

CNS OPERATIONS MANUAL ADMINISTRATIVE PROCEDURE 0.36.1 HEAT STRESS PREVENTION PROGRAM	USE: INFORMATION QUALITY: QAPD RELATED EFFECTIVE: 12/12/06 APPROVAL: ITR-RDM OWNER: M. I. STAUFFER DEPARTMENT: SAFETY
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REV.	DATE	CHANGES
10	4/23/04	Changed Shift Supervisor to Shift Manager throughout the procedure for Tech Spec Amendment 200.
11	12/12/06	Added NOTE prior to Step 3.2.2.1. Revised Attachment 4 to incorporate Entergy criteria for action times.

1. PURPOSE

1.1 This procedure should be used in potential heat stress situations when ambient temperatures are > 95°F, or the Wet Bulb Globe Temperature (WBGT) is > 90°F, or when employees are required to wear vapor barrier protective clothing such as plastic or rubber rain suits, or if the workplace is generally considered hot in the subjective judgment of workers or the Supervisor. Included is the basic information to develop an effective heat stress recognition, evaluation, and control program. It provides Supervisors with requirements for controlling heat stress and preventing heat related illnesses during work in hot environments.

2. PRECAUTIONS AND LIMITATIONS

2.1 Individuals who work in hot environments may become dehydrated due to sweating. Fluids should be replaced at periodic intervals to prevent heat illness.

2.2 Individuals who work in hot environments should go to a cooler area to shed body heat. Industrial Safety is available to assist with this determination.

- 2.3 Individuals who work in hot environments for the first time are more susceptible to heat illness than those accustomed to hot work. Progressive exposure to heat for an unacclimated employee should begin on the first day with increasing exposure for the next 5 days. The body adjusts or acclimates after 1 to 2 weeks of heat exposure and can tolerate longer heat exposures at higher work rates.
- 2.4 If an individual begins to feel symptoms of heat illness, he or she should immediately exit the area, notify the Supervisor, de-suit, rest in a cool area, and drink water or an electrolyte fluid. If symptoms persist, medical assistance should be requested through the Control Room.
- 2.5 A clean area may be designated near the work area by the Job Supervisor and Radiological Protection when the job will require an extended period of time in high temperatures performing moderate to heavy work in radiologically contaminated areas.
 - 2.5.1 Drinking water or electrolyte fluid in a squeeze bottle or equivalent should be supplied.
 - 2.5.2 This area will be controlled by Radiation Protection personnel.
 - 2.5.3 Personnel entering the area will as a minimum perform a hand and face frisk and follow any other Radiation Protection directives.
- 2.6 Heat Stress Prevention associated with Fire Brigade Training/Hazardous Materials Emergency Response Activities is covered under Nuclear Training Department document TPG-0206. Completion of the "Pre-Burn Checklist" from TPG-0206 for such activities replaces the Hot Environment Work Permit.

3. INSTRUCTIONS FOR EMPLOYEES AND JOB SUPERVISORS

3.1 EMPLOYEES ON-SITE

- 3.1.1 Attachment 5, Pre-Job Briefing For Work in Hot Environments, provides a listing of the physical and mental conditions that can lead to increased health risk and/or reduced ability to work in a hot environment. Employees with such conditions are encouraged to report them to the Job Supervisor prior to or at the pre-job briefing. Employees with physical or mental conditions that may adversely affect their ability to safely and competently perform their duties in a hot environment are expected not to enter a hot environment to work unless they have medical clearance to do so and until any necessary safety measures that have been identified are in place.
- 3.1.2 Each employee who works in a high temperature area should practice preventive measures to reduce the chance of developing heat related disorders. These include:
 - 3.1.2.1 Wearing personal protective equipment designated on the HEWP.
 - 3.1.2.2 Adhering to all instructions.

- 3.1.2.3 Being aware of the symptoms of heat stress and the condition of workers around him or her when working in a high temperature area.
- 3.1.2.4 Drinking water or other electrolyte fluids frequently.
- 3.1.2.5 Wearing appropriate clothing.
- 3.1.2.6 Working at a pace consistent with the work environment.

