HEAT STRESS AND ULTRAVIOLET RADIATION WHAT EVERY EMPLOYER & EMPLOYEE SHOULD KNOW

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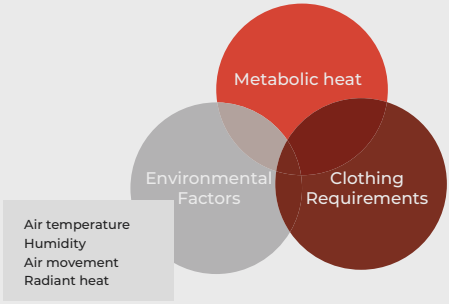
1. PURPOSE

The purpose of the document is to provide employers and employees with information on how to identify and control exposure to heat stress and ultraviolet radiation.

2. WHAT IS HEAT STRESS?

Heat stress is the overall heat load an employee may be exposed to, from a combination of:



3. WHAT IS ULTRAVIOLET RADIATION?

Ultraviolet radiation (UVR) is a form of non-visible electromagnetic radiation, which has shorter wavelengths than visible light, but longer wavelengths than x-rays.

4. WHAT ARE SOME OF THE SOURCES OF HEAT AND UVR

The table below lists some of the sources of heat and UVR.

HAZARD	SOURCE
Heat	furnaces ovens/cookers the sun electric fires dryers hot surfaces and machinery hot, molten materials workload
UVR	the sun electric arc welding and cutting germicidal lamps phototherapy lamps UV lasers sunlamps

5. WHO IS AT RISK OF EXPOSURE

Heat stress and UVR can affect employees employed in both outdoor and indoor workplaces.

For outdoor exposures, the sectors listed below are the most likely to perform intense physical work, as well as direct exposure to sunlight and heat :

- agriculture,
  - forestry,
  - road repair and maintenance,
  - fisheries,

- construction,
- brick manufacturing
- waste collection
- informal trading

The workplaces where exposure to indoor heat sources may have an effect on employees are:

- foundries and smelters
- steels mills
- glass manufacturing
- rubber manufacturing
- electricity generation plants
- ceramics plants
- laundries
- kitchens/bakeries

It is also important to identify employees who may be more susceptible to exposure to heat and UVR. These employees may or may not be employed in any of the above-mentioned examples.

6. EFFECTS OF EXPOSURE

The severity of a health effect as a result of to any occupational stressor is dependent on the intensity of the exposure and the duration.

What are some common effects of working in heat?

Working in hot environments can be hazardous and can cause harm to employees. The human body needs to maintain a core body temperature of approximately 37 degrees Celsius. If the body has to work too hard to keep cool or starts to overheat, an employee begins to suffer from heat-related illness. Heat-related illnesses are a general term used to describe a wide range of progressive heat related conditions. These include: fainting, heat rash, heat cramps, heat exhaustion and heat stroke.

Below is a list of some of the heat-related illness resulting from exposure to heat, as well as a description of the illness:

- Heat rash, where the skin becomes irritated and causes discomfort
- Heat cramps, where muscles cramp as a result of heavy sweating without replacing salt and electrolytes
- Fainting, which may occur when employees stand or rise from a sitting position
- Dehydration, as a result of increased sweating and not enough intake of drinking water
- Heat exhaustion, where the body is working too hard to stay cool

- Heat stroke, where the body can no longer cool itself and may result in death

Other side effects resulting from heat stress include:

- Burns, from contact between an employee and hot surfaces or tools
- Slips, one surfaces or of tools held by employees, as a result of increased sweat in hot conditions
- Reduced concentration, where working in heat makes it is more difficult to concentrate, resulting in increased mistakes and errors
- Increased chemical uptake into the body, as heat may cause the body to absorb chemicals differently, increasing the side effects of some medications and chemicals

What are some common effects of UVR?

UVR may have positive as well negative effects on human health. However, the effect is dependent on the conditions of exposure and wavelength of radiation. Small amount of UVR are essential for the human body to produce vitamin D however, excessive amounts of exposure can damage to the skin and the eyes. Some of the adverse health effects affecting the skin include: sunburn and skin cancer, while cataracts may developed in the eye due to long-term exposure.

