Northern Illinois University

Heat Related Illness Issues for the OHS Professional

NEIL ASSP Meeting

April 14, 2023

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Disclaimer

- The mention of any specific technology or company name is for illustrative purposes and does not constitute endorsement by NIU or the researchers
- All opinions in this presentation are the authors. This is a rapidly evolving area, so they are subject to modification with more data (and data analysis)

Extreme Heat

It's happening now!

Global urban population exposure to extreme heat

Cascade Tuholske[a,b,c,1], Kelly Caylor[a,d], Chris Funk[a,b], Andrew Verdin[e], Stuart Sweeney[e], Kathryn Grace[a,f],

pare exposure trends across geographies. Our results suggest that previous research underestimates extreme heat exposure, highlighting the urgency for targeted adaptations and early warning systems to reduce harm from urban extreme heat exposure.

climate change | hazards | public health | sustainability | urbanization

Sports related

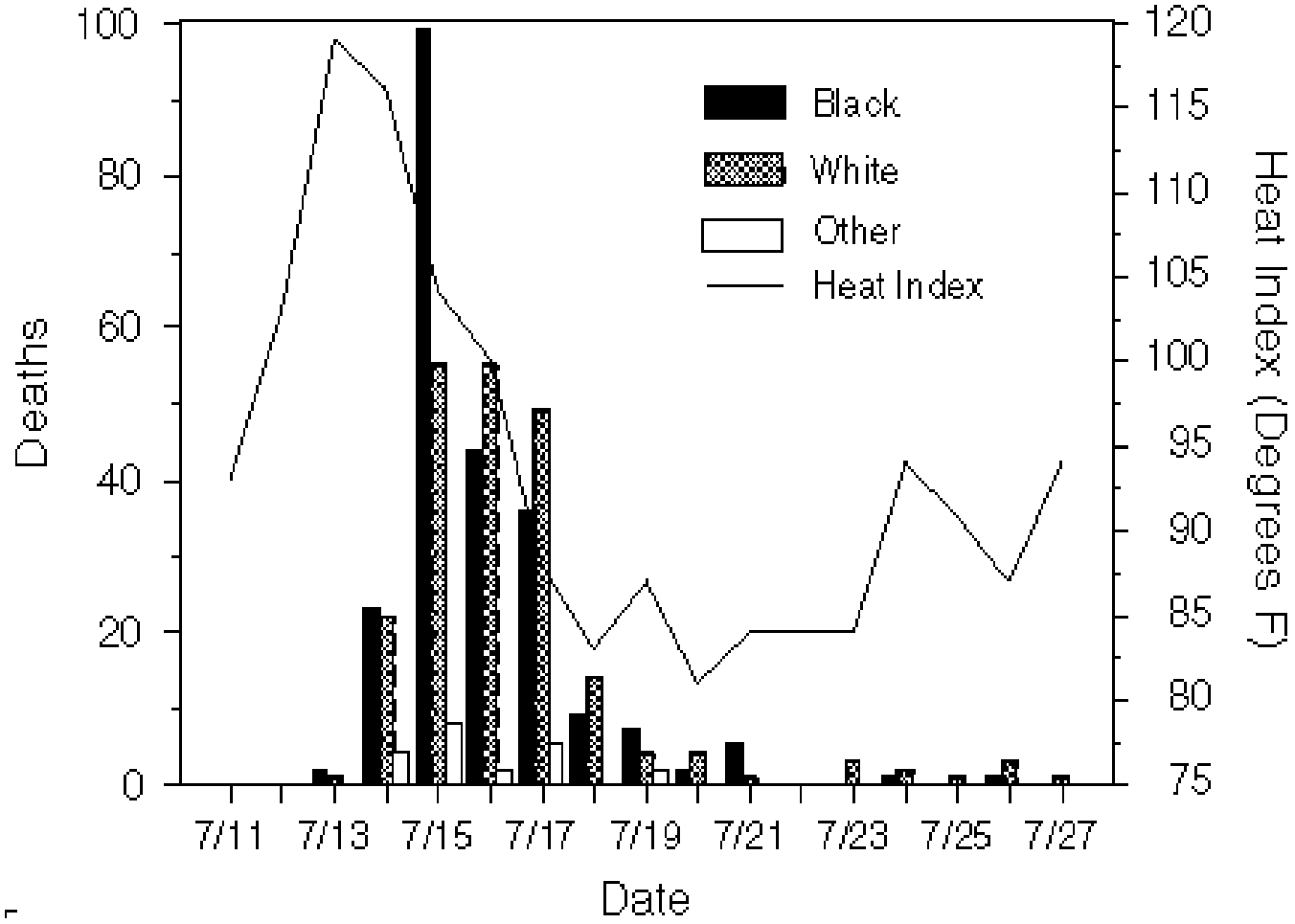
Science

‘This Was Preventable’: Football Heat Deaths and the Rising Temperature

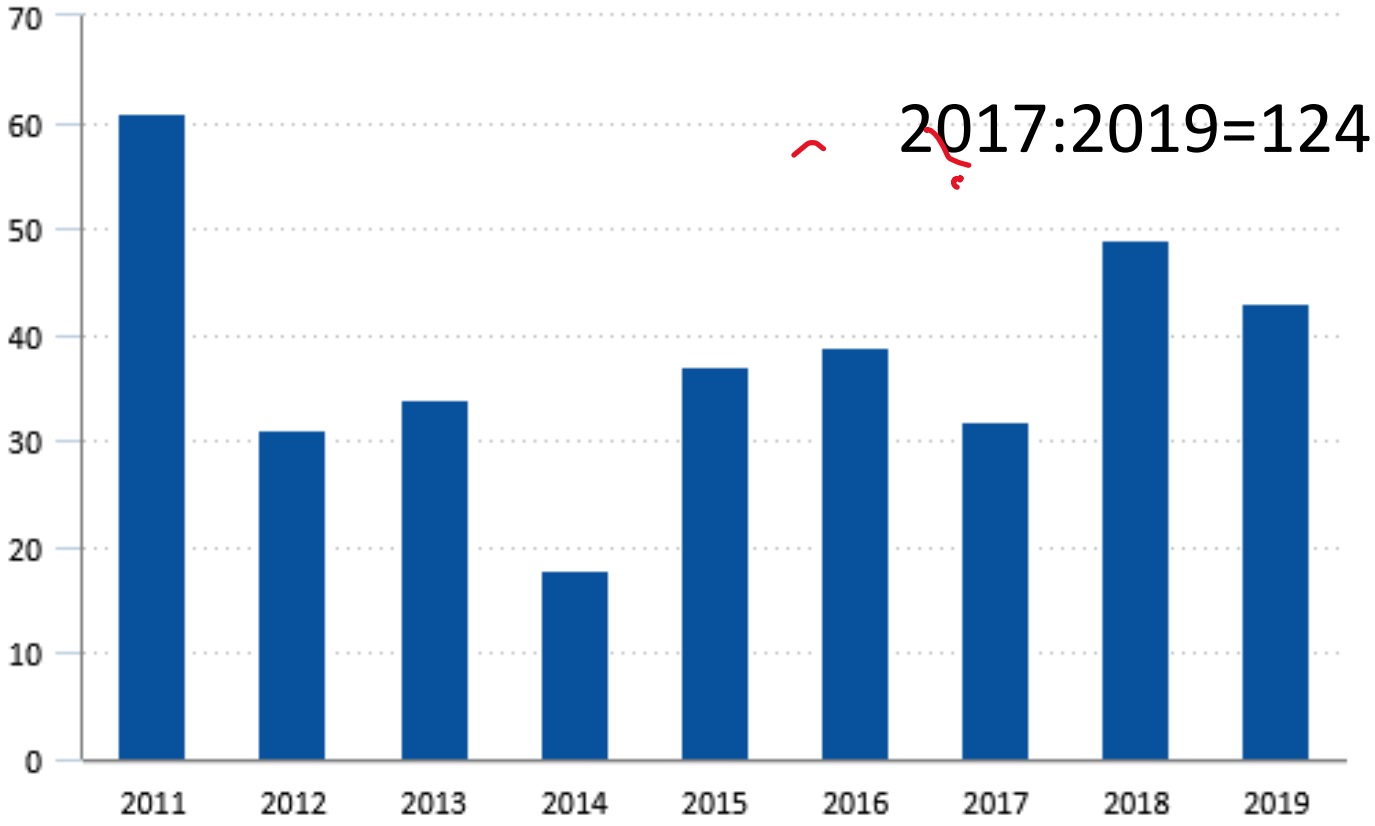
Most states rank poorly on heat safety for their high school football players. Too many teens have paid the price, and temperatures are only getting worse.

By James Bruggers
July 20, 2018

Chicago 1995-Deaths vs. Heat Index (HI)



US work-related deaths due to environmental heat exposure 2011-2019



2017:2019=124

Hover over chart to view data.
Source: U.S. Bureau of Labor Statistics.

