HEALTHIER WORKPLACES | A HEALTHIER WORLD

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Occupational Safety and Health Administration
United States Department of Labor

AIHA's Recommendations on OSHA's Proposed Standard on Heat Injury and Illness Prevention in Outdoor and Indoor Work Settings

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RIN: 1218-AD39

Dear Assistant Secretary Parker:

AIHA, the association for scientists and professionals committed to preserving and ensuring occupational and environmental health and safety (OEHS), appreciates the opportunity to provide feedback on OSHA's proposed standard on heat injury and illness prevention in outdoor and indoor work settings. We hope you find our feedback useful and are happy to answer any questions you may have. Below are our responses to the questions OSHA posed for public feedback in its notice of proposed rulemaking in the Federal Register for this standard.[1]

Has OSHA adequately identified and documented the studies and other information relevant to its conclusions regarding heat-related health effects, and are there additional studies OSHA should consider?

AIHA has provided several articles that OSHA should consider; all have been recently published.[2]

[1] https://www.federalregister.gov/documents/2024/08/30/2024-14824/heat-injury-and-illness-prevention-in-outdoor-and-indoor-work-settings

[2] See https://www.aiha.org/publications/the-synergist/synergist-archives/synergist-archives-2024 and https://www.aiha.org/blog

Are there additional data or studies OSHA should consider regarding the annual incidence of HRIs and heat-related fatalities among workers?

AIHA believes additional sources of studies might be helpful to consider regarding the annual incidence of "Heat Related Illness and Fatalities" among workers. Information on heat-related illness and fatalities are obtained from OSHA investigations, Bureau of Labor Statistics data, Workers compensation claims, Hospital and emergency room data, etc. Certain industries are at higher risk of heat exposure, such as construction and agriculture. Employees working outdoors in these specific industries are often exposed to extreme heat waves during the hot summer months. They are at risk for high rate of traumatic injuries and adverse health outcomes (Takeyasu Kakamu, Nature: Scientific Reports, 2021; June T Spector, Curr Environ Health Rep. 2019). Ending work shifts early on hot days may not be always feasible in construction. Indoor environments where employees are exposed to radiant heat from furnaces and ovens in foundry and bakery are at higher risk of HRI as well (AFS, 2022; Habib RR, Inquiry, 2021). The HRI rates from these specific industries might provide an insight into the heat related injuries and fatalities from these industries.

When looking at the relationship between heat exposure and traumatic injuries, fracture rather than work-related musculoskeletal disorders (such as carpal tunnel syndrome that might result from repetitive motions and awkward postures), have been usually considered. Workers in industries such as construction are at high risk of traumatic injuries and are also at high risk for heat stress. When investigating HRIs, musculoskeletal disorder studies need to be taken into account (June T Spector, Curr Environ Health Rep, 2019).

Specific personal characteristics and work factors such as age, gender, experience, training, preventive behaviors, physical exertion, and work environment may affect heat strain (Habibi P, Indian J Occup Environ Med. 2024; Andreas D Flouris et.al, The Lancet Planetary Health, 2018). Personal sensitivity to heat exposure may be considered. People with chronic illnesses such as heart problems, high blood pressure, and asthma, and taking specific medications may affect their health in extreme heat conditions and increase the risk severely for illness and injuries (Ebi, Kristie L et al. The Lancet, 2021, Liu, Jingwen et al. The Lancet Planetary Health, 2022; Azhu Han et.al, Environmental Research, 2023). Studies involving personal heat stress monitoring for sensitive populations need to be taken into account.

Exposure assessment traditionally has mostly relied on air temperature and humidity rather than net heat exposure (metabolic heat generation during heavy work, temperature, humidity, wind and solar radiation, and clothing). Use of hospitalization data, workers compensation claims, and Bureau of Labor Statistics reports fail to take into account less severe cases when calculating incidence rates. When calculating the incidence rate for heat-related illnesses or fatalities, often, only cases of employee hospitalization and fatalities are considered. Mild cases where hospital visits or stays do not occur are often not counted in the calculation. When severe injuries, illnesses, or fatalities are reported, they may not consider heat-related injuries, such as falls or myocardial infarctions, where heat was a

contributory cause (June T Spector, Curr Environ Health Rep, 2019; Diane M Gubernot et.al., Int J Biometeorol. 2013).

Certain employees, such as migrant workers, informal workers, and temporary workers who are not properly acclimatized on the job may suffer from heat-related injuries and illness and may be unable to report their injuries or illness due to lack of awareness or fear of losing their job. More research studies are needed on heat-related injuries among migrant workers. Such workers are often disproportionately exposed to heat waves while conducting heavy physical labor without frequent breaks (Ioannou LG, J Immigr Minor Health. 2023; Gubernot DM, Int J Biometeorol. 2013). We believe these additional studies might be considered when assessing and analyzing the annual incidence of HRIs and heat-related fatalities among workers.

Are employers aware of occupational HRIs that are not reported through BLS SOII, workers' compensation claims, or hospital discharge data? How commonly do HRIs occur that are not recorded on OSHA 300 logs?

Many members of AIHA within industry and governmental agencies openly recognize that heat-related illnesses and heat-related injuries are underreported when looking at the Bureau of Labor Statistics data and OSHA reporting as required by 29 CFR 1904. This data and recognition are supported by information collected by OSHA during the August 25, 2023, Small Business Advocacy Review Panel.

Most injuries and illnesses that are heat-related are either not recognized by those providing first aid or treatment as having heat exposure as a contributing factor or the primary exposure. Most heat-related illnesses do not escalate to the level of reporting as necessary by BLS, Workers' Compensation, or hospitalization, therefore, they are not captured outside of incident reports.

AIHA recommends that a training requirement for recognizing both heat-related illnesses and injuries be included within OSHA's final published standard. Recognition and reporting of heat-related injuries and illnesses, including those requiring first aid only, should be reported to provide additional data to further understand the scope of workplace heat hazards and drive awareness through required reporting.

Should OSHA consider other values for the initial and/or high heat trigger and if so, what evidence exists to support those other values?

