Texas Cooperative EXTENSION
The Texas A&M University System

TORNADO SAFETY

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Approximately 1000 tornadoes are documented each year in the United States, killing an average 60 people and causing millions of dollars in property damage. The majority of tornadoes form in late afternoon-early evening; occur in late spring-early summer; and develop just west of the Mississippi Valley in an area called "Tornado Alley." Texas records the greatest number of tornadoes in the U.S.; however Oklahoma has the greatest concentration of tornadoes on a land area basis.

Doppler radar technology and weather system modeling has proven useful for tracking and forecasting weather systems. However, tornado prediction is difficult because tornado formation depends mainly on small-scale variables that cannot be accurately measured or modeled far in advance. Today, local forecasters depend upon a combination of spotter reports, in-house analysis of the weather situation over the thunderstorm region, and general forecast guidance in order to issue tornado watches and warnings.

To protect yourself and your family from tornadoes, you must first recognize the weather conditions that are favorable for tornadic activity and be prepared to take the necessary actions. Early detection and preparation is the key. Have a tornado plan and know where to go and what to do depending upon where you are. Also, you must recognize and dispel the common myths about tornadoes that waste precious time, add a false sense of security, and cause you to take unnecessary risks.

Tornado Facts

- Approximately 1000 tornadoes are recorded in the US per year.
- Texas records the greatest number of tornadoes annually —124.
- Oklahoma has the highest concentration of tornadoes— 7.5 per 10,000 square miles

Source: National Climatic Data Center. Data range: 1950 – 1995.

HOW DO TORNADOES DEVELOP?

Meteorologists have defined a tornado as "a violently rotating column of air, pendant from a cumuliform cloud or underneath a cumuliform cloud, and often (but not always) visible as a funnel." So how do tornadoes form? The classic answer is "warm moist Gulf air meets cold Canadian air and dry air from the Rockies." However, this is a gross over-simplification when considering that these same conditions commonly produce only mild thunderstorms which never come close to producing tornadic activity. Though the true source of tornadoes is still unknown, scientists believe that tornado formation is more likely caused on a storm scale, in and around a thunderstorm that has a well-defined radar circulation.

Tornado size, strength, direction, and duration cannot be predicted. The size and strength of a tornado is not actually determined until after the damage has already occurred. Dr. T. Theodore Fujita developed a damage scale for winds, including tornadoes, which attempts to relate the degree of damage to the intensity of wind (see Table 1.) Though the Fujita – Person scale does provide a means to categorize tornadoes, it is not necessarily an accurate interpretation of damage. Different wind speeds may be needed to cause the

same damage depending on how well-built a structure is, wind direction, wind duration, battering by flying debris, and other factors.

Tornado direction is also unpredictable. Though most move from southwest to northeast, or from west to east, some tornadoes have changed direction amid path, or even backtracked. Direction is generally determined by the tornado producing weather patterns. Tornadoes can last several seconds to more than an hour. Most tornadoes last less than ten minutes.

Table 1. Fujita – Person Tornado Scale

Category	Wind Speed (mph)	Potential Damage
F-0	40-72	Chimney damage, tree branches broken
F-1	73-112	Mobile homes pushed off foundation or overturned
F-2	113-157	Considerable damage, mobile homes demolished, trees uprooted
F-3	158-205	Roofs and walls torn down, trains overturned, cars thrown
F-4	207-260	Well-constructed walls leveled
F-5	261-318	Homes lifted off foundations, carried considerable distance, autos thrown as far as 100 meters

WHAT ARE THE SIGNS OF AN APPROACHING TORNADO?

Most tornadoes develop from an intense thunderstorm or area where two or more weather patterns (or fronts) collide. Weather forecasters watch these systems carefully and issue watches and warnings when conditions are favorable. Individuals must take precaution when storms arise and look for signs of tornadic activity, especially at night when storm circulation patterns are not visible. Following is a list of some common tornado indicators.

