

Model Procedures for Response of Emergency Vehicles During Hurricanes and Tropical Storms

State of Connecticut

Commission on Fire Prevention & Control



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Table of Contents

Purpose	3
Introduction	3
Model Baseline Policy	4
Model Operational Guidelines	4
Preseason Preparations.....	4
Hurricane Watch: Hurricane may become a threat within 36 hours.....	6
Hurricane Warning: Hurricane is expected to hit within 24 hours.....	7
Hurricane Operations.....	8
Hurricane Eye Operations.....	10
Resuming Operations Post Hurricane	11
Additional Model Policies for Resuming Operations	11
Appendix A: The Nature of the Hazard.....	14
Appendix B: Hazard Agents.....	15
Appendix C: Force of Hurricanes: The Saffir-Simpson Hurricane Scale.....	16
Appendix D: National Weather Service Warnings.....	17
Appendix E: CT USAR Activation numbers.....	18
Appendix F: FEMA Structure Marking System.....	19
Appendix G: Author and Resources	21
Other Model Response Protocols	21

Purpose

The purpose of this guide is to provide guidance to Connecticut's chief fire officers in establishing a policy for response during hurricanes and coastal storms to minimize the risk to fire/EMS personnel and to protect the human, physical and cyber infrastructure critical to safeguard a community before, during and after a storm.

This guidance provides a common framework on which departments may build a local protocol tailored to a specific community.

Introduction

One of the most difficult decisions for an incident commander in these types of weather events is the determination to halt emergency response. It is the culture and nature of the fire service to go into any storm in order to save the lives of those they serve, even if it means sacrificing themselves.

However, responding at the height of a major storm risks the safety of the fire/EMS personnel, the emergency services infrastructure critical for sustaining long-term response and recovery efforts, and even the near- and long-term safety of citizens they mean to protect. Sustained winds or significant gusts can cause emergency vehicles to be pushed off the roadways or into oncoming traffic or cause vehicles to overturn. When winds reach a certain force, debris becomes a lethal weapon that can cause decapitation, penetrate turnout gear or crush a person, causing significant injuries or even death.

The time has come to evaluate various policies in place and recommend a model policy. The following model procedure, based on existing practices and sound principles, centers on the safety of personnel, complements the concepts of unified command and mutual aid and generates a standard framework of operating guidelines that all departments will recognize.

The emergency response community continues to maintain an exceptional level of service, despite the recent challenges posed by natural disasters. We cannot forget the efforts of all the responders along the East and Gulf Coasts of the United States, in the Caribbean islands and even in similar weather events in the Pacific Ocean and Southeast Asia. Many of the responders themselves have lost their homes and have had their families displaced, yet they continued to perform their fire/EMS/emergency duties. It is in honor of their dedication and sacrifice that we must continue to build a modern, forward-thinking operational policy that serves to protect both responders and the citizens they serve.

Model Procedures for Response of Emergency Vehicles During Hurricanes and Tropical Storms

Model Baseline Policy¹

During hurricanes and tropical storms, the fire department will maintain a safe work environment for its firefighters and EMS personnel and will provide essential emergency services to the public as long as the safety of the responders is not endangered by the storm conditions.

Model Operational Guidelines

Preseason Preparations

At least two months before the start of the hurricane season, the fire department should initiate the following actions:

- Review the fire department's standard operating guide, update as needed and review with all members. Obtain and review the most recent version of the fire department's continuity of operations plan (COOP).
- Update target occupancies list.

A target occupancy may be an occupancy with a high probability of trapped victims or a structure that stores a large amount of hazardous materials or is susceptible to structural failure. (Examples: schools, hospitals, health-care facilities, factories)

- All companies familiarize themselves with the topography of their response area to become aware of flood-prone areas.
- Inventory all equipment.
- Ensure apparatus readiness.
- Check the physical condition of each fire-department building and facilitate repairs of any damaged roof areas, windows or doors that could contribute to increased damage in a hurricane. Check and service as needed any sump pumps for basement areas. Be sure all surface-area drains around the exterior of buildings are free and clear of all debris to allow for proper drainage.
- Ensure all fire-department generators have been serviced and are working.
- Inventory and check batteries and chargers for portable equipment and be sure all are in working order and that there is an adequate number available.
- Maintain all apparatus fuel tanks at no less than three-quarters full.

