

HEAT STRESS MANAGEMENT PROCEDURE

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Document Author:	Team Leader Preventive Medicine Services	Document Coordinator:	Team Leader HSE Systems
Approved by:	KOC HSEMS Procedures Sub-committee		
Authorized by:	KOC HSSE Implementation Committee		
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1.0 Purpose/Scope

This procedure provides information and guidelines for assessment, prevention, and management of heat stress in the workplace.

This procedure is applicable to all KOC workers including contractors and sub-contractors, at all KOC facilities, who are exposed to the risk of heat stress in both outdoor & indoor work environments.

2.0 Definitions

Acclimatization: Acclimatization is the beneficial physiological adaptations that occur over a period of 7-14 days during repeated exposure to a hot environment. These adaptations include:

- Increased sweating efficiency (earlier onset of sweating, greater sweat production, and reduced electrolyte loss in sweat).
- Stabilization of the circulation.
- The ability to perform work with lower core temperature and heart rate.
- Increased skin blood flow at a given core temperature.

New workers will need more time to acclimatize than workers who have already had some exposure.

Administrative controls: Efforts by management to limit personnel's heat exposure by modifying their schedules (e.g. rotation) or locations.

Conduction: is the transfer of heat between materials that contact each other.

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.

Dry Bulb Temperature: The dry bulb temperature (t_a) is commonly used for estimating comfort conditions for sedentary people wearing conventional indoor clothing (1.4 clo including the surface air layer).

Heat: is a measure of energy in terms of quantity.

Heat Cramp: A heat-related illness characterized by spastic contractions of the voluntary muscles (mainly arms, hands, legs, and feet) usually associated with restricted salt intake and profuse sweating without significant body dehydration.

Heat Exhaustion: A heat-related illness characterized by elevation of core body temperature above 38°C (100.4°F) and abnormal performance of one or more organ systems, without injury to the central nervous system.

Heat rash: 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.

Heat Strain: The physiological response to the heat load (external or internal) experienced by a person, in which the body attempts to increase heat loss to the environment in order to maintain a stable body temperature.

Heat Stress: The net heat load to which a person may be exposed from the combined contributions of metabolic heat, environmental factors, and clothing requirements which may result in an increase in heat storage in the body.

Heat stress Index: is a single value that takes both workplace temperature and humidity into account. It is a range or sequence of single numbers that correlate with the degree of thermal strain likely to be experienced by the exposed person.

The Wet Bulb Globe Temperature (WBGT) index, is the most commonly used index for assessing heat stress based on its simplicity of use.

Heat Stroke: An acute medical emergency caused by exposure to heat from an excessive rise in body temperature [above 41.1°C (106°F)] and failure of the temperature-regulating mechanism.

Heat Syncope: Collapse and/or loss of consciousness during heat exposure without an increase in body temperature or cessation of sweating, similar to vasovagal fainting except heat induced.

Humidity, Relative (RH): The ratio of the water vapor present in the ambient air to the water vapor present in saturated air at the same temperature and pressure.

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.

Personal protective equipment (PPE): commonly referred to as "PPE", is equipment worn by a person to minimize exposure to potential hazards.

Psychrometric (Heat Index) chart: is the graphical representation for the relationships among the dry bulb temperature (Ta), wet bulb temperature (Twb), dew point temperature (Tdp), relative humidity (RH), and vapor pressure (pa). By knowing any two of these five climatic factors, the other three can be obtained from the psychrometric chart.

SENTINEL HEALTH EVENTS (SHEs): The occurrence of heat-related illnesses among a group of workers in a hot environment, or the recurrence of such illnesses in individual workers, represents "sentinel health events" (SHEs).

Wet Bulb Globe Temperature (WBGT): This is an environmental temperature arrived at by measuring dry air temperature, humidity, airflow and radiant energy (i.e., usually direct sunlight being absorbed by clothing), used to calculate a thermal load on the person.

The WBGT index: is a type of heat stress index. It is used to determine the exposure limits that can be considered to be safe for most people, and are generally conservative.

3.0 General Requirement

- ❖ KPC HSSE Policy
- ❖ KOC HSSE Management System Framework Guide, Element 3 “Risk and Compliance Management”
- ❖ KPC Occupational Health Management Standard (KPC-HSSE-E06-OH-S02)
- ❖ Kuwait Environment Public Authority (KEPA) Regulations

4.0 Key Responsibilities

4.1. Managers

- To provide necessary support for enabling compliance with this procedure.
- Ensure implementation of “Summer Working Hours” as per law.

4.2 Team Leaders

- *Ensure that the relevant elements of the Heat Stress assessment, prevention and management Procedure are completed, e.g., controls, information, training, etc.*
- Ensure that appropriate training about symptoms of heat illnesses and treatment is made available to all personnel (supervisors and workers) identified to receive training.
- Administer the Heat Stress Prevention Programmes (acclimatization protocol, provide more frequent/longer rest breaks, worker rotation or assigning more workers to perform the same tasks).
- Ensure that the personnel use appropriate heat protection controls (where applicable).
- Investigate the work relationship if signs and symptoms of heat related illnesses including heat stress are found.
- Ensure that the heat controls are put in place and maintained according to the hierarchy of Control.
- Ensure, where possible, to prevent exposure to the hazardous condition on the spot if within their jurisdiction.
- Assess and document the overall effectiveness of the heat stress prevention and management programs.
- Ensure the usage of signage in the areas where heat protection controls must be used.
- Ensure that the proper PPE is available and is used where needed.
- Conduct and document feasibility studies for engineering controls and to ensure that measures are implemented according to the plan.
- To ensure compliance with applicable regulations (KEPA).
- Ensure respective Contractors’ adherence to the regulations & procedure.

4.3 Team Leaders HSE (Asset/Directorate)

- Monitor the Heat Stress Prevention Programmes (acclimatization protocol, provide more frequent/longer rest breaks, worker rotation or assigning more workers to perform the same tasks).
- Ensure that the appropriate equipment, materials, supplies, and training services required by this procedure are budgeted for and acquired.

- ensure that appropriate Heat stress management training plan is developed by the groups within their respective assets/directorates
- Advise on the engineering controls (types, when and where), to reduce the workplace temperature.
- Conduct periodic heat/Temperature surveys using KOC approved heat survey equipment, by competent HSE Personnel (preferably Industrial/Occupational Hygienist).
- Identify worksites, when and where, controls to reduce the exposure to high temperatures at workplace may be used on the site, by Industrial Hygienist.
- Forward copies of heat/Temperature survey reports regularly to controlling team for data collection and record keeping.
- Forwards copies of Temperature/Heat survey reports to HSE Corporate for data collection and record keeping. TL H&E and TL PMS shall have access (online/hard copy) to this data.
- Notify Controlling Teams of any extreme changes in workplace temperature levels.
- Review **and approve** workplace illnesses pertaining to heat stress reported in *MyHSSE* and assign appropriate corrective actions.
- Ensure that all employees are provided awareness on this guideline.
- Assist Incident Owners in formation of Incident Investigation Committees for necessary Investigation.
- To ensure compliance with applicable regulations (KEPA).

4.4 Chief Industrial Hygienist (CIH)

- Identify worksites, when and where, controls to reduce the exposure to high temperatures at workplace may be used
- Develop the Heat Stress Prevention Programmes (acclimatization protocol, frequent/longer rest breaks, worker rotation or assigning more workers to perform the same tasks).
- Develop an appropriate Heat Stress Management Training plan.
- Notify Team Leaders HSE (Asset/Directorate) of any extreme changes in workplace temperature levels.

4.5 Industrial Hygienist (IH)

- Identify worksites, both indoors & outdoors, exposing employees to high temperatures at workplace.
- Conduct periodic heat/Temperature surveys using KOC approved heat survey equipment.
- Prepare heat/Temperature survey reports and forward copies of these reports to Team Leaders HSE (Asset/Directorate), via CIH, for data collection and record keeping.
- Monitor workplace illnesses pertaining to heat stress reported in *MyHSSE* and suggest appropriate corrective actions.
- Provide periodic Heat Stress Awareness Sessions to all employees.
- To participate in any activity related to Heat Stress Management.

