

Environmental Considerations Impacting Injury Recovery and Return to Work


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April 7, 2022

I have no conflict of interest to disclose.



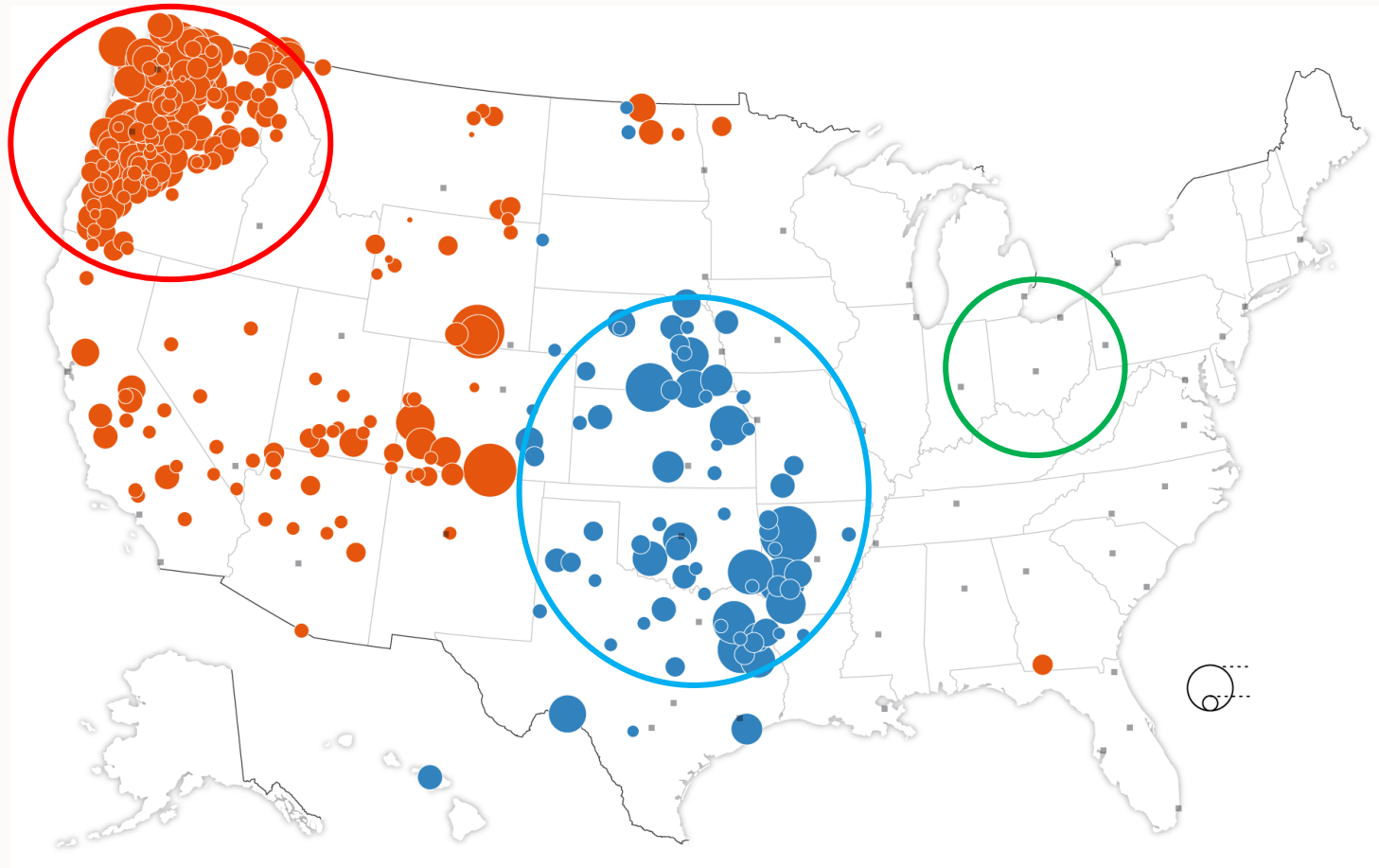


Learning Objectives

- Describe temperature change-related occupational injuries and illnesses.
 - Recognize occupational hazards and return to work obstacles due to environmental considerations.
 - Identify key information and work restrictions that improve health outcomes for workers returning to work.
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IPCC – extreme weather more common

Where all-time records were set in 2021 (NYTimes, Jan 11, 2022):



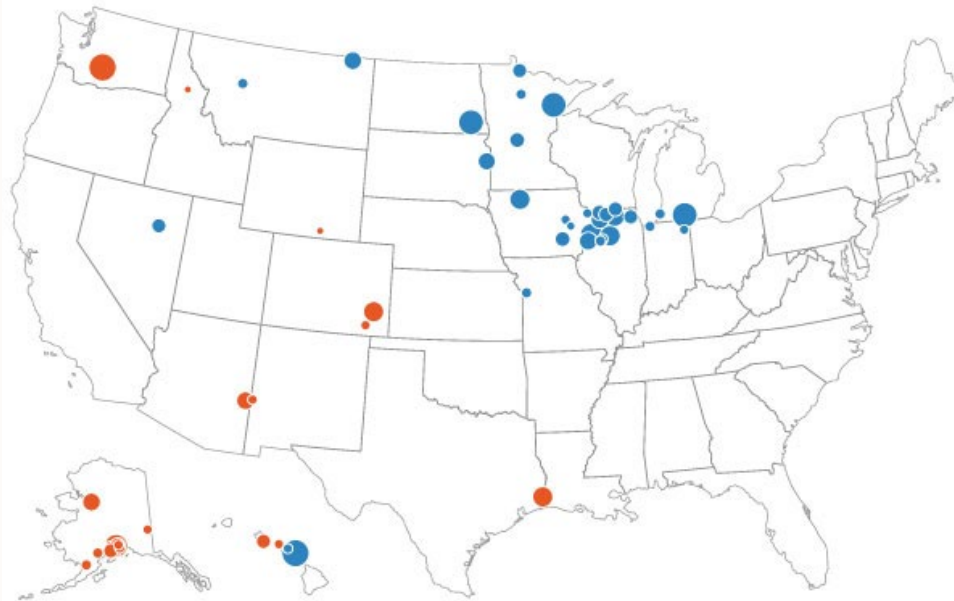
July 2002



June, July 2012



<https://www.nytimes.com/interactive/2022/01/11/climate/record-temperatures-map-2021.html?referringSource=articleShare>