¹ When developing a specific department policy/procedure, all departments should use the NIMS model for incident command including the use of incident action plans (IAP), which will ensure proper documentation is done as the event occurs, greatly easing the post-storm recovery process, including gaining federal reimbursement in the event the incident is declared a federal disaster.

- Contact the local emergency-management office to review their plans and submit the fire-department plan.

*Ensure the fire department is part of the local emergency management operations.
Review flood maps to determine if any fire-department building is within the flood zone.*

- Develop plans for the relocation of apparatus, equipment, electronic devices and departmental records. Check basement storage to be sure all items are raised off the floor in buildings that are subject to water penetration.

Per review of flood maps above.

- Update department and personal phone lists for call-in.
- Coordinate evacuation and special-needs shelters, including staffing requirements.
- Develop alternate communication plans for the event of a total system failure.
- Develop a post-storm food and water plan for 7–14 days.
- Update street maps due to probable loss of signage and landmarks.
- Develop and communicate emergency evacuation plans in the event a station needs to be evacuated during an incident:
 - Predesignation of safe havens
 - Instructions on shutting off the utilities
 - Recommendations on securing (or evacuating with personnel) electronic equipment and pertinent records
- Ensure all members have a personal family plan to secure their family and property in preparation for reporting to duty.
 - Establish a family contact number that family members can call to check on a department member.

The safest procedure for families is EVACUATION to friends or family outside the storm's impact area. Encourage members to periodically contact their families.

Hurricane Watch: Hurricane may become a threat within 36 hours

- Fire department command and general staff should develop and implement an incident action planning process.
- Top off station fuel tanks and apparatus, including spares, chain saws, generators, power units, portable pumps, etc.
- Test and ensure all power equipment is operational.
- Fill cascade bottles and SCBA bottles.
- Secure adequate drinking water for personnel.
- Secure all loose items around the exterior of stations.
- Ensure all first responder/EMS supplies are up to normal levels.
- Test all manual pumping equipment on fuel tanks (if available).
- As needed, have additional supplies delivered.
- Develop work schedules to ensure proper sleep/rehab time.
- When the local emergency operations center (EOC) is opened, ensure the fire department is represented at the EOC at all times. If needed, consider establishing a fire department-specific operations center.

Hurricane **Warning**: Hurricane is expected to hit **within 24 hours**

Additional recommendations for Hurricane Warnings: Chief and company officers are to use their discretion when responding, mindful of the safety of fire/EMS personnel as their top priority.

- Charge all batteries.
- Encourage all personnel to move personal vehicles to higher ground if possible.
(if appropriate based on geography, flood map data, history, etc)
- Consider relocating companies in flood-prone areas.
- Notify the public if fire protection in a certain area will be compromised.
 - The fire department should issue media releases to advise the public that when certain weather conditions occur related to a hurricane, fire-department response will cease *(be specific as to what those conditions are)*.
- Implement recall plans if necessary.
- Suggested items for members who will be reporting for duty, to bring:
 - 3 sets of clothes/work uniform/tee shirts
 - 1 jacket
 - 5 each of undershirts, underwear, pairs of socks
 - 1 extra pair of shoes
 - 3 bath towels
 - Sleeping bag/bedding
 - Personal flashlight and batteries
 - Personal articles for 3 days
 - Prescribed medication
 - Toothbrush and toothpaste
 - Deodorant
 - Soap
 - Shampoo
 - Razor and shaving cream
 - Mosquito repellent
 - 3 days supply of food that does not require refrigeration or cooking
 - 3 gallons of water
 - Other personal hygiene articles
- Staff spare apparatus as needed.

Hurricane Operations

To provide fire/EMS response until the last possible moment, when storm conditions dictate that operations cease, the department will need to make a conscious and calculated decision that takes into account the realization that some apparatus and equipment may be vulnerable to the storm effects and may be damaged or lost.