4.6 Team Leader Health and Environment (H&E)

- Advise on issues of Heat Stress Prevention Programmes including regulatory requirements.

4.7 Ahmadi Hospital/ Satellite Clinics, Ambulance Services

- Treat heat-related injuries and illnesses.
- Maintain accessible and confidential individual employee medical records.
- Provide adequate resources and support for provision of first aid services.
- Ensure all the emergency equipment in Ahmadi Emergency Unit and Satellite Clinics are periodically maintained, calibrated and kept in working condition (Bio Medical Engineering Team).
- Ensure all ambulances in Ahmadi Hospital and Satellite clinics are adequately equipped and maintained in good working condition.
- Ensure availability of relevant records pertaining to first aid care, emergency medicines / consumables, equipment maintenance, first aid kits & ambulances.

4.8 TL PMS

- Conduct pre-employment medical examination (PEME) test to ensure suitability of the employee to the assigned job.
- Conduct the medical screening of employees, during Periodic Medical Examination (PME), who may be exposed to hot environments at workplace.
- Establish, schedule and perform medical screening during Periodic Medical Examination (PME), to identify early symptoms of occupational disease at a reversible or treatable phase.
- Determine employee medical restrictions as appropriate.
- Advise on appropriate working conditions and rearrangements for employee to aid their prompt return to work and prevent further deterioration.
- Support HSE Group & Asset / Directorate HSE Teams in implementation of workplace programs for prevention and control of workplace heat related illnesses.
- To support Asset / Directorate HSE Teams in the investigation of incidents of workplace heat related illness.

4.9 Supervisors

- Report all workplace heat stress-related incidents in My HSSE.
- Ensure there is an adequate supply of cool drinking water or a fluid replenishment readily available.
- be alert for warning signs of heat stress; take action as needed (e.g; on warm or hot days, consider working the hotter jobs in the cooler part of the day, on nights or the use of other methods to reduce heat stress).
- Provide additional breaks, as needed, to cool off on hot jobs.
- Ensure that the worker who may be exposed to hot environments at workplace must wear the appropriate personal protective equipment (PPE).
- Periodically review heat stress hazards and precautions with personnel.

4.10 Contractors Management

- Responsible for preparing Heat Stress Management Plan and making it part of Contractor HSE Plan.
- Ensure the compliance of this procedure while carrying out any work in KOC areas.
- On warm or hot days, consider working the hotter jobs in the cooler part of the day, or the use of other heat stress reducing methods.
- Make available proper PPE during warm weather and for high temperature jobs.

- Ensure that the personal protective equipment (PPE) provided to the workers meet the KOC's specifications.
- Conduct pre-employment medical examination (PEME) test to ensure the suitability of the worker to the assigned job.
- Conduct periodical medical examination (PME) to ensure the workers are not being affected by any hot environments at workplace in KOC areas.
- Conduct heat/Temperature surveys using KOC approved heat survey equipment by a competent HSE Personnel (preferably Industrial/Occupational Hygienist).
- Submit heat/Temperature survey reports to controlling team for data collection and record keeping.
- Ensure that appropriate training / awareness is provided to all their identified Supervisors and workers.

4.11 Employees (KOC / Contractor)

- be familiar with the early warning signs of heat stress in themselves and coworkers and to take immediate action when they are noted.
- conduct periodic self-evaluations in hot or warm weather to get an early warning sign of impending heat stress.
- utilize appropriate personal protective equipment as needed.
- drink plenty of fluids when it is hot to prevent dehydration.
- inform your supervisor of any heat stress concerns (unsafe act or condition) if it does not appear that the job can be done safely as it is set up.
- be especially alert for signs of heat stress if recovering from an illness or if returning to work after being off for a week or more.
- comply with all specific requirements of this procedure in relation to protection from heat exposure in KOC.

5.0 Procedure

5.1 Health Effects of Occupational Heat Exposure

An essential requirement for continued normal body function is that the deep body core temperature be maintained within the acceptable range of about 37°C (98.6°F) ± 1°C (1.8°F).

Those at risk of heat stress include outdoor workers (working on warm and hot days) and workers in hot environments, such as fire fighters, construction workers, miners (particularly surface miners), boiler room workers, and factory workers.

Health Effects of Occupational Heat Exposure		
Occupational illnesses	Physical Injuries (due to)	Heat injuries
Acute (heat cramps, heat rashes, heat syncope, heat exhaustion, heat stroke, or death). The employees with known health conditions (Obesity, Diabetes, kidney disease etc) are more predisposed towards ill effects of heat exposure.	<ul style="list-style-type: none"> • Sweaty palms • fogged-up safety glasses • dizziness 	Burns (as a result of contact with hot surfaces, steam, or fire).
Chronic (kidney stones, increased death rate)	Reduce brain function (decreased reasoning ability).	

5.1.1 Risk Factors influencing heat-related illness (including heat stress) **(Refer to Appendix 2, Table 2.1: Risk Factors influencing heat-related illness).**

5.1.2: Acute heat-related illness:

These disorders range from simple postural heat syncope (fainting) to the complexities of heat stroke.

A summary of clinical features and first-aid treatment of heat-related illnesses is presented in **Appendix 2: Table 2.2: Signs & Symptoms and first aid of heat-related illness**.

5.1.3: Chronic heat-related illness:

In a study, heat-related illness cases were shown to have a 40% increased risk of all-cause mortality including increased incidence of kidney stones. Further, it was found that males with heat-related illness were at an increased rate of death from cardiovascular disease and ischemic heart disease.

5.2 Assessment of Heat Stress survey (methodology):

5.2.1 Competency of Assessor

Detailed environmental temperature and heat index assessments must be carried out by a competent HSE personnel (preferably Industrial/Occupational Hygienist). The personnel carrying out the assessment should have a thorough understanding of the:

- Objectives of the assessment
- Correct way to use Portable Heat Stress Monitor to measure heat index outdoors
- Correct way to use Indoor Air Quality Monitor to measure heat index indoors
- Limitations of heat index measuring instruments
- Limitations of the heat exposure assessment strategy
- Interpretation of the results
- Recording of the results
- The relevant legislation and KOC requirements

5.2.2 Frequency of heat stress surveys

Heat stress surveys shall be conducted at all work areas including buildings (which do not have centralized air conditioning) at the following intervals:

- Preliminary assessments should be carried out when:
 - ✓ there has been no previous assessment, or
 - ✓ when previous assessments are 2 or more years old, or
 - ✓ there are additions of equipment / change in process that may affect heat stress levels, or
 - ✓ when personnel notice increases in heat stress levels.
- Annually, for all industrial areas with heat producing processes (unless an operation has at least two years of data that show that heat stress levels remain consistent). In this case, the interval can also be extended to every 24 months (two years).
- Generally, plans for hot weather should be in place between May 1 and September 30 or based on the risks associated with heat stress.

5.2.3 Development of Heat Stress Survey

Refer to **Appendix 8: General Workplace Heat Stress Survey Checklist** (Factors to be evaluated during survey when reviewing a heat stress situation).

5.3 Control measures (Steps to prevent Heat Stress)

To control/prevent heat related illness including Heat stress, the two most important methods are hydration and acclimatization because they increase the ability of the body to tolerate heat stress. Engineering and administrative controls too are important in reducing heat exposure.

5.3.1 Hydration

The most important factor in preventing heat illnesses is adequate water intake.

- Thirst is not an adequate indicator. Relying on thirst will result in dehydration.
- Adequate water intake (except alcoholic beverages) throughout the day is necessary. Ample supplies of liquids should be placed close to the work area.
- Workers in hot jobs should drink at least five to seven ounces (one cup) of cool water every 15 to 20 minutes even if they're not thirsty.
- The water should be cool [10°-15°C (50-59°F)], but neither warm nor cold.
- Under conditions of profuse sweating (increased level of activity in a hot environment for a prolonged period of time ≥ 2 hours), a commercial electrolyte replacement drink may be used in place of water
- Salt tablets are to be avoided.
- Drinking from disposable drinking cups is preferable to using drinking fountains.
- The amount of dehydration can be estimated by measuring body weight. However, following a recommended water drinking schedule is usually satisfactory.

