

Hurricane Response Guide for Environmental Public Health Professionals 2024



This National Environmental Health Association (NEHA) Hurricane Response Guide (Response Guide) serves as operational guidance for experienced environmental public health (EPH) professionals at the state, tribal, local, and territorial level (STLT) in hurricane-prone regions. Designed for public sector use, this Response Guide aligns with and complements existing frameworks, such as the National Response Framework (NRF), the National Disaster Recovery Framework (NDRF), and the National Incident Management System (NIMS). It aims to bolster preparedness, response, and recovery efforts before, during, and after a hurricane strikes.

Key features of this Response Guide include:

1. **Operational Guidance:** Detailed task checklists centered around the 15 functional areas of the NEHA Environmental Public Health Emergency Preparedness and Response (EPHEPR) Capability Framework.
2. **Pro Tips:** An overview of essential concepts and best practices by functional area to increase environmental public health professionals' knowledge base.
3. **National Guidance, Standards, and Forms:** A selection of key resources by functional area to provide additional guidance and support.

This Response Guide provides information about the various consequences of hurricanes, including flooding, power outages, chemical hazards, food contamination, and increased vector-borne disease transmission. By outlining these potential impacts, this Response Guide equips EPH professionals with evidence-based considerations for formulating effective mitigation strategies and actionable responses, adaptable to various levels of emergency response.

Funding and Liability Statement

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This Response Guide is not intended to provide legal advice with regards to emergency response, life-safety, or life-saving efforts, actions, decisions, or activities. All content herein is solely for informational purposes only and does not replace practitioner, professional, organizational, agency, or departmental decisions making, incident action planning, or other emergency response actions.

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Key Contents

Click on a colored tile to jump straight to the section.

 Introduction Page 5	 EPHEPR Response Page 6	 Part 1: Pre-Incident Page 7
 Part 2: In the Field Page 11	 Part 3: Back from the Field Page 93	 Acronym List Page 97
 Appendix 1-A: Disaster Management Overview Page 100	 Appendix 1-B: Mutual Aid Page 102	 Appendix 1-C: Important Reference Documents Page 104



Full Table of Contents

Funding and Liability Statement	2
Acknowledgments	2
Introduction	5
Environmental Public Health and Hurricane Response	6
Part 1: Pre-Incident	7
Role of Environmental Public Health	7
Before a Hurricane	7
During a Hurricane	7
After a Hurricane	8
Preparing for Hurricane Season	9
Readiness Actions	10
Prepping for the Field	10
Part 2: In the Field	11
Identify Environmental Public Health Risks for the Affected Population	13
Coordinate Environmental Public Health Response and Resources	16
Assure the Safety and Integrity of Water Systems	21
Assure the Safety and Integrity of Solid Waste/Debris Management Systems	34
Assure the Safety and Integrity of Wastewater Systems	41
Assure the Safety of Emergency Shelters	46
Assure the Integrity of Food Supply and Delivery Systems	51
Assure the Safety and Integrity of Buildings	59
Assure the Safety of Indoor/Outdoor Air Quality	63
Provide Vector Surveillance and Control	67
Provide Environmental Public Health Support to Hazardous Material (HAZMAT) Management	73
Provide Environmental Public Health Support to Radiological Management	76
Assure the Safety of Recreational Water	80
Conduct Open Water Monitoring	86
Assure Effective Environmental Sampling	89
Part 3: Back From the Field	93
Notes	94
Acronym List	97
Appendix 1-A: Disaster Management Overview	100
Appendix 1-B: Mutual Aid	102
Appendix 1-C: Important Reference Documents	104
Attachment 1: Environmental Public Health Preparedness and Response Capability Framework	105
Attachment 2: Go-Bag Checklist	106



Introduction

At the National Environmental Health Association (NEHA), our mission is to build, sustain, and empower an effective environmental public health workforce. Since 1937, NEHA has been training and educating environmental public health (EPH) professionals. To continue our support, we have developed this Hurricane Response Guide (Response Guide) to assist professionals and help inform their decision-making processes across preparedness, response, and recovery efforts in hurricane-prone areas.

What is the Hurricane Response Guide?

The Response Guide is a comprehensive resource that compiles federal guidance, best practices, feedback from subject-matter experts, and national resources. It is organized around NEHA's Environmental Public Health Emergency Preparedness and Response (EPHEPR) Capability Framework (see Attachment 1) to provide a centralized reference for professionals.

Who is this Response Guide For?

This Response Guide was designed for state, tribal, local, and territorial (STLT) EPH professionals working in hurricane-prone regions or deployed to an area impacted by a hurricane. It is a valuable resource for individuals responsible for addressing EPH concerns during hurricane-related emergencies.

Why Should I Use This Response Guide?

Responding to disasters can be overwhelming. This Response Guide is designed to help professionals in the field understand the activities and considerations they should address when dealing with various EPH concerns during hurricane response. It provides a structured approach to navigating the complexities of hurricane response and recovery efforts, even in multi-tasking and high-stress environments.

When Should I Use This Response Guide?

The Response Guide should be reviewed before hurricane season as a preparedness measure. It can also be used during active response and recovery following a hurricane. This Response Guide was designed to be a versatile tool that supports EPH professionals at different stages of hurricane-related emergencies.

Where Can I Find Additional Resources?

In addition to this Response Guide, NEHA has several other resources that may be helpful. These are available at www.neha.org/practice.



Environmental Public Health and Hurricane Response

EPH professionals play a critical role in supporting the response to hurricanes by addressing the various EPH concerns that could arise during or after a hurricane. They bring a unique perspective and level of expertise to mitigating many of the risks hurricanes pose to public health and safety.

In the aftermath of a hurricane, state, tribal, local, and territorial (STLT) EPH professionals perform a wide range of tasks to protect the public's health and safety. For example, they ensure drinking water safety by conducting water quality tests and implementing water treatment measures, as floodwaters can contaminate drinking water sources with raw sewage, toxic chemicals, and debris.

Additionally, they provide guidance on proper food storage and disposal of spoiled or contaminated food from homes and businesses. They ensure that those providing mass feeding for victims and emergency responders adhere to safe food handling practices to prevent foodborne illnesses. EPH professionals also coordinate with agencies to restore and monitor sanitation services, manage debris removal, and prevent the spread of vectors and other pests that can contribute to the spread of disease.

Furthermore, EPH professionals perform many other duties, including assessing the safety and cleanliness of emergency shelters, collaborating with hazardous materials (HAZMAT) teams to manage HAZMAT released from damaged facilities, and providing the public with information about health risks, protective measures, and available resources during and after hurricanes.

By addressing these EPH concerns, EPH professionals help protect the health and safety of communities affected by hurricanes. These measures prevent the spread of disease and support the overall disaster response and recovery efforts.



Part 1: Pre-Incident

To prepare for hurricane season, it is crucial to familiarize yourself with the role of EPH professionals and challenges they typically face during hurricanes. The typical EPH challenges that can arise during hurricanes and take proactive steps to prepare.

This section of the Response Guide provides an overview of the role of EPH professionals and pre-incident actions they can take to enhance readiness for the upcoming hurricane season.

Reviewing this Response Guide throughout hurricane season will build muscle memory, confidence, and familiarity with the content.

Role of Environmental Public Health

The EPH hurricane response role is crucial in protecting community health and safety before, during, and after the event. EPH professionals are key players in mitigating the wide-ranging environmental hazards that hurricanes can create or exacerbate, affecting human health.

Before a Hurricane

EPH professionals assist in preparedness efforts by assessing potential environmental risks, developing response plans, and educating the public on safety measures. This includes identifying vulnerable infrastructure, such as water treatment facilities or hazardous waste sites, that could pose significant risks if compromised. EPH professionals also develop relationships with key partners prior to the storm and identify opportunities for Memoranda of Understanding (MOUs) with these partners.

During a Hurricane

EPH professionals play a critical role in hurricane response, but their effectiveness is greatly influenced by the complex relationship between national and state, tribal, local, and territorial (STLT) response systems in the United States. While most agencies follow the National Response Framework (NRF), there is a significant variation in how STLT systems operate, particularly in terms of activation triggers, authority, and autonomy. This variability directly impacts EPH responses to hurricanes.

While active response during the storm is limited, EPH professionals often work from Emergency Operations Centers (EOCs) to monitor developing environmental threats and coordinate with other emergency responders, often as a part of Emergency Support Function (ESF) #8.¹

EPH professionals working in hurricane-affected areas should take the following steps:

1. **Determine whether the STLT EOC has been activated** and identify the appropriate points of contact.
2. **Clearly define their roles, reporting requirements, and operating authorities** within the national and STLT response structures.
3. **Establish communication protocols** within the response structure.
4. **Understand the decision-making authority** for data collection, custody, and release.
5. **Familiarize themselves with the STLT procedures** for developing and approving public information messages, which is crucial for effective risk communication during hurricane response.
6. **Identify the need for establishing or activating MOUs.**
7. **Be prepared to adapt their approach** based on the level of autonomy and the specific incident management structure of the STLT government.
8. **Adapt to the challenging and harsh conditions** while performing the critical EPH duties to ensure the health and safety of food, water, air, and the environment.

¹ Emergency Support Functions vary by jurisdiction. The National ESF #8 is Public Health and Medical Services.



After a Hurricane

EPH professionals are most active after a hurricane. Their roles include the following actions:

1. **Conducting rapid EPH assessments** to identify immediate risks.
2. **Ensuring safe drinking water** by testing water sources, implementing boil water advisories (BWA) when necessary, and working to restore safe water systems.
3. **Monitoring food safety**, especially in areas affected by power outages, and providing guidance on safe food handling and storage.
4. **Assessing and mitigating risks from sewage overflows and wastewater treatment system failures.**
5. **Identifying and addressing hazardous materials (HAZMAT) releases** from damaged industrial facilities or flooded households.
6. **Implementing vector control measures** to prevent outbreaks of mosquito-borne diseases in areas with standing water.
7. **Providing guidance on safe cleanup of mold and other biological contaminants** in flood-damaged buildings.
8. **Monitoring air quality**, particularly in areas affected by burning debris or increased generator use.
9. **Ensuring proper management and disposal of disaster debris** to prevent environmental contamination.
10. **Conducting health and safety assessments of emergency shelters and temporary housing.**
11. **Providing public education on EPH risks and protective measures.**
12. **Collaborating with other agencies and jurisdictions** to coordinate EPH response efforts.
13. **Participating in mutual aid agreements**, such as the Emergency Management Assistance Compact (EMAC), to share resources, expertise, and personnel across STLT lines when local capabilities are overwhelmed.
14. **Ensuring proper credentialing** under the National Incident Management System (NIMS) to validate qualifications and authorize specific functions, especially when crossing state lines.
15. **Operating within various coordination facilities**, such as the Incident Command Post (ICP), EOC, or Joint Information Center (JIC), depending on the scale and phase of the response.

Throughout all phases, EPH professionals play a critical role in risk communication by helping to translate complex EPH information into actionable guidance for the public and policymakers. They also contribute to long-term recovery efforts, which assist in building community resilience against future hurricane impacts.

The effectiveness of EPH professionals in these roles often depends on their ability to navigate the complex interactions between national and STLT response systems by adapting their approach to the specific governance and incident management structures of the affected area. This includes understanding and utilizing various mutual aid agreements, from international to local levels, and being familiar with the NIMS resource typing system, which categorizes EPH professionals as EPH generalists, specialists, or team leaders.

EPH professionals may also be part of specialized EPH Strike Teams, which can be deployed before or after a hurricane through mutual aid agreements like EMAC. These teams provide crucial support to affected jurisdictions, bringing additional expertise and resources to enhance the overall hurricane response and recovery efforts.



Preparing for Hurricane Season

Hurricane season normally runs from June 1st to November 30th in the Atlantic and May 15th to November 30th in the eastern Pacific, but due to climate change, we are seeing hurricane activity outside of this time frame.

To prepare for hurricane season, EPH professionals can work proactively with other disaster readiness and response partners to enhance their ability to respond effectively to hurricanes and protect the health and safety of the communities they serve.



What is a hurricane?

Hurricanes (referred to as tropical cyclones or typhoons in other parts of the world) are low-pressure weather systems that rotate. They are characterized by organized thunderstorms and the absence of fronts, which are boundaries separating air masses of various densities. These cyclones are classified based on their maximum sustained surface winds. Those with winds below 39 miles per hour (mph) are called tropical depressions, while those with winds of 39 mph or higher are categorized as tropical storms.

Once a storm's maximum sustained winds reach 74 mph, it is classified as a hurricane. Hurricanes are categorized using the [Saffir-Simpson Hurricane Wind Scale](#), which rates the storms from 1 to 5, based on their maximum sustained winds. A higher category indicates a more significant potential for property damage.

Hurricanes typically form in the Atlantic basin, encompassing the Atlantic Ocean, Caribbean Sea, Gulf of Mexico, and eastern North Pacific Ocean. Less frequently, they can also originate in the central North Pacific Ocean.²

² [What is a hurricane? National Ocean Service, National Oceanic and Atmospheric Administration](#)



Readiness Actions

The following are readiness considerations to review before hurricane season (June 1st):

- **Understand the National Incident Management System (NIMS)/Incident Command System (ICS)** as learned in entry-level ICS courses (see [Appendix 1-A](#)).
- **Review national guidelines** to ensure understanding of national best practices in hurricane preparedness, response, and recovery.
- **Assess potential EPH risks and identify new community vulnerabilities and threats**, such as areas prone to flooding and new facilities or industries that may store or produce hazardous materials (HAZMAT).
- **Gather an adequate supply of resources** prior to hurricane season. This includes sampling equipment, communications, and radios.
- **Understand your role in your jurisdiction's ICS** and communicate how you can provide support before, during, and after a hurricane.
- **Coordinate with other local responders** to establish a working relationship before hurricane season begins.
- **Develop, update, print, and disseminate educational materials on EPH and risk communication strategies** to inform the public about hazards, protective measures, and emergency procedures.
- **Ensure proper functioning and maintenance of environmental monitoring and surveillance systems.**
- **Support the assessment of critical facilities and infrastructure to identify vulnerabilities** and recommend necessary upgrades or mitigation measures.
- **Identify and assess facilities with HAZMAT**, ensuring proper safety and containment plans and measures are in place.
- **Collaborate with emergency management and the lead disaster shelter organizations to list and assess potential shelter locations and temporary housing sites** to ensure facilities meet EPH and safety standards.
- **Develop, update, and gain approval for press releases or social media templates addressing common EPH issues** and provide these templates to public information officers.
- **Communicate with elected officials and boards of health** to determine where risk exposures exist and assess the magnitude of those anticipated risks.
- **Participate in training and exercises to test and refine emergency response plans, protocols, and decision-making processes.**

Prepping for the Field

Before working in the field to respond to a hurricane, whether locally or in collaboration with another jurisdiction, it is crucial to take proactive measures to enhance the safety, effectiveness, and readiness of responding personnel. These initial steps will prepare you to carry out your duties safely and effectively in the hurricane-affected area.

1. **Attend briefings about the incident** to understand the specific mission objectives, potential hazards, and overall situation on the ground. This information may be available through the Incident Action Plan (IAP) of your state, tribal, local, or territorial (STLT) Emergency Operations Center (EOC).
2. **Gather all necessary personal protective equipment (PPE)** (e.g., hard hats, safety glasses, hearing protection, gloves, gowns, high-visibility vests). [Ensure that the PPE is in good condition and fits properly.](#) Check all [expiration dates](#) on equipment and restock as needed. Specific guidance may be found in your [Health and Safety Plan](#).
3. If you are eligible, **enroll your cell phone into FirstNet.**
4. **Identify, print, or prepare existing health [communication materials](#)** that can be quickly distributed after a storm.
5. **Assemble a go-bag** (see [Attachment 2](#)).



Part 2: In the Field

EPH professionals play a critical role in assessing and mitigating potential health risks in the aftermath of a hurricane. Part 2 of this Response Guide is designed to support professionals navigating the unique challenges of post-hurricane EPH. By referencing this section, EPH professionals can ensure they have covered all the necessary bases, from assessing water quality and food safety to monitoring and managing vector-borne diseases.

Part 2 provides a step-by-step introduction to the functions outlined in the Environmental Public Health Emergency Preparedness and Response (EPHEPR) framework (see Attachment 1). It also includes a checklist of common tasks and “pro tips” from experienced professionals who have dealt with environmental impacts from hurricanes in the past. The “pro tips” are organized into 3 sections representing essential items, best practices, and national guidelines, standards, and forms resources.

Using the “In the Field” section increases EPH professionals’ confidence by giving them the tools and knowledge they need to address complex environmental challenges and protect the health and well-being of disaster survivors in affected communities.

This section is designed for use in the field. To make the most of this resource, print the individual issue pages and laminate them for durability. Use them to fill out important information and take notes while responding.



Functional Areas

Click on a colored tile to jump straight to a functional area.

 <p>Identify EPH Risks for the Affected Population EPHEPR Function 1</p> <p>Page 13</p>	 <p>Coordinate EPH Response and Resources EPHEPR Function 2</p> <p>Page 16</p>	 <p>Assure the Safety and Integrity of Water Systems EPHEPR Function 3</p> <p>Page 21</p>
 <p>Assure the Safety and Integrity of Solid Waste/Debris Management Systems EPHEPR Function 4</p> <p>Page 34</p>	 <p>Assure the Safety and Integrity of Wastewater Systems EPHEPR Function 5</p> <p>Page 41</p>	 <p>Assure the Safety of Emergency Shelters EPHEPR Function 6</p> <p>Page 46</p>
 <p>Assure the Integrity of Food Supply and Delivery Systems EPHEPR Function 7</p> <p>Page 51</p>	 <p>Assure the Safety and Integrity of Buildings EPHEPR Function 8</p> <p>Page 59</p>	 <p>Assure the Safety of Indoor/Outdoor Air Quality EPHEPR Function 9</p> <p>Page 63</p>
 <p>Provide Vector Surveillance and Control EPHEPR Function 10</p> <p>Page 67</p>	 <p>Provide EPH Support to Hazardous Material (HAZMAT) Management EPHEPR Function 11</p> <p>Page 73</p>	 <p>Provide EPH Support to Radiological Management EPHEPR Function 12</p> <p>Page 76</p>
 <p>Assure the Safety of Recreational Water EPHEPR Function 13</p> <p>Page 80</p>	 <p>Conduct Open Water Monitoring EPHEPR Function 14</p> <p>Page 86</p>	 <p>Assure Effective Environmental Sampling EPHEPR Function 15</p> <p>Page 89</p>



Identify Environmental Public Health Risks for the Affected Population



Aligns to EPHEPR Function 1

In the wake of a hurricane, communities face a myriad of EPH threats that can significantly impact human health and well-being. Identifying these EPH risks is crucial for the affected population during and after a hurricane because it allows professionals to develop effective mitigation strategies.

Hurricanes can cause widespread disruption to essential infrastructure and environmental systems, which leads to complex and evolving public health challenges. These challenges may include:

1. Contamination of drinking water sources caused by flooding and storm surges
2. Sewage overflows and wastewater treatment system failures
3. Widespread power outages affecting food safety and medical services
4. Accumulation of debris and hazardous materials
5. Increased vector breeding sites in standing water
6. Mold growth in flood-damaged buildings
7. Air quality issues due to damaged industrial facilities or widespread generator usage

The tasks within this function are designed to quickly assess these risks, especially for vulnerable populations who may be disproportionately affected. By engaging with the Incident Command System (ICS), EPH professionals contribute vital expertise in forecasting and addressing immediate and future health risks after a hurricane.

Effective execution of this function lays the groundwork for all subsequent EPH response activities, ensuring that resources are appropriately allocated and that mitigation efforts are targeted where they are most needed. This proactive approach is essential in protecting public health and supporting community resilience in the face of hurricane-induced environmental challenges.

Tasks

Conduct a rapid needs assessment to identify immediate EPH risks/needs and match them with existing capabilities.

Determine impacts on water systems by implementing a water quality monitoring program to assess the safety of drinking water, recommending regular testing of private water sources, or identifying contaminants and other pollutants in accordance with the [Safe Drinking Water Act \(SDWA\)](#).

Determine the impact to regulated facilities such as retail food establishments, schools, daycares, hospitals, and other institutions, such as jails.

Assess historical risks of vector-borne diseases and develop a plan to help control nuisances and pests, often exacerbated by floodwaters, debris, and solid waste.

Identify and map potential releases of HAZMAT from sources such as industrial facilities, storage tanks, or transportation accidents in the affected areas.

Evaluate the operational condition of key public health infrastructure (drinking water, wastewater, power, etc.).

Assess EPH conditions in disaster shelters, with a focus on monitoring medical shelters, shelters for pets, and those accommodating large numbers of individuals with access and functional needs (AFN), chronic health conditions, substance abuse issues, and disabilities. Verify that environmental issues such as sanitation, hygiene, food operations, facility safety, crowding, waste management, and indoor air quality are monitored and documented using tools such as the [CDC Shelter Assessment Tool](#).

Identify EPH risks specific to populations with AFN and areas with vulnerable communities.

Engage with emergency management and public health officials to forecast potential EPH risks based on changing post-hurricane conditions.



Coordinate with public health laboratories as appropriate.

Develop initial mitigation strategies for identified EPH risks, to be included in the Incident Action Plan (IAP).

Design a health monitoring and surveillance program to track potential exposures to HAZMAT among workers and responders.

Contribute EPH subject-matter expertise to the Emergency Operations Center (EOC).

Coordinate with state, tribal, local, territorial (STLT), and federal agencies and non-governmental organizations (NGOs) to ensure the necessary resources are available for EPH interventions, such as personnel, equipment, supplies, and funding.

Continuously monitor and adapt EPH mitigation measures based on emerging risks, changing conditions, and feedback from the affected population.

Pro Tips



Must Know

Incident Command System (ICS)

Each incident is unique. Environmental public health's roles within the ICS structure may vary based on the incident's needs, the jurisdiction, and the specific skill sets of the EPH professionals involved. EPH professionals should be prepared to collaborate across sections and contribute their expertise wherever it is needed in the response effort. Emergency Support Functions (ESFs) vary at the STLT and federal level. In an EOC, EPH may be part of what is federally recognized as ESF #8: Public Health and Medical Services. Often, EPH professionals work within the Operations Section, specifically supporting the Health and Medical Branch. EPH may also contribute to the Planning Section by providing subject-matter expertise for situation reports,³ developing EPH portions of the IAP,⁴ or helping to forecast potential EPH risks.

In some cases, an entire EPH Strike Team might be requested and deployed, functioning as a unit within the Operations Section.

Vulnerable Population Risks

Vulnerable populations may face disproportionate risks during and after hurricanes due to environmental factors and social inequities. EPH professionals should consider preexisting disparities in their communities, cumulative impacts that may arise from hurricane-induced environmental risks, access barriers, and long-term consequences that could potentially worsen existing health disparities.

³ During an incident, Situation Reports (SitReps), provide information on significant events related to the incident, including a description of the current situation, critical issues, emergency management resources, community lifelines, and upcoming planning activities. This information is often shared via an [ICS-201 Form - Incident Briefing](#).

⁴ The Incident Action Plan (IAP), which is developed during each operational period, is the result of a series of meetings and briefings that follow a specific sequence known as the Operational Period Planning Cycle, or "Planning P." This cycle is visually represented by a diagram that illustrates the order and connections between the various meetings, work sessions, and briefings that occur throughout the planning process.



Best Practices

Responder Resilience

Pre-Deployment

- Know behavioral health impacts
- Plan coping and support strategies
- Practice healthy stress management and self-care daily

During Deployment

- Seek support
- Take breaks and avoid overworking
- Exercise regularly and maintain healthy eating and sleep routines
- Rotate job tasks before stress impacts performance

Post-Deployment

- Know behavioral health impacts
- Get screened and use support resources
- Use pre-identified self-care and stress management strategies

Resources

National Guidance and Standards

- [An Introduction to the National Incident Management System](#)
- [Basic Incident Command System for Initial Response, ICS-200](#)
- [Best Practices and Lessons Learned in Deploying Private Sector and Volunteer Resources Through EMAC](#)
- [CDC All-Hazards Preparedness Guide](#)
- [CDC Preparedness Response Capabilities](#)
- [Community Assessment for Public Health Emergency Response Toolkit \(CASPER\)](#)
- [Draft Environmental Public Health Emergency Preparedness and Response Capability and Functions | NEHA](#)
- [Emergency Operations Center How-To Quick Reference Guide](#)
- [Environmental Health Training in Emergency Response \(EHTER\) | Environmental Health](#)
- [FEMA Support Function Annexes](#)
- [Hurricane and Flood Mitigation Handbook for Public Facilities](#)
- [ICS Organizational Structure and Elements](#)
- [Incident Action Planning Process](#)
- [Incident Action Planning Guide](#)
- [Introduction to the Incident Command System, ICS 100](#)
- [National Incident Management System](#)
- [National Response Framework](#)
- [National Response Framework, An Introduction](#)

Forms

- [Disaster Assessment, Response, and Recovery Checklist](#)
- [Disaster-Specific Memorandum of Understanding](#)
- [ICS Resource Center](#)
- [ICS Forms Descriptions](#)
- [ICS 201 - Incident Briefing](#)



Coordinate Environmental Public Health Response and Resources



Aligns to EPHEPR Function 2

In the aftermath of a hurricane, coordinating the environmental public health response is crucial for protecting a community's health and safety. This function involves efficiently allocating resources, aligning efforts across agencies, and maintaining clear communication channels to address the complex and evolving environmental public health challenges that arise in hurricane-impacted areas.

Key aspects of this function include:

1. **Resource Management:** Rapidly assessing and deploying environmental public health personnel, equipment, and supplies to areas of greatest need, which may include flood-damaged neighborhoods, compromised water systems, or areas with extensive debris.
2. **Interagency Collaboration:** Working seamlessly with emergency management, public health departments, utilities, and other relevant sectors to ensure a cohesive environmental public health response to hurricane-related hazards.
3. **Risk Assessment and Mitigation:** Continuously identifying and addressing environmental public health risks specific to the hurricane's aftermath, such as water contamination, foodborne illness outbreaks, vector-borne diseases, and mold growth in flooded and flood-damaged structures.
4. **Information Sharing:** Establishing robust communication networks to share timely, accurate information about environmental public health risks and response activities among all stakeholders, including response personnel and the public.
5. **Incident Command System (ICS) Integration:** Actively participating in the ICS structure to ensure environmental public health concerns are fully integrated into all phases of hurricane response and recovery planning.
6. **Responder Safety:** Identifying and mitigating health and safety risks for emergency response personnel working in potentially hazardous post-hurricane environments.

