MITIGATION IDEAS:

POSSIBLE MITIGATION MEASURES BY HAZARD TYPE

Flood Damage Prevention

Home Elevation

Lightning Dangers

Radiation Hazards

Tornado Preparedness

Safe Rooms

FEMA Region 5, September 2002

MITIGATION IDEAS:

POSSIBLE MITIGATION MEASURES BY HAZARD TYPE

A Mitigation Planning Tool For Communities

Hazard mitigation refers to any sustained action taken to reduce or eliminate the long-term risk to human life and property from hazardous conditions. The following list of possible hazard mitigation measures for communities is compiled from experience and discussion within the states of FEMA Region 5: Illinois, Indiana, Michigan, Minnesota, Ohio and Wisconsin. The list of hazard types and ideas starts generally with coverage of natural hazards, such as flood or earthquake. These are followed by types of man-made and technological hazards. As extensive as this list is, it does not preclude other ideas for activities to save lives and prevent or reduce damages in the future. Many of the ideas are developed in other FEMA publications, including www.fema.gov, as well as in publications of other federal and state agencies.

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A WORD ABOUT PLANNING

Mitigation planning is best accomplished from a multi-hazard perspective. Reducing the level of risk involving one natural or technological hazard may increase the risk of damage from another hazard. Consequently, it is important to consider that some mitigation alternatives may not be viable given a particular set of hazard conditions. For example, elevating a home on stilts to allow for water flow in a floodplain can be a good thing, but it becomes a problem if the home is in an earthquake zone and the ground starts shaking.

PREPAREDNESS FOR ALL TYPES OF HAZARDS

Some mitigation ideas fit easily into many or all hazard types. These also tend to fall under a type of planning generally referred to as "preparedness." A selection of mitigation/preparedness ideas is included here at the beginning; these ideas can be considered relevant to all sections of the mitigation ideas list.

Public Education and Awareness	State and local governments can provide information describing all types of hazards, methods for preventing damages resulting from hazardous conditions, and how to respond when a hazard threatens. Either directly or by lobbying elected officials, citizens can also get involved in comprehensive planning activities that identify and alleviate their communities' hazards.
Mutual Aid/Interagency Agreements	Local governments should establish mutual aid agreements for utility and communications systems, including 9-1-1. Mutual aid or interagency agreements have value for preventing or responding to other hazard or emergency situations, as fire and police departments often do.
9-1-1 and 3-1-1	Some communities have expanded their basic 9-1-1 location identification telephone service to include features such as "enhanced 9-1-1" that registers name, address, and a description of the building/site. It has become more common to use a "reverse 9-1-1" system with which a community can send out a mass telephone announcement to every number in the 9-1-1 system. Additionally, non-emergency 3-1-1 service can be used to have people call to get information, such as locations of cooling shelters during a heat wave.
NOAA Weather Radio	Communities can encourage the use of National Oceanic and Atmospheric Administration (NOAA) weather radios among their residents. At least one set of counties surrounding a chemical stockpile has provided NOAA weather radios to all homes and businesses within the area. NOAA Weather Radio continuously broadcasts National Weather Service forecasts, warnings and other crucial weather information. NOAA Weather Radio also provides direct warnings to the public for natural, man-made, or technological hazards, and it is the primary trigger for activating our country's Emergency Alert System (EAS) on commercial radio, television, and cable systems.

Emergency Alert System	Using digital technology to distribute messages to radio, television and cable systems, the EAS provides state and local officials with the ability to send out emergency information targeted to a specific area. The information can be sent electronically through broadcast stations and cable systems even if those facilities are unattended.
Continuity of Operations Planning	The goal of Continuity of Operations (COOP) planning is to ensure that the essential functions of an organization, including government, can continue to operate during and after an emergency incident which may prevent access to normally operating systems, such as physical plant, data or communication networks, or transportation. Communities can encourage businesses, other organizations, and families to prepare themselves by regularly backing up computer drives, copying essential files and/or important family information, and storing these items in a separate location. A larger organization may coordinate with another office from the organization in a different part of the country to take over operations when necessary.
Land Use Planning	Once a community is familiar with the location of its hazardous areas; it may adopt a land use plan, or modify an existing land use plan to: ❑ Guide development away from hazardous areas; ❑ Reduce density in the hazardous areas; or ❑ Encourage greater development restrictions on the property.
Site Emergency Plans	Communities can encourage development and testing of internal emergency plans and procedures, including COOP planning, by businesses and other organizations. Communities should develop and test site emergency plans for schools, factories, office buildings, shopping malls, hospitals, correctional facilities, stadiums, recreation areas, and other similar facilities.
Emergency Response Personnel	Emergency response personnel need to be trained and plan for various contingencies and response activities, such as evacuation, traffic control, search, and rescue.
Community Emergency Response Teams	A community may consider sponsoring a Community Emergency Response Team (CERT). A CERT is a volunteer group of citizens who are trained and equipped to respond if emergency services are unable to meet all of the immediate needs of the community following a major disaster, especially if there is no warning as in an earthquake.
Insurance	Insurance should not be considered an alternative to reducing damages for any type of hazard, but it does have the value of protecting oneself from financial devastation if damage were to occur.

Real Estate Disclosure	Real estate disclosure laws are important because they force a seller to advise a potential buyer about pre-existing conditions. This allows buyers to make more informed decisions about the potential risks involved in owning property, such as whether a property is located in a floodplain or if it had been previously damaged from flood water or any other type of hazard condition.
Family Disaster Plans and Supply Kits	Communities can encourage residents to prepare themselves by stocking up with necessary items and planning for how family members should respond if any of a number of possible emergency or disaster events strike.

FLOOD

Ninety percent of federal disaster declarations are for flood events. Response and recovery costs can be extremely high, so where risks are apparent it makes sense to take actions that prevent damage from occurring. If flood damage cannot be fully prevented, there may be mitigation techniques that lessen the damage. Flooding addressed in this section can be from high ground water, overland flooding from rivers or streams, or from a dam failure.

Acquisition	Land with structures may be purchased by and titled in the name of a local governing body that can remove structures and enforce permanent restrictions on development.
Relocation	A structure may be moved to a less hazardous location.
Elevation	A structure may be mechanically lifted so that the lowest floor, including the basement, is raised above the base flood elevation. Utilities or other mechanical devices should also be raised above expected flood levels.
Dry-Floodproofing	It may be possible to keep water out by strengthening walls, sealing openings, or using waterproof compounds or plastic sheeting on walls. Dry-floodproofing is not recommended for residential construction but may be a reasonable alternative for non-residential structures—either in new construction, while making a substantial improvement, or while repairing a substantially damaged structure.
Wet-Floodproofing	Using water resistant paints or other materials can allow for easy cleanup after floodwater exposure in accessory structures or in a garage area below an elevated residential structure. In a basement, wet-floodproofing may be preferable to attempting to keep water out completely, because it allows for controlled flooding to balance exterior and interior water forces and discourage structural collapse. Wet-floodproofing may not be used for basements in cases of new construction, substantial improvement, or substantial damage.

