

# Heat Illness Prevention Program



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## 1. PURPOSE

The University of Pennsylvania, in coordination with the Office of Environmental Health and Radiation Safety, is committed to provide the Penn community with a safe and healthful environment. The Heat Illness Prevention Program provides guidance to assist faculty, staff, and students prevent heat-related illness.

## 2. BACKGROUND

Each year, dozens of workers die and thousands more become ill while working in hot and/or humid conditions.

Workers become overheated from two primary sources:

1. The environmental conditions in which they work.
2. The internal heat generated by physical labor.

Heat related illnesses occur when the body is not able to lose enough heat to balance the heat generated by physical work and the external heat sources. Weather conditions are the primary external heat sources for outdoor workers.

- Almost half of heat-related deaths occur on a worker's very first day on the job. (Arbury 2014)
- Over 70 percent of heat-related deaths occur during a worker's first week. (Tustin 2018)
- While most strongly associated with work outdoors in warm weather, heat illness also occurs at indoor work environments.

Heat-related illness can often be prevented by education, assessment of conditions, proper acclimatization, implementation of safe work practices and use of supervision and/or the buddy system to monitor the condition of employees.

## 3. APPLICATION

This program applies to Penn faculty and staff. Penn faculty and staff should also apply the relevant parts of this program to at-risk students under their supervision.

## 4. GLOSSARY OF TERMS

- 4.1. **Acclimatization** – The gradual adaptation of the body to tolerate higher levels of heat stress.
- 4.2. **Heat Index** – An index that combines the temperature and relative humidity to more accurately describe how conditions feel to the human body. Typically used for shady and indoor areas.
- 4.3. **Heat Exhaustion** – Occurs when the body's means of controlling its internal temperature begins to fail. Heat exhaustion refers to multiple symptoms that can be a precursor to heat stroke.

- 4.4. **Heat Stroke** – Most serious heat-related illness. The body can no longer control its temperature and is unable to cool down. Can cause permanent disability and death.
- 4.5. **Metabolic Rate – Light** – Sitting with light manual work with hands or hands and arms, driving, standing with some light arm work. Occasional walking.
- 4.6. **Metabolic Rate – Moderate** – Sustained moderate hand and arm work, moderate arm and leg work, moderate arm and trunk work, or light pushing and pulling. Normal walking.
- 4.7. **Metabolic Rate – Heavy** – Intense arm and trunk work, carrying, shoveling, manual sawing, pushing, and pulling heavy loads. Walking at a fast pace.
- 4.8. **Metabolic Rate – Very Heavy** – Very intense activity at fast to maximum pace.
- 4.9. **Wet Bulb Globe Temperature (WBGT)** – Measure of the heat stress in direct sunlight, which considers temperature, humidity, wind speed, sun angle and cloud cover (solar radiation). Most accurate method for assessing heat conditions for work in direct sunlight.

### 5. RESPONSIBILITIES

- 5.1. **Environmental Health & Radiation Safety (EHRS):**
  - 5.1.1. Develop, periodically review, and update the Heat Illness Prevention Program.
  - 5.1.2. Complete heat assessments using heat index or WBGT with consideration of the required metabolic rates for tasks in areas that have the potential to place individuals at increased risk for heat stress. Document findings and recommended mitigation measures in the applicable job safety analysis (JSA) forms.
  - 5.1.3. Provide or coordinate presentation of required training.
- 5.2. **Penn Faculty, Management and Supervisors:**
  - 5.2.1. Implement this program with employees or students under their supervision.
  - 5.2.2. Assess or request assessment of locations or tasks where heat related illness may occur.
  - 5.2.3. Provide adequate supervision and/or implement buddy system to monitor employees for onset of heat illness symptoms.
  - 5.2.4. Identify those who require training and contact EHRS to schedule.
- 5.3. **At Risk Penn Personnel:**
  - 5.3.1. Understand personal risk factors. If these risk factors increase the likelihood of heat illness, notify supervisor, manager, or faculty member, so the appropriate measures are implemented to reduce the risk.
  - 5.3.2. Follow prescribed acclimatization process and safe work procedures.
  - 5.3.3. Request assessment of environments and tasks suspected of having the potential to cause heat-related illness if not previously completed, or if conditions have changed.
  - 5.3.4. Participate in heat illness prevention training sessions.
  - 5.3.5. Participate in the buddy system and watch out for others. Notify someone right away if heat-related symptoms are experienced or observed in someone else.

