

وقاية

هيئة الصحة العامة
PUBLIC HEALTH AUTHORITY

Working in High Temperatures with Direct Sunlight Exposure Guideline

Heat-related Health Issues and Preventative Methods

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Version 1.2



@Saudi_PHA

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Introduction

This guideline is a revised version as well as an extension of the first edition of the Heat-related Health Issues and Preventative Methods for Working in High Temperatures with Direct Sunlight Exposure Guideline; which was issued by the Public Health Authority (Formerly known as “the National Center for Disease Control and Prevention”) in 1442 AH-2021 AD.

This guideline aims to acquaint business and project owners, and employees with health issues associated with working in high temperatures and under direct sunlight. Prevention methods will be provided along with ways to deal with heat-related incidents once they occur. In addition, providing recommendations, preventive measures, and raising awareness via a variety of platforms.

In this regard, we must refer to the Ministry of Human Resources and Social Development decision No. 3337 dated 15/7/1435 AH corresponding to 15/05/2014 AD which states, “the worker must not be engaged in open labor under sunlight starting at 12:00 pm till 3:00 pm during the period from the fifteenth of June till the fifteenth of September”, and to the great effect such decision has on avoiding many health problems related to working in open locations under direct sunlight and at high temperatures.

The guidelines and directions mentioned herein are merely recommendations (non-binding and not deemed as laws and legislations) issued by the Public Health Authority and based upon adopted international references reviewed by the Authority’s experts. These guidelines and directions target people who work at high temperatures and under direct sunlight and aim to acquaint the workers with the methods of prevention and accommodate it.

We would like to extend our gratitude and appreciation to Abu Dhabi Department of Health and Abu Dhabi Occupational Safety and Health Center (OSHAD) for issuing the thermal work limit model in geographical areas with high temperatures; including a relevant preventive and regulation plan.

Terminology

Global Warming:

The increase in global surface temperature along with an increase in carbon dioxide levels, and an increase in methane gases as a result of the greenhouse gas effect, which contributes to an overall increase in earth's atmosphere temperature.

Self-work:

It is the work which should allow the workers to adjust their work rate according to the environmental conditions.

Non-adaptive Worker:

It refers to the non-adaptive worker who is new or those who have been out of work for more than 14 days due to sickness or a leave (in a cold climate area).

Light Work:

It is working without great effort and is limited to sitting, standing and moving the arms.

Heavy Labor:

It is the work which requires getting up, climbing, lifting, pushing, or use of all body parts to complete the work.

Indoor Workplaces:

They refer to indoor workplaces where an appropriate temperature is not less than 20 degrees Celsius maintained at cold places with the availability of cooling equipment in hot places in addition to adequate ventilation for the place.

Outdoor Workplaces (in Open Air):

When working in open air, the weather conditions in this environment can result in dangerous effects to the employee's safety, and if the risks are not properly considered and managed, this effect might be immediate or might occur on the long run.

Thermal Work Limit Indicator:

Thermal working limit is an indicator of thermal stress which gives a measure of the maximum safety rating for working in the important and current environmental conditions (temperature of the dry, wet and radiant thermometer and wind speed), which is designed to encourage workers to drink sufficient amounts of water and stay hydrated, in addition to urging them to organize their work schedule and adapt to the work environment.

Target Group:

This guideline targets all those who work in high temperature environments whether indoor or outdoor. The way of managing the temperature at your workplace depends on whether it is indoors or outdoors and on the normal operating temperature of this environment. You may also need a highly specific advice for your workplace for example, concerning thermal stress, drought, heat pressure and heat strokes that are provided to the government and private institutions, business owners, and workers to help them identify the health problems related to working at high temperatures.

Global Warming and its Effect on Workers

The climate expectations indicate an increase in the severity of temperatures and climate emergencies on the global level. Consequently, there might be a loss of jobs and a decrease in the workers' productivity. The increase in global temperatures due to climate change will make Health issues associated with high temperatures and direct exposure to sunlight (heat strokes, heat exhaustion, heat cramps, heat rash) more common.

The response to the global warming phenomenon must include:

- An inclusive strategy to mitigate climate change and reduce the extra temperatures
- Policies and procedures to protect workers in such circumstances

Structural reforms to help business owners and workers to take the necessary measures to prepare for climate risks and achieve sustainability and economic growth.