7. WHAT SHOULD THE EMPLOYER DO TO PROTECT THEIR EMPLOYEES FROM EXPOSURE TO HEAT AND UVR

Section 8 of the Occupational Health and Safety Act, Act 85 of 1993, requires an employer to provide and maintain a workplace that is safe and without risk to the health of his or her employees. In order for the employer to provide and maintain the safe workplace, that is without risk the health, the employer needs to conduct an assessment of all hazards to which an employee may be exposed to in the workplace. This assessment includes:

- establishing what hazards a person is exposed to (including heat and UVR);
  - To find out if it is a hazard in your workplace, consider:
    - air temperature
    - air flow
    - humidity
    - radiant heat sources
    - work requirements
    - the employees, and
    - the workplace.

When assessing heat risks, consider the following:

- Where the work is being done:
  - Working near heat sources or hot machinery and processes
  - Spaces with minimal air flow
  - In direct sun light (outdoors on concrete, tar roads or roofs)
  - Working in high levels of humidity
- The type of work:
  - Physical exertion, particularly over long periods
  - Performance-based work/pay
  - Complex and difficult tasks requiring concentration
  - Type of clothing worn, including: personal protective equipment (PPE), uniforms and standard dress.
- The individual employee:
  - Physical fitness level
  - If the employee has been acclimatised or not
  - Time taken to perform tasks
  - Individuals not performing the task, but are still required to be present at the task site
  - Disclosure of any information which may make the employee more susceptible to heat-related illness. These may include:
    - Taking certain medications such as diuretics, or taking non-medical drugs
    - Pregnancy
    - Suffering from a relevant condition or illness such as diabetes, obesity, heart disease or fever
    - Previously suffered from a heat-related illness
    - At higher risk of dehydration or electrolyte depletion for example are on a fluid-restricted diet
    - Younger (aged 25 or under) or older (aged 55 or more) employees
    - Returning to work after an absence

When taking the environment or workplace conditions into consideration, it is not only the normal conditions which must be taken into consideration. The assessment should also consider the impact of potential heatwaves. A heatwave occurs when the maximum and the minimum temperatures are hot over a period of time. When a heatwaves occurs, it may result in more risks to employees due to:

- warmer nights contributing to reduced sleep quality
- high temperatures being reached earlier in the day and lasting longer
- fatigue affecting employees' ability to perform work safely and effectively

Therefore, the employer should:

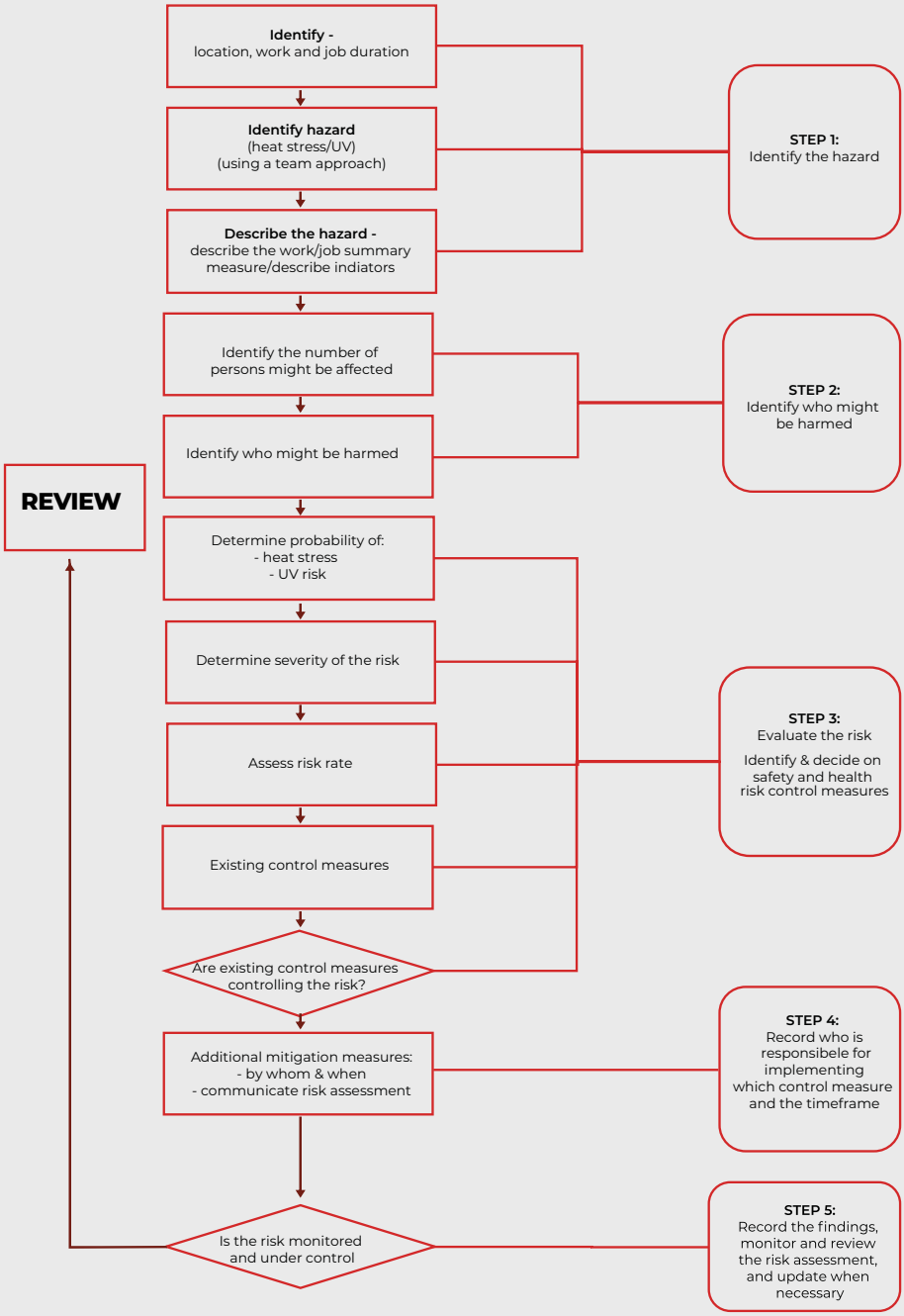
- establishing what precautionary measures should be taken to protect the health and safety of persons; and
- provide necessary means to apply the precautionary measures

This assessment processes, as required by the OHS Act, can be done through the risk assessment process.

An example of the risk assessment process has been provided in diagram 1. The process is based on the International Organization's (ILO) five-step risk assessment process and includes to aspect of identifying the hazards persons are exposed to (steps 1 & 2), identifying precautionary measures and applying them (steps 3, 4 & 5).

The five-step process is never a complete process and includes a review of the hazards and risk assessment.

DIAGRAM 1: RISK ASSESSMENT PROCESS.

