

# **CENTRAL ARIZONA PROJECT**



## **THERMAL STRESS AWARENESS PROGRAM**

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## SUMMARY – QUICK FACTS

- It normally takes between five to seven days to acclimate to working in a hot environment, but it can take as long as three weeks.
- During this acclimation period, employee's awareness about their body's reaction to heat stress should be heightened.
- Your body does not respond with a "thirst sensation" until more than 2 percent of body weight is lost.
- When performing strenuous activities, the body can lose up to 1 ½ quarts of perspiration (sweat) per hour.
- During heavy sweating, it is necessary to drink 10 to 12 ounces of water every 20 to 30 minutes.
- Drinks containing 40 to 80 grams of sugar and 0.5 to 0.7 grams of sodium per liter can be beneficial.
- Urine color darker than a "pale yellow" is an indication of dehydration.
- CAP will issue a Heat-Alert to help identify those periods of heightened probabilities to heat stress.



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THERMAL STRESS AWARENESS GUIDE**

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## 1.0 PURPOSE



Central Arizona Project (CAP) employees may be exposed to significant sources of heat stress through their work activities. Procedures in this guide can apply to all employees performing work in hot environments within or on CAP facilities or properties.

This Thermal Stress Awareness Guide is intended to provide employees with the information and guidance necessary to prevent work-related heat injuries and illnesses. The various components of the guide are to be a resource to all CAP employees to ensure that we continue to offer a safe and healthy work environment.

## 2.0 APPLICATION OF GUIDE

All work activities conducted by CAP employees in hot environments will be evaluated by all involved to determine if the environment could have a heat component, which could create a risk for thermal stress. Where a risk could be present, all involved will engage engineering controls and work practices controls, as well as acclimation and hydration efforts, to minimize the stresses of hot work places.

## 3.0 HEAT STRESS DISORDERS

Heat is generated in the body by muscle activity and metabolic functions and this heat increases as the workload increases. Heat from the work environment can decrease the body's ability to eliminate this metabolic heat. Environmental heat includes air temperature, direct sun exposure, air velocity, humidity, and radiant heat (running motors, reflected heat from buildings and water, hot metal surfaces, etc.). Working in a hot environment can pose special hazards to the health and safety of employees, including heat-related fatigue and actual illness. Heat increases the potential for accidents due to sweat in the eyes, slippery hands, fogged glasses, irritability, impaired judgment, or slower physical and mental reaction.

**3.1 The Five Heat-Related Illnesses:** There are five major categories of heat related illness:

**3.1.1 Heat Stroke** – Heat stroke is the most serious heat-related illness. It is always life-threatening because a person's temperature is so high it can cause brain damage and/or organ failure. It is caused by dehydration and the failure of the body's temperature regulating mechanisms.

Heat stroke symptoms usually include:

- Core temperature over 105° F
- Hot, dry skin (may be mottled, red or bluish)
- Mental confusion, loss of consciousness, and/or
- Convulsions or coma

Treatment for heat stroke includes:

- Call for help immediately. Medical treatment is imperative to prevent permanent injury to the brain and other vital organs.
- Remove the victim from the heat and/or sun.
- Immediately start cooling victim with ice packs, cool water, cool compresses, (never put ice directly on the skin), and increasing air movement (fans).
- Do not give the victim anything to drink, especially tea, coffee, or alcoholic beverages.
- Never give anything by mouth to someone who is unconscious.

**3.1.2 Heat Exhaustion** – Heat exhaustion is caused by the loss of body fluid and salt from sweating, decreased blood circulation to the brain and organs, or both. It is caused when a person does not take in enough water, electrolytes, or both. It is less serious than heat stroke, but can become serious and lead to heat stroke if not treated.

Symptoms usually include:

- Clammy, pale or flushed moist skin
- Extreme fatigue, headache, nausea
- Rapid pulse and low blood pressure
- Oral temperature that is normal or only slightly elevated

Treatment:

- Remove the victim to a cooler area and give them water as they desire (but never any liquids with caffeine or alcohol). “Sports” drinks may be consumed if desired, or slightly-salted water (only if not on a restricted diet). “Slightly-salted” means ¼ teaspoon or less of salt per gallon of water.
- Have the victim rest with their feet slightly elevated.
- Cool the body with ice packs (never place ice directly on the skin) or cool water if needed.
- Fanning the body to increase evaporation of sweat or water can help.

- If the victim becomes unresponsive or unconscious, call for help immediately and arrange for emergency response
- Some cases of heat exhaustion may take several days or longer for full recovery and the person will continue to be a higher risk of heat stress illnesses after experiencing heat exhaustion

**3.1.3 Heat Cramps** - Heat cramps are painful spasms of the working muscles of workers who are drinking large quantities of water, but have some salt depletion. The cramps may occur during or after working hours and are usually relieved by drinking slightly-salted water (approximately ¼ teaspoon of salt per gallon of water).

