

Safe work practices during heat stress events

Tim Pearson BSc (hons); Consultant Wildlife Ecologist

When planning for, or actively managing a heat stress event, it is critical that the health and wellbeing of the people attending be considered. It is very easy to get caught up in the rescue and care of the flying-foxes, and forget that the prevailing conditions are equally capable of causing discomfort, sickness, critical harm, or even death to humans.

By the very nature of a heat stress event, conditions will be such that most Workplace Health and Safety guidelines will recommend ceasing all outdoor activity if at all possible. As the whole point of what we are doing is to be rescuing the animals (and consequently out in the heat), it then becomes vital to actively monitor and manage the health of the personnel involved.

From a practical perspective, the key points are:

- Set up your triage / treatment areas in the shade. Set up awnings or marquees if required
- Provide a shaded rest area, with chairs and plentiful water supply
- Make sure that people working in the direct sun take frequent breaks, and drink plenty of water
- Be familiar with the symptoms of the stages of heat stress in humans, and the appropriate first aid measures (See *Appendix A: First aid fact sheet*)
- It is the responsibility of the person managing the heat stress event to ensure that the people involved take adequate breaks, drink plenty of water, rotate out of the direct sun as needed, and are monitored for symptoms of heat stress (See *Appendix B: Detailed heat stress guidelines*)

Heat Stress Guidelines for workplace Health and Safety

There are no set Australian workplace exposure standards or limits for heat stress. This is because setting a safe/unsafe limit is based on far too many variables - not just environmental conditions, but also the nature of the tasks being undertaken, and individual tolerance to conditions. And there are occasions when vital work has to be performed even in dangerous conditions.

Safe Work Australia provides a detailed guideline document [1] for working in heat stress conditions; however, while comprehensive, it does not provide an easy-to-follow summary. A good summary chart of heat stress levels and actions is provided by the US Occupational Safety and Health Administration [2]. It is based around the measured Heat Index, which is the most commonly used measure of human "apparent" temperature, and is calculated from a combination of temperature and relative humidity. Heat index is measured in the shade - note that being in the direct sun can add up to 9°C to the heat index!

To calculate heat index, cross reference the measured temperature and humidity on the chart below. Higher humidity increases the heat index, as it makes it more difficult for the body to remove heat via sweating. **It is critically important to remember that Heat Index is calculated based on human physiology - it is NOT applicable or relevant to flying-foxes.**

HEAT INDEX											
ENVIRONMENTAL TEMPERATURE (°C)											
	21.1°	23.9°	26.7°	29.4°	32.2°	35°	37.8°	40.6°	43.3°	46.1°	48.9°
Relative Humidity	Apparent Temperature *										
0%	17.8°	20.5°	22.8°	25.6°	28.3°	30.6°	32.8°	35°	37.2°	39.4°	41.7°
10%	18.3°	21.1°	23.9°	26.7°	29.4°	32.2°	35°	37.8°	40.6°	43.9°	46.7°
20%	18.9°	22.2°	25°	27.8°	30.6°	33.9°	37.2°	40.6°	44.4°	48.9°	
30%	19.4°	22.8°	25.6°	28.9°	32.2°	35.6°	40°	45°	50.6°		
40%	20°	23.3°	26.1°	30°	33.9°	38.7°	43.3°	50.6°			
50%	20.6°	23.9°	27.2°	31.1°	35.6°	41.7°	48.9°				
60%	21.1°	24.4°	27.8°	32.2°	37.8°	45.6°					
70%	21.1°	25°	29.4°	33.9°	41.1°	51.1°					
80%	21.7°	25.6°	30°	36.1°	45°						
90%	21.7°	26.1°	31.1°	38.9°	50°						
100%	22.2°	26.7°	32.8°	42.2°							

* Combined index of heat and humidity...what it "feels like" to the body. Source: National Oceanic and Atmospheric Administration

If you are not in a position to actually measure local conditions, it will be safe to assume (from examining the chart) that in any flying-fox heat stress event the heat index will be at least high and probably extreme – especially in the direct sun.

Once the heat index has been calculated, the appropriate risk level can be ascertained from the Heat Index Guidelines table (below).

These guidelines are based around an "average" person - defined as 170cm tall, weighing 66kg; dressed in long trousers and a short-sleeved shirt, and with an internal body temperature of 37°C. Many factors will increase the risk level, such as wearing of heavy personal protective equipment (PPE), e.g. long sleeves, gloves, etc., or working in the direct sun.

