4.8 Severe Winter Weather

Severe winter weather, including snow storms, ice storms and extreme cold, may affect any part of Cass, Clay, Jackson, Platte and Ray counties in any given winter season. Although the annual snowfall amount in the Kansas City area is moderate — generally around 20 inches — the area may be affected by a full range of snowy conditions, including blizzards, blowing snow, snow squalls, snow showers and snow flurries.\textsuperscript{xliii,xliv}

These snowy conditions are defined as follows:\textsuperscript{xlv,xlvi}

\textbf{Blizzard} – Winds of 35 mph or more with snow and blowing snow reducing visibility to less than one-quarter mile for at least three hours.

\textbf{Snow Squalls} – Brief intense snow showers accompanied by strong, gusting winds; accumulation may be significant.

\textbf{Blowing Snow} – Wind-driven snow that reduces visibility; blowing snow may be falling snow and/or snow on the ground picked up by the wind.

\textbf{Snow Showers} – Snow falling at varying intensities for brief periods of time. Some accumulation is possible.

\textbf{Drifting Snow} – Uneven distribution of snowfall caused by strong surface winds. Drifting snow does not reduce visibility.

\textbf{Snow Flurries} – Light snow falling for short durations with little or no accumulation.

Ice storms may also affect the Kansas City area during the winter months. In ice storms, damaging accumulations of ice occur during a period of freezing rain. According to the NWS, significant accumulations of ice are defined as one-quarter inch or more of ice. Other icy conditions that may affect the Kansas City area include freezing rain and sleet. Freezing rain or freezing drizzle occur when rain or drizzle freezes on surfaces, such as roads, bridges, cars and trees, forming a coating or glaze of ice. In freezing rain or freezing drizzle, air temperatures are warm enough for rain to form, but surface temperatures are below 32 degrees, causing rain or drizzle to freeze on contact with surfaces. Sleet is made up of raindrops that freeze and form ice pellets before reaching the ground. Like hail, sleet may bounce when it hits the ground or another surface instead of sticking and forming a coating. However, sleet may accumulate like snow. Heavy sleet accumulation is half an inch or more of sleet.\textsuperscript{xlvii}

In the winter, the Kansas City area’s normal low temperatures are 22.5 degrees in December, 17.8 degrees in January and 23.2 degrees in February.\textsuperscript{xlviii} However, the area may also experience periods of extreme cold in the wintertime. For example, the lowest temperature on record for the Kansas City area was minus 23 degrees on Dec. 22–23, 1989. The winter of 1978–79 had the lowest average seasonal temperature for the Kansas City metropolitan area, 21.5 degrees.\textsuperscript{xlix}

Wind chill can exacerbate winter’s cold air temperatures. Wind chill is not the actual air temperature, but rather how the cold and wind feel on exposed skin.\textsuperscript{1} As the wind velocity increases, heat is carried
away from the body at an accelerated rate, lowering the body temperature. People and animals outdoors are affected by wind chill, a situation that can be dangerous, because hypothermia can result from loss of body heat.

The NWS provides a number of advisories, watches and warnings in advance of severe winter weather. These include:

**Winter Weather Advisory** – Winter weather conditions are expected to cause significant inconveniences and may be hazardous. However, if caution is exercised, these situations should not become life-threatening. In conditions warranting a winter-weather advisory, the greatest hazard is often to motorists.

**Winter Storm Watch** – A significant winter storm may affect the area, but its occurrence, location and timing are uncertain. A winter storm watch is issued to provide 12 to 36 hours’ notice of the possibility of severe winter weather. A watch will often be issued when neither the path of a developing winter storm nor the consequences of the event are well-defined. A winter storm watch may be upgraded to a warning when the nature and location of the developing weather event becomes more apparent.

**Winter Storm Warning** – A winter storm warning is issued when hazardous winter weather is occurring, imminent or likely. A warning is used for winter weather conditions that may be a threat to life and property. Winter storm warnings are usually issued for heavy snow approaching or exceeding 6 inches, ice accumulations, dangerous wind chills or a combination of these conditions. Warnings can be issued for lesser amounts of snow, 3 to 6 inches, for example, if the snow occurs with strong winds in excess of 20 miles per hour and/or significant sleet or heavy ice accumulations from freezing rain. In the Central Plains, expected snow accumulation during a winter storm warning is 4 inches or more in 12 hours or 6 inches or more in 24 hours.

