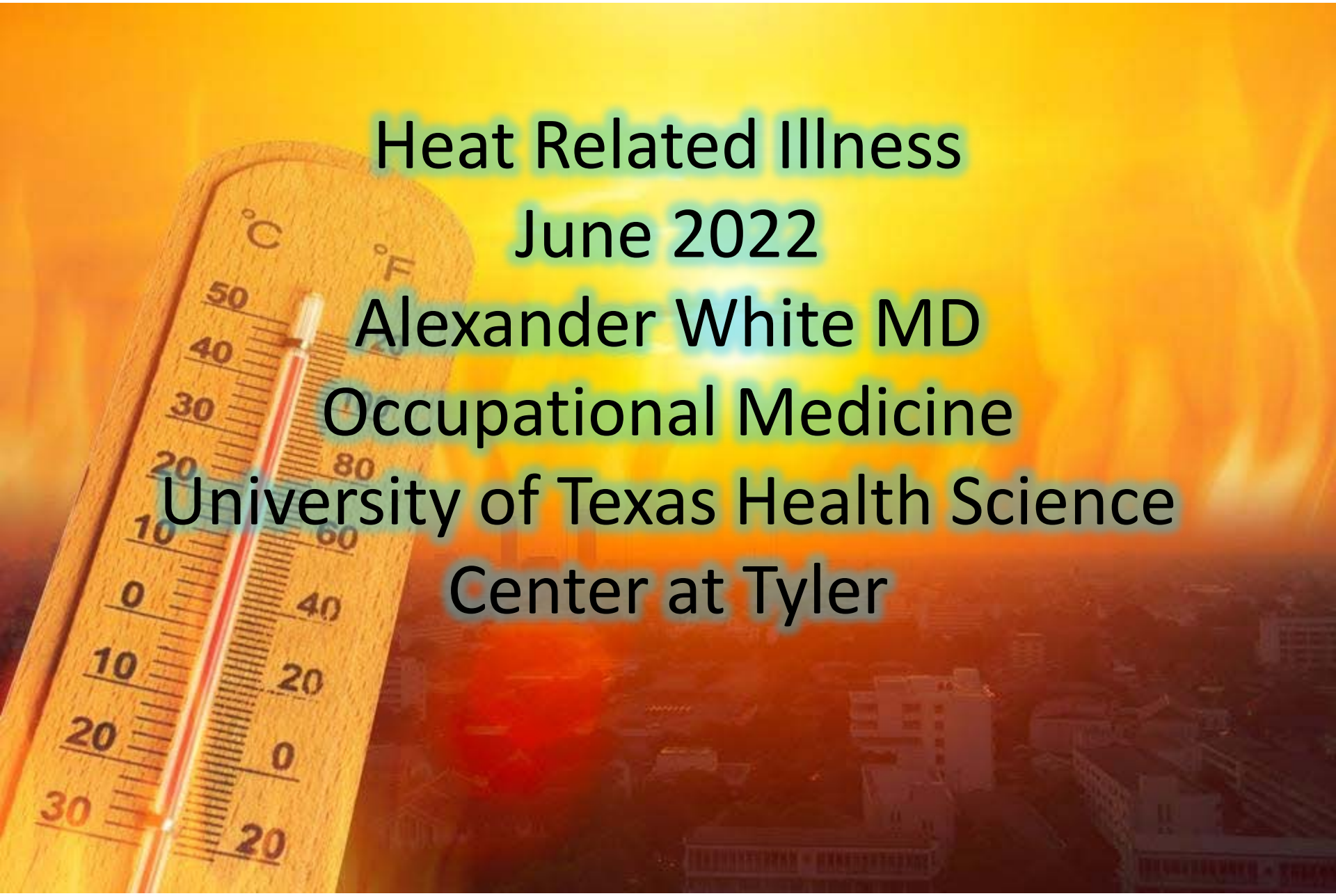

Heat Related Illness
June 2022
Alexander White MD
Occupational Medicine
University of Texas Health Science Center at Tyler

Source: constructionexecutive.com

Heat Illness Standard

- There is no OSHA heat illness standard
- Several states have heat illness standards
  - California
  - Oregon
  - Washington
  - Minnesota

Source: safetyandhealthmagazine.com

- OSHA General Duty Clause
  - all employers provide a work environment "free from recognized hazards that are causing or are likely to cause death or serious physical harm."

