Heat Stress and Air Quality Awareness

Introduction

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• Brief Overview of ANSI/ASSP A10.50-2024 • General Duty Clause
Understanding the Air Quality Index
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Why Heat Stress in Construction Matters

According to the Center for Construction Research and Training (CPWR):

- Over 100 workers died from heat-related illnesses from 2011 through 2018
- 78% of heat-related deaths occurred between June and August
- Most heat-related deaths occurred between 2 PM and 4 PM
- Construction workers accounted for only 7% of the U.S workforce but experienced 38% of all heat-related deaths at work in 2020.

Why Heat Stress in Construction Matters

Workers engaged in construction activities often have the following exposures that are likely to increase heat stress:

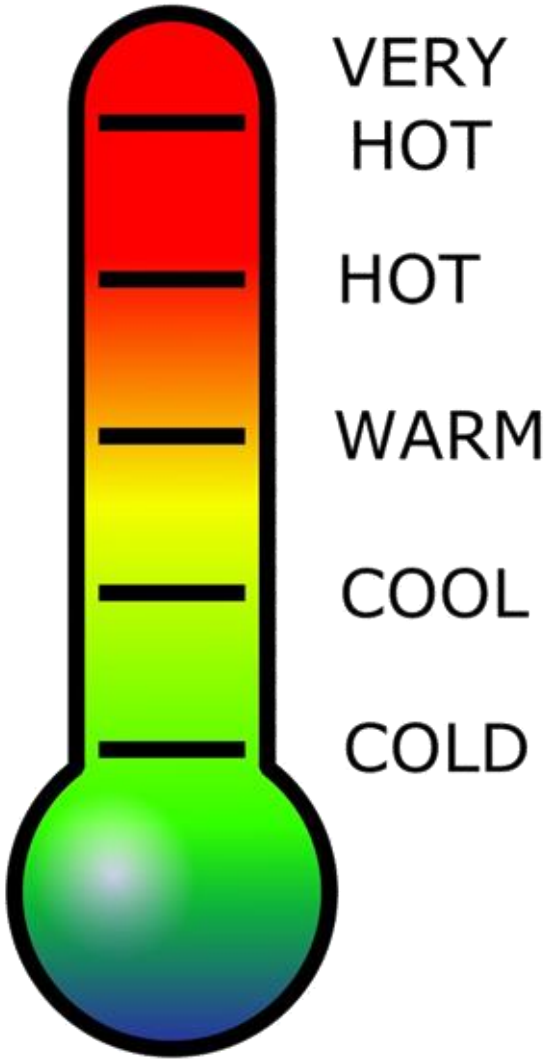
- Often work in direct sunlight
- Often wear heavy clothing, PPE, tools
- Heavy work loads increase metabolic work rates resulting in greater sweating
- Heavy sweating can cause electrolyte imbalance
- PPE can interfere with the body's ability to cool itself through evaporation of sweat

What is Heat Stress?

Heat Stress

Heat Stress is the net heat load to which a worker is exposed and includes the following factors:

- Physical Exertion
- Environmental Factors (Temperature, Wind, Radiant Heat, Humidity)
- Clothing



Measuring Heat Stress

The best method to measure the heat stress load is to utilize a Wet Bulb Globe Temperature (WBGT) Meter.

This is better than using the heat index alone as a guide as it accounts for solar load, wind, and radiant heat sources.

Heat Strain

Heat strain is the body's physiological response to heat stress.

- Increase in heart rate
- Sweating

When the body is unable to effectively regulate core body temperature, workers may develop the following illnesses:

- Heat Stroke
- Heat Exhaustion
- Heat Cramps
- Heat Syncope
- Heat Rash
- Rhabdomyolysis

Heat Stroke

Heat stroke is the most serious heat-related illness. It occurs when the body becomes unable to control its temperature. The bodies temperature rises rapidly, the sweating mechanism fails, and the body is unable to cool down. When heat stroke occurs, the body temperature can rise to 106^{o} F or higher within 10 to 15 minutes.

Symptoms of Heat Stroke

- Confusion, Altered Mental State
- Loss of Consciousness
- Hot, dry skin or profuse sweating
- Seizures
- Very high body temperature
- Death if treatment is delayed

Heat Exhaustion

Heat exhaustion is the body's response to an excessive loss of water and salt, usually through excessive sweating. Workers most prone to heat exhaustion are those that are elderly, have high blood pressure, and those working in a hot environment.

