

Hurricane Key Messages for Employers, Workers and Volunteers

This key messages document is for internal and external use. It contains the messaging that has been cleared for use in developing other materials related to this emergency response.

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KEY MESSAGES

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Background

Protecting the health and safety of responders and volunteers by preventing diseases, injuries, and fatalities is a National Institute for Occupational Safety and Health (NIOSH) Emergency Preparedness and Response Program priority (<https://www.cdc.gov/niosh/emres/default.html>). This document focuses on key messages for employers, workers, and volunteers responding to Hurricanes Harvey, Irma, and Maria. It will be updated as new information becomes available and will be distributed regularly. Please share this document with others as appropriate.

Carbon Monoxide

Workers deployed for hurricane disaster work need to be aware of the dangers of carbon monoxide (CO) poisonings. CO is an odorless, colorless gas that can cause sudden illness and death if inhaled. When power outages occur during natural disasters and other emergencies, the use of alternative sources of fuel or electricity for heating or cooking can cause CO to build up in a home, garage, or camper and to poison the people and animals inside. Generators, grills, camp stoves, or other gasoline, propane, natural gas, or charcoal-burning devices should never be used inside a home, basement, garage, or camper – or even outside near an open window or window air conditioner.

All relief workers and emergency responders should:

- Never use a generator, pressure washer, or any gasoline engine-driven tool (such as a concrete saw, water pump, or compressor) indoors or less than 20 feet from any window, door, or vent. One generator produces as much CO as hundreds of cars.
- Never run a generator, pressure washer, or any gasoline-powered engine inside a basement, garage, or other enclosed structure, even if the doors or windows are open.
- Never use a charcoal grill, hibachi, lantern, or portable camping stove inside a home, tent, or camper.
- Never leave the motor running in a vehicle parked in an enclosed or partially enclosed space, such as a garage.
- Learn to recognize the symptoms and signs of CO overexposure: headache, nausea, weakness, dizziness, visual disturbances, changes in personality, and loss of consciousness. Any of these symptoms and signs can occur within minutes of usage.

CDC provides guidance to prevent CO poisoning after a disaster that includes a basic overview on preventing CO poisoning after an emergency, clinical guidance, public safety announcements and other educational materials at <https://www.cdc.gov/disasters/carbonmonoxide.html>.

More Information

- Carbon Monoxide Hazards from Small Gasoline Powered Engines (<https://www.cdc.gov/niosh/topics/co/>)
- Carbon Monoxide Poisoning (<http://www.cdc.gov/co>)



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- CO Fact Sheet (<https://www.cpsc.gov/safety-education/safety-guides/carbon-monoxide/carbon-monoxide-fact-sheet>)
- Hazard Alert CO Poisoning: Gas-powered Generators, Tools and Other Equipment (https://www.cpwr.com/sites/default/files/publications/CARBON%20MONOXIDE_post.pdf)

Chain Saws/Tree Removal

Chain saws are an important tool for the clearing of downed or dangerous trees after natural disasters. However, misuse of chain saws can cause serious injuries or death to the operator, or to others working around them. Follow these tips to keep workers safe:

- Make sure workers wear proper clothing when using a chain saw (for example chain saw chaps, heavy boots, work gloves, hard hat, goggles/face shield, and hearing protection).
- Check that the saw has a chain-brake, hand guards, and is properly maintained.
- Check that the chain used is made for the saw, sharp, and properly adjusted (see the operator's manual).
- Provide workers with plastic wedges to help prevent the saw from pinching when cutting downed trees.
- Confirm that workers know how to correctly release tension in spring poles or tree limbs under stress.
- Keep co-workers a safe distance from the worker—30 feet when cutting downed trees, and 2 times the height of the tree when felling trees.

More Information

- Preventing Chain Saw Injuries During Tree Removal After a Disaster (<https://www.cdc.gov/disasters/chainsaws.html>)
- Chainsaw Safety Fact Sheet (<https://www.cdc.gov/disasters/hurricanes/pdf/flyer-chainsaw-safety.pdf>)
- Working Safely with Chain Saws Fact Sheet (https://www.osha.gov/OshDoc/data_Hurricane_Facts/chainsaws.pdf)

Chemical Safety Recommendations

Flooding and other damage caused by hurricanes can create a hazardous working environment for emergency responders and other disaster relief workers. Chemicals that would normally be stored safely could be released to the environment due to hurricane damage. Industrial settings could be a large source of potential chemical exposure, but chemicals stored in residences, retail establishments, or other places could also contribute to the hazardous conditions.

- The types and amounts of chemicals released depend on factors such as types of facilities in the area, types of chemicals produced or kept at affected facilities and homes, and structural damage to facilities and homes. (<https://www.cdc.gov/disasters/chemicals.html>)



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- Workers responding to hurricane damage can be exposed to many hazardous substances, including carbon monoxide, sewage, chemicals, along with many other potential hazards. (<https://www.cdc.gov/disasters/cleanup/index.html>)
- Workers should be aware of the hazards caused by carbon monoxide exposure due to exhaust from generators used during power outages. (<https://www.cdc.gov/disasters/carbonmonoxide.html>)
- Chemical agent information is needed for workers to appropriately plan for risks resulting from possible chemical incidents. The following link contains several chemical databases that provide detailed information on a variety of chemical agents associated with emergency response, including information on how to protect workers from exposures to these agents. (<https://www.cdc.gov/niosh/topics/emres/chemagent.html>)
- Chemical agent information can help workers be prepared to protect themselves during and after the release of a chemical that could harm people's health. The following link provides facts, descriptions, and emergency response information from the CDC related to over 80 specific chemical agents. (<https://emergency.cdc.gov/agent/agentlistchem.asp>)
- Chemical Hazards Emergency Medical Management (CHEMM) is a useful resource for first responders and it includes information on identifying categories of chemicals based on symptoms of toxicity. (<https://chemm.nlm.nih.gov/>)
- If hazardous chemical containers are found or leaking materials are detected, take self-protective measures (such as move to a safe distance upwind) and contact hazardous material response personnel for evaluation of the risk and removal before continuing work in the area. (<https://www.osha.gov/SLTC/etools/hurricane/recommendations.html>)

Cleaning Up and Restoring Power to Flooded Residences

Electrocution Hazards

Workers deployed for flood disaster work can be exposed to electrocution hazards.

