

# Heat Stress Hazards In The Workplace

Presented By:

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[www.michigan.gov/miosha](http://www.michigan.gov/miosha)

(517) 322-1809

# Summary

- Heat Stress factors
- Heat Stress >Strain> Illness
- How to manage heat strain
- Heat Prevention program elements
  - Basics
  - Resources
- A Heat Fatality case

# Dr. Thomas Adams

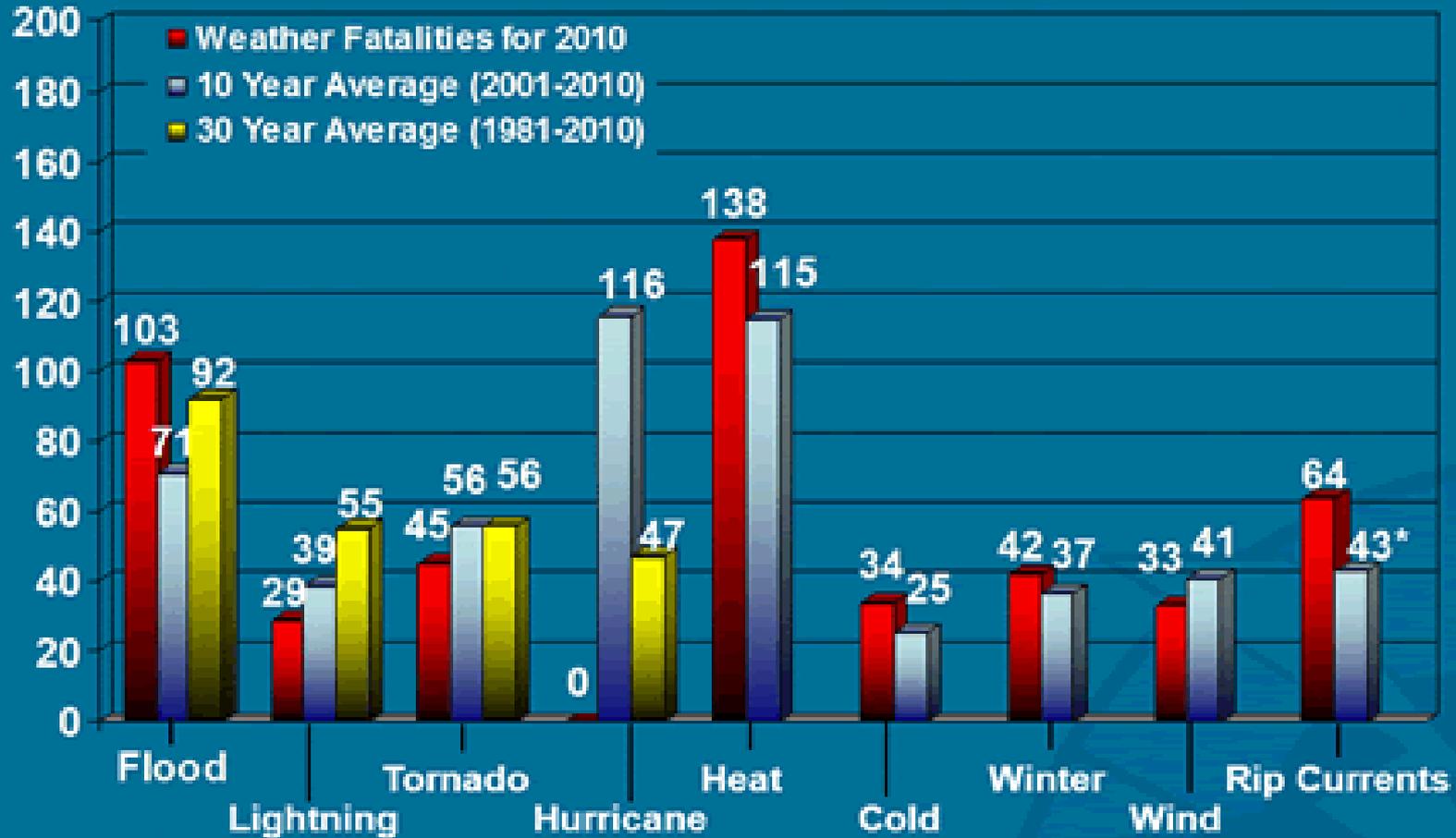
