Heat Stress Prevention Program

1.0 Purpose

- The following information has been collected from the National Institute for Occupational Safety and Health (NIOSH). The purpose of this program is to provide guidance for protecting employees from hazards of high heat conditions and to provide information on engineering, administrative and PPE controls. Being uncomfortable is not the major problem with working in high temperatures and humidity. Workers who are suddenly exposed to working in a hot environment face additional and generally avoidable hazards to their safety and health.

- Occupational risk factors for heat illness include heavy physical activity, warm or hot environmental conditions, lack of acclimatization, and wearing clothing that holds in body heat. Personal risk factors include medical conditions, lack of physical fitness, previous episodes of heat-related illness, alcohol consumption, drugs, and use of certain medications.

2.0 Responsibilities

2.1 Management:

- Provide a copy of this program to each supervisor.
- Provide information to workers on signs of heat stress
- Provide means of preventing heat stress and other heat related health hazards

2.2 Supervision:

- Ensure each employee has access to this program and the subject matter is reviewed periodically at safety meetings during potential heat stress situations.
- Ensures that each employee reviews this program as part of the site-specific orientation.
- Monitor conditions throughout the workday and implement the Heat Stress Prevention Plan when necessary.
- Provide adequate supply of drinking water for employees in the work area.
- Ensure proper heat stress prevention procedures are addressed on JSA.
• Ensure that proper cooling devices are utilized during prolonged work or severe heat exposure.
• Adjust work schedules and resources as necessary to minimize heat stress.
• Ensure Emergency Response Plan is current, and employees are aware of how to respond.
• Monitor new employees to ensure that they are properly acclimated to environment.

2.3 Employees:
• Maintain proper physical condition to perform assigned task.
• Maintain awareness of heat stress signs/symptoms and first aid procedures and Emergency Response.
• Follow work practices and schedule to minimize heat stress.
• Maintain proper amount of fluid intake.
• Maintain awareness of personal medical conditions and medications that increase the risk of heat stress.

3.0 Hazard Control
3.1 Engineering Controls
• Ensure all inside areas have adequate ventilation
• Provide shaded awnings for outside work when possible
• Provide portable ventilation when possible

3.2 Administrative Controls
• Provide training to all affected employees
• Provide adequate and sanitary drinking facilities and utensils
• Rotate workers during high heat operations

3.3 Protective Equipment
• Provide cooling PPE when appropriate
• Provide shaded rest area

3.4 Heat Stress Prevention Plan
• Each Job Site Supervisor will develop a site-specific plan to prevent heat stress and how to respond if a heat stress emergency
develops. Attachment 2 of this Section should be reviewed in development of a plan,

- The Plan as a minimum will address the following:
  - Employee training
  - Employee acclimatization
  - PPE requirements
  - Liquid replacement schedule
  - Work/rest schedule
  - Cool/shaded rest areas
  - First Aid (See Attachment 1 of this Section)
  - Emergency Response including transportation

### 3.5 High Heat Procedure

The following High Heat Procedure will be put in place when the temperature exceeds 95 degrees Fahrenheit

The supervisor will:
- Review procedures for Category II & III conditions in Attachment 2 of this program
- Verbally notify all employees on site of the High Heat conditions
- Increase observations of employees with emphasis on signs/symptoms of heat stress
- Remind employees to drink water throughout the workday.
- Closely monitor newly assigned employees for first 2 weeks for symptoms of heat stress

### 4.0 Effects of Heat Stress

#### 4.1 How the Body Handles Heat

- The human body, being warm blooded, maintains a constant internal temperature, even though it is being exposed to varying environmental temperatures. To keep internal body temperatures within safe limits, the body must get rid of its excess heat, primarily through varying the rate and amount of blood circulation through the skin and the release of fluid onto the skin by the sweat glands. These automatic responses usually occur when the temperature of the blood exceeds 98.6°F and are kept in balance and controlled by
the brain. In this process of lowering internal body temperature, the heart begins to pump more blood, blood vessels expand to accommodate the increased flow, and the microscopic blood vessels (capillaries) which thread through the upper layers of the skin begin to fill with blood. The blood circulates closer to the surface of the skin, and the excess heat is lost to the cooler environment.