1. Factors Causing Health Problems for Workers in High Temperatures and Most Vulnerable Group of Workers

The factors causing health problems related to working in high temperatures and under direct sunlight are as follows:

Environmental Factors

- Global warming and climate change on earth
- The increase in temperatures and humidity
- Direct exposure to sunlight or extreme heat
- Limited air movement (without breeze or wind)

Certain Job-Related Factors

- High physical exertion
- Use of heavy and impermeable personal protective clothing and equipment

Workers who are most vulnerable to health problems related to exposure to high temperatures and direct sunlight

- Those not used to work in high temperatures.
- Those not used to high physical exertion.
- Those not used to work outdoors and under direct sunlight.
- Those suffering from chronic diseases and obesity.
- Wearing heavy, dark or tight clothes or using heavy personal protective equipment.
- Those who showed early heat-related symptoms the day before.

2. Health Problems Related to Working in High Temperatures and Direct Sunlight

The reason for heat gain in the human body can be a combination of external heat from the environment and internal body heat resulting from metabolic processes. The fast increase in gaining heat due to exposure to more than average heat conditions leads to weakening the body's ability to organize its temperature and might lead to a range of diseases including heat cramps, thermal stress, heat strokes and fever.

Death or recovery from heat strokes or diseases resulting from heat might occur very quickly (in the same day), or may have a delayed effect (after several days) which leads to speeding up death and illness occurrence in people at high risk; especially in the first days of the heat waves. Even the slightest differences from the average seasonal temperatures are associated with increased illnesses and death. Extreme high temperatures can worsen chronic conditions such as cardiovascular, respiratory tract and cerebrovascular diseases and diabetes-related conditions.

Heat also has important non-direct health effects. Heat conditions can change human behavior, contribute to disease transmission and affect health services provision, air quality, vital social infrastructures such as power, transportation and water. The magnitude and nature of the heat health effects depend on the timing, severity and duration of the temperature, level of adapting to it, and the ability of the local population, infrastructure and institutions to adapt to the prevailing climate. The precise threshold upon which the temperature represents a dangerous situation varies depending on the area and other factors such as humidity, wind, local levels of human adaptation and preparation for the heat conditions.

Symptoms and Signs of Fever when Working at High Temperatures and Under Direct Sunlight



Headache,
dizziness, fainting



Fatigue and
generalized
weakness



Clammy skin



Irritability,
confusion



Thirst, nausea,
vomiting

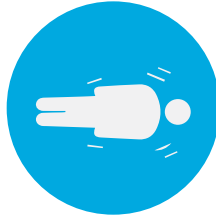
Workers' Health Problems Related to Working at High Temperatures and Under Direct Sunlight:

Heat stroke, Heat Exhaustion, Heat cramps and Heat rash.

Symptoms and Signs of Heat Stroke Associated with Working at High Temperatures and Under Sunlight:



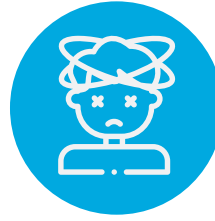
Confusion



Fainting



Excessive sweating or red, hot and dry skin



Convulsions



Very high body temperature (over 40 degrees Celsius)

Symptoms and Signs of Heat Exhaustion Associated with Working in High Temperatures and Under Sunlight:



Cold and moist skin



Excessive sweating



Headache



Nausea or vomiting



Vertigo and dizziness



Generalized weakness



Thirst



Irritability



Rapid heart rate



High body temperature (over 38 degrees Celsius)

Symptoms and Signs of Heat Cramps Associated with Working at High Temperatures and Under Sunlight:



Muscle spasm



Pain

Symptoms and Signs of Heat Cramps Associated with Working at High Temperatures and Under Sunlight:



Spots of a skin rash accompanied by redness often occurs on the neck, upper chest and skin folds

3. First Aid for Health issues associated with Working at High Temperatures and Under Direct Sunlight

Steps to be followed if a worker suffers a heat stroke:

- Call an ambulance.
 - Place the worker in a shaded and cool area.
 - Remove and loosen the person's clothes.
 - Help cool and ventilate the person by placing cold compresses and ice packs on the thigh and underarm or soaking the person's clothes in cold water.
 - Provide fluids (preferably water) as soon as possible.
- Stay with the person until help arrives.

Steps to be followed if a worker suffers a Heat Exhaustion:

- Call the supervisor at work and ask for medical help.
- Move the person to a shaded and cooler place to rest with observation.
- Give the person cold water as long as he is conscious and not vomiting.
- Remove and loosen the person's clothes.
- Help cool and ventilate the person by placing cold compresses and ice packs on the thigh and underarm or soaking the person's clothes in cold water.
- Take the worker to medical care center or emergency room for medical evaluation or treatment if the signs or symptoms worsen or did not get better.
- The worker must not return to work on this day even if he gets better.

