KEEP YOUR COOL

PREVENTING HEAT STRESS IN THE WORKPLACE
Presentation Outline:

1. Body's Response to Heat
2. Risk Factors
3. Signs, Symptoms, Prevention, and Treatment
4. Measuring Heat Stress
5. Heat-Related OSHA Standards
6. Recommended Heat Stress Exposure Limits
7. Heat Stress Prevention Program Elements
8. Case Studies – Occupational Safety and Health Review Commission
9. Review
BODY’S RESPONSE TO HEAT
• Reduced blood flow to brain
  – Reduced mental alertness and comprehension
• Reduced blood flow to active muscles
  – Fatigue, loss of strength
• Increased sweating
  – Slipperiness

Coping with Heat
• Reduced blood flow to brain
  – Reduced mental alertness and comprehension
• Reduced blood flow to active muscles
  – Fatigue, loss of strength
• Increased sweating
  – Slipperiness
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.
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**HI**

**Possible Heat Disorder:**

- **80°F - 90°F**: Fatigue possible with prolonged exposure and physical activity.
- **90°F - 105°F**: Sunstroke, heat cramps, and heat exhaustion possible.
- **105°F - 130°F**: Sunstroke, heat cramps, and heat exhaustion likely, and heat stroke possible.
- **130°F or greater**: Heat stroke highly likely with continued exposure.
• High air temperature reduces effectiveness of the cooling system
• High humidity reduces evaporation rate of sweat
• Excess loss of sodium
• Dehydration

When Cooling Mechanisms Fail
RISK FACTORS
$S = (M - W) \pm C \pm R \pm K - E - Res$

- $S = \text{the change in heat content of the body}$
- $M = \text{heat produced by metabolism}$
- $W = \text{rate of mechanical work accomplished}$
- $C = \text{net heat exchange by convection}$
- $R = \text{net heat exchange by radiation}$
- $K = \text{net heat exchange involving direct transfer}$
- $E = \text{body heat loss by evaporation}$
- $Res = \text{rate of heat exchange by respiration}$

**Body Heat Balance Equation**
Environmental Factors

• Temperature
• Relative humidity
• Radiant heat
• Air velocity
• Individual variability
• Acclimatization
• Age
• Overweight / body fat
• Drugs
• Caffeine
• History of heat-related illness

Individual Factors
• **Workload**
  – Type of work
  – Level of physical activity
  – Time spent working

• **Clothing**
  – Weight (heavy vs. breathable)
  – Color (dark vs. light)
  – PPE and protective gear / clothing

**Work-related Factors**
• Protective gear – police and emergency responders
• PPE and clothing adjustment factors
  • –Level A suit without microclimate cooling: 50°F


Work-related Clothing and PPE
Signs, Symptoms, Prevention, and Treatment
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<th>Cause</th>
<th>Signs/ Symptoms</th>
<th>Treatment</th>
<th>Prevention</th>
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<tr>
<td>☐ Hot humid environment and plugged sweat glands</td>
<td>☐ Red bumpy rash with severe itching</td>
<td>☐ Change into dry clothes</td>
<td>☐ Wash frequently to keep skin clean and dry</td>
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</table>

