

HSE360° summit

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HSE360° summit

Current PPE-practices under pressure - due to hot weather periods and aged workforce



Photo Cockburn

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Photo Canva

Protective effects of PPE

- Protection of skin and eyes against hazardous substances, sunlight and mechanical impact
- Protection of the body against mechanical injury
- Protection of the respiratory system against dust, smoke, allergens, hazardous substances (any type of pollutants)

Negative effects of PPE

- Coverage of the skin, enhancing sweating and reducing perspiration causing more body efforts to thermoregulate ([Literature](#), NIOSH Ch. 3.3)
- (Often) negative influence on unhindered movement, and on communication between workers
- Filter masks hamper breathing (battery-powered and breathing apparatus have other negative impacts)

The EU PPE Directive tries to cope with these negative effects, using general prescriptions like: *'PPE must be as light as possible without prejudicing its strength and effectiveness'*

Regulation of PPE - Risk categories according to the EU PPE Directive

REGULATION (EU) 2016/425 ... of 9 March 2016 on PPE

ANNEX I RISK CATEGORIES OF PPE (*only climate change related risks*)

Category I includes exclusively the following minimal risks:

- (c) contact with hot surfaces not exceeding 50 °C;
- (d) damage to the eyes due to exposure to sunlight

Category II includes risks other than those listed in Categories I and III

Category III ... very serious consequences such as death or irreversible damage to health

- (c) harmful biological agents;
- (e) high-temperature environments of at least 100 °C;

Prolonged outdoor work in hot weather is not explicitly addressed

EU Directive on 'Minimum requirements at workplaces'

Council Directive 89/654/EEC of 30 November 1989 concerning the minimum safety and health requirements for the workplace

- Regulates room temperature (only temperature, not humidity, not radiation)
- Excludes mobile workplaces, fields, woods etc.

This will change, the recommendation by the Advisory Committee on Safety and Health (ACSH) from Nov 2024 is:

'Amend workplace definition and add definitions of "off-premises" and "homeworking" workplaces.'

see in the Annex ['References / Literature'](#)
[ACSH Opinion on the Update of the Workplace Directive 89/654/EEC'](#)

How old is the workforce in the EU?

In 2025, the EU working population is approximately **5 - 7 years older** than 1995, **around 45 years instead of 38-40**.

Remarks and source

It is not possible (statistically) to identify the average age of administrative versus manual workers. Very probably, manual workers are in average some years younger.

Eurostat: Employed persons by professional status - quarterly data

https://ec.europa.eu/eurostat/databrowser/view/LFSQ_EGAPS_custom_18296339/default/table

Which mechanism let us withstand heat?

*‘Humans have the capability to withstand large variations in environmental temperatures, while relatively small increases in internal temperature (i.e. as little of $\sim 3^{\circ}\text{C}$) can lead to injury and even death. Elevations in **skin blood flow and sweating** are the primary heat exchange mechanisms in humans that protect against a heat-related injury.*

Quote from Crandall and González-Alonso

Impact of age – Sweating, breathing, cardiac system (heart)

Sweating - No clear connection of sweating to age

Factors like temperature, humidity, exertion (metabolic rate), emotional stress, and the thermal resistance of the clothing are more important than age. The response of the sweat glands is described as more 'sluggish' in older ages ([Literature: NIOSH](#))

Breathing - Clear connection to age

Age reduces the capacities of the lung and increases the risk of infection. The peak of lung capacity is at the age 20 (woman) and 23 (men), after that peak the FEV₁/FVC ratio decreases throughout life. [Literature: Lancet 2025](#), [Diagram in the annex](#)

Cardiac system – Clear connection to age

Practically all physiological capacities of the cardiac system decrease with age
[Literature: Ribeiro Quote: ... aging is the major risk factor for the development of cardiac disease conduction to heart failure and mortality.](#)

Impact of age: Cardiac capacity and heat

Thermoregulation in prolonged hot weather conditions significantly stresses the cardiac system

- **Skin blood flow** might increase from ~300 mL min upwards to 7500 mL min. (less with age, 'reduced ability to redistribute blood from the visceral circulation'. [Quote Minson](#))
- **Cardiac output** must increase to keep arterial blood pressure
- During physically demanding work / heavy work **the muscles receive up to 80% of the total blood flow**, whereas during rest it is only approx. 20%
- **Impact on the brain:** Cerebral blood velocity declines significantly.

