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Maine CDC Extreme Temperature Community Resilience Guidebook

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Maine CDC Extreme Temperature Community Resilience Guidebook



**Maine Center for Disease Control and Prevention
Environmental and Occupational Health Program**

April 2022

MAINE CDC EXTREME TEMPERATURE COMMUNITY RESILIENCE GUIDEBOOK

By

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Acronyms

CDC: Center for Disease Control and Prevention

NWS: National Weather Service

MEMA: Maine Emergency Management Agency

LEPC: Local Emergency Planning Committee

EOHP: Environmental & Occupational Health Program

PHEP: Public Health Emergency Preparedness

EPA: Environmental Protection Agency

HAN: Health Alert Network

Audience

Community leaders, public health agencies, municipalities, state and local emergency planning agencies, Environmental and Occupational Health Program at the Maine Center Disease Control and Prevention (CDC).

The Purpose for This Guidebook

The purpose of this guidebook is to help community leaders, public health departments, municipalities, and state and local emergency planning agencies prepare for extreme temperature events in Maine. The Environmental and Occupational Health Program at the Maine Center Disease Control and Prevention (CDC) developed this Extreme Temperature Community Resilience Guidebook using existing best practices and strategies to adapt to the changing climate and to address community needs during extreme temperature events. Because extreme temperature events are becoming more frequent, local leaders must work in collaboration with private and public community partners to prepare and respond to the impact of such public health events. Community partners should use this guidebook to advance health equity by addressing needs experienced by disadvantaged communities and vulnerable populations.

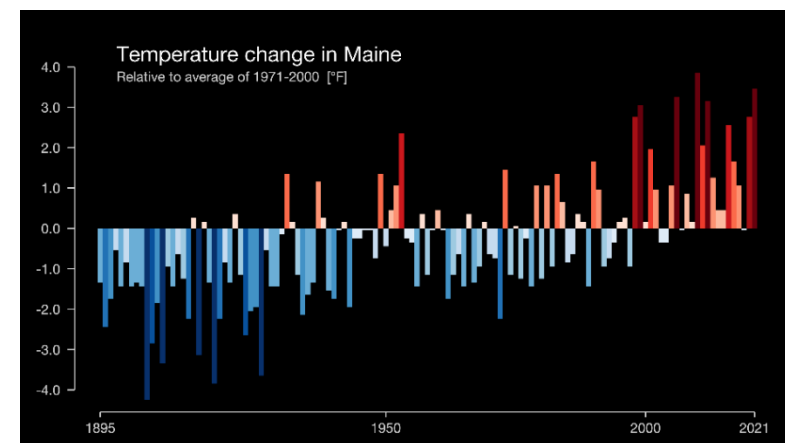
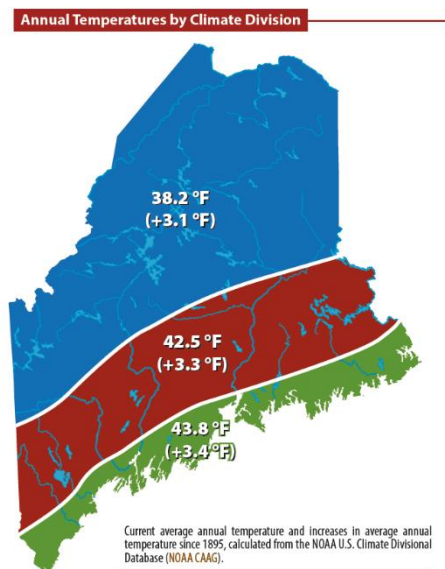
Part 1: Overview

Climate change presents a challenge for many parts of the world, including the state of Maine. Climate change induced temperature rise already affects different parts of Maine to varying degrees, as seen in Figure 1a. As a result, extreme temperature events are more frequent and pose a significant threat to the wellbeing of Maine’s population, especially the most vulnerable groups. Extreme heat events are defined as temperatures that are warmer and more humid than the seasonal average¹. Over the last 124 years, Maine’s temperature has increased by 3.2 degrees Fahrenheit (°F)². Maine has recorded the six warmest years on record since 1998². As seen in Figure 1b, temperatures in Maine have been on the rise since 1895, with the most severe increase from 1995-2020. With warmer and longer summers, extreme temperature events will significantly affect the health of Maine’s most vulnerable populations. The “Northeast is warming faster than any other region in the U.S. Maine and surrounding states are projected to warm by 5.4 °F (3 °C), while the rest of the world reaches 3.6 °F (2 °C)”³. At the rate the atmosphere is warming, heat-related illnesses and deaths may become more frequent in Maine.

In addition to how a warming climate will produce hotter weather, climate change will also cause more extreme cold events, such as polar vortex cold air blasts, severe snowstorms and ice storms. One study found that increased extreme winter events relate to rapid warming in the Arctic⁴.

Over the past four decades, satellite records shows how increasing global temperatures affect the Arctic⁵. This warming changed the wind patterns in the Arctic to facilitate the polar vortex, which streams extremely cold arctic air into North America and East Asia⁴. The polar vortex is not only stretching into Maine and New England but also to places not equipped or prepared to handle these extreme events, which poses a threat to the health and safety of individuals and infrastructure, such as Texas. In February 2021, Texas experienced record-breaking cold temperatures and snowstorms because of the Arctic low-pressure system⁶. Texas residents did not have preparation or warnings in place for the cold snap, which caused some people to freeze to death in their homes⁴. The changing climate has created many challenges for community leaders, the healthcare system, and public health professionals. According to the National Aeronautics and Space Administration (NASA), the 10 warmest years on records have occurred over the last 20 years, with 7 out of 10 since 2014⁷.

Figures 1a and 1b. Maine Average Annual Temperature between 1895 to 2021^{2,8}



Source: <https://showyourstripes.info/b/northamerica/usa/maine> (data from NOAA)

Climate change increases the likelihood of extreme temperatures, which also increases the likelihood of adverse health outcomes. Consequently, the state, local emergency management agencies, emergency response services, public health agencies, and municipalities have been working on adaptation strategies to reduce the effects of extreme temperature events: extreme heat and extreme cold. This guidebook aims to help community leaders develop strategies and plans to mitigate the effects of and respond to extreme temperature events to protect the health of Maine residents.

