

TORNADO SAFTEY TIPS

Oklahoma Department of Corrections

2016

Course Information

- Course author and date: Scott Magoon, April 2016
- Annual reviewer and date:
- Assigned catalog code: DOC 463
- Category: On-line, In-service
- Type of training credit: Safety
- Training credit: 1 hour
- Approved Instructor(s): N/A
- For classroom presentations: Certified DOC instructors
- Target population(s): All DOC staff and supervisors
- Delivery/presentation method: Self-paced or Classroom
- Evaluation procedures: None / Instructor observation

Sources

- <http://www.redcross.org/get-help/prepare-for-emergencies/types-of-emergencies/tornado#/Recover-After>
- <http://www.nssl.noaa.gov/education/svrwx101/tornadoes/>
- <https://www.ready.gov/tornadoes>
- <http://www.spc.noaa.gov/faq/tornado/f-scale.html>
- [https://en.wikipedia.org/wiki/Fujita scale](https://en.wikipedia.org/wiki/Fujita_scale)
- <http://www.universetoday.com/71983/how-are-tornadoes-formed/>
- <http://www.popularmechanics.com/science/environment/a7055/how-a-tornado-works-6327786/>
- <http://www.srh.noaa.gov/oun/?n=safety-severe-homesafety>

Sources (cont.)

- http://geoawesomeness.com/wp-content/uploads/2013/05/tornado_locations_tg5.png
- http://geoawesomeness.com/wp-content/uploads/2013/05/67749086_tornado_path_976.jpg
- <http://www.nssl.noaa.gov/about/history/may3rd/>

Course Objectives

- By the end of this course, students will be able to:
 - Define the difference between a tornado watch and warning, and what to do in each case
 - Define the Fujita scale of tornado classification
 - Explain how a tornado forms
 - Develop your own tornado safety procedures
 - Identify the safety measures to take after a tornado strikes

Facts

- Tornadoes are nature's most violent storms.
- A tornado appears as a rotating, funnel-shaped cloud that extends from a thunderstorm to the ground with whirling winds that can reach 300 miles per hour.
- Damage paths can be in excess of one mile wide and 50 miles long.
- Some tornadoes are clearly visible, while rain or nearby low-hanging clouds obscure others.
- Some tornadoes develop so rapidly that little, if any, advance warning is possible.



Facts (cont.)

- Before a tornado hits, the wind may die down and the air may become very still.
- A cloud of debris can mark the location of a tornado even if a funnel is not visible.
- They may appear nearly transparent until dust and debris are picked up or a cloud forms in the funnel.
- The average tornado moves southwest to northeast, but tornadoes have been known to move in any direction
- The average forward speed of a tornado is 30 mph, but may vary from stationary to 70 mph.

Facts (cont.)

- Tornadoes are most frequently reported east of the Rocky Mountains during spring and summer months.
- Peak tornado season in the southern states is March through May; in the northern states, it is late spring through early summer.
- Tornadoes are most likely to occur between 3 p.m. and 9 p.m., but can occur at any time.
- Tornadoes CAN and DO hit urban areas.
 - The Oklahoma City metro area has been hit by a violent tornado (rated F4 or F5) on 9 separate occasions, most recently on May 20, 2013. The metro area has been hit by a tornado over 150 times since records began in 1893.
- Flying debris from tornadoes cause most fatalities and injuries.



Moore, Ok, May 20, 2013

Terms:

- **Tornado Watch**

- Tornadoes are possible. Remain alert for approaching storms. Watch the sky and stay tuned to NOAA Weather Radio, commercial radio or television for information. Issued by the NOAA Storm Prediction Center.

- **Tornado Warning**

- A tornado has been sighted or indicated by weather radar. Take shelter immediately. Issued by your local NOAA National Weather Service Forecast Office.



Fujita Tornado Damage Scale

- Developed in 1971 by T. Theodore Fujita of the University of Chicago
 - Is a scale for rating tornado intensity, *based primarily on the damage tornadoes inflict on human-built structures and vegetation*. The official Fujita scale category is determined by meteorologists and engineers after a ground or aerial damage survey, or both; and depending on the circumstances, ground-swirl patterns (cycloidal marks), radar tracking, eyewitness testimonies, media reports and damage imagery, as well as photogrammetry or videogrammetry if motion picture recording is available.
- Enhanced F Scale for Tornado Damage
 - Developed by a team of meteorologists and wind engineers, implemented in the U.S. on 1 February 2007.

Fujita Tornado Damage Scale (cont.)

- **[E]F0: Wind Estimate (<73) [65-85]**

Typical Damage: Light damage. Some damage to chimneys; branches broken off trees; shallow-rooted trees pushed over; sign boards damaged.

