HEAT STRESS PROGRAM
VICTORVILLE FACILITY

PURPOSE

Reduce the potential effects of occupational heat illness through proactive measures in accordance with Cal-OSHA Title 8 Section 3395.

SCOPE

The Heat Illness Prevention Program covers all departments and operations.

DEFINITIONS

The American Conference of Governmental Industrial Hygienists (1992) states that workers should not be permitted to work when their deep body temperature exceeds 100.4°F.

1. **Acclimatization** is the temporary and gradual change in the body that occurs when the environmentally induced head load to which the body is accustomed is significantly and suddenly exceeded by sudden environmental changes.

2. **Heat** is a measure of energy in terms of quantity.

3. A **calorie** is the amount of heat required to raise 1 gram of water 1°C (based on a standard temperature of 16.5 to 17.5°C).

4. **Conduction** is the transfer of heat between materials that contact each other. Heat passes from the warmer material to the cooler material. For example, a worker's skin can transfer heat to a contacting surface if that surface is cooler, and vice versa.

5. **Convection** is the transfer of heat in a moving fluid. Air flowing past the body can cool the body if the air temperature is cool. On the other hand, air that exceeds 35°C (95°F) can increase the heat load on the body.

6. **Evaporative cooling** takes place when sweat evaporates from the skin. High humidity reduces the rate of evaporation and thus reduces the effectiveness of the body's primary cooling mechanism.

7. **Radiation** is the transfer of heat energy through space. A worker whose body temperature is greater than the temperature of the surrounding surfaces radiates heat to these surfaces. Hot surfaces and infrared light sources radiate heat that can increase the body's heat load.

8. **Globe temperature** is the temperature inside a blackened, hollow, thin copper globe.

9. **Metabolic heat** is a by-product of the body's activity.

10. **Natural wet bulb (NWB) temperature** is measured by exposing a wet sensor, such as a wet cotton wick fitted over the bulb of a thermometer, to the effects of evaporation and convection. The term natural refers to the movement of air around the sensor.

11. **Dry bulb (DB) temperature** is measured by a thermal sensor, such as an ordinary mercury-in-glass thermometer, that is shielded from direct radiant energy sources.

12. **Heat stroke** occurs when the body's system of temperature regulation fails and body temperature rises to critical levels. This condition is caused by a combination of highly variable factors, and its occurrence is difficult to predict. Heat stroke is a medical emergency. The primary signs and symptoms of heat stroke are confusion; irrational behavior; loss of consciousness; convulsions; a lack of sweating (usually); hot, dry skin; and an abnormally high body temperature.

13. **Heat Exhaustion.** The signs and symptoms of heat exhaustion are headache, nausea, vertigo, weakness, thirst, and giddiness. Fortunately, this condition responds readily to prompt treatment. Heat exhaustion should not be dismissed lightly, however, for several reasons. One is that the fainting associated with heat exhaustion can be dangerous because the victim may be operating machinery or controlling an operation that should not be left unattended; moreover, the victim may be injured when he or she faints. Also, the signs and symptoms seen in heat exhaustion are similar to those of heat stroke, a medical emergency.

14. **Heat cramps** are usually caused by performing hard physical labor in a hot environment. These cramps have been attributed to an electrolyte imbalance caused by sweating. It is important to understand that cramps can be caused by both too much and too little salt. Cramps appear to be caused by the lack of water replenishment.

15. In **heat collapse**, the brain does not receive enough oxygen because blood pools in the extremities. As a result, the exposed individual may lose consciousness.

16. **Heat rashes** are the most common problem in hot work environments. Prickly heat is manifested as red papules and usually appears in areas where the clothing is restrictive. As sweating increases, these papules give rise to a prickling sensation. Prickly heat occurs in skin that is persistently wetted by un-evaporated sweat, and heat rash papules may become infected if they are not treated. In most cases, heat rashes will disappear when the affected individual returns to a cool environment.

17. **Heat Fatigue.** A factor that predisposes an individual to heat fatigue is lack of acclimatization. The use of a program of acclimatization and training for work in hot environments is advisable. The signs and symptoms of heat fatigue include impaired performance of skilled sensorimotor, mental, or vigilance jobs.

Responsibilities

The site EHS Manager or designated Program Administrator is responsible for the implementation and administration of this Heat Stress Program. Site management will provide the necessary support to ensure the program remains active.