**Heat Rash**
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<th>Cause</th>
<th>Signs/ Symptoms</th>
<th>Treatment</th>
<th>Prevention</th>
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<td>☐ Over-exposure to the sun</td>
<td>☐ Red, painful, or blistering and peeling skin</td>
<td>☐ For skin blisters, seek medical aid</td>
<td>☐ Work in the shade: cover skin with clothing; use suntan lotions with a sun protection factor of at least 15</td>
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<td>☐ Use skin lotions (avoid topical anesthetics) and work in the shade</td>
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<tr>
<td>Cause</td>
<td>Signs/ Symptoms</td>
<td>Treatment</td>
<td>Prevention</td>
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<td>Muscle spasms that result from lack of water replenishment</td>
<td>Painful cramps in arms, legs, or stomach which may occur suddenly at work or later at home</td>
<td>Move to a cool area; loosen clothing and drink cool salted water (1 tsp. salt per gallon of water) or commercial fluid replacement beverage</td>
<td>Drink water and / or carbohydrate-electrolyte liquids</td>
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**Heat Cramps**
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<th>Cause</th>
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<td>☐Not enough blood flowing to the head, causing loss of consciousness</td>
<td>☐Sudden fainting after at least two hours of work  ☐Cool moist skin  ☐Weak pulse</td>
<td>☐Fainting may be due to a heart attack or other illness  ☐GET MEDICAL ATTENTION  ☐Assess need for CPR  ☐Move to a cool area  ☐Loosen clothing  ☐Make person lie down  ☐If conscious, offer sips of cool water</td>
<td>☐Reduce activity levels and/or heat exposure  ☐Drink fluids regularly  ☐Gradual acclimatization of workers  ☐Workers should check on each other to help spot the symptoms which often precede heat stroke</td>
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<tr>
<td>Cause</td>
<td>Signs/ Symptoms</td>
<td>Treatment</td>
<td>Prevention</td>
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| □ Inadequate salt and water intake causes a person’s body’s cooling system to start to break down | □ Heavy sweating  
□ Cool moist skin  
□ Body temperature over 100.4°F  
□ Weak pulse  
□ Normal or low blood pressure  
□ Person is tired, weak, clumsy, upset or confused  
□ Person is very thirsty  
□ Panting or breathing rapidly  
□ Vision may be blurred | □ GET MEDICAL AID  
□ This condition can lead to heat stroke  
□ Move the person to a cool shaded area  
□ Loosen or remove excess clothing  
□ Provide cool water to drink (salted if possible)  
□ Fan and spray with cool water | □ Reduce activity levels and/or heat exposure  
□ Drink fluids regularly  
□ Workers should check on each other to help spot the symptoms which often precede heat stroke |

**Heat Exhaustion**
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<th>Cause</th>
<th>Signs/Symptoms</th>
<th>Treatment</th>
<th>Prevention</th>
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</table>
| ☐ If a person’s body has used up all its water and salt, it will stop sweating, which can cause body temperature to rise. | ☐ High body temperature (over 105.8°F) and any one of the following:  
- weakness  
- the person is confused, upset or acting strangely  
- hot, dry, red skin  
- a fast pulse  
- headache or dizziness  
☐ In later stages, a person may pass out and have convulsions | ☐ CALL AMBULANCE  
☐ This condition can be fatal  
☐ Remove excess clothing  
☐ Fan and spray the person with cool water  
☐ Offer sips of cool water if the person is conscious  
☐ Do NOT send home or leave unattended unless approved by a physician | ☐ Reduce activity levels and/or heat exposure  
☐ Drink fluids regularly  
☐ Workers should check on each other to help spot the symptoms which often precede heat stroke |

**Heat Stroke**
• Humans perspire as a means of cooling the body.
• The higher the relative humidity, the less perspiration can be evaporated, reducing the cooling effect of evaporation and increasing heat load in the body.
• The combination of rising temperature and work demands can lead to heat stress situations for workers.

Temperature, Humidity and Body Cooling
Acclimatization

- Acclimatization is the ability of our body to adapt to working in a hot environment.
- Initial benefits occur within a few days. Longer-term benefits take a few weeks of exposure in a hot environment.
- Acclimatization can be lost quickly (for example, over a long weekend). Loss of acclimatization due to short absences (2 days or less) can be made-up quickly, but longer absences take up to a week to be made-up.
- Often, outdoor workers are considered not to be acclimatized because they don’t work at higher enough temperatures for long enough.
• For workers who have had experience working in a hot environment:

<table>
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<th>Day 1</th>
<th>Day 2</th>
<th>Day 3</th>
<th>Day 4</th>
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<td>50% exposure</td>
<td>60% exposure</td>
<td>80% exposure</td>
<td>100% exposure</td>
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</table>

• For workers who have not had experience working in a hot environment:

<table>
<thead>
<tr>
<th>Day 1</th>
<th>Day 2</th>
<th>Day 3</th>
<th>Day 4</th>
<th>Day 5</th>
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<tbody>
<tr>
<td>20% exposure</td>
<td>40% exposure</td>
<td>60% exposure</td>
<td>80% exposure</td>
<td>100% exposure</td>
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Acclimatization Regimens
Re-Acclimating

- After long absences
  - 50% exposure on day back
  - 20% per day increase for the next 2 days
  - Final 10% on the 3rd day
• Heat stress policy (or sun safety policy)
• Heat stress program or hot weather plan (could be part of a sun safety program):
  • Risk assessment process
  • Control measures: general controls and job specific controls
  • Training and education of workers
  • Incident response, reporting and investigation including first aid
  • ‘Check’ elements: workplace inspections, annual audits, documentation

Heat Stress Management
1. **Operational Review**: to gain an understanding of the operational environment and risk factors for heat stress

2. **Job Safety Analysis**: for specific positions/tasks which may have elevated risk

3. **Daily Assessment**: during summer, assessment undertaken when predetermined trigger values are reached (for example, humidex = 30°C, Environment Canada Heat Advisory’s):
   - **WBGT** (web bulb globe temperature) assessed using ‘heat stress monitor’ or **humidex** assessed using ‘thermal hygrometer’
   - Adjustments for clothing, radiant heat, work rate, work/rest cycle
   - Need a monitoring plan: who, where, when, how

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**Heat Stress Risk Assessment**
• Provide heat stress information and training through verbal and written instructions, annual heat stress training, orientation training, safety talks, etc
• Encourage workers to keep hydrated: drink 1 cup of water every 20 minutes
• Workers to report symptoms of heat stress
• Encourage self-limitation of exposure when supervisor is not present
• Workers to look out for signs and symptoms of heat stress in co-workers
• Additional training for high risk workers
• Encourage healthy lifestyles

General Control Measures
<table>
<thead>
<tr>
<th>Humidex 1 (°C)</th>
<th>Response Actions</th>
<th>Humidex 2 (°C)</th>
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<tbody>
<tr>
<td>25 – 29</td>
<td>Supply water to workers on an ‘as needed’ basis</td>
<td>32 – 35</td>
</tr>
</tbody>
</table>
| 30 – 33        | Post ‘Heat Stress Alert’ notice  
Encourage workers to drink extra water  
Start recording hourly temperature and relative humidity | 36 – 39 |
| 34 – 37        | Post ‘Heat Stress Warning’ notice  
Notify workers that they need to drink extra water  
Ensure workers are trained to recognize symptoms | 40 – 42 |
| 38 – 39        | Work with 15 minutes of relief per hour can continue  
Provide adequate quantities of cool (10 – 15°C) water  
At least one cup (250mL) of water every 20 minutes per worker  
Workers with symptoms should seek medical attention | 43 – 44 |
| 40 – 41        | Work with 30 minutes of relief per hour can continue, in addition to previously listed actions | 45 – 46* |
| 42 – 44        | If feasible, work with 45 minutes of relief per hour can continue, in addition to previously listed actions | 47 – 49* |
| > 45*          | Only medically supervised work can continue | > 50* |

**Humidex 1:**
- Unacclimatized, moderate work rate
- Acclimatized, heavy work rate

**Humidex 2:**
- Unacclimatized, light work rate
- Acclimatized, moderate work rate
• Provide barriers to shield workers from radiant heat exposure.
• Provide cooling fans when air temperature is below skin temperature (35°C) and the humidity is below 70%. Above these levels causes more heating.
• Consider cooling or dehumidifying the workplace.
• Provide mechanical aids for material handling — dollies, carts, lifting devices — to reduce physical activity. Organize the work to reduce the pace of activity.

Job Specific Control Measures
• If possible, postpone strenuous work until a cooler time of the day.
• If work is done outside, ensure that shaded areas are available.
• Rotate workers in and out of hot work areas whenever possible.
• Consider cooling vests, if feasible and effective for the worker.

