# Tectonic

PRACTICAL SOLUTIONS. EXCEPTIONAL SERVICE.

# **Heat Stress**

# Weather Fatalities





# What is Heat Stress?

## Heat production total from:

- Metabolic heat from converting food to energy
- Heat production from activity and work
- Heat gain from external heat sources
  - Radiation (sun and soil)
  - Convection
- Chemical resistant clothing/PPE

# What is Heat Strain?

#### **Heat Production**

- Metabolic heat from converting food to energy
- Heat production from activity and work
- Heat gain from external heat sources
- Heat trapped by clothing (PPE)

#### Heat Loss

- Evaporation (Sweating)
- Conduction
- Convection
- C Radiation

## Heat Production > Heat Loss

# Evaporation



Evaporation of sweat is your body's quickest and best way to lose heat.
High humidity slows or prevents evaporation.
If the body cannot lose heat through evaporation, body temperature goes up as if the air temperature was even high.
For example, if the air temperature is 95°

and the humidity is 75%, you body will feel and act as if the air temperature was 130° or higher.



#### Four Environmental (External Heat) Factors

- Temperature
  - Ambient Air Temperature
  - Humidity
    - Amount of Moisture in the air
  - Radiant Heat
    - Such as from the sun or furnace
- Air Velocity
  - Circulating air



#### **Heat Equation**

#### THE HEAT EQUATION

#### HIGH TEMPERATURE + HIGH HUMIDITY + PHYSICAL WORK = HEAT ILLNESS



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20

### **HEAT DISORDERS**

30

#### **Pre-Disposing Factors**

- Small body size
- Overweight/Inactivity
- Over 40 years old (the older the more sensitive)
- Heart disease/High bold pressure
- Previous heat illness
- Diabetes



# Heat Illnesses

Severity

Heat rash Heat cramps Syncope Heat exhaustion Heat stroke

# Heat Rash

- Most common problem in hot work environments
- Symptoms
  - Prickly heat is manifested as red papules and usually appears in area where the clothing is restrictive
  - Sweat cannot freely evaporate from the skin and sweat ducts become plugged



#### Heat Rash Prevention & Treatment

#### Prevention

- Wear breathable clothing
- Thorough cleansing of the skin
- Treatment
  - Keep skin dry, calamine lotion



# **Heat Cramps**

- May result after excessive water loss, sweating, dehydration
- Symptoms



 Severe pain and cramps in legs and abdomen, fainting or dizziness, weakness, profuse sweating

#### Treatment

Increase fluid intake, increase salt intake, rest and move to a cool place.



#### Syncope

Pooling of blood in extremities resulting in blurred vision, dizziness and fainting

Treatment

Lay down

• Hydrate

• Seek medical attention





### Heat Exhaustion

- Caused by depletion of salt/water due to:
  - Intense prolonged exercise
  - Gradual dehydration



- Mild form of shock
- Thirst
- Painful heat cramps, nausea
- Heavy sweating
- Fast/weak pulse; shallow breathing
- Un-coordination action/giddiness





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# **Heat Stroke**

A MEDICAL EMERGENCY AND LIFE THREATING CONDITION

Body becomes unable to regulate itself & sweating mechanism fails; core body temperature rises IMMEDIATE attention required...body temperature can rise to >106 in 10-15 minutes



#### Heat Stress Symptoms

- Skin is hot and dry, flushed, no sweating
- Rapid pulse
- Confusion will not realize what's happening to him/her
- Nausea
- Convulsions
- Unconsciousness
- Damage to brain and other vital organs
- Death

Condition: Heat stroke Sweating stops. Fainting. Danger of organ damage and death. Hot, dry skin Core temperature rises

EFFECTS OF HEAT ON THE BODY

#### Heat Stroke Treatment

- Remove to a cooler location
- Immediate aggressive cooling of the victim's body using wet cloths, immerse in cold water
- Wrap in wet sheets
- Cold compresses to the head, neck and groin
- IMMEDIATELY transport to emergency medical facility?



#### Warning Signs of Heat Disorders



# HEAT STRESS PREVENTION & CONTROL



# 2. Take Rest Breaks

 Breaks are best in an air conditioned area
 Alternately, breaks are taken in a wellshaded area.