[Literature: Crandall and González-Alonso, Minson](#)

Heat and PPE – a principal contradiction!?

Conflict between two principles

WHO principles to cope with hot weather periods

- *Keep your body cool and hydrated*
- *Use light and loose-fitting clothing* (Quote WHO)

PPE principles

- Protection of skin and body by coverage
- Filtering of breathable air, to achieve better protection against pollutants

The legal situation now in the EU

Temperature limits exist for indoor workplaces (Dir 89/654)

Special PPE regulations exist for certain 'hot' work tasks at industrial workplaces (steel, glass, foundries etc.)

No limits for outdoor and mobile work at EU-level, such limits exist in several Member States, particularly in Southern Europe

Unclear limits for workplaces with an indoor / outdoor mix (delivery services, warehouses, seamen, construction, cabin-operated machinery etc.)

No regulations prescribing general cooling PPE for outdoor work

Practice in the EU

Application of organisational measures in several enterprises
(breaks, tents, supply of (mineralised) water and beverages)

Use of classical anti-heat PPE (hats, sunglasses)

Cooling PPE in some enterprises

Few applications of WGBT

No heat-related work stops, exceptions in Southern Europe

No systematic info about the quantitative level of practical implementation, good-practice reports

Example of legal action:

<https://www.ekathimerini.com/economy/1276528/cyprus-fines-employers-for-ignoring-heat/>

Cyprus

Complete work interruption for acclimatized workers foreseen when the WBGT rises beyond 32.2°C for low-intensity work, 31.1°C for moderate-intensity work or 30.0°C for high-intensity work.

Similar in Spain, Greece, Italy, and Belgium

Countries exposed to extreme heat

Qatar

Under these rules, workers cannot work outside between 10 a.m. and 3:30 p.m. from 1 June to 15 September.

In addition, regardless of the time, all work must stop if the WBGT rises above 32.1°C in a particular workplace.

Thailand stops working if the WBGT rises beyond 34°C for low intensity work, 32°C for moderate intensity work, and 30°C for very high intensity work (ILO)

Similar in **Japan and Korea**

SUMMARY ILO

Countries often use heat stress indicators and, in most cases, this is the **WBGT**.

Maximum temperature thresholds **vary according to work intensity**
Other common protective measures include **rest areas, hydration, education, training, and PPE**

[WBGT – More explanation in the annex](#)

Other important regulation or norms

Industry standards on thermal comfort (ISO 7933 and ISO 9886)

ISO 7933

Body temperature always less than 38°C

Maximum 7,5% weight loss due to sweating (conservative 3%)

Engineering control technical measure: Reflective tents



Organisational measures: breaks, hydration, stop working periods

Photo: ILO

Workplace measures - Outdoor

Classic (anti-heat) PPE

- Hats
- Neck covers
- Sunglasses



PPE for hot weather conditions

- Cooling jackets – nonelectrical
- Cooling jackets (battery powered)
- Other PPE with cooling capacity (helmets etc)



Test report 2025: Cooling jackets significantly lose their positive cooling effect if worn in connection with other clothing

(Literature BGW)

Photos: Canva / Cockburn / BGW



ACSH Considerations

Occupational exposure to high levels of heat, as well as to UV radiation, should be treated as OSH hazards.

Provision of cool, shaded and ventilated rest areas.

Hydration strategies, including adequate sanitation facilities, especially for female workers.

Rest, breaks or modified work schedules to limit or avoid exposure to excessive heat, including the ability to self-pace without increasing other risks.

Heat acclimatization measures for workers without recent heat exposure.

Education and awareness on heat stress and heat-related illnesses, including early symptoms of negative effects of heat on the human body.

[Reference: ACSH Opinion on climate change and OSH](#)

What to expect?

