



BUILDING BLOCKS FOR A HEAT STRESS PREVENTION TRAINING PROGRAM

Purpose

This is a useful resource for identifying and implementing steps needed to reduce the risk of heat stress for workers in indoor and outdoor environments. Workers involved in disaster response and recovery, construction, transportation, agriculture, and many other jobs are vulnerable to the impacts of heat stress.

This document builds on information in existing tools, such as the [Occupational Safety and Health Administration \(OSHA\) and National Institute for Occupational Safety and Health \(NIOSH\) Heat Safety Tool App](#).




Organized into five sections and an Appendix, this document includes a glossary of terms and several helpful resources from federal agencies and nonprofit organizations.

HOW TO USE THIS DOCUMENT

- For questions that are answered with “yes,” make note with a check mark in the box.
- For questions that are answered with “no,” leave it blank.
- At the end (after reviewing each section), look over the items that have check marks or have been left blank.
- Use this as an opportunity to discuss what next steps and strategies are needed to better protect workers from heat stress on the job.

Know the Signs and Symptoms of Heat Illnesses and Injuries

Heat stress is the total heat load a worker is exposed to during work. Heat stress can lead to many related injuries and illnesses, such as heat exhaustion, heat stroke, and more. There are many factors that can contribute to heat stress, including physical exertion, environmental factors, poor ventilation, clothing, and personal protective equipment (PPE). Heat stress is a major concern during disaster response and cleanup efforts, and workers may be exposed to high temperatures in indoor and outdoor settings.

Symptoms/How It Shows Up	How to Respond
Heat Cramps	
Muscle pain or spasms in abdomen, arms, and legs. 	<ul style="list-style-type: none"> • Stop what you are doing, move to shade. • Drink water with a bit of salt, or a sports drink (especially if you have not eaten anything containing salt).
Heat Exhaustion	
Dizziness, headaches, nausea, weakness, clumsy or unsteady walk, muscle cramps. 	<ul style="list-style-type: none"> • Rest in shade away from any chemical exposures. • Remove PPE to reduce heat burden. • Consider other cooling techniques such as the Tarp Assisted Cooling and Convection Method.* • Seek medical treatment if condition worsens or does not improve within 30 minutes. • Drink up to 64 ounces, or 2 quarts, of water in an hour.
Heat Stroke: Medical Emergency	
Convulsions and chills, vomiting, confusion and mumbling, combative (angry or aggressive) behavior, passing out. 	<ul style="list-style-type: none"> • Cool victim and call emergency services ASAP! • Remove victim’s excess clothing. • Cool rapidly by plunging victim in ice bath. • Continue cooling victim while waiting for emergency services and during transport, if still present with victim.

***The Tarp-Assisted Cooling and Convection, or TACC, method,** is a method in which a potential heat stroke victim is treated with a combination of ice and cold water. The victim is placed on a tarp filled with ice and water, with the edges held up by co-workers to create a physical “wrap” to encase the victim within the tarp.

TIPS FOR PREVENTING HEAT ILLNESS

Heat-related illnesses can be prevented.



Hydrate before, during, and after work. Drink 1 cup of cool water every 20 minutes, even if you aren't thirsty. For longer jobs, drinks with electrolytes are best. Avoid energy drinks and alcohol.



Find shade or a cool area for rest breaks that allow your body to recover.



Dress for the heat. A hat and light-colored, loose-fitting (where allowed), breathable clothing are ideal.



If wearing a face covering, change it if it becomes wet or soiled. Check on others verbally and often.



Understand personal risk factors. Not everyone tolerates heat the same way.



Understand engineering controls, work practices, and PPE.



Urine Chart: How to Determine If Your Body Needs Water or Electrolytes



Needs Electrolytes!



Well-Hydrated



Hydrated



**Dehydrated!
DRINK WATER!**



**SEVERELY DEHYDRATED!
DRINK WATER ASAP!**

Section 1

How Hot Is It?

This section helps identify workplace protocols for determining heat stress on the job, both indoors and outdoors.

Has the workplace or employer performed a Heat Job Hazard or Task Hazard Analysis for each position and for key work tasks?