- **[E]F1: Wind Estimate (73-112) [86-110]**

Typical Damage: Moderate damage. Peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos blown off roads.

- **[E]F2: Wind Estimate (113-157) [111-135]**

Typical Damage: Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars overturned; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground.

Fujita Tornado Damage Scale (cont.)

- **[E]F3: Wind Estimate (158-206) [136-165]**

Typical Damage: Severe damage. Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted; heavy cars lifted off the ground and thrown.

- **[E]F4: Wind Estimate (207-260) [166-200]**

Typical Damage: Devastating damage. Well-constructed houses leveled; structures with weak foundations blown away some distance; cars thrown and large missiles generated.

Fujita Tornado Damage Scale (cont.)

- **[E]F5: Wind Estimate (261-318) [>200]**

Typical Damage: Incredible damage. Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 meters (109 yds.); trees debarked; incredible phenomena will occur.

- **IMPORTANT NOTE ABOUT F-SCALE WINDS:** Do not use F-scale winds literally. These precise wind speed numbers are actually guesses and have never been scientifically verified. Different wind speeds may cause similar-looking damage from place to place--even from building to building.

Items in [] brackets indicate the enhanced Fujita scale

Fujita Scale of Tornado Intensity

Scale	Wind Speed Estimate (mph)
F0	Under 72
F1	73-112
F2	113-157
F3	158-206
F4	207-260
F5	261-318

Damage Path

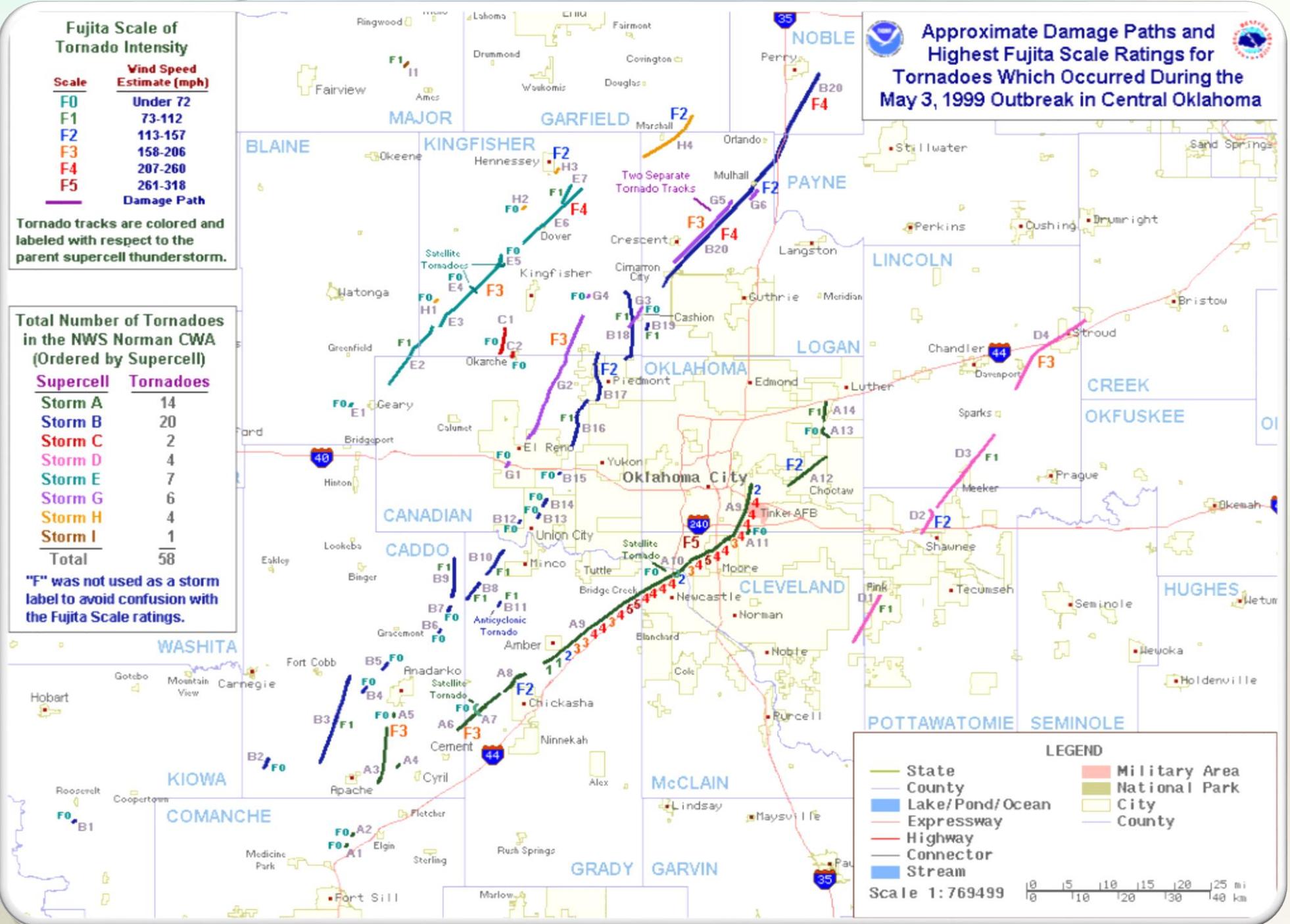
Tornado tracks are colored and labeled with respect to the parent supercell thunderstorm.