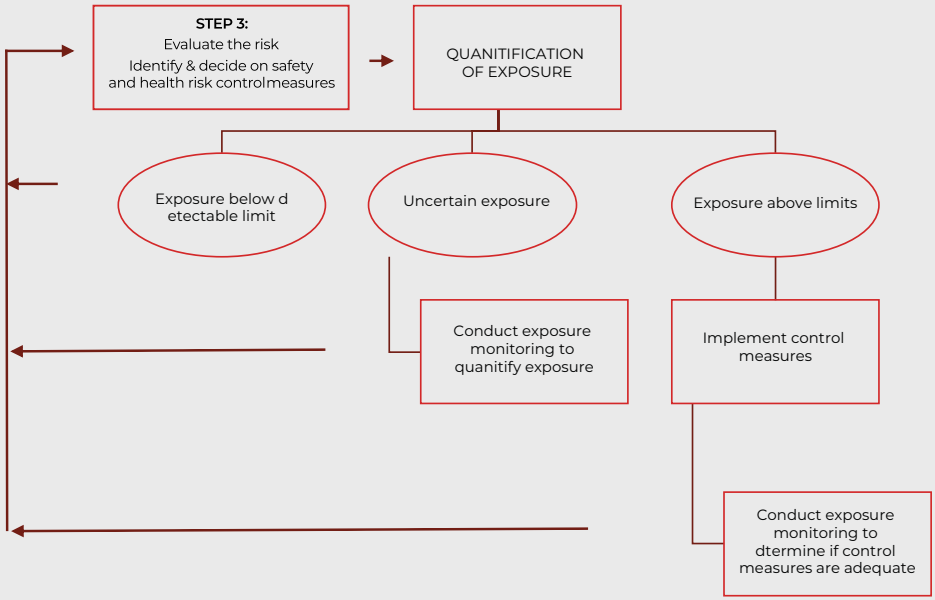


In steps 1 and 2, there are a number of resources of information, the competent person and risk assessment team, may use to identify the hazard (heat and UVR) and determine who may be exposed. A few of the resources, include, but not limited to:

- direct observation through a walkthrough;
- interviews with employees, supervisor and managers, etc.;
- checklists;
- data from previous risk assessments and exposure monitoring reports;
- employee surveys;
- medical screening and medical surveillance outcomes

However, step 3, requires the ":determination of severity" to be determined. This is done through the quantification of exposure through exposure monitoring. Exposure monitoring must be done when the risk assessment indicates that exposure is uncertain or above the exposure limit or action level (after control measures have been implemented). The results from the exposure monitoring must be feed back into step 3 of the risk assessment process, then continuing with steps 4 & 5.

DIAGRAM 2: QUANTIFICATION OF EXPOSURE PROCESS



8. PRECAUTIONARY MEASURES TO BE TAKEN BY THE EMPLOYER

Exposure to a heat and UVR should be mitigated to the lowest reasonably practicable level by implementing a progressive combination of the hierarchy of controls.

The hierarchy of controls is a step-by-step approach to eliminate or mitigate workplace hazards. It ranks controls from the most effective level of protection to the least effective level of protection. When choosing a control method, start from the top of the list below. Assess the feasibility of the first layer of controls (elimination) before moving on to the second layer (substitution). Continue this process until you reach the bottom of the list and have identified as many controls as possible to adequately protect the employee from the hazard.

The hierarchy of controls are listed as follows:

Elimination: Elimination is the process of removing the hazard from the workplace. It is the most effective way to control a risk because the hazard is no longer present. It is the preferred way to control a hazard and should be used whenever possible. Examples may include:

- not introducing the processes which produce heat or UVR into the workplace.
- redesigning the job or task so that heat or UVR is eliminated from the workplace

Substitution: If eliminating a hazard is not possible, substitution is the next control method that should be considered. Substitution is the act of replacing a hazard with a less hazardous one. The hazards and risks associated with an alternative must be thoroughly assessed to determine if it is an appropriate replacement, and the new hazard is actually lower, and not as harmful or more harmful. Examples may include:

- the current job or task should be replaced with a less hazardous job or task. It is important to ensure that the new design is less hazardous than the original.
- the current plant or machinery should be replaced with a less hazardous plant or machinery. It is important to ensure that the new plant or machinery is less hazardous than the original.

Engineering controls: Engineering controls are methods that will remove the hazard at the source, before it comes in contact with the employee. Engineering controls can be built into the design of a plant, machinery, or process to minimize the hazard. Engineering controls are a very reliable way to control employee exposures when the controls are designed, used, and maintained properly. Examples of engineering controls are:

- isolation and shielding – separating employees from the hazard by distance or the use of barriers
- enclosures – placing the material or process in a closed system (e.g., enclosed machines, booths, etc.)

- ventilation – using local exhaust or general dilution ventilation to eliminate or mitigate heat
- mechanical lifting devices – using mechanical methods to lift or move objects instead of manual lifting

Administrative controls: Administrative controls involve developing procedures to ensure the work is conducted in a way that minimizes the hazard. Administrative controls are ranked lower and have more limitations than elimination, substitution, and engineering controls because this method does not necessarily eliminate or mitigate the hazard from the workplace. Administrative controls should be used in combination with other control measures where possible.