Tasks

Conduct rapid assessments of EPH needs in hurricane-affected areas.

Prioritize and deploy EPH personnel, equipment, and supplies to high-risk areas (e.g., flooded neighborhoods).

Maintain an up-to-date inventory of available EPH resources and their locations.

Coordinate with logistics teams to ensure timely resupply of essential EPH equipment and materials.

Establish and maintain contact with key partners (e.g., emergency management, public health departments, utilities, etc.).

Participate in regular interagency briefings and planning sessions.

Share EPH findings and concerns with relevant agencies to inform their operations.

Coordinate joint field assessments with other agencies when appropriate.

Conduct ongoing EPH hazard assessments in affected areas.

Regularly update Incident Command and Public Information Officers (PIOs) on EPH risks and activities.

Contribute to the development of public health advisories and risk communication messages.

Maintain clear documentation of EPH activities, findings, and recommendations.

Participate in compilation and dissemination of daily situation reports.

Assign EPH liaisons to relevant ICS sections (e.g., Operations, Planning).

Attend and contribute to ICS planning meetings and operational briefings.

Ensure EPH objectives are incorporated into Incident Action Plans (IAPs).

Provide input on EPH resource needs for short-term and long-term recovery planning.

Conduct safety briefings for EPH field personnel before deployment.

Ensure all EPH staff have appropriate PPE for field work.



Monitor and report on environmental conditions that may pose risks to responders (e.g., heat, contaminated floodwaters).

Implement a buddy system for EPH field teams working in potentially hazardous areas.

Assist in organizing and staffing community information centers or health clinics.

Provide on-site guidance to residents on safe cleanup procedures and health protection measures.

Collaborate with community leaders to address specific EPH concerns in their areas.

Implement a system for collecting and managing EPH field data.

Produce regular reports on EPH activities, findings, and recommendations for leadership.

Pro Tips



Must Know

Key Partners in Hurricane Response

Environmental public health professionals must be familiar with the following partners and stakeholders typically involved in hurricane response:

- **Emergency Management Agencies:** State, tribal, local, territorial (STLT), and federal agencies (e.g., Federal Emergency Management Agency, or FEMA) that coordinate overall disaster response efforts
- **Public Health Departments:** STLT health departments that oversee public health measures and disease surveillance
- **Utility Companies:** Water, power, and gas providers crucial for infrastructure restoration
- **Healthcare Facilities:** Hospitals, clinics, and long-term care facilities that may need support
- **Environmental Protection Agencies:** STLT agencies responsible for environmental regulations and hazardous waste management
- **Law Enforcement and Fire Departments:** First responders who assist with evacuations and safety measures
- **Transportation Departments:** Responsible for road clearance and transportation infrastructure
- **Housing Authorities:** Involved in shelter operations and temporary housing solutions
- **Non-governmental Organizations (NGOs):** Organizations, such as the American Red Cross, that provide various support services
- **Community Organizations:** Local groups that can assist with outreach and support to vulnerable populations
- **Meteorological Services:** Provide ongoing weather information crucial for response planning
- **Waste Management Agencies:** Essential for debris removal and proper waste disposal
- **Vector Control Districts:** Help manage increased pest and vector issues post-hurricane
- **Mental Health Services:** Provide psychological support to affected communities and responders
- **Educational Institutions:** May serve as shelters or resource centers

Foundation of Risk Communication⁵

When developing communication strategies and messages in high-stress situations, remember that when people are concerned, stressed, or upset, they:

- want to know that you care before they care what you know
- have difficulty hearing, understanding, and remembering information
- focus most on what they hear first
- focus more on the negative than on the positive
- experience wider gaps between risk perceptions and reality

⁵ Adapted from Dr. Vincent Covello, Director of the Center for Risk Communication



Crisis and Emergency Risk Communication

The CDC's [Crisis and Emergency Risk Communication \(CERC\) manual](#) is based on psychological and communication sciences, studies in issues management, and practical lessons learned from emergency responses. Key principles of CERC include:

- Be first
- Promote action
- Be right
- Be credible
- Show empathy
- Show respect
- Involve stakeholders
- Plan and evaluate

Misinformation, Disinformation, and Malinformation

- Misinformation is the spread of false information without the intent to mislead.
- Disinformation is false information that is intentionally designed or spread with full knowledge of it being false (i.e., information has been manipulated). It is intended to deceive and cause harm.
- Malinformation is a term for information based on fact but removed from its original context to mislead, harm, or manipulate. Malinformation is true, but sharing it is meant to cause harm.

EPH professionals might struggle to combat false information, address misconceptions, and ensure that accurate information reaches the public to prevent panic and misinformation-driven actions. When distributing information to the public, always try to be a credible source and stay ahead of misinformation, especially during a crisis.

Safety Considerations for Field Work in Post-Hurricane Conditions

1. Always wear appropriate personal protective equipment (PPE).
2. When possible, work in pairs or teams. Maintain regular communications with team members.
3. Be alert to hazards (i.e., downed power lines, unstable structures, submerged objects, and displaced wildlife).
4. Avoid wading through floodwaters.
5. Assume all floodwater is contaminated.
6. Practice proper decontamination procedures after fieldwork, including hand hygiene.
7. Prevent heat stress by staying hydrated and taking regular breaks in shaded or cool areas.
8. Ensure immunizations (e.g., tetanus and hepatitis A) are up to date.
9. Use vehicles appropriate for specific conditions.
10. Carry emergency supplies.
11. Carry a fully charged mobile phone and bring backup power sources.
12. Know emergency contact numbers and evacuation routes.
13. Conduct safety briefings at the start of each workday to review hazards and protocols.
14. Adhere to work/rest cycles to prevent fatigue-related accidents.
15. Be aware of the signs of stress and trauma in yourself and colleagues.



Mental Health Support

In the aftermath of a hurricane, staff may face challenging situations involving extensive death and destruction. The impact can extend to their personal lives, affecting their property and loved ones.

Organizations must prioritize staff well-being, allowing time off to address personal needs. Staff should be prepared to interact with a grieving community and be aware of available mental health resources for both themselves and community members. The depression and despondency often common in shelters and recovery centers may necessitate the involvement of mental health professionals.

Supervisors must be vigilant for signs of overwork among staff, particularly those compensating for personal losses or empathizing with the affected community. Policies should be in place to monitor staff well-being and direct them to appropriate resources. Larger departments should consider offering group or peer counseling sessions, with individual support readily available.

Management must take staff feedback seriously and be proactive in addressing requests for assistance. EPH staff should be trained to recognize situations requiring mental health intervention and know how to make appropriate referrals.

Neglecting the mental well-being of staff during a disaster response can lead to further complications. It is crucial to plan ahead and establish contacts with relevant agencies to ensure prompt access to help and support when needed.

Best Practices

Developing Messaging

Five Questions to Help Develop Messages

1. Who are your stakeholders?
2. How do they like to receive important information?
3. What do you want to tell your stakeholders?
4. What do they want to know?
5. What is likely to be misunderstood?

Message Mapping

Message mapping is a simple technique for organizing information into key messages designed and tailored to address stakeholders' specific issues and concerns.

Steps:

1. Identify the stakeholder and their question or concern at the top.
2. Select three key messages to address each stakeholder's issue or concern. Consider answering these three questions:
 - What happened?
 - What is the health risk?
 - What actions can they take?
3. Add supporting facts (proof) under each key message.



Stakeholder: Question or Concern

Key Message 1	Key Message 2	Key Message 3
Supporting Fact 1.1	Supporting Fact 2.1	Supporting Fact 3.1
Supporting Fact 1.2	Supporting Fact 2.2	Supporting Fact 3.2
Supporting Fact 1.3	Supporting Fact 2.3	Supporting Fact 3.3

Getting Your Message Out

Bridging Technique

In a high-pressure situation, such as a TV interview, bridging can be a helpful technique. Bridging is a technique where you first acknowledge the difficult question and then transition to communicating the key message you want to deliver. Some examples include:

- *“That’s an important aspect to consider, and what I want to emphasize is...”*
- *“I understand your concern, and what we know right now is...”*
- *“These are challenging circumstances, and it comes back to...”*

Resources

- [CDC Publications on Demand](#)
- [CERC Engaging the Community with Credibility](#)
- [CERC Template for News Release](#)
- [Communication Resources | Natural Disasters | CDC](#)
- [Communicating Risk in Public Health Emergencies](#)
- [Crisis Emergency Risk Communication Plan Checklist](#)
- [Crisis Emergency Risk Communication Checklist: Basic tenets of emergency risk communication](#)
- [Heat-Related Illnesses and First Aid](#)
- [Message Development for Communication](#)
- [Natural Disasters and Severe Weather | Natural Disasters | CDC](#)
- [Public Service Announcements \(PSAs\) for Disasters | Natural Disasters | CDC](#)
- [Sample Message Planning](#)



Assure the Safety and Integrity of Water Systems



Aligns to EPHEPR Function 3

Hurricanes pose significant threats to water systems, potentially compromising the safety and availability of drinking water for affected populations. The powerful winds, storm surge, and flooding associated with hurricanes can damage water infrastructure, contaminate water sources, and disrupt water treatment and distribution systems.

Key hurricane-related challenges to water systems include:

1. Physical damage to water treatment plants, distribution pipes, and pumping stations
2. Contamination of water sources with flood waters, sewage, or chemical pollutants
3. Power outages affecting water treatment and distribution
4. Saltwater intrusion into freshwater sources in coastal areas
5. Increased demand for safe water due to disruptions in normal supply chains
6. Disruptions to water at restaurants, retail food establishments, schools, childcare, healthcare facilities and other institutions like jails or correctional facilities

Tasks

Assess water system infrastructure, including treatment plants, distribution networks, storage tanks, and pump stations, for damage, leaks, or potential contamination sources due to flooding, power outages, or debris.

Identify potential resources to conduct water quality testing (e.g., local health department environmental labs, private labs, or state, tribal, local, and territorial (STLT) or federal agencies).

Implement a [water quality testing program to monitor for contaminants such as bacteria, viruses, chemicals \(Maximum Contaminant Levels \(MCLs\)\)](#) from the Safe Drinking Water Act (SDWA), and debris in water sources, treatment facilities, and distribution systems.

Advise on proper water system disinfection by increasing chlorine levels or using alternative disinfectants as needed.

Issue boil water advisories (BWAs) or do not drink/use orders if water quality is not confirmed safe, providing clear instructions to the public (see [CDC Drinking Water Advisory Communication Toolkit](#)).

Assess the status of power supplies and backup generators for water treatment plants and pumping stations.

Assist in identifying damaged equipment to restore the water system to full operational capacity.

Identify key users (e.g., hospitals, pre-planned shelter locations, long-term care facilities, dialysis centers) that may have impacted water systems.

Establish communication and coordination with emergency management agencies, public health authorities, and other stakeholders to coordinate a response and ensure accurate public information.

Assess risks and coordinate with restaurants, grocery stores, and other retail food facilities that may not be able to operate due to water safety issues.

Identify and establish alternative water sources, such as bottled water distribution sites or temporary treatment systems, if necessary.

Coordinate the removal of debris or potential contamination sources from water sources, treatment facilities, and distribution systems to prevent further contamination.

Assess and address the needs of private well owners, who may face unique challenges after a hurricane.

Conduct long-term monitoring of water quality, as some contaminants may not be immediately apparent.

Coordinate with local utilities and government agencies for system repairs and restoration.

Educate the public on safe water practices during the emergency, including proper storage, treatment, and use of water from alternative sources.



Pro Tips



Must Know

Safe Drinking Water Act (SDWA) Requirements

The SDWA applies to every public water system in the United States. The [National Primary Drinking Water Regulations](#) are the primary standards and treatment techniques that apply to public water systems. These regulations set the enforceable MCLs for particular contaminants in drinking water and specify required methods for removing contaminants.

Types of Public Water Systems

The U.S. Environmental Protection Agency (EPA) has defined three types of public water systems:

- **Community Water System (CWS):** A public water system that supplies water to the same population year-round.
- **Non-Transient Non-Community Water System (NTNCWS):** A public water system that regularly supplies water to at least 25 of the same people at least six months per year. Some examples are schools, factories, office buildings, and hospitals which have their own water systems.
- **Transient Non-Community Water System (TNCWS):** A public water system that provides water in a place such as a gas station or campground where people do not remain for long periods of time.

Types of Individual Water Systems

The EPA has defined three types of individual water systems:

- Privately owned home or farm wells, springs, cisterns, or surface water sources
- Streams, ponds, or shallow wells not intended for drinking
- Bottled water and water vending machines

Waterborne Diseases

Natural disasters, particularly flooding, can severely impact access to safe water and sanitation, leading to an increased risk of waterborne diseases, especially in developing countries. Diarrheal diseases are among the most common health issues following natural disasters, with outbreaks caused by various pathogens such as *Vibrio cholerae*, enterotoxigenic *Escherichia coli*, *Salmonella enterica* serotype *Paratyphi A*, and *Cryptosporidium parvum*. These outbreaks have been documented in several countries, including Bangladesh, West Bengal, and Indonesia.

In addition to diarrheal diseases, hepatitis A and E, which are transmitted through the fecal-oral route, are also associated with a lack of access to safe water and sanitation. Hepatitis E outbreaks are particularly prevalent following heavy rains and floods in endemic areas.

Leptospirosis, a zoonotic bacterial disease, can also pose a significant health risk after flooding events. This disease can be transmitted through direct contact with water contaminated by rodent urine, and outbreaks have been reported in various countries following flood events.



Adequacy of Supply

When assessing the adequacy of the drinking water supply either before or after an event, consider the following basic parameters:

- **Accessibility:** the percentage of the population with reasonable access to an improved drinking water supply
- **Quantity:** the proportion of the population with access to different levels of drinking water supply (i.e., inadequate access, basic access, intermediate access, optimal access) as a proxy for the quantity of water used
- **Quality:** whether the supply has regularly verified water quality and an approved, validated water safety plan that is subject to periodic audits to demonstrate compliance with relevant regulations
- **Continuity:** the percentage of the time during which drinking water is available (daily, weekly, and seasonally)
- **Affordability:** the price of water paid by domestic consumers.

Water Sampling/Water Testing

In response to the incident, quickly prepare a Standard Operating Procedure (SOP) that focuses on key points from the EPA's [Quick Guide to Drinking Water Sample Collection](#).

Make sure to include:

- Location of where the water sample was obtained (i.e., the faucet of a potable water source)
- Sampling method used (bacteriological sample, volatile organic compounds, pesticides, total petroleum hydrocarbons, etc.)
- Sample coverage (number of samples taken)
- Sample volume (amount of water needed to conduct sampling)
- Storage and transportation (procedures for keeping samples secured and at the proper temperature during transport to state-certified laboratories)

Note: Coliform is a standard first test in an emergency. If you detect coliform, it is a signal that the system (and water) may be contaminated with disease-causing organisms (pathogens). Testing for coliform bacteria is quick, easy, and inexpensive. Make sure to check with your local lab to understand their specific lab submission requirements.

General Supplies for Water Sampling in the Field

- Stopwatch
- Waterproof markers
- Latex/nitrile gloves
- Labeling tape
- Insulated cooler⁶
- Sodium thiosulfate (or equivalent disinfectant neutralizing agent)
- GPS unit, area map, etc.
- Record-keeping documents (e.g., chain of custody, field logs)
- Communication devices (e.g., cell phone, two-way radio)
- Paper towels
- Alcohol, ethanol, and bleach wipes
- Trash bags and clear, reusable plastic bags
- Water quality meters and test kits (e.g., pH, free and total chlorine, temperature, turbidimeter)
- Camera (if allowed on-site)
- Shipping supplies
- Custody tape (optional)
- Graduated cylinder (1L)

⁶ Water samples should be protected and kept at a cool temperature (<10°C or 50°F) during transport.



General Sampling Procedures

1. Prepare a Sampling and Analysis Plan (SAP) detailing sampling locations, types, numbers, and quality control requirements.
2. Coordinate with the lab on acceptable equipment, preservatives, and procedures. Use lab-provided supplies if possible.
3. Handle dangerous acid and base preservatives with care. Wear gloves and eye protection. Have neutralization supplies ready.
4. Collect samples in a clean area free of contamination.
5. Select a clean, cold water faucet free of contaminating devices. Ensure the faucet is in good condition.
6. Use a faucet tall enough to fill sample bottles without physically contacting them.
7. Flush the faucet for 2-3 minutes until the temperature stabilizes. Adjust flow to avoid splashing.
8. Follow the provided collection instructions for each analyte. Wear gloves and eye protection.
9. For Lead and Copper Rule compliance:
 - a. Select a faucet without water-altering devices. Do not remove screens or aerators.
 - b. For the first flush, let water sit ≥ 6 hrs. Collect the first water for 1L sample.
 - c. For the lead service line, collect 8–10 sequential samples. See EPA guidance for details.
10. Fill out a chain of custody form with all pertinent collection information.
11. Deliver/ship samples to meet holding time requirements.
12. Return empty preservative containers to the lab for disposal.

Water Treatment Steps

Public water systems use a series of treatment steps to provide safe drinking water:

1. **Coagulation:** Chemicals with a positive charge are added to neutralize negative charges on dissolved particles, causing them to bind together.
2. **Flocculation:** Gentle mixing helps form larger, heavier particles called flocs.
3. **Sedimentation:** The heavy flocs settle to the bottom, separating from the clear water.
4. **Filtration:** The clear water passes through filters of varying pore sizes and materials to remove dissolved particles, chemicals, parasites, bacteria, and viruses. Advanced methods like ultrafiltration and reverse osmosis may also be used.
5. **Disinfection:** Chemical disinfectants (i.e., chlorine, chloramine, chlorine dioxide) are added to kill the remaining microbes. Ultraviolet (UV) light or ozone can also be used. Low levels of disinfectant remain to continue killing germs as water travels through pipes.

The pH is often adjusted, and fluoride is added after disinfection to improve taste, reduce pipe corrosion, and keep teeth strong.

Treatment varies by community, depending on the source of water. Surface water usually requires more treatment than groundwater because it contains more contaminants. Special methods may be needed if the water contains radionuclides, nitrates, or cyanobacterial toxins.

Home Preparedness

How Much Water to Store

Individuals should store 1 gallon of water per person per day (2-week supply) in their homes. Pregnant women, the elderly, service animals or pets, and those living in hot climates may need more than this recommended amount.

Bottled Water

Unopened, commercially bottled water is a safe, reliable water source in an emergency. Make sure you check the expiration date for store-bought water.



If you do not have bottled water, you can make your water safe to drink by:

- Boiling water to kill bacteria, viruses, and parasites. Boil for 1 minute (or 3 minutes at elevations above 6,500 ft).
- Disinfecting water to kill most viruses and bacteria. Add 8 drops (or a little less than $\frac{1}{8}$ of a teaspoon) of 5% - 9% unscented household bleach to 1 gallon of water. For cloudy tap water, use 16 drops (or $\frac{1}{4}$ teaspoon). If you do not have household bleach, chlorine dioxide tablets or iodine can be used according to label instructions.

Disinfecting Water with Bleach

Volume of Water	Amount of 6% Bleach to Add*	Amount of 8.25% of Bleach to Add*
1 quart/liter	2 drops	2 drops
1 gallon	8 drops	6 drops
2 gallons	16 drops ($\frac{1}{4}$ teaspoon)	12 drops ($\frac{1}{8}$ teaspoon)
4 gallons	$\frac{1}{3}$ teaspoon	$\frac{1}{4}$ teaspoon
8 gallons	$\frac{2}{3}$ teaspoon	$\frac{1}{2}$ teaspoon

*Bleach may contain 6% or 8.25% sodium hypochlorite.

Table adapted from EPA's [Emergency Disinfection of Drinking Water printout](#).

Filtering water is another method that can remove parasites. Choose a water filter labeled to remove parasites and follow the manufacturer's instructions. Filtered water might need additional treatment to be safe.

Other Types of Disinfection

Chemical processes used to treat water are described below:

Chlorine Gas	Calcium Hypochlorite	Sodium Hypochlorite	Chloramines
100% chlorine ion	65% to 75% chlorine ion	5.25% to 12.5% chlorine ion	-
It is "technically" a liquid under pressure inside the cylinder, but it evaporates into a gas when released (at atmospheric pressure).	Calcium hypochlorite (HTH) is a powder (granular or tablet) form of chlorine.	Sodium hypochlorite is a liquid and can vary from 5.25% (laundry bleach) to 12.5% (commercially available) chlorine ion.	Chloramine is produced by combining chlorine and ammonia. It is a weaker disinfectant than chlorine, but it is more stable and longer lasting. It is often used to maintain drinking water at approved residual levels.

In addition to boiling and chemicals, distillation, ultraviolet light, and ozone can be used.



UV Light

- Ultraviolet light (UV light) can be used to kill some germs.
- Portable units that deliver a measured dose of UV light help disinfect small amounts of clear water. UV light does not work well on cloudy water because small particles may block germs from the light.
- If the water is cloudy, first filter it through a clean cloth, paper towel, or coffee filter, OR allow it to settle. Then, draw off the clear water and disinfect it using the UV light.
- Always follow the manufacturer's instructions.

Solar Disinfection

- In emergencies, the sun's rays can improve the quality of water. This method may reduce some germs in the water.
- To disinfect water using the sun:
 - Fill clean, clear plastic bottles with clear water. Solar disinfection is not as effective on cloudy water because small particles may block germs from the light.
 - If the water is cloudy, first filter it through a clean cloth, paper towel, or coffee filter, OR allow it to settle. Then, draw off the clear water and disinfect that water using the sun.
 - Lay the bottles down on their sides and in full sun for 6 hours (if sunny) or 2 days (if cloudy). Laying the bottles down allows the sun's rays to more effectively disinfect the water inside.
 - Putting the bottles on a dark surface will also increase the effectiveness of the solar disinfection method.

Removing Chemical Contamination from Water

Distillation and Reverse Osmosis (RO) systems can remove some chemical contaminants from water. Distillation is the process of heating water to the boiling point and collecting water vapor as it condenses. Distillation Systems will remove common chemical contaminants, including arsenic, barium, cadmium, chromium, lead, nitrate, sodium, sulfate, and many organic chemicals. RO systems use the natural process of osmosis to reverse the flow of water so that it passes from a more concentrated solution to a more dilute solution through a semi-permeable membrane. Pre- and post-filters are often incorporated along with the reverse osmosis membrane itself. RO systems will remove common chemical contaminants (e.g., metal ions, aqueous salts), including sodium, chloride, copper, chromium, and lead. These systems may also reduce arsenic, fluoride, radium, sulfate, calcium, magnesium, potassium, nitrate, and phosphorus.

Choosing a Container for Water Storage

When storing water for emergencies, it is best to use FDA-approved food grade storage containers to prevent toxic substances from leaching into the water. These containers can be found at surplus or camping supply stores. If you are unsure whether a container is food grade, contact the manufacturer. If food grade containers are unavailable, choose containers that are made of durable, unbreakable materials and have tight-fitting lids. Preferably, opt for containers that have narrow necks or openings for easy pouring. Never use containers that previously held toxic chemicals like bleach or pesticides.

Cleaning and Sanitizing a Water Storage Container Before Use

To clean and sanitize water storage containers before filling, do the following:

1. Wash the container with soap and rinse thoroughly.
2. Make a sanitizing solution with 1 teaspoon of unscented bleach (5–9% sodium hypochlorite) per 1 quart of water.
3. Pour the solution into the container, cover tightly, and shake to ensure it touches all surfaces.
4. After 30 seconds, pour out the sanitizing solution.
5. Allow the container to air dry completely.
6. Fill the sanitized container with clean water and seal with a tight lid.



Storing the Water

When storing water from your home, clearly mark the containers as “drinking water” and label each container with the date you stored it. To maintain the quality of the stored water, replace it with fresh water every six months. Choose a storage location with a cool temperature, ideally between 50°F and 70°F, and keep the containers away from direct sunlight. It is also important to store water containers in an area separate from toxic substances like gasoline or pesticides to avoid contamination.

Using the Water

When removing water from your storage container, it is crucial to maintain the cleanliness of the water. Always use a clean scoop or device each time you take water out to prevent contamination. Avoid touching the water or the inside of the container with your hands, and never scoop water out using your hands directly. By following these guidelines, you can ensure that the stored water remains safe to drink.

The EPA regulates drinking water quality in public water systems. Water utilities are required to test for and address many germs and chemicals in drinking water. Furthermore, water utilities are required to tell customers about testing for contaminants and whether they found unsafe chemicals or germs in the water. Private well owners are responsible for testing their own water.

In an emergency, you can identify [alternative sources of water](#) in your home.

Inside the Home

- Water from your home’s tap water heater tank. This refers to the tank that connects to the water from your faucets and showerheads. (This differs from the tank that supplies hot water to radiators in older homes. In these homes, use the tap water heater tank, not the home heating system tank.)
- Melted ice cubes made with water that was not contaminated.
- Water from your home’s toilet tank (not from the bowl) can be used if it is clear and has not been chemically treated with toilet cleaners such as those that change the water color. However, it is recommended that the water be treated before consumption.
- Liquid from canned fruit and vegetables.
- Water from swimming pools and spas can be used for personal hygiene, cleaning, and related uses, but not for drinking.

Outside the Home

Water sources outside the home can be made safe if there is no existing chemical or radiological contamination. Possible sources of water that could be made safe by treatment include:

- Rainwater
- Streams, rivers, and other moving bodies of water
- Ponds and lakes
- Natural springs



Best Practices

Issuing Advisories

Initiating an Advisory

- Identify the situation and collect facts.
- Notify your drinking water primacy agency.
- Identify the geographic boundaries.
- Decide to issue an advisory.
- Notify your internal staff and external partners.

