4-Hour Heat Stress Training

Volpentest HAMMER

July 19-22, 2011

Volpentest HAMMER Training and Education Center
Managed by Mission Support Alliance, LLC

I know how to handle the HEAT!

Bernard Mizula, MS, CIH, CET, CHS-V, RPIH
Mizula, LLC
603-689-4225
Mizulallc@charter.net

This course is divided into five sections

1. Case studies, statistics and regulations
2. Physiology, Heat Stress Illnesses and treatment
3. Work environment evaluation
4. Work environment controls
5. Final group activity

At the end of this course you will be able to:

- Define heat stress, heat strain and heat-related illness (HRI)
- List five HRIs, identify their symptoms and state first aid measures for each
- List other issues heat stress can cause
- List two ways workers are protected from heat stress through regulations
- List five heat stress control methods
- Measure environmental conditions and develop a work plan to reduce heat stress for a given job

“Outdated, erroneous thinking about developing “dehydration tolerance” or that one’s unit can “stand” more than another because they are “tougher” or “more motivated” must be replaced by leadership decisions based on proven facts about heat and cold stress exposure.”-U.S. Navy

Volpentest HAMMER Training and Education Center
Managed by Mission Support Alliance, LLC

Section 1: Case Studies, Statistics and Regulations

Heat Stress Case Study #1

- June 15, 2006
- 90° F and 21% humidity
- DOE Security Protection Officer Training Competition participant
- Suffered heat injury
- Hospitalized for 8 days

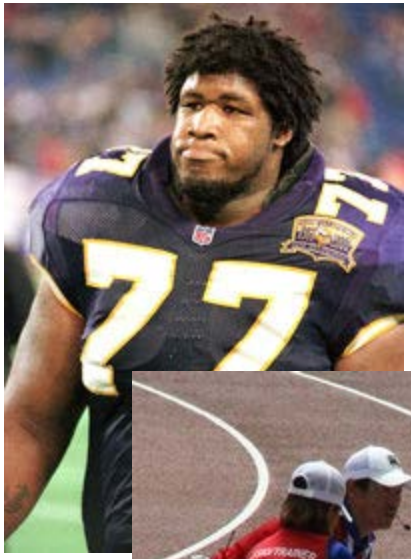
Heat Stress Case Study #2

- July 15, 2004
- 98°F ambient temperature
- Worker recently back from surgery
- Not acclimatized, no training
- Complained throughout the day about heat and dizziness
- On ladder removing trim from mobile office building
- Fell 6 feet from the ladder
- Died from severe head trauma

Heat Stress Case Study #3

- June 26, 2006
- 82-105º F with humidity 46 to 56%
- 27-year old construction laborer
- Laying pipe
- Not acclimatized to hot weather
- Suffered heat stroke; died 6 days later

Who is affected by heat stress?



Volpentest HAMMER Training and Education Center
Managed by Mission Support Alliance, LLC

How about these folks?

Volpentest HAMMER Training and Education Center
Managed by Mission Support Alliance, LLC

Article Launched: 08/28/2006 12:00:00 AM PDT

Unsafe conditions

OSHA complaint only latest concern over CIM's mental health

Mason Stockstill, Staff Writer

CHINO - Psychologist Stacy McLain was not surprised that the air conditioning didn't work in her office during last month's record-breaking heat wave.

Even though McLain works with mentally ill prisoners - most of whom take prescription drugs that make them susceptible to heat-related illnesses - she was never able to get a straight answer about why the air conditioner wasn't turned on.

Finally, after weeks of frustration, McLain filed a complaint with the state's Division of Occupational Safety and Health about the conditions at the California Institution for Men in Chino.

"I'm sure the quality of treatment goes down when you're sweating, sitting across the room from a felon who's sweating," she said.

Volpentest HAMMER Training and Education Center
Managed by Mission Support Alliance, LLC

Causal factors that affect heat stress

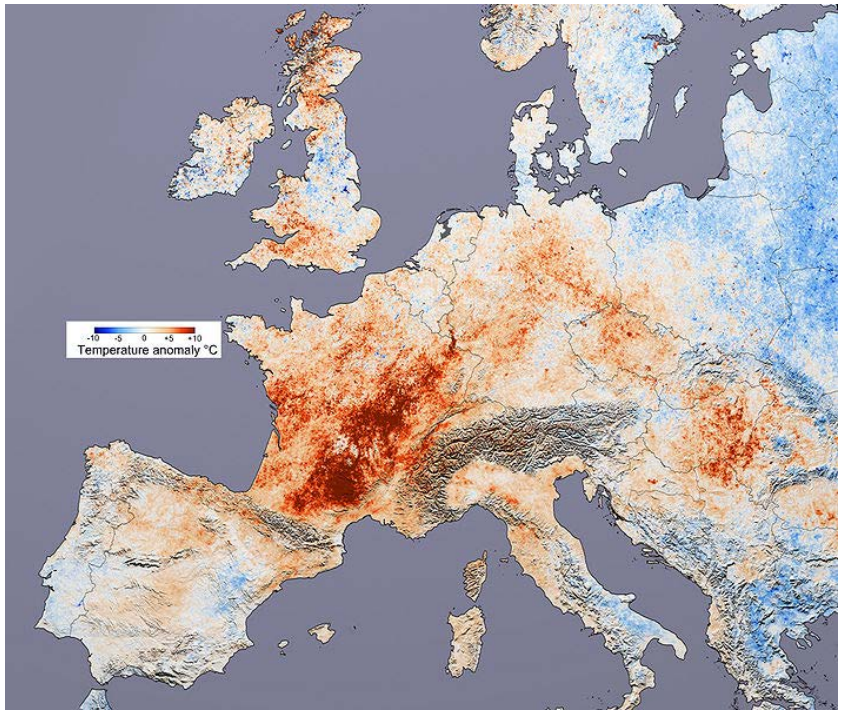
- Age and weight
- Degree of physical fitness
- Degree of acclimatization
- Metabolism
- Use of alcohol or drugs
- Medical conditions
- The type of clothing worn
- Prior heat injury

Between 1999 and 2003,
3,443 deaths occurred in the U.S. from exposure to extreme heat - CDC

2010 U.S. Northeastern heat wave, courtesy EPA

France was devastated by heat stress in 2003

- **14,802 heat-related deaths** -French NIH
- **Seven days of 104°F plus temperatures**



Nearly 40,000 heat-related deaths throughout Europe!

Volpentest HAMMER Training and Education Center
Managed by Mission Support Alliance, LLC

Cal/OSHA findings on heat-related illnesses-2005

- **Death in 54% of the cases**
- **38% required 24+ hours of hospitalization**
- **84% involved outdoor work exclusively**
- **92% involved moderate or strenuous work**
- **Average of 96°F ambient temperature**
- **Average humidity was 29%**
- **Work was in direct sunlight 76% of the time**
- **Shade was available 77% of the time**
- **Potable water was present 100% of the time**
- **78% of workers showed inadequate fluid consumption**

SHARP investigated heat-related illness in Washington State's workers from workers' comp claims filed from 1995 to 2004

- Construction - 150 claims (34%)
- Public Administration - 71 claims (16%)
- Manufacturing - 43 claims (10%)
- Agriculture, Forestry, Fishing and Hunting - 31 claims (7%)

What agencies protect workers from heat-related illnesses?

- OSHA
- DOE
- NIOSH/CDC
- WA State
- ACGIH

What does OSHA say?

Currently No Heat Stress Standard! OSHA will cite under the General Duty Clause

Section III: chapter 4 of the OSHA Technical Manual does cover Heat Stress and its investigation

However, OHSA currently has a campaign to prevent heat illness in outdoor workers

WATER. REST. SHADE.

The work can't get done without them.

Originated from Cal/OSHA

Section 534 of DOE-STD-1098-99, *Radiological Control*, discusses heat stress as it applies to radiological work

NIOSH/CDC

NIOSH and the CDC create recommended procedures and guidance for activities conducted in hot weather, such as NIOSH's "*Criteria for a Recommended Standard*: Occupational Exposure to Hot Environments" -1986

The state of Washington has a few regulatory requirements!

Temperature, radiant heat, or temperature-humidity combinations
[WAC 296-62-09013]

Workers…shall be afforded protection by use of adequate controls, methods or procedures, or protective clothing

Volpentest HAMMER Training and Education Center
Managed by Mission Support Alliance, LLC

WA has a specific Heat Stress standard for outdoor workers

WAC 296-62-095 Outdoor Heat Exposure

- Outdoor Temperature Action Levels
- Employer and employee responsibility
- Drinking water
- Responding to signs and symptoms of heat-related illness
- Information and training

Volpentest HAMMER Training and Education Center
Managed by Mission Support Alliance, LLC

Applies to outdoor work May 1 - September 30, annually, only when employees are exposed to outdoor heat at or above temperatures listed below

Outdoor Temperature Action Levels [WAC 296-62-09510]	
All other clothing	89°
Double-layer woven clothes including coveralls, jackets and sweatshirts	77°
Non-breathing clothes including vapor barrier clothing or PPE, such as chemical resistant suits	52°

Volpentest HAMMER Training and Education Center
Managed by Mission Support Alliance, LLC

First aid for wildland fire fighters
[WAC 296-305-07017]

- **…shall be provided with a minimum of one quart per two-hour time period of electrolyte drinks or potable water**
- **…shall be trained in the symptoms of heat-related disorders**

Volpentest HAMMER Training and Education Center
Managed by Mission Support Alliance, LLC

Control heat stress hazards created by PPE [WAC 296-824-60015]

Workers continue asbestos abatement tasks 224-U building at U Plant.

