



# **Geographic Information Systems Providing the Platform for Comprehensive Emergency Management**

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## An ESRI White Paper

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# Geographic Information Systems Providing the Platform for Comprehensive Emergency Management

**Introduction** Emergency management organizations are government agencies at federal, state, and local levels that are charged with reducing community vulnerability and establishing capabilities to manage and quickly recover from emergencies.

Over the last several years, emergency management has become more complicated. Large-scale emergencies seem to be more prevalent, and new threats exist. The need to plan for, prevent, and reduce the consequences of emergencies is greater than ever. Emergency management has the responsibility to collaborate with and coordinate and facilitate multiple departments in planning, response, and recovery. In the appendix, newly established emergency management principles supported by the Federal Emergency Management Agency (FEMA) and adopted by the International Association of Emergency Managers (IAEM) are provided. This paper will illustrate how geographic information system (GIS) technology effectively improves the workflow in all phases of emergency management and supports the requirements of the recently released emergency management principles.

The emergency management mission and workflow are organized into four phases.

**Mitigation** Mitigation efforts attempt to prevent hazards from developing into disasters altogether or reduce the effects of disasters when they occur. The mitigation phase differs from the other phases because it focuses on long-term measures for reducing or eliminating risk. Successful mitigation is a direct result of comprehensive planning and analysis.

**Planning and Analysis** Emergency management planning is the process of analyzing a community's hazards, risks, and values to determine its vulnerabilities to natural, technological, and terrorist-based disasters. A comprehensive risk and hazard analysis provides the foundation for the development of mitigation, preparedness, response, and recovery plans. Emergency management planning requires acquiring, integrating, and analyzing vast amounts of information and data in a variety of disparate formats to develop a comprehensive risk-based emergency management program.

GIS technology provides the capability to map and analyze hazards of all types and visualize their potential impacts. When hazards are fused with critical infrastructure, population densities, and other community values, vulnerabilities can be observed, modeled, and better understood. Based on the potential impact of any particular hazard to critical values, priorities for mitigation can be established. Contingency and response plans can also be developed based on important values at risk. The risk and hazard assessment provides the foundation for the overall emergency management program. GIS optimizes the planning analysis process as follows:

1. Identify and map natural and technological hazards:
  - Natural hazards may include
    - Earthquake faults
    - Storm surge exposure
    - Flammable vegetation
    - Areas prone to severe weather events
      - ◆ Landslides
      - ◆ Floods
  - Technological hazards may include
    - Hazardous materials locations
    - Transportation corridors where hazardous materials are routinely shipped (rail, highway, etc.)
    - Nuclear power plants
    - Petroleum processing and storage facilities
2. Identify and map critical values at risk:
  - Population densities
  - Critical infrastructure including government facilities, hospitals, utilities, and public assemblies
  - Natural resource concerns including scarce natural resources and plant and animal habitats
3. Identify values at risk that reside within the impacted areas of natural and/or technological hazards. GIS is used to model potential events (plumes, explosions, floods, earthquakes, etc.) and display projected areas of extreme, moderate, and light damage that could be caused by the event. Casualties can also be projected. Priorities for mitigation and emergency contingency and response plan development are highlighted through the use of GIS.
4. Develop site-specific strategies for mitigation to reduce losses; mitigation includes activities that prevent an emergency, reduce the chance of an emergency, or reduce the damaging effects of unavoidable emergencies. Mitigation activities take place before and after emergencies. Other mitigation functions may include enforcing building and fire codes, designating specific routes for hazardous materials shipments, requiring tie-downs for mobile homes, and shipping regulations for hazardous materials. Evaluate and model alternative mitigation strategies. Determine the best strategy for protecting critical assets from catastrophic damage or loss and reduce casualties.

Mitigation encompasses the comprehensive steps taken to prevent emergencies, reduce loss, and provide a proactive approach to the overall emergency management program. The hazard and risk assessment within the planning process provides the framework for decisions that are made in the preparedness phase.

## **Preparedness**

Emergency managers develop plans of action for when disaster strikes. Priorities for action plan development are identified in the planning and analysis process. Common preparedness measures include some of the following:

- Critical facility emergency contingency plans
- Communication plans with easily understandable terminology and chain of command
- Development and practice of multiagency coordination and incident command
- Proper maintenance and training of emergency services
- Development and exercise of emergency population warning methods combined with emergency shelters and evacuation plans and the stockpiling, inventory, and maintenance of supplies and equipment
- Developing the facilities, staff, equipment, and tools necessary to plan, monitor, and facilitate emergency management decision making and information sharing

GIS technology is utilized for preparedness as follows:

- Site selection for adequate evacuation shelters with consideration of where and how extensively an emergency might occur
- Selecting and modeling evacuation routes
  - Considerations for time of day
  - Considerations for road capacity versus population, direction of travel, etc.
- Identification and mapping of key tactical and strategic facilities
  - Hospitals
  - Public safety facilities
  - Suppliers to support response (food, water, equipment, building supplies, etc.)
- Training and exercises to test preparedness
  - Identify incident locations and impacts; map incident perimeters.
  - Model the incident (plumes, spread, etc.).

- Collect damage assessment, identify casualties, and prioritize for allocation of public safety resources.
- Develop and distribute incident action plans.
- Providing a key capability for the command and control information system that enables situational awareness and incident management support

To achieve comprehensive preparedness, a great deal of information must be gathered and managed. When disasters strike, the right information must be available at the right place to support emergency decision requirements. GIS, in addition to supporting the preparedness workflow, is a powerful data management system.