3.2 JOB SUPERVISOR

3.2.1 The Job Supervisor is responsible for implementing and enforcing the provisions of this procedure.

NOTE 1 – If HEWPs have been prepared by the Industrial Safety Staff or their designee per Step 3.3.1, the Job Supervisor may have employees use these permits for work in the RCA.

NOTE 2 – In an emergency, the Shift Manager or Control Room Supervisor has the authority to delay paperwork completion until time permits.

3.2.2 Each Job Supervisor is responsible for assuring work in hot environments is conducted in a safe and efficient manner by:

NOTE – A Hot Environment Work Permit (HEWP) can be initiated at the discretion of Industrial Safety or Supervision below 90°F WBGT if one or more of the following conditions exists: 1) workers are not acclimated to heat, fluid intake is restricted, work is in elevated areas (e.g., overhead cranes or near the ceiling), protective clothing in addition to work clothes is required; or 2) when heavy physical work is required.

3.2.2.1 Have Industrial Safety Staff or their designee obtain a WBGT reading when ambient temperatures are > 95°F, or employees are required to wear vapor barrier protective clothing such as plastic or rubber rain suits, or if the work place is generally considered hot in the subjective judgment of workers or the Supervisor.

- a. Job Supervisors should complete a Hot Environment Work Permit (HEWP) (Attachment 1) if the WBGT is > 90°F or the action time is < 60 minutes.
- b. Job Supervisors should have the Temperature Monitor complete Section 6.
- c. Job Supervisors should complete Section 7 using Attachment 3.
- d. Job Supervisors should determine the action time limit using Attachments 3 and 4, and enter the data on the HEWP.
 - 1. Work should be controlled by a HEWP when the action times are < 60 minutes.

2. The action time should be determined by:

- a) Using Attachment 3, Work Rate Determinations and Attachment 4, Action Times.
- b) Knowing the WBGT temperature, work rate, and protective clothing requirements, the Job Supervisor should determine the action time using Attachment 4, Action Times. Enter this data on the HEWP and HEWP Supplementary Report Forms, as required.
- e. Personnel should shed body heat in a cooler location at designated intervals prior to re-entry into a hot environment when working on a HEWP. These intervals should be determined from the following equation: Rest Time = Work Time divided by Action Time multiplied by 60 minutes or Industrial Safety can assist in the determination.
- f. Job Supervisors should mark the personal protective equipment, work practices, and Engineering controls needed to ensure maximum protection for personnel.
 - 1. The cooling vest or suit will provide body cooling only while the cooling substance retains its cooling capabilities. Action times can increase until the cooling capacity of the substance ceases. Once the substance has released its cooling capacity, the cooling vest or suit will retain body heat and the body temperatures will increase quickly.
 - 2. Some types of respiratory protection equipment can, in addition, provide some body cooling capability (e.g., supplied air hoods).
- g. Job Supervisor should have appropriate signatures completed in Sections 9, 10, and 11.
- h. The HEWP should be posted in the work area and kept with the work package (e.g., Work Order, Surveillance, etc.), available for review, and should remain part of the work packages documentation.

3.2.3 Job Supervisors should be aware of the work areas which could be a potential source of heat stress to a worker.

3.2.4 Care shall be taken in determining an individual's ability to withstand heat exposure. The Hot Environment Pre-Job Briefing (Attachment 5) and Attachment 6 should be reviewed by all employees prior to working on a HEWP.

3.2.5 For temperatures > 120°F WBGT, contact the Industrial Safety Group for a calculation of allowable action times and personnel protective measures to be used.

3.3 RADIATION PROTECTION PERSONNEL

- 3.3.1 During periods of weather-induced prolonged high temperatures, a series of Hot Work Environment Work Permits with instructions may be established to cover entries into areas of the RCA which are $\geq 90^{\circ}\text{F}$ WBGT or has an action time < 60 minutes. These permits will be in effect for all work except that having a specific HEWP. The Industrial Safety Staff or their designee should prepare the permits.
- 3.3.2 Industrial Safety may be contacted for guidance for methods of controlling heat stress for exceptionally hot work sites.
- 3.3.3 Industrial Safety may recommend safety equipment based on the type of work to be performed and the hazards involved.