Symptoms of Heat Stroke

- Headache, dizziness
- Nausea, weakness
- Irritability
- Thirst
- Elevated body temperature
- Heavy sweating, decrease urine output

Rhabdomyolysis

Rhabdomyolysis is a medical condition associated with heat stress and prolonged physical exertion, resulting in the rapid breakdown, rupture, and death of muscle. When muscle tissue dies, electrolytes and large proteins are released into the bloodstream that can cause irregular heart rhythms and seizures and damage the kidneys.

Symptoms of Rhabdomyolysis

- Muscle cramps/pain
- Abnormally dark urine
- Weakness
- Exercise intolerance
- Joint pain/stiffness

Heat Syncope

Heat syncope is a fainting (syncope) episode or dizziness that usually occurs with prolonged standing or sudden rising from a sitting or lying position. Factors that may contribute to heat syncope include dehydration and lack of acclimatization.

Symptoms of Heat Syncope

- Fainting
- Dizziness
- Light-headedness during prolonged standing or when rising from a sitting or lying position.

Heat Illness Prevention Programs

Program Elements

An employer's heat illness prevention program should include the following elements:

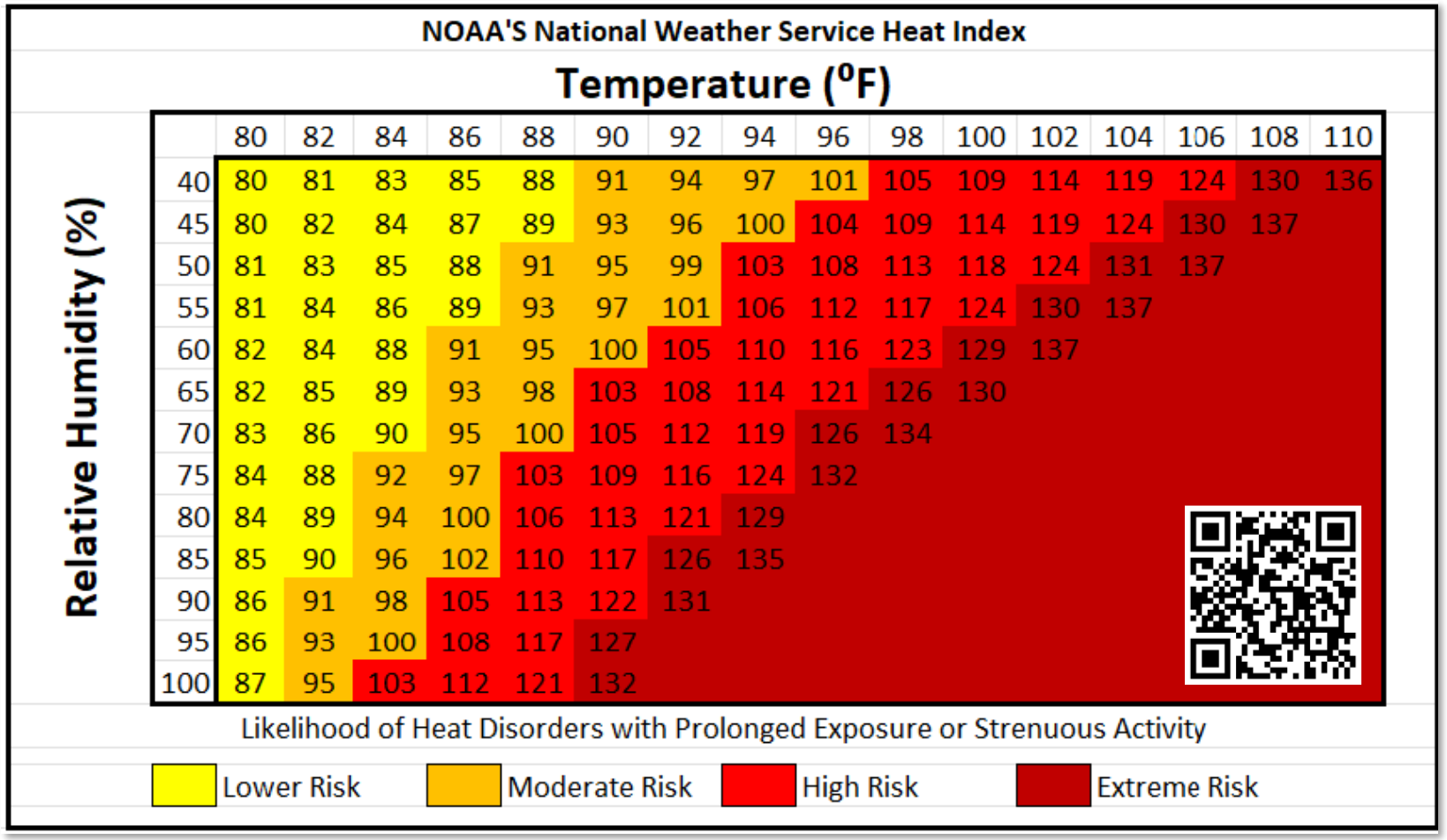
1. Procedures for monitoring the heat index
2. Procedures for access to water, rest, and shade
3. Procedures for acclimatization
4. Emergency response plan
5. First Aid response plan
6. Process for employee and supervisor training