January 2019

Heat-Related Illnesses (HRIs)

- Heat rash; heat syncope; heat cramps
- Heat exhaustion (non-specific symptoms, like sweating, dizziness, irritability, fatigue, thirst, nausea, vomiting)
- **HEAT STROKE = MEDICAL EMERGENCY**
 - Core body temp $\geq 104^{\circ}\text{F}$ (40°C)
 - CNS dysfunction (confusion, slurred speech, coma, death)

HRI's – Accompanying Diagnoses

- Skin burns
- Dehydration
- Rhabdomyolysis
- Acute kidney injury (AKI)
- And maybe chronic kidney disease (CKD)

Heat-Related Traumatic Injuries

- Increased risk of acute, traumatic injuries
- Probable mechanisms- HRI symptoms, impaired balance, muscle fatigue, dehydration, inattention.
- Both indoor and outdoor
- Young age
- Male

Washington state workers comp injuries, 2000-2012: more injuries on hotter, more humid days

Spector, 2016; Calkins, 2019; Spector, 2019

- Agriculture
- Strongest association:
ladder injuries, cherry pickers
- Construction
- Under 25 yo and over 54 yo
- New workers; Small employers



<https://savefamilyfarming.org/activists-drop-farm-worker-housing-demands-before-court-hearing/>



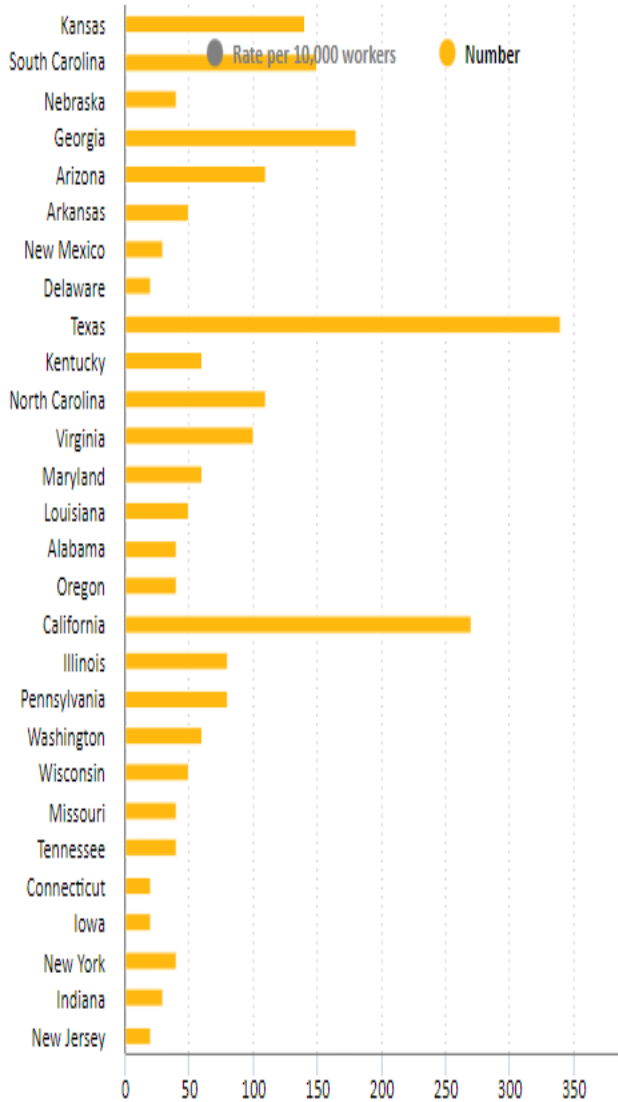
Photo by Koralie Hill

<https://www.osha.gov/stop-falls>

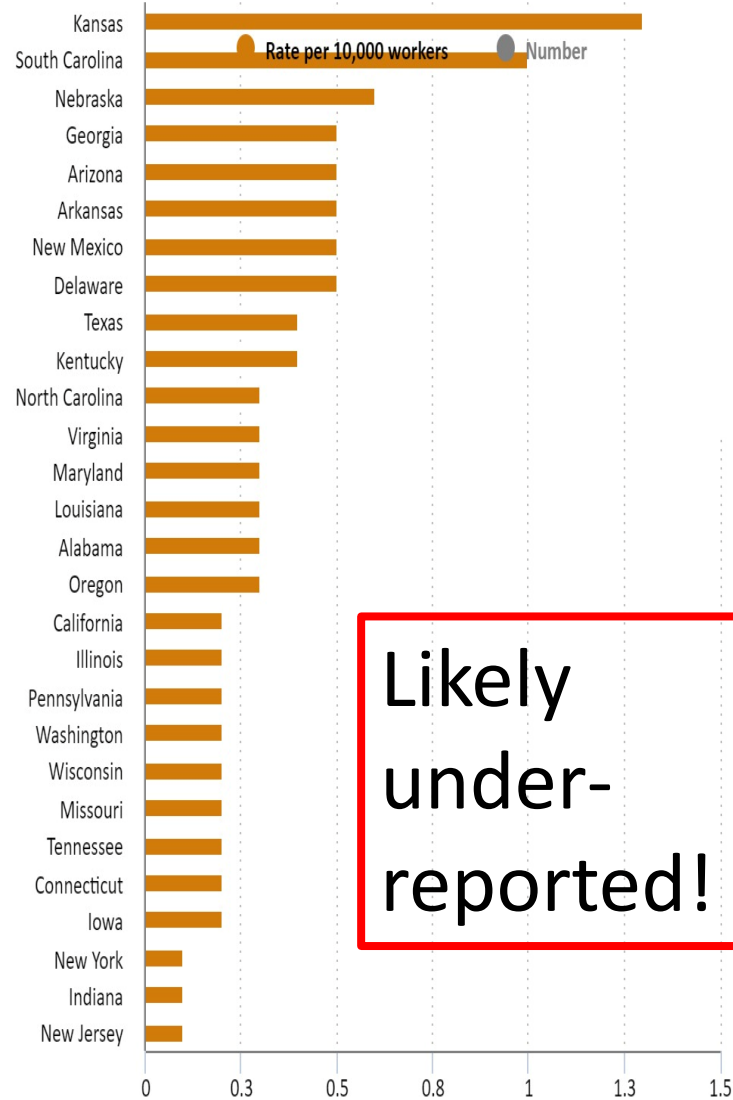
US Bureau of Labor Statistics

Nonfatal injuries and illnesses caused by heat, 2015

NUMBERS:

