



CONSTRUCTION
BUILD MOMENTUM

Heat Illness Prevention in Construction

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Presenter



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Areas of Expertise:

- ✓ Vertical Construction
- ✓ Heavy Industrial and Civil
- ✓ Oil & Gas
Transmission/Distribution
- ✓ Utilities, Foundations & Deep
Excavations
- ✓ Street, Road & Traffic Control
- ✓ Trucking/Fleet Operations
- ✓ Environmental Management
- ✓ Web-portal Prequalification

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Webinar Disclosure

- HMA Construction presenter has no actual or potential conflict of interests concerning any proprietary interests in any product, service, or any other materials presented in this webinar.



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Learning Objectives

- Identify environmental and personal risk factors that contribute to heat related illness in the construction industry.
- Describe the signs and symptoms of heat related illnesses and first aid/emergency procedures
- Identify engineering and administrative controls to reduce or eliminate the risk of heat related illness
- Understand employer requirements per the Occupational Safety and Health Administration's National Emphasis Program on Heat Illness Prevention
- Define the necessary elements for an effective heat illness prevention program
- Review resources provided by OSHA and other agencies



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Environmental and Personal Risk Factors

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Understanding Heat Stress

- Normal body temp around 98.6° F
(Normal body temperature range 97 – 99° F)
(100.4° F considered Fever Temperature)
- How the body rids itself of excess heat:
 1. Sweating
 2. Dilation of blood vessels
 3. Increased Pulse/Heart Rate
- Problems develop when:
 - Air temperature exceeds body temperature
 - Air is humid
 - Sweat doesn't evaporate easily with heavy exertion or while wearing PPE or other clothing



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Environmental Risk Factors



Air temperature



Humidity



Radiant heat



Air movement



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Personal Risk Factors

- Low fluid consumption
- Alcohol and substance use
- Not eating regularly
- Physical exertion
- Heavy personal protective clothing and equipment
- Poor physical condition or health problems
- Some medications such as some blood pressure pills or antihistamines
- Pregnancy
- Lack of recent exposure to hot working conditions
- Previous heat-related illness
- Advanced age (65+)

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Heat Illness Prevention

- From 2015 – 2019, environmental heat cases resulted in an average of **35 fatalities per year** and **2,700 cases away from work**. (US Department of Labor Statistics)
- This number is probably under reported and improperly diagnosed. The cause of death is often listed as a heart attack, when the aggravating cause may have been heat exposure related.
- How we identify high risk environments, provide controls to limit risk, identify signs and symptoms of heat illness and treatment can greatly reduce fatalities and overall heat related illness.



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Heat Related High Profile NFL Death

- Korey Stringer – Minnesota Vikings Right Tackle died at the age of 27 on the second day of training camp, 2001.
- July 30, 1st Practice – Vomited three times and left early via a cart with athletic trainers to air-conditioned trailer adjacent to practice fields.
- Korey was angry and embarrassed regarding having to leave practice early with teammates.
- July 31, 2nd Practice – Heat index over 90° Vomitted at least once and briefly left practice but finished.
- Post Practice drill, fell while hitting a blocking bag and medical help called
- Died 13 hours later at 1:50 a.m. on Aug. 1 Internal core temperature 108.8°
- Today we now know that if a person's rectal temperature exceeds 104, they have a 100% survival rate if they get medical attention within the first 30 minutes of the onset of symptoms.



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Types of Heat Illnesses and Symptoms

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Categories of Heat Illness

Heat Fatigue

Heat Rash

Heat Cramps

Heat Exhaustion

Heat Stroke



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Categories of Heat Illness

- Heat Rash – happens when your sweat glands become blocked. Heat rash can cause red spots or clear blisters that are itchy. Common in babies and in people who are adjusting to warmer temperatures.
- Heat Cramps – are painful muscle spasms that occur due to dehydration and loss of nutrients from excessing sweating. Most common in the abdomen, back, arms or legs. Drink fluids to replace lost minerals such as sodium, potassium, calcium and magnesium among others. Drinking fluids with electrolytes can be beneficial to recovery.



