

= February 2009 tornado outbreak =

The February 2009 tornado outbreak occurred on February 10 and February 11 , 2009 , affecting portions of both the Central and Eastern United States . During the two @-@ day period , 15 tornadoes touched down in seven states . Oklahoma was struck by six tornadoes , the most of any state . The first day of the outbreak produced the most tornadoes ; the second brought mainly high wind damage and rain or snow in most of the Northeast .

The storm system responsible for the tornado outbreak resulted from the unusual congruence of a cold , dry system , originating in the Four Corners and a warm , moist system , moving north out of Texas . Complicating factors included daytime heating and a strong wind field favorable to the creation of circulating thunderstorms . On the second day , the stronger cold front limited discrete supercell activity and the risk of tornadoes decreased significantly . A squall line , however , produced high winds and rain along the river valleys , primarily those of the Mississippi and Ohio Rivers . This squall line continued to renew its energy as it passed through the Midwest , Pennsylvania , New Jersey , New York , and New England , causing wind and water damage , and dumping 6 inches (15 cm) of snow in central and eastern Massachusetts . The resulting power outages affected homes throughout the northeastern seaboard .

The most destructive of the weather events , an EF4 tornado , traveled for nearly an hour through four counties in Oklahoma during the evening of February 10 . It destroyed 114 residences in Lone Grove alone . All casualties (8 deaths and 46 injuries) from the outbreak were due to the tornado in the Lone Grove area in Carter County . It was the deadliest tornado to hit Oklahoma since May 3 , 1999 and the strongest tornado during the month of February in Oklahoma since 1950 .

= Meteorological synopsis =

= = February 10 = =

During the afternoon hours of February 10 , 2009 , a strong , middle and upper storm system moved across the Four Corners region into the central and southern Great Plains . A moist , low @-@ level air mass streamed northward across Texas and Louisiana into eastern Oklahoma and the Ozarks ahead of the system . Daytime heating of the moistening boundary layer increased throughout the afternoon across Oklahoma and Texas as cloud cover shifted eastward . Cooling aloft , in conjunction with the approaching storm system , led to atmospheric instability , resulting in thunderstorms . A very strong wind field increased with height through the lower troposphere , resulting in a wind shear favorable for rotation in the thunderstorms .

Meteorologists expected large hail stones and damaging winds , and recognized the potential for strong tornadoes as thunderstorms developed from central Oklahoma southward into north @-@ central Texas in the afternoon . During the night , a cold front moved eastward toward the Mississippi Valley and organized the thunderstorms into a lengthy squall line . Along with a continued threat of hail and tornadoes , the risk of damaging winds increased . The Storm Prediction Center announced a " moderate risk " of severe weather for portions of eastern Oklahoma , northeastern Texas , western Arkansas , and northwestern Louisiana .

At around 1 : 00 pm CST (19 : 00 UTC) , a line of violent thunderstorms began developing near the Wichita Mountains in Comanche County , Oklahoma . The supercell that eventually produced the first tornado of the outbreak moved northeast through Caddo and Grady counties over the next 30 to 45 minutes , before reaching southeastern Canadian County at around 2 : 00 pm CST (20 : 00 UTC) . By 2 : 14 pm CST (20 : 14 UTC) , the line had formed a hook echo , which was fully developed four minutes later . Observers reported wall clouds from the Yukon area into western portions of Oklahoma City during the next 10 to 15 minutes . At 2 : 36 pm CST (20 : 37 UTC) , the supercell produced a tornado near the Wiley Post Airport in Oklahoma City , causing damage at the Northwest Expressway . According to the Doppler weather radar , the hook continued to show signs of rotation as it moved northeast across Oklahoma County . At 2 : 52 pm CST (20 : 52 UTC) , the

supercell produced its second tornado on the northwestern side of Edmond which caused its most severe damage near the Oklahoma and Logan County line . The tornado dissipated north of the Logan County Line at 3 : 05 pm CST (21 : 05 UTC) .