PROCEDURE

Baseline Assessment

A baseline assessment will be completed to identify building and operation characteristics that may pose as heat illness sources. Periodic assessments are conducted when weather conditions or operations may change and result in new potential heat stress sources. A consistent ambient temperature of 80°F will trigger heat illness prevention and control measures.

Table I. Identified Building and Operation Heat Stress Sources

Location / Operation	Heat Stress Source	Clothing	Workload Category
Outdoors / Unloading Raw Material	Direct sun exposure	Flame retardant clothing, safety glasses, work gloves, steel toe safety shoes	Moderate
Bldg. B.& F Manufacturing	Heat generated from general manufacturing equipment	Flame retardant clothing, safety glasses, work , gloves, steel toe safety shoes	Moderate
Welding Operations	Heat generation from welding equipment and tasks	Flame retardant clothing, Welding helmet, welding jacket, welding gloves, steel toe safety shoes	Heavy

Work-load Assessment

1. Under conditions of high temperature and heavy workload, the site will determine the work-load category of each job identified in the baseline assessment (Table 1). Work-load category is determined by averaging metabolic rates for the tasks and then ranking them:

    1. Light work: up to 200 kcal/hour
    2. Moderate work: 200-350 kcal/hour
    3. Heavy work: 350-500 kcal/hour

2. *Cool Rest Area:* Where heat conditions in the rest area are different from those in the work area, the metabolic rate (M) should be calculated using a time-weighted average, as follows:

Equation I: Average Metabolic Rate

$$Average\,M = \frac{(M_1)(t_1)+(M_2)(t_2)+\ldots+(M_n)(t_n)}{t_1+t_2+\ldots+t_n}$$

where: M = metabolic rate
t = time in minutes

See Table II or Attachment A for the Assessment of Work. In some cases, a videotape is helpful in evaluating work practices and metabolic load.

Sampling Methods

Environmental Measurements

Environmental heat measurements should be made at, or as close as possible to, the specific work area where the worker is exposed. When a worker is not continuously exposed in a single hot area but moves between two or more areas having different levels of environmental heat, or when the environmental heat varies substantially at a single hot area, environmental heat exposures should be measured for each area and for each level of environmental heat to which employees are exposed.

Wet Bulb Globe Temperature Index

1. Wet Bulb Globe Temperature (WBGT) should be calculated using the appropriate equation below. The WBGT for continuous all-day or several hour exposures should be averaged over a 60-minute period. Intermittent exposures should be averaged over a 120-minute period. These averages should be calculated using the following equation:

Equation II. Average Web Bulb Globe Temperature (WBGT)

$$Average\ WBGT = \frac{(WBGT_1)(t_1)+(WBGT_2)(t_2)+\ldots+(WBGT_n)(t_n)}{t_1+t_2+\ldots+t_n}$$

For indoor and outdoor conditions with no solar load, WBGT is calculated as:

$$WBGT = 0.7NWB + 0.3GT$$

For outdoors with a solar load, WBGT is calculated as

$$WBGT = 0.7NWB + 0.2GT + 0.1DB$$

where: WBGT = Wet Bulb Globe Temperature Index
NWB = Nature Wet-Bulb Temperature
DB = Dry-Bulb Temperature
GT = Globe Temperature

2. The exposure limits in Table III are valid for employees wearing light clothing. They must be adjusted for the insulation from clothing that impedes sweat evaporation and other body cooling mechanisms. Use Table IV to correct Table III for various kinds of clothing.

3. Use of Table III requires knowledge of the WBGT and approximate workload. Workload can be estimated using the data in Table II.

Measurements

Portable heat stress meters or monitors are used to measure heat conditions. These instruments can calculate both the indoor and outdoor WBGT index according to established ACGIH Threshold Limit Value equations. With this information and information on the type of work being performed, heat stress meters can determine how long a person can safely work or remain in a particular hot environment.

Table III. Permissible Heat Exposure Threshold Limit Values

	---------- Work Load* ----------		
Work/rest regimen	**Light**	**Moderate**	**Heavy**
Continuous work	30.0°C (86°F)	26.7°C (80°F)	25.0°C (77°F)
75% Work, 25% rest, each hour	30.6°C (87°F)	28.0°C (82°F)	25.9°C (78°F)

50% Work, 50% rest, each hour	31.4°C (89°F)	29.4°C (85°F)	27.9°C (82°F)
25% Work, 75% rest, each hour	32.2°C (90°F)	31.1°C (88°F)	30.0°C (86°F)

*Values are in °C and °F, WBGT.