Additional recommendations for Hurricane Operations

1. No member shall ride alone during a storm. All members will operate in pairs.
2. All members are to wear full bunker gear, including eye protection, for all responses in order to protect from flying debris.
3. Aerial devices should not be operated when sustained winds are 35 mph or per department policy.
4. Prior to sustained wind speeds reaching 50 mph, or wind gusts over 65 mph, any chief officer or company officer who feels the situations encountered are sufficiently dangerous to the safety of personnel may cease operations and return to quarters. The officer must advise the incident commander and the dispatch center.
5. For the safety of the members, the fire department should discontinue response to all fire/EMS calls when sustained wind speeds reach 50 mph or wind gusts are over 65 mph. When the order to cease response is given due to hazardous wind conditions:
 - Units responding to or on the scene of an emergency shall continue their work until completed, at which time the units will return to their assigned stations.
 - Units out of station, but not on a call, should return to their stations as soon as possible.

- When responses cease due to wind conditions, all apparatus should be parked headfirst in the station causing the rear of the unit to be facing outward, thus protecting the windshield.
- Dispatch will relay all requests for service to the hurricane command, which will prioritize these requests for response when conditions permit.
- Operating companies must notify dispatch and other responding companies of all hazardous conditions they encounter including high water, road damage or blockage, etc.
- Before walking through water, members should use a pike pole or stick to ensure the ground has not washed away or collapsed.
 - Use extreme caution when walking through water. Six inches of moving water can knock a person off their feet.
 - Be aware of hazards in the water such as downed live electrical wires.
- Use extreme caution and limit speed when driving. Be especially cautious where the ground is saturated or flooded—the road could be washed away.

- Generators used to supply electricity to the station must be outside and, if possible, elevated while ensuring the exhaust is ventilated to the outside.
- If stations must be evacuated, company officers will ensure utilities are shut off and the station is secure and the company will report to the identified safe haven, all in accordance with predetermined evacuations plans.

Hurricane Eye Operations

Additional recommendations for Hurricane Eye Operations: Operations during the period the eye of the hurricane passes by should be limited to resecuring the fire station. No companies will be dispatched during the eye of the hurricane. All operations during the eye of the hurricane should only be performed if they can be done safely. Members should help citizens who come to the station when it would be a danger to release them. Even though the skies appear clear, storm conditions will return suddenly. The safety of department personnel will remain the primary consideration during these operations.

Resuming Operations After the Hurricane

Additional recommendations for Resuming Operations

1. The chief of department or designee shall make the determination when the department can resume response operations. This decision will be announced by dispatch as a resume-response order.
2. Chief officers and company officers who believe it is safe to resume operations before receiving this order shall contact command and state the conditions at their location and their need to begin operations. Command shall order accordingly.
3. If these officers are unable to contact command, the decision to begin operations will be the responsibility of the highest-ranking officer on scene. Operations shall be undertaken only if such operations can be performed in a safe manner.
4. Personnel conducting emergency operations must realize that their own safety and wellbeing is their first priority. Many hazards will be encountered after a hurricane, including but not limited to live wires down, gas leaks, building fires, unsafe structures, flooding, hazardous materials, heat stress, traumatized victims, civil disturbance and displaced animals.

- Company officers shall conduct an immediate survey to give command an assessment of the following:
 - Personnel
 - Does any member require medical assistance?
 - Does adequate staffing exist?
 - Are there any other personnel problems?
 - Equipment
 - Report on damage to windshield, body, tires, aerial, equipment and pump.
 - Is the apparatus and related equipment operational?
 - Can the unit be dispatched?
 - Facilities
 - Is the station operational?
 - Do any hazards exist in or immediately adjacent to the station?
 - What significant repairs must be made?

