THE OHIO STATE UNIVERSITY

Heat and Cold Stress

Safety Program

July 2020

Prepared by
The Ohio State University
Environmental Health and Safety
1314 Kinnear Road • Columbus OH 43212

614-292-1284
ehs.osu.edu

Table of Contents

1. Introduction

Working in extreme temperatures (hot or cold) can overwhelm the body's internal temperature control system. When the body is unable to warm or cool itself, heat or cold related stress can result. Heat and cold stress can contribute to adverse health effects which range in severity from discomfort to death.

Environmental Health and Safety (EHS) has developed this Heat and Cold Stress Safety Program to minimize the effects of heat and cold stress on Ohio State University (Ohio State) employees. This program contains the procedures and practices for safely working in temperature extremes. EHS can also conduct exposure assessments and assist departments with the development of procedures to minimize the adverse effects of heat and cold stress among their employees. Additionally, EHS has developed an online training module to train employees on the hazards of thermal stressors.

The Occupational Safety and Health Administration (OSHA) does not currently have specific standards for heat or cold stress. However, the Occupational Safety and Health Act of 1970 General Duty Clause (Section 5(a)(1)) states that "Each employer shall furnish to each of his employees employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees." In addition, 29 CFR Subpart I relating to personal protective equipment requires employers to provide protection to employees exposed to hazards in the workplace. The OSHA website contains Fact Sheets and Guidance Documents that relate to heat and cold stress that have been incorporated into this program.

2. Responsibilities

Environmental Health and Safety

Environmental Health and Safety (EHS) shall maintain, review, and update this program as needed. EHS will also provide monitoring, upon request, and assist employees with the development of procedures to minimize the adverse affects of heat and cold stress in the workplace. EHS provides an online training to cover the basic hazards and safety precautions related to heat and cold stress.

Supervisors

Each supervisor managing employees exposed to heat and/or cold stress has the following responsibilities:

- Review and comply with the provisions outlined in this program.
- Ensure all employees are properly trained before working in extreme temperature conditions. Document any in-person training conducted.
- Assess the day-to-day heat or cold stresses on employees.
- Assess employees' workload and assigning work and rest schedules as needed.
- Ensure all employees have the appropriate personal protective equipment (PPE) prior to working in extreme temperature conditions.
- Ensure employees are familiar with this safety program.

Employees

Employees exposed to heat and/or cold stress when performing their job duties have the following responsibilities:

- Review and comply with the provisions outlined in this program.
- Complete training before working in extreme temperature conditions.
- Wear the appropriate PPE.
- Report heat and cold stress concerns to their supervisor.

3. Heat-Related Illnesses: Signs, Treatment, and Prevention

Signs and Treatment

While working in hot conditions, the human body may not be able to maintain a normal temperature just by sweating. If this happens, heat-related illnesses may occur. The most common health problems caused by hot work environments include:

Heat stroke – This is the most serious heat related effect. Heat stroke occurs when the body temperature increases above 1040F. Signs and symptoms of heat stroke are confusion, loss of consciousness, seizures, and lack of perspiration. This condition must be treated as a medical emergency and the employee must receive immediate medical attention. While waiting on medical assistance, the victim should be moved to a cool/shaded area, cooled with water/wet towels/ice packs, and fanned to increase cooling.

Heat exhaustion – Signs and symptoms of heat exhaustion include headache, nausea, dizziness, weakness, irritability, confusion, thirst, heavy perspiration and a body temperature greater than 100.40F. Employees experiencing heat exhaustion should be moved to a cool area, given fluids to drink and given cold compresses for their head, face and neck. Employees should also be taken to a clinic or emergency room to be monitored by medical personnel.

Heat cramps – Signs and symptoms of heat cramps include muscle pains usually caused by the loss of body salts/fluids, this can happen later as well. Employees should replace fluid loss by drinking water and/or carbohydrate-electrolyte replacement liquids (e.g. Gatorade) every 15 to 20 minutes. If cramps are severe, seek medical attention.

Heat rash – Heat rash is caused by excessive perspiration and looks like a red cluster of pimples or small blisters. Heat rash usually appears on the neck, upper chest, in the groin, under the breasts and in elbow creases. Treatment for heat rash is to provide a cooler, less humid environment.

Dehydration – Dehydration is a major factor in most heat disorders. Signs and symptoms of dehydration include increasing thirst, dry mouth, weakness or light-headedness (particularly if worse upon standing), and a darkening of the urine or a decrease in urination. Dehydration can be reversed or put back in balance by drinking fluids that contain electrolytes (i.e. Gatorade) that are lost during work related activities. Avoid caffeinated drinks.

