

# Tornadoes and Earthquakes: Response, Recovery and Clean-up Considerations for PPE Selection and Worker Safety

## Description

There are few natural disasters more devastating in terms of loss of human life and property damage than tornadoes and earthquakes. In the United States, tornadoes seem to be a common occurrence. In 2016, the US Storm Prediction Center reported 1,053 tornadoes resulting in 17 confirmed deaths. Although far less frequent, the earthquake aftermath presents serious hazardous conditions to both victims and rescue workers, the most serious of which is working in and around collapsed structures. Regardless of the type of natural disaster, selection of appropriate safety equipment, including personal protective equipment, is critical to all rescue workers, law enforcement, and other professionals involved in the aftermath.

The requirement for PPE applies not only to the professional responder or contractor, but also the businesses and homeowners attempting to protect and salvage their property, and the numerous volunteers who are willing participants. As these individuals represent such a diverse group, their knowledge and experience in the use of PPE may vary significantly. At a minimum, a basic understanding of the use and limitations of each type of PPE is necessary. For professional workers falling under the scope of the Occupational Safety and Health Administration (OSHA), specific regulatory requirements apply when using PPE. For others, following basic best practice guidelines will help reduce exposures to tornado and earthquake related hazards. If questions arise concerning the proper use of PPE, refer to the product *User Instructions* or contact the manufacturer directly.

## Potential Hazards

Tornadoes and earthquakes present both common hazards and those unique to each type of natural disaster. Both can present logistical challenges affecting initial response and recovery. These may include loss of electrical power, poor communication capabilities and interrupted or compromised water supply. Addressing these needs quickly will facilitate response efforts and the ability to protect the health and safety of victims and response workers.

Numerous hazards are present during the initial tornado/earthquake response and subsequent recovery and clean-up efforts. The following hazards are some of the most common hazards likely present during both types of natural disasters:

- Collapsed or dangerously unstable building structures
- Exposed and energized electrical wiring
- Natural gas leaks resulting in explosive environments
- Water system breaks and flooded areas
- Exposure to hazardous materials (leaking fuels, ammonia, etc.), including unknowns
- Exposure to airborne dusts including asbestos, lead, crystalline silica and mold
- Confined space work that may include insufficient oxygen and toxic environments
- Struck-by hazards from falling objects
- Sharp objects from glass and debris
- Ergonomic hazards from repeated lifting, twisting and working on irregular/uneven surfaces
- Heat stress and cold stress due to work environment
- Excessive noise during operation of heavy equipment, generators, power tools, etc.
- Slips and trips due to work around unstable, wet and slippery surface, uneven terrain and steep grades
- Fall hazards due to work at elevated heights and unstable surfaces
- Other health and safety exposure risks specific to the response site

A hazard assessment completed by a qualified health and safety professional is recommended prior to entering any response area presenting an adverse exposure risk. For collapsed or heavily damaged building structures, an inspection by a professional engineer should be completed prior to entry. Efforts should be made to brace or shore building walls and floors which have been damaged, when possible. In many cases, time constraints and limited resources may present obstacles to response workers, particularly when additional loss of human life is possible.

## Slips, Trips and Falls

After a significant event, such as a tornado or earthquake, we instinctively want to get back up on our feet and start the recovery process. Part of this includes inspecting damage, cleaning up debris and making the necessary repairs.

During this time, it is critical to protect ourselves and others from slips, trips and falls. As entries are made into affected areas, paths should be cleared to prevent stepping upon or over objects. In areas where the walking surface cannot be seen or where there is standing water, the floor should be checked or prodded before stepping forward. All hazards that cannot be moved should be identified and marked to help others.

When inspecting or repairing roof surfaces, a visual inspection from the ground should be conducted first. Ladders need to be secured to prevent slippage and a personal fall arrest system which includes a full body harness, energy absorber and solid anchor should be employed.

Additional information regarding fall protection can be obtained by calling our customer service line at 651-388-8282 or toll free 800-328-6146.

## General Types of PPE

Appropriate selection of personal protective equipment (PPE) and other safety equipment is critical to help control recognized hazards. The following describes the general types of PPE that are commonly applicable to tornado/earthquake response, recovery and clean-up. Refer to the end of this document for suggested 3M safety products that may be suitable for these applications.

**Respiratory protection** may be needed in all phases of natural disaster response. Appropriate selection is needed to assure the correct respirator is being worn for the work environment. In certain situations, the site may present inhalation exposure risk to unknown contaminants. Entry into these areas should be prohibited until adequately characterized.

