Bulletin n°42

Veille thermique
Période : octobre 2026

Objectifs :

L'INRS est de plus en plus sollicité sur des questions concernant les activités en entreprise par forte chaleur : les activités en extérieur, l'été en période de canicule, mais aussi les activités en intérieur, dans des lieux aux conditions thermiques extrêmes. L'objectif de cette veille est de se tenir informé sur ces thématiques, dans une période où la problématique thermique croît avec les changements climatiques.

La bibliographie extraite de la base de données INRS-Biblio, permet la consultation des ressources en version PDF.

Les liens mentionnés dans le bulletin donnent accès aux documents sous réserve d'un abonnement à la ressource.

La validation des informations fournies (exactitude, fiabilité, pertinence par rapport aux principes de prévention, etc.) est du ressort des auteurs des articles signalés dans la veille. Les informations ne sont pas le reflet de la position de l'INRS.

Sommaire :

INRS-Biblio 2

- Documents INRS 2
- Documents non-INRS 2

EPI, matériaux protecteurs/refroidissants 3

Maladies liées à la chaleur 5

Outils et capteurs de mesure 8

Travail dans une ambiance thermique extrême 10

Travail par fortes chaleurs et périodes de canicule 11

Actualités octobre 2026 14

INRS-Biblio

- ## Documents INRS

L. Vitaud.

Travail : un changement de paradigme.

IC RST - Pratiques et métiers, Références en santé au travail. 2026(185):61–76, 16.

https://www.inrs.fr/media.html?refINRS=TM%2089

Cette conférence a été donnée lors de la clôture du 37e congrès national de médecine et de santé au travail à Montpellier en juin 2024. Elle décrit les 4 défis auxquels la conception du travail doit faire face : la géographie du travail et la crise du logement, la transition démographique et la diversité générationnelle, l'intelligence artificielle, les technologies et la redistribution des tâches ainsi que le réchauffement climatique et la soutenabilité du travail.

- ## Documents non-INRS

M. P. Sassine, A. Adam-Poupart, B. Bakhiyi, K. Forest-Berard and C. Et.

Impacts des changements climatiques sur la santé et la sécurité des travailleuses et des travailleurs : cadre conceptuel.

Rapport de recherche. Québec (Canada): Institut national de santé publique du Québec (INSPQ); 2026. p. ill., bibliogr., 58.

Ce rapport porte sur le développement d'un cadre conceptuel qui présente des dangers professionnels et des conditions qui peuvent modifier les environnements de travail, lesquels sont susceptibles d'être exacerbés par les changements climatiques. Le cadre met en évidence que ces dangers et conditions auront potentiellement des impacts sur la santé et la sécurité des travailleurs du Québec et d'autres provinces et territoires au Canada. Il recense aussi les secteurs d'activités économiques les plus affectés. Les dangers professionnels pouvant entraîner des impacts sur la santé et la sécurité des travailleuses et des travailleurs sont l'augmentation des vagues de chaleur et des températures moyennes annuelles ; la dégradation de la qualité de l'air ; augmentation de l'exposition aux rayons ultraviolets ; l'augmentation des événements météorologiques extrêmes, tels que les inondations, les sécheresses, les tempêtes et les feux de forêt ; les changements dans la répartition géographique des animaux et risques sanitaires associés tels que l'augmentation des zoonoses et des accidents causés par la hausse des contacts entre les animaux et les humains. Les conditions pouvant modifier les environnements de travail et entraîner de façon subséquente des impacts sur la santé et la sécurité des travailleuses et des travailleurs sont les perturbations des écosystèmes agricoles, aquatiques, forestiers et glaciaires pouvant nuire à la santé et à la sécurité des travailleuses et des travailleurs œuvrant dans ces systèmes ; les conséquences d'ordre socio-économique pouvant nuire à la santé et à la sécurité des travailleuses et des travailleurs via la dégradation de l'environnement bâti et l'émergence de nouvelles industries « vertes » qui visent à diminuer ou à mitiger les impacts des changements climatiques par la réduction des émissions de gaz à effet de serre. Les applications du nouveau cadre conceptuel sont multiples.

