

U.S. Fire Administration/Technical Report Series

Special Report: Fire Department Preparedness for Extreme Weather Emergencies and Natural Disasters

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FEMA

Department of Homeland Security

U.S. Fire Administration

Major Fire Investigation Program

The U.S. Fire Administration (USFA) develops reports on selected major fires throughout the country. The fires usually involve multiple deaths or a large loss of property, but the primary criterion for deciding to write a report is whether it will result in significant “lessons learned.” In some cases these lessons bring to light new knowledge about fire—the effects of building construction or contents, human behavior in fire, and so forth. In other cases, the lessons are not new, but are serious enough to highlight once again because of another fire tragedy.

Under this project, USFA also develops special reports addressing a variety of issues that affect fire service such as homeland security and disaster preparedness, new technologies, training, fireground tactics, and firefighter safety and health.

The reports are sent to fire magazines and are distributed at national and regional fire meetings. The reports are available on request from USFA. Announcements of their availability are published widely in fire journals and newsletters.

This body of work provides detailed information on the nature of the fire problem and the many types of service provided by fire departments. The information informs policymakers, who must decide on allocations of resources between fire and other pressing problems, and personnel within the fire service, to improve codes and code enforcement, training, public fire education, building technology, and other related areas.

For reports on major fires and other critical incidents to which fire departments respond, USFA, which has no regulatory authority, sends an experienced fire investigator into a community only after having conferred with the local fire authorities to ensure that USFA’s assistance and presence would support, not interfere, with any local review of the incident. The intent is to arrive after the dust settles so that a complete and objective review of all the important aspects of the incident can be made. Local authorities review USFA’s report while it is in draft form. The USFA investigator or team is available to local authorities should they wish to request technical assistance for their own investigation.

For additional copies of this report write to the United States Fire Administration, 16825 South Seton Avenue, Emmitsburg, Maryland 21727 or visit our Web site: <http://www.usfa.dhs.gov>

**SPECIAL REPORT:
FIRE DEPARTMENT
PREPAREDNESS FOR EXTREME
WEATHER EMERGENCIES AND
NATURAL DISASTERS**

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Department of Homeland Security
United States Fire Administration
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U.S. Fire Administration
Mission Statement

We provide National leadership to foster a solid foundation for local fire and emergency services for prevention, preparedness and response.



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SPECIAL REPORT: FIRE DEPARTMENT PREPAREDNESS FOR EXTREME WEATHER EMERGENCIES AND NATURAL DISASTERS

OVERVIEW

Few organizations are as resourceful and multitalented as fire departments. Called upon to respond to many types of incidents, disasters, and situations—in all kinds of weather, day and night—our country's fire service represents an amazing cadre of specially trained and skilled individuals. They save heart attack victims, rescue people from flash floods, and ensure that buildings meet applicable fire and life safety codes. They can decontaminate individuals exposed to harmful chemical and biological agents, extricate victims of vehicle crashes, educate the public about preventing fires and how to escape, extinguish fires, and bring arsonists to justice.

The public relies heavily on first responders during emergencies, and the more substantial the incident or the disaster, the greater the need for assistance delivered by the fire department and others with public safety missions. When communities experience severe weather conditions, providing that assistance becomes more challenging. Earthquakes, hurricanes, blizzards and ice storms, floods, power outages, and extreme heat conspire to create dangerous working conditions, impassable roads, access nightmares, and some difficult dispatch and triage choices. The very circumstances that necessitate more staffing often interfere with the ability of responders to provide that assistance and support, travel to the station, or get to a scene.

Most fire departments have been through severe weather situations or natural disasters at some point. They have had to improvise strategies and tactics, revise deployment protocols, work extended shifts, and make do with whatever was available. Some departments have used this base of experience to help develop standard operating guidelines (SOGs) related to the types of extreme conditions that are most common in their area. Even so, occasionally the magnitude of a disaster exceeds predicted levels, or a community is hit with a natural disaster never before experienced. For example, there are documented seismic zones that have not been active but could become so at any point in time. A community may have gone through its fair share of flash floods but may not have encountered days of torrential rains and associated flood levels. Recent scientific studies have revealed new areas that are at risk from tsunamis in the United States; each year tornados touch down in a territory that has not previously been hit.

This report examines the impact of extreme weather and natural disasters on the fire service. It also addresses the types of service calls most likely to arise as a result of these disasters and what equipment and planning are needed in order to be prepared. Safety, mutual aid, shift management, resource identification, logistics, and other related issues are discussed, along with examples from case studies of fire departments that have learned from experience what can happen. The report provides information that fire departments can use to enhance their level of preparedness and ensure greater safety the next time disaster strikes.

Advance Planning

Many, if not most, of the operational challenges that the fire service faces during disasters can be anticipated and planned for while there is time to resolve any policy issues that would arise concerning operating procedures. The first step is to conduct a risk assessment—a procedure that can begin

simply by looking at the types of natural disasters and severe weather events that have affected the area in the past. It also is necessary to evaluate the area's vulnerability to less common, but perhaps higher consequence and potentially more deadly events. Though this report focuses on weather and natural disaster emergencies, fire department leadership will find that planning for these events is useful in their response to chemical, biological, and radiological incidents (accidental or intentional), as well.

There are common topics across the range of emergencies. For example, preparing for extended operations, coordinating with Emergency Operations Centers (EOCs), ensuring personnel safety, working out logistical challenges, caring for mass casualties, providing services under adverse, challenging conditions, and more—all require strategies with which fire and rescue personnel should become familiar. Fire department leadership and planning personnel also need to address demobilization and recovery from a major disaster.

State and Federal government disaster assistance can be requested during severe weather emergencies when local resources are exhausted or require additional support. However, this assistance normally arrives only after executing a series of procedures, and that takes time. Moreover, the extent and type of those resources is dependent upon preliminary damage assessments, and fire department personnel often are involved in quantifying and qualifying that information. The aftermath of Hurricane Katrina and other major disasters in recent years underscored a fundamental reality: Residents and communities need to be self-reliant for at least the first 3 days and maybe longer. Given this fact, it is critical to plan accordingly.

I. WARNING AND NOTIFICATION

Many severe weather situations provide warning of their impending arrival. Hurricanes, blizzards, ice storms, extreme cold, and extreme heat usually are predictable situations that meteorologists can track and monitor for hours or days prior to the onset of conditions. It is generally possible, therefore, to ramp up emergency operations in stages and make real-time adjustments in concert with changing conditions and the latest forecasts. Although technology improvements today permit better seismic activity monitoring, and we know when conditions are ripe for tornadoes to develop, earthquakes, tsunamis, and tornadoes offer little notice before threatening lives, property, and infrastructure. This reality underscores why it is so important to predetermine how essential services will be provided under disaster conditions. Continuity of operations is best accomplished when everyone who is responsible for essential services has been trained on special procedures and understands his or her role within the emergency management structure and the department's strategic plan.

Assessing Staffing Requirements

Significant events may demand an "all hands" response. Meaningful plans should cover the manner in which personnel will be activated, how coverage will be managed, and how shifts will be constructed. Career fire departments, by and large, have existing plans to ensure that there will be enough staffing to cover other than normal requirements. Typically, there are written procedures and rules governing callbacks, canceling leave, and so forth, and these plans are used to fill surge requirements of short duration. When planning for major natural disasters, those standing plans need to be reviewed with extended operations in mind. Very likely there will be roadblocks, both literally and figuratively, to providing services. Alternative staffing levels, redefining service priorities, and the operational environment all should be considered.

Another factor to consider in planning staffing resources is that reliance on standard mutual aid probably will not be possible. Blizzards, earthquakes, ice storms, and hurricanes may cause regional impacts, cross jurisdictional boundaries, and transcend State boundaries. Planning personnel should consider what other, more distant fire departments could be tapped for help and whether neighboring departments are looking for the same backup assistance. Ideally, fire departments will tackle these deliberations on a regional basis and develop their plans accordingly. Moreover, the fire departments that are identified for such longer-reach assistance need to agree with such designation and participate in the planning process.

Another element of mutual-aid planning should address those unrequested resources that will self-deploy. Despite standard protocols to the contrary, individuals and units likely will arrive unsolicited to the emergency scene. This ad hoc response often places an additional strain on the fire department at the worst possible time. Self-dispatch was a problem at the Columbine High School shootings, after the Oklahoma City bombing, at the September 11th attacks, and during Hurricane Katrina.

Fire departments should document what their resource requirements would be under the spectrum of disaster conditions and confirm that extra resources (including supplies) would be available. It is important to differentiate the types of assistance that could be needed, depending on the nature of the emergency. At the local and regional level, additional resources might include search and rescue personnel, paramedics, or Hazmat teams. Various types of fire apparatus might be needed, such as more Command vehicles and rescue units. Water tenders (tankers) may be needed to supplement depleted or damaged water distribution systems. Extra lights, cascade bottles, air compressors,

infrared cameras, and other equipment might be in short supply for a host of reasons, including the possibility that the department's supplies have been damaged, destroyed, or exhausted.