**Wind Chill Warning** – A wind chill warning is issued when life-threatening wind chills reach minus 50 degrees or below.

**Ice Storm Warning** – An ice storm warning is issued when a significant coating of ice, a quarter of an inch or more, is expected.

**Heavy Snow Warning** – A heavy snow warning is issued when snow accumulations are expected to approach or exceed 6 inches in 12 hours, but will not be accompanied by significant wind. A heavy snow warning could also be issued if 8 inches or more of snow accumulation is expected in a 24-hour period. Sleet and freezing rain are not expected during a heavy snow warning.

**Blizzard Warning** – A blizzard warning is issued when sustained winds or frequent gusts of 35 mph may occur in combination with considerable falling and/or blowing snow for a period of at least three hours. In a blizzard warning, visibilities will frequently be reduced to less than one-quarter mile, and temperatures will often be extremely cold.
4.8.1 Historical Occurrences

Severe winter weather is virtually an annual occurrence in the Kansas City area. Whether it is a snow storm, ice storm, freezing rain, sleet, period of extreme cold or combination of these conditions, citizens of the Kansas City area will normally experience some type of severe weather event each winter. Occurrences of severe winter weather spanning the last decade are described below. Each historical occurrence contains the date(s) of the severe winter weather event, the affected counties in the Kansas City area and a description of the event. Events occurring since 2009 are reflected in Table 4.8.1 below:

<table>
<thead>
<tr>
<th>County</th>
<th>Date</th>
<th>Event Type</th>
<th>Deaths</th>
<th>Injuries</th>
<th>Property Damage $</th>
<th>Crop Damage $</th>
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<tr>
<td>Platte</td>
<td>2/5/2008</td>
<td>Heavy Snow</td>
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<td>Clay, Jackson</td>
<td>2/28/2009</td>
<td>Heavy Snow</td>
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<td>0</td>
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</tr>
<tr>
<td>Cass, Clay, Jackson, Platte, Ray</td>
<td>3/28/2009</td>
<td>Winter Storm</td>
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<td>Platte</td>
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<td>Blizzard</td>
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<td>0</td>
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<td>0</td>
</tr>
<tr>
<td>Cass, Clay, Jackson, Platte, Ray</td>
<td>12/24/2009</td>
<td>Blizzard</td>
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<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Cass, Clay, Jackson, Platte</td>
<td>1/6/2010</td>
<td>Winter Storm</td>
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<td>0</td>
<td>0</td>
</tr>
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</tr>
<tr>
<td>Jackson, Platte</td>
<td>3/19/2010</td>
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<td>0</td>
</tr>
<tr>
<td>Cass</td>
<td>3/20/2010</td>
<td>Winter Storm</td>
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<td>Winter Storm</td>
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</tr>
<tr>
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<td>0</td>
</tr>
<tr>
<td>Clay, Jackson, Platte, Ray</td>
<td>2/24/2011</td>
<td>Winter Storm</td>
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<td>Winter Weather</td>
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<td>Winter Weather</td>
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<td>0</td>
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<td>Winter Storm</td>
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<td>0</td>
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<tr>
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<td>5/2/2013</td>
<td>Winter Storm</td>
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<td>0</td>
<td>0</td>
</tr>
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<td>Platte</td>
<td>12/9/2013</td>
<td>Winter Weather</td>
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<td>0</td>
</tr>
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<td>Ice Storm</td>
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<td>Winter Storm</td>
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</table>

Cass, Clay, Jackson, Platte and Ray Counties – December 24-26, 2009

An unusually strong storm system wreaked havoc on a large portion of the central United States during one of the heaviest travel periods of the year. Shortly after midnight on Thursday, December 24, an arctic cold front swept through the area, sending temperatures on a downward spiral through the 40s, 30s, 20s and eventually landing in the teens by nightfall on Christmas Eve. With warm air still present
aloft, the first round of precipitation fell mainly in the form of sleet, with some freezing rain across central Missouri. The sleet came down particularly heavy at times on eastern portions of the Kansas City metro, with ice pellet accumulations upwards of 2 inches in some areas. By mid-evening, enough cold air had wrapped in aloft to change all the precipitation over to snow. Heavy snow blanketed much of western Missouri and eastern Kansas, with winds of 30 to 45 mph resulting in blizzard conditions from Kansas City to the Iowa and Nebraska borders. Snowfall amounts averaged between 6 and 8 inches along and west of Interstate 35, with drifts 3 to 8 feet reported in many areas. Travel was crippled across many areas with portions of Interstate 29, which was closed north of St. Joseph. A white Christmas for many came at the expense of the first blizzard to impact the Kansas City area since 1989, and the first blizzard warning issued for Kansas City since 1982. Overall, a broad area of the lower Missouri River Valley region experienced snowfall totals in excess of 8 inches. Hardest hit areas of northwest Missouri and northeast Kansas received as much as 11 to 14 inches of snow during this storm.

