



Breakout Session

Heat Stress and Fatigue



Rodbell C

Bruce Lippy, CPWR, and Sharon D. Beard, NIEHS

Heat Stress and Fatigue - Questions to Consider (1)

- What H&S training materials used by awardees already address climate change related hazards, risks, and protection measures?
- Have HDPTP awardees modified existing H&S curriculum to specifically prepare workers for conditions that may result from an extreme weather disaster?
- Have awardees in other program areas modified curriculum to prepare workers for additional hazards that will result from climate change (temperature and humidity) helping workers understand these conditions could be for longer periods of the year?
- What are some of the climate change vulnerabilities that you have seen so far to affect workers?

Heat Stress and Fatigue - Questions to Consider (2)

- What are some steps that you have taken to ensure sustainability and resilience in your training?
- How can the training you provide help build community resilience and sustainability?
- What are some of the gaps you think exist in training, curriculum development, and/or intervention to mitigate climate change vulnerabilities?
- Do you have existing training and resources that addresses some of the climate change vulnerabilities/ gaps?

Heat Stress

- Background
- Occupational Statistics
- Standards and/or Guidance
- Thresholds and Work Rest Regiment
- Prevention/Conditions of Change
- Climate Change and Heat Stress
- Training and Resources Available



Heat Illness Conditions, Symptoms and First Aid

Illness	Symptoms	First Aid*
Heat stroke	<ul style="list-style-type: none"> Confusion Fainting Seizures Excessive sweating or red, hot, dry skin Very high body temperature 	<ul style="list-style-type: none"> Call 911 <p>While waiting for help:</p> <ul style="list-style-type: none"> Place worker in shady, cool area Loosen clothing, remove outer clothing Fan air on worker; cold packs in armpits Wet worker with cool water; apply ice packs, cool compresses, or ice if available Provide fluids (preferably water) as soon as possible Stay with worker until help arrives
Heat exhaustion	<ul style="list-style-type: none"> Cool, moist skin Heavy sweating Headache Nausea or vomiting Dizziness Light headedness Weakness Thirst Irritability Fast heart beat 	<ul style="list-style-type: none"> Have worker sit or lie down in a cool, shady area Give worker plenty of water or other cool beverages to drink Cool worker with cold compresses/ice packs Take to clinic or emergency room for medical evaluation or treatment if signs or symptoms worsen or do not improve within 60 minutes. Do not return to work that day
Heat cramps	<ul style="list-style-type: none"> Muscle spasms Pain Usually in abdomen, arms, or legs 	<ul style="list-style-type: none"> Have worker rest in shady, cool area Worker should drink water or other cool beverages Wait a few hours before allowing worker to return to strenuous work Have worker seek medical attention if cramps don't go away
Heat rash	<ul style="list-style-type: none"> Clusters of red bumps on skin Often appears on neck, upper chest, folds of skin 	<ul style="list-style-type: none"> Try to work in a cooler, less humid environment when possible Keep the affected area dry

* Remember, if you are not a medical professional, use this information as a guide only to help workers in need.