Notification and Callout

Fire departments should have a primary and a backup system for informing their members about the status of operations during major incidents. For events with warning—such as tropical storms, anticipated flooding, major snow or ice storms—communications with personnel can be carried out on several levels. Information can be disseminated before the emergency through local media. Messages can be sent via the Internet and any Intranet capability the department may have. Telephone calls (landlines and cell phones) are a standard for communicating, and simultaneous paging or data transmission systems may be used as well. Whatever system is in place, it should be redundant and sufficiently robust to survive the effects of a short- or no-notice event such as a tornado or earthquake and when catastrophic damage occurs. Many communities have invested in a commercial rapid notification system that uses multiple means of communication and keeps records using pre-established call lists and prerecorded instructions based on the type of emergency.

Once the system for notification and callout is established and tested, the content of the messages can be determined. Department members will need to know the following:

1. When to report for duty (regular hours or other).
2. Where to report for duty (especially important for support and nonoperations staff members such as fire prevention and training).
3. How long to anticipate the duty hours will last (24, 36, 48 hours, or more).
4. What to bring with them (extra uniforms, food, water, other supplies).
5. Where family members can call to check on the status and safety of fire department members.
6. Other essential information (station closings/relocation).

An essential element of the messages is the update on impending events and the impact of events on department operations. The members should be given as much information as possible. With some weather events, conditions may change rapidly, and the effects could be more or less severe than anticipated, or present localized conditions requiring special attention. The department's members can learn from the notifications what conditions are expected to occur, or have occurred, and whether any extraordinary requests have changed the department's normal operations.

The Palm Beach County (Florida) Fire Department activates its "Message Line" when the county is under a hurricane watch from the National Weather Service (NWS). The message line is a designated phone number with current information regarding the department's status. It is updated at least once a day and more often when conditions warrant.¹

¹ Palm Beach County Fire Rescue, 2006 Hurricane Annex.

Dispatch, Weather Service, and Utility Company Updates

Fire departments should establish and maintain liaisons with both the NWS and the utility companies that service their areas. This often is best done via the local EOC. The local EOC and its links to the State Emergency Management Agency can be vitally important in the lead-up to events during and in the aftermath of natural disasters.

The NWS will provide regular briefings on conditions, often through the State Emergency Management Agency. Typically, there are conference calls with multiple jurisdictions. Some local governments or departments may choose to use the services of private weather forecast organizations. These services may offer more detailed “microforecasts” for smaller areas for a fee.

Likewise, the fire department must be in close contact with the local utility companies that service their area. The restoration of essential services such as telephone, electric, water, sewer, and natural gas are the foundations of recovery. The status of such recovery efforts will affect the demands for fire department services directly. As the community recovers, the fire department will recover and be able to return to more normal operations. The fire department should have a liaison at the EOC and should be present when the emergency manager conducts regular briefings. Utility companies also should have a presence at the EOC to provide this information and to coordinate restoration of service with first responders and the Public Information Officer (PIO). Fire department and other emergency services facilities, along with other critical infrastructure assets, should be among the priority for the restoration of utility services.

II. MUTUAL AID

Mutual aid is the process of obtaining material or personnel support from other agencies. In some fire departments, mutual aid is a common occurrence, with nearby companies responding to emergency calls, covering stations, or other situations. In other fire departments, outside assistance is rarely available or requested.

In some communities, the mutual-aid agreement is informal—the departments have just always helped each other and it is understood that such assistance is available. Other departments have written agreements.

When a natural disaster strikes, the demands for fire department services surge. The larger the scope and scale of the emergency, the larger the surge and the longer it lasts. In events such as earthquakes, tsunamis, hurricanes, floods, and tornados, the department may have suffered damage to its facilities, and its personnel (both on and off duty) may have become casualties.

Personnel and equipment are the two key elements of any mutual-aid plan. Mutual-aid plans describe how a State (or region within a State) will mobilize personnel and equipment and how they will organize and administer those resources. If not in place already, fire departments should have a system set up so they can obtain and sustain incoming personnel quickly from outside agencies. The system should plan on supporting a personnel surge for at least several days, and ideally, for 2 or more weeks in the event of a catastrophic event. Generally, regional or statewide plans have similar components:

- a legal basis or authority for establishing the agreement;
- assumptions of the situations that could require mutual aid;
- a description of how mutual aid will be mobilized;
- definitions and terms:
 - types and location of equipment and supplies,
 - descriptions of disaster worker and first responder credentials,
 - assembly and reporting locations for mutual aid resources, and
 - regional boundaries or districts;
- operations:
 - Command structure,
 - communications,
 - local plans, and
 - EOCs; and
- policies and procedures:
 - liability,
 - workers' compensation coverage,
 - reimbursement,
 - dispatch procedures (plan activations),
 - logistical support (how long units are self-supporting),
 - documentation procedures, and
 - communications procedures.

The National Incident Management System (NIMS) is the template for organizing disaster response and is mandated by the Federal government for Federal agencies and those nonfederal agencies that receive Federal homeland security funds. In NIMS there are specific position descriptions covering all of the functions and tasks involved in supporting disaster response, public safety, and recovery. These can be found at <http://www.nimsonline.com/>

Assistance from Within Broader Region or Out of State

Departments that use mutual aid from adjacent communities know that these resources meet the needs of most common service requirements. This local aid often shifts back and forth, with communities routinely cooperating on individual incidents. When a severe weather event or other large-scale disaster occurs, regular mutual-aid response may not be available. Floods, high winds, and earthquakes, for example, do not follow geopolitical boundaries. The larger and more widespread the event, the greater the likelihood that the existing mutual-aid system will not meet the demands placed upon it. Fire departments will have to draw on assistance from fire departments beyond their normal mutual-aid area.

How then to address the needs of a situation where the demands for fire department services have multiplied at a time when the department's ability to respond to these demands has been limited or compromised? A method that has been adopted in many locations is a regional, statewide, and interstate mutual-aid system.

In their Lessons Learned Information Sharing (LLIS)² list server, the Department of Homeland Security (DHS) identifies several points central to the content of mutual-aid agreements. Communities benefit greatly from pacts that ensure

- coordinated planning, especially for incident Command;
- multiple response resources during major incidents or events;
- timely arrival and dependability of requested aid;
- availability of specialized resources; and
- minimal administrative conflict and litigation following a response.

The Emergency Management Assistance Compact (EMAC) is an example of interstate assistance. In this system, a State government passes legislation committing the State to join the Compact and provide major types of help, including fire services, to other members of the Compact.³ There are 48 States, territories, and the District of Columbia that are signers of the Compact. This agreement addresses a wide range of government services and includes public works and law enforcement.

The International Association of Fire Chiefs (IAFC) is supporting the National Fire Service Mutual-Aid System. Through a partnership with DHS and the NIMS Integration Center, IAFC is helping 10 States in a pilot project to develop an intrastate mutual-aid system so fire service resources can be activated and deployed rapidly.

² Lessons Learned Information Sharing, www.LLIS.gov

³ Model Intrastate Mutual Aid Legislation, National Emergency Management Assoc., Mar. 2004 <http://www.emacweb.org>

Project activities include work to design a model mutual-aid planning process. The National Fire Service Intrastate Mutual-Aid System is being designed to develop State plans that can be used to create a national model.⁴

Some States (e.g., California, Ohio, and Florida) have existing mutual-aid systems for the deployment of fire service resources within that State, and quite a few States are familiar with large-scale events that required help from other areas of the State.

⁴ International Association of Fire Chiefs, www.IAFC.org

III. SHIFT MANAGEMENT, ACCOMMODATIONS, AND FOOD

When a fire department designs plans for disaster operations, there are several internal components to consider: extended shifts, personnel accommodations, and food. There are a number of key issues. How will the department mobilize all of its personnel and provide shelter once everyone is mobilized? Additionally, how will the department provide food for them when the distribution system is disrupted?

Extended Shifts

Many career departments have plans and procedures in place to provide short-term (48 to 72 hours) increases in staffing by canceling vacations and other types of leave, or holding over shifts. Crew fatigue becomes an issue when shifts are extended, especially in times of higher than average activity or longer shift duration. One solution to preventing overload and burnout during emergencies is to condense three or four shifts down to two shifts, each of which then has larger staffing. The shifts work a 12-hours-on/12-hours-off rotation. This type of staffing requires some advance notice to implement and to mobilize.

For volunteer departments, the challenges are similar. The department should devise a schedule for its members that addresses longer range operations. If an event lasts for more than 2 or 3 days, there will be pressure on volunteers to return to their regular place of employment, so the availability of other resources becomes especially critical. State resources may be available to provide backup for disaster response in inadequate coverage areas, as may other volunteer or career departments.

