

Preparing Schools for Hazardous Weather

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Introduction

Hazardous weather is common in the Texas and Oklahoma panhandles. From snow and sleet in winter, tornadoes in the spring, and drought in summer, the high plains are one of the most active weather regions in the country. Some hazardous weather, like high wind, can be mere inconveniences. However, events like tornadoes, flash floods, severe thunderstorms, and blizzards can be life threatening.

The National Weather Service's mission is to protect life and property by issuing warnings, statements, and advisories before potentially hazardous weather. We work closely with the area's emergency managers and media to reach as many people as possible. Frequent safety and preparedness presentations are given, so people will respond quickly when hazardous weather is anticipated.

Schools pose a special concern regarding hazardous weather safety. Schools have large numbers of students and staff, all of which must move quickly to shelter if hazardous weather is occurring. Portable classrooms and larger campuses compound the vulnerability of schools to the effects of hazardous weather.

This guide is designed to help your school evaluate its hazardous weather preparedness plan. It will discuss the primary hazardous weather we face in the panhandle region, and give general safety tips to follow if hazardous weather is in your area.

If you would like assistance in developing a safety plan for your school, please contact Steve Drillette, Warning and Coordination Meteorologist, or Jose` Garcia, Meteorologist in Charge, at (806) 335-1121.

The National Weather Service in Amarillo frequently conducts tours for school groups. Guest speakers are also available from the National Weather Service office. There is no charge for guest speakers or tours. For more information or assistance in scheduling a tour or a guest speaker for your school group, please call the National Weather Service Forecast office at (806) 335-1121.

Types of Hazardous Weather

TORNADOES

Tornadoes occur in many parts of the world, but are most common in the United States. In an average year, 800 tornadoes are reported nationwide, with an average of 20 occurring in the Texas and Oklahoma panhandles. An average of 80 deaths, and more than 1,500 people are reported injured in the U.S. every year.

A tornado is defined as a violently rotating column of air extending from a thunderstorm to the ground. The most violent tornadoes are capable of widespread destruction with wind speeds of 250 mph or more.

HOW DO TORNADOES FORM ?

Before thunderstorms develop, a change in wind direction and an increase in wind speed with height creates an invisible, horizontal spinning effect in the lowest layers of the atmosphere. Rising air within the thunderstorm updraft tilts the rotating air from horizontal, to vertical. An area of rotation, two to 6 miles wide, now extends through much of the storm. Most strong to violent tornadoes form within this area of strong rotation.

Types of Hazardous Weather

TORNADO CLASSIFICATION

Class	% of all tornadoes		% of deaths caused by tornadoes		Typical Lifespan of Tornadoes	Estimated Wind Speed
	Nation	Panhandles	Nation	Panhandles		
Weak	80	85	less than 5	0	1-10 minutes	up to 110 mph
Strong	19	13	nearly 30	25	20 minutes or more	110 to 205 mph
Violent	1	2	nearly 70	75	up to an hour	more than 205 mph

Tornado Statistics for the Nation and Texas and Oklahoma Panhandles, 1950-2001.

TORNADO FACTS AND FIGURES

Tornadoes can and do occur any time of year.

In the Texas and Oklahoma panhandles, peak tornado occurrence is April through June.

A secondary tornado maximum can occur in the fall.

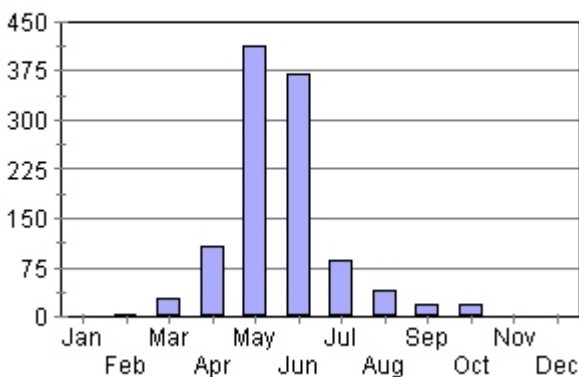
Tornadoes are most likely to occur between 3 and 9 PM, but have occurred in all hours of the day and night.