3.4 DEPARTMENT MANAGER

- 3.4.1 The responsible Department Manager or designees approval will be required on the HEWP for all entries where action times are < 30 minutes.

4. RECORDS

- 4.1 Attachments 1 and 2 (when completed and attached to a work package) are sent to CNS Records (quality record upon work package close-out).

ATTACHMENT 1 HOT ENVIRONMENT WORK PERMIT

ATTACHMENT 1 HOT ENVIRONMENT WORK PERMIT

1. Date: _____ 2. Initiator: _____

3. Job Function Number: _____ 4. Job Site Location: _____

5. Description of Work: _____

6. Environmental Survey Data For Hot Environment:

WBGT: _____
_____ _____
Temperature Monitor Signature Time/Date

7. Type of work:
- Light - Walking/Sitting
 - Moderate - Standing, Light Arm Work (Welding)
 - Heavy - Lifting, Pulling, Pushing, Climbing

8. Precautions:

Action Time: _____ Cooling Off Period: _____ Personal Protective Equipment: <input type="checkbox"/> Cooling Suit Or Vest <input type="checkbox"/> Heat Resistant Gloves <input type="checkbox"/> SCBA <input type="checkbox"/> Supplied Air/Hood <input type="checkbox"/> Air Purifying <input type="checkbox"/> Electrolyte Fluids	Work Practice And Engineering Controls <input type="checkbox"/> Two Person Team <input type="checkbox"/> Communication With Control Room Established (required) <input type="checkbox"/> Continuous Atmospheric Monitoring <input type="checkbox"/> Pre-Work Ventilation <input type="checkbox"/> Continuous Ventilation <input type="checkbox"/> Thermal Shielding <input type="checkbox"/> Isolation Of Heat Source <input type="checkbox"/> Introduction Of Cooled Air <input type="checkbox"/> Circulation Of Existing Air <input type="checkbox"/> Reduced Humidity
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9. _____
Job Supervisor's Signature Time/Date

10. _____
Department Manager's Approval Time/Date
(required for action times < 30 minutes)
(Department Which Initiates HEWP)

11. HEWP Terminated By Supervisor At:

Signature Time/Date

ATTACHMENT 4 ACTION TIMES

ATTACHMENT 4 ACTION TIMES

WBG (°F)	ALLOWABLE ACTION TIME IN WORK CLOTHES (minutes)			ALLOWABLE ACTION TIME IN SINGLE PC's (minutes)			ALLOWABLE ACTION TIME IN DOUBLE PC's (minutes)			ALLOWABLE ACTION TIME IN PLASTICS OR RESPIRATOR (minutes)		
	TYPE OF WORK			TYPE OF WORK			TYPE OF WORK			TYPE OF WORK		
	LOW	MOD	HIGH	LOW	MOD	HIGH	LOW	MOD	HIGH	LOW	MOD	HIGH
120	20											
118	20											
116	25											
114	25	15		15								
112	30	20		20								
110	35	20		25			20					
108	45	25		25	15		20					
106	50	25		30	20		25	15				
104	60	30	15	35	20		25	20		15		
102	75	35	20	45	25		30	20		20		
100	90	40	20	50	25		40	20		25	15	
98	105	45	25	60	30	15	45	25		30	15	
96	130	50	35	75	35	20	55	30		30	20	
94	165	55	40	90	40	20	70	30	20	40	20	
92	195	70	45	105	45	25	80	35	20	45	25	
90	230	85	55	130	50	35	100	40	25	55	30	
88	NL	110	70	165	55	40	120	45	30	65	30	15
86	NL	170	85	195	70	45	150	50	35	80	35	20
84	NL	240	115	230	85	55	180	60	40	100	40	25
82	NL	NL	240	NL	110	70	210	75	45	120	45	30
80	NL	NL	NL	NL	180	90	NL	95	65	150	50	35

NL - No Limit

The following is a list of conditions that can lead to increased health risk and/or reduced ability to work in a hot environment. Employees who have experienced or are experiencing these conditions are encouraged to inform their supervision.