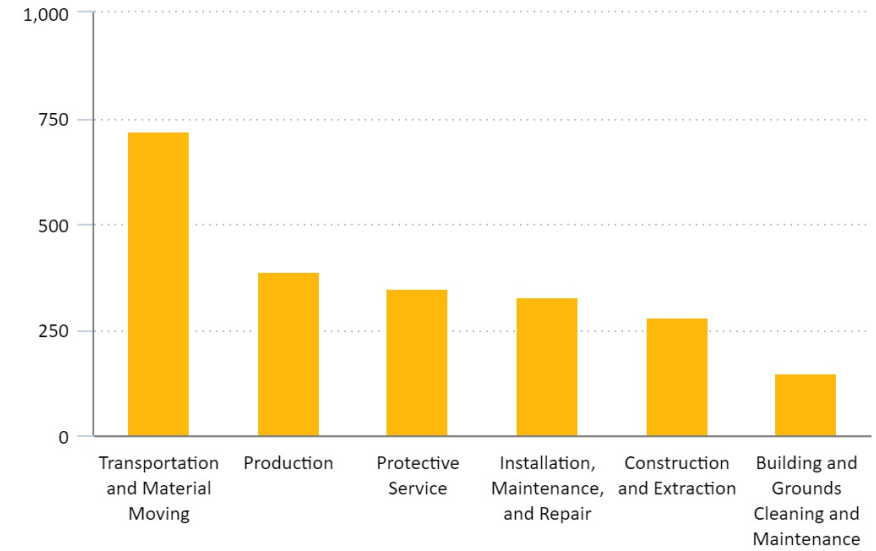


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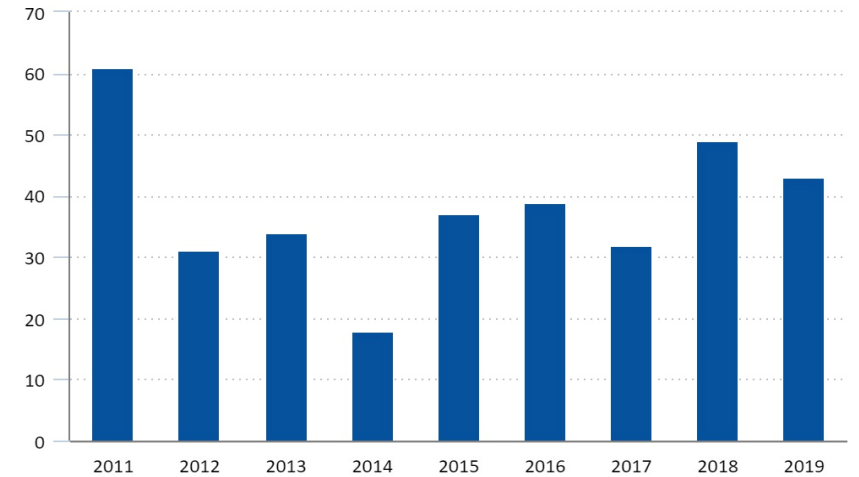


Likely under-reported!

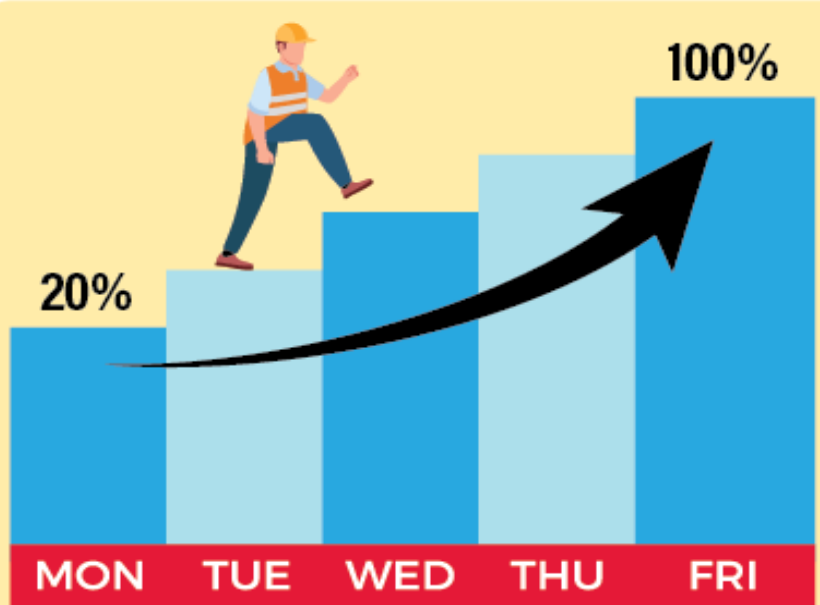
Nonfatal occupational injuries and illnesses caused by exposure to environmental heat, selected occupations, 2015



Number of work-related deaths from exposure to environmental heat, 2011-2019



ACCLIMATIZATION



Ease into Work. Nearly 3 out of 4 fatalities from heat illness happen during the first week of work.

Build a tolerance to heat by increasing intensity by 20% each day.