- Strong, persistent rotation in the cloud base.
- Whirling dust and debris on the ground under a cloud base—tornadoes sometimes have no funnels.
- Hail or heavy rain followed by dead calm or a fast, intense wind shift. Many tornadoes are wrapped in heavy precipitation and cannot be seen.
- Loud, continuous roar or rumble, much like the sound of an approaching freight train.
- At night, small, bright, blue-green to white flashes at ground level near a thunderstorm. These mean power lines are being snapped by very strong winds, maybe a tornado.
- At night, persistent lowering from the cloud base, illuminated or silhouetted by lightning—especially if it is on the ground or there is a blue-green-white power flash underneath.

Tornado Facts

- Most tornadoes rotate counterclockwise in the northern hemisphere and clockwise in the southern hemisphere.
- A “tornado watch” means that weather conditions exist where tornadoes are possible.
- A “tornado warning” means that a tornado has been spotted, or that Doppler radar indicates a thunderstorm rotation which can spawn a tornado.

WHERE SHOULD I SEEK SHELTER?

The best place to be during a tornado is a storm shelter specifically designed for that use located within the basement or outside the home. Many companies manufacture pre-fabricated shelters constructed of concrete, fiberglass or steel, that are installed below ground, and that blends in with home landscaping. Whatever the shelter, your entire family should know where to go and what precautions to take in case of a tornado. Conduct annual emergency drills to ensure that everyone remembers what to do and where to go automatically and without panic. Another good tip is to choose a friend or family member in another part of town or elsewhere to be a “contact person” that will be called by everyone should the family become separated.

You should also assemble a disaster supply kit to keep in the shelter. It should contain:

- A first aid kit with essential medication in addition to the usual items.

- A battery powered radio, flashlight, and extra batteries.
- Canned and other non-perishable food and a hand operated can opener.
- Bottled water.
- Sturdy shoes and work gloves.
- Written instructions on how to turn off your home utilities.

If you do not have a storm shelter, or if you find yourself away from home when a tornado strikes, follow the safety guidelines below.

In a house with a basement … Avoid windows. Get in the basement and under some kind of sturdy protection (heavy table or work bench), or cover yourself with a blanket, quilt, mattress or sleeping bag. Make sure that one or more of these items are stored in the basement. Precious time can be lost trying to find these items at the last minute. Know where very heavy objects rest on the floor above (pianos, refrigerators, waterbeds, etc.) and do not go under them. They may fall down through a weakened floor and crush you.

Tornado Facts

- The largest tornado outbreak occurred when 147 tornadoes touched down in 13 U.S. states on April 3-4, 1974.
- The record for most tornadoes in any month was set in May 2003, with 516 tornadoes confirmed.
- On average, tornadoes kill about 60 people per year—most from flying and falling debris.

Source: NOAA Storm Prediction Center.

In a house with no basement, a dorm, or an apartment … Avoid windows. Go to the lowest floor, small center room (like a bathroom or closet), under a stairwell, or in an interior hallway with no windows. Crouch as low as possible to the floor, facing down; and cover your head with your hands. Getting into a bath tub with a couch cushion over you gives you protection on all sides, as well as an extra anchor to the foundation. Even in an interior room, you should cover yourself with some sort of thick padding (mattress, blankets, etc.) to protect against flying glass and falling debris in case the roof and ceiling fall.

In an office building, hospital, nursing home or skyscraper … Go directly to an enclosed, windowless area in the center of the building, away from glass. Then, crouch down and cover your head. Interior stairwells are usually good places to take shelter, and if not crowded, allow you to get to a lower level quickly. Stay off the elevators; you could be trapped in them if the power is lost.

In a mobile home … Get out! Even if your home is tied down, you are probably safer outside, even if the only alternative is to seek shelter out in the open. Most tornadoes can even destroy tied-down mobile homes; and it is best not to play the low odds that yours will make it. If your community has a tornado shelter, go there fast. If there is a sturdy permanent building within easy running distance, seek shelter there. Otherwise, lie flat on low ground away from your home, protecting your head. If possible, use open ground away from trees and cars, which can be blown onto you.

At school …Follow the drill! Go to the interior hall or room in an orderly way as you are told. Crouch low, head down, and protect the back of your head with your arms. Stay away from windows and large open rooms like gyms and auditoriums.