- If heat loss from increased blood circulation through the skin is not adequate, the brain continues to sense overheating and signals the sweat glands in the skin to shed large quantities of sweat onto the skin surface. Evaporation of sweat cools the skin, eliminating large quantities of heat from the body.

- As environmental temperatures approach normal skin temperature, cooling of the body becomes more difficult. If air temperature is as warm as or warmer than the skin, blood brought to the body surface cannot lose its heat. Under these conditions, the heart continues to pump blood to the body surface, the sweat glands pour liquids containing electrolytes onto the surface of the skin and the evaporation of the sweat becomes the principal effective means of maintaining a constant body temperature. Sweating does not cool the body unless the moisture is removed from the skin by evaporation. Under conditions of high humidity, the evaporation of sweat from the skin is decreased and the body’s efforts to maintain an acceptable body temperature may be significantly impaired. These conditions adversely affect an individual's ability to work in the hot environment. With so much blood going to the external surface of the body, relatively less goes to the active muscles, the brain, and other internal organs; strength declines; and fatigue occurs sooner than it would otherwise. Alertness and mental capacity also may be affected. Workers who must perform delicate or detailed work may find their accuracy suffering, and others may find their comprehension and retention of information lowered.

### 4.2 Safety Problems

- Certain safety problems are common to hot environments. Heat tends to promote incidents due to the slipperiness of sweaty palms, dizziness, or the fogging of safety glasses. Wherever molten metal, hot surfaces, steam, etc. exists, the possibility of burns from incidental contact also exists.

- Aside from these obvious dangers, the frequency of incidents, in general, appears to be higher in hot environments than in more
moderate environmental conditions. One reason is that working in a hot environment lowers the mental alertness and physical performance of an individual. Increased body temperature and physical discomfort promote irritability, anger, and other emotional states which sometimes cause workers to overlook safety procedures or to divert attention from hazardous tasks.

4.3 Health Problems

- Excessive exposure to a hot work environment can bring about a variety of heat-induced disorders.

4.3.1 Heat Stroke

- Heat stroke is the most serious of health problems associated with working in hot environments. It occurs when the body's temperature regulatory system fails, and sweating becomes inadequate. The body's only effective means of removing excess heat is compromised with little warning to the victim that a crisis stage has been reached.

- A heat stroke victim's skin is hot, usually dry, red or spotted. Body temperature is usually 105°F or higher, and the victim is mentally confused, delirious, perhaps in convulsions, or unconscious. Unless the victim receives quick and appropriate treatment, death can occur.

- Any person with signs or symptoms of heat stroke requires immediate hospitalization. However, first aid should be immediately administered. This includes moving the victim to a cool area, thoroughly soaking the clothing with water, and vigorously fanning the body to increase cooling. Further treatment at a medical facility should be directed to the continuation of the cooling process and the monitoring of complications which often accompany the heat stroke. Early recognition and treatment of heat stroke are the only means of preventing permanent brain damage or death.

4.3.2 Heat Exhaustion

- Heat exhaustion includes several clinical disorders having symptoms which may resemble the early symptoms of heat stroke. Heat exhaustion is caused by the loss of large amounts of fluid by sweating, sometimes with excessive loss of salt. A worker suffering from heat exhaustion still sweats but experiences extreme weakness or fatigue, nausea, or headache. In more serious cases, the victim may vomit or lose consciousness. The skin is clammy
and moist, the complexion is pale or flushed, and the body temperature is normal or only slightly elevated.

- In most cases, treatment involves having the victim rest in a cool place and drink plenty of liquids. Victims with mild cases of heat exhaustion usually recover spontaneously with this treatment. Those with severe cases may require extended care for several days. There are no known permanent effects.

  **CAUTION:** Persons with heart problems or those on a low sodium diet who work in hot environments should consult a physician about what to do under these conditions.