Drink cool water even if you are not thirsty



Rest for long enough to recover from the heat



Take breaks in a shady or cool area



Wear a hat and dress for the heat



Watch out for each other



Verbally check on workers wearing face coverings

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

Cold-related Illnesses (CRIs)

- Symptoms: muscle pain and stiffness; weakness, swelling, decreased ROM, paresthesias; fatigue, confusion; erythema or pale skin, painful, numb fingers
- Frostbite
- Chilblains; Trench foot; Cold urticaria
- Hypothermia (leading to coma, death)

Cold-related Injuries and Aggravation of Underlying Conditions

- Slips, trips and falls
- Raynaud's (reindeer herders!)
- Musculoskeletal disorders (CTS, de Quervain's ...)
- Aggravation of Asthma, COPD, Heart disease, Skin diseases (i.e. psoriasis)

Stjernbrandt and Farbu, 2022; Makinen and Hassi, 2009

<https://www.bing.com/images/search?q=reindeer+herders+and+snowmobiles+pic&qvrt=reindeer+herders+and+snowmobiles+pic&form=IQFRML&first=1&tsc=ImageBasicHover>



Cold stress: Definition; Mechanisms; Epidemiology

- ***What constitutes cold stress?*** Varies by location, exposure scenarios, job duties, PPE, and host risk factors [OSHA Cold Stress]
 - ACGIH defines as core body temp < 96.8°F; Hypothermia is core body temp < 95°F
- ***What mechanisms are thought to cause cold-related health effects?***
 - Shifting of blood flow to keep body warm
 - Decrease in blood flow to muscles - ischemia; vasospasm – decreased agility; also limited movement due to PPE.
 - Increased energy needed to perform work.
 - Augmented pain response? [Stjernbrandt and Farbu, 2022]
- ***How common are CRIs?*** BLS: CRIs 2017 1.8/10,000 FTE's with a range of 1.4 in 2012 to 3.9 in 2014. (likely under-reported and under-counted!)

CRI Prevention

- Train workers and supervisors on signs and symptoms of CRI
- Monitor workers for CRI; buddy system
- Provide appropriate PPE
- Regular breaks to warm up
- Change out of wet clothes
- Hydration
- ***Acclimatization may be important in cold environments also!***

WORKPLACE SOLUTIONS

From the National Institute for Occupational Safety and Health

Preventing Cold-related Illness, Injury, and Death among Workers

Summary

Workers, both indoors and outdoors, in services, transportation, agriculture, construction, and other industries may be exposed to environmental cold stress that can lead to thermal discomfort and in some cases even severe injuries, illnesses, or death. The National Institute for Occupational Safety and Health (NIOSH) recommends that employers implement a cold-related illness and injury prevention program that includes preventive measures such as using engineering controls, establishing work/rest schedules, training workers about the hazards of working in cold environments, and providing appropriate cold-weather gear.

Description of Exposure

Workers who work in cold environments may be at risk of cold stress. Exposure to cold can be an uncomfortable and potentially dangerous situation. Health emergencies can occur in people who work outdoors or in an area

that is purposefully kept cold, poorly insulated, or without heat. People who have previously experienced frostbite, sedentary workers, and those with poor circulation may be especially susceptible. For indoor workers, work in cold, damp conditions can be uncomfortable and may lead to declining work performance (i.e., a decline in cognitive function and dexterity) or result in cold-related illness or injury. Cold-related conditions can also worsen musculoskeletal injuries and vascular disorders. For outdoor workers, what constitutes cold stress can vary across different areas of the country. In regions where workers are unaccustomed to winter weather, near freezing temperatures are considered factors for cold stress. Whenever outdoor temperatures drop substantially and wind speed increases, heat leaves the body more rapidly. According to the American Conference of Governmental Industrial Hygienists (ACGIH®) Threshold Limit Values (TLV®), workers should be protected from exposure to cold so that the deep core temperature does not fall below 96.8°F (36°C) and to prevent frostbite to body extremities [ACGIH 2019]. Serious health problems can occur when the body is unable to stay warm enough.

Cold-related Illnesses and Injuries

Cold-related illnesses and injuries include chilblains, trench foot, frostbite, and hypothermia.

Chilblains. Chilblains are the painful inflammation of small blood vessels in the skin that occur in response to repeated exposure to cold but nonfreezing temperatures. Small blood vessels in the skin may become permanently damaged by cold temperatures, resulting in redness and itching during additional exposures. Symptoms of chilblains include redness, itching, possible blistering, inflammation, and possible ulceration in severe cases.


