

Land Acknowledgement

- We acknowledge that what we now call Portland, Oregon and Multnomah County are the ancestral lands of the Multnomah, Wasco, Kathlamet, Clackamas, Cowlitz bands of Chinook, Tualatin Kalapuya, Molalla and many other Tribes who made their homes along the Columbia and Willamette Rivers.
- We are here because this land was occupied, and its traditional people were displaced by colonists and settlers. As settlers and/or guests, we recognize the strong and diverse Native communities in our region today, from Tribes both local and distant, and offer respect and gratitude for their stewardship of these lands throughout the generations.

Heat Illness in Oregon Workers

Public Health Division, Oregon Health Authority
Rulemaking Presentation

Oregon OSHA Rules Advisory Committee

March 25, 2021

Oregon
Health
Authority

(Enter) DEPARTMENT (ALL CAPS)

(Enter) Division or Office (Mixed Case)

Health defined

- Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.
- The enjoyment of the highest attainable standard of health is one of the fundamental rights of every human being without distinction of race, religion, political belief, economic or social condition.
 - World Health Organization definition of HEALTH

OHA's Health Equity Definition

- Oregon will have established a health system that creates health equity when all people can reach their full health potential and well-being and are not disadvantaged by their race, ethnicity, language, disability, gender, gender identity, sexual orientation, social class, intersections among these communities or identities, or other socially determined circumstances.
- Achieving health equity requires the ongoing collaboration of all regions and sectors of the state, including tribal governments to address:
 - The equitable distribution or redistribution of resources and power; and
 - Recognizing, reconciling and rectifying historical and contemporary injustices.

Outline

- Heat illness and progression
- Symptoms
- Acclimatization
- Temperature levels and heat hazard
- Limitations of tracking heat illness in Oregon
- Heat illness in Oregon: what we know
- Recommendations from the CDC National Institute of Occupational Safety and Health

Heat Stress

Heat Stress =
heat load from:

**Metabolic heat: heat produced by
the body from chemical processes,
exercise, hormone activity,
digestion**

+

Temperature and humidity

+

**Clothing requirements
(including PPE)**

NIOSH [2016]. NIOSH criteria for a recommended standard: occupational exposure to heat and hot environments. By Jacklitsch B, Williams WJ, Musolin K, Coca A, Kim J-H, Turner N. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication 2016-106.

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Heat Illness

- The body tries to maintain temperature within 1 degree
- If the body's temperature control system overloads...
- It can lead to a rapid rise in body temperature, reaching 106°F in 15 minutes (103+ is dangerous)
- Potential for damage to vital organs, brain or death
- Cognitive impairment: danger recognition, planning
- Classic heat stroke vs. exertional heat stroke