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Categories of Heat Illness

- Heat Exhaustion - signs and symptoms are headache, nausea, vertigo, weakness, thirst, and giddiness. Fortunately, this condition responds readily to prompt treatment. Heat exhaustion should not be dismissed lightly. Workers suffering from heat exhaustion should be removed from the hot environment and given fluid replacement. They should also be encouraged to get adequate rest and when possible, ice packs should be applied under arms, neck and head.
- Heat Stroke - is the most serious heat related disorder and occurs when the body's temperature regulation fails and body temperature rises to critical levels. Heat stroke is a true medical emergency. The condition is caused by a combination of highly variable factors, and its occurrence is difficult to predict. Heat stroke is a **medical emergency** that may result in death. The primary signs and symptoms of heat stroke are confusion; irrational behavior; loss of consciousness; convulsions; a lack of sweating (usually); hot, dry skin; and an abnormally high body temperature, e.g., a rectal temperature of 105.8°F (41°C). The elevated metabolic temperatures caused by a combination of work-load and environmental heat, both of which contribute to heat stroke, are also highly variable and difficult to predict.



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Emergency Response and First Aid

- Take the affected worker to a cooler area (e.g., shade or air conditioning).
- Cool the worker immediately. Use active cooling techniques such as:
 - Immerse the worker in cold water or an ice bath.
 - Remove outer layers of clothing, especially heavy protective clothing.
 - Place ice or cold wet towels on the head, neck, trunk, armpits, and groin.
 - Use fans to circulate air around the worker.
- Never leave a worker with heat-related illness alone. The illness can rapidly become worse.
- When in doubt, call 911!
- Confusion, slurred speech, or unconsciousness are signs of heat stroke. When these types of symptoms are present, call 911 immediately and cool the worker with ice or cold water until help arrives.



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Recognizing Heat-Related Illnesses

Heat-Related Illness	Signs & Symptoms
Heat rash	<ul style="list-style-type: none"> • Clusters of red bumps on skin • Often appears on neck, upper chest, and skin folds
Heat cramps	<ul style="list-style-type: none"> • Muscle spasms or pain • Usually in legs, arms, or trunk • Caused by loss of electrolytes due to excessive sweating – may occur without feeling thirsty
Heat syncope	<ul style="list-style-type: none"> • Fainting • Dizziness



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Recognizing Heat-Related Illnesses

Heat-Related Illness	Signs & Symptoms
Heat exhaustion	<ul style="list-style-type: none"> • Fatigue • Irritability • Thirst • Nausea or vomiting • Dizziness or lightheadedness • Heavy sweating • Core body temperature 104° F or less; fast heart rate
Heat stroke	<ul style="list-style-type: none"> • Confusion • Slurred speech • Unconsciousness • Seizures • Heavy sweating or hot, dry skin • Core body temperature greater than 104° F to 108° • Rapid heart rate



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Recognizing the Signs

Signs of **heat stress/exhaustion** include:

- Fatigue
- Irritable
- Headache/Dizziness
- Profuse sweating/Clothing visibly wet
- **Moist and clammy skin, usually pale**
- **Pupils Dilated**
- Thirst
- Nausea

Signs of **heat stroke** include:

- **No longer sweating**
- **Hot, dry skin, usually red**
- **Pupils constricted**
- Unconsciousness / seizures
- High body temperature
- Confusion
- Slurred Speech
- Combative
- Pulse strong and rapid



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Engineering and Administrative Controls

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Engineering Controls

- Air treatment/air cooling/air conditioning can be effective in reducing air temperature in specific areas such as cool rooms, site office trailers or company vehicles
- General ventilation - use of fans in sun shade tents or in shaded break areas (water misters, water cooled heat exchangers, etc. in the work area). Changes in air speed can also help workers stay cooler by increasing both the convective heat exchange (the exchange between the skin surface and the surrounding air).
- Heat conduction blocking methods include insulating the hot surface that generates the heat and changing the surface itself. Simple devices such as shields, can be used to reduce radiant heat, i.e., heat coming from hot surfaces (heat from the walking/working surfaces).
- Provide recovery areas such as air-conditioned enclosures or rooms, shaded areas and provide intermittent rest periods with water breaks.

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Administrative Controls

- **Acclimatize workers** by exposing them to hot work environment for progressively longer periods. NIOSH (1986) suggests that workers who have had previous experience in jobs where heat levels are high enough to produce heat stress may acclimatize with a regimen of 50% exposure on day one, 60% on day two, 80% on day three, and 100% on day four. For new workers who will be similarly exposed, the regimen should be 20% on day one, with a 20% increase in exposure each additional day.
- **Replace Fluids** by providing cool (50°-60°F) water or any cool liquid (except cola's, alcoholic beverages, energy drinks, etc.) to workers and encourage them to drink small amounts frequently, e.g., one cup every 20 minutes. Ample supplies of liquids should be placed close to the work area. Although some commercial replacement drinks contain salt, this is not necessary for acclimatized individuals because most people add enough salt to their summer diets.