(Appendix 3: Recommendations for fluid replacement during warm weather conditions).

5.3.2 Acclimatization

- A physiological adaptation will occur with repeated exposure to hot environments. Generally, individuals in good physical condition acclimatize more rapidly than those in poor condition.
- Approximately one week of gradually increasing the workload and time spent in the hot environment will usually lead to full acclimatization. NIOSH (1986) says that, for workers who have had previous experience (acclimatized) in jobs where heat levels are high enough to produce heat stress, the regimen should be
 - 50% exposure on day one,
 - 60% on day two,
 - 80% on day three, and
 - 100% on day four.

For new workers (unacclimatized) who will be similarly exposed, the regimen should be 20% on day one with a 20% increase in exposure each additional day.

- Acclimatization is lost when exposure to hot environments does not occur for several days. After one week absence, a worker needs to reacclimatize by following a schedule similar to that for initial acclimatization.

5.3.3 Engineering controls

Engineering controls shall be based on risk assessment. The types of Engineering controls are given below:

- General ventilation** is used to dilute hot air with cooler air (generally cooler air that is brought in from the outside). A permanently installed ventilation system usually handles large areas or entire buildings. Portable or local exhaust systems may be more effective or practical in smaller areas.

- b) **Air treatment/air cooling** differs from ventilation because it reduces the temperature of the air by removing heat (and sometimes humidity) from the air.
- c) **Air conditioning** is a method of air cooling. An alternative to air conditioning is the use of chillers to circulate cool water through heat exchangers over which air from the ventilation system is then passed.
- d) **Local air cooling** can be effective in reducing air temperature in specific areas. Two methods have been used successfully in industrial settings. One type, cool rooms, can be used to enclose a specific workplace or to offer a recovery area near hot jobs. The second type is a portable blower with built-in air chiller.
- e) Another way to reduce heat stress is to increase the air flow or **convection** using fans, etc. in the work area (as long as the air temperature is less than the worker's skin temperature).
- f) **Heat conduction** methods include insulating the hot surface that generates the heat and changing the surface itself.
- g) Simple engineering controls, such as shields, can be used to reduce **radiant heat**, i.e. heat coming from hot surfaces within the worker's line of sight. Having cooler surfaces surrounding the worker assists in cooling. With some sources of radiation, such as heating pipes, it is possible to use both insulation and surface modifications to achieve a substantial reduction in radiant heat.
- h) Polished surfaces make the best barriers, although special glass or metal mesh surfaces can be used if visibility is a problem.

5.3.4 Administrative controls - Training

Training is the key to good work practices.

- ✓ **Training program.** NIOSH (1986) states that a good heat stress training program should include at least the following **topics**:
 - Risk factors for heat-related illness.
 - Different types of heat-related illness, including how to recognize common signs and symptoms.
 - Heat-related illness prevention procedures.
 - Importance of drinking small quantities of water often.
 - Importance of acclimatization, how it is developed, and how your worksite procedures address it.
 - Importance of immediately reporting signs or symptoms of heat-related illness to the supervisor.
 - Procedures for responding to possible heat-related illness.
 - Procedures to follow when contacting emergency medical services.
 - Procedures to ensure that clear and precise directions to the worksite will be provided to emergency medical services.
 - Dangers of using drugs, including therapeutic ones, and alcohol in hot work environments;
 - Use of protective clothing and equipment; and
 - Purpose and coverage of environmental and medical surveillance programs (PEME, PME) and the advantages of worker participation in such programs.

- ✓ 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.
- ✓ Employers are prohibited from employing workers outdoors between the hours of 11am. and 4 pm. This section is only effective during the period from the first of June to the 31st of August (Ministerial Order No. 212(a) of 2011 amending Ministerial Order No. 189 of 2010 concerning working hours in open places. See http://www.ilo.org/dyn/natlex/natlex4.detail?p_lang=en&p_isn=89454

Train workers before it gets hot.

- ✓ Reinforce the training on hot days.

5.3.5 Other Administrative Controls

The following administrative controls can be used to reduce heat stress:

- ✓ Use **planning checklists** for daily planning and planning ahead to prevent heat stress
 - ✓ Reduce the physical demands of work, e.g., excessive lifting or digging with heavy objects;
 - ✓ Provide recovery areas, e.g., air-conditioned enclosures and rooms;
 - ✓ Use shifts, e.g., early morning, cool part of the day, or night work;
 - ✓ Use relief workers;
 - ✓ Use worker pacing; and
 - ✓ Assign extra workers and limit worker occupancy, or the number of workers present, especially in confined or enclosed spaces.
 - ✓ Use intermittent rest periods with water breaks;
- (Refer to Appendix 9: Elements of Heat-related illness Prevention Plan)**

5.3.6 Personal control measures

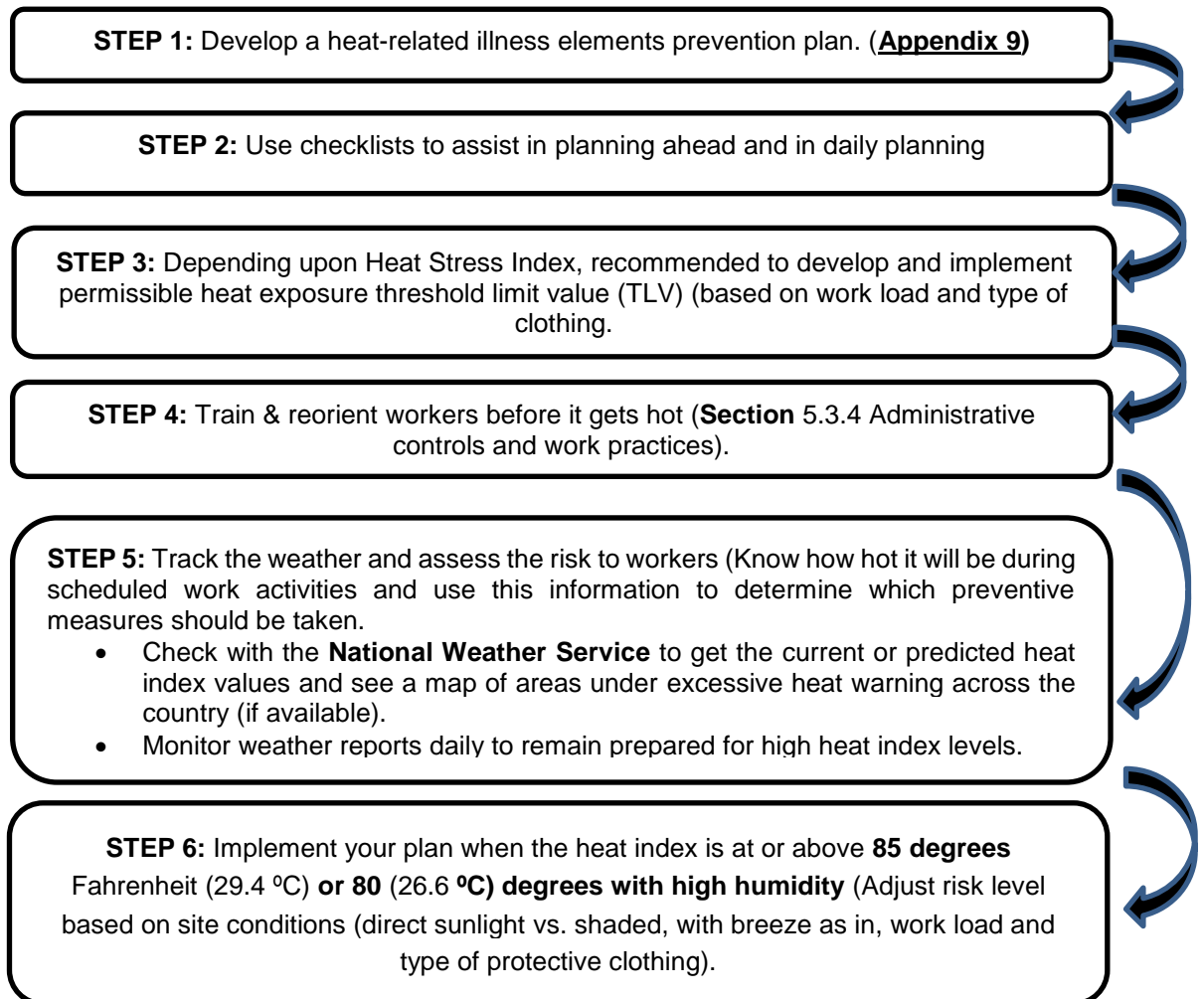
- ✓ Avoid eating large meals before working in hot environments.
- ✓ Avoid alcohol or beverages with caffeine.
- ✓ Wear light clothing that permits the evaporation of sweat (e.g., cotton clothing).
- ✓ Use sunscreen and cover your head if working outside.
- ✓ Advise workers to check with their doctor if their medication may affect their heat tolerance.
- ✓ Make healthy lifestyle choices (i.e., body weight, fitness, diet, rest, etc.)
- ✓ Undergo Pre employment medical examination (PEME) to be declared Fit for job.
- ✓ Regular Periodic medical examination (PME).
- ✓ Employee health evaluations may be requested if an employee who has been assigned work in hot environments is aware of individual risk factors that are present and may put them at greater risk for heat stress. Health evaluations shall also be provided in the event that an employee experiences health effects that are suspected to be heat illness or injury related.

