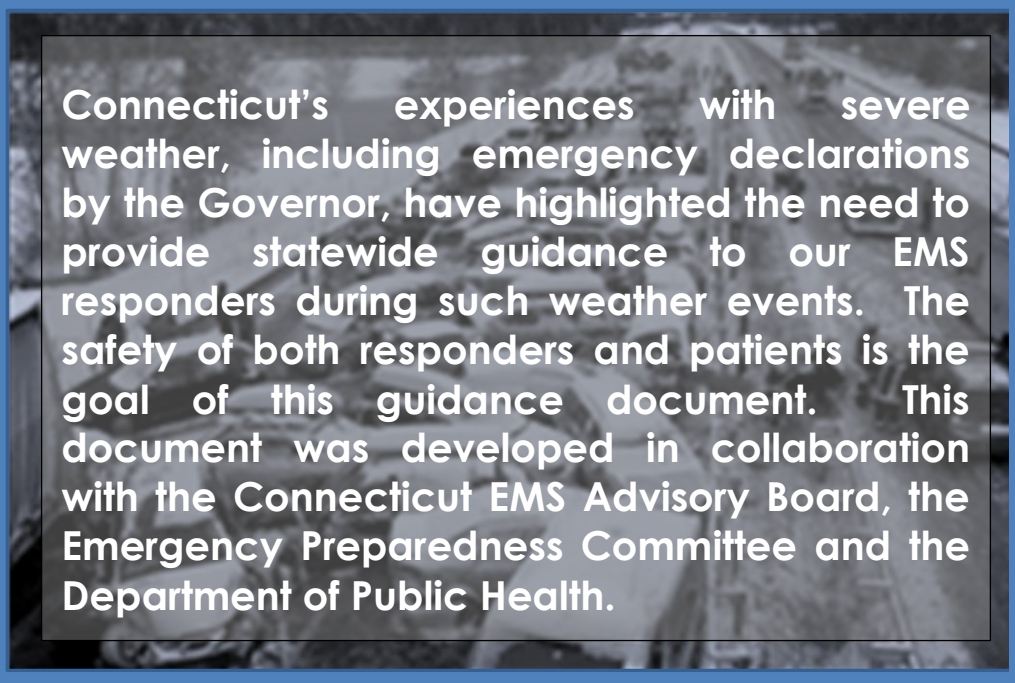
DPH POLICY GUIDANCE

EMS OPERATIONS DURING HAZARDOUS CONDITIONS



Connecticut's experiences with severe weather, including emergency declarations by the Governor, have highlighted the need to provide statewide guidance to our EMS responders during such weather events. The safety of both responders and patients is the goal of this guidance document. This document was developed in collaboration with the Connecticut EMS Advisory Board, the Emergency Preparedness Committee and the Department of Public Health.

NOVEMBER 2015

Keeping Connecticut Healthy

DPH

Connecticut Department of Public Health

Connecticut
DEPARTMENT OF PUBLIC HEALTH

OFFICE OF EMERGENCY MEDICAL SERVICES

STATE OF CONNECTICUT
DEPARTMENT OF PUBLIC HEALTH

Jewel Mullen, M.D., M.P.H., M.P.A.
Commissioner

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Date: November 19, 2015

To: EMS Chiefs of Service
EMS Medical Directors
EMS Pre-hospital Care Coordinators
CMED/Regional Communication Centers

From: Jewel Mullen, MD, MPH, MPA, Commissioner

Re: DPH Policy Guidance- EMS Operations During Hazardous Conditions

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The Department of Public Health approved the attached EMS Operations During Hazardous Conditions guidelines to ensure the safety of patients and respondents during severe weather events. Connecticut's Emergency Medical Services (EMS) Advisory Board collaborated to develop this guidance.

Connecticut's recent experiences with severe weather, including emergency declarations by the Governor, have highlighted the need to provide statewide guidance to our emergency medical responders during such weather events. The safety of both responders and patients is the goal of this guidance document.

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EMS OPERATIONS DURING HAZARDOUS CONDITIONS

Purpose

To provide guidance to Connecticut's Emergency Medical Services regarding operations prior to and during hazardous weather conditions in hopes of minimizing the risk to Emergency Medical Services personnel.

Scope

This procedure applies to all Emergency Medical Services certified and licensed under the State of Connecticut Department of Public Health, Office of Emergency Medical Services. While this procedure is not a directive, it provides important preparation information that should be considered by EMS Chiefs of Service and Command Level Staff.

