Global Risk Solutions

Heat Stress and Heat Strain

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With the summer season upon us, many parts of the country are already recording multiple days of 90-degree Fahrenheit temperatures. Preventing heat strain related illnesses such as heat stroke and heat exhaustion is often complicated because of the many variables that compound the heat stress that is imposed on a worker's body.

To help with assessing and preventing occupational health related heat illnesses in workers, this bulletin will highlight some of the key terms, concepts and resources available to help you better manage this serious occupational health risk.

Heat Stress includes a worker's physical exertion to do the job and adjusting to environmental factors such as air temperature and humidity, air movement, work rest regimens, clothing worn and other personal employee variables.

Heat Strain is an individual's physiological response to heat stress. Adverse heat strain, such as heat stroke, heat exhaustion and heat cramps, is what employees must avoid in order to prevent serious illness or death. Managers and supervisors should be trained in recognizing and preventing heat strain illnesses.

Heat Index

Although the Occupational Safety and Health Administration (OSHA) does not have a heat stress standard, OSHA does recommend the use of the heat index as a screening tool.[1] The heat index uses temperature and relative humidity to calculate an adjusted temperature. OSHA and The National Institute of Occupational Safety and Health (NIOSH) have created a Heat Safety Tool App (the "Heat Safety Tool") that is helpful in tracking the heat index.[2]

- Please use caution when using the heat index as other factors may increase risk of heat related illness. For example, a heat index of less than 91.0 degrees Fahrenheit may be classified as low to moderate risk on the Heat Safety Tool, UNLESS other factors such as direct sun, strenuous workload and little air movement are present. Since these other factors are all are very possible in outdoor work situations, employers must be mindful of them!

Acclimatization

This concept is extremely important and one that can be managed by employers. Acclimatization is a gradual physiological process of adaptation to heat conditions involving sweating, heart rate, blood flow, and temperature regulation. Sudden increases in air temperatures are a dangerous factor in causing heat strain because acclimatization is a gradual process where a person adapts to normal working conditions over the course of 7-14 days. For example, the Heat Safety Tool recommends only 20% of heat exposure duration on the first day of work for new workers. Each business should establish an acclimatization schedule for job tasks involving heat exposure. CDC/NIOSH offers additional guidance on heat acclimatization that can be found at this link: https://www.cdc.gov/niosh/topics/heatstress/recommendations.html.[3]

Clothing and Staying Cool

Free movement of cool, dry air over a skin surface allows for heat removal by evaporation and convection. Evaporation of sweat from the skin is the predominant heat removal mechanism. Single layer cloth woven materials that do not impede evaporation are recommended.

Quantifying Heat Stress via Heat Hazard Assessments

- **Quick and Easy**

– **OSHA/NIOSH Heat Safety Tool** – This app can be used as a guideline for heat risk and categorizes heat index risk ranging from minimal risk to extreme risk. The app also provides tips and reminders including heat risk factors such as air temperature, humidity, limited air movement and other variables for your specific geographic location. The heat index can also be obtained via the National Weather Service[4] or via other free weather applications.

– **OSHA's Safety & Health Topics** – Using the Heat Index: A Guide for Employers includes a basic color coded table with heat index, risk level and an example of protective measures that you can customize for your line of work and protective measures you provide in your prevention plan.[5]

Heat Index	Risk Level	Protective Measures
Less than 91°F	Lower (Caution)	Basic heat safety and planning
91°F to 103°F	Moderate	Implement precautions and heighten awareness
103°F to 115°F	High	Additional precautions to protect workers
Greater than 115°F	Very High to	Trigger

Plan Element	Heat Index Risk Level: Lower (Caution)	Moderate	High	Very High/Extreme
Supplies (ensuring adequate water, provisions for rest areas, and other supplies)	✓	✓	✓	✓
Emergency planning and response (preparing supervisors and crews for emergencies)	✓	✓	✓	✓
Worker acclimatization (gradually increasing workloads; allowing more frequent breaks as workers adapt to the heat)	✓	✓	✓	✓
Modified work schedules (establishing systems to enable adjustments to work schedules)		✓	✓	✓
Training (preparing workers to recognize heat-related illness and preventive measures)	✓	✓	✓	✓
Physiological, visual, and verbal monitoring (using direct observation and physiological monitoring to check for signs of heat-related illness)		✓	✓	✓

Review the pages of this guide to learn more about what you can do to protect workers from heat-related illness. Use checklists to assist in planning ahead and in daily planning.