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Administrative Controls

- **Reduce the physical demands** by reducing physical exertion such as excessive lifting, climbing, or digging with heavy objects. Spread the work over more individuals, use relief workers or assign extra workers. Provide external pacing to minimize overexertion.
- **Reschedule tasks** requiring a high level of exertion (concrete pour), maintenance of equipment or repair work for the cooler part of the day.
- **Utilize Heat reducing PPE** (Vest, head bands, etc.)
- **Monitor workers** who are at risk of heat stress.
- **Develop a heat stress training program** and incorporate into health and safety plans.



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OSHA National Emphasis Program on Heat Related Illness

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OSHA's Heat Illness Prevention Campaign April 8, 2022 - most recent update

- OSHA has created a National Emphasis Program related to indoor and outdoor heat-related injury and illness until they create a permanent standard
- OSHA is now instructed to conduct inspections based on two heat related criteria:
 - Heat Index at 80 degrees or higher
 - National Weather Service heat warnings/advisories for local area
- OSHA Citation can only be given under the General Duty Clause, (GDC) at this time.

**Heat Illness
Prevention**

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What to expect from an OSHA Heat-Related Inspection

- Review OSHA 300 and 301 Reports for heat related entries.
- Review records of heat-related emergency room visits and/or Ambulance transport. (May require Medical Access Order)
- Interview workers for symptoms of headache, dizziness, dehydration, etc.
- Document how the employer is monitoring the heat index. If using an app, take screen shot to document.
- Does the employer have a written plan
- How did the employer monitor temperatures and level of exertion.
- Is there adequate cool water available
- Did employer require or allow additional breaks for hydration
- Are there scheduled rest breaks and access to shaded areas
- Worker Acclimatization
- Buddy system on Hot days
- Administrative controls, start times, rotation
- Training on heat illness, signs/symptoms, hydration, etc.



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Highlights from Recent OSHA Citation

- A worker lost consciousness on a day that was 92 F and 58% humidity – heat index of 103.3. Employer required to notify OSHA due to hospitalization.
- OSHA identified the following deficiencies:
 - Company's heat stress program not fully implemented – new workers had not been trained
 - Air-conditioned break area on site but significant distance from work area
 - Shaded break areas not provided
 - Scheduled breaks not taken and additional breaks not scheduled during high heat
 - Electrolyte replacement methods were not encouraged
 - Acclimatization schedule not implemented
 - Personal cooling devices not provided or encouraged



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OSHA's Recommendations

- Environmental Monitoring
- Acclimatization
- Buddy System
- Emergency Medical Treatment
- Limiting Exposures
- Drinking Water
- PPE
- Increasing Air Velocities
- Radiant Heat Control
- Work Task Design
- Temporarily Suspend Monetary Incentives for Output
- Medical Monitoring



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Environmental Heat Monitoring

- OSHA recommends the use of wet bulb globe temperature (WBGT) monitor
- WBGT contains 3 different thermometers:
 1. A **dry bulb** thermometer to measure the ambient air temperature.
 2. A natural **wet bulb** thermometer to measure the potential for evaporative cooling.
 3. A **black globe** thermometer to measure radiant heat.
- Accounts for all four major environmental heat factors — temperature, humidity, radiant heat, and wind



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NIOSH/OSHA Heat App



- Useful resource for planning outdoor work activities
- Measures heat index only - measured in the shade and combines air temperature and relative humidity to represent how hot the conditions feel at rest
- Exposure to full sunshine can increase heat index values by up to 15°F
- Has a real-time heat index and hourly forecasts specific to your location
- Not as accurate as WBGT
- Take Screen Shot to document