**Cass, Clay, Jackson and Platte Counties – January 6-7, 2010**
On January 6 and 7, 2010, a potent storm system moved across the region. This storm brought widespread snowfall of 3 to 6 inches to eastern Kansas and much of the northern half of Missouri. The storm system also brought bitterly cold temperatures, strong northwesterly winds and brutal wind chills to the area. Northwest winds of around 20 to 25 mph and gusts to around 35 mph were common across the region on Thursday afternoon, creating significant blowing and drifting snow. These winds combined with temperatures in the single digits and lower teen, to produce wind chill values of -5 to -15 degrees during the daytime hours Thursday. The wind gradually decreased through Friday, as the storm system moved northeast of the region. Very cold temperatures overspread the area behind the storm system. Temperatures Friday morning ranged from 5 to -5 degrees, with Friday afternoon readings mainly in the 5 to 10 degree range.

**Cass and Jackson Counties – February 4-5, 2010**
An upper-level storm system, brought snow to the region on February 4 and 5, 2010. The heaviest snow fell across west central Missouri and north central Missouri. Accumulations of 4 to 8 inches were observed in these areas.

**Cass, Clay, Jackson, Platte and Ray Counties – February 20-21, 2010**
Yet another winter storm in an already active winter season impacted much of Kansas and Missouri during the weekend of February 20-21, 2010. This challenging winter storm, more typical of late February, brought numerous forecast problems with hazards ranging from heavy snow to sleet, ice, rain and even flooding. At the surface, several waves of precipitation moved through the area with periodic sleet, snow and rain showers persisting from late Saturday afternoon through daybreak Sunday. A large, incredibly intense band of snowfall developed in areas of northern Kansas and northern Missouri on the morning of February 21. This band of snow persisted through the evening hours, producing snowfall rates between 1 and 2 inches per hour at times. Snowfall totals reached 4-6 inches in Platte County, 6-8 inches in Clay County, and 2-4 inches in Ray County. A mixture of snow, freezing rain and sleet, was reported in Cass and Jackson counties with up to one-quarter of an inch of ice accumulation observed and 2 inches of snowfall.

**Cass, Jackson and Platte Counties – March 19-21, 2010**
A powerful, dynamic, and long-duration winter storm welcomed the arrival of spring to the Missouri River Valley. An initial band of snow moved through the region, during the overnight hours of March 19 into the morning hours of Saturday, March 20, as an upper-level storm system started to develop in the
Southern Plains. After a several-hour pause in the snow early Saturday morning, additional precipitation developed across Kansas, Oklahoma, Arkansas and southern Missouri, and then lifted northward into the area. Snow totals upwards of 9 to 10 inches were reported in Cass, Jackson, and Platte counties.

**Cass, Clay, Jackson, Platte and Ray Counties – January 10-11, 2011**
A prolonged winter snow event was observed across Missouri from early on January 10 through early on January 11. The snow was only light to moderate in intensity, but due to the extended period of snowfall, amounts ranged from 5 to 8 inches in the five-county area.

**Cass, Clay, Jackson, Platte and Ray Counties – January 19-20, 2011**
A storm system produced heavy snow along the Interstate 70 corridor, from Kansas City to Boonville. The snow began in the early afternoon hours of January 19 and ended in the morning hours of the 20th. Snowfall totals ranged from 6 to 7.4 inches in the five-county area.