### ***Data Management***

Data management is the development, execution, and supervision of plans, policies, programs, and practices that control, protect, deliver, and enhance the value of data and information assets. In the context of emergency operations, data management is gathering, managing, processing, and distributing information to users and across systems when and where needed. It is the capability to store, manage, update, and provide access to all of the unit's data through well-designed computer system architecture to meet the emergency management mission.

GIS provides a platform for the management of geographic data and disparate documents (plans, photographs, etc.) necessary to meet the emergency management mission. GIS provides a capability to access information based on the geographic location to which it pertains, allowing users to get various types of information from the map display. This could include emergency response plans, mitigations plans, and contact lists. The management of resources is essential to support the emergency management mission. Resources include public safety resources, as well as civilian resources (and their locations), such as dump trucks, buses, dozers, hardware suppliers, and food and water resources. When these types of assets are inventoried and accessible through GIS, the appropriate resources (proximity to an emergency) can be contacted for timely response. One of the most complex challenges of incident management is managing the location, status, and capabilities of all of the resources needed to meet incident requirements. Managing resources requires current and accurate data. GIS provides the ability to visualize all types of resources and their current availability and location for effective incident management.

In addition to managing existing data assets, GIS can access and display relevant dynamic data (camera feeds, weather, traffic, hospital status, automated vehicle location [AVL], incidents, sensors, etc.) to provide situational awareness for decision support. Without comprehensive data management, it is difficult to achieve and maintain accurate situational awareness.

### ***Situational Awareness***

Situational awareness is being aware of what is happening around you to understand how information, events, and actions will impact your goals and objectives both now and in the near future. This is especially important where information flows are high and poor decisions may lead to serious consequences.

In the context of an Emergency Operations Center (EOC), achieving timely situational awareness is essential to maintain an understanding of events, incidents, and

developments to anticipate, respond to, and manage actual or potential emergencies. GIS provides situational awareness through a common operating picture. A GIS map display with relevant GIS data (critical infrastructure, imagery, hazards, etc.) integrates dynamic event data (sensors, cameras, traffic, incidents, etc.) to represent the current situation throughout the jurisdiction, region, or nation. Comprehensive situational awareness provides the capability for emergency management personnel to make better decisions that can then be quickly displayed, shared, and understood by those who need to take action. The common operating picture can be enhanced when response plans, contingency plans, and other documents are linked to the location(s) for which they were developed. Rapid access to planning information through the common operating picture begins to "operationalize" the planning process. Examples of how GIS provides accurate situational awareness through a common operating picture include

- Maintaining and displaying the status of emergency and nonemergency events
- Designating and mapping incident locations/perimeters
- Site selection analysis for
  - Hot zones
  - Incident Command Post (ICP) locations
  - Additional evacuation sites
  - Staging areas
  - Logistical support and supply caches
  - Drop points
  - Division and branch boundaries
  - Heliports
  - Temporary medical facilities
- Maintaining and displaying the status of public safety resources both locally and in adjoining jurisdictions
- Modeling and displaying plumes, weather events, wildfires, floods, etc.
- Analyzing consequences and losses
- Determining intersections that should be closed (based on incident perimeter or plume) and transportation routes that avoid closures
- Importing and displaying damage assessment from mobile devices
- Displaying and printing appropriate incident command system (ICS) incident action plan maps
  - Operations maps
  - Logistics maps
  - Tactical maps
  - Air deployment maps
  - Transportation maps
  - Incident prediction maps



**Response**

Emergency management assists in the mobilization of emergency services and resources to support first responders for complex emergencies. This can include specialist rescue teams, logistical support, public safety, volunteers, nongovernmental organizations (NGOs), and others. The Emergency Operations Center is responsible to support incident management operation needs and maintain continuity of operations for the community. Acquiring, managing, and maintaining status of resources from various locations is an important function. GIS supports the response mission as follows:

- Provide warnings and notifications to the public and others of pending, existing, or unfolding emergencies based on the location or areas to be impacted by the incident. Areas in harm's way can be identified on the map, and mass notification can be performed from a GIS.
- Determine appropriate shelter activations based on the incident location and optimum routing for affected populations to access appropriate shelters.
- Maintain shelter location continuity of operations: supply inventories, external power requirements, shelter population capacities, etc.
- Identify the locations and capabilities of existing and mutual aid public safety resources.
- Provide facilities for the assembly of department heads to collaborate, make decisions, and develop priorities. Provide the capability to create remote connections to the command center for officials and others who need to participate but are unable to come to the command center.
- Establish the capability to collect and share information among department heads for emergency decision making to support emergency operations and sustain government operations.
- Establish the capability to share information and status with regional, state, and federal agencies.
- Support incident management operations and personnel, provide required resources, and exchange internal and external information.
- Maintain incident status and progress; facilitate damage assessment collection and analysis.
- Assure the continuity of government operations for the jurisdiction considering the impacts of the emergency.
- Prepare maps, briefs, and status reports for the executive leadership (elected officials) of the jurisdiction.

