

# Update: ANSI/ASSP Standard to Protect Construction Workers from Heat Stress and Strain.

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# Disclaimer

Opinions expressed in this presentation are my own and do not represent those of Keene State College, OSHA, ANSI, or ASSP.

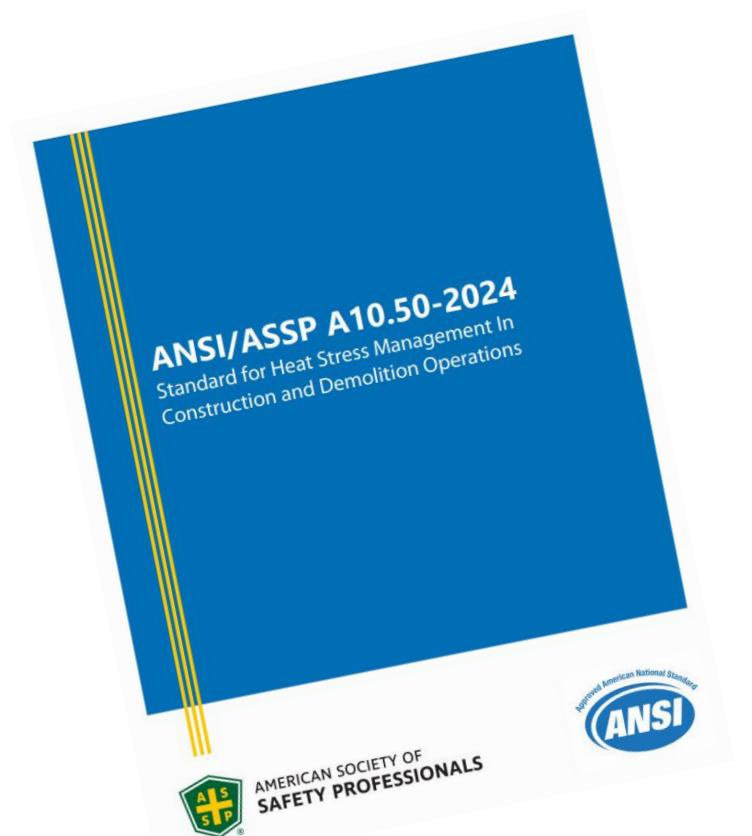
Mention of any product is for example only and does not constitute an endorsement.

# ANSI Standards

- Consensus Standard – A10 Committee - under the auspices of ASSP (American Society of Safety Professionals)
- Consensus “when substantial agreement has been reached directly and materially affected interests”
- A subcommittee (A10.50) of ~ 30 members charged with developing the document
- A10.50 was 3 years in the making and recently affirmatively voted by the A-10 Committee

# Why?

- To provide guidance for preventing the occurrence of heat strain
- No OSHA standard (several states have requirements although no two are the same)
- Significant interest by members of the ASSP
- Can adopt for uniformity



# Specifically

- To reduce the risk to workers of adverse effects from heat stress due to heat exposures in construction and demolition operations

## Specifically,

- to assist users in the signs and symptoms of heat related disorders
- to provide methods and strategies for reducing or eliminating worker's emergent heat-related disorders
- to provide help to establish training content

# Heat Stroke

## Classic vs. Exertional Heat Stress

### Classic

- Sedentary activity
- Ages: young children and elderly
- Underlying health issues
- Sweating usually absent

### Exertional

- Strenuous activity
- Ages: workers of all ages (and athletes)
- Healthy
- Sweating often present

# Heat stress determinants

Environmental heat

Metabolic Heat

Acclimatization status

Hydration status

## Elements that affects the ability of sweat to cool

Humidity

Wind / air velocity

Clothing/PPE with high vapor resistance and/or insulation

Personal factors

# Heat Stress Management Program – First Step.

- The written program should be developed in consultation with a “qualified person”
- Initiated prior to beginning work anticipated to greater than the initial trigger 70 WBGT (approximately 80° F Heat Index).
- An example of a heat stress management plan is found in the appendices





# Heat Stress Management Program - should include 11 elements:

- a. methods to **acclimatize workers** to heat stress environments
- b. methods to **assess workers' exposure** to heat stress
- c. requirements to **provide potable water** and electrolytes for employees involved with heavy work activities greater than 2 hours
- d. an **emergency action plan** for heat-related medical emergencies, including on-site first aid (including rapid cooling)
- e. requirements for **scheduled rest breaks**
- f. requirements for **shaded areas** where the workers can rest

# Heat Stress Management Program - should include

- g. identification **on-site controls** (engineering, administrative controls, and personal protective equipment)
- h. a method **for monitoring workers' heat strain** through means, such as the buddy system
- i. identification of **employee participation and responsibilities**
- j. heat stress **training**
- k. an annual **program review** and revision as necessary