October 3, 1930 - August 17, 2011







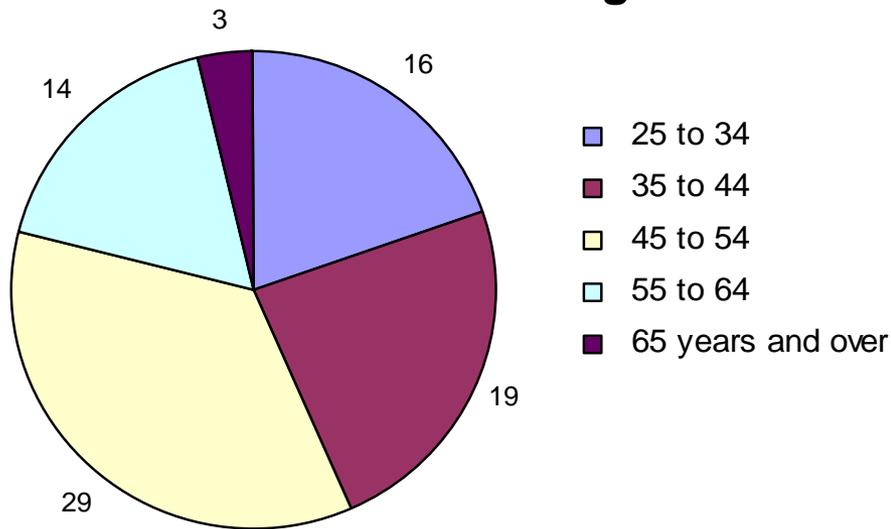
# Weather Fatalities



\*9 year average

# Work Heat Exposure Fatalities: 30 deaths/year (2003 – 2009)

**Age**



	<b>BLS</b>	<b>OSHA</b>
year		
2009	<b>33</b>	<b>9</b>
2008	<b>27</b>	<b>10</b>
2007	<b>32</b>	<b>13</b>



# Heat Stress Simulation

- Raising the room temperature  
1 degree F each 10 minutes
- Water and sports drinks available
- First Aid trained staff

