

HEAT STRESS POLICY

Heat stress generally describes the effect of heat, from any source, on the organs of the body and the person as a whole. The stresses of heat on the body manifest themselves in four common ailments: heat exhaustion, heat cramps, heat stroke, and heat rash.

Heat stress is due primarily to sustained exertion in a warm or hot environment. The following factors may contribute to an individual susceptibility to heat stress:

- Personal physical fitness
- Degree of acclimatization
- Rate that water and salt are lost through perspiration are replenished
- Recent alcohol intake
- Dehydration
- Obesity
- Medication such as diuretics, sedatives, tranquilizers, anticholinergic drugs, and some heart and pressure medications

The potential for heat stress is greatest when working for extended periods of time near heat sources, or when an employee is required to wear protective clothing for extended periods. During hot weather, the potential for heat stress is present in any non-air-conditioned work location where apparent temperatures exceed 90 degrees F (33 degrees C).

Definitions

- **Acclimatization** – Physiological adjustment to environmental change.
- **Apparent Temperature** – A temperature derived at by taking the ambient temperature and factoring in the relative humidity.
- **Biological Monitoring (Biomonitoring)** – The use of biological responses to assess changes in the environment, generally changes due to anthropogenic causes (of, relating to, or resulting from the influence of human beings on nature).
- **Convective Heat** – Heat transfer through circulation of air. Convective heat also represents the amount of heat energy transferred between the skin and air.
- **Dehydration** – The process of depletion of bodily fluids.
- **Heat Stress** – A physiological reaction that occurs when the body is accumulating heat faster than it can be dissipated. Heat stress situations include heat cramps, heat exhaustion, and heat stroke.
- **Metabolic Heat** – Heat produced by the body from the oxidation of food.
- **Radiant Heat** – A form of electromagnetic energy (from sources such as red-hot metal, open flames, and the sun) that heats through absorption by an object without physical contact.
- **Wet-Bulb Globe Temperature (WBGT)** – An index that correlates with deep body temperature and other physiological responses to heat.

Requirements

Work Area Surveillance

Since measurement of deep body temperature is an impractical method of monitoring an employee's heat load, ambient environmental factors are measured instead. These environmental factors are similar to deep body temperature and other physiological response to heat. The most widely accepted measure of environmental heat factors is the WBGT. This measure will be used to monitor ambient project temperature, specific work areas, and activities to determine heat stress factors.

Biological Monitoring

Employees will be instructed on how to monitor their heat stress by means of biological monitoring. Biological monitoring will commence when the temperatures reach 72.5 degrees F (22 degrees C) and at the frequency as defined below:

- 33°C/90°F or above after 45 minutes
- 31° C – 33° C /87.5° F – 90° F after 60 minutes
- 28° C – 31° C/82.5° F – 87.5° F after 90 minutes
- 25° C – 28° C/77.5° F – 82.5° F after 120 minutes
- 22° C – 25° C/72.5° F – 77.5° F after 150 minutes

The employee will monitor the radial pulse at the beginning of a rest period. If the heart rate exceeds 110 beats per minute the work cycle must be shortened by 1/3, while the rest period remains the constant.

Engineering Controls

- Convective heat gain, which occurs when air temperature exceeds skin temperature. Clothing affects the exchange of heat between the body and the environment. Controls are as follows:
 - Employees will be instructed on the types of cloth that provide the best ventilation (such as natural fiber) and types of cloth to avoid that retain body heat (such as synthetic fibers).
- Radioactive heat gain, which occurs when the temperature of surroundings solid objects exceeds skin temperature. Controls are as follows:
 - Placing shields or barriers that are radiant-reflective or heat-absorbent between the source of radiant heat and employees.
 - Isolating the source of radiant heat.
 - Modifying an operation or process.
- Evaporative heat loss, which occurs when the body loses excess heat through evaporation. Controls to increase heat loss are as follows:

- Increasing air movement around employees by fan or natural ventilation.
- Reducing the water – vapor content of air by air-conditioning.

Administrative Controls

When engineering controls are inadequate or not feasible, work modifications and hygienic practices will be implemented to control exposures to both environmental and metabolic heat. Controls that define preventive work and hygienic practices are as follows:

- Limiting the time an employee spends in a hot environment by means of the work/rest cycle program.
- Reducing the metabolic demands of the job through mechanization, use of special tools, or increase in the number of employees assigned to the task.
- Raising heat tolerance by means of the heat acclimatization program.
- Training supervisors and employees to prevent heat stress conditions, recognize early symptoms of heat illnesses, and first-aid procedures.
- Implementing a buddy system in which employees observe fellow employees for early symptoms of heat stress such as weakness, unsteady gait, irritability, perspiration levels, disorientation, or changes in skin color.
- Providing adequate amounts of cool 50-59 degrees F (10-15 degrees C) potable water in the work area and instructing employees to drink one cup of water every 15 to 20 minutes.

Information and Training

All employees assigned to work areas where there is the potential of heat injury or illness will be provide with the continuing safety and health education programs that keep them informed on the following topics:

- Heat stress hazards
- Signs and symptoms of heat injury and illness
- Heat stress prevention and first-aid procedures
- Work practices and control procedures that protect the health and safety of employees, including reporting the development of heat stress symptoms
- Effects of therapeutic drugs, over-the-counter medications, and alcohol that may reduce heat tolerance and increase the risk of heat injury or illness
- Proper use of protective clothing and equipment

Heat stress training will be included in the site orientation, and continuous education will be provided as part of the weekly supervisors' safety meetings and craft toolbox topics.