MIOSHA Sample Heat Illness Prevention Plan

Monitoring the Heat Index

The heat index table represents the real feel of the combination of both the air temperature and the level humidity present. Other factors that affect the level of heat stress that a worker feels include the type of clothing worn, the strenuousness of the activities performed, movement of air, and the levels of direct sunlight on the worker performing the work.

Monitoring the Heat Index



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										

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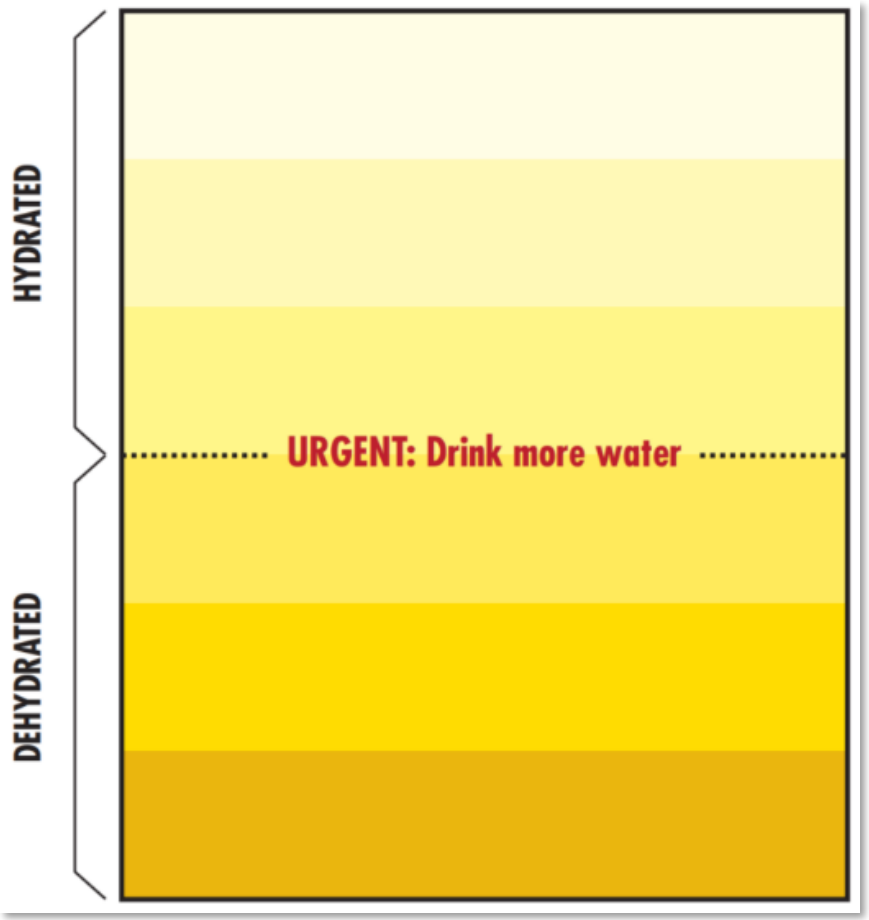
Access to Water

1. Workers should drink at least one cup (8 ounces) of water every 20 minute while working in the heat.
2. For jobs lasting longer than 2-hours, electrolyte fluids like sports drinks or packets to add to water should also be available.

Access to Water



One method that you can use to determine if you are properly hydrated is to pay attention to the color of your urine. Urine color can also be affected by:

- Medications
- Diet
- Illnesses

Generally, the darker your urine, the more dehydrated you are.

Access to Shade

1. Cooling or shade structures should be available when temperatures ≥ 80° Fahrenheit.
2. There should be enough shade structures to accommodate the number of employees.
3. Workers who request cooldown periods should be monitored as they may be experiencing heat stress.