Symptoms usually include:

- Painful spasms of muscles used during work (usually arms, legs, or abdomen).

Treatment:

- Drink slightly-salted water or “sports” drinks (unless on medical restriction). Use adequate salt amount during meals.

**3.1.4 Heat Syncope / Fainting** – Syncope / fainting may occur in workers who are not acclimated and stand still in the heat. Blood normally circulated to the heart and brain is sent to the skin for cooling, and pools in the enlarged blood vessels in the skin and in the lower part of the body. It may be prevented by moving around, assuming no other complications occur.

Symptoms usually include:

- Fainting or becoming dizzy while standing in the heat.

Treatment:

- Remove the victim to a cooler area.
- Allow them to drink water.
- Recovery should be prompt.
- Consult a physician if the condition persists

**3.1.5 Heat Rash** (prickly heat),

Symptoms Usually Include:

- "Prickly heat" or "miliaria" may occur in humid environments where sweat is not easily removed from the skin by evaporation.
- The sweat ducts become plugged, become inflamed, and a rash develops. Infection is a possibility.
- When extensive or complicated by infection, heat rash can be so uncomfortable that it impedes a person's performance or even results in a temporary total disability.

Treatment:

- Includes cooling and drying the skin and avoiding conditions that cause sweating.
- If infection develops, have it treated by a physician.

#### 4.0 HEAT STRESS PREVENTION

Heat related illnesses can be prevented through a number of means, including acclimation, proper hydration, electrolyte and salt replacement, and engineering and work practices controls.

**4.1 Acclimation:** Acclimation is a process by which a person's body adjusts to the hot environment over a period of time, usually five to seven days according to OSHA. However, the process may take up to three weeks, depending on the individual and their work environment. According to the American Industrial Hygiene Association, the process requires a consistent work level for at least two hours each day during the acclimation period in order for a worker to become acclimated. Mere exposure to heat does not acclimate someone, nor does acclimation at one heat stress level confer resistance to heat stress at a higher temperature or more vigorous work load.

The allowable heat load exposure for an un-acclimated worker is several degrees lower than that of someone who is fully acclimated. This can be of issue for new CAP employees, who may not be used to Arizona's extreme weather. People who are not sufficiently acclimated to the heat may experience heat fatigue resulting in a decline in performance, coordination, or alertness. They may also become irritable or depressed. This can be prevented through gradual adjustment to the new hot environment. People in good physical condition tend to acclimate better because their cardiovascular systems respond better, allowing their body to more easily adjust to the hot environment.

It is the supervisor's responsibility to be aware of and accommodate for this adjustment period in the manner that work is assigned / scheduled and allow for a reasonable amount of rest periods, according to individual requirements, and to

allow a re-acclimation period after an absence from work of a week or more or if the person is returning to work from an illness.

**4.2 Hydration:** Thirst is a mechanism the body uses to signal the need for water replacement. In sedentary, non-heat stress conditions, drinking to quench thirst adequately regulates body hydration. However, in heavy work heat stress conditions, thirst sensation lags behind the actual need for water. The body does



not typically respond with thirst until more than two percent of body weight is lost. If a person in heavy work/heat stress conditions only drinks to quench their thirst, water intake will significantly lag behind water loss for up to several hours after heat stress conditions cease.

Because of this, dehydration is a major factor in most heat disorders. The average body loses approximately 2½ quarts of sweat a day. When performing strenuous work, the body can lose up to 1½ quarts of sweat per hour. It is essential to drink more than is needed to satisfy thirst. It is necessary to drink 10-12 ounces of water every 20-30 minutes during heavy sweating.

Employees should be careful to consume a well-balanced diet and drink plenty of non-alcoholic beverages in the day preceding severe heat exposures. Employees should avoid diuretic drinks, including coffee, tea, commercially made fruit juices, energy drinks, and sodas because they take more water to remove them from your body. Just prior to work in a hot environment, drink as much as a half-liter of plain water. During work, employees should try to drink as much and as frequently as possible. Drinks containing 40 - 80 grams of sugar per liter and 0.5 to 0.7 grams of sodium per liter can be beneficial. Employees should be encouraged to rehydrate between work shifts.

Urine color is another indicator of hydration. The normal color for urine should be a pale yellow. Anything darker than this is an indication of dehydration. Certain medicines and vitamins may cause the color of the urine to change. If any of these have been taken, this basic color test is unreliable.

**4.3 Electrolyte and Salt Replacement:** Sweat not only eliminates water from the body, but salt (sodium chloride) and other electrolytes (sodium, potassium, and magnesium) too. The body needs a certain amount of salt to function properly, but salt tablets are not recommended because of stomach irritation, nausea, and vomiting. Employees should drink normal water throughout the day, but may drink an electrolyte solution such as Gatorade after working in a hot



environment, if desired. Normally, eating a good breakfast and lunch will provide adequate salt intake during a hot workday. Individuals on a salt restricted diet or those persons being treated for high blood pressure or heart problems must NOT try to replace salt without the advice of their physician.