These TLV's are based on the assumption that nearly all acclimatized, fully clothed workers with adequate water and salt intake should be able to function effectively under the given working conditions without exceeding a deep body temperature of 38°C (100.4° F). They are also based on the assumption that the WBGT of the resting place is the same or very close to that of the workplace. Where the WBGT of the work area is different from that of the rest area, a time-weighted average should be used (consult the ACGIH *1992-1993 Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices* (1992).

These TLV's apply to physically fit and acclimatized individuals wearing light summer clothing. If heavier clothing that impedes sweat or has a higher insulation value is required, the permissible heat exposure TLV's in Table III must be reduced by the corrections shown in Table IV.

Source: ACGIH 1992.

Table IV. WBGT Correction Factors in °C

Clothing type	Clo* value	WBGT correction
Summer lightweight working clothing	0.6	0
Cotton coveralls	1.0	-2
Winter work clothing	1.4	-4
Water barrier, permeable	1.2	-6

*Clo: Insulation value of clothing. One clo = 5.55 kcal/m^2/hr of heat exchange by radiation and convection for each degree °C difference in temperature between the skin and the adjusted dry bulb temperature.

Note: Deleted from the previous version are trade names and "fully encapsulating suit, gloves, boots and hood" including its clo value of 1.2 and WBGT correction of -10.

Source: ACGIH 1992.

Controls

Whenever the WBGT measurement triggers a work – rest regimen, the hierarchy of controls will be evaluated and the best control combination implemented. Heat stress awareness notifications will be also provided and employees reminded to take in a higher level of fluids for the day.

Provision of Water

Cool (50°-60°F), fresh, and pure water will be made available to workers to encourage them to drink small amounts frequently, e.g., one cup every 15 minutes. Water coolers have been placed in locations close to employee work activities. In addition, disposable drinking cups will be made available to employees and kept clean until used.

5 gallon water bottles and portable water coolers will provided by a local water service provider. The service provider will replenish at least on a monthly basis or more frequently as needed. A minimum of 15 five gallon water bottles will be maintained on site.

Water coolers will be maintained, serviced and kept in a sanitary condition by the local water service provider on a quarterly basis or more frequently as needed.

Personal water bottles may also be provided based on quantity and availability. Providing electrolyte powdered drink pouches, icicle pops and bags of ice, will be at the supervisor's discretion.

Access to Shade

A majority of employees work in covered building structures that provide shade and shelter from the direct sunlight. However, for those employees who work outdoors the following provisions have been established when temperature reaches or exceeds 80 degrees Fahrenheit:

- Portable canopies and fixed shelters are readily available
- Access to air conditioned break room

Weather Monitoring

The supervisor will be trained and instructed on how to check the local weather conditions. The work schedule will take into consideration high temperatures and or an anticipated heat wave.

During shift kick off meetings, employees will be informed on the importance of staying hydrated when the temperature is expected to reach or exceed 80 degrees Fahrenheit.

High Heat

When temperatures reach or exceed 85 degrees Fahrenheit outdoors the following procedures have been established:

- Continual communication via radio or verbal communication between the supervisor and employees will be heightened
- Sign/symptoms and basic first aid of heat illness will be reviewed by the supervisor or designated person with all employees
- Additional ten to fifteen 5 gallon water bottles will be stored and readily available to employees
- Increased water and restroom breaks as needed

Engineering Controls

- General ventilation- Bay doors remain open for general ventilation and air circulation. Portable industrial fans will be available and used as needed.
- Air conditioning- Air conditioning will be provided in the common break room area

Administrative Controls and Work Practices

The following administrative controls will be reviewed to determine the best approach to reduce heat stress:

- Reduce the physical demands of work, e.g., excessive lifting or digging with heavy objects;
- Use shifts, e.g., early morning, cool part of the day, or night work;
- Use intermittent rest periods with water breaks;
- Use relief workers;
- Use worker pacing;
- Assign extra workers and limit worker occupancy, or the number of workers present, especially in confined or enclosed spaces.
- Hot jobs should be scheduled for the cooler part of the day, and routine maintenance and repair work in hot areas should be scheduled for the cooler seasons of the year.
- Provide shade canopy for outdoor workers
- Provide shaded forklift overhead guard canopy
- Urine Color Chart will be posted in restrooms for quick visual hydration
- Heat Illness Prevention handouts will be distributed to all employees

Personal Protective Equipment

Auxiliary Body Cooling

1. Commercially available **ice vests**, may be used if requested. However, the cooling offered by ice packets lasts only 2 to 4 hours at moderate to heavy heat loads, and frequent replacement is necessary.