Heat-related health risks and illnesses

The health impacts from extreme temperature events go beyond a few days of extreme heat or cold. Heat-related conditions from 2004-2018 resulted in more than 10,527 deaths across the United States⁹. Repetitive exposure to extreme heat can potentially result in health problems or death, even over a short period¹⁰. For example, the Chicago heat wave of July 1995 was the deadliest weather event in Chicago history¹¹. The cumulative days of extreme heat, humidity, sunshine, and trapped pollutants were a deadly combination for 750 Chicago-area residents¹¹. More recently, the Pacific Northwest experienced recording-breaking heat in June 2021, with some areas of Oregon reaching 118 degrees Fahrenheit¹². The heatwave resulted in a high-pressure system that formed a “heat dome” and trapped hot air over the Pacific Northwest from June 24-29¹². This heat dome resulted in 96 deaths and 150 hospital visits¹². In Maine, the rate of heat illness emergency department visits was 26.3 per 100,000 from May 1 to Sept. 30, 2018 for all age groups¹³. The age group with the highest rate were ages 15-34 with a rate of 38.3 per 100,000¹³.

Exposure to prolonged extreme temperature events have resulted in several heat-related illnesses where the body is unable to maintain its normal temperature and cool the body through sweating. The conditions from heat stress can range from mild to fatal. Table 1 describes heat-related illnesses symptoms and prevention strategies with possible treatments.

Table 1. Heat-related illnesses, symptoms, and prevention strategies¹⁴

Related-Illness	Symptoms	What to do
Heat cramps	<ul style="list-style-type: none"> ▪ Painful muscle spasms and cramps ▪ Heavy sweating 	<ul style="list-style-type: none"> ▪ Stop all activities to apply pressure on the cramping muscles and gently massage the area to relieve spasms. ▪ Drink water and move to a cooler location ▪ If the cramps continue, seek medical assistance
Heat exhaustion	<ul style="list-style-type: none"> ▪ Dizziness or Fainting ▪ Heavy sweating ▪ Nausea or vomiting ▪ Dehydration or thirst ▪ Fatigue ▪ Weakness 	<ul style="list-style-type: none"> ▪ Avoid sun exposure ▪ Move to cooler or air-conditioned location ▪ Lay down and loosen clothing ▪ Wear lightweight clothing ▪ Take a cold shower or bath ▪ Use wet cloths ▪ Drink cold water <p><i>Seek immediate medical attention if the symptoms last longer than one hour or if the individual has pre-existing conditions.</i></p>
Heatstroke	<ul style="list-style-type: none"> ▪ Dizziness ▪ Loss of consciousness ▪ High body temperature (106 F or higher) ▪ Hot and dry skin ▪ Headache 	<p>Call 911 immediately because heatstroke is a severe medical emergency.</p> <ul style="list-style-type: none"> ▪ Move individual to a cooler or air-conditioned location to reduce the person’s body temperature. ▪ Use wet, cool cloths ▪ Repeat the process if the temperature rises again ▪ DO NOT give any fluids.

Sources: US EPA & US CDC. (2016). Climate Change and Extreme Heat: What you can do to prepare.

Extreme heat events: vulnerable populations

The most vulnerable groups to heat-related illnesses include older adults, children, people of low socioeconomic status, people with chronic diseases, people with disabilities, people experiencing homelessness, and people who work outdoors. Excessive heat endangers human health, especially being the oldest state in the nation, with 21.2% of the population over age 65¹⁵. For older adults, these risks of adverse outcomes are even higher as they may not be able to adapt to extreme temperature conditions. The rate of heat-related deaths between 2014-2018 for age 65 or older was 39%, which was the highest across all age groups⁹. Understanding heat-related illnesses help prevent future injuries and protect the population from exposure to extreme heat. Extreme temperature events can affect the ability to participate in summer activities such as outdoor recreation and work.

Cold-related health risks and illnesses

Similar to extreme heat events, extreme cold events pose potentially deadly health risks for the population. The Center for Disease Control and Prevention (CDC) defines extreme cold events as when temperatures drop below normal as the wind speed increase, which can result in rapid loss of body heat¹⁶. However, the effects of extreme cold can vary among individuals and regions of the state. Even though residents and towns in Maine are more prepared to handle extreme cold events, more people die from cold-related events than heat every year in the United States¹⁷. In the United States, about 750 people die from hypothermia every year¹⁸. In Maine, an average of 20 people die every year from hypothermia, including 3-4 that die in their homes¹⁸. Extreme cold events tend to be associated with severe winter storms where individuals may lose electricity and heat sources. Driving in extreme cold or winter storms can also increase the risk for motor vehicle accidents and injuries, which can expose people to the cold. Heavy snow and ice conditions may delay or impede emergency response assistance, leaving individuals in a dangerous environment.

Another severely dangerous but perhaps less well-known health risk of extreme cold events that cause power outages is carbon monoxide poisoning. This is more likely to happen during a power outage because residents may unknowingly leave a generator in a basement or garage that can emit silent, deadly carbon monoxide. Other exposures during extreme cold events can result from indoor use of charcoal grills, portable gas stoves, and space heaters¹⁹. In a study that focused on the outbreak of carbon monoxide poisoning after the severe 1998 ice storm in Maine, the

researchers found that 100 residents were exposed to carbon dioxide during the first week of power outages¹⁹. Most residents experienced headaches, dizziness, and nausea¹⁹. The most recent carbon monoxide poisoning emergency department visits in Maine from 2010-2014 showed a rate of 7.5 per 100,000²⁰.

Exposure to these conditions may result in serious health problems such as frostbite or hypothermia. These conditions are described in (Table 2) with symptoms, prevention strategies, and possible treatments.

Table 2. Cold-related illnesses, symptoms, and prevention strategies¹⁶

Related-Illnesses	Symptoms	What to do
Hypothermia	<p>For Children Cold skin, Red skin Very low energy</p> <p>For Adults Confusion and memory lost, Shivering, Exhaustion, Drowsiness, Slurred speech, Fumbling hands</p>	<ul style="list-style-type: none"> ▪ Use a temperature meter to record the temperature level. If it is less than 95 degrees, take the person to the nearest hospital. ▪ Move the victim into a warm room, shelter, or warming center. ▪ Remove any wet clothes on the individual. ▪ Warm the center of the body: chest, neck, head, using an electric blanket, if available. ▪ Use skin-to-skin contact under loose and dry layers of blankets, clothing, towels, or sheets. ▪ Drink warm beverages to increase the body temperature. ▪ Do not give the individual any alcoholic beverages. <p>Seek medical attention as soon as possible.</p>
Frostbite	<p>Numbness Change in skin color (white or grayish-yellow) Unusually firm skin Muscle stiffness</p>	<ul style="list-style-type: none"> ▪ Move into a warm room as soon as possible and warm the affected area using body heat. <p>Seek immediate medical attention if symptoms do not resolve.</p>

Sources: US CDC. (n.d.). Extreme Cold: A Prevention guide to promote your personal health and safety.