Total Number of Tornadoes in the NWS Norman CWA (Ordered by Supercell)

Supercell	Tornadoes
Storm A	14
Storm B	20
Storm C	2
Storm D	4
Storm E	7
Storm G	6
Storm H	4
Storm I	1
Total	58

"F" was not used as a storm label to avoid confusion with the Fujita Scale ratings.

Approximate Damage Paths and Highest Fujita Scale Ratings for Tornadoes Which Occurred During the May 3, 1999 Outbreak in Central Oklahoma



LEGEND

- State
- County
- Lake/Pond/Ocean
- Expressway
- Highway
- Connector
- Stream
- Military Area
- National Park
- City
- County

Scale 1:769499

0 15 10 15 20 25 mi
0 10 20 30 40 km

Enhanced Fujita Tornado Damage Scale

- Enhanced F Scale Damage Indicators
 - Implemented in the U.S. on 1 February 2007.
 - Uses 28 different indicators to assess tornado strength
 - #1 Small barns, farm outbuildings
 - #10 Strip mall
 - #20 Institutional bldg. (hospital, govt. or university)
 - #28 Tree – Softwood
 - Each indicator is broken down into “Degree of Damage,” which may have up to ten different degrees.

Not all indicators listed above, visit <http://www.spc.noaa.gov/ef-scale/> for more detailed information

Enhanced Fujita Tornado Damage Scale

1. SMALL BARNS AND FARM OUTBUILDINGS (SBO)

Typical Construction

- Less than 2500 sq ft
- Wood or metal post and beam construction
- Wood or metal roof trusses
- Wood or metal panel siding
- Metal or wood roof
- Large doors

DOD*	Damage description	EXP	LB	UB
1	Threshold of visible damage	62	53	78
2	Loss of wood or metal roof panels	74	61	91
3	Collapse of doors	83	68	102
4	Major loss of roof panels	90	78	110
5	Uplift or collapse of roof structure	93	77	114
6	Collapse of walls	97	81	119
7	Overturning or sliding of entire structure	99	83	118
8	Total destruction of building	112	94	131