### 6. TRAINING

- 6.1. **Training Frequency** - Employees or students at risk of heat-related illness shall receive heat illness prevention training prior to beginning work or studies in the high-risk environment and annually thereafter.
- 6.2. **Training Content** - Heat illness prevention training shall at minimum cover the following subject areas:
- Information contained in Penn's Heat Illness Prevention program.
  - Types of heat-related illness, including how to recognize common signs and symptoms.
  - Job-related and personal risk factors for heat-related illnesses.
  - How to assess the environment and apply heat illness prevention safe work practices.
  - Importance of protecting new unacclimatized workers. This includes work practices to help workers develop acclimatization.
  - Appropriate work/rest cycles (i.e., mandatory rest breaks) when heat stress is high. See appendix 3.
  - Importance of taking rest breaks in areas that are cooler than the work or study site - for example, shade or air-conditioned rooms and vehicles.
  - Fluid replacement guidelines.
  - How to provide aid to those suffering from heat related illness.
  - Procedures for contacting emergency medical services.

### 7. SAFE WORK PRACTICES

- 7.1. **Heat Acclimatization** - Heat acclimatization should be implemented for the following people and conditions:
- 7.1.1. People newly tasked to work or study in hot locations.
  - 7.1.2. People returning to work or study at a hot location after being away a week or more at a cooler location.
  - 7.1.3. When temperatures first begin to increase in the spring or early summer.
  - 7.1.4. Whenever the weather is significantly warmer than on previous days.
  - 7.1.5. People newly required to wear additional clothing including chemical protective clothing and personal protective equipment (e.g., waterproof aprons, surgical gowns, surgical caps, respirators, face shields, boots, and gloves).
  - 7.1.6. People required to perform tasks that are more physically demanding than to what they are accustomed.
- 7.2. **Acclimatization Process** - People should reduce the duration of their work in hot conditions but not the intensity of the work. The following schedule shall be implemented:
- 7.2.1. First day – New people should only work 20 percent of the normal duration within the hot environment.
  - 7.2.2. Additional Days – Increase work duration in the hot environment by 20 percent each day until performing the normal schedule.

This system should bring most people up to their normal operating schedule within one week. Some people with personal risk factors may require an additional week to fully acclimatize. People should be monitored closely during the acclimatization period to ensure the working durations are set properly.

7.3. **Clothing**

Loose fitting, light-colored breathable clothing (cotton) is recommended. A wide brimmed breathable hat can provide additional protection by providing shade.

7.4. **Heat Assessment Methods** – There are numerous methods available to complete heat assessments. EHRS recommends using one of the three methods covered below to characterize the work/study environment. Preference should be given to the WBGT method.

7.4.1. **Wet Bulb Globe Temperature (WBGT)** - WBGT is the most accurate method for heat assessments since it factors in radiant heat and direct sunlight. EHRS can complete WBGT studies by request. EHRS recommends that groups who routinely complete tasks in warm environments, especially in variable outdoor conditions, purchase a WBGT instrument to allow assessment and monitoring of conditions in real time.