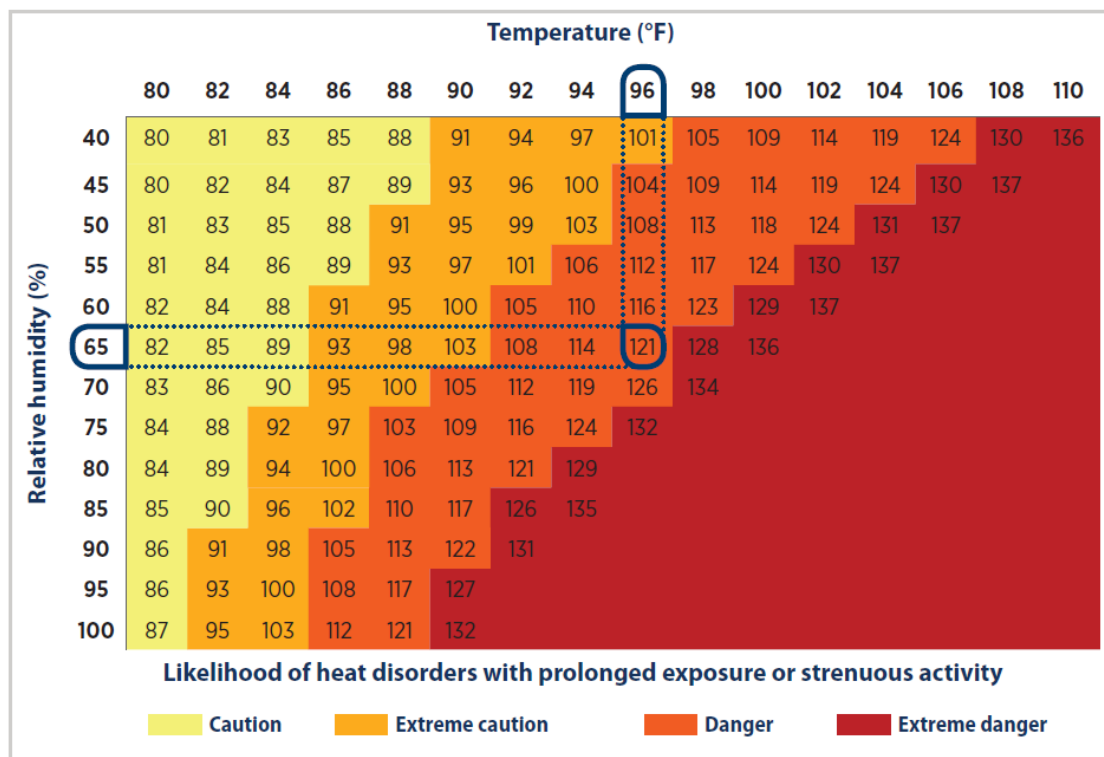
Extreme cold events: vulnerable populations

As noted above, more people die from hypothermia every year, making everyone vulnerable to extreme cold. Everyone is susceptible to extreme temperature events, but low-income communities are disproportionately impacted due to limited resources. While air conditioning, fans, and energy costs are expensive in Maine, the warm season is much shorter than the cold season, and heating costs are much more expensive. Necessary costs such as heating oil or propane, wood-supplied heat, or electric heat are all costly over a five to six month period, especially for families living with a low income. Again, older adults, children, people experiencing homelessness, and those who work outside are especially vulnerable to extreme cold.

The Heat Index

The heat index is a ratio of air temperature to humidity that displays a level of danger from extreme heat. Furthermore, it is a measurement of how hot it feels. The heat index is used by weather forecasters to provide “feel like” temperatures versus the “real feel temperature”. In this context, humidity is an important factor when determining how hot it feels. When the humidity is high, it is hard for water to evaporate, which makes it harder for your body to cool off through sweating¹⁴. The heat index chart, as shown in Figure 3, describes how high humidity and warm temperatures can present a danger to human health.

Figure 3. NOAA’s National Weather Service Heat Index¹⁴

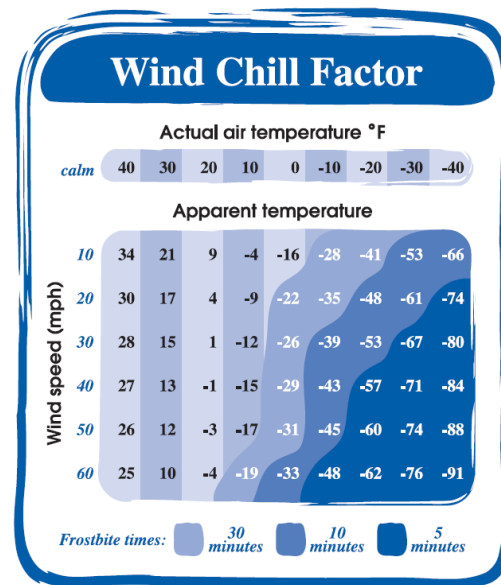


This chart shows that as the temperature (horizontal axis) and relative humidity (vertical axis) each increase, they combine to create a heat index (colored values) that feels hotter than the actual temperature. For example, when the temperature is 96°F, with 65 percent humidity, it actually feels like 121°F (indicated by the blue lines in the chart above). Source: NOAA National Weather Service, 2016¹

Source: <https://earthdata.nasa.gov/learn/pathfinders/disasters/extreme-heat>

Wind Chill Chart

The equivalent to the heat index for extreme cold events is the Wind Chill Chart (see Figure 4). Similar to the heat index, the Wind Chill Chart examines the wind chill index, which combines the actual air temperature and the wind chill speed (mph) to demonstrate the temperature the body feels in extreme cold events¹⁶. As wind increases, temperatures will feel colder because heat will leave the body faster. The colors associated with the levels of severity on the Wind Chill Chart also illustrate how quickly frostbite can occur on the extremities: from 30 minutes to 5 minutes. For example, if the air temperature is 0°F with 20mph winds, the temperature really feels like -22°F with frostbite that can develop after 30 minutes of exposure to the harsh cold and wind¹⁶.