### 4.3.3 Heat Cramps

- Heat cramps are painful spasms of the muscles that occur among those who sweat profusely in heat, drink large quantities of water, but do not adequately replace the body's salt loss. The drinking of large quantities of water tends to dilute the body's fluids, while the body continues to lose salt. Shortly thereafter, the low salt level in the muscles causes painful cramps. The affected muscles may be part of the arms, legs, or abdomen, but tired muscles (those used in performing the work) are usually the ones most susceptible to cramps. Cramps may occur during or after work hours and may be relieved by taking salted liquids by mouth.

  **CAUTION:** Persons with heart problems or those on a low sodium diet who work in hot environments should consult a physician about what to do under these conditions.

### 4.3.4 Fainting

- A worker who is not accustomed to hot environments and who stands erect and immobile in the heat may faint. With enlarged blood vessels in the skin and in the lower part of the body due to the body's attempts to control internal temperature, blood may pool there rather than return to the heart to be pumped to the brain. Upon lying down, the worker should soon recover. By moving around, and thereby preventing blood from pooling, the patient can prevent further fainting.

### 4.3.5 Heat Rash

- Heat rash, also known as prickly heat, is likely to occur in hot, humid environments where sweat is not easily removed from the
surface of the skin by evaporation and the skin remains wet most of the time. The sweat ducts become plugged, and a skin rash soon appears. When the rash is extensive or when it is complicated by infection, prickly heat can be very uncomfortable and may reduce a worker’s performance. The worker can prevent this condition by resting in a cool place part of each day and by regularly bathing and drying the skin.

### 4.3.6 Transient Heat Fatigue

- Transient heat fatigue refers to the temporary state of discomfort and mental or psychological strain arising from prolonged heat exposure. Workers unaccustomed to the heat are particularly susceptible and can suffer, to varying degrees, a decline in task performance, coordination, alertness, and vigilance. The severity of transient heat fatigue will be lessened by a period of gradual adjustment to the hot environment (heat acclimatization).

### 5.0 Reducing Heat Stress

#### 5.1 Acclimatization

- One of the best ways to reduce heat stress on workers is to minimize heat in the workplace. However, there are some work environments where heat production is difficult to control, such as when furnaces or sources of steam or water are present in the work area or when the workplace itself is outdoors and exposed to varying warm weather conditions.

- Humans are, to a large extent, capable of adjusting to the heat. This adjustment to heat, under normal circumstances, usually takes about 5 to 7 days, during which time the body will undergo a series of changes that will make continued exposure to heat more endurable. In addition, age, weight, and fitness will also affect the worker’s ability to endure exposure to heat. These factors should be considered when the supervisor lays out the work assignments.

- On the first day of work in a hot environment, the body temperature, pulse rate, and general discomfort will be higher. With each succeeding daily exposure, all these responses will gradually decrease, while the sweat rate will increase. When the body becomes acclimated to the heat, the worker will find it possible to perform work with less strain and distress.

- Gradual exposure to heat gives the body time to become accustomed to higher environmental temperatures. Heat disorders
in general are more likely to occur among workers who have not been given time to adjust to working in the heat or among workers who have been away from hot environments and who have gotten accustomed to lower temperatures. Hot weather conditions of the summer are likely to affect the worker who is not acclimatized to heat. Likewise, workers who return to work after a leisurely vacation or extended illness may be affected by the heat in the work environment. Whenever such circumstances occur, the worker should be gradually reacclimatized to the hot environment.

5.2 Lessening Stressful Conditions

- Many industries have attempted to reduce the hazards of heat stress by introducing engineering controls, training workers in the recognition and prevention of heat stress and implementing work-rest cycles. Heat stress depends, in part, on the amount of heat the worker's body produces while a job is being performed. The amount of heat produced during hard, steady work is much higher than that produced during intermittent or light work. Therefore, one way of reducing the potential for heat stress is to make the job easier or lessen its duration by providing adequate rest time. Mechanization of work procedures can often make it possible to isolate workers from the heat sources (perhaps in an air-conditioned booth) and increase overall productivity by decreasing the time needed for rest. Another approach to reducing the level of heat stress is the use of engineering controls which include ventilation and heat shielding.

