

WORKPLACE SOLUTIONS

From the National Institute for Occupational Safety and Health

Preventing Heat-related Illness or Death of Outdoor Workers

Summary

Outdoor workers in agriculture, construction, and other industries are exposed to a great deal of exertional and environmental heat stress that may lead to severe illness or death. The National Institute for Occupational Safety and Health (NIOSH) recommends that employers have a plan in place to prevent heat-related illness. The plan should include hydration (drinking plenty of water), acclimatization (getting used to weather conditions), and schedules that alternate work with rest. Employers should also train workers about the hazards of working in hot environments [NIOSH 1986, 2008, 2010; OSHA-NIOSH 2011].

Description of Exposure

Outdoor workers are exposed to two forms of heat stress: internal metabolic (body) heat generated by exertion

(hard physical labor) and environmental heat arising from working conditions. Moderate to high air temperature, particularly with high humidity; direct sun exposure; heavy or vapor-barrier clothing; and lack of adequate water, rest periods, or cooling off conditions all contribute to environmental heat stress and can make exertional heat stress worse. Workers of all ages are susceptible to heat-related illness, and their symptoms may quickly become worse after exposure. Getting their bodies used to the local weather conditions (acclimatization) may help reduce heat stress effects. Workers who are new to a worksite or returning from an absence of 4 or more days should gradually increase their work load and heat exposure over a week. When a spike in temperature or a heat wave occurs, workers lose their acclimatization to the environment, and the risk of heat stress increases.

NIOSH studied heat-related fatalities of workers in the United States during 1992 through 2006 [CDC 2008]. During this 15-year period, a total of 423 worker deaths

from exposure to environmental heat were reported. Of these 423 deaths, 102 were of workers employed in the agriculture, forestry, fishing, and hunting industries. A total of 68 crop workers died from heat stroke, representing a rate nearly 20 times greater than for all U.S. civilian workers. In 2011, the U.S. Department of Labor stated that 2 of every 1,000 workers are at risk for heat stress and that some occupations—such as logging, firefighting, agriculture, and construction—are at a greater than average risk [U.S. Department of Labor 2011].

Heat-related Illness

The human body tries to reduce the strain from excessive heat by sweating and increasing blood flow to the skin to promote cooling. Heat-related illnesses occur when heat exposure or physical exertion increases to the point at which the body's attempts to cool itself are no longer effective. Heat-related illnesses range from minor heat rash to serious heat stroke. The different forms of heat-related illness—heat rash, heat cramps,

heat syncope (fainting), heat exhaustion, and heat stroke—increase in severity as heat strain increases. This allows for a quick, deadly progression from heat exhaustion to heat stroke.

The loss of fluids and electrolytes from sweating, continued exertion, and environmental heat exposure results in symptoms such as dehydration, rapid heart rate, cramps, dizziness, nausea, fatigue, and core body temperatures of 100°F or above. Alertness and mental capacity are often affected as heat strain increases. Workers and supervisors must be able to recognize heat-related illness symptoms early. If the symptoms go untreated, heat-related illnesses can develop into heat stroke and lead to death.

Heat stroke occurs when body temperature rises above 104°F (40°C). Symptoms include hot and dry skin or profuse sweating, rapid pulse, throbbing headache, dizziness, nausea, confusion, loss of consciousness, and seizures. The body's inability to cool itself down may result in permanent organ damage if the worker survives. If heat stroke is suspected, call 911 immediately and begin first aid by moving the worker to a cool location, removing excess clothing, wetting them down with cool water, and fanning to accelerate the cooling down.

Case Reports

Report 1

A male Hispanic worker aged 56 died of heat stroke after working for 3 days hand-harvesting ripe tobacco leaves on a North Carolina farm [CDC 2008]. On the third day, the man started working at 6:00 a.m. and took a short mid-morning break and a 90-minute lunch break. Mid-afternoon, a supervisor observed the man working slowly and reportedly instructed him to rest, but the man continued working. An hour later, the man appeared confused and coworkers carried him to the shade and tried to get him to drink water. The man was taken by ambulance to an emergency department, where his core temperature was recorded as 108°F and, despite treatment, he died. On the day of the incident, the local temperature was approximately 93°F with 44% relative humidity and clear skies. The heat index (a measurement of how hot it feels when both actual temperature and relative humidity are considered) for the day was in the range of 86–112°F.

Report 2

A 30-year-old male landscape mowing assistant collapsed and died of heat stroke after a day of caring for residential lawns [NIOSH 2002]. Two hours before his death he had complained of feeling light-headed and short of breath, but he refused assistance offered to him by his partner. The worker was on medication that had a warning about exposure to extreme heat, and this could have possibly interfered with body temperature regulation. The landscape worker had been wearing two pairs of work pants on the day he died, but his partner did not notice any profuse sweating or flushed or extremely dry skin. Upon collapse, the victim was treated by EMS personnel at the site and then transported to the hospital. There he was pronounced dead, with an internal temperature of 107.6 °F. On the day of the incident, the maximum air temperature was 81°F.