**Recovery**

The aim of the recovery phase is to restore the affected area to its original state. It differs from the response phase in its focus; recovery efforts are concerned with issues and decisions that must be made after immediate needs are addressed. Short-term recovery is focused on restoring essential services and support. Long-term recovery efforts are concerned with actions that involve rebuilding destroyed property, reemployment, and the repair of essential infrastructure. GIS is integral for recovery by providing a central information repository for assessment of damage and losses that provides

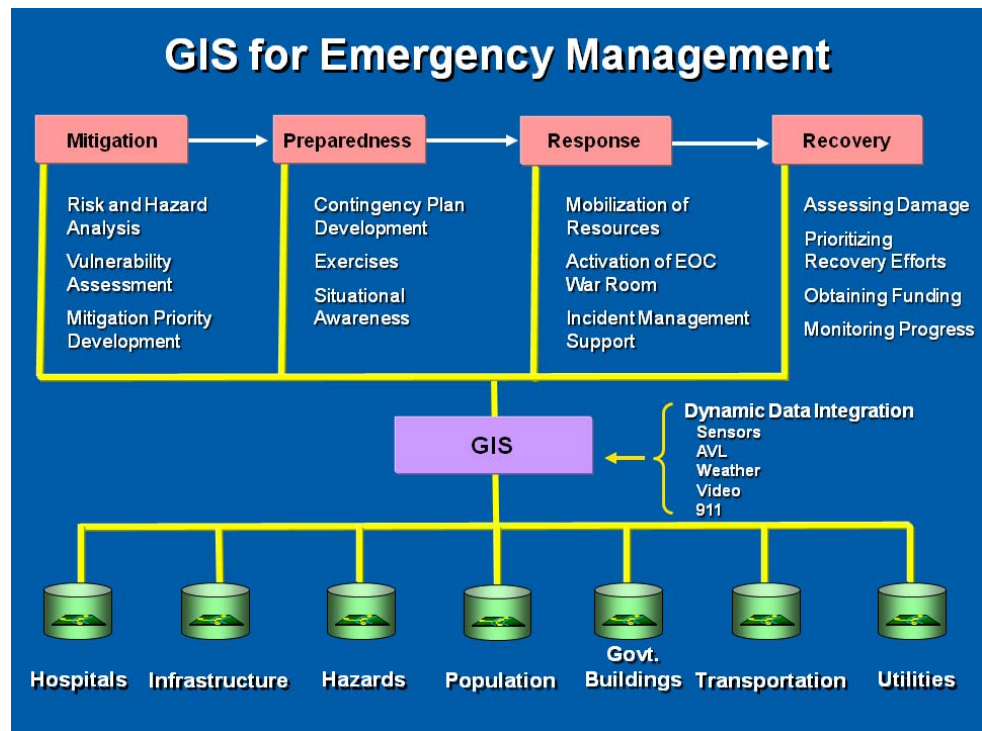
- Identification of damage (triage based on degree of damage or complete loss). GIS allows inspectors to code parcels with the degree of damage in order to visualize specific problems as well as area trends. (GIS on mobile devices expedites the difficult damage assessment problem and can include photographs and damage reports linked to the specific geographic sites.)
  - Overall damage costs and priorities for reconstruction efforts based on appropriate local criteria
  - Locations of business and supplies necessary to support reconstruction
- Assess overall critical infrastructure damage and determine short-term actions for the following:
  - First aid and health
  - Additional shelter needs
  - Optimum locations for public assistance
  - Alternate locations for government operations if government facilities are damaged
  - Alternate transportation routes for continued operations
  - Monitoring progress by specific location of reconstruction efforts for both long-term and short-term needs
  - Publishing maps to share information with the public and other government organizations of progress toward recovery objectives

***Field Operations***

Both response and recovery require close coordination and information exchange between the field and EOC. These requirements are often needed under stressful, chaotic conditions, when good information is required to support critical operations. GIS provides the capability for rapid data exchange that is easy to assimilate, understand, and act on. This capability allows EOC to provide elected officials, department heads, and other stakeholders with accurate situation status and data about actual and potential impacts. Current and timely information is also essential in order to provide the public with information such as shelter locations, evacuation routes, road closures, and hazard areas. Mobile GIS data can be easily integrated into the common operating picture and visualized, shared, and acted on without delay. When the common operating picture is current, better decisions can be made. These capabilities are important during response

but can play a very important role during recovery. Using mobile GIS in field recovery operations provides the EOC with a capability to rapidly integrate and display damage impacts from field inspectors in various locations.

In nonemergency situations, mobile GIS benefits data collection for planning, analysis, mitigation, and response. Data collected using mobile GIS in the field can be downloaded wirelessly or with physical docking as required. Detailed geospatial and other data (pictures, forms, etc.) can be collected and added to EOC's enterprise GIS for use in planning, preparedness, response, and recovery.



*GIS Support of the Emergency Management Workflow*

**Conclusion**

As the emergency management profession continues to be refined, the requirements to deal with complex issues across a variety of disciplines and stakeholders increase. Disaster events are increasing, populations are moving into more disaster-prone landscapes, and new threats exist. To meet the demands, professional tools and technology are required. GIS technology can serve a variety of purposes in supporting the workflows and mission of the emergency management profession. Comprehensive emergency management requires coordination and collaboration among many stakeholders—department heads, elected officials, privately held business, the community, and others. The collection of information, analysis of community vulnerabilities, development of mitigation strategies, and overall risk management preparedness is daunting. When emergencies occur, key stakeholders must share information on the scope of the event and collaborate on the most effective way to manage the incident and maintain government operations. Emergency Operations Centers activate their situation status rooms where various officials meet, share information, and provide their expert input for emergency decision support. GIS provides a platform for

the common operating picture, where dynamic data can be integrated to create a picture of events; their relationship to critical infrastructure can be shared with remote locations, which reduces the need to have everyone in one location. GIS provides a platform for the storage and management of all types of data that can be easily accessed for emergency decision support. The advent of mobile GIS enables geographic updates from the field that are immediately posted to the common operating picture, creating actionable information. The use of GIS is improving how emergency management professionals do their work.

# Appendix A: Federally Declared Disasters

During complex emergencies, under the response phase, the federal government can (at a governor's documented request) declare the incident to be a federal disaster (under the Stafford Act). The federal government will support the local response according to the National Response Plan (NRP).