# Heat in the Workplace



# Normal Temperature

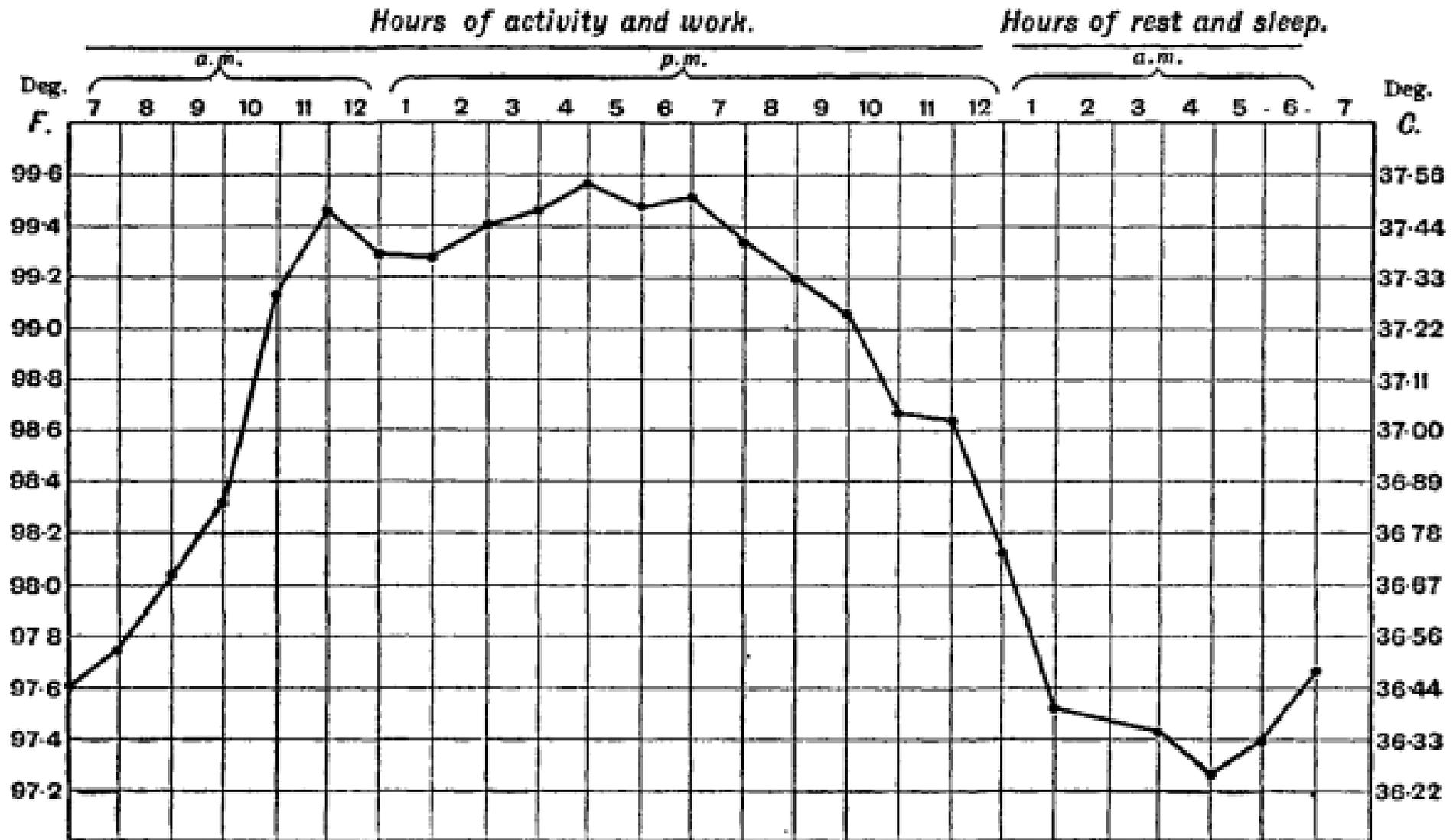
Average Human temperature is

98.6 °F +/- 0.9 °F

or

37 °C +/- 0.5 °C

# Daily Temperature



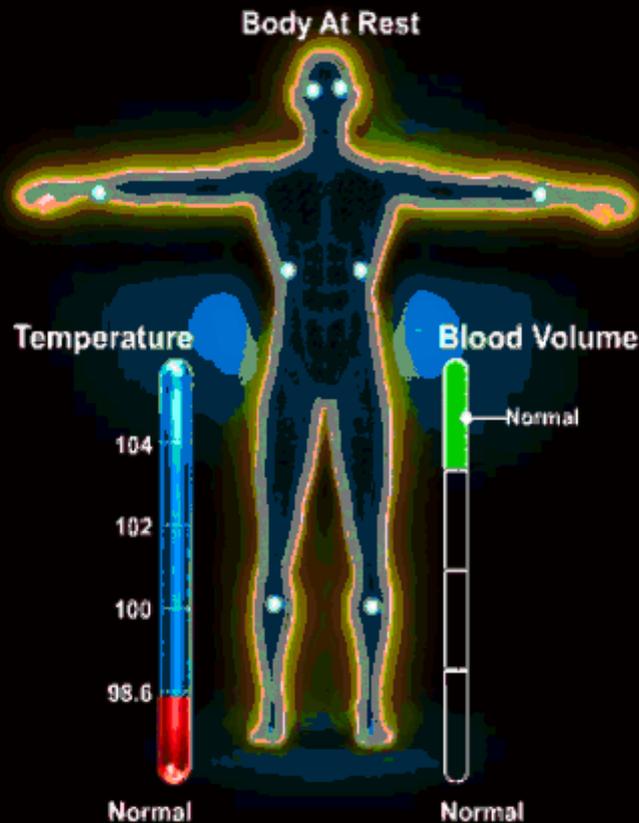
# Heat Stress Factors

- Environmental Factors
  - Temperature
  - Humidity
  - Air movement
  - Radiant heat
- Metabolic heat factor (work level)
- Age, weight, degree of physical fitness
- Degree of acclimatization
- Use of alcohol or drugs, and medical conditions
- Clothing factor