AIHA recommends that OSHA use recommendations from the National Weather Service and the American Conference of Governmental Industrial Hygienists (ACGIH) for heat stress monitoring requirements. The Wet Bulb Globe Temperature (WBGT) is a measure of heat stress in direct sunlight, which is based on temperature, humidity, wind speed, and solar

radiation. The WBGT differs from the heat index, which is based only on temperature and humidity, is most valuable when solar energy does not cause a heat load to the human body, and is mostly calculated for shady or indoor areas.

For workers involved in outdoor activities in direct sunlight, the WBGT is the best heat stress indicator to monitor. Examples of inside work where heat stress can be a concern are all work near furnaces such as steel, foundries, and other mills with primary furnaces or another heat source.

National Weather Service:

AIHA Recommended WBGT Values and Work Activity	
WBGT Index	**Work Risk for Heat Illness/Rest Regimen**
Less than 80 °F	No restrictions (for extreme exertion, 5 minutes rest/water break every 30 minutes for WBGT 78 – 79.9 °F).
80 – 84.9 °F	Low risk except with impervious PPE or high exertion jobs. Mandatory 5 minutes rest/water after 30 minutes of work involving high metabolic heat load and/or with non-permeable PPE covering the body.
85 – 87.9 °F	Moderate risk. Mandatory rest/water after 20 minutes of work Monitor workers for signs and symptoms of heat stress.
88 – 89.9 °F	High risk. Mandatory 5 minutes rest/water in a tempered (air-conditioned) area after 15 minutes of work.
90 °F and above	Extreme risk. Observation for signs and symptoms of heat stress, self-reporting of ill feeling, weakness. Mandatory 10-minute breaks every 15 minutes in tempered (air-conditioned/cooled area). Suspend work if possible.

A study from Australia showed risks for occupational injuries from elevated ambient temperatures where “temperatures above and below the optimum of 25 degrees C (77 degrees F) increased the risk of work-related injuries and illnesses, and the greatest risk was observed at extreme temperatures.”

"Occupational injuries can occur when an individual's coordination, strength, vision, endurance, or judgement are influenced by temperature-induced physiological changes (Kjellstrom et al., 2009, Xiang et al., 2014a, Spector et al., 2014, Grandjean and Grandjean, 2007). A U.S. study examining the association between temperature and injury risk found that compared to ambient temperatures of 10–16 °C, the odds ratios (OR) of acute injury risks in aluminum smelter workers were: 2.28 (95% CI:1.49–3.49) between 32 °C and 38 °C; and 3.52 (95% CI: 1.86–6.67) above 38 °C (Fogleman et al., 2005). In Australia, studies in Melbourne (McInnes et al., 2017), and Adelaide (Xiang et al., 2014b) have also shown increased risks for workers in hot weather and during heatwaves."

Please comment on the appropriateness of using the heat index to define the initial and high heat triggers.

The common goal of heat standards is reducing injuries and illnesses, including preventing serious heat-related disorders that can lead to worker death. AIHA believes OSHA is struggling with the main components of a heat stress management system by making any standard complicated and narrow by considering all specific methods for heat stress avoidance, while failing to provide guidance for the contents of a heat stress program for the regulated community. AIHA believes OSHA should not make the heat stress standard too restrictive without consideration of an employer implementing procedures for site or work-specific industries when methods for heat stress avoidance are necessary.

AIHA believes that OSHA is trying to simplify the risks from heat exposure by considering only ambient air temperatures while at the same time unnecessarily making heat stress regulations too rigid without the consideration of employer needs to adopt heat injury and illness prevention strategies suitable for their workforce and workplace. AIHA believes procedures and rules to prevent heat-related injuries and illnesses should be flexible and site-specific. AIHA agrees with OSHA that the standard should address exposure or "action" levels when a heat injury and illness prevention plan is needed, while not specifying specific required work compliance procedures, since these procedures would be site-specific.

Heat stress depends on environmental conditions as well as heat load from people wearing work-specific non-breathable protective clothing. The medical and industrial hygiene communities recognize that heat-related injuries and illnesses are a result of physiological responses caused by the net load of heat buildup in the body. Heat-related illnesses resulting from heat stress occur when the body's normal physiological responses dedicated to dissipating excess heat are overwhelmed and inadequate for dissipating this excess heat. Heat illnesses and fatalities are caused by a combination of the effects of metabolic heat (exertion, work activity levels typically measured in watts, representing the rate of heat production by a human body due to metabolic activity), environmental factors, and PPE or clothing requirements for specific work activities.

The metabolic rate is the energy expenditure generating internal heat that must be dissipated by the body. Metabolic heat is as important as the WGBT assessment (ACGIH 2023). ISO 8966, Ergonomics of the thermal environment – Determination of metabolic rate, classifies metabolic heat gain in four different levels of increasing accuracy: Level 1, screening with a table giving examples of activities with low, moderate and high metabolic rates; Level 2, observation where the metabolic rate is estimated by a time and motion study; Level 3, analysis where the metabolic rate is estimated from heart rate recordings or accelerometers measurements; and Level 4, expertise where more sophisticated techniques are described (ISO 8966). The estimation of metabolic heat and assignment into a metabolic category is the easiest and most convenient method for metabolic heat generation characterization. The standard, therefore, needs to consider metabolic heat loads and impermeable protective clothing along with environmental heat loads from, for example, radiant energy.

Should OSHA explicitly incorporate radiant heat into the initial and/or high heat triggers, and if so, how?

AIHA believes that OSHA should incorporate radiant heat and protective clothing into the exposure limit for evaluating heat stress injuries or illnesses. The radiant heat exposure is best calculated by incorporating the WBGT. The determination of WBGT depends on whether it is measured in direct sun (outside) or shaded or indoor work. AIHA recommends that OSHA adopt the recommended action levels (RALs) from NIOSH's recommended standard for occupational exposure to heat and hot environments.

The WBGT for outdoor areas uses ambient air or dry bulb temperature (T_{db}), natural wet bulb temperature (T_{nwb}) which accounts for humidity, and globe temperature accounting for radiant heat load (T_g).

For outdoor work, WBGT is calculated from the following formula (ACGIH):

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

For indoor work WBGT is calculated from the following formula:

$$WBGT_{in} = 0.7T_{nwb} + 0.3T_g$$

One State-specific heat stress standard (Minnesota), addressed below, has a requirement for consideration of the WBGT. However, Minnesota does not have a heat standard for outdoor work.