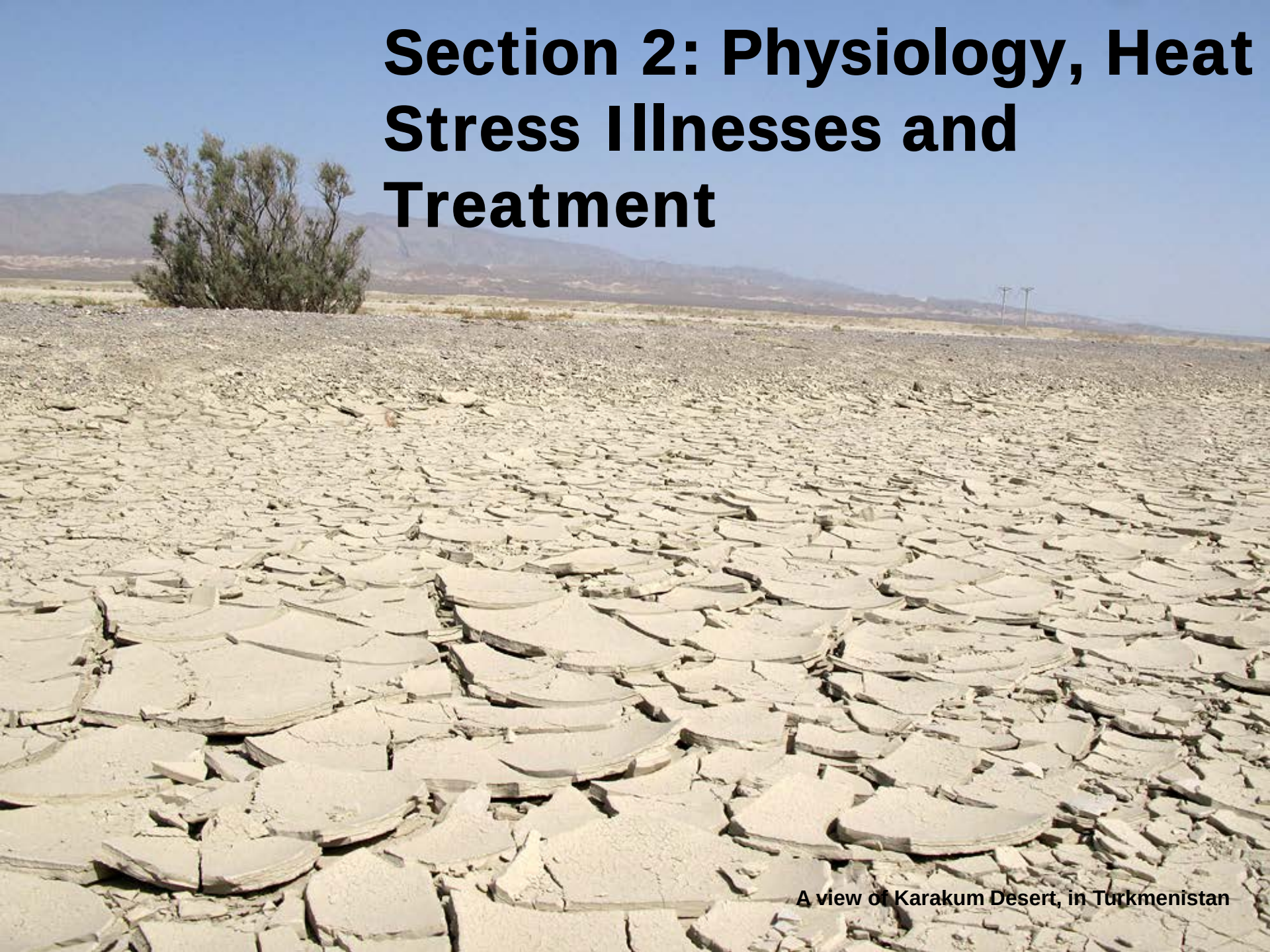
ACGIH recommends worker removal from heat exposure if:

- Sustained (several mins) Heart Rate > (180 bpm – accounting for age)
- Body core temp > 38.5° C for medical selected & acclimatized
- Body core temp > 38° C in unselected & un-acclimatized
- Recovery HR after 1 min peak effort > 120 bpm
- Symptoms of sudden & severe fatigue, nausea, dizziness or lightheadedness

ACGIH states individuals may be at greater risk if the following occurs:

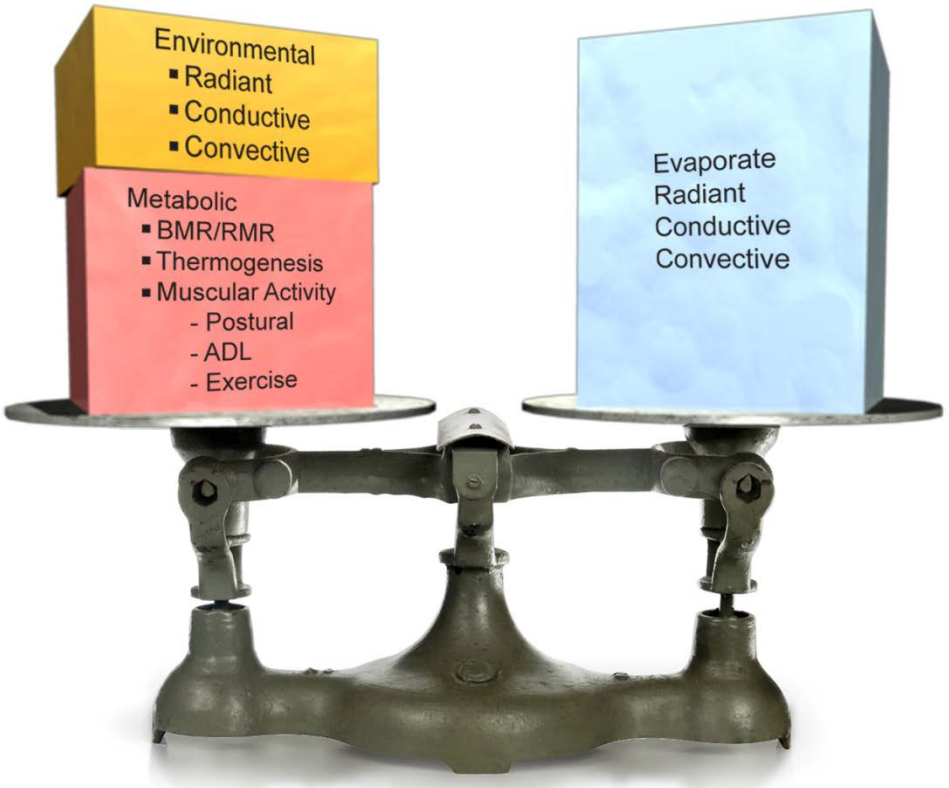
- Profuse sweating is sustained over hours
- Weight loss over shift > 1.5% body weight
- 24-hour urinary sodium excretion is < 50 mmoles

Section 2: Physiology, Heat Stress Illnesses and Treatment



A view of Karakum Desert, in Turkmenistan

Heat Balance is a necessity for the body in order to prevent harm



Normal Range in
Body Temperature
36-38º C

Simplified heat balance equation

$$S = M + R + C - E$$

Where:

- S = heat storage rate
- M = metabolic rate
- R = radiant heat exchange rate
- C = Convective heat exchange rate
- E = Evaporation rate of heat

So, what is Heat Stress, Heat Strain and Heat-Related Illness (HRI)?