# Heat Stress causes Strain (illness)

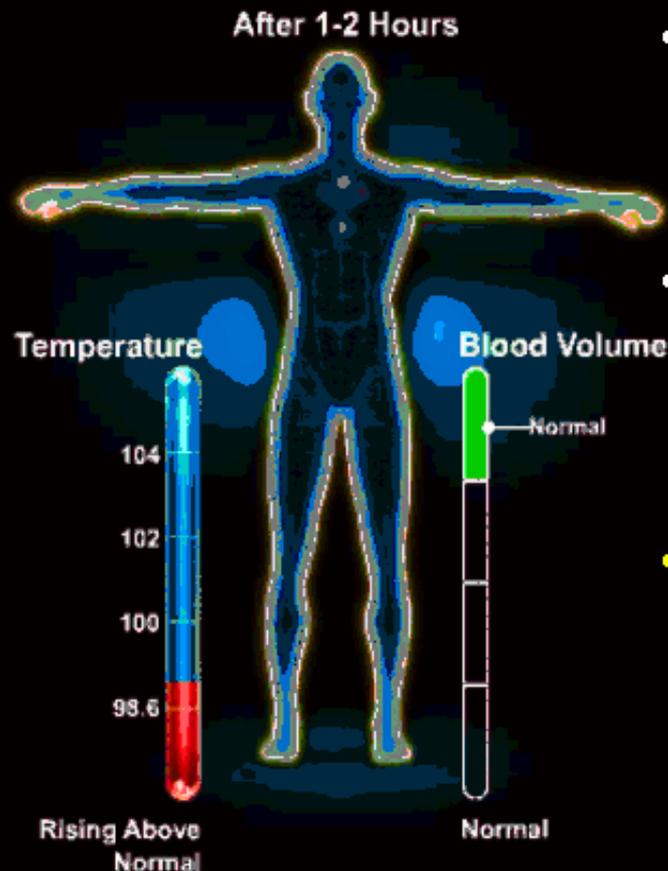
- Heat Rash
- Heat Cramps
- Heat Syncope (light headed > faint)
- Heat Exhaustion
  
- Heat Stroke (Medical Emergency)

# Physiology of Heat Stress



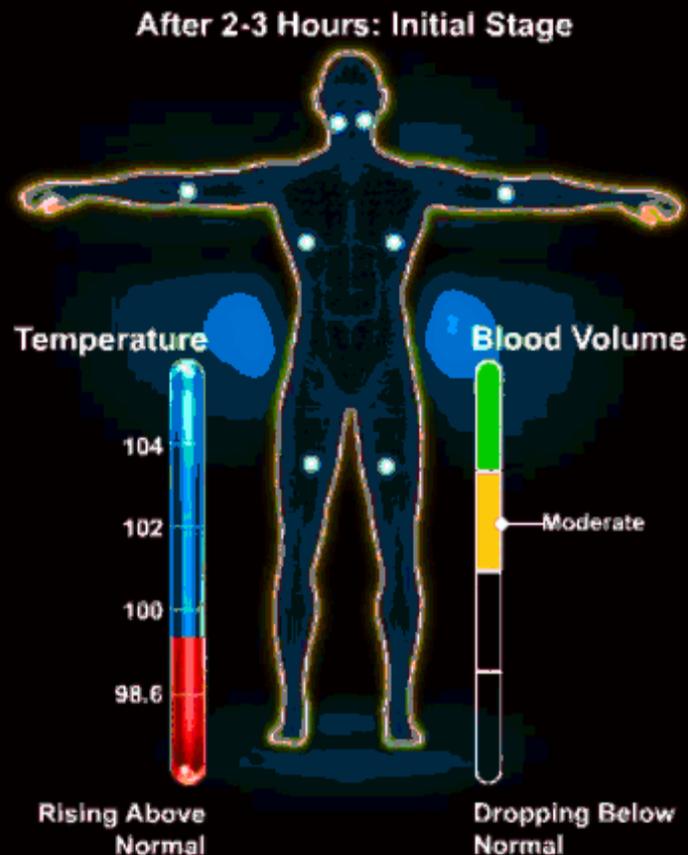
During both rest and activity, the human body tries to maintain an internal temperature of 98.6 F.

