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Tornado safety for businesses: Before, during and after the storm

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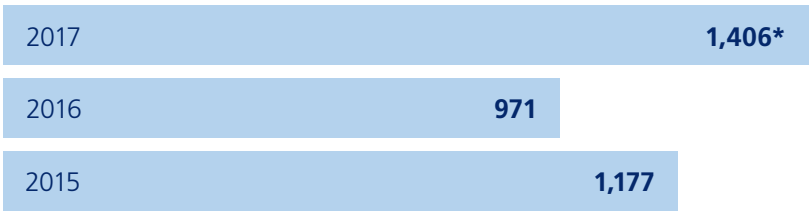
Tornadoes are among the most destructive, fearsome and potentially deadly forces of nature in existence. According to the National Oceanic and Atmospheric Administration (NOAA), the United States experienced 1,406 recorded tornadoes for all of 2017 (1,262 confirmed and 144 pending confirmation).[1] That compares with 971 for the entirety of 2016 and 1177 for all of 2015.[2]

Verified Tornadoes in the U.S.



Source: NOAA. *Count includes tornadoes confirmed and pending confirmation.

Statistically, most tornadoes do not strike major population centers due to the vast land area of the North American continent. Too often, however, twisters do strike towns and cities, causing significant damage and sometimes total destruction of businesses, residences, schools and other occupancies. Sadly, some tornadoes result in injuries and fatalities, many of which could have been prevented with effective planning and preparation.

While tornadoes can occur virtually anywhere in the world, the meteorological conditions that make the Great Plains of North America east of the Rocky Mountains such a fertile breeding ground for them are frequent thunderstorms spawned by collisions of warm, wet air masses with cool, dry ones. The peak time of day for tornado formation tends to be between 3-9 p.m. Late in a summer afternoon or evening, the atmosphere has soaked up a day's worth of solar energy, evaporating the massive quantities of water vapor that fuel powerful thunderstorms. However, tornadoes can and do form at almost any time of year if conditions are right, even during late fall with winter around the corner.

One of the most challenging characteristics of tornadoes is their unpredictability. Not every thunderstorm produces twisters, but when they happen tornados can form very quickly and with little or no warning. Tornadic wind speeds can reach more than 200 miles per hour. Damage paths have been recorded up to one mile in width and up to 50 miles in length. Most injuries and deaths during tornadoes are caused by flying debris from structural damage. Interestingly, since they are comprised of moving air, tornado funnels themselves are actually transparent, only becoming visible when dust, debris and water droplets from the parent thunderstorm are sucked into the vortex.

Tornadoes can occur virtually anywhere in the world.

Enhanced Fujita Scale[3]

EF 0 (Minor)
Wind speeds: 65-85 mph
Some damage to gutters, siding and roofs. Outdoor furniture blown over or away, some limbs broken off trees.

EF 1 (Moderate)
Wind speeds: 86-110 mph
Roofs severely stripped, mobile homes overturned or badly damaged, exterior doors, windows and other glass broken.

EF 2 (Considerable)
Wind speeds: 111-135 mph
Roofs torn off well-constructed houses, foundations of frame homes shifted, mobile homes completely destroyed, large trees snapped or uprooted, cars lifted.

EF 3 (Severe)
Wind speeds: 136-165 mph
Entire stories of well-constructed houses destroyed, severe damage to large buildings, trains overturned, trees debarked, heavy vehicles lifted off the ground

EF 4 (Extreme)
Wind speeds: 166-200 mph
Well-constructed homes and structures leveled, cars and other small objects thrown about.

EF 5 (Incredible)
Wind speeds: 200+ mph
Strong, well-built houses are torn from their foundations and swept away, steel-reinforced concrete structures are critically damaged, taller buildings collapse or have severe structural damage, cars, trucks and train cars can be thrown up to a mile away.

Measuring the power of tornadoes

Tornado strength and destructive power are categorized using the Enhanced Fujita (EF) Scale. The original Fujita Scale for measuring the power of tornadoes was developed by prominent University of Chicago severe storms researcher Tetsuya Fujita in 1971, in collaboration with Allen Pearson, then head of the National Severe Storms Forecast Center (NSSFC). The Fujita Scale was updated in 1973 to take into account path length and width. Tornadoes are rated on the EF Scale soon after occurrence.