7.4.2. **Calculation of Heat Index using NOAA Heat Index Chart** - This method can be used when the temperature and relative humidity in the location are known and a WBGT instrument is not available. **Caution: values on the chart reflect conditions in the shade. Direct sunlight can increase the Heat Index by up to 13.5°F.**

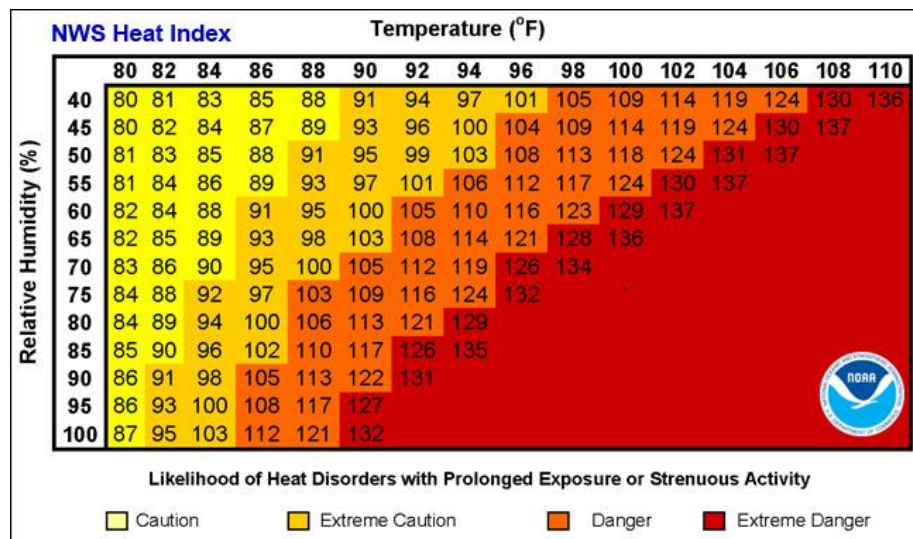


Figure 1 – NOAA Heat Index Chart

- 7.4.3. NIOSH Heat Index App - The app uses your location and provides instant information on current conditions. The app also provides an hour by hour forecast of conditions and information on symptoms and first aid. A link to download the app for IOS and Android devices is included in the resources section of this program. **Caution: values shown in the app reflect conditions in the shade. Direct sunlight can increase the Heat Index by up to 13.5°F.**



Figure 2 – NIOSH Heat App

7.5. Application of Heat Index Values to Implement Safe Work Practices

- 7.5.1. Risk Levels and Associated Protective Measures - Use the information in the tables below to assist with implementation of safe work practices to best protect personnel.

*Note: The heat index/risk level values listed in the tables below are more conservative than those listed in the NOAA table above. The information in the tables below is targeted more specifically to work situations whereas the NOAA table is not.*

Heat Index	Risk Level	Protective Measures
< 91°F	Lower (Caution)	<ul style="list-style-type: none"> <li>• Work within all metabolic rates can proceed with increased caution exercised for the heavy and very heavy rates.</li> <li>• Provide drinking water.</li> <li>• Ensure that adequate medical services are available.</li> <li>• Plan for times when the heat index is higher, including heat safety training.</li> <li>• Encourage people to wear sunscreen.</li> </ul> <p>If people must wear heavy protective clothing, perform strenuous activity, or work in the direct sun, additional precautions are recommended to protect them from heat-related illness.</p>

Heat Index	Risk Level	Protective Measures
91°F to 103°F	Moderate	<p>In addition to the steps listed above:</p> <ul style="list-style-type: none"> <li>• Remind people to drink water often (about four cups per hour).</li> <li>• Review heat-related illness topics including how to recognize heat-related illness, how to prevent illness, and what to do if someone gets sick.</li> <li>• Limit tasks to those that can be completed within the light to moderate metabolic rates.</li> <li>• Schedule frequent breaks in a cool, shaded area.</li> <li>• Acclimatize personnel working in hot environments.</li> <li>• Through close supervision or implementation of a buddy system, monitor personnel for signs of heat-related illness.</li> </ul> <p>If personnel must wear heavy protective clothing, perform strenuous activity, or work in the direct sun, additional precautions are recommended to prevent heat-related illness</p>