OSHA/NIOSH

- NIOSH Criteria for a Recommend Standard (Rev. **2016**)
- OSHA Technical Manual – Heat Stress chapter (Rev. **2017**)
- Advance Notice of Proposed Rulemaking – ANPRM (10/27/**2021**)
  - ANPRM for Heat Injury and Illness Prevention in Outdoor and Indoor Work Settings
  - OSHA published in the Federal Register
- OSHA National Emphasis Program (NEP) – Outdoor/Indoor Heat-Related Hazards (3/8/**2022**)

OSHA Heat-Related Hazards National Emphasis Program

During heat-related inspections, CSHOs shall:

- Review OSHA 300 Logs and 301 Incident Reports
- Review any records of heat-related ER visits and/or ambulance transport
- Interview workers for symptoms of heat-related illnesses
- **Determine if the employer has a heat illness program**
- Document the heat conditions
- Identify heat-related hazards

Elements Heat-Illness Prevention Plan

1. Training
2. Monitoring weather
3. Assess Heat-related hazards
4. Heat-Illness Prevention Strategies
5. Emergency Preparedness

Plan – Clipart

Progression of Heat-Related Illnesses

Less Severe — More Severe

Heat Rash

Heat Cramps

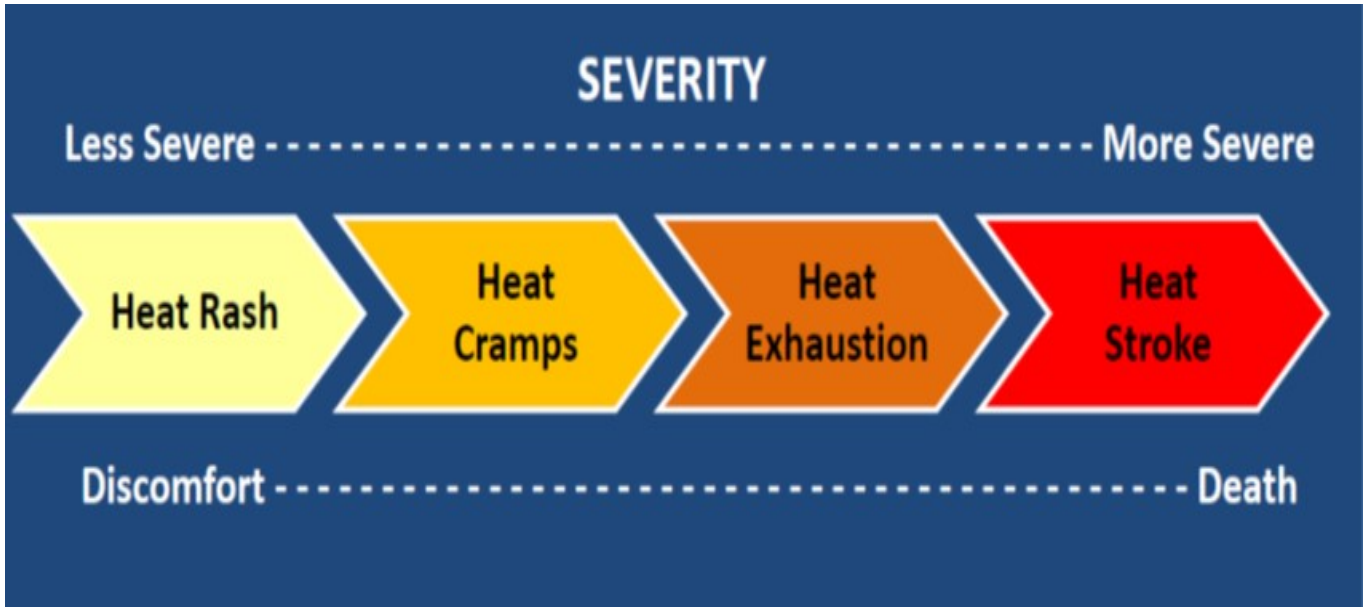
Heat Exhaustion

Heat Stroke

Heat Syncope

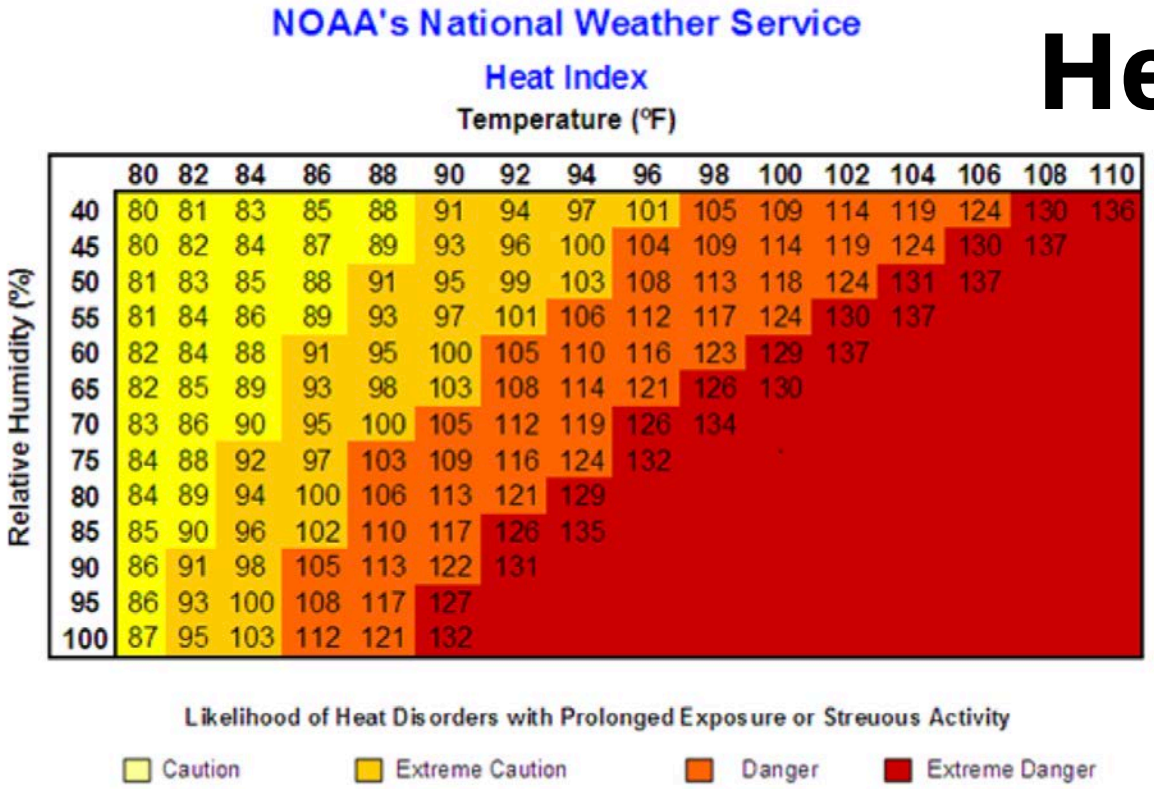
Rhabdomyolysis

Acute Kidney Injury



(Source: NIOSH)

Heat Index



Based on 2 variables

- Temperature
- Humidity

Source: OSHA Heat Index – A Guide for Employers *

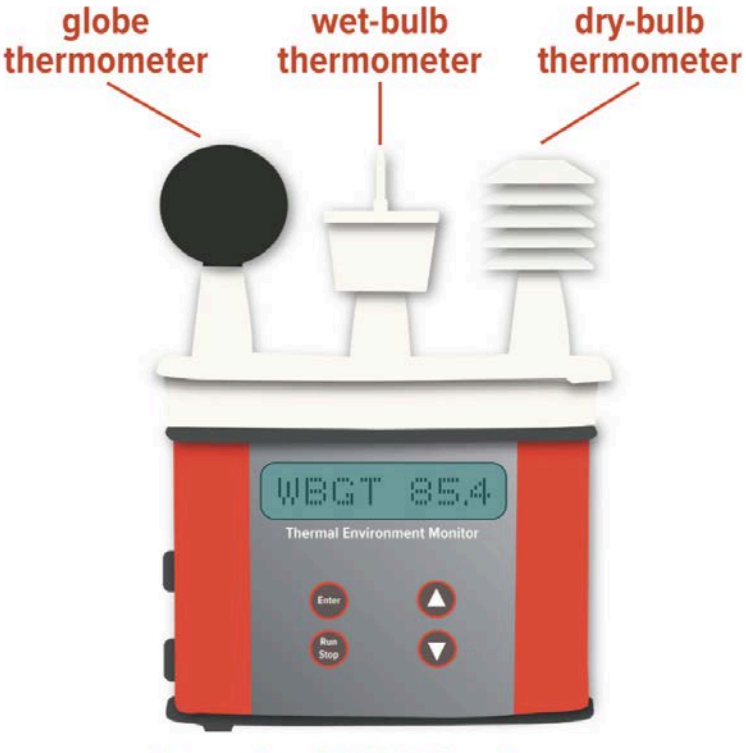
- **Implement a heat plan when H.I. > 80 degrees**
- Risk increases with H.I. > 91 degrees

