

HUMAN FACTORS NEWS

Issue 4

December 2012

THEME — HEALTH



Welcome

It's summer time, the cricket is on and most of us are enjoying a few beers and slightly overcooked sausages. We thought it would be a good time to discuss some health issues that may come into play during summer including heat stress and the effects of alcohol consumption on sleep.



We have also set dates for our classroom based incident investigation training course. The dates are:

- Darwin 23- 25 January 2013
- Perth 13 - 15 February 2013
- Cairns 16 - 18 April 2013

Dates for courses in Adelaide and Sydney will be announced shortly.

If you are interested in more information, or would like to register for a course, please contact us for price information and a registration form.

Heat, fatigue and rising terrain

On 24 July 2004, a B737 was on approach into Canberra after operating overnight from Perth.

As the aircraft approached the holding pattern, the co-pilot inadvertently entered the outbound leg of the holding pattern as a distance of 14NM instead of a limit of 14NM from Canberra. This error would take the aircraft 11NM beyond the published holding pattern limit.

Unaware of the error, the crew continued the approach. A single 'CAUTION TERRAIN' aural alert sounded and the crew commenced a climb. At its closest point, the aircraft was 810 ft above terrain and within 2.7 NM of a peak higher than their altitude.

The error was thought to be caused by fatigue which was exacerbated by hot cockpit conditions due to an air conditioning fault that was known prior to departure from Perth. Both crew members reported feeling abnormally hot during the flight.



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Stages of heat stress

Heat stress makes us feel uncomfortable, not so much because we feel hot, but rather because we sense how difficult it has become to lose body heat at the rate necessary to keep our inner body temperature close to 37°C. The body responds to this stress progressively through three stages:

1. Heat cramps - muscular pains and spasms caused by heavy exertion in hot conditions. Although heat cramps are the least severe stage they are an early signal that the body is having trouble with the heat.

2. Heat exhaustion - typically occurs when people exercise heavily or work in a hot, humid place and body fluids are lost through heavy sweating. Blood flow to the skin increases, causing a decrease of flow to the vital organs. This results in mild shock with symptoms of cold, clammy and pale skin, together with fainting and vomiting. If not treated the victim may suffer heat stroke.

3. Heat stroke - is life threatening. The victim's temperature control system, which produces sweating to cool the body, stops working. The body temperature may exceed 40.6°C potentially causing brain damage and death if the body is not cooled quickly.

Symptoms are:

- High body temperature
- Absence of sweating, with hot red or flushed dry skin
- Rapid pulse
- Difficulty breathing
- Strange behaviour
- Hallucinations
- Confusion
- Agitation
- Disorientation
- Seizure
- Coma

Heat stress prior to flight

A flight had been arranged to take passengers and freight from Pulparee, a seismic exploration field camp, to Brisbane. Just after the aircraft became airborne, the right wing struck two men who were working on the top of the cabin of a truck, both of whom received serious injuries.

A section of the right wing was torn from the aircraft, however the pilot was able to return to Pulparee without further incident.



The vehicle was struck 1110 metres from the start of the take-off roll and about 200 metres after the aircraft became airborne.

Shortly after becoming airborne, the pilot felt that the aircraft was not performing normally, and he looked into the cockpit to check the instruments. During this time, the aircraft diverged from the strip direction.

The pilot had been working in direct sunlight in temperatures of about 40 degrees Celsius for four hours prior to the flight. It was therefore likely that he experienced some degree of heat stress. One of the effects of heat stress is that the time taken to process information is increased. It is considered probable that when the pilot looked at his instruments, he required longer than normal to assimilate the information presented by the instruments and lost situational awareness.

Serious questions from the Coroner - Roof space fatality

A teenager offered to fill in for his best friend for the day at a roof insulation company in Sydney. After consuming only a Coke and a kebab, he went to work on a 40+ degree day.

About 1.30pm, the supervisor noticed the young man was red faced, sweating, irritable and mumbling to himself, but was unaware that these were signs of serious heat stress. Minutes later, he ran on to a busy road before collapsing.

He was placed in an induced coma, but died the next day from the effects of hyperthermia, muscle meltdown and total organ failure.

The coroner was critical of both staff and management for having a poor understanding of the dangers of heat stress. He recommended companies have a safety policy for work in hot environments and that all staff be familiar with good practice as well as understanding the symptoms of heat stress.

Consider the working conditions for flight crew, ground staff, cabin crew and engineers operating in most parts of Australia during summer. Many will experience times of operating in an aircraft that has been sitting on the tarmac in intense direct sunlight for considerable time. The temperature inside the aircraft can be extreme, and combined with high humidity levels, can quickly become dangerous.



Things you can do to reduce this danger include:

- Be aware of the temperature – keep a thermometer available.
- Keep hydrated and carry adequate water with you.
- Wear appropriate clothing, especially a hat that provides shade.
- Consider specialist apparel including cool vests and bandanas.
- Strictly plan your work so that your time in the heat is minimised.
- Be able to recognise the symptoms of heat exhaustion and heat stroke.



Stay safe - keep in the shade!

Moderate alcohol consumption and sleep disruptions

Moderate alcohol consumption 30–60 minutes before sleep, disrupts sleep architecture. Rebound effects occur once the alcohol has been largely metabolized, causing late night disruptions in sleep maintenance.

Under conditions of moderate alcohol consumption where blood alcohol levels average 0.06–0.08 percent and decrease 0.01–0.02 percent per hour, an alcohol clearance rate of 4–5 hours would coincide with disruptions in sleep maintenance in the second half of an 8 hour sleep episode.

In terms of sleep architecture, moderate doses of alcohol suppress REM and stage 1 sleep in the first half of an 8 hour sleep episode, and increase REM and stage 1 sleep well beyond baseline in the second half.



Moderate doses of alcohol also very quickly increase slow wave sleep in the first half of an 8 hour sleep episode.

So, what does all of this mean? Moderate levels of alcohol consumption lead to increased fatigue levels.

Heat Stress Index

		RELATIVE HUMIDITY (%)												
		40	45	50	55	60	65	70	75	80	85	90	95	100
T E M P E R A T U R E (C°)	27	27	27	27	27	28	28	28	29	29	29	30	30	31
	28	28	28	28	29	29	29	30	31	32	32	33	34	35
	29	29	29	29	30	31	32	32	33	34	36	37	38	39
	30	30	31	31	32	33	34	35	36	38	39	41	42	44
	31	31	32	33	34	35	37	38	39	41	43	45	47	49
	32	33	33	35	36	38	39	41	43	45	47	50	53	56
	33	34	36	37	38	41	42	44	47	49	52	55	58	
	34	36	38	39	41	43	46	48	51	54	57			
	36	38	40	42	44	47	49	52	56					
	37	41	43	45	47	51	53	57						
	38	43	46	48	51	54								
	39	46	48	51	54									
	40	48	51	55										
41	51	54												
42	54													
43	58													

Caution	Extreme Caution	Danger	Extreme Danger
Fatigue possible	Sunstroke, muscle cramps, and/or heat exhaustion possible	Sunstroke, muscle cramps, and/or heat exhaustion likely	Heat stroke or sunstroke likely