Has the supervisor or manager checked the weather and the National Weather Services' [Heat Index](#) before workers start their tasks, and established rest periods throughout the day?

Likelihood of Heat Disorders with Prolonged Exposure or Strenuous Activity

- Caution
- Extreme Caution
- Danger
- Extreme Danger

NWS Heat Index		Temperature (°F)															
Relative Humidity (%)		80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
	40	80	81	83	85	88	91	94	97	101	106	109	114	119	124	130	136
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137		
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137			
55	81	84	86	89	93	97	101	106	112	117	124	130	137				
60	82	84	88	91	95	100	105	110	116	123	129	137					
65	82	85	89	93	98	103	108	114	121	128	136						
70	83	86	90	95	100	105	112	119	126	134							
75	84	88	92	97	103	109	116	124	132								
80	84	89	94	100	106	113	121	129									
85	85	90	96	102	110	117	126	135									
90	86	91	98	105	113	122	131										
95	86	93	100	108	117	127											
100	87	95	103	112	121	132											

Figure 1. Heat Index Table is the “what it feels like” temperature on people’s weather apps. (Credit: National Weather Service)

Has the supervisor or manager checked the [Wet Bulb Globe Temperature](#) for the day?

Does the workplace have a plan in place to determine heat stress?

- If yes, are they using the [wet bulb globe temperature](#) (as well as considering how heavy and non-breathable a worker’s work attire is)?
- Has the workplace accounted for the heat added by PPE and the uniform a worker needs to wear?
- Does the heat hazard exceed the Threshold Limit Values and Action Limit for heat stress exposure based on a worker’s tasks for the day? (See Appendix for more information about Threshold Limit Values).



Figure 2. An example of a Wet Bulb Globe Thermometer. According to the Occupational Safety and Health Administration (OSHA), this [forecast](#) tool has proven to be an [effective indicator](#) of heat stress on the human body.

(Photo credit: [OSHA](#))

SECTION 1 TERMS AND DEFINITIONS

- **Heat Index** is a measurement that only accounts for temperature and humidity, and is calculated for shady areas (National Weather Service).
- **Heat Stress** is the total heat load a worker is exposed to during work. Physical exertion, environmental factors, and clothing worn, all contribute to heat stress.
- **Job/Activity Hazard Analysis** is the process of assessing how hazardous work tasks are and choosing how to address them to minimize risk. The process includes evaluation of the task, affected workers, tools, materials, and equipment, and identification of appropriate hazard controls.
- **Personal Protective Equipment (PPE)** is equipment worn to minimize exposure to hazards that cause serious workplace injuries and illnesses (Source: OSHA).
- **Wet Bulb Globe Temperature (WBGT)** is a measurement of the heat stress in direct sunlight, which accounts for temperature, humidity, wind speed, sun angle, and cloud cover (solar radiation).

Section 2

Building a Foundation for Heat Stress Management and Heat Illness Prevention

This section helps identify what training, resources, and approaches are necessary to create a complete heat stress management program.

- Does the workplace have a heat stress management program?
 - If so, have workers been provided a copy of the heat stress management program document or been informed of where they can easily access it during their shift?
- Have workers been trained to understand guidelines for those workers who are particularly vulnerable to the effects of heat stress (e.g. pregnant women), how to recognize and respond to symptoms of heat illness, and how to protect themselves and their coworkers in the workplace?
- Have workers been trained to properly hydrate in hot weather and been provided with enough clean, safe drinking water and electrolyte supplements (e.g. sports drinks) for proper hydration to make it through their work shift? (Note: The Centers for Disease Control and Prevention recommends drinking 4 cups (32 ounces) of water every hour when working in the heat, which adds up to 8 liters or 2 gallons of water for 8 hours).

- Are required cooling breaks built into workers' schedules?



- Do workers have access to bathrooms?
- Do workers have enough time to take breaks and are not given incentives to work through their breaks? (e.g., a production quota)
- Is there a workplace acclimatization (i.e., a weather/temperature adjustment) plan or program to help workers adjust to the heat stress?
 - Is the acclimatization period 7-14 days?
 - Does the plan require supervisors to monitor workers for symptoms of heat-related illness and injury?
 - Is there a plan in place for workers returning from extended leave?
 - Is there a plan in place for unacclimatized workers to have an adjusted rest schedule so they can properly acclimatize?
- Has the employer created a buddy system so workers can keep an eye on each other for signs of heat-related illness or injury?