# 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



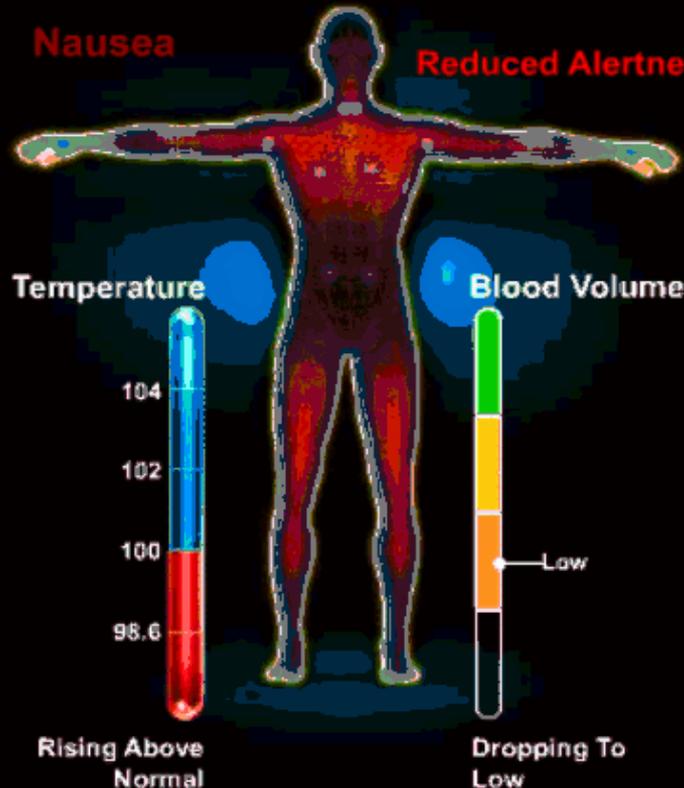
- During heavy work, a body can lose 1-2 liters of water per hour.
- After 2-3 hours of fluid loss, a person is likely to:
  - Lose endurance
  - Become uncomfortable
  - Feel hot
  - Become thirsty

# Physiology of Heat Stress

After 3-6 Hours: Heat Cramps/Heat Exhaustion

Nausea

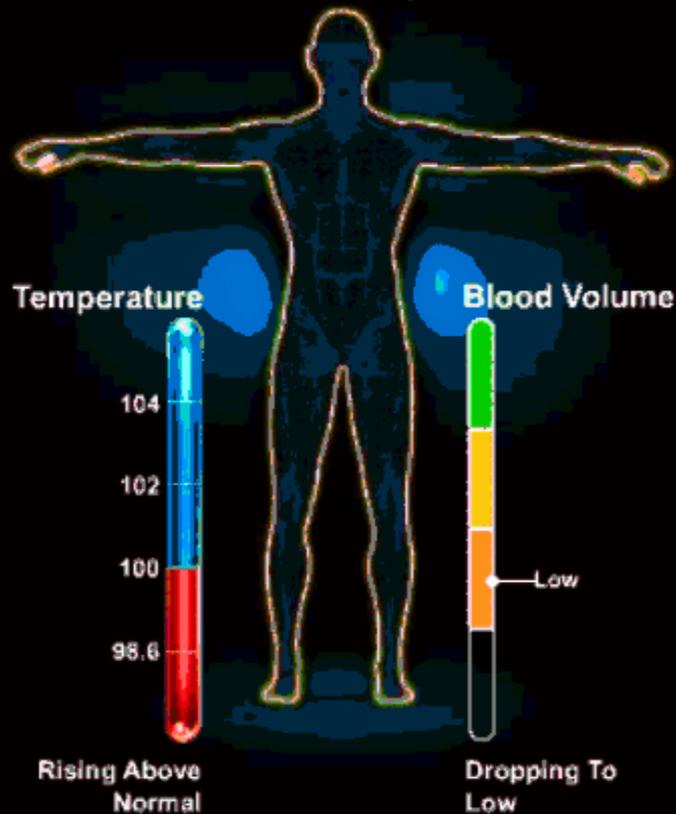
Reduced Alertness



- 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

After 3-6 Hours: Heat Cramps/Heat Exhaustion



- 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.

# Heat Stroke

- Heat Stroke is the most serious heat-related disorder.
- Body becomes unable to control its temperature.
  - Body temperature rapidly rises
  - Sweating mechanism fails
  - Body is unable to cool down
- Body temperature can rise to 106°F or higher in 10 to 15 minutes.
- Heat stroke can cause death or permanent disability if emergency treatment is not given.