# Acclimatization

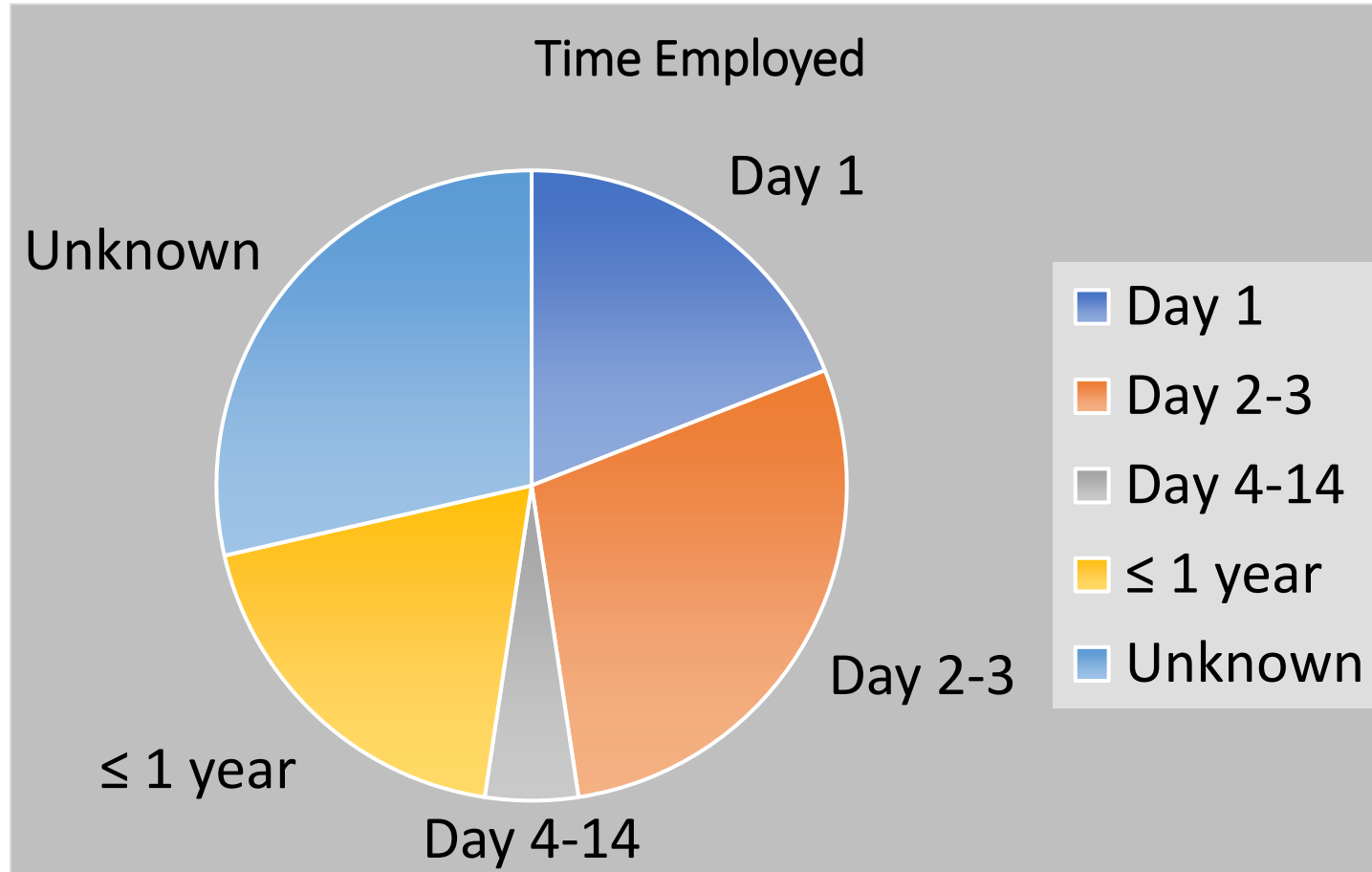
Employers shall determine employees' acclimatization status and take appropriate actions based on these ongoing assessments.

For employees who have not been acclimatized previously, initial acclimatization is needed.

For employees who have been acclimatized previously but have lost their acclimatization protection, re-acclimatization is needed.

**Note:** Some work covered by this standard may be performed on an emergency basis to benefit the public good. Employers with employees who will be performing emergency work to provide a public benefit may take alternative steps.