State-level resources may include State Police, National Guard, and other agencies. For example, in Louisiana following Hurricane Katrina, the Louisiana State Wildlife and Fisheries Agency provided small boats and operators, and was very successful in rescuing people who were trapped in New Orleans and the surrounding parishes.

Station Assignment and Crew Rotation

When staffing is increased, regardless of the method or plan, all personnel should have a clear indication of where to report and when. This may involve temporary assignments to other stations to fill gaps in coverage. Another consideration is the use of support services staff. Personnel assigned to training, public education, fire investigation, and code enforcement can be used to fill a departmental Command Post, coordinate information at the EOC, function as the PIO, or perform other duties as needed. Plans for the alternative assignment of staff should ensure that personnel are trained appropriately for those task requirements.

Failing to rotate crews during extended operations can have a severe negative impact. Given the immediate circumstances, some people will have to work for extended times. This may be particularly true of headquarters or EOC staffs. Managers should enforce 12-hour shifts and serve as examples of this policy. This concept was followed after the Oklahoma City bombing in 1995. While not a weather-related disaster, that emergency nevertheless demanded that a crew rotation policy be operational.⁵ An after-action report prepared for the State of Virginia after Hurricane Isabel struck in 2003 reflects the same theme: “Workers should establish and enforce a work/rest policy that applies to all emergency personnel that are engaged in disaster related activities. Guidelines should be widely disseminated and supervisors should be expected to enforce the guidelines.”⁶

⁵ National Memorial Institute for the Prevention of Terrorism. Oklahoma City, 7 Years Later: Lessons for Other Communities. April 19, 2002, <http://www.mipt.org/pdf/MIPT-OKC7YearsLater.pdf>

⁶ An Assessment: Virginia’s Response to Hurricane Isabel. System Planning Corporation, TriData Division, Dec. 2004, p. 52.

Relocation of Assets and Equipment

Part of the planning process mentioned earlier is assessing hazards and damage. By understanding the risks encountered by a community, fire department personnel can plan accordingly. Fire department leadership should consider that, prior to some weather events and following the effects of other events, it may be necessary to move fire department personnel and equipment to safer locations. This may be done in advance of an event such as a flood or as the result of damage from an earthquake or tornado. The Palm Beach County (Florida) Fire Rescue Hurricane Annex is part of the Palm Beach County Comprehensive Emergency Management Plan. This Annex addresses the many needs encountered by a fire department confronted with the effects of a hurricane. Among those needs is identifying what will be done in the event that a county fire station is threatened by flooding. Appendix D of the plan identifies 13 steps to be taken to secure as much of the property as possible.⁷

Relocation planning should include locations that are not in the path of the flooding or other dangers. When planning for relocation, the length of the stay is a factor, as are the changes in response time and patterns. Also, companies may be relocated, not because their station is in danger, but because response patterns may have been altered due to flood damage to roads and bridges or other hazards.

Relocation plans should consider, as much as is practical, the safe removal and storage of all types of equipment in the fire station, not just the personnel and apparatus. If time allows, anything that can be moved to higher ground should be. If time is short, then move as much equipment as possible to higher portions of the station, if possible. The equipment should include computers and other electronic gear, hard copy files, and records. Generally, as much as possible should be moved if time and conditions permit.

Personal Kits

When the members of a department are directed to report for extended duty hours, they should be reminded to bring along additional personal supplies for at least the expected duration of their overall assignment. For example, if members are directed to report for a minimum of 3 days, then they should bring at least a 3-day supply of materials such as the following:

- work clothing, uniforms, undergarments, socks, etc.;
- clothing for off-duty hours (if returning to the residence during off-duty time is not going to be possible);
- toiletries;
- bottled water;
- nonperishable food supplies;
- personal medication; and
- sleeping bag or extra sheets and blankets.

Members should report with their own supplies because, depending on the type of disaster, stores may not be open for several days or even weeks. Curfews, evacuations, road closings, power failures, or structural damage may affect access to needed personal items.

⁷ Palm Beach County Fire Rescue, 2006 Hurricane Annex, Appendix D.

Bunk Space, Food, and Basic Supplies

When planning for extended operations, fire departments need to consider shelter capacity, food services, and basic supplies to maintain the personnel on duty. Optimally, shelter space should be located away from operational areas. Portable cots, blankets, and so forth should be acquired and predeployed in designated sleeping areas. Cots may be available through the EOC or other service agencies.

The County of Los Angeles Fire Department provides Meals Ready to Eat (MREs), water, and Gatorade® to all of its units to support operations around the clock.⁸ Many departments have canteen units that respond to multialarm fires or other operations. Some departments have rehabilitation units that supply refreshments. These units, while effective for the short term, will not likely support the food service needs of an entire fire department and mutual-aid partners for several days. Just as with the personal kits, the normal food distribution systems probably will be disrupted by the disaster. This disruption may last for as long as it takes to restore power to stores, repair the stores, and reopen the highways and railroads that lead to the stores; and that time period could be weeks or months. Some businesses never recover from the effects of weather-related or natural disasters. Fire departments should develop plans for how their personnel will be fed while disaster response and recovery operations are in effect.

A variety of basic supplies are needed to sustain a fire station and the equipment that is kept there. The regular supplies and food will be consumed during the early days of disaster. If the department experiences increased service demands and staffing, the rate of consumption and use of supplies will rise.

While fire departments may have adequate support services during normal operation, a disaster and the extended operations that follow will affect the continuance of these services. One solution is to use the principles found in the NIMS to address logistical needs. While the subject of logistics may not be at the top of the priority list for planning, the fact is that if logistics fail and fuel, food, and other supplies are halted, tactical operations could be markedly hampered. Personnel should be dedicated to establishing a department-wide Logistics Section in a departmental Incident Command System (ICS) structure. By having such a system, supply restocking and maintenance during and after a disaster can be addressed systematically.

Safe Havens and Rehabilitation Locations for Surge Personnel and Off-Duty Personnel

A desirable alternative to quartering personnel in fire stations is to provide other location(s) where fire department members can stay if the fire stations are too crowded or lack basic services such as electricity, water, and sewer—or are structurally unsound or unfit for use. A safe haven or rehabilitation location can be established in a variety of places. There are several factors to consider for virtually any type of offsite location:

- secure—safe and patrolled by law enforcement;
- power for heat and air conditioning;
- showers;
- sleeping quarters;

⁸ Larry Collins. "Eight Years later: Lessons Learned from the Northridge Earthquake." *Fire Engineering Magazine*, Apr. 2002.

- kitchen area or means to refrigerate, store, heat, and prepare food;
- telephone, Internet, or other means for members to communicate with their families;
- lavatories; and
- other recreational facilities, if possible.

Departments with wildland firefighting experience will recognize the description above as elements of a “base.” Again, the NIMS offers position descriptions for the people and assignments to staff the logistical elements of an event.

IV. SUPPORT TO PERSONNEL

In the event of an extreme weather situation or natural disaster, the members of the fire department will encounter the same issues as the rest of the general population. Members' homes may be damaged, and department personnel or their family members may have suffered injuries, or worse. How does a fire department continue to operate efficiently when its members have been affected directly by a disaster?

- What does the department plan to do if members cannot report for duty?
- How will their shifts be covered?
- Will members be allowed to leave duty stations to check on the well-being of family members?
- How will family members stay informed about the safety of department members on duty?
- Should arrangements be made for family members to have specifically designated shelters?

Departments should develop and practice methods to check on their personnel to ensure that they are not in distress and can report for duty. If telephone, cell phone, and other communications are unavailable, and they may be, this task may require face-to-face verification, if that is possible.

Evacuation and Sheltering of Members, Families, and Pets

Fire department leadership and department policy should address the methods by which the department would shelter and evacuate its members. These deliberations may extend to providing similar assistance to the service members' families.

Several communities in Florida have established plans for specific shelters to house emergency workers. In the *2004 Hurricane Season After Action Report*, Volusia County, Florida, identified the need for such shelters and found the following:

Actions should be taken so that each County and each municipality have identified and pre-planned the equipping and staffing of shelters of emergency workers. Like other shelters, these should be capable of functioning under conditions of prolonged power failure. In addition, County Emergency Support Function #6 (ESF) could assist smaller municipalities in identifying and staffing employee family shelters, perhaps through joint facilities with other municipalities or the County.⁹

By having a central location or locations where the families of fire department members can be sheltered, a large stressor on the department's members can be reduced.

One of the lessons learned from many disasters in the past is that people may not evacuate to a shelter if they have to leave their pets behind. Some fire department families may feel the same way. Ideally, shelters should have provisions for common domestic pets.

Personnel Family Assurance Desk and Status Checks

The members of the department will be much more effective, and the stress on them and their families will be reduced, if there is a system to coordinate information about relief efforts. During a major weather disaster, fire departments should activate a department-wide Personnel Accountability

⁹ Volusia County, Florida. *2004 Hurricane Season After Action Report, Lessons Learned*. Author, June 2004.

