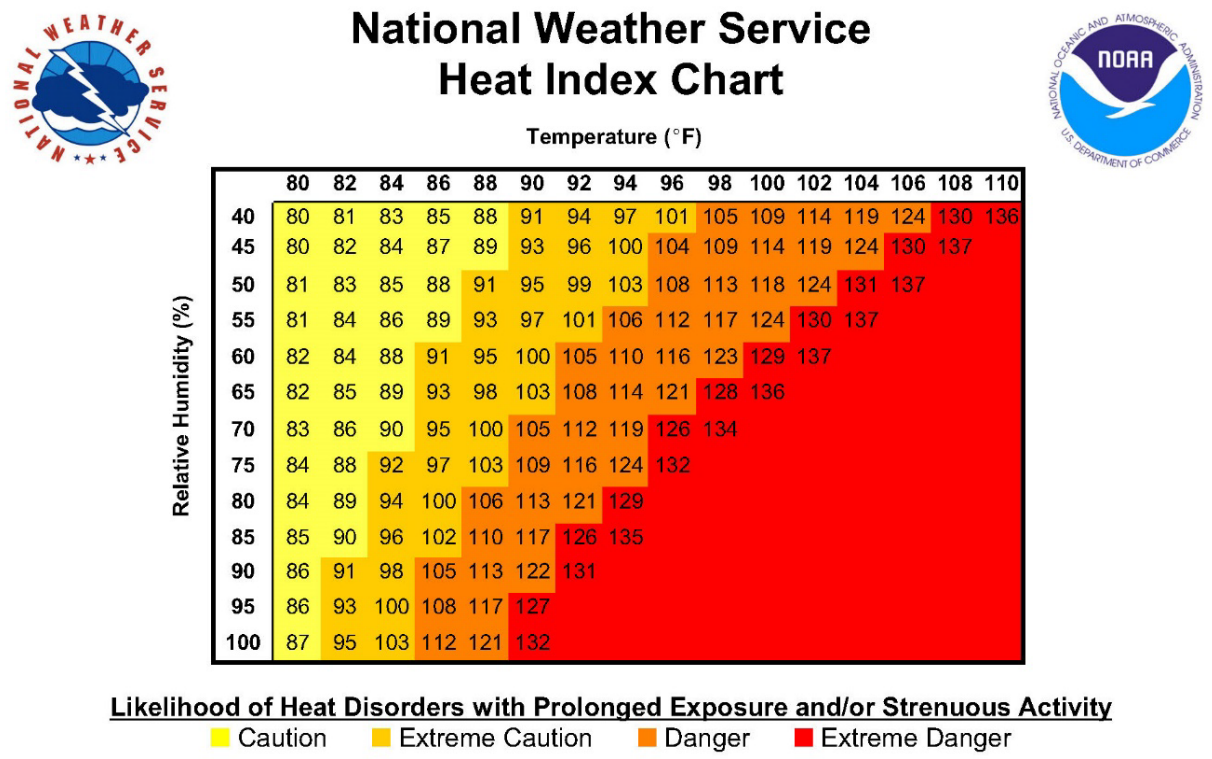
4.6 Extreme Temperatures (Heat & Cold)

4.6.1 Description

Extreme Heat

According to the states of New York, Washington, and California, temperatures that hover over ten degrees or more above the average high temperature for the region and last for several days are considered extreme heat. Humid conditions, which add to the discomfort of high temperatures, occur when a high-pressure weather system traps hazy, moist air near the ground. Extreme heat may also contribute to the formation of a drought if moisture and precipitation are lacking. The National Weather Service's Heat Index Chart is provided in **Figure 4.6.1**.

Figure 4.6.1: Heat Index Chart



Source: NWS

Each National Weather Service Forecast Office issues some or all of the following heat-related products as conditions warrant:

- An **Excessive Heat Warning** is issued within 12 hours of the onset of extremely dangerous heat conditions. The general rule of thumb for this Warning is when the maximum heat index temperature is expected to be 105 degrees or higher for at least 2 days and nighttime air temperatures will not drop below 75 degrees; however, these criteria vary across the country, especially for areas not used to extreme heat conditions.
- **Excessive Heat Watches** are issued when conditions are favorable for an excessive heat event in the next 24 to 72 hours. A Watch is used when the risk of a heat wave has increased, but its occurrence and timing is still uncertain.
- A **Heat Advisory** is issued within 12 hours of the onset of extremely dangerous heat conditions. The general rule of thumb for this Advisory is when the maximum heat index temperature is expected to be 100 degrees or higher for at least 2 days, and night time air

temperatures will not drop below 75 degrees; however, these criteria vary across the country, especially for areas that are not used to dangerous heat conditions.