# Heat Illness and Fatality Cases Cited by OSHA 2012-2013

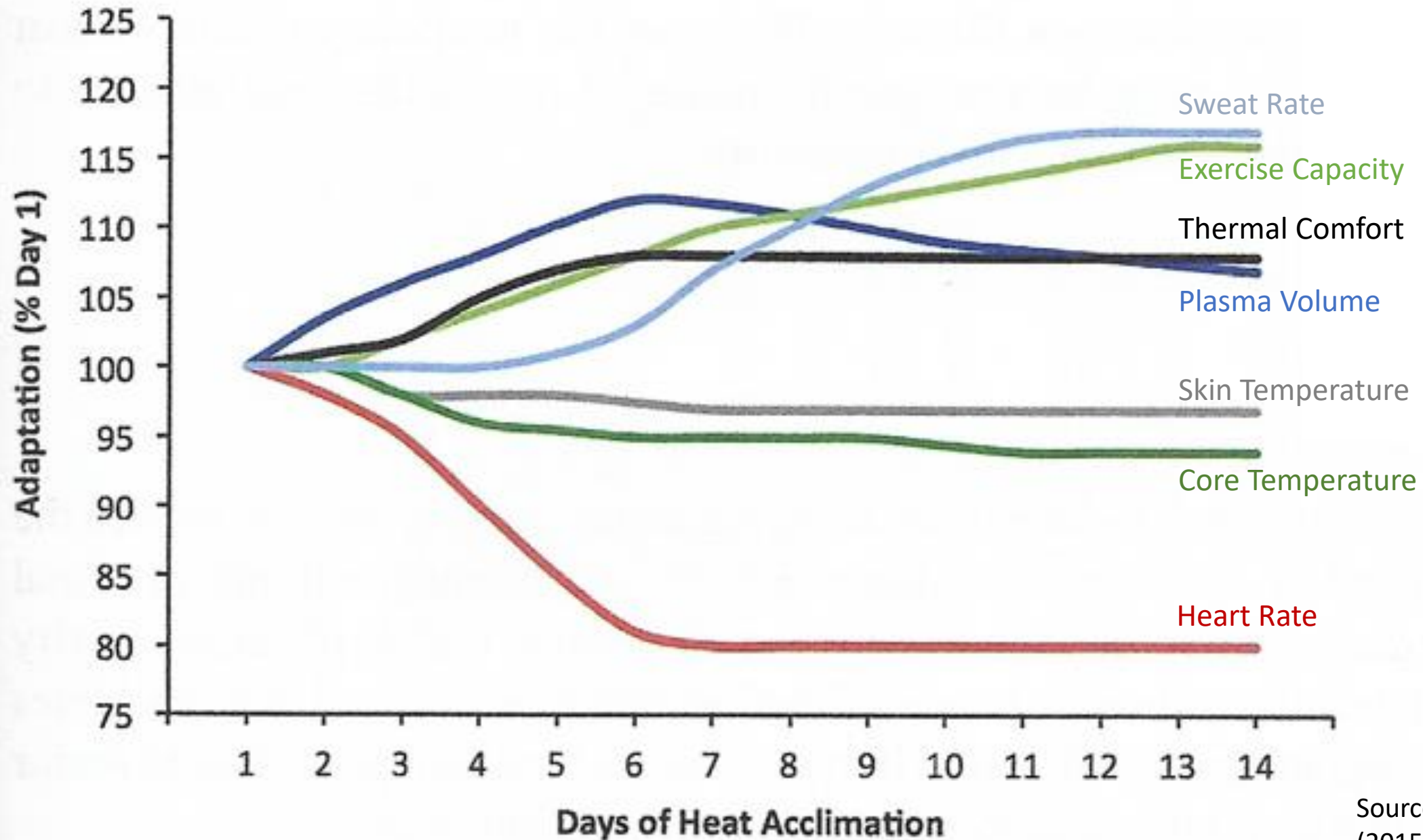


Data from Morbidity and  
Mortality Weekly Report  
August 8, 2014. Vol 63.No. 31

# Acclimatization

## The physiological adaptations include:

1. Increased sweating efficiency
  - earlier onset of sweating
  - greater sweat production
  - reduced electrolyte concentration in sweat
2. Stabilization of blood circulation
  - lower heart rate
  - better regulated blood pressure
3. Increased skin blood flow at a given core temperature.



Source: Periard, JD. et al. (2015).

# Acclimatization

New workers or existing workers facing a sudden large change in temperature, physical intensity or a new requirement for PPE/clothing that affects sweat evaporative cooling.

*Example*

Day Number	Percent of the Work Shift Spent Working in the Heat
1	20%
2	40%
3	60%
4	80%
5	100%

# Maintaining acclimatization

- Acclimatized workers can maintain their tolerance working 2 continuous hours in 5 of the last 7 days.
- There is noticeable loss of tolerance after 4 days of discontinued heat exposure and complete loss is apparent after 3 to 4 weeks.
- Re-acclimatization can be regained in 3 or 4 days.

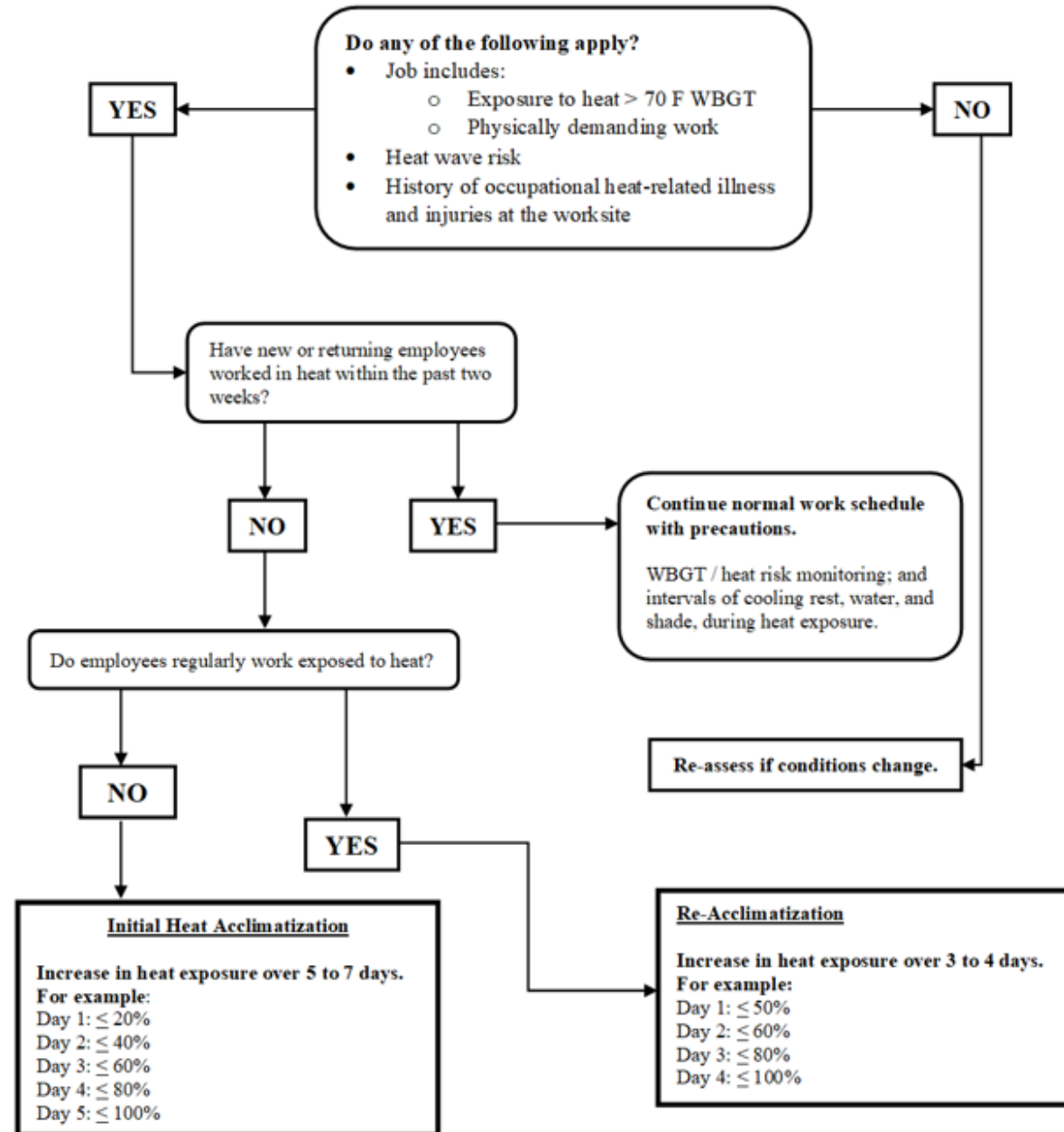
## Re-acclimatization example

Day #	Maximum percent of usual duration of work
Day 1	50%
Day 2	60%
Day 3	80%
Day 4	100%