Floodplain/Coastal Zone Management	Determining and enforcing acceptable land uses through planning and regulation may not prevent inevitable flooding in flood-prone areas, but planning and regulation can alleviate the risk of damage by limiting exposure in such hazard areas. Floodplain and coastal zone management can be included in comprehensive planning.
Capital Improvement Plans	Infrastructure planning decisions can affect flood hazard mitigation. For example, decisions to extend roads or utilities to an area may increase exposure. Some communities may consider structural flood protection such as levees or floodwalls.
Zoning Ordinance Adoption or Amendments	Examples of zoning methods that affect flood hazard mitigation include: 1) adopting ordinances that limit development in the floodplain; 2) limiting the density of developments in the floodplain; and 3) requiring that floodplains be kept as open space.
Subdivision Ordinances or Amendments	Subdivision design standards can require elevation data collection during the platting process. Lots may be required to have buildable space above the base flood elevation.
Building Code Adoption or Amendments	Requirements for building design standards and enforcement include the following possibilities: 1) that a residential structure be elevated; and 2) that a non-residential structure be elevated or floodproofed.
Conservation Easements	Conservation easements may be used to protect environmentally significant portions of parcels from development. They do not restrict all use of the land. Rather, they direct development to areas of land that are not environmentally significant.
Transfer of Development Rights	In return for keeping floodplain areas in open space, a community may agree to allow a developer to increase densities on another parcel that is not at risk. This allows a developer to recoup potential losses from non-use of a floodplain site with gains from development of a non-floodplain site.
Purchase of Easement/Development Rights	Compensating an owner for partial rights, such as easement or development rights, can prevent a property from being developed contrary to a community's plan to maintain open space. This may apply to undeveloped land generally or to farmland in particular.
Stormwater Management Ordinances or Amendments	Stormwater ordinances may regulate development in upland areas in order to reduce stormwater run-off. Examples of erosion control techniques that may be employed within a watershed area include proper bank stabilization with sloping or grading techniques, planting vegetation on slopes, terracing hillsides, or installing riprap boulders or geotextile fabric.

Multi-Jurisdiction Cooperation Within Watershed	Forming a regional watershed council helps bring together resources for comprehensive analysis, planning, decision-making, and cooperation.
Comprehensive Watershed Tax	A tax can be used as a mitigation action in several ways: 1) tax funds may be used to finance maintenance of drainage systems or to construct reservoirs; 2) tax assessments may discourage builders from constructing in a given area; or 3) taxes may be used to support a regulatory system.
Post-Disaster Recovery Ordinance	A post-disaster recovery ordinance regulates repair activity, generally depending on property location. It prepares a community to respond to a disaster event in an orderly fashion by requiring citizens to: 1) obtain permits for repairs, 2) refrain from making repairs, or 3) make repairs using standard methods.
Flood Insurance	Purchasing flood insurance does not prevent a flood from occurring, but it does mitigate a property owner's financial exposure to loss from flood damage. National Flood Insurance Program (NFIP) policies are only available in communities that participate in the program, which is administered by FEMA.
Floodplain Ordinances or Amendments	Communities that choose to participate in the NFIP must adopt ordinances that meet minimum federal and state requirements. Communities may pass more stringent ordinances to reduce risk even further.
Community Rating System	Also administered by FEMA, the Community Rating System (CRS) is a companion program to the NFIP. It rewards a community for taking actions over and above minimum NFIP requirements with the goal of further reducing flood damages in the community. The more actions a community takes, the lower the premiums for flood insurance within that community.
Updated Floodplain Mapping	By taking the initiative locally to more accurately map problem areas with information not already on FEMA maps, a community can warn residents about potential risks that may not have been anticipated. Upgrading maps provides a truer measure of risks to a community.
Storm Drainage Systems	Flood mitigation can involve installing, re-routing, or increasing the capacity of a storm drainage system that may involve detention and retention ponds, drainage easements, or creeks and streams. It can include separation of storm and sanitary sewerage systems as well as higher engineering standards for drain and sewer capacity.
Drainage System Maintenance	At most times, a drainage system will do its job and move water to intended areas. However, if a system is not maintained, erosion, material dumping, or deterioration of man-made reinforcement materials may reduce the carrying capacity of a stream. Therefore, regular maintenance, such

	as sediment and debris clearance, is needed so that the stream may carry out its design function. Also important is detection and prevention/discouragement of discharges into storm-water/sewer systems from home footing drains, downspouts or sump pumps.
Drainage Easements	Communities may consider obtaining easements for planned and regulated public use of privately owned land for temporary water retention and drainage.
Wetland Protection	With special soils and hydrology, wetlands serve as natural collection basins for floodwaters. Acting like sponges, wetlands collect water, filter it, and release it slowly into rivers and streams. Protecting and preserving wetlands can go a long way toward preventing flooding in other areas.
Roads	Roads are needed to get people and goods from place to place. In addition to planning for traffic control during floods, there are various construction and placement factors to consider when building roads. To maintain dry access, roads should be elevated above the base flood elevation. However, if a road creates a barrier it can cause water to pond. Where ponding is problematic, drainage and flow may be addressed by making changes to culvert size and placement. In situations where flood waters tend to wash roads out, construction, reconstruction, or repair can include not only attention to drainage but also stabilization or armoring of vulnerable shoulders or embankments.
Structural Flood Control Measures	Structural flood control measures (e.g., levees, dams, or floodwalls) channel water away from people and property. Structural measures may also increase drainage or absorption capacities (e.g., detention and retention basins, relief drains, spillways, drain widening/dredging or rerouting, logjam and debris removal, extra culverts, bridge modification, dike setbacks, flood gates and pumps, or channel redirection). However, structural measures may cause an increase in the base flood elevation. History has shown that structures that channel water may create a false sense of security and result in greater damage to nearby properties if the structures fail.
Minor Structural Projects	A minor structural project is similar but smaller and more localized than a structural project, in that the measures used to reduce flooding may include levees, floodwalls, dams or other activities that channel water away from people or property. However, a minor structural project should only be constructed in areas that cannot be mitigated through non-structural activities, or where structural activities are not feasible due to low densities.
Dam and Levee Maintenance	Although dams and levees may have been constructed properly, failure to maintain them can lead to significant loss of life and property if they are stressed and broken or