Operational Phases

The Operational Plan when hazardous weather is likely to affect any part of, or the entire, State of Connecticut is divided into two phases:

Phase A, the Preparation Phase, shall be declared when:

- There is a potential for adverse weather arriving within 12 to 36 hours; OR
- A severe weather advisory (i.e., watch or warning) has been announced by the National Weather Service; OR
- When predicted or actual severe weather conditions can be reasonably expected to affect operations

Phase B, the Implementation Phase, shall be declared when:

- Actual emergency conditions are imminent or present; OR
- Weather and/or traffic conditions are having an adverse effect on operations; OR
- When a Weather Emergency has been declared by the Governor, municipal leader, or local EOC

Phase A

1. An Incident Action Plan (IAP) should be developed in cooperation with other local public safety agencies and the local Emergency Management Team.
2. Ensure ample fuel supply for operations prior to, during, and post event
3. Test all power equipment (e.g. generators and emergency lighting)
4. Ensure all deliverable supplies are at levels to sustain operations prior to, during, and after the event
5. Secure loose items in and around buildings
6. Ensure all personnel have the appropriate level of PPE available to them (Including helmets, work gloves, eye protection, hearing protection, rain-gear/rescue turn-outs, ANSI vests)
7. Ensure proper work schedules to allow for sleep/rehab of personnel during multi-day events
8. Ensure EMS is represented at local EOC
9. Ensure all personnel move personal vehicles to safety
10. Consider relocation of EMS units/stations if based in flood prone areas
11. In conjunction with the local EOC and other local public safety agencies, notify the public if responses could potentially be compromised
12. Notify personnel of impending event and of any recall plans
13. Implement recall plans if necessary
14. Have sufficient supplies on hand to rehab personnel (MREs, Clothing, Toiletries)

15. Supply units with MREs & water if there is a potential for the personnel to be cut-off from other resources
16. Develop in conjunction with municipal leaders, leaders of other public safety agencies, and the local EOC a plan describing the point at which emergency responses will be reduced or cease entirely, specifically:
    a. What conditions must be present
    b. How reduced/suspended responses will be communicated to all personnel
    c. How dispatchers will communicate to 911 callers
    d. At what point responses will resume and how this will be communicated
    e. Once responses are resumed, how requests will be prioritized, to include call backs to verify the request
17. Personnel should arrange for the safety of family members to alleviate themselves of the stress of worrying about loved ones
18. Personnel should be prepared to be self-sufficient for up to 72 hours including food, water, and personal items
19. Personnel should monitor their radio and/or MDT (mobile data terminal) as appropriate for important updates and messages
20. Personnel should provide updates to their local dispatch and C-MED agencies of road conditions and of any hazards

Phase B

1. Personnel should use extreme caution and limit speed when driving
2. Appropriate equipment should be carried by personnel depending on the event, e.g. rain gear, head, and eye protection in tropical or hurricane type events, or cold weather gear, gloves, and shovels in cold weather events
3. Dispatch & C-MED centers should be notified by each unit of their location and assignment
4. Operating units should notify their dispatch centers and other responding units of any hazardous or potential ly hazardous conditions they are encountered
5. Generators used to power stations in the event of power outages should be placed outside and elevated to prevent carbon monoxide poisoning
6. Local EOCs should be notified of specific problems that EMS services encounter within their geographic area
7. C-MED and local dispatch centers should ensure timely transmission of announcements of the current contingency phase, hazardous driving condition warnings, and all other bulletins and messages appropriate to the current weather contingency phase
8. Personnel should not ride alone during hazardous weather conditions; all personnel should operate in pairs
9. Prior to weather conditions reaching hazardous levels, Chiefs of Service who feel the situations encountered are sufficiently dangerous to the safety of personnel should consult with the leaders of the other local public safety agencies as well as the municipal leader to potentially reduce or cease operations. EMS should notify the dispatch center as well as the incident commander
10. Determine reducing or ceasing response operations in consultation with the incident commander, all local public safety agencies, emergency management, service medical director and municipal leaders when conditions warrant

Ceasing Emergency Response Operations

Responding at the height of hazardous weather events risks the safety of the personnel, the emergency services infrastructure critical for sustaining long-term response and recovery efforts, and even the short- and long-term safety of citizens they mean to protect.

Discussions should be held with the incident commander, all local public safety agencies, emergency management, service medical director and municipal leaders before any EMS agency reduces or ceases emergency operations. Since weather conditions can vary across the state, even during a hazardous weather event, this decision needs to occur at the local level, but local leaders are encouraged to seek input from state and federal partners when developing their *Cease or Limited Response Plan.*

Dispatch protocols should be developed to ensure that dispatchers are knowledgeable on how to handle EMD situations when there will be no immediate response as well as to ensure callers are notified that emergency responses have been suspended.

Resuming Emergency Response Operations

Discussions should be held with the incident commander, all local public safety agencies, emergency management, service medical director and municipal leaders to determine when emergency operations shall resume. Since weather conditions can vary across the state, even during a hazardous weather event, this decision needs to occur at the local level, but local leaders are encouraged to seek input from state and federal partners when developing their *Resume Response Plan.*

EMS Services should consider the following when resuming emergency operations:

1. Ensuring adequate resources for safe response
    a. Outside agencies resources such as public works, fire/police, etc.
    b. Mutual Aid resources to assist with “stacked” calls

2. Determine method of prioritizing “stacked” calls
    a. Which are most critical
    b. Call backs done to ensure priorities
    c. Respond to every call even if caller refuses or states patient left scene

Safety determinates for modifying EMS response during hazardous conditions:

1. **Safe vehicle operations:**
   Sustained winds or significant gusts that can cause:
   - emergency vehicles to experience course deviations which can lead to accidents or vehicles being blown off the road
   - ambulances to overturn
   - dangerous situations to the personnel by falling trees and flying debris which can cause serious injury and/or death

     - ***sustained winds reach 50 miles per hour or greater***
     - ***wind gusts reach 65 miles per hour or greater***
     - ***Conditions of roadways***
       - Snow depths and/or ice that prevent safe travel
       - Flooding of roads
       - Debris such as falling trees, etc.