# Symptoms: Heat Stroke

- Hot, dry skin
- Hallucinations
- Throbbing headache
- High body temperature
- Confusion/dizziness
- Slurred speech
- Irrational behavior
- Loss of consciousness
- Convulsions

# First Aid: Heat Stroke

- Call 911 and notify their supervisor.
- Move the sick worker to cool shaded area.
- Cool the worker using methods such as:
  - Soaking their clothes with water.
  - Spraying, sponging, showering them with water.
  - Apply ICE.

# Heat Exhaustion

- Dehydration causes blood volume to decrease.
- The body's response to excessive loss of water and salt.
- Usually through excessive sweating.
- Workers most prone to heat exhaustion are the elderly, employees with high blood pressure and those working in hot environments.

# Symptoms: Heat Exhaustion

- Heavy sweating
- Extreme weakness or fatigue
- Dizziness
- Confusion
- Nausea
- Clammy, moist skin
- Pale or flushed complexion
- Muscle cramps
- Slightly elevated body temperature
- Fast and shallow breathing

# First Aid: Heat Exhaustion

- Have employees rest in a cool, shaded or air-conditioned area.
- Have employees drink plenty of water or other cool, non-alcoholic or non-caffeine beverages.
- Have employees take cool shower, use cold wet towels.

# Symptoms and First Aid: Heat Syncope

- Symptoms:
  - Light-headedness
  - Dizziness
  - Fainting
- First Aid:
  - Sit or lie down in a cool place
  - Slowly drink water, clear juice or a sports beverage

# Symptoms and First Aid:

## Heat Cramps

- Symptoms:
  - Muscle pain or spasms usually in the abdomen, arm and legs.
- First Aid:
  - Stop all activities and sit in a cool place.
  - Drink clear juice or a sports beverage.
    - Water must be taken every 15 to 20 minutes in hot environments.
  - Do not return to strenuous work for a few hours after the cramps subside.
  - Seek medical attention if any of the following apply:
    - Worker has heart problems.
    - Worker is on a low-sodium diet.
    - Cramps do not subside within one hour.

# Symptoms and First Aid:

## Heat Rash

- Symptoms:
  - Heat rash looks like a red cluster or pimples or small blisters.
  - Occurs on neck and upper chest, in the groin, under the breasts and in elbow creases.
- First Aid:
  - Try to work in a cooler, less humid environment when possible.
  - Keep the affected area dry.
  - Dusting powder may be used to increase comfort.

# Substances that inhibit cooling and cause dehydration

- Alcohol
- Caffeine
- Stimulants
- Medications

# Medications

- Anti-psychotics (e.g. Seroquel)
- medications for Parkinson's disease
- Tranquilizers (e.g. Xanax)
- Antidepressants (e.g. Prozac)
- diuretic medications or "water pills"
- Antihistamines (constriction of blood vessels) e.g. Benadryl,
- Beta Blockers, heart medication

# Control of HEAT

- Engineering Controls
  - Ventilation
  - Air cooling
  - Fans
  - Shielding
  - Insulation

# Administrative Controls & Work Practices

- Train employees on the hazards of heat stress,
- Recognition of predisposing factors, danger signs, and symptoms
- Awareness of first-aid procedures for and the potential health effects of, heat stroke
- Employee responsibilities in avoiding heat stress
- Dangers of using drugs and alcohol in hot work environments
- Use of protective clothing and equipment
- Coverage of environmental and medical surveillance programs

# Standards

- MIOSHA and OSHA do not have a Heat standard.
- This would be handled by the General Duty Clause, Section 11(a) of Act 154
- In addition, American Conference of Governmental Industrial Hygienists (ACGIH) guidelines are used when conducting a compliance investigation.

# Educational Resources

- MIOSHA website
  - Heat Stress – “Guidelines for Combating Heat Stress”
- Federal OSHA website
  - Water. Rest. Shade.
  - Quick Card “Protecting Workers from Heat Stress”
- Centers for Disease Control (CDC)

# Campaign to Prevent Heat Illness in Outdoor Workers

**WATER. REST. SHADE.**

*The work can't get done without them.*

Educational Resources

Using the  
Heat Index

Training

Media Resources



## Heat Smartphone App

Drink water often

Rest in the shade

Report heat symptoms early

Know what to do in an  
emergency



### HEAT SAFETY TOOL [en Español]

By U.S. Department of Labor (DOL), Occupational Safety and Health Administration (OSHA)



When you're working in the heat, safety comes first. With the OSHA Heat Safety Tool, you have vital safety information available whenever and wherever you need it — right on your mobile phone.

