ICF EXTREME HEAT GUIDANCE

GUIDANCE FOR ORGANISERS OF COMPETITIONS HELD IN HOT WEATHER

international canoe federation

1. BACKGROUND

Illness due to exercising in hot weather has long been recognised as a risk for competitive sport, not only for the competitors but also, potentially, for the officials. Exertional heat stroke is the second commonest cause of death in athletes. As the climate changes, it is increasingly likely that paddlesport competitions will be held in temperatures and humidities that could cause illness due to heat. For this reason, it is important that every competitive discipline in paddlesport can recognise and assess the risk for each event.

This guideline has been prepared by the European Canoe Association Medical Committee, in collaboration with the Technical Committees for each competitive discipline, in order to provide guidance for Host Organising Committees (HOCs) on how to assess the risk of heat-related illness for any given event and how to implement mitigation strategies. It also provides advice for the care of athletes, both to reduce the risk of heat-related illness (HRI) and for its immediate management.

This guideline is not an exhaustive description of all aspects of exercising in hot conditions and for more detailed analysis, readers should consult the reading list at the end of the document.

2. EXERCISING IN HOT OR HUMID ENVIRONMENTS

During strenuous exercise, heat production in the body can increase 20 times above normal and this heat must be dissipated to the environment to reduce harm to the body. The external environment is the main factor that determines how well heat is gained by and lost from the body and so an understanding of the four heat loss mechanisms is important for athletes, their coaches and competition organisers.

2.1 Conduction

This is the transfer of heat energy from the body to the still air surrounding it. Air is a good insulator so only 2% of body heat is usually lost through conduction. However, the thermal conductivity of water is at least 25 times that of air which is why the application of cold wet cloths can improve heat loss through conduction.

2.2 Convection

This is the loss of heat to the free air and water vapour molecules circulating around the body. The windier and wetter the conditions, the more heat will be lost from the athlete. As the ambient air temperature rises, the amount of heat dissipated by convection decreases until the air temperature exceeds that of the body, at which point the body will start to gain heat. If the still air surrounding the body is increased or the free air velocity is decreased, for instance by tight-fitting clothing, then both conductive and convective heat losses are reduced as is the possibility of radiant heat loss. Loose-fitting clothing therefore maximises convective and evaporative heat loss.

2.3 Radiation

Radiation refers to the process of heat transfer by electromagnetic waves (e.g. from the sun to the athlete). The hotter the sun, the more likely the athlete will gain heat energy. Up to 300kcal/hr can be gained from radiation when someone is exposed to hot summer sun. Similarly, heat can also be lost from the skin by radiation but this is reduced by all clothing.

2.4 Evaporation

Evaporation is the conversion of a liquid to gas and in the case of humans, this is how sweating reduces body temperature. Cooling is best achieved when the sweat evaporates from the skin and is minimal if the sweat is dripping off the skin. Evaporation of 1ml of sweat from the skin cools the body by 0.58kcal. Individuals exercising in hot environments commonly lose 1-2 litres per hour of sweat. 'Heavy' sweaters can lose up to 4 litres per hour. Heat loss by sweating is maximised by increasing blood flow to the skin (vasodilation) and is also affected by the ambient wind velocity and humidity. The ability of the environment to evaporate sweat is termed the atmospheric cooling power (ACP). The greater the wind, the greater the evaporation. In contrast, the higher the humidity, the lower the ACP. Evaporation also occurs through respiration (breathing) and this fluid loss must be remembered when determining fluid requirements in the strenuously exercising athlete.

3. ACCLIMATISATION

Heat adaptation, or acclimatisation, occurs by numerous physiologic processes and this process can be incorporated into training programmes so that experienced and heat-adapted athletes can tolerate higher core temperatures. For instance, in heat-adapted marathon runners, rectal temperatures as high as 42oc (107.6oF) have been recorded without harm.

Daily exposure to training and heat for 100 min/day results in near-maximal acclimatisation within 7-14 days (a minimum of 10 days is usually recommended for athletes). Acclimatisation will be recognised by earlier onset of sweating at a lower core temperature, increased sweat volume and decreased sodium content of the sweat. Multiple adaptations occur in the brain, thermal receptors, cardiovascular system and kidneys but these need to be maintained by repeated heat exposure at least every 4 days.