National Weather Service (NWS) Wind Chill Chart adapted May 2004 from <http://www.mws.noaa.gov/om/windchill/>

Part 2: Response Planning

Alert System Activation

The effects of extreme heat and cold on the health of Maine's population rely on responses from local emergency planning and management, public health professionals, community leaders, and local government. Preemptive preparations for extreme temperature events are crucial to limiting and managing risks associated with these events. To better prepare for extreme heat and extreme cold events, community leaders must establish a heat and cold alert response plans focusing on community engagement by assessing the needs of each community.

A heat and cold alert response plan should include:

- An alert system that serves as a warning when dangerous weather conditions are identified.
- A communication strategy to raise awareness and advise individuals before any extreme temperature events.
- Actions residents can take to reduce potential health impacts.
- Actions municipalities and their partners will take to protect and support their residents

Heat Event Activation Threshold

The Maine CDC activates its extreme heat response when the National Weather Service issues a Heat Advisory or Heat Warning for any portion of the state. County and Local Emergency Managers, Local Health Officers, and municipal leaders are encouraged to take action to protect residents by taking the following steps:

- Monitor weather forecasts.
- Communicate with stakeholders to identify resources and anticipate needs.
- Inform the public through press releases, social media posts, notices.
- Increase public awareness about health risks.
- Contact organizations that work with vulnerable populations.
- Consider opening cooling centers.

Table 3. Heat Event Thresholds		
Alert Level	National Weather Service (NWS)	Maine CDC
Heat Advisory	Daytime heat indices of 100°F-104°F for 2 or more hours	Daytime heat index $\geq 95^{\circ}\text{F}$ for two or more days
Excessive Heat Warning	Daytime heat indices of $\geq 105^{\circ}\text{F}$ for 2 or more hours	Daytime heat index $\geq 100^{\circ}\text{F}$ for two or more days
Heat Emergency	N/A	Daytime heat index $\geq 105^{\circ}\text{F}$ for three or more days

Cold Event Activation Threshold

As noted above, the Maine CDC takes appropriate action to prevent cold-related illnesses by following the National Weather Service²¹ winter weather protocols:

Wind Chill Watch	Conditions are favorable for Wind Chill temperatures to meet, or exceed, local Wind Chill Warning criteria in the next 12 to 48 hours.
Winter Storm Watch	Conditions are favorable for a Winter Storm event (Heavy Sleet, Ice Storm, Heavy Snow, and Blowing Snow or a combination of events) to meet, or exceed, local Winter Storm Warning criteria in the next 12 to 48 hours.
Blizzard Warning	Sustained wind or frequent gusts greater than or equal to 35 mph accompanied by falling and/or blowing snow, frequently reducing visibility to less than 1/4 mile for three hours or more.
Ice Storm Warning	Ice accumulation of ½ (one half) inch or more.
Wind Chill Warning	Wind chill temperatures reaching -30F or colder.
Winter Storm Warning	Winter weather event having more than one predominant hazard (i.e., heavy snow and blowing snow, snow and ice, snow and sleet, sleet and ice, or snow, sleet and ice) meeting or exceeding locally defined 12 and/or 24 hour warning criteria for at least one of the precipitation elements.
Snow Squall Warning	Heavy Snow reducing visibility to less than one quarter mile with rapidly falling temperatures resulting in a high likelihood of a flash freeze.
Wind Chill Advisory	Wind chill temperatures of -20F to -29F.
Winter Weather Advisory	Winter weather event where precipitation type cannot be determined with a high level of confidence, or event having more than one predominant hazard (i.e., snow and ice, snow and sleet, or snow, ice and sleet) meeting or exceeding locally defined 12 and/or 24 hour advisory criteria for at least one of the precipitation elements, but remaining below warning criteria.

Roles and Responsibilities

Response to extreme temperature events requires participation from all community partners. The Maine CDC works with local public health representatives and County Emergency Management Agencies to communicate to municipal and other partners when extreme temperatures are forecasted, and to provide guidance for how to protect residents' health.

In the case of heat and cold caution, advisory or warning, the following roles and responsibilities for local and county officials are described in Table 5 below.

Table 5. Roles and responsibilities of Local and County Officials

EXTREME HEAT EVENTS	EXTREME COLD EVENTS
Caution: Prolonged excess heat is forecasted. Active monitoring and communication phase.	Winter Weather Advisory
<ul style="list-style-type: none"> • Initiate or increase communications at the local level, i.e. between Public Health District Liaisons and County or local emergency management personnel, to assess community-specific readiness and needs. 	<ul style="list-style-type: none"> • Initiate or increase communications at the local level, i.e. between Public Health District Liaisons and County or local emergency management personnel, to assess community-specific readiness and needs.
Advisory: A Heat Advisory has been issued by the NWS.	Winter Storm Watch
<ul style="list-style-type: none"> • Initiate/increase communications at the local level to assess community-specific needs and community-level responses. • Encourage community-wide responses such as opening cooling centers if demand warrants. • Communicate information on any opened cooling centers or cancelled events back to MEMA, Maine 211, and Maine CDC/District Liaisons. 	<ul style="list-style-type: none"> • Initiate/increase communications at the local level to assess community-specific needs and community-level responses. • Encourage community-wide responses such as opening warming centers if demand warrants. • Communicate information on any opened warming centers or cancelled events back to MEMA, Maine 211, and Maine CDC/District Liaisons.
Warning: A Heat Warning has been issued by the NWS.	Winter Storm Warning
<ul style="list-style-type: none"> • Initiate or increase communications at the local level to assess community-specific needs and community-level responses. • Encourage community-wide responses such as opening cooling centers if demand warrants • Assess need to postpone local outdoor events (concerts, sporting events, etc.) OR work with event holders to ensure sufficient water, shade, and medical support are available. • Communicate information on any opened cooling centers or cancelled events back to MEMA, Maine 211, and Maine CDC/District Liaisons • Consider increasing capacity of EMS, 911 centers. 	<ul style="list-style-type: none"> • Initiate or increase communications at the local level to assess community-specific needs and community-level responses. • Encourage community-wide responses such as opening warming centers if demand warrants. • Communicate information on any opened warming centers or cancelled events back to MEMA, Maine 211, and Maine CDC/District Liaisons. • Consider increasing capacity of EMS, 911 centers.