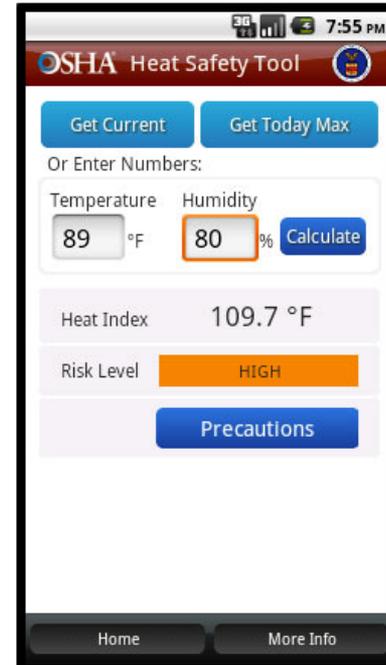
The App allows workers and supervisors to calculate the **heat index** for their worksite, and, based on the heat index, displays a **risk level** to outdoor workers. Then, with a simple "click," you can get reminders about the **protective measures** that should be taken at that risk level to protect workers from heat-related illness—reminders about drinking enough fluids, scheduling rest breaks, planning for and knowing what to do in an emergency, adjusting work operations, gradually building up the workload for new workers, training on heat illness signs and symptoms, and monitoring each other for signs and symptoms of heat-related illness.

Stay informed and safe in the heat, check your risk level.

For more information about safety while working in the heat, see OSHA's [heat illness webpage](#), including new [online guidance](#) about using the heat index to protect workers.

The source code for this app is available for download:

- Android: [English](#) [7 MB ZIP\*] | [Spanish](#) [6 MB ZIP\*]
- iPhone: [All-in-One](#) [1 MB ZIP\*]



**Accessibility Assistance:** Contact the OSHA Directorate of Technical Support and Emergency Management at (202) 693-2300 for assistance with accessing the application or ZIP materials.

\*These files are provided for downloading.

## Protecting Workers from Heat Stress

### Heat Illness

Exposure to heat can cause illness and death. The most serious heat illness is heat stroke. Other heat illnesses, such as heat exhaustion, heat cramps and heat rash, should also be avoided.

There are precautions your employer should take any time temperatures are high and the job involves physical work.

### Risk Factors for Heat Illness

- High temperature and humidity, direct sun exposure, no breeze or wind
- Low liquid intake
- Heavy physical labor
- Waterproof clothing
- No recent exposure to hot workplaces

### Symptoms of Heat Exhaustion

- Headache, dizziness, or fainting
- Weakness and wet skin
- Irritability or confusion
- Thirst, nausea, or vomiting

### Symptoms of Heat Stroke

- May be confused, unable to think clearly, pass out, collapse, or have seizures (fits)
- May stop sweating

### To Prevent Heat Illness, Your Employer Should

- Provide training about the hazards leading to heat stress and how to prevent them.
- Provide a lot of cool water to workers close to the work area. At least one pint of water per hour is needed.



### For more information:

**OSHA<sup>®</sup>** Occupational  
Safety and Health  
Administration  
U.S. Department of Labor  
[www.osha.gov](http://www.osha.gov) 1-800-321-OSHA (6742)

OSHA 3094 (8-10)

- Schedule frequent rest periods with water breaks in shaded or air-conditioned areas.
- Routinely check workers who are at risk of heat stress due to protective clothing and high temperature.
- Consider protective clothing that provides cooling.



### How You Can Protect Yourself and Others

- Know signs/symptoms of heat illnesses; monitor yourself; use a buddy system.
- Block out direct sun and other heat sources.
- Drink plenty of fluids. Drink often and BEFORE you are thirsty. Drink water every 15 minutes.
- Avoid beverages containing alcohol or caffeine.
- Wear lightweight, light colored, loose-fitting clothes.



### What to Do When a Worker is Ill from the Heat

- Call a supervisor for help. If the supervisor is not available, call 911.
- Have someone stay with the worker until help arrives.
- Move the worker to a cooler/shaded area.
- Remove outer clothing.
- Fan and mist the worker with water; apply ice (ice bags or ice towels).
- Provide cool drinking water, if able to drink.