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Heat Index Categories

National Weather Service vs OSHA-NIOSH Heat Safety App

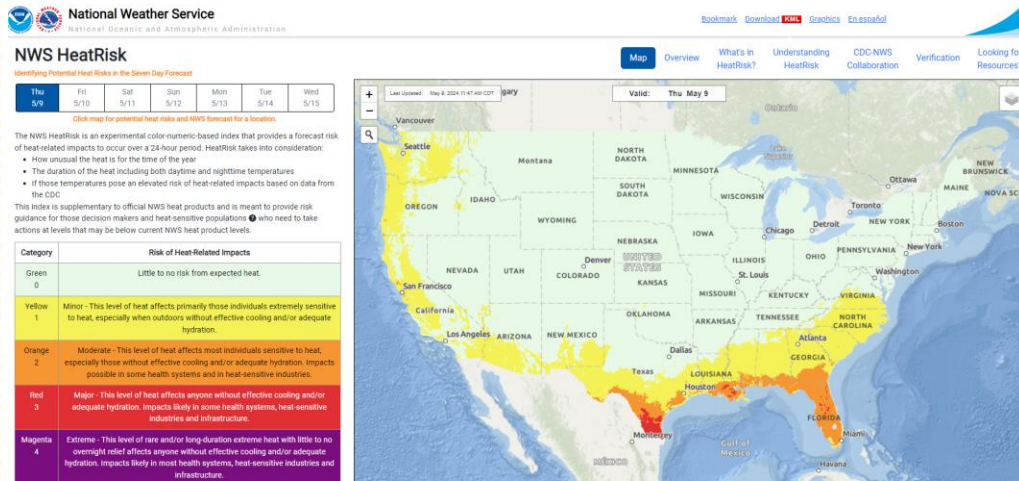
- | | |
|--|--|
| • National Weather Service | • OSHA-NIOSH Heat Safety Tool App |
| ✓ Caution – (80°F - 90°F) Heat Index | ✓ Caution – (less than 80°F) Heat Index |
| ✓ Extreme Caution – (91°F - 103°F) Heat Index | ✓ Warning – (80°F - 94°F) Heat Index |
| ✓ Danger – (103°F - 124°F) Heat Index | ✓ Danger – (95°F or higher) Heat Index |
| ✓ Extreme Danger – (126°F or higher) Heat Index | |



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CDC – NOAA Heat Risk Forecast Tool

Google: NWS Heat Risk



NWS HeatRisk

Identifying Potential Heat Risks in the Seven Day Forecast

Thu 5/9	Fri 5/10	Sat 5/11	Sun 5/12	Mon 5/13	Tue 5/14	Wed 5/15
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Click map for potential heat risks and NWS forecast for a location.

The NWS HeatRisk is an experimental color-numeric-based index that provides a forecast risk of heat-related impacts to occur over a 24-hour period. HeatRisk takes into consideration:

- How unusual the heat is for the time of the year
- The duration of the heat including both daytime and nighttime temperatures
- If those temperatures pose an elevated risk of heat-related impacts based on data from the CDC

This index is supplementary to official NWS heat products and is meant to provide risk guidance for those decision makers and heat-sensitive populations who need to take actions at levels that may be below current NWS heat product levels.

Category	Risk of Heat-Related Impacts
Green 0	Little to no risk from expected heat.
Yellow 1	Minor - This level of heat affects primarily those individuals extremely sensitive to heat, especially when outdoors without effective cooling and/or adequate hydration.
Orange 2	Moderate - This level of heat affects most individuals sensitive to heat, especially those without effective cooling and/or adequate hydration, impacts possible in some health systems and in heat-sensitive industries.
Red 3	Major - This level of heat affects anyone without effective cooling and/or adequate hydration. Impacts likely in some health systems, heat sensitive industries and infrastructure.
Magenta 4	Extreme - This level of rare and/or long-duration extreme heat with little to no overnight relief affects anyone without effective cooling and/or adequate hydration. Impacts likely in most health systems, heat sensitive industries and infrastructure.

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Heat Risk Dashboard



CDC HeatRisk Home

Hot days can affect anyone. If you are pregnant, are a child or teen with asthma, or have a heart condition or other chronic health conditions, heat can make your health worse.

Enter your zip code below to get the HeatRisk for this week and actions you can take to keep you and your family safe.

Get Your Local HeatRisk

HeatRisk Map
This map shows HeatRisk across the United States for Thursday, May 9, 2024.

You can view more local HeatRisk data on the Environmental Public Health Tracking Program's [Data Explorer](#).

HeatRisk is an experimental product and is not supported 24/7. Changes may occur without advance notice.

Source: [NOAA/NWS](#)

LEGEND

- Little to None
- Minor
- Moderate
- Major
- Extreme

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Work & Rest Schedules

Temperature (°F)	Light Work Minutes Work/Rest	Moderate Work Minutes Work/Rest	Heavy Work Minutes Work/Rest
90	Normal	Normal	Normal
91	Normal	Normal	Normal
92	Normal	Normal	Normal
93	Normal	Normal	Normal
94	Normal	Normal	Normal
95	Normal	Normal	45/15
96	Normal	Normal	45/15
97	Normal	Normal	40/20
98	Normal	Normal	35/25
99	Normal	Normal	35/25
100	Normal	45/15	30/30
101	Normal	40/20	30/30
102	Normal	35/25	25/35
103	Normal	30/30	20/40
104	Normal	30/30	20/40
105	Normal	25/35	15/45
106	45/15	20/40	Caution
107	40/20	15/45	Caution
108	35/25	Caution	Caution
109	30/30	Caution	Caution
110	15/45	Caution	Caution
111	Caution	Caution	Caution
112	Caution	Caution	Caution