Tornadoes can form very quickly and with little or no warning.

Before the storm

Develop a plan to protect your people and property

Map out a preparedness strategy

Tornadoes can occur virtually anywhere in the continental United States, so all businesses should develop tornado and severe weather response plans well in advance of any events. Your plan should include:

- Identifying the safest areas in a building so that your people know where to congregate in the event of a warning
- Designating roles and responsibilities of supervisors and employees, including the appointment of tornado wardens
- Practicing your sheltering plan so that you know how long it takes to move everyone to safety. The average warning time is 13 minutes, but tornadoes are unpredictable. You may have more time or far less. Activate any evacuation plan immediately upon warning or if you believe that weather conditions suggest a tornado is in the area.
- Posting signs in public buildings to direct customers and visitors to safe areas

Take steps to minimize property damage

Much property damage and injuries during a tornado are caused by flying debris. The strongest and most violent tornadoes will generate countless airborne missiles with force that is virtually impossible to resist. However, there are affirmative steps businesses can take to minimize damage from less severe tornadoes, including:

- Securing outdoor gear and outbuildings to prevent them from becoming airborne missiles
- Reinforcing vulnerable areas of a building, such as added supports to garage doors and bracing and strapping the roof
- Situating house servers and other vital equipment in protected areas of a building, preferably in tornado-resistant server rooms
- For new construction, working with an architect or contractor to incorporate wind mitigation techniques and high wind-rated products

Make business continuity a priority

Even if your business does not experience a direct hit from a tornado, it is likely that a severe storm will cause significant, local disruption that can impact your business for days or weeks. To help your business continue to operate in the aftermath of a storm, your plan should include:

- Addressing how employees will communicate, and where they will work if your facility experiences significant damage
- Considering how manufacturing and other critical business operations will continue until a damaged building is repaired or replaced
- Addressing how data and information technology will be restored and how supply chain logistics will be maintained

All businesses should develop tornado and severe weather response plans.

Stock up on emergency supplies

Because severe storms and tornadoes disrupt power and other vital utilities, have an ample supply of flashlights and batteries on hand, as well as drinking water, first aid kits and anything else you feel your people may need in the immediate aftermath of a storm. An especially good idea would be to own a well-maintained and fueled generator to supply your facility with emergency power if external power is interrupted.

Be aware – stay informed

The National Weather Service provides local weather broadcasts over a radio network called NOAA Weather Radio from more than 1,000 different transmitters worldwide. These radios are for sale for businesses and buying an NOAA Tone Alert Weather Radio can be an invaluable aid in monitoring severe weather. Your eyes can also be a first line of defense against tornadoes. Especially during the spring or summer, watch for signs of impending severe thunderstorms. Darkening skies; low-lying clouds; sharply defined front lines and "wall clouds;" hail; and the onset of high, gusty winds can mean trouble ahead. Pay attention to official warnings issued by the National Weather Service Forecast Office and through NOAA radio alerts. Every warning should be taken with the utmost seriousness, and appropriate measures should be taken immediately to protect lives and property.

Take shelter

When advised to "take shelter" by the National Weather Service and local media, do so immediately. Any delay could be life threatening.

- **Get inside** – Remember that most injuries and fatalities during tornadoes are caused by flying debris, which will be abundant during a violent storm. If you or your employees are caught outside – either on a job site, in a vehicle or some other venue – get inside the nearest substantial structure as quickly as you can. Remaining outside, exposed to wind-driven debris is a recipe for disaster.
- **Stay low** – Once all employees, customers and visitors have moved inside, seek shelter in a designated tornado shelter, basement or anywhere that is the lowest point in your building. If that is not possible, move everyone to an internal hallway more likely to have structural integrity to withstand tornado-force winds. Move everyone away from all windows, doors and other openings.
- **Take cover** – Remembering that flying and falling debris causes most injuries, take refuge whenever possible underneath anything that may provide increased protection – a table, desk, pillows, a mattress – whatever might come between you and falling or flying debris. If your business normally requires hardhats and other protective gear, do not hesitate to use them to protect against injury during a tornado.