Fig. 1. Model matrix to report the condition of a station

Damage Level →	None	Light	Moderate	Heavy	Notes
Bay DOORS					
Roof					
Windows					
Doors					
Flooding (note how deep)					
Electric					
Water					
Gas					
Sewer					
Telephone/cell phones					
Radio					
Computer network					

- Company officers should conduct an area survey as soon as possible surrounding the station (that which can be observed from the station property) and report conditions to command.
- Companies are to conduct a “drive by survey” of their first-due area, if possible, including all target hazards identified in the preseason planning, and report conditions to command so they may get a full assessment of the incident and deploy resources in an efficient manner to where they are most needed.
- While life-saving assistance remains the top priority, a search of predetermined target occupancies will be conducted as soon as possible.
Due to the lack of communications, the chief or company officer may have to determine the company’s need to self-dispatch based on the situation at hand.
- No member shall ride alone immediately following the storm. All members will operate in pairs or teams.
- Personnel shall utilize all safety equipment available, work in teams and keep well hydrated. Every attempt should be made in order to abate the after-storm hazards in a *safe* manner.
- Survey the area for any electric wires before cutting any trees or debris.
 - If wires are present, assume they are live and contact the electric company to determine the status of the wires. Make sure members are aware that generators used by civilians may backfeed into the system, thereby energizing downed wires.
- Use chain saws for their appropriate use. Use the proper care and protective gear.

- Chief and company officers will establish and strictly enforce periodic rehabilitation times for fire/EMS personnel, as well as a relief program for all members.
 - Additional health and safety considerations include:
 - Ensure all exposures to personnel are properly documented.
 - Provide vaccinations as necessary.
 - Provide post-storm follow-up care as needed.

Appendix A: The Nature of the Hazard

The term “hurricane” describes a severe tropical cyclone and sustained winds of 74 miles per hour or greater that occurs in the Gulf of Mexico, along the North American coastlines of the Atlantic and Pacific Oceans and in the Caribbean. Tropical cyclones rotate counterclockwise in the Northern Hemisphere. These storms are also called typhoons or cyclones in other regions of the world.

Tropical cyclones are classified as follows:

Tropical Depression – An organized system of persistent clouds and thunderstorms with a closed low-level circulation and maximum sustained winds of 38 mph (33 knots) or less.

Tropical Storm – An organized system of strong thunderstorms with a well-defined circulation and maximum sustained winds of 39 to 73 mph (34–63 knots).

Hurricane – An intense tropical weather system with a well-defined circulation and sustained winds of 74 mph (64 knots) or higher.

The hurricane season runs from the first of June until the last day of November for the United States and Caribbean. Seasons vary in other parts of the world.

Appendix B: Hazard Agents

The primary hazard agents associated with a hurricane are the high sustained winds, flooding from storm surge or heavy rains, battering from heavy waves and secondary hazards.

High Sustained Winds – The high winds impose significant loads on structures—both direct wind pressure and drag—and tend to propel loose objects at high velocity.

Flooding – A hurricane can cause many different types of flooding. Along the coast, the flooding may occur from storm surge, wind-driven water in estuaries and rivers or torrential rain. The flooding can be stillwater flooding or velocity flooding caused by wave action associated with wind-driven water along the coast. The rainfall associated with a hurricane can be from 6–12 inches or higher. The rain may precede landfall by hours and may persist for many hours after landfall, causing severe flooding.

Heavy Waves – The storm may generate waves with heights of 25 feet or more. These waves can batter the coastline, causing devastating damage to the shoreline itself and to structures near the shore. The velocity of the water moving back and forth undermines the foundations of buildings and piers by removing the soil from around them. Debris driven inland by the waves can cause severe structural damage. Persons exposed to the moving water and debris are likely to receive severe injuries.

Secondary Hazards – Hurricanes can also cause numerous secondary hazards. Tornadoes and electrical power outages are common, as are downed live power lines, broken gas lines and exposure to wildlife. Contamination of water supplies, flooding of sewage treatment facilities and even levee failures may occur.

Appendix C: Force of Hurricanes: The Saffir-Simpson Hurricane Scale

The Saffir-Simpson scale is a widely recognized and accepted practical tool that planners rely on to estimate the destructive forces associated with hurricanes. This scale classifies hurricanes into five categories based on wind speed and describes the destructive forces caused by wind, storm surge and wave action for each category. Hurricanes reaching category 3 or higher are considered major hurricanes because of their potential for loss of life and damage. Category 1 and 2 storms are still very dangerous and warrant preventative measures.

Saffir-Simpson Hurricane Scale

Type of Damage

Minimal: Damage primarily to shrubbery, trees, foliage and unanchored mobile homes. No real damage to other structures. Storm surge 4–5 feet. Coastal roads flooded.