**4.4 Engineering Controls:** Engineering controls can include any of the following:

- Ventilation – general ventilation to dilute hot air with cooler air from outside an enclosure.
- Evaporative Coolers – air cooling by use of portable evaporative coolers to significantly reduce heat loads.
- Air Conditioning – air conditioning that provides much cooler air and increased capacity for evaporative cooling.
- Cool Break Area – a cooled or air conditioned rest room or trailer at the work site for employees to take a break.
- Heat Barriers – shielding or barriers between the worker and a heat source that can significantly improve heat stress as long as the barrier does not interfere with air flow.

**4.5 Work Practice Controls:** Work practice controls can include any of the following:

- Modified Work Schedule – scheduling work for earlier in the workday such as starting work at 4:00 a.m. to take advantage of the cooler morning temperatures, or, if possible, re-schedule the work to be done in October through April.
- Limit Exposure – limiting the time (in hours) that the worker spends in the hot environment.
- Reduced Work Demands – reducing the labor demands by increasing the number of workers.
- Tool and Equipment – use of special tools such as power tools, hoists, and lifts, to ease the workload and decrease the workers' metabolic rate.
- Knowledge - learning to recognize early signs and symptoms of heat illnesses and know how to administer first aid.
- Buddy System – implementation of a "buddy-system" in which workers observe fellow workers for symptoms of heat intolerance.
- Adequate Cool Drinks – providing adequate amounts of cool (50° to 59°F.) water near the work area and encourage drinking five to seven ounces of water every 15 to 20 minutes.

**4.6 Impact of Protective Clothing:** Loose fitting clothes made of light cotton allow sweat to evaporate and transfer heat better than tight fitting synthetic fibers.

Wear a hat to shade the head but ensure the hat has adequate ventilation of the head itself. A significant amount of heat can be dissipated from the head and, if the hat cannot ventilate this heat, it actually is more harmful than helpful.

If the work activities require the use of personal protective equipment such as chemical resistant gloves or Tyvek-type coveralls, this will inhibit the evaporative cooling effect of sweating. Special precautions need to be taken to ensure that employees do not over-heat due to this lack of evaporative cooling. When wearing these types of PPE, employees should consider more frequent breaks, during which the PPE should be removed (fully or partially), to allow evaporation of the sweat and provide for cooling of the body's core temperature. Drink "cooler" water (approximately 50°F. but not less than 40°F.) to assist in cooling the internal organs.

- 4.7 Heat-Alerts:** A written Heat-Alert will be developed and implemented whenever the National Weather Service or other competent weather forecast service indicates a heat wave is likely to occur on the following day or days. At CAWCD, a heat wave is indicated when the daily maximum temperature exceeds 110°F. or when the daily maximum temperature exceeds 100°F. and is 9° F. or more above the maximum reached on one or both of the previous two days.



*Example: If the temperature on Monday was 99°F. and on Tuesday it was 98°F. On Wednesday the temperature is forecast to be 108°F. CAWCD would declare a Heat-Alert as the temperature was above 100°F. and was 9°F. greater than the maximum on Monday.*

When a Heat-Alert is issued by the EH&S Department, the following actions should be taken:

- EH&S Department will prepare and distribute a written Hazard Alert indicating that a Heat-Alert is declared for CAP.
- CAP employees are responsible to limit their exposures to heat stress in compliance with this Thermal Stress Awareness Guide.

## 5.0 EMPLOYEE INFORMATION AND TRAINING

All employees that will be potentially exposed to extreme heat should be trained prior to exposure. Refresher training should occur regularly thereafter, preferably annually; more often if the need arises. Training of employees should cover the following topics:

- Heat stress hazards.

- Predisposing factors and relevant signs and symptoms of thermal stress injury and illness.
- Potential health effects of heat stress and cold stress and appropriate first aid procedures for each.
- Employee responsibilities for following proper work practices and control procedures to help protect the health and provide for the safety of themselves and their fellow workers, including instructions to immediately report to their supervisor the development of signs or symptoms of thermal stress overexposures.
- The effects of therapeutic drugs, over-the-counter medications, or social drugs (including alcohol), that may increase the risk of heat injury or illness by reducing heat or cold tolerance.
- The purposes for and descriptions of the environmental and medical surveillance programs and of the advantages to the worker of participating in these surveillance programs.
- As necessary, proper use of protective clothing and equipment.

## **6.0 RECORDKEEPING**

Copies of this Thermal Stress Awareness Guide are kept in the EH&S Department and are available to all employees who wish to review them. They are also posted in Content Server. Also maintained in the EH&S Department are copies of training and other environmental monitoring records. These records will be updated as employees are trained or receive refresher training, and as additional testing is conducted. The medical records for all employees covered under this program may be maintained by the medical provider, but copies can be obtained by CAP employees through the EH&S Department.