EPI, matériaux protecteurs/refroidissants

W. H. Zhao, K. Nguyen, R. Bryce and S. S. Xu.

Study on thermal protection behavior of phase change material integrated firefighters' glove on a 3D hand model.

FIRE SAFETY JOURNAL. 2027;167.

https://doi.org/10.1016/j.firesaf.2026.104990

A glove requires a balance between thermal protection and hand dexterity, limiting the thickness of insulating layers and increasing the risk of hand burns. Phase change material (PCM) can absorb large amounts of latent heat while maintaining a constant melting temperature, which makes it a potential high-performance thermal insulation material. This study is the first experimental investigation using a three-dimensional (3D) gloved-hand model to identify the optimum design of PCM-integrated structural firefighting gloves for enhanced thermal protection. The gloves were exposed to radiant heat sources in a furnace to simulate flashover and other hazardous fireground conditions. Our findings indicated that the PCM layer could extend glove thermal protection times by 30%-107% under heat exposures. Thicker PCM provided greater thermal protection. However, PCM released latent heat as it solidified during the post-exposure period, reducing the heat dissipation rate at the skin surface. Thicker PCM layers resulted in a lower cooling rate during the post-exposure period. Therefore, an optimal PCM thickness of 0.5 mm was identified for firefighter gloves when both heat-exposure and postexposure conditions were considered. Additionally, several distinct moisture content levels in the PCMintegrated glove were studied to explore how the moisture content affected the glove thermal performance.

D. Zhu, T. L. Xu, P. B. Ma, X. L. Wang and A. L. Wan.

Knitted NiTi shape memory alloy layer enabling adaptive air thickness for enhanced thermal protection and thermo-wet comfort in firefighting clothing.

SMART MATERIALS AND STRUCTURES. 2026;35(10).

https://doi.org/10.1088/1361-665X/aeb297

The complex firefighting environment poses significant challenges to firefighter's safety and rescue activities, driving the increasing demand for superior thermal protection and comfortable firefighting protective clothing (FPC). This study investigated the optimization of NiTi shape memory alloy monofilament (SMM) parameters and their application in FPC. The influence of NiTi alloy monofilament diameter (ranging from 0.6-1.0 mm) and annealing temperature (400 degrees C-550 degrees C) on austenite-martensite phase transformation temperatures was systematically investigated. Four types of shape memory fabric were fabricated by inserting SMM into knitted fabric. The weft knitted spacer fabric was also made to replace two layers of traditional FPC. These materials were subsequently incorporated into a four-layered smart firefighting clothing (SFC) system. Comparative evaluation was conducted with conventional FPC in terms of thermal protective performance and thermo-wet comfort characteristics. The results demonstrated that the austenite start temperature (As) of SMM exhibited a negative correlation with annealing temperature. Thicker SMM exhibited superior shape stability in the austenitic state and enhanced mechanical properties. In the non-activated state, the SFC exhibited significantly improved thermo-wet comfort compared to conventional FPC. The second-degree burn time of the SFC in the activated state exceeded 33 s. Notably, the SFC incorporating 1.0 mm SMM achieved a stabilized surface temperature of 39 degrees C under constant exposure to 200 degrees C, demonstrating exceptional heat insulating property. In addition, the SFC had dynamic comfort

regulation capability and mechanical impact resistance. This fabrication strategy showed promising applications in thermal protection and comfort firefighting clothing.

Maladies liées à la chaleur

P. Y. Lai, C. Turangan, G. R. Xu, H. E. Tan, R. X. Li and C. W. Kang.

Estimating hourly outdoor WBGT from routine meteorological observations for heat-stress assessment in tropical Singapore.