4. EXERCISE-ASSOCIATED COLLAPSE (HEAT SYNCOPE)

Exercise-Associated Collapse (EAC) was previously known as Heat Syncope. It usually occurs when intense exercise ceases and has been noted in marathon paddlers during portages or on reaching the pontoons at the end of events. Whilst not specifically a heat-related illness, it can be more likely in situations where there is a high ambient temperature, inadequate hydration, over-hydration with water leading to low blood sodium, or a low blood sugar. The combination of factors results in cardiovascular stress and pooling of the blood in the lower limbs when standing up. This will result in dizziness, difficulty standing or walking or collapse (syncope).

Immediate management involves lying the person on their back and elevating the legs above head height. Check the core temperature and ensure that it is normal. Assess for other signs of Heat Exhaustion or Heat Stroke. If this is EAC then normal function should return within 5 minutes. Continue to monitor for signs of heat-related illness.

5. HEAT-RELATED ILLNESS

When the body is no longer able to regulate its temperature due to the intensity of exercise and the ambient conditions, the core temperature will start to rise and symptoms will occur. These range in severity from muscle cramps, heat exhaustion to heat stroke. Heat stroke is a medical emergency with a significant mortality (death rate) so it is important to recognise the early signs of heat exhaustion to prevent escalation to heat stroke.

5.1 Heat Cramps

An early warning of problems with exercising in the heat is that of heat cramps. These are muscle pains or spasms that usually occur in the muscles of the arms or legs or in the abdomen and is commonly attributed to the loss of salt and fluid due to sweating, resulting in altered muscle function.

WHAT TO DO IF SOMEONE HAS HEAT CRAMPS

- Stop all activity
- Rest in a cool, quiet place
- Drink cool clear juice or a sports drink
- Do not return to strenuous activity for at least one hour because it may worsen the cramps or progress to heat exhaustion
- Seek medical attention if cramps do not subside within 1 hour

5.2 Heat Exhaustion

- **Definition of Heat Exhaustion:** An illness resulting from prolonged, heavy activity in a hot environment with subsequent dehydration, electrolyte (salts) depletion, and rectal temperature >37.8° C (100° F) but ≤40° C (104° F).

Heat exhaustion is a form of heat-related illness that can develop after several days of exposure to high temperatures and inadequate or unbalanced replacement of fluids. In the mildest form, the athlete, coach or official may simply complain of fatigue and nausea but, unrecognised, this may progress to more serious symptoms. It is important to recognise that these symptoms are related to the heat so that appropriate rehydration and other interventions can be undertaken immediately. As heat exhaustion progresses, the following array of symptoms increase:

- Heavy sweating
- Paleness
- Muscle cramps
- Tiredness
- Weakness
- Dizziness
- Headache
- Nausea or vomiting
- Fainting

Examination:
On examining the person, the skin may be cool and moist. The pulse rate will be fast and weak, and breathing will be fast and shallow. If heat exhaustion is untreated, it may progress to heat stroke. Seek medical attention if symptoms worsen or last longer than one hour.

WHAT TO DO IF SOMEONE HAS HEAT EXHAUSTION

- Rest the person in a cool, quiet environment
- Provide cold, non-alcoholic drinks, such as dilute fruit juice or sports drinks
- Seek air conditioning if possible
- Get them to take a cool shower, bath or sponge bath
- Remove as much clothing as possible or reduce to lightweight, loose-fitting clothing

5.3 Heat Stroke This is an emergency

- **Definition of Heat Stroke:** A life-threatening heat illness characterized by extreme hyperthermia (core temperature >40° C [104.0° F]), dehydration, multiorgan failure, and neurologic manifestations. Heat stroke can be further subdivided into "exertional heat stroke" occurring in generally healthy individuals undergoing strenuous physical activity in warm conditions (the athletes) and "nonexertional heat stroke" often seen in elderly and/or debilitated patients with impaired thermal regulations due to illness or medications (potentially the ITOs etc)