The supercell produced three more tornadoes in Oklahoma as it continued to move northeast . The third tornado occurred northwest of Meridian in Logan County at 3 : 26 pm CST (21 : 36 UTC) . A fourth developed near Langston in Logan County and moved to about 4 mi (6 @.@ 4 km) southwest of Stillwater in Payne County . The fifth tornado occurred in Pawnee County . In addition to the five Oklahoma tornadoes , three tornadoes struck northern sections of Texas and one tornado hit Springfield , Missouri .

The most significant tornado , later named the Lone Grove Tornado , first touched down in southeast Jefferson County , Oklahoma at 6 : 48 pm CST (00 : 48 UTC) near the Red River . The tornado crossed through rural areas as it moved to the northeast into Love County , before going into Carter County at 7 : 10 pm CST (01 : 10 UTC) . The tornado continued moving to the northeast for the next 15 minutes before striking Lone Grove , Oklahoma . The tornado then crossed Interstate 35 just north of the Prairie Valley Road exit ramp and tracked through rural areas of northeastern Carter County to the east of Springer , ending at 7 : 43 pm CST (01 : 43 UTC) .

= = = February 11 = = =

The Storm Prediction Center issued a slight risk warning for February 11 . The warning included parts of the Deep South , Ohio Valley , Midwest , and Appalachians . The risk of tornadoes was lower on February 11 due to a stronger front , which limited discrete supercell activity and decreased atmospheric instability . The " slight risk " was later upgraded to a " moderate risk " as a powerful squall line developed .

= = Notable tornadoes = =

= = = Edmond , Oklahoma = = =

The second tornado to touch down during the outbreak formed at around 2 : 52 pm CST (20 : 52 UTC) about 3 mi (5 km) north @-@ northwest of Edmond , Oklahoma . The tornado traveled towards the northeast , crossing into Logan County and dissipating at 3 : 05 pm CST (21 : 05 UTC) . Following a survey by the National Weather Service , the tornado was estimated to have been about 75 yd (70 m) wide and was rated as an EF2 . Most of the downtown residences were left without power after the tornado struck the area around 2 : 59 pm CST (20 : 59 UTC) . Ten minutes earlier , tornado sirens were sounded as a tornado warning was issued for the area . Students who were being taken home by bus at the time were immediately taken to the nearest school for shelter . The schools were placed in lockdown for about two hours following the tornado sirens . In Edmond , six homes were destroyed , eight structures received major damage , 51 received minor damage and another 166 structures were affected . Some of the homes damaged by the tornado were estimated to be worth over \$ 1 million . The Oak Tree Golf Club sustained severe damage , with numerous trees being uprooted . Hundreds of trees were uprooted or significantly damaged along the tornado 's path . In Oklahoma County , the tornado left an estimated 28 @, @ 500 people without power . Monetary damage numbers were not available .

= = = Lone Grove , Oklahoma = = =

At 6 : 48 pm CST (00 : 48 UTC) , a large wedge tornado ? a tornado that is wider than the distance from ground to cloud base ? touched down near the Red River , along the Texas @-@ Oklahoma border . It crossed through Jefferson and Love counties before entering Carter County where it proceeded to slam into Lone Grove . The tornado dissipated at 7 : 43 pm CST (01 : 43 UTC) after remaining on the ground for nearly an hour and traveling an estimated 35 mi (56 km) .

After an assessment by the National Weather Service office in Norman , Oklahoma , the tornado was rated as an EF4 on the Enhanced Fujita Scale with winds reaching an estimated 170 mph (270 km / h) .

The Lone Grove Tornado was the deadliest to hit Oklahoma since May 3 , 1999 , and the strongest tornado during the month of February in Oklahoma since 1950 . The previous strongest were two F3 tornadoes which touched down on February 17 , 1961 .