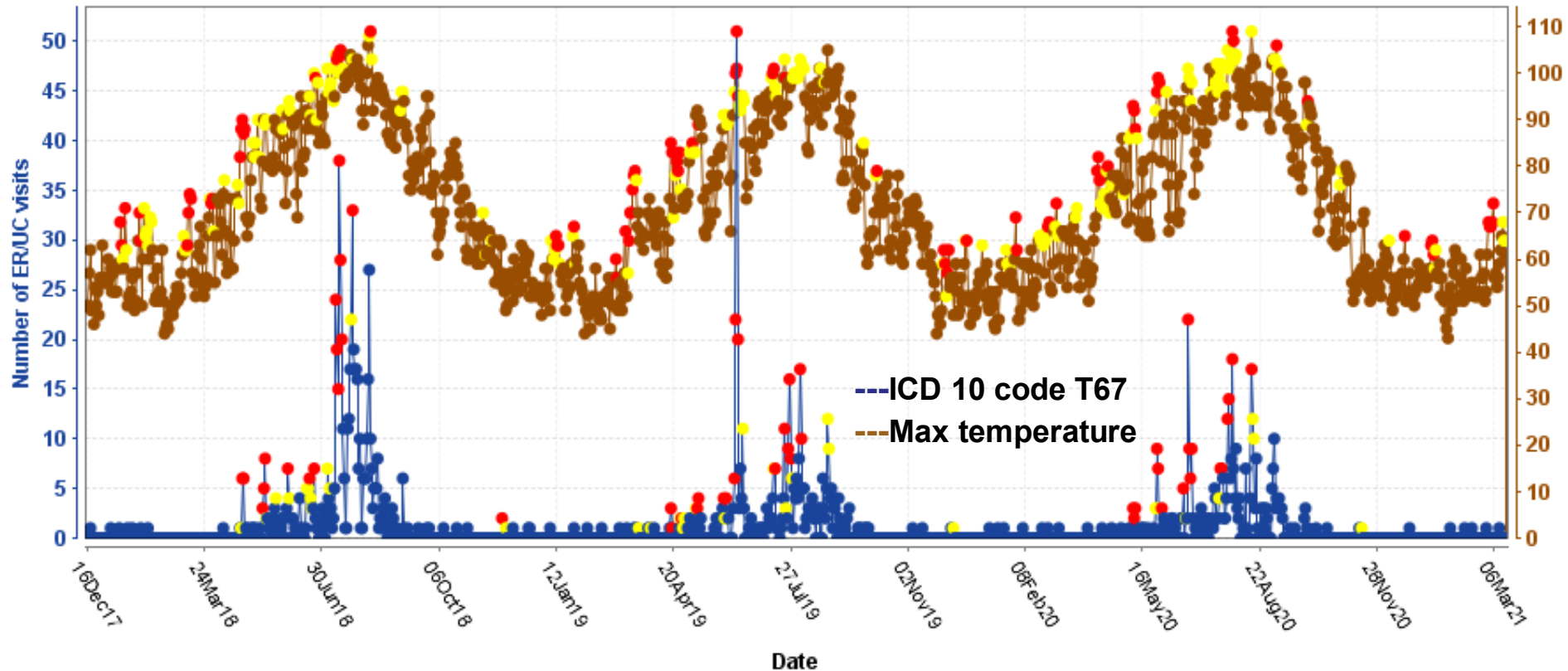
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“Classic” vs. Exertional heat stroke

Individual characteristics	Classic	Exertional (more often work-related)
Age	Children or elderly	15-45 years
Health	Chronic illness or debilitation	Usually healthy
Weather	Frequent in prolonged heat waves	Variable
Drug use	Diuretics, antidepressants, anticholinergics, phenothiazines	Usually none; sometimes ergogenic stimulants or cocaine
Activity	Sedentary	Strenuous exercise
Sweating	Usually absent	Often present
Acute renal failure	Fairly rare	Common
Rhabdomyolysis	Seldom severe	Common, may be severe
Hypoglycemia	Uncommon	Common

Diagnosed heat illness (OR-ESSENCE)

ICD10 code T67: effects of heat, with max temp



*This type of tracking misses many less severe cases, cases diagnosed differently and people who did not seek care

Work-related heat illness in Oregon

Occupational Health Indicators: Annual Number of Emergency Department Visits for Occupational Heat-Related Illness

- 2017: 11 cases
- 2016: 8 cases

Per 100,000 employed persons		
	OR	CA
2016	0.4	3.5
2017	0.5	4.78

- This type of tracking misses many cases that are less severe or are coded differently

Risk factors for workers

- Older age
- Obesity
- Fever
- Dehydration
- Heart disease
- Mental illness
- Poor circulation
- Sunburn
- Prescription drug use
- Alcohol use
- Pregnancy
- First day or week on the job

CDC: <https://www.cdc.gov/disasters/extremeheat/faq.html>

Image: Pocari Sweat VN - Own work, CC BY-SA 3.0, <https://commons.wikimedia.org/w/index.php?curid=30642367>

CDC NIOSH Acclimatization recommendations

Increase worker exposure to a hot working environment over time

	New workers (% of work day)	Workers with previous experience with the job (% of work day)
Day 1	20%	50%
Day 1	40%	60%
Day 3	60%	80%
Day 4	80%	100%
Day 5	100%	

CDC NIOSH: <https://www.cdc.gov/niosh/topics/heatstress/acclima.html>

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What physiological adaptations to heat stress do workers gain during acclimatization?