This is the most serious form of heat-related illness and occurs when the body becomes unable to control its temperature. The body temperature will rise rapidly, sweating stops and the body is unable to cool down. Within 10 to 15 minutes, the body temperature may rise to 41oc (106oF) or higher. Unless emergency treatment is not immediately provided, death or permanent disability can arise. The following symptoms occur:

- Dizziness
- Nausea
- Throbbing headache
- Increasing difficulty in mental function
- Confusion
- Unconsciousness

Examination:
The skin will be very hot, red and dry. The pulse will be rapid and strong. Core temperature will be >39.5oc / 103oF. They may be confused or become unconscious

WHAT TO DO IF SOMEONE HAS HEAT STROKE

Get someone to call for medical assistance immediately
Begin cooling the victim by:

- Lying them down in a shady or cool area
- Do not give anything to drink
- Cool them rapidly in whatever way is possible. Examples include an ice or cold bath (if available), spraying or pouring cool water over them, sponging them with cold water, covering them with a cold cloth (if humidity is low only)
- Fan them vigorously
- Monitor the body temperature and continue to cool the victim until the temperature drops to 38-39oc (101-103oF). If temperature <39oc is achieved within 30 minutes, mortality is usually low
- Stop cooling if the person starts shivering
- If they are unconscious, lie them on the side in the recovery position and maintain the airway
- Be prepared to give Cardio Pulmonary Resuscitation (CPR) and send someone for an automatic defibrillator (AED), if available
- If no medical personnel are available or if they are delayed, call the local hospital emergency department for further instructions

6. WHO IS AT RISK?

Anyone exposed to high air temperatures, hot sun or high humidity at lower temperatures can experience these symptoms. In the context of the paddlesport training or competitive environment, athletes, coaches, video operators, judges and water safety personnel are all at risk because they are likely to be in the sun, or outside, for extended periods. Athletes whose event is of long duration e.g. marathon, ultra-distance racing, are at particular risk, especially if they do not replace fluid appropriately or ambient conditions do not allow sufficient heat loss. Water safety personnel are at increased risk because of protective clothing that reduces the ability to lose heat. Technical officials (ITOs) and members of the Host Organising Committee (HOC) are often older and more likely to have underlying illnesses or take medication that increases the risk of heat-related illness. People >65 years of age, those with cardiac problems, diabetes or obesity are all at increased risk.

7. SUMMARY

A summary chart of symptoms, signs and action required is in Appendix 1. This can be downloaded and used in all appropriate places as an aide-memoire.

8. PARACANOE EVENTS

There are various reasons why the risks may be increased in athletes with a physical disability. In those with a spinal cord lesion, there is impairment of blood flow below the lesion level and so a reduced ability to lose heat. This is also the case for amputees. Athletes with a physical disability have to work harder for a given work output so heat generation can be higher. Prostheses and strapping to hold the paddler in their boat will reduce the flow of air around the body and therefore the convective heat losses.

The incidence of HRI in para-athletes is currently low but it is likely that, as the number and competitiveness of these athletes increases, there will be more risk of heat-related illness. Management of acute illness in paracanoe athletes may also be made more difficult by the problems of strapping or prostheses within the boat and difficulties in moving them to a place of safety for treatment.

Aspects of treatment may need to be modified according to the disability and any complications. For instance, if the athlete has pressure sores from prostheses then it is an imperative to keep these areas clean. Paraplegic athletes will require a wheelchair adapted route to the medical area and will require special attention if needing cold water immersion.

Further reading on this subject is shown in the reference section.

9. RESPONSIBILITIES OF EVENT ORGANISERS

The HOC must have prior knowledge of the likely weather conditions (both temperature and humidity) for their venue at the time of year the event is planned. If an event is planned for the summer months, they must have a heat policy in place and pay close attention to the local weather forecast. It is their duty to:

- Provide an environment for safe participation
- Decrease the risk of heat-related illness and injury among participants, officials and spectators
- Provide practical strategies to manage risks relevant to the event
- Ensure the needs of individuals are considered

Climatic conditions that increase the risk are rising temperatures and increased humidity. Increased humidity decreases the temperature at which symptoms may occur. The Event Heat Policy will vary according to the type of event (e.g. slalom vs marathon), the venue (access to a medical room or emergency services) and the possibility of putting mitigating procedures in place for that particular event. The Heat Policy must allow for the delay, alteration or, as a last resort, cancellation of events if conditions are deemed too dangerous.