Morissey et al 2023
2017-2019=78

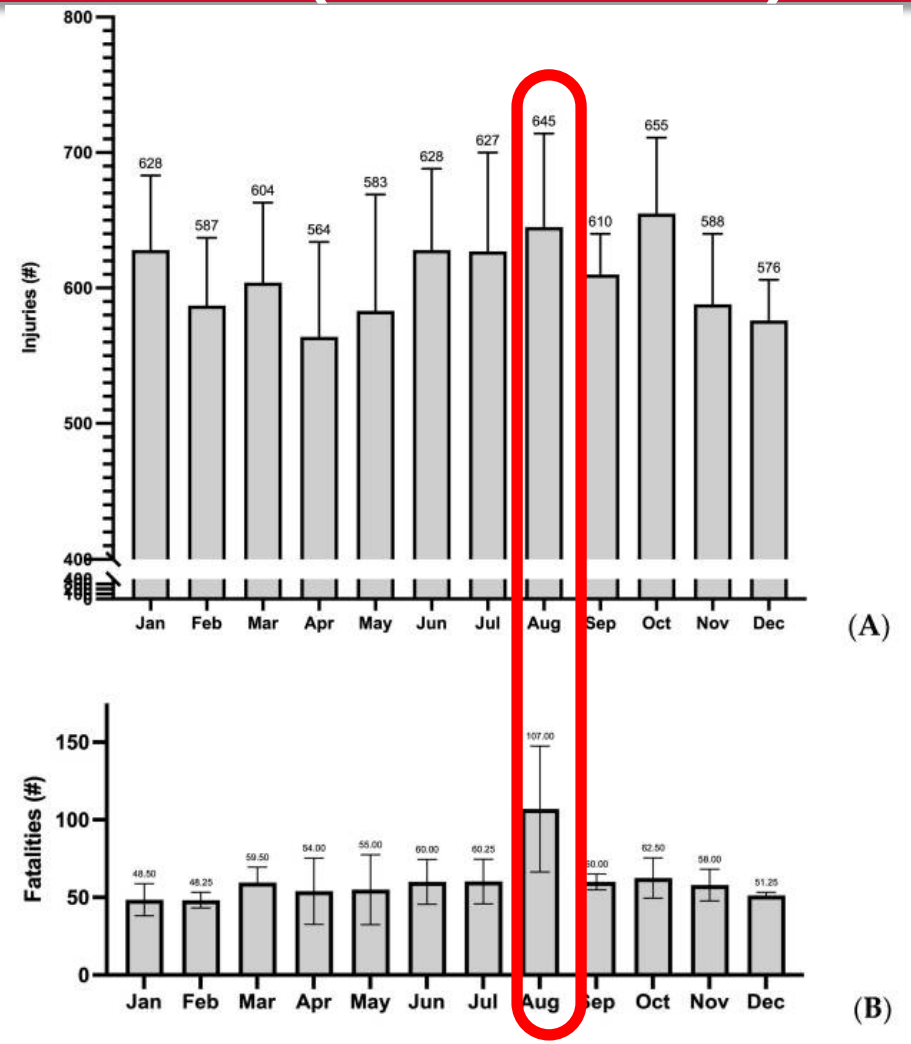
Morrissey, M. C., Z. Y. Kerr, et al. (2023). "Analysis of Exertion-Related Injuries and Fatalities in Laborers in the United States." Int J Environ Res Public Health, 20 (3).

907 U.S. workers from 1992-2019

2021 OSHA Proposed Rulemaking

https://www.bls.gov/opub/ted/2021/43-work-related-deaths-due-to-environmental-heat-exposure-in-2019.htm

Heat related injuries and Fatalities in US Labor Force (2015-2020)



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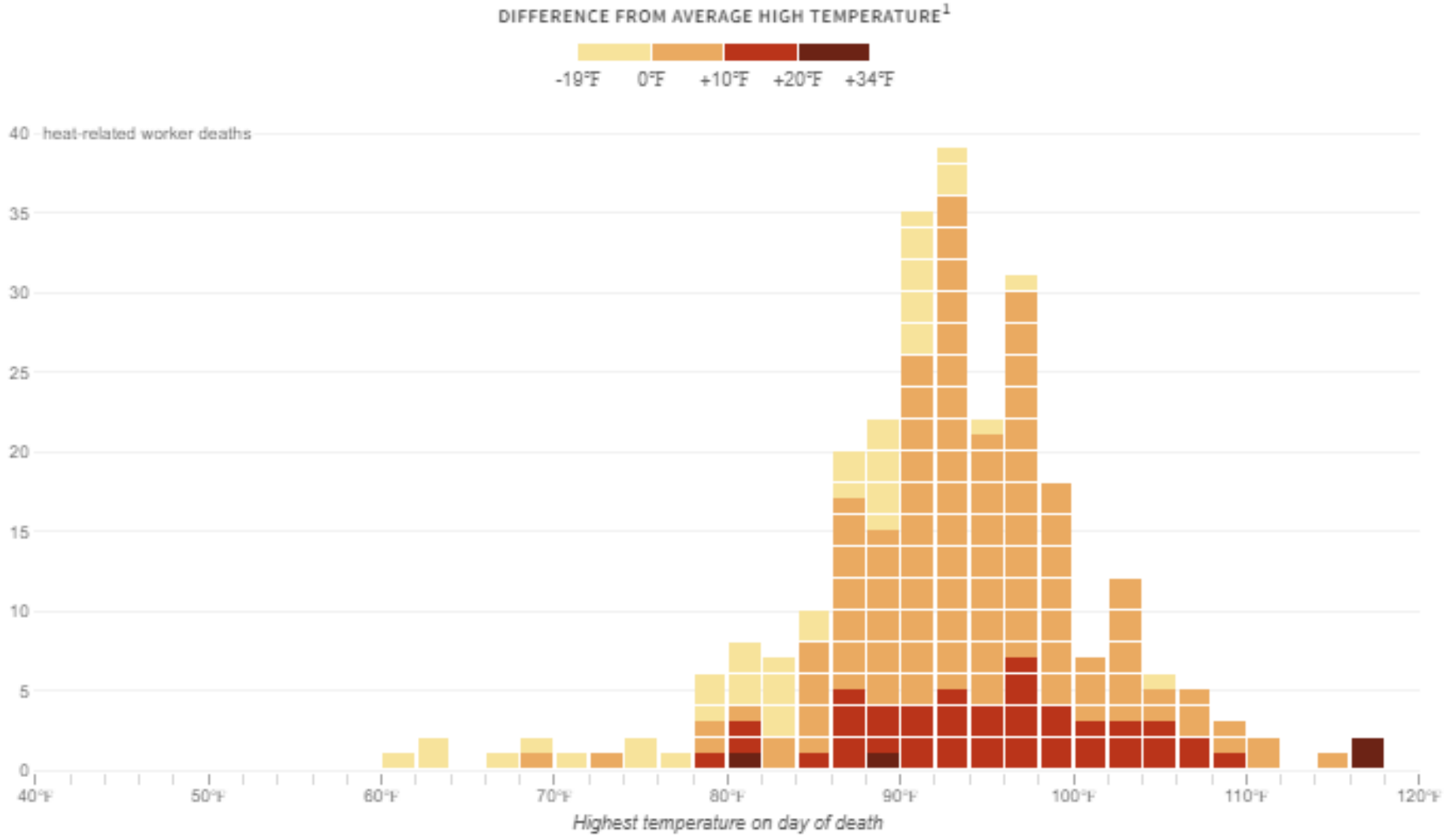
Most Heat-Related Worker Deaths Happened On 90°-Plus, Hotter-Than-Average Day



Types of Heat Related Illness terms

- Heat Stroke
- Heat Exhaustion
- Rhabdomyolosis
- Heat Syncope
- Heat Cramps
- Heat Rash

Most Serious **(Medical Emergency)**

Reasons for concern

- injury and fatality rates remain small (0.20 and 0.0160 per 100,000 full-time equivalent worker years), BUT

1. OSHRC cases
2. Chronic Kidney Disease(CKD) in Agricultural workers (AgW)
3. OSHA proposed rulemaking and NEP
4. Disproportionate geographical distribution (SE)
5. Continued climate change

AIHA, ACGIH, ASSP, NSC (& others) initiatives to address Heat Stress

Implementation of a Heat Stress & Strain Program

Proven Methods for a recognized occupational hazard

These are my personal thoughts on this topic informed by my experience in agriculture, construction, industry, governmental and consulting workplaces and organizations. 1972-2023

-Mike Schmoldt, PE, CIH, CHMM

Using physiological monitoring to manage heat stress

Workers are covered head to toe in protective clothing and gear at the Hanford nuclear reservation tank farms, even when the heat soars to 107 degrees. - Courtesy Washington River Protection Solutions

HANFORD

107 degrees. Heat-trapping gear. So why no heat illnesses at Hanford tank farms?

BY ANNETTE CARY

OSHA VPP Star Award Winner 2014

WRPS wins innovation award for heat stress mitigation

WRPS continues to receive national recognition for developing innovative tools and programs that advance worker safety.

On Feb. 21, the Campbell Institute at the National Safety Council presented WRPS with the 2017 Campbell Innovation Challenge for establishing a physiological monitoring program that has eliminated heat stress cases the past two years at the tank farms.

The Innovation Challenge award recognizes organizations for their achievement in the planning or implementation of an innovative program addressing critical environmental, health and safety topics in a way that demonstrates creative thinking, strategic implementation and significant impact.

"The Campbell Innovation Challenge award demonstrates not only the creativity and forward thinking of our employees, but also their steadfast commitment to protecting their co-workers, the public and the environment," said WRPS President and Project Manager Mark Lindholm, who accepted the award on behalf of WRPS and AECOM at the Campbell Symposium in New Orleans. "I'm very proud to be a part of team that constantly strives to make the tank farms a safer place to work."

This is the third time in the past two years that WRPS has received a national award for safety innovation. The company earned the Voluntary Protection Program's Innovation award in both 2015 and 2016.

In 2015, WRPS was honored for developing a tool to help reduce worker exposure during surveys of radioactive equipment used to retrieve tank waste. And last year, the company was lauded for helping develop a face shield that protects a worker wearing full-face respiratory equipment from an electrical arc flash.

What is physiological monitoring?