The “average” tornado moves from southwest to northeast, but tornadoes can move in any direction.

The average forward speed for a tornado is 30 mph, but vary from nearly stationary, to 70 mph.

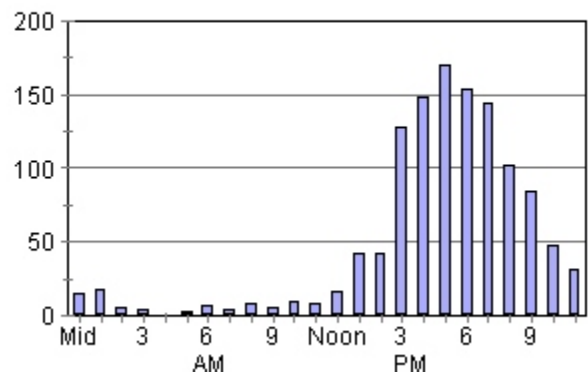
Number of Tornadoes By Month

TX / OK Panhandles



Number of Tornadoes by Time

TX / OK Panhandles



Number of Tornadoes by Month, and by time of Day in the Texas and Oklahoma Panhandles, 1950 - 2001.

Types of Hazardous Weather

FLASH FLOODS

A flash flood is a life threatening event. Floods and flash floods are the nation's number one thunderstorm related killer, with over 120 fatalities every year. A flash flood is defined as a rapid rise of water, usually during or after a period of heavy rain. Flood waters may rise several feet in just a few minutes.

HOW DO FLASH FLOODS OCCUR?

Several factors contribute to flash flooding. The two key elements are rainfall intensity and duration. Intensity is the rate of rainfall, and duration is how long the rainfall lasts. Topography, soil conditions, and ground cover are also factors in the flooding risk. Most flash flooding is caused by slow moving thunderstorms, or thunderstorms repeatedly moving over the same area. When heavy rainfall occurs over urbanized areas, covered by concrete and pavement, excessive runoff and flooding can occur.

VEHICLE DANGERS

Nearly half of all flash flood fatalities are vehicle related. In a school bus, or any other vehicle, look for flooding at highway dips, bridges, and low areas. Many flash floods occur at night, so be prepared to take quick action.

How can a foot or two of water cost you your life? Water weighs 62.4 pounds per cubic foot and typically flows downstream at 9 miles an hour. When a vehicle stalls, the water's momentum is transferred to the vehicle. For each foot the water rises, 500 pounds of lateral force is applied to the vehicle. The biggest factor is buoyancy. For each foot the water rises up the side of the vehicle, the vehicle displaces 1,500 pounds of water. In effect, the vehicle weighs 1,500 pounds less for each foot of water. Two to three feet of water will carry away most vehicles. Large vehicles, such as school buses with large tires are especially dangerous. The large tires will actually help float the vehicle off the road.

Types of Hazardous Weather

THUNDERSTORM WINDS

“Straight line” wind events are called downbursts. Downbursts, classified as either microbursts (small scale events) or macrobursts, (large scale events) occur when air rapidly descends from a thunderstorm to the ground. Downbursts strike the ground and rapidly move away from the contact point. They can cause damaging winds in excess of 100 mph, and may or may not be associated with rain. In the Texas and Oklahoma panhandle, most downbursts produce little or no rainfall, and are more common than tornadoes. Most wind damage caused by thunderstorms are actually caused by downbursts. Due to this fact, the risk associated with “non-tornadic” thunderstorms should be taken seriously.

