

BP OIL -- TOLEDO REFINERY

Certified	Area: Refinery Wide	Procedure No.: SAF 090
Effective Date: December 10, 2004	Heat Stress Management Guideline	Rev. No.: 0
Written By: Jean Mlynek	Auth. By: J.R. Cotner (Signature on file)	Page 1 of 4

SCOPE	This document will help guide supervisors who manage jobs that involve work in elevated air temperatures, radiant heat, high humidity, physical contact with hot objects, or strenuous physical activities in hot environments.
HEALTH Special PPE & Special Hazards	Several heat disorders can result if the body core temperature rises over 100.4 ^o F. Normal body core temperature is 98.6 ^o F.
SAFETY	Mental and physical performance can be altered as a result of heat stress which could lead to an injury or an accident.
REFERENCE DOCUMENTS	<ul style="list-style-type: none"> • OSHA Technical Manual, US DOL, 1995. • ACGIH TLV Handbook, 1999. • Principles of Industrial Hygiene, National Safety Council Third Edition, 1993. • National Oceanic and Atmospheric Administration
SPECIAL MATERIALS & EQUIPMENT	Wet Bulb Globe Thermometer (WBGT) Ice Vests, Fire Blankets, Air Movers
QUALITY	Improved health and productivity will result in workers who are not exposed to excess heat stress.
ENVIRONMENTAL	Ambient air temperatures, air movement, water vapor pressure (humidity), and radiant heat are environmental factors to be considered for heat stress assessments.

- 1.0 Workplace Description
- Almost all petroleum refinery processes occur outdoors. As the outside air temperature and humidity rises in warm weather months, the risk of a heat stress situation to workers can become evident.
 - Radiant heat from equipment such as hot process pipes, furnaces, heat exchangers, vessels, reactors, or air coolers (fin fans) can contribute to the heat stress environment.
 - Confined space entry into hot work environments can create additional heat hazards, due, in part, to limited air movement.
 - Semi-permeable or impermeable clothing such as flame-retardant suits and tyvek will minimize the worker's ability to remove body heat and needs to be considered.
- 2.0 Definitions
1. **Acclimitization:** the process of becoming accustomed to the heat. Acclimitized workers will have a lower heart rate, lower body temperature, higher sweat rate, and a more dilute sweat (less salt-containing).
 2. **Apparent Temperature (Heat Index):** a measure of the contribution humidity makes, with a high air temperature, to reduce the body's ability to cool itself.
 3. **Evaporative Cooling (Heat Loss):** when sweat evaporates from the skin. High humidity reduces the rate of evaporation and the effectiveness of this very essential body cooling system.
 4. **Heat Cramps:** painful muscle spasms as a result of exposure to excess heat . Too much or too little water replacement is involved.
 5. **Heat Exhaustion:** a condition usually caused by loss of body water because of exposure to excess heat. Symptoms include: headache, tiredness, nausea, and sometimes fainting.
 6. **Heat Stress:** the combined effect of environmental and physical work factors that create the total heat load onto the body.
 7. **Heat Stroke:** a medical emergency that includes a rise in body core temperature. Symptoms include: mental confusion, convulsions, hot, dry, red skin, loss of consciousness.
 8. **Wet-Bulb Globe Thermometer (WBGT):** an instrument that can simultaneously measure dry air temperature, radiant heat transfer, and humidity. It cannot reflect the effects of air movement, evaporative heat loss, nor the excess body heat build-up due to physical activity.
- 3.0 Engineering Controls
- Increase evaporative heat loss by: 1) ventilation with cooler air, or, 2) decrease the humidity with an air cooler.
 - Shield or insulate radiant heat sources from the worker. Fire blankets, insulation, or reflective shielding is recommended.

- If air temperature is above 95° F, attempt to reduce the air temperature, and reduce air speed across the skin. At 95° F, moving hot air across the skin will not provide evaporative cooling because the air is too hot.
- Provide heat stress training for workers and supervisors.
- Consider a Work/Rest Schedule and a cool area for rest when physical activity and high temperatures are present.

4.0 Work Practices

The following chart can be used as a guideline in order to help determine the schedule. Temperatures listed are determined using a WBGT (Safety Dept).

Work/Rest Regimen	Work Load		
	Light ^a	Moderate ^b	Heavy ^c
Continuous work*	90° F	86° F	80° F
75% Work---- 25% Rest, each hour	94° F	89° F	84° F
50% Work ---- 50% Rest, each hour	96° F	91° F	86° F
25% Work---- 75% Rest, each hour	100° F	95° F	90° F

*Continuous work implies an 8-hour workday with a 15 minute morning and afternoon break and a 30 minute lunch break. If additional breaks or rest are provided, these temperatures could be adjusted upward based on a time-weighted average calculation. This estimation can be done by the Safety Department.

a - Sitting

b - Standing, light or moderate work at a machine or bench

c - Heavy lifting, pulling, climbing

Alternately, the **Apparent Temperature** chart can be used as a guideline to help evaluate occupational exposures to heat stress. Apparent temperature is an index of the air temperature (dry globe) and the % relative humidity.

Heat Index (Apparent Temperature) Chart
Air Temperature and % Relative Humidity

		% Relative Humidity																		
		0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90
Air Temperature	140	125																		
	135	120	128																	
	130	117	122	131																
	125	111	116	123	131	141														
	120	107	111	116	123	130	139	148												
	115	103	107	111	115	120	127	135	143	151										
	110	99	102	105	108	112	117	123	130	137	143	150								
	105	95	97	100	102	105	109	113	118	123	129	135	142	149						
	100	91	93	95	97	99	101	104	107	110	115	120	126	132	138	144				
	95	87	88	90	91	93	94	96	98	101	104	107	110	114	119	124	130	136		
	90	83	84	85	86	87	88	90	91	93	95	96	98	100	102	106	109	113	117	122
	85	78	79	80	81	82	83	84	85	86	87	88	89	90	91	93	95	97	99	102
	80	73	74	75	76	77	77	78	79	79	80	81	81	82	83	85	86	86	87	88
	75	69	69	70	71	72	72	73	73	74	74	75	75	76	76	77	77	78	78	79
70	64	64	65	65	66	66	67	67	68	68	69	69	70	70	70	71	71	71	71	

Red =Extreme Danger **Pink** =Danger **Yellow** =Extreme Caution **Blue** =Caution

- Liquid replacement must be encouraged and be available. It is recommended to drink small amounts frequently, i.e., 8 ounces every 20 minutes, preferably water.
 - Reduce the physical demands of work; automate (mechanize) components of the work task. Reduce work time, rotate more workers into the job.
- 5.0 PPE
- When temperatures reach extremely high levels, additional plans for heat stress control need to be addressed. For entry into enclosed, or permit, confined spaces, such as fin fan cowlings, reactors, or furnaces, where temperatures exceed 100⁰ F, supplied air respiratory protection should be used to protect lung tissue from hot temperatures.
 - If extremely long periods of work time are necessary in a hot working environment (>95⁰ F and >75% relative humidity), PPE will need to be considered along with a worker rotation plan. Ice vests are available from the Safety Department or the Tool Room.
- 6.0 Other Factors
- Age, gender, and obesity influence the body's ability to sweat. Older workers and women cannot sweat as efficiently. The larger surface area of the obese worker is less favorable for heat dissipation. Be mindful to these factors when planning jobs.
 - Alcohol reduces heat tolerance and increases the risk of heat illnesses. Also, certain heart medications and diuretics (water pills) can alter the body's ability to control heat. Inform workers of these additional effects on the body.

THIS IS THE LAST PAGE