Physiological monitoring, or PM, measures the level of an individual's heat strain in response to heat-stress conditions. The WRPS program involves monitoring employees' heart rates using a novel chest-mounted heart rate monitor that allows for remote, real-time assessment of heat strain and core body temperature using a tympanic membrane thermometer for periodic assessment of heat strain.

"The great thing about our program is that it allows us to protect workers, by removing them from harmful heat-related tasks before they develop any heat-stress symptoms," said Edward Sinclair, an industrial hygienist who leads the WRPS Heat Stress Program.

WRPS President Mark Lindholm accepted the 2017 Campbell Innovation Challenge award Feb. 21 at the Campbell Symposium in New Orleans.

In the past, WRPS and other Hanford contractors conducted assessments for heat stress using wet bulb globe temperature measurement and relied on self-reporting of symptoms. When workers had symptoms, they exited the work location, removed multiple layers of personal protective equipment and had their heart pulse rate measured.

The WRPS PM program was spearheaded by former WRPS employee Mike Schmoldt and implemented in late summer 2014. Sinclair took over the program in December 2014 and spent several months developing more robust procedures in preparation for the 2015 heat stress season.

That first full PM campaign, which ran from May through September 2015, was conducted during one of the hottest

Continued on page 2...

What I'll cover

- Role of a H&S professional *(as I see it)*
- Heat Stress Management Plan (HSMP)
- Adopting heat stress exposure limits
  - ACGIH/NIOSH, ISO, or military
- Tiered/Accurate environmental exposure assessment
- Calculating TWA exposure for OELs
- Environmental and Physiological Monitoring
- Closing summary

The role of the H&S professional

- Anticipate and prevent thermal hazard excess exposure situation
- Recognize thermal stress conditions and exposure limits
- Deciding when to cease worker exposure and begin recovery
- Use *sufficiently* accurate measurements to inform decisions
- Support planning and execution of safe work practices
- Observe and monitor field conditions to verify control effectivenes
- Training/interpretation/communication

- Barriers
  - Legacy practices
  - Everyone is an ‘expert’ based on life experience, weather reports
  - Whatever you say will be ‘wrong’
  - Lacking recognized ‘requirements’
  - Worker’s job jeopardy concerns

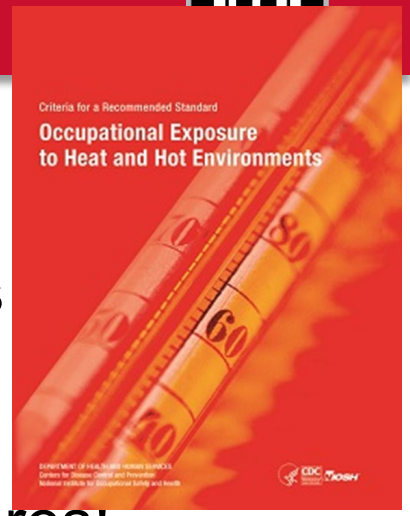
Key elements of a HEAT STRESS MANAGEMENT plan

The Heavy Lifting

- **Written policy/plan**
- General and Job Specific Controls
- Acclimatization
- **Environmental & Personal Monitoring**
- Training
- Hygiene/Hydration
- Emergency Respons
- Recordkeeping

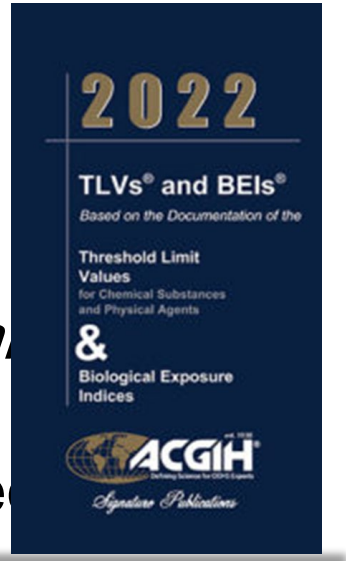
- Must have management, supervisor and worker buy-in and acceptance
- Must work through any medical/privacy, contract, HR, cyber/security and legal issues
- Provide the authority for the safety professional
- Is PM voluntary or mandatory?
- Describe how information will be used to make decisions
  - When to discontinue exposure
  - When is it safe to resume?
- Clarify recordkeeping

Occupational Exposure limits for Heat Stress



- No specific federal regulatory requirements
  - State specific regulations are evolving
- OSHA's General duty clause to protect workers from recognized hazards
- Organization legacy documents which may be inadequate
- Your written plan selected limits can be used in enforcement actions
- Don't wait for incidents or enforcement to tell you how to manage exposures!

- Your organization should determine which criteria to adopt
  - ACGIH *Heat Stress and Strain TLV*
  - NIOSH *Occupational Exposure to Heat and Hot Environments*
  - ISO 7243, 7933 *Ergonomics of Thermal Environment: Predicted Heat Strain*
  - Military: *Technical Bulletin Med 507/2003 (new version pending)*
  - Others (you should have a good justification and verify it is science based)



ACGIH Action Levels (AL) and Threshold Limit Values (TLV)

Strengths

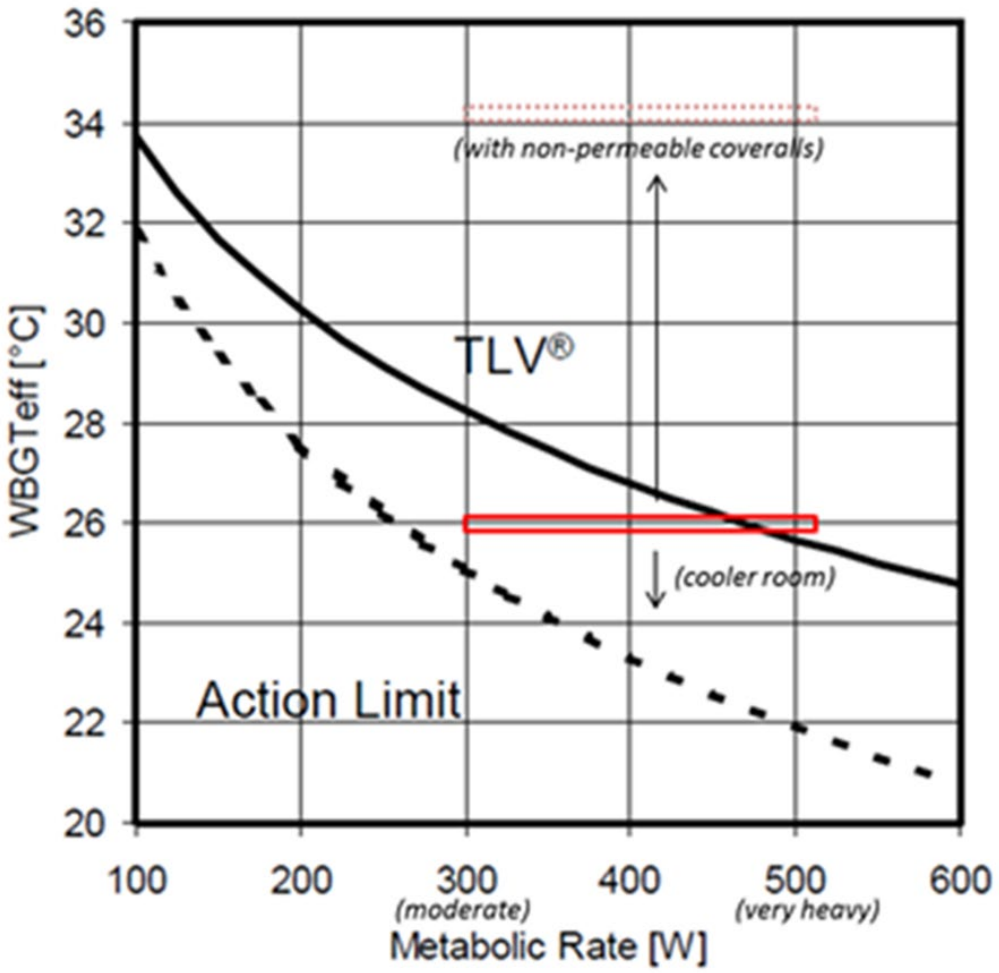
- Recommendations, not requirements, not consensus standards
- Widely used in U.S. and internationally
- Often cited by OSHA as a reasonable standard of care (see Technical Enforcement Manual)
- Decades of successful use in a variety of government, industrial and commercial uses

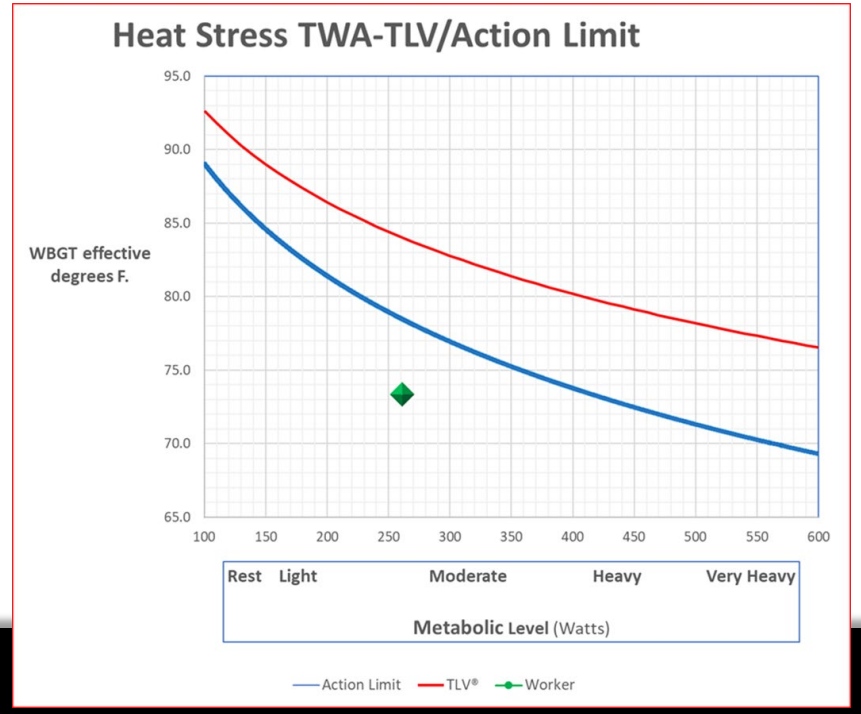
Qualifiers

- Limited adjustment for age, weight and other worker health variables.
- Updated emphasis on Warning, Written Policies and HSMP (2023 revision)
- Intended for use by qualified health and safety professionals
- Developed for 8 hour shift TWA 40 hour/week healthy workers
- Must be used in conjunction with the ACGIH documentation on thermal stress
  - A PM guidance document is under development by ACGIH

