

# Hazard Mitigation Techniques

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## ***Prevention***

Government administrative or regulatory actions or processes that influence the way land and buildings are developed and built. These actions also include public activities to reduce hazard losses. Examples include planning, zoning, building codes, subdivision regulations, hazard specific regulations (such as floodplain regulations), capital improvement programs, and open space preservation and storm water regulations.

## ***Property Protection***

Actions that involve the modification of existing buildings or infrastructure to protect them from a hazard, or removal from the hazard area. Examples include acquisition, elevation, relocation, structural retrofits, flood proofing, storm shutters, and shatter resistant glass. Most of these techniques are considered “sticks and bricks”; however, this category also includes insurance.

## ***Public Education and Awareness***

Actions to inform and educate citizens, elected officials, and property owners about potential risks from hazards and potential ways to mitigate them. Such actions include hazard mapping, outreach projects, library materials, real estate disclosures, hazard information centers, and school age / adult education programs.

## ***Natural Resource Protection***

Actions that, in addition to minimizing hazard losses also preserve or restore the functions of natural systems. These actions include sediment and erosion control, stream corridor restoration, forest and vegetation management, wetlands restoration/preservation, slope stabilization, and historic properties and archeological site preservation.

## ***Structural Projects***

These mitigation projects are intended to lessen the impact of a hazard by modifying the environment using structures. Such structures include storm water controls (culvert), dams/dikes/levees, beach nourishment, and safe rooms.

## ***Emergency Services***

These projects may not typically be considered mitigation techniques, but serve to reduce the impacts of a hazard event on people and property. These actions are often taken prior to, during, or in response to an emergency or disaster. Examples include warning systems, evacuation planning and management, emergency response training and exercises, and emergency flood protection procedures.

# Mitigation Action Ideas by Hazard

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## 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.

Mitigation Measure	Explanation	Category
<b>Acquisition</b>	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.	<b>Property Protection</b>
<b>Relocation</b>	A structure may be moved to a less hazardous location.	<b>Property Protection</b>
<b>Elevation</b>	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.	<b>Property Protection</b>
<b>Dry flood proofing</b>	It may be possible to keep water out by strengthening walls, sealing openings, or using waterproof compounds or plastic sheeting on walls. Dry-flood proofing 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.	<b>Property Protection</b>
<b>Wet-Flood proofing</b>	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-flood proofing 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-flood proofing may not be used for basements in cases of new construction, substantial improvement, or substantial damage.	<b>Property Protection</b>
<b>Floodplain/Coastal Zone Management</b>	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.	<b>Prevention</b>
<b>Capital Improvement Plans</b>	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.	<b>Prevention</b>

<b>Zoning Ordinance Adoption or Amendments</b>	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.	<b>Prevention</b>
<b>Subdivision Ordinances or Amendments</b>	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.	<b>Prevention</b>
<b>Conservation Easements</b>	Requirements for building design standards and enforcement include the following possibilities: 1) that a residential structure be elevated; and 2) that a nonresidential structure be elevated or flood proofed.	<b>Prevention</b>
<b>Transfer of Development Rights</b>	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 is not environmentally significant.	<b>Natural Resource Protection</b>
<b>Purchase of Easement/ Development Rights</b>	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.	<b>Prevention</b>
<b>Storm water Management Ordinances or Amendments</b>	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.	<b>Prevention</b>
<b>Multi-Jurisdiction Cooperation Within Watershed</b>	Storm water ordinances may regulate development in upland areas in order to reduce storm water 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.	<b>Prevention</b>
<b>Comprehensive Watershed Tax</b>	Forming a regional watershed council helps bring together resources for comprehensive analysis, planning, decision-making, and cooperation.	<b>Prevention</b>
<b>Post-Disaster Recovery Ordinance</b>	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.	<b>Prevention</b>
<b>Floodplain Ordinances or Amendments</b>	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.	<b>Prevention</b>