INTERNATIONAL JOURNAL OF BIOMETEOROLOGY. 2026;70(11).

https://doi.org/10.1007/s00484-026-03349-4

Site-specific hourly WBGT information is needed for outdoor heat-stress assessment in hot-humid tropical environments, where heat exposure varies across station locations and work periods. Dedicated WBGT sensors, however, remain spatially limited, constraining routine station-scale assessment and retrospective exposure analysis. This study develops a locally calibrated, compact, physics-motivated formulation (fWBGT) for estimating hourly outdoor WBGT from routine automatic weather-station observations in tropical Singapore. The zero-iteration linear formulation uses a closed-form psychrometric wet-bulb surrogate (), global horizontal irradiance represented by , dry-bulb temperature, and 2-m wind speed to retain radiation- and wind-aware predictors without iterative heat-balance calculations. It was calibrated using five years of hourly co-located data from Changi, Singapore (2020-2024;) and benchmarked against iterative, analytic, lookup-table, and multilayer perceptron (MLP) methods. fWBGT reproduced measured WBGT with RMSE = C, , and approximately zero MBE. It was less accurate than the MLP (RMSE = C) but executed approximately 1,750 times faster than the iterative Liljegren model. The simplified WBGT lookup approach showed nighttime errors exceeding C. In 2025 temporal and spatial validation, fWBGT achieved daytime RMSE C and nighttime RMSE C. These results demonstrate that locally calibrated WBGT estimation provides an efficient methodology for station-scale heat-stress screening and exposure assessment in tropical microclimates. While the calibration-and-validation procedure is transferable, the Singapore-specific coefficients require local recalibration prior to application in other environments.

O. P. Stoddard, K. Gibb, X. P. Vergara, M. Frederick, K. Fitzsimmons and S. Beckman.

Heat-Related Mortality in California Working-Age Adults From 2014 to 2023.

AMERICAN JOURNAL OF INDUSTRIAL MEDICINE. 2026.

https://doi.org/10.1002/ajim.70151

Extreme heat events are increasing. Workers, especially those who perform physical activity or work outdoors, are at greater risk of heat-related death than the general population. California has the largest workforce of any US state and a high proportion of workers at risk of heat-related death. This study aimed to characterize heat-related mortality among California workers by demographics and industry/occupation to inform prevention.Methods Heat-related deaths among California residents likely to be in the workforce were analyzed from 2014 to 2023 using data from the Electronic Death Registration System. Cases included were those with a final or contributing cause of death coded as ICD-10 codes X30 (exposure to excessive natural heat) or T67 (effects of heat and light). Denominators for rate calculations were derived from the American Community Survey 5-year estimates.Results There were 334 heat-related fatalities among working-age California decedents from 2014 to 2023. Most decedents were male (81%) and non-Hispanic White (42%) or Hispanic or Latino (42%). The overall mortality rate was 0.16 deaths per 100,000 workers per year. Among race/ethnicity groups, the heat-related mortality rate was highest in the non-Hispanic Black population (0.31). Individuals whose longest-held occupation was in the Agriculture, Forestry, Fishing, Hunting, and Mining industry group

had the highest rate (0.60), followed by Construction (0.53). Those working in primarily outdoors occupations had a mortality rate 5 times higher than those working primarily indoors. Riverside County had the highest number of deaths (n = 104).Discussion Tailored heat prevention strategies should be prioritized in high-risk industries, occupations, and regions to prevent fatalities among California workers.

T. Ikeda, T. Watase, T. Kondo, H. Watase, T. Funabiki and M. Iwata.

Low-volume body bag cooling for severe exertional heat stroke in the emergency department: a case report.

INTERNATIONAL JOURNAL OF EMERGENCY MEDICINE. 2026;19(1).