ALs and TLVs

- Need to use several inputs to calculate where a specific situation is with regard to the limit
- A graphical result is optional, but is an effective communications tool



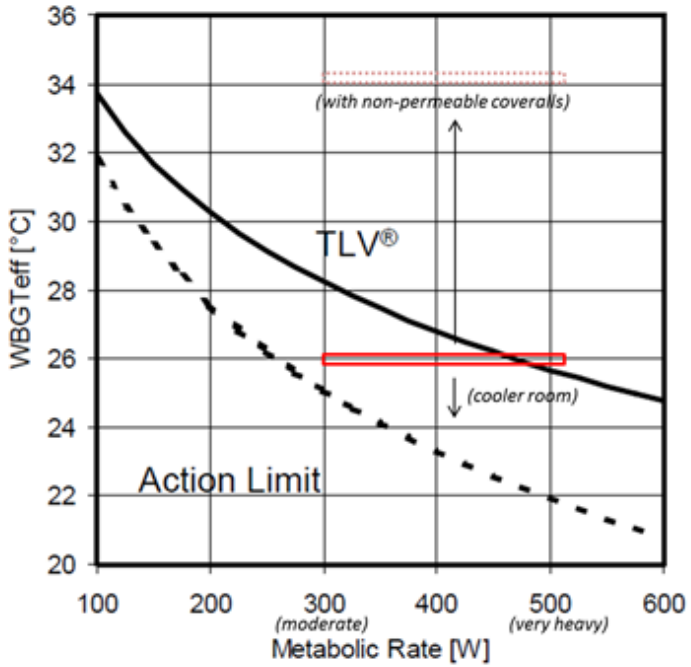


Levels of thermal stress and strain

Not expected → Screening levels → TLV/AL → Ex

Table F-1 Work/Rest Regimens

Work Demands	Unacclimated							
	Light	Moderate	Heavy	Very Heavy	Light	Moderate	Heavy	Very Heavy
100% Work	≤81.5	≤77.0	≤72.5	*	≤85.1	≤81.5	≤78.8	*
75% Work 25% Rest	81.6 – 84.2	77.1- 79.7	72.6- 76.1	*	85.2- 86.9	81.6- 83.3	78.9- 81.5	*
50% Work 50% Rest	84.3- 86.0	79.8- 82.4	76.2- 79.7	≤77.0	87.0- 88.6	83.4- 85.1	81.6- 83.3	≤81.5
25% Work 75% Rest	86.1- 87.8	82.5- 84.2	79.8- 82.4	77.1- 79.7	88.7- 90.5	85.2- 87.8	83.4- 86.0	81.6- 85.1



Three suggested 'bins' for heat stress

1) Use Screening Table

- Heat Stress Exposure based on $WBGT_{eff}$ & Work Effort

OR

2) Detailed Analysis:

- Based on objective data (historic or documented studies)
- Consideration of the level Metabolic Activity (Time-Weighted Effort)
- Data representing working conditions (Time-Weighted $WBGT_{eff}$)

OR

3). Physiological Monitoring (PM)

- Provides real time feedback and control
- Less reliant on estimates or conservative assumptions
- Limits for ceasing exposure until recovery is complete
- Basis for determining if existing controls are adequate or not

($WBGT_{effective}$) °F *See Note 1*	Work / Rest Cycle Per Hour (minutes) *See Notes 2 & 3*				Prevention and Control Strategy *See Note 4*
> 86.0	Contact Heat Stress SME	Contact Heat Stress SME	Contact Heat Stress SME	Contact Heat Stress SME	Contact Heat Stress SME prior to start of work for consultation regarding control methods and physiological monitoring requirements and/or heat stress control plan if work/rest cycle must be exceeded
86.0	15/45				
85.1	30/30				
84.2	30/30	15/45			
83.3	45/15	15/45			
82.4	60/0	15/45	15/45		
80.6	60/0	30/30	15/45	15/45	Implement mandatory work/rest cycle **AND** some combination of the general heat stress controls in Exhibit G (such as cool / shaded recovery location, hydration stations, etc.) **OR** Work with Heat Stress SME for physiological monitoring and / or a heat stress control plan if work/rest cycle must be exceeded
78.8	60/0	45/15	15/45	15/45	
77.9	60/0	45/15	30/30	15/45	
77.0	60/0	60/0	30/30	15/45	
76.1	60/0	60/0	30/30	30/30	
≤ 75.2	60/0	60/0	45/15	30/30	
	Light	Moderate	Heavy	Very Heavy	
	Work Category				

Heat Stress Exposure Time Weighted Average (TWA) Calculation

Version 3.2 August 25. 2022

Controlled Unclassified Information (CUI) when form is filled out with personally identifiable employee information.

Job Description:

Prepared by:		Date:	
Location			

Notes:

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er input fields are highlighted in yello

- Define Work
- Analyze the Hazards
- Develop and Implement Hazard Controls
- Perform Work Within the Controls
- Provide Feedback and Continuous Improvement

Inputs		Comments
Worker identification		
worker weight (lb.)	210	*Value in lbs. reported by worker*
ratio	1.36	*worker weight in lb. / 154 lb. standard worker*
worker age (years)	50	*Value in years reported by worker*
target heart rate	130	*180-age = maximum value in beats per minute*
Is the worker acclimatized?	no	*Acclimatization requires at least 2 hours/day for 5 of last 7 days or 10 of last 14 days.*

TWA factors	Time (min)	WBGT °F	Clothing Adjustment Factor °F	WBGT effective °F	Metabolic Level (Watts)	Weight adjusted metabolic level	Comments
Pre-job	5	72.0	0.0	72.0	115	157	
Task 1	20	72.0	26.2	98.2	360	491	
Task 2	0	75.0	0.0	75.0	0	0	
Recovery	35	72.0	0.0	72.0	115	157	
total time (min)	**60**						

segments for continuous work patterns or **up to 2 hours** for irregular patterns including rest periods. ACGIH documentation p. 22 2009. See comments workbook page line #5.

Calculated Values		
	268.2	TWA in Watts for total time worked

value used in x coordinate of graph

Input and Calc | Reference Tables | Graphics Input | Comments | Change Log

Environmental Monitoring for Heat Stress

- Moderate conditions don't require high accuracy
- Select a method accurate enough to support the decision being made.
- As conditions approach significant heat stress, accuracy becomes paramount
- WBGT is the gold standard in occ. health
  - Using it consistently avoids confusion

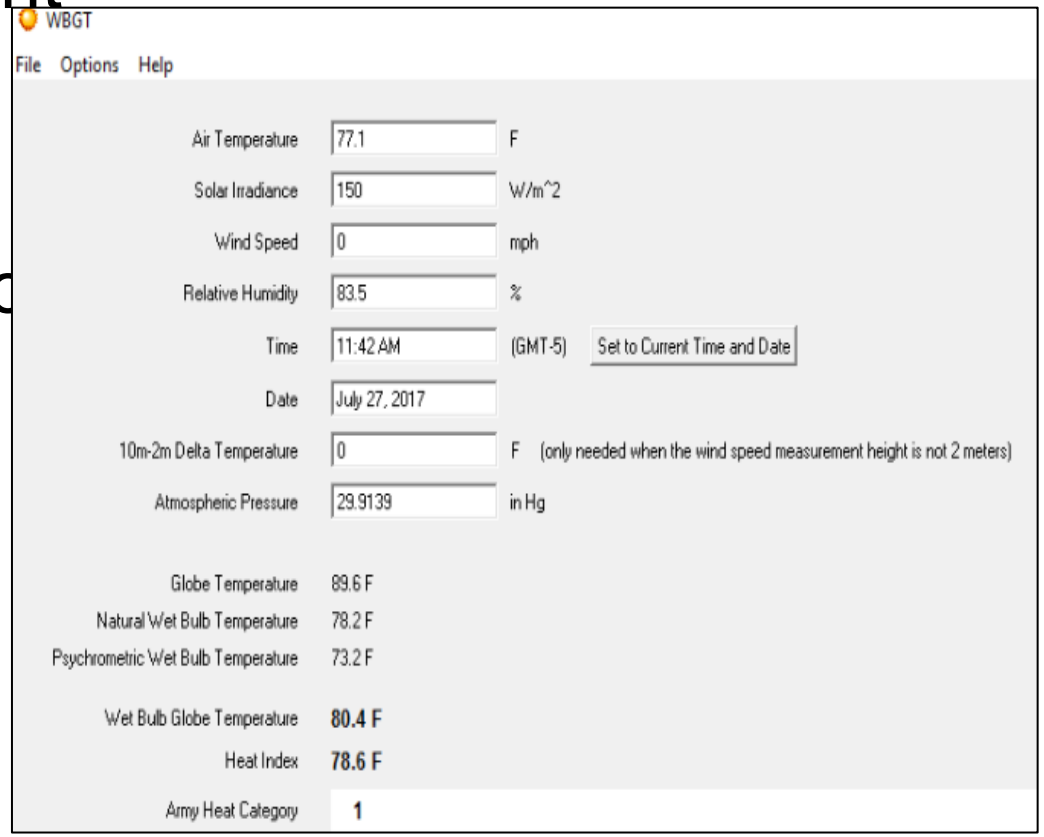
Predicting WBGT conditions

- Use of James Liljegren's model
- Equivalent methods are available, but you need to understand any assumptions and limitations used to simplify calculations
- NWS has limited regional WBGT trial site

- NWS meteorological forecasts ~3 days out
- Regional historical data
- Site specific data if available.
- Prior monitoring results from similar conditions.