Access to Rest

Work/Rest Schedules for Workers Wearing Normal Work Clothing*			
Adjusted Temperature (°F)†	Light Work (minutes work/rest)	Moderate Work (minutes work/rest)	Heavy Work (minutes work/rest)
90 - 94	Normal	Normal	Normal
95 - 96	Normal	Normal	45/15
97	Normal	Normal	40/20
98 - 99	Normal	Normal	35/25
100	Normal	45/15	30/30
101	Normal	40/20	30/30
102	Normal	35/25	Reschedule Work ǂ
103 - 104	Normal	30/30	Reschedule Work ǂ
105 - 107	40/20	Reschedule Work ǂ	Reschedule Work ǂ
>107	Reschedule Work ǂ	Reschedule Work ǂ	Reschedule Work ǂ

Table Notes:

*	Assumption that workers are physically fit, well-rested, fully hyrdated, under age 40, have adequate water intake, and that there is 30% RH and natural ventilation with perceptible air movement.
†	**Adjust the temperature reading as follows before going to the temperature column on the table:**
	Full Sun (no clouds): Add 13° / 30% Relative Humidity: No Adjustment
	Partly Cloudy/Overcast: Add 7° / 40% Relative Humidity: Add 3°
	No Shadows Visble/Night: No Adjustment / 50% Relative Humidity: Add 6°
	10% Relative Humidity: Subtract 8° / 60% Relative Humidity: Add 9°
	20% Relative Humidity: Subtract 4°
ǂ	High Levels of heat stress: Reschedule Activity

Table Based on CDC Criteria for Occupational Exposure to Heat & Hot Environment Table 6-2
DHHS (NIOSH) Publication No. 2016-106

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Acclimatization of Workers

New workers or workers that have been away from work for an extended period need to be acclimatized to working in extreme heat.

- Gradually increase exposure time in hot environmental conditions over a period of 7 to 14 days.
- For new workers, the schedule should be no more than 20% of the usual duration of work in the hot environment on day 1 and a no more than 20% increase on each additional day.
- For workers who have had previous experience with the job, the acclimatization regimen should be no more than 50% of the usual duration of work in the hot environment on day 1, 60% on day 2, 80% on day 3, and 100% on day 4.

Emergency Response and First Aid

Heat stress and strain can lead to heat stroke. Heat exhaustion and heat stroke are medical emergencies and should be treated as such.

- If medical care is unavailable, call 911 and follow the site-specific emergency procedures.
- Stay with the worker until medical services arrive.
- Cool the worker with cool liquids, and apply cold wet cloths to the head, neck, armpits, and groin.
- Circulate air around the worker to speed cooling.

Training

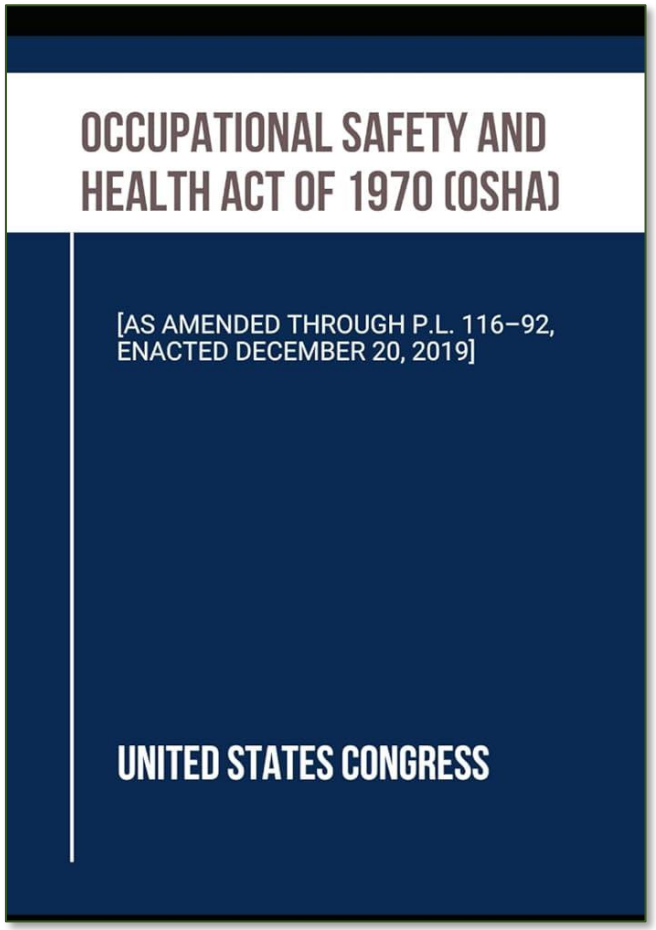
Workers and Supervisors need to be trained on:

- Signs and symptoms of heat stress
- Importance of hydration
- The need for acclimatization
- Review of the heat illness prevention program
- How to summon emergency services specific to their worksite

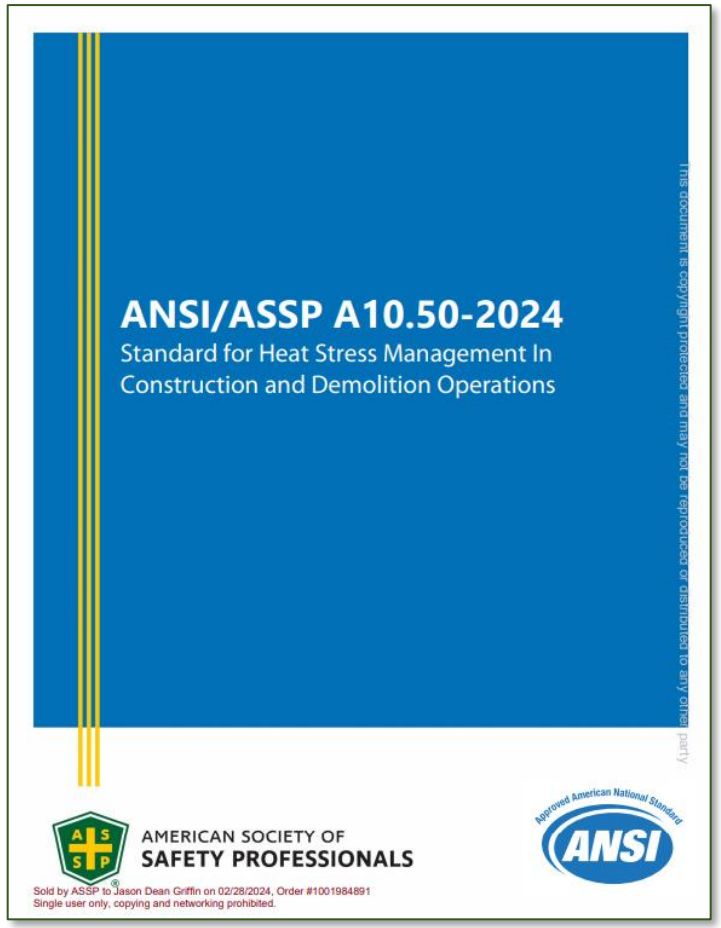
Standards ands Regulations

OSHA General Duty Clause

OSHA does not have a specific standard that covers working in hot environments. Employers have a duty to protect workers from recognized serious hazards in the workplace.



ANSI/ASSP A10.50-2024



Title:

Standard for Heat Stress Management in Construction & Demolition Operations

Approved:

January 4, 2004

Secretariat:

American Society of Safety Professionals

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Understanding the Air Quality Index

Air Quality Safety

Two of the most common pollutants in the US are Ozone and particles. High levels of this irritants at ground level can cause the following air quality related issues:

- Lung irritation & inflammation
- Increased susceptibility to respiratory diseases
- Coughing
- Asthma attacks
- Wheezing

Air Quality Index Chart

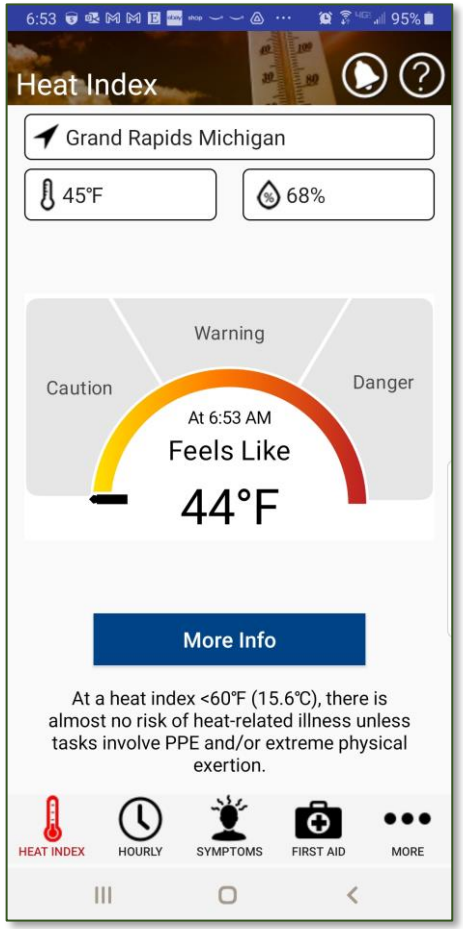
AQI Basics for Ozone and Particle Pollution