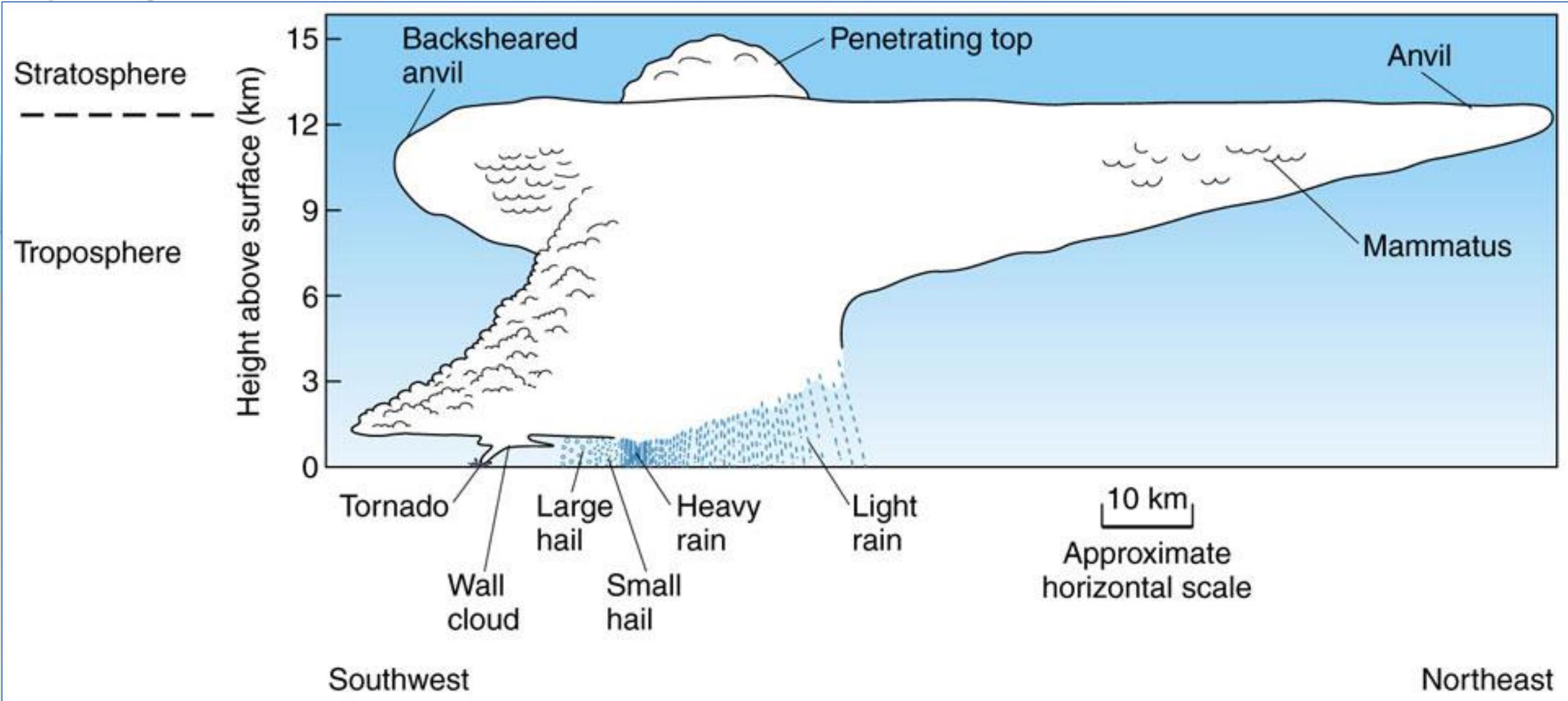
* Degree of Damage

How tornados are formed

- Tornadoes are usually the extreme result of a very large thunderstorm called a supercell. During the storm, cold air and warm air combine. The cold air drops as the warm air rises. The warm air eventually twists into a spiral and forms a funnel cloud. The sky turns a very dark green color and the tornado begins its destruction.



Diagram of a Tornado



How tornados are formed (cont.)

- **Supercell**

- Tornado-spawning thunderstorms, called supercells, arise where a current of low, warm, moist air traveling north from the Gulf of Mexico flows underneath a higher, cooler mass of air traveling east. Shear from these opposing winds causes the entire supercell to rotate slowly.

- **Updraft**

- The low, moist air is warmed by sunlight, making it increasingly buoyant. The moist air breaks through the cooler air above and rises. As it does so, vapor condenses into water droplets—dumping the heat of condensation back into the rising air, warming it and further feeding the updraft that will ultimately power the tornado.

How tornados are formed (cont.)

- **Downdraft**

- The updraft is counterbalanced by a downdraft of sinking air, which is cooled by rain. This cool, sinking air next to warm, rising air produces a pressure gradient in the bottom 3000 feet of the atmosphere, lending a spiraling motion to the updraft—which will become the tornado.

- **Stretching**

- The supercell travels northeast, towing the updraft like a leash. Stretching causes the updraft to narrow. As this occurs, its spiraling winds accelerate—much like a spinning ice skater speeding up as she pulls in her arms and legs. A violent tornado is born.

How tornados are formed (cont.)