Should OSHA explicitly incorporate clothing adjustment factors into the initial and/or high heat triggers, and if so, how?

AIHA believes that PPE clothing adjustment factors are needed. WBGT or other heat stress indices need to be modified or adjusted to estimate effective heat stress exposures.

Example adjustment values (modified from ACGIH (2023))[3]

PPE/Clothing adjustment factors (CAV) added to HSI or WBGT	
Clothing type	CAV
Short sleeves and work pants	-1
Long sleeve short and pants	0
Polypropylene coveralls	0.5
Polyolefin coveralls	1
Double layer clothing	3
Limited use chemical coated (non-permeable) vapor barrier coveralls with hood	11
EPA Level A protective clothing	Buddy system, case to case basis – cooling systems recommended

If WBGT values are not incorporated into OSHA heat stress action levels, then some other method must be used to account for added heat loads from non-breathable protective clothing. California is the only State that has one standard for indoor work, and another for outdoor work. California also has lower exposure limits for workers in clothing that restricts heat removal.[4]

Should OSHA use different triggers for different parts of the country, and if so, how?

No. There is some dependence of HI on dew point but not enough to justify complexity (USF MS theses: P Irvin and A. Giraldo) and no difference for WBGT.

Please comment on the appropriateness of applying the same triggers to employers who conduct on-site measurements as opposed to employers who use forecast data.

We suggest that OSHA recognize the limitations of environmental data estimates from local weather stations and websites. To accurately require activity modifications and assess heat exposure levels, it is crucial to understand that these estimates may not accurately reflect the actual conditions experienced by workers. Local weather stations and websites do not account for the surfaces workers are exposed to, such as asphalt, steel, or concrete, which can significantly affect environmental conditions. For instance, Pryor et al. (2017) compared WBGT estimates from local weather stations with readings taken from various athletic

[3] These values must not be used for completely encapsulating suits, often called Level A. CAV cannot be added for multiple layers. The coveralls assume that only modesty clothing is worn underneath, not a second layer of clothing.

[4] See Garzon, et al. (https://doi.org/10.1080/15459624.2019.1628348) for particle-barrier at 3 °F for vapor-barrier at +33 °F.

surfaces. Their findings indicated that local weather station estimates underestimated WBGT measurements when compared to on-site assessments across all athletic surfaces. Whether forecasted or estimated environmental data should use the same triggers as on-site measurements remains unclear. Therefore, OSHA must consider this limitation when establishing the heat stress standard.

Are there additional studies or evidence available that identify appropriate frequencies and durations of rest breaks for reducing heat strain and risk of HRIs?

Bernard, et al.[5] have shown that using WBGT-based TWAs to estimate rest times may not include the least tolerant workers. This argues that these prescribed rest times are a minimum. There is no reason to believe that HI-based TWAs are valid.

Where an employer relies on the exemption in proposed paragraph (a)(2)(iv) to exclude work activities performed in indoor work areas or vehicles where air-conditioning consistently keeps the ambient temperature below 80 °F, whether the standard should address situations where the air-conditioning system does not function properly and the ambient temperature reaches or exceeds 80 °F; for example, should certain requirements of the standard apply in this scenario? Additionally, please comment on whether the standard should specify how long the air-conditioning system can be out of order before the exemption no longer applies.

When the vehicle loses air conditioning, it should be addressed immediately. That is, no allowance beyond the day it fails, while allowing for that day's work to be completed.

Please comment on whether the standard should exempt all sedentary work activities indoors or limit the exemption to only activities performed below an upper limit (e.g., below the high heat trigger) at or above which the exemption would no longer apply, and if so, what the upper limit should be and what evidence exists demonstrating that even sedentary work performed indoors can be a hazard to workers at or above that limit.

AIHA recommends equal requirements for indoor or outdoor work based on heat exposure limit values. However, work below an OSHA "action level" for heat stress, where a low

[5] https://doi.org/10.1093/annweh/wxac083

probability of heat illness exists, should not be required to implement a written heat stress injury and illness program.

AIHA further believes that WBGT should be included in a heat stress avoidance program along with metabolic heat generation greater than 235 watts and WBGT above 80 °F

The following table provides examples of assigned metabolic rates:

Category	**Assigned Metabolic Rate (W)**	**Example Work Activities**
Light Indoor office other indoor work in unconditioned work environment, truck driver without conditioned cab, assembly line, and warehouse	115 – 235	Sitting at work terminal (115), light manual work with hands (stocking shelves, forklift operator, unpacking boxes light janitorial work, light assembly line work and driving in unconditioned cab (200 – 235W)
Moderate Outside work, hand arm work indoor in unconditioned building	235 – 300	Sustained moderate hand and arm work, occasionally lifting heavy objects, intense scrubbing and cleaning, light landscaping work
Heavy Outside work	300 – 415	Intense hand/arm work, shoveling, often pushing, pulling heavy objects, manual labor
Very Heavy	415 – 520	Jobs that require maximum physical exertion and requires a high level of strength and fitness.
Modified from ACGIH TLV (2023)		

Also, for example, the following State OSHA programs have occupational heat standards for indoor and/or outdoor work:

California's Indoor Heat Illness Prevention Standard:

- Measure the temperature and heat index and record whichever is greater whenever the temperature or heat index reaches 87 °F (or temperature reaches 82 °F for workers working in clothing that restricts heat removal or high-radiant-heat areas).

Control measures, beginning with engineering controls, will then have to be implemented to keep workers safe.

- Establish, implement, and maintain an effective written Indoor Heat Illness Prevention Plan. This Plan will include procedures for providing drinking water, cool-down areas, preventative rest periods, close observation during acclimatization, assessment, and measurement of heat, training, prompt emergency response, and feasible control measures.
- When indoor workplaces are affected by outdoor temperatures, supervisors will have to be trained on how to check weather reports and how to respond to hot weather advisories.
- Provide access to potable water that is fresh, suitably cool, and free, as well as strategically located near work and cool-down areas are less than 82 °F.