Review (PAR). Just like an operational PAR on the fireground or other emergency scene, confirming the status of personnel in the department is important for knowing who has been affected by the emergency and how. This information will help determine which personnel are available, who may need transportation to the station, or even which members require disaster assistance themselves. How would your department know if a member is just late for an assigned work period or if he or she is a victim of the storm and needs assistance? How will the department ascertain whether unavailable personnel are absent with just cause, or not?

In the Palm Beach County, Florida, Fire Rescue Hurricane Annex, there is a staff assignment for a “Family Relief and Recovery Coordinator.” This position has several specific tasks related to the welfare and recovery of fire department employees. In conjunction with Local 2928 of the International Association of Fire Fighters (IAFF), the coordinator provides the addresses of department members in order to check on their well-being. The local chapter assists with off-duty personnel conducting a poststorm survey of members’ homes.¹⁰

Chaplains and Health and Mental Health Services

The emotional and physical well-being of fire department members also will be a major operational consideration following a weather-related or other major disaster. Longer shifts and the affect of seeing widespread devastation both in the community and in the employees’ lives will have an impact on their state of mind. Rest, food, and rehydration, along with mental health support, is needed to help keep personnel working effectively during and after a disaster.

In a January 2006 interview in *Fire Chief Magazine*, the New Orleans Fire Department Superintendent described some of the issues and methods taken in New Orleans after Hurricane Katrina devastated the city. After two New Orleans police officers committed suicide, the fire department brought in critical incident stress management (CISM) teams from agencies such as the Red Cross, Louisiana State University, and the IAFF. The New Orleans Fire Department also has several chaplains who provided similar support.¹¹

The Superintendent summed up several of the issues facing the members of a department that has had a major disaster strike their community. “I hope people realize that this isn’t going to end any time soon. These people’s houses are not going to just reappear. The families--well established, solid families--are going to feel tremendous stress.”¹²

Mental health interventions may last for weeks or months following a large-scale event.

¹⁰ Palm Beach County Fire Rescue, 2006 Hurricane Annex.

¹¹ “Surviving the Storm, Interview with Superintendent Parent.” *Fire Chief Magazine*, Jan. 2006.

¹² *ibid.*

V. PERSONNEL SAFETY

During periods of extended or prolonged operations following a disaster, personal protective equipment (PPE) issues may arise. After the September 11th terrorist attacks and several anthrax incidents, the National Institute of Occupational Safety and Health (NIOSH) held a conference to share information and experiences regarding PPE and its use. While conditions are not exactly the same between a terrorist event and a natural disaster, there are parallels that can be made about operations following a disaster.

Structural firefighting PPE is not designed to be worn for extended time periods. An hour or two is generally accepted use. Wearing it for multiple hours contributes to fatigue and heat stress. The PPE may become damp from perspiration, increasing the hazard for steam burns if the PPE is not permitted to dry. Gloves, footwear, and eye protection all have similar limitations when they are worn for longer than originally intended.¹³

Considerations for Unusual and Dangerous Conditions

Natural disasters can present fire department personnel with situations they have seldom encountered. Hurricane force winds, extended power outages, and major infrastructure damage are only a few of the hazards that may arise. Protocols or standard operating procedures (SOPs) are needed for the following:

- dispatch and response in high (over 39 mph) winds: go/no-go policies;
- swift-water rescues;
- building collapse;
- water distribution system problems due to prolonged power failures; and
- street, bridges, and tunnel closures/access limitations.

Disasters can disrupt all types of business and supply systems. Many businesses use a “just-in-time” inventory management process. In that process, inventories of all types of materials are kept low intentionally to reduce storage costs. This system reduces the cost of excess inventory, but it relies on the uninterrupted transportation of goods. A disaster likely will disrupt these systems, and many materials and supplies will not be available. The number of days of motor fuel (gasoline or diesel) on hand for fire and emergency medical services (EMS) apparatus is the number of days the fire department continues operating if roads are closed and fuel deliveries cease. Accordingly, the department’s logistical plans should address how it will sustain the availability of critical, expendable supplies and other operational assets. Many departments maintain substantial caches of such materials to ensure operational readiness for extended periods.

Safety Officer

Many fire departments have a permanent, dedicated Safety Officer position. In a disaster environment, the demands on this position will increase. If a departmentwide ICS or Area Command is established, the safety function will require more personnel to handle the myriad assignments. At a departmentwide or Area Command level, safety personnel must monitor and evaluate the following conditions:

¹³ “Emergency Workers Share Experiences and Lessons Learned for Large-Scale Disaster Response.” *Fire Engineering*, June 2002.

- weather;
- seismic conditions (aftershock potential);
- work hours and crew fatigue;
- facilities for rest and sleep;
- crew conditions;
- food, water, and PPE;
- evidence of posttraumatic stress;
- station status, structural safety, sanitary conditions; and
- family support.

As in structural firefighting situations, the Safety Officer(s) must have the authority to suspend operations temporarily if conditions present too high a risk (e.g., a Category 4 hurricane), for personnel to respond or to continue operations.

Fire Station Vulnerability to Weather Emergencies

It is important to identify which fire stations in a community are at risk of flooding or other likely natural disasters. In selecting sites for new stations, consider flood plains, fault lines, wind resistance, and other natural hazards. Palm Beach County, Florida, has called for design features for all new fire department facilities to protect against the effects of a Category 5 (155+ miles per hour (mph) wind speed) hurricane.¹⁴ Many types of natural disasters can cause damage to fire stations. For example, substantial snow loading on flat-roof stations may produce structural failure risks. If stations must be evacuated, they should be inspected by qualified individuals who can evaluate the safety and operability of the building before the station is placed back in service.

Following an earthquake or other no-notice event such as a tornado, fire department safety personnel should assess viability of their stations to determine if they have been affected. The City of Los Angeles Fire Department has a policy called “Earthquake Emergency Mode.” After an earthquake of certain magnitude, the first order of business is for the companies to exit their quarters, account for personnel, and survey damage to the fire station and apparatus.¹⁵ This is done on a battalion level. The Battalion Chief will have an updated accounting of all personnel and resources. This served the Los Angeles Fire Department well after the Northridge Earthquake in 1994.¹⁶ Battalion 15 was the epicenter of the earthquake, and all eight stations in the battalion suffered various forms of damage. A fire department needs a plan to prepare for such events to readily assess its potential losses, readiness status, and additional assets required.

¹⁴ Palm Beach County Fire Rescue, 2006 Hurricane Annex, Mitigation.

¹⁵ Los Angeles Fire Department.

¹⁶ L. Schneider. *After Action Report, Battalion 15, Northridge Earthquake, Los Angeles Fire Department, Jan. 1994.*

VI. OPERATIONAL SUPPORT

There are other operational considerations beyond safety in the natural disaster environment. Fire departments must cooperate with other agencies more than usual. Coordination with local and State agencies (such as the Departments of Public Works (DPW), Transportation, Law Enforcement, and the National Guard), as well as utility companies and nongovernmental organizations (NGOs) is likely.

Coordination with Transportation and Public Works

Weather-related and other natural disasters may cause damage to the transportation infrastructure. Fire departments will be called to respond on streets that may not be passable because of:

- debris on the roadway;
- physical damage to the roadway, including traffic signals and signs;
- flood waters;
- snow and ice;
- downed, active power lines; and
- other hazards or conditions, such as abandoned vehicles.

The best way to coordinate the activities of multiple agencies is through a Unified Command structure. The agencies normally responsible for the roads—the Department of Transportation (DOT), the DPW, and the City Traffic Engineer's Office—should be represented, along with the fire department and other emergency services.

DPW usually can provide assistance with barricades for road and street closures. They also may have the heavy equipment needed to clear streets to provide passage for emergency vehicles. Many public works agencies have structural engineers on staff, and they can assist in making building safety assessments. Public works units may have pumping capabilities that could be a resource for removing water, thus augmenting fire department personnel providing that service or freeing them for other operations.

The DPW and DOT may be called to assist in opening the streets and roads to allow members access to the fire stations or operational areas. These agencies also may be a resource in moving personnel from one area to another. Due to traffic, safety, or other concerns, it may be best to have members stage their personal vehicles at a given location and use an expedient transit system to take them to and from their duty stations.

Transportation departments and traffic engineers can assist if they are the ones that manage the traffic signal system. The traffic signal system is not just about lights; it is an entire system of signage that directs and controls traffic flow. If the traffic lights and signs are disrupted due to damage or extended power failures, the DOT may be able to erect stop signs and make four-way-stop intersections to reestablish control of intersections. This can lessen the burden on law enforcement personnel, and help prevent accidents to which both fire and police would have to respond, increasing their operational burdens.