Job Specific Control Measures
Protection Measures Workers Should Take

USE THESE SIX SIMPLE STEPS TO PROTECT YOURSELF

1. Know the signs and symptoms of heat stress
2. Watch out for symptoms in yourself and others
3. Wear sunscreen, a hat, and lightweight, loose-fitting clothing
4. Drink water often - avoid drinks with alcohol and caffeine
5. Take breaks in the shade and more often on hot days
6. Know how your workplace deals with heat stress
The five major types of engineering controls

1. Ventilation
2. Air cooling
3. Fans
4. Shielding
5. Insulation
• General ventilation is used to dilute hot air with cooler air (generally cooler air that is brought in from the outside)
• Air treatment/air cooling differs from ventilation because it reduces the temperature of the air by removing heat (and sometimes humidity) from the air

Engineering Controls
• Air conditioning is a method of air cooling, but it is expensive to install and operate
• Local air cooling can be effective in reducing air temperature in specific areas
Heat conduction methods include insulating the hot surface that generates the heat and changing the surface itself.

- Shields, can be used to reduce radiant heat, i.e. heat coming from hot surfaces within the worker's line of sight.
• **Work rate**
  • The fastest way to decrease the rate of heat production is to decrease the work rate.

• **Age – (over 40)**
  • The maximum possible output of heat decreases with age.
  • Older people start sweating later and at a lower rate.

• **Body size**
  • Skin area to weight ratios
• Knowledge of 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

**Administrative Controls & Work Practices**
• Dangers of using drugs, including therapeutic ones, and alcohol in hot work environments
• Use of protective clothing and equipment
• Coverage of environmental and medical surveillance programs and the advantages of worker participation in such programs

Administrative Controls & Work Practices
• Personal monitoring
  • Heart rate
  • Recovery heart rate
  • Oral temperature
  • Extent of body water loss
Training

- Knowledge of hazards
- Predisposing factors – age, etc.
- Signs and symptoms
- PPE
- First aid
- Health effects of heat stroke
Measuring Heat Stress
• Temperature
  – Three thermometers
  – 5-minute averages using two-second readings from each thermometer

• Relative humidity
  – A single relative humidity sensor
  – 5-minute averages

NOAA NWS Meteorological Measurements
• WET BULB (WB) THERMOMETER
  – WB is measured with a thermometer that has a wet wick, which takes into account RH and wind speed (evaporative cooling)

• GLOBE (G) THERMOMETER
  – G indicates radiant heat exposure
  – A temperature sensor is placed inside a blackened copper sphere

• DRY BULB (DB) THERMOMETER
  – DB is the ambient air temperature

Wet Bulb Globe Temperature (WBGT) Devices
• HS Index devices [Temp and RH] Body temperature
  – Ear sensor
  – Skin sensor

  – Note: OSHA does not view ear canal or skin sensors as sufficiently reliable to use in compliance evaluations.

Personal Monitors
• Uses NOAA NWS data
• Allows workers and supervisors to calculate the OSHA heat index for their worksite
• Displays a risk level for outdoor work

OSHA Heat Safety Phone App
https://www.osha.gov/SLTC/heatillness/heat_index/heat_app.html
• Wet Bulb Globe Temperature (WBGT) takes into account:
  – temperature
  – humidity
  – wind speed
  – sun angle
  – cloud cover (solar radiation)

• Note: The WBGT differs from the OSHA heat index [OSHA HI takes into consideration T & RH and is calculated for shady areas].

