

EFFECTS OF HEAT



Dehydration
Heat Stress
Heat Exhaustion
Heat Stroke
Hyponatremia

This information is designed for wildfire situations; however you may face similar problems when fighting structural fires

Hard work and Heat

The body's temperature rises naturally during physical work and is controlled mainly through the evaporation of sweat from the skin.

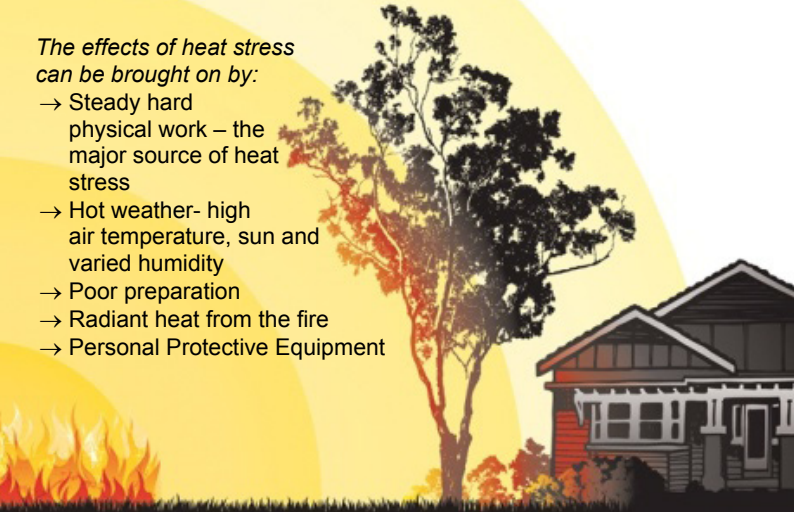
This process naturally cools the body, however, the effectiveness of sweat evaporation is limited when wearing PPC and the humidity and ambient air temperature is high as the environment becomes hotter.

Fire fighters regularly confront the problems of working in heat, the effects of which may include:

- Dehydration
- Heat stress
- Heat exhaustion
- Hyponatremia
- Premature fatigue
- Poor decision making (which can lead to accidents)
- Heat stroke

The effects of heat stress can be brought on by:

- Steady hard physical work – the major source of heat stress
- Hot weather- high air temperature, sun and varied humidity
- Poor preparation
- Radiant heat from the fire
- Personal Protective Equipment



Minimising heat stress

In fire fighting situations it is important to remain as alert and effective for as long as possible, often for many hours.

A significant number of heat stress cases can be avoided or minimised through preparation and rehabilitation.

Minimising heat stress on the fire ground

- Adopt a comfortable, conservative pace on the fire ground
- Share heavy workloads, such as dragging heavy hose lines by crew rotation
- Work at a comfortable distance from the fire
- Take regular breaks
- Wear appropriate clothing (PPC) for the task being undertaken
- No not run on the fire ground



Rehabilitation

During rest breaks active rehabilitation can significantly reduce the risk of heat illness and is crucial period of time to replenish fluids and restore your core temperature.

Active rehabilitation should include:

- **Hydration** – Approximately 600mL of electrolyte drink to 1200mL of water should be consumed per hour depending on work load*
- **Cool shaded area** – where possible a grassed, shaded area should be used for rest and rehabilitation
- **Lower arm cooling** – using cooling chairs, cooling towels, fans and/or water*
- **Remove/loosen excess clothing** – this promotes air flow and allows sweat to be evaporated from the skin

*Fluids should not be frozen, 10-20°C is ideal

Preparation and pre-hydration

Work on the fire ground demands good health and fitness, and the risk of heat illness can be increased in fire fighters who:

- Are overweight and physically inactive
- Suffer from heart disease or diabetes
- Have skin disorders
- Take medications
- Consume excessive amounts of alcohol or have other drug related problems
- Consume a diet high in saturated fat

Be prepared

Physical fitness and weight management will reduce the risk of heat illness and promote effective performance on the fire ground.

If you are not suitably prepared for the job you may not only jeopardise your own safety but that of fellow fire fighters as well.

It is important to achieve and maintain:

- **Physical fitness:** including cardiovascular endurance, muscular strength and flexibility – the guidelines for physical activity recommended at least 30 minutes of physical activity every day
- **A healthy body weight** and a healthy diet focusing on fruits and vegetables, whole grains, lean meat and legumes

Drink to survive

Avoiding or minimising dehydration by maintaining a constant fluid intake of water and electrolyte replacement drinks is the single most important method of sustaining energy and wellbeing on the fire ground.

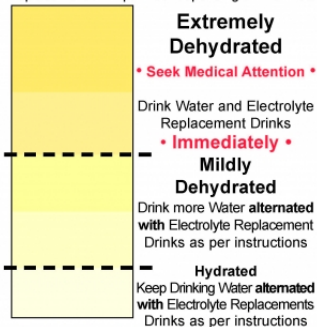
Sweat loss on the fire ground can cause you to lose up to two litres of fluid per hour, which depletes the body's stores of water and electrolytes. This can lead to heat stroke, the severest form of heat illness, if left unmanaged.

Fluid replacement

- Increase your body fluid before work commences
- Drink up to 600mL of electrolyte replacement drink to every 1200mL of water, pending workload
- Do not let thirst dictate when you drink
- Monitor your urine colour to determine your level of dehydration
- Avoid diuretics (things that dehydrate you) such as alcohol, tea, coffee, caffeinated drinks, energy drinks and sugary drinks
- Ensure that bottled water is available

What Colour is your Urine?