Preparing an Advisory

- Contact experts to answer key questions needed for specific messaging.
- Develop, format, and translate the message.
- Approve the advisory.
- Identify the spokespersons.
- Assign communication responsibilities.

Distributing an Advisory

- Inform elected officials, public officials, and key partners.
- Implement your communication platforms.
- Use your communication network to expand the distribution of the advisory.
- Work with the media.

Ending an Advisory

- Use water quality criteria and consult with water systems and health officials to assess and to make a decision.
- Coordinate with partners to develop and deliver clear lifting messages using established communication channels.
- Clearly state reasons for lifting the Advisory based on specific water quality results.
- Issue End of Advisory notice using the same communication methods, media partners, and outlets used to distribute the advisory.
- Issue guidance for post-advisory activities (e.g., flushing guidance).

Boil Water Advisory	Do Not Drink Advisory	Do Not Use Advisory
The water has or could have pathogens in it to make you sick. <i>Recommended for pathogens only. Chemical contaminants will not be removed and may concentrate when boiling.</i>	The water is or could be contaminated with harmful chemicals or toxins.	The water is or could be contaminated with pathogens, harmful chemicals, toxins, or radioactive materials.

Recommended Actions Before Returning to Normal Operations

For community and private water systems where EPH professionals have a role and responsibility, they should:

1. Inspect, flush, and disinfect the system
2. Verify water quality
3. Communicate to the public



Disinfecting Water with Unscented Household Liquid Chlorine

Cloudy Water:

1. Filter through a clean cloth, paper towel, or coffee filter, or allow it to settle.
2. Draw off clear water.
3. Follow instructions on the bleach container label for disinfecting drinking water.
4. If no instructions are present, check the “Active Ingredient” part of the label to find the sodium hypochlorite percentage and use the information in the table* below as a guide. Add the appropriate amount of bleach using a medicine dropper, teaspoon, or metric measure (milliliters/mL).
5. Stir the mixture well.
6. Let stand for at least 30 minutes.
7. Store disinfected water in clean, sanitized containers with tight covers.

Clear Water:

1. Follow instructions on the bleach container label for disinfecting drinking water.
2. If no instructions are present, check the “Active Ingredient” part of the label to find the sodium hypochlorite percentage and use the information in the table* below as a guide. Add the approved amount using a medicine dropper, teaspoon, or metric measure (milliliters/mL).
3. Stir the mixture well.
4. Let stand for at least 30 minutes.
5. Store disinfected water in clean, sanitized containers with tight covers.

Concentration of Sodium Hypochlorite	1 Quart/Liter Water	1 Gallon of Water	5 Gallons of Water
5% - 6%	2 drops / 0.1mL / Not measurable by teaspoon	8 drops / 0.5 mL / slightly less than $\frac{1}{8}$ teaspoon	40 drops / 2.5 mL / $\frac{1}{2}$ teaspoon
8.25%	2 drops / 0.1mL / Not measurable by teaspoon	6 drops / 0.5 mL / slightly less than $\frac{1}{8}$ teaspoon	30 drops / 2.0 mL / $\frac{1}{3}$ teaspoon

Cleaning Water Containers

1. Mix soap and clean water in container
2. Shake or stir to clean the inside of the container
3. Rinse container
4. Mix 1 teaspoon (~5 mL) bleach per 1 cup (240 mL) water and pour it into the container
5. Cover the container and shake so that the solution touches all inside surfaces
6. Cover and let stand for 30 minutes
7. Rinse container with clean water

Cleaning and Disinfecting Water Storage Tanks and Tankers

1. Drain any remaining liquid from the tank and dispose of it safely.
2. Clean the tank’s interior using a mixture of detergent and hot water, scrubbing all surfaces with a stiff brush or high-pressure sprayer.
3. Calculate the tank’s volume to determine the amount of chlorine needed for disinfection.
4. Wash and flush the tank with a high-pressure hose or water jet or fill it with hot water and let it stand for a few hours.
5. Drain and dispose of the water safely, continuing to flush until no traces of detergent remain.
6. Clean the hoses, pumps, and pipes used for filling and emptying the tank by flushing a mixture of hot water and detergent through them, followed by flushing with clean water.



7. Add the disinfectant by filling the tank a quarter full of clean water and sprinkling 80 grams of granular high-strength calcium hypochlorite (HSCH) per 1000 liters of tank capacity. Fill the tank completely, close the lid, and let it stand for 24 hours (or 8 hours if the chlorine quantity was doubled).
8. If the tank has a pump, circulate the disinfectant mixture through the hoses and pump for an hour, then repeat with clean water. If no pump is present, fill the hoses with disinfectant and let them stand for 24 hours before emptying and flushing with clean water.
9. Empty the tank, dispose of the disinfecting water safely, fill the tank with drinking water, let it stand for 30 minutes, then empty it again. The tank is now ready for use.

When selecting tanks for water storage, consider their normal use, ease of cleaning, and overall hygiene. Tanks that previously held water but have been out of use must undergo this thorough cleaning and disinfection process before being put back into service.

Cleaning and Disinfecting of Cisterns

1. If the cistern is connected to any water treatment units, close valves to those units. Follow manufacturer recommendations to disinfect the treatment system.
2. Add 3 cups (a little less than 1 liter) of 5% - 9% unscented liquid household bleach for every 100 gallons (about 380 liters) of water in the holding cistern.

Cistern Size (gallons)	Tank is $\frac{1}{4}$ full	Tank is $\frac{1}{2}$ full	Tank is $\frac{3}{4}$ full	Full Tank
200	1.5 cups	3 cups	4.5 cups	6 cups
450	3.5 cups	7 cups	10.5 cups	14 cups
600	4.5 cups	9 cups	13.5 cups	18 cups
1,000	7.5 cups	15 cups	22.5 cups	30 cups

Table adapted from CDC "Cisterns Before and After a Disaster."

3. If the cistern is connected to indoor plumbing, open each faucet and run the water until you smell chlorine (bleach).
4. Turn off all faucets and allow the solution to remain in the cistern and plumbing for at least 12 hours.
5. Drain all water from the cistern.
6. Refill the cistern with clean, safe water.
7. Open each faucet and run the water until you do not smell chlorine (bleach).

If your cistern uses untreated water and has open connections (for example, gutters and overflows), you might need to drain and clean your cistern. Ask your local health department whether this is needed. If so, use the following steps:

1. Remove all debris from the catchment or drainage area.
2. Remove all debris and water from the cistern.
3. If you can do it safely, scrub the inside of the cistern with a stiff brush and a solution of 1 cup (about 0.25 liter) of unscented liquid household bleach (5%–9% sodium hypochlorite) mixed with 10 gallons (about 38 liters) of water.
4. Rinse the cistern with clean water, then drain.
5. Refill the cistern.



Emergency Well Disinfection Steps

1. Determine your Standing Well Volume (SWV) and assess the general water quality of the well.
2. Use the tables below to calculate the required amounts of white vinegar and chlorine bleach (min. 5.25% sodium hypochlorite) based on your SWV and water quality.

Disinfection Quantities for Average Well Water Quality

NO sulfur, low-to-moderate bacteria and hardness

Standing Well Volume (gallons)	pH Control (white vinegar) Food Grade	Chlorine Required, min. 5.25% (Sodium Hypochlorite)*
500	1 ½ cups	1 cup
100	3 cups	2 cups
150	1 quart	2 ½ cups
200	5 ½ cups	3 ½ cups
250	6 ½ cups	1 quart
300	8 cups	5 cups
350	½ gal + 1 cup	6 cups
400	½ gal + 2 ½ cups	7 cups

*Amount of hypochlorite should be at least 5.25%; however, most household bleach now contains 8.25% sodium hypochlorite.

Table adapted from wellcare information on [Disinfecting Your Well](#).

Disinfection Quantities for Difficult Well Water Quality

HIGH bacteria, iron, hardness, and sulfur

Standing Well Volume (gallons)	pH Control (white vinegar) Food Grade	Chlorine Required, min. 5.25% (Sodium Hypochlorite)*
500	5 ½ cups	3 ½ cups
100	½ gal + 2 ½ cups	6 ½ cups
150	1 gallon	½ gal + 2 cups
200	1 gal + 5 cups	½ gal + 5 ½ cups
250	1 ½ gal + 2 cups	1 gal + 1 cup
300	2 gallons	1 gal + 1 quart
350	2 gal + 5 cups	1 ½ gal
400	2 ½ gal + 2 ½ cups	1 ½ gal + 3 cups

3. Switch OFF power to the pump and put the water treatment equipment into bypass mode.
4. Remove the well cap and pour the required amount of vinegar followed by chlorine into the well. Be sure to pour in one continuous flow, avoiding electrical connections and pitless adapters.
5. Switch the power back ON.
6. Attach a clean hose to a nearby faucet, place the other end into the well, and recirculate the chlorinated water for 1 hour to wash down the well casing and pump piping. Turn off the hose and recap the well.
7. Open each indoor faucet until a strong chlorine odor is detected, then shut off each one.



8. Allow the chlorine solution to remain in the well and plumbing system for 8 hours or overnight
9. Avoiding areas that drain into lakes or streams or onto plants, flush the entire system outdoors until the chlorine smell dissipates.
10. Flush the indoor faucets until the water runs clear.
11. Change water treatment filters and clean treatment devices per manufacturer's instructions, then put them back into service.
12. Retest your water supply for bacteria at least 2 days after disinfection to ensure the process was successful.

If the bacteria problem persists, consider installing a continuous disinfection system or consult a licensed well contractor or water treatment professional to assess potential issues with well construction or location.

Volume of water in well

$$\text{Volume (gallons)} = \text{Pi (3.14)} \times \text{Radius ft}^2 \times \text{depth of water in well (ft)} \times 7.48 \text{ gallons/ft}^3$$

Amount of chlorine

$$\text{Amount of chlorine required} = \frac{\text{Parts of chlorine desired}}{1,000,000} \times \frac{\text{Volume of water} \times 100}{\% \text{ Chlorine (whole number)}}$$

Resources

National Guidance and Standards

- [Drinking Water Advisory Communication Toolkit](#)
- [NEHA Water Quality Resources](#)
- [Planning for an Emergency Drinking Water Supply](#)

Forms

- [Emergency Repair Form](#)
- [EPA WARN Water System Status Report](#)
- [Natural Disaster Incident Report Form](#)
- [Photolog](#)
- [Suggested Questions for Water/Wastewater Utilities Damage Assessment Form](#)
- [Water System Status Report](#)

Regulations

- [CFR Part 141: National Primary Drinking Water Regulations](#)
- [CFR Part 142: National Primary Drinking Water Regulations Implementation](#)
- [CFR Part 143: National Secondary Drinking Water Regulations](#)
- [Regulation Timeline: Contaminants Regulated Under the Safe Water Drinking Act](#)

Sampling

- [Groundwater Sampling](#)
- [Industrial Stormwater Monitoring and Sampling Guide](#)
- [National Field Manual for the Collection of Water-Quality Data, Collection of Water Samples - USGS, 2019](#)
- [Potable Water Supply Sampling](#)
- [Surface Water Sampling](#)
- [Sampling Guidance for Unknown Contaminants in Drinking Water](#)



- [Quick Guide To Drinking Water Sample Collection](#)
- [Water, Sanitation, & Hygiene Preparedness Resource Library - NACCHO](#)
- [Water Sampling Method Specific Supplies](#)

Water Storage

- [Cisterns Before and After a Disaster | CDC](#)
- [Cleaning and Disinfecting Water Cisterns After Floods and Heavy Rains](#)
- [Cleaning and Disinfecting Water Storage Tanks and Tankers](#)
- [Creating and Storing an Emergency Water Supply](#)

Wells

- [Determining the Depth of a Well](#)
- [Disinfecting Wells After a Disaster](#)
- [Disinfecting Your Well / Desinfectar Su Pozo](#)
- [Inspecting A Well](#)
- [Managing a Flooded Well](#)
- [What to Do After a Flood](#)
- [Well Water Testing](#)



Assure the Safety and Integrity of Solid Waste/Debris Management Systems



Aligns to EPHEPR Function 4

Hurricanes generate enormous amounts of debris and can severely disrupt normal solid waste management systems, creating significant environmental and public health challenges. The combination of high winds, storm surge, and flooding can result in a complex mix of debris types, including vegetation, construction materials, hazardous waste, and even human remains.

Key hurricane-related challenges to solid waste and debris management include:

1. Overwhelming volume of mixed debris requiring rapid assessment and management
2. Damage to existing solid waste facilities and disruption of normal waste collection services
3. Potential for hazardous materials (HAZMAT) mixed with general debris
4. Flood-contaminated household items and building materials that require special handling
5. Blocked roads and access ways hampering debris removal efforts
6. Potential for vector breeding sites in accumulated debris and stagnant water
7. Need for rapid clearance of debris for search and rescue operations and restoration of critical infrastructure

Tasks

Assist in the removal or movement of chemicals to a safe area to prevent damage to property or the environment.

Assess the situation before beginning work, including how much waste is being produced, the types and volume of waste, and where and how often the waste is being disposed of. Determine whether there is any hazardous waste (see [Hazardous Waste Disposal](#)).

Characterize types and quantities of waste/debris, including household waste, construction and demolition debris, vegetative debris, and potentially HAZMAT (e.g., electronics, chemicals, asbestos).

Assess potential health risks associated with various debris types and disposal methods.

Collaborate with emergency management and other agencies to integrate EPH concerns into the overall debris management plan.

Identify suitable temporary staging areas and final disposal sites considering factors like distance from residential areas, soil conditions, groundwater protection, and potential environmental impacts.

Provide recommendations for alternative disposal methods (e.g., incineration) when necessary.

Establish protocols for safe handling (e.g., proper personal protective equipment, or PPE), storage, transportation, and disposal of hazardous waste materials in compliance with relevant regulations).

Ensure compliance with all relevant federal and state, tribal, local, and territorial (STLT) solid waste management regulations, including permitting requirements, transportation regulations, and environmental protection standards.

Develop public outreach and communication strategies to educate the community on proper waste segregation, hazardous waste handling, and responsible waste management practices.

Implement procedures for segregating waste streams at the source or during collection, separating HAZMAT, recyclables, and compostable organic matter.

Advise on the safe disposal of flood-contaminated household items.

Coordinate with relevant agencies to address special waste streams (e.g., electronic waste, household hazardous waste).

Ensure proper training, PPE, and safety protocols for all workers involved in waste management activities.

Consult local health services for advice on vaccination when handling debris.

Develop and implement vector control measures to prevent the proliferation of disease vectors like rodents, flies, and mosquitoes.



Monitor air quality at waste handling and disposal sites to detect and mitigate potential issues such as dust, odors, and pollutant emissions.

Monitor water quality near temporary debris sites and landfills to detect potential contamination.

Consider leachate (i.e., contaminated liquid that can seep from waste) collection issues that may arise due to the storm.

Conduct ongoing assessments of debris management operations to ensure they continue to meet public health and environmental standards throughout the recovery period.



Pro Tips

Must Know

Role of Environmental Public Health in Solid Waste and Debris

Within the Incident Command System (ICS), EPH responders may be asked to take on various roles related to post-disaster solid waste and debris management, which can be categorized into assessment, intervention, and communication:

- **Assessment** roles involve assisting other agencies in evaluating the types of waste and debris generated, determining potential health risks and safety hazards, and providing technical support to officials and stakeholders.
- **Intervention** roles include coordinating with waste management facilities and services, assessing waste management sites for safety and health risks, determining the need for regulatory waivers, and assisting in establishing timelines for resuming normal waste management services.
- **Communication** roles involve working with partners to ensure open lines of communication with authorities, responders, and the affected public. This includes providing information and guidance on emergency waste storage and disposal sites, changes in the waste management system, separation and collection of waste and debris, and potential safety and health risks associated with handling solid waste and debris. All information should be disseminated through a Public Information Officer (PIO) and in collaboration with the Joint Information Center (JIC).

Federal Laws Pertaining to Solid Waste and Debris

Statute	Purpose	Compliance Requirements
Robert T. Stafford Disaster Relief and Emergency Assistance Act, as mentioned (Stafford Act)	Provides the statutory framework for a Presidential declaration of an emergency or a declaration of a major disaster.	Section 316 allows for some statutory exclusions, generally applied to debris removal, clearance of roads, and demolition of unsafe structures; Section 403 covers Emergency Work, including debris removal and demolition; Section 407 specifically addresses debris removal; Section 502 authorizes direct Federal aid for debris removal.



Statute	Purpose	Compliance Requirements
National Environmental Policy Act (NEPA)	Requires Federal agencies to integrate environmental values into their decision making processes by considering the environmental impacts of their proposed actions and reasonable alternatives to those actions.	Requires decision-makers to be informed; Mandates public disclosure of environmental and historic considerations before work is initiated.
Resource Conservation and Recovery Act (RCRA)	Regulates facilities that generate, transport, treat, store, or dispose of hazardous waste.	Disposal of disaster-generated debris when hazardous and toxic waste are present.
Endangered Species Act (ESA)	Prohibits Federal actions that cause unnecessary harm to threatened or endangered plant and animal species.	Consultation with U.S. Fish and Wildlife Service or National Marine Fisheries Service when debris removal involves a known habitat of threatened or endangered species.
Coastal Barrier Resources Act (CBRA)	Protects the barrier islands, identified as Coastal Barrier Resource System (CBRS) units.	Debris removal in CBRS units is an eligible cost if it eliminates an immediate threat to lives, public health and safety, or protects improved property.
National Historic Preservation Act (NHPA)	Requires Federal agencies to consider the effects that a project or action may have on historic properties.	FEMA consults with State Historic Preservation Officers (SHPOs) and Tribal Historic Preservation Officers (THPOs) for the identification and evaluation of historic properties. This includes historic buildings and archaeological sites. Consultation may need to be completed prior to beginning work for a variety of projects including demolition and temporary housing.
Executive Orders (EO) 11988, 11990, and 12898	EO 11988 and 11990 preserve or restore the natural and beneficial values served by floodplains and wetlands; EO 12898 requires Federal agencies to evaluate actions for areas with disproportionately high minority and/or low-income populations and adverse effects on minority or low-income populations.	EO 11988 addresses Floodplain Management; EO 11990 addresses Wetland Protection; Debris management sites cannot be placed in a floodplain. The location of proposed debris management sites and final debris sites must be checked to ensure that water quality will not be affected adversely; EO 12898 addresses Environmental Justice.



Debris Collection

Household Garbage	Construction Debris	Vegetation Debris	Household Hazardous Waste	'White' Goods	Electronics
<ul style="list-style-type: none"> • Bagged trash • Discarded food • Packaging, papers • All garbage should be placed curbside the night before the scheduled weekly pickup. 	<ul style="list-style-type: none"> • Building materials • Drywall • Lumber • Carpet • Furniture • Mattresses • Plumbing 	<ul style="list-style-type: none"> • Tree branches • Leaves • Logs 	<ul style="list-style-type: none"> • Oils • Batteries • Pesticides • Paints • Cleaning supplies • Compressed gas 	<ul style="list-style-type: none"> • Refrigerators • Washers, dryers • Freezers • Air conditioners • Stoves • Water heaters • Dishwashers 	<ul style="list-style-type: none"> • Televisions • Computers • Printers • Radios • Stereos • DVD players • Telephones • Cell phones

Four Methods of Estimating Solid Waste and Debris

Ground Measurements	Visual observation and detailed data collection with equipment (e.g., measuring tapes, GPS units, formulas).
Aerial and Satellite Photography	Taken before and after a disaster.
Computer Modeling	There are several types of computer models for estimating the volume of solid waste and debris.
Combination of 2 or more of the above methods	

Best Practices

Worker Safety

Serious injuries may result from slips, trips, falls, puncture wounds, cuts, or collapsing materials, making it crucial to exercise caution in uneven or unstable areas. Debris can conceal hazards such as holes, leaking chemicals, and downed power lines, while destroyed structures may have hidden swimming pools, crawl spaces, and basements. Working with solid waste and debris also exposes individuals to various risks, including loud noise from equipment, carbon monoxide from machinery, animal bites or scratches, toxic gases, and other HAZMAT. Therefore, extreme caution is necessary when dealing with solid waste and debris to prevent injury or death.

Assess Waste and Debris

1. Understand federal, state, tribal, local, and territorial (STLT) laws on solid waste and debris.
2. Familiarize yourself with your jurisdiction's debris management plan. Make sure you are permitted to dispose of waste. If your jurisdiction does not have a debris management plan, refer to the U.S. Environmental Protection Agency's (EPA's) "[Planning for Natural Disaster Debris](#)" guidance.



3. Assist in assessing the types of wastes and debris generated by the disaster and identifying dangerous substances such as asbestos, mercury products, or chemicals and hazardous substances.
4. Help determine health risks and safety hazards.
5. Provide technical assistance and mitigation procedures concerning public health and safety. The EPA's [Incident Waste Decision Support Tool](#) assists planners in accessing vital technical information, regulations, and guidance. The tool is designed to aid in addressing crucial disposal concerns, ensuring safe and efficient removal, transportation, treatment, and disposal of debris and waste materials.

Eligible Debris Removal Activities

To be eligible for funding from the public assistance program, debris must:

- be generated by a Presidentially declared disaster;
- be located within the designated disaster area;
- be the legal responsibility of an eligible Applicant to remove; and
- present an immediate threat to life, improved property, or public health and safety.

Managing Waste During Disaster Events

General:

1. Develop a comprehensive waste management plan before a disaster strikes, including procedures for handling various types of waste and debris.
2. Coordinate with STLT authorities to ensure compliance with regulations and to access resources and support.
3. Clearly communicate waste management guidelines to the public and provide resources for proper disposal.
4. Prioritize the safety of waste handlers by providing appropriate personal protective equipment (PPE) and training.

Hazardous Waste:

1. Segregate hazardous waste from non-hazardous disaster debris to avoid disposing of the combined waste as hazardous, which can be costly.
2. Monitor collected business waste to ensure it does not meet the definition of hazardous waste.
3. Ensure waste handlers understand the requirements for managing hazardous waste and have a plan for controlling it and diverting it from the debris stream.
4. Obtain necessary permits for sites receiving hazardous waste and separate and store hazardous waste according to its toxicity and explosive properties.

Debris and Household Waste:

1. Call the facility contact before disposing of storm debris to ensure proper procedures are followed.
2. Separate storm debris by type, including construction and demolition materials, land clearing and inert debris, municipal solid waste, and white goods (major appliances).
3. Store storm debris only at Federal Emergency Management Agency (FEMA)-approved sites to ensure reimbursement eligibility.

Dead Livestock and Animals:

1. Properly dispose of dead animals and livestock to prevent disease and contamination of food and raw water sources.
2. Follow STLT regulations on carcass disposal, which typically involve burial.
3. Act quickly to remove and dispose of carcasses to minimize public health risks.



Food:

1. Assume that all foods in a disaster setting have been contaminated with water or debris.
2. Throw away all food that has come into contact with floodwaters or fire. Also dispose of all perishable food that has been above 40°F for more than 2 hours.
3. Educate the public on the importance of discarding unsafe food to prevent the spread of disease.
4. Encourage individuals to inspect food containers for damage, contamination, or expiration dates before consuming.

Disposal Options

Landfill

When disposing of trash in a municipal landfill, follow established STLT and federal regulations. If local facilities are unavailable, consider these alternatives:

1. Collaborate with neighboring communities or counties to set up a transfer station with compactors. This allows materials to be compacted and transported to the compactor's landfill.
2. Arrange to use a commercial landfill as an alternative disposal option.

Incineration

Burning or incineration can dispose of green waste, but it has significant environmental consequences. This method releases a large volume of greenhouse gases, primarily CO₂, and negatively impacts air quality. Close coordination with the EPA and the STLT environmental agency is necessary. Additional air monitoring and assistance from local fire departments will typically be required when burning green waste.

Recycle or Reclaim

The Resource Conservation and Recovery Act (RCRA) mandates reusing HAZMAT whenever possible and encourages recycling to minimize disposal costs. Some wastes can be treated and disposed of through ground application or agricultural uses, such as mulching and composting green waste.

Site Planning

1. **Assess** the need for facilities
 - Estimate the types and quantities of debris to be handled.
 - Evaluate the capacity of existing facilities to handle expected volumes and types of debris.
2. **Establish** criteria for evaluating potential sites
 - Consider storage time, real estate costs, truck size, location, site operations, capacity, collection, security, signage, accessibility, traffic conditions, roadway conditions, haul length, and equipment needs.
3. **Identify** temporary storage sites
 - Explore various options, including recycling facilities, landfills, transfer stations, vacant lots, corporation yards, parks, parking lots, rights-of-way, city/county-owned land, and private property.
4. **Review** emergency waiver of standards regulations
 - The Local Enforcement Agency (LEA) can issue "emergency waiver of standards" to solid waste facilities operators, providing temporary relief from specific state minimum solid waste standards or permit conditions, and establishing locally approved temporary transfer or processing sites.
 - The LEA may grant a waiver if the operator holds a valid permit; the waiver poses no threat to public health, safety, or the environment; and the operator implements diversion programs to maximize reuse, recycling, or composting of disaster-related waste.
5. **Identify** necessary permits or variances
 - Determine the agencies responsible for issuing permits/variances and the application processing time.
 - Utilize local authority to designate temporary storage areas and consider developing pre-approved waivers for these sites.



6. **Conduct** an environmental review of the site:
 - Perform a baseline assessment using a comprehensive checklist, including ground or aerial video/ photographs, soil and water samples, and monitoring for volatile organic compounds.
 - Establish groundwater monitoring wells and take progressive samples and updates throughout the site's operation.
 - Develop an environmental monitoring plan and have landowners sign liability waivers for private property use.
 - Note any nearby surface water that might receive runoff from the site.
7. **Develop** a site development and operation plan:
 - Create a plan for daily and long-term operations, including load inspection, contingency procedures for hazardous waste, material segregation, and processing techniques based on collected materials.
8. **Establish** inspection and site management guidelines:
 - Designate a disaster debris manager and set up inspection stands at the site, depending on the basis for payment.
 - Develop a tracking system for weight tickets if used as verification for payment.
9. **Create** a site restoration plan:
 - Identify the processing and removal of materials from the site.
 - Develop an environmental monitoring plan, including baseline monitoring and contamination testing.
 - Restore the site to its original condition upon project completion.