Heat Index	Risk Level	Protective Measures
Less than 91°F	Lower (Caution)	Basic heat safety and planning
91° to 103°F	Moderate	Implement precautions and heighten awareness
103° to 115°F	High	Additional precautions to protect workers
Greater than 115°F	Very High to Extreme	Triggers even more aggressive protective measures

Wet Bulb Globe Temperature (WBGT)

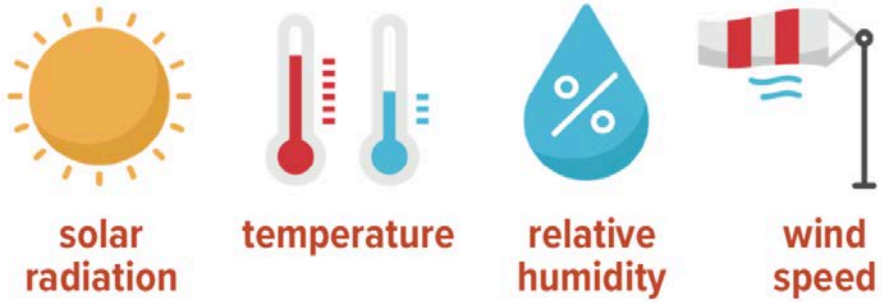
- Humidity
- Temperature
- Solar radiation
- Wind speed

Can be measured from a 3 thermometer setup



Comparing WBGT and Heat Index

	WBGT	HEAT INDEX
Measured in the sun	●	●
Measured in the shade	●	●
Uses temperature	●	●
Uses relative humidity	●	●
Uses wind	●	●
Uses cloud cover	●	●
Uses sun angle	●	●



Source: Weather.gov 2020 WBGT Handout

The University of Texas at TYLER HEALTH SCIENCE CENTER

Risk Factors for Heat Stress
Environmental risk factors

1. Temperature
2. Humidity
3. Air movement
4. Radiant heat (e.g., sun exposure)

Risk Factors
(Source: NIOSH)

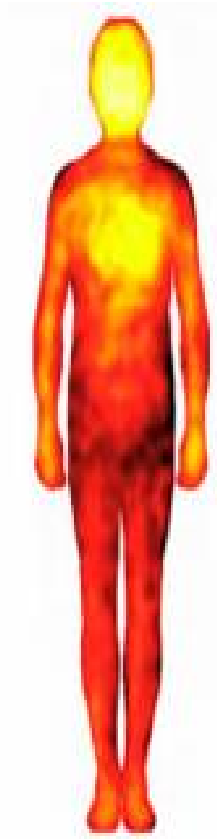
Risk Factors for Heat Stress
Work-related risk factors

1. Age
2. Physical fitness
3. Acclimatization
4. Medical conditions
5. Medications
6. Alcohol or drug use
7. Caffeine

Risk Factors
(Source: NIOSH)

Physiology

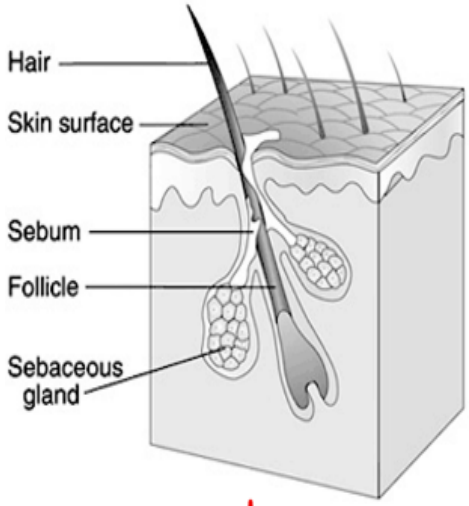
- Increased heart rate
- Increased blood circulation to skin
- Evaporative cooling from sweating



