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Heat Stress Prevention Planning and Guidance Materials for Supervisors

Purpose:

The purpose of this document is to provide information and guidance to supervisors to minimize the likelihood of a heat-related illness, provide acclimatization recommendations for new employees, employees returning from an extended leave, developing work rest cycles and controls for heat exposure. The EH&S department can be contacted to aid in determining controls to reduce exposures.

Many factors have a role in creating occupational heat stress to workers such as:

1. Environmental conditions (air temperature, humidity, sunlight, and air speed), especially on sequential days. This can include the presence of heat sources (ovens, furnaces, steam lines) in the work area.
2. Level of physical activity of the work being performed. The workload contributes to body heat production.
3. Individual/personal risk factors

Acclimatization:

New employees are the most at-risk population for heat-related illness because they may not be acclimatized to heat. New workers that have previously worked in hot environments may not need time to acclimatize.

To prevent heat-related illness new workers need approximately 1-2 weeks to acclimatize to working in hot environments and should spend shorter periods of time working in hot environments. OSHA and NIOSH recommend the "Rule of 20 percent" for building heat tolerance. Starting new employees at full intensity is not safe.

- 20% First Day: New workers should work only 20 percent of the normal duration in the heat on their first day
- 20% Each Additional Day: Increase work duration by 20 percent on subsequent days until the worker is performing a normal schedule.

*Adjustments to the acclimatization schedule may be needed depending on the worksite's situation and on individual/personal risk factors.

See the table below for a new worker acclimatization schedule recommended by NIOSH.



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NIOSH Acclimatization Recommendations for *New Workers*

1st day	20% usual work duration
2nd day	40% usual work duration
3rd day	60% usual work duration
4th day	80% usual work duration
5th day	100% usual work duration

Existing workers can lose heat tolerance during an extended absence after heat exposure stops (vacation or sick leave) when absent from work for a week or more. After one month away from work in the heat, most people’s heat tolerance will have returned to baseline.

See the table below for the NIOSH recommended acclimatization schedule for an existing worker returning to work from an extended absence.

NIOSH Acclimatization Recommendations for Workers with Previous Experience with the Same Job

1st day	50% usual work duration
2nd day	60% usual work duration
3rd day	80% usual work duration
4th day	100% usual work duration

*It is important to note that sudden shifts in work intensity or sudden increases in environmental temperature can increase the risk for heat illness even for acclimatized workers.

Personal Risk Factors:

The risk of heat stress varies from person to person because personal risk factors can influence an individual’s tolerance to heat.

Health Conditions that reduce heat tolerances:

- Short-term illnesses such as diarrhea, vomiting, or respiratory infections
- Chronic conditions such as diabetes and heart disease
- Pregnancy
- Prior heat related injury
- Cardiac or kidney disease
- Being overweight or obese
- Poor physical fitness



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Heat tolerance can be affected by medications taken for:

- Cold, allergies and congestion
- Muscle spasms
- Blood pressure
- Urine production (diuretics)
- High blood pressure
- Diarrhea
- Dizziness/vertigo
- Psychosis
- Depression

Additional risk factors:

- Age over 60
- Wearing more than one layer of clothing or non-breathable clothing
- PPE that adds extra layers of clothing or impermeable PPE such as disposable coveralls
- Alcohol use in the past 24 hours

Although employees are not required to disclose personal risk factors to management, it is your responsibility to be aware of symptoms of heat stress to respond appropriately. When in doubt, cool the worker and call 911.

Symptoms of Heat Stress:

Heat Rash/Prickly Heat: is skin irritation caused by excessive sweating during hot, humid weather.

- Symptoms include: red cluster of pimples or small blisters, usually on neck, upper chest, groin, under breasts and in elbow creases.
- First Aid Measures: work in a cooler less humid environment, if possible. Keep the rash area dry. Apply powder to increase comfort. Do not use ointments and creams.

Heat Cramps: usually affect workers who sweat a lot during strenuous activity causing loss of the body's salt and moisture levels. Low salt levels in muscles cause painful cramps. Heat cramps may also be a symptom of heat exhaustion.

- Symptoms include muscle cramps, pain or spasms in the abdomen, arms or legs.
- First Aid: Drink water and have a snack or drink that replaces carbohydrates and electrolytes (such as sports drinks) every 15 to 20 minutes. Avoid salt tablets. Get medical help if the worker: has heart problems, is on a low sodium diet, has cramps that do not subside within 1 hour.



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Heat Syncope: is a fainting (syncope) episode or dizziness that usually occurs when standing for too long or suddenly standing after sitting or lying. Factors that may contribute to heat syncope include dehydration and lack of acclimatization.