5.4 Management Of Heat Stress (Heat Stress Prevention Program):

- ✓ For hot work environments, a **Heat Stress Prevention Program** should establish implementation criteria or triggers, to put the plan into effect e.g; daytime temp at or exceeds 85 degrees (29.4 °C) or 80 degrees (26.6 °C) with high humidity (OGP/CDC/NIOSH recommended criterion for implementing Heat Stress Prevention Program).

- ✓ Once in heat stress season, Occupational/Industrial Hygienist (including workers and supervisors) eventually learn to anticipate when heat stress controls “kick in.”
- ✓ Workers must also learn to listen to what their bodies are telling them and know how to respond appropriately.

5.4.1 PLAN/RESPONSE TO MANAGE AN ELEVATED HEAT INDEX: The steps in response to manage an elevated heat index are;



5.4.2 PROTECTIVE MEASURES TO TAKE AT EACH HEAT STRESS RISK LEVEL: The Occupational/Industrial Hygienist will use the protective measures described for each Heat Stress Risk Level to help plan ahead, and schedule and train the workers so that everyone is prepared to work safely as the heat index rises.

5.4.3 RECOMMENDED ACTIONS ACCORDING TO LEVEL OF RISK CONDITIONS:

- ✓ Actions for Low Risk Conditions: Heat Index Less Than 91°F (33°C)
- ✓ Actions for Moderate Risk Conditions: Heat Index is 91°F to 103°F (33°C to 39°C)
- ✓ Actions for High Risk Conditions: Heat Index is 103°F to 115°F (39°C to 46°C)
- ✓ Actions for Very High to Extreme Risk Conditions: Heat Index Greater Than 115°F (46°C)

The most critical actions to be taken to help prevent heat-related illness at each risk level, depending upon the heat index are described (Refer to **Appendix 6: Heat Stress Risk Levels and Associated Protective & Preventive Measures**).

For establishing, maintaining and managing first aid facilities for Occupational Heat related illness at workplace, please refer to **KOC.HE.004: Occupational Health & Hygiene - First Aid Procedure** & in this procedure refer to **Appendix 4: First Aid in Heat Stroke**.

5.4.4 PERSONAL EMPLOYEE MONITORING (self-evaluation):

Personal employee monitoring can be done by checking the **heart rate**, recovery heart rate, oral temperature, or extent of body water loss.

Heart rate (rapid pulse) is a good indicator of the degree of heat stress that a person is experiencing. It is recommended that other than for short periods of time that the maximum heart rate is-kept below the following levels:

Age (in years)	Max. Heart Rate
20	162
30	157
40	152
50	147
60	141

(**Note:** Since each person is different and medical conditions can affect reaction to heat stress, it is important to remember that these are only average indicators).

To check the heart rate, count the radial pulse for 30 seconds at the beginning of the rest period. If the heart rate exceeds 110 beats per minute, shorten the next work period by one third and maintain the same rest period.

The recovery heart rate can be checked by comparing the pulse rate taken at 30 seconds (**P₁**) with the pulse rate taken at 2.5 minutes (**P₃**) after the rest break starts. The two pulse rates can be interpreted using **Table 1** shown below:

TABLE 1: HEART RATE RECOVERY CRITERIA

Heart rate recovery pattern	P ₃	Difference between P ₁ and P ₃
Satisfactory recovery	<90	--
High recovery (Conditions may require further study)	90	10
No recovery (May indicate too much stress)	90	<10

Oral temperature can be checked with a clinical thermometer after work but before the employee drinks water. If the oral temperature taken under the tongue exceeds 37.6°C, shorten the next work cycle by one third.

Body water loss can be measured by weighing the worker on a scale at the beginning and end of each work day. The worker's weight loss should not exceed 1.5% of total body weight in a work day. If a weight loss exceeding this amount is observed, fluid intake should increase.

5.4.5 USE OF PERSONAL PROTECTIVE EQUIPMENT (PPE):

The weight of a self-contained breathing apparatus (SCBA) increases stress on a worker, and this stress contributes to overall heat stress. Chemical protective clothing such as totally encapsulating chemical protection suits will also add to the heat stress problem. Subject to availability, Heat protective PPE maybe used as described below:

5.4.5.1. Reflective Clothing:

- ✓ Which can vary from aprons and jackets to suits that completely enclose the worker from neck to feet, can stop the skin from absorbing radiant heat. Reflective clothing should be worn as loosely as possible. In situations where radiant heat is high, auxiliary cooling systems can be used under the reflective clothing.

5.4.5.2. Auxiliary Body Cooling Recommendations:

- ✓ Commercially available **ice vests**, though heavy, may accommodate as many as 72 ice packets, which are usually filled with water. Carbon dioxide (dry ice) can also be used as a coolant.
- ✓ **Wetted clothing** is effective when reflective or other impermeable protective clothing is worn. The clothing may be wetted terry cloth coveralls or wetted two-piece, whole-body cotton suits. This can be quite effective under conditions of high temperature and low humidity.
- ✓ **Water-cooled garments** range from a hood, which cools only the head, to vests and "long johns," which offer partial or complete body cooling.
- ✓ **Circulating air** is the most highly effective, as well as the most complicated, personal cooling system. By directing compressed air around the body from a supplied air system, both evaporative and convective cooling are improved.

5.4.6 ADMINISTERING FIRST AID:

For establishing, maintaining and managing first aid facilities for Occupational Heat related illness at workplace, please refer to **KOC.HE.004: First Aid Procedure**. This procedure also specifies responsibilities and minimum requirements for First Aid services, personnel, training, first aid kits, ambulances and equipment including CPR / AED (In addition, refer to **Appendix 6: Heat Stress Risk Levels and Associated Protective & Preventive Measures & Appendix 4: First Aid in Heat Stroke**).