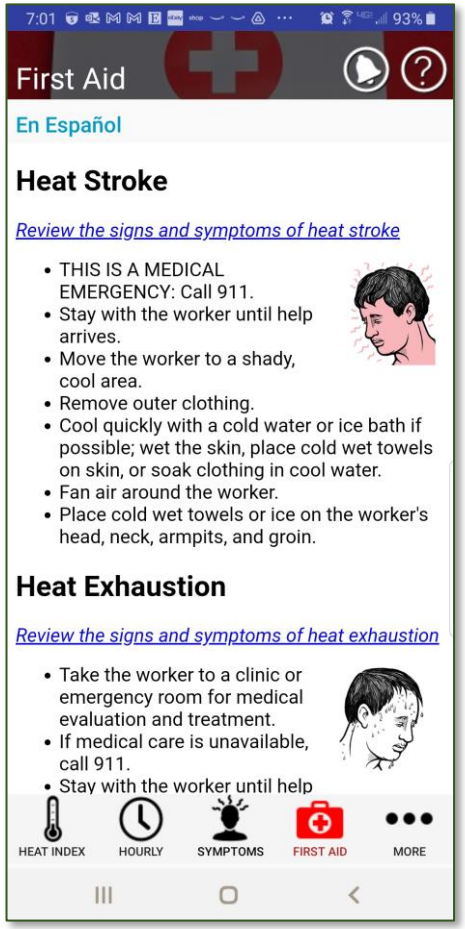
Daily AQI Color	Levels of Concern	Values of Index	Description of Air Quality
Green	Good	0 to 50	Air quality is satisfactory, and air pollution poses little or no risk.
Yellow	Moderate	51 to 100	Air quality is acceptable. However, there may be a risk for some people, particularly those who are unusually sensitive to air pollution.
Orange	Unhealthy for Sensitive Groups	101 to 150	Members of sensitive groups may experience health effects. The general public is less likely to be affected.
Red	Unhealthy	151 to 200	Some members of the general public may experience health effects; members of sensitive groups may experience more serious health effects.
Purple	Very Unhealthy	201 to 300	Health alert: The risk of health effects is increased for everyone.
Maroon	Hazardous	301 and higher	Health warning of emergency conditions: everyone is more likely to be affected.