Thermogram (Stock Photo)

The Importance of Acclimatization

- Reduces risks of dehydration and salt loss
  - Sweating and evaporative cooling becomes more efficient
  - Salt loss becomes more efficient (less loss)
- Core body temperature maintained more efficiently
- Reduces strain on heart
  - Blood circulation to skin becomes more efficient
- Recovery heart rate improves



More efficient sweating, blood flow to skin and heart rate recovery (CDC & Stock Photo)

Acclimatization Plan

- Gradually increase exposure time in hot environmental conditions over a period of 7 to 14 days.
- For new workers, the schedule should be no more than 20% of the usual duration of work in the hot environment on day 1 and a no more than 20% increase on each additional day.
- For workers who have had previous experience with the job, the acclimatization regimen should be no more than 50% of the usual duration of work in the hot environment on day 1, 60% on day 2, 80% on day 3, and 100% on day 4.
- The time required for non–physically fit individuals to develop acclimatization is about 50% greater than for the physically fit.

CAL-OSHA Acclimatization Standard

(1) All employees shall be ***closely observed*** by a supervisor or designee during a heat wave. For purposes of this section only, “heat wave” means any day in which the predicted high temperature for the day will be at least **80 degrees F** and at least ten degrees Fahrenheit higher than the average high daily temperature in the preceding five days.

(2) An employee who has been newly assigned to a high heat area shall be ***closely observed*** by a supervisor or designee for the first 14 days of the employee's employment.

Medications That Increase Risk of Heat Tress

- Heat illness
  - Amphetamines – narcolepsy or ADHD *
  - Diuretics *
  - Antihypertensives (blood pressure meds) *
  - Anticholinergics – COPD *
  - Antihistamines *
  - Seizure & psychiatric medication
- Rhabdomyolysis
  - Antipsychotics
  - Statins

* mentioned in OSHA National Emphasis Program – Outdoor and Indoor Heat-Related hazards

Table 4-2. Drugs implicated in intolerance to heat

Drug or drug class	Proposed mechanism of action
Anticholinergics (e.g., benzotropine, trihexyphenidyl)	▪ Impaired sweating
Antihistamines	▪ Impaired sweating
Phenothiazines	▪ Impaired sweating, (possibly) disturbed hypothalamic temperature regulation
Tricyclic antidepressants (e.g., imipramine, amitriptyline, protriptyline)	▪ Impaired sweating, increased motor activity and heat production
Amphetamines, cocaine, ecstasy	▪ Increased psychomotor activity, activated vascular endothelium
Analgesics (e.g., acetaminophen, aspirin)	▪ Liver or kidney damage
Ergogenic stimulants (e.g., ephedrine/ephedra)	▪ Increased heat production
Lithium	▪ Nephrogenic diabetes insipidus and water loss
Diuretics	▪ Salt depletion and dehydration
Calcium channel blockers (e.g., amlodipine, verapamil)	▪ Reduced skin blood flow and reduced blood pressure
Ethanol	▪ Diuresis, possible effects on intestinal permeability
Barbiturates	▪ Reduced blood pressure
Antispasmodics	▪ Impaired sweating
Haloperidol	▪ Tachycardia, altered central temperature regulation, and hyponatremia
Laxatives	▪ Dehydration
Beta blockers (atenolol, betaxolol)	▪ Reduced skin blood flow, reduced blood pressure, and impaired sweating
Narcotics	▪ Excessive sweating, salt depletion and dehydration
Levothyroxine	▪ Excessive sweating, salt depletion and dehydration