**Cass, Clay, Jackson, Platte and Ray Counties – February 1-2, 2011**
A historic winter storm impacted a wide swath of the central and eastern United States from Tuesday, February 1, into Wednesday, February 2. This was one of the strongest blizzards ever to impact the region. Snowfall of 12-18 inches fell along the Interstate 70 corridor, causing the first ever state-wide closure of Interstate 70 from Tuesday night into early Wednesday. Snowfall rates of 2 to 3 inches per hour also resulted in the temporary closure of Kansas City International Airport on Tuesday afternoon and evening. Snow rates brought travel in the Kansas City metropolitan area to a grinding halt, causing temporary closures of many of the urban expressways. Some schools were closed for several days. In addition to the heavy snow, this event also brought very rare blizzard conditions to the region. Strong northwest winds frequently gusted between 35 and 45 mph across the region, reducing visibilities to near zero at times in whiteout conditions, and drifting snow 3 to 4 feet deep in many areas. Significant snowfall of 9 to 12 inches fell across Clay, Jackson, Platte and Ray counties and 10 to 16 inches in Cass County. Blizzard conditions were observed across the five-county area, with frequent wind gusts up to 45 mph, visibilities less than one-quarter of a mile, and heavy snow. Travel was nearly impossible with the blowing and drifting snow and low visibilities. Kearney reported costs of $20,000 for overtime and contract plowing.

**Clay, Jackson, Platte and Ray Counties – February 24-25, 2011**
A potent winter storm moved across the area with a variety of precipitation beginning in the morning hours of February 24, 2011. The activity diminished to light snow, and ended in the early morning hours of February 25, 2011. Up to an inch of sleet, mixed at times with light freezing rain was observed, with many areas having 6.5 to 7 inches of snow. The combination of 3 to 5 inches of snow mixed with up to a half inch of sleet and blowing and drifting snow led to hazardous driving conditions across Jackson County. The combination of 6 inches of snow and blowing and drifting snow led to hazardous driving conditions in Clay, Platte and Ray counties.

**Cass and Jackson Counties – March 13-14, 2011**
A strong storm system that originated over the central high plains on March 13, 2011, moved into northern Arkansas in the morning hours of March 14. Precipitation began as rain, transitioned briefly to sleet, and then to snow in the late evening hours. The snow came to an end from west to east across the area, during the late morning and early afternoon hours of March 14. Isolated, heavier amounts of snow were located mainly along and south of the Missouri River. Snowfall of 4 to 5 inches was reported in Cass and Jackson counties. Hazardous driving conditions were reported.
Cass, Clay, Jackson, Platte and Ray Counties – February 13, 2012
An upper-level storm system moved across the region on February 13, 2012. Light to moderate snow began in the predawn hours along the Kansas-Missouri state line with the snow ending from west to east during the late morning and early afternoon hours. Patchy light freezing drizzle and drizzle were observed after the snow ended and continued into the early evening hours. Snowfall amounts were in the 1-to-3 inch range in the five-county area.

Cass and Jackson Counties – January 13, 2013
An upper-level disturbance produced some light snow across western Missouri, south of the Missouri River, on January 12, 2013. Snowfall amounts ranged from 1 to 3 inches.

Cass, Clay, Jackson, Platte and Ray Counties – February 21, 2013
A major winter storm impacted much of Kansas and Missouri on February 21, 2013, with very heavy snow and some sleet and freezing rain. Some areas received up to a foot of snow, placing this snow storm among the largest snow events in recent memory. Many locations reported thunder with heavy snow and sleet and snowfall rates as high as 3 inches per hour. The very heavy snowfall rates created havoc on area roads ways and many travelers became stuck and stranded. Many roads became clogged with stalled vehicles, essentially closing them down. Many motorists abandoned their cars altogether leaving roadways littered with snow-covered vehicles. Independence measured 9.8 inches of snow; Lee’s Summit, 10.2; Raytown, 13; Pleasant Hill, 11.2; Kearney, 8; KCI, 9.3; and Richmond, 7.7.

A major winter storm swept through the Plains on February 25-27, 2013, resulting in the second round of heavy snows that the region had experienced in less than a week. Temperatures near freezing led to a heavy wet snow that was slow to accumulate at the onset of the event. However, as snowfall rates increased overnight, snow rapidly began to accumulate sticking to trees and power lines, resulting in numerous power outages across the area. Unlike the event from five days earlier, the heaviest snow fell overnight and not during the morning commute, allowing road crews open access to the highways during the peak of the event. Road crews still struggled to keep up with snowfall rates as much as 2 inches per hour. By the time the morning commute rolled around most roads were snow-covered, but the combination of snow decreasing in intensity and many more people choosing not to travel, the morning commute was not nearly as disastrous as with the February 21 event. Snowfall reports were 14.5 inches of snow in Pleasant Hill; Lee’s Summit, 12; KCI, 11; Richmond, 12; and Liberty, 8. Peculiar reported $47,000 in property damage. The mayor of Independence declared a state of emergency.