California Outdoor Heat Illness Requirements:

- Establish, implement, and maintain an effective written Outdoor Heat Illness Prevention Plan and Include procedures for providing drinking water, shade, preventative rest periods, close observation during acclimatization, high-heat procedures, training, and emergency response.
- Provide access to potable water that is fresh, suitably cool, and free of charge, as well as strategically located near work areas.
- Implement heat injury procedures when temperature equals or exceeds 95 °F. These procedures include, but not limited to, observing and communicating effectively with workers and reminding workers to drink water and take cool-down rest breaks.
- Monitor outdoor temperature and ensure that when the temperature exceeds 80 °F, shade structures are made available to the workers.
- When the temperature reaches or exceeds 95 °F implement high-heat procedures including establishing effective communication methods so workers can contact a supervisor when needed; Cool-down rest periods: Ensure employees take a minimum of 10 minutes of preventative cool-down rest every two hours; water breaks; provide proper shade when temperatures exceed 80 °F; ensure employees are regularly observed for signs of heat illness; training and written plan.
- Train supervisors on how to check National Weather Service heat reports and how to respond to weather advisories.
- Shade must be present when temperatures are greater than 80 °F. When temperatures are less than 80 °F, shade must be available upon request.

Requirements for both indoor and outdoor workplaces in California include:

- Write and implement a written heat stress prevention program.
- Provide shade and cool-down areas blocked from direct sunlight and large enough to accommodate the workers on rest breaks.
- Encourage workers to take preventative cool-down rest periods.
- Permission for a cool-down rest period.
- Monitor workers who are taking rest periods for symptoms of heat-related illness.

- Provide first aid and emergency response to workers showing signs or symptoms of heat illness.
- Procedures for contacting emergency medical services.
- Observe new workers and newly assigned workers working in hot areas during a 14-day acclimatization period.
- Provide heat illness awareness training to workers and supervisors.

Colorado Heat Illness and Injury Prevention Program:

- Colorado's heat-related labor law only applies to agricultural workers.
- Requires indoor and outdoor agriculture employers with more than 10 employees to develop and implement a written heat injury and illness prevention plan.
- Heat illness and injury protection rules apply when the worksite ambient temperature is 80 °F or higher.
- Must measure the temperature and heat index at a worksite when either reaches 87 °F. If the temperature reaches 82 °F and the worker is wearing clothing that restricts heat removal or is in a high-radiant-heat area, the employer must also measure the heat index.
- Employers must provide employees with potable water to prevent heat illness.
- Employers must provide at least 32 ounces of water per hour that is kept at or below 60 °F to employees.
- The water must be from a sanitary source, such as a tap, fountain, or individual cup, and be located as close to the worksite as possible.
- Provide shaded areas for breaks, or air conditioning or moving air in indoor break areas. Employees should take at least 15-minute breaks every two hours during high temperatures. Time must be allowed for employees to drink water.

Minnesota Heat Stress Standard:

- No outdoor requirements.
- A two-hour time-weighted average WBGT 2-hour is used by Minnesota OSHA to measure an exposure to heat stress. Work activity needs to be categorized as light, moderate, or heavy work.
- If the heat exposure limit has been exceeded, steps must be taken to reduce the temperature of the work environment, the time spent in the hot area, and/or the amount of work done.
- Outside air shall be provided to all indoor workplaces at the rate of 15 cubic feet per minute per person. Air shall be provided and distributed in all workplaces as required unless prohibited by process requirements.
- Air circulated in any workroom shall be supplied through air inlets arranged, located, and equipped so that the workers shall not be subjected to air velocities exceeding 200 feet per minute except under special circumstances.
- Employees shall not be exposed to indoor environmental heat conditions exceeding the following temperatures listed below.

The values below apply to acclimatized workers.

Minnesota Indoor Environments	
Work Activity	**WGBT Heat Exposure Limit**
Heavy	77 °F
Moderate	80 °F
Light	86 °F

- All workers exposed to heat above heat thresholds shall be provided with the necessary awareness training. training must be conducted before an employee is exposed to heat approaching the limits in the heat stress standard, and refresher training must be conducted at least annually.
- Minnesota's indoor workplaces when steps must be taken to reduce the heat stress:
    - Light work: The WBGT limit is 86 °F
    - Moderate work: The WBGT limit is 80 °F
    - Heavy work: The WBGT limit is 77 °F
- Recirculated air from any exhaust system handling materials listed in the Code of Federal Regulations, title 29, subpart Z, shall not be recirculated without written permission from the Minnesota Department of Labor and Industry.

Oregon Heat Illness Prevention Requirements:

- Applies to outdoor and indoor workplaces when the heat index is 80 °F or higher.
    - Employers must provide access to a shared shaded area that can accommodate workers while on break and that doesn't expose them to unsafe conditions. If shade is not practical, employers must provide other cooling measures that offer the same level of protection.
    - Employees must be permitted access to cold or cool drinking water (35 – 77 °F) at no cost and be given opportunities to drink up to 32 ounces per hour.
    - Employers must develop and implement a written acclimatization and heat illness prevention plan, as well as an emergency medical plan.
    - Employers must provide awareness training on heat illness prevention.

Washington Outdoor Heat Illness Requirements:

- Washington does not have specific standards for indoor heat stress, heat requirements are specific to outdoor workers only.
- Must have a written program when temperatures are at or above 89 °F.
- Workers must be allowed to take paid, preventative cool-down breaks in the shade or other effective ways to reduce body temperature.

Washington Outdoor Ambient Temperature Action Levels	
Nonbreathable clothes including vapor barrier clothing or PPE such as chemical resistant suits	52 °F
Double-layer woven clothes including coveralls, jackets and sweatshirts	77 °F
All other clothing	89 °F

- Elevated temperature:
  - 90 °F or hotter, a 10-minute break is mandated every 2 hours.
  - 100 °F or hotter, a 15-minute break must occur every hour.
  - Longer and more frequent breaks are required when temperatures continue to increase.
- Employers must closely observe workers for signs and symptoms of heat-related illness for a duration of 14 days.
- Train employees and supervisors about heat exposure risks, including acclimatization, cool-down rest periods, and gradual increase of work duration.
- Prior to any outdoor work with elevated temperatures, training must be provided in a language the employee or supervisor understands and at least annually thereafter.
- Must have emergency procedures to respond appropriately to any worker with symptoms of heat-related illness.
- Rules do not apply to workers that fall under Chapter 296 – 305 WAC, Safety Standards for Firefighters.