Examples of administrative control include:

- developing or changing policies, implementing or improving training and education, and developing or enhancing work practices and procedures, such as -

  i. using job-rotation schedules or a work-rest schedule that limit the amount of time an employee is exposed to a physical agent.
  ii. implementing a preventative maintenance programme to keep plant and machinery in proper working order.
  iii. scheduling maintenance and other high exposure operations for times when minimal employees are present (such as evenings, weekends).
  iv. restricting access to a work area.
  v. restricting the task to only those competent or qualified to perform the work.
  vi. using signs to warn employees of a hazard.

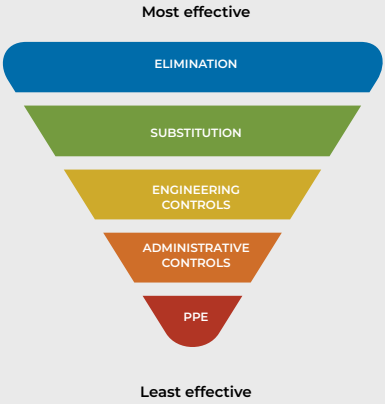
Personal protective equipment (PPE) refers to anything employees wear to help protect them from a physical agent. The use of PPE as the main method to control exposures should be limited to situations where elimination, substitution, engineering, or administrative controls are not practicable, or when:

- additional protection is required because other control methods are not sufficient to mitigate the hazard, or
- the hazard is a result of a temporary or emergency condition.

PPE limits exposure to the harmful effects of a hazard but only if the PPE is worn and used correctly. It is important that there is consultation at the workplace in the fitting and selection of assigned PPE, to ensure that the PPE is fit for use.

However, for heat exposure, the type of clothing provided to employees must be taken into account, as clothing prevents the evaporation of sweat (the human body's cooling mechanism).

DIAGRAM 3: HIERARCHY OF CONTROLS



Other precautionary measures which must be implemented by the employer, include:

- providing information and training on employees on the heat and UVR exposure
- providing supervision and instructions
- having a heat acclimatisation plan for employees
- having a work/rest programme
- medical screening and medical surveillance, for the early detection of adverse health effects related to exposure
- providing adequate amounts of cool, drinking for employees

9. WHAT SHOULD THE EMPLOYER DO TO PROTECT THEIR EMPLOYEES FROM EXPOSURE TO HEAT AND UVR

Section 14 of the Occupational Health and Safety Act, Act 85 of 1993, imposes duties on an employee while they are at work. These duties include:

- looking after their health and safety as well as their colleagues;
- cooperate with the employer in performing their duties;
- carry out any lawful instruction given to them;
- obey health and safety rules;
- report unsafe or unhealthy situations or incidents

Employees should also get involved in health and safety issues effecting themselves and their workplace. If they are nominated and appointed as a health and safety representative, also perform those duties, to the best of their ability.

ANNEXURE 1: FIRST AID FACT SHEET

Employers have a duty to provide first aid equipment and facilities, and access to trained first aiders.

Heat-related illness is progressive and if the employee is not treated or remains in a hot environment, it can be fatal.

NOTE ON PRE-EXISTING MEDICAL CONDITIONS AND MEDICATIONS:

Previous heat-related illness, certain medications and medical conditions can make an employee more susceptible to heat-related illness and can affect how the employee can be treated. Employers should alert employees to this risk and monitor them closely as far as is reasonably practicable.

HEAT-RELATED ILLNESS	SYMPTOMS	FIRST AID TREATMENT
Dehydration **Seek medical advice if symptoms don't improve or are severe**	Mild to severe thirst (remember that thirst is satisfied before fluid loss is fully replaced). Dry lips and tongue. Slowed mental function and lowered performance. Reduced or dark urine output.	Drink water. Avoid caffeinated, carbonated and alcoholic drinks, and salt tablets. Loosen tight clothing and remove unnecessary clothing, including PPE. In cases of extreme heat or dehydration, replace electrolytes.
Heat rash **Seek medical advice if symptoms don't improve**	Itchy rash with small raised red spots on the face, neck, back, chest or thighs.	Move to a cooler, less humid environment. Keep the affected area dry and remove unnecessary clothing, including PPE. Apply a cold compress.
Heat cramps **Seek medical advice if symptoms don't improve**	Painful and often incapacitating cramps in muscles, particularly when undertaking demanding physical work.	Stop activity and rest quietly in a cool place until recovered. Drink an electrolyte solution.