OSHA Heat Index Guidelines

HEAT INDEX	RISK LEVEL	PROTECTIVE MEASURES
Less than 32.8°C	Lower(Caution)	Basic heat safety and planning
32.8 to 39.4°C	Moderate	Drink ~4 cups of water/hour Take breaks as needed
39.4 to 46.1°C	High	Drink water every 15-20 minutes Take frequent breaks Schedule heavy work tasks when the heat index is lower
Greater than 46.1°C	Very high to extreme	Drink water frequently Reschedule non-essential heavy work if possible Alert workers to heat index for the day and identify precautions in place including who to call for medical help

This guidance is available online at www.osha.gov/SLTC/heatillness/heat_index

A detailed version of this table is included at Appendix B. Note that in these tables, the references to a "cup" of water are to a US legal cup – which is 240 ml.

The OSHA also states that "Under most circumstances, fluid intake should not exceed 1.5 litres per hour or 11 litres per day. This makes it particularly important to reduce work rates, reschedule work, or enforce work/rest schedules."

Accurately measuring heat index

While assuming the heat index is going to be high and taking the appropriate actions is probably a safe course of action, it is far better to actually measure the current conditions. A device such as the Kestrel Drop D2 [3] will allow you to do this easily – these devices measure temperature and humidity, and provide a calculated Heat index. Hung from a tree or gazebo in your triage area, and connected to from a Smartphone app, they can be configured to alert when thresholds are reached or exceeded.



Kestrel Drop D2, and smartphone with Kestrel LiNK app, showing (at top) heat index, (and below) temperature and relative humidity

A cheaper alternative that many carers may already have access to is the typical temperature/humidity monitor used while raising baby flying-foxes. While not ideal for outdoor use, they will at least give rough measurements of temperature and humidity, allowing heat index to be calculated.

A more accurate indication of working conditions is possible by using a dedicated heat stress instrument to ascertain the "Wet Bulb Globe Temperature", which takes into account solar radiation and wind speed as well as temperature and humidity. This is used to calculate a "Thermal Work Limit", which gives a far more accurate indication of how the human body is being affected, and in conjunction with graded guidelines, how to adjust work practices for the prevailing conditions. However, devices to measure this are not cheap [4], and except in extreme cases the application of the heat index and associated safe work guidelines will give an adequate indication for WHS purposes.

Links to source material:

1. Safe Work Australia guidance material for managing the risk of working in heat:

https://www.safeworkaustralia.gov.au/system/files/documents/1712/guide_for_managing_the_risks_of_working_in_heat_1.pdf

2. US Occupational Safety and Health Administration guidelines:

https://www.osha.gov/SLTC/heatillness/heat_index/

3. Kestrel weather meters Drop D2

<https://kestrelmeters.com.au/products/kestrel-drop>

4. Kestrel weather meters 5400 Heat Stress tracker

<https://kestrelmeters.com.au/products/kestrel-5400-heat-stress-tracker>

Appendix A: First aid fact sheet *per* SafeWork Australia

You have a duty to provide first aid equipment and facilities, and access to trained first aid officers, for sick or injured workers. Heat-related illness is a progressive condition and if left untreated it can be fatal. If you think someone has severe heat exhaustion, or heat stroke, you should call an ambulance immediately and perform first aid until the ambulance arrives.

For the early stages of heat-related illness first aid can often be effective, but you should always seek medical assistance if in doubt, or if the person's symptoms are severe.

Note on pre-existing medical conditions and medications. Previous heat-related illness, certain medications and medical conditions can make a worker more susceptible to heat related illness and can affect how the worker can be treated. You should alert workers to this risk and monitor them closely as far as is reasonably practicable.

Dehydration – Seek medical advice if symptoms don't improve or are severe

Symptoms	First aid for dehydration
<ul style="list-style-type: none">• 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.	<ul style="list-style-type: none">• 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

Symptoms	First aid for heat rash
<ul style="list-style-type: none">• Itchy rash with small raised red spots on the face, neck, back, chest or thighs.	<ul style="list-style-type: none">• 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

Symptoms	First aid for heat cramps
<ul style="list-style-type: none">• Painful and often incapacitating cramps in muscles, particularly when undertaking demanding physical work.	<ul style="list-style-type: none">• Stop activity and rest quietly in a cool place until recovered.• Drink an electrolyte solution.