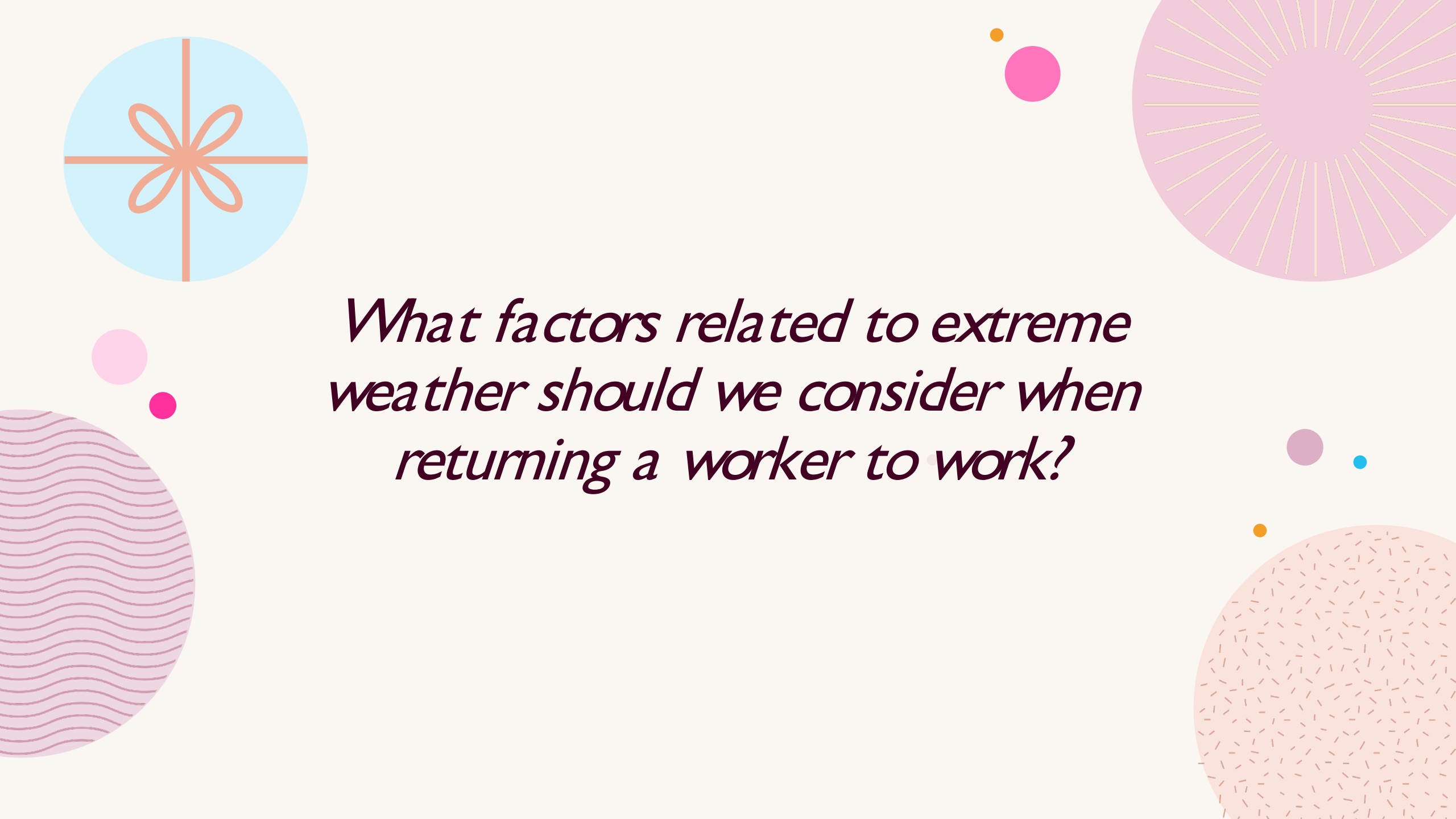


Photo by Marian Vecchi/Getty Images

Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health

The background features several decorative elements: a light blue circle with an orange flower-like pattern and a crosshair in the top left; a pink circle with a radiating line pattern in the top right; a pink circle with a wavy line pattern in the bottom left; and a pink circle with a dashed line pattern in the bottom right. Scattered throughout are smaller circles in shades of pink, orange, and blue.

What factors related to extreme weather should we consider when returning a worker to work?

CASE



<https://www.mercurynews.com/2018/07/25/woodland-hills-mail-carrier-peggy-frank-touched-so-many-peoples-hearts-sister-says/>

Case Information

- 63-year-old postal worker
- April 2018 slipped on wet leaves, rainy day, fractured ankle. Off work 3 months.
- July 6, 2018 – first day back on job.
- Temp reached 117°F
- 3pm – found by coworker unconscious in her truck
- EMS called. Resuscitation failed. Pronounced dead at scene.
- PMH- Cardiovascular disease, Obesity, Previous HRI
- Med Examiner: Cause of death – Hyperthermia
- OSHA investigation: General duty clause and recordkeeping citations; fine \$149,664

Acclimatization

- **Heat-related fatalities highest in new and returning, unacclimatized workers**
- Definition: body's ability to adapt to heat (thermoregulation)
- Improved sweating efficiency, higher plasma volume, improved circulation, redistribution to skin for evaporative heat loss
- Acclimatized people have increased skin blood flow, lower core body temps, and lower heart rates than unacclimatized

What does an acclimatization protocol look like?

- Takes 7 – 14 days to acclimatize
- Lose acclimatization in 7-14 days (so, need to re-acclimatize)
- Several acclimatization approaches. One approach is to increase work in heat by 20% over 5 days.
- Some workers may need longer time to acclimatize.
- Accompanying measures:
 - longer, more frequent rest breaks in shaded, cooler area
 - appropriate hydration
 - **buddy system**

Occupations and Job Tasks

Outdoors

- Agriculture
- Construction (particularly roads, roofing)
- Fire fighters
- Landscaping
- Mail and package delivery
- Oil and gas well operations
- Public Service workers (gas, electric)
- Truck drivers

Indoors

- Bakeries and kitchens
- Electrical utilities (particularly boiler rooms)
- Fire fighters
- Food processing
- Iron and steel mills; foundries
- Laundries
- Manufacturing with local heat sources, such as furnaces
- Warehousing (cold storage)