5.5 Reporting & Investigation Of Heat Related Illness:

Occupational Heat related illness at workplace must be reported and investigated in accordance with KOC procedure "**KOC.HE.020 – Workplace Illness Reporting and Investigation Procedure**". Other causes of occupational Heat related illness at workplace from acute heat exposures, which may or may not be accompanied by chronic medical condition, must also be reported and investigated in accordance with this KOC procedure

6.0 Key Documents/Tools/References

- KOC.HE.004 – First Aid Procedure
- KOC.HE.020 – Workplace Illness Reporting and Investigation Procedure
- KOC.HE.022 – KOC Guidelines for Employee Health Surveillance
- KOC.GE.012 – Contractors HSE Oversight Procedure
- ANSI/ASHRAE Standard 55-2004, Thermal Environmental Conditions for Human Occupancy
- Criteria for a Recommended Standard :Occupational Exposure to Heat and Hot Environments, Dept. of Health and Human Services (CDC,NIOSH), Feb, 2016

- Health Hazard Evaluation Program, Report No. 2012-0039-3242, CDC/NIOSH, April, 2015
- Heat Stress Awareness Guide, Occupational Health and Safety Council of Ontario (OHSCO), 2007
- Heat Stress, Minnesota Dept. of Labor & Industry, MNOSHA, August 2012
- Heat Stress Procedure, Exxon Mobil, Safety Procedures, Joliet Refinery, Oct, 2013
- International Organization for Standardization. (1989). ISO 7243 *Hot environments – Estimation of the heat stress on working man, based on the WBGT-index (wet bulb globe temperature)* (2nd Ed.). Geneva, Switzerland
- Kuwait Environmental Public Authority Regulations - Implemented Under Law No. 21 of 1995 as Amended by Law No. 16 of 1996 Regarding Environmental Requirements and Standards in the State of Kuwait - Chapter II – Article 10 - The Working Environment and the Indoor Environment, Appendix No. (6-1) maximum limits allowed for heat stress in industrial environment (WBGT) Effective Temperature, Appendix No. (6-2) Upper limits of exposure for unimpaired mental performance (WBGT) Effective Temperature, Appendix (6-3) Upper limits considered and allowed for exposure to low temperatures in industrial environment & Appendix (6-4) Limits required for temperatures in indoor environment.
- Kuwait Ministerial Order No. 212(a) of 2011 amending Ministerial Order No. 189 of 2010 concerning working hours in open places. See http://www.ilo.org/dyn/natlex/natlex4.detail?p_lang=en&p_isn=89454
- OSHA Heat Illness Prevention Training Guide (*Guide to carry out heat safety training, with lesson plans*), 2011
- OSHA Technical Manual, Section III: Chapter 4, Heat Stress
- OSHA online at: www.osha.gov/SLTC/heatstress/index.html
- OSHA online at: www.osha.gov/dts/osta/otm/otm_iii/otm_iii_4.html
- NIOSH online at: <http://www.cdc.gov/niosh/topics/heatstress/>
- Cal/OSHA's Heat Safety Program at: www.99calor.org/english.html
- 3M™ QUESTemp°™ Heat Stress Monitors (User Manual)

Resources/ References:

- OSHA Heat Illness Prevention Training Guide (*Guide to carry out heat safety training, with lesson plans*), 2011
- OSHA's [factsheets and worksite posters](#)
- Cal/OSHA Video/PDF: [Water, Rest, Shade: The Work Can't Get Done Without Them](#)**
- Washington State Department of Labor and Industries [Outdoor Heat Exposure](#)**
- [ADOSH- Staying Safe while Working in Extreme Heat](#) (Video)
- Arizona Division of Occupational Safety and Health
- [Heat Hazards in Agriculture: A Guide for Employers to Carry Out Tailgate Training for Workers](#) (PDF) -Labor Occupational Health Program's (University of California, Berkeley, 2008)
- [Extension Training Module: Heat Stress](#) - The Ohio State University Extension
- [Fact Sheet: Heat Stress](#) (PDF) - Texas Department of Insurance

Appendices:

- **Appendix 1:** Flow Chart of Heat Stress Management (and response to manage an elevated heat index)
- **Appendix 2: Table 2.1:** Risk Factors Influencing Heat-Related Illness, **Table 2.2:** Signs & Symptoms and first aid of heat-related illness
- **Appendix 3:** Recommendations For Fluid Replacement During Warm Weather Conditions

- **Appendix 4:** First Aid in Heat Stroke
- **Appendix 5:** Heat Index (WBGT) Protective Measures for Worksites
- **Appendix 6:** Heat Stress Risk Levels and Associated Protective & Preventive Measures
- **Appendix 7:** Recommended Specifications For Portable Heat Stress Monitor
- **APPENDIX 8:** GENERAL WORKPLACE HEAT STRESS SURVEY CHECKLIST (FACTORS TO BE EVALUATED DURING SURVEY WHEN REVIEWING A HEAT STRESS SITUATION)
- **Appendix 9:** Elements of Heat Stress Prevention Program/ Plan

7.0 Abbreviations

- **ACGIH** – American Conference of Governmental Industrial Hygienists
- **ANSI** – American National Standards Institute
- **ASHRAE** – American Society of Heating, Refrigeration and Air-Conditioning Engineers, Inc.
- **CDC** – Centers for Disease Control and Prevention
- **HSE** – Health, Safety and Environment
- **HSEMS** – HSE Management System
- **HSI** – Heat Stress Index
- **IH** – Industrial Hygienist
- **KEPA** – Kuwait Environmental Public Authority
- **KOC** – Kuwait Oil Company
- **KPC** – Kuwait Petroleum Corporation
- **OSHA** – Occupational Safety and Health Administration
- **NIOSH** – National Institute for Occupational Safety and Health (United States)
- **PEME** – Pre Employment Medical Examination
- **PME** – Periodic Medical Examination
- **SCBA** – Self Contained Breathing Apparatus
- **WBGT** – Wet Bulb Globe Temperature

8.0 HSE Records (Retention Period)

- Heat Stress survey reports (5 Yrs)
- Heat Stress Management Plan (5 Yrs)
- Complaint Transmittals (5 Yrs)
- Training Records (5 Yrs)
- Medical evaluation records (Indefinite period)

Record keeping is to be documented according to the **KOC.GE.045: HSE Records Management Procedure** and Ahmadi Hospital record keeping procedures. Where possible, records should be maintained electronically.

9.0 Review & Revision Log

Revision/ Review Date	Revision/Review Details
February 2, 2017	Draft procedure circulated for comments.
June 5, 2017	Approved by HSSE Implementation Committee and Issued for Implementation.
February 13, 2022	Section 1.0 – amended scope for better clarity and understanding. Section 2.0 – amended some definitions for better understanding and deleted some definitions for removing unnecessary/ irrelevant statements to make the procedure concise with more clarity. Section 4.0 – amended the responsibilities as per the current functions and added the responsibilities for IH & CIH. Section 5.0 – deleted or amended statements in relevant sub-sections to make the procedure concise, removing extra academic/medical information that does not add value and retaining only requirements that are relevant to the implementation in KOC. Section 5.2 – replaced references to “Heat Stress Profile” with “Heat Stress Survey”. Section 5.3.7 – deleted the requirement on purchasing/supply of equipment as it is out of scope of this procedure. Appendices 1, 2 & 8 updated as per the above changes in the related sections. Appendix 9 – added self-explanatory note at the bottom of Table on referring Appendix 5 for interpretation of Heat Index Risk Levels, and, Appendix 6 for details of associated protective & preventive measures. Deleted Appendices 7, 11, 12 & 13 as these appendices contains requirements that does not add value in implementation and thereby makes the procedure concise with better clarity. Accordingly, references to these appendices removed in the relevant sections. Section/sub-sections and appendices re-numbered, as needed, for continuity. Updated the titles of referenced documents as per the current/latest titles. Document format updated as per the latest requirements in the HSSE Document Control procedure.