Moderate: Some trees blown down. Major damage to exposed mobile homes. Some damage to roofing materials, windows and doors. Storm surge 6–8 feet, with up to 12-foot waves.

Extensive: Large trees blown down. Mobile homes destroyed. Some structural damage to roofing materials of buildings. Some structural damage to small buildings. Storm surge 9–12 feet, with waves up to 18 feet. Flooding can occur up to 10 miles inland.

Extreme: Trees blown down. Complete destruction of mobile homes. Extensive damage to roofing materials, windows and doors. Complete failure of roofs on many small residences. Storm surge 13–18 feet, with waves up to 25 feet. Flooding to 10 feet above sea level up to 30 miles inland.

Catastrophic: Complete roof failures on many residences and industrial buildings. Extensive damage to windows and doors. Some complete building failures. Storm surge over 18 feet. Flooding to 10 feet or more above sea level up to 30 miles inland.

Appendix D: National Weather Service Warnings

The National Weather Service (NWS) is responsible for issuing warnings of hurricanes and tropical storms. As soon as definite indications that a hurricane or tropical storm is forming exist, the storm is given a name and the NWS begins issuing advisories. The advisories are issued frequently throughout the day and night and provide information on where the storm is, how intense it is, its speed and direction of movement. If the hurricane moves toward land, hurricane watch or warning notices are included. Bulletins for the media are issued at frequent intervals to keep the public informed of the storm's progress.

Hurricane/Tropical Storm Watch: Hurricane/tropical storm conditions are possible in the specified area of the watch within 36 hours.

Hurricane/Tropical Storm Warning: Hurricane/tropical storm conditions are expected in the specified areas of the warning within 24 hours.

Short Term Watches and Warnings: These items provide detailed information on specific threats, such as floods and tornadoes.

Flood Watch: This product informs the public and cooperating agencies of possible flooding.

Flood/Flash-Flood Warning: A flood/flash-flood warning is issued for specific communities, streams or areas where flooding is imminent or in progress. Persons in the warning area should take precautions immediately.

Appendix E: CT USAR Activation Information

In the case of a collapse with potential or known victims the Incident Commander should call for CT Urban Search and Rescue:

To request and active the **CT US&R** call the following numbers

DPS Message center - 1-800-842-0200

State EOC - 860-566-3180

Duty Officer Pager - 860-708-0821

Please have available the following

- 1) Location of incident
- 2) I/C name and immediate contact info (cell phone)

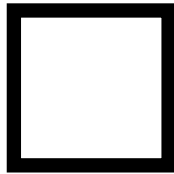
Appendix F: FEMA Structure Marking System²

FEMA STRUCTURE MARKING SYSTEM

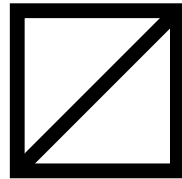
Structure/Hazards Evaluation Marking

- A 2' X 2' square box is outlined at any entrance accessible for entry into any compromised structure.
- Aerosol cans of spray paint (International Orange color only) will be used for this marking system.
- It is important that an effort is made to mark all normal entry points to a building under evaluation to ensure that TF personnel approaching the building can identify that it has been evaluated and discern its condition.
- Specific markings will be clearly made inside the box to indicate the condition of the structure and any hazards at the time of the assessment.
- Normally the square box marking would be made immediately adjacent to the entry point identified as safe. An arrow will be placed next to the box indicating the direction of the safe entrance if the Structure and Hazards Evaluation marking must be made somewhat remote from the safe entrance.
- The TIME, DATE, and SPECIALIST Identification (ID), will also be noted outside the box at the upper right-hand side. This information will be made with pieces of carpenter's chalk or lumber crayon (as noted in the Structure Specialist's Equipment List).
- All TF personnel must be aware of the possibility of, and look for other Structure and Hazards Evaluation markings made on the interior of the building.
- As each subsequent assessment is performed throughout the course of the mission, a new TIME, DATE, and SPECIALIST ID entry will be made (with carpenter's chalk) below the previous entry, or a completely new marking box made if the original information is now incorrect.

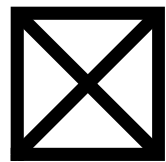
The depiction of the various markings is as follows:



Structure is accessible and safe for search and rescue operations. Damage is minor with little danger of further collapse.