2. **Wetted clothing** is a simple and inexpensive personal cooling technique. Hats and scarves will be made available and upon request.

Acclimatization

The body needs time to adapt when temperatures rise suddenly, and an employee risks heat illness by not taking it easy when a heat wave strikes or when starting a new job that exposes the employee to heat to which the employee's body hasn't yet adjusted.

Inadequate acclimatization can be significantly more perilous in conditions of high heat and physical stress. Site management are responsible for the working conditions of all employees, and will act effectively when conditions result in sudden exposure to heat that employees are not used to.

The following procedures will be implemented in regards to employee acclimatization;

- All employees and supervisors will be trained annually on the importance of acclimatization
- New employees will be monitored by their trainer/mentor and or supervisor for the first 14 days
- The weather will be monitored daily by the supervisor
- During a heat wave, all employees will be monitored closely with focus on proper hydration and the sign /symptoms associated with heat illness

Emergency Response

The following procedures will be implemented in regards to emergency response:

- Each work shift will have trained and certified First Aid Responders (including the supervisor)
- First Aid Responders will be knowledgeable and able to demonstrate how to respond to a heat related illness and activate outside emergency response services (911)
- All First Aid Responders will have radio to radio communication and ability to reach outside emergency response services (911)

Training

Training on Heat Illness Prevention will be conducted annually with all employees and will include the following components:

- Acclimatization
- Access to shade and water
- Knowledge of the hazards of heat illness
- Employee responsibilities in avoiding heat illness
- Recognition of predisposing factors, danger signs, and symptoms
- Awareness of first-aid procedures for, and the potential health effects of heat stroke
- Use of protective clothing and equipment

Program Evaluation

The Heat Illness Prevention Program is under continuous evaluation by supervisors and the program administrator. If there are any concerns with the PPE issued, the employee will be directed to the program administrator.

The employee will be asked questions about the effectiveness of the program and any concerns with the program during annual training.

The program is evaluated annually by the program administrator and safety committee to determine if the program is effective for the work being performed. Any recommendation or concerns will be discussed with the Corporate Industrial Hygiene Department and records kept of responses or actions. The review shall also include:

- Assigned Program Responsibilities (Assignments Current)
- Heat Stress Measurements (Records on File)
- Training Effectiveness (Verified by Quizzes and Employee Feedback)
- Documented Program Evaluation (Records on File)

Program Administrator: Manuel Jimenez Jr. 05/19/17
Print Name Date

Approved By Site Management: Raul Alonso 05/19/17
Print Name Date

Review Frequency: 1 year

Revision Log:

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-	Original Issue	*12/29/08*
01	Template Change	*07/28/09*
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03	Revised to include trigger temperature for Heat Illness Prevention controls per Cal/OSHA	*05/29/2015*
	Review with No Update	*12/13/16*
04	Revised to include additional Cal/OSHA Title 8 requirements	*05/19/17*

ATTACHMENT A – Table II Assessment of Work

Body position and movement	kcal/min*
Sitting	0.3
Standing	0.6
Walking	2.0-3.0
Walking uphill	add 0.8 for every meter (yard) rise

Type of work	Average kcal/min	Range kcal/min
Hand work		
Light	0.4	0.2-1.2
Heavy	0.9	
Work: One arm		
Light	1.0	0.7-2.5
Heavy	1.7	
Work: Both arms		
Light	1.5	1.0-3.5
Heavy	2.5	
Work: Whole body		
Light	3.5	2.5-15.0
Moderate	5.0	
Heavy	7.0	
Very heavy	9.0	

* For a "standard" worker of 70 kg body weight (154 lbs.) and 1.8m^2 body surface (19.4 ft^2).
Source: ACGIH 1992