LARGE HAIL

Large hail is the most destructive weather element to affect the United States. Each year, hail causes roughly \$ 1 Billion damage to vehicles, roofs, crops, livestock, and aircraft. Strong rising currents of air within a storm, called updrafts, carry water droplets to a height where freezing occurs. Ice particles grow, finally becoming too heavy to be supported by the updraft, then fall to the ground. Hailstones can become as large as softballs and can fall at speeds faster than 100 mph. Although fatalities from hail are rare, they do occur.

LIGHTNING

Rising and descending air within a thunderstorm separates positive and negative charges. Water and Ice particles also affect the distribution of electrical charge. Lightning results from the buildup and discharge of electrical energy between positively and negatively charged areas. The air near a lightning strike is heated to 50,000 degrees F, hotter than the surface of the sun! This rapid heating, and then cooling of the air near the lightning channel causes a shock wave, which results in thunder. Most lightning deaths or injuries occur when people are caught outdoors. Most lightning casualties occur in the summer months, during the late afternoon and early evening.

Preparing for the Storm

National Weather Service Hazardous Weather Products

TORNADO WATCH:	Tornadoes are possible in the area. Remain alert for approaching storms.
TORNADO WARNING:	A tornado has been sighted, or is imminent. If a tornado warning has been issued for your area, move to your pre-designated place of safety.
SEVERE THUNDERSTORM WATCH:	Severe thunderstorms are possible in your area. Thunderstorms are defined as severe if they produce winds in excess of 58 mph, and / or produce hail 3/4 of an inch in diameter or larger.
SEVERE THUNDERSTORM WARNING:	Severe thunderstorms are occurring, or imminent. Keep in mind that tornadoes occasionally develop in areas where severe thunderstorm watches or warnings are in effect. Remain alert to signs of an approaching tornado and seek shelter if threatening conditions exist.
FLASH FLOOD WATCH:	Flash flooding or flooding is possible within the watch area.
FLASH FLOOD WARNING:	Flash flooding has been reported, or is imminent. Take necessary precautions immediately.
URBAN/SMALL STREAM FLOOD ADVISORY:	Ongoing or imminent flooding of small streams, streets, and low-lying areas, like railroad underpasses and urban storm drains.
WINTER STORM WATCH:	Significant snow, freezing rain, or ice is expected within 24 to 36 hours.
WINTER STORM WARNING:	Severe Winter Weather is occurring, imminent, or highly likely within 12 to 24 hours.
Preparing for the Storm HEAVY SNOW WARNING:	Snow accumulations of 4 inches or more in 12

hours, OR snow accumulations of 6 inches or more in 24 hours.

WINTER WEATHER ADVISORY:

Issued for weather events which cause significant inconvenience, but do not meet warning criteria.

SNOW ADVISORY:

One to three inches of snow in 12 hours or less.

BLIZZARD WARNING:

A blizzard warning is issued when the following conditions occur for 3 hours or longer:

- a) wind speeds of 35 mph or greater
- b) snow or blowing snow which reduces visibility to 1/4 mile or less

FREEZING RAIN / DRIZZLE ADVISORY:

Light accumulation of freezing rain or drizzle that does not form on all exposed surfaces.

BLOWING / DRIFTING SNOW ADVISORY:

Snow that is expected to significantly reduce visibility.

WIND ADVISORY:

Sustained wind speeds of 35 mph or greater that are expected for one hour or longer.

HIGH WIND WARNING:

High Wind Warning is issued when the following conditions are expected:

- a) Sustained wind speeds of 40 mph or greater, and lasting for one hour or longer.
- b) Non-Thunderstorm winds of 58 mph or greater, for any duration of time.

DENSE FOG ADVISORY:

Fog which reduces visibilities to less than or equal to 1/4 mile.

SHORT TERM FORECAST:

A brief one to three hour forecast to keep you informed of rapidly changing weather conditions.

HAZARDOUS WEATHER OUTLOOK:

Issued twice daily, at 6 AM and 1 PM to highlight any potentially hazardous weather.

Preparing for the Storm

TORNADO SAFETY

In the school, move to the pre-designated shelter area.