Resources

- [Defining Hazardous Waste: Listed, Characteristic and Mixed Radiological Wastes](#)
- [Environmental Health Training in Emergency Response Awareness Course](#)
- [Final Rule: Storage, Treatment, Transportation, and Disposal of Mixed Waste](#)
- [Guidance for Septic Systems Before, During and After a Flood](#)
- [Guidance for Septic Systems Before, During, and After a Power Outage](#)
- [Incident Waste Decision Support Tool](#)
- [OSHA Fact Sheet Asbestos](#)
- [Planning for Natural Disaster Debris](#)
- [RCRA Online](#)
- [RCRA Training Module: Introduction to Hazardous Waste Identification](#)
- [Solid Waste Exclusion § 261.4 Exclusions](#)
- [User-Friendly Reference Guide About Hazardous Waste Listings](#)
- [WHO Solid Waste Management in Emergencies](#)



Assure the Safety and Integrity of Wastewater Systems



Aligns to EPHEPR Function 5

Hurricanes can severely impact wastewater systems, which can lead to significant environmental and public health risks. The combination of heavy rainfall, storm surge, and flooding can overwhelm and damage wastewater infrastructure, leading to system failures and potential contamination of water sources. This function is critical both in the immediate aftermath of a hurricane and throughout the recovery period to protect public health, prevent environmental degradation, and restore normal sanitation services.

Key hurricane-related challenges to wastewater systems include:

1. Excess accumulation within treatment plants and pumping stations, potentially causing system shutdowns
2. Overflow of sewage systems due to excessive stormwater infiltration
3. Physical damage to pipes, treatment facilities, and other infrastructure components
4. Power outages affecting pumping and treatment operations
5. Contamination of water bodies and soil due to sewage spills or backflows
6. Increased risk of waterborne disease outbreaks in affected communities
7. Need for emergency sanitation solutions in areas with compromised wastewater systems

Tasks

Assess wastewater infrastructure, including treatment plants, collection systems, pump stations, and equipment, to prioritize repairs.

Implement a monitoring and sampling program to assess treated effluent and receiving water body quality, ensuring compliance with water quality standards.

Provide clear communication to the public regarding wastewater issues, risks, precautions, and advisories.

Establish communication and coordination with relevant agencies and stakeholders for a coordinated response.

Conduct ongoing and follow-up assessments of alternative wastewater and unregulated systems.

Provide technical assistance and conduct monitoring of wastewater systems from a public health perspective.

Conduct assessments of temporary or emergency disposal practices in the disaster area.

Communicate health risks and actions to take regarding proper emergency sewage disposal.

Coordinate the availability of sanitary alternative toilet/latrine facilities.

Identify health and safety risks for emergency response personnel and implement mitigation measures.

Advise on the public health implications of power loss at critical wastewater facilities.

Recommend measures to mitigate public health risks from potential sewage overflows.

Advise on proper disinfection procedures to mitigate waterborne disease risks.

Assess the public health implications of plans for handling excess sludge generated during recovery.

Evaluate the need for and recommend implementation of emergency wastewater treatment methods.

Monitor for potential cross-contamination between wastewater and drinking water systems, especially in flooded areas.

Provide guidance on safe practices for cleanup and disinfection of areas affected by sewage backups or overflows.

Collaborate with environmental agencies to assess the impact of wastewater issues on local ecosystems and potential indirect public health effects.



Pro Tips



Must Know

Pre-Disaster Wastewater Preparedness

1. **Maintain** a comprehensive list of wastewater treatment plants.
2. **Consider** Recreational Vehicle (RV) parks as alternative treatment sites.
3. **Develop and maintain** emergency plans for alternative treatment sites.
4. **Keep** an updated contact list of septage haulers and portable toilet companies.
5. **Establish** a maintenance schedule for contact lists.
6. **Understand** your community's wastewater operations.
7. **Identify** unique wastewater vulnerabilities in your community.
8. **Invest** in preparedness and build wastewater system resiliency.
9. **Stock** service vehicles with equipment and supplies.

Minimum Recommended Personal Protective Equipment (PPE)

- Goggles to protect eyes from splashes of human waste or sewage
- Protective face mask or splash-proof face shield to protect nose and mouth from human waste or sewage splashes
- Liquid-repellent coveralls to keep human waste or sewage off clothing
- Waterproof gloves to prevent exposure to human waste or sewage
- Rubber boots to avoid exposure to human waste or sewage

Alternative Means of Treating Wastewater

1. Estimate wastewater volume
2. Determine the number of fixtures needed
3. Consider the population served
4. Ensure adequate service frequency
5. Coordinate location for holding device(s)

Holding Containers

If a natural disaster significantly damages a community's wastewater system, a thorough assessment must be conducted to determine the extent of the damage and the estimated time required for repairs. If the evaluation reveals that the repairs will take longer than the allotted time for reoccupation, it is crucial to implement alternative means of liquid waste disposal to maintain public health and sanitation standards. When normal waste collection systems are inoperable, temporary solutions can be employed to collect and store waste. These solutions include the use of the following:

- Grouped portable toilets
- Waste bladders
- Waste tanks

However, while these alternative devices may be readily available, they must be serviced daily to prevent the accumulation of waste and potential health hazards.

Septage and Sewage Disposal Options

- Disposal in a sewage treatment plant
- Temporary storage in a tank (holding tank)
- Lime stabilization with land application
- Drying beds
- Composting
- Landfill burial
- Transporting out of disaster-affected area



Best Practices

Emergency Facilities at Home - Options

Option 1: Modify an existing toilet.

In the aftermath of a disaster, the normal water supply to your toilet may be disrupted; however, if the wastewater system is still operational, you can manually flush your toilet by following these steps:

1. Locate a bucket or large container and fill it with water.
2. Carefully pour the water into the toilet tank until it reaches the normal fill line.
3. Flush the toilet as usual, and the water poured into the tank will help dispose of the waste.

If the wastewater system is not functioning or water is completely unavailable, you can still use your toilet to safely dispose of human waste by following this procedure:

1. Line the toilet bowl with a heavy-duty plastic bag, ensuring it covers the entire bowl and overlaps the edges.
2. After each use, add a small amount of bleach or disinfectant to the bag to help control odors and prevent the spread of germs.
3. Tightly tie or seal the bag when it is nearly full or after each use, if possible.
4. Remove the bag from the toilet and place it in a designated waste storage area, such as a lined trash can with a tight-fitting lid, until proper disposal is possible.

Option 2: Create a homemade port-a-john.

1. Use 5-gallon buckets lined with heavy-duty plastic garbage bags.
2. Add deodorizers such as lime, household bleach, or kitty litter.
3. Keep buckets in a cool, dark place with a tight lid.
4. Do not throw human waste in the regular trash.
5. Bury waste or dispose of it by flushing the toilet when services are restored.
6. Clean and disinfect buckets after use.

Note: Ensure portable waste collection systems (port-a-potties, waste bladders) are stored and easily accessible for servicing and that they meet minimum offset distances from a drinking water supply or human habitation area according to local regulations.

Outdoor Spills

1. Wear the appropriate PPE before working on a failed wastewater collection system.
2. Stop the source of the outdoor sewage spill.
 - Contact the utility responsible for the sewage system.
 - Focus on preventing further wastewater discharge.
 - Pump down lift stations using pumper trucks or divert wastewater flows to redundant transmission lines.
3. Estimate the volume of the sewage spill to determine the affected area.
 - Consider the normal flow of the failed lift station or pipe.
 - Utilize Supervisory Control and Data Acquisition (SCADA) systems, if available, to gather data on lift station pump run times and wastewater flow in transmission pipes.
 - If SCADA data is not available, estimate the normal flow by finding out the number of sewer connections to the affected lift station.
 - Survey residents and spill witnesses to determine the time and duration of the spill.
 - Use the collected information to make the best estimate of the spill volume.
 - Examine the surrounding terrain and drains to identify the geographic extent of the affected area.
4. Determine the type(s) of drains affected by the sewage spill.
 - Identify whether the spill has connected with storm sewers, sanitary sewer drains, combined



- sewers, or private property drains.
 - Be familiar with the local jurisdiction and the types of drainage systems utilized.
 - Understand that the network of drainpipes and systems can transport spilled wastewater in various directions and over long distances.
- 5. Block drains to minimize the extent of the affected area.
 - Use sandbags or parapets to block drains.
 - Prioritize blocking efforts based on the type of drains, focusing on those that connect with surface water first.
- 6. Communicate the possible hazard to the public.
 - Use caution tape and signage to quickly mark off the affected area.
 - Inform the public about the sewage spill and the potential health risks associated with the contaminated area.
- 7. Pump sewage off the ground.
 - Use appropriate pumping equipment to remove as much sewage as possible from the affected area.
 - Dispose of the pumped sewage according to state, tribal, local, and territorial (STLT) regulations.
- 8. Treat the affected area.
 - Spread powdered lime over the entire spill area to help neutralize odors and bacteria.
 - Alternatively, or in addition to lime, treat hard surfaces with calcium hypochlorite (HTH) or a bleach/water solution to disinfect the area.
 - Remove contaminated materials, such as playground sand, to prevent further contamination.
- 9. Allow the area to air dry.
 - Let the affected area air dry for at least a day to help reduce moisture and promote evaporation of remaining contaminants.
- 10. Clean up the area.
 - Rake up any excess lime, HTH, or contaminated materials, and place them in heavy-duty garbage bags for proper disposal.
 - Dispose of the bags according to STLT regulations.
- 11. Revegetate and restabilize the area.
 - If the affected area includes soil or landscaping, revegetate the area with appropriate plants or grass to help restore the environment and prevent erosion.
 - Ensure that the area is stabilized correctly to minimize the risk of future contamination or environmental damage.

Indoor Cleanup of Sewage Spill

- Wear rubber boots and gloves.
 - Disinfect all mops, sponges, and brushes.
 - Wash all clothes worn during cleanup separately from other laundry.
- Clean and disinfect contaminated surfaces.
 - Plumbing fixtures and vinyl, metal, wood, and concrete surfaces should be cleaned thoroughly with hot water and a mild detergent, such as dish detergent, and then disinfected with a bleach solution.
 - Mix one part of liquid household bleach with 10 parts of water (1:10). Thoroughly dampen contaminated surfaces and allow them to air dry.
- Remove and discard porous materials.
 - Upholstered furniture, loose rugs, and drapery cannot be salvaged and must be appropriately discarded.
 - Remove and replace all lath, plaster, plasterboard, and drywall that is saturated to the point of being soft to the touch.
 - Wall-to-wall carpeting and carpet pads cannot be reliably disinfected and must be removed and sent to a local transfer station.



Message Diagram: Providing the public information about dealing with sewage in their home

IMPORTANT: This information must be coordinated through the Public Information Officer (PIO).

Main Message: The County Health Department is concerned about your health and the spread of disease. Keeping pets, children, and others out of areas contaminated with sewage will help prevent the spread of disease.

1. What Should You Do if There Is Sewage in Your Home?

- Limit access to the area.
- Keep everyone, especially children and pets, out of all wet areas in your home.
- After the sewage is no longer backing up, thoroughly clean all areas, including but not limited to carpets, sheetrock, drywall, and baseboards.
- If your entire home has sewage in it, you may need to leave until all areas have been cleaned.

2. If You Have a Septic Tank:

- Do not pump your tank pre-storm or post-storm until groundwater has returned to normal.
- Limit the use of water in your home as much as possible.
- The dosing tank, which is used for adding chemicals or other substances, will not operate without electricity.
- Flood-prone areas and areas filled with water will not allow the septic tank to operate properly until the drain field dries out.
- Avoid contact with any septic system electrical devices until they are dry, clean, and repaired by a licensed technician.

3. What Can You Do to Prevent Illness or Injury?

- Avoid contact with any septic system electrical devices until they are dry, clean, and repaired by a licensed technician.
- If you encounter sewage, wash your hands thoroughly with soap and water.
- Wash clothes that encounter sewage in hot water with sanitizing detergent and dry them on high heat. Discard any clothing that is heavily soiled.
- If you become ill with symptoms such as diarrhea or vomiting, see your doctor.

4. If You Have City or Municipal Sewage:

- Contact your utility company to let them know you are having problems.
- If you do not know who your utility company is, contact the citizen's information line at (XXX) XXX-XXXX.

Resources

- [Emergency Repair Form](#)
- [Guidance for Septic and Onsite Wastewater Systems](#)
- [NEHA Wastewater Resources](#)
- [Suggested Questions for Water/Wastewater Utilities Damage Assessment Form](#)
- [Photolog](#)
- [Wastewater System Status Report](#)



Assure the Safety of Emergency Shelters

Aligns to EPHEPR Function 6



Hurricanes often require the rapid establishment and operation of emergency shelters to offer safe refuge for displaced individuals. These shelters play a crucial role in protecting individuals from the immediate dangers of the storm and its aftermath. However, the concentrated population, potential for extended stays, and the challenging conditions created by hurricanes can pose significant public health risks within these facilities. EPH professionals are essential in ensuring that these shelters remain safe and healthy environments throughout the emergency period.

Key hurricane-related challenges for emergency shelters include:

1. Rapid influx of displaced individuals, potentially overwhelming shelter capacity
2. Extended shelter operations due to widespread damage and prolonged recovery periods
3. Potential loss of power, water, and sanitation services
4. Risk of communicable disease spread in close-quarter living conditions
5. Challenges in maintaining food and water safety under emergency conditions
6. Management of diverse populations, including those with different access and functional needs (AFN) or medical requirements
7. Potential for vector-borne disease risks due to standing water and debris near shelters
8. Stress on shelter infrastructure and resources during prolonged use
9. Mental health issues and substance abuse issues at the shelter
10. Pet owners wanting to bring their pets or identify a pet-friendly shelter

Tasks

Coordinate with local health authorities, emergency management agencies, and disaster shelter providers to ensure access agreements are in place, allowing EPH agency assessors to enter facilities.

Conduct EPH assessments of emergency shelter conditions (e.g., water, feeding, sanitation, spatial considerations, structural hazards, pests, nuisances).

Ensure requirements for adequate numbers of hygiene facilities are met, including bathrooms, showers, and hand washing stations.

Verify that the facility has adequate access to safe water and ice for drinking, cooking, cleaning, and personal hygiene. If needed, provide alternatives, like bottled or bulk delivery.

Implement proper waste management, labeling, and separation, including adequate receptacles, regular collection, and hazardous/medical waste handling.

Evaluate food storage, preparation, and serving capacity, ensuring food safety compliance with local Food Code Standards.

Assess ventilation and indoor air quality to mitigate the risks of mold, carbon monoxide, and other pollutants. Ensure fire alarms, smoke detectors, and carbon monoxide detectors work and are in good operational condition.

Develop and implement infection control protocols, including hand hygiene, surface disinfection, children's food preparation and play areas, and isolation procedures.

Implement vector, fly, and rodent monitoring and control measures.

Assess and advise on health-related accommodations for individuals with disabilities or different AFN.

Verify gas-operated generators and cleaning equipment are located at a safe distance from facilities and homes, away from doors and windows that can allow infiltration of toxic fumes.

After the initial assessment, establish a risk-based schedule for monitoring EPH conditions within shelters. To ensure prompt remediation, visit facilities with numerous critical deficiencies or impacts more frequently.

Provide guidance and training to shelter staff and volunteers on EPH principles, safety protocols, hygiene practices, and emergency response procedures.



Collaborate with medical professionals to address health needs and prevent disease outbreaks in shelter populations.

Develop communication strategies to inform occupants about health risks, safety measures, and available resources.

Identify and recommend necessary resources to maintain safe and healthy conditions in shelters.

Ensure critical areas in the disaster shelter are identified (e.g., fire exits, pet holding or relief areas, isolation, smoking, hazardous substances).

Verify that shelter facilities designated for house pets are identified and assessed to ensure they meet health and safety standards conducive to humane housing and protecting the health and safety of animals and their caretakers.

Conduct regular reassessments and adapt EPH measures as needed based on changing conditions and emerging risks.

Pro Tips



Must Know

Shelter Assessments

EPH professionals play a crucial role in ensuring the health and safety of shelter occupants, staff, and volunteers throughout the shelter cycle. Their responsibilities include:

1. **Assessing available facilities:** Before or immediately after an emergency or disaster, responders help identify and assess potential shelter locations and their capacities, ensuring they have adequate support functions such as access, sanitation facilities, food services, and sleeping accommodations.
2. **Pre-operational assessments:** Ideally, responders should conduct assessments before a shelter opens to proactively identify and address health and safety issues.
3. **Operational assessments:** Once shelters are open, responders conduct routine assessments to ensure ongoing health and safety. The frequency of assessments depends on factors such as shelter size, type, and occupancy, with larger or higher-risk shelters requiring more frequent attention.
4. **Using standardized tools:** The Center for Disease Control and Prevention (CDC)'s [Environmental Health Assessment Form for Shelters](#) is a valuable tool for rapidly assessing conditions, identifying priorities, providing recommendations to shelter management, and documenting data for future planning.
5. **Coordination with partners:** EPH must work closely with shelter management and other partners to determine the appropriate nature and extent of EPH assessments for each shelter.

Classifications, Estimated Space Requirements, and Typical Operation Periods of Shelters

Shelter Classification	Sleeping Space Allocation	Operation Period
Evacuation Shelter General Population (Short-Term)	20 ft ² (4 x 5 ft)	24 hours before to 72 hours after event
Shelter General Population (Recovery Phase)	40 ft ² (4 x 10 ft)	72 hours after the event and beyond
Access and Functional Needs Shelter (AFN)	60 - 100 ft ² (Up to 10 x 10 ft)	24 hours after the event and beyond
Responder / Base Camps	40 ft ² (4 x 10 ft)	Beginning of event and beyond



Basic Shelter Guidance

Shelters should be located in protected inland areas away from hazards and accessible to the population via major highway or road routes. Schools, places of worship, and sports facilities are often used as shelters because they have flexible floor plans, restrooms, and food facilities all in one location.

Consideration	Description
Life-safety compliant	Two: fire egress, emergency lighting
Space	ARC evacuation shelter, useable space 20ft ² per person (short term). ARC recovery shelter, useable space 40ft ² (longer term). Adequate air space/person. Adequate spacing: 3 feet between cots (consider family clusters).
Structural Integrity	Hurricane rating
Water and Sanitation	<ul style="list-style-type: none"> ▪ 4 - 5 gallons of water per person/day ▪ ARC 1 toilet per 20 people ▪ ARC 1 shower per 20 people ▪ ARC 1 hand sink per 20 people ▪ Laundry facilities: onsite or contracted services
Solid Waste	One 30-gallon container per 10 people
Sewage Disposal	Consider system capacity

Best Practices

Environmental Public Health (EPH) Staff for Shelters

As part of the health and medical team within the shelter operations, EPH may be asked to assess the various operations of the shelter to ensure health and safety standards are met and maintained.

Consider:

- 24-hour on-call staff
- Permanent staff in large facilities
- Minimum of one EPH specialist per facility depending on size
- Security staff

Do-It-Yourself Hand washing Station

Materials Needed:

- Clean 5-gallon water jug with a spigot
- Liquid soap, preferably in a pump dispenser
- Paper towels or cloth towels
- Waste bin for used towels
- Optional: Sanitizer gel, a sturdy table or stand, and signage with hand washing instructions

Steps to Set Up:

1. Prepare the Water Jug: Fill the 5-gallon water jug with clean water. If clean water is scarce, treat the water with purification tablets or methods recommended by health authorities.
2. Set Up the Station: Place the water jug on a raised platform or table where it is easily accessible but stable. Ensure the spigot hangs over the edge so users can wash their hands without spilling water on the platform.



3. **Dispense Soap:** Place the liquid soap dispenser next to the water jug. If using bar soap, consider placing it in a mesh bag to keep it clean and dry between uses.
4. **Towel and Waste Bin:** Arrange paper towels or a stack of clean cloth towels nearby. If using cloth towels, plan for laundering. Place a waste bin near the station for used towels and other waste.
5. **Hand Sanitizer (Optional):** Place a bottle of hand sanitizer at the station for an additional disinfection option after washing hands.
6. **Instructional Signage:** Create or print out clear instructions for effective hand washing and display them prominently at the station. Include steps for wetting hands, applying soap, scrubbing for at least 20 seconds, rinsing, and drying.
7. **Regular Maintenance:** Check the station to refill supplies and ensure the water is clean. Dispose of waste materials appropriately and clean the area to maintain hygiene.
8. **Accessibility:** Ensure the station is accessible to everyone, including children and those with disabilities. Adjust the height and setup as necessary.

Spill Kit Personal Protection and Supplies Checklist

Protective equipment:

- Disposable latex/vinyl gloves
- Eye protection/face shield
- Masks/respirator
- Protective gowns or aprons

Supplies:

- Paper towels
- Plastic garbage bags
- Absorbent
- Mop and mop bucket
- Approved disinfectant for norovirus

Spills and Cleanup

Disinfectants (Bleach - Household 5.25%)

Food/Mouth Contact Surfaces	1/3 cup per gallon of water or 1,000 ppm.
Nonporous Surfaces	1/3 cup per gallon of water or 1,000 ppm.
Porous Surfaces, Floors	1 1/2 cup per gallon of water or 5,000 ppm.
Spot Cleanup	1 1/2 cup per gallon of water or 5,000 ppm.

Cleaning Large Spill of Vomitus or Stool

1. Put on appropriate PPE before cleanup.
2. Secure the area before beginning the cleanup process.
3. Remove visible/organic debris with absorbent material.
4. Double-layer the absorbent material and place it in a plastic bag to minimize exposure to aerosols.
5. Liberally disinfect the area and surrounding objects with an appropriate environmental disinfectant.
6. Multiple applications may be required.
7. Ensure appropriate dilution and contact time for the chosen disinfectant.



Laundry Service Considerations

Here are some considerations for laundering for shelter operations:

- Always wear gloves and aprons when handling laundry to prevent the spread of germs and to protect your clothing.
- Use a hot wash cycle with water temperature between 105 - 120°F (40 - 49°C) for at least 10 minutes to effectively kill germs.
- Dry laundry on a hot setting at 160°F (71°C) for at least 30 minutes to ensure thorough disinfection.
- If the above washing and drying criteria are met, no bleach is necessary for disinfection.
- If linens are heavily soiled, it is best to dispose of them to prevent the spread of contamination.
- Designate separate areas for sorting and folding laundry to minimize the risk of cross-contamination.
- Mark and separate storage areas for clean and soiled linens to prevent mixing and contamination.
- Ensure that clean linen storage is easily distinguishable from soiled linen storage to avoid confusion.

Infection Control

- Ensure a separate area for ill persons.
- Provide hand washing/sanitizing stations at each entrance to the isolation/observation area.
- Increase cleaning schedule frequency.
- Encourage respiratory hygiene (i.e., disposable tissues, frequent hand washing, hand sanitizers available, cough/sneeze into sleeve).
- Maintain adequate supplies (i.e., tissues, soap, disposable towels, hand sanitizer) on-site.
- Open restroom doors.
- Increase restroom cleaning frequency to hourly.
- Sanitize common surfaces with bleach or other EPA-approved disinfectants.

Resources

- [ADA Checklist for Shelters \(2007\)](#)
- [AMCA's Best Management Practices - American Mosquito Control Association](#)
- [Caring for Our Children](#)
- [CSPECE Disaster Recovery Supplement | Safe Places for Child Care | ATSDR \(cdc.gov\)](#)
- [Emergency Shelter - Immediate Needs](#)
- [Environmental Health Assessment Form for Disaster Shelters](#)
- [Environmental Health Disaster Shelter Assessment Guide](#)
- [EPA - Registered Disinfectants](#)
- [Humanitarian Charter and Minimum Standards in Disaster Response](#)
- [Integrated Pest Management Principles](#)
- [Minimum Design Loads for Buildings and Other Structures, ASCE/SEI 7-10](#)
- [Minimum Design Loads And Associated Criteria for Buildings And Other Structures](#)
- [Ready.gov/Shelter](#)
- [Shelter Based Care for Homeless Populations](#)
- [Shelter Field Guide](#)
- [Sheltering Handbook: Disaster Services](#)
- [Shelter Operations: Pet-Friendly Shelters \(ready.gov\)](#)
- [Social Media Graphics – messaging \(different languages\)](#)
- [Standards for Hurricane Evacuation Shelter Selection](#)



Assure the Integrity of Food Supply and Delivery Systems



Aligns to EPHEPR Function 7

Hurricanes can severely disrupt food supply and delivery systems, posing significant risks to public health and safety. The combination of power outages, flooding, and infrastructure damage can compromise food safety at various points in the supply chain, from storage facilities to retail outlets and households. This function is critical both in the immediate aftermath of a hurricane and throughout the recovery period to prevent foodborne illnesses and ensure access to safe, nutritious food for affected populations.

Key hurricane-related challenges to food supply and delivery systems include:

1. Extended power outages leading to food spoilage in refrigerators and freezers
2. Flood contamination of food storage facilities and retail establishments
3. Disruption of transportation networks, hindering food distribution
4. Damage to food processing and packaging facilities
5. Compromised sanitation in food preparation areas due to lack of clean water
6. Increased risk of foodborne disease outbreaks due to improper food handling and storage.
7. Potential for contamination of crops and agricultural lands by floodwaters
8. Challenges in maintaining cold chain integrity during emergency food distribution

Tasks

Assess food production, processing, storage, and distribution facilities for damage, power outages, and contamination risks.

Assess and provide guidance on maintaining proper cold chain temperatures for perishable foods during storage, transportation, and distribution.

Evaluate the safety of food exposed to floodwaters, debris, or contaminants and dispose of contaminated or unsafe items.

Assess water sources used in food facilities for safety and potability, establishing alternatives if needed.

Implement pest control measures to prevent infestation and contamination.

Identify potential food safety risks associated with disruptions in transportation and distribution systems.

Provide recommendations for emergency food supplies, alternative sources, and distribution channels that meet food safety standards.

Coordinate with agencies and organizations for a unified response to restore the food supply chain.

Implement communication strategies for food safety, handling, storage, and assistance programs.

Provide just-in-time training on food safety principles and emergency protocols for food industry personnel, emergency responders, and volunteers.