- Symptoms include fainting of a short duration, dizziness, light-headedness from standing too long or suddenly rising from a sitting or lying position.
- First Aid: sit or lie down in a cool place. Slowly drink water, clear juice or a sports drink.

Rhabdomyolysis: is a medical condition associated with heat stress and prolonged physical exertion. Rhabdomyolysis causes the rapid breakdown, rupture, and death of muscle. When muscle tissue dies, electrolytes and large proteins are released into the bloodstream. This can cause irregular heart rhythms, seizures, and damage to the kidneys.

- Symptoms include muscle cramps/pain, abnormally dark (tea or cola-colored) urine, weakness, exercise intolerance, sometimes can be asymptomatic.
- First Aid: workers with symptoms of rhabdomyolysis should stop activity, drink more liquids (water preferred), seek immediate care at the nearest medical facility, ask to be checked for rhabdomyolysis (i.e., blood sample analyze for creatine kinase).

Heat Exhaustion: is the body's response to an excessive loss of water and salt, usually through excessive sweating and most likely to affect: the elderly, people with high blood pressure, those working in a hot environment.

- Symptoms include headache, nausea, dizziness, weakness, irritability, thirst, heavy sweating, elevated body temperature, decreased urine output.
- First Aid: remove worker from the hot area and give liquids to drink, remove unnecessary clothing, including shoes and socks, cool the worker with cold compresses or have the worker wash their head, face, and neck with cold water, encourage frequent sips of cool water, if symptoms do not improve, worsen or symptoms of heat stroke are observed, call 911.

Heat Stroke: is the most serious heat-related illness. It occurs when the body can no longer control its temperature: the body's temperature rises rapidly, the sweating mechanism fails, and the body is unable to cool down. When heat stroke occurs, the body temperature can rise to 106 °F or higher within 10 to 15 minutes. Heat stroke can cause permanent disability or death if the person does not receive emergency treatment.

- Symptoms include confusion, altered mental status, slurred speech, loss of consciousness (coma), hot and dry skin or profuse sweating, seizures, very high body temperature, fetal if treatment delayed
- First Aid: call 911 for emergency care, stay with the worker until emergency medical services arrive, move the worker to a shaded, cool area and remove outer clothing, circulate the air



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around the worker to speed cooling, place cold wet cloth or ice on the head, neck, armpits, and groin; or soak the clothing with cool water.

- Cool the worker quickly using the following methods:
 - with a cold water or ice bath, if possible
 - wet the skin
 - place cold wet cloths on the skin
 - soak clothing with cool water.



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Work Rest Cycles

The intensity of work being performed is a critical factor in preventing heat stress as the harder the employee works the faster the body generates heat. This is known as metabolic heat production. Heavy and very heavy metabolic rates require substantial rest periods.

The table on the right provides NIOSH guidance for suggested work/rest cycles for workers wearing normal work clothing. The guidance assumes the workers are physically fit, well-rested, fully hydrated, under age 40, have adequate water intake and that there is 30% relative humidity and natural ventilation with perceptible air movement.

To adjust the work/rest cycle guidance to account for humidity and sun conditions utilize the following additions and subtractions:

Full sun (no clouds): Add 13°

Partly cloudy/overcast: Add 7°

No shadows visible/work is in the shade, indoors or at night: no adjustment

Per relative humidity:

10%: Subtract 8°

20%: Subtract 4°

30%: No adjustment

40%: Add 3°

50%: Add 6°

60%: Add 9°

‡High levels of heat stress; consider rescheduling activities.

Adapted from EPA [1993]

Temperature (°F)	Light Work Minutes Work/Rest	Moderate Work Minutes Work/Rest	Heavy Work Minutes Work/Rest
90	Normal	Normal	Normal
91	Normal	Normal	Normal
92	Normal	Normal	Normal
93	Normal	Normal	Normal
94	Normal	Normal	Normal
95	Normal	Normal	45/15
96	Normal	Normal	45/15
97	Normal	Normal	40/20
98	Normal	Normal	35/25
99	Normal	Normal	35/25
100	Normal	45/15	30/30
101	Normal	40/20	30/30
102	Normal	35/25	25/35
103	Normal	30/30	20/40
104	Normal	30/30	20/40
105	Normal	25/35	15/45
106	45/15	20/40	Caution
107	40/20	15/45	Caution
108	35/25	Caution	Caution
109	30/30	Caution	Caution
110	15/45	Caution	Caution
111	Caution	Caution	Caution
112	Caution	Caution	Caution

Table is from NIOSH Publication Work Rest Schedules.
<https://www.cdc.gov/niosh/mining/UserFiles/works/pdfs/2017-127.pdf>



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Examples of Work at Different Intensity Levels:

Light	Moderate	Heavy
Operating equipment	Carrying equipment/supplies weighing 20-40 pounds	Carrying equipment/supplies weighing 40 pounds or more
Inspection work	Raking, light shoveling (less than 10 pounds per minute)	Climbing
Walking on flat, level ground	Planting trees and trimming shrubs	Installing utilities
Using light hand tools (wrench, pliers, etc.). However, this may be moderate work depending on the task	Pushing power lawn mower	Swinging an axe, hand splitting logs
Standing watch	General carpentry	Welding

Control of Heat Stress:

Ensuring employees drink an adequate amount of water, take frequent breaks, and seek out shade or cooler locations while taking a break are simple controls to prevent heat-related illnesses. OSHA's heat stress campaign emphasizes the importance of water, rest, and shade.

Hydration is essential in preventing heat stress. Employees should have access to potable water that is less than 59°F and made accessible near the work area. Job planning should include an estimation of how much water is needed and identifying someone to get and check on water supplies.

- For moderate activities in the heat that last less than 2 hours, drink 1 cup (8 oz.) of water every 15-20 minutes.
- If sweating lasts for several hours, drink sports drinks containing balanced electrolytes.
- Generally, fluid intake should not exceed 6 cups per hour.

If necessary, individual drinking cups should be provided for each worker. Workers should be encouraged to hydrate themselves during the day. Workers should be encouraged to avoid alcohol and drinks with high caffeine or sugar.

Rest Breaks should be permitted and encouraged to allow workers time to cool down and hydrate. Permit rest and water breaks when a worker feels heat discomfort. Modify work/rest periods to give the body a chance to get rid of excess heat. Assign new and unacclimatized workers lighter work and longer, more frequent rest periods.

Shorten work periods and increase rest periods:



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- As temperature, humidity, and sunshine increase.
- When there is no air movement.
- If protective clothing or equipment is worn.
- For heavier work.

Engineering controls are utilized to make the work environment cooler and to utilize mechanical equipment to reduce manual labor. Examples include:

- air conditioning,
- increased general ventilation,
- cooling fans,
- use of local exhaust ventilation at points of high heat production or moisture,
- reflective shield to redirect radiant heat,
- insulation of hot surfaces (such as furnace walls),
- elimination of steam leaks,
- cooled seats of benches for rest breaks,
- use of mechanical equipment to reduce manual work,
- misting fans that produce a spray of fine water droplets

Work practice controls are utilized to modify work practices when worksites cannot be cooled through engineering controls. Examples include:

- Modify work schedules and activities for workers who are new to warm environments
 - Schedule shorter periods of time working in the heat for newly hired workers and unacclimatized workers. Gradually increase heat exposures over the first 1-2 weeks.
 - Require workers to take breaks in a cooler environment (such as a shady location, under a canopy tent, or in an air-conditioned building). Duration of the rest breaks should increase as heat stress rises
 - Schedule the most strenuous tasks during a cooler time of day, such as early morning or late afternoon
 - Reduce physical demands as much as possible by planning the work to minimize manual effort
 - Rotate job functions among workers to help minimize exertion and heat exposure
 - Ensure workers drink an adequate amount of water or electrolyte-containing fluids
 - Workers should watch out for each other's symptoms of heat-related illness prepared to administer first aid to anyone who is developing a heat-related illness.
- Personal Protective Equipment should be used in limited situations where engineering controls and work practice controls are not feasible in reducing



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The EH&S department can be contacted to assist with evaluating PPE for operations with high heat stress.

OSHA NIOSH Heat Stress Safety Tool Smartphone App

OSHA and NIOSH have developed a smartphone app that forecasts real-time heat index, identifies risk levels to outdoor workers that include health recommendations and controls for preventing heat related illness, and provides hourly forecasts. This app is useful resource for planning outdoor work activities based on how hot it feels throughout the day. It is available in the Google Play Store and the Apple App Store by searching “OSHA NIOSH Heat Safety Tool”.



OSHA-NIOSH Heat Safety Tool 15+
Centers For Disease Control and Prevention
#12 in Weather
4.4 ★ (2.5k+ ratings)
Free

OSHA Heat Stress Materials:

- [Prevent Heat Illness at Work](#)
- [Protecting Workers from Heat Illness](#)
- [Protecting Workers from the Effects of Heat](#)
- [Quick Card: Protecting Workers from Heat Stress](#)

NIOSH Heat Stress Materials:

- [Heat Stress Risk Factors](#)
- [Prevent Heat-Related Illness](#)
- [Heat Stress Work/Rest Schedules](#)
- [Heat Stress Acclimatization](#)
- [Heat Stress: Hydration](#)

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