All respirators used should be tested and certified by the National Institute for Occupational Safety and Health (NIOSH). When selecting a respirator for particulate hazards, a disposable respirator or reusable half/full facepiece with a minimum 95 class particulate filter (e.g., N95, R95, P95) is suitable for most types of dusts. Particulate respirators/filters with an N95, R95 or P95 rating offer a minimum 95% filtration efficiency. For gases and vapors, a reusable respirator with an appropriate cartridge is needed, depending on the specific contaminant.

A higher level of respiratory protection, such as a full facepiece respirator, or Powered Air Purifying Respirator (PAPR) may be needed for certain tasks, such as clean-up in buildings/homes that may contain lead, asbestos, PCB's and heavy mold contamination. OSHA requires specific respirator selection requirements for lead and asbestos. The US EPA offers guidance in respirator selection for mold.

Respirators must be used in accordance with the OSHA Respiratory Protection Standard, 29 CFR 1910.134. Mandatory use of respirators requires a written respiratory protection program established by the employer. Program elements include selection, employee training, fit testing, medical evaluations, maintenance and inspection, and record-keeping. Any air purifying respirator, which includes disposable, reusable half and full facepiece and PAPRs, should never be used in IDLH (immediately dangerous to life and health) environments. OSHA prohibits use of tight fitting respirators by anyone with facial hair. Refer to the OSHA website at [www.osha.gov](http://www.osha.gov) for a copy of 29 CFR 1910.134.

**Eye, head and face protection** can help reduce the risk of injury due to falling or flying debris, or airborne dusts. Eye and face protection may include safety glasses or goggles and face shields. Use of safety glasses with side shields should be considered minimum protection at all natural disaster sites. Unvented or indirectly vented safety goggles may be used for dusty environments or situations where splashing can occur, and may fit over prescription eyewear. Safety glasses with a foam seal around the lens area forming a partial seal are also suitable for dusty environments or for environments where minor debris may be falling or floating in the air. Protective eyewear should meet the requirements of the American National Standards Institute (ANSI) Standard Z87.1 for safety eyewear. As per Z87.1-2015 requirements, impact rated eyewear will be marked “+” or “Z87+”. Protective eyewear will be marked “D3” when designed splash protection and D4 for dust protection. Face shields are considered supplemental protection and should be used only in combination with approved safety glasses or goggles.

Hard hats should meet the requirements of ANSI Standard Z89.1. Look for a sticker or markings on the inside of the hard hat indicating that it meets this standard. The sticker or markings will also state the type and class of hard hat. Type refers to impact performance, with Type I hard hats reducing force of minor impacts from the top resulting from a blow to the top of the head, and Type II hard hats reducing the force of impact resulting from a blow from either the top or side of the head. Class refers to electrical performance. Class G (general) hard hats reduce the danger of contact exposure to low voltage (tested to 2200 volts). A Class E (Electrical) hard hat reduces the danger of exposure to high voltage conductors (tested at 20,000 volts). A Class C (Conductive) hard hat is not intended to protect against contact with electrical conductors. The type and class of hard hat selected will depend on the anticipated hazards present at the site.

**Hearing protection** is usually necessary when operating heavy machinery or power tools. Both earplugs and earmuffs are available. Hearing protectors are required under regulation to have a Noise Reduction Rating (NRR), which is the reduction (in decibels) that the hearing protection device (HPD) can provide when worn correctly in a controlled laboratory test. In the real world, many users will receive less noise reduction than indicated by the NRR due to variation in hearing protector fit, fitting skill and motivation of the user. 3M strongly recommends fit testing of hearing protectors. If the NRR is used to estimate typical workplace protection, 3M recommends that the NRR be reduced by 50% or in accordance with applicable regulations.

Comfort is also an important factor to consider. If the HPDs are comfortable, they are more likely to be worn and to be worn correctly. Likewise, the hearing protectors must be compatible with the other gear that needs to be worn during a natural disaster response. Selecting a hearing protector that also offers communication capabilities is a vital consideration when both noise attenuation and communication between response workers is needed. Hearing protectors are available that physically connect to portable radio systems, or provide all-in-one, fully contained wireless protective communication solutions. Level-dependent environmental microphones are also available to help wearers maintain important situational awareness and face-to-face communications, while still protecting them from harmful noise levels. Environmental microphone capabilities can commonly include:

- Sampled impulse/impact and steady-state sound levels are limited to 82 dB or less
- Quiet or softer sounds can be amplified

Dual active hearing protection (electronic earmuff with electronic earplugs) will provide a slightly increased level of hearing protection while still allowing audibility and situational awareness.

**Protective Clothing, gloves, and boots** require consideration of the types of anticipated contaminants, and environment/work conditions to be encountered. Selection criteria may need to address both chemical and physical protection. These may include:

- Preventing skin contact, while maintaining durability and dryness.
- Heat and cold stress prevention.
- Worker visibility, particularly in high traffic or low visibility areas.
- Electrical hazards.
- Task specific protective clothing, such as welding and cutting.