	breached during a flood event. An inspection, maintenance and enforcement program helps to ensure continued structural integrity. Dams or levees need to be kept in good repair. Unnecessary or old and structurally unsound dams should be removed. Planning for dam breaks can include constructing emergency access roads as well as automating pump and flood gate operation. And it never hurts to regulate development in a dam's hydraulic shadow, where flooding would occur if there were a severe dam failure.
Community Outreach and Education	Communities may use outreach programs to: 1) advise homeowners of risks to life, health and safety; 2) facilitate technical assistance programs that address measures that citizens can take; or 3) facilitate funding for mitigation measures. Driver safety strategies for flooded areas can be addressed through driver safety/education classes and by the media. Local officials can be trained on flood fighting, floodplain management, flood proofing, traffic control during flooding, and other measures.
Debris Control	Community members can participate in debris control by securing debris, yard items, or stored objects that may otherwise be swept away, damaged, or pose a hazard if floodwaters would pick them up and carry them away. Additionally, a community can pass and enforce an ordinance that regulates dumping.
Hazardous and Buoyant Material Protection	Containers of hazardous materials such as petroleum or chemicals should not be located in a flood hazard area. If such a location is necessary, hazardous material containers need to be anchored, because the contents can contaminate water and multiply the damaging effects of flooding by causing fires or explosions, or by otherwise making structures unusable. Also, buoyant materials should be anchored, because if they float downstream, they may cause additional damage to buildings or bridges or may plug a stream resulting in higher flood heights.
Manufactured Homes	Manufactured or mobile homes should be elevated above the base flood elevation and anchored, or more preferably, kept out of the floodplain.
Flood Warning	In addition to a communication strategy, a flood warning system may consist of people or machines monitoring water level with stream gauges. Although a flood warning system generally does not provide long-term damage reduction, it can alleviate health and safety risk by providing citizens time to escape and possibly remove belongings that could be damaged. NOAA weather radio and EAS broadcasts can be incorporated into a community's flood warning system.

Back-up Generators	A community may consider back-up generators for pumping and lift stations in sanitary sewer systems, along with other measures (e.g., alarms, meters, remote controls, and switchgear upgrades).
Basement Backflow Prevention	Depending on its infrastructure capabilities, a community may encourage the use of check valves, sump pumps, and backflow prevention devices in homes and buildings.

LANDSLIDE AND DEBRIS FLOW

Landslides or debris flow can be caused by the same high water levels or rain that result in flooding. Landslides can also be caused by earthquakes. Although many mitigation measures resemble those for flooding, landslides pose unique considerations.

Mapping	Local governments, developers, and residents can make better decisions using maps. Soil types, slope percentage, drainage, or other critical factors are used to identify landslide prone areas.
Building Codes	Building codes can set construction standards, including minimum foundation requirements, in landslide-prone areas.
Zoning Ordinances	Zoning ordinances may be used to create buffers between structures and high-risk areas.
Slide-Prone Area Ordinance	A special purpose ordinance for slide-prone areas may be used to limit fill or dumping, as well as address drainage and other landslide related problems.
Code Enforcement	A strong community commitment to code enforcement is necessary to ensure compliance with building codes and zoning ordinances.
Drainage Control Regulations	Drainage regulations are similar to storm water management regulations. By controlling drainage, a community can reduce the risk of landslides resulting from saturated soils.
Grading Ordinances	Grading ordinances require developers and landowners to obtain permits prior to filling or regrading. Such ordinances may also provide specific design standards.
Hillside Development Ordinances	Hillside development ordinances are special purpose ordinances that set specific standards for construction on hillsides.
Subdivision Ordinances	Subdivision ordinances set guidelines on how land will be divided, the placement and size of roads, and the location of infrastructure. Such ordinances can also be used to regulate open space and buildable areas.
Sanitary System Codes	Sanitary system codes can reduce the effect of drainage on landslides by limiting the type and location of sanitary systems.

Geological Hazard Overlay Zones	A geological hazard overlay zone requires a detailed geo-technical analysis prior to any construction activity. Used in association with building codes, this may reduce damage potential by providing clear information about risk.
Open Space Designations	Open space designations keep landslide prone areas undeveloped.
Relocation	Structures may be moved to less hazardous locations.
Acquisition	Land and structures may be purchased by and titled in the name of a local governing body that can remove structures and enforce permanent restrictions on development.
Restraining Structures	Restraining structures may be designed and used to hold soil in place.
Debris-Flow Measures	Debris-flow measures may include stabilization, energy dissipation, and flow control measures, all of which may reduce damage in sloping areas.
Grading	Grading can be used to increase slope stability, depending on types of soils, height of fill or cut, and compaction.
Vegetation Placement and Management Plans	Various types of vegetation increase soil stability through root length and strength and by absorbing precipitation. Management plans are aimed at ensuring long-term maintenance of vegetation appropriate for an area.
Utility Location	Placing utilities outside of landslide areas decreases the risk of service disruption.
Abatement Districts	A special taxing district, such as an abatement district, can be used to pool resources to mitigate common hazards.
Restrictive Covenants	A legally binding agreement in a private development can be used to impose restrictions on land use.

THUNDERSTORMS / LIGHTNING

Damage from thunderstorms and lightning is often underestimated. Everyone should have an appreciation for the dangers of lightning. Although not entirely preventable, damage and life safety risk from these events can be minimized.

Community Outreach and Education	Communities may use outreach programs to promote awareness of thunderstorm dangers. Driver safety strategies for severe weather events can be addressed by driver safety/education classes and by the media.
Early Warning Systems	Local and state governments can invest in public early warning systems/networks, as well as train people to serve as weather spotters.
Building Construction	Public and private buildings can be designed with structural bracing, shutters, laminated glass in window panes, and hail-resistant roof shingles or flashing to minimize damage.

Surge Protectors and Lightning Protection	Surge protection can be installed on critical electronic equipment. Lightning protection devices and methods, such as lightning rods and grounding, can be installed on a community's communications infrastructure and other critical facilities.
Burying Power Lines	Buried power lines offer the security of uninterrupted power during and after storms. However, consideration needs to be made for maintenance and repair, particularly in cold climates where soil freezes more readily.

TORNADO

Tornadoes can strike anywhere and cause extensive damage. Damage and life safety risk may not be entirely preventable, but it can be minimized.

Construction Standards and Techniques	To strengthen public and private structures against severe wind damage, communities can require or encourage wind engineering measures and construction techniques that may include structural bracing, straps and clips, anchor bolts, laminated or impact-resistant glass, reinforced pedestrian and garage doors, window shutters, waterproof adhesive sealing strips, or interlocking roof shingles. Also, architectural design can make roofs less susceptible to uplift.
Safe Rooms	Risk to lives can be improved through construction and use of concrete safe rooms in homes and shelter areas of mobile home parks, fairgrounds, shopping malls, or other vulnerable public areas.
Manufactured Homes	Damage and injury can be prevented by anchoring manufactured homes and exterior attachments such as carports and porches.
Loose Items	Loose items like yard and patio furniture should be secured.
Temporary Debris Disposal	Temporary debris disposal sites can be protected by fencing and/or located away from populated areas.

SEVERE WIND

Severe wind can be as destructive as tornadoes. Damage and life safety risk may not be entirely preventable, but it can be minimized.

Roofing Shingles	Requiring the use of special roofing shingles designed to interlock and resist uplift forces in extreme wind conditions can reduce damage to a roof or to other structures.
Building Construction	Engineered construction can accommodate foundation design, braced elevated platforms, and the ability of a structure to withstand the lateral forces of winds and waves.

Manufactured Home Tie-Downs	The risk of manufactured home damage can be reduced by using tie-downs with anchors and ground anchors appropriate for the soil type.
Burying Power Lines	Buried power lines offer the security of uninterrupted power after severe winds, but consideration needs to be made for maintenance and repair.
Designed-Failure Mode	Designed-failure mode refers to power line design that allows for lines to fall or fail in small sections rather than as a complete system, so restoration can be done more quickly.
Backup Power	Backup power resources can enable critical facilities to continue basic services and can be used by businesses to ensure security and protect refrigerated goods.
Tree Management	Tree pruning near power lines can reduce the potential for trees falling on and breaking power lines.