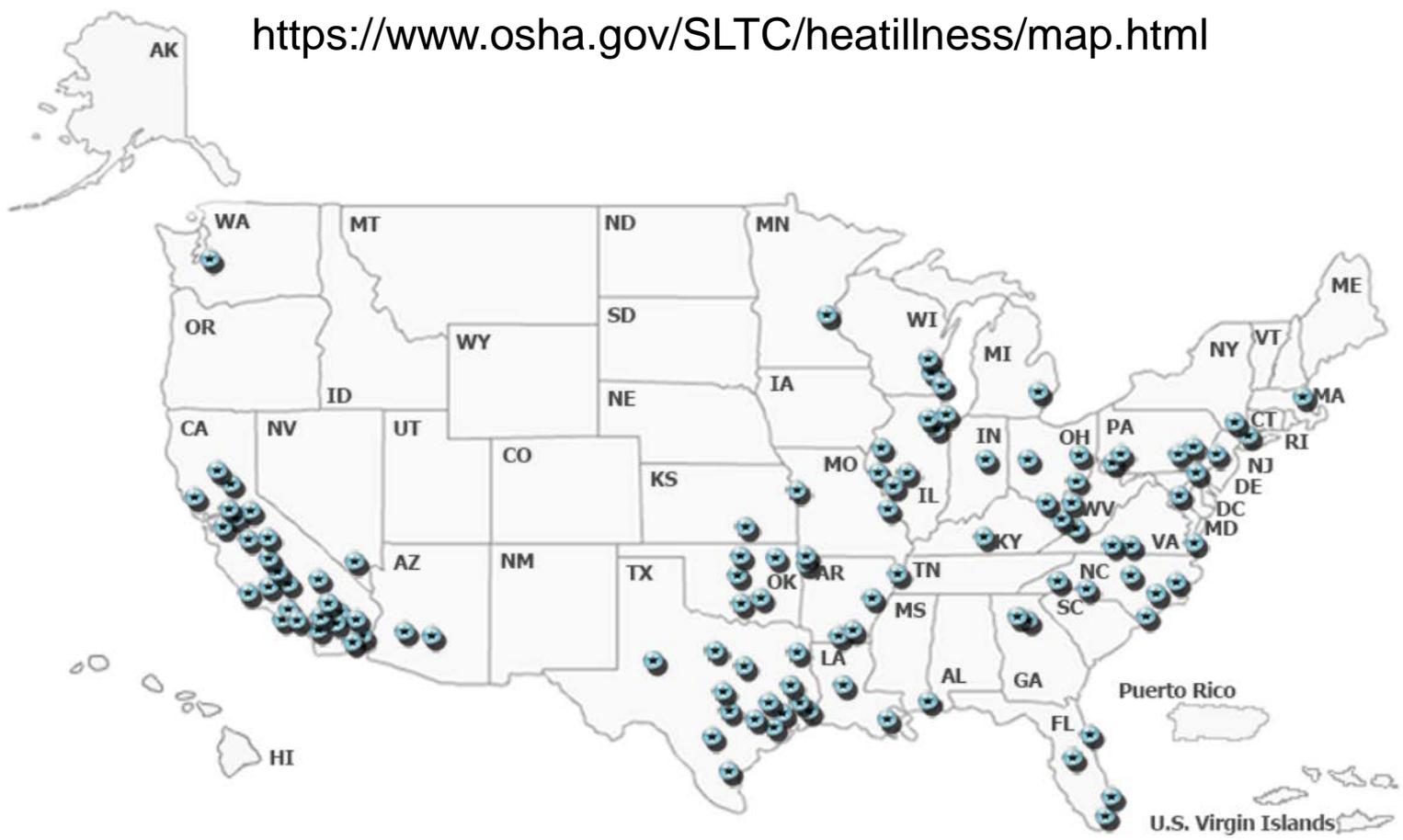
Occupational Factors that May Contribute to Heat Illness

- High temperature and humidity
- Low fluid consumption
- Direct sun exposure (with no shade) or extreme heat
- Limited air movement (no breeze or wind)
- Physical exertion
- Use of bulky protective clothing and equipment

Re: https://www.osha.gov/SLTC/heatillness/heat_index/heat_app.html and
https://www.osha.gov/SLTC/heatstress/heat_illnesses.html.

Heat Illness Statistics – OSHA/BLS 2008-2014

<https://www.osha.gov/SLTC/heatillness/map.html>



Regulations, Standards and Guidance

OSHA[®] FactSheet

Protecting Workers from the Effects of Heat

At times, workers may be required to work in hot environments for long periods. When the human body is unable to maintain a normal temperature, heat illnesses can occur and may result in death. It is also important to consider that hot work environments may exist indoors. This fact sheet provides information to employers on measures they should take to prevent worker illnesses and death caused by heat stress.

What is Heat Illness?

The following are illnesses that may result from exposure to heat in the workplace.

Heat Stroke is the most serious heat-related health problem. Heat stroke occurs when the body's temperature regulating system fails and

body temperature rises to critical levels (greater than 104°F). **This is a medical emergency that may result in death!** The signs of heat stroke are confusion, loss of consciousness, and seizures. Workers experiencing heat stroke have a very high body temperature and may stop sweating. If a worker shows

signs of possible heat stroke, **get medical help immediately**, and call 911. Until medical help arrives, move the worker to a shady, cool area and remove as much clothing as possible. Wet the worker with cool water and circulate the air to speed cooling. Place cold wet cloths, wet towels or ice all over the body or soak the worker's clothing with cold water.

Heat Exhaustion is the next most serious heat-related health problem. The signs and symptoms of heat exhaustion are headache, nausea, dizziness, weakness, irritability, confusion, thirst, heavy sweating and a body temperature greater than 100.4°F. Workers with heat exhaustion should be removed from the hot area and given liquids to drink.

Cool the worker with cold compresses to the head, neck, and face or have the worker wash his or her head, face and neck with cold water. Encourage frequent sips of cool water. Workers with signs or symptoms of heat exhaustion should be taken to a clinic or emergency room for medical evaluation and treatment. Make sure that someone stays with the worker until help arrives. If symptoms worsen, call 911 and get help immediately.

Heat Cramps are muscle pains usually caused by the loss of body salts and fluid during sweating. Workers with heat cramps should replace fluid loss by drinking water and/or carbohydrate-electrolyte replacement liquids (e.g., sports drinks) every 15 to 20 minutes.