• Military services, agencies, many nations, and a few states use the WBGT as a guide to managing workload in hot environments

  **NWS WBGT Prototype**


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**NOAA NWS Tulsa WBGT**
HEAT-RELATED OSHA STANDARDS
• OSHA does not have a specific standard that covers working in hot environments

• General Duty Clause, Section 5(a)(1): in addition to compliance with hazard-specific standards, all employers must provide a work environment “free from recognized hazards that are causing or are likely to cause death or serious physical harm” to employees. 29 U.S.C. § 654(a)(1)
• OSHA has issued GDC citations for heat exposures in the following industries:
  – Landscaping
  – Roofing
  – Farming
  – Construction/paving
  – Tree cutting
  – Garbage collection
• 35 Citations issued 2015–2016

Heat Exposure Citations
RECOMMENDED HEAT STRESS EXPOSURE LIMITS
• NOAA's National Weather Service Heat Index
• OSHA's Modified NWS Heat Index ACGIH TLVs for Chemical Substances
• and Physical Agents (Thermal Stress) Heat Stress and Heat Strain

Exposure Limits
# NOAA’s National Weather Service

## Heat Index

**Temperature (°F)**

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<td>95</td>
<td>103</td>
<td>112</td>
<td>121</td>
<td>132</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

### Likelihood of Heat Disorders with Prolonged Exposure or Strenuous Activity

- **Caution**
- **Extreme Caution**
- **Danger**
- **Extreme Danger**

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# NOAA’s National Weather Service Heat Index
Based on a modification of NOAA's National Weather Service (NWS) Heat Index System

- NOAA's system relates a given heat index to a “caution level”
- The NOAA NWS heat index is calculated from two numbers: the air temperature and the relative humidity
- OSHA points out that NOAA devised the heat index values for shaded conditions and light winds

OSHA Guidance for Heat Stress
<table>
<thead>
<tr>
<th>Heat Index</th>
<th>Risk Level</th>
<th>Protective Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 91°F</td>
<td>Lower (Caution)</td>
<td>Basic heat safety and planning</td>
</tr>
<tr>
<td>91°F to 103°F</td>
<td>Moderate</td>
<td>Implement precautions and heighten awareness</td>
</tr>
<tr>
<td>103°F to 115°F</td>
<td>High</td>
<td>Additional precautions to protect workers</td>
</tr>
<tr>
<td>Greater than 115°F</td>
<td>Very High to Extreme</td>
<td>Triggers even more aggressive protective measures</td>
</tr>
</tbody>
</table>

OSHA Caution Labels
• OSHA does not provide an explanation as to how it modified the NOAA NWS heat index or how to adjust the heat index based upon the amount of sunshine or level of work.

• Here is what OSHA does say -
  
  –“Full sunshine can increase heat index values by up to 15° Fahrenheit. Strenuous work and the use of heavy or specialized protective clothing also have an additive effect. As a result, the risk at a specific heat index could be higher than that listed in the [table] if the work is in direct sunlight without a light breeze, or if work involves strenuous tasks or the use of heavy or specialized protective clothing. Extra measures, including implementing precautions at the next risk level, are necessary under these circumstances.”

OSHA Explanation of Caution Labels
• Assumes that nearly all acclimatized, fully clothed workers with adequate water and salt intake can work without exceeding a deep body temperature of 100.4°F
• Measurement of deep body temperature is impractical for monitoring the workers' heat load
• WBGT is the simplest and most suitable technique to measure the environmental factors
<table>
<thead>
<tr>
<th>Allocation of Work in a Cycle of Work and Recovery</th>
<th>TLV [WBGT values in °F]</th>
<th>Action Limit [WBGT values in °F]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Light</td>
<td>Moderate</td>
</tr>
<tr>
<td>75 to 100%</td>
<td>87.8</td>
<td>82.4</td>
</tr>
<tr>
<td>50 to 75%</td>
<td>87.8</td>
<td>84.2</td>
</tr>
<tr>
<td>25 to 50%</td>
<td>89.6</td>
<td>86.0</td>
</tr>
<tr>
<td>0 to 25%</td>
<td>90.5</td>
<td>88.7</td>
</tr>
</tbody>
</table>