SECTION 2 TERMS AND DEFINITIONS

- **Acclimatization** is the process of becoming accustomed to new work conditions. An effective heat acclimatization program increases the time each day, over a 7-to-14-day period, that an unacclimatized worker is exposed to heat stress while the worker conducts normal work activities. Also, acclimatized workers who are not exposed to heat stress for a week or more may need some time to re-acclimatize — typically two or three days.
- **The Buddy System** is a type of safety practice where workers are paired up to help monitor each other's safety and health throughout their shift.
- **Electrolytes** are minerals people need in their diet, such as sodium/salt, potassium, magnesium, and calcium. These minerals play a role in keeping the body properly hydrated.

HEAT STRESS Risk Factors

Workers should be aware of the many factors that can impact the risk of heat illness.

▶ ENVIRONMENT

- High temperatures, especially with high humidity, which makes sweating less effective.
- Direct sun exposure.
- Lack of wind or breeze to cool the body; however, when ambient conditions are higher than body temperature, warm airflow can actually increase heat gain.
- Proximity to engines or other hot equipment.



▶ ACTIVITIES

- High physical demand on body.
- Not enough rest breaks.
- Repeated days in the heat performing physically demanding or difficult activities.
- High motivation to push through discomfort from heat strain.



▶ NO ACCLIMATIZATION

- New workers.
- Experienced workers returning from time away from the heat.
- Acclimatized workers who experience a sudden change in worksite temperature, such as heat waves or mining in a new area.



▶ MEDICATIONS

Heat tolerance can be affected by medications taken for:

- Cold, allergies, and congestion.
- Muscle spasms.
- High blood pressure.
- Urine production (diuretics).
- Diarrhea.
- Dizziness/vertigo.
- Psychosis.
- Depression.



▶ HEALTH CONDITIONS

- Short-term illnesses, such as diarrhea, vomiting, or respiratory infections.
- Chronic conditions, such as diabetes and heart disease.
- Being overweight or obese.
- Poor physical fitness.



▶ PRIOR HEAT ILLNESS

- Illness increases the risk of heat illness in the future.



▶ DEHYDRATION

- One of the most important risk factors.



▶ OTHER FACTORS

- Age over 60.
- Non-breathable clothing or PPE.
- Alcohol use in the past 24 hours.



Source: [NIOSH](#)



A worker may be affected by many risk factors at the same time. Workers should talk to a healthcare provider about their personal risk factors.

Section 3

How Is Heat Controlled in/at the Workplace?

This section helps identify and understand how heat stress is controlled or addressed in the workplace.

- What workplace controls are in place to minimize the risk of heat stress? (for example: ventilation or cooling fans, mandated cooling breaks, reflective shields to redirect sunlight).
- Does the worksite have clearly designated cool-down areas?
 - Are these areas readily accessible and free of hazards?



- Have workplace schedules been adjusted and/or task rotations been established to reduce heat stress when temperatures are above the Threshold Limit Values (TLV) recommendations listed in the Appendix?
- Can workplace schedules or protocols be adjusted to factor in temperatures that are above the TLV action limits?
- Have workers been authorized to take hydration breaks as needed? Have workers been instructed to follow science-based work-rest guidelines on heat hazard severity?

- Have workers been trained to use cooling vests, shades (for example: umbrella or tents), and other equipment and tools to reduce core body temperature?
- INDOOR-SPECIFIC:** Has the ventilation system been maintained to keep indoor temperatures at a safe level to prevent risk of heat stress for workers?



- INDOOR-SPECIFIC:** Has the employer installed physical barriers to help shield workers from excess heat caused by hot work? (For example: open flames, hot kettles).

SECTION 3 TERMS AND DEFINITIONS

- **The Buddy System** is a type of safety practice where workers are paired up to help monitor each other's safety and health throughout their shift.
- **Hot Work** is work involving electric or gas welding, cutting, or brazing, or flame- or spark-producing operations.