Steps to be followed if a worker suffers Heat cramps:

- Make the worker rest in a shaded and cool place.
- The worker should drink water or other cold drinks.
- Wait for a few hours before allowing the worker to get back to the hard work.
- Ask the worker to seek medical care if the cramps do not get better.

Steps to be followed if a worker suffers a Heat rash:

- Try to work in cooler and less humid environment whenever possible.
- Keep the affected area dry.

4. Preventive Measures for Health issues associated with Working at High Temperatures and Under Direct Sunlight, Recommendations for Employers

Employers must take the following steps to protect the employees from high temperatures and working under direct sunlight:

- Set the schedule for performing maintenance and repair works in hot areas at colder times.
- Set the schedule for performing thermal works at times of the day during which temperatures drop.
- Enable workers to gradually adapt to the periods of working in hot weather.
- Reduce the physical demands which the workers have to meet.
- Hire additional workers or assign tasks that require physical effort to more workers.
- Provide cold water or fluids for the workers.
- Avoid drinks containing large amounts of sugar and caffeine.
- Provide breaks to drink water.
- Provide cool places to sit during breaks and encourage workers to take separate breaks during the working hours in shaded and cold places.
- Encourage workers to wear sun protection equipment such as head coverings, safety glasses for the eyes and light-colored clothes.
- Reduce the physical demand as much as possible by providing the appropriate engineering and electrical tools and equipment (such as electrical lifting equipment).
- Monitor workers who are prone to Heat exhaustion risk.
- Appoint an observer for the workers (who is trained to the methods of prevention and dealing with health problems related to high temperatures) while working in a high temperature environment and under direct sunlight to look for any symptoms or signs of health problems associated with high temperatures.

Providing required training with regards to dealing with health conditions associated with high temperatures in addition to providing information about:

- Risks which threaten workers.
- Methods of prevention.
- Monitoring symptoms.
- The importance of the worker monitoring himself and his coworkers to check symptoms.
- Treatment.
- Personal protective equipment.

1.Recommendations for Workers' Supervisors

Workers should avoid exposure to extreme temperatures and exposure to direct sunlight and high humidity whenever possible. If this is not possible, they should take the following preventive steps:

- Instruct the workers to wear light-colored and loose clothes which allow air flow; such as cotton clothes, avoid clothes made of synthetic fabrics which prevent air flow.
- Progression in workload from light to heavy.
- Set a schedule for higher workload at colder times of the day.
- Take more breaks at times of extremely high temperatures and humidity.
- Take breaks in shaded or cool places if possible and provide cold drinking water.
- Encourage workers to drink water frequently even if they are not feeling thirsty (4 cups per hour).
- Avoid drinks containing caffeine, alcohol, or large amounts of sugar.
- Inform workers that protective clothing or personal protective equipment may increase the risk of injury if not used properly.
- Encourage workers to wear personal cooling tools (such as ice vests and cooling bandanas) and loose and breathable clothing, as long as such items do not pose a danger to safety.
- Plan for emergencies and train workers on protection against Heat Exhaustion and treatment.
- Increase the frequency of communicating with the workers and encourage them to monitor themselves and others for signs of heat-related diseases.
- The worker should monitor his physical condition and the physical condition of his coworkers.
- Ensure the availability of first aid on the worksite and the existence of a clear plan to contact the medical service providers in case of a medical emergency.
- Train workers to recognize health problems related to working at high temperatures, methods of prevention and how to handle emergencies if they occur.
- Prepare a schedule for workers' rotation so that there are periods for working in an environment with less temperature and away from direct sunlight.
- Follow the guidelines and times of banning work under sunlight issued by the Ministry of Human Recourses.

5. Acclimatization for New Workers in Hot Areas and Training Methods

Acclimatization means the helpful physiological coping which occurs during the recurrent exposure to a hot environment.

This coping includes the following:

Increase the efficiency of sweating:

(Early sweating, increased sweat secretion, reduced salt loss in sweat with recommending not to drink water mixed with salt during work to replace salts)

Circulatory Stability:

Ability to do work with lower core temperature and heart rate, increased blood flow to the skin at a certain core temperature.