For indoor workplaces

Stricter regulation and implementation of regulation

More applications of the WGBT-index instead of temperature

Technical solutions

For mixed indoor/outdoor workplaces

Difficult and probably very specific regulations

For outdoor workplaces

Much stricter regulation and implementation

Prescription of organizational measures

Perhaps coming: 'Cooling'-PPE'

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**Thank you for
listening!**

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Annex

References / Literature

Advisory Committee on Safety and Health at Work (EUROPEAN COMMISSION, DG Employment, Social Affairs and Inclusion , Working Conditions and Social Dialogue)
Opinion Climate Change – extreme weather conditions, Adopted on 27/11/2024

Advisory Committee on Safety and Health at Work (EUROPEAN COMMISSION, DG Employment, Social Affairs and Inclusion , Working Conditions and Social Dialogue)
Opinion on the Update of the Workplace Directive 89/654/EEC, Adopted on 27/11/2024

Berufsgenossenschaft für Gesundheitsdienst und Wohlfahrtspflege BGW, 2025: Kühlwesten auf dem Prüfstand - Vergleichender Produkttest für Gesundheitseinrichtungen (Cooling jackets test - comparative test in health care facilities)
<https://www.bgw-online.de/bgw-online-de/service/medien-arbeitshilfen/medien-center/bgw-test/kuehlwesten-auf-dem-pruefstand-116850>

Crandall and González-Alonso: Cardiovascular function in the heat-stressed human
<https://pmc.ncbi.nlm.nih.gov/articles/PMC3496876/pdf/nihms417033.pdf>

EU PPE Directive

REGULATION (EU) 2016/425 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 9 March 2016 on personal protective equipment and repealing Council Directive 89/686/EEC

EU Workplace Directive

COUNCIL DIRECTIVE of 30 November 1989 concerning the minimum safety and health requirements for the workplace (first individual directive within the meaning of Article 16 (1) of Directive 89/391/EEC)

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A global review of the science, policy and practice, 2024

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<https://www.aginganddisease.org/EN/10.14336/AD.2023.0115>

World Economic Forum: Extreme heat is forcing Spain's outside workers to shift their hours
<https://www.weforum.org/stories/2023/08/climate-crisis-extreme-heat-work-hours/>

WHO Heat and Health
<https://www.who.int/news-room/fact-sheets/detail/climate-change-heat-and-health>

(Easy-to-read) **Young, A.** Ageing and physiological functions
<https://pmc.ncbi.nlm.nih.gov/articles/PMC1692134/pdf/9460068.pdf>

WBGT - WET BULB GLOBE TEMPERATURE

Excursion WBGT - WET BULB GLOBE TEMPERATURE

Measures **four factors** that are relevant for heat stress

- temperature
- humidity
- wind
- radiation

An index for all factors is calculated based on this formula:

$$0,7 \cdot t_{nw} + 0,2 \cdot t_g + 0,1 \cdot t_a \text{ (outdoor)}$$

Natural wet-bulb temperature (t_{nw}), black globe temperature (t_g), and dry bulb temperature (t_a): $WBGT = 0.7t_{nw} + 0.2t_g + 0.1t_a$

Example outdoor and sunshine: $32^{\circ}\text{C} \times 0,7 + 36^{\circ}\text{C} \times 0,2 + 34^{\circ}\text{C} \times 0,1 = 31,6^{\circ}\text{C}$

Literature: **Explicit Calculations of Wet-Bulb Globe Temperature Compared With Approximations and Why It Matters for Labor Productivity**

<https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2021EF002334>



Impact of age: Age and lung capacity

Diagrams from the Lancet article: 'General population-based lung function trajectories over the life course: an accelerated cohort study.' *Dashed lines added by LL.*