The tornado destroyed businesses and residences across a swath over 0 @. @ 5 mi (0 @. @ 80 km) wide and 35 mi (56 km) long . In Lone Grove alone , buildings were thrown off their slabs and the local chamber of commerce office was flattened . The tornado destroyed a furniture store , and shattered the glass lobby of the local UPS building . The destruction of a mobile home park containing 40 homes left close to 100 people homeless . One mobile home was thrown 100 yd (91 m) from its foundation . A total of 114 residences were destroyed in Lone Grove .

To the east of Lone Grove , the area north of Ardmore was also hard hit . Several buildings , including those of the Beaver Academy and the Ardmore Adventist Academy , were destroyed . Although damage centered on the Ardmore Academy gymnasium , most of the campus was considered a total loss . In Ardmore , eight homes were destroyed and another 20 sustained damage .

Eight people were confirmed dead as a result of the tornado . Seven of these fatalities were in the town of Lone Grove ; most were determined to have been caused by " blunt @-@ force trauma to the head " . Three of the victims were found inside their homes and two were found outside . A victim found in an open field was reportedly picked up and thrown by the tornado , and died on impact with the ground . One victim was crushed when a pickup truck fell on him ; similarly , a truck driver died after being pinned under his vehicle on Interstate 35 . Two other victims , the parents of a 13 @-@ year @-@ old girl , were killed when the tornado picked the three of them out of their home and threw them 400 ft (120 m) . Three people were rescued after being trapped in the ruins of their home for almost a day . Officials stated that 10 to 15 people remained unaccounted for on the night of February 12 but they were presumed to have left the area . An additional 46 people were injured . Total monetary damages from the tornado were estimated at \$ 3 million .

= = Non @-@ tornadic events = =

During the evening of February 10 , a long line of severe thunderstorms developed along the tail @-@ end of a cold front in central Texas . Meteorologists predicted embedded supercell thunderstorms that could produce hail up to 2 @. @ 5 inches (6 @. @ 4 cm) in diameter and wind gusts up to 90 mph (140 km / h) . North of the squall line , bow echo thunderstorms developed in Missouri , causing widespread wind damage . By the morning of February 11 , the squall line reached as far southeast as eastern Louisiana , where winds were recorded in excess of 70 mph (110 km / h) along with hail up to 1 inch (2 @. @ 5 cm) in diameter . Around 12 pm EST (17 : 00 UTC) , the first line of thunderstorms significantly weakened , but a new , narrow line developed in eastern Kentucky and Tennessee . A strong , deep layer wind field prevented a number of tornadoes from forming but instead caused widespread wind damage . Throughout the day , the line of low @-@ topped thunderstorms continued eastward , reaching Ohio and West Virginia by 4 pm EST (21 : 00 UTC) . Several hours later , the line broke apart , with the strongest storms tracking through Pennsylvania . By February 12 , rain showers , accompanied by high winds up to 60 mph (97 km / h) , affected most of the Northeastern United States .

= = = Oklahoma = = =

In addition to the strong tornadoes , Oklahoma was affected by high winds and large hail . The hail , measuring up to 4 @. @ 5 inches (11 cm) in diameter , caused significant damage in Okesa . Numerous cars were hit and several houses sustained roof damage ; the cost of the hail damage was estimated at \$ 100 @, @ 000 in the town . Heavy rains produced by the storms also caused isolated flooding , inundating numerous streets with several feet of water . Lightning also produced

damage in the state , with one bolt striking an oil tank , igniting a fire . The fire severely damaged the tank , leaving \$ 13 @, @ 000 in damages . Throughout the state , an estimated 61 @, @ 000 people lost power : 29 @, @ 000 lost power due to thunderstorms and 32 @, @ 000 due to tornadoes . In Mississippi , strong winds on the backside of the cold front blew a metal roof off a power company building , bringing down several trees and power lines . Damages in the state amounted to \$ 35 @, @ 000 .