- Earlier onset and increased sweating
- Reduced electrolyte loss
- Stabilized circulation
- Improved ability to do work with a lower internal temperature and a lower heart rate
- Increase in skin blood flow

CDC NIOSH: <https://www.cdc.gov/niosh/topics/heatstress/acclima.html>

What is "Safe" for workers?

CDC NIOSH: Recommended heat stress alert limits (RALs) for unacclimatized workers

CDC NIOSH: Recommended heat stress exposure limits (RELs) for acclimatized workers

Safety models include: Temperature (Humidity, Wind, Radiant Heat), Work intensity

1. Wet Bulb Globe Temperature

$$WBGT_{outside} = 0.7T_{nwb} + 0.2T_g + 0.1T_{db}$$

T_{db} = the dry-bulb temperature

T_{nwb} = the natural wet-bulb temperature

T_g = the globe temperature



WBGT: Argonne National Laboratory (ANL) developed a utility using algorithmic equations to get WBGT from weather data. Also an app!

https://www.osha.gov/dts/osta/otm/otm_iii/otm_iii_4.html

2. Wet Bulb Globe Temperature, *Effective*

$$\text{WBGT}_{\text{effective}} = \text{WBGT}_{\text{outside}} + \text{CAF}$$

Clothing Worn	CAF
Work clothes (long sleeves and pants).	0
Double-layer woven clothing.	3
SMS Polypropylene Coveralls	0.5
Limited-use vapor-barrier coveralls. Examples: Encapsulating suits, whole-body chemical protective suites, firefighter turn-out gear.	11

Example: WBGT is 75°F, the worker is wearing double-layer woven clothing. Add a CAF of 3. WBGT effective equals 78°F

3. Metabolic work rates

$$MR_{\text{estimated}} = \frac{(\text{watts}) \times (\text{worker body weight})}{154 \text{ lbs}}$$

Work category	Metabolic rate (watts)	Examples
Rest	115	Sitting
Light	180	Sitting, standing, light arm/hand work and occasional walking
Moderate	300	Normal walking, moderate lifting
Heavy	415	Heavy material handling, walking at fast pace
Very Heavy	520	Pick and shovel work

Example: 180lb worker, moderate lifting:

$$MR_{\text{estimated}} = (300 \text{ watts} * 180\text{lbs}) / 154\text{lbs} = 351 \text{watts}$$