Medical Conditions That Increase Heat Illness Risk

Diabetes mellitus

BMI > 30

COPD

Diabetes insipidus

Renal disease

Skin disease

<u>Heart Diseases</u>

Ischemic heart disease

Valvular heart disease

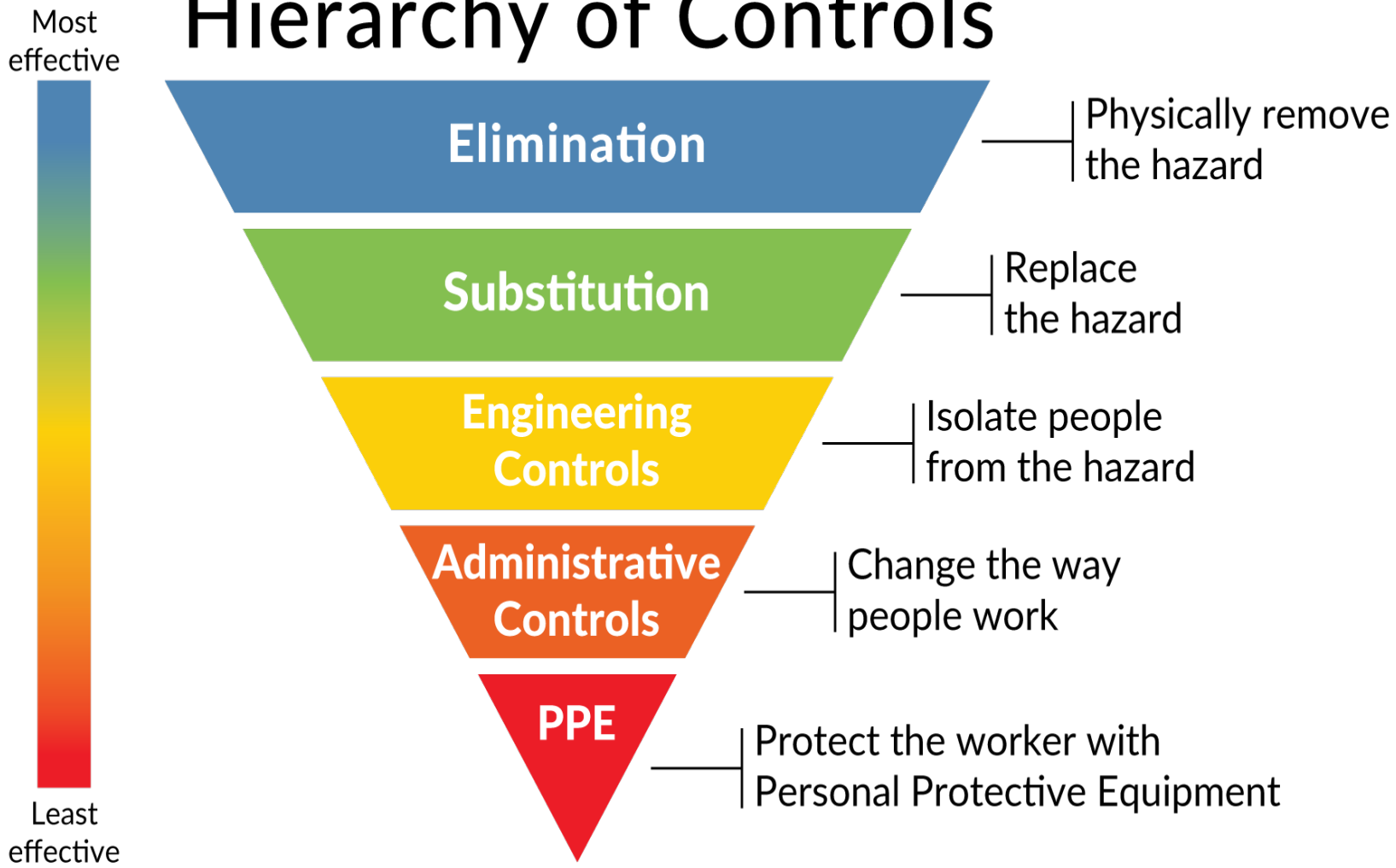
Cardiac arrhythmias

Cardiomyopathy

CHF

Congenital heart disease

Hierarchy of Controls



Engineering Controls

- Use air conditioning
- Increase general ventilation
- Provide cooling fans
- Run local exhaust ventilation where heat is produced (e.g., laundry vents)
- Use reflective shields to block radiant heat
- Insulate hot surfaces (e.g., furnace walls)
- Stop leaking steam
- **Provide shade for outdoor work sites**

