AMERICAN SOCIETY OF SAFETY PROFESSIONALS

A New ANSI/ASSP Construction Heat Stress Standard Approved

(A10.50: Heat Stress Management in Construction & Demolition Operations)

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Consensus Standards

- The American National Standards Institute (ANSI) does not develop standards; it approves them.
- "Approval of an American National Standard requires verification by ANSI that the requirements for due process, consensus, and other criteria for approval have been met by the standards developer."
- "Consensus is established when … substantial agreement has been reached by [all parties involved]."
- "Substantial agreement means much more than a simple majority, but not necessarily unanimity." (*A10 requires 2/3 majority*).
- "Consensus requires that all views and objections be considered, and that a concerted effort be made toward their resolution." *and*
- The use of American National Standards is completely voluntary.

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Background (1/2)

- Planet is getting hotter; Washington Post: non-profit "Climate Central" 2023 was hottest 12 months on record since NWS began keeping records in 1870 *(over 150 years)*
- No OSHA Standard for Occupational Heat Stress (3-5 yrs?)
- OSHA issued ANPRM (construction specified) (10/27/21)
- OSHA established a National Emphasis Program (4/8/22)
- OSHA called for response from Small Businesses
- PRM issued 8/30/2024; OSHA will still use the General Duty Clause
- Currently, States with regulations: CA, OR, WA, MN (indoors), MD *(maybe later this year)*, CO (ag only); none are the same.

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Background (2/2)

- Jan 2020: ASSP A10 Committee approved a proposal to develop ANSI/ASSP Heat-related Consensus Standard
- Started Sept 2020; Jan 2021 started weekly mtgs; finally completed full draft June 2023; expert review; subcommittee review; review by full A10 Committee; respond to 131 comments from 15 orgs; resubmit to A10; final approval received.
- Submitted to ANSI Nov 2023; approved Jan 4, 2024; available for purchase Feb 2024
- ANSI/ASSP A10.50 is the first National Consensus Standard dealing with heat stress management in construction and demolition operations.

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Major Sections of Newly Approved Standard (17pp)

1. Scope and Purpose
2. Abbreviations, References, and Other Resources
3. Definitions
4. Overview of Heat Stress Management Program
5. Acclimatization Plan
6. Risk Assessment & Control
7. Self-Awareness of Personal Risk Factors (list of 17)

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Major Sections of Newly Approved Standard, continued…

8. First Aid and Emergency Action Plan
9. Employee Participation
10. Implementation of Heat Stress Controls
11. Employer, Supervisor, Employee, Competent Person, and Qualified Person Responsibilities
12. Supervisor, Employee, Competent Person, and Qualified Person Training

Nine Appendices provide a variety of background material and technical information

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List of Appendices (34pp)

1. Model Heat Stress Program format and Two Checklists (Daily Worksite Checklist – THA; Heat Stress Program Checklist)
2. Heat Stress Measurement Methods (A10.50 recommends WBGT)
3. Features of WBGT Instruments
4. Scheduled Rest Breaks
5. Vests and Cooling Accessories
6. Acclimatization Information and Decision Flow Chart
7. Body Cooling Methods
8. Medical Surveillance and Physiological Monitoring
9. Emergency Action Plan for Heat Stroke

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Scope of Standard

- The Standard establishes requirements to prevent heat illnesses and manage heat stress hazards in construction and demolition operations.
- It establishes procedures to select and use appropriate engineering and administrative controls to reduce heat-related risks in all work environments.

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Objectives of Standard

- Assist users to recognize heat stress symptoms in co-workers in both outdoor and indoor work environments;
- Provide ideas for engineering and administrative controls to reduce or eliminate workers' symptoms at construction worksites; and
- Provide planning help to develop training content for workers and supervisors related to heat stress.