- **Excessive Heat Outlooks** are issued when the potential exists for an excessive heat event in the next 3-7 days. An Outlook provides information to those who need considerable lead time to prepare for the event.

Extreme Cold and Wind Chill

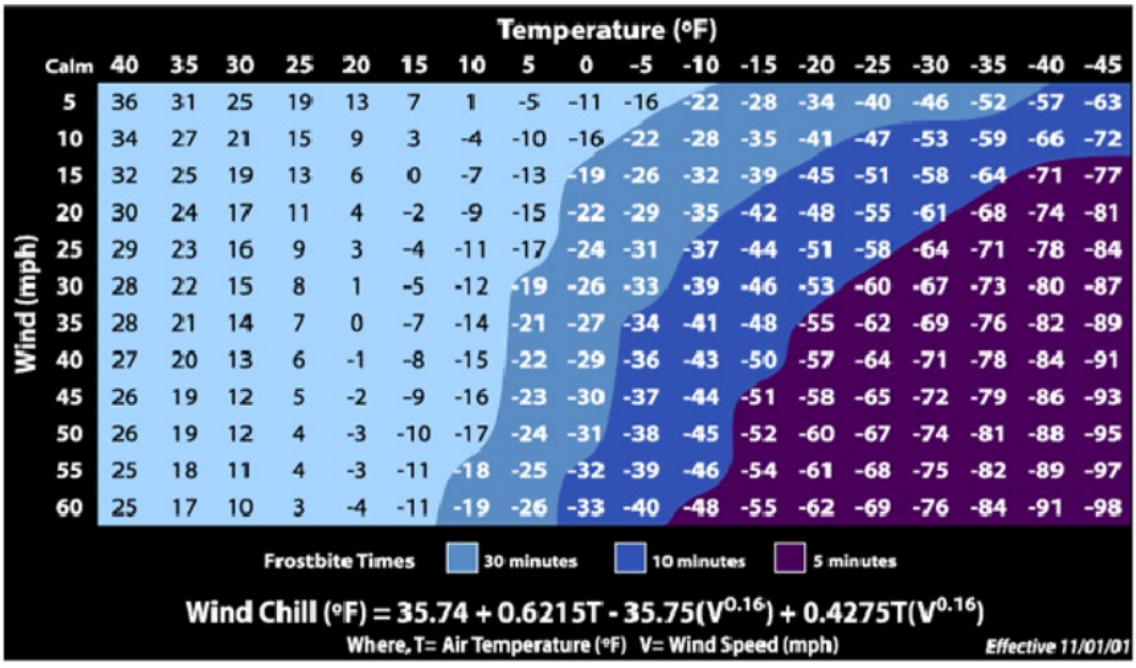
Wind chill is the term used to describe the rate of heat loss on the human body resulting from the combined effect of low temperature and wind. As winds increase, heat is carried away from the body at a faster rate, driving down both the skin temperature and eventually the internal body temperature. Animals are also affected by wind chill.

The National Weather Service offers the following definitions for wind chill and can issue the following related warnings:

- **Wind Chill:** Wind Chill refers to the Wind Chill Factor. Increased wind speeds accelerate heat loss from exposed skin, and the wind chill is a measure of this effect. No specific rules exist for determining when wind chill becomes dangerous. Generally, the threshold for potentially dangerous wind chill conditions is about -20°F.
- **Wind Chill Advisory**: A Wind Chill Advisory is issued when the wind chill temperatures with the combination of the wind and cold air will be between -10° F to -24° F.
- **Wind Chill Factor**: Increased wind speeds accelerate heat loss from exposed skin. No specific rules exist for determining when wind chill becomes dangerous. Generally, the threshold for potentially dangerous wind chill conditions is about -20°F.
- **Wind Chill Warning**: A Wind Chill Warning is issued when the wind chill or feel-like temperature with the combination of the wind and cold air will be -25° F or colder.