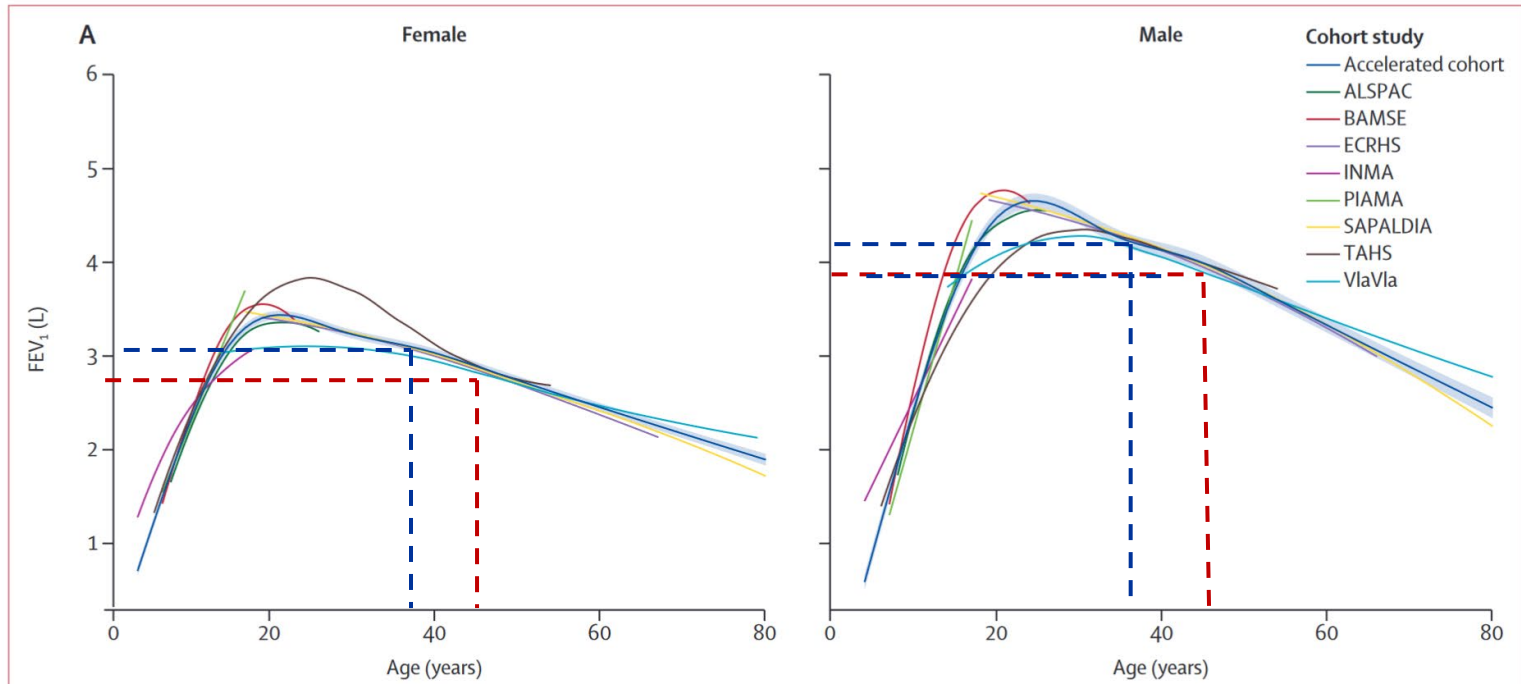


Table from ILO: Heat at work (p58)

► **Table 8. Recommended water intake based on WBGT levels and acclimatization state.**

It is essential for workers exposed to excessive heat to start their workday well-hydrated, which includes rehydrating from the previous day and consuming roughly 500 millilitres of fluid with electrolytes about an hour before beginning work (Notley et al. 2018b). It is equally important for workers to sustain water balance by drinking regularly based on their sensation of thirst throughout their shift (Kenefick and Sawka 2007; Morris et al. 2020).

WBGT	Water intake (litres/hour)		
	Low-intensity work	Moderate-intensity work	High-intensity work
25.0-28.0	0.35	0.55	0.65
28.0-29.4	0.40	0.55	0.70
29.5-30.9	0.40	0.60	0.75
31.0-32.4	0.45	0.65	0.80
≥32.5	0.50	0.70	0.85

Note: Work intensity follows levels provided in Table 1 of ISO 7243:2017; Simulation performed with the FAME Lab Predicted Heat Strain model (Ioannou et al. 2019). Simulation data - height: 170 cm; body mass: 70 kg; clothing worn: hat, short-sleeve shirt, bra, denim overalls, underwear, socks and shoes.

Table from ILO: Heat at work (p58)

► Figure 8. Urine colour scale to evaluate the level of hydration status.