Heat Stress = Environmental Heat + Metabolic (Heat) Load

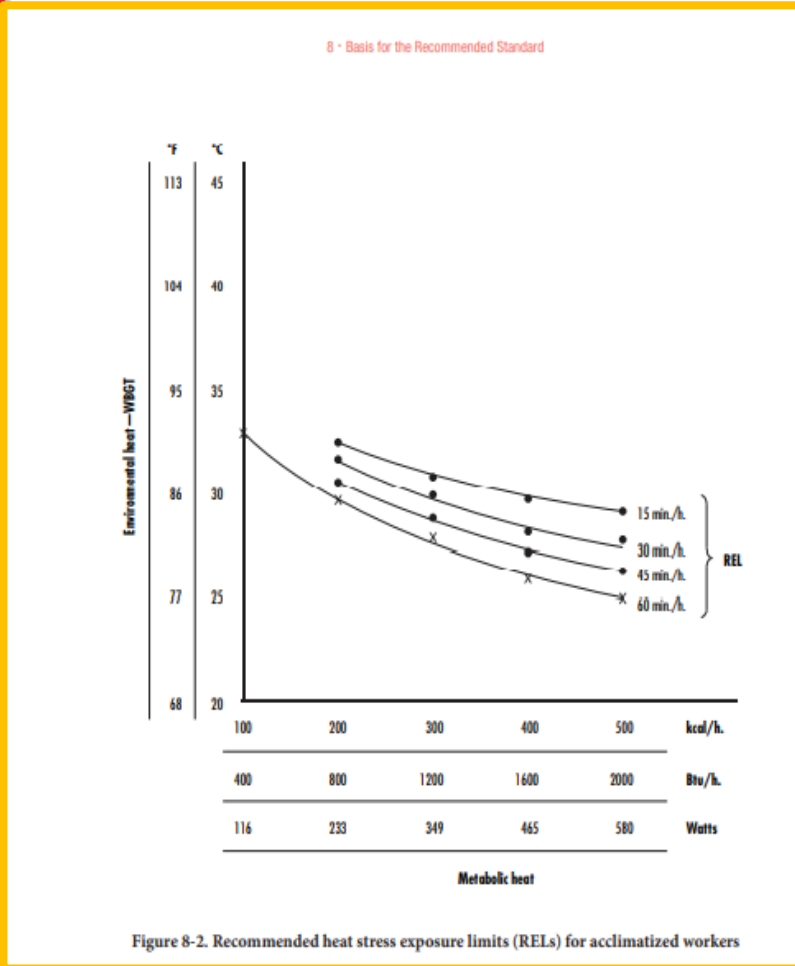
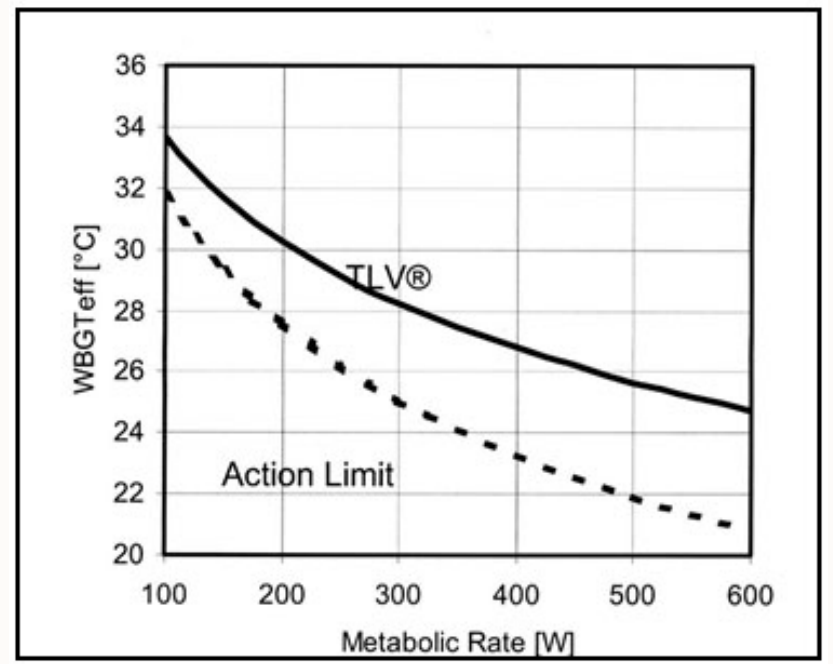


Figure 8-2. Recommended heat stress exposure limits (RELs) for acclimatized workers

ACGIH (2020) TLV – Heat Stress:



Clothing, PPE, Work hours and environment



Personal Risk Factors

- Age
- Pregnancy
- Acute infection or illness
- Previous history of HRI
- Obesity (particularly if deconditioned)
- Chronic diseases, such as HPTN, CVD, DM, Asthma, COPD, Kidney Disease, MS, Hyper and hypothyroidism
- Skin diseases, such as psoriasis

Personal risk factors - Medications

- Many medications:
 - Diuretics
 - ACE inhibitors, beta-blockers,
 - Antihistamines, anticholinergics,
 - Anticonvulsants,
 - Antipsychotics, benzodiazepines, tricyclic antidepressants
 - And more
- Drugs, both legal and illegal:
amphetamines, opioids, cocaine, alcohol





What factors related to extreme weather should we consider when returning a worker to work?

- ACCLIMATIZATION
- Occupation (indoor, outdoor)
- Job tasks (workload)
- Work hours, shiftwork
- PPE, clothing
- Personal risk factors
- **Social determinants of health**

RTW in Extreme Temperatures - *What you can do to prevent HRIs and CRIs*

- Be aware of the weather.
- Is worker at risk?
- Ask your patient: “Do you have any concerns about hot/cold temperature at work?”
- THINK – Is this worker unacclimatized?
- Prescribe an acclimatization schedule.
- Ask for help – IH, OEM nurse or doctor.
- Educate your patient

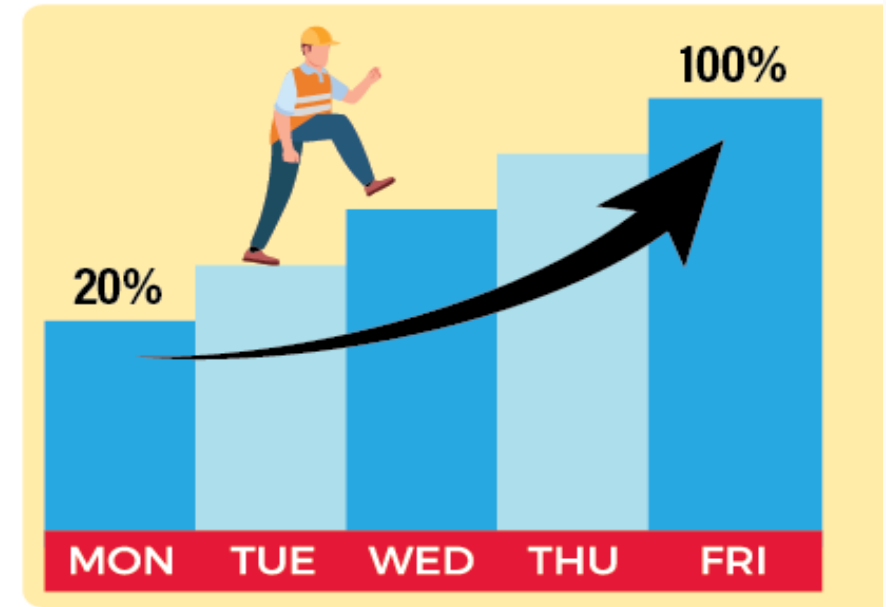
You might save a life ...

- I'm glad your ankle is feeling better. Your physical therapist tells me you reached all your goals! That's great. I think you can return to work.
- I notice the temperatures are going to be pretty high this next week. Do you have any concerns about the heat?
- Tell you what, I am going to recommend a gradual return to full duty for this next week. That should help your ankle get used to the walking and your body get used to the heat. Does that sound ok with you?
- And remember to drink plenty of liquids and take some rest breaks in a cool, shaded place!