- **Comprehensive Assessments**
  – Protecting employees from heat stress requires incorporating heat related variables into work activities. Whereas the heat index only considers temperature and humidity, the wet bulb globe temperature (WBGT) adjusts the temperature for heat stress factors including air movement, radiant heat and temperature. A calculator used easily on your computer to calculate WBGT is available via this link: http://www.osha.gov/dts/osta/otm/otm_iii/wbgtutil.zip.[6] The calculator can allow you to adopt work/rest regimens for heat recovery by knowing WBGT and work type being conducted.

Heat Strain Prevention

It is important to have a strategy and plan or program to address your heat stress exposures to prevent heat strain. The following elements of a Heat Strain Prevention strategy can be considered:

- Establish an acclimatization schedule for un-acclimated employees-both new and long-term employees
  – Follow recommended acclimatization schedules as suggested by NIOSH for workers https://www.cdc.gov/niosh/topics/heatstress/recommendations.html
  – Adjust work schedules to avoid the hottest part of the day
  – Allow for re-acclimatization after vacations and leaves of absence
- Ensure proper clothing is worn including light colored, reflective, single layer woven materials and head coverings to protect a person's head and face
- Hydration: Provide mandatory rest breaks where cool (< 59 degrees Fahrenheit) potable water is available; Monitor and encourage fluid intake
- Work/rest regimens per WBGT calculations to include limited time in heat and increased recovery time in a cool environment
- Environmental monitoring via phone weather applications that give temperature, humidity, wind speed, sun and cloud information and barometric pressure.
- Trained supervisors and managers who recognize the signs and symptoms of heat strain,[7] and who know the consequences of heat stress variables (double click to enlarge this graphic that outlines types of heat strain symptoms and what to do)
- Provide extra workers for known tasks that require greater physical exertion and greater metabolic rate
- Ensure availability of supplies such as water and ice, in addition to medical personnel to provide first aid in the event of a heat strain related illness
- PPE such as water-cooled clothing where necessary
- QBE Global Risk Solutions offers video training on heat stress and heat strain through Safety Source Productions. To obtain free access to Safety Source videos please contact the Risk Solution Center.

Additional Resources to Help Recognize, Evaluate and Control Heat Stress

- National Weather Service https://www.weather.gov/
- OSHA Using the Heat Index: A Guide for Employers https://www.osha.gov/SLTC/heatillness/heat_index/pdfs/all_in_one.pdf
- NIOSH/CDC https://www.cdc.gov/niosh/topics/heatst ress/

Awareness Tools

- NIOSH Prevent Heat Related Illness Poster – Basic reminders for workers exposed to heat and hot environments. Source: CDC/NIOSH.
- NIOSH Fast Facts: Protecting Yourself from Heat Stress free card for easy access to important safety information. Source: CDC/NIOSH.
- NIOSH Infographic: Protect your workers from Heat Stress Learn some tips to protect workers including: acclimatization, rest breaks, and fluid recommendations. Source: CDC/NIOSH.
- NIOSH Heat Stress Podcast Heat stress can be a major concern for indoor and outdoor workers, especially during the hot summer months. Learn how to identify the symptoms and protect yourself from heat stress. Source: CDC/NIOSH.
- OSHA-NIOSH Info sheet: Protecting Workers from Heat Illness Provides information to employers on measures they should take to prevent heat-related illnesses and death
- Learn the symptoms and what to do if you or a loved one shows signs of having a heat-related illness Español (Spanish). Source: OSHA/CDC/NIOSH.
- OSHA Protecting Workers from Heat Stress Quick Card™ Exposure to heat can cause illness and death. The most serious heat illness is heat stroke (Spanish: PDF Vietnamese: PDF). Source: OSHA.

QBE Global Risk Solutions

Contact the Global Risk Solutions Center for more information at 888.560.2635 or rsc@us.qbe.com.

[1] Source: U.S. Department of Labor, Occupational Safety and Health Administration, www.osha.gov.
[2] Source: CDC/NIOSH, https://www.cdc.gov/niosh/topics/heatstress/heatapp.html.
[3] Source: CDC/NIOSH.
[4] Source: National Weather Service, https://www.weather.gov/safety/heat-index.
[5] Source: U.S. Department of Labor, Occupational Safety and Health Administration, https://www.osha.gov/SLTC/heatillness/heat_index/.
[6] Source: U.S. Department of Labor, Occupational Safety and Health Administration. This product (the calculator) includes software produced by UChicago Argonne, LLC under Contract No. DE-AC02-06CH11357 with the Department of Energy.
[7] Source: CDC

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