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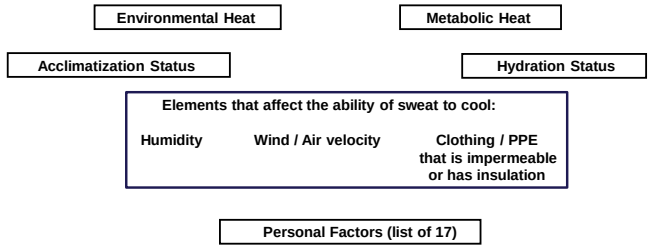
Definitions

- **Heat Stress.**
  - The net heat load to which a worker is exposed. Physical exertion, environmental factors, and clothing or other personal protective equipment that is worn all contribute to heat stress.
- **Heat Strain.**
  - How the body responds to heat stress and attempts to cool itself. Excessive heat strain may result in heat-related illnesses.

Heat Stress Factors



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Heat Stress Management Program

First Step:

- The written program should be developed in consultation with a "qualified person"
- Initiated prior to beginning work that is 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 Appendix 1.

Qualified Person – **someone who has** recognized degree, certificate, or professional standing **OR** by extensive knowledge, training, or experience **has … the ability to solve … problems** relating to the … work or the project.

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Heat Stress Management Program (1/2)

Should include the following:

a. methods to **acclimatize workers** to heat stress environments
b. methods to **assess workers' exposure** to heat stress
c. requirements to **provide potable water for all crew members**
   - (electrolyte replacement drinks for employees involved with *heavy work activities* for more than 2 hours)
d. requirements for **scheduled rest breaks**
e. requirements for **cool shaded areas** where the workers can rest
f. identification **on-site controls** (engineering, administrative controls, and personal protective equipment)

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Heat Stress Management Program (2/2)

g. a method for **monitoring workers' symptoms** of heat stress through means such as the buddy system

h. an **emergency action plan** for heat-related medical emergencies, including on-site first aid (including rapid cooling)

i. requirements for **worker participation**;

j. list of **responsibilities** for employer, supervisor, employee, competent person, and qualified person

k. heat stress **training** for supervisor, employee, competent & qualified persons

l. an annual **program review** and revision as necessary

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Acclimatization (1/3)

- Not being acclimatized to high heat conditions is a major risk factor of heat stroke and death from heat stress
- Data from BLS CFOI**:** worker deaths on the job due to excessive heat averaged 45 per year for 2018 to 2022; OSHA data: 50% to 60% occurred on 1st or 2nd day on job
- The changes that occur in the body because of acclimatization reduce the risk of heat-related illness and improve heat stress tolerance
- The A10.50 Standard states workers shall be allowed to adapt gradually to working in hot environments over a period of at least five days

One Example

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

OSHA / NIOSH Heat Safety Tool mentions 7 to 14 days for full acclimatization; five days is also mentioned

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Acclimatization (2/3)

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
   - blood pressure controlled better
3. Increased blood flow to the skin
4. Lower body core temperature

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Acclimatization (3/3)

- Acclimatization is maintained for a few days away from working in the heat (over the weekend)
- The A10.50 Standard requires re-acclimatization after a week of not working in a hot environment; this should occur over a period of four days.
- Some work covered by this standard may take place during an emergency situation to benefit the public good. Employers with workers who will provide disaster relief to restore essential services may take alternative steps to protect those workers (e.g., more frequent or longer rest breaks in shade w/ cooling fans and extra water).

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Personal Risk Factors

•Employees should be encouraged to consult with their primary medical care provider, if they know of any personal risk factors that they have that could affect them while working in hot environments.

•"Several federal, state, or local privacy statutes, as well as some labor agreements, [prevent employers from] asking employees about personal medical conditions."

•"During new employee orientation and regular training for current employees, the importance of employee self-awareness of personal risk factors and the need to communicate with their primary care provider [must] be emphasized."