- Thanks doc! I really miss my route. ...
- Well, I have been pretty comfortable at home in the air-conditioning. I guess I'll just need to get used to the heat again! You know, I wish they would air-condition our postal vehicles.
- Yes, thanks!

Tools for HRI Prevention



Drink cool water even if you are not thirsty



Rest for long enough to recover from the heat



Take breaks in a shady or cool area



Wear a hat and dress for the heat



Watch out for each other

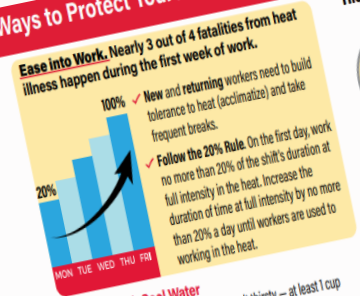


Verbally check on workers wearing face coverings

<https://www.cdc.gov/niosh/topics/heatstress/heatapp.html>

OSHA Resources

Ways to Protect Yourself and Others



✓ **New and returning workers** need to build tolerance to heat (acclimatize) and take frequent breaks.

✓ **Follow the 20% Rule.** On the first day, work no more than 20% of the shift's duration at full intensity in the heat. Increase the duration of time at full intensity by no more than 20% a day until workers are used to working in the heat.

- Drink Cool Water**
Drink cool water even if you aren't thirsty – at least 1 cup every 20 minutes.
- Take Rest Breaks**
Take enough time to recover from heat given the temperature, humidity, and conditions.
- Find Shade or a Cool Area**
Take breaks in a designated shady or cool location.
- Dress for the Heat**
Wear a hat and light-colored, loose-fitting, and breathable clothing if possible.
- Watch Out for Each Other**
Monitor yourself and others for signs of heat illness.
- If Wearing a Face Covering**
Change your face covering if it gets wet or soiled. Verbally check on others frequently.

First Aid for Heat Illness

The following are signs of a medical emergency:

- Abnormal thinking or behavior
- Slurred speech
- Seizures
- Loss of consciousness

- 1 >> **CALL 911 IMMEDIATELY**
- 2 >> **COOL THE WORKER RIGHT AWAY WITH WATER OR ICE**
- 3 >> **STAY WITH THE WORKER UNTIL HELP ARRIVES**

Watch for any other signs of heat illness and act quickly. When in doubt, call 911.

If a worker experiences:

- Headache or nausea
- Weakness or dizziness
- Heavy sweating or hot, dry skin
- Elevated body temperature
- Thirst
- Decreased urine output

Take these actions:

- >> Give cool water to drink
- >> Remove unnecessary clothing
- >> Move to a cooler area
- >> Cool with water, ice, or a fan
- >> Do not leave alone
- >> Seek medical care



For more information:
1-800-321-OSHA (6742)
TTY 1-877-889-5627
www.osha.gov/heat

Federal law entitles you to a safe workplace. You have the right to speak up about hazards without fear of retaliation. See www.osha.gov/workers for information about how to file a confidential complaint with OSHA and ask for an inspection. OSHA 4135-7

OSHA QUICK CARD

Protecting Workers from Cold Stress

Cold temperatures and increased wind speed (wind chill) cause heat to leave the body more quickly, putting workers at risk of cold stress. Anyone working in the cold may be at risk, e.g., workers in freezers, outdoor agriculture and construction.

Common Types of Cold Stress

- **Hypothermia**
 - Normal body temperature (98.6°F) drops to 95°F or less.
 - **Mild Symptoms:** alert but shivering.
 - **Moderate to Severe Symptoms:** shivering stops; confusion; slurred speech; heart rate/breathing slow; loss of consciousness; death.
- **Frostbite**
 - Body tissues freeze, e.g., hands and feet. Can occur at temperatures above freezing, due to wind chill. May result in amputation.
 - **Symptoms:** numbness, reddened skin develops gray/white patches, feels firm/hard, and may blister.
- **Trench Foot (also known as Immersion Foot)**
 - Non-freezing injury to the foot, caused by lengthy exposure to wet and cold environment. Can occur at air temperature as high as 60°F, if feet are constantly wet.
 - **Symptoms:** redness, swelling, numbness, and blisters.
- **Risk Factors**
 - Dressing improperly, wet clothing/skin, and exhaustion.
- **For Prevention, Your Employer Should:**
 - Train you on cold stress hazards and prevention.
 - Provide engineering controls, e.g., radiant heaters.
 - Gradually introduce workers to the cold; monitor workers; schedule breaks in warm areas.

For more information:
OSHA Occupational Safety and Health Administration
U.S. Department of Labor
www.osha.gov (800) 321-OSHA (6742)

OSHA QUICK CARD

How to Protect Yourself and Others

• Watch for symptoms; monitor yourself and co-workers.
• Wear warm, layered clothing (wool, heavy, wind-resistant, waterproof, and windproof).
• Wear loose-fitting, insulating clothes (sweater, jacket, gloves, and a hat (waterproof, if needed) and waterproof boots.

What to Do When a Worker Suffers from Cold Stress

For Hypothermia:

- Immediately in an emergency, get the worker to a warm place.
- Remove wet clothing and dry the worker.
- Cover the body (including the head and neck) with blankets, and with something to block the cold wind.
- Do not cover the face.
- Give warm, sweetened drinks if alert (no alcohol).
- Call 911 for additional rearming recommendations.

For Frostbite:

- Do not break blisters.
- Cover the area from contact with snow/water. Do not break blisters.
- Rewarm the area unless directed by a medical professional.

For Immersion Foot:

- Remove shoes/socks; air dry (in warm area); keep it elevated and avoid walking. Get medical attention.

For more information:
OSHA Occupational Safety and Health Administration
U.S. Department of Labor
www.osha.gov (800) 321-OSHA (6742)



“The environment we create will determine what prevails. In other words, what we nurture and encourage wins.”