- Continuous work in the heat is not advisable
- Periodic rest breaks allow your body to cool
- Adjust the temperature in the table based on:
 - Direct sunlight:
 - Full sun (no clouds): Add 13 °F
 - Partly cloudy/overcast: Add 7 °F
 - Humidity:
 - 40% humidity: Add 3 °F
 - 50% humidity: Add 6 °F
 - 60% humidity or more: Add 9 °F

CDC NIOSH Work Rest Schedule



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Heat Acclimatization

- Acclimatization is the beneficial physiological adaptations that occur during repeated exposure to a hot environment. These physiological adaptations include:
 - Increased sweating efficiency (earlier onset of sweating, greater sweat production, and reduced electrolyte loss in sweat).
 - Stabilization of the circulation.
 - The ability to perform work with lower core temperature and heart rate.
 - Increased skin blood flow at a given core temperature.
- As part of the program, gradually increase exposure time in hot environmental conditions over a period of 7 to 14 days.



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Acclimatization Schedule

New Workers

Day 1	20% usual work duration
Day 2	40% usual work duration
Day 3	60% usual work duration
Day 4	80% usual work duration
Day 5	100% usual work duration

Most can safely handle a full workload after 4 days of gradual increase, even though they will usually not be fully acclimatized yet. Most will continue to see beneficial improvements in heat tolerance for up to 2 weeks after exposure starts.

Returning Workers

Day 1	50% usual work duration
Day 2	60% usual work duration
Day 3	80% usual work duration
Day 4	100% usual work duration

How fast do I lose and regain acclimatization?



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Preventive Measures



- Hydrate before, during and after work.
- Find shade or a cool area for rest breaks that allow your body to recover.
- Dress for the heat. A hat and light-colored, loose-fitting (where allowed), breathable clothing are ideal.
- Check on others verbally and often.
- Not everyone tolerates heat the same way. Understand personal risk factors.
- Understanding engineering controls, work practices, and PPE.



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Hydration

Before Work	During Work	After Work
<ul style="list-style-type: none"> • Being hydrated when you start work makes it easier to stay hydrated through the day. • If you are dehydrated when you start work, you may not be able to drink enough to catch up with your body's need for water. 	<ul style="list-style-type: none"> • Drink before feeling thirsty • When working in the heat, drink 1 cup (8 ounces) of water every 15–20 minutes. • Drinking at shorter intervals is more effective than drinking large amounts infrequently. • Do not drink more than 48 oz per hour 	<ul style="list-style-type: none"> • May need several hours to drink enough fluids to replace what was lost through sweating • More important if you work in the heat on a regular basis. Chronic dehydration increases the risk for several medical conditions, such as kidney stones.

What to drink?

What to avoid?



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ARE YOU HYDRATED? Urine Color Chart

<p>NO COLOR. TRANSPARENT You're drinking a lot of water</p>		
<p>PALE STRAW COLOR You're normal & well hydrated</p>		
<p>TRANSPARENT YELLOW Normal</p>		
<p>DARK YELLOW You need to drink some water soon</p>		
<p>AMBER OR HONEY You're body isn't getting enough water</p>		
<p>SYRUP OR BROWN ALE You need to drink water. NOW & A LOT!</p>		

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Elements of an Effective Heat Illness Prevention Plan

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Elements of a Heat Stress Plan

Heat Stress Plan Elements

- Written policy
- Hierarchy of controls
- Heat acclimatization plan
- Environmental monitoring
- Training
- Hydration

Employee Training Elements

- Heat Illness Signs and symptoms
- First Aid Treatment
- How to contact emergency personnel
- Prevention – Engineering controls and Administrative Controls
- Importance of Hydration
 - ✓ What to drink and not drink
 - ✓ Hydrate prior to work
 - ✓ Drink more frequently vs large amounts at one time.
 - ✓ Electrolyte Replacement



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Additional Resources

<https://www.osha.gov/heat-exposure>

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Additional Resources

OSHA National Emphasis Program – Outdoor and Indoor Heat-Related Hazards Directive:

https://www.osha.gov/sites/default/files/enforcement/directives/CPL_03-00-024.pdf

OSHA Heat-Illness Prevention Plan Template:

https://www.osha.gov/sites/default/files/enforcement/directives/CPL_03-00-024.pdf

Heat Index Guide for Employers:

<https://www.northwestern.edu/environmental-health-safety/docs/health-docs/osha-heat-index-guidelines.pdf>

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Thank You.



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