5.3 Number and Duration of Exposures

- Rather than be exposed to heat for extended periods of time during a job, workers should, wherever possible, be permitted to distribute the workload evenly over the day and incorporate work-rest cycles. Work-rest cycles give the body an opportunity to get rid of excess heat, slow down the production of internal body heat, and provide greater blood flow to the skin. Frequent short breaks work best to minimize heat stress.

- Workers employed outdoors are especially subject to weather changes. A hot spell or a rise in humidity can create overly stressful conditions. The following practices can help to reduce heat stress:

  o Postponement of nonessential tasks
  o Permit only those workers acclimatized to heat to perform the more strenuous tasks
5.4 Rest Areas

- Providing cool rest areas in hot work environments considerably reduces the stress of working in those environments. There is no conclusive information available on the ideal temperature for a rest area. However, a rest area with a temperature near 76 degrees F appears to be adequate and may even feel chilly to a hot, sweating worker, until acclimated to the cooler environment. The rest area should be as close to the workplace as possible, shaded, open to the air or provided with ventilation. Access to the rest areas shall be permitted. Individual work periods should not be lengthened in favor of prolonged rest periods. Shorter but frequent work-rest cycles are the greatest benefit to the worker.

5.5 Drinking Water

- During a day's work in the heat, a worker may produce as much as 2 to 3 gallons of sweat. Because so many heat disorders involve excessive dehydration of the body, it is essential that water intake during the workday be about equal to the amount of sweat produced. Most workers exposed to hot conditions drink less fluid than needed because of an insufficient thirst drive. A worker, therefore, should not depend on thirst to signal when and how much to drink. Instead, the worker should drink 5 to 7 ounces of fluids every 15 to 20 minutes to replenish the necessary fluids in the body. There is no optimum temperature of drinking water, but most people tend not to drink warm or very cold fluids as readily as they will cool ones. Whatever the temperature of the water, it must be potable, palatable, and readily available to the worker throughout the work shift. Individual drinking cups should be provided----never use a common drinking cup.

- Heat acclimatized workers lose much less salt in their sweat than workers who are not adjusted to the heat. The average American diet contains adequate salt for acclimatized workers even when sweat production is high. If, for some reason, salt replacement is required, the best way to compensate for the loss is to add a little extra salt to the food. Salt tablets should not be used.
5.6 Protective Clothing

- Clothing inhibits the transfer of heat between the body and the surrounding environment. Therefore, in hot jobs where the air temperature is lower than skin temperature, wearing clothing reduces the body’s ability to lose heat into the air.

- When air temperature is higher than skin temperature, clothing helps to prevent the transfer of heat from the air to the body. However, this advantage may be nullified if the clothes interfere with the evaporation of sweat.

- In dry climates, adequate evaporation of sweat is seldom a problem. In a dry work environment with very high air temperatures, protective clothing could be an advantage to the worker. The proper type of clothing depends on the specific circumstance. Certain work in hot environments may require insulated gloves, insulated suits, reflective clothing, or infrared reflecting face shields. For extremely hot conditions, thermally conditioned clothing is available. One such garment carries a self-contained air conditioner in a backpack, while another is connected to a compressed air source which feeds cool air into the jacket or coveralls through a vortex tube. Another type of garment is a plastic jacket which has pockets that can be filled with dry ice or containers of ice.

5.7 Special Considerations

- During unusually hot weather conditions lasting longer than 2 days, the number of heat illnesses usually increases. This is due to several factors, such as progressive body fluid deficit, loss of appetite (and possible salt deficit), buildup of heat in living and work areas, and breakdown of air-conditioning equipment. Therefore, it is advisable to make a special effort to adhere rigorously to the above preventive measures during these extended hot spells and to avoid any unnecessary or unusual stressful activity. Adequate sleep and good nutrition are important for maintaining a high level of heat tolerance. Workers who may be at a greater risk of heat illnesses are the obese, the chronically ill, and older individuals.