https://doi.org/10.1186/s12245-026-01321-y

Exertional heat stroke (EHS) is a life-threatening emergency in which delayed or inadequate cooling substantially increases the risk of death and permanent neurological injury. Core temperature reduction to below 39 degrees C within 30 min is the therapeutic target, and cold-water immersion achieves the fastest cooling rates (0.15-0.35 degrees C/min) but is frequently unavailable in emergency departments (ED) due to equipment and space limitations. Body bag-based tarp-assisted cooling with oscillation (TACO) has been proposed as an alternative using universally available materials; however, clinical evidence supporting its emergency department use remains limited. Case presentation A 57-year-old immunocompromised male construction worker (acute myeloid leukemia, status post umbilical cord blood transplantation, maintained on prednisolone and tacrolimus) presented with EHS following 90 min of outdoor labor in ambient conditions of 36 degrees C and 65% relative humidity. On ED arrival, rectal temperature was 42.0 degrees C, Glasgow Coma Scale score was 4, blood pressure was 125/80 mmHg, and heart rate was 183 beats/minute. Body bag-based TACO was initiated immediately upon arrival using 15 L of tap water and 15 kg of ice. Endotracheal intubation for airway protection was performed concurrently, demonstrating patient accessibility during cooling. Target temperature (rectal temperature < 39 degrees C) was achieved in 39 min at a cooling rate of 0.085 degrees C/min. Glasgow Coma Scale score improved to 14 within 7.5 h of admission. The hospital course was complicated by bacteremia requiring prolonged antimicrobial therapy. The patient was discharged ambulatory on hospital day 42 without neurological sequelae. Conclusions Body bag-based TACO required substantially less water (15 L) than the water/ice volumes reported in TACO studies (114-151 L) using materials available in any ED. Although the cooling rate achieved (0.085 degrees C/min) fell below published benchmarks, the patient achieved complete neurological recovery, suggesting that immediate initiation of cooling may help offset a suboptimal rate. While a single case cannot establish equivalence to cold-water immersion, body bag-based TACO offers a practical, low-cost option for initiating cooling when standard infrastructure is unavailable, and merits further comparative evaluation.

T. Wiskel, R. D. Meade, K. Budeski, N. S. Bedi, P. Bain, C. O. Buckee and S. Balsari.

Trends in Occupational Heat-Health Research in Low-and Middle-Income Countries: A Mapping Review.

CURRENT ENVIRONMENTAL HEALTH REPORTS. 2026;13(1).

https://doi.org/10.1007/s40572-026-00567-1

Purpose of review Extreme heat is increasingly threatening the health of workers worldwide and disproportionately impacting workers in low- and middle-income countries (LMICs). This mapping

review was conducted to characterize the existing literature and to identify key gaps in field assessments of heat stress impacts on workers in LMICs.Recent findings A total of 210 reports were included in the analysis. Almost two-thirds of included articles reported on studies conducted in lower-middle income countries (65%), with most reports from the South-East Asia Region (40%) and from India (30%), Iran (16%), and China (9%). At-risk populations were underrepresented, with 39% of reports not including any female participants and only 10% specifying migrant status, with wide variation in reporting of additional demographic, occupational, and workplace characteristics. Manufacturing and agriculture were by far the occupations most studied (36% and 33%, respectively). The most common index of heat stress was the wet bulb globe temperature (WBGT), with a report-level average ranging from 17.1 to 38.5 degrees C, with peaks as high as 54.4 degrees C. The most commonly reported outcomes were cardiovascular responses (50%) such as heart rate and blood pressure, body temperatures (43%), and self-reported symptoms of heat illness or heat strain (35%). Among all reports, only 9% included some form of intervention to protect workers.Summary This review identifies the key trends and gaps in populations, occupations, and regions evaluated in heat-health research. As emerging technologies facilitate research expansion, this mapping review can guide future efforts to promote comparability of studies, overcome gaps, and protect worker health.

Outils et capteurs de mesure

P. Chen, L. Ding and X. P. Liu.

Acute Whole-Body Heat Exposure Modulates EEG Microstate Dynamics, Phase-Lagged Connectivity, and Cortical Source Activity.

BRAIN TOPOGRAPHY. 2026;39(6).