= = = Texas = = =

Strong straight @-@ line winds near 70 mph (110 km / h) caused significant damage in Hamilton County , Texas . A barn sustained severe damage and a home lost most of its roof . 80 mph (130 km / h) wind destroyed a small outbuilding and carried debris about 1 @. @ 5 mi (2 @. @ 4 km) north . A trailer near Hamilton Municipal Airport was broken off its moorings and moved 20 ft (6 m) . Several mobile homes near Hamilton sustained damage after tree limbs fell on them . In Huron , several outbuildings were damaged or destroyed and a permanent building was damaged at a youth retreat center . An estimated 15 @, @ 000 residences were without power following the storms in Texas . One home in McGregor was destroyed by the winds . The three people who lived in the home , one of whom was a child , all sustained injuries . The father had a few broken ribs and several scratches , injuries sustained during a search for his son . In Louisiana , 12 @, @ 000 residences lost power due to the storm system . Two wildfires were sparked in Kenedy County and Kleberg County , burning 300 and 20 acres (121 @. @ 4 and 8 @. @ 1 ha) respectively . The larger of the two fires was along Texas State Highway 77 . The second fire burned three homes and threatened 20 others .

= = = Arkansas = = =

In Arkansas , high winds produced by the squall line knocked out power to 315 @, @ 324 residences and caused widespread structural damage . Trees and power lines were brought down in eight counties , and several homes in Independence and Van Buren County sustained damage . The damage in these counties was caused by winds gusting up to 57 mph (92 km / h) and leaving \$ 200 @, @ 000 in damages . An 80 mph (130 km / h) wind gust in Van Buren blew a barn onto Arkansas Highway 9 . Hundreds of trees were blown down , many of which fell on homes , causing widespread damage which amounted to approximately \$ 625 @, @ 000 . In Conway County , a sawmill and two barns were destroyed , while several homes and a church also sustained damage , mainly roof damage . Damages in the county were estimated at \$ 300 @, @ 000 . Numerous homes sustained wind damage and two mobile homes and a recreational vehicle were overturned . Damages in the county were estimated at \$ 750 @, @ 000 . Total damages throughout the state were estimated at \$ 2 @. @ 4 million . Seven people sustained injuries in the state .

= = = Ohio = = =

In Ohio , 70 mph (110 km / h) wind gusts led to a highway accident that killed a truck driver . The high winds also caused significant damage throughout the state . Heavy rains produced by the same system inundated several streets in flood @-@ prone towns in Ohio . In Scioto County , the high winds destroyed a brick house and brought down power lines . The most significant damage resulted from the strong pressure gradient behind the frontal system . Thousands of tree were knocked down or uprooted by winds gusting in excess of 75 mph (121 km / h) , cutting power to 585 @, @ 775 residences . Ten railroad cars were knocked off their tracks near Shelby . Several hundred homes lost shingles and gutters due to the winds . Wind also overturned two semi @-@ trailers , though the drivers of both vehicles were unharmed . A vacant school building in Epworth lost its entire roof . Some windows were damaged or broken by flying debris or fallen trees . Power outages forced numerous schools to close for at least two days following the storm . A large barn was leveled just north of Brighton in Lorain County by 64 mph (103 km / h) winds . Throughout the

state , damages from the storm system amounted to \$ 4 @. @ 7 million .

= = = Missouri , Kentucky , Tennessee and Michigan = = =

In Missouri , high winds caused widespread damage and knocked out power to 7 @, @ 629 residences . Several homes and businesses lost their windows due to 65 mph (105 km / h) wind gusts produced within squall lines . In Huntsville , Alabama , a car carrying four people lost control on rain @-@ slicked roads and crashed into a van , killing one of the occupants and injuring the other three . Another fatality occurred in Kentucky when a utility worker was knocked over by high winds and fell 30 ft (9 @. @ 1 m) to his death while trying to restore power . Following the widespread power outages from a severe ice storm , an additional 161 @, @ 588 residences lost power due to 60 mph (97 km / h) winds . Flooding and high winds in Michigan knocked out power to about 57 @, @ 000 residences . In southern Michigan , upwards of 0 @. @ 8 inches (2 @. @ 0 cm) of rain fell , leading to faster snowmelt . In Tennessee , several structures were damaged and numerous trees were knocked down , closing roads throughout the state as the squall line tracked eastward . A total of 74 @, @ 052 residences lost power due to the winds . Winds gusting up to 85 mph (137 km / h) caused substantial damage in Rutherford County . Several commercial buildings had major roof damage , leaving \$ 150 @, @ 000 in damages . Throughout Tennessee , damages from the storm system were estimated at \$ 1 @. @ 1 million .