Heat Rash is the most common problem in hot work environments. Heat rash is caused by sweating and looks like a red cluster of pimples or small blisters. Heat rash may appear on the neck, upper chest, groin, under the breasts and elbow creases. The best treatment for heat rash is to provide a cooler, less humid work environment. The rash area should be kept dry. Powder may be applied to increase comfort. Ointments and creams should **not** be used on a heat rash. Anything that makes the skin warm or moist may make the rash worse.

Prevention Made Simple: Program Elements

Heat Illness Prevention Program key elements include:

- A Person Designated to Oversee the Heat Illness Prevention Program
- Hazard Identification
- Water, Rest, Shade Message
- Acclimatization
- Modified Work Schedules
- Training
- Monitoring for Signs and Symptoms
- Emergency Planning and Response

- OSHA General Duty Cause
- OSHA Technical Manual (OTM) TED 01-00-015 [TED 1-0.15A],
- Cal OSHA and MN DOL
- Washington State- Specific Heat Stress standard for outdoor workers WAC 296-62-095 Outdoor Heat Exposure
- ACGIH , ASPR for Disasters/Extreme Environments
- NIOSH

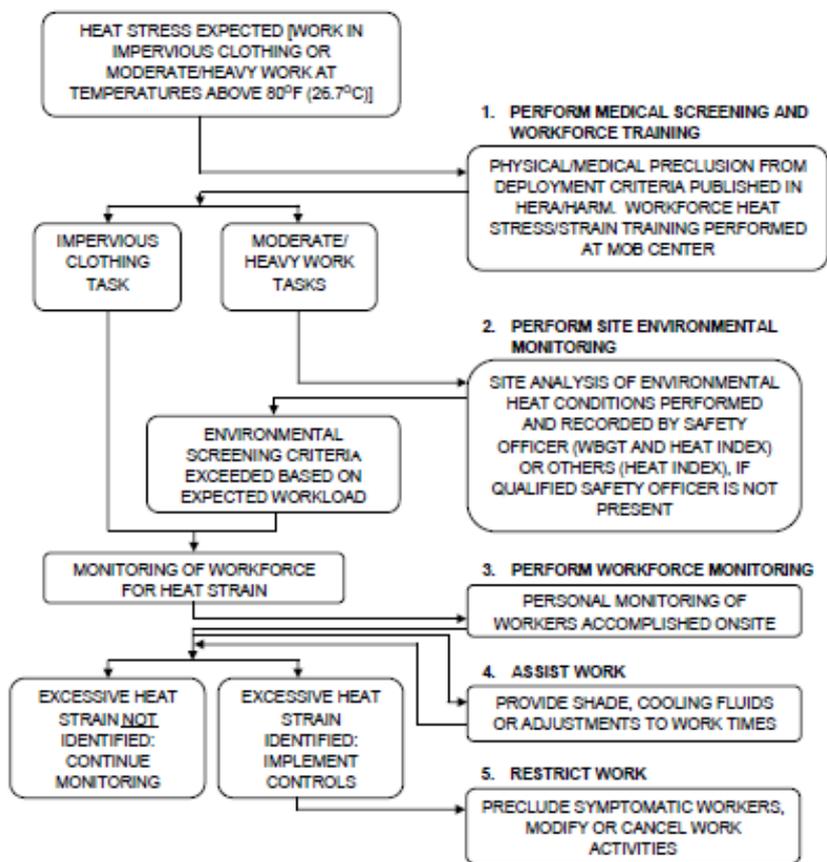
ASPR Thresholds/Heat Stress Management



Work Regimen, Heat



TABLE I
HEAT STRESS/STRAIN MANAGEMENT PROCESS



Note to Table I: ImperVIOUS clothing includes limited use vapor barrier coveralls (e.g. Tyvek Suits); moderate work includes sustained/moderate hand or arm work (e.g. Triage and Medical Activities performed on deployments). For analysis purposes, activities performed in imperVIOUS clothing is considered heavy work; heavy work includes intense arm or trunk work, carrying, and manual labor such as pushing or pulling loads (e.g. Moving Equipment/Erecting Tents).

- Work Regimen-Heat Strain Management Process –US HHS/ASPR – Office of the Assistant Secretary for Preparedness

When values in Table II are not exceeded, there is little risk of exposure to heat stress. If values are exceeded, workforce monitoring and the assistance with or restriction of work occurs.