If an underground shelter is not available, move to an interior room or hallway on the lowest floor. Crouch down against a wall or get under a sturdy piece of furniture.

Stay away from windows.

Do not attempt to outrun a tornado in a bus, truck, or car; instead, abandon it for a strong building.

Consider holding buses at the school if severe weather is an imminent threat.

Overpasses offer little protection from tornadoes and should not be used as shelters.

If caught in the open, take cover in a ditch or low spot. Remember, this will not provide the same protection as a sturdy building.

Portable classrooms, even if tied down, are poor shelters from tornadoes and should be abandoned.

Occasionally, tornadoes develop so rapidly that advance warning is not possible. Remain alert for signs of an approaching tornado. Flying debris from tornadoes cause most deaths and injuries.

Preparing for the Storm

FLOOD SAFETY

Know your flood risk, does your area flood easily? Are you in a flood prone area? If so, be prepared to move to a place of safety during bouts of heavy rainfall.

Make sure bus drivers are familiar with the flood prone areas along their routes.

Keep a NOAA weather radio, a battery powered portable radio, and flashlights in good working order.

Move out of areas subject to flooding. This includes dips, low spots, canyons, etc.

Avoid already flooded and high velocity flow areas. Do not attempt to cross flowing streams.

If driving, be aware that the road bed may not be intact under flood waters. Turn around and go the other way. NEVER drive through flooded roadways.

If the vehicle stalls, leave it immediately and seek higher ground if you can do so safely. Rapidly rising water may engulf the vehicle and its occupants and sweep them away.

Be especially cautious at night when it is harder to recognize flood dangers.

Preparing for the Storm

THUNDERSTORM AND LIGHTNING SAFETY

If you can hear thunder, you are close enough to the storm to be struck by lightning. Go to safe shelter immediately! Remain in the shelter area until 30 MINUTES after the last rumble of thunder is heard.

Move to a sturdy building. Do not take shelter in small sheds, under isolated trees, or in convertible automobiles.

If lightning is occurring and a sturdy shelter is not available, get inside a hard top automobile and keep windows up. Beware, though, since vehicles offer poor protection from tornadoes and downburst winds, and only offer fair protection from hail.

Telephone lines and metal pipes can conduct electricity. Unplug appliances not necessary for obtaining weather information. Keep a battery powered NOAA Weather Radio or Commercial Radio on hand. Avoid using the telephone or any electrical emergency. Use hardwire phones ONLY in an emergency. Cell phones are safer and preferred.

Turn off air conditioners. Power surges from lightning can overload the compressors.

Preparing for the Storm

Six Steps to Build Your School's Preparedness Plan

1) DESIGNATE SHELTER AREAS

Basements offer the best protection from tornadoes and downbursts, otherwise, interior rooms and hallways provide the best protection from tornadoes and downburst winds. If hallways are used, only use areas which are well clear of external doors or classrooms with windows. Auditoriums, gymnasiums, and other structures with high, wide-span roofs do not offer good protection. Portable buildings are poor shelters and should not be used.

2) PRACTICE REGULARLY

Like fire drills, the hazardous weather safety plan should be practiced as often as feasible. Regular practice will enable staff members to become familiar with their duties. In addition, the practices will allow administrators to identify and correct any flaws in the plan, such as how much time it takes to get people into shelter areas, or traffic flow problems through hallways.

3) HAVE RELIABLE, REDUNDANT MEANS TO RECEIVE WEATHER INFORMATION.