Prevention

While heat related illness are dangerous and potentially life threating, they can be prevented. Prevention methods include:

Acclimation – Acclimation is a process by which the physical processes of an employee's body adjusts to the environment over a period of time. Based on data obtained from OSHA, this process usually takes five to seven days. This process could take up to three weeks depending on the individual and their work environment. According to the American Industrial Hygiene Association, the process requires a consistent work level for at least two hours each day during the acclimation period in order for an employee to

become acclimatized. Mere exposure to heat does not confer acclimatization, nor does acclimatization at one heat stress level confer resistance to heat stress at a higher temperature or more vigorous workload. Employees who are not adequately acclimatized to the heat may experience temporary heat fatigue resulting in a decline in performance, coordination or alertness. They may also become irritable or depressed. This can be prevented through gradual adjustment to the hot environment. People in good physical condition tend to acclimatize better because their cardiovascular systems respond better.

Engineering Controls – For employees working indoors, the best way to prevent heat-related illness is to make the work environment cooler. Where and if possible, use air conditioning to cool the work area. Alternatively, increase the general ventilation as much as possible by opening windows or doors. When available, use cooling fans to aid in increasing ventilation.

Safe Work Practices – For employees working outdoors or working indoors without air conditioning or ventilation, take scheduled breaks in cool areas. Ensure there is plenty of cool water to drink and take water breaks as needed. Immediately report any problems to a supervisor. Supervisors should consider scheduling the hottest work for the coolest part of day, assigning extra employees to high demand tasks, and using work-saving devices (e.g. power tools, hoists or lifting aids) to reduce the body's work load. All employees should watch out for the safety of their coworkers.

Heat Index – The Heat Index is a single numeric value that uses both temperature and humidity to inform the public on how the weather outdoors "feels". The higher the Heat Index, the hotter the weather feels. OSHA has used the Heat Index to assign protective measures for workers as the Heat Index increases. These protective measures may reduce the likelihood of heat related illnesses. The Heat Index and related protective measures are contained in Appendix A.

4. Cold-Related Illnesses and Injuries: Signs, Treatment, and Prevention

Signs and Treatment

During cold weather, an employee's body will use energy to maintain a normal internal body temperature. This will result in a shift of blood flow from employee's extremities (hands, feet and legs) and outer skin to the employee's core (chest and abdomen). If this happens, cold-related illnesses and injuries may occur if exposed to cold conditions for an extended period of time. The most common health problems caused by cold work environments include:

Hypothermia – Hypothermia is a potentially serious health condition. Hypothermia occurs when body heat is lost faster than it can be replaced. When the core body temperature drops to approximately 95°F, the onset of symptoms normally begins. The employee may begin to shiver, lose coordination, have slurred speech, and fumble with items in the hand. The employee's skin will likely be pale and cold. As the body temperature continues to fall these symptoms will worsen and shivering will stop. Once the body temperature falls to around 85°F severe hypothermia will develop and the person may become unconscious, and at 78°F, vital organs may begin to fail.

Treatment depends on the severity of the hypothermia. For cases of mild hypothermia move to warm area and stay active. Remove wet clothes and replace with dry clothes or blankets, cover the head. To promote metabolism and assist in raising internal core temperature drink a warm (not hot) sugary drink. Avoid drinks with caffeine. For more severe cases do all the above, plus contact emergency medical personnel (Call 911 for an ambulance), cover all extremities completely, place very warm objects, such as hot packs or water bottles on the victim's head, neck, chest and groin. Arms and legs should be warmed last. In cases of severe hypothermia, treat the employee very gently and do not apply external heat to re-warm. Hospital treatment is required.

Frostbite – Frostbite occurs when the skin freezes and loses water. In severe cases, amputation of the frostbitten area may be required. While frostbite usually occurs when the temperatures are 30° F or lower, wind chill factors can allow frostbite to occur in above freezing temperatures. Frostbite typically affects the extremities, particularly the feet and hands. The affected body part will be cold, tingling, stinging or aching followed by numbness. Skin color turns red, then purple, then white, and is cold to the touch. There may be blisters in severe cases.

Do not rub the area to warm it. Wrap the area in a soft cloth, move the employee to a warm area, and contact medical personnel. Do not leave the employee alone. If help is delayed, immerse in warm (maximum 105 °F), not hot, water. Do not pour water directly on affected part. If there is a chance that the affected part will get cold again do not warm. Repeated heating and cooling of the skin may cause severe tissue damage.

Trench Foot – Trench Foot is caused by having feet exposed to damp, unsanitary and cold conditions including water at temperatures above freezing for long periods of time. It is similar to frostbite, but considered less severe. Symptoms usually consist of tingling, itching or burning sensation. Blisters may be present. For treatment, soak feet in warm water, then wrap with dry cloth bandages. Drink a warm, sugary drink. Seek medical attention if necessary.