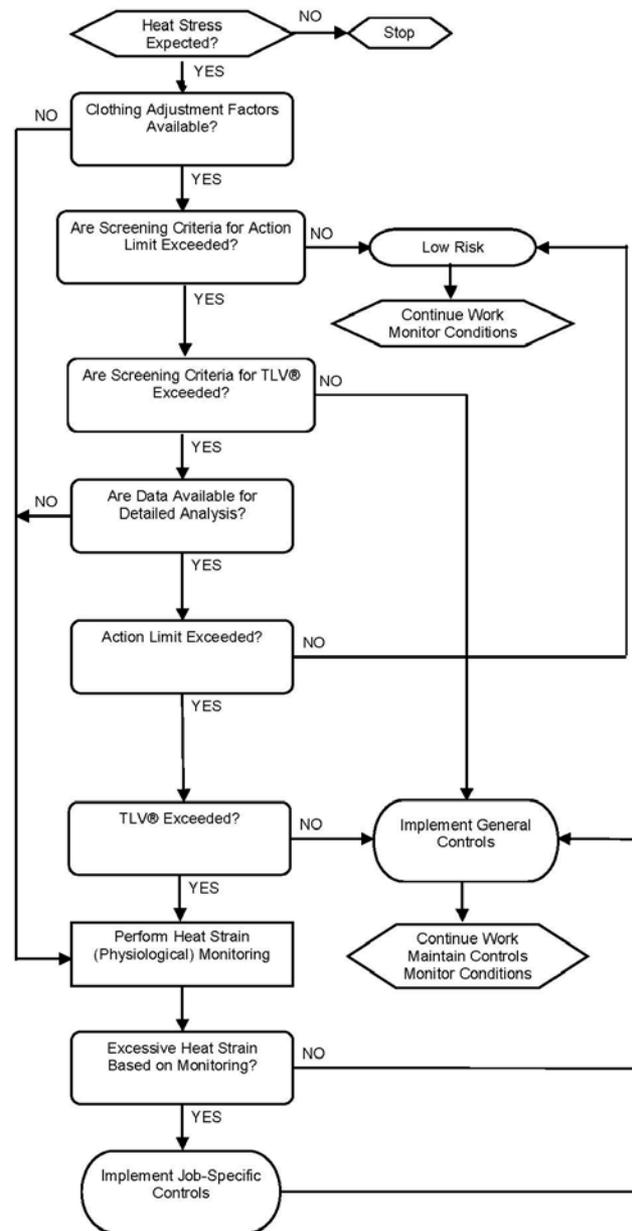
Work % in Work/Rest Cycle ¹	Threshold Limit (Acclimatized) ¹		Action Limit (Non-Acclimatized)	
	Moderate Work	Heavy Work	Moderate Work	Heavy Work
75% - 100%	82.4 (28°C)	---	77 (25°C)	---
50% - 75%	84.2 (29°C)	81.5 (27.5°C)	78.8 (26°C)	75.2 (24°C)
25% - 50%	86 (30°C)	84.2 (29°C)	80.6 (27°C)	77.9 (25.5°C)
0% - 25%	88.7 (31.5°C)	86.9 (30.5°C)	84.2 (29°C)	82.4 (28°C)
0%	WBGT of > 90°F (32.2°C) and Heat Index of > 121°F (49°C)			

Note 1: Acclimatization is physical activity under physical conditions similar to anticipated work, five (5) of the last seven (7), or ten (10) of the last fourteen (14) days. Noticeable loss of acclimatization occurs after four (4) days without acclimatization activities.

Note 2: When WBGT is not available, the following heat index action points may be used. These are conservative action points: Heat Index of <90°F (32.2°C) ; Heat Index of <103°F (39.4°C) ; Heat Index of <121°F (49.4°C) ; Heat Index of >121°F (49.4°C) . A reduction of one (1) level flag should be imposed upon non-acclimatized workers.

ACGIH 2008 Heat Stress/Strain TLV Decision Flow Chart

ACGIH® Heat Stress and Strain TLV® Decision Flow Chart



Re: Mizula and Lippy: Volpentest
HAMMER Heat Stress 4 hour Training



Prevention Made Simple: Program Elements

- Heat Illness Prevention Program key elements include:
- A Person Designated to Oversee the Heat Illness Prevention Program
- Hazard Identification
- Water. Rest. Shade Message
- Acclimatization
- Modified Work Schedules
- Training
- Monitoring for Signs and Symptoms
- Emergency Planning and Response



Climate Change and Worker Health

- Number of heat waves has almost tripled the long-term average -3rd Nat'l Climate Assessment Report (2011 & 2013)
- CDC Study indicated that in 20 cases of heat illness or death over 2 years, 9 deaths in 1st 3 days and several on 1st day- inexperienced workers have higher incidents of heat illness and death
- Outdoor workers and those in high ambient air indoor location such as warehouses have increased risk of heat illness
- Full acclimatization is critical and may take up to 14 days (Arbury 2014)
- New workers should be slowly exposed to hot environments
- PPE use and other Engineering Controls needed.