A major early-spring winter storm tracked across the Interstate 70 corridor, March 23-24, 2013. Widespread snowfall amounts of 6 to 10 inches were observed. This ranked in the 10 highest spring-time snow amounts (March 21 and later) in Kansas City history. Independence reported 10 inches of snowfall; Pleasant Hill, 7.8; Gladstone, 7; Kearney, 7; and Ray County, 4-7.

Cass, Clay and Jackson Counties – May 2-3, 2013
A strong cold front with unseasonably cold temperatures moved through the area during the day on May 2, 2013. An upper-level storm system then passed across western Missouri during the evening and overnight hours of May 2-3, 2013. Rain changed to snow across western Missouri, with the heaviest band setting up from Bethany southwest through southeastern Kansas City. Snowfall amounts ranged from 2 to 3 inches in the Kansas City area.
Platte County – December 9, 2013
Light snow on December 8, 2013, left icy patches on Kansas City area roads. On the morning of December 9, a college student lost control of her car on an icy spot on the road and collided with the center barricade and an 18-wheeler. She passed away as a result of the incident.

Cass, Clay, Jackson, Platte and Ray Counties – December 21, 2013
Early on the morning of December 21, 2013, an area of light to moderate rain moved northward into eastern Kansas and western Missouri. At the time of the rain, surface temperatures were in the middle to upper 20s. The result was several hours of freezing rain across eastern Kansas and western and central Missouri, including the Kansas City metro area. Trained spotters reported one-tenth to four-tenths of an inch of ice accumulation in the five-county area. After sunset the freezing rain gradually transitioned into sleet, then snow. By 9 p.m. Saturday, most of the area was receiving light to moderate snow of 1 to 3 inches. The snow moved out of the area late Saturday night, leaving behind very slick roads and some minor damage caused by the ice. In Clay County, 1 to 6 inches fell on top of the ice accumulation. Several vehicle spinouts were reported across the Kansas City metro area. According to broadcast media, a vehicle incident involving slippery roads occurred at Highway 152 and North Indiana Avenue in Clay County. The driver passed away as a result of the incident. Despite scattered power outages and several disabled vehicles on the roads, widespread effects were not incredibly high impact.

Cass, Clay, Jackson, Platte and Ray Counties – January 6, 2014
A polar plunge of arctic air slammed into Kansas, bringing wind chill values to around 30 degrees below zero to the five-county area on the morning of January 6, 2014.

Cass, Clay, Jackson, Platte and Ray Counties – February 4-5, 2014
A major winter storm tracked from southern Kansas into Maine on February 4-5, 2014. Some of the highest snow totals with this system fell from northeast Kansas into northern Missouri, where some areas exceeded a foot of snow. Northerly winds on the back side of this system gusted up to 30 mph and produced substantial blowing and drifting. Many areas reported drifts of 2 to 3 feet. Most of the metro area received a foot of snow.

Cass, Clay, Jackson, Platte and Ray Counties – March 1-2, 2014
During the afternoon to evening hours on March 1, light freezing rain and sleet fell across portions of western and central Missouri. While there was not a period of incredible accumulation, the long duration of the event allowed for several areas to receive more than one-half inch of sleet and around 3 to 5 inches of snow. The storm lasted overnight with several rounds of wintry precipitation occurring. Trained spotters across the area reported about a half-inch to an inch of sleet, occurring mostly during the evening hours on March 1 through the overnight hours on March 2. Aside from the sleet accumulations, snowfall approaching 3 to 6 inches also accumulated through the overnight hours on March 1 into March 2d. The long-duration event ended during the afternoon hours on March 2.