Calculating WBGT from meteorological data

- Essential for planning future work
- Conditions should be chosen to represent actual work situation
- NWS meteorological inputs
- Solar radiance input from actual data c tables
- Program developed by Argonne meteorologist James Liljegren
- Available for Windows & web online
- Peerreviewed publications



Physiological Monitoring

DOE Hanford Site – Richland, Washington

WRPS (AECOM) uses physiological monitoring to manage heat stress

Workers are covered head to toe in protective clothing and gear at the Hanford nuclear reservation tank farms, even when the heat soars to 107 degrees. - Courtesy Washington River Protection Solutions

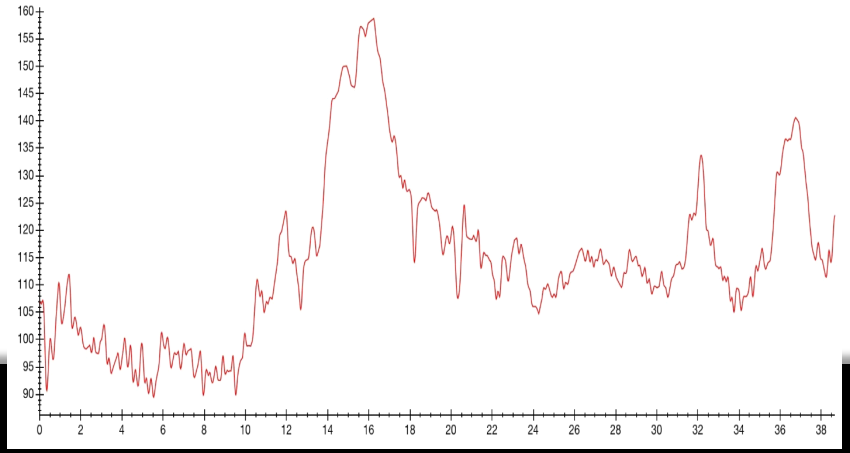
HANFORD

107 degrees. Heat-trapping gear. So why no heat illnesses at Hanford tank farms?

BY ANNETTE CARY

Worker heart rate by Polar Heart Monitor

47



- *NEVER ignore signs and symptoms of exces thermal strain by workers*
- Cohort sampling: all or selected workers?
- Understand artifacts and limitations of selected method/hardware
  - Heart Rate, Worker Core Temperature
- Point, continuous logging or direct safety staff oversight?
- These records are **valuable** resources for assessing effectiveness, planning future similar work and targeting when PM is still needed. *The key to mastering your specific workplace controls effectiveness*

Planned ACGIH guidance document on Physiological Monitoring

- Similar to previous documents on Laser, Noise and other Physical Agents.
- Tiered approach depending on field expertise
- Take advantage of advances in continuous monitoring technology
- Interpretation of results (non-medical)
- When to ‘pause’ or ‘stop work’ based on HSMP policies adopted
- Use of baseline values for comparison rather than absolute values
- Recordkeeping and communication of results (privacy concerns)
- Basis for future detailed analysis of similar task conditions

Summary

- Thermal exposure is like any other physical or chemical exposure hazard, there are generally safe expo limits for healthy workers
- The HSMP is the foundation of your program and authority to protect workers from thermal stress
- Predicting and planning for excessive thermal conditions is as important as monitoring working situation
- The tiered approach of using screening is a proven effective tool for worker protection
- Professionals use professional methods and instruments

YOU are the first line in
protecting workers from
this recognized serious hazard

Excel TWA spreadsheet available from

mikeschmoldt@hotmail.com or gmoss@anl.gov

Seyfarth

Heat Illness in the Workplace

Click to add subtitle

Mark A. Lies, II
Adam R. Young

May 13, 2022

Seyfarth Shaw LLP

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Heat Illness Legal Liabilities

- Employer Obligations
  - General Duty Clause – Section 5(a)(1)
  - Whistleblower Protection – Section 11(c)
- 2017 Federal OSHA Statistics
  - 11 Citations
  - 55 Hazard Alert Letters
- Representative Cases
  - *Secretary of Labor v. Aldridge Electric, Inc.*, OSHRC Docket No. 15-2319 (OSHRC ALJ 2016)
  - *Secretary of Labor v. A.H. Sturgill Roofing, Inc.* (OSHRC 2019)
  - *Secretary of Labor v. USPS*, Nos. 16-1713, 16-1813, 16-1872, 17-0023, 17-0279 (OSHRC ALJ July 15, 2020)

Heat Illness Legal Liabilities

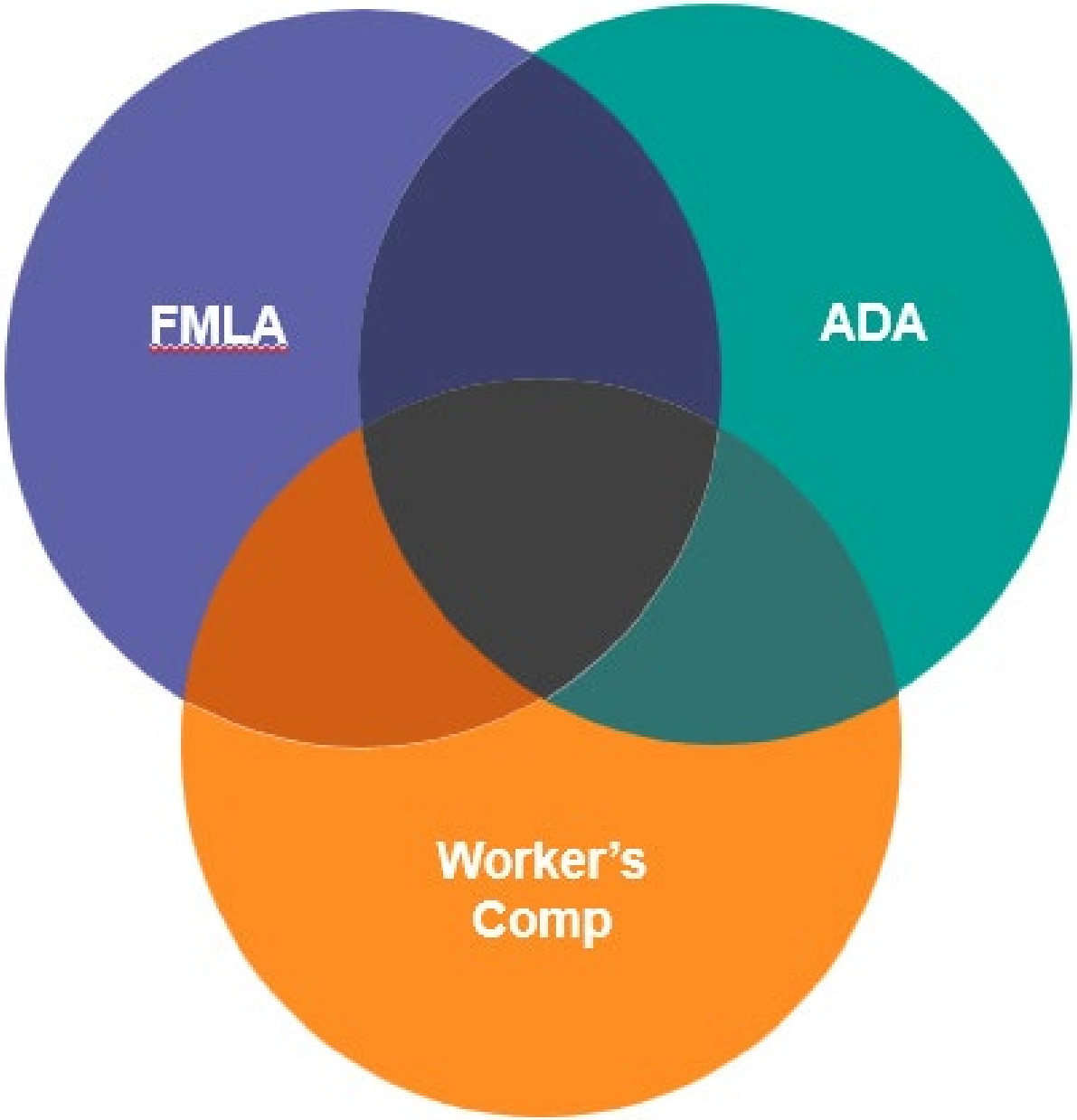
Employee Rights

- American with Disabilities Act (ADA)
- Protected “Disabilities” that May Be Affected by Heat
  - Obesity
  - Diabetes
  - Cardiovascular Disease
- Duty to Hire and Accommodate Qualified Employees with Disabilities

Family and Medical Leave Act (FMLA)