Ensure compliance with food safety regulations related to handling, transportation, labeling, and recordkeeping.

Conduct rapid assessments to identify impacted food service establishments and inspect them to ensure the safety of continuing or resuming operations.

Investigate potential foodborne disease outbreaks related to hurricane-impacted food systems. Identify and prioritize high-risk foods and food systems for immediate intervention and monitoring.

Provide technical assistance and guidance on proper disposal of contaminated or potentially contaminated foods.

Identify risks to the health and safety of emergency response personnel involved in food-related operations and implement mitigation measures.





Pro Tips

Must Know

Food Safety Basics

- **Clean and Sanitize:** Wash hands and surfaces often. Sanitize food contact surfaces.
- **Separate:** Do not cross-contaminate.
- **Cook:** Cook to proper temperatures, checking with a food thermometer.
- **Chill:** Refrigerate promptly.

Mandatory Reportable Illnesses

Food workers are required to report any of the following diagnoses to the person in charge. Some of these diseases, such as norovirus, may not be required to be reported to the health department or included in the National Notifiable Diseases Surveillance System (NNDSS). Additional symptoms such as vomiting, diarrhea, etc., must also be reported to the person in charge and the food worker displaying the symptoms must be sent home. Workers cannot work while they are sick.

Send	<i>Salmonella</i> *
Sick	<i>Shigella</i>
Employees	<i>E. coli</i>
Home	Hepatitis A
Now	Norovirus

*Nontyphoidal *Salmonella* and Typhoid Fever (*Salmonella Typhi*)

When Potable Water is Not Available

- **Discontinue:** Discontinue service until an alternative water supply is approved.
- **Disconnect:** Disconnect ice and beverage systems from the water supply.
- **Limit:** Limit menu and use only single-service utensils.
- **Dishwasher Unavailable:** Fill a 3-compartment sink with boiled water for ware washing. Boiling water can remove bacteria but will have minimal impact on chemical contamination.
- **Stations:** Set up hand washing stations.

Reopening After Water Supply Issues

- Flush water lines, water heaters, and other reservoirs for at least 5 minutes.
- Clean ice machine, bins, and other equipment connected to the water system, including all filters and strainers in equipment and water lines.
- Discard the first hour of production of replacement ice (2–3 bins) and at least the first 5 minutes of the beverage.

Reopening after Sewage Backup or Flood

- Suspend food and beverage service until reopened by regulatory authority.
- Remove standing floodwater and sewage.
- Remove and discard affected food, single-service, and uncleanable surfaces.
- Thoroughly air-dry area to remove residual moisture.
- Clean affected hard surfaces with hot detergent solution then rinse and disinfect/sanitize.
- Use a qualified service person to inspect equipment before reconnecting utilities.
- Replace all damaged food, single-service, and other supplies.
- Replace all damaged physical facilities with approved materials.



Reopening after the Power Goes Out

1. **For freezers with thermometers:** Check temperature when power returns. Food is safe to refreeze if it is 40°F or below.
2. **Without a freezer thermometer:** Inspect each food item individually. Items are safe to refreeze or cook if ice crystals remain or temperature is 40°F or below. Do not judge by appearance or smell alone.
3. **For power outages under four hours:** Refrigerated food should be safe if doors remained closed. Upon power restoration, check the fridge or food temperature. Discard perishables (e.g., meat, dairy, leftovers) above 40°F for 4+ hours. Items at 45°F or below are likely safe but they should be cooked and eaten soon.

Remember: Inadequately refrigerated or frozen perishables may cause illness even after thorough cooking.

Hazard Analysis and Critical Control Point (HACCP)

The Hazard Analysis and Critical Control Point (HACCP) approach, commonly used in daily food service operations, can also be applied during emergencies and disasters. The Food and Drug Administration (FDA) defines HACCP as a management system that addresses food safety by analyzing and controlling biological, chemical, and physical hazards throughout the entire food production process, from raw materials to the finished product.

Critical actions for safe food handling during emergencies include:

1. Using disposable and single-service items to minimize dishwashing
2. Keeping food in bags and containers to reduce cross-contamination
3. Separating drinks from food items
4. Avoiding ice baths for cooling drinks

If refrigeration is not available:

1. Pack ice on top of and around food, keeping in mind that cold air sinks and warm air rises.
2. Use separate coolers for raw foods, such as lettuce and raw meat products, to prevent cross-contamination.
3. Ensure that the ice used comes from a safe, approved source.

By implementing the HACCP approach and following these critical actions, food safety risks can be minimized during emergency and disaster situations.

Protecting Food from Contamination

To protect food from contamination, ensure the following measures are implemented:

1. Cleaning and sanitizing equipment and food contact surfaces
2. Proper handling of raw food
3. Proper handling of prepared food
4. Proper storage, holding, and serving temperatures

Consult with food operation managers, workers, and volunteers to ensure these measures are being followed and provide guidance and on-site education and training if necessary.

Equipment should be washed in warm soapy water, rinsed in warm water, sanitized, and air-dried. Food preparation surfaces should be cleaned and sanitized before, during, and after food preparation.

Proper handling of raw food includes storing meat, poultry, seafood, and eggs separately from ready-to-eat food items, refrigerating at 41°F or below, and cooking food until it reaches recommended temperatures to destroy pathogenic organisms.



Prepared food should be stored separately from raw foods and surfaces where raw foods have been prepared or stored, wrapped, covered, or sealed with appropriate material, and placed in proper containers for transport to feeding sites.

Cold food should be stored and maintained at 41°F or below, while hot food must be maintained at 135°F or above. Food within the “Danger Zone” (between 41°F and 135°F) for more than four hours should be discarded. Food cooked in large pots and pans should be cooled quickly using shallow food storage pans or ice paddles.

Food is recommended to be cooked and served, with all leftovers discarded, to ensure food safety.

The American Red Cross developed the “Rules of Four” to help volunteers comply with food safety rules: Keep food cold below 40°F, hot above 140°F, and discard food outside of this temperature range after four hours.

Posters, fliers, and other educational materials with key food safety messages can be great reminders for those preparing and serving food at mass feeding operations.

Checking Temperature Reminders

- For meat, poultry, and fish, insert the thermometer into the thickest part of the food.
- For liquids, insert the thermometer until the sensing area is completely submerged.
- Do not touch the bottom or sides of the container or any bones in the meat.

Food Type	Cooking Temperatures
Poultry	165°F (74°C) for 15 seconds
Seafood	145°F (63°C) for 15 seconds
Eggs (raw, prepared for immediate service)	145°F (63°C) for 15 seconds
Eggs (held for later service)	155°F (68°C) for 17 seconds
Beef and pork injected with tenderizers	155°F (68°C) for 17 seconds or to 158°F (70°C)
Steak (intact)	145°F (63°C) <i>Note: Intact steak does not require a time requirement but a color change.</i>
Pork chops and tenderloin medallions	145°F (63°C) for 15 seconds
Ready-to-eat (RTE) foods commercially processed in airtight containers or intact packaging	135°F (57°C) within 2 hours
Stuffing made with Time/Temperature Control for Safety (TCS) foods, stuffed fish, meat, poultry, or pasta	165°F (74°C) for 15 seconds
Leftovers or previously cooked TCS foods	165°F (74°C) for 15 seconds
Ground meats/fish	145°F (63°C) for 3 minutes 150°F (66°C) for 1 minute 155°F (68°C) for 15 seconds 158°F (70°C) for more than 1 second



Unpermitted Food Operations

Unpermitted food operations often emerge during emergencies and disasters, ranging from complex operations serving large amounts of food to individuals serving soup and sandwiches. Although well-intended, these operations pose the same health and safety risks as donated food.

Environmental public health (EPH) should:

1. Use critical thinking, sound judgment, and professionalism when addressing unpermitted food operations.
2. Assess the level of risk for foodborne illness.
3. Follow state, tribal, local, and territorial (STLT) rules, laws, and guidance.
4. Implement a system for identifying assessed operations.
5. Confirm that feeding operations are properly authorized to operate.

In extreme cases, warnings and citations can be issued, and operations can be forced to close by appropriate authorities, with assistance from the Incident Safety Officer (ISO), jurisdictional health officer, or law enforcement, if needed.

Reopening Food Establishments

1. EPH's Role:
 - Assess affected food establishments before reopening.
 - Be aware that requirements vary by jurisdiction.
 - Consult with supervisors to clarify responsibilities, workload, hours, and partners.
2. Assessment Planning:
 - Collaborate with community leaders and stakeholders.
 - Develop plans based on jurisdictional priorities, guidelines, and procedures.
 - Consider factors such as:
 - Reopening priorities
 - Needs of at-risk populations
 - Availability of critical utilities
 - Establishments' willingness to open with limited menus or single-service items
 - Adequacy of staff
 - Political considerations
 - Other community needs
3. Rapid Assessments:
 - Conduct initial assessments to determine which establishments can reopen quickly and which may take longer.
 - Use incident-specific assessment forms or checklists.
4. Tracking:
 - Maintain records of progress on reopening establishments.
 - Report progress to relevant authorities (e.g., EOC, IC, health officer).
5. Common Issues:
 - Decomposed food requiring specialized disposal
 - Limited trash service necessitating additional waste disposal services
 - Rodents, insects, and animals attracted to decomposing food and harborage sites
 - Lack of utilities prolonging closures
 - Mold, especially after water-related incidents
 - Limited access to cleaning supplies, equipment, and approved food sources



Mass Feeding Centers

Pre-Operational Assessment

EPH plays a critical role in ensuring the safety and health of mass feeding sites during emergencies. Whenever possible, they should conduct pre-operational assessments of these sites to identify and mitigate potential risks. This involves reviewing mass feeding plans, discussing safety and health concerns with site managers, and providing food safety training to staff and volunteers before operations begin. Many issues can be prevented by ensuring that the kitchen facility is properly designed for food preparation, storage, and service; has an adequate supply of safe drinking water; and is staffed by well-trained volunteers.

During pre-operational assessments, EPH professionals should review the following items:

1. 24/7 management contact information
2. Type of food operation
3. List of menu items
4. Approved food suppliers
5. Food preparation, service, and disposal procedures
6. Food preparation schedule
7. Food safety training of management and staff/volunteers
8. Safe, approved water source
9. Sewage disposal
10. Solid waste disposal
11. Vector control and pest management
12. Plans for disrupted utilities
13. Personal hygiene practices

Operations: Personal Hygiene

To minimize the risk of food contamination in mass feeding operations, workers and volunteers should always use approved gloves and serving utensils. Ill workers and volunteers should not participate in mass feeding operations, as they can spread pathogens directly onto food or to their coworkers.

Hand washing stations are essential in maintaining proper hygiene and should be equipped with the following supplies:

1. Soap
2. Clean, running water
3. A wastewater disposal system
4. Disposable towels (common towels should be avoided)
5. A trash can

By ensuring that workers and volunteers follow proper hygiene practices and have access to well-stocked hand washing stations, the risk of food contamination and the spread of illness can be significantly reduced in mass feeding operations.

Best Practices

Temperature Measurement Reminders

There are four things to consider when using temperature devices:

1. **Calibration:** Make sure your thermometer is accurate.
2. **Cross-contamination:** Clean the probe with an alcohol swab after use.
3. **Positioning:** How do you take the temperature of a large pot of soup in the refrigerator? Stir the pot. For meats, insert the thermometer into the thickest part of the meat.
4. **Interpretation:** What are the required temperatures for various cooked, hot, and cold foods? (See [Checking Temperature Reminders](#)).



You can use a crushed ice bath to calibrate. The thermometer should read 32°F in an ice bath. Use a wrench to adjust the nut on the back of the thermometer to adjust the temperature. Electronic devices can also be calibrated.

Food Safety Assessment Supplies

- Approved food temperature measurement devices:
 - Bayonet-type thermometer: simple, basic, and low-cost
 - Thermistor: slightly more expensive; requires batteries
 - Thermocouple: most accurate, some have storage capacity
 - Infrared thermometer: can be expensive; suitable for quick surface temperature readings, but has limitations
- Approved alcohol swabs
- Sanitizer test strips
 - The three primary chemical types are chlorine (most common), quaternary ammonia, and iodine.
 - At minimum, carry chlorine and quaternary test strips. Quaternary ammonia test strips should be matched with the correct generation of quaternary ammonia sanitizer that is being used.
- Temperature strips
- Flashlight
- GPS
- Disposable gloves
- Hand washing reminder signs
- Permit modification forms
- Closure signs
- Camera
- Paper, tape, and markers

Retail Food Facilities

After a hurricane, food safety at retail food facilities can be compromised. When environmental public health (EPH) professionals arrive on-site, they should assess the following elements:

- Building/electrical safety
- Water supply
- Waste disposal
- Food waste disposal
- Food salvage
- Vermin control
- Cleanup
- Refrigeration
- Food/provision resupply
- Ice machines
- Beverage systems



Food Product Salvage Evaluation Guide

When in doubt, throw it out!

Flood / Water Damage		
Food Product	Action	Explanation/Instruction
Fresh fruits and vegetables	Destroy	Contaminants can be absorbed by produce.
Screw-top, crimped cap, twist-cap, pop-top containers submerged or splashed	Destroy	Not cleanable under/around caps. Containers returned for deposits or recycling must be drained.
Permeable (paper, cardboard, cloth, plastic, etc.) containers submerged	Destroy	Inadequate barrier to contaminants and water.
Hermetically sealed containers (cans, pouches) submerged or splashed	Salvage	Re-label, if necessary, by removing the label; wash, rinse, sanitize (100 ppm chlorine), dry, and re-label with all required information and codes.
Alcoholic Beverages (closed with cork, screw-top, twist-top, crimped cap)	Destroy	Check with the Bureau of Alcohol, Tobacco, Firearms, and Explosives (ATF) regarding alcohol tax reimbursement (large volume).
Electrical Outage		
Refrigerated foods (PHF, TCS Food > 41°F more than 4 hours)	Destroy	If less than 4 hours, can be iced or moved to the working unit.

Resources

National Guidance and Standards

- [A Consumer's Guide to Food Safety: Severe Storms and Hurricanes](#)
- [Bad Bug Book: Handbook for Foodborne Pathogenic Microorganisms and Natural Toxins](#)
- [CDC National Outbreak Reporting System](#)
- [CIFOR Guidelines for Foodborne Disease and Outbreak Response](#)
- [FDA Investigations Operations Manual](#)
- [Foodborne Illness Investigation: Food Worker Interview](#)
- [Food Sorting Guidance and Model Consumer Commodity Salvage Code](#)
- [Food Safety During Power Outage](#)
- [Food Worker Illness Flowchart](#)
- [FSMA Final Rule for Preventive Controls for Human Food](#)
- [Hazard Analysis and Critical Control Point \(HACCP\) Approach](#)
- [National Environmental Assessment Reporting System \(NEARS\)](#)
- [National Retail Food Program Courses](#)
- [NEHA Food Establishment Inspection Report](#)
- [NEHA Food Safety Resources](#)
- [State Retail and Food Service Codes and Regulations by State](#)
- [U.S. Food and Drug Administration 2022 Food Code](#)

Forms

- [Food Establishment Inspection Report](#)
- [Minimum Standards for Operation of a Retail Food Establishment While Under a Boil Advisory](#)



Assure the Safety and Integrity of Buildings

Aligns to EPHEPR Function 8



Hurricanes can cause extensive damage to buildings through high winds, flooding, and storm surge, potentially rendering them unsafe for occupancy. Even after the immediate danger has passed, buildings may harbor hidden hazards that pose significant risks to public health.

Key hurricane-related challenges to building safety and integrity include:

1. Structural damage from high winds and flying debris
2. Water damage and potential mold growth from flooding and roof leaks
3. Contamination from sewage backflows or chemical spills
4. Compromised electrical systems posing fire and electrocution risks
5. Damage to Heating, Ventilation, and Air Conditioning (HVAC) systems affecting indoor air quality
6. Potential exposure to hazardous materials (HAZMAT) like asbestos or lead from damaged building materials
7. Displacement of pests and wildlife into buildings
8. Challenges in safely cleaning and restoring flood-damaged structures

Tasks

If requested, **participate** in damage assessments of buildings and identify potentially HAZMAT (e.g., asbestos, lead-based paint, mold).

Identify EPH hazards resulting from building damage, such as water intrusion, structural damage, debris, damaged electrical wires, gas leaks, roof damage, and other risks.

Evaluate buildings for mold growth and implement appropriate remediation protocols.

Conduct indoor air quality monitoring for contaminants like carbon monoxide, volatile organic compounds (VOCs), and particulate matter.

Assess the integrity of sewage and wastewater systems in buildings and prevent backflow or overflows.

Evaluate the potability of building water supplies, establishing alternative sources or treatment methods if needed.

Inspect ventilation systems for contamination with debris, mold, or pollutants.

Identify and assess the potential for disturbance of asbestos-containing materials and lead-based paint in damaged buildings.

Develop and implement occupant safety protocols and communicate potential health and safety risks.

Coordinate with local officials, agencies, and emergency management for a unified response to building safety and EPH concerns.

Train building owners, managers, and occupants on EPH, safety protocols, hazard identification, and best practices after a hurricane.

Provide technical assistance to responding agencies in the planning of temporary housing sites.

Provide technical assistance and guidance to the public for assessing, restoring, and maintaining the sanitation, safety, and EPH integrity of homes, public buildings, and businesses for safe re-occupancy.

Identify risks and implement mitigation measures for health and safety risks to emergency response personnel involved in building assessments and restoration.





Pro Tips

Must Know

National Center for Health Housing (NCHH) Seven Guiding Principles of Safe and Healthful Homes:

1. Dry
2. Clean
3. Ventilated
4. Pest-free
5. Safe
6. Contaminant-free
7. Maintained

Damage and Hazard Assessment Process

1. Assess structural stability:
 - Inspect for creatures, chemicals, and biohazards
 - Inspect utilities: electrical, gas, and water
 - Inspect heating, ventilation, and cooling (HVAC) systems
 - Assess health hazards (e.g., mold, lead in paint, dust, soil)
2. Restore
3. Maintain Sanitation, Safety, and Environmental Integrity

Best Practices

Pre-Assessment Coordination

Pre-assessment coordination is crucial before conducting post-disaster building assessments. During this coordination, work with key partners such as emergency management, code enforcement, building owners/operators, support staff, property appraisers, and utility services to gather information about damages, potential hazards, and building-specific details. The topics discussed during pre-assessment coordination may include:

1. **Mission scope:** Describes the work to be performed, number and types of buildings to be assessed, operational period, Health and Safety Plan, and roles and responsibilities.
2. **Legal right of entry:** Established before assessments begin and varies by jurisdiction.
3. **Equipment needs:** Depends on the mission scope and EPH's roles and responsibilities.
4. **Special training needs:** May be required for evaluating specific contaminants (e.g., lead, asbestos) or using field equipment for sampling.
5. **Assessment forms:** Provided by authorities and used to record the condition of key building elements. Forms should be completed thoroughly and accurately.
6. **Personal Protective Equipment (PPE) needs:** Practitioners should be familiar with the required PPE for specific buildings, which is usually Level D with a possible N-95 respirator.
7. **Communication/contact needs:** Established during pre-assessment coordination; includes personnel accountability, communication equipment, specific contact protocols, and chain of command.

Assessment Teams

Post-disaster building assessments are best conducted by teams of two or more people to ensure safety, efficiency, and multiple perspectives. One team member can perform the assessment and take photographs while others complete the assessment forms. EPH responders collaborate with the assessment team to determine:

1. The safety of the building exterior
2. Whether the building is safe to enter
3. Types of hazards in and around the building
4. The condition of utilities in or around the building

As the team approaches the building, they continue to note the type and extent of damage and potential hazards. Team members work around the structure, moving in one direction, then assess the exterior again by walking in the opposite direction to ensure a comprehensive visual assessment.



Exterior Assessments

During exterior assessments, the building assessment team evaluates the condition of utilities, HVAC systems, water supply, wastewater systems, foundation, and the overall building structure.

Utilities	<ul style="list-style-type: none"> ▪ Look for broken water or sewer lines, standing water, damaged heat pumps and HVAC units, and sparking wires. ▪ Qualified team members assess utilities for damage; if none are available, contact utility companies. ▪ Do not enter structures with suspected gas or fuel leaks and treat downed power lines as if they were live. ▪ Assess electrical power status visually or using a non-contact voltage meter.
HVAC	<ul style="list-style-type: none"> ▪ Visually assess for physical damage, electrical damage, and evidence of flooding. ▪ Consider the potential for mold growth if flooded; may require cleaning or replacement before activation. ▪ If needed, have a qualified HVAC technician perform a detailed inspection.
Water Supply	<ul style="list-style-type: none"> ▪ Determine whether the building is connected to a public or private water system. ▪ For public systems, look for damage to service connections, leaking pipes, and water availability/pressure. ▪ For private systems, look for damage to well cap/casing and holding tank, system pressure, leaking pipes, and potential contamination sources.
Wastewater Systems	<ul style="list-style-type: none"> ▪ Determine whether the building is connected to a public or private wastewater system. ▪ For public systems, check if lift stations and pumps are operable, and look for visible sewage, damaged pipes, and signs of backflow. ▪ For private systems, check for inoperable pumps, tank damage, visible sewage, leaking manholes, drain field damage, saturated soil, and signs of backflow.
Foundation	<ul style="list-style-type: none"> ▪ Assessed by a structural engineer or qualified individual; EPH may provide consultation on potential safety and health hazards.
Building Structure	<ul style="list-style-type: none"> ▪ Look for damage to windows, doors, vents, siding, roof components, holes, and other missing or damaged exterior components.

Interior Assessments

Interior assessments are conducted to identify broken, damaged, warped, or cracked walls, floors, ceilings, and other interior structural and non-structural items that may pose safety and health hazards. Assist with assessing, identifying, and alerting team members to these hazards, which may include:

1. Damaged or collapsed floors, walls, and ceilings
2. Broken flooring, wall plaster, or ceiling tiles that may contain asbestos or harmful chemicals
3. Wet ceilings, drywall/sheetrock, wallpaper, carpeting, and padding that may contain mold or be conducive to mold growth
4. Damaged or chipped paints that may contain lead, especially in older buildings
5. Damaged cabinets, garages, and storage areas that may contain leaking chemicals

Two frequently used assessment patterns for the interior of a building are:

1. Go Right/Stay Right
2. High-to-Low/Low-to-High



When assessing large open areas like auditoriums, cafeterias, or open office spaces, an effective assessment technique is to:

1. Walk slowly with team members in a horizontal line through the open area to the far wall and back, making a general visual assessment.
2. Return to the starting point and utilize the Go Right/Stay Right or High-to-Low/Low-to-High techniques or patterns.

Post-Assessment Communication

After a building assessment is completed, the assessment team compiles the results and communicates them to building owners, authorities, response partners, and other community stakeholders. The building owners are informed that the assessment does not replace an insurance assessment. Assessment findings and recommendations can be communicated using an information sheet or placard, which should be translated into appropriate languages for the community.

Before approving a building for re-entry and re-occupancy, the EPH professional and the assessment team review the assessment information in the context of the disaster, building function, and potential occupant safety and health risks. The following questions are taken into consideration:

Disaster Considerations:

- Does the building serve a critical need that outweighs any potential safety and health hazards or building function concerns?
- Do the benefits of using the building outweigh the negatives of potential safety and health hazard exposure or building function loss?

Building Function:

- Do the potential safety and health hazards impact or diminish building function?
- How much of an impact can building function absorb?
- Can the occupants modify the use of the building, or can building components be modified to allow temporary use until hazards are abated?

Occupant Risk Assessment:

- What level of potential safety and health hazard exposure is acceptable, given the building's function, use, and intended occupants?
- What are the potential short-term and long-term safety and health risks that could arise from that exposure?

If the risk of injury or illness from potential safety and health hazards is deemed low enough, EPH can recommend that a building is safe to reenter and reoccupy. However, they typically do not have the official role or authority to condemn, clear, or determine whether a building is habitable or uninhabitable. They can make safety and health recommendations and offer guidance to those who have the official role or authority within a jurisdiction.

Resources

- [Damage Assessment Operations Manual: A Guide To Assessing Damage and Impact](#)
- [Environmental Testing and Sampling Methods](#)
- [FEMA Post-disaster Building Safety Evaluation Guidance](#)
- [HUD Guide to Post-disaster Restoration for a Safe and Healthy Home](#)
- [Identification and Treatment of Health Issues of Concern](#)
- [NEHA Healthy Homes Resources](#)



Assure the Safety of Indoor/Outdoor Air Quality

Aligns to EPHEPR Function 9



Hurricanes can significantly impact both indoor and outdoor air quality, creating potential health risks for affected populations and emergency responders. The aftermath of a hurricane often presents a complex array of air quality challenges, from mold growth in water-damaged buildings to the release of hazardous substances from damaged industrial facilities or flooded households.

Key hurricane-related challenges to air quality include:

1. Mold proliferation in flood-damaged buildings, leading to indoor air quality issues
2. Release of hazardous materials (HAZMAT) from damaged industrial sites, storage facilities, or households
3. Increased particulate matter in the air due to debris and cleanup activities
4. Emissions from generators used during power outages
5. Potential for asbestos and lead dust from damaged building materials
6. The release of chemicals/gases from flood-soaked materials
7. Increased allergens and irritants from disturbed vegetation and debris
8. Air quality impacts from post-hurricane fires or burning of debris

Tasks

Establish an outdoor air monitoring program to assess levels of particulate matter, volatile organic compounds (VOCs), and other pollutants released due to debris, flooding, or industrial facility damage.

Conduct indoor air quality assessments in buildings and shelters, focusing on contaminants like mold, carbon monoxide, and asbestos.

Design and implement mold remediation protocols for water-damaged buildings, ensuring proper containment, removal, and disposal.

Inspect and evaluate ventilation systems in buildings for contamination or compromise.

Provide recommendations for debris management strategies to minimize air quality impacts during cleanup and demolition.

Identify and contain potential sources of HAZMAT released into the environment.

Develop and disseminate clear communication and advisories to the public regarding air quality risks, protective measures, and safe return guidance.

Coordinate with relevant agencies and authorities for a unified response to air quality concerns.