10. PRE-COMPETITION ASSESSMENT OF RISK

Assessment of risk starts early on in the organisation phase of a competition. Knowledge of the usual day and night-time temperatures, humidity and wind conditions at the venue at that particular time of year will help the HOC know whether mitigation procedures might be required. As the competition approaches, close attention to the weather forecast will be required. If temperatures or humidity are likely to be high, planning for alteration of the programme or other changes should start and participating teams kept fully informed of any likely changes.

One week before

- Identify the level of risk and need for further monitoring
- If zero risk is established – no action required outside of regular pre-event communication
- If some risk is established - communicate to the teams that hot weather has been identified as a threat to safety, that the situation is being monitored and mitigation processes will be put in place if required. Further updates will be communicated before the event.

Three days before

- Assess the forecast temperature
- Identify level of risk and need for further monitoring
- If zero risk is established – no action required outside of regular pre-event communication
- If some risk is established – communicate the following:
  - What strategies will be used (e.g. extra shade and water)
  - Fact sheets about how individuals can reduce risks (e.g. stay hydrated, stay in cool place)
  - Further updates will be communicated before the event
  - If cancelling, communicate message to all teams

On the day

- Identify level of risk and need for further monitoring
- Make a final decision on event modification or cancellation (if needed)
- Communicate the following:
  - What strategies will be used (e.g. extra shade and water)
  - How individuals can reduce their own risks (e.g. stay hydrated, stay in cool place)

After event

- Communicate success of mitigation strategies (measured by number of heat illnesses through first aid treatment)
- Communicate any learnings or future mitigation strategies
- Ask for feedback about mitigation strategies