Figure 1. When to Implement a Heat Acclimatization Program

Acclimatization information and decision flow chart provided

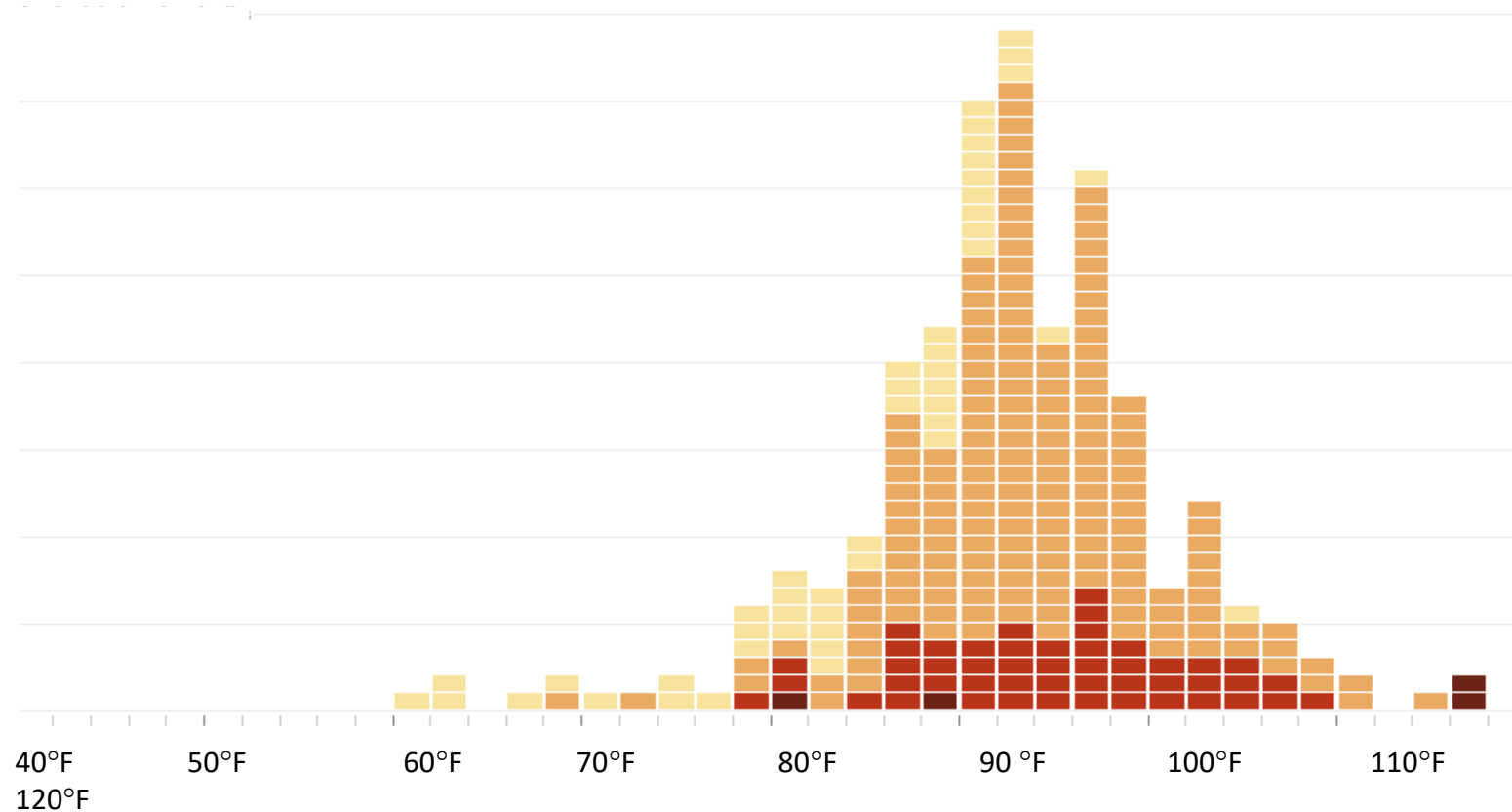
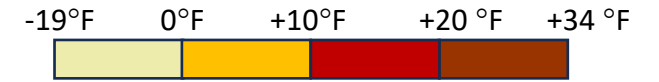


# Workplace Surveillance – Heat Risk Assessment

- Pre-task assessment
  - Before beginning work on any task with potential for heat stress
  - Daily, if anticipated to be greater than trigger level (*70 WBGT* or ~ Heat Index of 80°F)
  - Assessment conducted by a *competent* person
  - Keep written inventory of local conditions that affect or increase heat exposure
  - Checklist examples can be found in the appendices

# High temperature on day of death among 267 workers from heat-related causes in the US from 2010 to 2020

Difference from average high temperature



# Workplace Surveillance – Heat Risk Assessment

*If above the trigger, the assessment should include the following, if relevant:*

- ambient air temperature, direct sunlight, humidity, air movement (i.e., weather conditions)
- other sources of local heat exposure: ex. hot asphalt, space heaters, steam piping, urban island heat, etc.
- estimation of the physical intensity of the work
- situations where workers are working with limited rest breaks
- wearing extra clothing and/or personal protective equipment (PPE) that limits sweat evaporation and heat removal
- limited access to drinking water and electrolytes

# Workplace Surveillance – Environmental Assessment

Account for climatic factors including air temperature, humidity, air velocity, and radiant heat sources

- The standard recommends using Wet Bulb Globe Temperature (WBGT). This is a composite index made up of two or three temperatures.
- Allows for consideration metabolic heat sources and modification of heat transfer from the worker by *extra clothing* or certain PPE.

# Comparison between WBGT and Heat Index

Ability to account for:	WBGT	Heat Index
Measurements taken in the shade	✓	✓
Measurements taken in the sun	✓	
Ambient temperature	✓	✓
Relative humidity	✓	✓
Wind	✓	
Effects of cloud cover	✓	
Effects of sun angle	✓	
<i>This assessment can integrate:</i>		
Use of additional protective PPE/clothing	✓	
Metabolic heat load (i.e., work intensity)	✓	
Differences between acclimatized and unacclimatized workers	✓	

# Environmental heat stress measurement

## Option: 1 (Best) Measure with an instrument



- **Wet-Bulb Globe Temperature** (WBGT) is recommended to evaluate working conditions, including both environmental and “local sources”
- it is based on:
  - **dry bulb**
  - **natural wet bulb** and
  - **globe temperature.**
- Results from these two (or three) separate measurements are weighted and added according to formula that differ for **indoor** and **outdoor** work.
- The measuring device will integrate all these numbers into a single value.