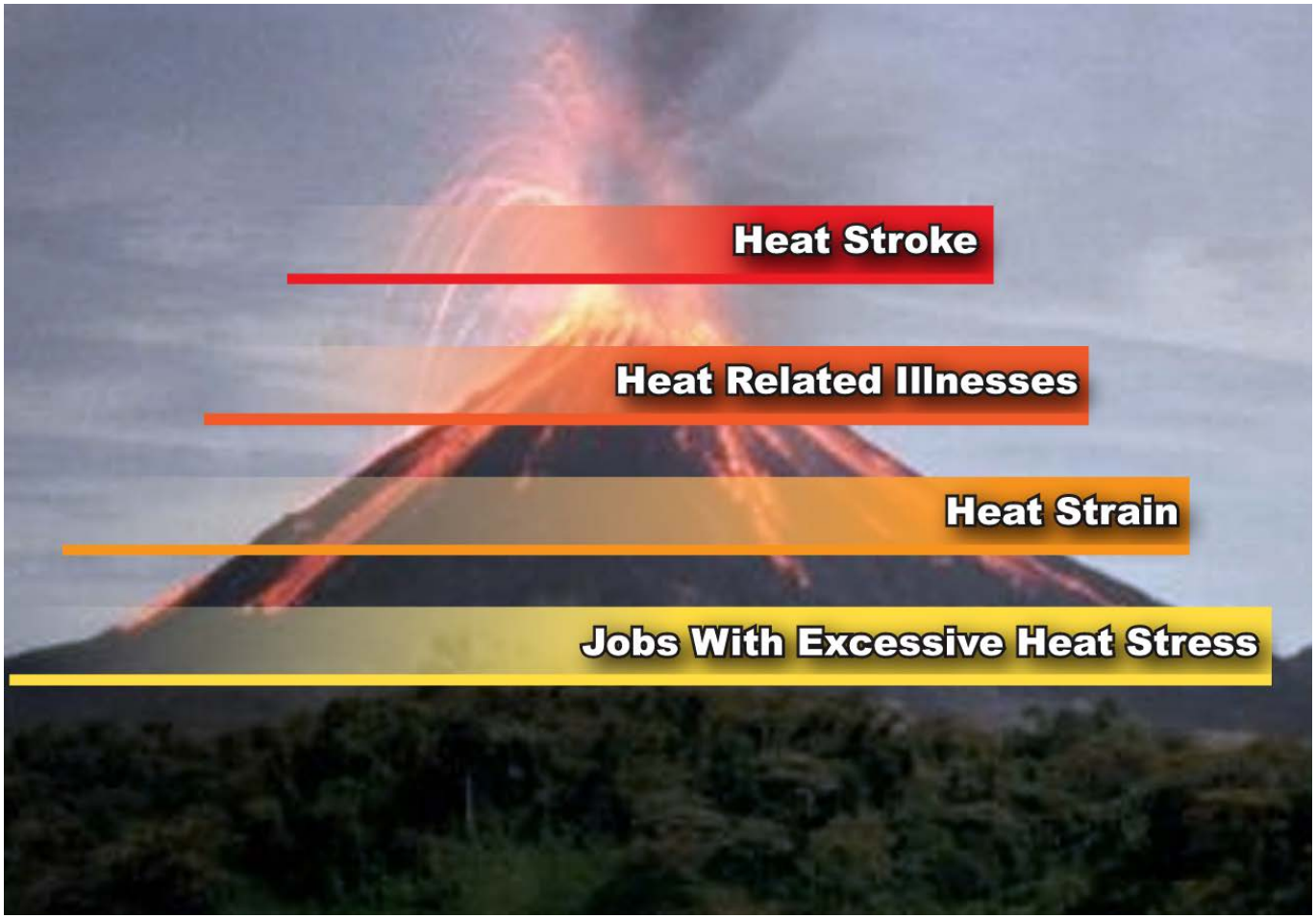
They all come from Thermal Stress on the body!

Heat Stress

Heat stress is the net heat load to which a worker may be exposed from the combined contributions of metabolic cost of work, environmental factors and cooling requirements - ACGIH

A close-up of construction, Hanford DOE

Heat Stress can be like a volcano - explosive and deadly



Volpentest HAMMER Training and Education Center
Managed by Mission Support Alliance, LLC

NIOSH advises that workers suffering from heat stress are also more prone to suffer other injuries

Such as burns while operating a grill, yes, in some circles this is work!

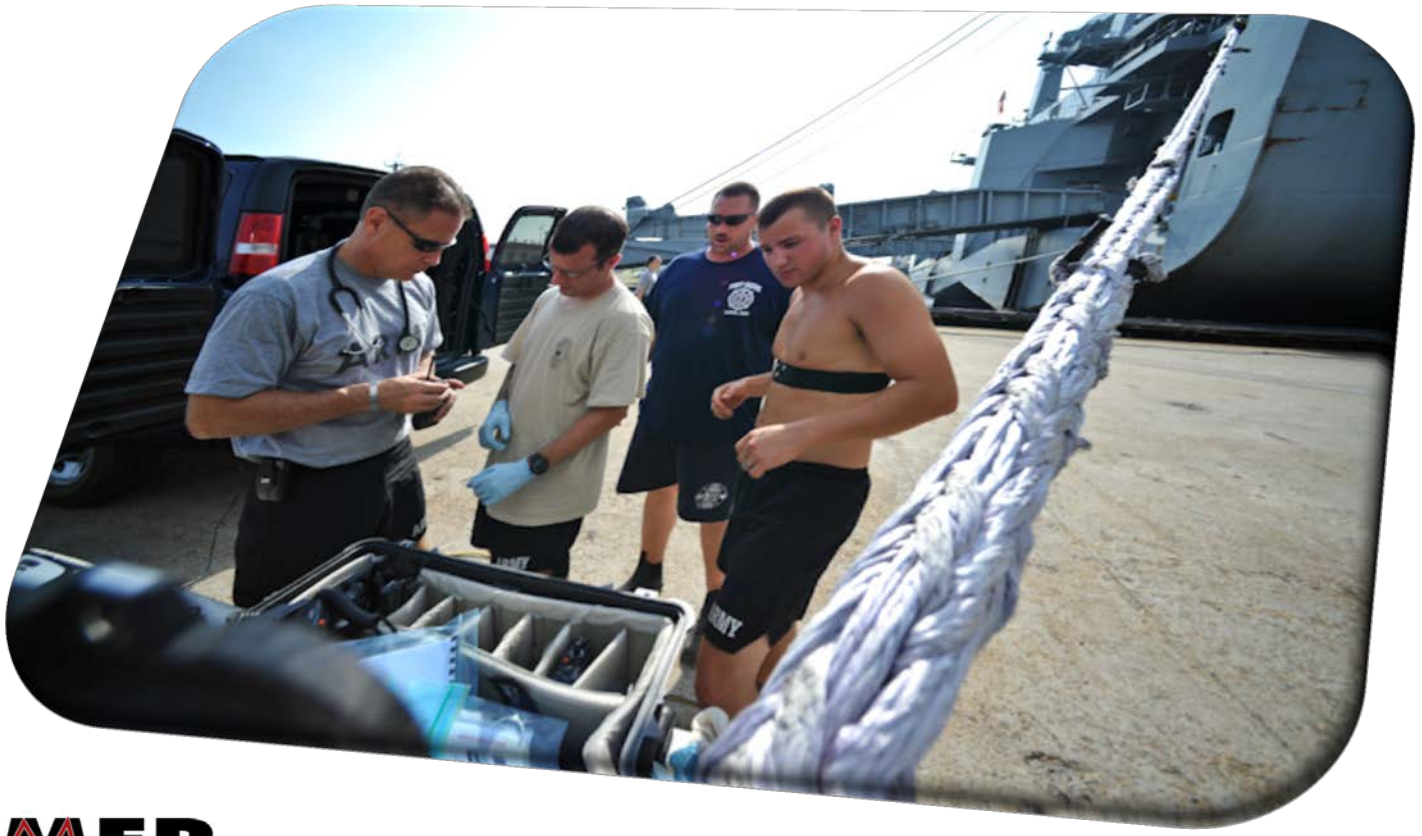
Heat Strain

Heat **strain** is the overall physiological response resulting from heat stress - ACGIH

It's how your body tries to stay in BALANCE!

Volpentest HAMMER Training and Education Center
Managed by Mission Support Alliance, LLC

Heat-Related Illness is the health effect seen on the body if heat strain is not brought under control



Volpentest HAMMER Training and Education Center
Managed by Mission Support Alliance, LLC

What signs and symptoms might you notice if your body is too hot?

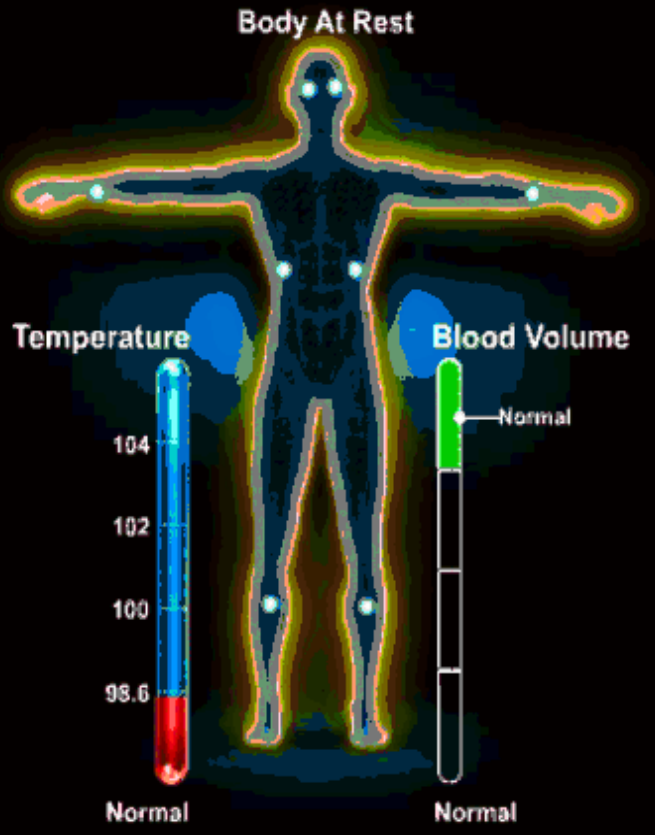
Volpentest HAMMER Training and Education Center
Managed by Mission Support Alliance, LLC

Let’s look at what happens when the body is placed under heat strain

Sequoyah Nuclear Plant Fire Operations perform an annual fire protection valve maintenance.

