

Safe Working in a Hot Environment

Number	WCEF-GM-R&S-0002				
Reasons for Creating or Amending Document	Full Review of Document and Profile - No Change				
Actual Change Details	Full review of document and profile carried out - No Changes Required				
Version	3.0.0	Published	16/04/2024	Review Date	16/04/2027

TABLE OF CONTENTS

1. GENERAL PRINCIPLES	2
2. OBJECTIVES.....	2
3. LEGISLATION	2
4. ROLES AND RESPONSIBILITIES.....	3
5. EVALUATION OF HEAT STRESS.....	4
6. CONTROL MEASURES/OPTIONS.....	4
6.1 MODIFY THE ENVIRONMENT TO SUIT THE WORK.....	4
6.2 MODIFY WORK TO SUIT THE ENVIRONMENT.....	5
7. TRAINING AND AWARENESS	6
8. REFERENCE MATERIAL.....	7
APPENDIX 1 – THE THERMAL ENVIRONMENT	8
WORKING IN HOT ENVIRONMENTS.....	8
HEAT STRESS FACTORS.....	9
EFFECTS OF HEAT STRESS ON THE BODY.....	9
TABLES	
Table 1 - Effects of heat stress on the body.....	10

1. GENERAL PRINCIPLES

The human body functions best in a moderate climate, and variations that can result in a lowering or increase of the core body temperature can lead to serious physiological injury or illness. Workers in hot environments, around boilers, confined spaces, hot surfaces, incinerators or outside in the sun can be subjected to considerable thermal stress. These environments can pose significant health hazards to workers if not managed correctly.

The following general principles apply:

- a. The goal is for all work to be conducted in a moderate climate. Accordingly, consideration is given to schedule and conduct work during the cooler parts of the year/day/during shutdowns, where practical, in preference to other control methods.
- b. Reasonable steps must be taken to identify all work in hot environments.
- c. Where identified, a risk assessment must be completed, and controls such as fitness for work, regular breaks and adequate fluid replacement implemented.

2. OBJECTIVES

This document will provide:

- a. Details of the applicable legislation.
- b. Roles and responsibilities of workers and contractors.
- c. Evaluation methods for heat stress.
- d. Control measures to reduce heat stress.

3. LEGISLATION

Provision in the regulations for hot environments is covered in the work health and safety (general) regulations 2022 as follows.

Regulation 41A Duty to protect from extremes of heat and cold

A person conducting a business or undertaking must ensure:

- a. that work practices are arranged so that workers are protected from extremes of heat and cold; and
- b. if the workplace is in a structure that, so far as is reasonably practicable, heating and cooling are provided to enable workers to work in a comfortable environment.

This document should be read in conjunction with referenced documents in Section 8.

4. ROLES AND RESPONSIBILITIES

Health and safety team

- a. Provide information and instruction to workers.
- b. Review, approve and distribute this document.
- c. Respond to any issues and actions that may arise through implementation of this document.
- d. Conduct heat stress assessments as required and maintain records of any results.
- e. Engage consultants to organise assessments.
- f. Provide fitness for work assessments to all workers.
- g. Respond to any emergency situations that occur at the site.
- h. Report any issues and actions to the responsible manager.

Responsible officer/Accountable person/Leaders/Supervisors

- i. Ensure a risk assessment is completed by to identify work in hot environments.
- j. Ensure adequate controls such as fitness for work, adequate breaks in cool areas and fluid replacement are implemented to reduce the risk.
- k. Ensure appropriate and maintained personal protective clothing and equipment are used.

Workers/Contractors

- l. Complete a risk assessment to identify work in hot environments.
- m. Controls such as fitness for work, adequate breaks in cool areas and fluid replacement are adhered to reduce the risk.
- n. To wear, as instructed, all personal protective clothing and equipment provided.
- o. Reporting any uncontrolled working in hot environments during their work.
- p. Participating in awareness sessions and monitoring programs.