[Home](#) / [Tools](#) / Wet Bulb Globe Temperature (WBGT) Tool

## Wet Bulb Globe Temperature (WBGT) Tool

[What is WBGT](#)

[How to measure WBGT](#)

[Understanding the Tool](#)

[FAQ](#)

[Contact Us](#)

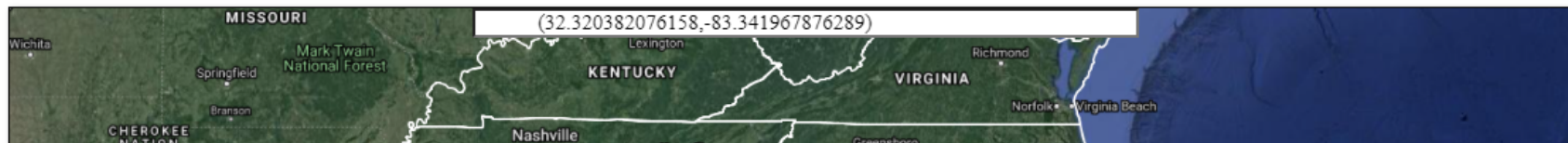
**1. Type your location/address in the white box or select a location within the southeast region on the map below.**

- NC, VA, SC, GA, FL, AL, MS, TN, KY

**2. Click the “Submit” button at the bottom of the map and scroll down the page to see the forecast.**

**If you would like to see an earlier forecast, select a model time in the white box (at the bottom) and click the “Submit” button.**

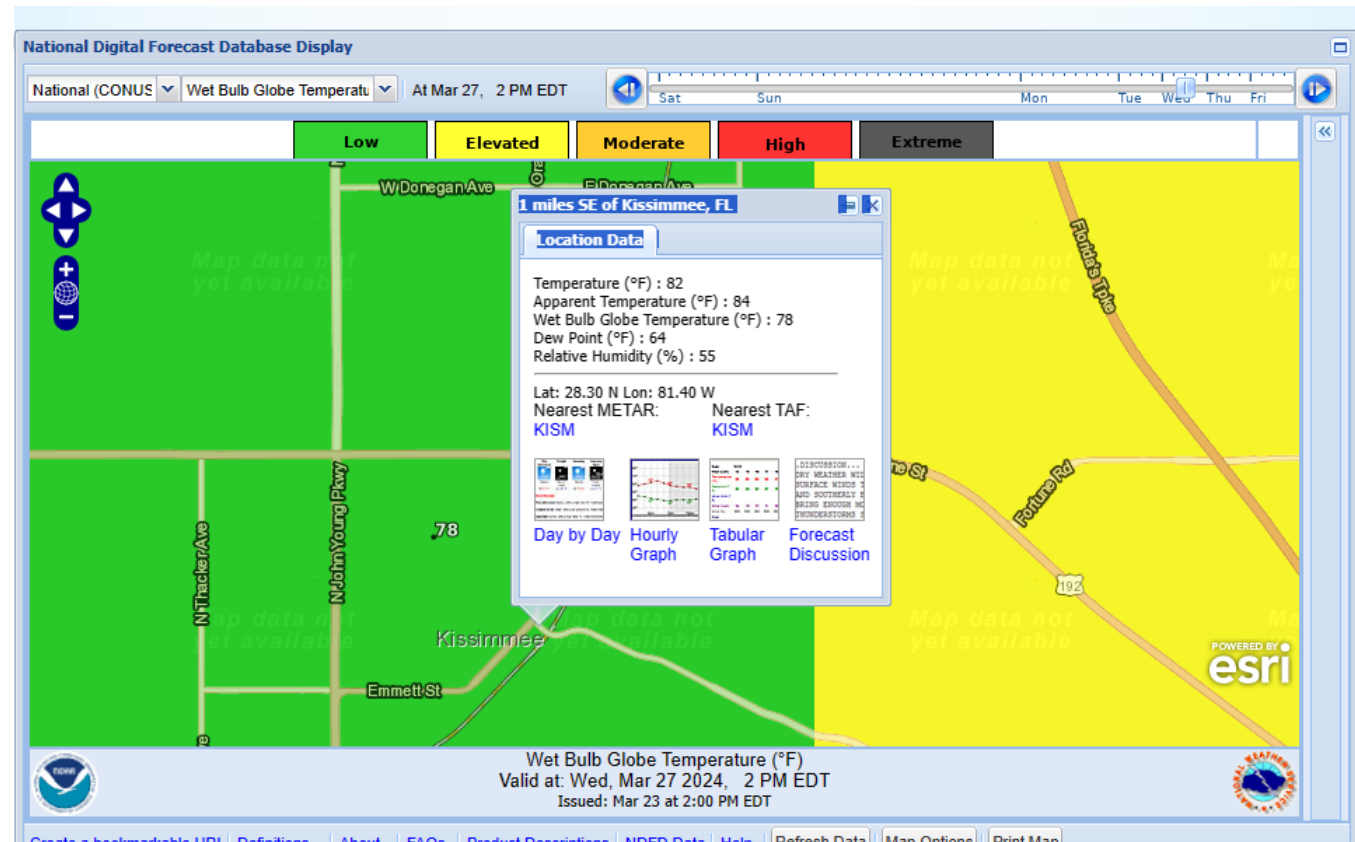
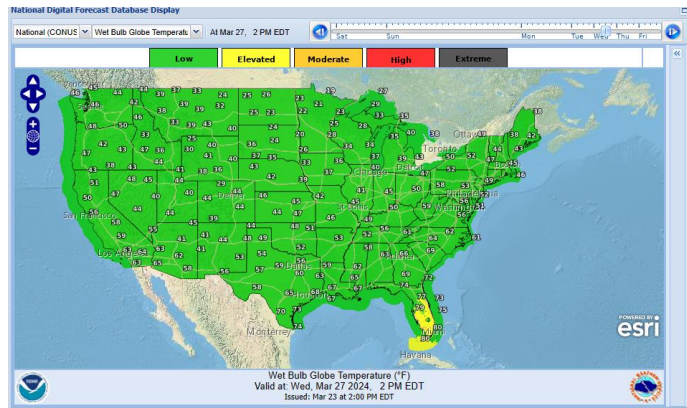
**3. Scroll further down the page to see the WBGT activity guidelines.**