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Personal Risk Factors

(Listed alphabetically; other factors, not listed, may also contribute)

- Age
- Alcohol
- Asthma & Other Respiratory Issues
- Cardiac Conditions
- Diabetes
- *Excessive* Caffeine
- Fatigue / Sleep Deprivation
- High Blood Pressure
- Inability to cool off after work
- Mis-use of OTC and use of illicit drugs
- Obesity / High BMI
- Poor General Health or Diet
- Poor Physical Fitness
- Pregnancy
- Previous Heat-related Illness(es)
- Smoking and Tobacco Use
- Use of Certain Prescription Meds

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Now, Dr. David May will discuss the middle portion of this presentation …

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Magnitude of the heat stress disease (and injuries)

- Millions of workers exposed (OSHA)
- Over 28,000 lost time injuries in US from 2011 to 2018 (BLS)
- 16,000 cases in CA from 2000 to 2017 (CA Workers Compensation System)
- 359 Occupational heat related deaths in US from 2000 to 2010. (Gubernot et al.2015)
  - Predominately males
  - Median fatality age = 41 (risk increased with age)
  - Hispanic fatalities were 3 x more likely than non-Hispanics
  - Highest rates were agriculture, construction and waste/remediation services

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Heat Stress Deaths in Relation to Construction

Between 1992 and 2016 Construction represented:

6% of the workforce, but

19% of all work-related fatal traumatic injuries, and

36% of all heat work-related deaths

Source: Dong et al, 2019

Heat Stroke Diseases
Classic vs. Exertional Heat Stress

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

Exertional
- Strenuous activity
- Healthy
- Sweating often present

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Heat stroke (exertional)

- Core body temperature > 104˚F
- Signs of central nervous system dysfunction
- Slurred speech
- Confusion
- Seizures
- Loss of consciousness

-Can lead to death

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Rhabdomyolysis:

Associated with heat stress and prolonged physical exertion

1. Results from the rapid breakdown of affected muscles
2. Released electrolytes and large proteins can damage heart and long-term damage to kidneys
3. Symptoms include muscle cramps and pain, dark cola-colored urine, weakness

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Heat Exhaustion

- Occurs more frequently than heat stroke; dehydration is a contributing factor.
- Cardiac insufficiency
- Symptoms can include fatigue, weakness, heavy sweating, fast pulse, nausea/vomiting, vertigo, thirst, headache, irritability, thirst, elevated temperature.
- Can represent first stage of heat stroke; may require medical evaluation. The onset of heat stroke can be rapid and unpredictable.

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Heat Syncope (Fainting)

- Typically occurs during sudden rising or standing or prolonged standing
- Caused by pooling of blood in peripheral veins which in turn causes a decrease in the filling of the heart with blood
- Contributing; dehydration and lack of acclimatization
- Does not exhibit a rise in body temperature

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Heat Cramps

- Heavy sweating during intense work
- Associated with loss of salt in sweat with intake of large amounts of water without salt replacement (salt or electrolyte imbalance)
- Cramps usually occur in the muscles used during work and consist of spastic contractions and pain in muscles mainly in the arms, legs, or torso/abdomen.
- Replace electrolytes

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Heat Rash

- Appears as clusters of red bumps on the skin
- Itching occurs in an area where sweat has been trapped underneath layers of skin.
- (Avoid working in sweat soaked clothing for prolonged periods. Change at breaks as needed).

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Performance/cognitive effects

Decrease in performance

Increase in errors

Decrease safety

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Performance/cognitive effects

When compared to 60-65°F.

Temperature	Increase in workplace injury risk
>100°F	10-15%
80-90°F	5-7%

(Park et al, 2021)

California study of 11 million workers compensation claims from 2001 to 2018.