- **NEVER** touch a downed power line.
- **Do not** clean up or work near a downed power line unless utility workers have turned off the power and grounded the lines
- **Do not** enter flooded areas or touch electrical devices or appliances if the ground is wet unless you know the power is off.
- **Turn off** the power at the main breaker or pull the main fuse on the service panel if water has been in the building.
- **Do not** turn the power back on until electrical devices and circuits have been inspected by a qualified electrician. Even though water is no longer present, circuits and devices, inside building walls, may still be wet causing an electrocution hazard.

Backfeed Power from Portable Generators

Residents may have connected a portable generator to the house. This can cause backfeed where power flows in the opposite direction from its usual flow or voltage can be present on a conductor or associated equipment



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after it has been disconnected from its normal source. Because of this, workers restoring power to homes may be exposed to electrocution from backfeed power. NIOSH recommends:

- Treat all lines as "hot" unless you positively know they are no longer hot and are properly disconnected and grounded on both sides of the work area.
- Wear the required protective equipment for the voltage level you may be exposed to.
- Make sure there is a visible open point between the load and the power supply by opening a fused disconnect, fused switch, or by removing a tap jumper if the load permits.
- Provide workers with appropriate protective equipment and trained in procedures for all voltage levels they are exposed to.

More Information

- Electrical Safety and Generators Web Page (<https://www.cdc.gov/disasters/elecgenerators.html>)
- Electrical Safety (<https://www.cdc.gov/niosh/topics/electrical/default.html>)

Emergency Responder Health Monitoring and Surveillance™

The Emergency Responder Health Monitoring and Surveillance™ (ERHMS™) framework provides recommendations for protecting emergency responders and recovery workers, including volunteers, during small and large emergencies in any setting, including natural disasters.

ERHMS™ establishes recommendations for pre-, during, and post- deployment monitoring and surveillance of deployed personnel. Examples include pre-deployment training, medical clearance, and respirator fit testing (if needed); during-deployment surveillance for exposures, physical and mental illnesses, and injuries; and post-deployment assessments for physical and mental illnesses and potential need for short- or long-term follow-up.

ERHMS Info Manager™ is free software developed by NIOSH that organizations can use to implement the ERHMS™ framework. The ERHMS™ framework and software can be used by anyone involved in the deployment and protection of emergency responders and recovery workers/volunteers, including: incident command staff, response organization leadership, health, safety and medical personnel, and emergency responders.

More Information

- Emergency Responder Health Monitoring and Surveillance (ERHMS)™ including the ERHMS framework and online trainings (<https://www.cdc.gov/niosh/erhms/default.html>)
- Emergency Responder Health Monitoring and Surveillance™: NRT Technical Assistance Document (https://www.nrt.org/sites/2/files/ERHMS_Final_060512.pdf)
- Emergency Responder Health Monitoring and Surveillance™: A Guide for Key Decision Makers (https://www.nrt.org/sites/2/files/ERHMS_Decisionmakers_060512.pdf)
- ERHMS Info Manager™ (<https://www.cdc.gov/niosh/erhms/erhms-info-manager.html>)



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Fall Prevention

Falls from heights (including stepladders and one-story structures) are more likely to result in death, but slips, trips, and falls on the same level are more common and can still cause serious injury. Slipping feet at any height can lead to a serious fall. When working in wet or slippery areas, use slip-resistant footwear. When using stepladders for repair work after hurricane damage, never climb a stepladder in the closed position or leaning against something, and do not stand higher than the second step from the top. While climbing a ladder, use three points of contact, and do not carry materials, do not overreach to the side of the ladder, and do not pull or push extensively since this can destabilize the ladder and lead to a fall.

Recommendations

- Use footwear labelled as slip-resistant when working in wet or slippery areas
- Never climb a stepladder in the closed position or leaning against something
- Do not stand higher than the second step from the top on a stepladder
- When climbing a ladder, use three points of contact, and do not overreach to the side of the ladder, and do not pull or push extensively since this can destabilize the ladder and lead to a fall.

More Information

- Slip, Trip, and Fall Prevention Guide (<http://www.cdc.gov/niosh/docs/2011-123/pdfs/2011-123.pdf>)
- GRIP Rating Scheme for the Slip Resistance of Footwear (<https://www.hsl.gov.uk/products/grip/grip-ratings>)
- Ladder Safety App (<https://www.cdc.gov/niosh/topics/falls/mobileapp.html>)

Fire Ants

Fire ants are often disturbed during hurricanes because of flooding. They are able to cling together and float along in floodwaters. If disturbed, they will bite and sting. They are aggressive when stinging, and inject venom, which causes a burning sensation. Red bumps form at the sting, and within a day or two they become white fluid-filled pustules.

If stung or bitten:

1. Rub off ants briskly, as they will attach to the skin with their jaws
2. Antihistamines may help (drowsiness may occur)
3. Seek medical attention immediately if experiencing: severe chest pain, nausea, severe sweating, loss of breath, serious swelling, or slurred speech.