# Environmental heat information source

- [National Weather Service - Graphical Forecast \(noaa.gov\)](https://www.noaa.gov)



# Assessment of clothing (examples)

Different ensembles are compared to a baseline of conventional work clothing typically consisting of long-sleeve shirt and pants.

Clothing Type	Addition to WBGT Index
Work clothes (long sleeve shirt and pants)	0
Woven cloth coveralls (assumes only modesty clothing underneath)	0
Non-woven SMS <sup>1</sup> coveralls as a single layer	0
Hood of any fabric with any clothing ensemble	1.8
Non-woven polyolefin coveralls as a single layer	3.6
Double layer of woven clothing	5.4
Vapor-barrier apron with long sleeves and long length over cloth-coveralls	7.2
Vapor-barrier over cloth coveralls, without hood	21.6
Full-face, negative pressure respirator <sup>2</sup>	0

**Add the effect of clothing to the ambient WBGT to create a  $WBGT_{clo}$**

# Estimating Metabolic Heat

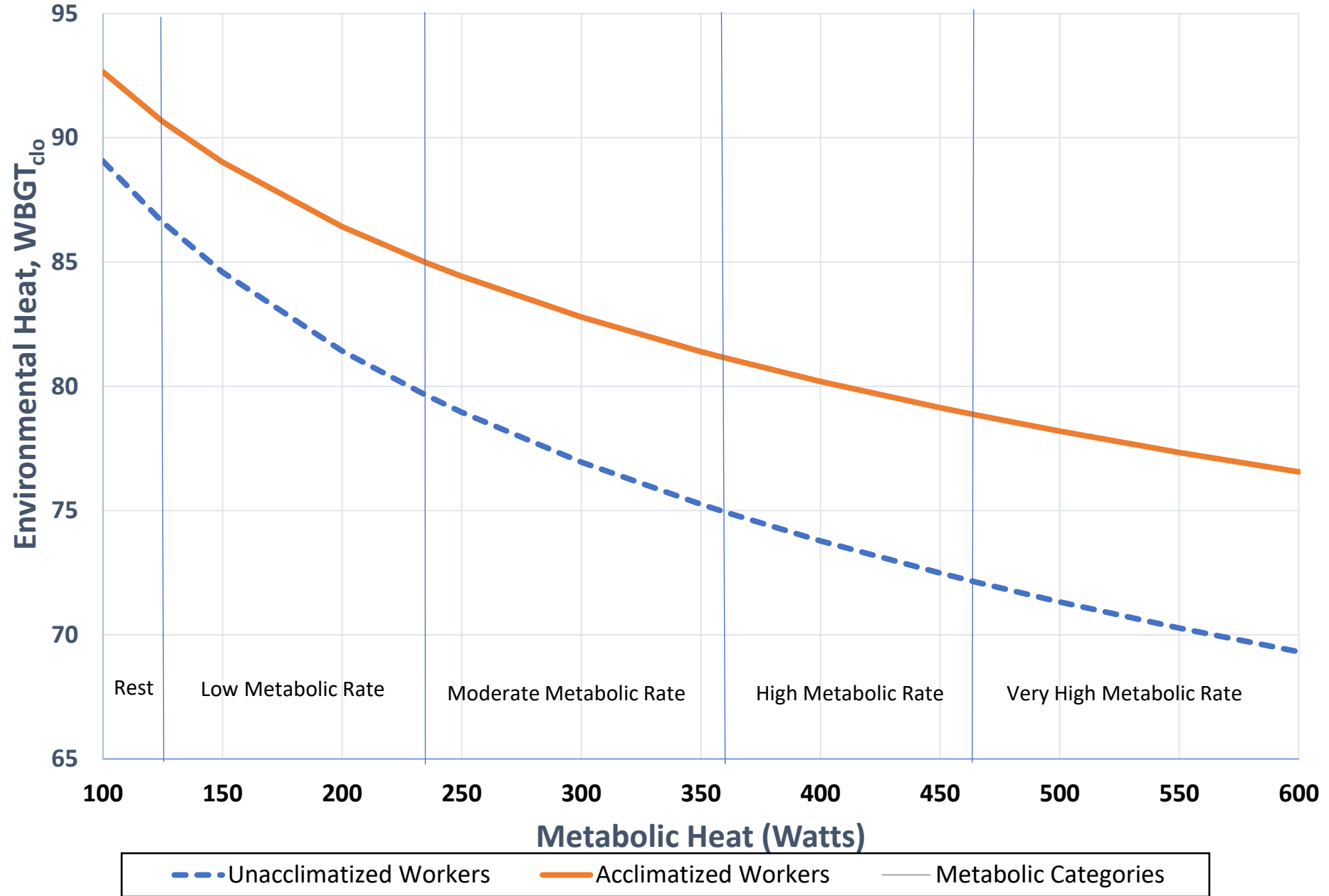
## Examples

Work Category	Metabolic rate	Examples
	Watts	
Rest	115	Sitting
Light	180	Sitting, standing, light arm/hand work and occasional walking
Moderate	300	Normal walking, moderate lifting, light pushing pulling
Heavy	415	Heavy material handling, walking at a fast pace, manual sawing, shoveling
Very Heavy	520	Pick and shovel work

[More comprehensive tables at:](#)

[Heat - Heat Hazard Recognition | Occupational Safety and Health Administration \(osha.gov\)](#)

# Heat Stress Exposure Limits



# Buddy System

- When workers are exposed at or above the heat stress exposure (WBGT) limits the employer should implement a buddy system for monitoring workers.
- If working alone – must use lone worker procedures such as regular communications and/or physiological monitoring devices.