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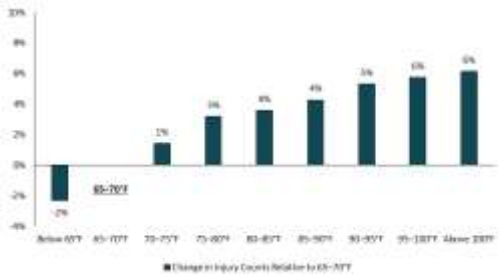
Higher temperatures associated with more safety incidents



Impact of Excessive Heat on the Frequency of Work-Related Injuries

Negrusa, S.et.al. *WCR*, 2024

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Workers Comp data, 2016 to 2021, across 24 states

Chronic illnesses associated with excessive heat stress

- Cardiovascular and ischemic heat disease, kidney and liver disease
  - Wallace et al. 2007
- Progressive chronic kidney disease
  - Wesseling et al. 2013, Lucas, 2015

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Workplace Surveillance – 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 80F)
- Assessment conducted by a competent person; includes 9 key factors
- Keep written inventory of local conditions that affect or increase heat exposure
- Checklist examples can be found in the Appendices

Competent Person – can identify existing & predictable hazards in the [workplace] which are … hazardous or dangerous … **AND** who has authorization to take prompt corrective measures to eliminate them.

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Workplace Surveillance – Heat Risk Assessment

If above the trigger, the assessment should include the following, where 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 heat island, 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

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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.
- It allows for consideration of metabolic heat sources and modification of heat transfer from the worker by extra clothing or certain PPE.

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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	✓	
This assessment can integrate:		
Use of additional protective PPE/clothing	✓	
Metabolic heat load (i.e., work intensity)	✓	
Differences between acclimatized and unacclimatized workers	✓	

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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 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.
- Pertinent features such as range and accuracy are given in Appendix 3.

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Environmental Heat Information

Option 2: Internet or App data

- National Weather Service - Graphical Forecast (noaa.gov)
- Screen shot of WBGT values;

  forecast for 2 pm on Sept 4th, 2024
  (taken on Sept 4th at 9 AM, 2024)

National Weather Service - Graphical Forecast

https://digital.weather.gov/

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Environmental heat information source (option 2)

- National Weather Service - Graphical Forecast (noaa.gov)

Environmental Heat

Option 3:

- Convert Heat Index data to an estimated WBGT value.
- An estimation to correct for the presence of radiant heat is provided in Appendix 2.

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Assessment of clothing

(See Appendix 2 for examples)

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

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 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	0

Reference: ISO 7443:2017, Fletcher et al. 2014

Additional Information at ACGIH: Heat Stress and Strain: 2022

Estimating Metabolic Heat, Examples (Appendix 2)

Work Category	Metabolic rate Watts	Examples
Rest	115	Sitting, resting
Light	**180**	**Light arm/hand work, standing drilling small parts, casual walking on a level surface**
Moderate	300	Normal walking, moderate lifting, light pushing or pulling lightweight carts, hammering nails,
Heavy	**415**	**Heavy material handling, walking at a fast pace, manual sawing, shoveling, laying concrete blocks**
Very Heavy	520	Intense shoveling or digging, climbing ladders, running on level surface

Heat - Heat Hazard Recognition | Occupational Safety and Health Administration (osha.gov)

A less detailed approach is provided in Appendix 2 which *assumes* a work category of “Heavy”.

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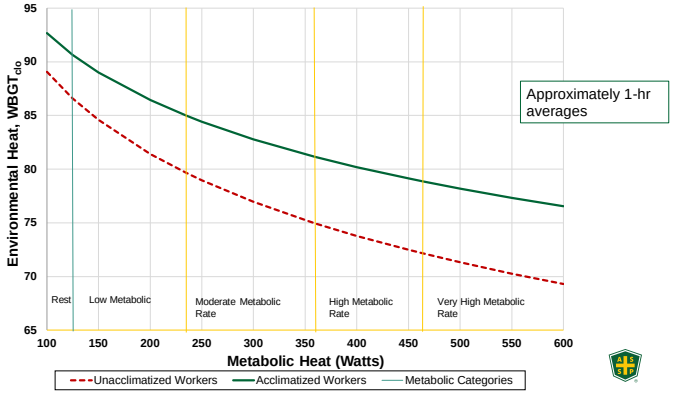
Heat Stress Exposure Limits



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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 in the standard