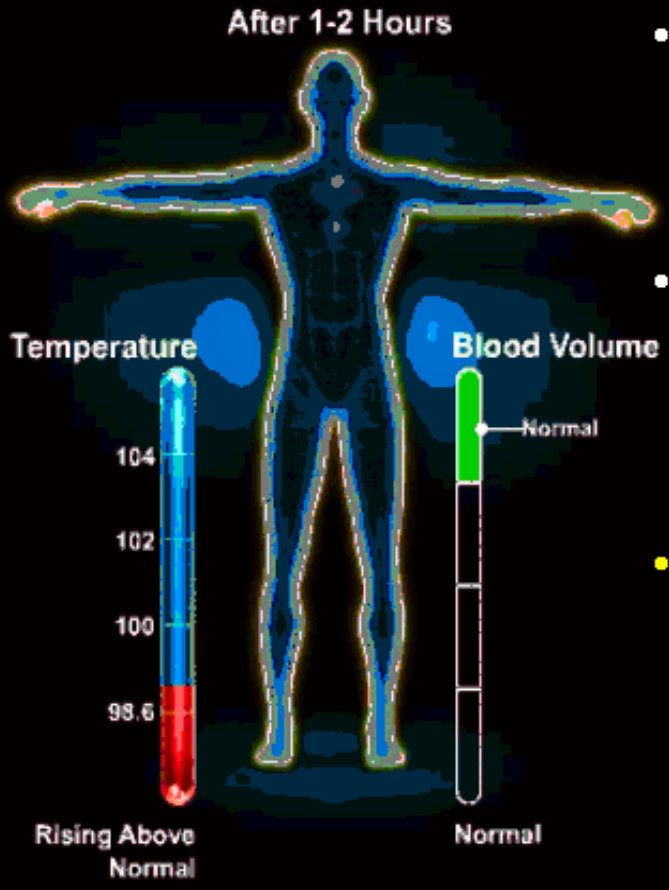
Volpentest HAMMER Training and Education Center
Managed by Mission Support Alliance, LLC

Physiology of Heat Stress



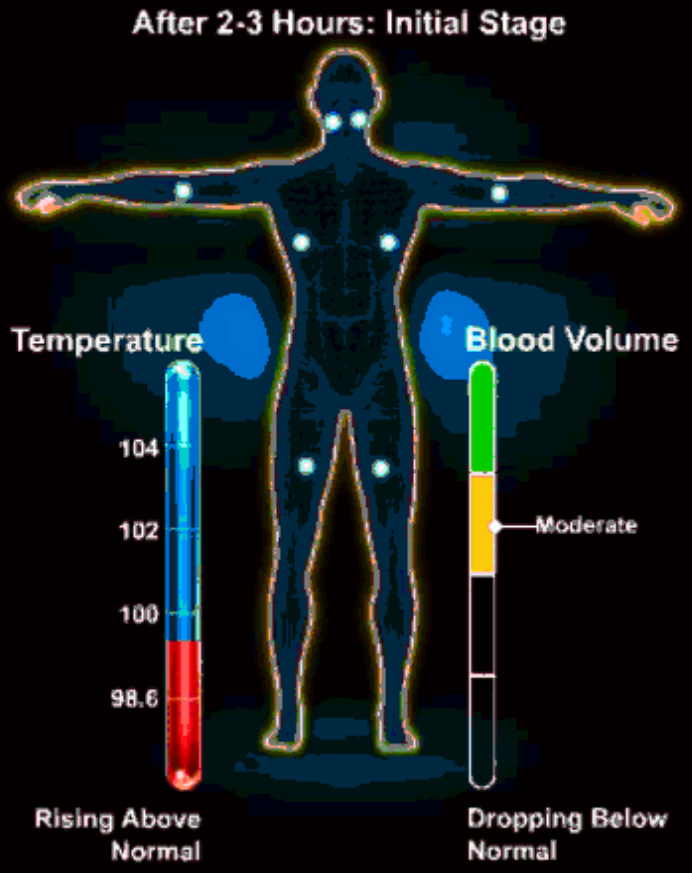
During both rest and activity, the human body tries to maintain an internal temperature of 98.6 F.

Physiology of Heat Stress



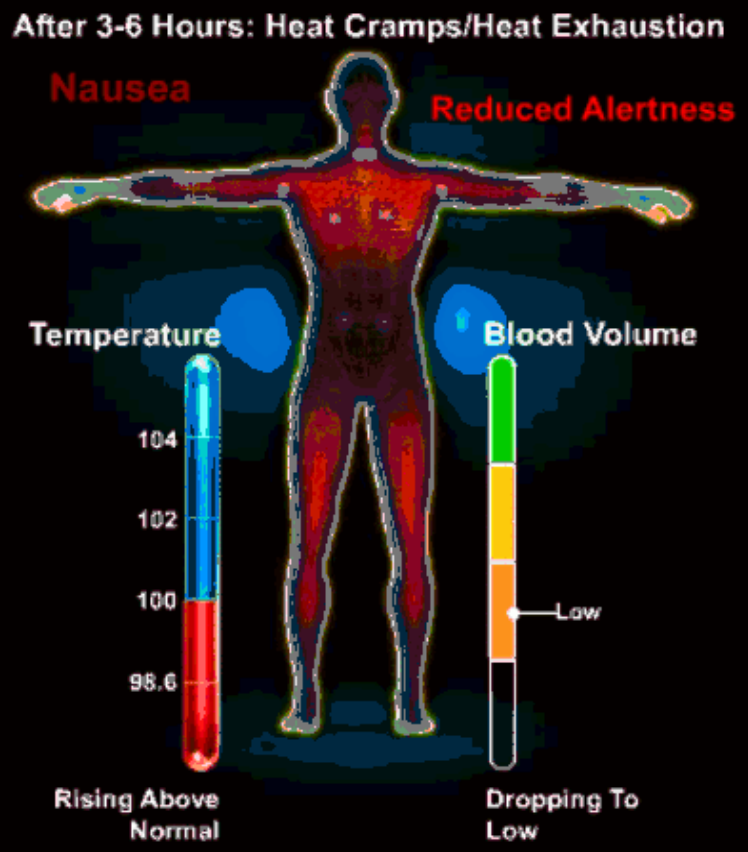
- Hot weather, heat sources, and hard work raise the body's core temperature.
- Heated blood is pumped to the skin's surface, where body heat transfers to the environment, if cooler.
- If heat has to be shed faster, sweat carries it outside skin and evaporates to aid cooling.

Physiology of Heat Stress



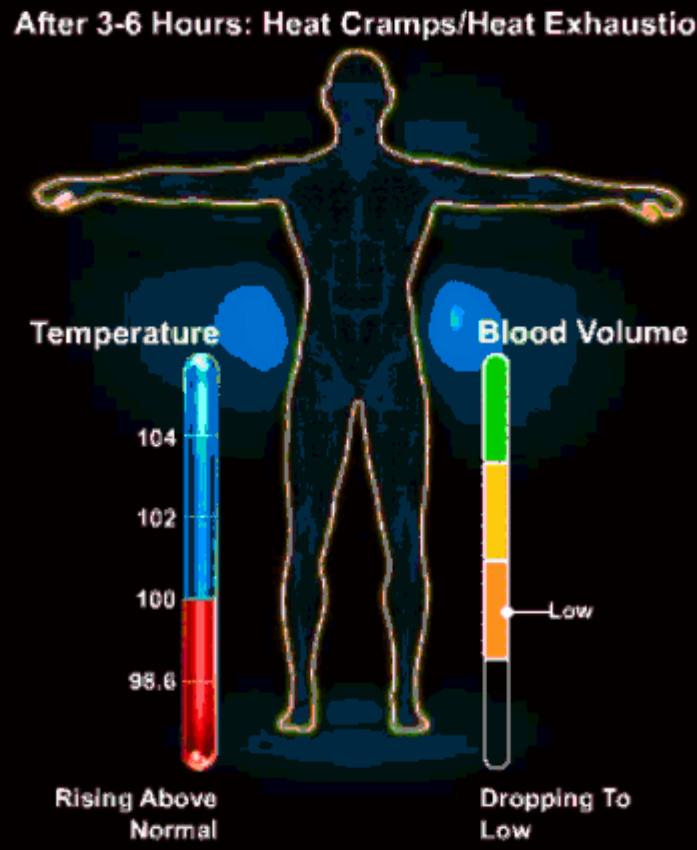
- During heavy work, a body can lose 1-2 liters of water per hour.
- After 2-3 hours of fluid loss, a person is likely to:
  - Lose endurance
  - Become uncomfortable
  - Feel hot
  - Become thirsty

Physiology of Heat Stress



- The longer a body sweats, the less blood there is to carry excess heat to skin or oxygen and nutrients to muscles.
- After 3 hours, a dehydrated worker may experience:
  - Headaches
  - Muscle fatigue
  - Loss of strength
  - Loss of accuracy and dexterity
  - Heat cramps
  - Reduced alertness
  - Nausea

Physiology of Heat Stress



- Water is key to cooling body and combatting heat stress.
- Without fluid replacement during an extended period of work, the body is at risk of exhaustion.
- Untreated heat exhaustion may lead to heat stroke.