https://doi.org/10.1007/s10548-026-01258-8

Acute exposure to elevated ambient temperature affects physiological regulation, thermal perception, and cognitive functioning, yet its influence on the spatiotemporal organization of human brain activity remains insufficiently understood. This study investigated temperature-related changes in EEG spectral power, microstates, functional connectivity, and cortical source activity. Fifteen healthy male participants completed three randomized 45-min seated exposures at ambient temperatures of 21, 30, and 38 degrees C while wearing standardized winter protective clothing (3.2 clo). EEG, skin temperature, core body temperature, and subjective thermal sensation were recorded. Mean skin temperature, core body temperature, and thermal-sensation votes increased with temperature and exposure duration. Global delta-band connectivity differed significantly across temperatures (chi 2=12.64, FDR-adjusted q=0.0090). Delta connectivity was significantly higher at 38 degrees C than at 21 degrees C. Microstate D coverage differed across temperatures, with values of 0.145, 0.178, and 0.150 at 21, 30, and 38 degrees C, respectively (chi 2=12.88, FDR-adjusted q=0.0064, W=0.429). Source-space analysis further demonstrated increased relative delta source power with temperature and reduced beta and gamma source power at 38 degrees C, particularly in occipital, parietal, sensorimotor, and posterior cingulate regions. Increasing ambient temperature was associated with a shift in EEG spectral activity toward lower frequencies, enhanced delta-band functional synchronization, and altered microstate temporal organization. Together, these exploratory findings indicate that spectral power, regional phase-lagged connectivity, and microstate dynamics show distinct responses to ambient temperature in healthy young men wearing protective clothing.

C. J. Coehoorn, C. J. Fernandes, M. Alomani, P. Townsend, H. Cowart and J. Lalonde.

A supervised machine learning approach to predict core temperature for workers with high-level personal protective equipment.

APPLIED ERGONOMICS. 2027;140.

https://doi.org/10.1016/j.apergo.2026.104902

This study assesses machine-learning approaches to predict core temperature (Tc) in workers wearing high-level personal protective equipment (PPE), hypothesizing improved accuracy over conventional methods. Methods: Fifty participants (48 male, 2 female) performed exercise protocols while wearing high-level PPE in one of two conditions (NORM [n = 14]: 25-26 degrees C, 45% humidity, HYPR [n = 36]: 35-36 degrees C, 45-50% humidity). The variables collected were skin temperature (Tsk), heart rate (HR), time, respiratory rate (RR), and rate of skin temperature acquisition per minute (Tsk/min). A total of 4063 data points were utilized in two separate, complementary supervised machine learning analyses (random forest [RF] and generalized additive models [GAM]). Model performance was evaluated using both leave-one-subject-out (LOSO) cross-validation and an observation-level 80/20 split (80/20). The two models' performance was measured using adjusted R2, bias, limits of agreement (LoA), root mean squared error (RMSE), mean absolute error (MAE), and standard error of the estimate (SEE). Results: LOSO approach: GAM model (R2 of 0.84, a bias of 0.00, a 95% LoA [-0.50 degrees C, 0.50

degrees C], an RMSE of 0.26 degrees C, an MAE of 0.21 degrees C, and a SEE of 0.26 degrees C), RF model (R2 of 0.84, a bias of 0.01, a 95% LoA [-0.50 degrees C, 0.50 degrees C], an RMSE of 0.26 degrees C, an MAE of 0.20 degrees C, and a SEE of 0.26 degrees C). 80/20 approach: GAM model (R2 of 0.89, a bias of 0.00, a 95% LoA [-0.41 degrees C, 0.41 degrees C], an RMSE of 0.21 degrees C, an MAE of 0.17 degrees C, and a SEE of 0.21 degrees C), RF model (R2 of 0.96, a bias of 0.00, a 95% LoA [-0.26 degrees C, 0.26 degrees C], an RMSE of 0.13 degrees C, an MAE of 0.09 degrees C, and a SEE of 0.21 degrees C). Conclusion: Supervised machine learning approaches can effectively predict Tc among workers wearing highlevel PPE.

Travail dans une ambiance thermique extrême

A. R. Bah, M. Muntaha, L. Metlitsky, C. P. Vasquez, T. Ayala, I. M. Lopez, S. Larose, K. Ditsch, K. Nielsen, S. Sharma, R. Blake and H. Norouzi.

The hidden heatwave: Thermal hazards in the New York City subway system.

BUILDING AND ENVIRONMENT. 2026;306.

https://doi.org/10.1016/j.buildenv.2026.115327

Underground transit systems (Subway) are susceptible to frequent heat waves, which pose serious health and safety risks to commuters and transit workers. Yet, the patterns and extent of temperature changes within the subway system remain insufficiently understood. To address this gap, we conducted a study of thermal variability across 112 subway stations in New York City. Temperature and relative humidity were measured at both platform and street levels. Results show that during the summer, 70% of subway stations had platform heat index higher than street level heat index. We also developed a machine learning forecasting model to predict platformlevel temperatures. The model achieved strong predictive performance of (R2 = 0.85 at platform-level). These findings highlight stations where heat management is most needed and demonstrate the potential for predictive tools to inform targeted interventions that improve the resilience and safety of urban transit systems.