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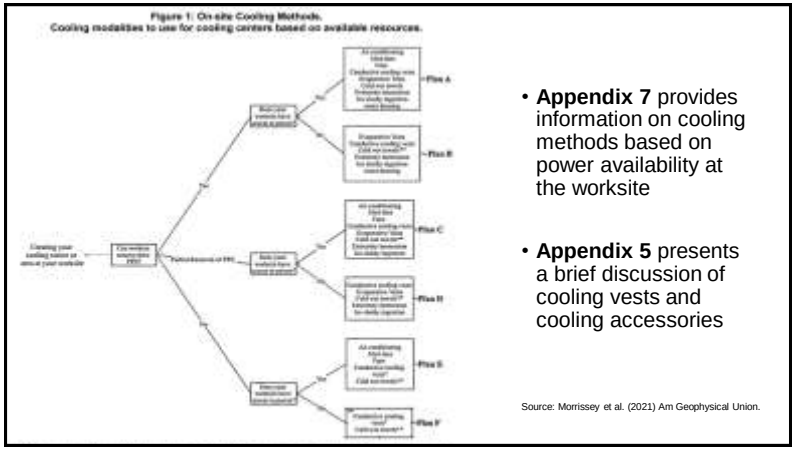
Controls

Metabolic engineering controls

Elimination/Substitution

Engineering controls

PPE



- **Appendix 7** provides information on cooling methods based on power availability at the worksite
- **Appendix 5** presents a brief discussion of cooling vests and cooling accessories

Source: Morrissey et al. (2021) Am Geophysical Union.

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.

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Acclimatized Workers, Selected Examples of Minutes of Work/Rest, Three Levels Metabolic Workload

Appendix 4: Work/Rest in Minutes per hour

$WBGT\ Index_{clo}$	$WBGT\ Index_{clo}$	Metabolic Work Load	Metabolic Work Load	Metabolic Work Load
Work Exposure	Rest Exposure*	Moderate	Heavy	Very Heavy
85	85	40 / 20	25 / 35	17 / 43
85	80	47 / 13	35 / 25	29 / 31
85	75	51 / 9	42 / 18	36 / 24
85	70	53 / 7	46 / 14	41 / 19

***** "Rest Exposure" needs to be *measured* in the rest area

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Tom will finish the presentation…

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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 or alternatively, use physiological monitoring.
- If working alone – must use lone worker procedures such as regular communications and/or physiological monitoring devices.

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Access to drinking water (hydration)

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

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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.

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Emergency action plan

Emergency Personnel on-site

- Supervisor or team member trained in proper care for heat illness
- Trained in emergency rapid cooling techniques, CPR and use of AED (if available)

Emergency Communication

- Contact numbers for EMS, hospital, fire/police station should be current & stored in phone of supervisor or that team member

Emergency Equipment

- Worksite should have extra water, bags of ice, cooling fan, towels, and a water immersion tub or tarp (TACO) (Appendix 9 has full page of information)

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First-Aid and Emergency Action Plan

- If there is a **suspected heat stroke**, call 911 immediately; give specific directions and/or location & say "suspected heat stroke"
- There should be immediate, aggressive, **full-body cooling**, by placing the worker in a tub or tarp of cold water (TACO method)

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Responsibilities

Responsibilities for each of these groups:

- Employer – **Develop** the Heat Stress Management Program (8 items)
- Supervisor – **Ensure Compliance** (8 items)
- Employee – **Comply** (6 items)
- Competent Person – **Implement** (12 items)
- Qualified Person – **Assist** (4 items)

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Training

Training specified for each of these groups:

- Supervisor (4 topics)
- Employee (15 topics)
- Competent Person (17 topics)
- Qualified Person (trained on competent person req’ts + 15 add’l topics)

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Retraining

- Shall occur annually
- Whenever a heat wave is predicted by the National Weather Service
  - a heat wave is a period of abnormally hot weather, generally lasting more than two days
- After a heat-related incident or when a close call occurs (e.g., when a worker stops work due to signs of heat-related stress) → time for a toolbox talk.

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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 (“stop working” authority)

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Thank You!

Any Questions or Comments?

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