Recommendations

- Do not disturb or stand on or near ant mounds.
- Be careful when lifting items (including animal carcasses) off the ground, as they may be covered in ants.
- Fire ants may also be found on trees or in water, so always look over the area before starting to work.



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- If you have a history of severe allergic reactions to insect bites or stings, consider carrying an epinephrine auto injector (for example an EpiPen[®]) and wear medical identification jewelry stating the allergy.

More Information

- Stinging Insects: Fire Ants Web Page (<https://www.cdc.gov/niosh/topics/insects/fireants.html>)

Heat Stress

Heat stress is a concern during hurricane response, as workers and volunteers are often exposed to hot and humid temperatures, wear protective clothing and equipment, and have physically difficult tasks. Additional risk factors may make a heat-related illness more likely to occur, such as: dehydration, physical condition and health problems, medications, pregnancy, lack of recent heat exposure, and advanced age. Exposure to extreme heat can result in heat-related illnesses and injuries. Heat-related illnesses include: heat stroke, heat exhaustion, rhabdomyolysis (muscle breakdown), heat cramps, or heat rash. Symptoms and first aid information can be found at <https://www.cdc.gov/niosh/topics/heatstress/default.html>. Heat-related injuries may result from sweaty palms, fogged-up safety glasses, mental confusion, and dizziness.

Recommendations

- Train about the symptoms and risk factors of heat-related illnesses; first aid; and prevention.
- Take time to acclimatize. Gradually increase time working in hot conditions over 1-2 weeks.
- Work with a buddy and observe each other for signs of heat-related illness.
- Stay hydrated. If in the heat <2 hours, drink 1 cup (8 oz.) of water every 15–20 minutes. If sweating for several hours, drink low sugar sports drinks. Avoid alcohol even during off-work hours, as it can cause dehydration.
- Take frequent rest and hydration breaks in a cool area (air conditioning, vehicle, misting fans)
- Rhabdomyolysis symptoms may not start until several days after heat exposure. Seek medical evaluation immediately if experiencing symptoms.

More Information

- Heat Safety Tool App (<https://www.cdc.gov/niosh/topics/heatstress/heatapp.html>)
 - App is available in Spanish when phone language settings are set for Spanish
- Fast Facts: Protecting Yourself from Heat Stress
 - English: print (<https://www.cdc.gov/niosh/docs/2010-114/>) or order (<https://www.cdc.gov/pubs/CDCInfoOnDemand.aspx?ProgramID=147>)
 - Spanish: print (https://www.cdc.gov/spanish/niosh/docs/2010-114_sp/)
- Protect Workers from Heat Stress Infographic (<https://www.cdc.gov/niosh/topics/heatstress/infographic.html>)
- Criteria for a Recommended Standard: Occupational Exposure to Heat and Hot Environments (<https://www.cdc.gov/niosh/docs/2016-106/default.html>)



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Identifying and Handling Human Remains

Human remains can contain viruses including Hepatitis A, Hepatitis B, Hepatitis C, and HIV and bacteria that can cause diarrheal diseases. Personal protective equipment should be used to protect the skin and mucous membranes from these infectious agents.

This equipment would include:

- Face protection such as a face shield and surgical mask
- Cut- proof and nitrile gloves
- Cut-proof boots
- Additional clothing such as Tyvek® could be used to protect the skin from splashes

More Information

- Interim Health Recommendations for Workers who Handle Human Remains After a Disaster (<https://www.cdc.gov/disasters/handlerremains.html>)
- Management of Dead Bodies After Disasters: A Field Manual for First Responders (<http://www1.paho.org/English/DD/PED/DeadBodiesFieldManual.pdf>)
- Guidelines for Protecting Mortuary Affairs Personnel from Potentially Infectious Materials (<http://dmort4.com/DMORT4/resources/TG195a.pdf>)

Medical Recommendations for Relief Workers and Emergency Responders

Pre-exposure Medical Screening

Workers deployed for hurricane disaster work should undergo pre-exposure medical screening. The goal of this screening is to evaluate a worker's fitness to perform potentially hazardous or stressful work safely.

Additional guidance on medical screening for workers before beginning disaster response activities is available at <https://www.cdc.gov/niosh/topics/emres/preexposure.html>.

Required immunizations for disaster responders, in addition to routine vaccines, include:

- The tetanus booster if they have not been vaccinated for tetanus during the past 10 years, in accordance with current CDC guidelines.
- The Hepatitis B vaccine series for responders performing direct patient care or otherwise expected to have contact with bodily fluids.
- Additional immunizations, including the Hepatitis A vaccine and the typhoid vaccine, should be considered for relief workers traveling to Puerto Rico and the USVI, in accordance with current CDC guidelines.



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More Information

- Immunization Recommendations for Disaster Responders (<https://www.cdc.gov/disasters/disease/responderimmun.html>)
- Health Information and Vaccination Information for Travelers to:
 - Puerto Rico (U.S.) (https://wwwnc.cdc.gov/travel/destinations/traveler/mission_disaster/puerto-rico?s_cid=nceid-dgmg-travel-single-001)
 - U.S. Virgin Islands (https://wwwnc.cdc.gov/travel/destinations/traveler/none/usvirgin-islands?s_cid=nceid-dgmg-travel-single-001)

Post-exposure Medical Screening

Workers deployed for hurricane disaster work should also undergo post-exposure medical screening. The purpose of this screening is to determine if individual workers have been adversely affected by their work. It is also to identify any workers needing preventive measures or medical care.

Additional information on working in physically demanding, unclean, or unstable work environments, such as hurricane recovery areas is available at <https://www.cdc.gov/niosh/topics/emres/medScreenWork.html>.