<b>Flood Insurance</b>	Communities that choose to participate in the NFIP Amendments must adopt ordinances that meet minimum federal and state requirements. Communities may pass more stringent ordinances to reduce risk even further. 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.	<b>Prevention</b>
<b>Updated Floodplain Mapping</b>	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.	<b>Prevention</b>
<b>Storm Drainage Systems</b>	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.	<b>Public Education and Awareness</b>
<b>Drainage System Maintenance</b>	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.	<b>Structural Projects</b>
<b>Drainage Easements</b>	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.	<b>Structural Projects</b>
<b>Wetland Protection</b>	Communities may consider obtaining easements for planned and regulated public use of privately owned land for temporary water retention and drainage.	<b>Prevention</b>
<b>Roads</b>	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.	<b>Natural Resource Protection</b>

<p><b>Structural Flood Control Measures</b></p>	<p>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 (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.</p>	<p><b>Property Protection</b></p>
<p><b>Dam and Levee Maintenance</b></p>	<p>A minor structural project is similar to, 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 nonstructural activities, or where structural activities are not feasible due to low densities.</p>	<p><b>Structural Projects</b></p>
<p><b>Community Outreach and Education</b></p>	<p>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.</p>	<p><b>Structural Projects</b></p>
<p><b>Debris Control</b></p>	<p>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, and traffic control during flooding, and other measures.</p>	<p><b>Public Education and Awareness</b></p>

<b>Hazardous and Buoyant Material Protection</b>	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. 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.	<b>Property Protection/Prevention</b>
<b>Flood Warning</b>	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.	<b>Emergency Services</b>
<b>Manufactured Homes</b>	Manufactured or mobile homes should be elevated above the base flood elevation and anchored, or more preferably, kept out of the floodplain.	<b>Property Protection</b>

### *Landslide and Debris Flow*

Landslides or debris flow can be caused by the same high water levels or rain that results in flooding. Landslides can also be caused by earthquakes and are typically present in areas of high topographic relief. Although many mitigation measures resemble those for flooding, landslides pose unique considerations.

<b>Mitigation Measure</b>	<b>Explanation</b>	<b>Category</b>
<b>Mapping</b>	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.	<b>Public Education and Awareness</b>
<b>Building Codes</b>	Building codes can set construction standards, including minimum foundation requirements, in landslide-prone areas.	<b>Prevention</b>
<b>Zoning Ordinances</b>	Zoning ordinances may be used to create buffers between structures and high-risk areas.	<b>Prevention</b>
<b>Slide-Prone Area Ordinance</b>	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.	<b>Prevention</b>
<b>Code Enforcement</b>	A strong community commitment to code enforcement is necessary to ensure compliance with building codes and zoning ordinances.	<b>Prevention</b>

<b>Drainage Control Regulations</b>	Drainage regulations are similar to storm water management regulations. By controlling drainage, a community can reduce the risk of landslides resulting from saturated soils.	<b>Prevention</b>
<b>Grading Ordinances</b>	Grading ordinances require developers and landowners to obtain permits prior to filling or regrading. Such ordinances may also provide specific design standards.	<b>Prevention</b>
<b>Hillside Development Ordinances</b>	Hillside development ordinances are special purpose Ordinances that set specific standards for construction on hillsides.	<b>Prevention</b>
<b>Subdivision Ordinances</b>	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.	<b>Prevention</b>
<b>Geological Hazard Overlay Zone</b>	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.	<b>Prevention</b>
<b>Sanitary System Codes</b>	Sanitary system codes can reduce the effect of drainage on landslides by limiting the type and location of sanitary systems.	<b>Prevention</b>
<b>Open Space Designation</b>	Open space designations keep landslide prone areas undeveloped.	<b>Prevention</b>
<b>Relocation</b>	Structures may be moved to less hazardous locations.	<b>Property Protection</b>
<b>Acquisition</b>	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.	<b>Property Protection</b>
<b>Restraining Structures</b>	Restraining structures may be designed and used to hold soil in place.	<b>Structural Projects</b>
<b>Debris-Flow Measures</b>	Debris-flow measures may include stabilization, energy dissipation, and flow control measures, all of which may reduce damage in-sloping areas.	<b>Structural Projects</b>
<b>Grading</b>	Grading can be used to increase slope stability, depending on types of soils, height of fill or cut, and compaction.	<b>Property Protection</b>
<b>Vegetation Placement and Management Plans</b>	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.	<b>Prevention</b>
<b>Utility Location</b>	Placing utilities outside of landslide areas decreases the risk of service disruption.	<b>Property Protection</b>
<b>Abatement Districts</b>	A special taxing district, such as an abatement district, can be used to pool resources to mitigate common hazards.	<b>Prevention</b>
<b>Restrictive Covenants</b>	A legally binding agreement in a private development can be used to impose restrictions on land use.	<b>Prevention</b>