**TLV WBGT Values**
<table>
<thead>
<tr>
<th></th>
<th>ACGIH</th>
<th>OSHA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measured in the sun</td>
<td>✔</td>
<td>✗</td>
</tr>
<tr>
<td>Measured in the shade</td>
<td>✗</td>
<td>✔</td>
</tr>
<tr>
<td>Uses Temperature</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Uses RH</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Uses Wind</td>
<td>✔</td>
<td>✗</td>
</tr>
<tr>
<td>Uses Cloud Cover</td>
<td>✔</td>
<td>✗</td>
</tr>
<tr>
<td>Uses Sun Angle</td>
<td>✔</td>
<td>✗</td>
</tr>
</tbody>
</table>

**Comparison – ACGIH and OSHA**
The NOAA NWS HI relies on only two variables, T and RH

- Obtain Temperature = 90°F
- Obtain Relative Humidity = 42%
- Use the NOAA NWS Heat Stress table, interpolate to obtain the result
- Compare the result with OSHA Guidance

A OSHA HI of 92°F = “Moderate Risk Conditions”

Note: For light work, in clear skies, in accordance with OSHA Guidance, the heat index may be increased 0 – 15°F. For our example, the clothing adjustment factor is “0.”

Sample Data – OSHA Guidance
• Develop your plan before heat index levels rise
• Train workers before it gets hot Track the weather daily to assess risk
• Implement heat stress plan when HI >80°F
• Take protective measures appropriate for the risk level

**OSHA Guidance Approach**
Employers should establish a program that includes:

- Training for supervisors and employees
- Heat acclimatization
- Proper hydration
- Work/rest regimens
- Access to shade or cool areas
- Prompt medical attention to workers who show signs of heat-related illness
- Monitoring weather reports
- Scheduling jobs to cooler parts of the day

Preventing Heat-Related Illness – Employers
<table>
<thead>
<tr>
<th>Plan Element</th>
<th>Heat Index Risk Level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lower (Caution)</td>
</tr>
<tr>
<td></td>
<td>Moderate</td>
</tr>
<tr>
<td></td>
<td>High</td>
</tr>
<tr>
<td></td>
<td>Very High/Extreme</td>
</tr>
<tr>
<td>Supplies (ensuring adequate water, provisions for rest areas, and other supplies)</td>
<td></td>
</tr>
<tr>
<td>Emergency planning and response (preparing supervisors and crews for emergencies)</td>
<td></td>
</tr>
<tr>
<td>Worker acclimatization (gradually increasing workloads; allowing more frequent breaks as workers adapt to the heat)</td>
<td></td>
</tr>
<tr>
<td>Modified work schedules (establishing systems to enable adjustments to work schedules)</td>
<td></td>
</tr>
<tr>
<td>Training (preparing workers to recognize heat-related illness and preventive measures)</td>
<td></td>
</tr>
<tr>
<td>Physiological, visual, and verbal monitoring (using direct observation and physiological monitoring to check for signs of heat-related illness)</td>
<td></td>
</tr>
</tbody>
</table>
• Designate a person to develop, implement, and manage the program
• Monitor the temperature (e.g., heat index and wet bulb globe temperature) at the worksite
• Provide water and rest breaks in a shaded, cool area
• Acclimatize workers by gradually increasing the exposure to heat or a hot environment
• Modify work schedules as necessary to reduce workers' exposure to heat
• Train workers on the signs and symptoms of heat illness
• Monitor workers for signs of heat stress

Elements of a Heat Stress Prevention Plan
Workers should do the following:

- Drink water and other liquids
- Eat during lunch and breaks
- Wear light colored, loose-fitting, breathable clothing (e.g., cotton)
- Wear wide-brimmed hats
- Take breaks in shade or cool area
- Monitor your condition and that of co-workers
- Tell supervisor if you have symptoms
- Talk with your doctor about medications

Preventing Heat-Related Illness – Employees
1. Body's Response to Heat
2. Risk Factors
3. Signs, Symptoms, Prevention, and Treatment
4. Body Heat Balance Equation
5. Measuring Heat Stress
6. Heat-Related OSHA Standards
7. Recommended Heat Stress Exposure Limits
8. Heat Stress Prevention Program Elements
9. Case Studies – Occupational Safety and Health Review Commission

Review
QUESTIONS