Appendix 1. Working in Extreme Heat, an Invisible Occupational Risk: Legislation, Risk Management and Policy Recommendations for Türkiye

Determining Occupational Heat Stress

Figure 1 shows the use of Wet-Bulb Globe Temperature (WBGT) measurement in determining occupational heat stress in Qatar.[1]

Level of occupational heat stress	WBGT
None	Lower than 27.8 °C
Low	27.8 °C to 29.4 °C
Moderate	29.5 °C to 31.0 °C
High	31.1 °C to 32 °C
Extreme	Higher than 32.1 °C

Figure 1. The use of WBGT measurement in determining occupational heat stress in Qatar[1]

WBGT: Wet-Bulb Globe Temperature

Below, the WBGT index is explained in detail, along with its measurement methods and application examples, in the fields of Occupational Health and Safety, Sports, and Military Training.

1. Occupational Health and Safety (OHS) Practices

Standards and Guidelines

• WBGT measurement offers the possibility of evaluation in both indoor and outdoor environments (under the sun and in the shade) according to the TS EN ISO 7243:2017 standard. The TS EN ISO 7243: December 2017 Standard aims to evaluate the total exposure of workers to heat stress resulting from daily tasks.[2] This standard is used to screen the heat stress level in work periods lasting up to eight hours.

• In the American Conference of Governmental Industrial Hygienists "2024 threshold limit values (TLV) and biological exposure indices" guide, tolerance limit values have been determined for different metabolic workload categories.[3] Example threshold values (WBGT, °C):

• Light work (200–350 W): 27.8 °C

• Medium work (350–500 W): 26.7 °C

• Heavy work (>500 W): 25.6 °C

• Rest (<115 W): 30.0 °C

Measurement and Evaluation

• Measurements should be taken in the work area at intervals of at least 15–30 minutes; attention should be paid to spatial differences (shadow, wind, reflection, etc.).

Control and Precautions

• When WBGT exceeds the relevant TLV value, engineering controls (shading, ventilation), followed by administrative measures (work/rest cycle, shift arrangement) and finally personal protective equipment (cooling suit, suitable clothing) are implemented (Ministry of Labour and Social Security).

In practice, an example of work/rest ratios according to WBGT:

-WBGT < TLV: 50–75% work, 25–50% rest

-WBGT ≈ TLV: 25–50% work, 50–75% rest

-WBGT > TLV: interim evaluation and work stoppage if necessary.

2. Sports Practices

Institutions and Protocols

• Organizations such as the American College of Sports Medicine (ACSM) and the University Interscholastic League establish training and competition protocols according to WBGT. These protocols include regulations such as work/rest ratios, hydration breaks, equipment removal, and shortening of practice time.[4,5]

Risk Categories and Color Codes

• ACSM uses a five-color "flag" system (black flag value example only):

- Black Flag: WBGT > 28 °C (82 °F), cancel activity or voluntary withdrawal[6]

- In other colors (green, yellow, red), training intensity should be decreased and rest intervals should be gradually increased.

WBGT (°C)	Color	Recommendation
<18	Green	Normal training, regular hydration
18–23	Yellow	Increase rest intervals; lighten equipment
23–28	Red	Short periods of high intensity, frequent breaks and shading
>28	Black	Cancel or postpone all outdoor training/competitions

Figure 2. Risk categories application example

3. Military Training and Operational Applications

Flag System

• Many military units, primarily the US Army, use a five-level flag system according to WBGT. Work-rest cycle and water consumption are adjusted according to measurements.

Flag color	WBGT (°C)	Explanation and restriction
White	<27.8	Normal operation
Green	27.8–30.5	Standard work/rest cycle
Yellow	30.6–32.2	Restrictions for new or less-acclimatized staff
Red	32.3-33.3	Heavy work restrictions for all staff
Black	>33.3	All challenging external activities are suspended

Figure 3. Five-level flag system

Acclimatization and Its Management

• Acclimatization process: New personnel are trained in lighter flag conditions for the first 2–3 weeks.

• Monitoring and Recording: WBGT should be measured every 30 minutes in the training area, and daily records should be kept. Staff officers or field force medical personnel are responsible.[7]

REFERENCES

1. State of Qatar, Ministry of Labour. *Heat stress legislation in Qatar: a guide for employers* [Internet]. Doha: Ministry of Labour; 2023 Apr [cited 2026 Jul 17].
2. T.C. Çalışma ve Sosyal Güvenlik Bakanlığı. TS EN ISO 7243:2017 Sıcak Ortamlar – WBGT (Yaş Termometre Küre Sıcaklığı) İndeksi ile Isı Stresinin Tahmini. Ankara: ÇSGB; 2018. https://www.csgb.gov.tr/Media/ceqikham/31-10-2018-ts-en-iso-7243-aral%C4%B1k-2017-standard%C4%B1-rehberi.pdf
3. American Conference of Governmental Industrial Hygienists (ACGIH). 2024 TLVs® and BEIs®: Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices. Cincinnati, OH: ACGIH; 2024. p. 232.
4. University Interscholastic League of Texas. *2025-2026 Heat Stress & Athletic Participation Recommended Plan* [Internet]. Austin (TX): University Interscholastic League; [cited 2026 Jul 17].
5. Armstrong LE, Casa DJ, Millard-Stafford M, Moran DS, Pyne SW, Roberts WO. American College of Sports Medicine position stand: exertional heat illness during training and competition. *Med Sci Sports Exerc*. 2007;39(3):556-572. doi:10.1249/MSS.0b013e31802fa199
6. Road Race Management. *ACSM heat and humidity guidelines for races* [Internet]. [cited 2026 Jul 17].
7. https://search.usa.gov/search?query=heat%20stress&affiliate=jbsa&utf8=%26%23x2713%3B