Y. Y. Zhao, Y. R. Huang and W. W. Liu.

Thermal and cognitive effects of frontal thermal radiation on body regions under low-activity conditions in a 32 °C hot environment.

BUILDING AND ENVIRONMENT. 2027;307.

https://doi.org/10.1016/j.buildenv.2026.115408

In high-temperature occupational environments, such as metallurgy, glass manufacturing, and maintenance of high-temperature equipment, workers are often exposed to local thermal radiation from hot surfaces, which may increase thermal discomfort and reduce work performance. Existing studies have mainly focused on whole-body thermal radiation, leaving the differential effects of radiation on individual body regions underexamined. This laboratory study investigated local thermal radiation in a climate chamber at an initial temperature of 32 degrees C under four conditions: whole-body frontal radiation, below-head radiation, head radiation, and no radiation. A directional infrared source with a nominal intensity of 2 kW/m2 was used under otherwise identical environmental conditions. Thirty-six healthy adults remained seated under low-activity conditions 1.5 m from the source and completed two cognitive test sessions at 30-65 and 75-110 min. The measured frontal radiation intensity at the body was 195 W/m2, and exposure lasted 135 min. Physiological parameters, including local skin, core, and eardrum temperatures and body weight loss, and subjective responses, including thermal comfort and sick building syndrome, were continuously monitored throughout exposure. Torso radiation primarily increased overall thermal sensation and thermal strain, whereas head radiation significantly reduced accuracy in cognitive tests involving memory and executive function. These findings indicate that the head and torso should be considered key protective regions in high-temperature occupational environments involving local thermal radiation, although their functional effects differ. Head heating was more closely associated with cognitive performance impairment, whereas torso heating mainly intensified overall thermal sensation and thermal strain.

Travail par fortes chaleurs et périodes de canicule

R. Vilasau, R. Puentes, K. Yohannessen, M. Cruz and C. Albornoz.

Extreme temperatures and workplace injuries by economic sectors in Santiago, Chile, from 2012-2019.

ENVIRONMENTAL RESEARCH. 2026;309.

https://doi.org/10.1016/j.envres.2026.125831

Background: Climate change increases extreme temperature events, posing critical risks to occupational safety. However, quantitative evidence for Latin America remains scarce. This study estimated relative risks (RR) and occupational injury burden associated with extreme heat and cold in Santiago Metropolitan Area (SMA), Chile, across economic sectors and demographic groups. Methods: A time-stratified case-crossover study (2012-2019) analyzed 603,676 occupational injuries using distributed lag non-linear models (DLNMs) with conditional quasi-Poisson variance to capture non-linear exposure-response associations and delayed-lag effects (5-day lag), controlling for humidity, PM2.5, and ozone. Risks at the 2.5th (4.8 degrees C) and 97.5th (23.4 degrees C) percentiles were compared to the all-industry Minimum Injury Temperature (10.7 degrees C). Results: Extreme heat increased injury risk in Hotel (RR =1.36; 95% CI: 1.09-1.70) and Transportation (RR =1.25; 95% CI: 1.02-1.53) sectors, affecting males (RR =1.30; 95% CI: 1.12-1.52) and females (RR =1.40; 95% CI: 1.20-1.65). Extreme cold increased risk in Other Industrial Activities (RR =1.18; 95% CI: 1.06-1.32) and Construction (RR =1.12; 95% CI: 1.02-1.24). Overall, 5542 injuries were attributable to non-optimal temperatures. Workers aged 25-34 showed the highest heat (RR =1.43; 95% CI: 1.22-1.68), whereas workers aged 55 and older were most vulnerable to cold (RR = 1.14; 95% CI: 1.04-1.24). Conclusion: Extreme temperatures elevate occupational injury risks in a Latin American metropolitan setting, displaying differential vulnerability across sectors and demographic profiles. These findings underscore the urgency of integrating climate-based early warning systems into regional occupational health policies.