Maryland Heat Illness Prevention Standard:

- Applies to both indoor and outdoor settings when employees are exposed to a heat index that equals or exceeds 80 °F. But excludes emergency response, incidental exposures (less than 15 consecutive minutes per hour), or where buildings, structures, and vehicles have a mechanical ventilation system or fan that maintains the heat index below 80 °F.
- Heat index includes ambient temperature and humidity levels based on the National Weather Service Chart.
- Employees exposed to heat at or above 80 °F must develop a written Heat Illness Prevention and Management Plan which includes:
  - Provision of sufficient amounts of drinking water (at least 32 ounces per hour per employee per day)
  - Methods for identifying how employees will be provided sufficient opportunities and encouragement to stay hydrated;
  - How to recognize the symptoms of heat-related illness, including heat exhaustion and heat stroke;

- How to implement rest break schedules as necessary;
- Training for employees on the hazards of heat exposure and steps to prevent heat-related illness;
- Procedures for heat acclimatization of up to 14 days for newly exposed or returning employees;
- Procedures employers must follow when the heat index reaches or exceeds 90 °F.
- A minimum rest period of 10 minutes for every 2 hours worked.
- A minimum rest period of 15 minutes for every hour worked where employees are exposed to a heat index above 100 °F.
- Monitoring employees for signs of heat-related illness through regular communications. Communications must include phone or radio, a buddy system, or other effective means to observe employees.
- Procedures must be in writing in a language and manner that all employees can understand. Employers develop emergency response procedures and include those in the plan.
- Provide initial and re-training to employees and supervisors. Retraining is required at least annually and following any incident at the worksite involving a suspected or confirmed heat-related illness.

Please comment on the approaches that stakeholders are taking to assess heat stress and prevent HRI in employees wearing vapor-impermeable clothing.

HRI prevention when working in vapor impermeable suits requires diligent biomonitoring combined with pre/post-medical screening. This can be accomplished in a variety of ways and is changing rapidly with new technologies emerging daily.

Depending on the work environment, these programs may look different but have some of the same core elements. Response teams may have limited field capabilities but should, at a minimum, establish prescribed rest and rehydration periods that include vital checks by a medic.

1. Pre/Post “entry” screening (e.g., weight, temperature, vitals, urine specific gravity)
2. Heart rate and/or other biomonitoring during work activity
3. Parameters and protocols for stop work/abort entry
4. Established rest and rehydration protocols
5. Follow up and focused review by a cross-functional team to evaluate heat stress/strain prevention aspects of all HRI incidents and entries aborted for potential heat stress/strain. At a minimum, the team should include medical, operation/supervision, safety, and industrial hygiene.

Clearance parameters are established by an occupational health physician who is aware of work, work environment, and medical response capabilities. These parameters may be based on deviation from established individual baselines and/or set medical guidelines.

Pre-screening can be utilized for other work in high-heat areas such as furnace rooms, mills, molten metal operations, etc., where PPE may not be fully encapsulating but prevents air movement in areas with high radiant heat sources.

Please comment on whether OSHA should specify a temperature that would trigger all or certain requirements of the standard for employees wearing vapor-impermeable clothing.

Trigger temperatures are not useful in environments where vapor-impermeable clothing is worn. ACGIH recognizes in a footnote to their WBGT temperature tables that clothing adjustment values and screening temperatures should not be applied to the use of vapor-impermeable clothing, especially fully encapsulated suits. These ensembles create a micro-climate inside the suit. Even in a 70 °F room, the temperature inside the suit will be 95 °F or greater.

Chemical protective clothing often has temperature limitations based on the permeability of chemicals through the material or temperature at which extended exposure to temperatures above 90 °F (for example) cause the integrity of the suit material to be compromised.

The values for HI or WBGT should be reduced as described in ACGIH for WBGT (e.g., CAV = 11 °C) and by 33 °F for HI.[6]

Please comment on whether the proposed requirement to seek input and involvement from non-managerial employees and their representatives under paragraph (c)(6) is adequate, or whether the explanation should be expanded or otherwise amended (and if so, how and why).

The proposed requirement under paragraph (c)(6) to seek input and involvement from non-managerial employees and their representatives in the development and implementation of the Heat Illness and Injury Prevention Program (HIIPP) appears to be adequate in general. However, there are several key areas where further clarification or expansion could enhance its effectiveness and ensure meaningful employee participation.

1. **Flexibility in Approaches to Employee Input:** While the flexibility in methods for soliciting employee feedback allows for adaptability across different workplace sizes and structures, additional specificity may be beneficial. OSHA could provide clearer guidance or examples of effective strategies for different workplace environments, particularly in industries or settings with high variability in job functions. For example, structured feedback tools, such as anonymous surveys or regularly scheduled focus group meetings, could be recommended for larger or more complex operations to ensure broad input.

[6] See Garzon, et al. (https://doi.org/10.1080/15459624.2019.1628348)

2. **Ensuring Comprehensive Representation:** The requirement for involving representatives, particularly in unionized settings, is an important element. However, in non-unionized workplaces, it may be helpful to emphasize the need for safety committees or similar bodies to be composed of employees from a diverse range of job functions and exposure levels. This would ensure that those most directly affected by heat-related hazards are adequately represented and that input reflects a comprehensive understanding of workplace risks.
3. **Documenting the Feedback Process:** To ensure accountability, OSHA may consider requiring employers to document the process of soliciting employee input, the feedback received, and how it was incorporated into the HIIPP. This transparency would help ensure that the process is not merely procedural, but that employee concerns are actively considered and addressed in the program's implementation. Documentation would also aid in future reviews or audits of the program's effectiveness.
4. **Ongoing Employee Involvement:** While the proposed paragraph addresses employee involvement during the development and initial implementation of the HIIPP, it may be beneficial to emphasize the importance of continuous employee engagement. Heat-related risks can evolve due to changing conditions, work practices, or seasonal factors, and regular opportunities for feedback would ensure that the program remains responsive and up to date.