Controls

Prevention is the best way to avoid heat-related illness. Employers, field supervisors, and workers should follow the recommendations below to reduce the risk of heat-related illness in outdoor workers. NIOSH recommends that employers establish a heat-related illness prevention program that includes the following measures:

- Training for supervisors and workers to prevent, recognize, and treat heat-related illness
- Implementing a heat acclimatization program for workers
- Providing for and encouraging proper hydration with proper amounts and types of fluids
- Establishing work/rest schedules appropriate for the current heat stress conditions (an industrial hygienist may need to be consulted)
- Ensuring access to shade or cool areas
- Monitoring workers during hot conditions
- Providing prompt medical attention to workers who show signs of heat-related illness
- Evaluating work practices continually to reduce exertion and environmental heat stress
- Monitoring weather reports daily and rescheduling jobs with high heat exposure to cooler times of the day



Workers should do the following:

- Drink water or other liquids frequently enough to never become thirsty (about 1 cup every 15–20 minutes). Hydration is the most important tool in preventing heat-related illness, and workers should try to be well-hydrated before arriving at work.
- Eat during lunch and other rest breaks. Food helps replace lost electrolytes.
- Wear light-colored, loose-fitting, breathable clothing such as cotton.
- Wear a wide-brimmed hat when possible.
- Take breaks in the shade or a cool area when possible.
- Be aware that protective clothing or personal protective equipment may increase the risk of heat stress.
- Monitor their physical condition and that of co-workers.

- Tell their supervisor if they have symptoms of heat-related illness.
- Talk with their doctor about medications they are taking and how the medications may affect their tolerance of heat.

Employers and workers should look out for signs of heat-related illness, not only in themselves but also in their coworkers, and be prepared to seek and provide medical assistance [NIOSH 1986].

References

- CDC (Centers for Disease Control and Prevention) [2008]. Heat-related deaths among crop workers—United States, 1992–2006. *MMWR Morb Mortal Wkly Rep* 57(24):649–653.
- NIOSH [1986]. Working in hot environments. 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 No. 86–112.
- NIOSH [2002]. Landscape mowing assistant dies from heat stroke, Michigan. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health. Fatality Assessment and Control Evaluation (FACE) Investigation Report No. 02-MI-75-01 [www.cdc.gov/niosh/face/stateface/mi/02mi075.html].
- NIOSH [2008]. NIOSH safety and health topic: heat stress. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health [www.cdc.gov/niosh/topics/heatstress].
- NIOSH [2010]. NIOSH fast facts: protecting yourself from heat stress. 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 No. 2010–114 [www.cdc.gov/niosh/docs/2010-114/pdfs/2010-114.pdf].
- OSHA-NIOSH [2011]. OSHA-NIOSH infosheet: protecting workers from heat illness. 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 No. 2011–174 [www.cdc.gov/niosh/docs/2011-174/pdfs/2011-174.pdf].
- U.S. Department of Labor [2011]. Occupational outlook handbook, 2010–2011. New York: Skyhorse Publishing.

DEPARTMENT OF HEALTH AND HUMAN SERVICES

Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health
4676 Columbia Parkway
Cincinnati, OH 45226-1998

Official Business
Penalty for Private Use \$300



For More Information

Information about Heat Stress can be found on the following Web sites:

<http://www.cdc.gov/niosh/topics/heatstress/>
<http://www.osha.gov/SLTC/heatillness/index.html>
http://www.osha.gov/SLTC/heatillness/heat_index/heat_app.html
To obtain information about other occupational safety and health topics, contact NIOSH at:

Telephone: 1-800-CDC-INFO (1-800-232-4636)
TTY: 1-888-232-6348 • CDC INFO: www.cdc.gov/info

or visit the NIOSH Web site at www.cdc.gov/niosh

For a monthly update on news at NIOSH, subscribe to *NIOSH eNews* by visiting www.cdc.gov/niosh/eNews. Mention of any company or product does not constitute endorsement by NIOSH. In addition, citations to Web sites external to NIOSH do not constitute NIOSH endorsement of the sponsoring organizations or their programs or products. Furthermore, NIOSH is not responsible for the content of these Web sites.

This document is in the public domain and may be freely copied or reprinted. NIOSH encourages all readers of the *Workplace Solutions* to make them available to all interested employers and workers.

As part of the Centers for Disease Control and Prevention, NIOSH is the Federal agency responsible for conducting research and making recommendations to prevent work-related illness and injuries. All *Workplace Solutions* are based on research studies that show how worker exposures to hazardous agents or activities can be significantly reduced

Preventing Heat-related Illness or Death of Outdoor Workers

DHHS (NIOSH) Publication No. 2013-143