- Employee Entitlement for Unpaid Leave for Hea Related Illness

The ADA, FMLA, and Worker's Comp Overlap



Heat Illness Legal Liabilities

Workers' Compensation

- An employee who incurs an illness that arises out of and in the course of the employment relationship is protected
- An employee who has a prexisting condition that is aggravated or accelerated by the workplace is also protected
- An employer cannot retaliate against an employee because he or she files a WC claim

Heat Illness OSHA Standards

- State plan heat illness standards:
  - CA (outdoor heat standard; proposed indoor heat standard)
  - CO (agriculture, effective 5/22)
  - MD (law required MD-OSHA to adopt by 10/22)
  - NV (proposed rule)
  - OR (proposed rule, anticipated 4/22)
  - WA (outdoor heat standard, 5/1-9/30, 89 degrees+)

State-Specific Heat Illness Standards – *California*

- Started as an emergency standard; made permanent in 2006 under 8 CCR 3395
- Applies to all <u>outdoor</u> places of employment
  - one that is not an indoor workplace
- Cal/OSHA can (and does) cite employers for <u>indoor</u> heat hazards under its IIPP standard
  - rulemaking for an indoor heat standard underway

State-Specific Heat Illness Standards – *California*

- **Primary requirements:**
  - ✓ Develop and implement a written heat illness prevention program.
  - ✓ Train all employees and supervisors about heat illness prevention
  - ✓ Emergency response procedures
  - ✓ Acclimatization
  - ✓ Provide enough fresh water so that each employee can drink at least 1 quart per hour.
    - applies regardless of temperature
  - ✓ Provide access to shade.
    - applies when temperature exceeds 80ºF
    - if less than 80ºF, still have to make shade available upon request.
    - need to encourage workers to take preventive cool down rest if they feel th need
    - risks for employees driving vehicles without AC.

State-Specific Heat Illness Standards – *California*

- **Enhanced requirements when temperatures equals or exceeds 95ºF (aka high heat procedures)**
  - only for certain industries
    - agriculture
    - construction
    - landscaping
    - oil and gas extraction
  - transportation of heavy materials unless worke are vehicles with AC and work does not requir loading/unloading

-

State-Specific Heat Illness Standards-Oregon

Emergency Temporary Rule Issued July 8, 2021

- In effect for 6 months (January 3, 2022)
- In response to June 2021 Pacific Northwest heat wave
- Heat index thresholds:
  - > 80ºF
    - Access to shade (not A/C) and cool drinking water
    - Training
  - > 90ºF
    - Communication and observation
    - Emergency Medical Plan
    - Acclimatization

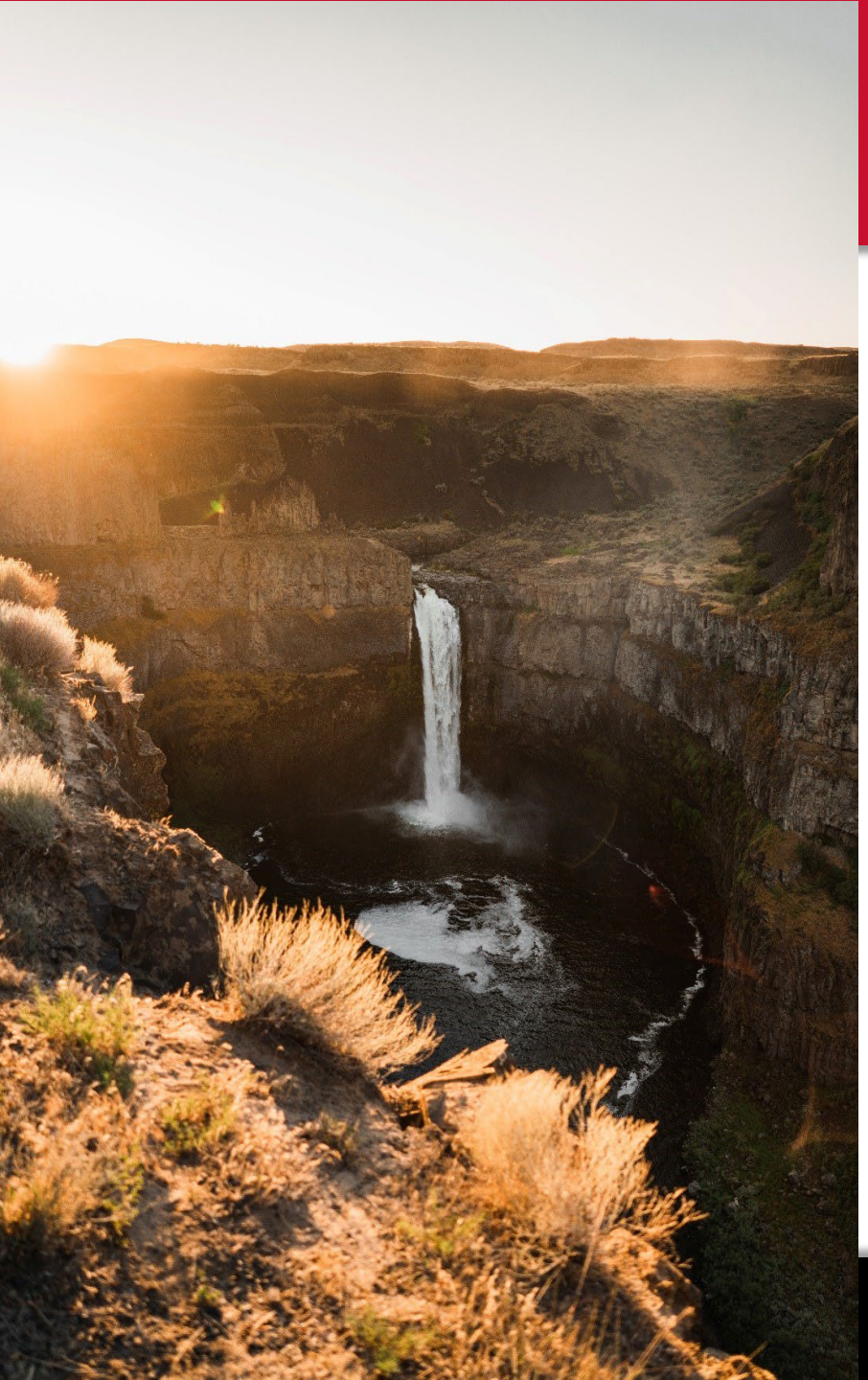
State-Specific Heat Illness Standards - Oregon

- Permanent Rule Issued May 9, 2022
  - Effective **June 15, 2022**
    - Heat Illness Prevention Plan – temperature monitoring
    - Acclimatization Plan
    - Supervisor and Employee Training
  - Heat index thresholds:
    - > 80ºF (+)
      - Access to shade (not A/C)
      - Cool drinking water (32oz/hr)
    - > 90ºF (+)
      - Communication and observation (actively monitor temperature)
      - Work/Rest Schedule
  - Exempt:
    - Exposed < 15 min/hr
    - Heat generated from work process
      - still have basic requirements
    - Emergency operations
    - Operations with artificial cooling to reduce temperature below 80ºF

State-Specific Heat Illness Standards- Oregon - Sample Work/Rest Schedule

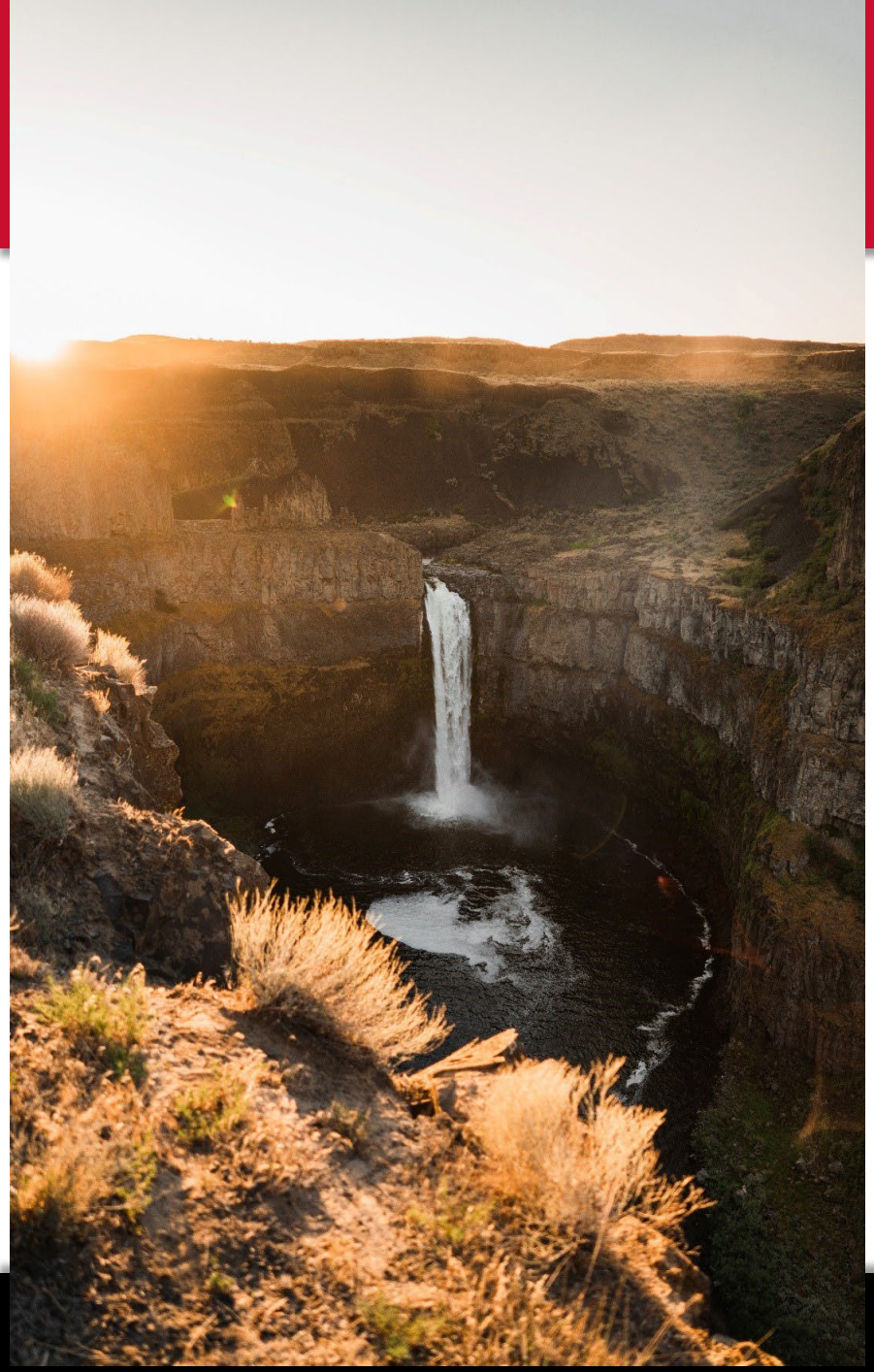
Adjusted temperature (°F)†	Light work (minutes work/rest)	Moderate work (minutes work/rest)	Heavy work (minutes work/rest)
90	Normal	Normal	Normal
91	Normal	Normal	Normal
92	Normal	Normal	Normal
93	Normal	Normal	Normal
94	Normal	Normal	Normal
95	Normal	Normal	45/15
96	Normal	Normal	45/15
97	Normal	Normal	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‡