Coordination with Law Enforcement Departments and the National Guard

Disaster and major incidents demand effective coordination among fire and police personnel. Traffic control, curfews, and limits on access to damaged areas all affect fire department operations and require close cooperation with law enforcement. Some disasters may spawn lawlessness in the form of looting and arson, which can place unarmed fire and EMS personnel at risk. Plans should spell out how fire and police will communicate, and when law enforcement needs to indicate an “all clear” before fire department members respond at a scene.

If the disaster is large enough or local governments request such assistance, the Governor of the State declares that a “state of emergency” exists and mobilizes the National Guard.

The National Guard, law enforcement, DPW, and the DOT may have various overlapping duties and capabilities. The National Guard can assist with traffic control and security needs while also assisting with tasks like debris removal. Some National Guard units may assist with other challenges, such as providing shelter with tents, or other assistance. The National Guard will need a liaison in the EOC to coordinate support for local officials.

DPW, DOT, and the National Guard may be able to help fire departments get to and from the scene of an emergency. This may require the use of heavy equipment to clear the streets of debris or other hazards, such as snow and ice. DPW, DOT, and the National Guard will have four-wheel-drive vehicles, which can be used to gain access to various types of emergencies. For example, EMS patients in places that are not accessible to regular vehicles can be picked up by four-wheel-drive vehicles and taken to regular EMS transport vehicles. These same agencies also may have small boats for the same purpose.

If there is a United States Coast Guard (USCG) presence in the community, the fire department should develop disaster response plans with them. If not, contingency planning for flooding should include swift (moving) water and other waterborne operations. The USCG possesses various resources to support these kinds of operations.

Aircraft may be another resource for use in the movement of patients or in other operations. Some law enforcement agencies have this capability, as do the National Guard and the USCG.

If a local transit system has buses, they may be pressed into service for the movement of personnel, as mentioned above, or used in the evacuation of civilians and for medical transportation. There also may be National Guard or public school transportation resources available for this purpose.

Emergency Medical Services for Evacuees in Shelters

Providing EMS care for people in emergency shelters will be a factor in disaster response. In many, but not all communities, agencies such as the Salvation Army or American Red Cross (ARC) are the responsible organizations for shelter management. They may provide a nurse for medical support. The ARC, however, does not, as a matter of practice, transport people to and from shelters.

If the fire department provides EMS transport services, then planning should anticipate the surge of patients that will follow the opening of shelters. Some people come to shelters in bad health; some have their conditions aggravated by the process of travel to, and the life in, the shelter. Many people will not have their medications with them at the shelter, and that can quickly develop into serious health situations.

EMS units at shelters will be governed by the same go/no-go procedures as when high winds or other hazards are present, limiting safe operations. If EMS transport units are to operate from shelters, plans should address certain considerations, such as:

- whether these EMS units will be dedicated to shelter services only, or whether they will be available to respond to other emergencies near the shelters;
- how crew rotation and logistical issues at shelters (such as fuel, supplies, and staff rehabilitations) will be addressed; and
- what to do if hospitals and emergency departments are over capacity and cannot take more patients.

Finally, shelters may remain open for several days. Any EMS deployment must take extended operations into account.

VII. SPECIAL CONCERNS AND CASE STUDIES

This section addresses particular concerns related to several different types of weather-related emergencies, and provides the NWS definition for the event. An event in one part of this country (e.g., a snowstorm) may be considered a disaster, while in other parts it is just considered inclement weather. Part of the hazard assessment process is an understanding of historical weather patterns for your community, and how local capabilities are prepared to address the likely consequence of those events, as well as more extreme conditions.

Blizzards and Heavy Snows

Blizzards are defined as a snow event with sustained winds of 35 mph or more.¹⁷ In addition to the hazards from the accumulation of snow, visibility decreases from blowing snow. Snow accumulation may damage utility lines and disrupt highway and rail transportation. Structural collapse is a real threat from heavy accumulations of snow that increase the structural load on roofs and walls. The blizzard of 1996 on the eastern seaboard caused major damage to buildings, and collapses killed several people.¹⁸ In 1922, following a heavy snow (24 inches) in Washington, DC, the Knickerbocker Theater collapsed, killing 97 people.¹⁹

As heavy snow falls on highways, snow removal becomes essential to maintaining public safety services. Many cities have well-fielded procedures in place to mobilize de-icing and snow removal operations during winter storms. However, a 12-inch snowfall in Boston is not the same event as it would be in Atlanta. Fire departments where heavy snow is an anomaly nevertheless should establish procedures on how to handle the unlikely, but not impossible, threat from snow. As mentioned earlier, coordination with the DOT and DPW is crucial during these types of events. There will be stranded motorists, and recovering them will be a challenge; fire departments will be called upon to help.

If blizzard conditions close highways and streets for several days, the demand for EMS services could increase dramatically. This is particularly true for situations where residents require regular treatment at health care facilities. People who need chemotherapy or dialysis and who make frequent trips to treatment centers will end up calling EMS for transportation. Typically, these people use some form of public or private transportation, which may cancel service in seriously inclement weather.

At the same time that EMS responses take longer due to road conditions (increased travel times), there also will be an increase in demand for services. As many fire departments know from experience, this situation will strain the fire department and EMS system. One solution for this problem is to have a pre-established network of four-wheel-drive vehicles that can take ambulatory patients from their homes to and from treatment centers. In this way, the patient receives the best level of care while reducing the demand on both the fire/EMS services and the emergency departments in hospitals.

¹⁷ "Know Your Winter Weather Terms." National Oceanic and Atmospheric Administration's National Weather Service. Oct. 2001, <http://www.noaanews.noaa.gov/stories/s794c.htm>

¹⁸ Ray Downey. "Beware of the Roof." *Fire Engineering*, May 1996.

¹⁹ Francis Brannigan. *Building Construction for the Fire Service*. 2nd Ed. pp. 25-26.

Severe (Nontidal) Flooding

Nontidal flooding can be caused by heavy rains, rapid snow melt, or failure of dams. Depending on the circumstances, the onset of flooding can be sudden or anticipated. In either case, water levels will rise well above the norm and inundate the surrounding area. This condition may last for several days or even weeks.

During flooding, fire departments are faced with compounding challenges:

- structural damage from moving water;
- disruptions to utility services;
- damage from debris being moved by the water;
- evacuation of low-lying areas;
- increased rescue problems:
 - people trapped in structures by rising waters, and
 - people trapped in motor vehicles by rising waters; and
- damage to infrastructure such as roads and bridges, limiting response.

During flood events, the fire department usually works closely with law enforcement and the agencies that maintain the roads and highways. Access to many areas may be limited or impossible without assistance from other agencies and special equipment.

The movement of the water and the speed of the water's movement also can affect fire department operations. Flash flooding, or a rapid rise of water, can catch a community off guard, as occurred in a low-lying Richmond, Virginia, area in August, 2004. A tropical storm that was predicted to produce 4 inches of rain became stuck over the Shockoe Bottom neighborhood, and dumped over a foot of rain in a matter of hours. The result was a terrifying and raging surface flood over 10 feet deep near the James River that devastated a historic neighborhood.

Some communities that are prone to this type of weather predeploy their specialized rescue teams when heavy rains are forecast or when ground saturation levels reach predetermined points. Ventura County, California, is one such community. The County Fire and Sheriff's Departments both operate swift-water rescue teams. These teams can deploy to areas known for flooding that the Sheriff's Department patrols. These teams include rescue swimmers, small boat handlers, rope riggers, and team leadership. The program is an ongoing activity of both departments and requires a commitment to training and the acquisition and ongoing maintenance of equipment.²⁰

Hurricanes

Officially, hurricanes are tropical cyclones with sustained surface winds of at least 74 mph in the Atlantic and eastern Pacific Ocean basins. In the western Pacific, these storms are called typhoons. Hurricanes are further defined as Categories 1 through 5, based on the velocity of sustained winds. Category 3 hurricanes and higher are considered major hurricanes that will likely require special operations and present atypical challenges in any affected community. Tropical storms are cyclones with sustained surface winds of at least 39 to 73 mph.²¹

²⁰ Jon Jelle. "Watery Save." *Fire Chief Magazine*, Aug. 2005.

²¹ "Hurricanes...Unleashing Nature's Fury: A Preparedness Guide." National Oceanic and Atmospheric Administration's National Weather Service, Aug. 2001.

The entire eastern seaboard and Gulf Coast of the United States, as well as California and Hawaii, are vulnerable to these storms. The heavy rains and winds cause damage far from the coastline. For that reason, even fire departments not located along the coasts must be aware of the potential for effects from storms that have made landfall several States away.

Perhaps the most dangerous hurricane threat is tidal flooding along the coast that develops near the eye of the storm as it approaches landfall. Storm surges raise water levels several feet above normal high tide, and may last for more than one tidal cycle. Wave action driven by storm winds increases the potential for damage to property. With higher category storms, the potential for damage can rise to catastrophic proportions as was seen along the Gulf Coast from Hurricane Katrina in 2005.