It is recommended that you drink up to 1200ml of water per hour and 600ml of electrolyte replacement drink per hour depending on work rate.



DO YOU PASS THE TEST?

Note: Urine colour may vary because of diet or supplements (e.g. multivitamins).



Electrolytes

Electrolytes are salts that play a vital role within the body. The main electrolytes that are lost through sweating and therefore need to be replenished are sodium, potassium, magnesium and calcium.



Sodium- The primary role of sodium in the body is to regulate blood volume and bodily fluids. Sodium also plays a vital role in transmitting neural signals. Hyponatremia occurs when sodium levels are too low.

Potassium- Potassium assists in maintaining a healthy heart rhythm and also works with sodium to transmit neural signals. Dangerous levels of potassium can cause arrhythmias.

Magnesium- Magnesium is responsible for muscle relaxation. Low levels of magnesium are characterised by muscle cramps.

Calcium- Calcium is crucial for muscle contractility. In cases where dietary intake and blood concentrations of calcium are low the body take calcium out of bones.

Heat illness

'Heat illness' is a term used to describe a spectrum of disorders caused by exposure to extreme temperatures and/or workloads, and occurs when the body is unable to adequately cool itself. Heat illness includes everything from heat cramps to heat stroke.



Heat cramps

Heat cramps occur when the body's stores of water, magnesium and other electrolytes become depleted, often as a result of strenuous workloads.

Heat exhaustion

Heat exhaustion is the pre-cursor to heat stroke, symptoms of which include faintness, light-headedness, dizziness, changes in mood, poor decision making, headaches and nausea.

With rest, rehabilitation and replacement of fluids victims of heat exhaustion tend to recover quickly.

Heat stroke

A heat stroke victim usually has a rapid pulse, shallow breathing and hot, dry skin with no apparent sweating. This condition can be life threatening and *urgent medical assistance* should be sought.

Heat exhaustion is the next stage following heat exhaustion. Individuals with heat stroke often display a loss of co-ordination, confusion, inappropriate and/or aggressive behaviour, symptoms of shock, collapse and/or convulse, and may lose consciousness.

Should you suspect that someone has heat stroke seek medical assistance.

DO NOT give fluids to an unconscious person.

Hyponatremia

Hyponatremia occurs when the body's stores of sodium are depleted to a dangerously low level, and often occurs when people rehydrate using water only following strenuous activity and significant fluid loss.

Hyponatremia highlights the importance of consuming appropriate amounts of electrolyte replacement drinks as well as water to ensure that a healthy balance of all electrolytes, including sodium, is maintained.

First Aid treatment of heat illness

Early recognition of symptoms and early treatment is vital to reduce the risks associated with serious heat illness.

Any person who feels exhausted, hot or unwell, or is noticed by other crew members to be affected by heat illness should:

- **Stop work**
- **Seek shade**
- **Loosen/remove excess clothing to circulate air flow**
- **Cool lower arms with cool chairs, moist towels or water***
- **Drink water and electrolyte replacement drinks***
- **Sponge skin with water***

*water should not be frozen, 10-20°C is ideal

Where the victim is affected by heat illness and does not recover quickly they should be regarded as heat stroke victims.

Active cooling and rehabilitation should continue while waiting for medical assistance, and emergency first aid (DRSABCD) should be followed if the person becomes unconscious.



Protective clothing

Personal Protective Clothing (PPC) provides considerable protection from the external environment during fire suppression; however PPC restricts the ability of the body to dissipate heat through sweating.

Dress properly for wildfires

To reduce radiant heat load on the body when fighting the fire either wildfire jacket and over trousers or overalls should be worn, closed at the neck and cuffs and gloves worn. Trouser legs should be worn outside the boots so that cinders do not get inside the boot and cause burns to the feet.

When not working very close to the fire, open up and roll up the sleeves to encourage cooling leaving the trouser legs open at the bottom also assists in the ventilation process between the over trousers and the wearer. This assists in the reduction of core body temperature.

If you are affected by radiant heat move back to a cooler, more comfortable environment.



Warning;

Jewellery (including body jewellery), synthetic tight fitting clothing, optical glasses and ventolin puffers may be affected by radiant heat. Matches and lighters should not be carried in fire fighter protective clothing.

Wildfire Ensemble – NOT – turnout coats

Wildfire ensemble or overalls provided for rural fire fighting have been selected to provide an appropriate level of protection.

In wildfire conditions, personnel are working vigorously and generating a great deal of body heat. Wildfire protective clothing allows this heat to escape but also protects from radiant heat. The wearing of structural turn out coats at rural fires is dangerous, as the coats will cause the body to retain excessive levels of metabolic heat.

If structural turn out coats are taken on the appliance of wildfires, they should only be used for protection:

- If caught in a fire storm
- As protection against the cold, particularly at night, when away from the fire line

Helmets

Structural helmets are not designed to be worn at wildfires, as they will not allow adequate dissipation of heat for the prolonged periods involved. Their weight may also cause severe discomfort if worn for long periods of time as encountered in rural fire fighting. Wear a wildfire helmet and when not on the fire ground wear a cap or wide brimmed hat.



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