EXTREME TEMPERATURE

When temperatures reach levels that are extremely high or extremely low, they pose dangers that can be alleviated by planning for how to handle such situations.

Outreach/Public Awareness	A local government can organize outreach to vulnerable populations during periods of extreme temperature, including establishing and promoting accessible heating or cooling centers in the community.
Heating Requirements	Housing/landlord codes can require minimum temperatures.
Heating Bills	If not already required by state law, communities can encourage utility companies to offer special arrangements for paying heating bills.
Heating and Cooling Centers	A community can establish heating and/or cooling centers for vulnerable populations. Center operations should be linked to outreach projects that encourage at-risk populations to use the centers.

WINTER WEATHER/SNOWSTORMS

Proper preparation can decrease the risks of injury that can occur during cold weather, and snowstorms in particular.

Family and Traveler Emergency Preparedness	A local or state government can produce and distribute family and traveler emergency preparedness information relating to severe winter weather hazards.
Driver Safety	Safety strategies for severe weather events can be included in driver education classes and materials.
Power Lines	Burying or otherwise protecting electric and other utility lines can prevent utility disruption by protecting lines from ice,

	wind or snow damage. Nevertheless, lines buried in frozen soil may be difficult to reach if repair is necessary.
Code Enforcement and Building Maintenance	Local governments can impact building/site design through building code enforcement of snow-related ordinances such as snow loads, roof slope, snow removal, and storage. Communities can also monitor snow amounts to provide site-specific snow load data.
	Home and public building maintenance should be encouraged in order to prevent roof and wall damage from “ice dams,” particularly resulting from ice and sleet storms.
Shelters	A community can establish heating centers or shelters for vulnerable populations, not only for residents, but also for stranded motorists/travelers.
Outreach	A community can plan to systematically contact isolated, vulnerable, or special-needs populations.
Animal Protection	Farmers and other animal custodians should plan for addressing livestock or other animal needs.
Roads	Local governments need to always plan for and maintain adequate road and debris clearing capabilities.
Snow Fences	Using snow fences or “living snow fences” (rows of trees or other vegetation) can limit blowing and drifting of snow over critical roadway segments.

SNOW LOAD

Buildings can only hold so much snow before they collapse. Paying attention to snow load weight capacities can prevent damage and injury.

Snow Load Design Standards	A single snow load weight capacity standard may not be adequate for all areas within a community. Local building departments should determine the snow load limits for their communities based on local data. A community’s building code can include snow load limits or weight capacity standards in an appendix.
Snow Weight Data Collection	Establishing a program of systematic snow weight data collection will enable a community’s building department to better establish realistic snow load design standards.
Maintenance	Building owners should be educated and encouraged to inspect older buildings for deterioration and make subsequent repairs.
Modifications	As buildings are modified, new technology may be used to create or increase structural stability.

Analysis and Repair or Replacement of Structural Systems	Existing support systems may be vulnerable to load stress. A community may wish to set up an inspection system and recommend repairs to building owners.

SUBSIDENCE

Some areas of land are susceptible to collapse. Risks of collapse can be determined and managed.

Community Awareness	Local and state governments can promote community awareness of subsidence risks and effects.
Mapping	Old mining areas or geologically unstable terrain should be identified and mapped so that development can be prevented or limited.
Open Space	Areas susceptible to collapse can be maintained as public open space.
Acquisition	Land or structures may be purchased by and titled in the name of a local governing body that can enforce permanent restrictions on development.
Filling or Buttressing	Filling or buttressing subterranean open spaces, as with abandoned mines, can prevent or alleviate collapse.
Relocation	A structure may be moved to a less hazardous location.
Hydrological Monitoring	Groundwater levels can be monitored in subsidence-prone areas.

EARTHQUAKE

Some regions are particularly susceptible to earthquake damage. Risks of injury and damage from earthquake events can be determined and managed.

Seismic Hazard Mapping	Information gained from seismic hazard mapping can be used to assess risk. The first step is collection of geologic information on seismic sources, soil conditions, and related potential hazards. The second step is to prepare a map showing the approximate locations of various hazards.
Related Hazard Mapping	Other earthquake related hazards include liquefaction and land slides. Maps of these related hazards may be used for vulnerability analysis and risk assessment.
Map Education	Map users should be educated in the appropriate uses and limitations of maps.
Rapid Visual Screening	Rapid visual screening is a technique used to quickly inspect a building and identify disaster damage or potential seismic structural and non-structural weaknesses. This method may be used to screen and prioritize retrofitting efforts, or inventory high-risk structures and critical facilities. In a post-

	disaster setting, rapid visual screening can be used to assess risk during response and recovery efforts and determine if buildings are safe to re-occupy.
Loss Estimation Studies	After seismic hazards have been identified, planners can create an earthquake scenario to estimate potential loss of life and injuries, the types of potential damage, and existing vulnerabilities within a community. Scenarios can be particularly useful in predicting lifeline performance, i.e., the sustainability of critical public services or systems such as electricity, water, or roadways. This knowledge can be used to develop earthquake mitigation priorities.
HAZUS	FEMA's HAZUS is a computer-based tool that can be used to quantitatively estimate losses from an earthquake.
Seismic Safety Committees	Duties of a local or state seismic safety committee can include providing policy recommendations, evaluating and recommending changes in state and local seismic safety standards, and an annual assessment of local and statewide implementation of seismic safety improvements.
School Survey Procedures	Schools are critical facilities not only because of the special population they accommodate, but also because they are often identified as shelter sites for a community. Due to this sheltering role, it is essential that these buildings function after a seismic event. A community can develop a survey procedure and guidance document to inventory structural and non-structural hazards in and near school buildings. Survey results can be used to determine mitigation priorities that can be incorporated into capital improvement plans.
Capital Improvement Planning	School districts, local governments, corporations, and others have developed capital improvement plans to ensure that facilities remain operational for years down the road. It is more efficient and cost effective to incorporate structural and non-structural seismic strengthening actions into on-going building plans and activities, rather than to rehab later.
Guidelines and Model Ordinances	Earthquake hazards can be mitigated through land use planning. Communities can develop and distribute guidelines or pass ordinances that require developers/building owners to locate lifelines, buildings, critical facilities, and hazardous materials out of areas subject to significant seismic hazards. Particular consideration should be given to enforcing such ordinances in areas with steep slopes or subject to ground displacement, severe ground shaking, or liquefaction.
Building Codes	Although land use management that avoids building on hazardous sites is an effective way to reduce earthquake risk, there may be times when it is necessary to build on such sites. Engineers and architects have designed buildings in ways that reduce the impact of ground shaking. Encouraging all local governments to adopt and enforce