2. **Visibility:**

   Conditions that prevent operators from safely visualizing the road
   - Downpours, sheets of heavy rain
   - Blizzard conditions
   - Heavy fog or smoke with zero or significantly limited visibility

3. **Flooding**
   Work related hazards that must be considered by command level emergency services personnel in flood conditions include:
   - Trauma/Drowning
   - Electrical hazards
   - Carbon monoxide hazards
   - Musculoskeletal hazards
   - Heat stress
   - Motor vehicle hazards
   - Hazardous materials
   - Fire hazards
   - Confined spaces
   - Falls

Reference:

USDOT – Federal Highway Administration
Road Weather Management Program

Model Procedures for Response of Emergency Vehicles During Hurricanes & Tropical Storms
State of Connecticut Department of Emergency Services & Public Protection
Commission on Fire Prevention & Control
Version 1.2 June 2011

Hurricanes: When to "Go/Don't Go"
M.C. Madigan
NFA – Executive Fire Officer Program
August 2005

Appendix A

Sustained High Winds / Wind Gusts Information Guide:

Effect of winds on the performance of emergency vehicles is not the limiting factor when making an emergency response decision. The wind's effect on rescue personnel maybe the key-limiting-factor, even more so then flying debris. Sudden gusts even at low wind speed can affect the ability for personnel to work effectively. People will have difficulty making progress in winds 39-49 mph. This assumption is also verified by the findings of Fisher (2004) and Weaver (1997) who agree that effects of winds on the ability for fire rescue workers to function are the deciding factor when determining if conditions warrant emergency response.

Vehicles will be caused to veer off course at much lower wind speeds.

- Wind speed 32-38 mph - inconvenience felt when walking
- Wind speed 39-46 mph winds impede progress

Sustained winds refer to a one-minute average speed. Gusts can be much higher and generally are 1.3 times faster than the sustained winds.
Wind gusts are not uniformly steady over time, and gusts may exceed the sustained winds by more than 50%.

Although emergency vehicles could be operated in high winds, other factors would limit their operations. Hazards including debris in the air and on the roads, flooding and the difficulty in working outdoors in severe winds and heavy rains would play more of a role in emergency response than exclusively evaluating wind conditions on emergency vehicles.

Appendix B

Blizzards and Heavy Snow:

This section addresses particular concerns related to several different types of weather-related emergencies. 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 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 Knickerbockers' Theater collapsed, killing 97 people.

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.

Emergency services operational personnel should be on the lookout for accumulating snow, ice and large ice cycles on roofs, overhangs of any structure they are entering or working around. Exhaustion experienced by operational personnel due to the potential demand of extended working hours as well as the physiologic factors involved when operational personnel are working in the extreme cold should also be considered and mitigated as much as possible.

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 constructions for the Fire Service*.2nd Ed. pp. 25-26

Appendix C

Severe (Non-tidal) Flooding:

Non-tidal 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 in 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 pre-deploy 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.

Appendix D

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: pre-landfall and post landfall. Each mode has its own set of circumstances and challenges. In the pre-landfall mode there is generally 48 to 72 hours of 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 pre-landfall 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. This process is completed before rescue or other fire operations mission begin. 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 post landfall 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 post hurricane 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.

Appendix E

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 on-scene 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.

Emergency service 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.

Appendix F

Drought and Extreme:

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.

Appendix G

Power Outages:

Power outages can be bought 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.

Emergency services 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 the plans entail and address their operations accordingly.

Appendix H

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. 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.

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

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

Appendix I

Earthquakes and Earthquake-Related Tsunamis

During an earthquake, the plates of the earth's surface moves and releases energy in the form of seismic waves. Such waves vary in intensity, duration, and in 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 there is no proven prediction system. There are areas that are well defined as earthquake-prone, with fault lines and historical data on such events, such as California and Alaska and the area around New Madrid fault line in Missouri, Illinois, and Arkansas; but many other areas also are at risk. The entire Eastern seaboard and Gulf Coast of the United States, as well as California and Hawaii, are vulnerable to the storms. The heavy rains and winds cause damage far from the coastline. For that reason, even fire departments not located along the coast must be aware of the potential for effects from the storms that have made landfall several states away.

31 Larry Collins "Tsunamis: A Wakeup Call for the U.S., Part 2." *Fire Engineering*, Oct. 2005
32 National Weather Service Web site