Heat Index	Risk Level	Protective Measures
103°F to 115°F	High	<p>In addition to the steps listed above:</p> <ul style="list-style-type: none"> <li>• Alert personnel of high-risk conditions.</li> <li>• Actively urge personnel to drink plenty of water (about four cups per hour).</li> <li>• Limit physical exertion to be predominantly within the light metabolic rate. Use engineering controls to maintain lower metabolic rate.</li> <li>• Have a knowledgeable person at the worksite who is well-informed about heat-related illness and able to determine appropriate work/rest schedules.</li> <li>• Adjust work activities (e.g., reschedule work, adjust pace, rotate jobs).</li> <li>• Use cooling techniques.</li> <li>• Monitor and always maintain communications with personnel.</li> </ul> <p>When possible, reschedule activities to a time when heat index is lower.</p>

Heat Index	Risk Level	Protective Measures
>115°F	Very High to Extreme	<p>Reschedule non-essential activity for days with a reduced heat index or to a time when the heat index is lower.</p> <p>Move essential work tasks to the coolest part of the work shift; consider earlier start times, split shifts, or evening and night shifts. Strenuous work tasks and those requiring the use of heavy or non-breathable clothing or impermeable chemical protection clothing should not be completed when the heat index is at or above 115°F</p> <p>If essential work must be completed, in addition to the steps listed above:</p> <ul style="list-style-type: none"> <li>• Alert personnel of extreme heat hazards.</li> <li>• Establish water/electrolyte drinking schedule (about four cups per hour).</li> <li>• Develop and enforce protective work/rest schedules.</li> <li>• Conduct physiological monitoring (e.g., pulse, temperature, etc.).</li> <li>• Stop work if essential control methods are inadequate or unavailable.</li> </ul>



- 7.6. **Engineering Controls** - Where possible, implement the following engineering controls to reduce heat stress:
- 7.6.1. Provide shade by use of portable canopy or umbrella, etc.
  - 7.6.2. Air conditioning.
  - 7.6.3. Cooling fans.
  - 7.6.4. Misting fans that produce a spray of fine water droplets.
  - 7.6.5. Increased general ventilation.
  - 7.6.6. Local exhaust ventilation at point of high heat production or moisture.
  - 7.6.7. Insulation on hot surfaces.
  - 7.6.8. Elimination of steam leaks.
  - 7.6.9. Use of mechanical equipment to reduce manual work (forklifts, riding vs. push mowers, etc.).
- 7.7. **Administrative Controls** - Implement the following administrative controls:
- 7.7.1. **Supervision and Buddy System** – Implement close supervision and/or a buddy system where personnel can watch out for one another and identify onset of heat illness symptoms.
  - 7.7.2. **Hydration**: Provide cool water to those working in hot environments to maintain adequate hydration.
    - 7.7.2.1. **Water** - Drink at least 8-ounces of water every 15 to 20 minutes regardless of thirst.
    - 7.7.2.2. **Electrolyte Drinks** – In higher heat stress environments, having electrolyte drinks available in addition to water is recommended.
  - 7.7.3. **Rest Breaks** - Mandatory breaks should be prescribed in a cooler environment (such as a shady location or an air-conditioned building or vehicle). The duration of the rest breaks should increase as heat stress rises. See Appendix 3 for an example work/rest schedule.

## 8. SYMPTOMS AND CARE

- 8.1. **Personal Risk Factors** – Personal risk factors must be assessed and considered when assigning tasks in hot environments. Some people tolerate heat stress less effectively than others. Heat intolerance happens for a variety of reasons. Personal risk factors include the following:
- Obesity (body mass index greater than or equal to 30).
  - Diabetes
  - High blood pressure.
  - Heart disease.
  - Lower level of physical fitness.
  - Use of certain medications such as diuretics (water pills) and some psychiatric or blood pressure medications.
  - Some medications can result in a person's inability to feel heat conditions and/or the ability to sweat, so symptoms of heat stress may not be evident.
  - Alcohol use.
  - Use of illicit drugs such as opioids, methamphetamine, or cocaine.