In a car or truck … Vehicles are extremely dangerous in a tornado. If the tornado is visible, far away, and the traffic is light, you may be able to drive out of its path by moving at right angles of the tornado. (For example, if the tornado is moving east, move north or south.) Otherwise, park the car as quickly as possible—out of the traffic lanes. It is safer to get the vehicle out of the mud later if necessary than to cause a crash. Get out and seek shelter in a sturdy building. If in the open country, run to low ground away from any cars (which may roll over onto you.) Lie flat and face-down, protecting the back of your head with your arms. Avoid seeking shelter under bridges, which can create deadly traffic hazards while offering little protection against flying debris.

In the open outdoors … If possible, seek shelter in a sturdy building. If not, lie flat and face-down on low ground, protecting the back of your head with your arms. Get as far away from trees and cars as you can; they may be blown onto you in a tornado.

In a shopping mall or large store … Do not panic. Watch for others. Move as quickly as possible to an interior bathroom, storage room or other small enclosed area, away from windows.

In a church or theater … Do not panic. If possible, move quickly but orderly to an interior bathroom or hallway, away from windows. Crouch face-down and protect your head with your arms. If there is no time to do that, get under the seats or pews, protecting your head with your arms or hands.

WHAT SHOULD I DO AFTER A TORNADO?

The trauma of going through a tornado can pale in comparison to dealing with the aftermath, destruction, loss of life, injuries, mental anguish, and the many hazards left behind. After the tornado has passed, proceed with caution and listen to instructions from emergency crews. Keep your family together and wait for emergency personnel to arrive. Carefully render first aid to those who are injured. Unless a seriously injured person is in immediate danger, don't try to move the person. Stay out of damaged buildings; they could collapse at any time. Stay away from power lines and puddles with wires in them; they may still be carrying electricity. Don't use matches or lighters, in case of leaking gas pipes or fuel tanks nearby. If you smell gas or chemical fumes, leave the building immediately.

Tornado Facts

- The "Tri-state" tornado of March 18, 1925 is the deadliest tornado documented to date, killing 695 people in Missouri, Illinois, and Indiana.
- The largest tornado ever recorded occurred in the Texas Pandhandle near Gruver on June 9, 1971. The tornado expanded over 2 miles wide, with an average width of 2500 yards.
- The strongest tornado was documented to produce wind speeds of 318 mph in May 1999 near Bridge Creek, Oklahoma.

Source: NOAA Storm Prediction Center.

COMMON MYTHS

Myth 1: *"An underpass is a safe place to be in case of a tornado."*

Stopping under a bridge to take shelter from a tornado is very dangerous. Deadly flying debris can be blasted into the spaces between the bridge and grade, impelling any people hiding there. People may be blown out from under the bridge and possibly up the tornado itself. The bridge may collapse, peel apart, or create large flying objects.

Myth 2: *"You should make sure to open all the windows in the house to equalize pressure."*

Opening the windows is useless, a waste of precious time, and very dangerous. You may be injured by flying glass trying to do it. If the tornado hits your home, it will blast the windows anyway.

Myth 3: *"Mobile home parks attract tornadoes."*

It may seem that way, considering most tornado deaths occur in mobile homes and the most graphic damage comes from mobile home parks. However, the reason that mobile homes are more likely to experience damage is the home's construction. A strong straight-line wind or small-sized tornado can easily blow a mobile home off its foundation, even one that's tied down.

Myth 4: *"I can outrun an approaching tornado."*

Most tornado deaths occur in cars and mobile homes. Cars are easily tossed and destroyed. There's no way to know the speed of an approaching tornado, and since tornadoes change directions, you cannot predict their paths. Your get-away speed may also be affected by traffic, road obstructions, and weather. The best option is to get as far away from the car as possible, find a sturdy building or lay face down in a low lying ditch with your hands and arms over your head.

Myth 5: *"Hail always comes before a tornado."*

Rain, wind, lightning, and hail vary from storm to storm, from one hour to the next, and even with the direction the storm is moving with respect to the observer. While large hail can indicate the presence of an unusually dangerous thunderstorm, and can happen before a tornado, hail is not a reliable predictor of a tornado threat.