Potential Key Stakeholders/Community Partners

Implementation of extreme temperature plans requires the participation and input of many key stakeholders. The initial stakeholders include but are not limited to the following list:

- Maine Centers for Disease Control and Prevention
- County Local Emergency Planning Committee
- Maine Emergency Management Agency
- Local Emergency Planning Committee (LEPC)
- Local Public Health Department
- The National Weather Service
- Local Municipalities
- First Responders
- Hospitals and healthcare centers
- Organizations that work with children or older adults
- Local schools and universities
- Maine Department of Transportation – and local transportation partners?
- Non-profits organizations such as the Red Cross, YMCA
- Local Businesses
- Faith-based organizations
- Utility companies such as the CMP
- City Council members
- Immigrant and multi-cultural organizations

Community and Stakeholders Engagement

Engaging community partners and stakeholders is important when preparing for and responding to extreme temperature events. Once a community has identified a need for extreme temperature planning, an organizational leader or group of organizations should come together to discuss goals and outcomes of the process. From there, local leaders will engage with community partners and stakeholders to understand their level of interest and commitment.

When engaging stakeholders, local leaders should involve organizations that work with vulnerable populations. Vulnerable groups may include low-income communities, older adults,

children, people with disabilities, immigrants with limited English, those who are experiencing homelessness, and more. This is not an exhaustive list, since all members of the community possess some degree of risk for health problems associated with extreme temperature events.

Communication and public education

Effective communication strategies before and after extreme temperature events are crucial to reaching the target audiences. Because Maine is a rural state, messages around extreme temperature events must be presented in ways that everyone can understand. There are various platforms to communicate important information, including local news stations, automated text alert systems, town social media platforms, and radio stations. Communities should use channels they know are effective for groups most at risk. Understanding health information related to extreme heat and cold is very important to ensure the safety of Maine's population.

Community leaders should communicate information in plain language to meet the needs of those with limited health literacy. Messages should be distributed with the goal of maximum impact. One strategy for leaders to use is the Universal Communication Design (UCD), which is a communication framework that considers the needs of vulnerable populations when designing communication products²². UCD is geared towards universal challenges people face as they age²². The use of plain language ensures that those with all health literacy levels can understand and interpret the information²². The goal is to create unified materials and ensure residents can understand the impact of extreme temperature events. Please see appendix C, D,& E for sample press releases and social media posts.

It is important to know that culture can impact how some people understand information; therefore, incorporating cultural values and practices is crucial in all communication strategies. All public announcements, training, and documents should be provided in multiple languages to address the needs of every individual, especially in the most diverse areas of the state.

Part 3: Preventive Action

Preventive actions to reduce the health risks and problems associated with extreme temperatures are needed in Maine. These actions require long-term planning that focuses on broad measures such as climate change mitigation and local adaptation for extreme temperature event response.

Because Maine is mostly a rural state with a pocket of cities and towns, implementation of any prevention action will vary based on population density and needs. Adaptation strategies include:

- Establish cooling and/or warming centers
- Increase green space for ultraviolet light reduction
- Update buildings and building permitting systems for energy efficiency
- Change policies for land-use planning
- Develop water playground for children

Cooling and Warming Centers

Cooling and warming centers refer to temporary air-conditioned or heated facilities that provide relief and safety during extreme temperature events (See Appendix B). Cooling and warming centers function only on a temporary, short-term basis to prevent and reduce cold- and heat-related illnesses. Before opening a cooling or warming center, community leaders and local public health departments must assess:

- If a cooling and warming center already exists in the community.
- Identify key stakeholders and other agencies that should be involved in the implementation.
- Demographics such as population density
- Identify stakeholders who work with vulnerable populations.
- Location of the center
- How to access the center
- Available transportation to the center
- Resources such as sufficient staffing, backup generator, and air-conditioning

It is important to know that some elements of this guidebook may not be applicable based on the characteristics of each town and city. Many factors should be considered to maximize the effectiveness of the cooling or warming center (See Table 6). These factors include setting characteristics, population characteristics, and interventions characteristics¹⁰.

Table 6. Factors to consider when open a cooling and warming center¹⁰

Setting Characteristics	Population Characteristics	Interventions Characteristics
<ul style="list-style-type: none"> • Region/state • Urban/suburban/rural/mixed • Population density • Neighborhood characteristics • Air conditioning prevalence • Greenspace • Built environment • Public transit availability and reliability • Safe environment 	<ul style="list-style-type: none"> • Age • Socio-economic status and educational attainment • Health status (such as pregnancy, existing conditions, medicine that affects the body’s ability to regulate temperature) • Pet ownership • Language • Homelessness; housing status • Employment status • Accessibility; American with Disabilities Act compliance • The burden of disease and preventability 	<ul style="list-style-type: none"> • Accessibility of center (transit, walkable, free parking lot, etc.) • Location and density of centers • Transportation, parking, transit • Convenient hours of operation • Capacity • Center sponsor (church, Red Cross, local health dept, YMCA) • Can free food be offered? • Water access (drinking fountain) • Heat and cold health materials • Stakeholder engagement • Cost / funding • Feasibility • Energy usage • Public restroom availability • Trained staff • Back-up generator • Child-friendly • Accommodations for pets • Hours of Operation • Charging stations

Sources: Center for Disease Control and Prevention (Widerynski, et al. n.d.).

Location

When selecting a cooling or warming center location, community leaders should ensure proper infrastructure is in place. The more important aspect of selecting an appropriate location is ensuring functional cooling and heating of the building. In addition, the facility should have adequate power for the cooling and heating function and backup generators in case of power outages. The facility should be large enough to hold a predicted percentage of the population that may utilize a cooling and heating center, if one is activated. Cooling and heating centers should also have bathrooms, running water, and phone lines in case of emergency. Possible locations

could include public libraries, schools (when not in session), recreation centers, non-profit organizations, or faith-based organizations.

Access

Cooling and warming centers should ideally be accessible for most of the town, especially for vulnerable populations. Considerations should be made to select a location in the town center that is accessible by foot and for those with disabilities. Possible solutions to increase accessibility are proposed in the next section. To the extent possible, locations should have access consistent with the Americans with Disabilities Act accessibility standards: (<https://www.access-board.gov/ada/>).

Transportation

One of the biggest barriers for Maine's population is transportation to the cooling and warming centers. Due to the rural nature of the state, each city and town may want to consult with public transportation and rideshare companies to determine their capacity for transporting residents to centers during an extreme temperature event. Towns and cities should consider working with county LEPC's, state MEMA, and other state and local agencies and entities involved in extreme temperature response. These agencies may also identify funding sources for subsidizing or covering transportation costs during extreme temperature events to increase access to cooling and heating centers.