A. Sinha and S. Pattnaik.

Heat stress intensification and workforce exposure over the Indian region.

ACTA GEOPHYSICA. 2026;74(6).

https://doi.org/10.1007/s11600-026-02062-5

Heatwaves across India have intensified substantially over the past few decades. Most existing assessments focus primarily on air temperature and often neglect the influence of atmospheric moisture on human thermal stress. High humidity makes people feel much hotter, especially in tropical regions, with direct effects on their health and work productivity. Therefore, this study investigates the evolution of extreme heat conditions across India from 1975 to 2024 using India Meteorological Department (IMD) observations and ERA5 reanalysis data. Extreme-heat days were identified independently in both datasets using a maximum temperature (Tmax) threshold of >= 45 degrees C and a two-day persistence criterion, and dates common to both datasets were retained for subsequent heat-stress analysis. Long-term trends are assessed with the Mann-Kendall test and Sen's slope estimator. To better reflect physiological heat stress, the Heat Index (HI) combines air temperature and relative humidity to represent apparent temperature. The corresponding impacts on labour productivity are estimated using the Decline in Work Performance (DWP) metric. The results indicate an overall increase in heat days over the study period, with substantial inter-decadal variability and the highest decadal average during 2015-2024. The HI analysis shows that atmospheric moisture makes

heat events much worse by raising the apparent temperature above the dry-bulb temperature. This intensification is associated with substantial reductions in work performance, leading to a decline in work capacity. Regionally, northwest and central India consistently experience the highest levels of heat stress and associated productivity loss. The results demonstrate that heatwaves in India cannot be characterised solely by temperature, as atmospheric moisture is a critical factor in intensifying thermal stress. The associated productivity losses indicate an increasing socio-economic burden of heat stress and workforce exposure across India. These results highlight the need for integrated climate adaptation and heat-risk management strategies that account for both climatic and workforce vulnerability.

P. Wrona, N. Koch, Z. Rózanski, G. Pach, A. P. Niewiadomski and J. Fernandes.

Model-Based Assessment of Heat Wave Impacts on Occupational Heat Stress and the Economic Sustainability of Mitigation Measures.

SUSTAINABILITY. 2026;18(20).

https://doi.org/10.3390/su182010282

Increasing exposure of workers to heat-wave conditions and occupational heat stress highlights the need for methods that integrate the assessment of thermal working conditions with the selection of sustainable and economically justified protective measures. This article proposes an integrated technical-economic framework for assessing heat stress during outdoor work, based on the Wet Bulb Globe Temperature (WBGT) index and dry-bulb temperature td. The framework also enables the determination of cost-effectiveness domains for selected protective solutions. Three environmental scenarios and four variants of meteorological conditions were analysed, representing different combinations of solar exposure, humidity, and air movement. The calculations assumed an 8-h work shift, including 4 h during which conditions exceeded the adopted criterion, a 10-person work team, and a labour cost of EUR 30/(worker & centerdot; h). The preventive measures analysed included organisational measures, shading, local mechanical cooling, combinations of technical solutions, and a separated cooled work zone; PCM cooling vests were considered solely as a supplementary measure. For each variant, avoided losses, implementation costs, economic balance, the equivalent number of avoided work stoppages, and the minimum number of avoided work stoppages required to achieve cost-effectiveness were determined. The cost-effectiveness threshold ranged from one avoided work stoppage for shading, through three avoided work stoppages for mechanical cooling and the technical package, to eight avoided work stoppages for a separated cooled zone. The proposed approach constitutes a modifiable framework for selecting measures to mitigate the effects of heat stress under different climatic, organisational, and cost conditions.

X. Liang, H. T. Dang and W. Lawal.

Weather Effects on Construction Worker Safety in the United States.