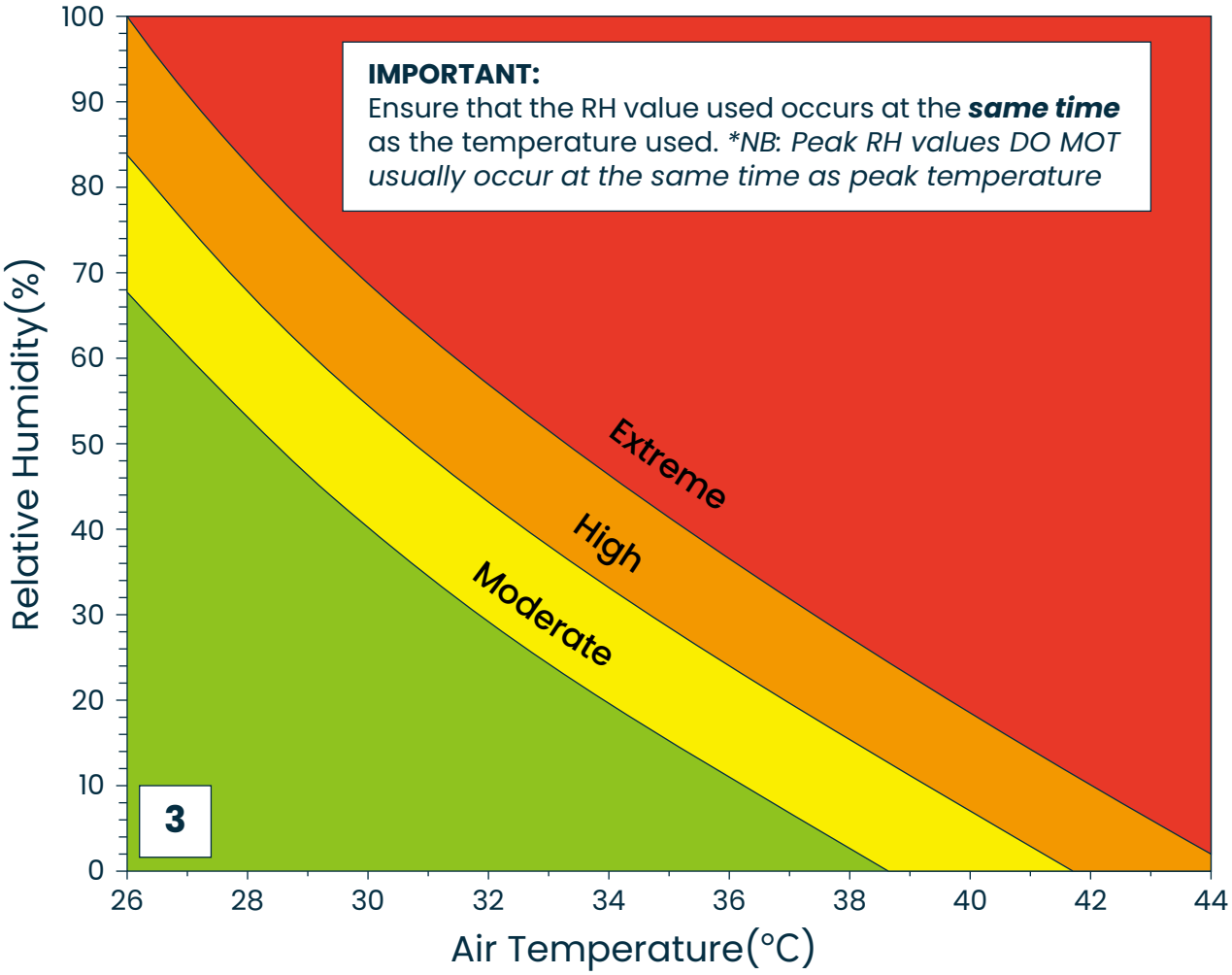
11. HOW TO MEASURE ENVIRONMENTAL CONDITIONS AND ASSESS RISK

The heat risk associated with participation in each event, should be assessed using the Wet Bulb Globe Temperature (see below). The temperature and humidity for the location where competition or practice will be taking place needs to be acquired.It is essential that the peak temperature during the time of competition is used ***with the accompanying relative humidity at that specific time***. If the peak relative humidity is used for a particular day, which usually occurs when temperature is lowest, heat stress risk will be over-estimated and competition unnecessarily disrupted or cancelled. In addition, the type and duration of event affects the risk i.e. the longer the duration and higher the intensity, the greater the risk. Sprint events lasting less than 5 minutes pose the least risk, although the requirement for course walks and warm-up in the heat need to be considered. Additionally, events that keep the athlete wet, such as slalom, are less dangerous than where the athlete will remain mostly dry, such as marathon.

11.1 The Wet Bulb Globe Temperature

The Wet Bulb Globe Temperature (WBGT) is recognised as the best way of assessing heat related stress for sporting events held in direct sunlight. It takes into account multiple variables including temperature, humidity, wind speed, sun angle and cloud cover. Validated and calibrated machines must be used by personnel familiar with their use. Once readings have been obtained, they can be compared to the average risk for canoeing as shown below in Fig 1.

Figure 1 WBGT readings and potential risk for outdoor canoeing events



These are average risk assessments for canoe events (classed as Category 3 risk).
Other risks, such as duration of event and type of

11.2 Using the Risk Chart

There is insufficient data from specific paddlesport disciplines to dictate absolute policies according to the WBGT risk chart. In general, the longer the event, the more likely that HRI may occur for each given point on the chart. Similarly, the 'drier' the event, the less cooling will occur and therefore there is greater risk. In addition, the risks for well acclimatised athletes will be less than for athletes with no acclimatisation and even less than for untrained officials. Even athletes that are well acclimatised can be at increased risk if they have had less than optimal preparation e.g. prior illness, insufficient or inappropriate hydration.

It has also been found that events in hot weather at the end of summer are less likely to cause illness than at the beginning of summer or in an exceptional heat event, suggesting ongoing acclimatisation of athletes.