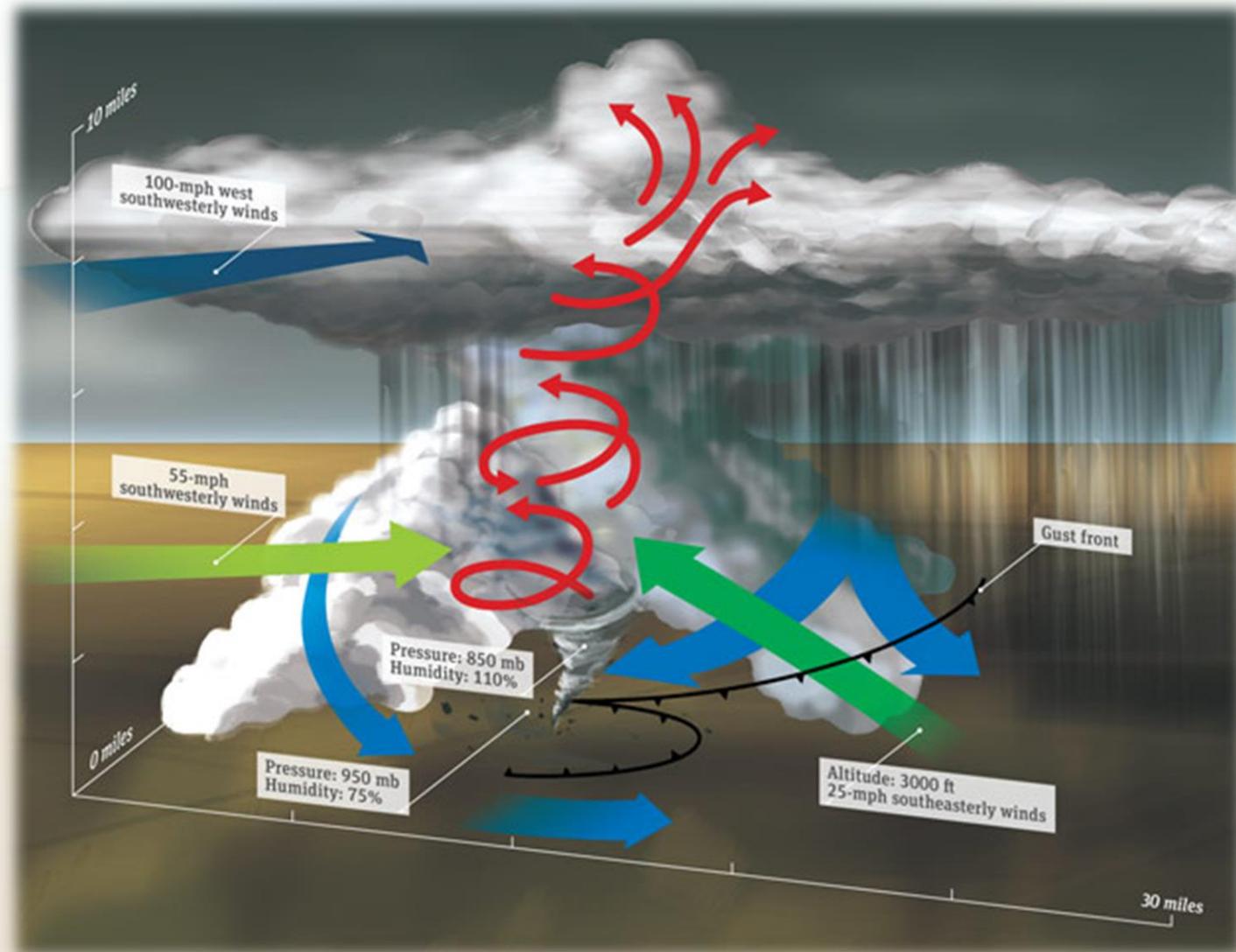
- **Pressure**

- The tornado's updraft creates a low-pressure zone at its core. That pressure differential relative to the surrounding air is roughly equal to that of a Category 5 hurricane—except that in the case of the tornado, the differential exists within half a mile rather than 100 miles—helping fuel ferocious winds that can far exceed those of a hurricane.

- **Effects**

- Supercells don't just spawn tornadoes. They can also produce powerful down drafting wind bursts miles from the tornado. These bursts can sometimes flip mobile homes. Supercells can also produce dangerous lightning and hail as large as golf balls or grapefruit.

How tornados are formed (cont.)

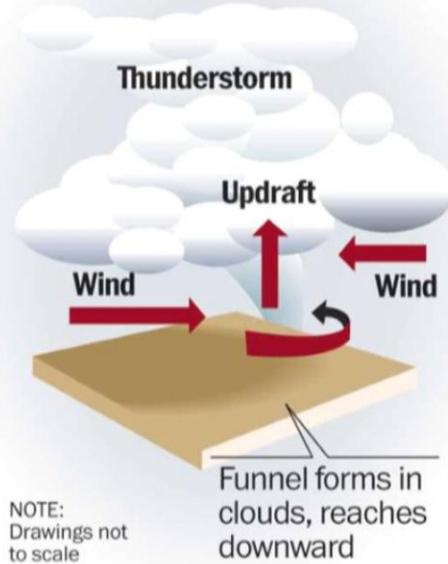


SUPERCCELL – OR NOT

Radar studies conducted during the 1990s revealed that not all tornadoes start the same way. Several different kinds of weather can start a twister.