Acclimatization Schedule:

To acclimatize workers, their exposure time can be gradually increased in hot environmental conditions over the period of 7-14 days. New workers will need more time to adapt than workers who have previously been exposed. As for the new workers, the exposure schedule must not exceed 20% of exposure on the first day, and this percentage should be increased by no more than 20% on every additional day.

As for workers who have prior experience in the job, Acclimatization schedule should not exceed 50% on the first day, 60% on the second day, 80% on the third day and 100% on the fourth day.

In addition, the acclimatization level reached by each worker is related to the primary physical fitness of the person and overall thermal stress suffered by the person.

Preserving Acclimatization:

Workers can preserve their acclimatization even if they were away from work for a few days, like when going back home to spend the weekend. However, if they were absent for a week or more, there might be a great loss in the helpful adaptations which leads to an increased possibility of developing heat related diseases and the need to gradually adapt to the hot environment.

Some additional information about preserving acclimatization:

- acclimatization can often be restored within two to three days upon returning to a job in a high temperature work environment.
- People who are in top physical condition certainly better preserve their acclimatization.
- Seasonal changes in temperatures may lead to difficulties in acclimatization.
- Working in hot and humid environments provides acclimatization advantages which also applies to hot and desert environment and vice versa, which proves that air conditioning has no effect on adaptation.

We would like to note that thermal stress is the health condition resulting from the body's inability to get rid of unhealthy high temperatures when exposed to many internal and external factors.

It may result from a variety of internal or external sources for increased thermal stress, such as:

- Heat resulting from work processes and machinery (for example, forging).
- Environmental temperatures, humidity and lack of air movement (for example, lack of wind or insufficient air circulation).
- Internal metabolic processes (for example, diseases causing fever).
- The heat generated by muscles from physical activity.

6. Criteria of choosing a temperature indicator and dealing with it:

There is more than an indicator to use, and they are as follows:

- Limit work temperature in work environments
- Outdoor temperature indicators

The two previous indicators have been chosen based on applying them to work environments similar to the work environment in the Kingdom of Saudi Arabia. The Public Health Authority recommends using the limit work temperature especially in internal and external work environments exposed to different weather conditions such as humidity, wind speed and high temperatures in dry areas.

Thermal Work Limit Indicator in Indoor and Outdoor Work Environment:

When to use the Thermal Work Limit Indicator:

- Thermal Work Limit Indicator is used in indoor and outdoor work environments, during exposure to different weather conditions such as humidity, wind speed and high temperatures in dry areas.

To calculate the thermal Work Limit Indicator, the value of the following measurements should be taken into consideration:

- Dry thermometer temperature (ambient air temperature) (Celsius)
- Wet thermometer temperature (humidity/evaporation) (Celsius)
- Black thermometer temperature (radiant temperature) (Celsius)
- Wind speed (m/s)

The devices used to take all these measurements and automatically calculate the limit work temperature are available. There are also alternate devices that can be used to take the measurements, and then entering these measurements in the electronic calculator to calculate the limit work temperature.

1- Measuring the thermal Work Limit Indicator:

Example of a device



The Public Health Authority recommends the following:

In case of performing heavy works or exposure to heat exhaustion, sweating rate increases to 1.2 liter/hour. Consequently, drinking fluids at amounts exceeding this rate is impractical and might lead to gastrointestinal issues and discomfort due to reaching the maximum stomach tolerance to get rid of fluids and excrete them at 1.5 liter/hour rate. Therefore, thermal conditions must be controlled in addition to providing enough water to replace the lost amounts of fluids.

Thermal Work Limit Indicator (TWL)- Work Zones

Procedures and Measures- Rest and Work, Schedule of Drinking Water Needs

Work Zones	Procedures	Schedule for Needed Amounts of Drinking Water (hours)	Schedule for Rest/Work (minutes)
<p>Low risk Unrestricted zone TWL from 140 to less than 220</p>	No restriction on self-working rhythm for trained workers who drink large amounts of water	Light work 600 – 1000 mL/h	This zone is safe for all continuous self-works
<p>Intermediate risk Warning zone TWL from 115 to less than 140</p>	<p>Caution area refers to the situations where environmental conditions require additional precautionary procedures: practically applying the engineering preventive measures to reduce thermal stress, for example, providing shaded areas and enhancing ventilation. It is not recommended for any person to work alone, nor to hire a nonadaptive person. Make sure to drink enough fluids suitable for the work type.</p>	Light work 1-1.2 L/h	This zone is safe for continuous light self-work
		Heavy work More than 1.2 L/h	Continuous self-work 45 minutes work- 15 minutes rest
<p>High risk zone TWL less than 115</p>	<p>Focus on applying the required (work - rest cycle): It is not recommended for any person to work alone. It is not recommended to hire a non-adaptive person. In a high-risk zone, drinking water and identifying the signs of thermal stress should be emphasized. The worker should be equipped with a personal 2 liters water bottle on the site at all times.</p>	<p>All types of work More than 1.2 L/h</p>	Light work 45 minutes work- 15 minutes rest
			Heavy work 20 minutes work- 40 minutes rest