Appendix 1:

FLOW CHART OF HEAT STRESS MANAGEMENT (AND RESPONSE TO MANAGE AN ELEVATED HEAT INDEX)

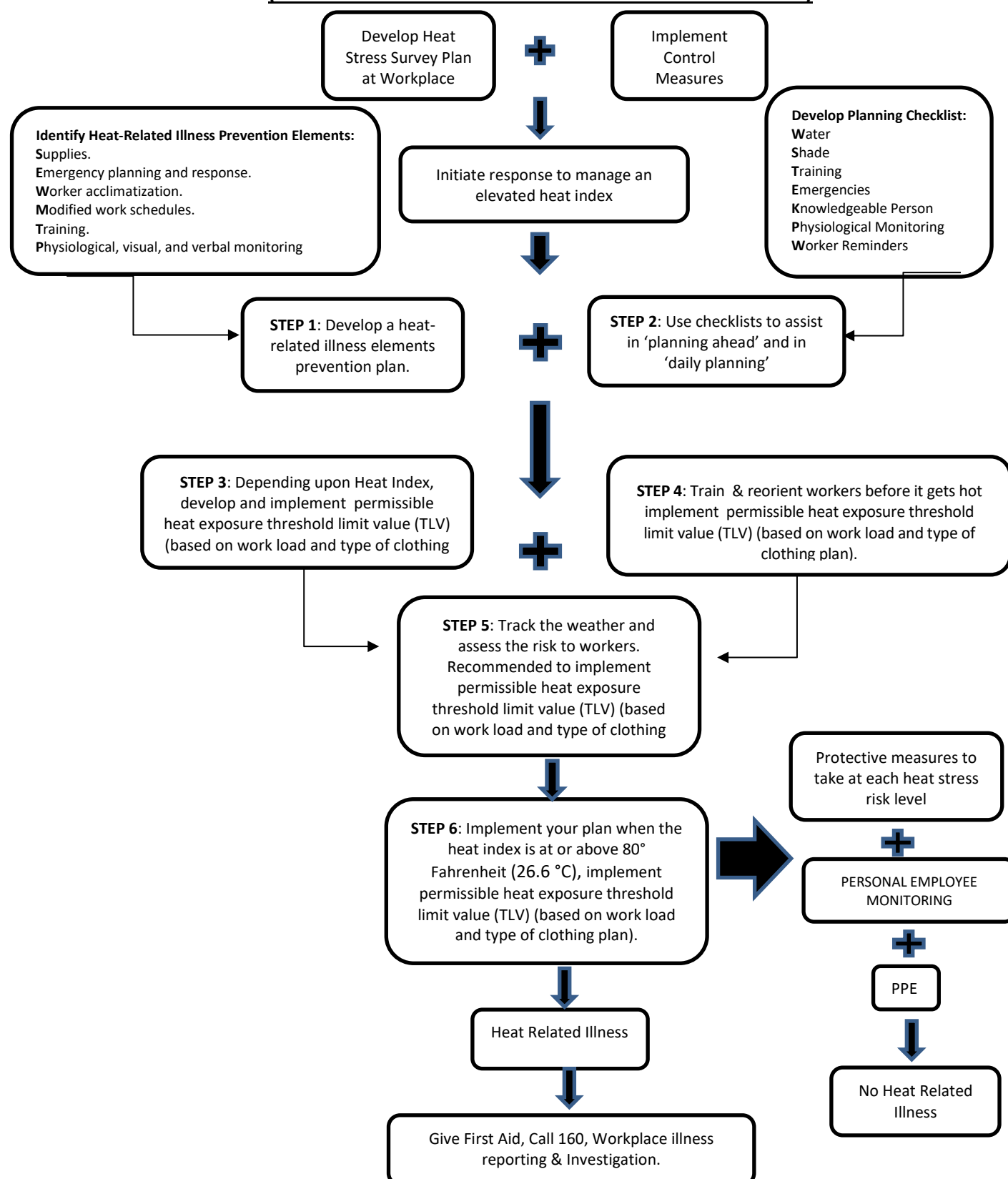


Table 2.1: Risk Factors influencing heat-related illness:

RISK FACTORS INFLUENCING HEAT-RELATED ILLNESS	
Risk Factor	Explanation
Age	The older people are more susceptible to the effects of heat and, after the age of 60, this population represents a significant fraction of those suffering from heat disorders. The age-related susceptibility to heat may be related to decreases in sweating, cutaneous blood flow, changes in cardiovascular function and decreases in overall fitness in hotter environments.
Gender	Females have a lower whole-body sweat response during exercise in the heat, which resulted in a greater increase in body temperature (effects of hormonal variations may also play a part).
Outdoor operations	Conducted in hot weather, especially those that require workers to wear semipermeable or impermeable protective clothing, are also likely to cause heat stress among exposed workers.
Prior heat injury	Predisposes an individual to additional injury.
Degree of acclimatization	Degree of acclimatization to working in hot environment too affects a person's sensitivity to heat.
Respiratory heat loss	It is generally of minor consequence except during hard work in very dry environments. Other factors may be related to characteristics of each individual worker or an individual's current status of health at the time of exposure to heat stress in a hot environment.
Obesity	Heat disorders occur 3.5 times more frequently in the obese than in the lean individual.
The ingestion of alcohol	Prior to or during work in the heat reduces heat tolerance and increases the risk of heat-related illnesses.
Employee Work Rate	The rate at which an employee works and the activities being performed will have a direct effect on their potential to experience heat stress. This work rate must be taken into consideration when establishing safe work practices for employees working in hot environments
Location of Heat Sources	An employee who works in an environment which is generally cool, but in close proximity to hot objects may be at risk for heat stress. Sources of heat must be identified and their location in relation to the employee considered when assessing potential for heat stress.
Diuretics	Coffee, tea, soft drinks, energy drinks, cocoa, chocolate contain caffeine which has a diuretic effect and should not be considered for replacing volume lost to sweating. Coffee has the potential to exacerbate heat stress by reducing fluid volume and resulting in cardiovascular strain during exposure to the heat.
Physical Barriers to Heat Loss	Extra caution must be exercised in establishing work practices for employees wearing personal protective equipment (PPE) that poses as a barrier to heat loss. This equipment could include coveralls, gloves and respirators, and chemical protective clothing.
Medication	Many drugs prescribed for therapeutic purposes can interfere with thermoregulation. and cause heat intolerance.
Certain individual risk factors	Can put employees at greater risk for heat stress. Employees should be made aware of these risk factors, and given the opportunity for medical consultation if those risk factors apply to them. Training will consist of a video and review of this written program.
The rate of heat exchange with the environment	It is a function of air temperature and humidity, skin temperature, air velocity, evaporation of sweat, radiant temperature, and type, amount, and characteristics of the clothing worn.

Table 2.2: Signs & Symptoms and First aid of heat-related illness.

SIGNS & SYMPTOMS (CLINICAL FEATURES)		FIRST AID (AS PER SIGNS & SYMPTOMS)
1. Temperature Regulation		
Heat stroke <ul style="list-style-type: none"> Hot, dry skin or profuse sweating Confusion Loss of consciousness Seizures Very high body temperature Fatal if treatment delayed	<ul style="list-style-type: none"> A medical emergency: Call 160 for emergency medical care. Someone should stay with worker until emergency medical services arrive. Move the worker to a shaded, cool area and remove outer clothing (including socks and shoes). If available, put the person in a cool tub of water or a cool shower. Otherwise, wet the worker's skin, place cold wet compresses or ice packs on head, face, neck, armpits, and groin; or soak their clothing with cool water. Circulate the air around the worker to speed cooling. Fluids should be replaced as soon as possible. Regardless of the worker's protests, no employee suspected of being ill from heat stroke should be sent home or left unattended unless a physician has specifically approved such an order. Begin CPR if the person loses consciousness and shows no signs of circulation, such as breathing, coughing or movement. 	
2. Circulatory Hypostasis (settling of blood in the lower part of an organ or the body as a result of decreased blood flow)		
Heat Syncope Fainting, dizziness, or light-headedness during prolonged standing or suddenly rising from a sitting or lying position	<ul style="list-style-type: none"> Move the worker to a shaded, cool area to sit or lie down. Encourage the worker to slowly drink water, clear juice, or a carbohydrate-electrolyte replacement liquid (e.g., sports drinks). 	
3. Water and/or Salt Depletion		
Heat Exhaustion <ul style="list-style-type: none"> Headache Nausea Dizziness Weakness Irritability Thirst Heavy sweating Elevated body temperature Decreased urine output	<ul style="list-style-type: none"> Take workers to a clinic or emergency room for medical evaluation and treatment. If medical care is unavailable, call 160. Someone should stay with worker until emergency medical services arrive. Move the worker to a shaded, cool area and remove outer clothing (including socks and shoes). Encourage the worker to frequently drink water, clear juice, or a carbohydrate-electrolyte replacement liquid (e.g., sports drinks), should also be encouraged to get adequate rest. Wet the worker's skin, place cold wet compresses or ice on head, face, or neck. 	
4. Skin Eruptions		
Heat Rash (prickly heat) <ul style="list-style-type: none"> Looks like red cluster of pimples or small blisters that usually appears on the neck, upper chest, groin, under the breasts, and in elbow creases 	<ul style="list-style-type: none"> When possible, a cooler, less humid work environment is best treatment. Keep rash area dry. □ Powder may be applied to increase comfort. Ointments and creams should not be used. 	
Anhidrotic (absence of sweating) Heat Exhaustion <ul style="list-style-type: none"> Extensive areas of skin which do not sweat on heat exposure, but present gooseflesh appearance, which subsides with cool environments Associated with incapacitation in heat	<ul style="list-style-type: none"> No effective treatment, recovery of sweating occurs gradually on return to cooler climate 	
5. Behavioral Disorders		
Transient Heat Fatigue <ul style="list-style-type: none"> Impaired performance of skilled sensorimotor, mental, or vigilance tasks, in heat 	<ul style="list-style-type: none"> First aid is not indicated unless accompanied by other heat-related illness. Acclimatizing the worker over a period of time and training for work in hot environments is advisable will lessen the severity. 	