Supercell tornado

Begins with an updraft inside a giant “supercell” thunderstorm



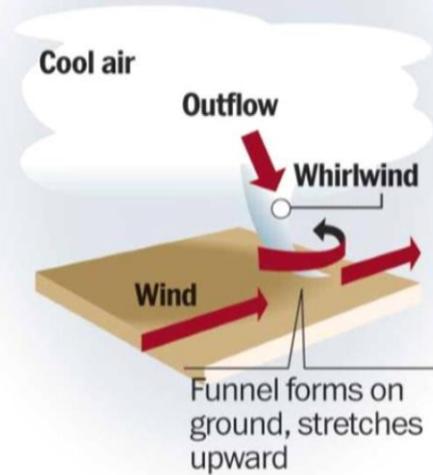
Winds blowing in different directions at different altitudes spin the updraft into a tornado

Most susceptible Southeast in spring; Midwest later



Nonsupercell tornado

Begins with cool air flowing outward from a rainstorm or cold front



Wind blowing across the outflow starts a small whirlwind, which grows into a tornado

Most susceptible Southeast and South



Source: U.S. National Oceanic and Atmospheric Administration, University of Illinois Urbana-Champaign

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THE WASHINGTON TIMES

Be Prepared

- A tornado is a low probability, high impact event. Chances are, you will never experience a tornado. Even if you live in the heart of tornado alley, the chances that your house will be struck by a tornado are small. However, you need to be ready just in case.
- NOAA recommends multiple sources of weather information:
 - Weather radio
 - Television
 - Radio
 - Internet
 - Phone App



Be Prepared (cont.)

- **Have a Plan**

- Be weather aware and plan to be somewhere safe at the predicted time of the weather event if possible.
 - Being stuck in your car on the highway as a tornado cross is not good planning.
- Have the necessary emergency items in your safe place before you need them.
 - Trying to find items to bring into your safe place as the tornado bears down on you is not good planning.
- Ensure everyone in your care knows the plan.
 - Include the safety of your pets in the plan.

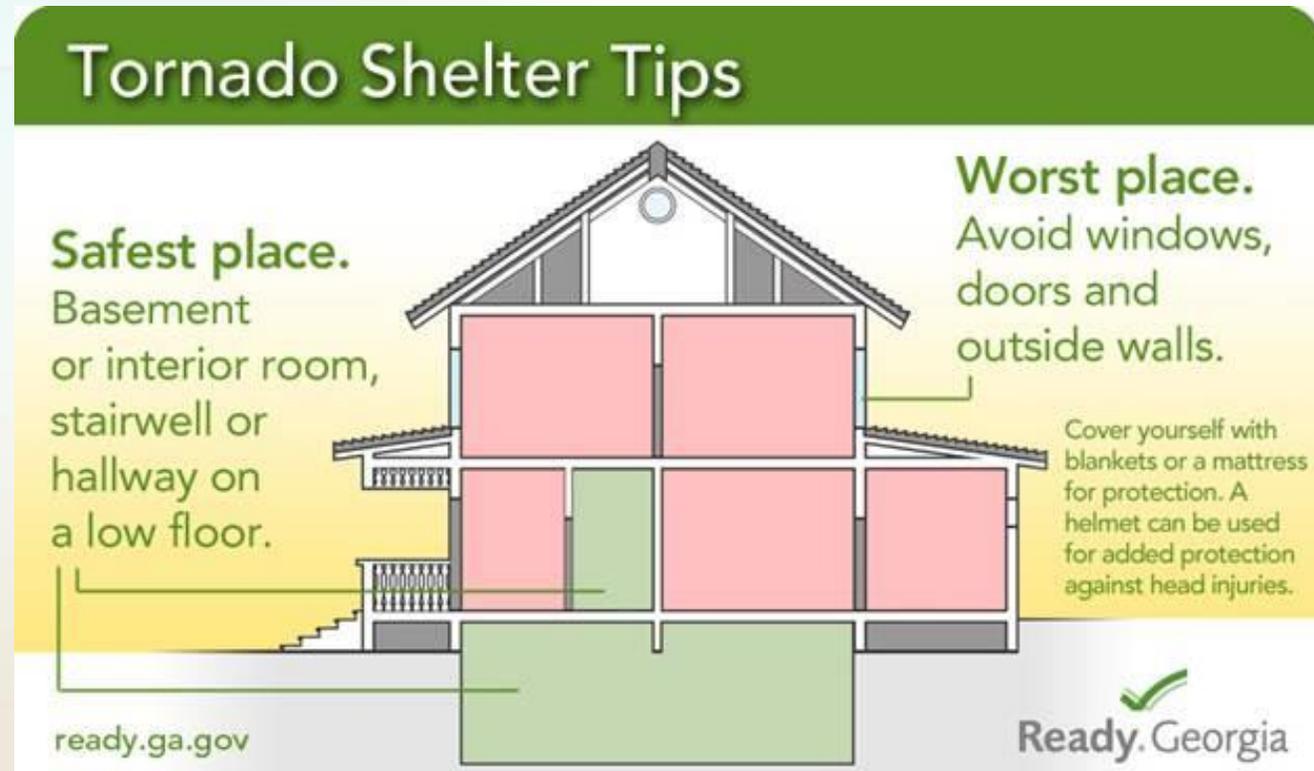


Be Prepared (cont.)