The National Response Plan will provide federal support under a set of emergency support functions (ESFs). NRP uses a functional approach to group the types of federal assistance that a state is most likely to need under the 15 emergency support functions. Each ESF is headed by a primary agency that has been selected based on its authorities, resources, and capabilities in the particular functional area. Other agencies have been designated as support agencies for one or more ESFs based on resources and capabilities.

ESF#	Title/Function	Coordinating Federal Agency
<b>ESF #1</b>	<b>Transportation</b>	<b>DOT</b>
	Aviation/Airspace management and control	
	Transportation safety	
	Restoration/Recovery of transportation infrastructure	
	Movement restrictions	
	Damage and impact assessment	
<b>ESF #2</b>	<b>Communications</b>	<b>DHS/IAIP/NCS</b>
	Coordination with telecommunications and information technology industries	
	Restoration and repair of telecommunications infrastructure	
	Protection, restoration, and sustainment of national cyber and information technology resources	
	Oversight of communications within the federal incident management and response structure	
<b>ESF #3</b>	<b>Public Works and Engineering</b>	<b>DoD/USACE</b>
	Infrastructure protection and emergency repair	
	Infrastructure restoration	
	Engineering services and construction management	
	Emergency contracting support for lifesaving and life-sustaining services	
<b>ESF #4</b>	<b>Firefighting Coordination of Federal Firefighting Activities</b>	<b>USDA/FS</b>
	Support to wildland, rural, and urban firefighting operations	
<b>ESF #5</b>	<b>Emergency Management</b>	<b>DHS/FEMA</b>
	Coordination of incident management and response efforts	
	Issuance of mission assignments	
	Resource and human capital	
	Incident action planning	
	Financial management	

<b>ESF #6</b>	<b>Mass Care, Emergency Assistance, Housing, and Human Services</b> Mass care Emergency assistance Disaster housing Human services	<b>DHS/FEMA</b>
<b>ESF #7</b>	<b>Logistics Management and Resource Support</b> Comprehensive national incident logistics planning, management, and sustainment capability Resource support (facility space, office equipment and supplies, contracting services, etc.)	<b>GSA</b>
<b>ESF #8</b>	<b>Public Health and Medical Services</b> Public health Medical Mental health services Mass fatality management	<b>HHS</b>
<b>ESF #9</b>	<b>Search and Rescue</b> Lifesaving assistance Search and rescue operations	<b>DHS/FEMA</b>
<b>ESF #10</b>	<b>Oil and Hazardous Materials Response</b> Oil and hazardous materials (chemical, biological, radiological, etc.) response Environmental short- and long-term cleanup	<b>EPA</b>
<b>ESF #11</b>	<b>Agriculture and Natural Resources</b> Nutrition assistance Animal and plant disease and pest response Food safety and security Natural and cultural resources and historic properties protection and restoration Safety and well-being of household pets	<b>USDA</b>
<b>ESF #12</b>	<b>Energy</b> Energy infrastructure assessment, repair, and restoration Energy industry utilities coordination Energy forecast	<b>DOE</b>
<b>ESF #13</b>	<b>Public Safety and Security</b> Facility and resource security Security planning and technical resource assistance Public safety and security support Support to access, traffic, and crowd control	<b>DHS/DOJ</b>
<b>ESF #14</b>	<b>Long-Term Community Recovery</b> Social and economic community impact assessment Long-term community recovery assistance to states, local governments, and the private sector Analysis and review of mitigation program implementation	<b>DHS/FEMA</b>

<b>ESF #15</b>	<b>External Affairs</b>	<b>DHS</b>
	Emergency public information and protective action guidance	
	Media and community relations	
	Congressional and international affairs	
	Tribal and insular affairs	
	ESF notification and activation	

The North Region Contracting Center (NRCC), a component of the National Operations Center (NOC), develops and issues operations orders to activate individual ESFs based on the scope and magnitude of the threat or incident.

Depending on the situation, a response may require no ESF presence, some ESF involvement, or activation of most or all ESFs. When ESFs are activated, their representatives work on emergency teams to provide needed support and services. A local jurisdiction may categorize their emergency management support requirements exactly the same as the federal ESFs, or they may have their own system of providing emergency support functions.

GIS technology may be deployed to support one or many ESF requirements. Typically, GIS support will come through ESF #5—Emergency Management, which is responsible for coordination of incident management and response efforts, issuance of mission assignments, resources and human capital, incident action planning, financial management, and other direct support.

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## Appendix B: Incident Command Systems

To provide consistency and continuity of operations during complex emergencies, the incident command system is the standard for incident management (Homeland Security Presidential Directive #5). This system provides structure and uniformity for response operations. It is the management system that is used to identify the objectives for a specific incident and oversee the resources needed to achieve those objectives. The ICS structure can be applied to all incidents. It can be expanded or contracted to meet the demands of a particular incident.

The following is a list of key features of ICS:

- Applies across all emergency management disciplines
- Applies to a broad range of incidents from small to complex
- Uses a management by objectives approach
- Utilizes an Incident Action Plan (IAP)
- Is organized by function
- Standardizes operating structures
- Allows organizational flexibility
- Establishes common terminology

The incident command system is a process structured to organize personnel and resources quickly (from a variety of agencies) to manage an emergency. This requires identifying priority actions and allocating public safety resources to the most important tasks. GIS plays an important role in the incident command system. Some of the GIS products required within the ICS process include the following:

### Primary Map Products

The planning section needs several maps for operational planning. One of their primary requirements is to assemble information and produce each operational period incident action plan.