### 8.2. **Heat Exhaustion Symptoms and Care**

#### 8.2.1. **Symptoms:**

- Heavy sweating
- Thirst
- Cold, pale, and clammy skin
- Rapid, weak pulse
- Nausea or vomiting
- Muscle cramps
- Tiredness or weakness
- Dizziness/light headedness
- Headache
- Decreased and darker color urine

8.2.2. **What to do** - Move person to a cool place, loosen or remove clothing, including shoes and socks, place cool, wet compresses on the head, neck, and face or take a cool bath or shower. Sip cool water or electrolyte replacement drink. Seek medical help right away if vomiting, symptoms worsen or symptoms last longer than 1-hour.

### 8.3. **Heat Stroke Symptoms and Care**

#### 8.3.1. **Symptoms:**

- High body temperature (103°F or higher)
- Hot, red, dry skin or profuse sweating
- Fast, strong pulse
- Headache
- Dizziness
- Nausea
- Confusion
- Fainting

8.3.2. **What to do** – **Call emergency services right away.** Heat stroke is a medical emergency. Move the person to a cooler place and help lower their body temperature through loosening or removal of clothing, including shoes and socks. Wet the person with cool water and circulate the air to speed cooling. Place wet cloth or ice all over the body or soak the person's clothing with cool water. Do not give the person anything to drink. Remain with the person until help arrives.

### 8.4. **Medical Care and Reporting**

8.4.1. **Main Campus Emergency** - Contact PennComm at 511 from a campus phone or (215) 573-3333 from a cell phone to request an ambulance.

8.4.1.1. For non-emergency situations:

- **Faculty and Staff** - Visit Occupational Medicine located at HUP - 3400 Spruce Street - Ravdin Building 2<sup>nd</sup> floor during normal work hours or the HUP emergency department located in the Pavilion at 1 Convention Avenue, after hours.

- Students - Visit Student Health Services located at 3535 Market Street during normal business hours or the HUP emergency department located at the Pavilion at 1 Convention Avenue after hours.
- 8.4.2. Morris Arboretum Emergency – For emergency, call 911. For less severe cases, transport to Chestnut Hill Hospital located at 8835 Germantown Ave, Philadelphia.
- 8.4.3. New Bolton Center Emergency – For emergency, call 911. For less severe cases, transport to Chester County Hospital at 701 East Marshall Street, West Chester.
- 8.4.4. Other off Campus Location – Call 911. Preplan when traveling to ensure there is cell phone signal or other means to summon help. Identify availability and contact information for emergency services at the beginning of the trip.
- 8.5. **Injury/illness Reporting** - Notify EHRs of all cases of heat illness. Heat illness requiring medical treatment must be reported to EHRs at 215-898-4453 as soon as possible.

### 9. RECORDKEEPING

- 9.1. EHRs shall maintain heat assessments and job safety analysis (JSA) forms.
- 9.2. Managers and Supervisors shall maintain copies of JSA forms that define task specific safety requirements, including those related to heat stress.
- 9.3. EHRs/Workday system shall maintain training records of any EHRs-coordinated training.

### 10. REFERENCES/RESOURCES

- 10.1. OSHA Heat Illness Prevention Information - <https://www.osha.gov/heat> Includes heat illness general education, employer responsibilities and information for workers. Includes helpful posters in English and Spanish.
- 10.2. Centers for Disease Control and Prevention (CDC) and National Institute for Occupational Safety and Health (NIOSH) Heat Stress Resources - <https://www.cdc.gov/niosh/topics/heatstress/default.html>
- 10.3. NIOSH Heat Index Tool App – Easy to use App that uses location to calculate heat index based on local temperature and humidity and provides a graphic indication of current conditions including Caution, Warning and Danger. Also provides hourly forecast and information on Heat Illness Symptoms and First Aid. Free download.



## 11. APPENDIX 1 CHECKLIST - PLANNING AHEAD for HOT WEATHER

Use the following checklists to prepare for hot weather and to make sure that all appropriate precautions are in place.