- Identify safe places to go in case of a tornado
- It is important to figure this out before you need it

Work or Home:

- Small inner rooms with no windows (bathroom, hallway, closet, [close all doors])
- On the lowest floor of the building
- Building should be well constructed (metal buildings or large open structures such as Walmart stores are not good choices)
- Get as low as possible - completely underground is best.
- Put as many barriers between you and the outside as possible.



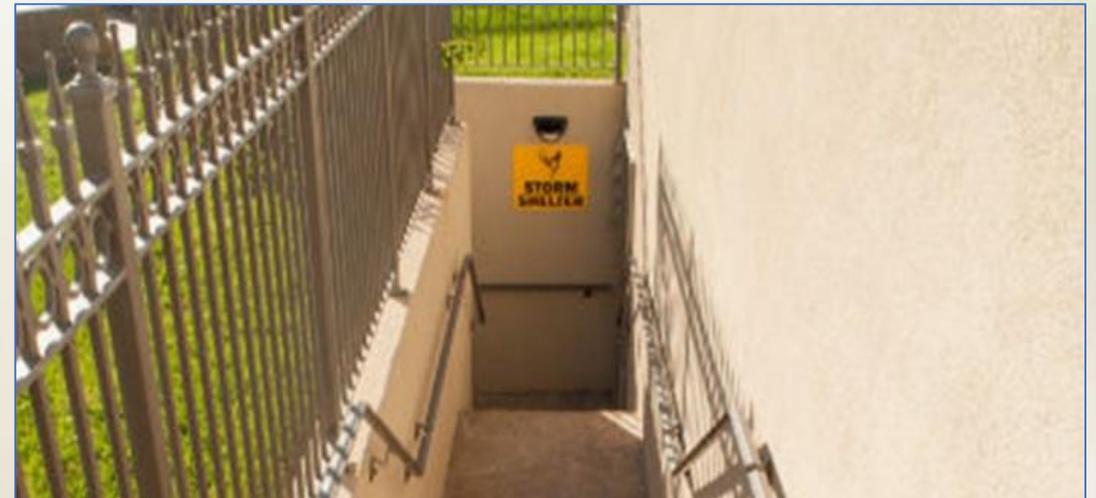
Be Prepared (cont.)

Storm Shelters:

- If you have an underground storm cellar, use it. Make sure the door is securely fastened.
- If the entrance to your storm cellar is outside, you should allow plenty of time to get to the shelter before the storm arrives. If you wait until the storm is upon you, you may be exposed to wind, hail, rain, lightning and maybe even flying debris as you go to the cellar.

Apartments:

- Get to the lowest floor, with as many walls between you and the outside as possible.
- If your complex does not have a reinforced shelter, you should make arrangements to get to an apartment on the lowest floor possible.
- You need to have a shelter area that's accessible at all times of the day or night.



Be Prepared (cont.)

Mobile Homes

- Mobile homes are especially susceptible to high winds from severe thunderstorms and tornadoes
- Mobile homes cannot stand up to even a weak tornado, and you should make plans **BEFORE** the storm arrives to get to a safe shelter
- Get out of mobile homes and find a more substantial shelter as quickly as possible. Do not wait for the tornado warning!



Be Prepared (cont.)

Public Buildings - Malls, Stores, Restaurants, Hospitals

- Same basic safety rules apply
 - Put as many walls as you can between you and the outside
 - Get as low as possible
 - Cover your self with whatever you can to protect yourself from flying missiles

Outdoor Activities - Campgrounds, RV Parks, Sporting Events, Fairs, Festivals

- Being exposed outdoors is one of the worst places to be in a tornado or severe thunderstorm. Being involved in outdoor activities can sometimes put you at increased risk, because you're exposed outdoors and possibly in an unfamiliar area.

Be Prepared (cont.)

Being In a Vehicle

- Is a terrible place to be when a severe thunderstorm threatens
- AVOID the situation and be weather aware and off the road before the storms arrive
- Never try to outrun a tornado in your vehicle.
- The worst-case scenario for motorists would be to be trapped in your vehicle on the road with no escape possible.
 - Highway overpasses are NOT tornado shelters, and these should be avoided.
 - Ditches, culverts, and ravines should be used only as an absolute last resort. You will be exposed to flying debris, rain and hail, lightning and extreme wind.

After the Storm

- Continue listening to local news or a NOAA Weather Radio for updated information and instructions.
- If you are away from home, return only when authorities say it is safe to do so.
- Wear long pants, a long-sleeved shirt and sturdy shoes when examining your walls, doors, staircases and windows for damage.
- Watch out for fallen power lines or broken gas lines and report them to the utility company immediately.
- Stay out of damaged buildings.
- Use battery-powered flashlights when examining buildings – do NOT use candles.