### Thunderstorm/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.

Mitigation Measure	Explanation	Category
<b>Community Outreach and Education</b>	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.	<b>Public Education and Awareness</b>
<b>Early Warning Systems</b>	Local and state governments can invest in public early warning systems/networks, as well as train people to serve as weather spotters.	<b>Emergency Services</b>
<b>Surge Protectors and Lightning Protection</b>	Surge protection can be installed on critical electronic lightning protection 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.	<b>Property Protection</b>
<b>Building Construction</b>	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.	<b>Structural Projects</b>
<b>Burying Power Lines</b>	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.	<b>Property Protection</b>

### Tornado

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

Mitigation Measure	Explanation	Category
<b>Construction Standards and Techniques</b>	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.	<b>Prevention</b>
<b>Safe Rooms</b>	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.	<b>Structural Projects</b>
<b>Anchoring Manufactured Homes</b>	Damage and injury can be prevented by anchoring manufactured homes and exterior attachments such as carports and porches.	<b>Property Protection</b>

### 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.

Mitigation Measure	Explanation	Category
<b>Roofing Shingles</b>	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.	<b>Property Protection</b>
<b>Building Construction Standards</b>	Engineered construction can accommodate foundation design, braced elevated platforms, and the ability of a structure to withstand the lateral forces of winds and waves.	<b>Prevention</b>
<b>Manufactured Home Tie-Downs</b>	The risk of manufactured home damage can be reduced by using tie-downs with anchors and ground anchors appropriate for the soil type.	<b>Property Protection</b>
<b>Designed-Failure Mode</b>	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.	<b>Property Protection/Prevention</b>

### 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.

Mitigation Measure	Explanation	Category
<b>Outreach/Public Awareness</b>	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.	<b>Public Education and Awareness</b>
<b>Heating Requirements</b>	Housing/landlord codes can require minimum temperatures.	<b>Prevention</b>

### Winter Weather/Snowstorms

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

Mitigation Measure	Explanation	Category
<b>Burying Power Lines</b>	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.	<b>Property Protection</b>
<b>Code Enforcement and Building Maintenance</b>	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.	<b>Prevention</b>

## Earthquake

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

Mitigation Measure	Explanation	Category
<b>Seismic Hazard Mapping</b>	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.	<b>Public Education and Awareness</b>
<b>Related Hazard Mapping</b>	Other earthquake related hazards include liquefaction and landslides. Maps of these related hazards may be used for vulnerability analysis and risk assessment.	<b>Public Education and Awareness</b>
<b>HAZUS</b>	FEMA's HAZUS is a computer-based tool that can be used to quantitatively estimate losses from an earthquake.	<b>Public Education and Awareness</b>
<b>Loss Estimation Studies</b>	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.	<b>Public Education and Awareness</b>
<b>Capital Improvement Planning</b>	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.	<b>Prevention</b>
<b>Guidelines and Model Ordinances</b>	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.	<b>Prevention</b>
<b>Building Codes</b>	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.	<b>Prevention</b>

<b>Retrofitting – Securing Building Components and Contents</b>	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.	<b>Property Protection</b>
<b>Infrastructure Hardening</b>	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	<b>Property Protection</b>
<b>Bridge Strengthening</b>	State and local highway departments should review construction plans for all bridges to determine their susceptibility to collapse. Problem bridges should be retrofitted.	<b>Property Protection</b>

### **Drought**

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

<b>Mitigation Measure</b>	<b>Explanation</b>	<b>Category</b>
<b>Water Use Ordinances</b>	Communities can pass ordinances to prioritize or control water use, particularly for emergency situations like firefighting.	<b>Prevention</b>
<b>Contingency Plans</b>	Drought contingency plans can help anticipate needs and actions to take during a drought.	<b>Prevention</b>