Follow the manufacturers recommendation for donning of protective clothing, gloves and boots to assure optimum fit, performance and comfort.

OSHA regulations, such as, those relating to confined space, lockout/tagout, and fall protection may also identify other types of safety-related equipment that are required. OSHA fall protection provisions, for example, are applicable when a fall of greater than 4 feet is possible from any improperly guarded walking/working surface. Unlike other PPE that protect specific body areas (respiratory, hearing, head, eyes, hands, and feet), fall protection equipment is designed to help protect the whole body in the event of a fall. When selecting fall protection for a natural disaster application, careful consideration for the work environment is needed. Hazards typically include unstable shifting materials, sharp edges, and numerous slip/trip/fall conditions. Fall protection equipment may include confined space, rescue systems, body harnesses, ropes/lanyards, and anchorage devices. Use of this equipment requires specialized training that must include information related to intended use, as well as capabilities and limitations.

## Suggested 3M Products

It is always the employer's responsibility to evaluate PPE needs and to select a proper product for the intended use by workers. Additional or alternative 3M products may be available in addition to those listed.

Visit [www.3m.com/workersafety](http://www.3m.com/workersafety) for a complete and up-to-date listing.

### Response/Recovery

#### Hearing Protection (Active)

- 3M™ PELTOR™ Tactical Earplug Kit, TEP-100 (active in-ear)
- 3M™ PELTOR™ TacticalPro™ Communications Headset MT15H7F SV (active earmuff)
- 3M™ PELTOR™ Tactical Sport™ Electronic Headset MT16H210F-SV, (active earmuff)
- 3M™ PELTOR™ Lite Com Plus 2-Way Radio Headset

### Recovery/Clean-up

#### Respiratory Protection (Reusable)

- 3M™ 6000 series Half or Full Face Respirator with 2071 P95 or 2091 P100 filters

#### Respiratory Protection (Disposable)

- 3M™ Particulate Respirator 8210 N95
- 3M™ Particulate Respirator 8511 N95
- 3M™ Particulate Respirator 8214 N95

#### Eye Protection

- 3M™ SecureFit™ Protective Eyewear 600 Series
- 3M™ Virtua™ CCS Protective Eyewear
- 3M™ Virtua™ AP Protective Eyewear
- 3M™ GoggleGear™ 500 Series
- 3M™ Fectoggles™ Safety Goggles

#### Head Protection

- 3M™ Hard Hat Series H-700 - cap style
- 3M™ Hard Hat Series H-800 - full brim style

#### Hearing Protection (Passive)

- 3M™ E-A-R™ EXPRESS™ Pod Plugs™ Earplugs
- 3M™ PELTOR™ X4 Over-the-Head Earmuffs

#### Protective Clothing

- 3M™ Disposable Protective Coverall Safety Work Wear 4520

## Fall Protection

See [www.3M.com/FallProtection](http://www.3M.com/FallProtection) for a complete list of products.

- [Full Body Harnesses](#)
- [Confined Space](#)
- [Rescue and Descent](#)

## References

1. “Latest U.S. Tornado Statistics”. Storm Prediction Center. National Oceanic and Atmospheric Administration. October 1, 2016.
2. OSHA Asbestos Standard, 29 CFR 1910.1001; and OSHA Lead Standard, 29 CFR 1926.1025.
3. EPA, [http://www.epa.gov/mold/mold\\_remediation.html](http://www.epa.gov/mold/mold_remediation.html) information on mold remediation in schools and commercial buildings.
4. OSHA, [https://www.osha.gov/OshDoc/data\\_Hurricane\\_Facts/demolition\\_cleanup.pdf](https://www.osha.gov/OshDoc/data_Hurricane_Facts/demolition_cleanup.pdf) “Demolition and Cleanup” – project preparation to protect worker health and safety.
5. OSHA, [https://www.osha.gov/OshDoc/data\\_Hurricane\\_Facts/search\\_and\\_rescue.pdf](https://www.osha.gov/OshDoc/data_Hurricane_Facts/search_and_rescue.pdf) “Search and Rescue Operations” – health and safety contingencies for rescue workers and emergency responders during a catastrophic event.
6. OSHA, <https://www.osha.gov/dts/weather/tornado/response.html> Tornado Preparedness and Response – potential hazards and general precautions applicable to response workers.
7. OSHA, <https://www.osha.gov/dts/earthquakes/index.html> “Earthquake Preparedness and Response” – potential hazards and general precautions applicable to response workers.

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