- **Planning Map**—The planning map is the basis for supporting what gets documented in the ICS 215 planning worksheet. Where are the branches, divisions, and so forth? What are the objectives for each geographic area, and what resources will be assigned to meet those objectives? Where are the personnel and equipment drop points, supply sources, helispots, hazardous areas, and so forth?
- **Situation Status Map**—The situation status map must provide the planning section intelligence and dynamic updates. A variety of maps are usually generated to communicate situation status from incident progression to resource availability to potential values at risk, and so forth.
- **Incident Action Plan Map**—The incident action plan map shows an overview of the entire incident including facilities, geographic divisions, incident status, areas



controlled and uncontrolled, ICP, staging areas, and medical facilities. Typically, following the ICS form 204 (Assignment List) for the division or branch specified, a detailed map for that specific division or branch is attached with information relevant to the personnel assigned to that area.

- **Briefing Maps**—These are often a combination of the planning map, situation status map, and the incident prediction maps and are large plotted maps that provide the basis for incident orientation and current assignments and objectives. They are used to brief the emergency operational personnel prior to each operational period. Supervisors are given the incident action plan, which contains much of the information in maps and documents. The briefing typically allows the incident commander (IC), operations chief, safety officer, and other key command staff an opportunity to emphasize critical issues and answer questions.
- **Traffic Map**—As part of IAP, a traffic plan map should be an attachment. It covers the access to and from the incident locations, areas closed to the public, locations of transportation support facilities, and so forth, and is attached to the IAP.
- **Facilities Maps**—All the incident facilities and their locations can be included on the transportation map; these are attached to the IAP.
- **Public Information Map**—This is helpful in the ICP and press briefing area. This may be several different maps, but the information is vetted and approved by IC(s) or the agency administrator(s) prior to being posted at ICP or via the Web or otherwise. (This is a very important function and can make work for the IC much easier with the community, elected officials, and the press if done right.)
- **Incident Progression Maps**—These help model progression of the incident and the progress and accomplishments made toward the incident objectives by operational period.
- **Incident Prediction Maps**—These help predict where the incident will progress, asking What values are at stake? and What are the worst-case scenarios? (This may be attached to the IAP.)
- **Jurisdictional Boundaries and Area Responsibility Maps**—These help determine what agencies are affected and to what extent. They help ensure that all the right organizations are represented in the incident command system (either at a command level or as liaisons).
- **Area of Special Concern Maps**—These are based on the unique issues related to the incident. They could be political concerns, sensitive critical infrastructure concerns, natural resource concerns, and so forth.
- **Air Operations Map**—This helps consider the air hazards (towers, power lines, air restrictions, etc.). What are the prescribed flight patterns over the incident for ingress and egress into and out of the operational area?
- **Damage Inspection Map**—This is an initial survey of damage and evolving detailed damage.
- **Rehab Map**—This outlines priorities for rehabilitation or reconstruction.

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# Appendix C: Principles of Emergency Management

In March 2007, Dr. Wayne Blanchard of FEMA's Emergency Management Higher Education Project, at the direction of Dr. Cortez Lawrence, superintendent of FEMA's Emergency Management Institute, convened a working group of emergency management practitioners and academics to consider principles of emergency management. This project was prompted by the realization that while numerous books, articles, and papers referred to "principles of emergency management," nowhere was there an agreed-upon definition of what these principles are.

The group agreed on eight principles that will be used to guide the development of a doctrine of emergency management. This monograph lists these eight principles and provides a brief description of each.

IAEM was well represented in the working group, and the IAEM Board endorsed these principles upon their publication.

## Definition, Vision, Mission, Principles

**Definition**—Emergency management is the managerial function charged with creating the framework within which communities reduce vulnerability to hazards and cope with disasters.

**Vision**—Emergency management seeks to promote safer, less vulnerable communities with the capacity to cope with hazards and disasters.

**Mission**—Emergency management protects communities by coordinating and integrating all activities necessary to build, sustain, and improve the capability to mitigate against, prepare for, respond to, and recover from threatened or actual natural disasters, acts of terrorism, or other man-made disasters.

**Principles**—Emergency management must be

1. **Comprehensive**—Emergency managers consider and take into account all hazards, phases, impacts, and stakeholders relevant to disasters.
2. **Progressive**—Emergency managers anticipate future disasters and take preventive and preparatory measures to build disaster-resistant and disaster-resilient communities.
3. **Risk-driven**—Emergency managers use sound risk management principles (hazard identification, risk analysis, and impact analysis) in assigning priorities and resources.
4. **Integrated**—Emergency managers ensure unity of effort among all levels of government and all elements of a community.

**Emergency  
Management  
Principles**

- 5. **Collaborative**—Emergency managers create and sustain broad and sincere relationships among individuals and organizations to encourage trust, advocate a team atmosphere, build consensus, and facilitate communication.
- 6. **Coordinated**—Emergency managers synchronize the activities of all relevant stakeholders to achieve a common purpose.
- 7. **Flexible**—Emergency managers use creative and innovative approaches in solving disaster challenges.
- 8. **Professional**—Emergency managers value a science- and knowledge-based approach based on education, training, experience, ethical practice, public stewardship, and continuous improvement.

1. **Comprehensive**

*Emergency managers consider and take into account all hazards, phases, impacts, and stakeholders relevant to disasters.*

Comprehensive emergency management can be defined as the preparation for and the carrying out of all emergency functions necessary to mitigate, prepare for, respond to, and recover from emergencies and disasters caused by all hazards, whether natural, technological, or human caused. Comprehensive emergency management consists of four related components: hazards, phases, impacts, and stakeholders.