4.8.2 Probable Locations
Severe winter weather events tend to be regional in scope. Therefore, the entire Kansas City metro area including Cass, Clay, Jackson, Platte and Ray counties may be affected.
4.8.3 Extent, Severity, Magnitude

Severity: Medium
Magnitude: 3

Historical occurrences have shown the impact severe winter weather can have on the Kansas City area. Winter storms have caused injuries and loss of life, traffic accidents, property damage, power outages, transportation and telecommunications disruptions, and economic losses. One of the most glaring examples of the impact severe winter weather can have on the Kansas City area is the ice storm of January 29-31, 2002, in which each of the five counties experienced many of the aforementioned adversities. The damage costs associated with this severe winter storm were enormous — $61.9 million in federal public assistance alone — making it the second-costliest disaster in Missouri’s history.

On average, Missouri counties north of the Missouri River receive annual snowfall of 18 to 22 inches; counties south of the Missouri River receive 8 to 12 inches. The events often involve borderline conditions of freezing rain, ice and high winds, causing high unpredictability. Besides snow and ice, extremely cold temperatures can produce problems. The wind chill is determined by factoring cold temperatures and wind speed. See Figure 4.3.1. The situation can be dangerous to people outdoors because their bodies can experience rapid heat loss, resulting in hypothermia (abnormally low body temperature).

An indirect winter hazard is carbon monoxide poisoning. Improperly vented gas and kerosene heaters or the indoor use of charcoal briquettes create dangerous levels of carbon monoxide. In Missouri, there were 212 reported fatal carbon monoxide poisoning cases from 2001–2007. Accidental poisonings and deaths are also more likely to occur in colder months.

People: Winter storms are deceptive killers because many of the deaths and injuries that occur are indirectly related to the storm. Indirect causes of death and injury include traffic accidents on snow-covered or icy roads and heart attacks due to overexertion from shoveling snow and related activities. According to the NWS, about 70 percent of injuries related to ice and snow are the result of vehicle accidents, about 25 percent occur to people outdoors in a storm, and most happen to males more than 40 years old. Ice- or snow-covered roads, or roads blocked by tree limbs or power lines, may also inhibit the ability of emergency services and medical personnel to travel and assist people who are injured or in harm’s way, posing a secondary hazard to life. Other, though less common, causes of injury and death indirectly related to severe winter weather include pedestrians slipping and falling on icy walkways, carbon monoxide poisoning from improperly vented heaters, and electrocutions and fires from downed power lines.

The most direct causes of injuries and death from severe winter weather are frostbite and hypothermia. Frostbite occurs when body tissue is damaged by extreme cold. (See Figure 4.8.1) Frostbite usually affects the body’s extremities, such as fingers, toes, ear lobes and the tip of the nose, and causes a loss of feeling and a white or pale appearance. Hypothermia is a potentially deadly condition that occurs when body temperature drops to less than 95 degrees. Hypothermia can cause lasting kidney, liver and pancreas problems for those who survive the condition. Early symptoms of hypothermia include uncontrollable shivering, memory loss, disorientation, incoherence, slurred speech, drowsiness and exhaustion. According to the NWS, approximately 50 percent of injuries related to cold temperatures occur in people more than 60 years old, more than 70 percent happen to men, and about 20 percent
occur at home. The elderly, infants, the poor and the homeless may be particularly susceptible to extremely cold conditions.

![Figure 4.8.1: 2001 NWS Wind Chill Index](image)

**Property**: Residential and commercial property in the Kansas City area is susceptible to severe winter weather. Snow and ice may accumulate on trees, breaking branches or toppling the entire tree. Falling trees and branches can knock down power and telephone lines, disrupting power and telephone service. Falling trees and branches can also damage homes, commercial buildings and other structures. Ice can accumulate on power and telephone lines, causing them to break. Heavy accumulations of snow can cause roofs to collapse. Extremely cold temperatures may injure or kill unprotected pets and livestock, and damage or destroy crops. Extreme cold can also cause water lines in houses and commercial property to freeze and break.

**Transportation Infrastructure and Services**: Transportation infrastructure and services in the Kansas City area are highly susceptible to severe winter weather. Snow-covered and/or icy roads may result in traffic accidents. Bridges and overpasses are particularly susceptible to icy conditions because they tend to freeze sooner than other roadways. Roads may also be blocked and traffic disrupted by downed trees, tree limbs and power lines. Heavy snow, ice, freezing rain, high winds and reduced visibility can close airports, disrupt barge traffic on the Missouri River and disrupt or slow rail traffic.