After the Storm (cont.)

- If you smell gas or hear a blowing or hissing noise, open a window and get everyone out of the building quickly and call the gas company or fire department.
- Take pictures of damage, both of the building and its contents, for insurance claims.
- Use the telephone only for emergency calls.
- Keep all of your animals under your direct control.
- Clean up spilled medications, bleaches, gasoline or other flammable liquids that could become a fire hazard.

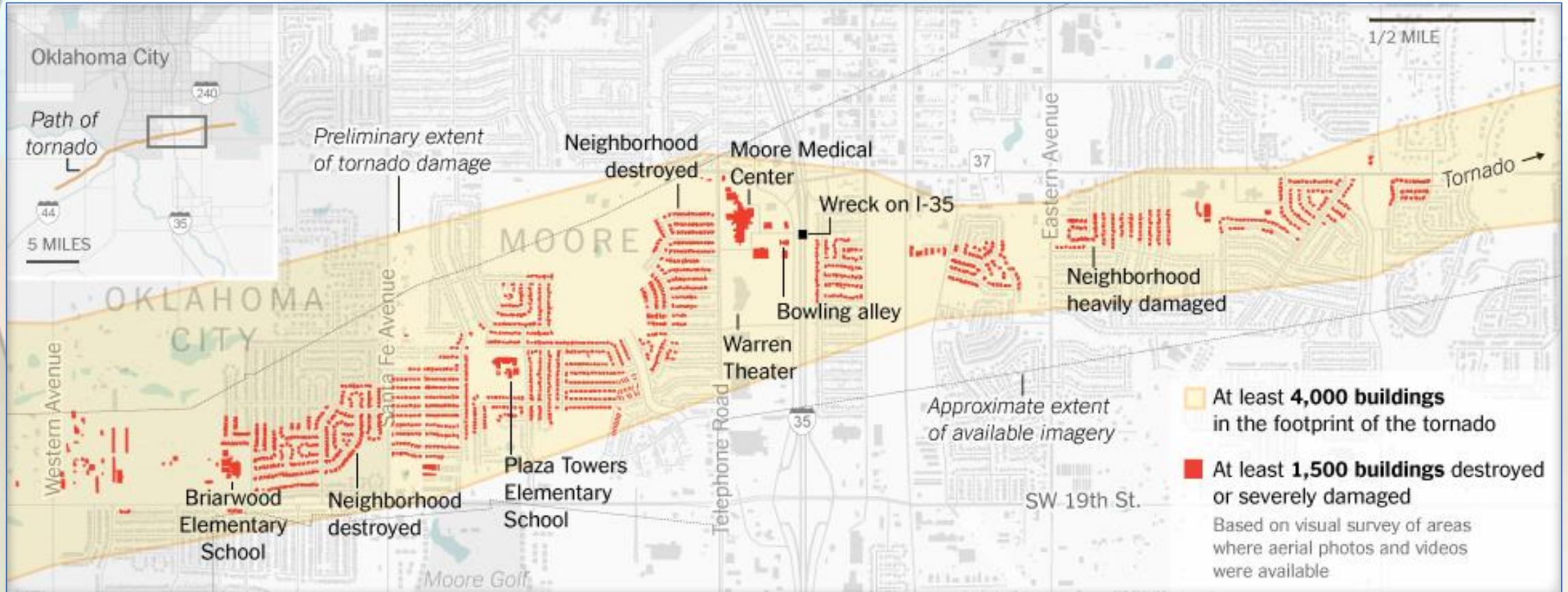
After the Storm (cont.)

- Check for injuries. If you are trained, provide first aid to persons in need until emergency responders arrive. Administer first aid as necessary while you wait for rescue workers.
- Watch for loose debris that may fall on you.
- Let your family know you are safe.
 - If your community has experienced a disaster, register on the American Red Cross Safe and Well web site to let your family and friends know you are safe. You may also call 1-866-GET-INFO to register yourself and your family.

Don'ts:

- DO NOT Use highway overpasses/bridges as a shelter from tornados. They do not provide any protection against high winds and projectiles
- DO NOT block highway and prevent free flow of traffic.
- DO NOT seek shelter in a hallway or bathroom of a mobile home.
- DO NOT wait until you see the tornado to seek shelter.

EF-5 Tornado--Path of Destruction Moore, Oklahoma May 20, 2013



Conclusion:

- Being informed is the first step in being prepared for the possibility of a severe storm impacting your community. The next step is using the knowledge gained to protect yourself, family, friends, neighbors and community. Your safety is paramount in completing your mission as a member of the Department of Corrections, as well as being around to watch your family grow up in a neighborhood and community that you will cherish for years to come.
- Stay safe!