= = = Iowa , Indiana and Virginia = = =

In Iowa , heavy rains triggered rapid snowmelt , causing isolated flooding . Only minor impacts resulted from the flooding and total damages from the event was estimated at \$ 25 @, @ 000 . A total of 14 @, @ 590 residences lost power in Indiana . Several large trees were brought down by high winds , one of which fell on a home in South Bend , leaving \$ 50 @, @ 000 in damages . In the town of Carmel , a total of 2 @. @ 75 inches (70 mm) of rain fell , the highest in the state . The heavy rains , in combination with unseasonably warm temperatures , led to significant snowmelt and flooding . The highest wind gust recorded in the state was 80 mph (130 km / h) in Crawford County . A total of 70 @, @ 695 residences lost power in Illinois . Rainfall up to 4 inches (100 mm) fell throughout most of the state . Several major roadways were covered in flood waters . The Little Wabash River overflowed its banks and inundated nearby roads . Along Illinois Route 1 , a large tree blocked a section of the road near Georgetown . The fallen tree resulted in a vehicle accident but the driver was unharmed . One person was killed by high winds in Davy , West Virginia when a gymnasium roof collapsed . Throughout the state , power was knocked out to an estimated 225 @, @ 000 residences . In Montgomery County , Virginia , winds knocked down power lines which sparked two brush fires , one of which burned a total of 12 acres (4 @. @ 9 ha) . Winds up to 65 mph (105 km / h) cut power to 28 @, @ 059 residences in the state . The strong winds also cut power to 50 @, @ 820 residences in Maryland .

= = = Western Pennsylvania and Chesapeake watershed = = =

Hurricane @-@ force wind gusts up to 92 mph (148 km / h) caused significant damage and power losses in Pennsylvania . Throughout the state , at least 400 @, @ 000 residences lost power due to the winds . Allegheny Power stated that the loss of power due to this system was the largest ever experienced by the company . Thousands of trees and power lines were brought down by strong winds and numerous homes sustained significant damage . Although most of the damage to homes consisted of shingle damage , several homes lost gutters and had portions of their siding blown off .

In Pottstown , a large portion of the roof of a four @-@ story building was blown off , forcing residents to evacuate the building . An 18 ft (5 @. @ 5 m) pillar was knocked down at the First Moravian Church in Easton . In Northampton County , a fire sparked by fallen power lines destroyed a barn and partially melted a nearby metal shed . The blaze was fully contained by 40 firefighters . Another fire sparked by fallen power lines destroyed a garage in Lower Merion Township . In

Philadelphia , the roof of a portable classroom began to peel off , forcing the forty students inside to evacuate to a safer structure . A large tree fell through one house and severely damaged the roof of a nearby home . Numerous major highways and local streets were shut down for several hours to allow cleanup crews to clear debris . Throughout the state , damages from the storm system amounted to \$ 3 @. @ 7 million .

= = = New York = = =

In upstate New York , winds in excess of 50 mph (80 km / h) shattered windows , toppled numerous trees , and brought down power lines , cutting power to more than 50 @, @ 000 residences . Unseasonably warm temperatures and heavy rains from the storm system increased the snowmelt rate in northern areas of the state . In Genesee County , an estimated 2 to 5 inches (5 @. @ 1 to 12 @. @ 7 cm) of the snowpack melted , triggering flash floods along several rivers . The Tonawanda Creek reached a height of 14 @. @ 38 ft (4 @. @ 38 m) , 2 @. @ 38 ft (0 @. @ 73 m) above flood stage . Several homes were inundated by flood waters throughout the region . In all , 84 @, @ 624 residences lost power in New York State . The storm system continued producing gusty winds through February 12 , which caused tree damage and power outages , and killed a construction worker in the New York City metropolitan area . The construction worker was killed after a cinder block wall collapsed due to high @- @ winds . Winds in the city gusted to 65 mph (105 km / h) in the Bronx . Throughout Long Island , an estimated 4 @, @ 000 people lost power .