Mold

Mold Clean-up

Control of moisture is the most important step in stopping mold growth. The amount of mold growth and type of material determines the remediation techniques to use

The most common personal protective equipment used for mold clean-up includes:

- NIOSH-approved N-95 respirator
 - Information on how to correctly put on and take off a respirator and perform a user seal check can be found at <https://www.osha.gov/video/20091216-respirator-1-english-high.wmv>
- Gloves
- Eye protection such as goggles
- Clothing such as long pants and long-sleeved shirts

Individuals who are immunocompromised or have pre-existing conditions such as asthma may be at increased risk of mold infections and health problems if they perform mold clean-up.

More Information

- Recommendations for the Cleaning and Remediation of Flood-Contaminated HVAC Systems: A Guide for Building Owners and Managers (<https://www.cdc.gov/niosh/topics/emres/Cleaning-Flood-HVAC.html>)
- Mold: Worker and Employer Guide to Hazards and Recommended Controls (https://www.hud.gov/sites/documents/IEPWG_MOLD_WORKER.PDF)
- Mold Remediation in Schools and Commercial Buildings (<https://www.epa.gov/sites/production/files/2014-08/documents/moldremediation.pdf>)



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- Mold Hazards during Disaster Cleanup (https://www.osha.gov/Publications/OSHA_FS-3713.html)
- Mold Remediation Training Tool (https://tools.niehs.nih.gov/wetp/public/hasl_get_blob.cfm?ID=9855)
- UCONN Center for Indoor Environments and Health: Hurricanes and Mold (<https://health.uconn.edu/hurricanes-mold/>)

Mold in the Workplace

Mold exposure and damp indoor environments have been associated with health symptoms including asthma, allergies, and respiratory infections.

Information on respiratory disease related to indoor dampness and recommendations for preventing and remediating damp buildings is available in the document “Preventing Occupational Respiratory Disease from Exposures Caused by Dampness in Office Buildings, Schools, and Other Nonindustrial Buildings” (<http://www.cdc.gov/niosh/docs/2013-102/>).

The document “Moisture Control Guidance for Building Design, Construction and Maintenance” provides useful information on controlling moisture in buildings (<https://www.epa.gov/sites/production/files/2014-08/documents/moisture-control.pdf>).

More Information

- Indoor Air Quality Web Pages (<http://www.cdc.gov/niosh/topics/indoorenv/>)
- Mold Web Pages
 - (<https://www.cdc.gov/mold>)
 - (<https://www.osha.gov/SLTC/molds/>)

Motor Vehicle Safety

Most emergency responders drive or ride in a motor vehicle during a disaster response. If you or your employees operate or ride in a motor vehicle responding to a hurricane or other disaster, you are at risk of a motor vehicle crash. The risk extends to all vehicles (cars, SUVs, emergency response or power company vehicles, and large trucks) and all workers, whether they are drivers or passengers. NIOSH recommends the following to ensure that workers in vehicles can carry out their response mission safely:

- Plan all trips and routes
 - Assess potential road hazards before starting each trip.
 - Know where and when workers will be driving.
 - Combine trips and loads when possible. This reduces crash risks and saves fuel.
 - Provide extra information to responders unfamiliar with the local road system.
- Prevent driver fatigue
 - Avoid driving in the early morning hours when fatigue is most likely.
 - Design work schedules that allow enough time off so drivers can get adequate sleep.
 - Encourage drivers to take rest breaks during their work shift.
- Prevent distracted driving



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- Pull over in a safe location if you must text, make a call, or use your phone for other purposes such as looking up directions.
- Let someone in the vehicle that is not driving take care of communications.

More Information

- Preventing Work-related Motor Vehicle Crashes: You Can Protect Your Employees and Others on the Road from Being Hurt or Killed in Motor Vehicle Crashes (<https://www.cdc.gov/niosh/docs/2015-111/default.html>)
- Interim NIOSH Training for Emergency Responders: Reducing Risks Associated with Long Work Hours (<https://www.cdc.gov/niosh/emres/longhourstraining/>)
- Disaster Response: Roadway Safety⁺ Awareness Program
 - English - https://www.workzonesafety.org/files/documents/training/courses_programs/rsa_program/RoadwaySafety_Booklets_English/RoadwaySafety_Booklet_DisasterResponse_English.pdf
 - Spanish- https://www.workzonesafety.org/files/documents/training/courses_programs/rsa_program/RoadwaySafety_Booklets_Spanish/RoadwaySafety_Booklet_DisasterResponse_Spanish.pdf

Personal Protective Equipment (PPE)

Rescue workers and emergency responders can be exposed to a wide variety of hazards during and following hurricane and flooding events. The routes of exposure include inhalation, skin absorption, and ingestion. Chemical and biological contaminants can be released to the environment from various sources such as industrial and commercial facilities, households, and sewage plants and waste lines. Response workers can also be exposed to bodily fluids that may contain infectious disease agents during victim recovery and while handling human remains. Flooded buildings often provide an ideal environment to promote mold growth that can cause health effects such as nasal, eye, and skin irritation, as well as respiratory problems such as bronchitis and asthma attacks. Debris and unstable surfaces can cause worker injuries by slips, trips, falls, cuts, and abrasions.

Responders and employers can minimize or eliminate these hazards by the selection and use of appropriate PPE for each response situation. Specifically,

- Use cut resistant gloves when handling debris to minimize cuts and scrapes and puncture wounds.
- Wear safety glasses, goggles, or face shields and protective head cover (helmets) appropriate for the hazard
- Use slip and puncture resistant safety shoes to prevent slips, trips, falls and foot injuries
- Wear hearing protection (such as ear plugs) during work in high noise areas (for example chain saw work)
- Use nitrile gloves and liquid resistant gowns/aprons/garments or ensembles to minimize or prevent exposures to blood and bodily fluids
- Use NIOSH approved respirators that are designated as appropriate for chemical, biological, and particulate hazards.