**Utilities**: Above-ground power and telecommunications lines in the Kansas City area are highly susceptible to severe winter weather. Heavy accumulations of snow and ice on trees can cause trunks and branches to break and fall on power and telecommunications lines, damaging the lines and disrupting power and service to customers. Utility poles and telecommunications towers may also be toppled by heavy accumulations of ice. The October 22-23, 1996, snow storm and the January 29-31, 2002, ice storm caused widespread power and telecommunications outages across the region. Older and more rural parts of the Kansas City area are generally more likely to experience service disruptions due to severe winter weather because they tend to have more above-ground power and
telecommunications lines than newer areas where those utilities are often underground. Extremely cold temperatures may cause main water lines to break, disrupting the supply of water to communities.

**Commerce and Essential Services:** By damaging property, hampering transportation and disrupting utility services, severe winter weather can have an adverse impact on the economy of a community. As an example, the costs associated with property damage, power restoration and debris removal following the January 29-31, 2002, ice storm were so high for local governments in the Kansas City area that Missouri received a Presidential Disaster Declaration. Cass, Clay, Jackson, Platte and Ray counties were among the 26 Missouri counties eligible for both federal Individual and public assistance programs as a result of this winter storm event. Severe winter weather can impact surface, air and rail transportation systems by disrupting the flow of goods and services into and out of the metro area. Similarly, commuters can be delayed or stranded, causing a loss of business productivity. Downed power and telecommunications lines can interfere with business’ ability to power equipment, communicate or execute financial transactions. Essential services such as law enforcement, fire protection and EMS may be hampered by icy and hazardous road conditions. Area schools are routinely closed due to snow-covered or icy roads and extremely cold temperatures. In addition, beneficial programs for the elderly and/or persons with disabilities, such as home-delivered meals for home-bound senior citizens, may be temporarily curtailed due to the hazardous driving conditions snow-covered or icy roads.

**Natural Environment:** The early snow storm of October 22–23, 1996, and the ice storms of December 6, 1994, and January 29–31, 2002, caused considerable damage to the environment in the Kansas City area. Thousands of trees and other vegetation in both natural and developed areas were seriously damaged or destroyed by the storm. Trimming and removal efforts, though necessary in most cases, exacerbated this problem. In addition, air quality may have been affected due to the permitted burning of storm debris in some communities.

All critical facilities are susceptible to the hazard. Refer to the supplemental hazard-specific information in *Appendix C: Maps and References*.

**4.8.4 Probability of Future Occurrence: High**

It is likely that some or all of the Kansas City metro area will experience some form of severe winter weather each year. At any hour of the day or night, snow, ice, freezing rain, sleet and/or extreme cold may affect the region in the wintertime (generally between November and April). As a result, the entire region is at risk from severe winter weather.

Some of the adverse effects of severe winter weather may be reduced, however, through certain mitigation measures, such as public education campaigns that stress winter safety; proper tree-trimming (to keep branches away from power lines); and programs to reduce, eliminate or defer home heating costs for low-income and at-risk residents.

**Seasonal Pattern:** In general, severe winter weather may affect Greater Kansas City between November and April; severe winter weather is most likely during the months of December, January and February. But, as historical records indicate, it is possible for severe winter weather to affect the region early in the season, such as October snow storms. Similarly, it is not uncommon for the Kansas City area to receive severe winter weather late in the season, such as snow or freezing rain in March.
Probable Duration: The dangerous conditions associated with severe winter weather, such as accumulation of snow and ice or extremely low temperatures, can occur within a few hours. Snow and ice may be present for several days; extreme cold may also persist for several days. The cascading effects of severe winter weather, such as utility outages, can also last for several days. In the aftermath of the January 29–31, 2002, ice storm, some parts of the Kansas City area were without electrical power for more than a week.

Potential Speed of Onset (probable amount of warning time):

- Minimal (or no) warning
- 6 to 12 hours warning
- 12 to 24 hours warning
- More than 24 hours warning

4.8.5 Vulnerability Analysis and Potential Loss Estimates

The same statistical risk assessment methodology to determine tornado and severe thunderstorm loss potential was used for winter weather. Again, this methodology uses NOAA data for winter storm losses between 1994 and March 2009.

