operation centers)
- ◆ Schools
- ◆ Dams
- ◆ Hazardous materials facilities
- ◆ Roads, airports, and other transportation facilities
- ◆ Electric power, oil, and gas lines and other utility facilities.

Consequences Assessment Tool Set (CATS)

Show Visual 2-29.

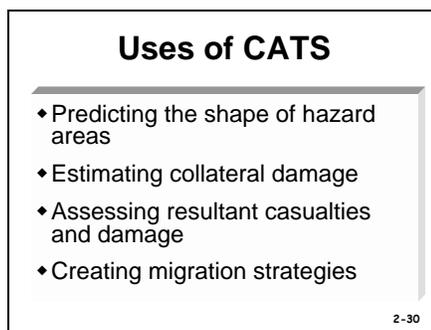
Describe the CATS.



The Consequences Assessment Tool Set is a consequence management tool package that integrates hazard prediction, consequence assessment, emergency management tools, including the Hazard Prediction and Assessment Capability (HPAC) system, and critical population and infrastructure data within a commercial Geographical Information System.

Show Visual 2-30.

Explain the purpose of CATS.



Its uses include:

- ♦ Predicting the shape of hazard areas caused by earthquakes, hurricanes or chemical, biological, radiological, nuclear or explosive events;
- ♦ Estimating collateral damage in such events to military, civil and industrial installations;
- ♦ Assessing resultant casualties and damage to facilities, resources and infrastructure; and
- ♦ Creating mitigation strategies for both tactical and strategic force support.

Background

The Defense Threat Reduction Agency and the U.S. Federal Emergency Management Agency developed the Consequences Assessment Tool Set to support emergency managers' training, exercises, contingency planning and logistical planning, as well as to calculate requirements for humanitarian aid and force protection. The Geographical Information System interface enables the user to combine and manipulate multiple layers of information on a variety of visual information backgrounds and maps to assess affected persons, property and infrastructure. Through user-friendly graphical interfaces and pre-defined event scenarios, CATS can be used regardless of the user's level of expertise or access to information.

Consequences Assessment Tool Set

Features:

- ◆ Integrated hazard prediction tools
 - Military and terrorist weapons of mass destruction hazards: nuclear, biological and chemical
 - Natural hazards: hurricanes, storm surges and earthquakes
 - Other technological hazards: hazardous materials, high explosives and radiological material
- ◆ Effects assessment tools
 - Population: deaths, injuries and displacement
 - Infrastructure: structural damage and service interdiction
- ◆ Supporting data
 - Geo-spatial databases: imagery, maps, population and infrastructure
 - Supporting metadata
 - User data input and modification in real-time
- ◆ Mitigation analysis
 - Logistical, facility, commodity and service resource queries
 - Medical resource queries

Applications for the Consequences Assessment Tool Set

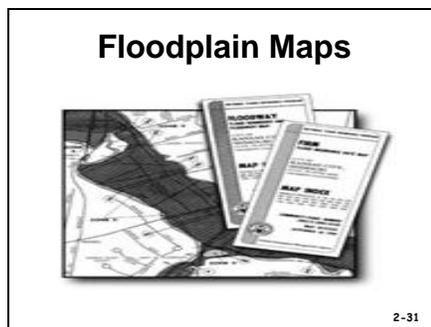
The Consequences Assessment Tool Set has supported:

- ◆ Activities covered by local fire departments and emergency response personnel
- ◆ The September 11th attacks on the World Trade Center and the Pentagon

Floodplain Maps

Show Visual 2-31.

Discuss the purpose and use of Floodplain maps.



Refer participants to the following web site:

<http://www.esri.com/hazards/>

FEMA has created Flood Insurance Rate Maps (FIRM) for more than 19,000 communities, which illustrate areas in the 100-year floodplain, but also coastal high hazard areas, the floodway, and the 500-year floodplain.