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- Wear rubber boots or waders of an appropriate height to protect feet, legs, and torso from contaminated flood waters.
- Wear liquid-resistant dry suits to protect the neck, torso, arms, and legs when working in contaminated flood waters
- Be aware of electrical shock hazards. Recovery workers should use insulated PPE when working on electrical equipment
- Wear appropriate chemical protective garments or ensembles to protective against liquid or vapor chemical hazards

More Information

- Flood Web page (<https://www.cdc.gov/niosh/topics/emres/flood.html>)
- Hazard Based Guidelines: Protective Equipment for Workers in Hurricane Flood Response (<https://www.cdc.gov/niosh/topics/emres/pre-workers.html>)
- PPE Web page (<https://www.cdc.gov/niosh/topics/emres/ppe.html>)
- Guidance for Supervisors at Disaster Rescue Sites (<https://www.cdc.gov/niosh/topics/emres/emhaz.html>)
- Clean Up Safely After a Disaster
 - English - <https://www.cdc.gov/disasters/cleanup/facts.html>
 - Spanish- <https://www.cdc.gov/es/disasters/cleanup/facts.html>
- Keeping Workers Safe during Disaster Cleanup and Recovery (<https://www.osha.gov/Publications/OSHA3698.pdf>)

Respirator Selection and Use

Emergency responders and those involved in clean-up activities after a hurricane or flooding event can be exposed to a wide variety of chemical and biological respiratory hazards. Sources of exposure can include industrial chemicals, commercial and household chemicals, sewage, other hazardous waste, and biological sources, such as mold, which is common in flooded buildings.

CDC/NIOSH tests and approves respirators for use by workers to protect against workplace hazards when utilized within a Respiratory Protection Program that conforms with the Occupational Safety and Health Administration's (OSHA) requirements found with the Respiratory Protection Rule (29 CFR 1910.134). Respirators that have been approved by NIOSH for specific hazards have been assigned an approval number and are provided to the end user with a NIOSH approval label outlining their approved protections. Responders or employers can minimize or eliminate respiratory hazards by selecting and using appropriate respiratory protection for each response situation. Specifically,

- Identify the hazard(s) and make appropriate respirator selections, just because a respirator is NIOSH approved does not mean it will offer protection from ALL hazards
- Do not use surgical or medical procedure masks in place of a NIOSH approved particulate respirator (for example N95) as they do not provide adequate protection



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- Obtain training on how to use, store and clean the respirator in accordance with the manufacturer's user instructions
- Ensure that respirator selected fits properly by conducting an OSHA recognized qualitative or quantitative fit test prior to use
- Beware of respirators that falsely claim NIOSH approval, the NIOSH Certified Equipment List (CEL) should be consulted if NIOSH approval is suspect
- Use A Self-Contained Breathing Apparatus for entry into oxygen deficient environments

During Pregnancy

Pregnant women involved with a natural disaster response where respiratory protection is needed (for example post-hurricane cleanup with a moldy environment) should consider the following recommendations that are based on CDC/NIOSH research findings:

- If possible, consult with your physician before wearing a respirator to ensure you can safely and comfortably use the respirator during all stages of the pregnancy.
- If a respirator is needed, you can safely wear a fit-tested NIOSH-approved N95 respirator at one hour intervals.
- Make sure the respirator fits properly, even if not fit-tested, by performing a user seal check (see user seal check FAQ under "More Information" below).
- Try to avoid touching the contaminated surface of the N95 respirator (the outer surface) so you do not transfer potentially harmful particles to your hands.
- When done using the N95 respirator, dispose of it properly so that others (for example children) cannot come in contact with it.

Depending on the location, the safest option for you and your baby may be to remove yourself from the area.

More Information

- Storm, Flood, and Hurricane Response Web Page (<https://www.cdc.gov/niosh/topics/emres/flood.html>)
- N95 Respirator Infographic (<https://www.cdc.gov/niosh/nppt/pdfs/infographic-n-95.pdf>)
- Respirator Trusted-Source Information Web page
 - Section 1: NIOSH-Approved Respirators – What Are They? How Can They Be Identified? Where Can I Get Them? (https://www.cdc.gov/niosh/nppt/topics/respirators/disp_part/respource1quest2.html)
 - Section 2: Use of NIOSH-Approved Respirators (https://www.cdc.gov/niosh/nppt/topics/respirators/disp_part/respource2.html)
- Pocket Guide to Chemical Hazards
 - Print (<https://www.cdc.gov/niosh/docs/2005-149/pdfs/2005-149.pdf>)
 - Web and Downloadable Version (<https://www.cdc.gov/niosh/docs/2005-149/default.html>)
- N95 Respirator Use During Pregnancy – Findings from Recent NIOSH Research (<https://blogs.cdc.gov/niosh-science-blog/2015/06/18/respirators-pregnancy/>)
- User Seal Check FAQs from NIOSH's Respirator Trusted-Source (https://www.cdc.gov/niosh/nppt/topics/respirators/disp_part/respource3fittest.html)



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- Respirator Basics: Fit Testing Web Page (https://www.osha.gov/SLTC/etools/respiratory/respirator_basics.html#fit_testing)
- OSHA Respiratory Protection eTool (<https://www.osha.gov/SLTC/etools/respiratory/index.html>)
- American Journal of Infection Control- N95 respirator use during advanced pregnancy (<http://www.sciencedirect.com/science/article/pii/S0196655314009407?via%3Dihub>)

Stress Associated with Traumatic Incidents and Emergency Response

A *traumatic incident* is one that may involve exposure to catastrophic events, severely injured children or adults, dead bodies or body parts, or a loss of colleagues. NIOSH recommends that all workers involved in response activities help themselves and their coworkers and reduce the risk of experiencing stress associated with a traumatic incident by utilizing simple methods to recognize, monitor, and maintain health on-site and following such experiences.