*With the assumption that workers are physically fit, well-rested, fully hydrated, under age 40, and have adequate water intake and that there is 30% RH [relative humidity] and natural ventilation with perceptible air movement.



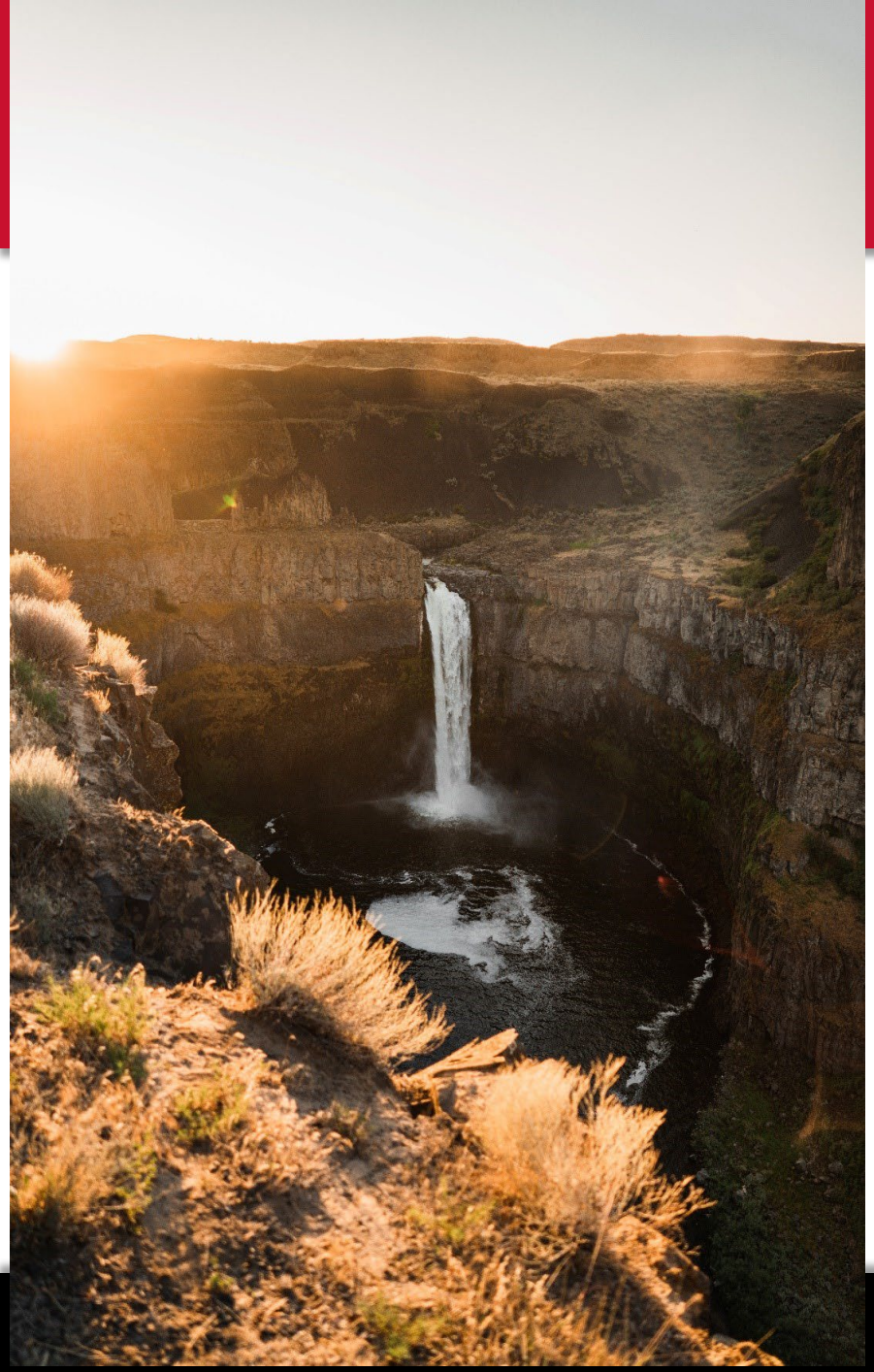
State-Specific Heat Illness Standards – Washington

- Permanent Rule Issued July 5, 2008
  - Outdoor Heat Exposure Only
    - May 1 – September 30
      thresholds:
    - > 52ºF – chemical resistant suits
    - > 77ºF – double-woven clothing
    - > 89ºF – all other clothing
  - Requirements:
    - Training regarding heat illness
    - Include heat exposure in Accident Prevention Program
    - Encourage employees to consume H_2O or other hydration
    - Employees responsible for self-monitoring
      - Employees showing signs & symptoms must be relieved and monitored
  - Exempt:
    - Exposed < 15 min/hr



State-Specific Heat Illness Standards
Washington

- Temporary Rule Effective July 13, 2021
  - Expired November 6, 2021
  - In response to June 2021 Pacific Northwest heat wave
  - Added prescriptive measures for “high heat” (>100ºF)
    - Water required to be “cool”
    - Have and maintain one or more areas with shade at all times while employees are present.
      - May use artificial body cooling methods in lieu of shade
    - Ensure employees take preventative cool-down rest periods
      - 10 min / 2 hr.



State-Specific Heat Illness Standards
Washington

- Permanent Rulemaking Initiated August 17, 2021
  - Stakeholder meetings ongoing
  - No draft language yet

- **L&I Will Adopt 2022 Temporary Rule (exp. 6/1/22)**
  - Acclimatization
    - Lost when > 7 days away
  - Access to shade
    - Other measures appropriate
  - Additional > 89ºF Requirements
    - Mandatory rest breaks – 10 min / 2hr
    - Effective communication
    - Effective observation
  - Training
    - Acclimatization
    - Rest periods
    - Preventative measures

OSHA Heat Illness Prevention Program

1) Heat acclimatization program for new employees returning to work from absences of three or more days
2) Formalized work/rest regimen based on environmental working conditions and metabolic heat
3) Guidelines for removal of employees through worksite monitoring when employees are exhibiting signs and symptoms of heat-related illness
4) Provide cool, climate-controlled areas where employees can recover when signs of heat-related illnesses are recognized

OSHA Heat Illness Prevention Program

5) Ensure employees and supervisors understand the signs, symptoms and prevention of heat-related illnesses and disorders
6) Provide employees with information on certain medical conditions and medications that may increase the risk of developing heat-related illness.