**IF THE WORKER IS NOT ALERT or seems confused, this may be a heat stroke. CALL 911 IMMEDIATELY and apply ice as soon as possible.**

**If you have any questions or concerns, call OSHA at 1-800-321-OSHA (6742).**

### For more information:

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# Heat Prevention Program

## Recommendations for Employers

- Schedule maintenance and repair jobs in hot areas for cooler months.
- Schedule hot jobs for the cooler part of the day.
- Acclimatize workers by exposing them for progressively longer periods to hot work environments.
- Reduce the physical demands of the workers.
- Use relief workers or assign extra workers for physically demanding jobs.
- Provide cool water or liquids to workers (avoid drinks with caffeine, alcohol, or large amounts of sugar).

# Heat Index

- The U.S. National Oceanographic and Atmospheric Administration (NOAA) developed the Heat Index system.
- Heat Index combines relative humidity with temperature to give an “apparent” temperature.
- What the conditions “feel” like.

# 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	118	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 Strenuous Activity

Caution

Extreme Caution

Danger

External Danger

# Basic Heat Program

- Know your work environment
- Provide basic training to employees
- Monitor the heat level
- Monitor the employees for signs/symptoms
- Provide water or sports drinks
- Provide feasible controls
- Adjust work/rest schedule if HI > 90

# Fatality Due to Heat

- Mike
- 39 year old Male
- Dishwasher in kitchen of a restaurant
- Died July 7
- Last exposure to heat July 3

# Heat Stress

## UNIVERSITY OF MICHIGAN HOSPITALS DEATH NOTICE

**INSTRUCTIONS:** Physicians must complete and sign immediately.  
Patient care unit must route completed forms via messenger.  
See reverse side for additional instructions.

DATE AND TIME OF DEATH		
DATE: 7/7	TIME: 10 <sup>15</sup>	<input type="checkbox"/> A.M. <input checked="" type="checkbox"/> P.M.

Indicate morbid conditions or disease processes which gave rise to the immediate cause of death. The ultimate underlying cause is listed last. It is used by the Michigan Department of Vital Statistics for statistical and research purposes. Terms such as "heart failure" or "respiratory failure" are not acceptable as causes of death.

PART I. Enter the diseases, injuries, or complications that caused the death. On <u>ONE</u> enter the mode of dying, such as cardiac or respiratory arrest, shock, or heart failure. List only one cause on each line.		Appropriate Interval Between Onset and Death
IMMEDIATE CAUSE (Final disease or condition resulting in death)	a. <del>Respiratory Failure</del> Cerebral Hemiation	7/4/77
Sequentially list conditions, (if any), leading to immediate cause. State UNDERLYING CAUSE (Disease or injury that initiated events resulting in death) LAST	b. Heat Stroke	7/4/77
	c. _____	
	d. _____	
	e. _____	
PART II. <u>Other</u> significant conditions contributing to death but not resulting in the underlying cause given in Part I.		

# Employee Conditions

- 100 pounds over ideal weight (obese). 6' and 280 lbs.
- Drank cola during all shifts (dehydrated)
- Drank beer after all shifts (dehydrated)
- Wore baseball hat (barrier)
- Wore a plastic apron (barrier)
- No training on heat illness or prevention
- Complained of heat, only took one brief break
- Red faced “Rambo,” sweating heavily

# Work Conditions on July 3

- Outside temp. reached 88 °F,  
lowest RH was 72%
- Open doors to a patio
- Kitchen was 74%-87% humidity
- Kitchen was 95 – 105 °F
- HI ?

# 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	118	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
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Likelihood of Heat Disorders with Prolonged Exposure or Strenuous Activity

Caution

Extreme Caution

Danger

External Danger



# Heat





# Heat



# Mike

- Left work 1 am
- On bicycle
- Crashed after 1 block
- Homeowners gave water, he collapsed
- Ambulance
- Thought he was drunk
- Never regained consciousness
- Died 3 days later

# Heat Illness Prevention

- Have a plan
- Train on symptoms/signs, incl. medications
- Monitor temp. and humidity
- If the **HEAT INDEX > 90 °F**, then continuously
- Monitor employee signs and symptoms
- Consider effect of added clothing
- Provide extra water and sports drinks
- Provide cooler rest areas
- Provide shaded rest areas
- Provide extended break times



*Any  
Questions*