- When feasible, the most stressful tasks should be performed during the cooler parts of the day (early morning or at night). Double shifts
and overtime should be avoided whenever possible. Rest periods should be extended to alleviate the increase in the body heat load.

The consumption of alcoholic beverages during prolonged periods of heat can cause additional dehydration. Persons taking certain medications (e.g., medications for blood pressure control, diuretics, or water pills) should consult their physicians to determine if any side effects could occur during excessive heat exposure. Daily fluid intake must be adequate to prevent significant weight loss during the workday and over the workweek.

6.0 Heat Stress Signs/Symptoms and First Aid-Attachment 1
- Attachment 1 outlines in a quick reference table the basic signs/symptoms of the common heat stress disorders and the basic First Aid that should be administered.

7.0 Work Practices to Prevent Heat Stress-Attachment-2
- Attachment 2 list the 4 Categories of potential Heat Stress environments based upon the ambient temperature with a humidity of 80%.

8.0 Training
- Training will take place as an element of the Toolbox Training Schedule and will occur prior to the Summer Heat Stress season and will be repeated midway through the season.

8.1 Supervisors
- Supervisors will be trained in recognition of Heat Stress Symptoms and related Illnesses, First Aid, Emergency Response procedures and Heat Stress Preventative Work Practices. This training will be conducted prior to any assignment as a supervisor where Heat Stress may be a factor.

8.2 Employees
- Employees will be trained in the following areas pertaining to Heat Stress:
  - Environmental factors-Section 4.1,5.7
  - Personal risk factors-Section 4.1
  - Acclimatization-Section 5.1
  - Water consumption-Section 5.5
  - Signs and symptoms of Heat Stress-Section 4.3
  - First Aid, incident reporting and emergency response-Attachment 1 of this program
## Attachment 1
### Heat Stress Signs/Symptoms and First Aid

<table>
<thead>
<tr>
<th>Disorder</th>
<th>Symptoms</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Heat Stroke</strong></td>
<td>• Red or Flushed Skin</td>
<td>• <strong>Emergencies: Call 911</strong></td>
</tr>
<tr>
<td>Least common, but most Dangerous</td>
<td>• Confusion, Irrational behavior</td>
<td>• If heat stroke is suspected, call ambulance immediately</td>
</tr>
<tr>
<td></td>
<td>• Lack of sweating, hot dry skin (although person may have been sweating earlier)</td>
<td>• Do Not Delay transport to a medical facility</td>
</tr>
<tr>
<td></td>
<td>• High body temperature</td>
<td>• Move to cool environment and remove unnecessary clothing</td>
</tr>
<tr>
<td></td>
<td>• Dizziness, convulsions, nausea, vomiting and headache can result</td>
<td>• Sponge body with cool water and fan individual</td>
</tr>
<tr>
<td></td>
<td>• Loss of consciousness</td>
<td>• If patient is alert, give sips of cool water</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• No one suspected of being ill from heat stroke should be sent home without medical evaluation</td>
</tr>
<tr>
<td><strong>Heat Exhaustion</strong></td>
<td>• Weakness, fatigue</td>
<td>• <strong>Emergencies: Call 911</strong></td>
</tr>
<tr>
<td>May occur after working in moderate to hot environments without adequate fluid replacement. Heat exhaustion may be confused with heat stroke which is a medical emergency.</td>
<td>• Headache, nausea, vomiting and/or loss of appetite, thirst</td>
<td>• Call ambulance and move employee to cool environment</td>
</tr>
<tr>
<td></td>
<td>• Pale, clammy skin with large amount of sweating</td>
<td>• Do Not Delay transport to a medical facility</td>
</tr>
<tr>
<td></td>
<td>• Lightheadedness, fainting</td>
<td>• Remove unnecessary clothing</td>
</tr>
<tr>
<td></td>
<td>• Impaired performance</td>
<td>• If patient is alert, give sips of cool water</td>
</tr>
<tr>
<td>Heat Cramps</td>
<td>Heat Rash</td>
<td></td>
</tr>
<tr>
<td>-------------------------------------------------</td>
<td>------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>May Occur after working in moderate to hot environments. This disorder usually occurs after hard physical labor. Heat Cramps may occur during or after work.</td>
<td>The most common heat related disorder. Restrictive or impermeable clothing aggravates this disorder.</td>
<td></td>
</tr>
<tr>
<td>• Cramps in skeletal muscles or abdominal muscles.</td>
<td>• Skin rash commonly occurs on the arms, shoulders, chest and behind the knees</td>
<td></td>
</tr>
<tr>
<td>• Cramps may be recurrent</td>
<td>• May be accompanied by a tingling or prickly feeling</td>
<td></td>
</tr>
<tr>
<td>• Muscle pain may continue after cramps subside</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Move employee to cool environment</td>
<td>• Move to cooler environment</td>
<td></td>
</tr>
<tr>
<td>• Remove unnecessary clothing</td>
<td>• Remove restrictive or impermeable clothing, if present</td>
<td></td>
</tr>
<tr>
<td>• Provide water</td>
<td>• Avoid Scratching</td>
<td></td>
</tr>
<tr>
<td>• Transport to medical facility</td>
<td>• Seek medical attention</td>
<td></td>
</tr>
<tr>
<td>• Move employee to cool environment</td>
<td>• Shower and dry skin thoroughly after working in hot environments</td>
<td></td>
</tr>
<tr>
<td>• Remove unnecessary clothing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Provide water</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Transport to medical facility</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Attachment 2