FEMA and the Environmental Systems Research Institute (ESRI) have formed a national partnership in part aimed at providing multi-hazard maps and information to U.S. residents, business owners, schools, community groups, and local governments via the Internet. The information provided here is intended to assist in building disaster-resistant communities across the country by sharing geographic knowledge about local hazards.

(<http://www.esri.com/hazards/>)

Mention that now participants will have a chance to see how these programs have been used successfully in communities.

Case Studies: Successful Approaches

20 minutes

Give examples of successful approaches to hazard mitigation. Ask the class to share examples.

Show Visual 2-32.

Review the Oregon Showcase State Program or use a recent example.

Oregon Showcase State Program

- Partners for Disaster Resistance
 - Comprehensive framework for government and private sector to prepare for and minimize risk and impact of natural hazards
 - Organized around 14 elements, such as:
 - Formal commitment and strategic plan
 - Statewide hazard and risk assessment
 - Business recovery alliances
 - Incentives and disincentives
 - Focus on creating partnerships

2-32

PARTNERS FOR DISASTER RESISTANCE: OREGON SHOWCASE STATE PROGRAM: A CASE STUDY

What is Partners for Disaster Resistance: Oregon Showcase State?

On December 12, 2000, Oregon Governor John Kitzhaber signed an Executive Order designating Oregon a "Showcase State for Natural Disaster Risk Reduction." This Executive Order follows a model developed and tested in Rhode Island by the Institute for Business & Home Safety (IBHS), an initiative of the insurance industry to reduce deaths, injuries, property damage, economic loss and human suffering caused by natural disasters. The Executive Order builds upon the sound foundation established by the state's land use planning laws, building code requirements, emergency preparedness planning, hazards assessment, and other policies and programs. The Showcase State program provides a comprehensive framework for government and the private sector to prepare for and minimize risk and impact of natural hazards. Specifically, the mission of the Showcase State Initiative is to:

Prevent injuries and deaths,

Protect public and private property

Create a disaster-ready statewide economy through public and private partnerships.

Organized around 14 interdependent elements the Showcase State model provides an integrated, cost-effective and systematic approach for all levels of government and the private sector by bringing together resources—both human and financial—to prepare for and minimize natural disaster impacts. These elements are measurable activities that serve both to institutionalize disaster protection into long-range policies, procedures, programs, designs and plans and to take immediate action to begin to reduce costs associated with disasters.

The Partners for Disaster Resistance: Oregon Showcase State Program provides a unique opportunity to demonstrate how state and local governments, the insurance industry, academia, and private sector can work together to promote awareness of natural hazard risks and associated risk reduction strategies. Oregon Natural Hazards Workgroup (ONHW) at the University of Oregon is serving as the statewide

Disaster-Resistant Jobs: Strategies for Community, Emergency, and Economic Risk Management

coordinator for the program. A primary aim of the program is to create and strengthen private/public partnerships to enhance disaster safety and preparedness statewide. In its coordinating role, ONHW facilitates and implements activities to motivate behavioral change among communities, individuals and businesses.

Interest in the partnership emerged from both the public and private sectors following the Rhode Island Showcase State announcement in late 1998. The Oregon Department of Geology and Mineral Industries and Oregon Emergency Management continue to lead state agency interest from their missions in identifying hazards and reducing public safety risks. SAFECO Insurance Companies, and the Insurance Information Service of Oregon and Idaho (IISOI) lead private sector interest in minimizing property damage and economic losses and expediting economic recovery after a disaster. The initiative is bolstered by the ongoing work and coordination of ONHW. For more information on the Partners for Disaster Resistance: Oregon Showcase State Program please visit www.oregonshowcase.org.