Heat stress controls will be included in the daily job safety analysis (JSA) during the peak months and any time there is the potential of radioactive heat gain caused by surrounding process pipes, equipment, etc.

Liquid electrolyte supplements will not be provided on the project because of medical conditions that can be aggravated by the supplements and the potential for the supplements to be consumed improperly, potentially contributing to heat stress problems. Electrolyte tablets should be provided at the tool room and first-aid facility, and proper diets should be included as part of the education program.

The schedule for water distribution will be such that distribution is complete 30 minutes after start of work. Provisions will be made for replenishing water kegs during the course of the day to ensure that an ample cool water supply is always available in the work areas.

Apparent Temperature Index chart

Heat Index

Air Temperature

°F/°C

70/21 76/24 81/27 85/29 90/32 95/35 100/38 105/41 110/43 115/46 120/49

Relative Humidity	Apparent temperature(°F/°C)										
0%	64/18	70/21	73/23	79/26	82/28	88/31	91.4/33	95/35	99/37	102/39	108/42
10%	64/18	70/21	75/24	81/27	84/29	90/32	95/35	100/38	106/41	111/44	117/47
20%	66/19	77/22	77/25	82/28	88/31	93/34	99/37	106/41	111/44	120/49	129/54
30%	66/19	73/23	79/26	84/29	90/32	97/36	104/40	113/45	124/51	135/57	148/64
40%	68/20	73/23	79/26	86/30	93/34	100/38	109/43	122/50	137/58	151/66	
50%	70/21	75/24	79/27	88/31	97/36	108/42	120/49	135/57	151/66		
60%	70/21	75/24	82/28	90/32	100/38	115/46	133/56	149/65			
70%	70/21	77/25	84/29	93/34	106/41	124/51	144/62				
80%	72/22	79/26	86/30	97/36	113/45	137/58	156/69				
90%	72/22	79/26	88/31	102/39	122/50	151/66	171/77				
100%	72/22	81/27	91/33	108/42	133/56	165/74					

HEAT STRESS DANGERS POSED BY APPARENT TEMPERATURES

90-100 Degrees F (32-39 Degrees C):

Sunstroke, heat cramps, and heat exhaustion are possible with prolonged exposure and physical activities.

105-129 Degrees F (41-54 Degrees C):

Sunstroke, heat cramps, and heat exhaustion likely. Heat stroke possible with prolonged exposure and physical activities.

129 Degrees F (54 Degrees C) or Higher:

Heat stroke or sunstroke imminent.

WORK/REST REGIMENT

WORK RATE CHART

CATEGORY	TYPE OF ACTIVITY	EXAMPLES
Light	Sitting with moderate arm and trunk movement.	Inspections and surveys with minimal climbing.
	Sitting with moderate arm and leg movement.	Supervising or monitoring areas or equipment.
	Standing; light work at machine or bench.	Stationary welding.
	Standing; light work with some walking and minimal climbing.	Bench work.
Moderate	Standing with moderate work and some walking.	Painting.
	Walking with moderate lifting or pushing.	Floor cleaning.
	Walking with occasional ladder or stair climbing.	Insulation removal or installation.
		Fitting and welding light pieces.
Heavy		Surveys and inspections with moderate climbing.
	Walking with frequent stair or ladder climbing.	Scaffold erection.
	Heavy lifting, pushing, or pulling.	Transporting equipment by shoveling.
		Shoveling.

RECOMMENDED WORK TIME LIMITS

Temperature Range (EF)	Light Work				Moderate Work				Heavy Work				Supplied Air Hood/Helmets (hours)	Vortex Tube Suit (hours)
	Single PCs (min)	Double PCs (min)	Wet Suit (min)	Ice Vest (min)	Single PCs (min)	Double PCs (min)	Wet Suit (min)	Ice Vest (min)	Single PCs (min)	Double PCs (min)	Wet Suit (min)	Ice Vest (min)		
60-65	No Limit	240	180	No Need	No Limit	240	180	No Need	No Limit	240	120	160	4	4
65-70	No Limit	240	180	No Need	No Limit	240	120	180	No Limit	240	75	145		
70-75	No Limit	240	120	180	No Limit	180	80	150	No Limit	180	55	130	4	4
75-80	No Limit	180	75	160	No Limit	140	50	130	240	80	40	115		
80-85	240	150	50	140	210	80	40	120	180	50	30	105	4	4
85-90	180	70	40	120	150	50	30	110	90	40	25	95		
90-95	100	45	30	110	80	30	25	95	45	25	20	85	3	4
95-100	60	35	25	100	40	20	20	90	25	20	20	80		
100-105	25	25	20	90	20	20	20	80	15	15	15	75	2-1/2	3
105-110	20	20	20	80	20	15	15	75	15	15	15	70		
110-115	15	15	15	75	15	15	15	70	15	15	15	65	2	3
115-120	15	15	15	70	15	15	15	65	15	10	15	60		
120-125	15	15	15	65	15	15	10	60	10	10	10	55	1-1/2	2
125-130	10	10	10	60	10	10	10	55	10	10	10	50		
130-135	10	10	10	55	10	10	10	50	10	10	10	45	1	2
135-140	10	10	10	50	10	10	10	50	10	10	10	45		

NOTES:

1. A minimum rest period of 15 minutes must be given.
2. Use a single PCs schedule for work in normal street clothes.
3. Schedule for WET SUIT also pertains to work in CHEMICAL SUITS.
4. Schedule for ICE VEST pertains to all conditions where ice vests are used, including when ice vests are worn under PCs and WET SUITS.