The wind chill chart displayed in **Figure 4.6.2** shows the wind chill based on the wind and temperature. The shaded areas show how long it will take for exposed skin to become frostbitten.

Figure 4.6.2: NWS Windchill Chart



Source: NWS

4.6.2 Location

Extreme heat is a countywide hazard that can affect all locations and jurisdictions in Clinton County. Like drought (Section 4.2), this hazard typically occurs at a regional scale. The season for extreme heat is typically from June through August.

Extreme cold events are countywide and can affect all areas and jurisdictions. The cold season typically lasts from November to March with average temperatures ranging from approximately 25 degrees to 30 degrees Fahrenheit. Typically, these events will occur at a regional or even national scale.

4.6.3 Extent

Extreme Heat

Due to the widespread nature of extreme heat events, all structures, croplands, and infrastructure may experience impacts. More specifically, severe lack of moisture can cause soil – especially expansive soil - to recede from foundations of buildings leading to structural instability. All residents of the County may also be impacted, especially at-risk populations that are more susceptible. The elderly and infants are the most vulnerable populations for extreme heat.

The most common symptoms caused by extreme heat, according to the Centers for Disease Control (CDC) include:

- **Heat Cramps** are muscle spasms, often in the abdomen, arms, or calves, caused by a large loss of salt and water in the body. Heat cramps can occur from prolonged exposure to extreme heat combined with dehydration, and they commonly happen while participating in strenuous outdoor activities such as physical labor or sports.
- **Heat Exhaustion** is a severe illness requiring emergency medical treatment. It can occur from exposure to extreme heat over an extended period of time (usually several days), especially when combined with dehydration.
- **Heat Stroke** is the most serious medical condition caused by extreme heat requiring emergency treatment. Heat stroke (or hyperthermia) occurs when the body can no longer regulate its temperature and its temperature rises rapidly—up to 106°F or higher. It usually occurs as a progression from other heat-related illnesses such as heat cramps or heat exhaustion; however, it can also strike suddenly without prior symptoms, and it can result in death without immediate medical attention.

Extreme heat is especially dangerous because people might not recognize their symptoms as signs of a more serious condition. For example, symptoms like sweating or fatigue may just appear to be normal reactions to a hot day. People may be in more danger if they experience symptoms that alter their decision making, limit their ability to care for themselves, or make them more prone to accidents. If untreated, heat-related illnesses can worsen and eventually lead to death. Heat can also contribute to premature death from health impacts other than those listed above. This is because extreme heat can worsen chronic conditions such as cardiovascular disease, respiratory disease, and diabetes.

Extreme Cold and Wind Chill

According to the National Weather Service, frostbite is an injury to the body caused by freezing body tissue. Fingers, toes, ears, and tip of the nose are most vulnerable. Symptoms include white or pale appearance to the affected area. The area affected should be slowly re-warmed. Immediate medical attention is needed. **Figure 4.6.3** shows the onset time for frostbite at certain temperatures and wind speeds.

Figure 4.6.3: Minutes to Frostbite

Wind speed at 10 meters (MPH) ↕	Air Temperature in °F												
	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45	-50
5	>2 h	>2 h	>2 h	>2 h	31	22	17	14	12	11	9	8	7
10	>2 h	>2 h	>2 h	28	19	15	12	10	9	7	7	6	5
15	>2 h	>2 h	33	20	15	12	9	8	7	6	5	4	4
20	>2 h	>2 h	23	16	12	9	8	8	6	5	4	4	3
25	>2 h	42	19	13	10	8	7	6	5	4	4	3	3
30	>2 h	28	16	12	9	7	6	5	4	4	3	3	2
35	>2 h	23	14	10	8	6	5	4	4	3	3	2	2
40	>2 h	20	13	9	7	6	5	4	3	3	2	2	2
45	>2 h	18	12	8	7	5	4	4	3	3	2	2	2
50	>2 h	16	11	8	6	5	4	3	3	2	2	2	2

Source: NWS

4.6.4 History

According to the National Centers for Environmental Information (NCEI), there have been a total of five extreme temperature events in Clinton County since February of 1996, including two extreme cold/wind chill events and three excessive heat events. These events resulted in $20,000 in property damage and no crop damage. These events were not responsible for any deaths or injuries. The description of these events, which is provided by the NCEI, is supplied below.