	updated building code provisions is one effective way to reduce earthquake damage risk.
Seismic Code Training	Legislators often enact seismic building provisions that do not get enforced because architects, engineers, and building departments are unaware of the provisions. Conducting information sessions or other forms of outreach on seismic code provisions for new and existing buildings can enhance code use and enforcement by local architects, engineers, contractors and code enforcement personnel.
Buildings as Structural Hazards	Homeowners and businesses can take simple measures to strengthen their buildings before the next earthquake. Bracing walls and bolting sill plates to the foundation are examples. Non-reinforced masonry buildings and non-ductile concrete facilities are particularly vulnerable to ground shaking. These buildings should be strengthened and retrofitted against future seismic events.
Non-Structural Hazards	Many injuries in earthquakes are caused by nonstructural hazards, such as attachments to buildings. These include lighting fixtures, windows (glass), pictures, tall bookcases, computers, ornamental decorations on the outside of the buildings (like parapets), gas lines, etc. Activities that can reduce the risk of injury and damage include: anchoring tall bookcases and file cabinets, installing latches on drawers and cabinet doors, restraining desktop computers and appliances, using flexible connections on gas and water lines, mounting framed pictures and mirrors securely, and anchoring and bracing propane tanks and gas cylinders.
Technical Assistance for Homeowners	Developing a technical assistance information program for homeowners and teaching them how to seismically strengthen their houses can be an effective mitigation activity. The program could include providing local government building departments with copies of existing strengthening and repair information for distribution to homeowners. Other potential distribution sources include insurance companies, realtors and libraries.
Infrastructure Hardening	Identification and hardening of critical lifeline systems, i.e., critical public services such as utilities and roads, to meet “Seismic Design Guidelines and Standards for Lifelines,” or equivalent standards, may distinguish a manageable earthquake from a social and economic catastrophe.
Bridge Strengthening	State and local highway departments should review construction plans for all bridges to determine their susceptibility to collapse. Problem bridges should be retrofitted.
Hazard Mitigation Awareness	Local or state governments can use community outreach activities to foster an awareness of earthquake mitigation activities in homes, schools and businesses.

Financial Incentives	Local or state governments can support financial incentives like low interest loans or tax breaks for home and business owners who seismically retrofit their structures.
Insurance	Local or state governments can work with insurance industry representatives to increase public awareness of the importance of earthquake insurance. Home structural improvements can be factored into the process of obtaining insurance coverage or reduced deductibles.
Reference Library	A local or state government can establish a library consisting of technical documents on structural and nonstructural mitigation options, as well as model ordinances and procedures that have been used by other jurisdictions to reduce earthquake risk.

DROUGHT

Periods of time with little or no precipitation can pose risks that can be managed with conservation and preparation.

Water-Saving	Citizens can be encouraged to take water-saving measures, especially when extra water is needed for irrigation and farming. Possibilities include installing low-flow water saving showerheads and toilets, and turning water flow off while brushing teeth or during other cleaning activities.
Water Storage	Human consumption is the primary reason to maintain a storage of water. People cannot live without consuming water regularly.
Water Use Ordinances	Communities can pass ordinances to prioritize or control water use, particularly for emergency situations like fire fighting.
Contingency Plans	Drought contingency plans can help anticipate needs and actions to take during a drought.
Water Delivery Systems	Designs or plans for water delivery systems can include consideration of drought events.
Crop Insurance	Crop insurance can preserve economic stability for farmers during a drought.

WILDFIRE

Wildfires typically start in woodland or prairie areas. They can occur naturally though they are often exacerbated by human activities. Wildfires can be hard to control as they threaten homes and communities located nearby. Although preventing or controlling wildfires is preferable, there are many mitigation efforts we can take to prevent or alleviate damage to our homes and communities when fires inevitably occur.

Public Education	Outreach efforts can promote such items as non-combustible roof covering, fire safe construction, and the importance of clearing brush and grass away from buildings. It is important to promote public education on smoking hazards and the risks of recreational fires.
Neighborhood Groups	Citizens may organize neighborhood wildfire safety coalitions to plan how their neighborhoods can work together to prevent a wildfire.
Zoning	Zoning can be used to cluster development into defensible areas and keep development away from fire hazards such as steep slopes, where fires are difficult to contain.
Defensible Space	Damage potential can be reduced by ensuring that structures are surrounded by defensible space or buffer zones. Buffer zones are manageable areas, generally 30 to 100 feet and cleared of combustible materials.
GIS Mapping	GIS mapping of vegetative coverage can facilitate analysis and planning decisions through comparison with topography, zoning, developments, infrastructure, or other markers.
Power Line Maintenance	Local power companies can help prevent or alleviate wildfires by proper maintenance and separation of power lines, as well as efficient response to fallen power lines.
Insurance Company Promotions	Insurance companies can include wildfire safety information in materials provided to area residents.
Property Maintenance	Maintenance of property in or near wildfire prone areas can go a long way toward preventing or reducing the spread of fire. Maintenance includes fuel management techniques such as pruning and clearing dead vegetation, selective logging, keeping grass short, planting fire-resistant vegetation, and creating fuel/fire breaks, i.e., areas where the spread of wildfires will be slowed or stopped by the removal of fuels. Other helpful techniques include use of fire resistant roofing and building materials; use of functional shutters on windows; keeping flammables such as curtains secured away from windows, or using heavy fire-resistant drapes; taking advantage of the fire department's home safety inspections; sweeping/cleaning dead or dry leaves, needles, twigs, and combustibles from roofs, decks, eaves, porches and yards; keeping woodpiles and other combustibles away from structures; use of boxed or enclosed eaves on a house; thorough clean-up of spilled

	flammable fluids; and keeping garage areas protected from blowing embers, whether from a chimney or outdoor fire place.
Fireplace and Chimney Maintenance	Residents should be encouraged to inspect chimneys at least twice a year and clean them at least once a year. Safe fireplace/chimney use and maintenance includes spark arrestors and emphasis on proper storage of flammable items.
Building Codes	Building codes can be used to require upgrades to existing as well as new structures.
Waste Disposal	Wildfire risk can be reduced by safe disposal of yard and household waste rather than through open burning.
Arson Prevention	Wildfires can be prevented by arson prevention clean up activities in areas of abandoned or collapsed structures, accumulated junk or debris, and in areas with a history of storing flammable materials where spills or dumping may have occurred.
Burning Restriction	Local ordinances can require burn permits and restrict campfires and outdoor burning.
Road and Driveway Clearance	Roads and driveways should be kept accessible to emergency vehicles and fire equipment. Driveways should be relatively straight and flat, with at least some open spaces to turn. Bridges should be strong enough to support emergency vehicles, with clearance wide and high enough for two-way traffic and emergency vehicle access. Addresses should be visible from the road, and keys to gates around property should be provided to the local fire department.
Hillside Construction	It is important to note that hillsides facing south or west are more vulnerable to increased dryness and heat from sun exposure. Structures should be set back from slopes outside of the “convection cone” of intense heat that is projected up the slope of a hill as a wildfire “climbs” it.
Building Foundations	In wildfire prone areas, risk may be decreased by enclosing the foundations of homes and other buildings, rather than leaving them open where undersides can be exposed to blown embers or other materials.
Motorized Equipment	Proper maintenance and storage of motorized equipment can decrease wildfire risk.
Flammable Materials	Wildfire risk can be alleviated by safely using and storing necessary flammable materials, including machine fuels. Approved safety cans should be used for storing gasoline, oily rags and other flammable materials. Firewood should be stacked at least 100 feet away and uphill from homes.
Smoke/Fire Detectors and Sprinklers	Citizens can install and maintain smoke detectors and fire extinguishers on each floor of their homes or other buildings.