Section 4

What Makes Heat Stress Worse?

This section helps identify what factors make heat stress worse.

Some PPE can increase heat stress if it is not made of breathable fabric or it makes breathing difficult. Have workers been provided with less obstructive PPE to reduce the risk of heat injury/illness?

Air pollution makes heat stress symptoms worse, as it effects the worker's ability to breathe and more. Does the worksite have an indoor/ outdoor air monitoring program to limit exposure to hazardous air pollution?

Have workers and volunteers been made aware of this resource?

If the program has not been established, are workers aware of where they can go to access this information? (e.g. [AirNow.gov](https://www.airnow.gov), [EPA](https://www.epa.gov), or [NWS](https://www.nws.gov))

Have workers been trained on personal risk or vulnerability to heat stress caused by medication, pre-existing health history, fitness level, and other personal traits, illnesses, injuries, or characteristics?

Are there established, reasonable productivity goals and resources provided to workers to ensure they are not incentivized to avoid cool-down breaks or take unnecessary risks to reach productivity goals?

Are there unnecessary burdens that workers struggle with in the workplace that could contribute to excess work, such as equipment or maintenance failures that make equipment more difficult to operate?

SECTION 4 TERMS AND DEFINITIONS

- **Personal Protective Equipment (PPE)** is equipment worn to minimize exposure to hazards that cause serious workplace injuries and illnesses (Source: [OSHA](https://www.osha-slc.gov)).
- **Less or Non-Obstructive PPE** is equipment that does not place a significant burden on the worker (e.g., prevent, slow down, or put worker at risk due to its size, difficulty to handle, or apply).



Section 5

Approaches to Ensure Workers' Rights

This section helps identify what rights workers have, and what resources are available to help improve worker power in the workplace. (See Appendix for more information and resources related to Workers' Rights).

Has the employer, supervisor, or manager made workers aware of their right to a workplace free of recognized hazards (General Duty Clause), and that it is illegal to retaliate against workers if they report a hazard in the workplace?

Has the employer, supervisor, or manager alerted workers to their state's regulations regarding heat stress management?

Does the worksite have an established workplace/community benefit agreement, or any other agreement, in which health and safety protocols have been established between the employer and the workers and/or community?

Has the employer or contractor made heat stress management resources, such as those listed in this document, readily available to all workers regardless of their employment or citizenship status?

Is there a physical and/or digital copy that workers can access easily?

Is there a workplace health and safety committee that includes key stakeholders, such as workers, with equitable power and authority to develop a heat stress management program?

SECTION 5 TERMS AND DEFINITIONS

- **The General Duty Clause** is a section of the Occupational Safety and Health Act of 1970 that legally requires employers to provide employees with employment and a workplace that are free from recognized hazards and to comply with occupational safety and health standards. This applies to undocumented and contract workers ([OSHA](#)).
- **A Community or Workplace Benefit Agreement** is a written agreement between community members, workers, and/or a representative organization (e.g. a labor union), and the employer or contractor. Within the agreement are established plans and provisions to ensure the target audience receives key benefits that have been negotiated, such as health and safety requirements or restrictions (e.g. restricting chemicals from being used by workers due to their toxic/hazardous properties).



Threshold Limit Values

Threshold Limit Values (TLVs) are health-based values supported by scientific research. These TLVs suggest that most healthy workers who are exposed at or below the level of a TLV will not have an unreasonable risk of disease or injury. In other words, these workers will show no to minor symptoms if a hazard does not exceed a corresponding TLV (in this case, a heat level or temperature reading). If these thresholds are exceeded, workers should refer to the [Heat Exposure Work/Rest and Water Consumption Table](#).