If you are in broadcast range, NOAA Weather Radio is the best way to receive information from the National Weather Service. NOAA Weather Radio is a broadcast of weather information directly from the National Weather Service Forecast Office in Amarillo. NOAA Weather Radio receivers have an alarm feature which will activate only when watches or warnings are issued for your county. Information on NOAA Weather Radio is available online at <http://www.srh.noaa.gov/AMA/html/radio.htm>

The Emergency Managers Weather Information Network (EMWIN) is another means of receiving National Weather Service products. EMWIN is a nationwide satellite based system which broadcasts watches, warnings, forecasts, observations, and summaries from NWS offices. EMWIN requires a satellite dish, a signal demodulator, display software, and a Pentium class Personal Computer. The display software features alarming and printing capabilities when specific products are received. Several vendors sell pre-packaged units, including the dish, demodulator, and software. Once the receiving station is established, there are no recurring costs for the data. More information on EMWIN is available online at <http://iwin.nws.noaa.gov/emwin/index.htm>

Commercial radio, Television, alphanumeric pagers, and two-way radio systems are all ways of getting information. Have as many of these methods available as possible. Each method should have a battery backup, in case the electricity goes out.

Six Steps to Build Your School's Preparedness Plan

4) HAVE RELIABLE, REDUNDANT SYSTEMS TO RELAY INFORMATION WITHIN THE SCHOOL

If hazardous weather threatens your school, you may have only seconds to activate your plan and get the students and staff to shelter. Utilize as many methods as possible to get people to safety, with battery backup in case of commercial power loss. The school intercom, walkie-talkies, cell phones, and a battery powered bullhorn are a few possibilities.

5) ENSURE EACH STAFF MEMBER IS FAMILIAR WITH THEIR RESPONSIBILITIES

This is where some of the tougher questions must be asked. Who in your school is responsible for developing or modifying the hazardous weather plan? Who will be assigned to monitor conditions during potentially severe weather? Who has the lead role in authorizing or activating the plan? Are backup assignments in place in the event that severe weather strikes while key staff members are absent? Who has the authority to hold buses at the school if hazardous weather threatens?

6) WHEN HAZARDOUS WEATHER THREATENS, ENACT THE PLAN IMMEDIATELY!

We at the National Weather Service attempt to have all hazardous weather preceded by a warning or advisory. In some cases, the lead time between when the warning is issued and when the storm hits will be short. The warnings we issue are on a county by county basis. When a warning is issued for your county, listen closely to the entire warning message. We will specify precisely where in the county the storm is located, and list the towns in the path of the storm. If your school is near the path of the storm, enact your plan well in advance of the storms expected arrival time.

In rare cases, a storm may strike before a warning is issued. It is recommended that one or more of your staff members receive storm spotter training and become familiar with cloud structures which suggest severe weather. If a trained spotter observes a potentially severe storm approaching the school, activate the safety plan immediately. Please contact the National Weather Service in Amarillo for more information concerning storm spotter training.

Your School's Preparedness Plan

Review Questions

4. List at least three methods we currently have for relaying hazardous weather information within the school.

5. Who is responsible for developing and modifying our severe weather plan?

6. Who is responsible for monitoring weather developments? Who is their backup?

7. Who is responsible for activating the safety plan? Who is their backup?

8. Who is responsible for holding or releasing buses? Who is their backup?

9. How many of the school staff have attended spotter training within the past three years?

Useful Internet Sites:

Amarillo Forecast Office - *warnings, forecasts, and current conditions for the Texas and Oklahoma panhandles.*

<http://www.srh.noaa.gov/AMA>

National Weather Service Radar Data - *NWS radar images from the Panhandles and the nation.*

<http://www.srh.noaa.gov/radar/latest/DS.p19r0/si.kama.shtml>

Online preparedness information - *spotter training, safety tips*

<http://www.nws.noaa.gov/om>

National Weather Service Southern Region Headquarters - *Links to all forecast offices in the United States.*

<http://www.srh.noaa.gov/>

NOAA Weather Radio Information - *From the Amarillo NWS Office*

<http://www.srh.noaa.gov/AMA/html/radio.htm>

EMWIN Information - *Satellite broadcast of National Weather Service Products.*

<http://iw.in.nws.noaa.gov/emwin/index.htm>

Acknowledgment

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