The following HRIs can occur if a worker's heat stress is not controlled

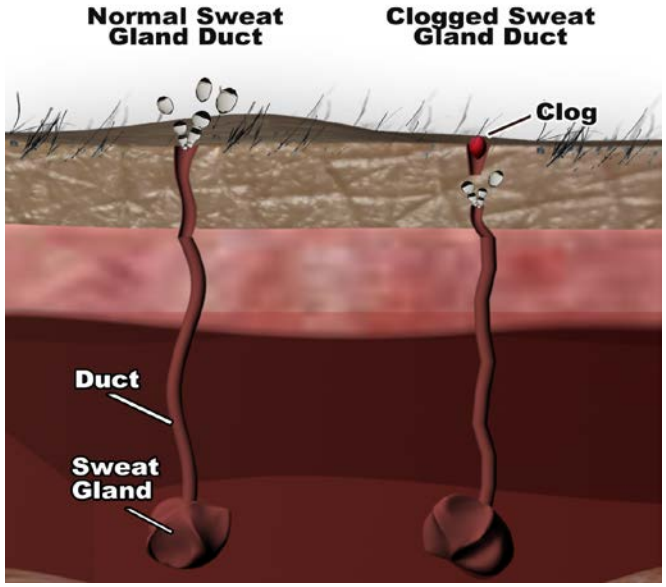
- Heat Fatigue
- Heat Rashes
- Heat Cramps
- Heat Exhaustion
- Heat Syncope (collapse/fainting)
- Heat Stroke

Be aware of the signs and symptoms of heat fatigue, including impaired performance of skilled sensor motor, mental, or vigilance jobs

There is no treatment for heat fatigue except removing the heat stress before a more serious HRI develops

Heat rash is the most common HRI in hot work environments

- First sign of concern
- Red papules
- Restrictive clothing
- Un-evaporated sweat
- May become infected
- Hot, humid conditions
- Reduces heat tolerance



Treatment for Heat Rash includes the following:

- Work in a cooler environment
- Reduce humidity
- Keep the affected area dry
- Starch powder, calamine lotion, corticosteriod lotion

Heat Cramps

- Caused by performing hard physical labor in a hot environment
- Attributed to an electrolyte imbalance caused by sweating
- Cramps can be caused by too much or too little salt

Treatment for Heat Cramps includes the following:

- Removal from work with rest
- Water with salt replacement
- Electrolyte replacement liquids is effective in minimizing physiological disturbances during recovery

Heat exhaustion should not be dismissed lightly for several reasons

- Heat Exhaustion is caused by the loss of body fluids and important salts
- Usually exposed to heat for a prolonged amount of time, such as cleaning out tanks, and dehydration occurs
- Fainting associated with heat exhaustion can be dangerous
- Victim may be injured when he or she faints

Watch for Heat Exhaustion signs and symptoms

- Headaches, dizziness/light headedness, weakness
- Mood changes (irritable, or confused/can't think straight)
- Feeling sick to your stomach, vomiting
- Decreased and dark-colored urine, fainting/passing out, and pale clammy skin
- Skin is cool and pale
- Pupils become dilated
- Victim is usually conscious but may faint, has a core temperature of over 102°F

Treatment for Heat Exhaustion includes:

- Remove from the hot environment and give fluid replacement
- They should also be encouraged to get adequate rest

Heat Syncope

- In heat collapse, the brain does not receive enough oxygen because blood pools in the extremities
- The onset of heat collapse is rapid and unpredictable

Acclimatizing workers to hot environments can reduce Heat Syncope

Volpentest HAMMER Training and Education Center
Managed by Mission Support Alliance, LLC

Heat Stroke: a medical emergency!

- Occurs when the body's system of temperature regulation fails and body temperature rises to critical levels
- Caused by a combination of highly variable factors
- Occurrence is difficult to predict

Watch for Heat Stroke's signs and symptoms

- Confusion, irrational behavior, loss of consciousness, convulsions
- Lack of sweating (usually); hot, dry skin, and an abnormally high body temperature, e.g., an internal temperature of 105.8°F
- If body temperature is too high, it causes death
- Pulse is strong and rapid
- Small pupils

Treatment for Heat Stroke includes:

- Professional medical treatment should be obtained immediately
- Move worker to shady area and the outer clothing should be removed
- Skin should be wetted and air movement around should be increased to improve evaporative cooling
- Fluids should be replaced as soon as possible

Heat stress can lead to an increase in other safety, health and job-related issues - NIOSH

- Reduced work performance
- Increased accidents
- Reproductive problems
- Heart/lung strain

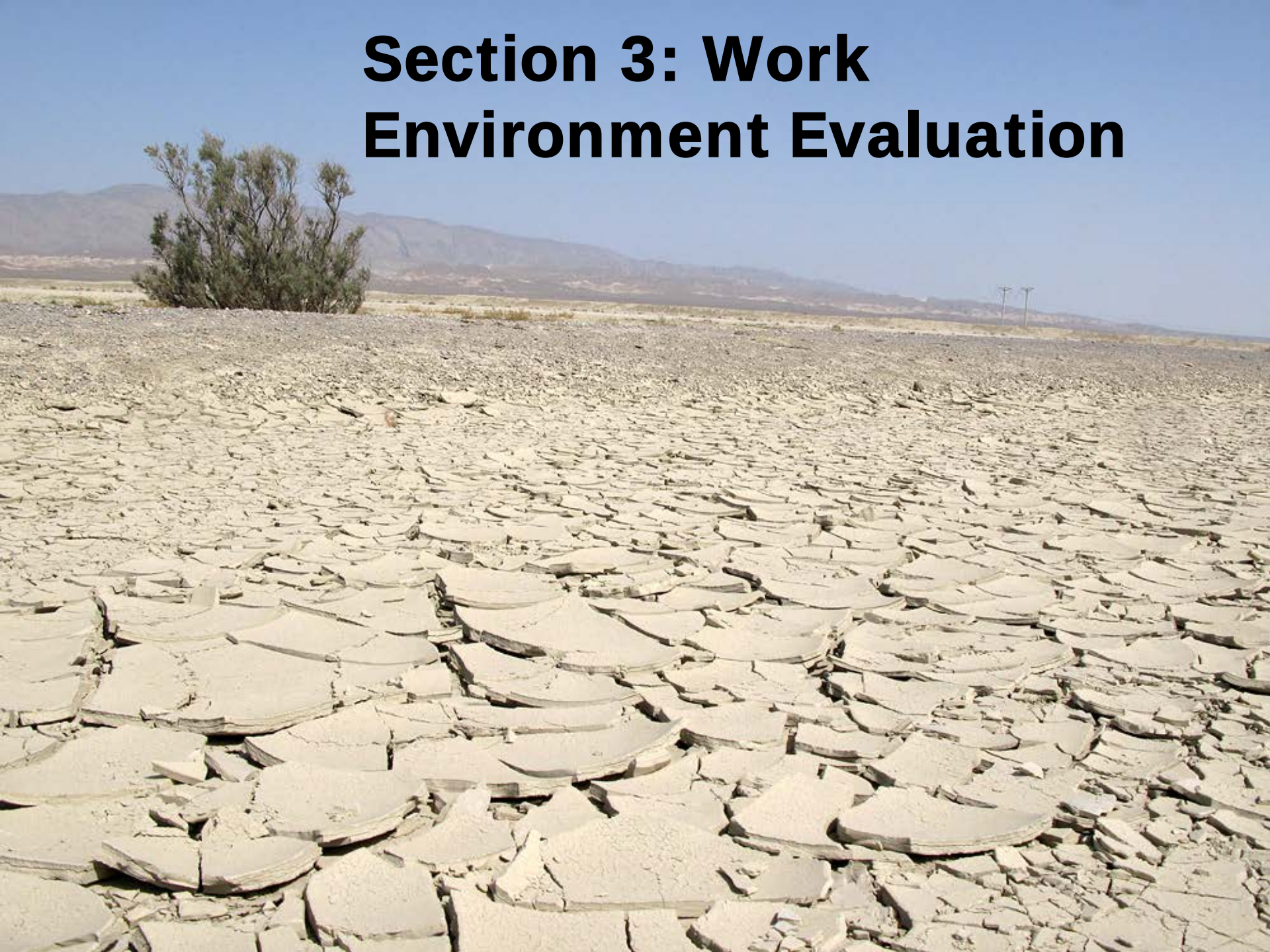
NASA conducted a study, CR-1205-1, "A Compendium of Human Responses to the Aerospace Environment.“ They found as temperature increases, work quality is negatively affected

NASA CR-1205-1							
Temperature in ^{o}F	75	80	85	90	95	100	105
% Loss is work output	3	8	18	29	45	62	79
% Loss in accuracy		5	40	300	700		

Heat stress affects helicopter pilots' job skills

- Workers aren't as alert or productive in the heat
- 1993 study of Israeli helicopter pilot errors (n=500) found dose-response relationship with ambient temp (Froom)
- Work/rest scheduling can greatly reduce amount of productive work time

Section 3: Work Environment Evaluation



You must evaluate environmental factors and work conditions in order to select proper controls

Volpentest HAMMER Training and Education Center
Managed by Mission Support Alliance, LLC

Environmental measurements should be made at, or as close as possible to, the specific work area where the worker is exposed

Measure each work area for the level of each environmental factor to which workers are exposed

What is a WBGT?

1. Normal thermometer (dry-bulb)
2. Wet-bulb thermometer
   - humidity
3. Globe temperature
   - radiant heat

Wet Bulb Globe Temp

Work environment evaluation: Wet Bulb Globe Temperature

- **With direct exposure to sunlight:**

$$WBGT_{out} = 0.7T_{nwb} + 0.2T_g + 0.1\ T_{db}$$

- **Without direct exposure to the sun:**

$$WBGT_{in} = 0.7T_{nwb} + 0.3T_g$$

ACGIH evaluation tools are based on WBGT for workers in a basic, summer work uniform

ACGIH WBGT additions for different work clothing	
Type of clothing	**WBGT addition °C**
Summer work uniform	0
Cloth (woven materials) overalls	3.5
Double-cloth overalls	5.0

NEVER avoid warnings from workers even if measurements say it should be OK!