# Work Rest Regimes

work demands:	light	moderate	heavy	very heavy
100% work;	82	77	not	not
(breaks incl.)	88	82	allowed	allowed
75% work;	83	79	75	not
25% rest	88	84	81	allowed
50% work;	81	80	78	76
50% rest	90	86	84	82
25% work;	84	84	82	81
75% rest	91	86	87	86

40



# Work Activity Classifications

Classification	Description
Light	Standing, some arm/leg movement, small hand too use
Moderate	Walking, carry moderate loads, active arm work (e.g., Scrubbing in a standing position, moderate lifting or pushing)
Heavy	Some heavy lifting, active movement (e.g., shoveling, carpenter sawing by hand, heavy assembly work on a non-continuous basis)
Very Heavy	Lifting or moving heavy object with little or no break in between movements

# **Clothing Correction**

Clothing type	WBGT Correction
Work Clothes (long sleeve shirt and pant)	0
Double cloth overalls	+3
Chemical resistant clothing	+11

# 3. Hydration

# Drink Plenty of water Schedule AND Take frequent water breaks



# Dehydration

ACCESS OF	fluid loss	time*	effect & symptoms (* timing may vary based on intensity of work and heat/humidity)
10 N	0.75 L	1 hr	unnoticed (at 1.5% weight loss you are considered dehydrated)
	1.5 L	2-3 hrs	loss of endurance, start to feel thirsty, feel hot, uncomfortable
	2.25 L	3-4 hrs	loss of strength, loss of energy, moderate discomfort
	3 L	4-5 hrs	cramps, headaches, extreme discomfort
4	3.5-4 L	5-6 hrs	heat exhaustion, nausea, faint
	5+ L	7+ hrs	heat stroke, collapse, unconsciousness
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# Water and Liquids

- Acclimatization does not decrease your body's need for water.
- Workers must have access to sufficient amount of cold drinking water.
- Must be available at all times.
- Do not drink caffeinated, carbonated, diet drinks as they take water out of your body.
- Water is the best; juices and/or non-caffeine sport drinks are also good (juices contain energy restoring glucose).



# 4. Use Buddy System

- A worker heading into a heat stroke will no longer realize what's happening to him/her.
- It is vital that co-workers work together as "buddies" and the buddy can recognize what's happening and intervene, if necessary.
- Without quick attention, the coworker may die!



#### 5. Promote Cooling

- Wear light-colored loose clothes that allow sweat to evaporate easily (cotton).
- Take into account any personal protective clothing that prevents sweat from evaporating.
- Wash clothes regularly and maintain good personal hygiene.



## **Cooling with Fans**

- Cooling fans increase the rate of sweat evaporation but it also cools by convection if the air is cooler than the skin.
- If relative humidity is over 75-80%, the fan will no longer increase evaporation of sweat.
- The closer the air temperature is to skin temperature the less effective the cooling.
- If the air temperature exceeds skin temperature than the fan may even heat up the body.



# 6. Acclimatization

- Each person has a different limit for the amount of heat required to cause heat strain.
- Repeated exposure to elevated heat stress causes physiological adaptions called acclimatization where the body becomes more efficient in coping with heat stress.
- Acclimatization takes about 3-7days depending on the heat exposure and the individual being exposed.
- Must be done gradually.
- Process requires frequent breaks/rest periods and the intake of fluids until the individual is acclimatized (4 glasses per hour).



# **Acclimatization Requirements**

Start with a light work load and gradually increase it.

Initially:

20% exposure for the first day

Followed by 20% per day increase in exposure over the next 4 days.

Start with longer rest periods and gradually decrease their length

#### Acclimatization

#### **Required when:**

- There are new hires
- Work load increases
- Protective clothing is required
- After long absences
  - O 50% on day back
  - **O** 20% per day increase for next 2 days
  - Final 10% on the 3<sup>rd</sup> day



# 7. Cooling Vests

Special cooling vests or ice vests have been developed to wear under chemical resistant suits



# 8. Training

Prior to work employees must be trained on the following:

- Heat illness prevention procedures
- Environmental and personal risk factors for heat illness
- Use of the buddy system
- The importance of consuming water throughout he work shift
- The importance of acclimatization
- Common signs/symptoms of heat illnesses
- The importance of reporting signs/symptoms of heat stress to the supervisor
- Emergency response procedures

# HEAT STRESS EVALUATION AND ASSESSMENT

# **Types of Assessment**

Environmental	Individual
Evaluate the ambient environment and its affects on the person	Evaluate the heat being generated within the person
Most commonly used	Core temperature
Heat Index	Heart Rate
WBGT	Heart rate

# Wet Bulb Globe Temperature (WGBT)

- Takes air temperature, humidity and radiant into account.
  - The WBGT gives an indication of the effects of humidity and wind on an individual.
  - Basis for heat stress measurements



Remember, when it's hot:

Heed your body! Watch for symptoms!
Ensure you're drinking enough!
Adjust your activity level – slow down
Take clothing/PE into account!



# Quiz Time

- 1. Which of the following is NOT a way to prevent heat stress?
  - a. Starting work before it gets to the hotter part of the day.
  - b. Taking a coffee break.
  - c. Acclimating to the heat.
  - d. Where light colored loose fitting clothing.
- 2. If someone is suffering from heat stroke:
  - a. Have them drink water, take a break and send them back to work.
  - b. Never move them, keep them in the location where you found them.
  - c. Apply wet cold compresses and call for emergency medical assistance.