Future Climate: Is Heat Stress a Real Risk for the Future and How Can We Better Manage It?

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Katestone
Table 5 – Comparison of fatality totals with other Australian natural hazards (from PerilAUS).

<table>
<thead>
<tr>
<th>Natural hazard</th>
<th>Deaths 1900–2011</th>
<th>% total natural hazard deaths 1900–2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extreme heat</td>
<td>4,555</td>
<td>55.2</td>
</tr>
<tr>
<td>Flood</td>
<td>1,221</td>
<td>14.8</td>
</tr>
<tr>
<td>Tropical cyclone</td>
<td>1,285</td>
<td>15.6</td>
</tr>
<tr>
<td>Bush/grassfire</td>
<td>866</td>
<td>10.5</td>
</tr>
<tr>
<td>Lightning</td>
<td>85</td>
<td>1</td>
</tr>
<tr>
<td>Landslide</td>
<td>88</td>
<td>1.1</td>
</tr>
<tr>
<td>Wind storm</td>
<td>68</td>
<td>0.8</td>
</tr>
<tr>
<td>Tornado</td>
<td>42</td>
<td>0.5</td>
</tr>
<tr>
<td>Hail storm</td>
<td>16</td>
<td>0.2</td>
</tr>
<tr>
<td>Earthquake</td>
<td>16</td>
<td>0.2</td>
</tr>
<tr>
<td>Rain storm</td>
<td>14</td>
<td>0.2</td>
</tr>
</tbody>
</table>
Over 30 deaths per year by 2050
IS HEAT CAUSING A PROBLEM IN THE AUSTRALIA WORKPLACE?
Are our current practices working?

• Is excessive heat exposure an existing threat to health of working people in the Australian context
  – 95% experienced excessive heat at work
  – 75% experienced heat exhaustion at work
  – 35% indicated heat exhaustion was frequent
  – 100% indicated that heat caused a loss in productivity

Source: Singh et al (2013)
14 fatalities from 2003 to 2013 due to exposure to environmental heat.
Heat not a big killer

• Most people exposed to heat won’t die!
• BUT – long term exposure can have health issues
• AND – reduced cognitive performance can result in memory loss, poor decision making and increased accidents

**FIGURE 1**

UBI AS A FUNCTION OF WBGT: PREDICTED SECOND ORDER REGRESSION FOR THREE DIFFERENT WORKLOADS

<table>
<thead>
<tr>
<th>Temperature °C (WBGT)</th>
<th>Unsafe Behavior Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.0</td>
</tr>
<tr>
<td>3</td>
<td>0.9</td>
</tr>
<tr>
<td>5</td>
<td>0.8</td>
</tr>
<tr>
<td>7</td>
<td>0.7</td>
</tr>
<tr>
<td>9</td>
<td>0.6</td>
</tr>
<tr>
<td>11</td>
<td>0.5</td>
</tr>
<tr>
<td>13</td>
<td>0.4</td>
</tr>
<tr>
<td>15</td>
<td>0.3</td>
</tr>
<tr>
<td>17</td>
<td>0.2</td>
</tr>
<tr>
<td>19</td>
<td>0.1</td>
</tr>
<tr>
<td>21</td>
<td>0.0</td>
</tr>
<tr>
<td>23</td>
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<td>25</td>
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<tr>
<td>33</td>
<td>0.0</td>
</tr>
<tr>
<td>35</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Legend:
- Heavy Workload
- Moderate Workload
- Light Workload
Occupational Injuries/Illness

Review of 3 years of injury data:
For every death due to heat there are nine injuries
What does heat cost us?

“in the three years to July 2011 there were 497 claims for workplace fatigue and heat stroke at a cost of $4.3 million to the NSW Workers Compensation Scheme”

- WorkCover NSW
What does heat cost us?

“estimated to cost Australia US$6.2 billion per year in lost productivity in current climatic conditions” - Zander et al 2015
Which is worse for heat stress?

Condition A
- 44°C Temp
- 25% RH
- 5 m/s Wind

Condition B
- 29°C Temp
- 75% RH
- 0.2 m/s Wind

Based on TWL
So what is Heat Stress?

Heat Stress is the net heat load to which the body is exposed from both external factors (e.g. temperature, humidity, air movement, radiant temperature exchange, clothing) and internal factors (e.g. biological, physical activity).

Heat Strain is the body’s overall response resulting from heat stress.
Major Factors Contributing to Heat Stress

+ HIDDEN FACTORS

**Weather**
Air temperature, humidity, air speed, radiant surfaces.

**Isolation**
Working alone and/or remote locations.

**Clothing**
PPE

**Culture**
Working without breaks, drinking energy drinks & alcohol.

**Work Rate**
Strenuous work, when and how often breaks scheduled.

**Monitoring & Controls**
Reactive controls, poor monitoring, wrong choice of heat stress variables / indices to monitor.

**The Individual**
Acclimatisation, age, medical conditions.

**Education**
Lack of knowledge on signs of heat stress & dehydration, amount of water to drink.
How hot is too hot?

• In 1947 E. Schickele plotted 157 heatstroke deaths in military training camps against temperature and humidity

• Identified the ‘heat death line’

• Air temperatures ranging from 26 to 49°C and relative humidities of 10 to 100%

• She commented that ‘Death can occur at surprisingly low temperatures, provided the evaporative power of the air is sufficiently reduced’

Source: Environment and fatal heat stroke; an analysis of 157 cases occurring in the Army in the U.S. during World War II.
SAFE NOT
WHAT DOES THE FUTURE HOLD?
Temperature changes at the end of the 21st C are dependent on scenario

RCP 2.6

RCP 8.5

Change in average surface temperature (1986–2005 to 2081–2100)

IPCC (2013) Figure SPM.8
“What effect will a few degrees of climate change have on human heat balance? Implications for human activity”, Maloney, Shane K. Forbes, Cecil F (2011)
Challenges to management of heat stress

• No one size fits all policy
• Lack of understanding of the drivers
• Modern comforts increase vulnerability
• “Monitoring” solutions not always the right choice
Review of “general duty clause” of Occupational Safety and Health Act of 1970

Reviewed 20 cases over a 2 year period where heat illness or death were cited
Factors that increase the risk of heat illness

- A new job
- Inadequate rest facilities with no shade or poor water management
- A lack of heat management policies, procedures or training
SYSTEMATIC MANAGEMENT OF HEAT STRESS
Systematic Heat Stress Management

Stage 1
Pre-summer preparation

Stage 2
Summertime Daily Monitoring

Stage 3
Post Summer Review
Stage 1 – Pre-summer Prep

- Risk assessment
- Identify high risk jobs
- Assess control options to mitigate risk
- Assess lead time to implement controls
- Document
- Education and training
Thermal Risk Assessment

Field worker – moderate activity

- **Low**: Risk of a heat related illness – low to moderate
- **Moderate**: Potential for heat-induced illness occurring if conditions are not addressed
- **High**: Onset of heat-induced illness is very likely
**Controls to manage heat stress**

1. **Elimination / Substitution**
   - Reschedule work
   - Roofs / walls to use light reflective colours
   - Structure design for good airflow
   - Walls / roofs insulated

2. **Engineering**
   - Hot objects to be insulated
   - Fans & chiller units installed
   - Screens / barriers to shield heat source
   - Relocate hot processes
   - Dehumidifying the air
   - Mechanical aids to lower metabolic workload

3. **Administrative**
   - Ready access to water
   - Cool area for breaks
   - Training / education of workers
   - Use heat stress indices to assist in determining work-rest regimes
   - Self paced work encouraged

4. **PPE**
   - Phase change vests
   - Vortex tube air cooling
   - Clothing choice

Source:
**What to do if.....**

**Possible**
- Trigger – Risk of a heat event predicted later in the week
- Actions – Early preparation and identification of high risk jobs

**Imminent**
- Trigger – Risk of heat event high for today
- Actions – Notification, controls, consider rescheduling

**Occurring**
- Trigger – Early signs of heat illness observed
- Actions – Notification, reschedule or monitor
OUTPUT from your pre-summer preparation should be a plan with defined controls, and actions for each status level. Set up your foundation. Plan what actions you may take based on the daily status.
Stage 2 - Daily Monitoring

Reassess your risk every day as conditions change.

Today’s Status is: Imminent
Early Warning System

Importance of communication

• Determine your daily status and then disseminate the appropriate information to others
• Simple target messages
• Clear actions for TODAY

• E-mail and or sms alerts
• Chart on a notice board
• Summary for tool box talk
Stage 3 - Annual Review

- Post Summer review
- Assess accidents/incidents
- Review behaviours
- Review risk assessments
- Rethink triggers
1. Preparedness
   Risk profiling and establishing triggers for each daily status

2. Mitigation
   Determine controls & actions for each daily status

3. Daily monitoring
   Monitoring your triggers and determine your daily status

4. Alerts
   Targeted alerts with predefined controls & actions

5. Review
   Post summer analysis to update triggers
Thank you

Please download a free sample Heat Management Plan from heatmanger.com.au