Fortunately, hurricanes generally provide ample time for communities and fire departments to prepare and to situate personnel and equipment in safe areas. One prediction tool in use by some emergency managers is called Sea, Lake, and Overland Surge from Hurricanes (SLOSH).²² This is one of several programs or models that can be used to project the track and potential damage from hurricanes. Communities can use this model to estimate storm surge depths and determine which areas need to be evacuated. This also would help project which stations would be threatened by the various categories of hurricanes, and whether evacuations should be considered in advance of landfall. These prediction tools also aid in planning for which infrastructure (such as roads, bridges, power-generating and water-treatment facilities) may be the most vulnerable to flooding from storm surge. The threat to other high-risk target hazards such as hospitals and nursing homes likewise can be identified.

Hurricane Operations: For practical purposes, hurricane operations can be categorized in two ways: prelandfall and postlandfall. Each mode has its own set of circumstances and challenges. In the prelandfall mode there are generally 48 to 72 hours' notice. With all of the media attention given to tropical weather and with other resources such as Internet sites, there is little reason to be surprised by the approach and timing of a named storm. The forward motion of these storms can slow or accelerate, or the storm may change course, but they **never** arrive without warning.

Most prelandfall operations address preparing for the storm. Fire stations, equipment, and personnel have to be made ready for the storm, which may require evacuation of fire department personnel and equipment to safe havens if flooding is a concern. Backup generators and special equipment to support special response demands—swift-water rescue, for example—will need to be secured. Cooperation with law enforcement and agencies with boat and airlift capabilities may be essential for rescue of people isolated by flood waters. With tidal surges, the flooding could last for several days. As the storm approaches and winds increase, decisions will have to be made regarding ongoing operations. Winds above storm force (above 39 mph) will cause debris and any other objects not secured to move or become airborne, posing serious hazards to personnel, vehicles, and structures.

Departments that have hurricane plans should include a provision for the cessation of response operations at a given wind threshold. Sustained winds of 39 mph generally are the accepted threshold. This “no-go” period will last until the sustained winds once again drop below the threshold.

²² “Sea, Lake, and Overland Surge from Hurricanes,” http://www.fema.gov/plan/prevent/nhp/slosh_link.shtm

During this time, procedures should be in place to put calls “on hold” until conditions warrant a safe response. Because fire departments normally are accustomed to answering every call as soon as it is received, personnel may need specific policies and direction to restrict unsafe operations.

After the storm has passed and the winds have diminished, fire departments will have to assess whether there are continuing risks to personnel, and if their structures and equipment have sustained damage. Some fire departments also help conduct damage assessment in the community. Palm Beach County, Florida, conducts an “Initial Damage Impact Survey” (IDIS). Units from each station have a predetermined list of target hazards to survey for preliminary damage.²³ This process is completed before rescue or other fire operations missions begin.²⁴ A preliminary damage assessment also is crucial as a prerequisite for requesting Federal disaster assistance through the Federal Emergency Management Agency (FEMA). The information obtained also permits an orderly prioritization of operations for specialized units such as Urban Search and Rescue (US&R) teams. Palm Beach also conducts a “Family Relief and Recovery Survey” to determine the status of the homes of fire and rescue personnel.²⁵

One of the major postlandfall challenges is restoration of services, in particular electrical service. In the aftermath of Hurricane Charley in 2004, the City of Cape Coral, Florida, responded to several hundred calls for fire department services. Many calls were for electrical fires that occurred as the power restoration process began (power was shut down by the utility company prior to the storm’s arrival) in structures where the electrical service had been damaged. Restoring power in buildings with damaged wiring caused some fires, as did tree limbs fallen on overhead power lines.²⁶

Flooding, wind-damaged roads, missing signs, and inoperable signals that control traffic flow may, in turn, affect the timely arrival of mutual-aid resources attempting to assist. Cape Coral, Florida, provided a firefighter to coordinate logistics with mutual-aid companies and act as a “navigator” to direct incoming units after Hurricane Charley hit in 2004.²⁷

Planning efforts for the posthurricane environment should anticipate that there will be an increase in requests for EMS service resulting from minor injuries such as falls, sprains, and lacerations as people begin debris removal and repairing their homes.

Earthquakes and Earthquake-Related Tsunamis

During an earthquake, the plates of the earth’s surface move and release energy in the form of seismic waves. Such waves vary in intensity, duration, and in the amount of damage they cause. The epicenter is the point of highest energy release and typically of the greatest damage. Earthquakes strike without warning, as currently there is no proven prediction system. There are areas that are well identified as earthquake-prone, with fault lines and historical data on events, such as California and Alaska and the area around the New Madrid fault line in Missouri, Illinois, and Arkansas; but many other areas also are at risk.

²³ Palm Beach County Fire Rescue, 2006 Hurricane Annex, p. 20.

²⁴ *ibid.*, p. 21.

²⁵ *ibid.*, p. 21.

²⁶ David G. Kilbury. “Coping with Hurricane Charley.” *Fire Engineering*, Nov. 2004.

²⁷ *ibid.*

Earthquakes can cause massive damage to buildings, power and water distribution, pipeline systems, and the infrastructure in general. Fire department properties are not exempt from this potential for damage. The damage from earthquakes can include

- damage to buildings;
- damage to roadways and other infrastructure, e.g., power plants, water systems, rail systems, etc.;
- fires from ruptured gas lines, downed wires, and collapsed structures;
- the release of hazardous materials;
- multiple rescues of people who were occupying damaged buildings; and
- potential for mass casualties and mass fatalities.

After an earthquake, the fire department first should check to see if any of its resources have been comprised. Then, a survey to determine the extent of damage in each company's first-due district should be conducted. Responding to earthquakes in this manner requires a plan and training on the plan, such as used by the City of Los Angeles.

Immediately following the Northridge earthquake in 1994, the Los Angeles Fire Department went into "Earthquake Emergency Mode." Companies conducted a PAR at the battalion level. Following the PAR, the companies performed "district drive through" where they surveyed damage in their area. Companies should not respond to emergencies until this survey is completed, rather than committing to the first emergency they see.²⁸ There may be more serious emergencies having greater priority.

Depending on the magnitude of the earthquake, fire department operations may continue for some time. There are many cases of people surviving for days in collapsed buildings. The US&R system likely will deploy its resources, which will involve mutual aid, extended shifts, and all of the challenges associated with large-scale operations.

Tsunamis are a disruption of regular wave action caused by underwater seismic activity. These waves can travel great distances at high speed until they collide with a shore line.

When a tsunami impacts the shoreline, it often behaves like a flash flood (or perhaps more closely, a dam failure). Instead of waves that simply break on the beach, tsunamis have the entire mass of the ocean behind them. When they strike land, they are basically miles-long walls of water. As they roll across the land, they pick up boats, debris from crushed buildings, automobiles, and people. When tsunamis reach the apex, they reverse-course and rush back to the sea, carrying everything they picked up with them.²⁹

There may be more than one of these "waves" as the result of a seismic event. The most recent tsunami of great magnitude was the Indonesian tsunami of December 26, 2004, which killed almost 300,000 people. No portion of the U.S. coastline is immune from this phenomenon.

While earthquakes are a no-notice event, there is a system in place for tsunami warning. The NWS operates two tsunami warning centers, one in Alaska and the other in Hawaii. These centers can provide information regarding the intensity and speed of the tsunami. Tsunamis created close to the

²⁸ L. Schneider. *After Action Report, Battalion 15, Northridge Earthquake*, Jan. 1994, Los Angeles Fire Department.

²⁹ Larry Collins. "Tsunamis: A Wakeup Call for the U.S., Part 1." *Fire Engineering*, Sept. 2005.

shore will limit the warning time. The only way to protect oneself against tsunamis safely is to get out the way. Evacuation inland and to higher elevations along the direct path of the tsunami is the most effective way to save lives.

Fire departments, in conjunction with emergency managers, should have a formal means to receive tsunami warnings when they are issued. An article in *Fire Engineering* (September 2005), described problems with how fire departments reacted to the warnings that were issued following the June 14, 2005, earthquake off the coast of northern California.³⁰ While fire departments in coastal areas are performing damage assessments, rescue, and firefighting operations, they could be at risk from a tsunami in the hours following an earthquake.

This is exactly what happened in the earthquake that struck the Japanese Island of Okushiri in 1993. As residents evacuated the coastline for high ground in the dark of night, fires started by the earthquake lit up the city, and within three to five minutes a black wave swept into the city and destroyed burning buildings and fire engines alike. Several more tsunamis followed, destroying large sections of the city and killing more than 200 people, including many fire fighters.³¹

Ice Storms and Extreme Cold

The NWS defines an ice storm as “A form of winter storm where ice accumulates 1/4 inch or more.”³² The accumulation of ice, especially on power lines, and on trees that fall on power lines, can cause major disruptions to electrical and telephone service. Until the streets can be treated with sand, salt, or other chemicals, the roads may be impassible to vehicles without tire chains. Motor vehicle accidents will increase until the roads are safe, and fire departments can expect requests to assist people who are stranded in their homes or vehicles. Power outages force people to seek other means for heating their homes, often with deadly results. Unvented generators or other improvised heating systems may cause structure fires or carbon monoxide poisoning.