Volpentest HAMMER Training and Education Center
Managed by Mission Support Alliance, LLC

Humidity and Temperature

Humidity	Temperature
70 %	100°F/ 37.8°C
60 %	95°F/ 35°C
50 %	90°F/ 32.2°C
40 %	85°F/ 29.4°C
30 %	80°F/ 26.7°C

Volpentest HAMMER Training and Education Center
Managed by Mission Support Alliance, LLC

NOAA's National Weather Service

Heat Index

Temperature (°F)

Relative Humidity (%)	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	130	137			
60	82	84	88	91	95	100	105	110	116	123	129	137				
65	82	85	89	93	98	103	108	114	121	126	130					
70	83	86	90	95	100	105	112	119	126	134						
75	84	88	92	97	103	109	116	124	132							
80	84	89	94	100	106	113	121	129								
85	85	90	96	102	110	117	126	135								
90	86	91	98	105	113	122	131									
95	86	93	100	108	117	127										
100	87	95	103	112	121	132										

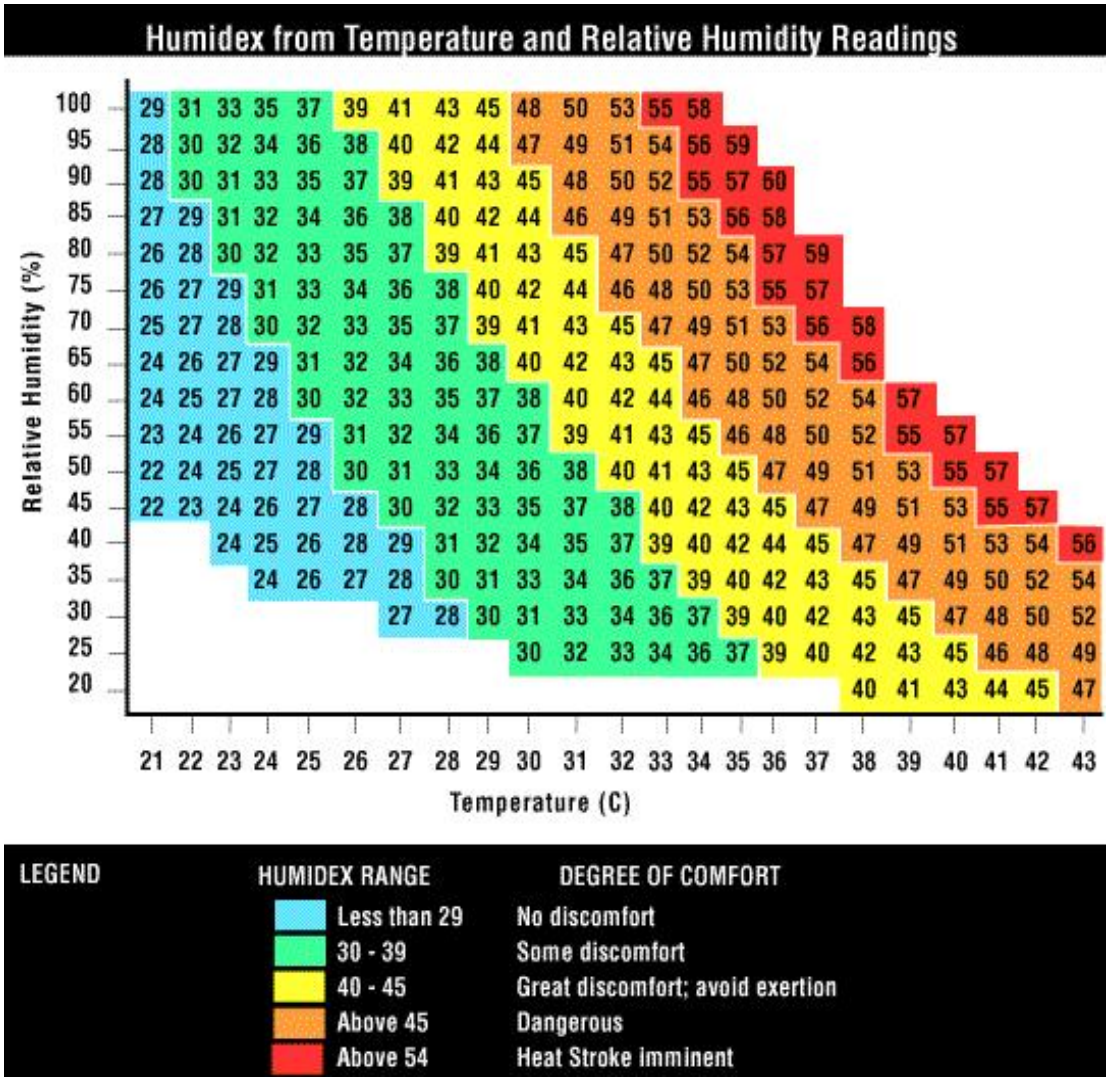
Likelihood of Heat Disorders with Prolonged Exposure or Streuous Activity

Caution | Extreme Caution | Danger | Extreme Danger

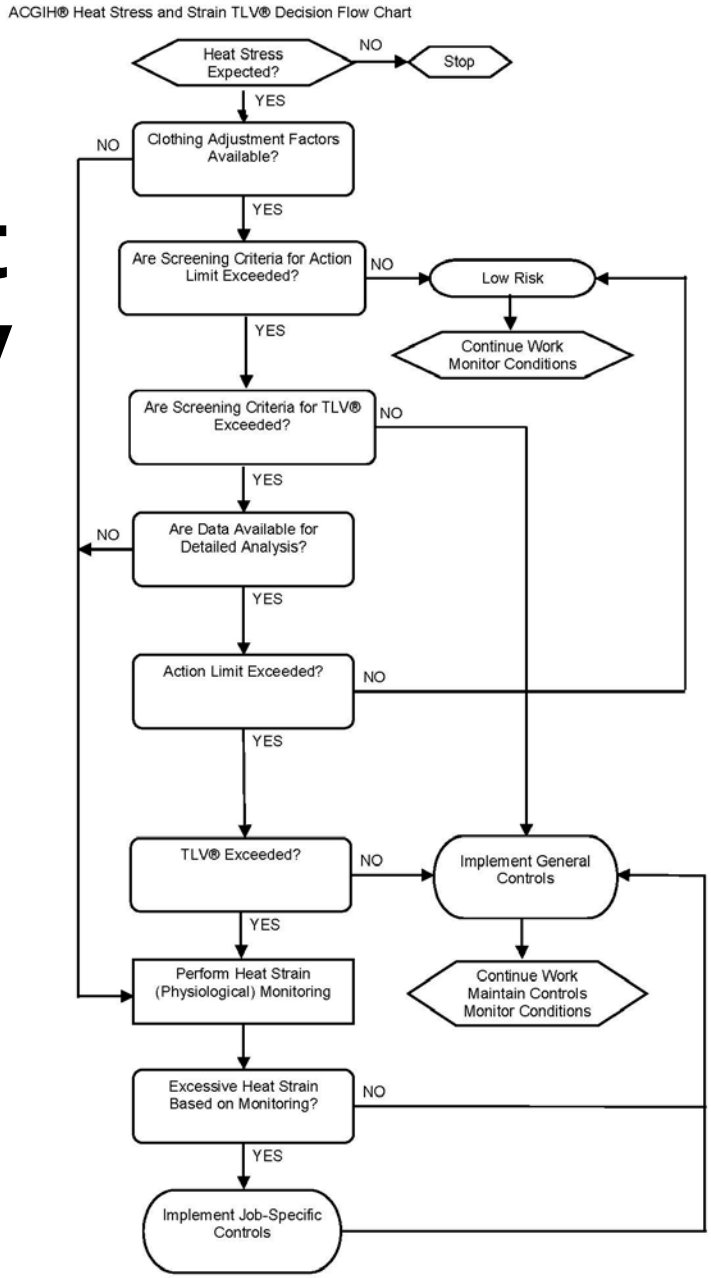
Exposure to full sunshine can increase heat index values by up to 15° F

Volpentest HAMMER Training and Education Center
Managed by Mission Support Alliance, LLC

Canadian Humidex



ACGIH 2008 Heat Stress/Strain TLV Decision Flow Chart



Volpentest HAMMER Training and Education Center
Managed by Mission Support Alliance, LLC

Section 4: Work Environment Controls

We will now look at five major types of engineering controls to reduce heat stress

- Ventilation
- Air cooling
- Fans
- Shielding
- Insulation

Ventilation

General ventilation, images courtesy Roda

Air Cooling

HVAC units at NREL

Fans

Insulation can reduce the effects of conductive heat

Shielding can protect workers from radiant heat

Good thing these take care of convection heat too!

Volpentest HAMMER Training and Education Center
Managed by Mission Support Alliance, LLC

Administrative controls and work practices

A break in the shade at NREL

Acclimatization is a key component for reducing HRI

Cal/OSHA acclimatization findings shed light on its importance-2005

- 80% incidents in the first 4 days
- 46% incidents in the first day
- 34% incidents on days 2 - 4
- 4% incidents in 5 days - 2 weeks period
- 16% incidents in weeks 3 - 52

NIOSH suggests the following heat exposures during acclimatization

Day Number	Experienced Heat Worker	New Worker
1	50%	20%
2	60%	40%
3	80%	60%
4	100%	80%
5	100%	100%

Acclimatization, oh so good!