The NIOSH Traumatic Incident Stress web page

(<https://www.cdc.gov/niosh/topics/traumaticincident/default.html>) includes descriptions of symptoms of stress (physical, cognitive, emotional, and behavioral), and recommendations for on-site monitoring and maintaining post-incident health of emergency workers.

Recommendations

The following are recommendations for monitoring your emotional and physical health during and after recovery efforts:

- Control the organization and pace of the rescue and recovery efforts
 - Pace yourself. Rescue and recovery efforts at the site may continue for days or weeks.
 - Watch out for each other. Coworkers may be intently focused on a particular task and may not notice a hazard nearby or behind.
 - Be conscious of those around you. Responders who are exhausted, stressed, or even temporarily distracted may place themselves and others at risk.
 - Take frequent rest breaks. Rescue and recovery operations take place in extremely dangerous work environments. Mental fatigue, particularly over long shifts, can greatly increase emergency workers' risk of injury.
- Maintain adequate nutrition and rest
 - Eat and sleep regularly. Maintain as normal a schedule as possible and adhere to the team schedule and rotation.
 - Drink plenty of fluids such as water and juices.
 - Try to eat a variety of foods and increase your intake of complex carbohydrates (for example, breads and muffins made with whole grains, granola bars).
 - Whenever possible, take breaks away from the work area. Eat and drink in the cleanest area available.
- Monitor mental/emotional health



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- Recognize and accept what you cannot change—the chain of command, organizational structure, waiting, equipment failures, etc.
- Talk to people when YOU feel like it. You decide when you want to discuss your experience. Talking about an event may be reliving it. Choose your own comfort level.
- If your employer provided you with formal mental health support, use it!
- Give yourself permission to feel rotten: You are in a difficult situation.
- Recurring thoughts, dreams, or flashbacks are normal—do not try to fight them. They will decrease over time.
- Communicate with your loved ones at home as frequently as possible.

More Information

- Resilience Resources for Emergency Response Web page (https://www.osha.gov/SLTC/emergencypreparedness/resilience_resources/index.html)
- Coping with Traumatic Events Web page (<https://www.nimh.nih.gov/health/topics/coping-with-traumatic-events/index.shtml>)
- Disaster Preparedness and Recovery Web page (<https://www.samhsa.gov/disaster-preparedness>)

Traffic Control

Controlling Traffic along the Roadway

Workers who direct traffic risk serious and fatal injury when hit by passing vehicles under ideal conditions. Following disasters, workers who lack traffic control training may find themselves in the position of directing traffic following roadway incidents and during response operations. Workers can use the following safe traffic control practices:

- Follow the seven fundamental principles of temporary traffic control
 1. Develop general plans or guidelines to provide safety for motorists, bicyclists, pedestrians, workers, enforcement/emergency officials, and equipment
 2. Inhibit road user movement as little as practical
 3. Give clear and positive guidance to motorists, bicyclists, and pedestrians approaching and traveling through temporary traffic control zones and incident sites
 4. Conduct routine day and night inspections of temporary traffic control elements to provide acceptable levels of operations
 5. Maintain roadside safety during the life of the temporary traffic control zone by establishing clear zones and channelizing road users using signs, pavement markings, and crashworthy detectable channelizing devices
 6. Each person whose actions affect temporary traffic control zone safety should receive training appropriate to the job decisions each individual is required to make
 7. Maintain good public relations
- Provide advance warning to motorists
- Wear high-visibility retro-reflective clothing



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- Identify and maintain a safe location while working in or near moving traffic
- Provide adequate lighting to the flagger station during night work
- Use a stop/slow paddle as the primary hand-signaling device—STOP/SLOW paddles shall:
 - Have an octagonal shape on a rigid handle
 - Be at least 18 inches wide with letters at least 6 inches high
 - The STOP face shall have white letters and a white border on a red background
 - The SLOW face shall have black letters and a black border on an orange background.
 - When used at night, the STOP/SLOW paddle shall be retro-reflectorized.
- If a flag has to be used instead of a slow/stop paddle then
 - Flags shall be red or fluorescent orange/red in color
 - Shall be a minimum of 24 inches square
 - Shall be securely fastened to a staff that is approximately 36 inches in length
- Use a flashlight with a red glow cone at night to supplement the STOP/SLOW paddle or flag if the flagger station cannot be illuminated
 - When a flashlight is used for flagging in an emergency situation at night in a non-illuminated flagger station, the flagger shall hold the flashlight in the left hand, shall hold the paddle or flag in the right hand and shall use the flashlight in the following manner to control approaching road users:
 - To inform road users to stop, the flagger shall hold the flashlight with the left arm extended and pointed down toward the ground, and then shall slowly wave the flashlight in front of the body in a slow arc from left to right such that the arc reaches no farther than 45 degrees from vertical.
 - To inform road users to proceed, the flagger shall point the flashlight at the vehicle's bumper, slowly aim the flashlight toward the open lane, then hold the flashlight in that position. The flagger shall not wave the flashlight.
 - To alert or slow traffic, the flagger shall point the flashlight toward oncoming traffic and quickly wave the flashlight in a figure eight motion.