5. EVALUATION OF HEAT STRESS

Heat stress assessments will be conducted as per the AIOH Guide to managing heat stress which has been developed for use in the Australian environment. A summary of this guide can be found [here](#).

It's a 3-stage assessment as per below:

- a. Level 1: [Basic thermal risk assessment](#) (non-technical, no equipment required).
- b. Level 2: Detailed analysis using rational heat stress indices (contact hygiene team)
 - Predicted heat strain or
 - Thermal work limit.
- c. Level 3: Undertake physiological monitoring (contact medical centre).

Please contact the hygiene team to obtain a copy of the guide.

6. CONTROL MEASURES/OPTIONS

6.1 MODIFY THE ENVIRONMENT TO SUIT THE WORK

6.1.1 Control the source of the heat

- a. Reduce the temperature of the heat source by allowing the section of plant or equipment to cool down before work commences.
- b. Insulate hot surfaces which can also provide protection from contact burns.
- c. Clad or cover sources of radiant heat.
- d. Use radiant heat shields or barriers. Shields and barriers require good insulation properties and low emissivity/high reflectivity to reflect heat rather than absorb.
- e. Use shade barriers (i.e. temporary gazebos) over the work area to block heat from the sun.

6.1.2 Ventilation, air conditioning and air movement

- a. Remove or dilute hot/humid air and replace it with cooler/drier air. This is the most efficient method and can be achieved by either forced mechanical ventilation or naturally. It is especially important in hot and humid environments. Examples include:
 1. Mechanical ventilation which draws cool air from outside the work area to displace warm air.
 2. Exhaust or extraction fans to remove warm air.
 3. Natural ventilation via windows, doors and roof vents/louvres.

- b. Increase air movement in the work area i.e. portable fans.
- c. Use artificial cooling such as evaporative coolers, air conditioning or chillers.

6.2 MODIFY WORK TO SUIT THE ENVIRONMENT.

6.2.1 Modify the work process

- a. Use mechanical aids such as cranes, forklifts and mobile equipment to reduce the workload.
- b. Conduct work at ground level to minimise climbing up and down stairs and ladders.
- c. Do the work indoors or in a cool shaded area.
- d. A risk assessment is recommended when insulating, impervious or encapsulated clothing is recommended for the task.

6.2.2 Administrative controls

- a. Select workers who have become acclimatised to the work environment who are at less risk than unacclimatised workers.
- b. Conduct work in cooler parts of the year, especially where the work requires personal protective clothing.
- c. Conduct work at night, early morning or late afternoon rather than the hot parts of the day.
- d. Implement a buddy system, where trained workers can keep an eye on each other for signs of heat effects, reducing risks compared to isolated workers.

6.2.3 Fitness for work

- a. A urine test can be undertaken which assesses the specific gravity of the urine. The result determines whether a person is well hydrated, partially dehydrated or unacceptably dehydrated. Contact the medical centre for further information.
- b. Workers should monitor themselves for heat-related symptoms, and their urine output and concentration (colour).
- c. Worker should be in good physical condition to reduce the likelihood of heat strain.
- d. Workers are required to come to work hydrated.

6.2.4 Provide cool rest areas for breaks

- a. Implement work-rest intervals where workers spend rest periods in a cool and shaded rest area.
- b. Locate cool and shaded rest area as close to the work area as possible.

- c. Workers should take regular breaks as identified in risk assessment.
- d. Remove personal protective clothing during breaks to allow workers to cool off.

6.2.5 Fluid replacement

Note: *No drink bottles are to be taken into the plant areas at Sodium Cyanide manufacturing..*

- a. Drink small volumes as frequently as possible during work.
- b. Provide palatable cool (6-15°C) drinks or water as close as possible to the work area.
- c. Avoid diuretic drinks (e.g. tea/ coffee) immediately prior to starting work and to rehydrate between shifts.
- d. Consume water at the start of the shift to maximise hydration status.
- e. Replace electrolytes in high sweat scenarios by ordering the below from stores:
 - 1. Thorzt icypole JDE # 1473715.
 - 2. Thorzt solo shot JDE # 1473723.
 - 3. Thorzt 600mL bottle JDE # 1473782.