Resources

OSHA Heat Illness Prevention Campaign

OSHA-NIOSH Heat Safety Tool





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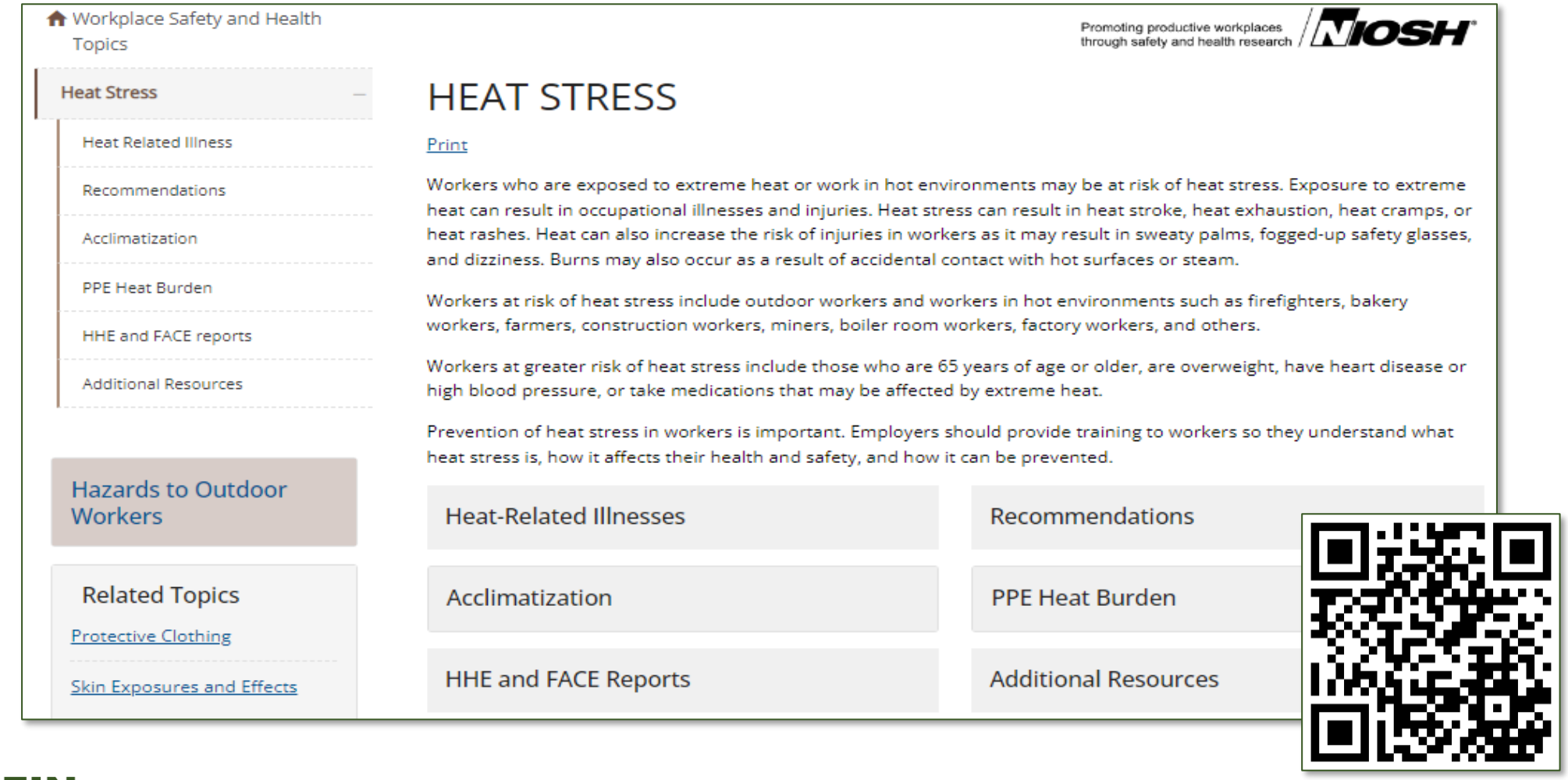
NIOSH- Heat Stress Topic Page



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CPWR- Heat Hazards Topic Page

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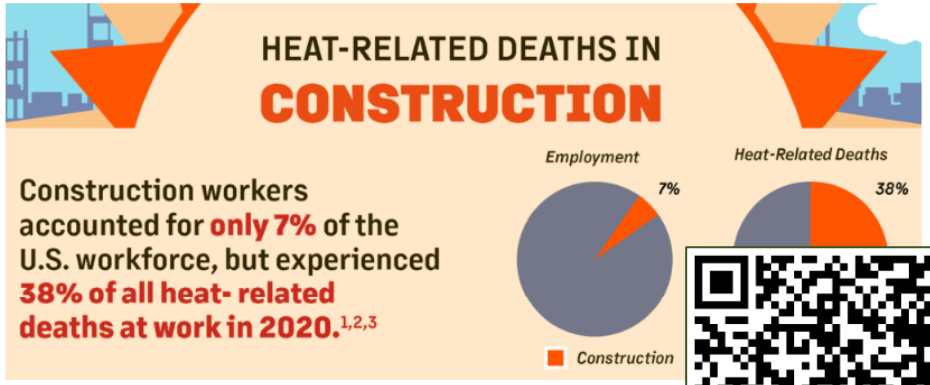
Heat Hazards

Construction workers, who often work outdoors in direct sunlight or in hot, enclosed spaces, are at risk for heat-related illnesses and, in severe cases, death. Rising global temperatures in recent decades increase that risk. However, **these illnesses and deaths are preventable.**

The resources below are organized by topic and contain information about heat hazards in construction and ways to prevent related illnesses. The sections correspond to the following new checklists from the CPWR-OSHA Alliance:

- Overall Heat-Illness Prevention Program Checklist for Construction (en español)
- Daily Heat-Illness Prevention Checklist for Construction (en español)



CPWR's webinar with OSHA provides an overview of their National Emphasis Program (NEP) and answers your questions about preventing heat-re