CONSTRUCTION RESEARCH CONGRESS 2026: CONSTRUCTION EDUCATION; WORKFORCE DEVELOPMENT; AND HEALTH, SAFETY, AND WELLBEING2026. p. 1216–25.

https://doi.org/10.1061/9780784486993.119

Construction workers often operate outdoors, making them highly vulnerable to weather-related risks. Previous studies have mainly focused on the impacts of extreme weather on worker safety, while systematic research on the effects of different weather conditions, such as moderate cold, heat, and rain, remains limited. This study addresses this gap by analyzing construction accidents across a broader range of weather scenarios. A total of 16,365 Occupational Safety and Health Administration

(OSHA) accident reports from 2015 to 2024 were matched with historical weather data. Using a hybrid classification approach combining rule-based natural language processing and machine learning, 554 weather-attributed accidents were identified under high-temperature, low-temperature, and rainy conditions. The results reveal distinct risk patterns: exposure-related incidents are predominant in hot weather, while fall-related accidents are most frequent in cold and rainy conditions. Polynomial regression analysis confirmed nonlinear relationships between accident frequency and weather variables, identifying peak risks near 0 degrees C, around 31.4 degrees C, and under light rainfall. These findings highlight the need for weather-responsive safety strategies in construction. Although limitations exist, such as the exclusion of additional weather factors such as wind speed and humidity, this study still provides valuable insights to support the development of safety interventions targeting weather- related construction risks.

Actualités octobre 2026

- ## Travail par fortes chaleurs et périodes de canicule

« Les travailleurs ont besoin d'un cap clair et de marges de manœuvre pour envisager leur travail dans la transition écologique ». Lemonde.fr, 29 septembre 2026

La future gendarmerie, qui doit ouvrir en 2027, sort de terre. Le Journal de Saône et Loire (presse, p.16), 4 octobre 2026

« C'est du jamais vu » : victime de la sécheresse, cette cidrerie du Finistère est en pénurie de pommes. Ouest-france.fr, 10 octobre 2026

Un colloque sur l'adaptation aux changements climatiques. La Terre de chez nous (presse, p.27), 14 octobre 2026

Coup de chaud sur les usines de la filière aéronautique. Latribune.fr, 29 octobre 2026

Réchauffement climatique : la France perdrait 79 millions d'heures de travail par an sous l'effet de la chaleur. Riskassur-hebdo.com, 30 octobre 2026

De nouvelles études de l'OIT révèlent les effets croissants du stress thermique sur l'emploi et la productivité dans six pays. Ilo.org, 29 octobre 2026

Le stress thermique pourrait coûter l'équivalent de 2,5 millions d'emplois à temps plein à l'Éthiopie, au Ghana et au Sénégal d'ici à 2040. Ilo.org, 30 octobre 2026

81.25% of workers reported heat stress: Sri Lanka is still treating heat as weather. Ft.lk, 1 octobre 2026

Restaurant workers face hidden dangers from gas stoves, including pollution and extreme heat. Latimes.com, 6 octobre 2026

Inside scorching Pakistani factories making clothes for global fashion brands. Apnews.com, 21 octobre 2026

LCQ13: Heat Stress at Work Warning system. Info.gov.hk, 29 octobre 2026

- ## Maladies liées à la chaleur

Summer events need a heat safety overhaul. The Mercury (presse, p. NA), 13 octobre 2026

Fire lieutenant dies battling Bucheon factory blaze. Chosun.com, 17 octobre 2026

- ## Outils et capteurs de mesure

STMicroelectronics International N.V.'s US Patent application for "ON-CHIP TEMPERATURE SENSOR" is in published phase now. Plus Patent News (fil de presse), 3 octobre 2026

Un thermomètre ingérable pour un suivi continu de la température. ElectroniqueS (presse, p. 41-42), 5 octobre 2026

Ever heard of a touchscreen garment? World's 1st is here - washable, breathable; it responds to finger presses, wireless. Livemint.com, 24 octobre 2026

- **EPI, matériaux protecteurs/refroidissants**

Le chiffre du jour : Un textile intelligent qui régule la température corporelle! Radiolac.ch, 20 octobre 2026

Un textile intelligent capable de refroidir le corps au soleil et de le réchauffer grâce aux mouvements. Vibration.fr, 20 octobre 2026