Measuring Heat Stress
Background

Risks

- High radiant heat
- Chance of flash over
- Steam burns from moisture in Protective clothing

Risk Mitigation

- Introduce a higher level of protective clothing (to meet Aust Standards)
- Introduce flash hoods
- Include moisture barrier
Outcome

- Risk mitigated (Radiant protection)
- Introduced another risk .......Heat Stress
- Can it be reduced or mitigated ........NO!
- Can it be managed ..................Maybe
Stats

- **2 Year injury data (heat stress)**
  - 14 cases of heat stress (CFA)
  - 12 cases since introduction of new PPC
  - 4 cases treated in hospital (WorkSafe notification x 2 cases)
  - 2 Improvement Notices issued (Worksafe legal direction)
Can it be managed?

• Maybe ????

If we can recognise Heat Stress
Heat Stress Recognition

- Blood Pressure
- Heart Rate
- Sensation
- Temperature measurement
Core Temperature v Tympanic
Research

- 50 Firefighters
- 3 Locations (2 x CFA Training grounds, 1 x Alpine)
- Ambient temperature range 0°C – 21°C
- Working temperature 60°C – 124°C
- PBI Gold & Nomex PPC
- SCBA
- 20 minute task duration (search & rescue)
- 20 minute Rehab period
Tympanic temperature monitoring

• Most commonly used in the field
• First assessment in most medical examinations
• Ease of use
• Economical
Condition One

Temperature (°C)

Time (minutes)

Core temperature

Tympanic temperature

Condition Two

Temperature (°C)

Time (minutes)

Core temperature

Tympanic temperature

Condition Three

Temperature (°C)

Time (minutes)

Core temperature

Tympanic temperature

Condition Four

Temperature (°C)

Time (minutes)

Core temperature

Tympanic temperature
Why the differences

- Air movement through the ear canal (external)
- Breathing (internal)
- Ambient temperature
- Blood circulation
Can Tympanic Temperature be trusted?

- Simple answer is NO! (unless in controlled environment)
- First Priority - Continued research into detecting heat stress
- We need to understand the functions of the human body
Management is the key to protecting our firefighters
Level 1 Rehab
Thermoregulation of the Human Body

Normal Blood Flow

4% of Blood Flows to the Skin for Heat Loss

Blood Flow Under Heat Stress

48% of Blood Flows to the Skin for Heat Loss

Hydration & Cooling
Average Core Temp over time during different recovery methods

Average Tympanic Temp over time for different recovery methods
Level 2 Rehab

Rehab chairs (where available) and health monitoring
Full Rehab Unit

Rehab unit, Ambulance and health monitoring team
Northern Territory

Full immersion baths (strong evidence that this method can be very effective)

• Where conditions and time is an asset – Full body immersion could be an option.

• Immersion baths are effective but probably only practical at the highest level incidents
Heat stress chart

### Heat Stress Chart for Structural fire and Hazmat Incidents

#### Normal working conditions
- Incident controller should ensure all crews are monitored for signs of fatigue and heat illness.
- Ensure hydration procedures and rest periods are used.

#### Hot working conditions
- Incident controller should ensure all crews are monitored for signs of fatigue and heat illness.
- Ensure extra supplies of water and Staminade Hydrate are available.
- Task rotation should be used to assist crews—For example, let one task, then change to light task, then back to BA task. (Refer to BA training manual.)
- Ensure hydration procedures and rest periods are used.
- Implement cooling techniques (see Heat Stress Active Cooling Techniques page).

#### Extreme working conditions
- Incident controller should monitor all crews for signs of fatigue and heat illness.
- Respond extra crews to assist with 15-26 min’s task rotation.
- Ensure hydration procedures and rest periods are used. 15-20 min’s work 20 min’s rest in shaded area.
- Arrange back up supplies of water and Staminade Hydrate for the incident.
- Request Ambulance standby during internal structural attack period.
- Use active cooling techniques.

#### Extreme+ working conditions
- Incident controller should ensure all crews are monitored for signs of fatigue and heat illness.
- Respond extra crews to assist with 16-15 min’s task rotation.
- Ensure hydration procedures and rest periods are used. 10-15 min’s work & 30 min’s rest in shaded area.
- Arrange back up supplies of water and Staminade Hydrate for the incident.
- Request Ambulance standby.
- Use active cooling techniques (see Heat Stress Active Cooling Techniques page).

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Ver 1.2 / December 1, 2016
Task rotation

Rotate existing crew when possible.

Where conditions permit, request an extra crew to assist with 15-20 min’s task rotation.

Ensure hydration procedures and rest periods are used. 10-20 min’s work 20 min’s rest in shaded area.

Hydration

Ensure all crew members drink fluids at regular intervals.

Follow correct hydration procedures with water and electrolyte drink.

Water should not be frozen, approximately 15-20°C is ideal.

Cool shaded area for rehabilitation

Where possible, provide cover under a tree or shelter.

A tarp can be set up to give shelter from the sun.

Do not set up on concrete or road as heat will be transferred from the surface. Use a grassed area where possible.

Where possible, tanning using a towel, jacket or fan will assist.

Lower arm cooling

Pour water over lower arms short and back from a hose or bottled water.

Where possible, tanning using a towel, jacket or fan will assist.

Blood flow through the arms will be cooled and will return cool blood to the core of the body.

Water should not be frozen, approximately 15-20°C is ideal.

Use of towels to assist cooling

Place cool towels under the armpits and around the neck to assist in cooling circulating blood and return cool blood to the core of the body.

Where possible, fanning using a towel, jacket or fan will assist.

Water should not be frozen, approximately 15-20°C is ideal.
Where to now?
Way forward

- Each state doing own research
- Centralise data
- Find consistencies and gaps
- National research project (All Hazards Research Institute)
- National guidelines