- Gradually build up your ability to handle heat (increase exposure time by an hour/day)
- When your body gets used to the heat (acclimatized) your sweating becomes more “efficient” (more sweat, quicker but with less salt in sweat)
- Blood flow to skin is reduced; more blood is available to muscles
- Heart rate more stable, heart stroke volume increases and blood volume increases

Seek assistance

Speak with your supervisor or occupational medical staff if you are having trouble adjusting to the heat or if you have questions about how heat may affect a medical condition you have

Acclimatization does not decrease your body's need for hydration!

Keep workers hydrated!

Photo courtesy Cal/OSHA

Dehydration can lead to severe health effects

Water loss is a serious issue in hot environments

- Normally, with light activity, your body looses 2 to 3 quarts of water daily
- In a hot weather environment, you loose 2 to 3 gallons of sweat
- Thirst mechanism is not sensitive enough to indicate body's needs
- >2% BW lag for thirst

Encourage workers to drink water–a cup of water every 15 to 20 minutes

AVOID alcohol, caffeine and soft drinks

Volpentest HAMMER Training and Education Center
Managed by Mission Support Alliance, LLC

Train workers about heat stress issues!

Volpentest HAMMER Training and Education Center
Managed by Mission Support Alliance, LLC

Schedule work in cooler parts of the day or in a cooler season

"Night work" courtesy DOT

Break areas are important for workers to get out of the heat, rest, and cool down

Volpentest HAMMER Training and Education Center
Managed by Mission Support Alliance, LLC

ACGIH Work/rest schedule for acclimatized workers (WBGT °C)

Work Demand	Light	Mod	Heavy	Very Heavy
100% work	29.5	27.5	26	
75% work; 25% rest	30.5	28.5	27.5	
50- 50	31.5	29.5	28.5	27.5
25% work; 75% rest	32.5	31	30	29.5

Volpentest HAMMER Training and Education Center
Managed by Mission Support Alliance, LLC

Work/Rest and Water Consumption Table

Applies to average sized, heat-acclimated soldier wearing BDU, hot weather. (See TB MED 507 for further guidance.)

Easy Work	Moderate Work	Hard Work
• Weapon Maintenance • Walking Hard Surface at 2.5 mph, < 30 lb Load • Marksmanship Training • Drill and Ceremony • Manual of Arms	• Walking Loose Sand at 2.5 mph, No Load • Walking Hard Surface at 3.5 mph, < 40 lb Load • Calisthenics • Patrolling • Individual Movement Techniques, i.e., Low Crawl or High Crawl • Defensive Position Construction	• Walking Hard Surface at 3.5 mph, ≥ 40 lb Load • Walking Loose Sand at 2.5 mph with Load • Field Assaults

Heat Category	WBGT Index, F°	Easy Work		Moderate Work		Hard Work	
		Work/Rest (min)	*Water Intake (qt/hr)*	*Work/Rest (min)*	*Water Intake (qt/hr)*	*Work/Rest (min)*	*Water Intake (qt/hr)*
1	78° - 81.9°	NL	½	NL	¾	40/20 min	¾
2 (GREEN)	82° - 84.9°	NL	½	50/10 min	¾	30/30 min	1
3 (YELLOW)	85° - 87.9°	NL	¾	40/20 min	¾	30/30 min	1
4 (RED)	88° - 89.9°	NL	¾	30/30 min	¾	20/40 min	1
5 (BLACK)	> 90°	50/10 min	1	20/40 min	1	10/50 min	1

- The work/rest times and fluid replacement volumes will sustain performance and hydration for at least 4 hrs of work in the specified heat category. Fluid needs can vary based on individual differences (± ¼ qt/hr) and exposure to full sun or full shade (± ¼ qt/hr).
- **NL** = no limit to work time per hr.
- **Rest** = minimal physical activity (sitting or standing) accomplished in shade if possible.
- ***CAUTION: Hourly fluid intake should not exceed 1½ qts.***

  Daily fluid intake should not exceed 12 qts.
- If wearing body armor, add **5°F** to WBGT index in humid climates.
- If doing Easy Work and wearing NBC (MOPP 4) clothing, add **10°F** to WBGT index.
- If doing Moderate or Hard Work and wearing NBC (MOPP 4) clothing, add **20°F** to WBGT index.

For additional copies, contact: U.S. Army Center for Health Promotion and Preventive Medicine Health Information Operations Division at (800) 222-9698 or CHPPM - Health Information Operations@apg.amedd.army. mil.
For electronic versions, see http://chppm-www.apgea.army.mil/heat. Local reproduction is authorized.
June 2004

CP-033-0404

Workers in conditions that increase the risk of heat stress should be personally monitored

Volpentest HAMMER Training and Education Center
Managed by Mission Support Alliance, LLC

Personal monitoring can be done by checking the heart rate, recovery heart rate, oral temperature, or extent of body water loss

Heart rate recovery criteria - OSHA Technical Manual		
Heart rate recovery pattern	P_3	Difference between P_1 and P_3
Satisfactory recovery	<90	-
High recovery; further monitoring	90	10
No recovery; too much heat stress	90	<10

Volpentest HAMMER Training and Education Center
Managed by Mission Support Alliance, LLC

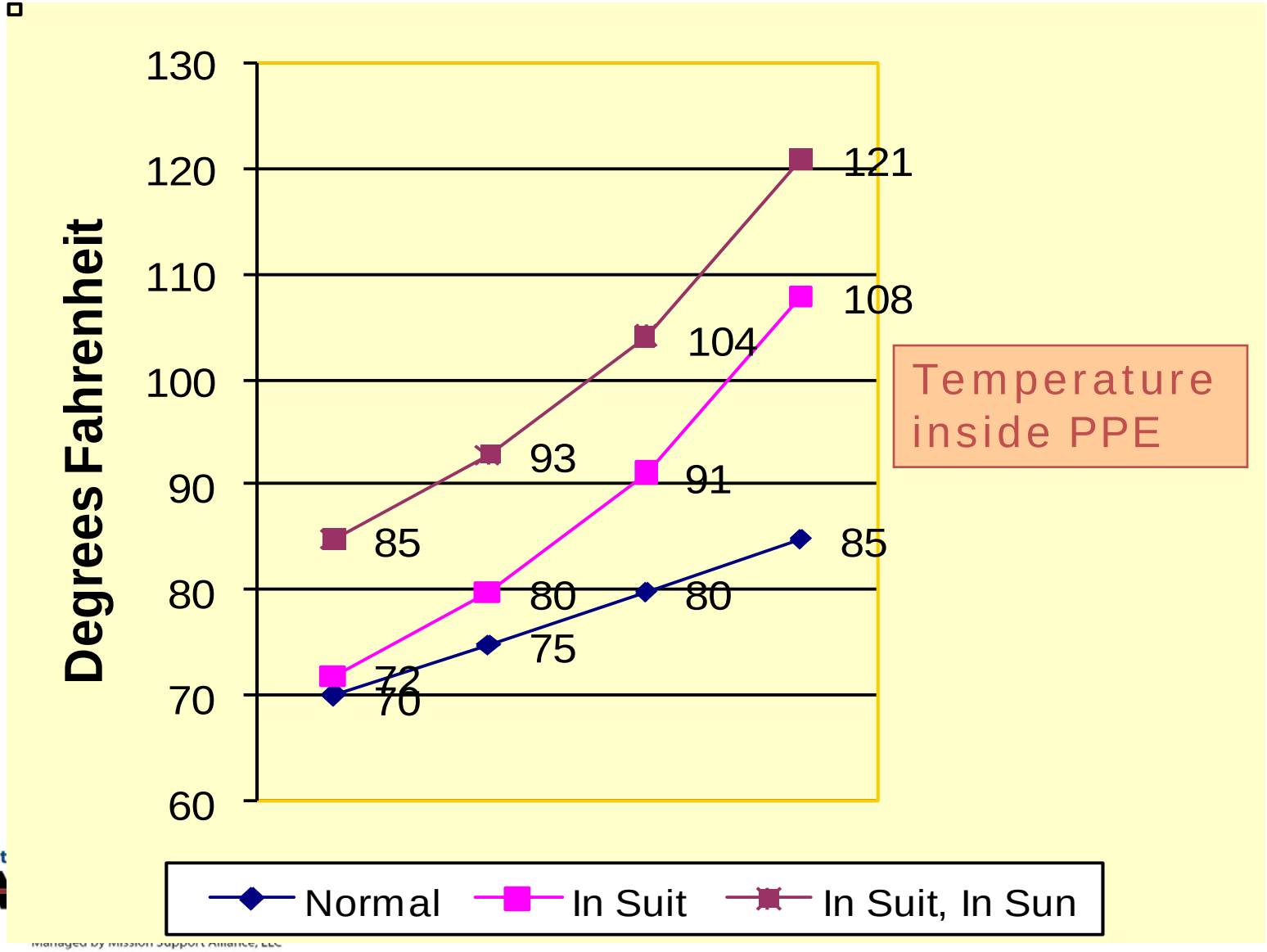
ACGIH suggests frequency of physiological monitoring (minutes)

Adjusted Temperature (º F)	Normal Work Clothing	Impermeable Clothing
90 or above	Every 45	Every 15
87.5 - 90	Every 60	Every 30
82.5 - 87.5	Every 90	Every 60
77.5 - 82.5	Every 120	Every 90
72.5 - 77.5	Every 150	Every 120

Clothing inhibits the transfer of heat between the body and the surrounding environment

The DOE's HSS follows the guidelines recommended by the ACGIH for physiological monitoring of fit and acclimatized workers wearing semi-permeable and impermeable, encapsulating clothing

Wearing an impermeable suit greatly increases risk of heat stress illnesses!