# Common Signs and Symptoms

## Included in Appendices:

Heat Cramps

Heat Exhaustion

Heat Rash

Heat Stroke

Heat Syncope

Rhabdomyolysis

Should be included in training of all affected employees since:

- 1) Workers need to know when *they* are becoming heat strained and
- 2) Workers need to be able to play an important role in the surveillance of heat strain *in coworkers (buddy system)*.



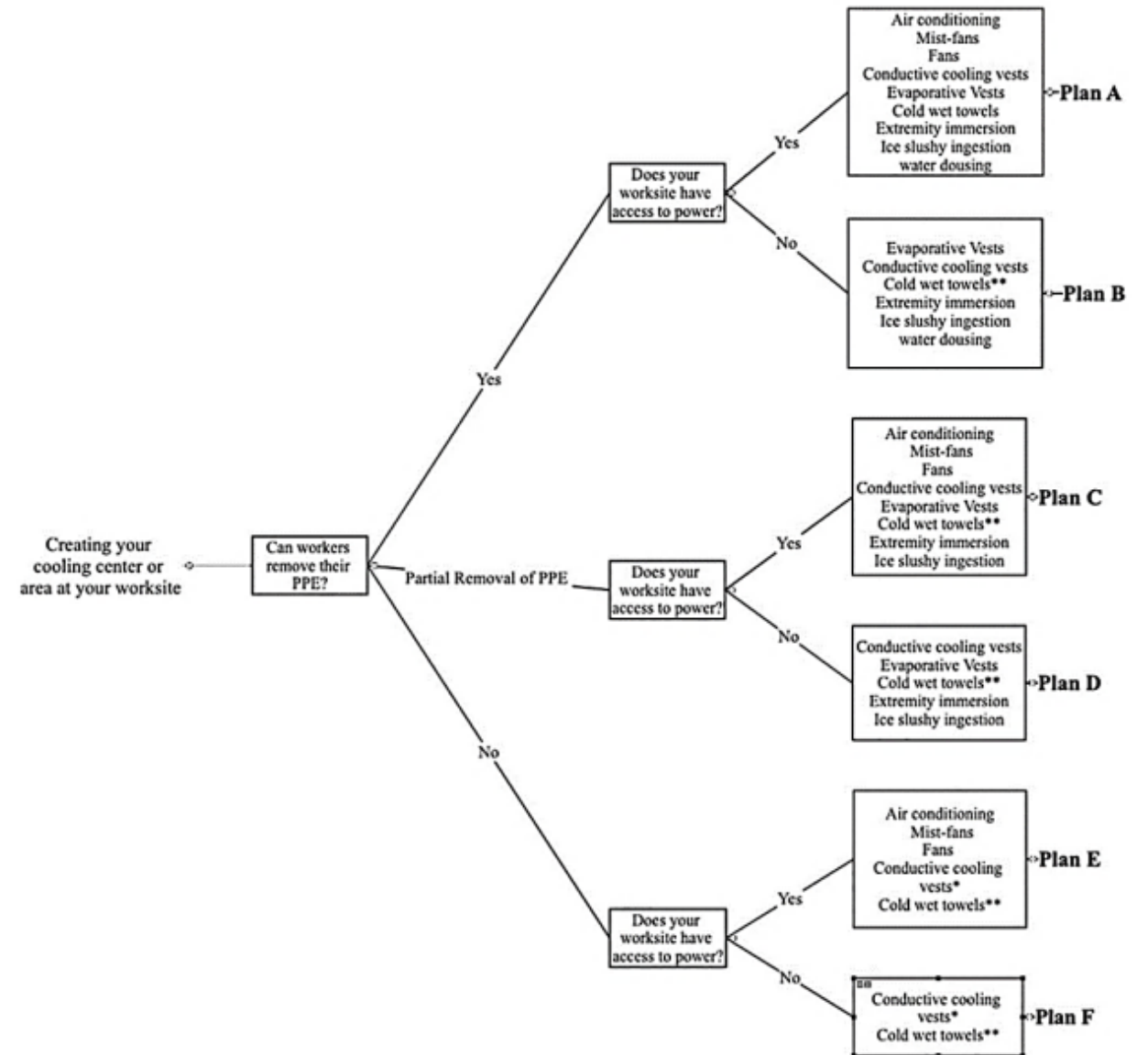
# Controls

- HSMP (Heat Stress Management Program) is implemented at *70 WBGT*
- Employer to use a *competent person to implement* the site-specific heat stress program.
- Engineering, administrative, work-rest procedures and PPE controls are *based on the heat stress task hazard analysis*.
- *Hierarchy of controls* – categorical examples provided

Appendix provides information on cooling methods based on power availability at the worksite

Another appendix presents a brief discussion of cooling vests and cooling accessories.

**Figure 1: On-site Cooling Methods.**  
Cooling modalities to use for cooling centers based on available resources.



NOTE: \*Vests must be donned prior to work shift; \*\*cold wet towels must be rotated every 1–2 min to obtain optimal cooling potential.

This material is adapted from Morrissey et al. (2021) with permission from the American Geophysical Union



# Access to drinking water (hydration)

- Suitably cool
- Close proximity
- Sufficient quantity ~ 1 qt / ee / hr
- Better to drink multiple times each hour rather than once an hour;  
e.g., 12 oz every 20 minutes



# Electrolytes

- When employees are involved with heavy work activities for greater than 2 hours employees shall also have access to electrolyte replenishment beverages. (e.g., sports drinks)
- Provided free of charge.
- Avoid high caffeinated and high sugar electrolyte replenishment beverages



# Rest breaks and shaded break locations

- Used as an administrative control to reduce the overall heat load by providing a **temporary cool environment while reducing the metabolic heat load by resting.**
- Provide shaded rest and hydration break areas for workers **above** the program initiation **action level.**
- The length and frequency of rest **breaks should increase** as the **heat exposure increases.**
- Workers should be encouraged **to remove PPE**, protective garments and extra clothing while resting wherever safety considerations allow.
- Cooling the rest area will enhance the recovery of core temperature and reduce productivity losses due to heat stress and lengthy rest breaks.