In summary, while the proposed paragraph (c)(6) provides a solid framework for involving non-managerial employees in the development and implementation of the HIIPP, expanding the explanation to include more detailed guidance on feedback mechanisms, representation, and accountability would help ensure that employee involvement is both meaningful and effective

Please comment on whether there could be situations in which a lack of cellular service prevents an employer from using weather forecasts or real-time predictions, and if so, what alternatives would be appropriate.

Good practice would be to assess forecasts prior to the workday or area near the worksite in the case cell service is lost.

Please comment on whether OSHA should require a specific temperature or ranges of temperature for drinking water as some State regulations do (e.g., Colorado requires that drinking water is kept 60 °F or cooler).

Describing drinking water as cool should be sufficient. Good practice would have it below 60 °F.

Please comment on whether the agency should require the provision of electrolyte supplements/solutions in addition to water.

The recently approved ANSI/ASSP A10.50-2024 consensus standard, *Heat Stress Management in Construction and Demolition Operations*, comments in section 6.2.2, Provision of Electrolyte Replenishment Beverage that

> "When employees are involved with heavy work activities for greater than 2 hours (work examples in Table 2, Appendix 2) employees shall also have access to electrolyte replenishment beverages (e.g., sports drinks) that are commercially available, and provided to employees free of charge. Caffeinated and high sugar electrolyte replenishment beverages should be avoided."

The statement in 6.2.2 of the A10.50 standard was based on information previously stated in the NIOSH Criteria for a Recommended Standard, *Occupational Exposure to Heat and Hot Environments* NIOSH publication No. 2016-106. On page 29 (last line) and page 30, the following is stated:

> "A general rule of thumb for those exercising in the heat 1 to 2 hours is to drink plain, cool water. Sweat is hypotonic to the [blood] plasma, and one does not lose a significant amount of sodium in the first hour or two of exercise [McArdle et al. 1996b]. Therefore, one does not require fluids containing electrolytes for this exposure. However, during prolonged sweating lasting several hours, it is advisable to consume a sports drink that contains balanced electrolytes to replace those lost during sweating, as long as the concentration of electrolytes/carbohydrates does not exceed 8% by volume. Exceeding the 8% limit will slow absorption of fluids from the gastrointestinal (GI) tract [Parsons 2003]."[7] [8]

Thus, as stated in section 6.2.2 of the A10.50 Consensus Standard, employees involved with heavy work activities for greater than two hours should have access to electrolyte replenishment beverages/supplements to the water being used for hydration.

Good practice dictates that electrolytes or salty snacks are a first aid intervention for mild heat exhaustion and thus should be available.

Please comment on whether the requirement to provide a minimum of 1 quart per hour per employee is appropriate.

Yes, that is an appropriate amount of water for employees to consume.

During the preparation of the ANSI/ASSP A10.50 consensus standard, the subcommittee reviewed the OSHA website for exposure to excessive heat, the NIOSH website for working in excessive heat, and the NIOSH Criteria Document mentioned in the response a question elsewhere in OSHA's request for public comment on its proposed heat standard. All three of

[7] McArdle WD, Katch FL, Katch VI [1996b]. Exercise physiology. 4th ed. Baltimore: Williams & Wilkins.
[8] Parsons KC [2003]. Human thermal environments: the effects of hot, moderate, and cold environments on human health, comfort, and performance. 2nd ed. London" Taylor and Francis.

these sources indicated that individuals who are working in high-heat conditions should drink about one quart of water per hour to replenish water lost during sweating.

The NIOSH Criteria for a Recommended Standard, *Occupational Exposure to Heat and Hot Environments* publication No. 2016-106 states on page 29:

> "Because the normal thirst mechanism is not sensitive enough to ensure a sufficient water intake [Greenleaf and Harrison 1986; DOD 2003], every effort should be made to encourage individuals to drink water or other fluids (e.g., sport drinks). The fluid should be as palatable as possible, at less than 15 °C (59 °F). Small quantities taken at frequent intervals is a more effective regimen for practical fluid replacement than the intake of large amounts of fluids per hour [McArdle et al. 2010b]. Individual, not communal, drinking cups should be provided. Individuals are seldom aware of just how much sweat they produce or how much water is needed to replace that lost in the sweat; $1 L \cdot h^{-1}$ is a common rate of water loss."[9] [10] [11]

Because of the information from the NIOSH Criteria Document and the OSHA and NIOSH websites, the ANSI/ASSP A10.50-2024 consensus standard for *Heat Stress Management in Construction and Demolition Operations* included the following text:

> "**6.2.1 Water.** Employees shall have access to potable (drinking) water including, but not limited to, the requirements that it be suitable cool and provided to employees free of charge. The water shall be in close proximity to the areas where employees are working. Where drinking water is not plumbed or otherwise continuously supplied, it shall be provided in sufficient quantity to provide approximately one quart (~1 liter) per employee for drinking each hour over the entire shift."
>
> "Employers may begin the shift with smaller quantities of water if they have effective procedures to replenish the supply during the shift, as needed, to allow employees to drink one quart per hour. When the work environment is hot and employees are likely to be sweating more than usual in the performance of their duties, it is important to frequently consume small quantities of water, such as 12 ounces (~0.35 liter) every 20 minutes, rather than waiting to drink a larger quantity less frequently, such as a whole quart at hourly intervals."

[9] Greenleaf JE, Harrison MH [1986]. Water and electrolytes. ACS Symp Series 294:107-124.
[10] DOD [2003]. Technical bulletin: heat stress control and heat casualty management. TB MED 507/AFPAM 48-152 (1). Washington, DC: Departments of the U.S. Army, Navy, and Air Force.
[11] McArdle WD, McArdle FI, Katch VI [2010b]. Exercise physiology. In: McArdle WD, McArdle FI, Katch VI, eds. Exercise physiology, nutrition, energy, and human performance. 7th ed. Philadelphia: Lippincott Williams & Wilkins.

Please comment on whether there are any challenges to providing the required amount of drinking water (e.g., for employees who work on foot in remote areas) and, if so, alternatives that OSHA should consider.

