Title:

Guidelines for managing issues relating to Indoor Thermal Comfort (hot conditions)

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Responsible officer	
Responsible office	
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1. PURPOSE

These guidelines are designed to provide information to assist managers and their staff to manage issues relating to thermal comfort (hot conditions) of the indoor environment.

These guidelines do not deal with the engineering or maintenance aspects of heating or cooling systems, or the processes of justifying and seeking the installation of new systems.

2. BACKGROUND

Charles Sturt University has an obligation to provide a healthy and safe physical environment for all users, including staff, students and visitors. Complimenting these obligations are objectives to create facilities that are enjoyable, comfortable and productive places to work and learn. CSU's physical assets must also be flexible and adaptable to meet changing needs, provide users with a positive experience, be environmentally sympathetic and be cost effective places to construct and operate over their economic life.

The Facilities Management sustainability mission requires that CSU buildings are designed, built and operated in such a way that emissions and energy consumption are minimised whilst producing a good indoor environment. Buildings are known contributors to green house gasses.

Australia has no current thermal comfort standard. The key referenced standard is the American Society of Heating Refrigeration and Air-conditioning Engineers (ASHRAE) standard ASHRAE 55-2004. This standard combines the older ASHRAE 55 and European ISO 7730 standards.

Due to the prevailing weather conditions during the peak summer period, many of our campuses experience a number of days of above average temperatures. These extremely hot days can make a number of the office and teaching buildings uncomfortably hot. In the main, this is due to the fundamental building design and fit-out rather than a system failure; an issue that requires a longer term commitment to resolve.

The Division of Facilities Management has undertaken a condition audit of all buildings and has been working on improving the thermal comfort in many buildings. The works to improve thermal comfort are aimed to meet both occupant and sustainability requirements. This is on ongoing process, given the large number and age of many of the buildings across the University and needs to be considered in the broader master planning context of the University

3. THERMAL COMFORT

The National Occupational Health and Safety Commission described thermal comfort as "the best temperature for the workplace is the temperature most people find comfort without discomforting the few people who have unusual temperature preferences".

Comfort is a subjective issue and can vary widely from person to person. The most important factors influencing the thermal comfort of an individual are: air temperature, humidity, air movement, radiant heat, activity level and clothing.

The level of comfort perceived by a person can also be affected by their level of job satisfaction and other psychological and physical factors. However, there is a generally agreed range of temperatures at which at least 80% of people will feel comfortable and will perform effectively and efficiently. The National Occupational Health and Safety Commission advises that in winter wearing heavy clothes, a comfortable temperature is 20° to 24°C. In the summer, wearing light clothes, 23° to 26°C is more comfortable. Outside of this temperature range performance declines, and rapidly deteriorates in extremes of heat or cold. Intellectual, manual, and perceptual performance is highest when thermal comfort is maintained.

Indicators of poor thermal comfort (hot conditions) include: sweating, heat rash or prickly heat, hot dry skin, headaches, poor concentration, general tiredness, dehydration or nausea.

4. HEAT RELATED ILLNESS

Personal Factors and Heat

Heat is continually generated within the body to convert food into energy. The body generates approximately 4 times as much heat as the physical energy expended. To maintain the body core temperature at a stable level, the blood vessels in the skin dilate, allowing more blood to carry heat from the body. If the body temperature continues to rise because sufficient heat cannot be lost from the skin, then sweat glands are activated until evaporation of the sweat from the skin causes sufficient cooling effect to restore the body temperature. Up to one litre of water may be lost per hour under very hot conditions. The health effects resulting from working in hot conditions are referred to as heat stress. The effects of heat stress can vary from person to person. The most extreme form of heat stress is heat stroke. Common occupational health effects arising from heat stress are as follows:

Skin Rashes:

The most common skin rash is known as 'prickly heat', which is identified by reddening of the skin normally covered by clothing, with associated 'hotness of the affected area, with a prickly, tingling or burning sensation'. Skin rashes can also be caused by blocked sweat glands. Wearing tight fitting under garments in hot weather will often cause localised skin rashes in hot and humid conditions. Rashes may persist for a number of weeks after their outbreak.

Heat Exhaustion

Heat exhaustion occurs when sweating is incapable of providing sufficient cooling and the body core temperature rises. Unfit, unacclimatised persons are prone to dehydration and sweating difficulties, which lead to an increase in core temperature. Symptoms include general tiredness, giddiness, nausea, sighing, yawning, shallow or irregular breathing and loss of colour about the face. Recovery is rapid if person is moved to a cooler environment, given fluid and allowed to rest. Prior to the full effects of heat exhaustion, the person may also suffer from the effects of heat cramp, which results from abnormal perspiration, resulting in the body losing excess water and electrolytes such as sodium and potassium. This may initially cause cramps in the arms, legs and the body.

Heat Stroke*:*

If the heat stress is severe and/ or prolonged the result is heat stroke and medical treatment must be sought quickly to prevent irreversible damage. Symptoms of heat stroke include, hot dry skin, disorientation, delirium and convulsions. Unfortunately,

when the latter symptoms appear, the person may be very close to a physical collapse, or even death. It is very common for persons suffering from heat stroke for the condition to overcome them very quickly, without any warning.

Other Medical Risks:
Workers with heart problems, high or low blood pressure, respiratory conditions and kidney disease, may be 'at risk' when working in hot conditions. As a rule of thumb, any worker who suffers from a permanent or temporary medical condition requiring continuous medication, or treatment, may be at risk when required to work in conditions that exceed the comfort range.

IMPORTANT:
WorkCover NSW in its "Code of Practice – Work in Hot & Cold Environments" notes "It is important to distinguish between a condition, which threatens health and safety, and a feeling of discomfort. Terms like heat stroke and hypothermia refer to serious medical conditions. Hypothermia is where a person gets an abnormally low body temperature as a result of exposure to cold environments; it is a serious condition, which can lead to death. Heat stroke is an uncommon and more severe form of heat illness, which is a medical emergency. It occurs when the body can no longer control the body temperature and it rises to temperatures where mental function is seriously impaired".

"Heat exhaustion is related to lack of fluids, or a rapid loss of body fluids. Heat stress is more serious, and can lead to death. It is more likely to occur in conditions of high humidity, and to affect non-acclimatised persons – that is, those unused to the conditions."

"Thermal discomfort may be experienced even when there is little likelihood of a medical condition developing. For example, office workers may feel uncomfortable if their air conditioning is not working to optimum effect in hot weather. While that problem should be addressed (and if air temperatures rise sufficiently, could result in a real risk of heat related illness) it would not usually create a serious threat to health."

"Preventive steps should aim to reduce thermal discomfort as much as is practicable, and to develop working conditions and work practices which will not give rise to more serious problems."

5. THERMAL PERFORMANCE OF BUILDINGS

The University has a large variety of building types and styles with as many different types of methods to achieve environmental comfort. Examples include passive systems, evaporative cooling systems and refrigerative systems. These may be locally controlled, occupant controlled at a building level or electronically controlled via a BMIS system.

It is important, to achieve the best performance out of a buildings system, that the occupants of a building fully understand how their system operates. Please contact the Division of Facilities Management if you have any questions about the function or operation of your building system(s).

Types of building cooling systems

Passive
Passive systems utilise the differential of the prevailing weather conditions to cool the building. Manual (passive) systems rely on the occupants to open up the building during cooler temperatures and close up the building (windows) to keep out the heat of the day. Some buildings have automatic systems that open louvers or vents at specific locations depending on the temperatures within and outside of the building.

Evaporative cooling
Evaporative cooling systems rely on the flow of moist air to provide cooling. These systems work optimally in conditions of low humidity. For evaporative systems to work effectively, the system must be turned on early and windows must be opened. Air flow through the building improves the evaporative cooler performance and can lower the temperature by up to 10^0C. If there is a prevailing wind, close the windows on the windward side of the building, leaving other windows open.

Refrigerative systems
In buildings with refrigerative systems, the windows should remain closed. Rooms may have individual control or the building may be controlled via a thermostat. These systems can be very complex and occupants should contact the Division of Facilities Management should they feel the system requires changing. For buildings with central control, the temperature is set at a point that is comfortable for the majority of occupants. Individuals should adjust their dress if further (personal) change is required.

Some controls and systems take a little time to respond to changes in temperature or thermal load. In buildings that have functioning systems, please be patient during this period.

It is important to mention that the use of personal fans or heaters in an air-conditioned area where people are experiencing discomfort may exacerbate the situation. It may make the area hotter or colder due to interference with the automatic control system of the air conditioning system. For example, a personal fan may cause a nearby air conditioning thermostat to falsely sense that the room is too cool, consequently increasing the warm air supplied to the room. This exacerbates the already uncomfortably warm environment.

6. INFORMATION FOR MANAGERS AND STAFF TO MANAGE THERMAL COMFORT ISSUES

The first step in addressing thermal comfort issues is to ensure that the buildings system is functioning correctly. If the building has a closed refrigerative system, ensure that windows and doors are closed. If the system is of the evaporative type, ensure that windows are partially open in all rooms. It should be noted however that on days of extreme temperature, even a fully functioning system may not have the capacity to maintain a temperature in the mid 20s.

In addition to confirming the optimum performance of the building system, a number of other controls can be attempted to manage thermal comfort issues. Other control options include:

- The wearing of appropriate clothing. Wear appropriate clothing which enables arms and legs to be uncovered to assist with cooling

- Negotiate with your supervisor to take breaks in cooler and/or less humid areas or transfer some work to cooler and/or less humid areas
- Negotiate to alter working hours so that work can be done in the cooler parts of the day such as early morning. (eg. arrive early/leave early)
- Assessing specific individual needs such as those arising from medical conditions.
- Job rotation
- Frequent intake of cool water
- Optimise air movement by using a small fan, as air passing over the skin helps to cool the skin

When considering the impact thermal comfort might have on the health and safety of persons occupying a building/work space, a risk assessment should be completed. A risk assessment should include, but might not necessarily be limited to consideration of:

- The temperatures workers are exposed to and their exposure times.
- The level of exposure to radiant heats, especially direct sunlight and glare.
- The humidity, ventilation and average air movement rate.
- The rate and nature of the work.
- Employees' level of acclimatisation to heat or cold.
- Employees' whose health places them more at risk (e.g. low level of health and/or fitness, fever due to infection, dehydration, use of medications).

If following the completion of a risk assessment some of the identified thermal comfort hazards have been assessed as being an unacceptable risk (that is, despite implementation of the controls listed above there is still an imminent risk of injury/illness), these particular thermal comfort issues should be referred to either the Division of Human Resources (OHS Manager) or the Division of Facilities Management for further investigation and, as required, the identification of additional hazard controls. For information on completing a risk assessment and relevant risk assessment forms please refer to the OHS Website under OHS Risk Management Forms.

7. FURTHER INFORMATION

In order to improve indoor thermal comfort, concerned staff and students should raise the matter with their supervisor. The Division of Facilities Management and the Division of Human Resources can provide professional assistance in understanding your buildings system, capturing issues related with the function within your building and planning future improvements.

Division of Human Resources

http://www.csu.edu.au/division/hr/

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Division of Facilities Management

http://www.csu.edu.au/division/facilitiesm/

Contact the Office on your campus for assistance

8. REFERENCES

- Air-Conditioning and Thermal Comfort in Australian Public Service Offices. An information booklet for health and safety representatives – Comcare
- ASHRAE 55-2004, *Thermal Environmental Conditions for Human Occupancy*
- Comfort at Work – National Occupational Health and Safety Commission [NOHSC]
- Guidelines for Indoor Thermal Comfort & Ventilation, University of Sydney
- Guidelines for the management of indoor thermal comfort v2.0, December 2004, Division of Human Resources
- Health and Safety at Work, Chapter 7 Heat and Cold – John Mathews, Pluto Press
- National Occupational Health and Safety Commission (2004) Comfort at Work
- Thermal comfort at work – Occupational Safety & Health Working Thermal Comfort, Safety & Health, University of Western Australia
- Environment Series 14 – Commonwealth of Australia.
- Workplace Safety Australia, Fact Sheet 57, Office Temperatures
- Work in Hot or Cold Environments, Workcover NSW, Code of Practice, 2001