Tornadoes can disrupt power and utilities. Be sure to have these essentials on hand:

- Ample supply of flashlights and batteries
- Drinking water
- Well-maintained and fueled generator
- First aid kits

After the storm

Watch for the hazards left behind

Communicate!
Your tornado survival plan should include protocols for your employees to communicate location, conditions and well-being in the aftermath of a storm. While mobile technologies make post-storm communications more reliable than landlines, there is no guarantee that local cell towers will emerge unscathed. While cellphones can be critical in the aftermath of severe weather, wireless technologies independent of cellular networks (such as conventional, handheld "walkie-talkies") could be useful backups.

Use caution inside and outside your building
If the building you are occupying was damaged, use extreme care when exiting. If you smell gas or sense flammable liquids may be present, do not use an open flame, such as matches or a cigarette lighter. Anyone trapped should try to remain calm and text or call for help. If possible, bang on a wall or exposed pipe to attract attention.

Once outside, do not enter any damaged structures until they are deemed structurally stable by first responders. Watch for, avoid and report downed power lines. During cleanup in the days following the storm, use care when using chainsaws and removing debris. Wear appropriate footwear and gloves to protect against sharp edges, exposed nails and other hazards.

Tornado shelters / safe rooms

Taking cover in a basement, lower floor or interior hallway has been shown to increase survivability during a tornado. However, many organizations have found that a far more secure and reliable alternative is the installation of hardened or shielded "safe room" – a tornado shelter specifically designed and constructed to protect against injury.

There are three principal approaches to the design and installation of tornado safe rooms:

- Underground shelters – Underground shelters may be constructed from reinforced steel or concrete and are typically installed near a structure. Because they are specifically designed for maximum survivability during a tornado, those taking refuge in these types of shelters will not be threatened by falling or flying debris as they might be in a basement. However, underground shelters should be situated close enough to your building to make them quickly and readily accessible during already difficult weather conditions, when a tornadic storm may be approaching.
- Shelters built into the facility – If ground conditions such as high local water tables or the likelihood of flooding preclude underground shelters, a suitable alternative can be the incorporation of a safe room inside a facility during initial construction or renovation. Constructed of reinforced concrete or steel, the shelter should be self-contained and firmly anchored to the foundation to prevent overturning or dislodging during a storm.
- Prebuilt shelters – If the first two options are impractical, manufacturers of pre-built shelters can provide installations made from sturdy steel frames and panels that can be retrofitted into existing structures. Once again, the shelter must be firmly anchored to the building's foundation for maximum effectiveness.

A Federal Emergency Management Administration (FEMA) publication – "Safe Rooms for Tornadoes and Hurricanes: Guidance for Community and Residential Safe Rooms" – presents valuable information about the design and construction of safe rooms to provide protection during tornadoes and hurricanes. The guide presents criteria for safe rooms reflecting extensive post-damage assessments. The publication is available at www.fema.gov in the FEMA Media Library.

No matter how potentially devastating a tornado may be, proper planning, preparation, practice and proactive steps to reduce and limit damage can help businesses survive and become more resilient against the implacable, elemental force of these storms. With concerted action, including well-constructed tornado shelters and safe rooms, serious injury and death may be prevented.

For more information on severe weather, go to:
zurichna.com/severeweather

1. National Oceanic and Atmospheric Administration (NOAA) National Centers for Environmental Information. State of the Climate: Tornadoes - Annual 2017. Published online January 2018; retrieved on 9 May 2018.
2. National Oceanic and Atmospheric Administration (NOAA) Storm Prediction Center. Monthly and Annual U.S. Tornado Summaries. Published online 16 January 2018; retrieved on 9 May 2018.
3. National Oceanic and Atmospheric Administration (NOAA) Storm Prediction Center. Enhanced F Scale for Tornado Damage. Retrieved 9 May 2018.
4. "Weather Explained." Water Encyclopedia, www.weatherexplained.com/Vol-1/Tornadoes.html.

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