% Work	Workload			
	Light	Moderate	Heavy*	Very Heavy*
75-100% (Non-stop)	(87.8°F)	(82.4°F)	---	---
50-75%	(87.8°F)	(84.2°F)	(81.5°F)	---
25-50%	(89.6°F)	(86°F)	(84.2°F)	(82.4°F)
0-25%	(90.5°F)	(86°F)	(86.9°F)	(86°F)

Table 1. American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs). Source: ACGIH 2017 TLVs and Biological Exposure Indices (BEIs) – Used by [OSHA](#)

*Criteria values are not provided for Heavy/Very Heavy work for continuous and 25% rest because of the extreme physical strain. Extreme caution and protective measures should be used to keep workers safe. Detailed job hazard analyses and physiological monitoring should be used for these cases rather than these screening criteria. In other words, these criteria should be more protective even though direct guidance is not provided.

% Work	Workload			
	Light	Moderate	Heavy*	Very Heavy*
75-100% (Non-stop)	(82.4°F)	(77°F)	---	---
50-75%	(83.3°F)	(78.8°F)	(75.2°F)	---
25-50%	(85.1°F)	(80.6°F)	(77.9°F)	(76.1°F)
0-25%	(86°F)	(84.2°F)	(82.4°F)	(80.6°F)

Table 2. ACGIH Action Limits. Source: ACGIH 2017 TLVs and BEIs – Used by OSHA



Worker Rights

Federal law entitles workers to a safe workplace. Exposure to heat can cause illness and death. Workers should know their rights and what they can do to prevent heat illness.

When it comes to extreme heat at work, workers have the right to:

- Speak up about hazards without fear of retaliation. For more information on whistleblower protections, visit [OSHA's Whistleblower Protection Program website](#).
- Request an OSHA inspection and speak to OSHA inspectors.
- Report an injury or illness, and review and get copies of medical records from an employer.
- See the results of workplace examinations or tests taken to identify workplace hazards.
- For more information, visit the [OSHA Worker Rights and Protections page](#).

Employer Responsibilities

Under the Occupational Safety and Health Act, employers are responsible for providing workplaces free of known safety and health hazards.

This includes protecting workers from heat-related hazards. Here are some actions employers should take:

- Create a Heat Illness Prevention Plan.
- Provide training for workers, including supervisors, so they understand heat exposure risks, prevention actions, and first aid.
- Share all hazard-warning materials with workers so they understand the risks and what actions to take to prevent and treat heat stress. **These materials must be easily and readily accessible to workers.**

AS A WORKER YOU HAVE THE RIGHT TO:

- A safe and healthful workplace.
- Tools and equipment needed to do your job safely.
- Training in a language you understand.
- And more...

If you think your job is unsafe and you have questions, call OSHA.

It's confidential. We can help!

**1-800-321-OSHA (6742)
TTY 1-877-889-5627**



Source: [OSHA](#)



To access other relevant resources from the NIEHS Worker Training Program, visit the [Extreme Heat and Climate Resilience](#) page.

Additional Resources

- [Be Heat Smart! Your Outdoor Heat Safety Program | Washington State Department of Labor & Industries](#)
- [Climate and Health Outlook | U.S. Department of Health and Human Services \(HHS.gov\)](#)
- [Fired Up! Workers for Heat Justice | National Council for Occupational Safety and Health](#)
- [Heat | Migrant Clinicians Network](#)
- [Heat Hazards | CPWR – The Center for Construction Research and Training](#)
- [Heat Illness Prevention Campaign - Employer Responsibilities | Occupational Safety and Health Administration \(osha.gov\)](#)
- [Heat Illness Prevention Training | California Division of Occupational Safety and Health](#)
- [Heat Injury and Illness Prevention in Outdoor and Indoor Work Settings Rulemaking | Occupational Safety and Health Administration \(osha.gov\)](#)
- [Heat Illness Prevention Campaign - Information for Workers | Occupational Safety and Health Administration \(osha.gov\)](#)
- [Heat Overview: Working in Outdoor and Indoor Heat Environments | Occupational Safety and Health Administration \(osha.gov\)](#)
- [Heat Stress Guide | Occupational Safety and Health Administration \(osha.gov\)](#)
- [NWS HeatRisk Tool | The National Weather Service | National Oceanic and Atmospheric Administration \(noaa.gov\)](#)
- [Preventing Heat-Related Deaths in Construction: The Importance of Acclimatization | CPWR – The Center for Construction Research and Training](#)
- [Tools & Information | HEAT.gov - National Integrated Heat Health Information System](#)