Fainting – Seek medical advice

Symptoms	First aid for fainting
<ul style="list-style-type: none">• Fainting (heat syncope) can occur while standing or rising from a sitting position.	<ul style="list-style-type: none">• Lie the worker flat immediately with their legs slightly raised.• Do not raise the head.• Treat as for heat exhaustion.

Heat exhaustion – Call an ambulance immediately

Symptoms (not all will be present)

- Dehydration, thirst, and reduced or dark urine output.
- Sweating.
- Elevated body temperature.
- Weakness or fatigue.
- Headaches and dizziness.
- Nausea.
- Muscle cramps.

Severe symptoms:

- The worker stops sweating.
- Cold, pale or clammy skin.
- Clumsiness or slower reaction times.
- Disorientation or impaired judgement.
- Rapid or short breathing.
- Rapid weak pulse or heart palpitations.
- Tingling or numbness in fingers or toes.
- Visual disturbance.
- Vomiting or an unwillingness to drink.

First aid for heat exhaustion

- Move the worker to a cool place with circulating air.
- Lie the worker flat.
- Remove unnecessary clothing, including PPE.
- Loosen tight clothing.
- If the worker is fully conscious sit them up to facilitate drinking and provide cool – not cold fluid to drink.
- Provide an electrolyte solution or water.
- Cool the worker with cold compresses or apply cold water to skin.
- Observe the worker and obtain medical advice if symptoms don't improve.
- Seek medical assistance if there is no improvement or the first aider is in doubt.

Heat stroke – Call an ambulance immediately

Symptoms (not all will be present)

- The person stops sweating.
- Skin can be pink, warm and dry, or cool and blue.
- High body temperature above 39 degrees Celsius.
- Cramps.
- Pounding, rapid pulse.
- Headache, dizziness and visual disturbances.
- Nausea and/or vomiting.
- Clumsiness or slower reaction times.
- Disorientation or impaired judgement.
- Irritability and mental confusion.
- Collapse, seizures and unconsciousness.
- **Cardiac arrest.** Can be characterised by unconsciousness, stopped breathing and no pulse

First aid for heat stroke

- Call 000 and evacuate by ambulance immediately.
 - Ensure that the ambulance is updated if the worker experiences seizures or becomes unconscious.
 - If cardiac arrest occurs follow DRSABCD action plan
 - Move the worker to a cool place with circulating air.
 - Remove unnecessary clothing, including PPE
 - Loosen tight clothing.
 - Cool the worker by splashing room temperature water on their skin or sponging their skin with a damp cloth.
 - Make a wind tunnel by suspending sheets around, not on, the worker's body. Use a fan to direct gentle airflow over the worker's body.
 - Apply cold packs or wrapped ice to the worker's neck, groin and armpits.
 - If the worker is fully conscious sit them up to facilitate drinking and provide cool – not cold – fluid to drink.
 - Provide an electrolyte solution with sugar. Do not attempt to give oral fluid if the worker 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 worker starts shivering, stop cooling immediately and cover them until they stop. Once they have stopped recommence first aid treatment
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Appendix B: Detailed Heat Stress Guidelines *per* US OSHA

Heat Index	Risk Level	Protective Measures
< 32.8°C	Lower (Caution)	<ul style="list-style-type: none"> • Provide drinking water • Ensure that adequate medical services are available • Plan ahead for times when heat index is higher, including worker heat safety training • Encourage workers to wear sunscreen • Acclimatize workers <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>
32.8°C to 39.4°C	Moderate	<p>In addition to the steps listed above:</p> <ul style="list-style-type: none"> • 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 workers • Set up buddy system/instruct supervisors to watch workers for signs of heat-related illness <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 • Develop work/rest schedules • Monitor workers closely
39.4°C to 46.1°C	High	<p>In addition to the steps listed above:</p> <ul style="list-style-type: none"> • Alert workers of high risk conditions • Actively encourage workers to drink plenty of water (about 4 cups/hour) • 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 work, pace/rotate jobs) • Use cooling techniques • Watch/communicate with workers at all times <p>When possible, reschedule activities to a time when heat index is lower</p>
>46.1°C	Very High to Extreme	<p>Reschedule non-essential activity for days with a reduced heat index or to a time when the heat index is lower</p> <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 46.1°C.</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) • Develop and enforce protective work/rest schedules • Conduct physiological monitoring (e.g., pulse, temperature, etc) • Stop work if essential control methods are inadequate or unavailable.