Ensure availability and proper use of personal protective equipment (PPE) for individuals involved in cleanup or remediation activities.

Provide information to the public about generator safety and carbon monoxide awareness.

Train local health workers, emergency responders, and community members on air quality monitoring, hazard identification, and best practices.

Establish a long-term monitoring and remediation plan to address persistent air quality issues and ensure continued safety during recovery.

Assist in conducting assessments to collect and analyze data needed to determine safe reentry and re-occupancy of homes and facilities in the community.

Identify air-quality-related risks to health and safety of emergency response personnel and implement mitigation measures.





Pro Tips

Must Know

Mitigation and Remediation Efforts for Property Owners/Communities

Indoor Air Quality:

- **Source Control:** Eliminate individual sources of pollution or reduce their emissions.
 - Remove or reduce the source
 - Seal or cover the source
 - Modify the environment
- **Improved Ventilation:** Increase the amount of outdoor air coming indoors.
 - Dilute contaminants with outdoor air
 - Isolate or remove contaminants by controlling air pressure relationships
 - Dilute contaminants by increasing the flow of outdoor air
- **Air Cleaners:** Remove particles with air cleaners.
 - Particulate filtration
 - Electrostatic precipitation
 - Negative ion generation
 - Gas sorption

Mold:

The most common indoor molds are:

- *Cladosporium*
- *Penicillium*
- *Aspergillus*
- *Alternaria*
- *Stachybotrys chartarum* (also known as black mold)

To prevent and get rid of mold:

- Keep your house clean and dry
- Fix water problems such as roof leaks, wet basements, and leaking pipes or faucets
- Make sure your home is well-ventilated, and always use ventilation fans in bathrooms and kitchens
- If possible, keep humidity in your house below 50% by using an air conditioner or dehumidifier
- Avoid using carpeting in areas of the home that may become wet, such as kitchens, bathrooms, and basements
- Dry floor mats regularly

To find mold that might be growing in your home:

- Search for moisture in areas that have a damp or moldy smell, especially in basements, kitchens, and bathrooms
- Look for water stains or colored, fuzzy growth on and around ceilings, walls, floors, windowsills, and pipes
- If you smell a musty odor, search behind and underneath materials such as carpeting, furniture, or stored items
- Inspect kitchens, bathrooms and basements for standing water, water stains and patches of out-of-place color

To control moisture problems and mold:

- Fix any water problems immediately and clean or remove wet materials, furnishings, or mold.
- Clean up spills or floods within 1 day. If practical, take wet furniture outside to dry and clean. Direct sunlight prevents mold growth.
- Dry all surfaces and fix the problem or leak to prevent further damage.
- Install a dehumidifier when a moisture problem is evident or when the humidity is high.



Best Practices

Environmental Sampling for Outdoor Air Quality:

Pre-Sampling Considerations:

- Determine the purpose and objectives of the sampling event.
- Review background information and historical data for the sampling site.
- Identify potential sources of air pollutants and evaluate meteorological conditions.
- Select appropriate sampling methods and equipment based on the target pollutants.

Sampling Site Selection and Preparation:

- Choose a sampling site that meets the site selection criteria outlined in the document.
- Prepare a site sketch and document site conditions and potential interferences.
- Establish a suitable upwind background location for background sampling, if required.
- Set up the sampling equipment and ensure proper operation and calibration.

Sampling Methods and Procedures:

- Ambient air sampling can be conducted using various methods, including:
 - Integrated sampling (e.g., High-Volume [HV] samplers, Particulate Matter [PM] samplers)
 - Continuous sampling (e.g., continuous emission monitors)
 - Grab/Direct sampling (e.g., Summa canisters, Tedlar bags)
- Follow the specific procedures outlined for each sampling method, including flow rate adjustments, leak checks, and quality control measures.
- Properly handle, preserve, and label the collected samples.

Documentation and Quality Assurance/Quality Control:

- Maintain detailed field notes and sampling logs.
- Document site conditions, weather data, and any deviations from standard procedures.
- Collect and analyze field blanks, trip blanks, and other quality assurance/quality control (QA/QC) samples as required.
- Ensure proper chain of custody procedures for sample handling and transport.

Post-Sampling Activities:

- Properly decontaminate and store sampling equipment.
- Package and ship samples to the analytical laboratory following appropriate protocols.
- Review and validate the sampling data, considering QA/QC results.
- Interpret the data and prepare a comprehensive report summarizing the sampling event and findings.

Sample Analysis

Analyze sampling results from various environmental sources against baseline results and/or preexisting standards.

Exposure Guidelines

Provide recommendations on exposure guidelines and health risks presented by indoor and outdoor air quality.

Assessment for Reentry and Re-Occupancy

1. Evaluate the building structure to determine whether it is safe to enter or use the structure.
2. Ensure the building is connected to utility infrastructure.
3. Inspect the structure's interior to determine which materials, furnishings, and items can be salvaged or need to be replaced or disposed of.
4. Provide clearance of the building for reentry or re-occupancy based on sampling and assessment of environmental media.



Resources

- [Diagnosing IAQ Problems](#)
- [Emergencies and Indoor Air Quality](#)
- [EPA Ambient Air Sampling](#)
- [Improving Indoor Air Quality](#)
- [Mitigation and Remediation Efforts for Property Owners/Communities](#)

Flood Cleanup

- [Flood Cleanup and Indoor Air Quality: Resource Summary](#)
- [Flood Cleanup to Protect Indoor Air Quality and Your Health](#)
- [Resources for Flood Cleanup and Indoor Air Quality](#)

Mold

- [About Mold and Moisture](#)
- [A Brief Guide to Mold, Moisture, and Your Home](#)
- [Damp Buildings, Human Health, and HVAC Design](#)
- [Homeowner's and Renter's Guide to Mold Cleanup after Disasters](#)
- [Indoor Air Quality by Building Type](#)
- [Mold Cleanup](#)
- [NIEHS Disaster Recovery - Mold Remediation Guidance](#)
- [Worker and Employer Guide to Hazards and Recommended Controls](#)



Provide Vector Surveillance and Control



Aligns to EPHEPR Function 10

Hurricanes can create ideal conditions for disease carrying vectors to thrive. This significantly increases the risk of vector-borne diseases in affected areas. The aftermath of a hurricane often leaves behind standing water, debris, and disrupted ecosystems, which can lead to explosive growth in populations of mosquitoes, rodents, and other vectors.

Key hurricane-related challenges for vector surveillance and control include:

1. Widespread creation of new breeding sites for mosquitoes in floodwaters and debris
2. Displacement of rodents and other animals into human-populated areas
3. Disruption of normal vector control programs due to infrastructure damage
4. Increased human exposure to vectors in emergency shelters and during cleanup activities
5. Potential for introduction of new vector species or diseases into affected areas
6. Challenges in implementing control measures in flooded or debris-filled environments
7. Heightened public concern about vector-borne diseases following a disaster

Tasks

Conduct assessments of insect, animal, and rodent vectors to include population densities, infectivity rates, and human risk potential.

Lead or support surveillance, mitigation, and control of insect and animal vectors.

Develop an Integrated Pest Management (IPM) strategy combining source reduction, biological control, and targeted chemical control.

Develop and disseminate educational materials on vector-borne disease risks, personal protection measures, and eliminating breeding sites.

Coordinate with relevant agencies for a unified vector control response. Utilize existing materials, plans, and systems that can be modified to fit your needs.

Identify and pursue appropriate Federal Emergency Management Agency (FEMA) assistance for mosquito control activities.

Coordinate with appropriate agencies to ensure availability of licensed public health pesticide applicators.

Establish a data management system to record and evaluate vector surveillance and control activities.

Train local health workers, vector control personnel, and community members on surveillance techniques, control methods, and personal protection measures.

Assess potential vector breeding sites and population levels a week after the hurricane, surveying areas with standing water, debris accumulation, and damaged infrastructure.

Implement a mosquito surveillance program using adult trapping, larval dipping, and oviposition trapping.

Apply larvicides to standing water and conduct targeted adulticide applications based on surveillance data, following safety protocols.

Implement rodent control measures, including trapping, baiting, and environmental management.

Ensure safe and proper use of pesticides, adhering to label instructions, use of personal protective equipment (PPE), and regulations.

Continuously monitor vector populations and disease incidence, adapting the control strategy as needed based on trends, conditions, and effectiveness.

Identify potential risks associated with vector control activities and implement mitigation measures.

Communicate vector-borne disease health risks and actions that the public can take to reduce vector populations and prevent disease transmission.





Pro Tips

Must Know

Integrated Pest Management (IPM)

IPM is a comprehensive approach to pest control that focuses on minimizing the use of pesticides while effectively managing pest populations. The National Pest Management Association (NPMA) recommends the following five steps for implementing an IPM program:

1. **Inspection and Surveillance:** Identify pest issues and monitor pest populations.
2. **Pest Identification:** Determine the type of pests present for targeted control.
3. **Action Thresholds:** Set levels that trigger pest control measures.
4. **Control Measures:** Implement a mix of physical, biological, and chemical control methods.
5. **Evaluation:** Monitor and adjust control strategies for effective pest management.

Insecticides

Insecticides are substances designed to manage insect populations by either causing their death or disrupting their behavior to prevent them from causing damage or being a nuisance. Insecticide applications may be necessary after other control options have been considered, data from surveillance efforts justify use, or a public health need exists. When feasible, using both larvicides and adulticides in a mosquito control program best manages populations of mosquitoes by killing existing adults and preventing new adults from emerging.

Best Practices

Work quickly to get sanitation services back online. Power outages will lead to spoiled food that needs to be disposed of properly to keep it from becoming a rodent food and shelter source.

After a disaster, the rodent population can be decimated, and it will take time to reestablish colonies. During reestablishment, engaging the community and promoting awareness of rodent control measures through varying communication strategies can help create a collective effort to reduce the risk of infestations.

Rodent Control Activities After a Disaster:

1. Understand where there are established rodent populations. If the area does not have a rodent control program, see if you can map rodent service requests made through systems like 311.
 - Monitor long-term reports of disease following a disaster.
2. Observe signs of growing rodent populations and identify areas most vulnerable to rodent access and human contact, such as:
 - Shelters
 - Food storage areas
 - Garbage dumps
 - Abandoned vehicles
3. Work to control rodent populations and get sanitation services back online to handle increased waste following the hurricane.
4. Engage experienced professionals to capture and study rodents for potential health threats.
 - Professionals should examine rodents for fleas, mites, lice, and any illnesses they may carry.
 - Ensure proper equipment is used, especially if rodent-borne diseases are identified.
 - Do not allow inexperienced personnel to handle this task.



5. Disseminate educational materials on how to safely clean up after rodent infestations, covering the following key points:
 - Recognizing signs of rodent presence
 - Implementing precautions when entering structures heavily infested with rodents to minimize health risks
 - Advice on the wetting and wiping of contaminated surfaces to reduce the risk of inhaling dried rodent waste particles
 - Providing guidelines for properly disposing of rodent carcasses to prevent further contamination and potential health hazards

Assisting with Rodent Control Measures

Environmental public health (EPH) may assist with rodent control measures after a disaster through direct involvement, supervising activities, or providing technical information and guidance. The two main rodent control methods are trapping and chemical control through rodenticides.

Chemical control:

- Uses edible baits containing rodenticides
- Baits vary by species and geographic region
- Different types of rodenticides have varying mechanisms and advantages/disadvantages
- Always follow manufacturer recommendations and regulations when using rodenticides
- Most common are multi-dose baits (blocks, pellets, toss packs) placed strategically in infested areas
- Use generous amounts of fresh bait, place bait out of reach of children and pets, and use bait stations to prevent accidental exposure
- Risks include accidental poisoning of children, pets, and wildlife, and secondary poisoning of animals that ingest poisoned rodents

Trapping:

- An alternative to rodenticides
- Used for parasite/blood sampling, rodenticide failure, or high risk from rodenticides
- When removing dead rodents from traps:
 - Spray with EPA-approved disinfectant or bleach solution.
 - Use gloves, double seal in bags, and discard in outdoor waste receptacles.
 - Disinfect reusable gloves, wash hands thoroughly, and disinfect traps before reuse.

Activity Documentation

Maintain thorough documentation and detailed records of rodent control activities according to established procedures in the jurisdiction. This documentation is crucial for:

1. Evaluating the effectiveness of rodent control efforts
2. Securing cost reimbursement for disaster-related activities from various authorities
3. Establishing baseline data for future disasters
4. Addressing potential post-disaster legal concerns

Responders should also be prepared for rodent hysteria and avoid overreacting. Misconceptions about rodents may be more prevalent following a disaster. EPH should collaborate with Public Information Officers (PIOs) and the Joint Information Center (JIC) to dispel rumors and misinformation related to rodent populations.



Mosquitoes

1. Assess the situation.

- Conduct a rapid assessment of potential mosquito breeding sites
 - Prioritize high-risk locations, such as densely populated areas, critical infrastructure, and vulnerable populations to efficiently allocate resources and reduce risks.
 - Understand that nuisance mosquitoes will hatch immediately after a hurricane.
 - Understand the types of mosquitoes common to the affected area and determine whether any of the twelve disease-carrying species are present.
 - Understand current vector monitoring and control measures in the area if you are part of a strike team.

2. Implement larviciding measures.

Type of Larvicide	Description
Liquids	Liquid larvicide products are applied directly to water using backpack sprayers and truck- or aircraft-mounted sprayers.
Dunks, tablets, bits, pellets, granules, and briquettes	These forms of larvicide are also applied to areas where mosquitoes lay eggs.

- Steps for Application:
 - Select your larvicide. Factors include:
 - Effectiveness
 - Environmental impact
 - Compatibility
 - State, tribal, local, and territorial (STLT) regulations and expert guidance for effective control

- Use larvicides to treat standing water that:
 - Will not be used for drinking.
 - Cannot be covered, dumped, or removed.

- Apply larvicides where mosquitoes lay eggs.

IMPORTANT: Some states, tribes, and territories require an applicator license. Check STLT laws concerning who can apply pesticides, including larvicides.

Use larvicides where mosquitoes lay eggs to help reduce the number of mosquitoes in an area. Mosquitoes lay eggs in items that hold water, such as:

- Buckets and rain barrels
- Fountains
- Gutters or downspouts
- Non-chlorinated swimming pools
- Pool covers that collect water
- Tires
- Tree holes

ALWAYS follow the instructions on the label. Do not apply more than directed or reapply more often than instructed.

3. Perform adult mosquito surveillance.

- Set up traps to monitor adult mosquito populations and species composition.
- Focus on areas with a high likelihood of human exposure, such as residential areas where people have stayed in homes that may be damaged.
- Maintain detailed surveillance records and analyze data to verify the efficacy of control efforts. Reimbursement for control efforts typically requires surveillance data to qualify for financial reimbursement through FEMA.



4. Coordinate with local vector control agencies.
 - Collaborate with STLT agencies to share information, resources, and expertise.
 - Ensure a unified approach to vector control efforts to maximize effectiveness.
5. Educate the public on personal protection measures.
 - Encourage the use of EPA-registered repellents.
 - If practical, promote wearing long-sleeved shirts and long pants to minimize skin exposure.
 - Advise residents to use window screens and eliminate standing water around their homes.
6. Consider aerial spraying in high-risk areas.
 - If adult mosquito populations reach critical levels, coordinate with local agencies to conduct targeted aerial spraying. If local resources are unavailable, request assistance through STLT or federal partners.
 - Ensure proper communication with the public about the spraying schedule and any necessary precautions.
7. Monitor and respond to vector-borne disease outbreaks.
 - Work with epidemiologists to track reported cases of mosquito-borne illnesses such as West Nile virus or Zika virus.
 - Adjust vector control strategies based on disease surveillance data and outbreak investigations.

Control Measures

Physical Control (Source Reduction)

Source reduction, also known as physical or permanent control, is a method of mosquito control that involves physically altering mosquito breeding habitats to prevent the completion of their life cycle. The complexity of source reduction methods varies depending on the targeted mosquito species and their breeding habitats:

1. For container-breeding mosquitoes (e.g., *Aedes aegypti*, *Aedes albopictus*, *Culex spp.*), source reduction involves discarding water-holding containers that serve as breeding sites. Proper management of tire facilities is crucial, as tires provide an ideal habitat for these mosquitoes.
2. In freshwater habitats, source reduction may involve creating ditches or channels to drain areas of water or establish habitats for natural predators of mosquito larvae, such as fish. This helps reduce mosquito populations by eliminating standing water and promoting the presence of natural control agents.
3. For salt marsh mosquitoes (e.g., *Aedes sollicitans*), source reduction can be more complex and may require soil manipulation to restore the habitat and control mosquito breeding. Altering the landscape and drainage patterns can effectively eliminate their breeding sites.

Biological Control

Biological control of mosquitoes is a natural process that involves introducing various predators to feed on adult mosquitoes, larvae, and pupae. Operational biological control focuses on the aquatic stages of the mosquito life cycle and can be supported by introducing predators to target larvae and pupae, as well as manipulating the environment to favor predators.

1. Fish are commonly used for mosquito control due to their varied diet which includes mosquito larvae and pupae. Topminnows and killifish are popular choices, but their use may be limited in smaller bodies of water or in areas with aquatic vegetation.
2. Copepods are tiny crustaceans that feed on first-instar mosquito larvae. They are effective in navigating through thick vegetation and can be produced inexpensively. Discarded tires provide the best environment for copepod use, but they have limitations in controlling some *Culex* mosquitoes and maintaining populations in large habitats.
3. Toxorhynchites mosquitoes are large, non-biting mosquitoes whose larvae feed on other mosquito larvae. Gravid female releases have proven to be more effective than introducing eggs or larvae. However, using these mosquitoes alone for long-term control is not sustainable due to the high cost and labor demands.



Before implementing biological control methods, it is essential to check with STLT authorities to ensure compliance with regulations and prevent unauthorized species introductions.

Chemical Control

Adulticide application is an effective mosquito control strategy that involves applying insecticides in ultra-low volumes (ULV) using aircraft or ground equipment to quickly reduce mosquito populations and interrupt disease transmission. Proper application requires careful calibration of spray equipment and appropriate timing to minimize the impact on non-target insects.

Application methods include handheld units, small vehicles, and trucks. Implementing weather-tracking policies and local monitoring is necessary to determine how weather conditions influence control decisions. Regular calibration of application equipment, checking flow rates, and measuring droplet size and deposition are essential. Continuous testing for insecticide resistance using bottle bioassays and cage tests is crucial, and appropriate changes should be made if resistance is detected.

Larviciding, which involves targeting mosquito breeding sites with various formulations, can reduce the reliance on and expense of adulticides. However, after a disaster, larviciding may be limited to small areas due to the large, affected area, damaged infrastructure, and shortage of trained personnel, unless applied aerially.

Note: Understand the requirements of the licensing agency and the product's label. Know the water discharge pesticides permit requirements of your state. The state, tribe, or territorial required forms and other operational records produced must be reviewed for accuracy and to ensure that sufficient information is collected and recorded. Data generated by spray units mounted to the spray trucks must be kept and reviewed in addition to all other operational documents to determine compliance to STLT and federal laws.

Resources

- [ArboNet](#)
- [CDC Environmental Surveillance](#)
- [Contingency Pest Management Guide, 2012 Edition](#)
- [Creating a Mosquito Control Policy](#)
- [Do's and Don'ts of Pest Control](#)
- [Find the Repellent that is Right for You](#)
- [Integrated Mosquito Management](#)
- [Introduction to Integrated Pest Management](#)
- [Mosquito Control: What You Need to Know About Larvicides](#)
- [Mosquito Abatement – FEMA Public Assistance Program and Policy](#)
- [NEHA Vectors & Pests Resources](#)
- [Pest Control and Pesticide Safety for Consumers](#)
- [Protection Times of Mosquito Repellent](#)
- [NEHA Vector Control Toolkit](#)
- [What to Do After a Hurricane or Flood](#)
- [What to Do to Protect Yourself From Animals After a Disaster](#)
- [What to Look for – Identifying Active Rodent Signs](#)
- [World Health Organization Vector-Borne Disease List](#)



Provide Environmental Public Health Support to Hazardous Material (HAZMAT) Management



Aligns to EPHEPR Function 11

Hurricanes can create significant challenges for hazardous material management (HAZMAT), potentially leading to widespread environmental contamination and public health risks. The powerful winds, storm surge, and flooding associated with hurricanes can damage industrial facilities, storage tanks, and hazardous waste sites, leading to the release of dangerous substances into the environment.

Key hurricane-related challenges for HAZMAT management include:

1. Damage to chemical storage facilities and industrial sites, causing leaks or spills
2. Flooding of hazardous waste sites, potentially spreading contamination
3. Displacement of household HAZMAT (e.g., cleaning products, pesticides) during flooding
4. Compromised containment of underground storage tanks due to high water tables
5. Mixing of various HAZMAT in floodwaters, creating complex contamination scenarios
6. Challenges in accessing and assessing HAZMAT sites due to flooding or debris
7. Increased risk of exposure to responders and the public during cleanup and recovery efforts

Tasks

Participate actively in response to HAZMAT incidents.

Assess potential sources of HAZMAT, including industrial facilities, storage tanks, transportation accidents, and debris containing substances like asbestos, lead-based paint, or chemicals.

Evaluate risks posed by identified HAZMAT based on type, quantity, exposure pathways, and proximity to populated areas or sensitive environments.

Provide technical assistance, consultation, and support regarding decontamination procedures.

Advise on containment and stabilization procedures for HAZMAT releases or spills, ensuring proper safety protocols and personal protective equipment (PPE) use.

Establish an environmental monitoring program to assess levels of hazardous contaminants in air, water, soil, and other media.

Develop and implement a risk communication strategy to inform the public about health risks, safety precautions, and advisories or evacuation orders.

Provide technical assistance, consultation, and support for plume modeling and evacuation.

Coordinate safe decontamination and cleanup of affected areas, ensuring proper handling, transportation, and disposal of hazardous waste.

Establish coordination and communication with relevant agencies and stakeholders for a unified response.

Ensure compliance with regulations governing HAZMAT management, transportation, and disposal.

Train local health workers, emergency responders, and community members on HAZMAT identification, safety protocols, and best practices.

Integrate EPH support into the Incident Command System (ICS) for effective communication, resource allocation, and decision-making.

Develop a long-term monitoring and remediation plan to address persistent environmental contamination and health risks associated with HAZMAT.

Identify risks and implement mitigation measures for health and safety risks to emergency response personnel dealing with HAZMAT.

Communicate mitigation or remediation efforts for individual property owners and communities.





Pro Tips

Must Know

Management of Hazardous Waste:

To effectively manage hazardous waste, it is essential to collaborate with the Local Emergency Planning Committee (LEPC), Fire Departments, and HAZMAT teams to identify facilities within the affected area that have HAZMAT on-site, including Tier II facilities, and to determine the specific locations in the community where these HAZMAT are present.

Hazardous Waste Generation:

- Generators must determine if their waste is hazardous and oversee its fate.
- Generators must ensure proper identification, management, and treatment of hazardous waste before recycling or disposal.
- The level of regulation depends on the amount of waste generated.

Hazardous Waste Transportation:

- Transporters move hazardous waste from generators to recycling, treatment, storage, or disposal facilities.
- Transporters must comply with the EPA's HAZMAT regulations and the Department of Transportation's (DOT) HAZMAT regulations.
- Regulations apply when moving hazardous waste on public roads, highways, rails, and waterways.

Hazardous Waste Recycling, Treatment, Storage, and Disposal:

- EPA regulations balance resource conservation with protecting human health and the environment.
- Recycling hazardous waste reduces raw material consumption and waste volume that requires treatment and disposal.
- Improper storage can lead to spills, leaks, fires, and soil and drinking water contamination.
- EPA regulations ensure safe and environmentally sound recycling practices.

Treatment, Storage, and Disposal Facilities (TSDFs):

- TSDFs provide temporary storage and final treatment or disposal of hazardous wastes.
- TSDFs are strictly regulated due to large waste volumes and potentially higher-risk activities.
- TSDF requirements establish facility management standards, provisions for hazardous waste management units, and precautions to protect soil, groundwater, and air resources.

Best Practices

Personal Protective Equipment (PPE)*

- Full-face or half-mask, air purifying respirators (National Institute for Occupational Safety and Health (NIOSH) approved)
- Hooded, chemical-resistant clothing (overalls; two-piece chemical-splash suit; disposable chemical-resistant overalls)
- Coveralls
- Gloves (outer) chemical-resistant
- Gloves (inner) chemical-resistant
- Boots (outer) chemical-resistant steel toe and shank
- Disposable boot covers (outer) chemical-resistant
- Hard hat
- Escape mask
- Face shield

*Appropriate PPE will depend on the incident.



Resources

Chemical Emergencies

- [ACE Adult Survey](#)
- [ACE Survey Consent Forms](#)
- [ACE General Survey](#)
- [ACE Hospital Survey](#)
- [ACE Household Survey](#)
- [ACE Pet Survey](#)
- [Chemical Emergencies](#)

Hazardous Materials

- [Emergency Response Guidebook \(ERG\)](#)
- [Emergency Planning and Community Right-to-Know Act \(EPCRA\)](#)
- [EPA's Guide for Recycling Industrial Hazardous Waste](#)
- [Frequent Questions About Hazardous Waste Identification](#)
- [Hazardous Materials Incidents: Guidance for State, Local, Tribal, Territorial, and Private Sector Partners](#)
- [Hazardous Materials Warning Placards](#)
- [OSHA General Description and Discussion of the Levels of Protection and Protective Gear](#)
- [OSHA Personal Protective Equipment](#)
- [Safety Awareness for Responders to Hurricanes: Protecting Yourself While Helping Others](#)
- [Safe Hazardous Waste Recycling Fact Sheet](#)
- [Underground Storage Tank Flood Guide](#)



Provide Environmental Public Health Support to Radiological Management



Aligns to EPHEPR Function 12

While radiological incidents are not typically associated with hurricanes, these powerful storms can potentially impact facilities that house radioactive materials or disrupt radiological safety measures, creating unique challenges for EPH professionals. In hurricane-prone areas with nuclear power plants, research facilities, or medical institutions using radiological materials, the possibility of a hurricane-induced radiological incident requires specialized preparedness and response capabilities.