Jane Goodall

<https://www.bing.com/images/search?q=jane+goodall+on+climate+change&qvpt=Jane+Goodall+on+climate+change&tsc=ImageHoverTitle&form=IQFRML&first=1>



“Whether you’re a government leader, an entrepreneur, or a voter with a busy life and too little free time (or all of the above), there are things you can do to help avoid a climate disaster. That’s it. Let’s get started.”

Bill Gates

<https://www.bing.com/images/search?q=Bill%20Gates%20pic&qvpt=Bill+Gates+pic&tsc=ImageHoverTitle&form=QBIR&sp=1&pq=bill%20gates%20pic&sc=8-14&cvid=641199ACCB2B4F7291ADD1E3F786DCB2&first=1&tsc=ImageHoverTitle>

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Extra slides

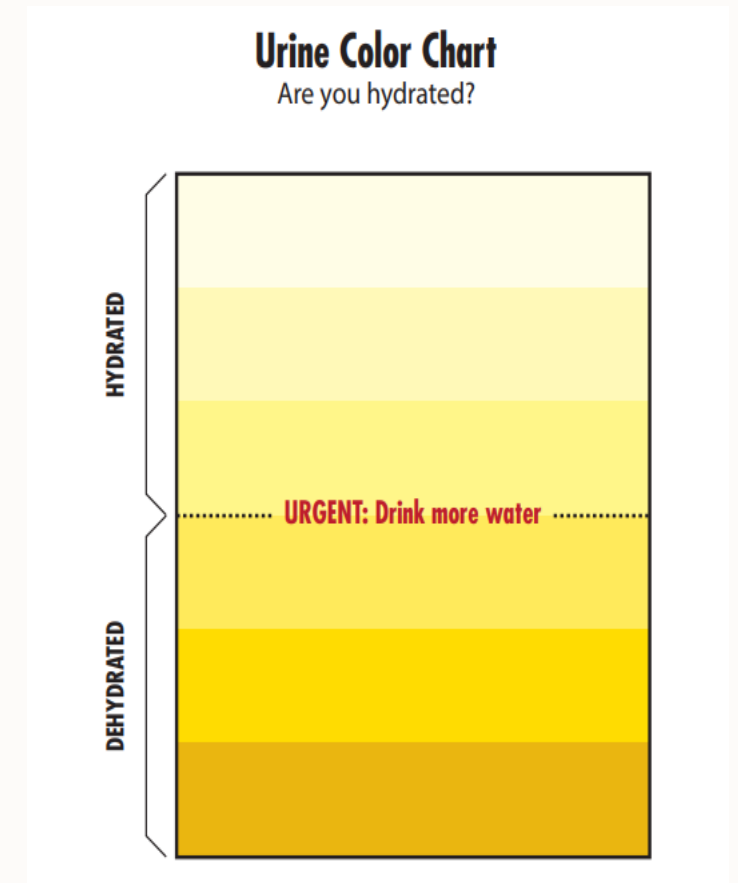
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Acclimatization Schedules

- Best Practices:
 - Identify at-risk workers (new, returning, temp workers)
 - Gradual return to extreme temp environment
 - Closely monitor
- Longer acclimatization periods (14 days plus) confer longer lasting benefit
- Additional considerations:
 - Adjust time of workday (cooler times)
 - Decrease workload
 - Work farther from heat source

Hydration

- 1 cup water every 15-20 minutes
- If in heat more than 2 hours, begin drinking electrolyte-containing fluids (can alternate)
- Well-balanced diet also important
- “Hypo-hydration” increases with age
- Remember to consider meds (ie. Diuretics)
- Worker monitoring options: pre- and post-shift weights; training to assess urine color



Heat and Chronic Kidney Disease

- CKD in agricultural workers – Latin American, Sri Lanka, India, Egypt, ?US
- Recurrent dehydration and AKI with high workload
- Other possible causes: pesticides, arsenic, NSAIDs, fructose, hypokalemia, hyperuricemia
- Several studies show that hydration and decreasing workload prevents decreased kidney function (sugarcane workers)
- Consider kidney function testing in medical surveillance

Medical surveillance

- Consider a pre-placement and RTW questionnaire (several OH clinics have developed these)
- Consider a physical exam- particularly BP, vital signs, focused exam
- Consider labs – serum creatinine, GFR

Why doesn't OSHA have a heat stress (or cold stress) standard?



OSHA's Advance Notice of Proposed Rulemaking for Heat Injury and Illness Prevention in Outdoor and Indoor Work Settings: How You Can Participate

The Occupational Safety and Health Administration (OSHA) has issued an Advance Notice of Proposed Rulemaking (ANPRM) for Heat Injury and Illness Prevention in Outdoor and Indoor Work Settings, a significant step toward a federal heat standard. The ANPRM was published on October 27, 2021 and initiated a public comment period allowing OSHA to gather information, diverse perspectives and technical expertise on topics including heat stress thresholds, heat acclimatization planning, and exposure monitoring.

What opportunities are there for participation?

OSHA's notice-and-comment rulemaking process relies heavily on input from the public

www.federalregister.gov/d/2021-23250 and at www.regulations.gov, which is the Federal e-Rulemaking Portal.

[Heat Injury and Illness Prevention in Outdoor and Indoor Work Settings Rulemaking | Occupational Safety and Health Administration \(osha.gov\)](https://www.osha.gov/heat-injury-and-illness-prevention-outdoor-and-indoor-work-settings-rulemaking)



OSHA National News Release

U.S. Department of Labor

September 20, 2021

US Department of Labor announces enhanced, expanded measures to protect workers from hazards of extreme heat, indoors and out
Part of an interagency Biden-Harris administration effort to protect workers, communities

WASHINGTON – To combat the hazards associated with extreme heat exposure – both indoors and outdoors – the WH enhanced and expanded efforts the U.S. Department of Labor is taking to address heat-related illnesses.

As part of the Biden-Harris administration's interagency effort and commitment to workplace safety, climate resilience, and the department's Occupational Safety and Health Administration is initiating enhanced measures to protect workers better in order to reduce the dangers of exposure to ambient heat.

[US Department of Labor announces enhanced, expanded measures to protect workers from hazards of extreme heat, indoors and out | Occupational Safety and Health Administration \(osha.gov\)](https://www.osha.gov/press-releases/2021/09/20/2021-09-20-heat)