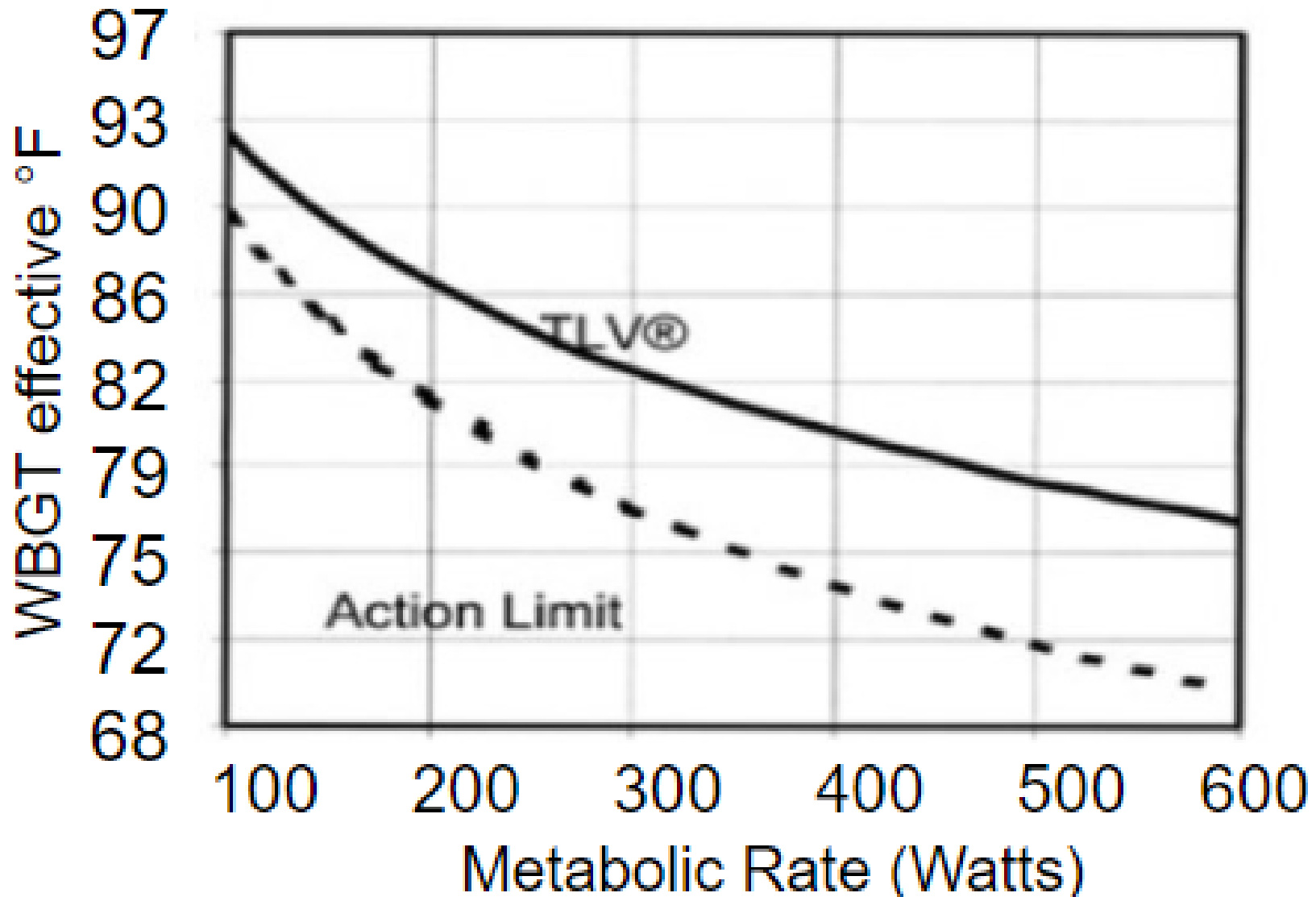
4. Is there a hazard?

The temperature, clothing and metabolic rates can be calculated to provide graphs that show safety limits in slightly different ways:

- American Conference of Governmental Industrial Hygienists (ACGIH). Factors in clothing/PPE then displays acclimated and not acclimated on the same graph
- CDC NIOSH. Uses assumptions of a “standard man” with 154 lb body weight and 19.4 ft² body surface.

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American Conference of Governmental Industrial Hygienists (ACGIH)



CDC NIOSH Heat Illness Recommendations

Year-round regulations protect worker health, including the following:

- Exposure monitoring
- Acclimatization plan
- Heat stress thresholds: RAL and REL curves, ceiling exposure limits
- PPE considerations
- Employee training: Upon hiring and continuously thereafter.
- Medical monitoring: Medical screening and surveillance
- Hazard notification. Injury tracking. Record-keeping. Written Heat Alert Program

For immediate supervisors:

- Rest breaks: Based on amount of work per hour
- Hydration: 1 cup cool (50–59° F), potable water every 15–20 mins. For workers sweating more than 2 hours, provide electrolytes.
- Shade requirements: air-conditioned or shaded area for rest.

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