

OAR 437-002-0156

Appendix A:

Mandatory Information for Heat Illness Prevention

To protect the health and safety of employees from heat-related illnesses, employers should consider using the resources in this appendix. Please note that some resources may use temperatures in Celsius instead of Fahrenheit. To convert to degrees Fahrenheit, use this formula: Fahrenheit (°F) = (Celsius x 1.8) + 32

1. Most heat-related illnesses affect workers who do strenuous physical activity. When workers engage in intense work, their bodies create heat. This "metabolic" heat combines with environmental heat (from temperature, sunlight, humidity, etc.) so workers' core temperature can rise to dangerous levels. To prevent a hazardous combination of environmental and metabolic heat, employers should be aware of workers' activity level.

Workload can be classified as rest, light, moderate, heavy, or very heavy.

- Light: Sitting or standing with minimal arm and leg work.
- Moderate: Continuous modest intensity, such as light pushing/pulling or normal walking.
- Heavy: Intense upper body work such as carrying loads or sawing.
- Very heavy: Intense activity at an almost maximum pace.

Table 1.1 Metabolic Heat and Workload (Physical Activity Level)

Level of Workload / Physical Activity *	Examples	Metabolic Rate in Watts, "typical" recognizing that different ways of doing the same task may lead to dramatically different wattage
Rest	<ul style="list-style-type: none">• Sitting• Thinking	115
Light	<ul style="list-style-type: none">• Sitting with minimal hand and arm work• Sewing• Writing or drawing• Driving a car• Occasional or slow walking• Stooping, crouching, or kneeling• Standing watch	180
Moderate	<ul style="list-style-type: none">• Pushing and pulling light carts• Hammering nails• Picking fruit or vegetables	300

	<ul style="list-style-type: none"> • Continuous normal walking • Driving or operating mobile equipment • Raking • Mopping or vacuuming floors • Scraping, painting, or plastering • Laundry/dry cleaning • Tapping and drilling • Machining • Molding • Packaging • Laboratory work • Cooking • General carpentry • Using hand tools • Light pushing/pulling or normal walking. 	
Heavy	<ul style="list-style-type: none"> • Intense arm and trunk work • Carrying loads • Shoveling • Sawing or heavy carpentry • Roofing • Pushing and pulling heavy carts or wheelbarrows • Fast walking (> 4 mph) • Landscaping • Casting • Manual raising and lowering loads • Stacking lumber • Truck and automobile repair • Waxing and buffing by hand • Welding • Heavy item assembly • Grinding and cutting • Drilling rock or concrete • Mixing cement • Felling trees 	415
Very heavy	<ul style="list-style-type: none"> • Any activity done at near maximum pace • Climbing stairs, ladder, or ramp • Using an axe • Intense shoveling or digging • Sledgehammer use • Stacking concrete • Brick or stone masonry 	520

* Workers who are overweight or obese might produce more metabolic heat than other workers who perform the same tasks. The above table assumes a 70-kg (154-pound) worker.

Table 1.1 is copied from federal OSHA’s guidance on Heat Hazard recognition, which can be accessed at: <https://www.osha.gov/heat-exposure/hazards> under the Metabolic Heat and Workload (Physical Activity Level) tab

2. The OSHA-NIOSH Heat Safety Tool app is a useful resource for planning outdoor work activities based on how hot it feels throughout the day. It features real-time heat index and hourly forecasts specific to your location, as well as occupational safety and health recommendations from OSHA and NIOSH. It can be accessed and downloaded at: <https://www.osha.gov/heat/heat-app>

3. NIOSH Work/rest schedules.

A. Table 3.1. Work/rest schedules for workers wearing normal work clothing*

Adjusted 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‡

*With the assumption that workers are physically fit, well-rested, fully hydrated, under age 40, and have adequate water intake and that there is 30% RH [relative humidity] and natural ventilation with perceptible air movement.

†Note: Adjust the temperature reading as follows before going to the temperature column in the table: Full sun (no clouds): Add 13°
 Partly cloudy/overcast: Add 7°
 No shadows visible/work is in the shade 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]

Table 3.1 above is copied from the following publication; see page 76 in NIOSH [2016]. *NIOSH criteria for a recommended standard: occupational exposure to heat and hot environments*. By Jacklitsch B, Williams WJ, Musolin K, Coca A, Kim J-H, Turner N. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication 2016-106.