Such a situation would present challenges. Remote workers have challenges with available shade, transportation, means of communication, and access to drinking water. Proper planning would be needed before assigning employees to work on foot in a remote area during high-heat conditions. Relevant questions include, 'Does the employee have their shade/transportation for the entire shift?' and 'Is the employee without shade/transportation until the end of the work shift?' If transportation remains with the employees, then one or more ice chests can be loaded with the required number of water bottles needed for half the shift. The remainder of the needed water bottles can be located next to the ice chest. As cold bottles are removed for personal use, a warm replacement bottle will be inserted into the ice. Extra bags of ice will be needed to keep the chest filled throughout the shift. An extra empty ice chest would be ideal to help keep the extra bags of ice frozen for use in the other ice chests. Properly charged cell phones or walkie-talkies will be needed to maintain contact with the main work location in case some emergency occurs.

If the employees are just dropped off at the remote location and do not have transportation until a vehicle returns to pick them up, then that presents a more complicated situation for protecting the worker(s). Multiple ice chests already filled with ice and the correct number of water bottles must be prepared and then placed at the remote work location with the worker(s). Temporary shade would also be needed for use during the shift. That would have to be brought to the remote location also. Thus, proper planning is required to protect the health and safety of these workers.

Please comment on whether OSHA should limit the use of indoor break areas to those that are equipped with air-conditioning.

AIHA believes that air-conditioned break areas are preferable for minimizing heat-related illnesses; however, break area temperatures depend on exposure values. A cooler ambient environment may be required for extreme heat conditions such as work in nonbreathable protective clothing. Extreme hot environments may require air-conditioned rest areas. AIHA supports the NIOSH heat stress Criteria for a Recommended Standard (NIOSH, 2016) work/rest schedules for workers wearing normal work clothing. NIOSH recommendations do not specify required temperatures for rest areas, but specifies "cool areas (e.g., air-conditioned or shaded area) for rest and recovery." One published study from Japan found that "while providing cool rest areas is beneficial for worker recovery and preventing heat-related illnesses, however, higher tiredness levels were reported when break areas were cooler." (Kawakami et. al. Building and Environment, 2024)

Under very demanding heat stress conditions, employees prefer to step down to ambient (outdoor) conditions before going to an air-conditioned room.

Please comment on whether OSHA appropriately defined shade; if not, how should OSHA define shade for outdoor break areas.

AIHA believes that OSHA has appropriately defined shade.

Please comment on whether there are situations where shade is not protective and should not be permitted; and in these cases, what should be required for break areas.

The implementation of shade is a cost-effective solution that can be implemented during rest breaks. No research suggests that shade is not protective and should not be permitted.

Please comment on whether there are additional options for shade that are protective, but which OSHA has not included.

As the proposed standard indicates, OSHA should only allow for artificial shade (e.g., tents, pavilions) or natural shade (e.g., trees) and not allow for shade from equipment. However, OSHA should recognize natural shade sources may produce partial shade cover, and this should not be permitted as it does not exclude solar radiation penetration.

Please comment on whether there are situations when trees are not appropriate for use as shade and other measures should be required.

As indicated above, OSHA should recognize natural shade sources may produce partial shade cover, and this should not be permitted as it does not exclude solar radiation penetration. Employers should be required to ensure that natural shade must provide complete blockage of sunlight at all times.

Please comment on whether there are situations when employers should be permitted to use equipment as shade; in those situations, how would employers mitigate other safety concerns such as run-over incidents.

We do not believe that shade from equipment is an adequate method to provide shade.

Please comment on whether there are situations when employers should not be able to use large vehicles as shade or concerns, including those related to safety, with generally allowing the use of large vehicles for shade.

We do not believe that shade from equipment is an adequate method to provide shade.

Please comment on whether there are other control options that would be both as effective as shade at reducing heat strain and feasible to implement.

Research suggests that passive rest (i.e., no active solutions such as body cooling) has little effect on physiological recovery, particularly during repeated bouts of physically demanding work in the heat. OSHA should recognize the positive impacts of body cooling modalities with high cooling rates as a prevention strategy to reduce core temperature, skin temperature, heart rate, and other physiological and perceptual measures. Active body cooling strategies should not be used as an alternative to shade; however, they should be used together to promote optimal cooling rates to reduce the risk of heat illness.

Please comment on whether OSHA should specify a temperature that break areas must be kept below.

When specifying a ceiling temperature, care should be taken so that the temperature is not too low for comfort (upon entering and after they have been in the area for a while). That is, there should be a floor.

Please comment on whether there are other control options that would be both effective at reducing heat strain and feasible to implement.

AIHA considers that there are effective control options other than engineering controls that can be utilized in reducing heat strain and are more feasible and economical to implement. Although we acknowledge the importance of engineering controls such as ventilation, cooling fans, reflective shielding, and insulation in reducing heat stress and PPE as the last line of defense in the NIOSH hierarchy of controls (CDC/NIOSH), implementing administrative controls and PPE might be helpful when engineering control is not feasible. Administrative controls can be helpful in reducing heat stress-related disorders by utilizing scheduled work during cooler times of the day, giving frequent breaks to employees, acclimatization, encouraging hydration, training to identify heat stress-related symptoms, and following work-rest cycles (Brenda Jacklitsch et.al, CDC 2016). Kidney disease among agricultural workers has been reported in several studies. Severe dehydration with heavy work in excessive heat may lead to acute kidney injury (Chula Herath et.al. Kidney Int Rep, 2017). Encouraging proper hydration, such as drinking one cup of water or other fluids every 15 – 20 minutes and scheduling work-rest cycles when conducting heavy work, will reduce heat stress-related disorders (CDC/NIOSH Feb 2017).

Air conditioning indoor areas or proper shaded areas for resting may not always be available for outdoor workers. Cooling intervention studies using cooling gadgets has been studied extensively among outdoor workers in agriculture, construction, firefighters and other industrial process where employees are often exposed to extreme heat conditions

(Roxana Chicas et.al, Am J Ind Med., Sept 2020; Leonidas G Ioannou et.al, Temperature [Austin], April 2022).