1. History or recurrent episodes of heat illness or heat-related disorders increase an individual's susceptibility to heat illness.
2. Colds, viruses, infections, etc., increase susceptibility to heat illness.
3. Nausea or diarrhea in the past 24 hours.
4. Infection or disease resulting in a fever.
5. High blood pressure.
6. Medications (prescription or non-prescription). It is the employee's responsibility to provide the District documentation from their physician if prescription medications will not allow them to work in high temperature or humidity work areas.
7. Organic diseases of the heart or vascular system.
8. Diagnosed hypertension (high blood pressure).
9. Chronic obstructive pulmonary diseases or an active lung disease.
10. History or recurrent episodes of seizures.
11. Pregnancy.
12. Core temperatures above 100.4°F may be associated with temporary infertility in males and females.

1. DISCUSSION

HEAT-RELATED DISORDERS

The human body maintains a fairly 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 circulating 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 37°C (98.6°F) and is kept in balance and controlled by the brain. When lowering internal body temperature, the heart pumps more blood, blood vessels expand to accommodate the increased flow, and the capillaries which thread through the upper layers of 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 heat from the body.

If air temperature is as warm as or warmer than the skin, cooling of the body becomes more difficult because 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 or plastic PCs, the evaporation of sweat from the skin is markedly decreased. The body's efforts to maintain an acceptable body temperature is 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, brain, and other internal organs. Strength declines and fatigue occurs. Alertness and mental capacity also may be affected. Workers who must perform delicate or detailed work may find their accuracy suffering as well as comprehension and retention of information lowered.

If the workers internal body temperature begins to rise, the signs and symptoms of heat-related illness may develop. Symptoms of heat stress illnesses should be reported to the Supervisor and evaluated by Occupational Health. The information presented below details a variety of heat induced disorders:

Heat Rash - Also know as a prickly heat, is likely to occur in hot, humid environments where the skin remains wet and sweat is not easily removed from the surface of the skin by evaporation. The sweat ducts become plugged and a skin rash soon appears. The rash can be complicated by infection when extensive and reduce worker performance due to irritation. This condition can be prevented by resting in a cool place part of each day and by regularly bathing and drying the skin.

Heat Syncope (Fainting) - Can occur to a worker who is not accustomed to hot environments and who stands erect and immobile while in the heat. Blood vessels enlarge as the body attempts to control internal temperature, blood may pool rather than return to the heart to be pumped to the brain. Upon lying down, the worker should soon recover. This condition can be diminished by the worker moving around to avoid blood pooling. This could be fatal if a person were to be alone and become unconscious in an upright position.

Heat Cramps - Are painful spasms of the muscles that occur to those who sweat profusely in the heat, drink large quantities of water, but do not adequately replace the body's electrolytes. The drinking of large quantities of water tends to dilute the body's fluids while the body continues to lose electrolytes. The low electrolyte level in the muscles causes painful cramps usually affecting the arms, legs, and abdomen; but tired muscles used in performing the work are usually the ones most susceptible to cramping. Cramps may occur during or after work hours and may be relieved by replacing the electrolytes.

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, giddiness, 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 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. Heat exhaustion may be a prelude to heat stroke. Do not wait for signs of heat stroke to remove the employee from the hot area. The employee should then be referred to EMTs for treatment.

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 40.5°C (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 administered immediately. This includes removing the victim to a cool area, thoroughly soaking the clothing with water, and vigorously fanning the body to increase cooling. Early recognition and treatment of heat stroke are the only means of preventing permanent brain damage or death.