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Weather Underground App

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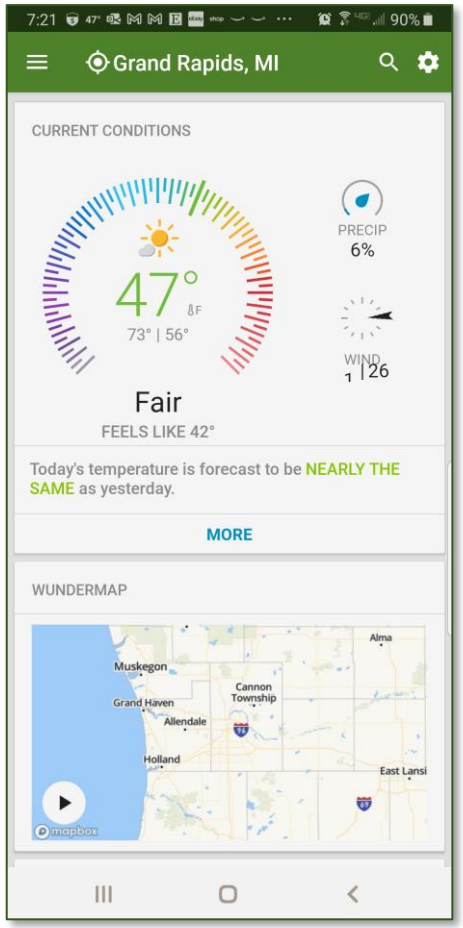

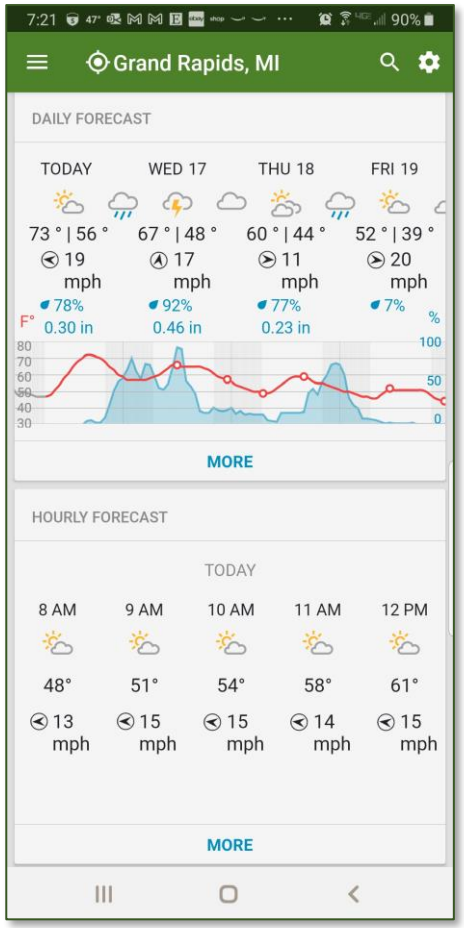

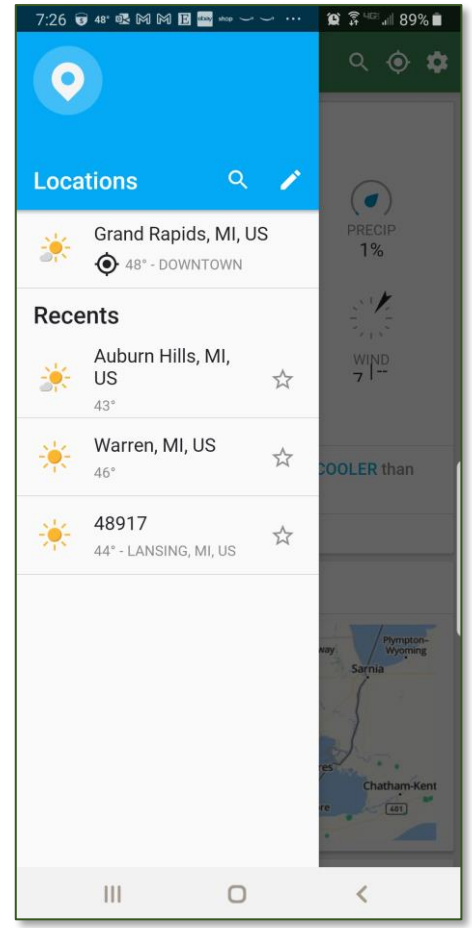

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