Traffic Control at Intersections

Intersections pose unique hazards because traffic enters from multiple directions at the same time. Following disasters, workers who lack traffic control training may find themselves in the position of directing traffic at intersections where traffic control signals are inoperable. Workers can use the following techniques of traffic control from the California Highway Patrol to safely control intersections.

- Establish a position that will allow you to control the intersection, yet is safe.
 - Establish authority in stance and demeanor
 - Be sure you can see traffic and traffic can see you
 - Wear high-visibility retro-reflective clothing
- Give clear uniform signals so drivers and pedestrians know what you want them to do.
 - Use established hand signal techniques for stopping traffic, starting traffic, and guiding traffic movements
- Determine how much and what type of traffic regulation is needed



- Does the intersection require traffic regulation? If so, what type?
- Direct turning movements
- Anticipate congestion
 - Watch exits to intersections
 - Check for traffic breaks
 - Never let a vehicle enter an intersection that does not have room to exit
 - Keep alert for traffic blocking the space between intersections
 - Make sure motorists complete turns

More Information

- Death in the Line of Duty: Volunteer Fire Chief Struck and Killed on Interstate Highway While Directing Traffic—Pennsylvania (<https://www.cdc.gov/niosh/fire/pdfs/face201312.pdf>)
- Manual on Uniform Traffic Control Devices for Streets and Highways: Temporary Traffic Control (<https://mutcd.fhwa.dot.gov/pdfs/2009r1r2/part6.pdf>)
- A Guidebook for Nighttime Construction: Impacts on Safety, Quality, and Productivity (<https://www.nap.edu/catalog/22723/a-guidebook-for-nighttime-construction-impacts-on-safety-quality-and-productivity>)

Violence

During natural disasters and other catastrophic events when basic necessities such as water, food, medicine and gas become scarce and the local economy increasingly relies on cash. Also, hostility, looting and violence may increase. NIOSH recommends that all response workers reduce their risk of experiencing violence by adhering to the following recommendations:

- Honor the curfew set by the local government
 - Curfews are in place to keep everyone safe when crime is known to be at its highest. If responders must be outside of their temporary housing due to emergency response activities then they should work in pairs—there is safety in numbers.
 - If no curfew is in place, that does not mean the environment is safe. Many responders may be unfamiliar with the response area and should not work alone. It is important to maintain frequent contact with coworkers.
- Be vigilant and self-aware if working with relief supplies and materials
 - First and foremost, protect yourself. You cannot help anyone if you are hurt or killed.
 - Make sure everyone knows who is in charge. A central incident command is necessary to protect all responders working in the area.
 - Be conscious that the relief supplies in your possession (food, water, medical supplies, and medications) may be incredibly valuable in the present circumstances. Anything you have can be replaced, so do not put yourself at risk to protect supplies.
 - Be conscious of your environment and those around you at all times. Work as a team to keep an eye on patients and bystanders. A responder will generally be seen as a person with resources and a potential target.



- Try to work in environments that are well-lit, well-maintained and visible to patrolling security forces.
- Secure goods not in use in a guarded or locked environment when possible. Minimize the number of responders who have access to relief items. A perceived sense of fair distribution of goods and services promotes safe work environments.
- Keep interpersonal interactions from escalating into violence during response activities
 - Medical responders in contact with potentially violent patients, responders distributing food, water, gasoline or other supplies, or support responders providing cash or vouchers for temporary assistance should remain calm and try to keep others calm to reduce tense encounters from escalating to violent ones.
 - It may become necessary to evacuate the response site and return when it is safe.

More Information

- Mitigation of Occupational Violence to Firefighters and EMS Responders (https://www.usfa.fema.gov/operations/ops_safety.html#violence)

Workers-on-Foot Hazards

Large operating vehicles and equipment can cause serious injury or death to workers-on-foot. Visibility limitations (<https://www.cdc.gov/niosh/topics/highwayworkzones/bad/default.html>) in such vehicles and equipment make it hard to see other workers on the ground.

Workers can take the following steps to reduce this hazard (<https://www.cdc.gov/niosh/docs/2001-128/pdfs/2001-128.pdf>):

- Wear high-visibility clothing
- Be aware of blind areas around vehicles and equipment
- Keep eye contact and positive communication with equipment operators
- Avoid backing vehicles and equipment whenever possible
- Stop driving the vehicle or equipment if worker-on-foot is out of view
- Control movement of equipment and vehicles through an internal traffic control plan (such as a plan that coordinates the flow of vehicles, equipment, and workers operating in close proximity)
 - Create a simple drawing depicting movement of workers, vehicles, and equipment at the work site
 - Make a checklist of site-specific hazards (for example downed power line, damaged culvert)
 - Separate workers-on-foot from moving vehicles and equipment by setting up equipment routes and worker-free zones (for example keep workers out of equipment paths)
 - Share on-site traffic control plan with workers-on-foot, truck and equipment operators, and anyone entering the site

More Information

- Work Zone Safety Web Page (<https://www.cdc.gov/niosh/topics/highwayworkzones/default.html/>)



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Work Hours and Fatigue

Disaster response often means working long shifts and many hours per week. Recognize that working long hours, irregular hours, and at night can lead to sleep deprivation and as a result many risks to health and safety including deaths from worker errors, injuries, vehicle crashes, and development of chronic illnesses.

- Sleep is a biological need for life and health. Sleep affects mental and physical performance as well as long-term health.
- Emergency response workers and managers should view sleep as a critical logistical item, just like water, food, and the supplies needed to carry out operations. Make sleep a priority.
- Most adults need 7 to 8 hours of good-quality sleep every 24 hours to perform during emergency operations.
- Not getting enough sleep over a series of days builds up sleep debt that will seriously impair performance. The only way to pay off this debt is to get enough sleep.