6.2.6 Other factors

- 1. Age: The older a person is, the less capacity they have for coping in heat stress.
- 2. Obesity: This is a factor in a persons ability to reduce body core temperature.
- 3. Physical Fitness: The fitter a person, the better they manage in heat stress conditions.
- 4. Medical conditions and medications: These influences a persons ability to acclimatise and cope in hot conditions.

Medical conditions for consideration include heart disease, high blood pressure on medication, asthma on medication, kidney disease. Medications for concern include the use of steroid (cortisone, prednisolone) tablets, blood pressure tablets and diuretics. Contact the medical centre for further information and any queries regarding medication and impacts associated with heat stress.

7. TRAINING AND AWARENESS

Training regarding working in hot environments and associated risks should be conducted for workers that are required to work in hot environments. The education program should include, at a minimum:

- a. Background information regarding working in hot environments, including heat-related symptoms which indicate the worker should stop work to cool down and rehydrate, and the potential harmful health effects which can occur.
- b. Familiarisation with regulations applicable to working in hot environments.

- c. Procedures for managing work in hot environments.
- d. The correct use of control measures and safe work methods to minimise the risks of heat stress.

8. REFERENCE MATERIAL

Personal protective equipment ([CSBP-GM-11-031-01](#))

Use of personal protective equipment ([KHO-GM-OHS-070-28](#))

Respiratory protection ([CSBP-GM-11-031-05](#))

Health surveillance and biological monitoring ([WCEF-PD-OHS-090-02](#))

Work permit system ([CSBP-GM-11-031-51](#))

STOP and Job Safety Analysis Risk Assessment ([WCEF-GM-HSE-0011](#))

Basic safety rules ([CSBP-GM-11-035-02](#))

Confined spaces ([CSBP-GM-11-031-52](#))

Confined spaces procedures ([KHP-GM-OHS- 070-02](#))

APPENDIX 1 – THE THERMAL ENVIRONMENT

WORKING IN HOT ENVIRONMENTS

The effects of heat may be encountered during:

- a. Work in confined workplaces without adequate ventilation.
- b. Work where there is direct exposure to solar radiation.
- c. Work in hot and humid conditions.
- d. Work performed in the vicinity of hot sources such as furnaces, heaters and ovens.
- e. Heavy physical work in moderately hot and humid conditions.
- f. Work situations where impermeable protective clothing has to be worn (i.e. coveralls).
- g. Any situation where a worker has previously shown signs of heat-related effects (i.e. dizziness, fainting and heat cramps).

Working in hot environments can put workers at risk of impaired performance, heat illnesses and heat stroke. Impaired performance may result in unsafe acts and may also tend to promote accidents due to sweaty palms or impairment of vision through fogging of safety glasses.

By way of further introduction, this guideline refers to:

1. **Heat stress** - which is the burden or load of heat that must be dissipated if the body is to remain in thermal equilibrium; and
2. **Heat strain** – which is the normal physiological or abnormal pathological change resulting from heat stress.

The physiological condition referred to as heat strain is characterised by increases in deep body temperature, heart rate, blood flow to the skin, and water and salt loss due to sweating.

Most adverse effects arise from a failure of the body's cooling mechanisms or as a result of overloading of the system.

Normally, several physical and physiological mechanisms assure transfer of excess body heat to the environment. Even when the body is at rest, heat is generated by normal metabolism. With exercise, the heat produced by muscle activity rises rapidly.

This generated heat is moved to the skin by the blood with the aim of transferring body heat to the environment. Heat may then be lost through convection, evaporation of sweat, radiation and conduction.

Safe Working in a Hot Environment

To maintain the appropriate body temperature three issues are essential:

- a. The metabolic heat produced must be transferred to the skin via the circulation for dissipation.
- b. The sweat glands must be able to produce the necessary amount of sweat; and
- c. The sweat must be able to evaporate.