Summary

Organisers should use the chart to decide:

- The extent of venue countermeasures to implement at each level of risk for each specific event
- To decide which events to reschedule to cooler times of day
- Whether or not rules will need altered e.g. longer intervals in Canoe Polo
- To give advice to teams prior to the event according to expected risk

12. MITIGATION PROCEDURES FOR ACCREDITED PERSONNEL APPLICABLE TO ALL PADDLESPORT EVENTS AND DISCIPLINES.

12.1 For athletes:

- Cool, quiet, shady or air-conditioned rest area
- Misting stations
- Freely available cold, non-alcoholic drinks
- Ice machine
- Limitation of time spent outside in the heat e.g. timing of practice or demonstration runs at cool times of the day
- Changing the timing of events to cooler times of the day
- Consideration of a shaded warm-up area where appropriate
- Advise against tight-fitting or dark competition clothing
- Shaded but not enclosed areas for equipment check, 'kiss and cry,' media etc
- Continuously available transport to and from hotels / accommodation
- Rapid access to a medical room for assessment

12.2 For officials:

- Screening for those officials at increased risk of heat-related illness
- Lightweight, light-coloured and loose-fitting official uniform
- Caps or broad-brimmed hats
- Limitation of time spent on task in the heat
- Cool areas for when 'off-duty'
- Shaded, but not enclosed, areas for judges and other ITOs, where possible
- Fans in enclosed areas
- Misting stations
- Freely available cold, non-alcoholic drinks
- Ice machine
- Water safety team able to immerse themselves in the water at regular intervals
- Shaded but not enclosed areas for equipment check, 'kiss and cry,' media etc
- Rapid access to a medical room for assessment

13. POTENTIAL MITIGATION PROCEDURES SPECIFIC TO DISCIPLINE

In addition to the general advice for ALL Paddlesports disciplines shown above, discipline specific advice has been created with each Technical Committee. Examples of an Organiser Template is provided in the Appendices and a blank template can be downloaded from the ECA website.

Dragon Boat Racing:
- Shaded boat cover for ITO personnel on the regatta course
- Shaded areas at marshalling for ID-control for ITO personnel and athletes.
- Shaded area for each participating team (permanent or temporary structures)
- Cool boxes with cold drinks and ice packs on each ITO position (especially CU/Aligners)
- In case of a temporary structure for finish tower, shaded covered and closed area with air-conditioning or fans for ITOs and timing personnel with cool drinks and snacks available at intervals
- Scheduling races earlier in the day, with longer lunch breaks avoiding the hottest part of the day

Freestyle:
- No specific mitigation procedures beyond those indicated above

Marathon
- Misting stations on the course
- Obligatory portages with misting stations, ice packs and cold drinks
- Medical personnel or first-aiders at portages
- NB: reducing the length of the event may not mitigate, as athletes may work at a harder pace and push body temperature even higher
- Access to an ice bath

Ocean Racing:
- Highlight importance of hydration to safety boat personnel
- Cold drinks on safety boats
- Shading on safety boats where possible

Canoe Polo:
- Lengthen interval between halves
- Provide shaded area during intervals
- Cold drinks, ice packs available at intervals

Slalom and Kayak Cross:
- Shading for Starter on Kayak Cross ramp
- Cool box with cold drinks and ice packs on starter ramp for Kayak Cross
- Air-conditioning or fans in OVR
- Demonstration runs at cool times of day
- Increase intervals between runs if high risk identified or reschedule to cooler parts of the day

Sprint:
- Shaded boat cover for ITO personnel on the regatta course
- Cool boxes with cold drinks and ice packs on each ITO position (especially CU/Aligners)
- Medical personnel on the post-race boat control and disembarkation pontoons areas
- Cool water available at the post-race boat control (preferably in a closed bottle)
- In case of a temporary structure for finish tower, shaded covered and closed area with air-conditioning or fans for ITOs and timing personnel with cool drinks and snacks available at intervals
- Scheduling races earlier in the day, with longer lunch breaks avoiding the hottest part of the day

Stand-up Paddleboarding (SUP):
- Shaded cover and cold water for ITOs on the regatta course
- Cool boxes with cold drinks and ice packs at Board Control

Wildwater Canoeing:
- Shaded cover (tents, big umbrellas) for ITO personnel and timing personnel on the regatta course
- Medical personnel or first aiders in the finish area