Excerpts adapted from [Minard 1973; TBMed 2003; OSHA-NIOSH 2011] & Heat Stress. OSHA.

Recommendations for fluid replacement during warm weather conditions.

WBGT Index (°F)	Easy work (250 W)	Moderate work (425 W)	Hard work (600 W)
	Water Intake ¹ (qt/hr)	Water Intake (qt/hr)	Water Intake (qt/hr)
78 – 81.9	0.5	0.75	0.75
82 – 84.9	0.5	0.75	1.0
85 – 87.9	0.75	0.75	1.0
88 – 89.9	0.75	0.75	1.0
90+	1.0	1.0	1.0

Fluid intake should not exceed 1.5 quarts/hour; daily fluid intake generally should not exceed 12.5 quarts (note: this is not to suggest limiting fluid intake by highly conditioned persons, who may require greater than 12 quarts daily) – **Excerpts adapted from DOD [2007]**

First Aid in Heat Stroke

FIRST AID IN HEAT STROKE	
1	Take workers to a clinic or emergency room for medical evaluation and treatment.
2	If medical care is unavailable, Call 160 .
3	Someone should stay with worker until emergency medical services arrive.
4	Move the worker to a shaded, cool area and remove outer clothing (including socks and shoes).
5	If available, put the person in a cool tub of water or a cool shower .
6	Wet the worker's skin, place cold wet compresses or ice packs on head, face, neck, armpits, and groin; or soak their clothing with cool water. Cover with cool, damp sheets.
7	Circulate the air around the worker to speed cooling. Fan while misting with cool water.
8	Fluids should be replaced as soon as possible. Encourage the worker to slowly drink cool water, or other nonalcoholic beverage without caffeine like clear juice, or a carbohydrate-electrolyte replacement liquid (e.g., sports drinks).
9	Do not give the person anything to drink if the person is not alert or is vomiting. If the person vomits, turn the person on their side to keep the airway open.
10	If the person experiences seizures, keep him or her safe from injury.
11	Regardless of the worker's protests, no employee suspected of being ill from heat stroke should be sent home or left unattended unless a physician has specifically approved such an order.
12	Begin CPR if the person loses consciousness and shows no signs of circulation, such as breathing, coughing or movement.

(Adapted from [Minard 1973; TBMed 2003; OSHA-NIOSH 2011] & Heat Stress, OSHA & Mayo Clinic)

Appendix 5:

Heat Index (WBGT) & Protective Measures for Worksites.

Heat index	Risk level	Protective measure
Less than 91°F (33°C)	Lower (caution)	Basic health and safety planning
91°F to 103°F (33°C to 39°C)	Moderate	Implement precautions and heighten awareness
103°F to 115°F (39°C to 46°C)	High	Additional precautions to protect workers
Greater than 115°F (46°C)	Very high to extreme	Even more aggressive protective measures

Adapted from OSHA [2012c].

There are four bands of colors that are associated with four risk levels; for use on worksites. This chart is used for estimating the risk to workers from environmental heat sources and recommended protective measures.

Appendix 6:

Heat Stress Risk Levels and Associated Protective & Preventive Measures.

Heat Index	Risk Level	Recommended Protective & Preventive Measures
<91°F (33 °C)	<u>Lower</u> <u>(Caution)</u>	<ul style="list-style-type: none"> Provide drinking water Ensure that adequate medical services are available (e.g., where emergency medical services, clinic, hospital are not available within 3-4 minutes, have appropriately trained personnel and adequate medical supplies on site) Plan ahead for times when heat index is higher, including worker heat safety training Encourage workers to wear sunscreen. Provide shade, hats, and sunscreen, when possible Acclimatize workers Check the weather forecast regularly Train workers on how to recognize symptoms of heat-related illness, individual risk factors for heat-related illness, how to prevent it, and what to do if someone has symptoms so they are prepared when hotter, higher-risk work conditions arise. <p>If workers must wear heavy protective clothing, perform strenuous activity or work in the direct sun, additional precautions are recommended to protect workers from heat-related illness.*</p>

<p>91°F to 103°F</p> <p>(33°C to 39°C)</p>	<p><u>Moderate</u></p>	<p>In addition to the steps listed above:</p> <ul style="list-style-type: none"> ▪ Alert workers to the heat index anticipated for the day ▪ Remind workers to drink water often (about 4 cups/hour)** ▪ Review heat-related illness topics with workers: how to recognize heat-related illness, how to prevent it, and what to do if someone gets sick ▪ Schedule frequent breaks in a cool, shaded area ▪ Acclimatize new and returning workers ▪ Set up buddy system/instruct supervisors to watch workers for signs of heat-related illness ▪ Respond to heat-related illness and medical emergencies without delay. <p>Workers who show symptoms of heat-related illness need immediate attention. Treating milder symptoms (headache, weakness) early by providing rest in a shaded area and cool water to drink can prevent a more serious medical emergency. Call 160 immediately if a worker loses consciousness or appears confused or uncoordinated. These are signs of possible heat stroke. <i>Heat stroke is fatal if not treated immediately.</i></p> <p>If workers must wear heavy protective clothing, perform strenuous activity or work in the direct sun, additional precautions are recommended to protect workers from heat-related illness.*</p> <ul style="list-style-type: none"> ▪ Schedule activities at a time when the heat index is lower ▪ Recommended to develop work/rest schedules ▪ Monitor workers closely
<p>103°F to 115°F</p> <p>(39°C to 46°C)</p>	<p><u>High</u></p>	<p>In addition to the steps listed above:</p> <ul style="list-style-type: none"> ▪ Alert workers to the heat index anticipated for the day and identify each precaution in place at the work site to reduce the risk of heat-related illness. ▪ Alert workers of high risk conditions ▪ Actively encourage workers to drink plenty of water (about 4 cups/hour)** before they become thirsty. Under most circumstances extended hourly fluid intake should not exceed 6 cups per hour or 12 quarts per day. ▪ Limit physical exertion (e.g. use mechanical lifts) ▪ Have a knowledgeable person at the worksite who is well-informed about heat-related illness and able to determine appropriate work/rest schedules ▪ Establish and enforce work/rest schedules ▪ Adjust work activities (e.g., reschedule heavy work earlier in the day, pace/rotate jobs, set up shade canopies over work areas, move jobs to shaded areas if possible, deploy additional personnel) ▪ Permit only those workers acclimatized to heat to perform the more strenuous tasks ▪ Use cooling techniques ▪ Watch/communicate with workers at all times

		<ul style="list-style-type: none"> When possible, provide workers with personal cooling measures (e.g., water-dampened clothing, cooling vests with pockets that hold cold packs, reflective clothing, or cool mist stations), especially for workers wearing heavy or non-breathable clothing or impermeable chemical protective clothing. Maintain effective communication with your crew at all times (by voice, observation, or electronic communications). Confirm that communication methods are functioning effectively. <p>When possible, reschedule activities to a time when heat index is lower.</p>
>115°F (>46°C)	<u>Very High to Extreme</u>	<p>Move essential work tasks to the coolest part of the work shift; consider earlier start times, split shifts, or evening and night shifts.</p> <p>Strenuous work tasks and those requiring the use of heavy or non-breathable clothing or impermeable chemical protective clothing should not be conducted when the heat index is at or above 115°F.</p> <p>If essential work must be done, in addition to the steps listed above:</p> <ul style="list-style-type: none"> Alert workers of extreme heat hazards Establish water drinking schedule (about 4 cups/hour)** Recommended to develop and enforce protective work/rest schedules Recommended to conduct physiological monitoring (e.g., pulse, temperature, etc) Stop work if essential control methods are inadequate or unavailable.