Dehydration – It is easy to become dehydrated during cold weather. Signs of dehydration include increasing thirst, dry mouth, weakness or light-headedness (particularly if worse upon standing), and a darkening of the urine or a decrease in urination. Dehydration can be reversed or put back in balance by drinking fluids that contain electrolytes (i.e. Gatorade) that are lost during work related activities. Avoid caffeinated drinks

Prevention

Just as with heat related illness, cold related illnesses and injuries are dangerous and potentially life threating, however, they can be prevented. Prevention methods include:

Acclimation – Employees exposed to the cold should be physically fit, without any circulatory, metabolic, or neurologic diseases that may place them at increased risk for hypothermia. A new employee should not be required to work in the cold full time during the first days of employment until they become adjusted to the working conditions and required protective clothing. New employees should be introduced to the work schedule slowly and be trained accordingly.

Engineering Controls – For employees working indoors, the best way to prevent cold-related illness is to make the work environment warmer. Where and if possible, use heaters to warm the work area. Alternatively, decrease the general ventilation as much as possible by closing windows or doors.

Safe Work Practices – For employees working outdoors or working indoors without heat, take scheduled breaks in warm areas. If available, use wind barricades to block the wind from the employees. Ensure there is plenty of water to drink and take water breaks as needed. Immediately report any problems to a supervisor. Supervisors should consider scheduling the most work for the warmest part of day, assigning extra employees to high demand tasks that will require longer periods in cold areas. All employees should watch out for the safety of their coworkers.

Personal Protective Equipment (PPE) – PPE is an important factor in preventing cold stress related illnesses and injuries. Employees should adhere to the following recommendations when dressing for work in a cold environment:

- Wear at least three layers of clothing; an inner layer of wool, silk or synthetic to wick moisture away from the body; a middle layer of wool or synthetic to provide insulation even when wet; an outer wind and rain protection layer that allows some ventilation to prevent overheating.
- Wear a hat or hood; up to 40% of body heat can be lost when the head is left exposed.
- Wear insulated boots or other footwear.
- Do not wear tight clothing; loose clothing provides better ventilation.
- Keep a change of clothing available in case work clothes become wet.

The Cold Stress Equation - OSHA has incorporated information obtained from the American Conference of Governmental Industrial Hygienists (ACGIH) threshold limit values into the Cold Stress Equation. As the temperature decreases and/or the wind speed increases, the potential for cold stress related illnesses and injuries increases. The Cold Stress Equation and the Wind Chill Temperature Index is contained in Appendix B.