	This equipment should be tested and/or inspected regularly, and smoke detector batteries should be changed twice a year. Everyone in a household or building can be taught how to use a fire extinguisher. Other valuable fire mitigation systems include interior and exterior sprinkler systems.
Spotters	Early detection of wildfires, while fires are smaller, can help make fire fighting more successful. Detection can be accomplished by fire spotters who work from either towers or planes.
Media	Media can broadcast information about fire watches and fire warnings.
Response Personnel	Response personnel should have regular training and exercise experience.
Water Supplies	Water supplies for emergency fire fighting should be maintained in accordance with National Fire Protection Association (NFPA) standards. Residents should identify and maintain any number of outside water sources such as small ponds, cisterns, wells, swimming pools or hydrants. It is a good idea to have a garden hose that is long enough to reach any area of a home or other structures on a property. Freeze-proof exterior water outlets are recommended for at least two sides of a home or other structures. Additional outlets can be installed at least 50 feet from a home. It may be a good idea to obtain a portable gasoline powered pump in case electrical power is cut off.
Evacuation	Residents should be instructed on proper evacuation procedures, such as wearing protective clothing (e.g., sturdy shoes, cotton or woolen clothing, long pants, a long-sleeved shirt, gloves and a handkerchief to protect the face); taking a Disaster Supplies Kit; and choosing a route away from fire hazards.
Individual Response	Fire emergency telephone numbers should be posted at every telephone. Residents should plan several escape routes away from their homes, by car and foot. It is a good idea to keep a set of hand tools that can be used as fire tools, such as a rake, axe, hand/chainsaw, bucket and shovel. When wildfire threatens, residents should be instructed to carry and listen to battery-operated radios for reports and evacuation information, and follow instructions from local officials. Cars should be backed into garages or parked in open space facing the direction of escape, with doors and windows closed and the key in the ignition. Garage windows and doors should be closed but left unlocked. If residents have time, they can take steps to protect their homes by closing windows, vent doors, venetian blinds and heavy drapes; removing lightweight curtains; shutting off natural

	gas at the meter; turning off pilot lights; closing fireplace screens; and moving flammable furniture into the center of the home away from windows and sliding-glass doors. Outside, residents can seal attic and ground vents with pre-cut plywood or commercial seals; turn off propane tanks; place combustible patio furniture inside; connect garden hose to outside taps; set up a portable gasoline-powered pump; place lawn sprinklers on the roof and near above-ground fuel tanks; wet the roof, wet or remove shrubs within 15 feet of the home; and gather fire tools.

STRUCTURE FIRES

The risk of structure fires varies by location and demographics. Studies commissioned by the U.S. Fire Administration find that certain populations are more at risk of death or injury from structure fires. These groups include people who are economically disadvantaged, very young or very old.

Codes and Enforcement	Building codes and enforcement are the first measure for preventing structure fires.
Building Design	Building designs can include firewalls and fire doors, as well as alarm and sprinkler systems, especially in tall buildings, dormitories, and attached structures.
Public Education and School Programs	Communities can encourage public education and school programs, especially regarding stoves, heaters, fireworks, matches/lighters, smoke detectors, and evacuation. Public education can particularly focus on safe handling and disposal of cigarettes, cigars, pipes, and matches, as careless smoking and children playing with matches and lighters are significant hazards in some neighborhoods. Alcohol and other drug use can exacerbate the risks.
Personal Preparation	Citizens can install and maintain fire extinguishers and smoke detectors. Everyone in a household or workplace can be taught how to use a fire extinguisher. Residential standards established by the National Fire Protection Association (NFPA) require a smoke detector in each bedroom, or adjacent to all sleeping areas. All equipment should be tested and/or inspected regularly, and smoke detector batteries should be changed twice a year. Installing a sprinkler system is another valuable mitigation measure. Also, fire emergency telephone numbers should be posted at every telephone, and residents or building occupants should plan escape routes and assembly points away from their homes or workplaces.
Heating Systems	Fire risk can be controlled through proper installation and maintenance of heating systems.

Space Heaters	If electric space heaters are necessary, they should be placed at least 3 feet from objects, particularly combustible objects. Kerosene heaters pose additional risks relating to flammable liquids and carbon monoxide.
Fireplace and Chimney Maintenance	Residents should be encouraged to inspect chimneys at least twice a year and clean them at least once a year. Safe fireplace/chimney use and maintenance includes installation of spark arrestors and emphasis on proper storage of flammable items.
Electrical Outlets	Fire risk can be controlled through safe installation, maintenance and use of electrical wiring, outlets and fault interrupters.
Arson Prevention	Structure fires can be prevented by clean up activities in areas of abandoned or collapsed structures, accumulated junk or debris, and in areas that have a history of storing flammable materials where spills or dumping may have occurred. Older communities in particular should consider establishing a quick process to secure and/or demolish abandoned structures.
Flammable Materials	Fire risk can be controlled by using proper procedures, from training and exercising to safe handling of explosive and flammable materials.
Power Line Maintenance	Local power companies can help prevent or alleviate fires by proper maintenance and separation of power lines, as well as efficient response to fallen power lines.
Fire Departments	Fire departments should be deployed, equipped and trained per NFPA standards and ISO recommendations.
Transportation Planning	Transportation planning is important for assessing roads, overpasses, etc., in order to maximize access and improve emergency response times to all inhabited or developed areas of a community. Subdivisions should include more than one entrance to allow access if one of the entrances becomes blocked.
Civil Disturbances	It is important to gain control of civil disturbances and criminal activities that could lead to arson.
Fireworks	It is important to enforce fireworks regulations.
Illegal Drug Laboratories	Fire risk can be improved by elimination of clandestine methamphetamine, or other illegal drug, laboratories through law enforcement and public education.

SCRAP TIRE FIRES

Burning tires emit toxins into the surrounding air. Scrap tire fires not only are difficult and dangerous for fire fighters, they also pose health hazards for the surrounding community.

Tire Disposal Policies	A sample of policies for regulating safe disposal and management of scrap tires includes the following: separation of stored scrap tires from other materials; limits on the size of each pile; minimum distances between piles and property lines; covering, chemically treating, or shredding tires to limit mosquito breeding; providing for fire vehicle access to scrap tire piles; training employees in emergency response operations; installation of earthen berms around storage areas; prevention of pools of standing water in the area; control of nearby vegetation; an emergency plan posted on the property; and storing only the permitted volume of tires authorized for a particular site.
Facility Siting	Land use planning should recognize that scrap tire storage and processing facilities can pose a real environmental and health threat to a community.
Law Enforcement	Law enforcement agencies can be alerted to watch for illegal tire dumping.
Alternate Use/Recycling	Promoting technologies that recycle tires can be an asset. Examples include using whole tires in roadbeds, for culvert wingwalls, or as slope protection, or using shredded tires for a playground surface.
Pest Control	Pest-control measures for mosquitoes and other nuisances around scrap tire yards will not prevent fires, but controlling pests can decrease the risk of disease to people in the vicinity.