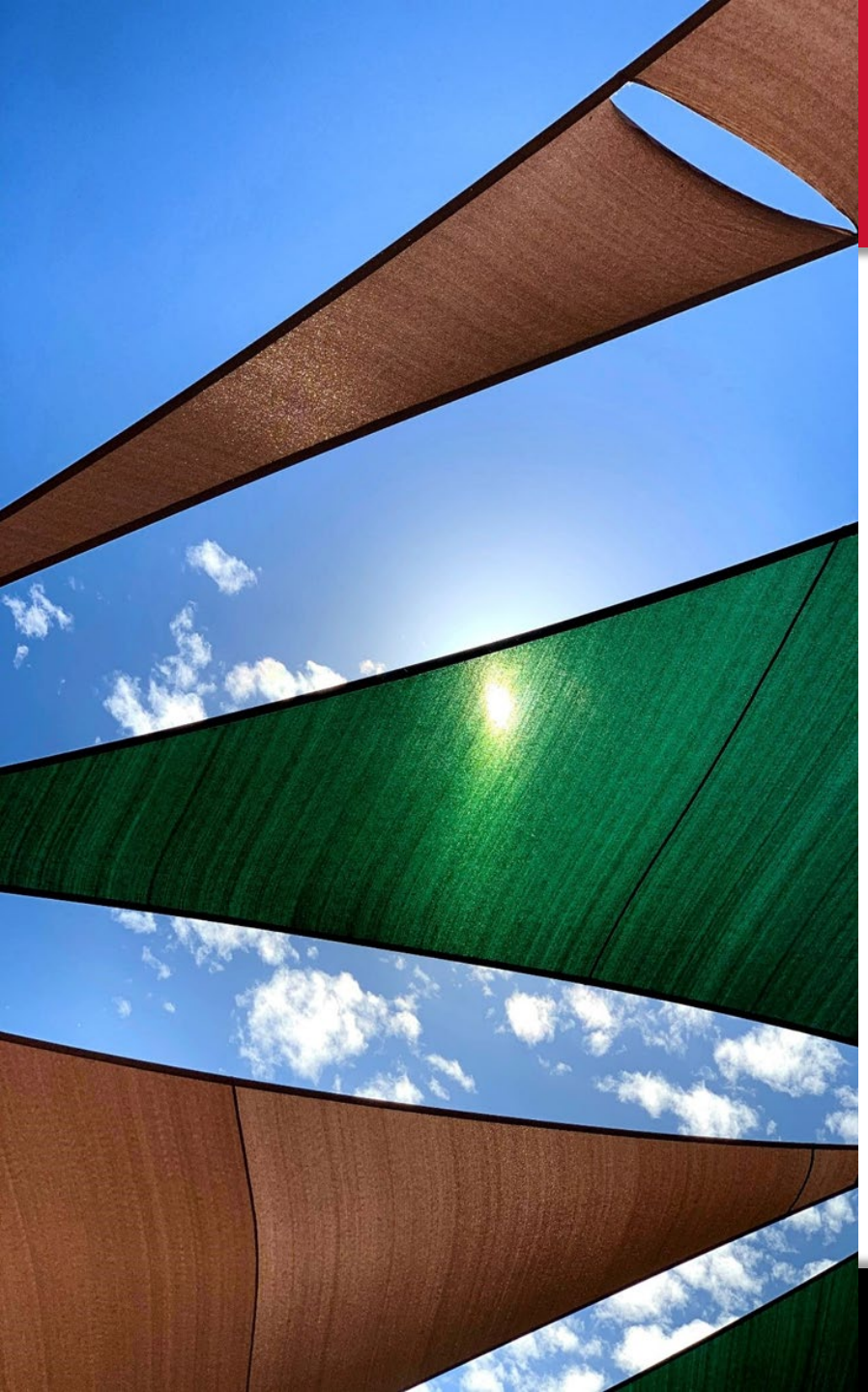
- Advise employees to consult with their doctors or pharmacist

7) Track weather conditions at the job site

- dry bulb temperature, wet bulb temperature, globe thermometer temperature, relative humidity, and wind speed

OSHA Heat Illness Prevention Program

- **Evaluating Employee Work Tasks To Determine Metabolic Heat**
  - Feasibility of Assessing Specific Work Tasks (tools, weights, repetitions, etc.) to Determine Potential Employee Heat Generation
  - Individual Employee Pre-Existing Physical Health Conditions
  - Employer Restrictions On Inquiries Into Employee-Pre-Existing Health Condition (GINA, ADA, Employee Privacy)
  - Employer Restrictions On Company Conducting Medical Examinations (ADA, Employee Privacy)



OSHA Heat Illness Prevention Program

Employer Challenges To Address

- Heat Acclimatization
  - Determining when Environmental Conditions Require Acclimatization
  - Identification of Particular Jobs for Acclimatization
  - Availability of Sufficient Employees To Perform Work
  - Impact of Time Off Work
  - Impact on Collective Bargaining Agreements
- Work/Rest Regimen
  - Determining when Environmental Conditions Require Regimen
  - Determining Time Frame for Work/Rest Period
  - Availability of Sufficient Employees To Perform Work

Heat Illness Prevention Program

Removal Of Employees

- Objective Criteria for Signs And Symptoms of Heat Related Illness For Removal
- Difficulty Determining Whether Individual Employee is Experiencing Heat Related Illness

Thank You!

Mark A. Lies II
Partner
Chicago

Adam R. Young
Partner
Chicago

2 (?) OSHRC cases

https://www.oshrc.gov/assets/1/18/13-2119.pdf?5041

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United States of America
OCCUPATIONAL SAFETY AND HEALTH REVIEW COMMISSION
1120 20th Street, N.W., Ninth Floor
Washington, DC 20036-3419

SECRETARY OF LABOR,

Complainant,

v.

ALDRIDGE ELECTRIC, INC.,

Respondent.

OSHRC Docket No. 13-2119

- Sec. Labor vs. Aldridge Electric, Inc. (2013)

Decided Dec. 2016

SOL vs USPS

San Antonio, Texas (Docket No. 16-1713)
Des Moines, Iowa (Docket No. 16-1813)
Benton, Arkansas (Docket No. 16-1872)
Houston, Texas (Docket No. 17-0023)
Martinsburg, West Virginia (Docket No. 17-0279).

United States of America
OCCUPATIONAL SAFETY AND HEALTH REVIEW COMMISSION
1120 20th Street, N.W., Ninth Floor
Washington, DC 20036-3457

SECRETARY OF LABOR,

Complainant,

v.

UNITED STATES POSTAL SERVICE,

Respondent.

OSHRC Docket Nos. 16-1713, 16-1872, 17-0023, 17-0279

Epidemic of Chronic Kidney Disease in Agricultural Workers

Exposure to pesticides, heat stress, or both ,or something else?

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Risk Factors for Heat Related Illness

- Environment
- Activities
- Acclimatization status
- Medications
- Dehydration
- Prior Heat Illness
- Health Conditions
- Other
  - Age >60
  - Clothing
  - Alcohol use

Thermal Balance-Heat Exchange Model

$$S = M \pm R \pm C \pm E$$

S=Heat Storage Rate

M=Metabolic Energy Rate

R=Radiant Heat Storage Rate

C=Convective Heat

E=Evaporative Heat

1. NOAA Heat Index (HI)

NWS Heat Index

Temperature (°F)

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	128	136					
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 | Extreme Danger

Literature references

https://scholar.google.com/scholar?q=Steadman+R+G+1979+The+assessment+of+sultriness.+Part+I%3A+a+te

Capture Reference | wmills11-niu email | Institution Page niu | My files -NIU OneDri... | Mail - William Mills - ... | Home - OneDrive NIU | Mail - Wil

The assessment of sultriness. Part I: A temperature-humidity index based on human physiology and clothing science [PDF] ametsoc.org

RG Steadman - Journal of Applied Meteorology and …, **1979** - journals.ametsoc.org

Using as bases the amount of clothing needed to achieve thermal comfort and the reduction in the skin's resistance needed to obtain thermal equilibrium, the relative sultriness of warm-humid and hot-arid summer climates is assessed. Conditions of equal sultriness are referred to a vapor pressure of 1.6 kPa in order to prepare a table of apparent temperature corresponding to summer temperatures and humidities.

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The assessment of sultriness. Part II: effects of wind, extra radiation and barometric pressure on apparent temperature [PDF] cdc.gov

RG Steadman - Journal of Applied Meteorology (1962-1982), **1979** - JSTOR

A scale is derived in which any likely combination of summer temperature, humidity, wind and extra radiation can be expressed as apparent temperature. The effect of extra radiation (direct and indirect insolation; terrestrial and sky radiation) is considerable. The effect of wind is relatively slight in summer. The total direct effect of altitude (barometric pressure) is negligible. These results are compared with the use of globe thermometers and linear formulas. Maps show wind and extra-radiation effects which combine with ambient …

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ENVIRONMENTAL RESEARCH
LETTERS

LETTER • OPEN ACCESS

Chronically underestimated: a reassessment of US heat waves using the extended heat index

David M Romps[4,1,2] and Yi-Chuan Lu[2,3]

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Environmental Research Letters, Volume 17, Number 9

Citation David M Romps and Yi-Chuan Lu 2022 *Environ. Res. Lett.* **17** 094017

DOI 10.1088/1748-9326/ac8945

Article PDF

Article ePub

Error in NWS HI

Temperature (°F)

Relative humidity (%)	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
40	1	−1	−1	−1	−1	−1	−1	−1	0	0	0	0	−1	−10	−13	−12
45	0	0	−1	0	−1	0	−1	0	0	0	0	−1	−15	−15	−14	
50	1	0	−1	0	−1	0	0	0	1	0	−5	−16	−15	−15		
55	0	0	−1	−1	0	0	0	0	1	−8	−17	−17	−16			
60	0	0	0	0	0	1	1	0	−8	−18	−18	−16				
65	0	0	0	1	1	1	1	−8	−19	−19	−17					
70	0	0	0	1	1	0	−6	−20	−20	−19						
75	0	1	1	1	2	−3	−22	−21	−19							
80	−1	1	1	2	1	−18	−22	−21								
85	−1	0	1	1	−13	−24	−22	−20								
90	−1	0	1	−9	−26	−24	−22									
95	−2	0	−4	−23	−26	−23										
100	−2	0	−16	−28	−27	−23										

Error in the NWS Heat Index Chart

“Extended Heat Index”

Temperature (°F)

Relative humidity (%)	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
40	79	82	84	86	89	92	95	98	101	105	109	114	120	134	143	148
45	80	82	85	87	90	93	97	100	104	109	114	120	139	145	151	
50	80	83	86	88	92	95	99	103	107	113	123	140	146	152		
55	81	84	87	90	93	97	101	106	111	125	141	147	153			
60	82	84	88	91	95	99	104	110	124	141	147	153				
65	82	85	89	92	97	102	107	122	140	147	153					
70	83	86	90	94	99	105	118	139	146	153						
75	84	87	91	96	101	112	138	145	151							
80	85	88	93	98	105	131	143	150								
85	86	90	95	101	123	141	148	155								
90	87	91	97	114	139	146	153									
95	88	93	104	131	143	150										
100	89	95	119	140	148	155										

Corrected NWS
Heat Index Chart