Staff

Paid and volunteer staff for cooling and warming centers are a key component of the center operation. Towns should identify resources and establish procedures for assigning staff to center locations before an extreme temperature event. Communication, activation criteria, and staff responsibilities should be established ahead of time. Staff members should be required to attend annual trainings on emergency response. A handbook should be written and distributed to share policies and procedures for those working at the cooling and heating centers, such as the CDC guidebook on cooling centers, which can be used as a guide for warming centers¹⁰

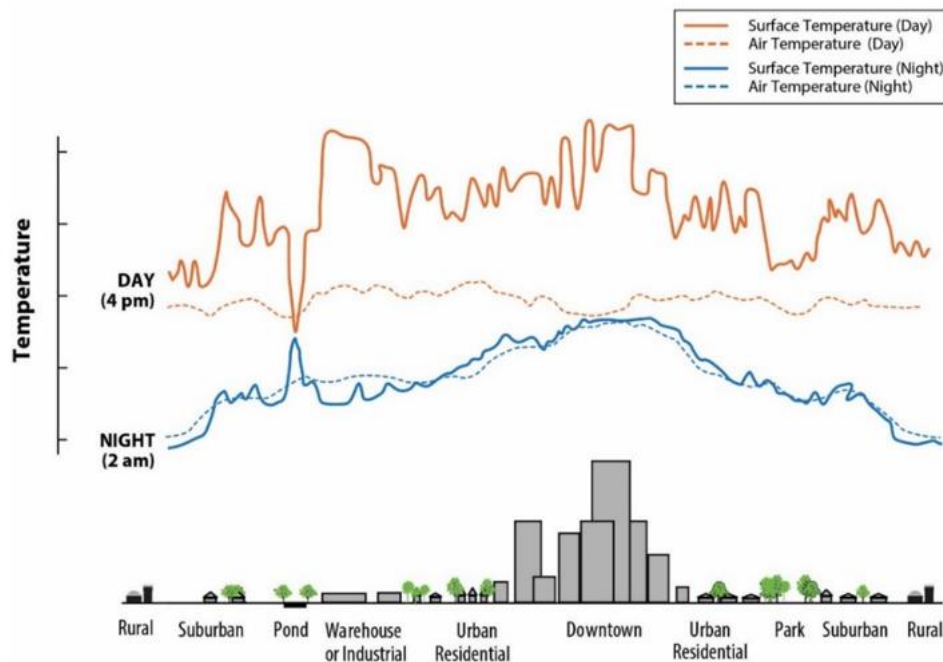
Resources

Resources should be allocated for the opening and operating of cooling and warming centers. Towns and cities' emergency management agencies should identify and apply for available public and private funding to offset the costs of operating a center. Other activities such as fundraising should also be considered to help supplement operational costs.

Combating heat island effects

Because the state of Maine is mostly rural, extreme temperature events will impact some parts of the state more than others. Extreme heat in most urban areas tends to be more intense and prolonged than rural areas. Cities tend to have a higher concentration of buildings, roads, infrastructure, and less green space or trees, which can re-emit the sun's heat²³. With the concentration of these structures and limited green space, urban areas become a “heat island,” which is characterized as when urbanized areas experience higher temperatures compared to the rural areas²³. For example, even a small city in Maine like Biddeford is taking steps to combat the heat island effect by preserving and adding green spaces and using surfaces that are more porous²⁴. The phenomenon of heat islands can take place during the daytime or nighttime in most cities including suburban areas and even in northern climates like the state of Maine (see figure 5).

Figure 5. Heat Island Effect



Sources: <https://www.epa.gov/heatislands/learn-about-heat-islands>

Figure 5 demonstrates the variation of surface temperature in rural, urban, and other areas. Temperatures tend to be lower in rural areas, parks, and open lands than urban, downtown regions. The diagram also illustrates the difference in air and surface temperature during the day and at night. Water can be a factor that reduces air and surface temperatures during the day, as shown by the “pond” graphic.

Strategies to Reduce Extreme heat events

Because cooling centers may not be applicable for some cities and towns in Maine, towns may implement strategies such as:

- Plant trees and vegetation
- Install green roofs
- Install cool pavements



Plant trees and vegetation



Install green roofs

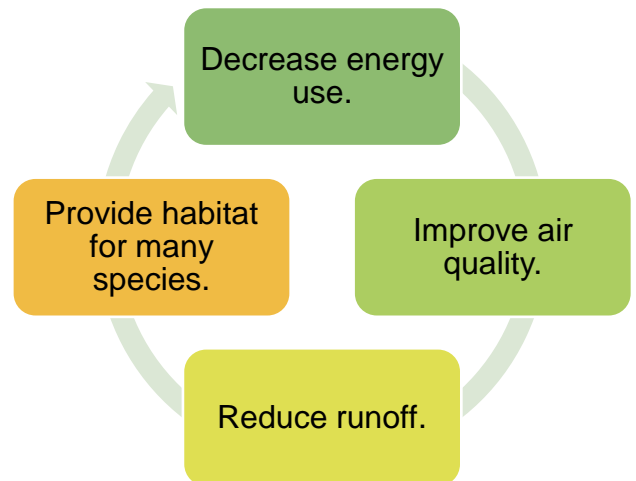


Install cool pavements

Plant trees and vegetation

Increased trees and vegetation proved to be one of the most effective and natural ways to reduce the impact of extreme heat events²⁵. For new and existing developments, cities and towns should find ways to plant more trees and vegetation around buildings, which can help lower surface and air temperatures²⁵. As a mitigation strategy, planting trees around buildings, streets, and parking lots can help:

- Decrease energy use by reducing the cost of air conditioning.
- Improve air quality by removing air pollutants and carbon dioxide.
- Reduce runoff, which can help improve water quality.



Install green roofs

Green roofs can be an effective strategy to reduce heat in urban areas. Installing green roofs can help in providing shade, which can help reduce the temperature by removing the heat from the air. Using green roofs can also enhance storm water management by slowing runoff in the environment, lowering the incidence of heat effects related with heat waves, and reducing air pollution by reducing energy demand²⁶.