= = = New Jersey , Connecticut and Massachusetts = = =

In New Jersey , strong winds gusted up to 55 mph (89 km / h) , bringing down tree limbs that killed two people . A total of 93 @, @ 816 residences were also left without power at the height of the storm . High winds on the backside of the storm brought down a power line that sparked a small fire in Galloway Township , burning a total of 40 acres (16 ha) . A total of 8 @, @ 486 Connecticut residences were left without power and one boy was injured after high winds damaged numerous power lines and tree limbs . In Massachusetts , gusts up to 55 mph (89 km / h) brought down several trees and cut power to residences in Middleborough , Boston , Brookline and Hingham . The Western Massachusetts Electric Company reported that at least 360 residences lost power during the storm . Moderate snow fell across portions of The Berkshires late on February 12 as the storm system began entering the Atlantic Ocean , while isolated areas received upwards of 6 inches (15 cm) .

= = Aftermath = =

In the wake of the tornado outbreak law enforcement officers , including 30 national guard troops , were sent to Lone Grove to provide security . The American Red Cross opened shelters in Ardmore , Edmond , and Oklahoma City . About 100 volunteers from the Sorghum Mill Estates Neighborhood Association traveled to affected areas in Edmond to help with cleanup efforts . A local restaurant provided free meals to the volunteers as they assisted relief workers . The Salvation Army had two canteens in Oklahoma City , one in Lone Grove , and one in Perkins . About 2 @, @ 000 meals , drinks , and snacks were provided by the Salvation Army to emergency responders . Feed the Children sent two truckloads of relief supplies to Carter County . They also sent three food trucks , containing a total of 619 meals , 900 drinks , and about 500 snacks , to Ardmore . On February 22 , the New Life Baptist Church sent drinks and prepackaged snacks , along with items needed for clean @- @ up . Baptist Disaster Relief assisted in Lone Grove with food and emotional care . The Oklahoma City Thunder of the National Basketball Association (NBA) gave away two tickets to anyone who made a donation of \$ 25 or an equivalent amount of food to benefit victims of the tornado . A concert featuring Chris Cagle and other local musicians at Heritage Hall in Ardmore raised over \$ 18 @, @ 000 to benefit Carter County tornado victims . Another concert set up by the Salvation Army raised \$ 2 @, @ 300 more for victims .

The Governor of Oklahoma Brad Henry declared a State of Emergency in 17 counties and described the outbreak as the worst natural disaster he had seen since becoming governor . On February 15 , President Obama approved Henry 's request for federal assistance in Carter , Logan and Oklahoma counties . A disaster recovery center was set up by the Federal Emergency Management Agency (FEMA) on February 20 . Homeowners were allowed to borrow \$ 200 @, @ 000 to repair damages to their home or find a temporary or permanent shelter . They were also allowed to borrow up to \$ 40 @, @ 000 to replace lost property . Businesses were allowed to borrow up to \$ 2 million for damage repair , property loss , and economic loss . By February 23 , about \$ 781 @, @ 000 had been given in federal grants . On February 25 , FEMA approved Governor Henry 's request for public assistance in Carter , Coal and Love counties . The estimated cost to clear the 7 @, @ 000 tons of debris in Lone Grove was placed at \$ 500 @, @ 000 , of which \$ 90 @, @ 000 has been paid for by FEMA . The Department of Homeland Security offered to assist with the reconstruction of homes and businesses and to support those who were left homeless . President Barack Obama passed along his condolences and best wishes to the victims of the tornado .