NIOSH recommended temperature adjustments for clothing as follows

Normal work clothes and cloth coveralls	Add 0.0°C / 0.0°F
Polyethylene-based, particle-barrier coveralls	Add 0.5°C / 0.9°F
Water-barrier, vapor-permeable film laminate coveralls	Add 2.0°C / 3.6°F
Limited-use vapor-barrier coveralls	Add 10°C / 18°F

Protective, encapsulating, impermeable, liquid resistant clothing and heat stress

- **Turner - No current consensus on appropriate adjustments for WBGT limits with impermeable protective clothing**
- **Reneau and Bishop - 10º C adjustment for encapsulating protective clothing**
- **NIOSH and ACGIH - Worker-acceptable physiological monitoring should be used when workers are in suits**

Use the buddy system

Protective clothing and heat can increase rad exposure

- Reichelt, Clay, and Eichorst analyzed 68 cases in the ORPS database of rad contamination through protective clothing
- 84% identified hot, humid, or damp conditions
- Most involved strenuous work with perspiration

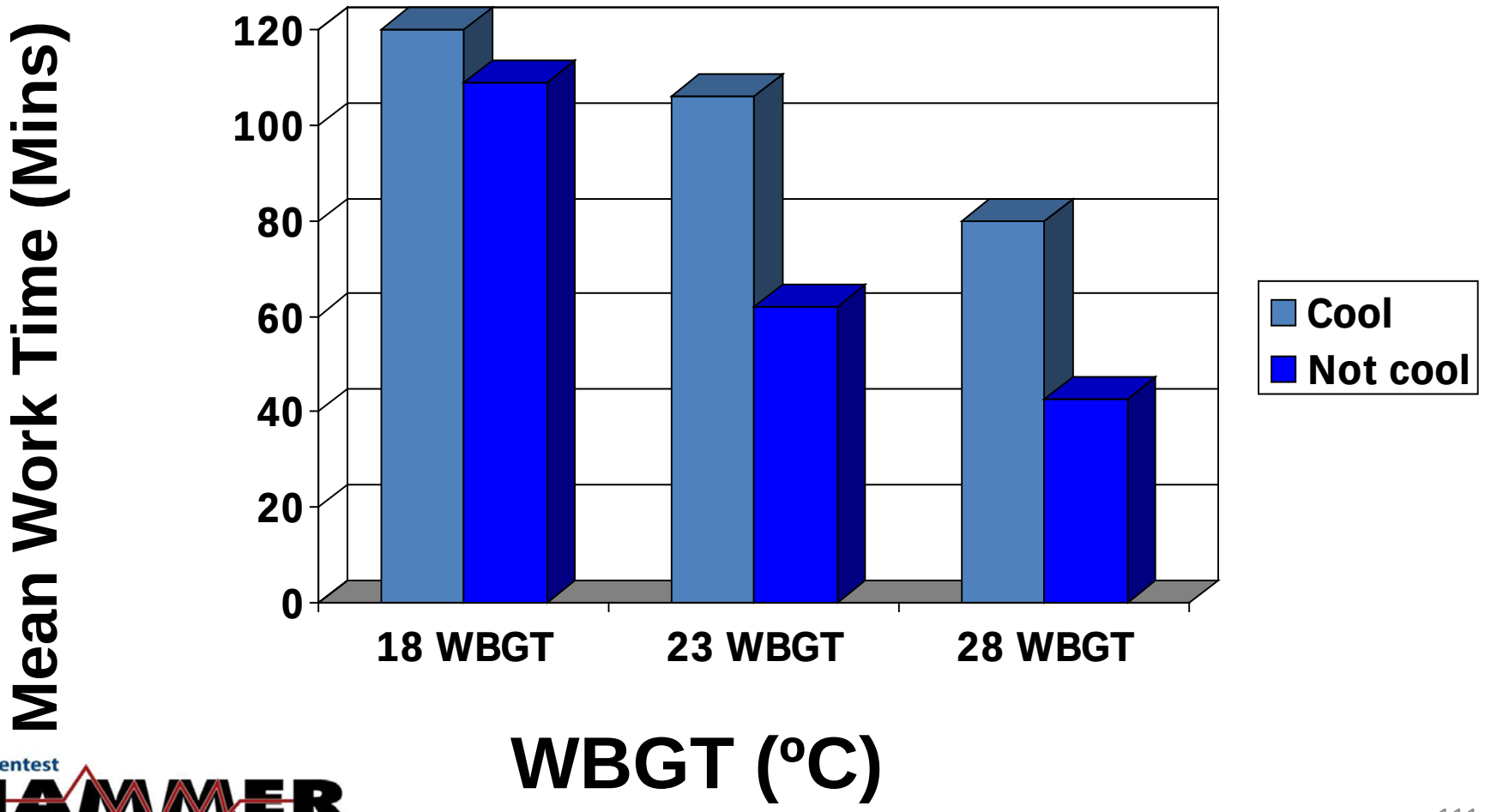
Reichelt, Clay, and Eichorst Findings

- Cloth or water-resistant clothing often fails to protect during demanding work
- Multiple layers do not provide significantly increased protection. Many incidents of contamination (4 layers in one case.)
- Multiple layers greatly increases heat stress risks (1995 ORNL heat stress case)
- 79% of cases involved perspiration-soaked clothing

Personal Protective Equipment (PPE)

- Reflective clothing
- Ice vests
- Wetted clothing
- Water-cooled garments
- Circulating air

Effects of Ice-cooling on work in PPE Muir, Bishop, and Ray, 1999



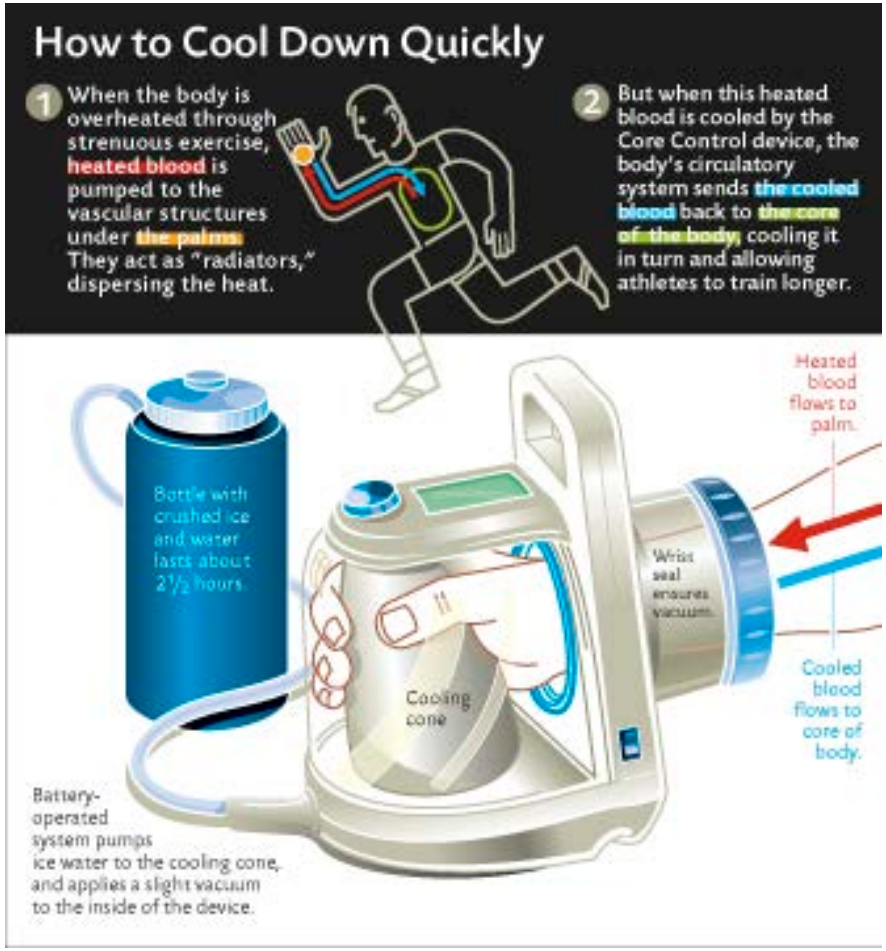
Volpentest HAMMER Training and Education Center
Managed by Mission Support Alliance, LLC

OENHP Findings on CORETECH

Body Cooling System (previously PICS)

- Bechtel Hanford needed ensemble for D&D of 233-S Process Hood
- Wanted to determine if 2-hour production goal could be met
- Used CorTemp pill to measure core temp
- Staged very similar tasks with 5 field-experienced operating engineers
- Results showed CORETECH kept workers protected

RTX tech, something new but needs more study



Section 5: Group Activity

Now time for a group activity

- Evaluating a job
- Conducting environmental evaluations
- Creating a work plan to reduce HRIs
- Presenting your ideas

Comments or Questions?

You MADE IT!

Volpentest HAMMER Training and Education Center
Managed by Mission Support Alliance, LLC