Install cool pavement

Another strategy to reduce the effects of extreme heat is to use cool pavement, which is made of materials that reflect more solar energy, enhance water evaporation, and reduce air pollution. Compared to conventional pavement, these materials are designed and modified to remain cooler. Using cool pavement can “reduce tire noise by two to eight decibels and keep noise levels below 75 decibels, although noise reduction may decline over time”²⁷. In addition, these materials tend to be reflective, which can increase visibility at night and permeable, which can help reduce runoff and improve water quality²⁷.

Strategies to Reduce Extreme Cold Events

	Short-term solutions	Long-term resilience strategies
Built environment strategies	<ul style="list-style-type: none">• Home weatherization (increased insulation, better windows)• Multifamily housing reduces heat loss per housing unit	<ul style="list-style-type: none">• Sidewalk and driveway plowing programs• Home energy assistance programs for low income households• Underground energy distribution systems• Ice dam resistant construction
Neighborhood strategies	<ul style="list-style-type: none">• Increased coniferous tree planting in high wind areas• Solar heating• District heating and cooling systems to prevent outages	<ul style="list-style-type: none">• Undergrounded utilities to prevent ice/storm damage to substations and transmission/distribution systems• Warming centers

Conclusion

Climate change is contributing to extreme temperature events across the state of Maine. In many parts of the United States, local governments and public health professionals are already using strategies to adapt to extreme heat and cold. Preemptive and long-term planning is essential to reduce the health impact on Maine's population. The cost of inaction is significant, to not only human health but also economic losses. The U.S. Department of Environmental Protection Agency (EPA) projects extremely hot days to be more than triple from 2050 to 2100, which will increase deaths²⁹. The EPA also projects that over 1.8 billion labor hours will be lost due to extreme heat events, which would cost more than \$ 170 billion in wages²⁹. The benefits of the strategies discussed in this guidebook will help the community not only adapt to climate change but also be more resilient to extreme temperature events. Without these mitigation strategies in urban and rural planning, building design, and regulations, cities and towns across the state will be affected by extreme temperature events.

Part 4: Appendices

Appendix A: Extreme temperature preparedness checklist

Checklist for Opening

Location	<ul style="list-style-type: none"> <input type="checkbox"/> Heating/ventilation/air conditioning system operable; generators available <input type="checkbox"/> Lavatory capacity is sufficient for expected number of people <input type="checkbox"/> The space will accommodate the expected number of people <input type="checkbox"/> Number of electrical outlets is sufficient for charging and equipment <input type="checkbox"/> Features are compliant with the American Disabilities Act (ADA) <input type="checkbox"/> Safety hazards are mitigated, and space is available for multiple purposes <input type="checkbox"/> Determine need for Memorandum of Understanding (MOU) with owners
Access	<ul style="list-style-type: none"> <input type="checkbox"/> Roads to the facility are kept open <input type="checkbox"/> Location is accessible by foot and public transportation <input type="checkbox"/> The facility is available for the duration of the incident
Transportation	<ul style="list-style-type: none"> <input type="checkbox"/> Public transportation stations are nearby and available <input type="checkbox"/> Public transportation agencies will provide rides <input type="checkbox"/> Rideshare companies will provide rides
Staff	<ul style="list-style-type: none"> <input type="checkbox"/> Enroll volunteer and paid staff <input type="checkbox"/> Require staff to complete safety trainings <input type="checkbox"/> Generate policy book <input type="checkbox"/> Ensure communication methods for activation <input type="checkbox"/> Identify and procure translation services that can be provided to non-English speaking residents
Resources	<p>Physical resources:</p> <ul style="list-style-type: none"> <input type="checkbox"/> First Aid kits, AED, PPE <input type="checkbox"/> Chairs <input type="checkbox"/> Tables if available <input type="checkbox"/> Registration and common area <p>Clerical resources:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Office supplies for staff <input type="checkbox"/> Forms <p>Financial resources:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Fundraise <input type="checkbox"/> Find state and local funding <input type="checkbox"/> Apply for grants

Appendix B: Checklist for Operating Cooling & Warming Centers

<p><i>Activation</i></p>	<ul style="list-style-type: none"> <input type="checkbox"/> Determine triggers for opening and closing centers (NWS advisory issued; heat index/wind chill values exceeded; power outages affecting residents; etc.). <input type="checkbox"/> Determine who will notify towns and center operators of activation (Maine CDC, MEMA, others). <input type="checkbox"/> Anticipate need for shelter operations. <input type="checkbox"/> Activate mass notification system (phone, email, text, TV, radio, social media). <input type="checkbox"/> Receive authorization to open center from municipality. <input type="checkbox"/> Activate paid and volunteer staff members. <input type="checkbox"/> Set up separate areas as possible: registration, emergency, common, quiet, etc. <input type="checkbox"/> Inspect the building and center space before opening; mitigate any identified health and safety hazards.
<p><i>Closing</i></p>	<ul style="list-style-type: none"> <input type="checkbox"/> Give 24-hour mass notification of center closing. <input type="checkbox"/> Ensure all community members have transportation to their home. <input type="checkbox"/> Clean, replenish supplies, remove signage, inspect facility. <input type="checkbox"/> Collect and file paperwork (registration, incident reports).
<p><i>Post-Emergency</i></p>	<ul style="list-style-type: none"> <input type="checkbox"/> Debrief with staff on operations. <input type="checkbox"/> Ask community members (or those who accessed the center) to complete a survey. <input type="checkbox"/> Conduct an after-action meeting including all staff. <input type="checkbox"/> Determine successes, shortfalls, suggestions for improvement. <input type="checkbox"/> Write an improvement plan, assign individuals to implement improvements <input type="checkbox"/> Update policy manual and put new procedures in place as needed.

Appendix C: Extreme Heat Events Press Release

Contact Information

[Address]

[City, State]

[Date]

FOR IMMEDIATE RELEASE

[Extreme Heat Preparations]

[City, State] - With much of Maine under an excessive heat watch or advisory issued by the National Weather Service, the Maine Center for Disease Control and Prevention (CDC) reminds Mainers to stay cool and recognize the signs of heat illness early.

In Maine, individuals over the age of 65 represent the largest proportion of people who are hospitalized for heat-related illnesses. Lack of air conditioning, taking prescription medication, and physical or mental health challenges common among older adults increase the potential for heat-related illnesses. It is important for family and friends to visit older adults at least twice daily and watch for signs of heat exhaustion or heat stroke. Those signs include headache, lightheadedness, weakness, rapid heartbeat, rapid breathing, nausea, or vomiting.