*All hazards:* All hazards within a jurisdiction must be considered as part of a thorough risk assessment and prioritized on the basis of impact and likelihood of occurrence. Treating all hazards the same in terms of planning resource allocation ultimately leads to failure. There are similarities in how one reacts to all disasters, and these event-specific actions form the basis for most emergency plans. However, there are also distinct differences between disaster agents that must be addressed in agent- or hazard-specific plans, and these can only be identified through the risk assessment process.

*All phases:* The Comprehensive Emergency Management Model<sup>1</sup> on which modern emergency management is based defines four phases of emergency management: mitigation, preparedness, response, and recovery. *Mitigation* consists of those activities designed to prevent or reduce losses from disaster. It is usually considered the initial phase of emergency management, although it may be a component of other phases. *Preparedness* is focused on the development of plans and capabilities for effective disaster response. *Response* is the immediate reaction to a disaster. It may occur as the disaster is anticipated or soon after it begins. *Recovery* consists of those activities that continue beyond the emergency period to restore critical community functions and manage reconstruction.<sup>2</sup> Detailed planning and execution are required for each phase. Further, phases often overlap, as there is often no clearly defined

<sup>1</sup> National Governors' Association, *1978 Emergency Preparedness Project: Final Report*. Washington, D.C., 1978.

<sup>2</sup> Waugh, William L., Jr., *Living with Hazards, Dealing with Disasters: An Introduction to Emergency Management*. Armonk, New York, M.E. Sharpe, 2000.

boundary where one phase ends and another begins. Successful emergency management will coordinate activities in all four phases.

*All impacts:* Emergencies and disasters cut across a broad spectrum in terms of impact on infrastructure, human services, and the economy. Just as all hazards need to be considered in developing plans and protocols, all impacts or predictable consequences relating to those hazards must also be analyzed and addressed.

*All stakeholders:* This component is closely related to the emergency management principles of coordination and collaboration. Effective emergency management requires close working relationships among all levels of government, the private sector, and the general public.

## **2. Progressive**

*Emergency managers anticipate future disasters and take preventive and preparatory measures to build disaster-resistant and disaster-resilient communities.*

Research and data from natural and social scientists indicates that disasters are becoming more frequent, intense, dynamic, and complex. The number of federally declared disasters has risen dramatically over recent decades. Monetary losses are rising at exponential rates because more property is being put at risk. The location of communities and the construction of buildings and infrastructure have not considered potential hazards. Environmental mismanagement and a failure to develop and enforce sound building codes are producing more disasters. There is an increased risk of terrorist attacks using weapons of mass destruction.

Emergency management must give greater attention to prevention and mitigation activities. Traditionally, emergency managers have confined their activities to developing emergency response plans and coordinating the initial response to disasters. Given the escalating risks facing communities, however, emergency managers must become more progressive and strategic in their thinking. The role of the emergency manager can no longer be that of a technician but must evolve to that of a manager and senior policy advisor who oversees a community-wide program to address all hazards and all phases of the emergency management cycle.

Emergency managers must understand how to assess hazards and reduce vulnerability, seek the support of public officials, and support the passage of laws and the enforcement of ordinances that reduce vulnerability. Collaborative efforts between experts and organizations in the public, private, and nonprofit sectors are needed to promote disaster prevention and preparedness. Efforts such as land-use planning, environmental management, building code enforcement, planning, training, and exercises are required and must emphasize vulnerability reduction and capacity building, not just compliance. Emergency management is progressive and not just reactive in orientation.

### 3. Risk-driven

*Emergency managers use sound risk management principles (hazard identification, risk analysis, and impact analysis) in assigning priorities and resources.*

Emergency managers are responsible for using available resources effectively and efficiently to manage risk. That means that the setting of policy and programmatic priorities should be based on measured levels of risk to lives, property, and the environment. The National Preparedness Standard (NFPA) 1600 states that emergency management programs "shall identify hazards, monitor those hazards, the likelihood of their occurrence, and the vulnerability of people, property, the environment, and the entity [program] itself to those hazards."<sup>3</sup> The Emergency Management Accreditation Program (EMAP) standard echoes this requirement for public sector emergency management programs.

Effective risk management is based on (1) the identification of the natural and man-made hazards that may have significant effect on the community or organization; (2) the analysis of those hazards based on the vulnerability of the community to determine the nature of the risks they pose; and (3) an impact analysis to determine the potential effect they may have on specific communities, organizations, and other entities. Mitigation strategies, emergency operations plans, continuity of operations plans, and pre- and postdisaster recovery plans should be based on the specific risks identified, and resources should be allocated appropriately to address those risks.

Communities across the United States have very different risks. It is the responsibility of emergency managers to address the risks specific to their communities. Budgets, human resource management decisions, plans, public education programs, training, and other efforts necessarily should focus on the hazards that pose the greatest risks first. An all-hazards focus ensures that plans are adaptable to a variety of disaster types and that, by addressing the hazards that pose the greatest risk, the community will be better prepared for lesser risks as well.

### 4. Integrated

*Emergency managers ensure unity of effort among all levels of government and all elements of a community.*

In the early 1980s, emergency managers adopted the Integrated Emergency Management System (IEMS), an all-hazards approach to the direction, control, and coordination of disasters regardless of their location, size, and complexity. IEMS integrates *partnerships* that include all stakeholders in the community's decision-making processes. IEMS is intended to create an organizational culture that is critical to achieving unity of effort between government, key community partners, nongovernmental organizations, and the private sector.

Unity of effort is dependent on both vertical and horizontal integration. This means that at the local level, emergency programs must be integrated with other activities of

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<sup>3</sup> *NFPA 1600 Standard on Disaster/Emergency Management and Business Continuity Programs*, 2007 Edition, Section 5.3. National Fire Protection Association, Quincy, Massachusetts.

government. For example, department emergency plans must be synchronized with and support the overall emergency operations plan for the community. In addition, plans at all levels of local government must ultimately be integrated with and support the community's vision and be consistent with its values.