HEAT-RELATED ILLNESS	SYMPTOMS	FIRST AID TREATMENT
Fainting **Seek medical advice**	Fainting (heat syncope) can occur while standing or rising from a sitting position.	Lie the employee flat immediately with their legs slightly raised. Do not raise the head. Treat as for heat stroke and follow medical advice.

HEAT-RELATED ILLNESS	SYMPTOMS	FIRST AID TREATMENT
Heat stroke **Call an ambulance immediately**	Dehydration, thirst and reduced or dark urine output Sweating and the person stops sweating Skin can be pink, warm and dry, or cool and blue High body temperature above 39 degrees Celsius. Weakness or fatigue. Cramps. Pounding, rapid pulse and heart palpitations.	Call emergency services and evacuate by ambulance immediately. Ensure that the ambulance is updated if the employee experiences seizures or becomes unconscious. Follow all directions given by the ambulance operator. While waiting for the ambulance: Move the employee to a cool place with circulating air. Remove unnecessary clothing, including PPE Loosen tight clothing. If practicable and safe to do, immersion in a bath of cold water is the most effective means for cooling a person. Continuously observe the employee to ensure an open airway in case of any change in their level of consciousness.

HEAT-RELATED ILLNESS	SYMPTOMS	FIRST AID TREATMENT
Heat stroke **Call an ambulance immediately**	.Headache, dizziness and visual disturbances. Muscle cramps. Nausea and/or vomiting or an unwillingness to drink. Clumsiness or slower reaction times. Disorientation or impaired judgement. Irritability and mental confusion. Tingling or numbness in fingers or toes. Rapid or short breathing. Collapse, seizures and unconsciousness. **Cardiac arrest**. Can be characterised by unconsciousness, stopped breathing and no pulse	If a cold bath is not available, or is not reasonably practicable or safe to use, use a combination of the following as available: Cool the employee by splashing cool or cold water on their skin or sponging their skin with a damp cloth. Make a wind tunnel by suspending sheets around, not on, the employee's body. Use a fan to direct gentle airflow over the employee's body. Apply cold packs or wrapped ice to the employee's neck, groin and armpits. If the employee is fully conscious sit them up to facilitate drinking and provide cool fluid to drink. Provide an electrolyte solution with sugar. Do not attempt to give oral fluid if the employee is not fully conscious. Shivering is an automatic muscular reaction which warms the body. It will make the body temperature rise even further. If the employee starts shivering, stop cooling immediately and cover them until they stop. Once they have stopped recommence first aid treatment.

ANNEXURE 2 – RISK MANAGEMENT CHECKLIST

RISK FACTORS TO CONSIDER	WHY THIS IS IMPORTANT	IS THE RISK PRESENT? IS IT CONTROLLED?
Are ambient conditions hot?	This contributes to incidents such as heat-related illness and burns.	
Are days and nights hotter than usual?	A heatwave can make it harder to sleep and workers may become fatigued.	
Is it humid?	High humidity makes it harder for the body to cool itself.	
When is work done?	Certain times of the day and year will be hotter.	
How often can workers take breaks somewhere cool?	Working in heat for long periods of time is very dangerous.	
Is there air movement or a breeze?	This can help cool workers.	
Is the work intense or long?	The harder the body is working the more heat it needs to lose.	
Are workers physically fit and acclimatised?	Fit and acclimatised workers generally have higher heat tolerances.	
Do workers wear hot clothing (including PPE)?	Some clothing can prevent the evaporation of sweat or prevent air movement.	
Are the workers qualified, trained and experienced?	Experienced workers may be more efficient and use less energy for the same work. They may also be more aware of the hazards, health effects and controls.	
(If known) do workers have medical conditions?	Some conditions and medications can make workers less able to cope with heat.	
Is there cool drinking water or electrolyte drinks on hand?	Dehydration can be dangerous and contributes to heat-related illness.	

10. RESOURCES AND ADDITIONAL READING

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