### **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.

<b>Mitigation Measure</b>	<b>Explanation</b>	<b>Category</b>
<b>Public Education</b>	Outreach efforts can promote such items as noncombustible 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.	<b>Public Education and Awareness</b>
<b>Zoning Regulations</b>	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.	<b>Prevention</b>

<b>Defensible Space</b>	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.	<b>Property Protection/Prevention (if in code)</b>
<b>GIS Mapping</b>	GIS mapping of vegetative coverage can facilitate analysis and planning decisions through comparison with topography, zoning, developments, infrastructure, or other markers.	<b>Public Education and Awareness</b>
<b>Building Codes</b>	Building codes can be used to require upgrades to existing as well as new structures.	<b>Prevention</b>
<b>Burning Restriction</b>	Local ordinances can require burn permits and restrict campfires and outdoor burning.	<b>Prevention</b>
<b>Hillside Construction</b>	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.	<b>Property Protection</b>
<b>Building Foundations</b>	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.	<b>Property Protection</b>
<b>Smoke/Fire Detectors and Sprinklers</b>	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.	<b>Property Protection</b>

### *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.

<b>Mitigation Measure</b>	<b>Explanation</b>	<b>Category</b>
<b>Safety Procedures and Policies</b>	Regulations require training in and compliance with all and policies safety procedures and systems related to the manufacture, storage, transport, use, and disposal of hazardous materials.	<b>Prevention/Public Education and Awareness</b>
<b>Public Awareness and Worker Education</b>	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.	<b>Public Education and Awareness</b>

<b>Emergency Plans</b>	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.	<b>Prevention</b>
<b>Risk Management Plans</b>	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).	<b>Prevention</b>
<b>Local Emergency Planning Committee Education</b>	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.	<b>Public Education and Awareness</b>
<b>Industrial Site Buffering</b>	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.	<b>Prevention</b>

### ***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.

<b>Mitigation Measure</b>	<b>Explanation</b>	<b>Category</b>
<b>Threat Assessment</b>	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.	<b>Prevention</b>
<b>Critical Infrastructure Protection</b>	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.	<b>Prevention</b>
<b>Hazard Resistant Building Materials</b>	Public buildings and critical facilities can be constructed or retrofitted using laminated glass, metal shutters, structural bracing, and other hazard-resistant, durable construction techniques.	<b>Property Protection</b>
<b>COOP Planning</b>	Communities can encourage private sector development and testing of internal emergency plans and procedures including Continuity of Operations (COOP) planning.	<b>Prevention</b>

### Public Health Emergencies

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

Mitigation Measure	Explanation	Category
<b>Immunization</b>	Immunization against communicable diseases can be encouraged among residents of a community.	<b>Prevention/Public Education and Awareness</b>
<b>Ventilation Retrofits</b>	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.	<b>Property Protection</b>
<b>Water and Sewer Maintenance</b>	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 storm water might otherwise overflow a sewer system.	<b>Structural Projects</b>
<b>Public Health Systems and Public Awareness</b>	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.	<b>Public Education and Awareness</b>

### 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.

Mitigation Measure	Explanation	Category
<b>Users of Radiological Materials</b>	Users, transporters, and disposers of radiological materials are required to follow strict procedures that prevent or minimize radiation release.	<b>Prevention</b>
<b>Emergency Planning for Transportation Routes</b>	Communities located along major transportation routes should develop and practice an emergency plan for handling transportation accidents involving radiological materials.	<b>Prevention</b>

<b>Radiological Emergency Preparedness for Nuclear Plants</b>	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).	<b>Prevention</b>
<b>Shelters and Warning Systems</b>	Communities can promote awareness of designated shelters and accident warning systems. They also may develop and promote workable population protection plans, i.e., evacuation and in-place sheltering plans.	<b>Emergency Services</b>
<b>Safe Rooms</b>	Concrete safe rooms or shelters can be constructed in houses, trailer parks, community facilities, and business districts.	<b>Emergency Services</b>
<b>Hazard Resistant Building Materials</b>	Public buildings and critical facilities can be constructed using laminated glass, metal shutters, structural bracing, and other hazard-resistant, durable construction techniques.	<b>Property Protection</b>