1.1 DEFINITIONS

- 1.1.1 Acclimatization - Enhanced tolerance to heat, occurring after 1 to 2 weeks of exposure to hot environments, resulting in the ability to stay longer in such hot environments with minimal difficulty as compared with the response on initial exposure.
- 1.1.2 Ambient Temperature - The surrounding air temperature in a room or general area as measured with a standard dry bulb thermometer.
- 1.1.3 Chemical Suits - Full body impermeable plastic coveralls used to prevent chemical skin contamination.
- 1.1.4 Cooling Vest or Suit - A vest or suit containing packets of ice or other frozen or cold material which is used to slow the rise in the body's temperature.
- 1.1.5 Dry Bulb (DB) - An uncorrected direct measurement of the air temperature. This temperature is proportional to the heat exchange by convection.
- 1.1.6 Heat Cramps - Painful muscle twitching and cramping, usually following heavy work and profuse sweating, causing a loss of salt in the body.
- 1.1.7 Heat Exhaustion - Exhaustion caused by an insufficient flow of blood to the brain. Symptoms include dry mouth, excessive thirst, loss of coordination, headache, dizziness, fatigue, pale and shaky look, and cold, clammy skin. May develop into heat stroke.
- 1.1.8 Heat Illness - Occurs due to an increased body temperature and/or a loss of body fluids and salts. The five types of heat illness are heat cramps, heat exhaustion, heat rash, heat stroke, and heat syncope.

- 1.1.9 Heat Stress - The physiological stress which occurs when the body's temperature rises above normal and the body produces or gains more heat than it is capable of losing.
- 1.1.10 Heat Stroke - A serious medical emergency caused by the failure of the body's cooling mechanism. Heat stroke is a life-threatening illness and shall always be treated as such.
- 1.1.11 Heat Syncope - Weakness, fatigue, blurred vision, and often times fainting spells due to the pooling of blood in areas away from the brain. Usually caused by standing, squatting, kneeling, or sitting immobile for long periods.
- 1.1.12 Heat Rash - A common skin irritation caused by the skin being continuously wet with sweat. It is prevalent in industrial environments that give a worker unrelieved exposure to humid heat. Also called prickly heat.
- 1.1.13 Hot Environment - An area or condition in which a worker may be exposed to conditions capable of causing heat stress. They may include, but are not limited to:
- 1.1.13.1 Areas of high heat and/or humidity (i.e., Drywell, steam pipes, or steam or hot water leak areas).
 - 1.1.13.2 Areas with significant sources of radiant heat (i.e., boiler rooms, diesel generator rooms, steam piping, and other heated vessels).
 - 1.1.13.3 Working in protective clothing such as plastic protective clothing or chemical suits.
 - 1.1.13.4 Work involving heavy physical labor.
- 1.1.14 Protective Clothing - A term generally referring to cotton overalls or tyvek materials at CNS.
- 1.1.15 Plastic Protective Clothing - Full body or two-piece impermeable plastic suits used to prevent radioactive skin contamination or contamination from hazardous chemicals.
- 1.1.16 Radiant Heat - Heat transferred from a hot object to the surrounding environment through invisible waves. For example, the warmth a person feels when standing next to a hot surface such as a steam line.
- 1.1.17 Respiratory Protection Devices - Devices which supply filtered, supplied or self-contained respirable air supplies to the individual wearer.
- 1.1.18 Action Time - The calculated time most healthy average individuals can expect to work before a break should be given. The time generally reflects an ~ 2°F rise in the body's temperature.

2. REFERENCES

2.1 COMMITMENTS AND OBLIGATIONS MATRIX

COMMITMENTS AND OBLIGATIONS	AFFECTED STEPS
QAPD	Unvalidated

2.2 CODES AND STANDARDS

- 2.2.1 29CFR1900, Labor, Occupational Safety, and Health Administration.
- 2.2.2 Electric Power Research Institute, Heat-Stress Management Program for Nuclear Power Plants.
- 2.2.3 NIOSH Publication 72-10269, Criteria for a Recommended Standard, Occupational Exposure to Hot Environments.
- 2.2.4 NIOSH, The Industrial Environment - Its Evaluation and Control, Chapters 30, 31, and 38.