Appendix I

Heat-Related Illness Action Chart

Symptoms (What the person feels)	**Signs** (What you see or measure)	**Action** (What you need to do)
Exercise-Associated Collapse Dizziness Unsteadiness Difficulty walking Collapse (fainting)	Normal core temperature Normal pulse Skin sweaty Recovers in <5 mins	Lie person on back Raise legs above head height Check core temperature Check pulse and blood pressure Not to return to exercise until fully recovered and rehydrated
Muscle Cramps Cramping pain in muscles or abdomen	Person otherwise well	Stop all activity Rest in a cool, quiet place Drink cool clear juice or a sports drink Do not return to strenuous activity for at least one hour because it may worsen the cramps or progress to heat exhaustion Seek medical attention if cramps do not subside within 1 hour
Heat Exhaustion Fatigue Nausea Headache Muscle /Abdominal cramps Vomiting Weakness Dizziness Feeling faint Heavy sweating	Skin pale, cool and sweaty Rapid, weak pulse Rapid, shallow breathing Fainting (syncope) Core temperature usually <40oc Normal brain function	Move to shady quiet and cool area Give cold drinks Start cooling procedures • Wetting of skin • Fanning Monitor closely until return to normal
Heat Stroke Dizziness Nausea Throbbing headadache Confusion Unconsciousness	Skin red, hot and dry Rapid strong pulse Rapid breathing Low blood pressure Extremely high core temperature usually >40oc Confusion Unsteadiness Aggression or irrational behaviour Unconsciousness Seizures Coma	**THIS IS AN EMERGENCY** Call the Emergency Services Patient can deteriorate rapidly ABC (airway, breathing, circulation) If unconscious, lie in recovery position Remove clothing Aggressively cool the person with ice, water and fanning Do not give anything to drink Continue cooling while transferring to hospital **Cool First, Transport Second**

Appendix II

Example of Organisers template for Mitigation of Heat-Related Illness (Marathon Racing)

Event: E.g. European Marathon Championships	Date: 25-28.07.2024	Venue: Poznan, Poland
Average daily temperature for that period	15.5 – 24.6 oc	
Average daily humidity for that period	70%	Average 13 days of rain in July with 76mm precipitation
Local weather reports available at	https://www.pwsweather.com/station/mid/as410	
Forecast for 25-28.07.2024	Temperature: X ℃	Humidity: X% Wind: Xkph
Forecast WBGT for each day of training / racing	8am 12pm 5pm	If WBGT Risk Assessment is in yellow, amber or red zone, mitigation MUST be considered
Are mitigation procedures likely to be required?	Yes Follow table below	No No further action required but continue to monitor situation

- *If some risk is identified, inform the teams prior to the event that high temperatures have been identified as a possible risk and advise what mitigation may take place.*
- *This process must be repeated each day and accredited personnel informed of any change.*

Consider the following options for mitigation and consult with ECA and Technical Committee

Yellow risk assessment	Amber risk assessment	Red risk assessment
General advice to all accredited personnel regarding hydration and heat avoidance Fact sheet available	All yellow risk procedures plus:	All procedures for yellow and amber risk plus:
Design official uniform appropriate to the likely risk	Schedule longest events to early morning	Cancel all events over 20 minutes
Ensure cool areas available for athletes and officials	Ensure air conditioning areas available to athletes and officials	Ice bath essential at finish pontoon
Cold drink stations for athletes and officials	Consult with medical and first aid teams to ensure all staff are aware of the risk and that appropriate equipment and emergency action plans are available	Consider restricting admission to spectators
Shaded areas for spectators	Design course to have obligatory portage if event >20 minutes long	
	First aid responders available at pontoons and portages	
	Misting stations, ice packs and cold drinks at portages	
	Fans, sponges and cold water immediately available at pontoons and portages in case of HRI	
	Misting stations and free cold water for spectators	
	First aid responders available at pontoons and portages	
	Misting stations, ice packs and cold drinks at portages	
	Fans, sponges and cold water immediately available at pontoons and portages in case of HRI	
	Misting stations and free cold water for spectators	

Appendix II

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