Showcase State Model – 14 Elements

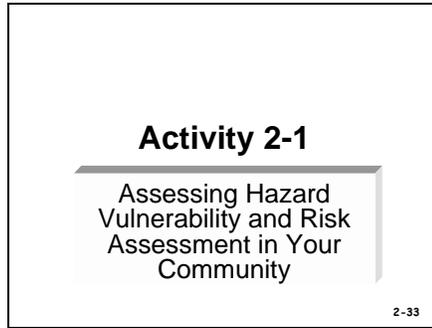
1. Formal commitment and strategic plan	Obtain Governor-level executive order to formalize partnership. Create 5-year plan, with 1-year action plan.
2. Statewide hazard and risk assessment	Identify hazards and what's at risk statewide to help prioritize disaster-resistant actions.
3. Business recovery alliances	Develop partnerships with businesses for coordinated mitigation, preparedness, response, and recovery.
4. Enforceable building code	Adopt and enforce a statewide model code that incorporates hazard-resistant design.
5. Land use plans	Address relevant hazards in state-level land use decisions. Encourage adoption of local plans that incorporate hazards and mitigation strategies.
6. Response and recovery plans	Maintain a state emergency response plan. Develop a post-disaster recovery plan with local post-disaster plans.
7. Rating and regulatory systems	Improve compliance and participation in natural-hazard related rating and regulatory systems (e.g., the NFIP, Community Rating System, etc.).
8. Lifeline protection	Incorporate disaster protection measures into public and private lifeline utilities, infrastructure, and critical facilities.
9. Community-level disaster resistance	Encourage the development of disaster-resistant communities within the state and coordinate at local and regional levels.
10. Public awareness and outreach	Develop programs to increase the public's awareness of natural hazards and how to reduce or prevent damage
11. School curricula	Incorporate natural hazard awareness and reduction programs into grade school and higher education curricula.
12. Protection of childcare centers	Support IBHS and its partners in the nonstructural retrofit of nonprofit childcare centers.
13. Professional training	Conduct mitigation training for building design and construction professionals and others to incorporate disaster resistance into policy and practice.
14. Incentives and disincentives	Identify existing incentives and disincentives for hazard loss reduction action. Develop and enact appropriate incentives or adjustments.

Activity 2-1: Assessing Hazard Vulnerability and Risk Assessment in Your Community

45 minutes

Show Visual 2-33.

Review the directions for the **Assessing Hazard Vulnerability and Risk Assessment in Your Community** exercise.



Activity 2-1: Assessing Hazard Vulnerability and Risk Assessment in Your Community

Time

15 minutes (individual work)

20 minutes (table group discussions)

10 minutes (class discussion)

Purpose

The purpose of this exercise is to acquaint you with tools and techniques that your community is using and to share information with others about what they are using.

Directions

- 1.** Work in small table groups, as assigned.
- 2.** Using the work sheet provided, individually answer the questions. After you have finished, discuss your answers within your group. As you come up with new uses, record them on the easel pad.
- 3.** Be prepared to share your findings with the class. Choose a spokesperson and be prepared to relay the following information to the class:
 - ◆ Key tools and technologies used in your communities
 - ◆ Unique examples of how a tool or technology has been used in the community
 - ◆ Ideas for use of a particular tool in the future

ACTIVITY 2-1: ASSESSING HAZARD VULNERABILITY WORKSHEET

1. Has your community completed a comprehensive, all-hazard vulnerability assessment?
2. Who has been involved in developing this assessment?
3. How is the hazard vulnerability assessment actively being used to address risk and to foster disaster resistance in your community?
4. What tools and technologies are currently being used in your community for the hazard vulnerability analysis and risk assessment?
5. How are these tools and technologies actively being used for hazard vulnerability assessment, public awareness or other approaches to reducing local hazards?
6. Who uses these tools and technologies?

Summary

3 minutes

Show Visual 2-34.

Summarize the unit.

Summary

- Reasons for developing a hazards vulnerability baseline
- Steps for conducting a hazard vulnerability analysis
- Types of natural, technological, and man-made hazards that can affect our community and our nation

2-34

Show Visual 2-35.

Summarize the unit.

Summary

- Cascading "ripple" impact of disasters
- Demographic changes are affecting vulnerability to hazards
- Tools and technologies for vulnerability analysis

2-35