Key hurricane-related challenges for radiological management include:

1. Potential damage to nuclear facilities or radiological storage sites due to high winds or flooding
2. Disruption of power supply to critical safety systems in radiological facilities
3. Possible compromise of containment structures or shielding due to storm damage
4. Risk of flooding in areas where radiological waste is stored
5. Challenges in accessing and assessing radiological sites due to hurricane-related obstacles
6. Potential for dispersion of radiological materials by flood waters or high winds
7. Complications in evacuation procedures due to storm conditions

Tasks

Assess potential sources of radiological hazards, such as nuclear power plants, medical facilities, research laboratories, radiological production sites, or industrial sites using radioactive materials.

Implement an environmental monitoring program to detect and measure radiation levels in air, water, soil, and other media, as well as ambient radiation exposure rates.

Analyze potential exposure pathways (i.e., inhalation, ingestion, external surface, skin contamination) to identify vulnerable populations and prioritize protective measures.

Provide technical assistance, consultation, and support regarding decontamination procedures.

Provide technical assistance, consultation, and support for the appropriate collection and disposal of radiological waste.

Provide technical assistance, consultation, and support for plume modeling and evacuation.

Develop and disseminate clear information to the public regarding radiological risks, safety precautions, and advisories or evacuation orders. Work with existing pre-scripted messaging.

Coordinate safe decontamination of affected areas, ensuring proper handling, transportation, and disposal of radioactive materials.

Implement radiation protection measures (i.e., time, distance, shielding) for emergency responders, cleanup personnel, and the public.

Establish hot, warm, and cold zones.

Establish coordination and communication with relevant agencies and stakeholders for a unified response using experts such as the Federal Emergency Management Agency (FEMA), the Radiological Operations

Support Specialist (ROSS) and Advisory Team agencies.

Ensure compliance with regulations governing radioactive materials management, transportation, and disposal.

Provide specialized training for local health workers, emergency responders, and community members on radiological hazard identification, radiation safety, and best practices.

Integrate EPH support into the Incident Command System (ICS) for effective communication, resource allocation, and decision-making.

Develop long-term environmental monitoring and remediation plans to address persistent radiological contamination or health risks.

Identify risks associated with radiological hazards and implement mitigation measures for emergency response personnel.





Pro Tips

Must Know

Protecting human life during a radiation incident involves one or more of the following measures:

- Limiting time of exposure
- Maintaining a safe distance from radiation sources
- Shielding from radiation sources
- Decontamination

State Radiation Control Programs play a vital role in the planning, response, and recovery phases of a radiation event. Each state has its own Radiation Control Program, and it is crucial for EPH to establish and maintain contact with their designated point of contact within this program. The [Conference of Radiation Control Program Directors \(CRCPD\) website](#) is a valuable resource for obtaining further information and connecting with these essential partners in radiation emergency preparedness and management.

Principles of Radiation Protection

- **Time:** For people exposed to radiation in addition to natural background radiation, limiting or minimizing the exposure time reduces the dose from the radiation source.
- **Distance:** Just as the heat from a fire reduces as you move further away, the dose of radiation decreases as you increase your distance from the source.
- **Shielding:** Barriers of lead, concrete, or water provide protection from penetrating gamma rays and x-rays. This is why certain radioactive materials are stored under water or in concrete or lead-lined rooms and why dentists place a lead blanket on patients receiving x-rays of their teeth. Therefore, inserting the proper shield between you and a radiation source will significantly reduce or eliminate the dose you receive.

Best Practices

Priorities for Control of Contaminated Area

1. Prioritize urgent medical care over decontamination efforts or time-consuming protection of attendants.
2. In early-phase scenarios, do not waste effort trying to contain contaminated wash water if it interferes with lifesaving and public health protection priorities, but notify sewage treatment plants.
3. Do not allow monitoring and decontamination to delay an ordered evacuation.
4. Establish emergency contamination monitoring stations in areas with elevated background radiation levels after plume passage to monitor people emerging from possible high-exposure areas, provide rapid decontamination, and evaluate the need for further care.
5. Set up monitoring and decontamination facilities at evacuation centers or locations in low-background areas (less than 0.1 mrem/1 μ Sv per hour gamma exposure rate) to control surface contamination, using the guidance provided in Section 2.4.4.
6. Encourage evacuees from areas with potential particulate material release to self-decontaminate by changing and bagging clothes, storing them away from people and pets, washing exposed surfaces, and reporting to evacuation centers for monitoring.
7. Consider setting up monitoring and decontamination stations at exits from highly contaminated parts of the evacuation area, acknowledging that low levels of contamination may be undetectable.
8. Advise individuals to bathe and change clothes within 24 hours and refer those exceeding surface contamination screening levels for further decontamination or medical attention.



Evacuation vs. Shelter-in-Place

During a radiation event, the decision to evacuate or shelter-in-place is complex and requires input from various authorities, partners, and stakeholders, including public health and emergency management. Many factors must be considered, such as the event's type, size, location, and scope, as well as available resources. Timely decision-making is crucial to save lives and protect public health and safety.

If an evacuation is ordered, EPH may be asked to support the process by ensuring that evacuation locations are safe and suitable for use. This involves addressing issues similar to those in shelters, such as ensuring safe food, water, waste disposal, and appropriate sanitation and hygiene.

Population Monitoring

The primary objectives of population monitoring are as follows:

1. Identifying individuals who are in immediate danger and need prompt attention
2. Identifying people who require medical treatment for radiation contamination and/or exposure
3. Recommending and facilitating practical measures to minimize risks to the affected population
4. Registering individuals for long-term health monitoring to track potential health effects over time

When participating in population monitoring activities, such as screening for radiation contamination and/or exposure, EPH should prioritize preventing or mitigating acute radiation health effects. While cross-contamination issues (e.g., people spreading contamination from themselves, clothing, or personal articles) are a concern, they are considered secondary to the immediate health risks posed by radiation exposure.

Community Reception Centers (CRCs)⁷

EPH may be called upon to assist at CRCs following a radiation event. CRCs serve as locations where potentially contaminated or exposed individuals can receive assistance and are ideal for conducting population monitoring.

At CRCs, EPH practitioners provide the following essential services:

1. Registering affected individuals to maintain records and facilitate follow-up
2. Conducting external contamination screening to identify people who may have been exposed to radiation
3. Performing external decontamination to remove radioactive materials from the skin and clothing of affected individuals
4. Prioritizing people for further care based on the severity of their contamination or exposure

⁷ CRCs could be used in incidents other than radiological and may be used in other situations where contamination or certain exposures have occurred.



Resources

- [Community Reception Centers](#)
- [CDC's Community Reception Center Toolkit](#)
- [Guide for Development of Sample Collection Plans for Radiochemical Analytes in Environmental Matrices Following Homeland Security Events](#)
- [Guide for Development of Sample Collection Plans for Radiochemical Analytes in Outdoor Building and Infrastructure Materials Following Homeland Security Incidents](#)
- [Hot Spot Calculator to Optimize Radiological Cleanup Decisions](#)
- [NEHA Radiological and Chemical Preparedness Resources](#)
- [PAG Manuals and Resources](#)

Radiation

- [How to Self-Decontaminate after a Radiation Emergency](#)
- [Radiation Emergencies](#)
- [Radiation Infographics](#)

Sample Collection

- [Sampling Collection Plan \(SCP\) Template Tool for Addressing Radiochemical Analytes in Environmental Matrices](#)
- [Sample Collection Procedures for Radiochemical Analytes in Environmental Matrices](#)
- [Sample Collection Procedures for Radiochemical Analytes in Outdoor Building and Infrastructure Materials](#)



Assure the Safety of Recreational Water

Aligns to EPHEPR Function 13



Hurricanes can significantly impact recreational water bodies, creating potential health and safety hazards for communities recovering from the disaster. The powerful winds, storm surge, and flooding associated with hurricanes can damage pool facilities, contaminate natural water bodies, and create dangerous conditions in beaches, lakes, and rivers.

Key hurricane-related challenges for recreational water safety include:

1. Physical damage to pool structures, equipment, and surrounding facilities
2. Contamination of natural and man-made water bodies with flood waters, sewage, or debris
3. Increased bacterial and chemical contamination in recreational waters
4. Formation of new, potentially hazardous water bodies in flooded areas
5. Changes in water quality and safety conditions in beaches, lakes, and rivers
6. Disruption of normal water treatment and monitoring processes
7. Potential for waterborne disease outbreaks associated with recreational water use

Tasks

Implement a water quality monitoring program to regularly test recreational water bodies for contaminants.

Identify and control potential contamination sources, such as sewage, stormwater runoff, animal waste, and industrial waste.

Issue public advisories or temporary closures when water quality standards are unmet, or health risks are identified.

Understand jurisdictional pool regulations to help owners address gaps and meet requirements.

Advise on appropriate water treatment methods or remediation strategies to improve water quality and reduce contaminants when necessary.

Develop and disseminate educational materials to raise public awareness about recreational water safety and personal protection measures.

Coordinate with relevant stakeholders to ensure a unified recreational water quality management approach.

Ensure compliance with recreational water quality regulations, monitoring, reporting, and standards.

Train local health workers, monitoring personnel, and community members on water safety, sampling techniques, and hazard identification.

Establish long-term management plans to address persistent water quality issues and assess the effectiveness of remediation efforts.

Develop incident response protocols and remediation plans for unexpected events impacting recreational water quality.

Provide recommendations for closing facilities or ceasing operations when appropriate.

Provide recommendations for addressing non-compliant facilities or operations.

Identify health and safety risks to emergency response personnel involved in recreational water assessments and implement mitigation measures.





Pro Tips

Must Know

Damage Assessment (Recreational Water)

	Treated Recreational Water (Swimming Pools, Waterparks, Water Playgrounds, Hot Tubs/Spas)	Hot Tubs/Spas	Oceans, Lakes, Rivers (Untreated Water)
Description	<p>Outbreaks associated with exposure to treated recreational water can be caused by pathogens or chemicals in venues such as pools, hot tubs/spas, and water playgrounds. The most frequently reported illness for treated-recreational-water-associated outbreak is diarrhea. Swallowing even a small amount of water contaminated with enteric pathogens can make swimmers sick.</p>	<p>“Hottub rash,” a skin infection caused by <i>Pseudomonas</i>, is a common Recreational Water Illness (RWI) spread through improperly operated hot tubs and spas. <i>Legionella</i> can cause Legionnaires’ disease, a severe type of pneumonia, and Pontiac fever, a milder illness than Legionnaires’ disease without pneumonia; both diseases are commonly associated with improperly operated hot tubs/spas. High water temperatures and aerosolization of water pose a challenge for maintaining the disinfectant concentration. When disinfection concentration decreases, bacteria can amplify in hot tub and spa water.</p>	<p>Oceans, lakes, and rivers can be contaminated with pathogens from sewage spills, animal waste, water runoff following heavy rain, fecal incidents, and naturally occurring organisms. Illnesses associated with ocean, lake, and river exposure can vary based on the type of pathogen and can affect the gastrointestinal tract (e.g., diarrhea, vomiting), ears, eyes, skin, or central nervous system. Harmful Algal Blooms (HABs) are visible colonies of cyanobacteria and microalgae. Contributors to the formation of HABs include nutrient pollution and warm water. Some HABs can create toxins that cause illness in people or animals through direct contact, ingestion, or inhalation. Cyanobacteria are usually found in freshwater but have occasionally caused coastal blooms, sometimes severe.</p>



	Treated Recreational Water (Swimming Pools, Waterparks, Water Playgrounds, Hot Tubs/Spas)	Hot Tubs/Spas	Oceans, Lakes, Rivers (Untreated Water)
Detection	An outbreak associated with recreational water is characterized by the occurrence of similar illnesses in two or more individuals who have been exposed to recreational water or its associated airborne pathogens or chemicals, all within the same location and timeframe. Public health officials might be alerted to an outbreak when they see an increase in case reports. Typically, these reports come from diagnostic laboratories or healthcare providers. Additionally, public health officials might receive inquiries from healthcare providers or the public regarding illness in a specific group of people.	An outbreak associated with recreational water is characterized by the occurrence of similar illnesses in two or more individuals who have been exposed to recreational water or its associated airborne pathogens or chemicals, all within the same location and timeframe. Public health officials might be alerted to an outbreak when they see an increase in case reports. Typically, these reports come from diagnostic laboratories or healthcare providers. Additionally, public health officials might receive inquiries from healthcare providers or the public regarding illness in a specific group of people.	An outbreak associated with untreated recreational water is characterized by the occurrence of similar illnesses in two or more individuals who have been exposed to untreated recreational water or its associated airborne pathogens or chemicals, all within the same location and timeframe.



	Treated Recreational Water (Swimming Pools, Waterparks, Water Playgrounds, Hot Tubs/Spas)	Hot Tubs/Spas	Oceans, Lakes, Rivers (Untreated Water)
Investigation	Working with an environmental public health (EPH) practitioner can help identify the issues related to the operation and management of public treated recreational water venues that contributed to the outbreak. Outbreaks caused by chlorine-susceptible pathogens signal the need for proper halogenation (chlorination or bromination) of the water. Outbreaks caused by the highly chlorine-tolerant pathogen <i>Cryptosporidium</i> do not necessarily signal issues in operations.	Working with an EPH practitioner can help identify the issues related to the operation and management of public treated recreational water venues that contributed to the outbreak. Outbreaks caused by chlorine-susceptible pathogens signal the need for proper halogenation (chlorination or bromination) of the water. Outbreaks caused by the highly chlorine-tolerant pathogen <i>Cryptosporidium</i> do not necessarily signal issues in operations.	Investigations of outbreaks associated with untreated recreational water can be supported by environmental investigations (including, but not limited to, beach monitoring data and sanitary surveys) to provide information about potential sources of contamination (e.g., sewage spills, nutrient pollution). Pathogens introduced by environmental contamination or ill swimmers might not be killed or removed as readily as in treated venues due to the lack of disinfection and filtration.
Control	Chlorine (or bromine) concentration and pH should be tested and recorded to ensure that most pathogens are properly inactivated. Chlorine will inactivate most pathogens that cause Recreational Water Illnesses (RWIs) within minutes. However, <i>Cryptosporidium</i> can survive for more than 7 days in adequately treated recreational water.	Drain all water from the hot tub/spa. Vigorously scrub all hot tub/spa surfaces, skimming devices, and circulation components. Replace filters (for cartridge or diatomaceous earth filters) or filter media (for sand filters).	Control measures might take into account water quality results obtained from beach monitoring activities. Beach closures or other restrictions on use (e.g., no swimming, no fishing) may be implemented by water body managers until water quality concerns are eliminated. Control measures may also involve factors that would improve water quality (e.g., reducing the influx of environmental contaminants, improving the circulation of stagnant water). Monitoring requirements for untreated recreational water venues vary by jurisdiction.



Best Practices

Process for Assessing a Pool

Determining whether a pool can operate as expected can be accomplished by:

1. Evaluating for damage of the pool and any storage areas.
2. Determining whether the pool can operate as expected by answering the following questions:
 - Is there contamination of the pool water and recirculation system?
 - Is there debris in the pool?
 - Is any equipment broken or inoperable?
 - Is a clean water source available for refill if you need to drain the pool?
 - Should pools be a priority right after a storm if source water is available? If not, when?

If a pool is suspected of being contaminated with sewage or floodwaters, the following measures are recommended:

1. Drain it
2. Clean it
3. Flush it
4. Hyperchlorinate it
5. Test it

Recommended Steps for Hyperchlorination When Chlorine Stabilizer is in the Water

1. Close the aquatic venue to swimmers. If multiple venues use the same filtration system, all affected venues must be closed to swimmers. Do not allow anyone to enter the venue(s) until the hyperchlorination process is completed.
2. Use unstabilized chlorine (sodium hypochlorite) to raise the water's free chlorine concentration (see bullets below) and maintain water at pH 7.5 or less.
3. Hyperchlorinate. Chlorine stabilizer slows the rate at which free chlorine inactivates or kills Crypto, and the more stabilizer there is in the water, the longer it takes to kill Crypto. Use unstabilized chlorine if the cyanuric acid concentration is 1–15 parts per million (ppm).
 - Raise the free chlorine concentration to 20 ppm and maintain it for 28 hours; or
 - Raise the free chlorine concentration to 30 ppm and maintain it for 18 hours; or
 - Raise the free chlorine concentration to 40 ppm and maintain it for 8.5 hours.
 If the cyanuric acid concentration is more than 15 ppm, lower the concentration to 1–15 ppm by draining partially and adding fresh water without chlorine stabilizer before attempting to hyperchlorinate.
4. Ensure that the filtration system operates while the water reaches and is maintained at the proper free chlorine concentration and pH for hyperchlorination.
5. After hyperchlorination is complete, backwash the filter thoroughly. Be sure to discharge directly to waste according to state, tribal, local, and territorial (STLT) regulations. Do not return the backwash through the filter. Where appropriate, replace the filter media.
6. Swimmers can be allowed back into the water only after hyperchlorination is completed and the free chlorine concentration and pH are within the operating range allowed by the STLT regulatory authority.



Resources

- [Aquatic Facility Inspection Form](#)
- [Beaches](#)
- [Best Practice Guide: Standard for Aquatic Facility Environments](#)
- [Harmful Algal Blooms \(NOAA\)](#)
- [Harmful Algal Bloom \(HAB\) - Associated Illness](#)
- [Model Aquatic Health Code](#)
- [National Recommended Water Quality Criteria - Human Health Criteria Table](#)
- [2019 Recreational Water Quality Criteria or Swimming Advisories for Cyanotoxins](#)
- [Inspection Toolkit: Training](#)
- [Hyperchlorination to Kill Cryptosporidium When Chlorine Stabilizer is in Water](#)
- [Recreational Water Illnesses \(Video\)](#)
- [Summary of the BEACH Act](#)
- [What Is a Red Tide?](#)



Conduct Open Water Monitoring

Aligns to EPHEPR Function 14



Hurricanes can have a profound impact on open water systems, including coastal waters, rivers, lakes, and estuaries. The intense rainfall, storm surge, and flooding associated with hurricanes can lead to significant contamination of these water bodies, posing serious risks to human health through direct contact with water or consumption of fish and shellfish.

1. Key hurricane-related challenges for open water monitoring include:
2. Widespread contamination of water bodies with flood waters, sewage, and debris
3. Increased runoff leading to elevated levels of pollutants and pathogens in water systems
4. Potential for chemical spills or releases from damaged industrial facilities into open waters
5. Disruption of normal ecosystems, potentially affecting fish and shellfish populations
6. Increased risk of harmful algal blooms due to nutrient loading from runoff
7. Challenges in accessing and sampling water bodies due to storm damage or flooding
8. Potential for long-term impacts on water quality and aquatic life

Tasks

Design and conduct appropriate environmental sampling and fish and shellfish sampling in open water systems affected by the hurricane.

Implement a water quality monitoring program to test for contaminants in open water bodies due to flooding, sewage overflows, or industrial releases.

Identify and mitigate potential contamination sources, such as leaking septic systems, agricultural runoff, or industrial effluents affecting open waters.

Assess coastal areas, rivers, and lakes to identify and document hazardous debris, oil spills, or other contaminants.

Mobilize and equip personnel with appropriate personal protective equipment (PPE) and direct sampling and monitoring strategies in a manner that protects public and environmental safety after a contaminant is identified.

Recommend closing or restricting the use of waters when appropriate based on sampling results and risk assessments.

Communicate health risks related to open water contamination and seafood safety to the public.

Post closure signs and communicate when the threat has passed for affected water bodies.

Develop and disseminate educational materials to raise awareness about open water hazards, protection measures, and adherence to advisories.

Coordinate with relevant agencies and personnel to respond to open water quality issues and seafood safety concerns.

Ensure compliance with open water quality regulations, monitoring, reporting, and standards.

Train local health workers, monitoring personnel, and community members on open water safety, sampling techniques, and hazard identification.

Establish a long-term monitoring and management plan to address persistent water quality issues and ensure the safety of open water systems and seafood.

Identify risks and implement mitigation measures for health and safety risks to emergency response personnel involved in open water monitoring.





Pro Tips

Must Know

Follow water safety professionals and understand coastal United States Lifesaving Association (USLA) flag warnings that may coincide with EPH conditions of interest.

Vibrio

Vibrio is a genus of bacteria that naturally inhabit certain coastal waters, including salt water and brackish water (a mixture of saltwater and freshwater often found where rivers meet the ocean). These bacteria are more prevalent during the warmer months of May through October when water temperatures are higher.

Approximately 12 species of *Vibrio* can cause a human illness called vibriosis. In the United States, the most common species responsible for human illness are:

1. *Vibrio parahaemolyticus*
2. *Vibrio vulnificus*
3. *Vibrio alginolyticus*

Vibriosis is the term used to describe the illness caused by infection with *Vibrio* bacteria. The severity and symptoms of vibriosis can vary depending on the specific *Vibrio* species involved and the individual's health status.

Best Practices

Recreational Surface Water Sampling

1. Know your jurisdiction's regulations and lab capacity.
 - Research and familiarize yourself with the specific bacteriological indicators, sample methodology, and bacteria indicator levels used in your area to determine public health risks.
 - Be aware that criteria may vary for different named surface water bodies or recreational sites.
2. Understand common indicators.
 - Fecal coliform, *E. coli*, and enterococci bacteria counts are the most commonly used indicators for surface water sampling.
 - Some water bodies may be routinely sampled through federal or STLT programs using one or more of these indicators.
3. Consider background levels.
 - When evaluating the extent and effects of a sewage spill, consider the available background levels of bacteria in the affected water body or site.
4. Tailor sample methodology to the site.
 - Base your sampling methodology on historic sampling results and established baselines for the specific site.
 - Remember that one-time grab samples can provide an idea of current conditions but do not allow for the evaluation of normal bacteria levels.
5. Act quickly to protect public health.
 - If a sewage spill has contacted an open water body, advise the public immediately without waiting for lab results.
 - Remember that sample results will take time, and you may need to collect subsequent samples while waiting for the initial results.



6. Prepare advisory signs in advance.
 - Create advisory signs before a sewage spill event occurs.
 - Determine who will be responsible for posting and authorizing the removal of signs, such as utilities or County Health Departments.
7. Involve all affected parties.
 - When posting signage after a sewage spill, involve STLT political bodies, local industries (e.g., tourism), and utilities to ensure buy-in and cooperation.
 - Discuss and agree upon sign symbols and verbiage, such as using “advisory,” “warning,” or “beach closed.”

Resources

- [FDA BAM Chapter 9: Vibrio](#)
- [Harmful Algal Bloom \(HAB\) - Associated Illness](#)
- [About Naegleria fowleri Infection](#)
- [National Beach Guidance and Required Performance Criteria for Grants, 2014 Edition](#)
- [Other Clean Water Act Test Methods: Microbiological](#)
- [State, Territorial, Tribal and EPA Beach Program Contacts](#)
- [USLA Approved Beach Warning Flags](#)



Assure Effective Environmental Sampling

Aligns to EPHEPR Function 15



Hurricanes can cause widespread environmental disruption, potentially introducing a complex array of contaminants into air, water, soil, and food systems. The flooding, wind damage, and infrastructure failures associated with hurricanes can create diverse and evolving EPH risks that require thorough assessment through strategic sampling.

Key hurricane-related challenges for environmental sampling include:

1. Widespread contamination across multiple environmental media (i.e., air, water, soil, food)
2. Rapidly changing environmental conditions requiring adaptive sampling strategies
3. Potential for both acute and long-term EPH impacts
4. Difficulties in accessing sampling sites due to storm damage or flooding
5. Need for rapid assessment and communication of results to guide public health actions
6. Challenges in coordinating sampling efforts across multiple agencies and jurisdictions
7. Importance of tracking contaminant spread and migration over time and space

Tasks

Conduct site characterization to identify contamination sources, areas of concern, and environmental media requiring sampling.

Develop a sampling plan outlining objective, timeframe of sampling, locations, methods, parameters, quality control, and data management.

Ensure availability of appropriate sampling equipment, containers, preservatives, and personal protective equipment (PPE).

Implement proper sample collection techniques, following labeling, preservation, storage, and transportation protocols.

Incorporate Quality Assurance/Quality Control (QA/QC) measures, such as field blanks, trip blanks, and duplicate samples, to ensure reliable results.

Establish and maintain a clear chain of custody documentation to ensure legal defensibility and data integrity.

Select accredited laboratories capable of performing required analyses with appropriate detection limits and turnaround times.

Implement a data management system to organize, review, and interpret analytical results for informed decision-making and risk assessment.

Provide health impact assessment of sampling results from various sources such as water, air, soil, and food supply.

Assess potential health risks based on sampling results and communicate them to the public in a timely manner where appropriate.

Provide recommendations and/or lead remediation efforts for individual property owners and communities based on sampling results.

Adhere to health and safety protocols during sampling, including PPE use, decontamination, and hazard communication.

Coordinate with relevant agencies to ensure a unified and comprehensive sampling approach.

Provide training and quality control measures for sampling personnel to ensure consistent and accurate procedures.

Develop communication strategies to report and interpret sampling results to stakeholders, decision-makers, and the affected public.

Identify health and safety risks to personnel involved in environmental sampling and implement mitigation measures.





Pro Tips

Must Know

Food

The Food and Drug Administration (FDA) conducts three main types of sampling to ensure food safety:

1. **Product Sampling:** Collecting samples of food products, including finished products, in-process items, and raw ingredients. This helps prevent harmful contaminants from reaching consumers and verifies accurate labeling. It includes microbiological surveillance sampling, gluten-free food product surveillance sampling, and milk allergen sampling.
2. **Environmental Sampling:** Collecting samples from the environment surrounding the food, usually in production facilities. This helps identify potential sources of contamination that may affect finished products.
3. **Emergency Response/Emerging Issues Sampling:** Conducting both environmental and product sampling in response to foodborne illness outbreaks or potential food safety issues based on trends or intelligence. This helps identify the source of disease-causing pathogens and aids in gathering information on emerging food safety concerns.