Both managers and workers share in the responsibility of reducing risks from fatigue. Managers are responsible for designing the work and work schedules that promote an alert workforce.

- Regular Rest. Establish at least 10 consecutive hours per day of protected time off-duty in order to obtain 7–8 hours of sleep.
- Rest Breaks. Frequent brief rest breaks (for example every 1–2 hours) during demanding work are more effective against fatigue than a few longer breaks. Allow longer breaks for meals.
- Shift Lengths. Five 8-hour shifts or four 10-hour shifts per week are usually tolerable. Depending on the workload, twelve-hour days may be tolerable with more frequent interspersed rest days. Shorter shifts (for example 8 hours), during the evening and night, are better tolerated than longer shifts.
- Workload. Examine work demands with respect to shift length. Twelve-hour shifts are more tolerable for “lighter” tasks (for example desk work).
- Rest Days. Plan one or two full days of rest to follow five consecutive 8-hour shifts or four 10-hour shifts. Consider two rest days after three consecutive 12-hour shifts. At minimum, plan one full day of rest per week for each team member (including the team leader).
- Training. Provide training to make workers aware of strategies to reduce health and safety risks and the resources available to help with any difficulties.
- Incident Analysis. Examine near misses and incidents to determine the role, if any, of fatigue as a root cause or contributing cause to the incident.

More Information

- Interim NIOSH Training for Emergency Responders: Reducing Risks Associated with Long Work Hours (<http://www.cdc.gov/niosh/emres/longhourstraining/>)
- Preventing Worker Fatigue Among Ebola Healthcare Workers and Responders (<https://www.cdc.gov/niosh/topics/ebola/pdfs/preventingworkerfatigueamongebolahcw122914.pdf>)



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Working with Livestock and Poultry Wastewater and Sludge

Farms, animal production sites, and processing plants contain animal waste or manure. Workers may be at risk of exposure to animal diseases that can be passed from animals or their manure through contact with workers' broken skin, eyes, nose, mouth, or mucous membranes. Manure and wastewater may also contain additional hazardous compounds such as chemicals, hormones, antibiotics, metals, and allergens. In addition, workers may encounter musculoskeletal hazards (e.g., lifting heavy animals and objects), physical hazards (e.g., unsafe buildings and structures, sharp objects, heat, noise), chemical hazards (e.g., fuels, fertilizers, pesticides, cleaning agents, hydrogen sulfide) and allergens (e.g., latex and animal saliva, skin, urine).

- Before responding to an animal facility, check with state and local authorities for current guidance
- Ensure you have the correct immunizations before beginning work (e.g., tetanus-diphtheria)
- When working in or near water:
 - Wear a Coast Guard-approved personal flotation device
 - Do not drive through standing water
 - Avoid downed or exposed power lines (see also Electrocutation Hazards section)
 - Avoid contact with wild animals
 - Avoid walking through flood debris
- Wear appropriate personal protective equipment (PPE) for each activity (e.g., goggles or face shield, face mask or respirator, impermeable coveralls, waterproof gloves, and rubber boots) [see also Personal Protective Equipment (PPE), Respirator Selection and Use, and Heat Stress sections]
- Follow basic hygiene practices:
 - Wash skin with soap and water frequently, and immediately after contact with animals, contaminated materials, wastewater, or floodwater. If soap and water is not available, use alcohol-based sanitizer
 - Wash your hands after removing gloves and before eating, drinking, smoking, taking a break, or leaving work
 - Keep any wounds clean, dry, and covered with waterproof bandages
 - Do not smoke or chew tobacco or gum while working
- When dealing with displaced domestic animals:
 - Do not work with displaced animals unless you have received proper training
 - When working with displaced animals, use appropriate restraint techniques and equipment and follow established procedures, infection prevention and control practices, and PPE requirements
- Before entering any flooded building:
 - Check for structural damage
 - Shut off electrical power and disable machinery
 - Ventilate the building to decrease exposure to ammonia and hydrogen sulfide
- When handling carcasses:
 - Contact local and state authorities for current guidance and for carcass handling and disposal
 - Wear task appropriate PPE (including NIOSH-approved respirator, rated N-95 or higher filter efficiency) and use duct tape to seal the tops of gloves and boots to prevent water seepage
 - Decontaminate equipment, materials, and facilities to prevent the spread of contaminants



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- Do not work in confined spaces unless you are specially trained, and be aware of hydrogen sulfide. It is a dangerous manure-related gas and can result in death
- Be aware of the potential chemical hazards on the site you are working. Examples include fuels, fertilizer, pesticides, herbicides, and cleaning agents (see also Chemical Safety section)
 - Know how to minimize your exposure to Carbon Monoxide (see also Carbon Monoxide section)
 - Stop work and move to a safe distance upwind if chemical containers are found to be leaking and then contact hazardous material response personnel
- Watch for signs and symptoms of illness such as diarrhea, vomiting, fever, cough, fever with cough or sore throat, rash, dermatitis, wound infections, pink eye, neurological signs, or other indications of infection and if they develop, report them to your supervisor and seek medical evaluation right away.

More Information

- NIOSH/USDA Interim Guidance for Protecting Workers from Livestock and Poultry Wastewater and Sludge During and After Floods (<https://www.cdc.gov/niosh/topics/emres/pdfs/IG-Livestock-Workers-9-23-18.pdf>)
- NIOSH Interim Guidance on Health and Safety Hazards When Working with Displaced Domestic Animals (<https://www.cdc.gov/niosh/topics/emres/animals.html>)
- National Association of Local Boards of Health: Understanding Concentrated Animal Feeding Operations and Their Impact on Communities (https://www.cdc.gov/nceh/ehs/docs/understanding_cafos_nalboh.pdf)



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