# Unacclimatized Workers

RWS=Regular Work Schedule

## Minutes of Work/Rest per hour

WBGT <sub>clo</sub> Index		Metabolic Workload			
Work Exposure	Rest Exposure*	Light	Moderate	Heavy	Very Heavy
70	70	RWS	RWS	RWS	RWS
80	80	RWS	36/24	22/38	16/44
80	75	RWS	45/15	33/27	26/34
80	70	RWS	49/11	39/21	33/27
*↓*	*↓*	*↓*	*↓*	*↓*	*↓*
90	90	0/60	0/60	0/60	0/60
*↓*	*↓*	*↓*	*↓*	*↓*	*↓*
90	70	41/19	32/28	27/33	23/37

# Acclimatized Workers

## Minutes of Work/Rest per hr

RWS = Regular Work Schedule

WBGT <sub>clo</sub> Index		Metabolic Workload*			
Work Exposure	Rest Exposure**	Light	Moderate	Heavy	Very Heavy
70	70	RWS	RWS	RWS	RWS
80	80	RWS	RWS	RWS	43/17
80	75	RWS	RWS	58/2	49/11
80	70	RWS	RWS	59/1	52/8
*↓*	*↓*	*↓*	*↓*	*↓*	*↓*
90	90	17/43	6/54	3/57	2/58
*↓*	*↓*	*↓*	*↓*	*↓*	*↓*
90	70	53/7	43/17	38/22	34/26

# Personal Risk Factors

- Employees must be made aware that personal health conditions or risk factors may contribute to heat stress and the warning signs attributed to those risk factors.
- Employees should be encouraged to consult with their primary medical care provider
- Medical surveillance should be established for covered workers. The assessment with an HCP should include personal risk factors.

# Personal Risk Factors - Examples

- age
- poor diet
- poor physical fitness
- alcohol use
- fatigue and sleep deprivation
- diabetes
- smoking and tobacco use
- pregnancy
- insufficient acclimatization
- obesity and high body mass index (BMI)
- excessive caffeine use (coffee, caffeinated soft drinks, energy drinks, etc.)
- asthma and other respiratory issues
- cardiac conditions
- high blood pressure
- prior heat illness episodes
- use of certain prescriptions or non-prescription and over the counter drugs, medications, or supplements

# First Aid and Emergency Action Plan

An employee exhibiting signs or symptoms of heat illness shall be monitored and shall not be left alone or sent home without being offered on-site first aid and/or being provided with emergency medical services in accordance with the employer's procedures.

Monitoring should include measuring the heart rate. Estimated core temperature measurements (via temporal, oral, ear canal) are subject to error and biases low.





# First Aid and Emergency Action Plan

- If a worker is suffering from heat stroke that include any central nervous system (CNS) impairment signs, there should be immediate, aggressive, full-body cooling, by placing the worker in a tub or tarp of cold water.
- Medical help should be contacted immediately.



# Employee Participation

- The employer shall establish a means for employee feedback and input relating to heat stress and the heat stress management program
  - Use of the safety committee
  - Reporting heat related hazards
- Employees shall be permitted to refuse to do work or enter a location because of a potentially unsafe condition related to heat-related illness or death.

# Responsibilities (examples)

- **Employer** responsibilities
  - Develop a *written* heat stress management *program*
  - Provide *training* before workers are assigned to tasks involving a risk of heat illness and in language they understand. Maintain training records.
  - Establish a *supportive heat illness culture* to encourage workers to
    - (i) identify signs and symptoms of heat illness and
    - (ii) stop work if they are feeling symptoms of heat illness.
  - Provide the means to address a heat-related illness, e.g., emergency materials

# Responsibilities (examples)

- **Supervisor** responsibilities

- *Know* the personal, metabolic, and environmental risk factors for heat illness.
- Ensure employees have access to and use of sufficient *and adequate shade to cool down* during breaks.
- Ensure employees working in hot conditions do not exhibit symptoms of heat illness and are *accounted for* throughout and at the end of the work shift.
- *Implement proactive steps* as set out in the written plan when *high heat conditions* are anticipated *or unacclimatized workers are present*.

# Responsibilities (examples)

- **Employee** responsibilities
  - *Comply with the company's heat stress management program's procedures and policies.*
  - *Provide input to the employer's checklist of heat stress sources.*
  - *Be aware of their personal risk factors and have discussions with their healthcare provider.*
  - *Look for signs and symptoms of heat illness in themselves and co-workers (buddy system), and report signs and symptoms promptly to a supervisor.*

# Responsibilities (examples)

- **Competent Person** responsibilities
  - *Implementing the site-specific* heat stress management *program* and the requirements of this standard.
  - *Performing job/task hazard analyses* for heat stress.
  - *Implementing controls* according to the hierarchy of controls
  - Checking on *effectiveness* of controls.

# Responsibilities (examples)

- **Qualified Person** responsibilities.

- *Assist with the development and review of the heat stress management program, including making changes to reduce risk using the hierarchy of controls.*
- *Assist with the use and interpretation of the WBGT*
- *Assist with the development and review of the first aid and emergency action plan.*
- *Provide guidance or in-person support to the competent person on implementation of the program as needed*

*NOTE: A generic heat stress management program could be developed by the qualified person, e.g., for a trade association, that can be customized for an individual worksite.*



# Training (to carry out their respective responsibilities)

- Broken out by:

- Supervisors
- Competent Persons
- Qualified Person
- Employees

- Retraining

- Retraining shall occur annually and whenever there is a recognized lack of knowledge.





# Program review



An annual **program review** should be conducted to determine whether any provisions require modification.

**Feedback** from workers, field supervisors and competent persons regarding the effectiveness of elements of the program should be sought.

# Requests for Interpretations.

- Upon a request in writing to the Secretariat, the A10 Committee will render an interpretation of any requirement of the standard.

ANSI A10.50

QUESTIONS?