Extreme Heat: July 20, 2019

With a combination of high temperatures in the 90-degree range and added humidity, heat index values across the region reached into the triple digits for a second day in a row.

Extreme Heat: July 19, 2019

With a combination of high temperatures in the 90-degree range and added humidity, heat index values across the region reached into the triple digits.

Extreme Cold/Wind Chill: January 30, 2019

An arctic airmass was pushed into the Ohio Valley behind a cold front. Sub-zero temperatures reached the lower teens in some areas and combined with wind gusts of 30 to 45 MPH creating wind chills from 20 to 40 degrees below zero.

Extreme Heat: August 7, 2007

Oppressively hot and humid conditions with heat indices near 105 degrees impacted southern Ohio August 7-10, 2007.

Extreme Cold/Wind Chill: February 1, 1996

Arctic high pressure brought the coldest air of the season to the Ohio Valley. Cincinnati broke its record low on February 4, 1996 with a temperature of -11 degrees. Cincinnati also experienced its record low maximum temperatures of 7 and 6 degrees on February 3rd and 4th respectively. The extreme cold was entrenched for 5 days freezing and bursting numerous water pipes. There were at least 2 house fires indirectly related to the cold weather as space heaters, which were thawing

frozen water lines, caught on fire. On February 6, 1996, six thousand customers were without power near Portsmouth as over-usage caused outages. AAA Motor Club had an extremely high number of calls during this cold wave when cars would not start. This event resulted in $20,000 in property damage.