HAZARDOUS MATERIALS

Various government agencies regulate the use, storage, release, and disposal of hazardous substances, because exposure to these substances can result in imminent injury, illness, or damage to property. Mitigation begins with regulatory compliance.

Safety Procedures and Policies	Regulations require training in and compliance with all safety procedures and systems related to the manufacture, storage, transport, use, and disposal of hazardous materials.
Public Awareness and Worker Education	The Emergency Planning and Community Right-to-Know Act (EPCRA), also known as SARA Title III, provides an infrastructure at the state and local levels to plan for chemical emergencies. Facilities that store, use, or release certain chemicals may be subject to reporting requirements. Reported information is publicly available so that interested parties may become informed about potentially dangerous chemicals in their community. Employers must also communicate the hazards of workplace chemicals and ensure that workers receive education and training.
Local Emergency Planning Committee	To address the possibility of hazardous material incidents, communities are required under Federal law (SARA Title III)

	to maintain an active and viable Local Emergency Planning Committee (LEPC) to develop an emergency plan for preparing for and responding to chemical emergencies, such as spills, leaks, explosions, or other releases. The LEPC is required to review, test, and update the plan each year.
Emergency Plans	The community's emergency plan must include the following: identification of local facilities and transportation routes where hazardous materials are present; procedures for immediate response in case of an accident, including a community-wide evacuation plan; a plan for notifying the public that an incident has occurred; names of response coordinators at local facilities; and a plan for conducting simulation exercises that test the plan.
Risk Management Plans	U.S. Environmental Protection Agency (EPA) regulations require development of Risk Management Plans for sites that manufacture, store, or handle hazardous materials. The details of Chemical Accident Prevention and Risk Management Programs are managed by EPA's Chemical Emergency Preparedness and Prevention Office (CEPPO).
Transportation	The U.S. Department of Transportation (USDOT) administers a labeling and placarding system for identifying the types of hazardous materials that are transported along the nation's highways, railways, and waterways. This system enables local emergency officials to identify the nature and potential health threat of chemicals being transported. If an accident were to occur, local emergency officials would be able to determine the proper emergency response procedures for the situation. Local law enforcement and other emergency officials should be well-versed in compliance with and enforcement of USDOT and state regulations regarding hazardous material and hazardous waste transportation.
Disposal	The U.S. EPA's Office of Solid Waste regulates disposal of hazardous waste, as required by the Federal Resource Conservation and Recovery Act (RCRA). RCRA's goals are to: 1) protect us from the hazards of waste disposal; 2) conserve energy and natural resources by recycling and recovery; 3) reduce or eliminate waste; and 4) clean up waste that may have spilled, leaked, or been disposed of improperly.
Emergency Response Teams	Regulations require trained, equipped, and prepared emergency response teams, for hazardous material sites and for the community in general.
Search and Rescue	Search and rescue teams need to be trained, equipped, and prepared to work among hazardous materials.
Industrial Site Buffering	Hazardous material exposure can be prevented or reduced by separation and buffering between industrial areas and

	other land uses. Industrial areas should be located away from schools, nursing homes, hospitals, and other facilities with large or vulnerable populations.
Radioactivity and Radon	Radioactive soils and high-radon areas can pose risks that should not be ignored. Mitigation actions may include avoiding development, removing soils, and capping openings in basements.
Cleanup of Brownfields	A brownfield site is real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant. Cleanup activities are expensive, but they are recommended for preventing exposure to harmful substances. Grants, low interest loans, or tax relief may be available to assist in the cost of mitigating these sites. Cleaned sites may then be redeveloped and added back to a community's tax roles.
Security	Security considerations should include preparedness for terrorism, sabotage, or civil disturbance.

TRANSPORTATION ACCIDENTS

Ground, air, and water transportation issues can pose risks to transportation users and to the general public.

Driver Education	The risk of transportation accidents can be reduced through improvements in driver education, traffic law enforcement, and transportation planning that balances needs of public transportation conveyers with safety of the general public. Commercial operators also need training and skill enhancement programs.
Road Design	Improved design, routing, and traffic control at problem roadway areas can reduce risk of transportation accidents. Designated truck routes, as well as enforcement of weight and truck travel restrictions, can help. In long-term planning, communities can consider establishing more connector roads to reduce congestion on arterial roads.
Railroads	Accidents can be reduced through railroad inspections and improved designs at problem railway/roadway intersections.
Airports	Airport maintenance, security, and safety programs are essential for reducing accident risk.
Marine Safety	Accident risk can be reduced through programs that address marine safety and general boater awareness.
Mass Casualty Preparation	It is important to consider training, planning, and preparedness for mass-casualty incidents involving all modes of transportation.

Traffic Control	Road closures and traffic control in accident areas becomes especially critical during a hazardous material incident response.

UTILITY FAILURE

Public utilities are critical infrastructure for any community. The potential for failure needs to be reviewed, and inadequacies need to be addressed.

Water and Sewer	Consideration is needed for proper location, design, and maintenance of water and sewer systems, including insulation of critical components to prevent damage from ground freeze. Sewer and storm water systems should be separated or expanded to handle anticipated storm water volumes.
Electrical Lines	A community may consider burying electric and telephone lines, where possible, to resist damage from severe winds, lightning, ice, and other hazards.
System Redundancies	One place where redundancies are recommended is in utility and communications systems, especially lifeline systems, e.g., essential public utilities. The intention is that if one system fails, the other shadow system can take over.
Backup Power	Generators can be used for backup power at critical facilities.
Maintenance	Regular maintenance and equipment checks are important, along with replacement or renovation of aging structures and equipment, which should be made as hazard-resistant as economically possible.
Rolling Blackouts and Brownouts	Sometimes it is a good idea to implement “rolling blackouts” in electrical systems that will otherwise fail completely due to overloading.
Lightning Protection	Electrical and communications systems should be protected from lightning strikes.
Tree Trimming	Tree trimming and maintenance is important for preventing limb breakage and for safeguarding nearby utility lines. A model measure would be to establish a community forestry program with a main goal of creating and maintaining a disaster-resistant landscape in public right-of-ways.
Digging Hotlines	Most, if not all, states have a utility damage prevention hotline that people can call before digging.
Vulnerable Populations	Communities can develop programs/networks for contacting and assisting elderly or homebound persons during periods of infrastructure failure.

OIL AND NATURAL GAS WELLS; PETROLEUM AND NATURAL GAS PIPELINES

Regions with oil and natural gas wells and/or petroleum and natural gas pipelines need to consider the risks of release.