Administrative Controls

- **Schedule hot jobs for cooler parts of the workday**; schedule routine maintenance and repair work during cooler seasons of the year when possible.
- Provide adequate, cool **drinking water** on the worksite that is easily accessible
- Permit employees to take **frequent rest and water breaks** and use work/rest schedules
- Use a shaded and cool space nearby for rest and water breaks.
- Acclimatization
- Give training on the recognition of the signs and symptoms of heat-induced illness
- Buddy system
- Provide alerts for extreme heat events

PPE

- **Hats for work outdoors in the sun**
- For indoor work, loosely worn reflective clothing designed to deflect radiant heat, such as vests, aprons, or jackets.
- Cooling vests and water-cooled/dampened garments may be effective under high temperature and low humidity conditions. However, be aware that cooling vests can become an insulator when they reach the body's temperature.
- In environments where respirator usage is necessary, consult with an industrial hygienist to determine the appropriate clothing to prevent heat stress while still protecting the workers.
- “Consider” …

Physiological Monitoring

- Oral temperature
- Heart rate recovery
- Additional measures to help reduce dehydration
  - Body weight
  - Urine color

Oral temperature monitoring (US ARMY DOD)

NEP Physiological Monitoring

- *"Consider* the use of **dermal patches for monitoring core temperature** to better identify when workers need to be removed from the work area."
- *"Consider* the use of **heart rate monitoring** to better identify when workers need to be removed from the work area."
  - "Both sustained (180 bpm minus age) and recovery (120 bpm after a peak work effort) heart rates are recommended guidelines for limiting heat strain."

An Approach to Heart Rate Recovery Monitoring

- Take pulse rate readings at the beginning of a scheduled rest break, with worker sitting and resting
- If above 110 bpm, then take additional readings at a two-minutes and again two-minutes later
- Heart rate should drop by at least 10 bpm every 2-minutes
- If not and if HR remain > 110 bpm, remove individual from work for evaluation

State Standards

- California
  - Targets specific industries
    - Agriculture
    - **Construction**
    - Landscaping
    - Oil/gas extraction
    - Transportation (excludes vehicles w/ AC where driver does not do un/loading)
  - Emergency response procedures
  - Acclimatization
  - Training
  - Prevention plan
- Minnesota
- Oregon
- Washington

State Standards

Req's	CA	MN	OR	WA
Worksite	Outdoor, year-round	Indoor, year-round	Indoor &outdoor, emergency rul	Outdoor (May through Sept)
Add'l high heat protection	At 95F	No	At 90F	At 100F
Acclimate	Yes	No	Yes (over 90F)	No
Record-keeping	Yes	Yes	No	Yes

NEP Questions for Inspectors

Is there a written program?

How did the employer monitor ambient temperature(s) and levels of work exertion at the worksite?

Was there unlimited cool water that was easily accessible to the employees?

Did the employer require additional breaks for hydration?

Were there scheduled rest breaks?

Was there access to a shaded area?

Did the employer provide time for acclimatization of new and returning workers?

Was a “buddy” system in place on hot days?

Were administrative controls used (earlier start times, and employee/job rotation) to limit heat exposures?

Did the employer provide training on heat illness signs, how to report signs and symptoms, first aid, how to contact emergency personnel, prevention, and the importance of hydration?

References

- CAL-OSHA Standard
- https://www.dir.ca.gov/title8/3395.html
- NIOSH Criteria for a Recommended Standard https://www.cdc.gov/niosh/docs/2016-106/pdfs/2016-106.pdf?id=10.26616/NIOSHPUB2016106
- OSHA Technical Manual https://www.osha.gov/otm/section-3-health-hazards/chapter-4
- OSHA National Emphasis Program https://www.osha.gov/enforcement/directives/cpl-03-00-024
- OSHA Advanced Notice of Proposed Rulemaking https://www.federalregister.gov/documents/2021/10/27/2021-23250/heat-injury-and-illness-prevention-in-outdoor-and-indoor-work-settings
- Heat Index, a guide for employers https://www.nalc.org/workplace-issues/body/OSHA-All-in-One-Heat-Guide.pdf
- Weather Service WBGT Handout https://www.weather.gov/media/safety/heat/2020-WBGT-Handout.pdf