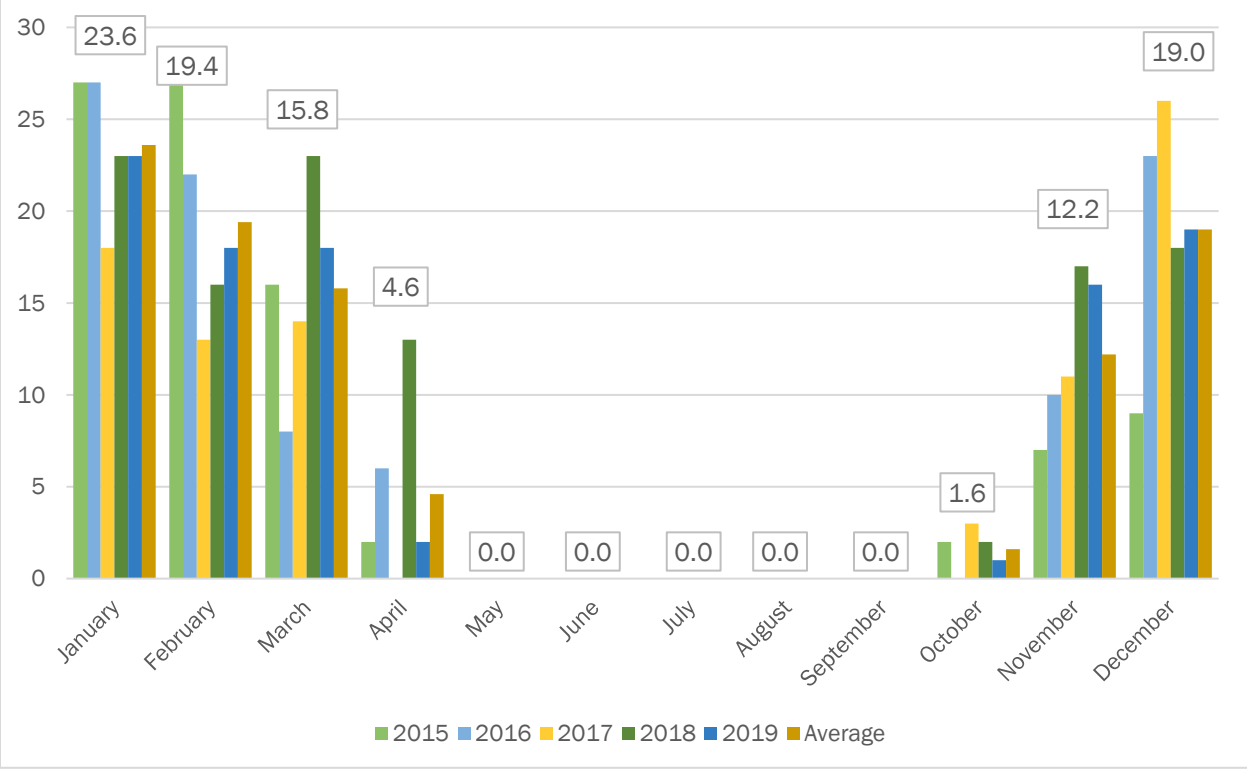
4.6.5 Probability

Clinton County has experienced extreme temperature events in the past, and the potential exists for the County to experience more of these events in the future. Seasons of extreme heat and seasons of extreme cold have the potential to occur during any particular year when necessary conditions are met.

More specifically, the County has record of five extreme temperature events from February 1996 to June 2020 resulting in $20,000 in property damage, which amounts to a 20.8 percent chance of an extreme temperature event occurring any given year. Annualized damages for this time frame amount to $833.33 in property damages each year from extreme temperature events (specifically, extreme cold events).

Even when official wind chill advisories are not issued, temperatures can still drop below safe levels. **Figure 4.6.4** displays the days below freezing by month for 2015-2019. The average number of days below zero each month is displayed above each month. Over the last five years, January is the month with the greatest number of days below zero, on average, followed by February and December. The annual average over the last five years is 96.2 days below freezing with all of those days occurring between October and April.

Figure 4.6.4: Days with Minimum Temperatures Below Freezing, 2015-2019



Source: NWS

4.6.6 Vulnerability Assessment

Infrastructure Impact

Extreme heat is not likely to have impacts on infrastructure; however, it is possible that extreme heat could lead to a power outage if the electric grid is overtaxed due to heavy air conditioning use. Extreme cold can have secondary impacts on infrastructure due to the accumulation of snow and ice. The primary impact of extreme cold on infrastructure is typically the freezing of exposed water pipes and systems.

Population Impact

Although there is no history of population impact, extreme heat can have an impact on the population of the entire County. Groups that are particularly vulnerable to extreme heat include young children, older adults, and people with chronic health conditions, such as obesity, hypertension, and cardiopulmonary or vascular disease. Residents should be aware of the dangers of extreme heat and how to recognize the symptoms of such conditions as heat cramps, heat exhaustion, and heat stroke.

Both people and livestock can be impacted by extreme cold. People should stay indoors during extreme cold events. If someone is outside during an extreme cold event, they should wear loose-fitting and warm clothing and cover all exposed skin. Efforts should be made to protect livestock, pets, and other animals during extreme cold events.

Property Damage

Property damage is a possibility due to extreme heat. Vehicles are at risk of breaking down from excessive heat, as heat can reduce battery life and reduce the efficiency of the cooling system resulting in overheated engines. Extreme heat can also cause a home to dry out and prematurely age. Excessive heat in combination with lack of rainfall (drought) can cause soil to shrink and crack, which puts stress on a home's foundation that can be costly to fix. Extreme cold events are also likely to cause property damage in the form of frozen pipes that burst.

Loss of Life

Loss of life is a potential outcome from any extreme temperature event, especially for at-risk populations such as the elderly. Extreme heat can lead to heat exhaustion or heat stroke which has the possibility to lead to death. According to the National Safety Council, 372 people died in the U.S. in 2013 from exposure to excessive heat. Additionally, extreme cold events can cause severe hypothermia in the event of loss of heat or prolonged exposure.

Economic Losses

Extreme heat can have an economic impact by compromising crops and livestock, which are both vulnerable to extended extreme heat events. Human productivity can also be adversely affected when working conditions become too hot.

While there are no recorded economic losses in Clinton County due to extreme cold, the potential certainly exists. Businesses have the potential to close temporarily if pipes freeze and services are temporarily suspended. Additionally, agricultural crops can also be put at risk by extreme cold, especially if an extreme cold event occurs outside the traditionally coldest months of the year.

4.6.7 Land Use and Development Trends

Extreme temperatures do not have a significant influence on land use or where development should take place.