### PLANNING AHEAD for HOT WEATHER: EMPLOYER CHECKLIST

	Develop a list of hot weather supplies (e.g., water, shade devices, etc.). Estimate quantities that will be needed, and decide who will be responsible for obtaining and transporting supplies and checking that supplies are not running low.
	Create emergency action plan for heat-related illnesses (who will provide first aid and emergency services, if necessary).
	Develop acclimatization schedule for new workers or workers returning from absences longer than one week.
	Identify methods to gain real-time access to important weather forecast and advisory information from the National Weather Service and ensure the information is available at outdoor work sites (e.g., laptop computer, cell phone, other internet ready device, weather radio).
	Determine how weather information will be used to modify work schedules, increase the number of water and rest breaks or cease work early if necessary.
	Train workers on the risks presented by hot weather, how to identify heat-related illnesses, and the steps that will be taken to reduce the risk.
	Plan to have a knowledgeable person on the worksite who can develop and enforce work/rest schedules and conduct physiological monitoring, when necessary, at high and very high/extreme risk levels for heat-related illness.

## 12. APPENDIX 2 - DAILY CHECKLIST

### DAILY CHECKLIST

<b>Water</b>	Is there plenty of fresh, cool drinking water located as close as possible to the workers?	
	Are water coolers refilled throughout the day? (Has someone been designated to check and make sure water is not running low?)	
<b>Shade</b>	Is shade or air conditioning available for breaks and if workers need to recover?	
<b>Training</b>	Do workers know the:	
	Common signs and symptoms of heat-related illness?	
	Proper precautions to prevent heat-related illness?	
	Importance of acclimatization?	
	Importance of drinking water frequently (even when they are not thirsty)?	
	Steps to take if someone is having symptoms?	
<b>Emergencies</b>	Does everyone know who to notify if there is an emergency?	
	Can workers explain their location if they need to call an ambulance?	
	Does everyone know who will provide first aid?	
<b>Knowledgeable Person</b>	For high and very high/extreme heat index risk levels, is there a knowledgeable person at the worksite who is well-informed about heat-related illness and able to determine appropriate work/rest schedules and can conduct physiological monitoring as necessary?	
<b>Physiological Monitoring</b>	Are workers in the high or very high/extreme heat index risk levels being physiologically monitored as necessary?	
<b>Worker Reminders</b>	Drink water often	
	Rest in shade or in air-conditioned space or vehicle.	
	Report heat-related symptoms early.	

## 13. APPENDIX 3 - EXAMPLE WORK/REST SCHEDULE

Use the following chart as a guide to set up work/rest schedules. Adjust temperature values in the chart with sunlight and humidity factors listed below. Assumptions: Workers are physically fit, well-rested, fully hydrated, under age 40 and environment has 30% humidity and perceptible air movement. Use metabolic work rate definitions in section 4 to help define work categories.

Temperature (°F)	Light Work Minutes Work/Rest	Moderate Work Minutes Work/Rest	Heavy Work Minutes Work/Rest
90	Normal	Normal	Normal
91	Normal	Normal	Normal
92	Normal	Normal	Normal
93	Normal	Normal	Normal
94	Normal	Normal	Normal
95	Normal	Normal	45/15
96	Normal	Normal	45/15
97	Normal	Normal	40/20
98	Normal	Normal	35/25
99	Normal	Normal	35/25
100	Normal	45/15	30/30
101	Normal	40/20	30/30
102	Normal	35/25	25/35
103	Normal	30/30	20/40
104	Normal	30/30	20/40
105	Normal	25/35	15/45
106	45/15	20/40	Caution
107	40/20	15/45	Caution
108	35/25	Caution	Caution
109	30/30	Caution	Caution
110	15/45	Caution	Caution
>110	Caution	Caution	Caution

**Adjustments: Add for the following environmental and humidity conditions:**

**Full Sun (No clouds):** Add 13 °F

**Partly cloudy/overcast:** Add 7 °F

**No Shadows visible, in the shade, or at night:** No Adjustment

**Humidity:** 40% - Add 3 °F

50% - Add 6 °F

60% - Add 9 °F

**Example:** Conditions - 90 °F, partly cloudy skies and 50 % humidity. Add 7°F for partly cloudy, and 6 °F for 50% humidity to arrive at 103 °F value.