*The heat index is a simple tool and a useful guide for employers making decisions about protecting workers in hot weather. It does not account for certain conditions that contribute additional risk, such as physical exertion. Consider taking the steps at the next highest risk level to protect workers from the added risks posed by:

- Working in the direct sun (can add up to 15°F to the heat index value)
- Wearing heavy clothing or protective gear

**Under most circumstances, fluid intake should not exceed 6 cups per hour or 12 quarts per day. This makes it particularly important to reduce work rates, reschedule work, or enforce work/rest schedules.

Appendix 7:

Recommended Specifications For Portable Heat Stress Monitor

Measurements

Globe, dry bulb, wet bulb, WBGT_{in}, WBGT_{out}, WBGT weighted average (if 3 sensor sets), relative humidity, Heat Index, Humidex.
Temperatures given in Celsius or Fahrenheit.

Languages

English, French, Spanish, Italian, German.

Housing

Designed water resistant to a light rain or mist. If rain is frequent, best practice would be to remote the sensor bar and keep the instrument sheltered.

Size

Height 9.2in (23.5cm); Width 7.2in (18.3mm); Depth 3.0in (7.5mm)
Dimensions include mounted sensor assembly.

Weight

2.6 lbs. (1.2 kg) with mounted sensor assembly.

Sensor Types

Temperature: 1000 ohm platinum RTD
Humidity: Integrated circuit with capacitive polymer sensor

Accuracy

Temperature: +/-0.5°C between 0°C and 120°C
Relative Humidity: +/-5% between 20 to 95% (non-condensing)

Operating Temperature Range

Sensor Assembly: -5°C to +100°C
Electronics: -5°C to 60°C

Remote Sensor Bars

2 x 15pin D-sub jacks are located on the side of the unit for plugging in 1 or 2 additional sensor bars by using remote cables up to 200 feet (61m). The top sensor bar can also be remote with a cable.

Power Options

9V alkaline, 7.2V NiMH rechargeable pack (charged in the unit), or AC adaptor wall power cube (AC adaptor will operate the unit or recharge the NiMH battery pack).

Battery Life

9V alkaline: 140 hours
Rechargeable Nickel Metal Hydride: 300 hours (Adding additional sensor bars reduces battery life.)

Charge Time (NiMH Battery Pack)

16 hours (charge in the unit)

Safety Approvals

ETL, cETL: Class I,II,III Groups A,B,C,D,E,F,G, Temperature code T3
KEMA 04ATEX1072 X<Ex> II 2 G EEx ia IIC T3 CE mark

Product Markings and Special Conditions

KEMA 04ATEX1072 X<Ex> II 2 G EEx ia IIC T3

(Compliance with: EN 50014 : 1997 and EN 50020 : 2002. The year of manufacture is determined by the number. "A" was 2001, manufactured "B" in 2002, in "C" in 2003).

Special conditions for safe use:

1. Only the following battery types may be used:

Non-rechargeable battery:

<u>Type</u>	<u>Manufacturer</u>
U9V	Ultralife
MN1604	Duracell
522 or EN22 or 6LR61	Energizer
A1604 or BR232	Rayovac
6LR61 or 6AM6	Panasonic

Rechargeable battery:

Integral NiMH battery pack type DC2121.

Appendix 8:

General Workplace Heat Stress Survey Checklist (Factors to be evaluated during survey when reviewing a heat stress situation):

Note: Listed below are sample questions that the IH may wish to consider when investigating heat stress in the workplace.

General Workplace Heat Stress Survey Checklist			
Date:	WBGT index:	Heat stress index risk levels:	
Time:	OR	Lower	<input type="checkbox"/>
Location:	Relative Humidity:	Moderate	<input type="checkbox"/>
	Temperature:	High	<input type="checkbox"/>
	Air Velocity (Flow Rate):	Very High/Extreme	<input type="checkbox"/>
Heat Stress Monitor (Model & Serial Nos):			
Last Calibration Date of the Heat Stress Monitor Instrument(s):			
Workplace Description;			
1. Type of business			
2. Heat-producing equipment or processes used			
3. Previous history (if any) of heat-related problems			
4. At "hot" spots:			
a) Is the heat steady or intermittent?			
b) Number of employees exposed?			
c) For how many hours per day?			
d) Is potable water available?			
e) Are supervisors trained to detect/evaluate heat stress symptoms?			

Are Exposures Typical For A Workplace In This Industry?	
1. Weather at Time of Review	
2. Temperature	
3. Humidity	
4. Air velocity	
5. Is Day Typical of Recent Weather Conditions? (Get information from the Weather Bureau)	
6. Heat-Reducing Engineering Controls	
7. Ventilation in place?	
8. Ventilation operating?	
9. Air conditioning in place?	
10. Air conditioning operating?	
11. Fans in place?	
12. Fans operating?	
13. Shields or insulation between sources and employees?	
14. Are reflective faces of shields clean?	
Work Practices To Detect, Evaluate, And Prevent Or Reduce Heat Stress;	
1. Training program?	
2. Content?	
3. Where given?	
4. For whom?	
5. Liquid replacement program?	
6. Acclimatization program?	

7. Work/rest schedule?	
8. Scheduling of work (during cooler parts of shift, cleaning and maintenance during shut-downs, etc.)	
9. Cool rest areas (including shelter at outdoor work sites)?	
10. Heat monitoring program?	
11. Personal Protective Equipment	
12. Reflective clothing in use?	
13. Ice and/or water-cooled garments in use?	
14. Wetted undergarments (used with reflective or impermeable clothing) in use?	
15. Circulating air systems in use?	
16. First Aid Program	
17. Trained personnel?	
18. Provision for rapid cool-down?	
19. Procedures for getting medical attention?	
20. Transportation to medical facilities readily available for heat stroke victims?	
21. Medical Screening and Surveillance Program	
22. Content?	
23. Who manages program?	
Additional Comments:	
Survey Conducted By:	Name:
KOC#:	Designation:
Signature:	
Telephone no:	

Source: OSHA Technical Manual, Section III: Chapter 4, Heat Stress

Appendix 9:

Elements of Heat Stress Prevention Program/Plan.

(Adapted from concepts appearing in OSHA's Heat-related Illness Prevention Training Guide)

Plan Element	Heat Index Risk Level			
	Lower (Caution)	Moderate	High	Very High/Extreme
Supplies (ensuring adequate water, provisions for rest areas, and other supplies)	✓	✓	✓	✓
<u>Emergency planning and response</u> (preparing supervisors and crews for emergencies)	✓	✓	✓	✓
<u>Worker acclimatization</u> (gradually increasing workloads; allowing more frequent breaks as workers adapt to the heat)	✓	✓	✓	✓
<u>Modified work schedules</u> (establishing systems to enable adjustments to work schedules)		✓	✓	✓
<u>Training</u> (preparing workers to recognize heat-related illness and preventive measures)	✓	✓	✓	✓
<u>Physiological</u> , visual, and verbal monitoring (using direct observation and physiological monitoring to check for signs of heat-related illness)		✓	✓	✓

(Note: Please refer to Appendix 5 for interpretation of Heat Index Risk Levels & Appendix 6 for details of associated protective & preventive measures)