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THERMAL COMFORT AND HEAT IN TRAIN CABS			
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<u>Summary</u>	Working in train cabs during hot weather can result in increased risk of heat stress and in deteriorating human performance. This document is intended to assist ORR inspectors when discussing the issue with mainline passenger and freight companies only .		
<u>Consultation on 2019 revision</u>	Laura Sutton, Team Manager Specialist Inspectors Team; Paul Hooper, Head of Interoperability and Rail Vehicles; Matthew Farrell and Keith Shepherd, Mainline Operators Team		

Detail

Introduction

Working in train cabs during hot weather can result in an increased risk of heat stress (defined as when the body's means of controlling its internal temperature starts to fail) and deteriorating human performance.

Some of the effects of exposure to high temperatures include:

- reduced concentration;
- tunnelling of vision (reduced peripheral vision);
- reduced vigilance;
- reduced work rate (on self-paced tasks); and
- increased cycle time i.e. slower performance on discrete, repetitive tasks.

There is limited statistical data available on the effects of exposure to high temperatures in the rail industry. Related information from other industries (Pilcher et al, 2002; Hancock et al, 2007) suggests that hot temperatures negatively impact performance on a wide range of tasks which require the processing of information.

Above an Effective Temperature in the surroundings of around 29.4C (85F) (and its Wet Bulb Globe Temperature equivalent of 30.8C (87.4F)), the body becomes unable to dissipate heat quickly enough to maintain core body temperature, which will begin to rise unless conditions are alleviated in some way to provide cooling (Hancock et al 2007, p860).

Hancock's 2007 review of previous studies on the effects of the thermal environment on human performance confirmed that thermal stressors adversely affect performance, though often in subtle ways due to the interaction of multiple factors including not only the intensity of heat but also the exposure time, task type etc. Excessive heat seems to cause an individual to allocate some of their attention to the heat stressor, reducing their capacity to process task-relevant information. Excessive heat affects in particular:

- perception, (which could include e.g. observing signals and the lineside environment). Heat stressors reduce the speed and accuracy of response for perceptual tasks;
- psychomotor skills (e.g. operation of controls). Heat stressors reduce psychomotor accuracy, but seem to make responses faster. Whether the overall outcome of this trade-off is positive or negative depends on the task; and
- cognitive processes (thinking, memory etc) are affected, but to a

much smaller extent. The Railway Safety and Standards Board (RSSB) report on Category A signals passed at danger (SPADS) for the year ending December 2006 discussed the effects of rising temperatures due to climate change, and noted the increased level of SPADS during the high temperatures in July 2006. The report made reference to the positive correlation between temperature and the incidence of SPADS but acknowledged that several other causal factors are also involved.

ORR's publication RSP1 "*Developing and maintaining staff competence*" available on ORR's website at (http://orr.gov.uk/_data/assets/pdf_file/0016/4264/developing-and-maintaining-staff-competence-rsp1.pdf) outlines how developing drivers' non-technical skills, including techniques to help maintain concentration, can help reduce risks from reduced driver attention. Although clearly important for general driving competence, especially in conditions which may reduce vigilance and concentration, such attention management skills are no permanent substitute for ensuring an adequate thermal working environment.

Current Position

The Health and Safety Executive (HSE) has produced guidance on thermal comfort (<http://www.hse.gov.uk/temperature/thermal/index.htm>), including an information sheet on heat stress <http://www.hse.gov.uk/pubns/indg451.htm>

ORR Inspectors have also undertaken work in this area, primarily where complaints have been raised by staff.

Guidance

This guidance is for inspectors to aid discussion with the industry regarding mainline passenger and freight operations. Similar considerations will usually apply to driving cabs of on-track machines. Suggested discussion points include:

Assessment

Thermal comfort depends on a number of parameters including air temperature; radiant temperature (e.g. from the sun or any hot cab surfaces); humidity; air-flow; clothing; and levels of activity.

Dutyholders should have assessed the risks under Regulation 3 of the Management of Health and Safety at Work Regulations 1999, and should have appropriate processes in place to identify when cab temperatures are likely to rise above company specified temperature limits, including ensuring that "hot weather" risk control measures are initiated where necessary.

There are no set upper limits for temperature in the workplace, however, and Regulation 7 of the Workplace (Health, Safety and Welfare)

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Regulations 1992 “temperature in indoor workplaces” does not apply to locomotives or rolling stock. The outcome of a case taken in 2007 under the Provision and Use of Work Equipment Regulations 1998 (PUWER), regarding the suitability of train drivers’ seats, would suggest that regulation 4 of PUWER “suitability of work equipment” may apply.

Hot weather risk control measures

BS EN 16186-2: 2017 requires the driver’s cab in new interoperable rolling stock (in the scope of Directive 2008/57/EC) to be equipped with a means of regulating the temperature which is compliant with EN 14813-1 and EN 14813-2 (essentially, air conditioning).

Where train cabs are not fitted with air conditioning, dutyholders should have plans in place for the implementation of air conditioning in cabs within a specified timeframe or justification that such fitting is not reasonably practicable using, where appropriate, suitable cost benefit analysis and a professional decision making process.

Additional good practice control measures would include :

1. The issue of cotton/breathable loose-fitting uniforms;
2. The issue of cooled water when booking on duty, preferably in a thermos, with additional cooled water available at other locations;
3. Properly secured fans and open-able windows may assist cooling by air movement, though care should be taken regarding increased noise;
4. A reduction in driving periods and an increase in rest periods where possible;
5. The provision of suitable rest areas with fans or air conditioning and cooled water;
6. The provision of information to drivers on the symptoms of heat stress and exhaustion e.g. nausea and muscle cramps, and the risks of dehydration;
7. The provision of information to drivers on their legal duty to advise their managers if they are suffering from symptoms of heat stress or exhaustion, or otherwise feel unable to carry out their work safely;
8. The provision of information to driver managers regarding the need for drivers to be relieved from duty if they feel symptoms of heat stress or exhaustion;
9. Provision, where reasonably practicable, of sun visors or blinds to reduce radiant heat (provided that they do not obscure the primary vision area or adversely affect the sighting of signals or other vital visual information);
10. Procedures for the removal of cabs from service when the internal temperature exceeds certain levels (28°C or above has been used

by some rail duty holders);

11. The development of individual policies, with occupational health departments' input, for drivers with existing medical conditions such as cardiovascular conditions or diabetes, or obese or pregnant drivers who may be more susceptible to higher temperatures; and
12. Monitoring and review of the control measures to ensure that they are in place and effective.

Drivers and their safety representatives should be consulted on the suitability of these and other measures, as appropriate.

Inspectors should refer to RIG 2009-05 "*Assessing whether risks on Britain's railways have been reduced SFAIRP*" for general guidance on assessing whether risks have been reduced so far as is reasonably practicable (available at

http://www.orr.gov.uk/_data/assets/pdf_file/0007/2140/rig-2009-05-assessing-whether-risks-on-britains-railways-have-been-reduced-sfairp.pdf).

References:

Pilcher et al, 2002, Effects of hot and cold temperature exposure on performance: a meta-analytic review, *Ergonomics*, vol 45, no 10, pp 682-698)

Hancock et al, 2007. A meta-analysis of performance response under thermal stressors. *Human Factors*, Volume 49, No5, pp 851-877

BS EN 16186-2: 2017. Railway applications – Driver's cab. Part 2: Integration of displays, controls and indicators.

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Action

Where relevant, Account Holding Inspectors and/or Inspector Assistants should establish what steps their respective train/freight operating companies have taken as part of their hot weather preparedness arrangements to prevent or reduce the risk of drivers suffering from heat stress and/or exhaustion and reduced performance as a result of high temperatures in cabs.

Copies of appropriate risk assessments and cost/benefit analyses should be obtained, where necessary, with details of mitigation methods that are, or will be, put in place. Inspectors should satisfy themselves that these are suitable and sufficient, and that adequate control measures, which avoid importing additional risk, have been implemented.

If in doubt about the adequacy of these processes, to ensure consistency across ORR, or if enforcement action is being considered, the Specialist Inspectors Team, the Interoperability and Rail Vehicles Team, and the Mainline Operators Team may be consulted, as appropriate.

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