Safety Regulations	The first step in oil and natural gas well accident prevention is community and operator compliance with industry safety regulations and standards.
Contingency Plans	Companies and surrounding communities need to address contingency planning for worker and public protection, including rescue and evacuation procedures.
Well Segregation	Accidents can be prevented by using buffer strips of land to segregate wells, storage tanks, and other production facilities from transportation routes and adjacent land uses, in accordance with state regulations, and consistent with the level of risk.
Pipeline Location and Design	Pipelines should be well-marked and located away from dense development, critical facilities, special needs populations, and environmentally vulnerable areas whenever possible. Proper pipeline design, construction, maintenance and inspection are essential, especially in high hazard seismic zones.
Digging Hotlines	Most, if not all, states have a utility damage prevention hotline that people can call before digging.

RADIOLOGICAL EMERGENCIES

People receive radiation exposure each day from the sun, radioactive elements in soil and rocks, household appliances like television sets and microwave ovens, and medical and dental x-rays. These exposures may prompt controversy, but they do not pose the risk of imminent danger from radiation release that might occur if a nuclear power plant had a meltdown. Serious radiological accidents can occur anywhere radioactive materials are used, stored, or transported. A nuclear power plant, hospital, university, research laboratory, industrial plant, major highway, railroad line, or shipping yard could be the site of a radiological emergency.

Users of Radiological Materials	Users, transporters, and disposers of radiological materials are required to follow strict procedures that prevent or minimize radiation release.
Emergency Planning For Transportation Routes	Communities located along major transportation routes should develop and practice an emergency plan for handling transportation accidents involving radiological materials.
Radiological Emergency Preparedness for Nuclear Plants	Radiological Emergency Preparedness (REP) for communities surrounding nuclear power plants requires proper awareness of, training on, and implementation of radiological emergency procedures. Specific planning requirements for communities within primary and secondary Emergency Planning Zones are found in the Code of Federal

	Regulations (44 CFR § 350, 351, 352) and in a Nuclear Regulatory Commission guidance document (NUREG-0654).
Three Ways To Minimize Exposure	A community can promote the following three ways to minimize radiation exposure: 1) distance; 2) shielding; and 3) time. The more distance between a person and the source of the radiation, the less radiation received. Like distance, the more heavy, dense materials between a person and the source of the radiation, the better. Finally, most radioactivity loses its strength fairly quickly. Limiting the time spent near the source of radiation reduces the amount of radiation received.
Shelters and Warning Systems	Communities can promote awareness of designated fallout shelters and accident warning systems. They also may develop and promote workable population protection plans, i.e., evacuation and in-place sheltering plans.
Safe Rooms	Concrete safe rooms or shelters can be constructed in houses, trailer parks, community facilities, and business districts.
Building Materials	Public buildings and critical facilities can be constructed using laminated glass, metal shutters, structural bracing, and other hazard-resistant, durable construction techniques.

SABOTAGE / TERRORISM / WEAPONS OF MASS DESTRUCTION

Sabotage, terrorism, and the potential for exposure to weapons of mass destruction (WMD) have become part of our social conscious and should be considered in mitigation planning.

Assessment	Local governments can start with development of a thorough community risk and threat assessment that identifies potential vulnerabilities and targets for a sabotage/terrorism/WMD attack.
Critical Infrastructure Protection	Critical Infrastructure Protection (CIP) is extremely important. The federal government has begun a systematic effort to define, prioritize, and develop effective strategies for protecting the Nation's critical infrastructure. Local governments are an integral part of the effort with regard to critical local services, such as water, electricity, telephones, roads and bridges. CIP should be a prominent part of community risk and threat assessment.
Computers	Every person and institution with computers that interface with other computers should consistently use computer data back-up systems and anti-virus software.
Building Materials	Public buildings and critical facilities can be constructed or retrofitted using laminated glass, metal shutters, structural bracing, and other hazard-resistant, durable construction techniques.

Monitoring and Reporting	Prevention can be addressed through alertness, awareness, and monitoring of organizations and activities that may threaten a community. A community can establish a system for reporting information that can be used to prevent terrorist incidents or sabotage. One model may be the U.S. Department of Justice's Operation TIPS, the Terrorism Information and Prevention System, piloted in select cities beginning in August 2002.
Emergency Responder Preparedness	Communities can establish programs for law enforcement/emergency responder training, planning, and preparedness for terrorist/sabotage/WMD attacks.
School Violence	School safety and violence prevention programs are valuable, particularly since school violence is unfortunately becoming more common.
Public Gatherings	Communities may consider heightening security at public gatherings, special events, and critical community facilities and industries.
Mental Health Services	Communities can develop a greater awareness of, and provision for, mental health services in schools, workplaces, and other institutional settings.
Private Emergency Plans	Communities can encourage private sector development and testing of internal emergency plans and procedures, including Continuity of Operations (COOP) planning.

CIVIL DISTURBANCE

The potential for civil disturbance and resulting problems should be addressed in mitigation planning. Civil disturbances can include prison or institutional rebellions, disruptive political gatherings, violent labor disputes, urban protests or riots, or problems at large-scale events.

Law Enforcement	Local and state governments can provide law enforcement agencies with training, staffing, and resources.
Planning and Documentation	Local governments or other organizations can anticipate and plan for incidents. When a civil disturbance occurs, it may be a good idea to record the event on videotape for later study and use in prosecutions.
Facility Design	Emergency and security provisions can be included in design requirements for schools, factories, office buildings, shopping malls, hospitals, correctional facilities, stadiums, recreation areas, and other similar facilities.
Environmental Design	Crime Prevention Through Environmental Design (CPTED) is a field of planning that examines design, management, integration, and lowered density of poor or blighted areas with the goal of reducing vandalism, crime, and some types of riot events.

PUBLIC HEALTH EMERGENCIES

If left unchecked, various diseases or environmental conditions can result in widespread illness and threats to life.

Immunization	Immunization against communicable diseases can be encouraged among residents of a community.
Ventilation	The spread of communicable diseases can be thwarted by compartmentalizing ventilation systems in areas/facilities prone to crowding, or areas that may involve exposure to contagions or noxious atmospheres.
Radon	Communities can increase public awareness of radon dangers and the prevention efforts that can be taken to reduce concentrations of radon in homes and buildings.
Water and Sewer	Communities need to maintain water and sewer infrastructure at acceptable operating standards. Back-up generators for water and wastewater treatment facilities can help maintain acceptable operating levels during power failures. Separation of storm and sanitary sewer systems can also prevent release of untreated sanitary waste when stormwater might otherwise overfill a sewer system.
Vacant Structures	Demolition and clearance of vacant condemned structures can prevent rodent infestations.
Public Health Systems and Public Awareness	Communities can maintain public health systems with sufficient disease monitoring and surveillance capabilities to protect the population from large-scale outbreaks; they can also support free or reduced-cost clinics and school health services. Public awareness campaigns can emphasize the causes, symptoms, and protective actions for disease outbreaks or other potential public health emergencies.
Contamination Containment	Public contact with contaminated sites or waters, including floodwaters, should be prevented as much as possible.
Waste Disposal	Communities need to address pollution control, enforcement, and cleanup. Particular procedures need to be followed for disposing of chemicals, including hazardous waste and scrap materials.
Septic Tanks	Septic tanks need to be properly located, installed, cleaned, monitored, and maintained.