After an ice storm, if thawing is rapid and begins before power is restored, there is an increased risk of flooding, especially in properties protected by sump pumps. Fire departments can expect more calls for assistance. EMS calls also go up for ice-related injuries caused by falls (fractures, sprains, etc.). In severe cases, communities may need to open special shelters to protect indigent populations, and EMS support for these shelters may be required.

Extreme cold and ice will complicate fire department operations in several ways:

- Roads are less passable or altogether impassible from heavy ice on the roadway or from broken water mains that flood and then freeze.
- Snow and ice present operational hazards to onscene personnel (slips, falls).
- Equipment and apparatus will be more susceptible to damage (pumps freezing, etc.).
- Improvised heating systems may cause more fires or carbon monoxide poisoning, placing additional service demands on the fire department.
- The risk of hypothermia for both firefighters and civilians increases.

³⁰ *ibid.*

³¹ Larry Collins. “Tsunamis: A Wakeup Call for the U.S., Part 2.” *Fire Engineering*, Oct. 2005.

³² National Weather Service Web site.

Fire department personnel must take precautions to limit exposure to extreme cold. This often is accomplished by rotating crews more often and providing heated rehabilitation areas. It also is recommended that personnel have an extra change of dry uniforms and protective clothing.

An extended cold spell may cause bodies of water to freeze that do not normally do so. There is a greater potential for ice rescue calls. Fire departments should prepare for ice rescue operations with the proper equipment and training to reduce the risk of injury and enhance unit effectiveness.

Drought and Extreme Heat

Just as extreme cold and ice will complicate fire department operations, extreme heat and droughts can cause problems too. Extreme heat is an additional stressor for personnel and equipment. The same strategies of more frequent crew rotations and, in this case, an air-conditioned rehabilitation area, are needed. Fires that might be handled with a single alarm may need additional companies to provide more crews to minimize the potential for heat-related injuries (heat exhaustion and heat stroke). Again, just as with extreme cold, communities may open “cooling centers” to provide relief, and these shelters may need EMS support. EMS service requests likely will increase, especially from the elderly and others with respiratory and heart problems. In urban areas the problem is even more pronounced, because people are more likely to keep windows or doors open when there is no air conditioning.

Droughts generally will reduce community water supplies. Provisions for additional water supply may be needed. These provisions may include acquiring additional water tenders (tankers) and large-diameter hose companies to supplement the existing water distribution system shortfalls. Beyond the challenge of providing sufficient water for structural suppression operations, departments may be requested to support subsistence effort for livestock, wildlife, or other nontraditional service requirements.

Power Outages

Power outages can be brought on by a variety of situations. One type is from intentional reductions in service to prevent system failure. During a period of extreme heat or cold, there are times when the demand for electricity exceeds the supply, and the utility companies selectively ration the supply by curtailing service to various areas for short periods of time, a practice called “rolling blackouts.” Such events should be addressed in the department’s preparedness efforts. Liaisons should be identified who will alert the department to service interruptions, and to where and when such interruptions will occur.

Another type of impact to power is caused by physical damage to lines and generating stations, such as from the effects of tornados, hurricanes, and earthquakes. These extreme weather conditions can disrupt power for hours, days, or even weeks. There also have been situations where generation and distribution systems have failed due to mechanical causes not related to a weather event. One such occasion was on August 14, 2003, when eight States and Provinces in an area exceeding 9,000 square miles in the United States and Canada lost power, affecting millions of people.

The sudden loss of electrical power can cause huge problems. People get stuck in elevators, are thrown into darkness, or are left without power to run critical medical equipment, refuel vehicles, communicate, conduct banking, and so forth. If a blackout occurs for more than a few hours, other problems will arise. Water supply becomes a problem if pumping stations are without power

for extended periods of time, as was the case in the Northeast after the 2003 blackout.³³ Cell phones will fail within a few hours when the batteries that provide backup power to the towers are exhausted. Communications in general are affected severely when electrical power is lost. Battery-operated radios are often the only means of staying informed about conditions, warnings, and instructions. Individuals with home health care equipment may call for assistance when the batteries are exhausted on their machines. Response times and patterns may be affected by loss of power to traffic light systems. Mass transit may be shut down or severely curtailed.

Fire departments should develop contingency plans for blackouts that last longer than 4 hours. The plan should include a clear protocol for liaison with representatives of the local emergency management agency and the power companies. Restoration of service priorities will affect fire department operations, and the fire department should have a role in determining when and where power is restored. In many areas, power companies already have established priority locations and zones for power restoration. Fire departments should know what those plans entail and address their operations accordingly.

Tornados

At a localized level, a tornado is the most destructive of all atmospheric phenomena.³⁴ Tornados are measured in the Fujita or F Scale of wind damage intensity. The range is from F0 (40 to 72 mph) to F5 (261 to over 300 mph). On average, 1,000 tornados occur every year in the United States, resulting in approximately 80 deaths and 1,500 injuries.

Tornados can develop anywhere in the country, although they are more prevalent in the Midwest and South. Most tornados form between March and September and often are associated with violent weather such as thunderstorms. Tornados also may form when tropical weather systems make landfall.³⁵ These storms have the potential for causing catastrophic damage to anything in their path.

Weather forecasters can warn residents when conditions become conducive for tornados to develop and, with the ever-improving technology of Doppler radar, it is possible to detect the formation and likely path of tornados. Despite these measures, tornados develop quickly with relatively little, if any, advance notice. The prompt warning of the general population and those with special needs remains a challenge for emergency managers and weather officials.

If a tornado travels through a residential area, there is the likelihood that people could become trapped in damaged homes. Fire departments may be faced with multiple collapsed buildings and rescue emergencies. Tornados may travel for several miles causing a linear event that can cross jurisdictional lines. Mutual-aid agreements may be compromised as the damage path becomes more widespread. One of the first tasks confronting a fire department following a tornado should be to determine the status of its members and equipment.

³³ IFAC Report: *Performance of the Fire Service during the 2003 Northeast Blackout and Implications for Critical Infrastructure Protection*.

³⁴ National Weather Service Web site.

³⁵ *ibid.*

Tornados can cause especially challenging problems for smaller jurisdictions, as was the case during the Utica, Illinois, tornado of April 20, 2004. That tornado severely damaged the downtown area of Utica, including a restaurant located across the street from the fire department and next to the EMS station. Even given the restaurant's proximity to help, eight of the 15 people who became trapped in the basement perished. The response to this tornado continued around the clock for 6 days and resulted in the activation of the statewide mutual-aid plan.³⁶

³⁶ "Mutual Aid Box Alarm System, Utica Tornado Statewide Plan Activation: Assessment and Critique," Oct. 2004.

VIII. INCIDENT COMMAND AND UNIFIED COMMAND ISSUES

It is evident that large-scale natural and weather-related disasters will strain the resources of a fire department. In all cases, the workload of the fire department will increase and will require that the fire department work closely with other agencies. These agencies may be from the same jurisdiction; mutual-aid jurisdictions; or State, Federal, and private-sector organizations. There may be conflicting lines of authority and competing goals and objectives among agencies. “Who is in charge?” (Who **should** be in charge?) is the classic dilemma of large-scale emergencies.

Some events will be spread over large distances; others may have multiple events in close proximity. The responses generated by some events will last for hours; some will last for days or longer. Fire departments must have command structures that allow for expansion and contraction of the scope of operations, and for cooperation with other agencies. Fortunately, two structures in NIMS specifically address command and control in a multilayered response situation. They are Unified Command and Area Command, derived from the ICS, a system with which fire departments are quite familiar. NIMS defines Unified Command as:

An application of ICS used when more than one agency has incident jurisdiction or when incidents cross political jurisdictions. Agencies work together through the designated members of the Unified Command, often the senior person from agencies and/or disciplines participating in the Unified Command, to establish a common set of objectives and a single Incident Action Plan.³⁷

Unified Command is particularly appropriate for large-scale disaster operations, as natural disasters seldom limit themselves to political boundaries, thus creating a need for more multiagency cooperation. During the course of major operations, the requirements will change as the incident itself changes, and it may become necessary to have representatives from different agencies assume various leadership positions. For example, 30 dwellings in a neighborhood have been heavily damaged by a tornado. After the area has been searched and injuries triaged, treated, and transported, which agency has jurisdiction to ensure the security of the property? What agency can limit access or reentry into the affected area? What agency is responsible for the legal identification and removal of human remains? As the event shifts from rescue to recovery mode, the leadership of the Unified Command may shift from fire/EMS to law enforcement or other agency like public works that has a mission to complete. The fire service still has a role to play at this point, but it may not be the lead role.