<table>
<thead>
<tr>
<th>Category</th>
<th>Ambient Temp (Deg. F) Wearing regular clothing (See 1)</th>
<th>Ambient Temp (Deg. F) Wearing PPE (See 2)</th>
<th>Action Steps</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>&lt;90</td>
<td>&lt;70</td>
<td>None Required</td>
</tr>
<tr>
<td>II</td>
<td>90-100</td>
<td>70-90</td>
<td>Drink plenty of water, 8 oz. of water every 15-20 min. Take periodic breaks</td>
</tr>
</tbody>
</table>
| III      | 100-110                                             | 90-100                                   | All requirements for Category II, plus at least one of the following as appropriate for the work in progress  
  • More frequent rest breaks in cooler area  
  • Shading, if working in the sun  
  • Reflective barriers for radiant heat  
  • Temporary insulation  
  • Spot cooling using fans  
  • Personal cooling devices |
| IV       | >110                                                | >100                                     | All requirements for Category II, plus:  
  • At least one of the options listed for Category III  
  • Job-specific heat stress plan incorporated into JSA.  
  • Job–specific work/rest schedule (See 3) |

**Work Practices to Prevent Heat Stress**

1. Regular clothing means, FRCs, cotton coveralls, long-sleeve shirt & pants, hard hat, work shoes.
2. Use of PPE such as rain suites, impermeable coveralls, over-suiting with disposable coveralls, welding leathers, etc., may interfere with the body’s ability to cool itself.
3. Unless additional steps are taken, i.e. fans, personal cooling devices, etc., follow 50% work/50% rest schedule.
California Operations per Cal/OSHA Requirements

1. Water must be fresh, pure, suitably cool and located as close as practicable to where employees are working, with exceptions to when it is infeasible.
2. Shade must be present when temperatures reach 80 degrees and must be able to accommodate all employees during rest and meal periods.
3. Employees taking a “preventative cool-down rest” must be monitored for symptoms of heat illness, encouraged to remain in the shade and not ordered back to work until symptoms are gone. Employees with symptoms must be provided appropriate first aid or emergency response.
4. High-heat procedures (which will remain triggered at 95 degrees) shall ensure “effective” observation and monitoring, including a mandatory buddy system and regular communication with employees working by themselves. During high heat, employees must be provided with a minimum 10-minute cool-down period every 2 hour.
5. Emergency response procedures must include effective communication, response to signs and symptoms of heat illness, and procedures for contacting emergency responders when needed.
6. Acclimation procedures including close observation of all employees during a heat wave, which is defined as at least 80 degrees, must be implemented.
7. New employees must be monitored and observed for their first 2 weeks on the job.