Table No. 1

2- Outdoor Temperature Indicator :

Temperature Measuring Definition:

It means measuring the increase in the ambient temperature of the worker above the limit it cannot endure, which exposes the worker to many risks where death may be the final stage. The source of heat in the work environment may come from natural sources such as sunlight or from industrial sources such as heat resulting from ovens, welding operations or other work equipment.

Target Group:

All people who work in outdoor work environments with high temperatures according to table No. 2.

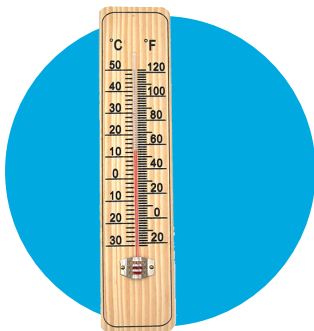
Outdoor Workplaces (in the Open Air)

When working in the open air, the weather's effects in this environment can have a very significant and dangerous impact on the employee's safety, and if the risks are not properly considered and managed, this effect might be immediate or might occur on the long run. For example, direct exposure to sunlight may cause skin damage including sunburns, blisters and skin aging and this may lead to an increased risk of developing skin cancer in the long run.

Measuring the Temperature:

The devices used to take these measures are available, some are electronic, and others are mercurial.

Example of a mercurial thermometer:



Example of an electronic thermometer:



When to use an Outdoor Temperature Indicator:

A thermometer can be used to help identify the risks of heat-related diseases for workers in the open air the procedures needed to protect the workers, and when to put such procedures into force. Depending on the value the thermometer indicates, the risks of developing heat-related diseases may range from low to very high to extreme. With the increase of the thermometer indicator value, there is a need for more preventive measures to protect the workers.

The thermometer values are divided into four scopes associated with four risk levels, which help to take the appropriate procedure according to the temperature data. This has been developed for workers to use on worksites according to table No. 2.

Thermometer Indicator	Preventive Measures	Risk Level
Less than 32.7 degrees Celsius	Thermal safety basics	Low (caution)
From 32.7 to 39.4 degrees Celsius	Implement precautions and raise awareness	Intermediate
From 39.4 to 46.1 degrees Celsius	Additional precautions to protect the workers.	High
More than 46.1 degrees Celsius	Issue stricter preventive measures	High Risk

Table No. 2

Employers should respond to any high temperature indicator; such response matches the type of steps to be followed to treat the other risks in the workplace including **the following:**

- Train workers on how to identify and prevent heat-related diseases.
- Daily Monitoring of the thermometer on working site and notify the workers to take necessary precautions.
- Implement a preventive plan with constant revision.

Use of protection measures to be taken at each level of risk to notify the workers with the appropriate preventive plan. The plan should address the following:

Preventive Plan	Risk Indicator Level			
	High Risk	High	Intermediate	Low (caution)
Providing supplies (ensure availability of enough water, provisions for break areas and other supplies)	✓	✓	✓	✓
Providing canopies, personal protective equipment, fans, steam sprayers, air fresheners and portable thermometer.)	✓	✓	✓	✓
Emergency planning and response (train supervisors and crews for emergencies)	✓	✓	✓	✓
Workers' acclimatization (increasing the workloads gradually, allow more frequent breaks so that workers can adapt to temperature)	✓	✓	✓	✓
Modified work schedules (create systems to enable modifications to the work schedule)	✓	✓	✓	
Training (train workers to identify diseases related to heat and acquaint them with the relevant preventive measures)	✓	✓	✓	✓
Physiological, visual and verbal monitoring (using direct observation and physiological monitoring to check for symptoms and signs of heat-related diseases)	✓	✓	✓	

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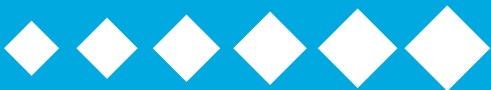
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