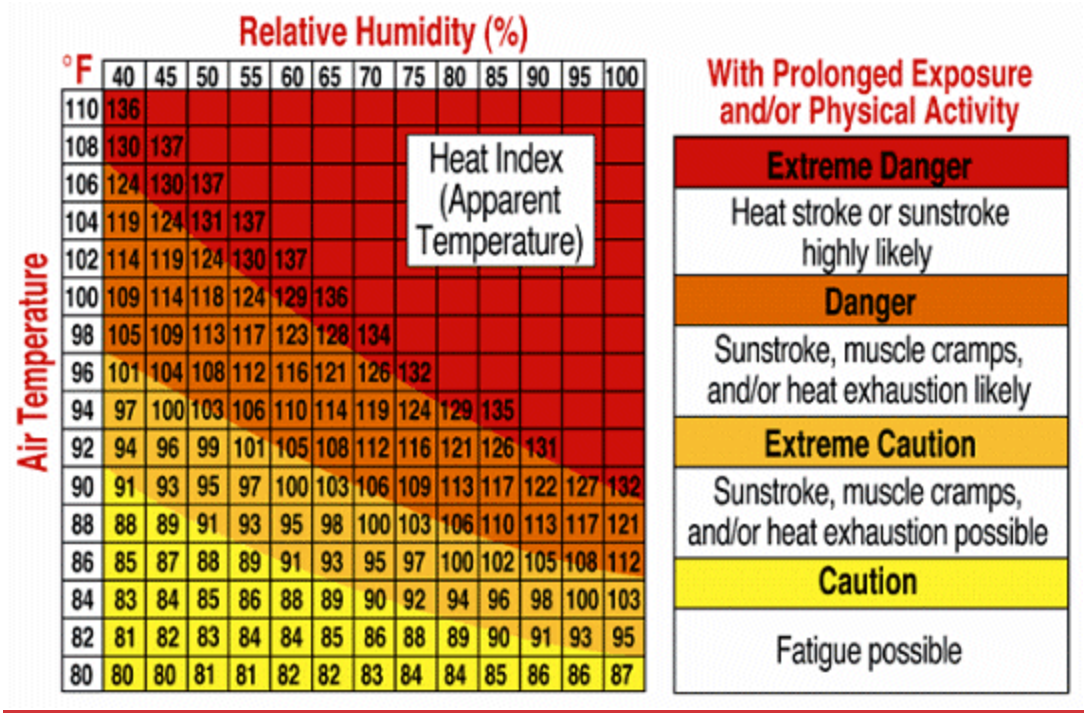
5. Training

Employees who may be exposed to extreme hot or cold conditions must receive training prior to working in such conditions. An online training module is available from EHS. To find this training, visit https://buckeyelearn.osu.edu/ and search for “Thermal Stressors.” This training will cover the general safety precautions related to heat and cold stress. However, employees must still be trained on any additional precautions specific to their equipment or work areas.

5. Appendix A: Heat Index

The heat index is a simple tool and a useful guide for employers/employees making decisions about protecting employees in hot weather. It does not account for certain conditions that contribute additional risk, such as physical exertion. Consider taking the steps at the next highest risk level to protect employees from the added risks posed by:

- Working in the direct sun (can add up to 15°F to the heat index value)
- Wearing heavy clothing or protective gear



Appendix A: Heat Index Continued

Heat Index	Risk Level	Protective Measures
<91°F	**Lower (Caution)**	• Provide plenty of drinking water • Ensure that adequate medical services are available • Plan ahead for times when heat index is higher, including worker heat safety training • Encourage workers to wear sunscreen • If workers must wear heavy protective clothing, perform strenuous activity or work in the direct sun, additional precautions are recommended to protect workers from heat related illness
91°F to 103°F	**Moderate**	**In addition to the steps listed above:** • Remind workers to drink water often (about 4 cups per hour) • Review heat related illness topics with workers such as recognition, prevention and first-aid • Schedule frequent breaks in cool, shaded areas • Acclimatize workers • Set up a buddy system and instruct workers and supervisors to watch for signs of heat related illnesses • Schedule strenuous activities at a time when the heat index is lower • Develop and enforce work rest schedules • Monitor workers closely
103°F to 115°F	**High**	**In addition to the steps listed above:** • Alert workers of high risk conditions • Limit physical exertion • Have a knowledgeable person at the work site who is well informed about heat related illness and able to determine appropriate work/rest schedules • Adjust work activities (e.g. reschedule work, pace/rotate jobs) • Use cooling techniques • Watch/communicate with workers at all times
115°F	**Very High to Extreme**	**If essential work must be done, in addition to the steps listed above:** • Conduct physiological monitoring (e.g. pulse, temperature, etc.) • Stop work if essential control methods are inadequate or unavailable • Reschedule non-essential activities for days with a reduced heat index or to a time when the heat index is lower • Move essential work tasks to the coolest part of the work shift • Consider earlier start times, split shifts or evening/night shifts • Strenuous work tasks and those requiring the use of heavy or non-breathable clothing or impermeable chemical protective clothing should not be conducted when the heat index is at or above 115°F

5. Appendix B: Wind Chill Temperature Index

WIND CHILL TEMPERATURE INDEX
Frostbite Times are for Exposed Facial Skin

Air Temperature (°C)

Wind Speed (km/h)	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45	-50
5	4	-2	-7	-13	-19	-24	-30	-36	-41	-47	-53	-58
10	3	-3	-9	-15	-21	-27	-33	-39	-45	-51	-57	-63
15	2	-4	-11	-17	-23	-29	-35	-41	-48	-54	-60	-66
20	1	-5	-12	-18	-24	-30	-37	-43	-49	-56	-62	-68
25	1	-6	-12	-19	-25	-32	-38	-44	-51	-57	-64	-70
30	0	-6	-13	-20	-26	-33	-39	-46	-52	-59	-65	-72
35	0	-7	-14	-20	-27	-33	-40	-47	-53	-60	-66	-73
40	-1	-7	-14	-21	-27	-34	-41	-48	-54	-61	-68	-74
45	-1	-8	-15	-21	-28	-35	-42	-48	-55	-62	-69	-75
50	-1	-8	-15	-22	-29	-35	-42	-49	-56	-63	-69	-76
55	-2	-8	-15	-22	-29	-36	-43	-50	-57	-63	-70	-77
60	-2	-9	-16	-23	-30	-36	-43	-50	-57	-64	-71	-78
65	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79
70	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-80
75	-3	-10	-17	-24	-31	-38	-45	-52	-59	-66	-73	-80
80	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81

FROSTBITE GUIDE

Increasing risk of frostbite for most people in 10 to 30 minutes of exposure

High risk for most people in 5 to 10 minutes of exposure

High risk for most people in 2 to 5 minutes of exposure

High risk for most people in 2 minutes of exposure or less