Failure in any of these mechanisms for heat transfer may cause the body core temperature to rise, leading to heat strain and subsequent heat illness.

Additionally, for the successful maintenance of the thermoregulatory system, adequate fluids must be consumed to prevent dehydration. When the air temperature is above skin temperature (around 36°C), evaporation of sweat is the main mechanism for the body to lose heat.

HEAT STRESS FACTORS

There are six factors influencing a person's capacity for heat exchange with the environment:

3. **Air temperature (dry bulb).** Above 36°C the body can gain heat from the environment;
4. **Absolute humidity (wet bulb temperature).** When the absolute humidity is high, evaporation of sweat is reduced, thereby reducing the body's opportunity to lose its heat;
5. **Radiant heat** from objects such as the sun, furnaces, and other hot surroundings. The direction of heat transfer depends on the absolute temperature difference between the body and the surrounding surfaces. It is not affected by the air temperature or humidity;
6. **Air movement.** This can influence both convection and evaporation and can have a marked effect on heat exchange at the exposed skin surfaces (face, arms and legs). Convective heating or cooling does depend on the air temperature. Air movement assists with the evaporation of sweat from the skin and hence cooling capacity;
7. **Muscular activity.** This is the most significant as it imposes a variable heat load. Work rates may increase heat production up to ten times the resting level and can cause a rapid body heat rise if this cannot be lost to the surroundings; and
8. **Clothing.** This can have a major effect on the amount of heat transfer from the body. Clothing may limit convective exchange and may interfere with the body's capacity to lose heat through the evaporation of sweat. However clothing can reduce the radiant heat to the body from surrounding surfaces (firefighters, furnace operators, underground motors and machinery).

EFFECTS OF HEAT STRESS ON THE BODY

The body core temperature is significantly affected by body activities and by the ability of the body to lose this core heat. The extent of any rise is related to the physical work level. Skin temperature, on the other hand, depends on several environmental conditions.

Safe Working in a Hot Environment

Increased blood flow through the skin allows body core heat to be dissipated at the body surface. Evaporation of sweat cools the skin and in conjunction with increased skin blood flow assists in achieving thermal balance.

The body uses its own water reserves to generate sweat, so maintaining body temperatures within safe limits. Sweat loss if not replaced leads to dehydration which in turn puts a strain on the circulation causing the heart to beat at a higher rate additionally sweat rate is reduced, so affecting thermoregulatory capacity and adaptation.

Repeated exposure to heat over a period (usually not less than 7 days) produces physiological changes enabling a person to respond more efficiently to the heat demands - this is acclimatisation. This increases water requirement, reduces strain, improves performance and comfort. There are reductions in core temperature and heart rate reached at the same rate of work as before, there is an increase in blood volume, the body sweats more readily and the salt content of sweat is decreased.

A description of the symptoms of the various effects is tabulated below.

Table 1 - Effects of heat stress on the body

Adverse Effect	Description
Skin problems (i.e. prickly heat)	Caused by blockage of sweat ducts and associated inflammation of the skin.
Heat strain	This is the change in pulse, body temperature and sweating. It may lead to heat illness if the heat load continues.
Heat illness	This is a feeling of weakness, dizziness and nausea. The person loses concentration. Safety awareness and performance may deteriorate.
Heat exhaustion	<p>If there is insufficient replacement of water loss from sweating, progressive dehydration occurs. These can be pallor, profuse sweating, hypotension, rapid heart rate, alteration of consciousness, thirst and increase in body temperature. Blood pooling may cause fainting.</p> <p>Salt deficiency, especially following extended periods of sweating may also produce a form of heat exhaustion and can cause muscle cramps.</p>
Heat stroke	This is more severe and may be life-threatening. A person may become irritable, confused and apathetic before a life-threatening stage is reached. The person may also have fits. The body temperature is high (over 40°C) and the skin may be hot and dry. Heat stroke can occur if treatment is not given immediately. Any increase in body core temperature beyond that point is life-threatening and must be treated accordingly.