Similarly, private sector continuity plans should take into account the community's emergency operations plan. Businesses are demanding greater interface with government to understand how to react to events that threaten business survival. Additionally, businesses can provide significant resources during disasters and thus may be a critical component of the community's emergency operations plan. In addition, given the high percentage of critical infrastructure owned by the private sector, failure to include businesses in emergency programs could have grave consequences for the community.

The local emergency management program must also be synchronized with higher-level plans and programs. This is most noticeable in the dependence of local government on county, state, and federal resources during a disaster. If plans have not been synchronized and integrated, resources may be delayed.

Emergency management must be integrated into daily decisions, not just during times of disasters. While protecting the population is a primary responsibility of government, it cannot be accomplished without building partnerships among disciplines and across all sectors including the private sector and the media.

## 5. Collaborative

*Emergency managers create and sustain broad and sincere relationships among individuals and organizations to encourage trust, advocate a team atmosphere, build consensus, and facilitate communication.*

There is a difference between the terms "collaboration" and "coordination," and current usage often makes it difficult to distinguish between these words. Coordination refers to a process designed to ensure that functions, roles, and responsibilities are identified and tasks accomplished; collaboration must be viewed as an attitude or organizational culture that characterizes the degree of unity and cooperation that exists within a community. In essence, collaboration creates the environment in which coordination can function effectively.

In disaster situations, the one factor that is consistently credited with improving the performance of a community is the degree to which there is an open and cooperative relationship among those individuals and agencies involved. Shortly after Hurricane Katrina, *Governing* magazine correspondent Jonathan Walters wrote: "Most important to the strength of the intergovernmental chain are solid relationships among those who might be called upon to work together in times of high stress. 'You don't want to meet someone for the first time while you're standing around in the rubble,' says Jarrod Bernstein, a spokesman for the New York Office of Emergency Management."<sup>4</sup> It is this kind of culture and relationship that collaboration is intended to establish.

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<sup>4</sup> Walters, Jonathan, GOVEXEC.com. December 1, 2005.

A commitment to collaboration makes other essential roles and functions possible. Louise Comfort and Anthony Cahill acknowledge the essential nature of collaboration within the emergency management function: "In environments of high uncertainty, this quality of interpersonal trust is essential for collective action. Building that trust in a multiorganizational operating environment is a complex process, perhaps the most difficult task involved in creating an integrated emergency management system."<sup>5</sup> Thomas Drabek<sup>6</sup> suggests that collaboration involves three elements:

- a. We must commit to ensuring that we have done everything possible to identify all potential players in a disaster event and work to involve them in every aspect of planning and preparedness for a disaster event.
- b. Having achieved this broad involvement, we must constantly work to maintain and sustain the real, human contact necessary to make the system work in a disaster event.
- c. Finally, the involvement of all of our partners must be based on a sincere desire to listen to and incorporate their concerns and ideas into our planning and preparedness efforts. This element is probably the most critical because it is this sincere interest that engenders trust, cooperation, and understanding and allows us to truly have a team approach to protecting our communities in times of disaster.

This principle can perhaps best be encapsulated by remembering: "If we shake hands before a disaster, we won't have to point fingers afterwards."<sup>7</sup>

## 6. Coordinated

*Emergency managers synchronize the activities of all relevant stakeholders to achieve a common purpose.*

Emergency managers are seldom in a position to direct the activities of the many agencies and organizations involved in the emergency management program. In most cases, the people in charge of these organizations are senior to the emergency manager, have direct-line authority from the senior official, or are autonomous. Each stakeholder brings to the planning process his or her own authorities, legal mandates, culture, and operating missions. The principle of coordination requires that the emergency manager gain agreement among these disparate agencies on a common purpose, then ensure that their independent activities help to achieve this common purpose.

In essence, the principle of coordination requires that the emergency manager think strategically—that he or she sees the "big picture" and how each stakeholder fits into

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<sup>5</sup> Comfort, Louise K., and Anthony G. Cahill, *Managing Disaster, Strategies and Policy Perspectives*. Durham, North Carolina, Duke University Press, 1988.

<sup>6</sup> Drabek, Thomas E., *Strategies for Coordinating Disaster Responses*. Boulder, Colorado, Program on Environment and Behavior, Monograph 61, University of Colorado, 2003.

<sup>7</sup> Selves, Michael D., Oral testimony before the United States House Subcommittee on Emergency Management of the Committee on Transportation and Infrastructure, April 26, 2007.

that mosaic. This type of thinking is the basis for the strategic program plan required under the NFPA 1600 and the Emergency Management Accreditation Program. In developing the strategic plan, the emergency manager facilitates the identification of agreed-upon goals and persuades stakeholders to accept responsibility for specific performance objectives. The strategic plan then becomes a mechanism for assessing program progress and accomplishments.

This same process can be used on a smaller scale to develop a specific plan such as a community recovery plan; it is also an inherent component of tactical and operational response. The principle of coordination is applicable to all four phases of the comprehensive emergency management cycle and is essential for successful planning and operational activities related to the emergency management program. Application of the principle of coordination provides the emergency manager with the management tools that produce the results necessary to achieve a common purpose.

## **7. Flexible**

*Emergency managers use creative and innovative approaches in solving disaster challenges.*

Due to their diverse and varied responsibilities, emergency managers constitute one of the most flexible organizational elements of government. Laws, policies, and operating procedures that allow little flexibility in the performance of duties drive more traditional branches of government. Emergency managers are instead encouraged to develop creative solutions to solve problems and achieve goals.