Structure is significantly damaged. Some areas are relatively safe, but other areas may need shoring, bracing, or removal of falling and collapse hazards. The structure may be completely pancaked.



Structure is not safe for search and rescue operations and may be subject to sudden additional collapse. Remote search operations may proceed at significant risk. If rescue operations are undertaken, safe haven areas and rapid evacuation routes should be created.



Arrow located next to a marking box indicates the direction to the safe entrance to the structure, should the marking box need to be made remote from the indicated entrance.

HM

Indicates that a HAZMAT condition exists in or adjacent to the structure. Personnel may be in jeopardy. Consideration for operations should be made in conjunction with the Hazardous Materials Specialist. Type of hazard may also be noted.

- The TIME, DATE, and TF ID, are noted outside the box at the upper right-hand side. This info is made with carpenter's chalk or lumber crayon. An optional method is to apply duct tape on the exterior of the structure and write the information with a grease pencil or black marker.

The example indicates that a safe point of entry exists above the marking (possibly a window, upper floor, etc.). The single slash means the structure may require some shoring and bracing. The assessment was made on July 15, 1991, at 1:10 PM. There is an apparent indication of natural gas in the structure. The evaluation was made by TF #1 out of the State of California.

- All TF personnel must be aware of the possibility of, and look for other Structure and Hazards Evaluation markings made on the interior of the building.
- As each subsequent assessment is performed throughout the course of the mission:
 - ◊ A new TIME, DATE, and TF ID entry will be made below the previous entry; and/or
 - ◊ A completely new marking box made if the original information is now incorrect.
- Marking boxes are also placed in each of the specific areas within the structure (i.e., rooms, hallways, stairwells, etc.) to denote conditions in separate parts of the building.

Search Assessment Marking

- A separate and distinct marking system is necessary to conspicuously denote information relating the victim location determinations in the areas searched.
- The Search Assessment marking system is designed to be used in conjunction with the Structure and Hazards Evaluation marking system.
- An "X" that is 2' X 2' in size will be made with International Orange color spray paint. This X will be constructed in two operations:

Single slash drawn upon entry to a structure or area indicates search operations are currently in progress. The time and TF identifier are posted as indicated.



Crossing slash drawn upon personnel exit from the structure or area.

- Distinct markings will be made inside the four quadrants of the X to clearly denote the search status and findings at the time of this assessment.
- The marks will be made with carpenter chalk, lumber crayon, or duct tape and black magic marker.

Appendix G: Author and Resources

State of Connecticut -Model Procedures for Response of Emergency Vehicles During Hurricanes and Tropical Storms was developed by **William M Higgins, Statewide Fire Service Disaster Response Administrator** - using the IAFC recommended model compiled by Commissioner (Ret.) David H. Fischler, Suffolk County (N.Y.) Fire Rescue, and reviewed by the IAFC Safety Health and Survival Section on behalf of the IAFC.

The IAFC thanks the following departments and agencies for sharing their guidelines and resources:

New Orleans Fire Department

<https://secure.cityofno.com/portal.aspx?portal=51>

City of Miami (Fla.) Department of Fire Rescue

www.ci.miami.fl.us/Fire/pages/default.asp

Virginia Beach (Va.) Fire Department

www.vbgov.com/vgn.aspx?dept_list=60ddfd67f3ad9010VgnVCM100000870b640aRCR

Bay Shore (N.Y.) Fire Department

<http://departments.firehouse.com/dept/BayShoreNY>

Florida Institute of Technology, “Wind Effects on Emergency Vehicles”, Jean-Paul Pinella, Ph.D., P.E., Chelakara Subramanian, Ph.D., P.E.

http://coe.fit.edu/civil/pinelli_papers/WindEffectsonEmergVehicle.pdf

Other Model Response Protocols

Model Procedures for Responding to a Package with Suspicion of a Biological Threat
IAFC, January 2004

www.iafc.org/associations/4685/files/suspicious_packages.pdf

Comments or Recommendations regarding this document should be sent to Bill Higgins at Statefireplan1@ct.gov .

NOTES: