

Knowledge Exchange Note: 005

Date: 16/07/2024

Workplace Extreme Heat

This knowledge exchange note is shared in order to promote learning and improve safety. You should seek appropriate guidance regarding the relevance, accuracy, and completeness of this alert to your circumstances prior to implementation.

Themes

People, Plant and Process – Human Factors and Procedures, Culture

Summary of the issue

The UK climate continues to reflect the projections of the Climate Change Committee (CCC) on global warming, with more extremes of weather, storms and wind strength being experienced more commonly in all parts of the country. In terms of heat, the UK has experienced several instances of prolonged elevated temperatures. 2022 saw the fourth warmest summer in series for the UK and was underlined with temperatures in excess of 40°C recorded in the UK for the first time. Coningsby, Lincolnshire, recorded the highest temperature, with 40.3°C exceeding the previous UK record by 1.6°C. The Met Office issued its first ever red warning for extreme heat with widespread impacts for the UK. Wales also recorded a new daily maximum temperature record of 37.1°C, with Scotland seeing a new record of 34.8°C.

This pattern was repeated in 2023 and, while not breaking the 2022 records, it became the second hottest year on record with extended periods of hot conditions during summer and autumn months. The clear message is that periods of increased heat in workplaces need to be managed to prevent harm – both in terms of process control in some cases, and for individual risk for some of the workforce of occupational heat stress from working in hot conditions. Working practices may need to be risk assessed and adjusted to avoid heat related stress for both employees and contractors.

The following paragraphs give information on planning for managing work in extreme conditions, including situations where the risk of heat stress or heat exhaustion is exacerbated by some factors such as the wearing of Personal Protective Equipment (PPE) while working in hot conditions.

Note: refer to the Further Reading section of this Knowledge Exchange for reference to applicable HSE guidance.

Measuring and Monitoring Workplace Temperatures

To ensure adequate planning to avoid heat related stress, it is important to first monitor temperature. In the first instance, a normal calibrated thermometer (digital or dry bulb thermometer) reading can be taken to assess the temperature within the workplace. Repeat measurements or continuous monitoring may be required to get a representative measurement of the thermal environment where work is to take place. Temperature measurements can be taken to compile a 'temperature profile' to enable actions to be taken to ensure the planned work can be carried out safely.

Additional data can be obtained by using a 'Wet Bulb Globe Temperature (WBGT)' which allows calculation of the humidity of the air. If the measurement of the workplace temperature with a dry bulb thermometer identifies issues, measurement with a WBGT can be used before progressing as there can be significant difference between dry bulb and WBGT measurements.

Heat Stress Factors and Symptoms

The factors that can lead to heat stress include high temperature, high humidity, direct sun or heat, limited air movement, physical exertion, poor physical condition, some medicines, type and quantity of PPE and inadequate tolerance for hot workplaces. Any of these factors could result in heat exhaustion or heat stroke.

Symptoms of heat exhaustion include:

- Headaches, dizziness, light-headedness or fainting.
- Muscle cramps
- Weakness and moist skin.
- Heat rash
- Mood changes such as irritability or confusion.
- Upset stomach.

Symptoms of heat stroke include:

- Dry, hot skin with no sweating.
- Mental confusion or losing consciousness.
- Seizures or convulsions.

Type of Work

The type of work to be carried out and duration can significantly impact the temperature at which the activity can be safely carried out, for example:

- If the work rate is low, for example light manual work such as operating a low power hand tool whilst standing, the maximum temperature at which the work can be safely carried out will be higher before heat stress becomes an issue.
- If the work rate is high, for example carrying heavy material, shovelling, digging, the maximum temperature at which the work can be safely carried out will be lower before heat stress becomes an issue.

The impact of wearing PPE on the risk of heat exhaustion and heat stroke

In many process industries, the wearing of PPE to prevent exposure to occupational hazards is an essential part of managing safety and health, where the risk cannot be eliminated by other means. The PPE can include any or all of full-body chemical protection suits, overalls, hoods and hard hats, gloves, boots and goggles. The more PPE necessary, and the greater the level of protection against exposure to hazardous substances, the more it can exacerbate the risk of heat-related illness in extreme heat and work in confined spaces such as vessel entry.

In such cases, a targeted Thermal Risk Assessment should be carried out in advance of the work beginning so that the level of risk can be understood and suitable mitigation measures identified and put in place. There are a number of ways in which this can be done – **an example of a Heat Risk Assessment template is included at Annex 1 of this paper, to illustrate the factors that may need to be taken into account.**

Different industrial activities and specific operational situations will need to be taken into account to determine an effective risk management strategy to safely manage the risk of serious heat-related illness in circumstances of extreme ambient temperature; and especially if exacerbated by the use of PPE. But the typical operational activities and situations where experience has shown this to be a potential issue for employees or contractors can include:

- Working outdoors in direct sun, or hot weather conditions;
 - Working on or near hot plant or materials;
 - Working in confined spaces where airflow is restricted and therefore temperatures can increase due to the work activity;
 - Work at height that involves significant climbing of stairs or ladders;
- (The above list is not exhaustive)*

Heat-related illness

From a medical perspective, the following indicators have been used to highlight the symptoms of excessive heat strain:

- Sustained (several minutes) heart rate in excess of a figure derived from: 180 beats per minute (bpm), minus the individual's age in years (i.e. $180 - \text{age}$). With modern technology, wrist watches with functions that include heart rate monitoring can be used;
- Recovery heart rate, at 1 minute after peak work effort, is greater than 120 bpm;
- Elevated body core temperature.

People carrying out activities in elevated temperatures, including where PPE is also a factor, should be briefed such that they:

- Know the signs/symptoms of heat-related illnesses (see above, under Heat Stress factors and symptoms);
- Understand the importance of self-monitoring and also looking for possible symptoms in co-workers;
- Know and understand the control measures that have been implemented;
- Drink water regularly, average daily consumption should be about 2 litres;
- Avoid alcohol before and after working in hot environments;
- Avoid caffeinated drinks and heavy meals.

Controls to minimise the risk of heat stress can include:

- Reviewing shift patterns to ensure people's exposure to heat stress factors are reduced.
- Reviewing PPE requirements, and adjusting exposure times or the types of PPE issued accordingly.
- The possibility of using lighter PPE, if an appropriate risk assessment indicates that a lower level of PPE is appropriate.
- The use of PPE that includes cooling air introduced and circulated within full- protection PPE suits or headgear.
- Provision of more frequent and/or longer break periods.
- Provision of shaded areas.
- Provision of drinking water stations.

Controls for heat stress should be discussed as part of the pre-job brief. Any suggestions on further measures to mitigate risks, both in the short and long term, should be discussed.

Legislation

- Workplace health, safety and welfare. Workplace (Health, Safety and Welfare) Regulations 1992 - [L24](#)
- The Construction (Design and Management) Regulations 2015 - [L153](#)

Further reading

1. HSE [Temperature in the workplace](#)
2. HSE [Heat Stress Checklist](#)
3. Advisory, Conciliation and Arbitration Service [Health and Wellbeing](#)

ANNEX 1

Planning for Managing Risk of Heat-Related Illness

In Australia, where there is far more experience of working in the sort of extreme temperatures that the UK is now having to get used to periodically, much valuable work has been done on tools to help manage risk assessment for working in extreme heat environments. This includes a Basic Thermal Risk Assessment Template developed by the **Australian Institute of Occupational Hygienists (AIOH)** reproduced and shared below.

This and other relevant information is available via the AIOH website at the following link:

<https://www.aioh.org.au/resources/tools/>

The **American Conference of Governmental Industrial Hygienists (ACGIH)** also has information that may be of value and interest on Heat Stress – see the ACGIH website via the following link:

<https://www.acgih.org/about/>

(Please note, Copyright restrictions apply and you would need to subscribe to ACGIH to be able to gain access)

Basic Thermal Risk Assessment Template

(refer to annex)

The Process Safety Forum has been set up to provide an industry association platform whereby initiatives, best practice, lessons from incidents and process safety strategy can be distilled and shared across sectors, to influence our stakeholders (including the Regulators), and to drive the process safety management agenda. The Process Safety Forum consists of representatives from across industry, refer to the website for details.

The website is www.p-s-f.org.uk.