Data Limitations: As noted previously, there are serious data limitations associated with winter storm losses. The NOAA NDC database groups damage estimates cumulatively for all counties affected by a winter storm event. Therefore, it is impossible to calculate an accurate annualized loss at the county level. Also, no losses were reported in the online database for the current five-year period. The economic impacts of a winter storm differ greatly from those of a tornado or severe thunderstorm as the duration of the event and its indirect impacts can last up to one week. In a tornado, the majority of the economic impact is generally isolated to the direct losses (infrastructure, property, etc.) in the affected area. A severe winter storm, however, can have wide-ranging secondary effects such as utility and transportation disruption, debris removal, etc. The exact cost of these secondary effects is difficult to quantify. In order to achieve a measurable figure for damages, annualized loss was calculated using the gross sum of all damages for all storms that affected the individual counties. Multiple counties may be involved in the same storm event. Since one county’s share of the damages is unknown, annualizing the total damages provides a measurable analysis of the probable economic impact. To compound the problem further, the magnitude of the historic winter storm events is unknown. Citing the general nature of storms that have affected the entire region, it seems reasonable to assume a magnitude of four for all counties.

Table 4.8.2 and Table 4.8.3 provide maximum and minimum loss estimates for severe winter weather.

<table>
<thead>
<tr>
<th>County</th>
<th>Overall Risk (probability and severity)</th>
<th>Magnitude (percent of county affected)</th>
<th>Total Exposure ($ value, thousands)</th>
<th>Total Population (in thousands)</th>
<th>Maximum Loss Estimation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cass</td>
<td>Medium = 2</td>
<td>&gt;50% = 4</td>
<td>5,400,904 = 2</td>
<td>101 = 2</td>
<td>High</td>
</tr>
<tr>
<td>Clay</td>
<td>Medium = 2</td>
<td>&gt;50% = 4</td>
<td>14,958,612 = 3</td>
<td>234 = 2</td>
<td>High</td>
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<tr>
<td>Jackson</td>
<td>High = 3</td>
<td>&gt;50% = 4</td>
<td>76,612,242 = 3</td>
<td>683 = 3</td>
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</tr>
</tbody>
</table>
### Table 4.8.2: Maximum Loss Estimation, Severe Winter Weather

<table>
<thead>
<tr>
<th>County</th>
<th>Overall Risk (probability and severity)</th>
<th>Magnitude (percent of county affected)</th>
<th>Total Exposure ($ value, thousands)</th>
<th>Total Population (in thousands)</th>
<th>Maximum Loss Estimation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Platte</td>
<td>Medium = 2</td>
<td>&gt;50% = 4</td>
<td>7,907,587 = 2</td>
<td>95 = 1</td>
<td>Medium</td>
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<tr>
<td>Ray</td>
<td>High = 3</td>
<td>&gt;50% = 4</td>
<td>935,940 = 1</td>
<td>23 = 1</td>
<td>Medium</td>
</tr>
</tbody>
</table>

### Table 4.8.3: Minimum Loss Estimation, Severe Winter Weather

<table>
<thead>
<tr>
<th>County</th>
<th>Overall Risk (probability and severity)</th>
<th>Average Magnitude (percent of county affected)</th>
<th>Annualized Loss ($ value, thousands)</th>
<th>Average Deaths and Injuries</th>
<th>Minimum Loss Estimation</th>
</tr>
</thead>
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<td>2,143 = 3</td>
<td>0 = 1</td>
<td>Medium</td>
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<td>2,500 = 3</td>
<td>1 = 2</td>
<td>Medium</td>
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<tr>
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<td>1</td>
<td>2,370 = 3</td>
<td>0 = 1</td>
<td>Medium</td>
</tr>
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<td>1</td>
<td>2,486 = 3</td>
<td>1 = 2</td>
<td>Medium</td>
</tr>
<tr>
<td>Ray</td>
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<td>1</td>
<td>2,470 = 3</td>
<td>0 = 1</td>
<td>Medium</td>
</tr>
</tbody>
</table>

### 4.8.6 Problem Statements

Problem statements, such as those below, can support development of mitigation strategies for severe winter weather:

- Cascading impacts of severe winter weather can have lasting, cross-jurisdictional impacts. Normal mutual-aid partners or regional resources may be unavailable or unable to support response.
- Many critical facilities don’t have emergency backup power, or rely on generators that will need to be refueled in 24–72 hours.
- Economic impacts from extreme, long-duration winter storms will stress local government resources.
- Debris management/snow removal will likely be a tremendous challenge; many jurisdictions don’t have approved debris management plans.