Although older persons are most at risk of serious heat-related illness and hospitalizations, most heat-related illness and emergency department visits occur in Mainers ages 15-64, especially men. These illnesses may be due to outdoor jobs or recreational activities.

Anyone recreating outside should pay attention during high heat conditions.

Other people at risk for serious health effects due to heat include infants and young children, and people who work outside, have chronic health issues, or have trouble caring for themselves.

Signs of heat-related illnesses include dry, hot, red skin; a rapid pulse; a high temperature; headache; confusion or loss of alertness; rapid breathing; unconsciousness or coma. If you notice someone with these signs, call 911 immediately and move the person out of the sun, loosen their clothes, and cool them rapidly with ice, fans, cold water, or wet cloths.

To prevent heat-related illness:

Keep Cool

Use air conditioning to cool down or go to an air-conditioned building such as a store, a library, or a cooling center. Call 2-1-1 to find out if a cooling center is open near you or visit the Maine Emergency Management Agency's online list.

- If you don't have air conditioning in your home, open windows and shades on the shady side and close them on the sunny side.

- Take a cool shower or bath.
- Wear loose, lightweight, light-colored clothing.
- Stay out of the sun as much as possible.
- Wear sunscreen and a ventilated hat (e.g., straw or mesh) when outdoors, even if it is cloudy.
- Never leave children, pets or those with special needs in a parked car, even briefly. Temperatures in the car can become dangerous within a few minutes. Even with the windows rolled down two inches, it takes only 10 minutes for the inside of a vehicle to reach deadly temperatures on a hot summer day.

Drink Fluids

- Drink more fluids regardless of your activity level.
- Avoid alcohol, caffeine, and sugary drinks, since these cause you to lose more body fluid.
- If you are on fluid restrictions or take diuretics, ask your doctor how much fluid you should drink.

Lie Low

- Take regular breaks from any necessary physical activity - at least every hour.
- Avoid strenuous activity during the hottest part of the day (between 11 a.m. and 4 p.m.).

If you must be out in the heat:

- Try to limit your outdoor activity to morning and evening hours.
- Cut down on exercise. If you must exercise, drink one cup (8 ounces) of cool, nonalcoholic fluids every 20 minutes. A sports beverage can replace the salt and minerals you lose in sweat. If you are on a low-salt diet, talk with your doctor before drinking a sports beverage.
- Rest often in shady areas at least every hour.
- Protect yourself from the sun by wearing a wide-brimmed hat and sunglasses and by putting on sunscreen of SPF 15 or higher (the most effective products say "broad spectrum" or "UVA/UVB protection" on their labels).

For more information visit:

- www.maine.gov/dhhs/mecdc/environmental-health/heat
- www.cdc.gov/disasters/extremeheat/index.html
- data.mainepublichealth.gov/tracking

Appendix D: Extreme Cold Events Sample Press Release

Contact Information

[Address]

[City, State]

[Date]

FOR IMMEDIATE RELEASE

[Winter Weather Preparations]

[City, State] - With much of Maine under a [Winter Weather Advisory/ Winter Storm Watch/ Winter Storm Warning] issued by the National Weather Service, the Maine Center for Disease Control and Prevention (CDC) reminds Mainers to stay safe and recognize the signs of hypothermia and frostbite early.

Winter storms can cause power outages that last for days. They can make roads and walkways extremely dangerous and also negatively affect services including public transportation, childcare, and health programs³⁰. Injuries and deaths may occur from winter weather exposure, dangerous road conditions, carbon monoxide poisoning, and other winter storm conditions³⁰.

In Maine, everyone is at risk of negative impacts from winter storms. On average, 20 people die every year from hypothermia in Maine, including 3-4 that die in their homes¹⁸. It is important for family and friends to visit older adults at least twice daily. Other people at risk for serious health effects due to extreme cold include infants and young children, people who work outside, have chronic health issues, or have trouble caring for themselves.

- Signs of hypothermia in adults include confusion or memory loss, shivering, fatigue, drowsiness, slurred speech, or fumbling hands.
- Children suffering from hypothermia may present with cold and/or red skin or very low energy.
- Signs of frostbite include numbness, change in skin color (white or grayish-yellow), firm skin, and muscle stiffness.

To prevent cold-related illness³⁰:

Prepare

- Use safe heat sources to warm up or go to a heated building such as a store, a library, or a warming center. Call 2-1-1 to find out if a warming center is open near you or visit the Maine Emergency Management Agency's online list.
- Sign up for local alerts and warnings.
- Stock emergency supplies, including battery-powered carbon monoxide and smoke detectors.

- Winterize your home.
- Never leave children, pets or those with special needs in a parked car, even briefly. Temperatures in the car can become dangerous within a few minutes.

During

- Stay indoors and off the roads. If you must drive, keep emergency supplies in your car.
- Limit your time outdoors and stay dry.
- Close off rooms to consolidate and retain heat.
- Dress in layers and use blankets to stay warm.
- Bring pets into a warm place and out of the storm and severe cold.
- Never use a generator, camp stove, charcoal grill, or gasoline or propane heater indoors, as these items can start accidental fires, cause electric shock, and/or cause deadly carbon monoxide poisoning.
- Never heat a home with a cooktop or oven.

After

- Only drive if necessary. Remove snow and ice from your car, especially the tailpipe.
- Dress in warm clothing and prevent prolonged exposure to cold and wind.
- Avoid overexertion clearing or shoveling snow, as this can lead to a medical emergency.
- Monitor local news and alerts for emergency information and instructions.

For more information visit:

- <https://www.ready.gov/prepare>
- <https://www.cdc.gov/disasters/winter/index.html>
- <https://data.mainepublichealth.gov/tracking/data-topics/cold-related-illness>

Appendix E: Sample social media posts

Sample social media posts for extreme heat events:

- Extreme heat can affect everyone. Check on your neighbors to make sure they are okey, especially older adults and children. #StayCool
- Call your town office or call 211 for the location of a cooling center near you. #BeatTheHeat
- Call 911 if you suspect heat exhaustion or stroke. #StaySafe
- If you must work outside, be alert for signs of overheating. #BeatTheHeat

Sample social media posts for extreme cold events:

- Extreme cold can affect everyone. Check on your neighbors to make sure they are okey, especially older adults and children. #StayWarm
- Call your town office or call 211 for the location of a warming center near you. #StaySafe
- Call 911 if you suspect hypothermia or frostbite #StayWarm
- If you must drive in winter weather, be prepared and pack emergency supplies. #StaySafe

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