B. Table 3.2 Work/rest schedules for those wearing chemical resistant suits.

Air Temp (°F)	Light work			Moderate work			Heavy work		
	Full sun	Partly cloudy	No sun†	Full sun	Partly cloudy	No sun†	Full sun	Partly cloudy	No sun†
75	Normal	Normal	Normal	Normal	Normal	Normal	35/25‡	Normal	Normal
80	30/30	Normal	Normal	20/40	Normal	Normal	10/50	40/20	Normal
85	15/45	40/20	Normal	10/50	25/35	Normal	Caution [§]	15/45	40/20
90	Caution [§]	15/45	40/20	Caution [§]	Caution [§]	25/35	Stop work	Caution [§]	15/45
95	Stop work	Stop work	15/45	Stop work	Stop work	Stop work	Stop work	Stop work	Stop work

¶With the assumption that workers are heat-acclimatized, under the age of 40, physically fit, well-rested, fully hydrated, and wearing Tyvek coveralls, gloves, boots, and a respirator. Cooling vests may enable workers to work for longer periods. Adjustments must be made when additional protective gear is worn.

†No shadows are visible or work is in the shade or at night.

‡35 minutes work and 25 minutes rest each hour.

§High levels of heat stress; consider rescheduling activities.

Adapted from EPA [1993]

Table 3.2 above is copied from the following publication; see page 77 in NIOSH [2016]. *NIOSH criteria for a recommended standard: occupational exposure to heat and hot*

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

4. Acclimatization.

Table 4.1 Acclimatization in workers

Topics	Additional information
Disadvantages of being unacclimatized	<ul style="list-style-type: none"> • Readily show signs of heat stress when exposed to hot environments. • Difficulty replacing all of the water lost in sweat. • Failure to replace the water lost will slow or prevent acclimatization.
Benefits of acclimatization	<ul style="list-style-type: none"> • Increased sweating efficiency (earlier onset of sweating, greater sweat production, and reduced electrolyte loss in sweat). • Stabilization of the circulation. • Work is performed with lower core temperature and heart rate. • Increased skin blood flow at a given core temperature.
Acclimatization plan	<ul style="list-style-type: none"> • Gradually increase exposure time in hot environmental conditions over a period of 7 to 14 days. • For new workers, the schedule should be no more than 20% of the usual duration of work in the hot environment on day 1 and a no more than 20% increase on each additional day. • For workers who have had previous experience with the job, the acclimatization regimen should be no more than 50% of the usual duration of work in the hot environment on day 1, 60% on day 2, 80% on day 3, and 100% on day 4. • The time required for non-physically fit individuals to develop acclimatization is about

	50% greater than for the physically fit.
Level of acclimatization	<ul style="list-style-type: none"> Relative to the initial level of physical fitness and the total heat stress experienced by the individual.
Maintaining acclimatization	<ul style="list-style-type: none"> Can be maintained for a few days of non-heat exposure. Absence from work in the heat for a week or more results in a significant loss in the beneficial adaptations leading to an increased likelihood of acute dehydration, illness, or fatigue. Can be regained in 2 to 3 days upon return to a hot job. Appears to be better maintained by those who are physically fit. Seasonal shifts in temperatures may result in difficulties. Working in hot, humid environments provides adaptive benefits that also apply in hot, desert environments, and vice versa. Air conditioning will not affect acclimatization.

Adapted from [Moseley 1994; Armstrong and Stoppani 2002; DOD 2003; Casa et al. 2009; ACGIH 2014; OSHA-NIOSH 2011].

Table 4.1 above is copied from the following publication; see page 34. NIOSH [2016]. *NIOSH criteria for a recommended standard: occupational exposure to heat and hot environments*. By Jacklitsch B, Williams WJ, Musolin K, Coca A, Kim J-H, Turner N. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication 2016-106.

5. Clothing adjustment factors.

Table 5.1 Clothing adjustment factors exist for various types of clothing.

Clothing	Clothing adjustment factors (°C-WBGT)	
	Previous	2006
Work clothing (baseline)	0	0
Cloth coveralls	3.5	0
Double-layer cloth clothing	5	3

Spunbound melt-blown synthetic (SMS) coveralls	-	0.5
Polyolefin coveralls	-	1
Limited-use vapor-barrier coveralls	-	11

Adapted from Bernard TE, Threshold Limit Values for Physical Agents Committee, ACGIH [2014].

Table 5.1 above is copied from the following publication; see page 19. NIOSH [2016]. *NIOSH criteria for a recommended standard: occupational exposure to heat and hot environments*. By Jacklitsch B, Williams WJ, Musolin K, Coca A, Kim J-H, Turner N. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication 2016-106.