Unified Command is difficult to establish on the spur of the moment. Only through joint training and exercises can the stakeholders establish the relationships and test written plans to implement Unified Command effectively. Unified Command is not easy. To apply the construct effectively requires personal and organizational discipline, delegation skills, and a substantial understanding of the roles and responsibilities of each function. Turf battles are not uncommon among the agencies that have designated response roles. Some agencies have a history of competition, and this factor adds to the challenge of operating under a Unified Command structure. Independent dispatching and freelancing groups complicate the situation. Working out some of these issues before a major incident can reduce the likelihood that tense situations will develop during actual operations.

³⁷ HSPD-5, *The National Incident Management System*. Department of Homeland Security, Mar. 2004, p. 138.

The September 2004 edition of *Fire Chief Magazine* contained an article that illustrates several issues that may develop during Unified Command. Key among those issues is the relatively common failure of the Incident Commander (IC) to activate the logistics and planning functions on scene and instead to rely on the already overburdened dispatch center.³⁸ The dispatch center may serve the IC well during normal operations, but relying on it in larger scale weather emergencies or disasters may overburden an already stressed, critical communications asset. Likewise, an incident that may last for several days must have its own incident management structure that includes the Planning, Logistics, and Finance/Administration Sections. Most municipal fire departments do not establish those functions on structure fires and other operations because the incident concludes quickly, generally in a matter of hours or less. Disaster operations should be thought of and planned for in terms of days, weeks, or months.

Area Command

Area Command is another tool for fire departments to use when faced with a disaster. As noted earlier, some disasters can cover large geographic areas or create multiple incidents that must be handled separately. Hurricanes, earthquakes, extremes in heat and cold, and floods all can present multiple incidents and operations for a fire department. Area Command is defined as:

An organization established (1) to oversee the management of multiple incidents that are each being handled by an ICS organization or (2) to oversee the management of large or multiple incidents to which several Incident Management Teams have been assigned. Area Command has the responsibility to set overall strategy and priorities, allocate critical resources according to those priorities, ensure that incidents are properly managed, and ensure that objectives are met and strategies followed. Area Command becomes Unified Area Command when incidents are multi-jurisdictional. Area Command may be established at an emergency operations center facility or some other location other than an incident command post.³⁹

As many of the disasters that have been described are large scale in both impact and geographic area, Area Command helps to coordinate scarce resources among the huge requirements arising from multiple incidents. Area Command is widely used by the U.S. Forest Service, and has been used in postearthquake operations in California.

The effective application of either Unified Command or Area Command structures or principles will benefit from and be materially enhanced by appropriate training for all the participants. To operationalize this knowledge transfer, the department must conduct periodic drills and exercises which will help to hone specific skills and identify planning shortfalls. Rotating personnel through various functions also improves participant awareness of each capability and the inter-relationship of current activities. Consequently, the typical byproduct of such exercises is improved readiness and more capable staff.

³⁸ John Lindstrom. "Co-Located, But Still Not Unified Command." *Fire Chief Magazine*, Sept. 2004.

³⁹ HSPD-5, *The National Incident Management System*. Department of Homeland Security, Mar. 2004, p. 127.

IX. COORDINATION WITH EMERGENCY OPERATIONS CENTERS

The EOC is a designated location in a community where the response and recovery actions of a community or government can be coordinated during a disaster or other large-scale event. The EOC is the location for strategic, big-picture decisions, **not** a dispatch center for the tactical assets of response agencies. A dispatch center may be, and often is, located in the same structure as the EOC, but it is preferable that the EOC and the dispatch center are not in the same room.

State agencies have EOCs to coordinate their resources in support of local government; FEMA and the DHS have regional and national-level facilities as well. Typically, a local EOC will designate space for representatives from the State and Federal government, or will arrange for those coordinators to operate in a nearby, satellite facility with communications links to the main EOC.

EOCs should have sufficient conference and telecommunications capabilities to interact with all the agencies and organizations that their planning efforts suggest would be involved in resolving the respective types of emergencies. An EOC should have redundant power, water, and sanitation facilities for around-the-clock operations when normal services are not available. Some EOCs dating back to the Cold War era had dormitories and were hardened (often below grade) to minimize the effect of nuclear blast and fallout. EOCs must be able to withstand the effects of the usual and foreseeable risks for that community and remain operational. However, plans also should include provisions for relocation of the facility to an alternate location.

When fully staffed and operational, EOCs become the focal point for the level of government (Federal, State, county, or local) they represent. The agencies of that level of government should provide senior-level managers to form a Unified Command that deals with issues relating to disaster response and recovery. Senior-level members of the fire department should be part of the Command team in the EOC. Those members must have the authority to commit resources and make decisions appropriate to the role of the respective agency representatives.

EOCs typically coordinate evacuation and sheltering of threatened populations. The EOC and the emergency manager are the conduits for requests for assistance that are outside existing mutual-aid capabilities. For example, any requests for Federal assistance, such as a team from the National Disaster Medical System (NDMS) or a US&R team, go from local to State to Federal levels prior to the deployment of assistance. Federal financial assistance also goes through this channel, and that requires proper documentation and coordination with the emergency manager. It is vital, then, that fire department officers are familiar with the capabilities and limits of their local emergency management system. Some of the tasks that are handled at the EOC include

- warning for threatened populations;
- dissemination of official, public information;
- evacuation and shelter management;
- curfew and re-entry to damaged areas controls;
- damage assessment and requirements documentation;
- requests for State and Federal assistance;
- coordination of resources (food, water, financial assistance);
- documentation, reporting, and auditing; and
- coordination with volunteer organizations and private sector assistance.

Note that these tasks are strategic-level functions not the dispatch of individual resources such as fire or EMS units. As with all disaster scenarios and the resources that accompany them, the best time to become familiar with the operation of the EOC is before the event by participating in drills and exercises. Inviting the emergency manager to participate in fire department training and planning activities likewise brings the emergency manager into the fire department “loop” and provides understanding of the capabilities and limitations of the local fire department.

X. USE OF COMMUNITY EMERGENCY RESPONSE TEAMS

Disasters often bring out the best and the worst in people. One of the better traits exhibited is it that ordinary people will go to great lengths to assist others in need. This trait was demonstrated in California and in Mexico City after earthquakes, and in Oklahoma City and New York City after the Murrah Building and World Trade Center bombings. Sadly, there have been injuries to the volunteer, would-be rescuers and lives of these well-intentioned citizens lost because they lacked knowledge of the hazards they were facing. The last person reported killed in the 1995 Oklahoma City bomb attack was a nurse who was struck by falling debris as she tried to enter the building to render aid.

The Community Emergency Response Team (CERT) initiative is a federally established program designed to use community members after a disaster strikes. The CERT concept was developed by the Los Angeles City Fire Department in 1985. The idea was to train citizens in the hazards and conditions they might face when providing disaster assistance through the CERT program. They would be better prepared to help themselves and others, and to know when they should wait for more highly trained assistance to arrive.

The CERT program has been embraced by FEMA and has expanded all over the country. There are now CERT programs in some 340 communities in 45 States.⁴⁰ The CERT program today provides trained teams to assist local first responders in fire suppression, medical assistance, light search and rescue, and disaster psychology. There are special teams to assist law enforcement as well. FEMA has provided grant monies for training and to start or expand existing programs. CERT member training includes

- Disaster Preparedness: This portion of the training deals with actions that citizens can take prior to, during, and after a disaster to lessen the effects upon themselves and their neighbors. The organization and background of the CERT programs also is covered, as well as any laws that apply to volunteers in that jurisdiction.
- Disaster Fire Suppression: This training covers the basics of fire dynamics and the safe use of portable fire extinguishers. Awareness training on hazardous materials also is covered, as is controlling utilities such as electricity and natural gas to reduce hazards.
- Disaster Medical Operations: In this section, the CERT member is given basic first-aid skills such as airway management and bleeding control. Simple triage and the concept of establishing a safe and sanitary medical treatment area also are covered.
- Light Search and Rescue: CERT members receive basic search and rescue training, sizeup, and safety for the rescuers. The ability to determine if a structure is safe for operation is an important concept and is covered in this section.
- Disaster Psychology and Team Organization: The effects of a disaster are not only physical. The emotional impacts of the event on both the worker and victims are addressed. The need for proper documentation and organizational principles are covered.⁴¹

⁴⁰ FEMA Web site Press Release HQ-03-123a.

⁴¹ Citizen Corps Web site. "About CERT."

Fire departments should know if their community has organized a CERT, and should take advantage of this resource. A well-trained CERT volunteer can provide some extra support at times when a fire department is stretched thin. CERTs are being established all over the country and are being incorporated into disaster plans, drills, and exercises in many communities. Their participation as part of a citizen volunteer corps is a resource that should be identified in a community's disaster plans, along with specific information on what roles they will be assigned and can support effectively, given a specific incident type and scope.