Several studies have focused on cooling vests, water or air-cooled garments, and wetted over-garments to mitigate heat strain among workers during an increase in the frequency and severity of heat waves. A fan-attached jacket that transferred ambient air underneath the jacket at a rate of 30 L/s (FAN) was able to reduce core body temperature in a study (Kahori Hashimoto, Nature: Scientific Reports, 2021). A study reported vests with radiative cooling coating increased significant human comfort among outdoor workers at a WBGT of 26 °C (Yao Wang et. Al. Nanomaterials, 2024). Another study focused on the cooling effects of the neck scarfs, brimmed hats, and cooling vests during a red pepper harvest among farm workers. They reported that the vest with a 3.3% body surface area reduced heat strain in farm workers effectively. The use of a cooling vest, neck scarf, and brimmed hat worn simultaneously was able to eliminate considerable heat strain among farm workers, with the total cooling area of 4.2% body surface area (Jeong-Wha Choi, et.al, Industrial Health, 2008). A study conducted among construction workers reported wearing personal cooling garments reduced sweat loss, heart rate and chest skin temperatures (Shirish Ashtekar et.al., Workplace Health and Safety,2018). Phase change cooling packs are chemically engineered cooling packs that can be adjusted to change composition at different temperature changes. Some studies reported using phase change cooling packs helped reduce skin temperature and promoted effective absorption and release of latent heat more than using ice packs/ice vests (Huijuan Xu, Building and Environment, Feb 2024; James R House, Eur J Appl Physiol. May 2013). A combination of controls might be able to reduce heat strain among workers when engineering controls alone may not be feasible in reducing heat-related disorders.

Please comment on whether there are other control options (besides fan use or air-conditioning) that would be both effective at reducing heat strain and feasible to implement in cases where indoor employees are exposed to ambient heat.

Conductive cooling vests and extremity immersion, if used according to best practice, are body cooling strategies that should be considered as other control options for fan use and air conditioning. Body cooling control options must cover as much body surface area as possible and stay cold to ensure effectiveness. These strategies can be used to limit heat strain and with the intent to preserve or improve physical and cognitive performance (Chicas et al., 2020; DeMartini et al., 2011; McDermott et al., 2009).

Please comment on whether there are work areas where maintaining a high ambient temperature is necessary for the work process and, if so, how OSHA should address these work areas in the standard.

There are many manufacturing areas where process heat is unavoidable. The use of WBGT-based limits with TWAs for exposures have been used to manage the exposures.

Please comment on whether OSHA has appropriately derived recommendations for fan use from Foster et al., 2022a, and whether additional data or research should be used to supplement or revise the recommendations.

The effectiveness of fans is best realized when the airflow is over the skin or promotes the circulation of air under clothing.

Please provide data or examples of successful implementation of an acclimatization program.

For outdoor work involving landscaping and road maintenance, starting the unacclimatized employee with jobs involving low energy expenditure and increasing that to normal duties has been used. In a different way for new employees in manufacturing, letting day one be observation and slowly bringing them into full duties.

Please comment on whether the standard should require annual acclimatization of all employees at the beginning of each heat season (e.g., the first hot week of the year) and approaches for doing so.

The gradual change in the environment should be sufficient; the exception would be heat waves.

Please comment on whether OSHA should require removal of PPE that may impair cooling during rest breaks.

The recently approved ANSI/ASSP A10.50-2024 consensus standard, *Heat Stress Management in Construction and Demolition Operations*, states in the 2nd and 3rd paragraphs of section 6.2.3 Rest Breaks and Shaded Break Locations that:

> "Rest breaks are commonly used as an administrative control to reduce the overall heat load by providing a temporary cool environment while reducing the metabolic heat load by resting. The length and frequency of rest breaks should increase as the heat exposure potential rises above recommended limits. Cooling the rest area

will enhance the recovery of core temperature and reduce productivity losses due to heat stress and lengthy rest breaks."

"Workers should be encouraged to remove PPE, protective garments, and extra clothing while resting to facilitate sweat evaporative cooling whenever safety considerations allow."

Thus, whenever it is safe to do so, workers should remove extra clothing or take down the top portion of their coveralls to give themselves a better opportunity to cool off while they are resting. Also, rest breaks are another good opportunity to rehydrate.

Please comment on whether employers should be able to select a designee to implement observation in situations where it may not be possible to have a supervisor or heat safety coordinator present.

Yes. The observing employee should be trained and have explicitly delegated responsibility.

Please comment on possible logistical concerns regarding proposed requirements for communication at least every two hours for employees who work alone at the work site; whether there are examples of successful implementation of these types of communication systems; examples of the types of technologies or modes of communication that most effectively support this type communication; and whether there are innovative approaches for keeping employees working alone safe from HRI and allowing for prompt response in an emergency.

Innovative approaches that may allow employers to communicate with employees working alone include using hearing protection devices with integrated radios and wearable devices, which can help monitor employees' vital signs.

Please comment on whether the agency should require annual refresher training or whether the more performance-based supplemental training requirements are sufficient.

The recently approved ANSI/ASSP A10.50-2024 consensus standard, *Heat Stress Management in Construction and Demolition Operations*, states in section 13.5 Retraining Requirements that:

"Retraining shall occur annually and whenever there is a recognized lack of knowledge. Toolbox talks and pre-job meetings are opportunities for a brief retraining session of the important points, for example, whenever a heat wave is

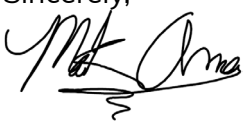
predicted by the National Weather Service. Heat-related issues should also be discussed after a heat-related incident and/or a close call occurs (e.g., when a worker stops working due to signs of heat-related stress due to a lack of understanding of the potential dangers or application of controls)."

Thus, the agency should require annual refresher training, along with regular toolbox talks and posting of hydration charts during the hot season, to help keep workers safe.

Conclusion

If you have any questions about AIHA's comments on this proposed rulemaking or other matters, please contact me at mames@aiha.org or (703) 846-0730. Thank you for your time and consideration.

Sincerely,



Mark Ames
Chief Advocacy Officer
AIHA

About AIHA

AIHA is the association for scientists and professionals committed to preserving and ensuring occupational and environmental health and safety in the workplace and community. Founded in 1939, we support our members with our expertise, networks, comprehensive education programs, and other products and services that help them maintain the highest professional and competency standards. More than half of AIHA's nearly 8,500 members are Certified Industrial Hygienists, and many hold other professional designations. AIHA serves as a resource for those employed across the public and private sectors as well as to the communities in which they work. For more information, please visit www.aiha.org.

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