A principal role of the emergency manager is the assessment of vulnerability and risk and the development of corresponding strategies that could be used to reduce or eliminate risk. However, there can be more than one potential mitigation strategy for any given risk. The emergency manager must have flexibility to choose not only the most efficient course of action but also the one that would have the most chance of being implemented.

In the preparedness phase, the emergency manager uses many resources to create and maintain a well-organized community response structure. One such resource is development of a risk-based community emergency operations plan. While most policies and procedures in government are specific and designed to offer little room for interpretation, the emergency operations plan is designed to be flexible and applicable to all community emergency operations. It is based on the consequences of the event, not the promulgating action.

The most dramatic phase of emergency management is response. In this phase, the emergency manager coordinates activities to ensure overall objectives are being met. The emergency manager must be flexible enough to suggest variations in tactics or procedures and adapt quickly to a rapidly changing and frequently unclear situation. The emphasis is on creative problem solving based on the event and not on rigid adherence to preexisting plans.



As part of the community team that will determine recovery priorities, the emergency manager must be capable of dealing with political, economic, and social pressures in making these decisions. It is natural to focus on short-term efforts in disaster recovery. However, the emergency manager cannot lose sight of the long-term needs of the community, and it is this aspect of recovery that often must be driven by the emergency manager.

Flexibility is a key trait of emergency management, and success in the emergency management field is dependent on it. Being able to provide alternate solutions to stakeholders and having the flexibility to implement these solutions is a formula for success in emergency management.

## **8. Professional**

*Emergency managers value a science- and knowledge-based approach based on education, training, experience, ethical practice, public stewardship, and continuous improvement.*

Professionalism in the context of the principles of emergency management pertains not to the personal attributes of the emergency manager but to a commitment to emergency management as a profession. A profession, as opposed to a discipline or a vocation, has certain characteristics, among which are

*Code of ethics:* While no single code of ethics has yet been agreed upon for the profession, the Code of Ethics of the International Association of Emergency Managers, with its emphasis on respect, commitment, and professionalism, is generally accepted as the standard for emergency managers.

*Professional associations:* Emergency managers seeking to advance the profession of emergency management are members of professional organizations such as the National Emergency Manager's Association (NEMA) and IAEM. They also participate in appropriate state, local, and professional associations.

*Board certification:* Emergency managers seek to earn professional certification through such programs as the Certified Emergency Manager™ program of IAEM. Professional certification demonstrates the achievement of a minimum level of expertise and encourages continued professional development through periodic recertification.

*Specialized body of knowledge:* The knowledge base for emergency managers consists of three principal areas. The first is the study of historical disasters, particularly as it pertains to the community for which the emergency manager is responsible. Second, the emergency manager must have a working familiarity with social science literature pertaining to disaster issues. Third, the emergency manager must be well versed in emergency management practices, standards, and guidelines.

*Standards and best practices:* The principal standards used in emergency management are NFPA 1600 and EMAP standards. These two standards provide the overarching context for the use of other standards and best practices.

## Appendix D: Glossary

<b>Acronym</b>	<b>Description</b>
AVL	Automated vehicle location
DHS	Department of Homeland Security
DoD	Department of Defense
DOE	Department of Energy
DOJ	Department of Justice
DOT	Department of Transportation
EMAP	Emergency Management Accreditation Program
EOC	Emergency Operations Center
EPA	Environmental Protection Agency
ESF	Emergency support function
FEMA	Federal Emergency Management Agency
FS	Forestry Service
GIS	Geographic information system
GSA	General Services Administration
HHS	Health and Human Services
IAEM	International Association of Emergency Managers
IAIP	Information Analysis and Infrastructure Protection
IAP	Incident Action Plan
IC	Incident Commander
ICP	Incident Command Post
ICS	Incident command system
IEMS	Integrated Emergency Management System
NCS	National Communications System
NEMA	National Emergency Manager's Association
NFPA	National Preparedness Standard
NGO	Nongovernmental organization
NOC	National Operations Center
NRCC	North Region Contracting Center
NRP	National Response Plan
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture



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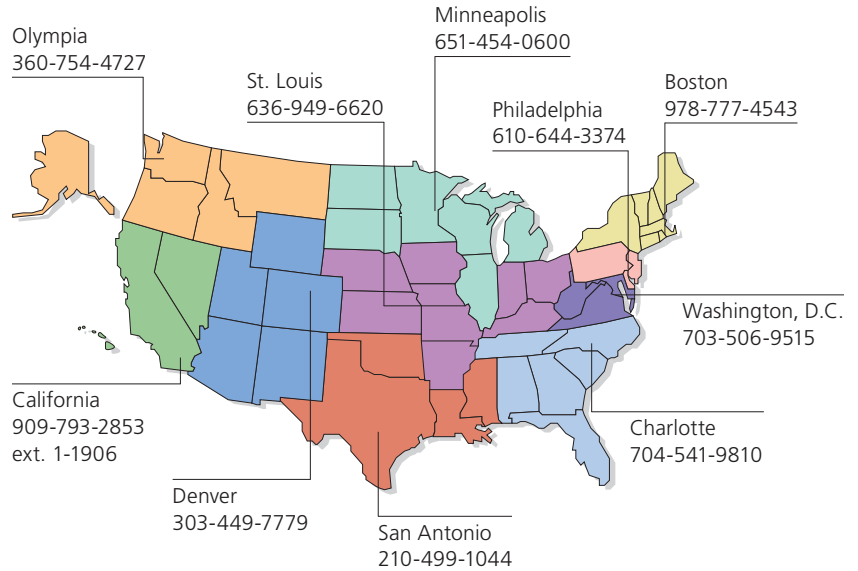
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