Water

Large-volume and grab-sampling collection methods include dead-end ultrafiltration (DEUF) from pressurized and non-pressurized sources, as well as grab sampling. The key points are as follows:

1. **DEUF from a pressurized source:** This method uses the pressure within a piped system to push water through an ultrafilter, without requiring a pump. The inlet pressure is controlled by maintaining a flow rate of <4 liters (L) per minute. For low-turbidity water (<5 Nephelometric Turbidity Unit or NTU), 100 L or more can be filtered.
2. **DEUF from a non-pressurized source:** This method uses a peristaltic pump to draw water through the ultrafilter. The inlet pressure is controlled by maintaining a flow rate of <4 L per minute. For surface water or high-turbidity water, a maximum of 50 L is recommended. DEUF is effective for wastewater effluent samples and water samples with turbidity values up to 80 NTU.
3. **Grab sampling:** A 1 L grab sample is collected following standard methods and shipped to a laboratory for direct assay or further concentration and analysis. This method is the simplest but may limit the ability to capture microorganisms present at low concentrations.

Sampling methods can be modified based on water source, specific site conditions, or equipment limitations. If ultrafiltration cannot be performed in the field or if contaminants are suspected to be smaller than 20 nanometer (nm) or 30,000 Daltons (Da), grab samples can be collected and transported to the laboratory for concentration and analysis.



Best Practices

Field Sampling Equipment and Supplies

- Sampling devices (e.g., soil coring device, water autosampler, bottles, filters, air filter canister or collection tube, wipes)
- Preservatives and dechlorinating agents (If feasible, it is recommended that preservatives and dechlorinating agents be added to sample containers prior to sample collection)
- Sample volumetric measuring devices and/or weighing devices.
- Sample containers and packaging materials, including wet ice or ice packs (Ensure ice does not come into direct contact with samples)
- PPE
- Record-keeping devices (e.g., logbooks, chain of custody forms, writing instruments, camera)
- Site maps, GPS recorders, etc.
- Sample location markers
- Shipping containers, shipping forms, and shipping labels.
- Waste containers
- Materials for cleaning equipment and sample container exteriors
- Field testing equipment (e.g., dissolved oxygen, pH, conductivity meters)

Field Data Documentation

All data collected in the field should be adequately documented. Documented information should include (for example):

- Names of field sampling personnel
- Sampling Collection Plan (SCP)
- Sample location(s) (including GPS coordinates, if appropriate)
- Date and time of sampling
- Sample identification number
- Sampling depth
- Sample type and collection methods used
- Sample collection medium
- Physical and meteorological conditions
- Expected contaminants
- Expected radionuclides (if applicable)
- Sample size (weight, volume), sample duration (air filters), air volume, preservation, etc.
- Sample handling precautions
- Field screening data (if applicable)

When performing radiological dose rate measurements of samples in the field, it is important to document and transmit the results to the laboratory along with the samples. The documentation should include the background count rates, units of measurement, and information about the instrument used to obtain the dose rate, such as the type, serial number, and calibration date.

Electronic data recording devices are also available for use to collect, store, and report sampling and analytical data.



Preparation of Sample Containers

- **Sample Container Labels:** Each sample container must have a unique label with information such as sample collection date, time, site, preservation details, identification numbers, and the names and signatures of sampling personnel.
- **Preparing Sample Containers for Packaging:** After sample collection and preservation, containers are labeled, sealed, decontaminated, and/or disinfected before being packed into transport or shipping containers.
- **General Sample Shipment Guidelines:** Sampling personnel must ensure compliance with Department of Transportation (DOT) and International Air Transport Association (IATA) regulations for the transfer of hazardous substances and environmental samples. Only trained and certified shippers may ship hazardous materials (HAZMAT).
- **Chain of Custody (COC) Forms:** COC forms document the creation, possession, and handling of samples from collection through analysis. Sampling personnel are responsible for providing the required information on the COC form and maintaining its integrity during transport.
- **Custody Seals/Tamper-evident Bags:** Custody seals or tamper-evident bags are used to ensure that samples have not been opened or tampered with after collection and packaging. The seals must be signed and dated by the person responsible for packing the container.

Resources

- [DoD Environmental Field Sampling Handbook, DOD, 2013](#)
- [Environmental Sampling](#)
- [Environmental Sampling and Analytical Methods \(ESAM\) Program](#)
- [Protocol for Collection of Water Samples for Detection of Pathogens and Biothreat Agents](#)
- [Sampling and Analysis Plan - Guidance and Template v.4 - General Projects](#)
- [Sampling and Analysis Plan \(SAP\) Template Tool](#)
- [Sample Collection Information Document for Chemicals, Radiochemicals, Pathogens, and Biotoxins: Companion to Selected Analytical Methods for Environmental Remediation and Recovery \(SAM\) 2022](#)
- [Sample Collection Information Documents \(SCID\)](#)
- [Sample Collection Procedures and Strategies](#)
- [SAP Template Tool User Guide](#)
- [Trade-off Tools for Sampling](#)



Part 3: Back from the Field

Upon returning from a hurricane response, EPH personnel should prioritize several key tasks to ensure the safety of their team and effectively share crucial information. First, they should properly dispose of any single-use or damaged personal protective equipment (PPE) according to local regulations. Then, they should thoroughly clean and sanitize any reusable PPE that may have been exposed to hazardous materials (HAZMAT) during the response, following established decontamination protocols for each specific type of PPE used.

Next, the team should conduct an EPH-specific hot wash⁸ within 24–48 hours of returning from the field. During this debriefing, team members should share their notes and any relevant documentation collected during the response; identify areas for improvement in the team's response procedures, communication, and coordination; and brainstorm potential solutions for future responses. The information collected during this meeting should be documented in a structured format, such as a standardized after-action report template, and shared with the broader response team and relevant leadership within the organization.

The team should then compile a comprehensive list of EPH issues or concerns encountered during the response, prioritizing them based on their potential impact on public health and safety. A detailed report should be prepared, outlining the identified issues, their locations, and any immediate actions taken in the field, along with recommendations for further investigation, mitigation, or remediation of the identified EPH concerns.

If the Incident Command System (ICS) structure is still in place, this information should be shared with the Emergency Operations Center (EOC) via your liaison or ESF #8 representatives. If the ICS structure has been demobilized, coordinate with your organization's leadership to determine the appropriate channels for sharing this information with relevant authorities. The team should provide a clear and concise summary of the most critical issues that require immediate attention or action, offer to provide additional information or clarification as needed to support decision-making processes, and collaborate with appropriate authorities to develop a plan for addressing the identified EPH issues and allocating necessary resources.

Finally, team members should prioritize self-care and seek mental health support if needed, as hurricane response work can be physically and emotionally taxing. The team leader or designated staff member should provide information on available [resources](#), such as employee assistance programs or local mental health services. A supportive team environment where members feel comfortable discussing their experiences and seeking help should be fostered.

⁸ A hot wash is an immediate post-operation debriefing for all participants to share experiences and identify issues.



Acronym List

Acronym	Definition
ACP	Area Contingency Plan
AFN	Access and Functional Needs
ARC	American Red Cross
ATF	Alcohol, Tobacco, Firearms, and Explosives
ATSDR	Agency for Toxic Substances and Disease Registry
BAM	Bacteriological Analytical Manual
BWA	Boil Water Advisory
CASPER	Community Assessment for Public Health Emergency Response
CBRS	Coastal Barrier Resource System
CDC	Centers for Disease Control and Prevention
CERC	Crisis and Emergency Risk Communication
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	Chain of Custody
CRCPD	Conference of Radiation Control Program Directors
DEUF	Dead-End Ultrafiltration
DOT	Department of Transportation
EHTER	Environmental Health Training in Emergency Response
EMAC	Emergency Management Assistance Compact
EOC	Emergency Operations Center
EPA	Environmental Protection Agency
EPHEPR	Environmental Public Health Emergency Preparedness and Response
ERP	Emergency Response Plan
ESAM	Environmental Sampling and Analytical Methods
ESF	Emergency Support Function
FBI	Federal Bureau of Investigation
FDA	Food and Drug Administration
FEMA	Federal Emergency Management Agency
HACCP	Hazard Analysis and Critical Control Point
HAB	Harmful Algal Bloom
HAZMAT	Hazardous Materials
HSCH	High Strength Calcium Hypochlorite
HTH	Calcium Hypochlorite
HUD	Housing and Urban Development



Acronym	Definition
HV	High-Volume
HVAC	Heating, Ventilation, and Air Conditioning
I&I	Inflow and Infiltration
IAP	Incident Action Plan
IAQ	Indoor Air Quality
IATA	International Air Transport Association
ICP	Incident Command Post
ICS	Incident Command System
IPM	Integrated Pest Management
JFO	Joint Field Office
JIC	Joint Information Center
JOC	Joint Operations Center
LEA	Local Enforcement Agency
LEPC	Local Emergency Planning Committee
MCL	Maximum Contaminant Level
MRP	Mission Ready Packages
NCHH	National Center for Healthy Housing
NCP	National Contingency Plan
NDRF	National Disaster Recovery Framework
NEHA	National Environmental Health Association
NEMA	National Emergency Management Association
NGO	Non-Governmental Organizations
NIC	National Integration Center
NIOSH	National Institute for Occupational Safety and Health
NIMS	National Incident Management System
NNDSS	National Notifiable Diseases Surveillance System
NPG	National Preparedness Goal
NPMA	National Pest Management Association
NRC	National Response Center
NRF	National Response Framework
NRT	National Response Team
NTNCWS	Non-Transient Non-Community Water System
NWR	NOAA Weather Radio All Hazards
OPA	Oil Pollution Act
OSC	On-Scene Coordinator



Acronym	Definition
OSHA	Occupational Safety and Health Administration
PHEP	Public Health Emergency Preparedness
PIO	Public Information Officer
PM	Particulate Matter
PPE	Personal Protective Equipment
RCP	Regional Contingency Plan
RCRA	Resource Conservation and Recovery Act
RTE	Ready-to-Eat
RV	Recreational Vehicle
RWI	Recreational Water Illness
SAP	Sampling and Analysis Plan
SCP	Sampling Collection Plan
SARA	Superfund Amendments and Reauthorization Act
SCADA	Supervisory Control and Data Acquisition
SDWA	Safe Drinking Water Act
SitReps	Situation Report
SOP	Standard Operating Procedure
STLT	State, Tribal, Local, and Territorial
SWV	Standing Well Volume
TCS	Temperature Control for Safety
TCL	Target Capability List
TNCWS	Transient Non-Community Water System
TSDF	Treatment, Storage, and Disposal Facilities
ULV	Ultra-low Volume
USLA	United States Lifesaving Association
UV	Ultraviolet
VOC	Volatile Organic Compounds



Appendix 1-A: Disaster Management Overview

National Incident Management System (NIMS)

NIMS provides stakeholders across the country with the shared vocabulary, systems, and processes that guide personnel's collaboration during incidents.

Incident Command System (ICS)

The Incident Command System (ICS) is a key component of NIMS. It is a standard, on-scene, all-hazards incident management system. ICS is a versatile and widely adopted framework for managing incidents effectively. It is employed by organizations of all types and sizes and government entities at every level to handle both small- and large-scale incidents, including emergencies and planned events. ICS facilitates coordination among multiple jurisdictions and agencies, ensuring a cohesive response. It establishes standardized planning and resource management processes at the incident level, seamlessly integrating various resources, such as facilities, equipment, and personnel, within a unified organizational structure.

This is a depiction of a basic ICS structure. The incident commander or incident command is at the top of the chart. They are supported by Command staff, which includes the Public Information Officer (PIO), Safety Officer, and Liaison Officer. Command is supported by General Staff sections: Operations, Planning, Logistics, Finance/Administration, and Information/Intelligence. Each section has a Chief.

National Response Framework (NRF)

The National Response Framework (NRF) guides the nation's response to all types of disasters and emergencies. It is built on scalable, flexible, and adaptable concepts identified in NIMS to align key roles and responsibilities. The NRF includes the following:

- [Emergency Support Functions](#) (ESFs) that describe federal coordinating structures that group resources and capabilities into functional areas most frequently needed in a national response.
- [Support Annexes](#) that describe how support is organized among the private sector, non-government organizations (NGOs), and federal partners.

Facilities and Co-ordination

Location	Description
Incident Command Post (ICP)	Field location at which the primary tactical level, on-scene incident command functions are performed.
Staging Area	Temporary locations established during an event or incident.
Emergency Operations Center (EOC)	Typically fixed physical locations found at all levels of government (federal and state, tribal, local, and territorial (STLT)).
Joint Information Center (JIC)	A physical or virtual location that serves as the focal point for the release of incident-related information to the public.
Joint Field Office (JFO)	The unified command center of the disaster at the federal level.
Joint Operations Center (JOC)	A specialized facility established by the Federal Bureau of Investigation (FBI) to coordinate law enforcement activities during a threat or incident.



Federal Emergency Support Functions

- ESF #1: Transportation
- ESF #2: Communications
- ESF #3: Public Works and Engineering
- ESF #4: Firefighting
- ESF #5: Information and Planning
- ESF #6: Mass Care, Emergency Assistance, Temporary Housing, and Human Services
- ESF #7: Logistics
- ESF #8: Public Health and Medical Services
- ESF #9: Search and Rescue
- ESF #10: Oil and Hazardous Materials Response
- ESF #11: Agriculture and Natural Resources
- ESF #12: Energy
- ESF #13: Public Safety and Security
- ESF #14: Cross-Sector Business and Infrastructure
- ESF #15: External Affairs

National Disaster Recovery Framework (NDRF)

The National Disaster Recovery Framework (NDRF) outlines key principles for recovery, defines the roles and responsibilities of recovery coordinators and stakeholders, establishes a structure for communication and collaboration, provides guidance for pre- and post-disaster actions, and details the overall process for communities to rebuild stronger, smarter, and safer. The NDRF includes Recovery Support Functions (RSFs) that provide a structure to facilitate problem-solving, improve access to resources, and foster coordination among state, tribal, local, territorial (STLT) and federal agencies, non-governmental partners, and stakeholders.

The RSFs include:

- Community Planning and Capacity Building
- Economic Recovery
- Health and Social Services
- Housing
- Infrastructure Systems
- Natural and Cultural Resources



Appendix 1-B: Mutual Aid

Mutual Aid Agreements

Mutual aid agreements and assistance agreements are agreements between agencies, organizations, and jurisdictions that provide a mechanism for quickly obtaining emergency assistance in the form of personnel, equipment, materials, and other associated services.

The primary objective is to facilitate rapid, short-term deployment of emergency support before, during, and after an incident. There are many different types of mutual aid agreements that can be formed with multiple partners at all levels, including:

- International
- Regional
- State-to-State
 - Emergency Management Assistance Compact (EMAC), which was the first Congressionally ratified mutual aid agreement
- County-to-County
- City-to-City
- Between agencies (interagency) and within agencies (intra-agency)
- Private Sector-to-Government

The [National Incident Management System \(NIMS\) Guideline for Mutual Aid](#) provides guidance on different types of mutual aid agreements and their key components.

Emergency Management Assistance Compact (EMAC)

Emergency Management Assistance Compact (EMAC) is a voluntary interstate mutual aid compact. The mission of EMAC is to share resources during disasters, including any type of resources or personnel, such as EPH personnel, resources, and assets. EMAC is administered and managed by the National Emergency Management Association (NEMA).

Credentialing

Under NIMS, credentialing is the administrative process for validating personnel qualifications, providing authorization to perform specific functions, and obtaining specific access to an incident involving mutual aid, particularly when crossing state lines. The National Integration Center (NIC) developed the NIMS Guideline for the credentialing of personnel, which describes national credentialing standards and provides written guidance regarding using those standards. The typing library has three general EPH positions. Additionally, there are currently three job credentialing titles for EPH professionals. These are:

- [Environmental Public Health Specialist](#)
- [Environmental Public Health Team](#)
- [Environmental Public Health Team Leader](#)

The categorization of personnel, resources, and assets is resource typed in NIMS. Resource typing categorizes by capability and the resources requested, deployed, and used in incidents. EPH is a Tier 1 resource-typing definition under Medical and Public Health Teams.

Note: Some states, tribes, local jurisdictions, and territories use different terminology for EPH professionals.



Other titles that may be used in the EPH career field also include, but are not limited to:

- *Environmental Health Specialist/Officer*
- *Public Health Sanitarian*
- *Environmental Health Scientist*
- *Environmental Health Director/Manager*
- *Industrial Hygienist*
- *Emergency Preparedness Coordinator*
- *Environmental Compliance Specialist*
- *Food Safety Specialist*
- *Vector Control Specialist*
- *Water Quality Specialist*
- *Air Quality Specialist*
- *Hazardous Materials Specialist*
- *Occupational Health Specialist*
- *Public Health Consultant*
- *Animal Control*

EMAC Mission Ready Packages (MRPs)

NEMA has released 120 EMAC Resource Typed Mission Ready Packages. They are designed to address the specific mission in question, limitations that might impact a particular mission, support required to fulfill that mission, space requirements to complete the mission, and the estimated cost for the mission. These are based on the NIMS resource types we discussed earlier, according to:

- Category
- Kind
- Components
- Metrics
- Type

Environmental Public Health Strike Teams

Through mutual aid agreements like EMAC, states can request and share resources, expertise, and personnel to enhance emergency response capabilities and support affected communities. EPH Strike Teams may be deployed before or after a hurricane. These teams of specialized EPH personnel support other states during emergencies.



Appendix 1-C: Important Reference Documents

The [National Preparedness System](#) outlines an organized process for everyone in the community to move forward with their preparedness activities and achieve the National Preparedness Goal (NPG). The National Response Framework (NRF) is the nation's comprehensive, all-hazards approach to domestic incident response. It overviews key response principles, roles, and structures that guide national response.

The [National Oil and Hazardous Substances Pollution Contingency Plan](#) (NCP) is the federal government's blueprint for responding to oil spills and hazardous substance releases. Key elements of the NCP include:

- The National Response Team (NRT) and Regional Response Teams (RRTs) are established to plan, coordinate, and provide guidance for responses at the national and regional levels.
- The National Response Center (NRC) is the central point for reporting all pollution incidents.
- The On-Scene Coordinator (OSC) is authorized to direct all response activities and submit reports on removal actions.
- A unified command structure is established for managing responses and coordinating personnel and resources from federal, state, tribal, local, and territorial (STLT), and responsible parties.
- Federal agencies have specific responsibilities and may provide assistance based on their expertise and capabilities.
- The NCP defines the objectives, authority, and scope of Federal Contingency Plans, including the NCP, Regional Contingency Plans (RCPs), and Area Contingency Plans (ACPs).
- National priorities and the general pattern of response are established, with special considerations for spills of national significance and worst-case discharges.
- The Oil Spill Liability Trust Fund provides funding for responses to oil releases, with the responsible party liable for federal removal costs and damages.
- The NCP Product Schedule lists dispersants and other products that may be used in response actions.
- The lead agency is authorized to initiate appropriate removal action for hazardous substance releases based on various threats and factors affecting public health or the environment.

The [Comprehensive Environmental Response, Compensation, and Liability Act \(CERCLA\)](#), also known as Superfund, has two primary focuses. First, it aims to clean up inactive hazardous waste sites. Second, it establishes the liability for cleanup costs on arrangers and transporters of hazardous substances, as well as on current and former owners of facilities where hazardous substances were disposed.

The [Oil Pollution Act \(OPA\) of 1990](#) streamlined and strengthened the Environmental Protection Agency's (EPA's) ability to prevent and respond to catastrophic oil spills. A trust fund financed by a tax on oil can clean up spills when the responsible party is incapable or unwilling to do so.

The [Superfund Amendments and Reauthorization Act \(SARA\)](#) sets the requirements for facilities that manufacture, process, or store certain hazardous or toxic chemicals of certain thresholds on-site. It requires them to report annually to the state and local governments and report any accidental releases in a timely manner.

The [Resource Conservation and Recovery Act \(RCRA\)](#) gives EPA the authority to control hazardous waste from cradle to grave. This includes generating, transporting, treating, storing, and disposing of hazardous waste. RCRA also set forth a framework for the management of non-hazardous solid wastes.

The [Emergency Planning and Community Right-to-Know Act of 1986](#) requires industry to report on the storage, use, and release of certain chemicals to federal and STLT governments. It also requires these reports to be used to prepare for and protect their communities from potential risks.



Attachment 1: Environmental Public Health Preparedness and Response Capability Framework (EPHEPR)

The Environmental Public Health Emergency Preparedness and Response (EPHEPR) Capability Framework is a set of standards developed in 2022 by the National Environmental Health Association (NEHA) to assist state, tribal, local, and territorial (STLT) jurisdictions in preparing for, responding to, and recovering from emergencies. EPHEPR aligns with the CDC's Public Health Emergency Preparedness (PHEP) Capabilities, which guide public health coordination during disaster preparedness and response. It also aligns with the Federal Emergency Management Agency (FEMA) Community Lifelines, Centers for Disease Control (CDC) Readiness Framework, and the U.S. Department of Homeland Security's Target Capabilities List (TCL).

EPHEPR consists of 15 functional areas, each representing a priority EPH area essential to address in emergency management:

- Function 1: Identify EPH Risks for the Affected Population and Design Plan for Mitigation
- Function 2: Coordinate EPH Response and Resources
- Function 3: Assure the Safety and Integrity of Water Systems
- Function 4: Assure the Safety and Integrity of Solid Waste/Debris Management Systems
- Function 5: Assure the Safety and Integrity of Wastewater Systems
- Function 6: Assure the Safety of Emergency Shelters
- Function 7: Assure the Integrity of Food Supply and Delivery Systems
- Function 8: Assure the Safety and Integrity of Buildings
- Function 9: Assure the Safety of Indoor/Outdoor Air
- Function 10: Provide Vector Surveillance and Control
- Function 11: Provide EPH Support to Hazardous Materials (HAZMAT) Management
- Function 12: Provide EPH Support to Radiological Management
- Function 13: Assure the Safety of Recreational Water
- Function 14: Conduct Open Water Monitoring
- Function 15: Assure Effective Environmental Sampling



Attachment 2: Go-Bag Checklist

Individual	
Personal Identification and Documentation	Identification (e.g., driver's license, passport)
	Contact information for family, colleagues, and emergency contacts
	Copy of credentials (e.g., licenses, certifications)
	Medical information (e.g., allergies, medication)
Communication and Navigation	Fully charged cell phone with charger and portable power bank
	Handheld two-way radio (min 2-mile radio) or satellite phone (if available)
	Local maps and GPS device or application
	Inverter car plug-in for 12 Volt to 120 Volt (small for phones/laptops)
	NOAA Weather Radio All Hazards (NWR) and/or weather apps
	FEMA Daily Operations Briefing
	List of open fuel points
Personal Protective Equipment (PPE)	N-95 particulate respirator mask (fit testing per occupational health)
	Gloves (leather: sized to fit, local supply)
	Gloves (nitrile: sized and rotated with local supply, box)
	Bug repellent spray can (min 6 ounces) and/or insect repellent towelette (box) like X30
	Safety glasses or goggles
	Protective clothing (e.g., waterproof, durable, multi-pocket vest)
	Safety vest (reflective preferred)
	Hat/hard hat
	Sunscreen (at least SPF 15)
First Aid Kit	Basic first aid supplies (e.g., bandages, antiseptic wipes, gauze)
	Prescription medications (enough for several days)
	Over-the-counter medications (e.g., pain relievers, antihistamines)
	Hand sanitizer (minimum 2 ounces, 70% alcohol)
	Sterile water/saline



Individual	
Tools and Equipment	Specialty equipment: thermocouple, alcohol wipes, well-testing supplies, etc. (locally acquired with state support)
	Whistle or signaling device
	Multi-tool with pliers or Swiss Army knife
	Duct tape and plastic sheeting
	Screwdriver
	Hammer
	Rope
	Nails
	Headlamp
	Measuring Utensils
Hygiene and Sanitation	Personal hygiene items (e.g., toothbrush, toothpaste, soap, hand sanitizer)
	Moist towelettes or baby wipes
	Plastic bags (for waste disposal and waterproofing)
	Pepper Spray
Food and Water	Water bottle
	Bottled water (at least 3-day supply)
	Manual can opener
	Non-perishable food items (e.g., energy bars, canned goods)
	Food emergency supplies (incident dependent) 7-day supply
Documentation and Resources	Notebook and pens/pencils
	Clipboard or waterproof folder for documents
	Local emergency response plans and protocols
Specialty Items	Environmental testing kits (e.g., for water quality, air quality)
	Field survey equipment (e.g., measuring devices, sampling tools)
	Incident-specific protocols or checklists
Additional Considerations	Cash (small bills and coins)
	Blanket or sleeping bag
	Personal comfort items (e.g., extra clothing, sturdy shoes)
	Additional prescription glasses
	Umbrella
	Tarp
	Pop-up tent



Team

Air-monitoring equipment (basic: type 1 team)
Alcohol wipes (box)
Batteries for flashlights/radio/weather radio (minimum 8 pack, each type)
Bio-Hazardous Waste Red Bags
Bottled water (case: 32)
Candles (5-inch)
Caution tape roll
Coil-tag water sampling powder and bottles (incident dependent)
Duct tape roll
Emergency Blankets (backup supply)
Face Masks (box)
First Aid Kit
Flashlights handheld backups
Food Emergency Supplies (incident dependent) 7-day supply
Gloves (nitrile; M/L/XL, one box of each)
Goggles
Hand sanitizer refill and backup bottles (70% alcohol)
Incubator (incident dependent)
Insect repellent spray cans (min 6 ounces) backup supply
Inverter backup power supply (larger: 1500 watts/peak 2500)
Light stick (6 inch safety style)
Matches (box)
Multi-tool with pliers
Paper towels (minimum pack of 6)
Radio (min 2-mile radio; cell phone preferred)
Radio AM/FM
Razor knife
Shovel/pick folding multi-tool
Tool Kit (i.e., basic hammer, screwdriver, pliers)
Water Purification Tablets (bottle or packet) ⁹ ¹⁰
Water Filter (absolute pore size of 1 micron or smaller)

⁹ If you potentially need to treat water, an absolute 1-micron filter should be used to remove crypto and giardia before using purification tablets.

¹⁰ Water purification tablets are used for naturally occurring water sources. They should not be used in a post-disaster environment.



