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CLIMATE CHANGE AND LABOUR: IMPACTS OF HEAT IN THE WORKPLACE

CLIMATE CHANGE, WORKPLACE ENVIRONMENTAL CONDITIONS, OCCUPATIONAL HEALTH RISKS, AND PRODUCTIVITY – AN EMERGING GLOBAL CHALLENGE TO DECENT WORK, SUSTAINABLE DEVELOPMENT AND SOCIAL EQUITY

Climate Vulnerable Forum
Forum de la Vulnérabilité Climatique
Foro de la Vulnerabilidad Climática

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65 YEARS
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This Issue Paper was prepared by academic and institutional experts as well as experts from the CVF country members to inform policy formulation. The information contained in this document is not necessarily intended for use in other contexts such as UN resolutions or UNFCCC negotiations and interested groups are encouraged to take contact with initiative partners for follow-up.

CONTENT

KEY FINDINGS[1]

- Excessive workplace heat is a well-known occupational health and productivity danger: high body temperature or dehydration causes heat exhaustion, heat stroke and in extreme cases, death. A worker's natural protection is to slow down work or limit working hours, which reduces productivity, economic output, pay and family income.
- A range of key international and national labour standards informed by decades of ergonomic and occupational health and safety research are designed to protect workers from adverse thermal conditions (high heat levels).
- Levels of heat in many tropical locations are already very high with respect to thermal tolerances even for acclimatised populations. Hot days and hot hours affect virtually all workers operating outdoors or in non-climate controlled conditions across several world regions. The continued changes to the climate with growing heat worsen the situation.
- Highly exposed zones, with effects experienced on a macro-scale, include the Southern United States, Central America and the Caribbean, Northern South America, North and West Africa, South and South East Asia.
- By the mid-1990s, heavily exposed countries, such as Bangladesh, have been estimated to have lost approximately 3% of the entirety of available daylight work hours due to heat extremes, underscoring the current nature of the problem with workers and employers needing protection now.
- Future climate change will increase losses. Even if the current commitments of the world governments to combat climate change are realized, losses by the end of this century to most vulnerable economies of all available daylight work hours will double or triple.
- The IPCC's 5th Assessment Report confirmed that labour productivity impacts could result in output reductions in affected sectors exceeding 20% during the second half of the century–the global economic cost of reduced productivity may be more than 2 trillion USD by 2030.
- The lowest income-bracket work – heavy labour and low-skill agricultural and manufacturing jobs – are among the most susceptible to climate change.
- Through this and other challenges altered thermal conditions also undermine development and present multi-faceted hurdles for the achievement of the Sustainable Development Goals (SDGs) related to poverty (SDG1) and hunger (2), health (3), education (4), gender (5) and income inequalities (10), good jobs and growth (8), and sustainable cities and communities (11), as well as climate change (13).
- Heat extremes also affect the very habitability of regions, especially in the long term, and may already constitute an important driver of migration internally and internationally.
- Since November 2015, the ILO adopted Guidelines for governments and other labour organizations to address the health and safety ramifications of climate change. But no international organization has established a programme to assist countries vulnerable to the challenges of climate change for the workplace.
- Limiting warming to 1.5 Celsius degrees as enshrined in the UNFCCC Paris Agreement would still result in a substantial escalation of risks but increases the viability of adaptation measures and contains the worst impacts in health, economic and social terms.
- Actions are needed to protect workers and employers now and in the future, including low cost measures such as assured access to drinking water in workplaces, frequent rest breaks, and management of output targets, carried out with protection of income and other conditions of Decent Work.
- Further analysis of the health and economic impacts of climate change in the workplace is needed to understand the full impacts of current and future climate. This should be linked to application of specific heat protection methods based on sustainable energy systems and conditions of Decent Work. Current and emerging analysis results should be the basis for effective national adaptation and mitigation policies.

[1] See the full list of references at the end of this document.

FIGURE 1.
Typical workplaces with excessive heat exposures during several months each year.

Sugar cane cutting by hand in Nicaragua, 2003.

This work and other heavy labour agricultural activities in many tropical areas have to be carried out during the hottest season each year. Solar heat radiation adds substantially to the ambient air heat.
Heat stress and heavy work create injuries, clinical health risks and daily productivity losses. Many of these workers are paid by production output, so heat causes longer workdays or reduced daily income.

T.Kjellstrom photos

Shoe manufacture in Haiphong, Viet Nam, 2002.

Factories in low and middle income countries that produce consumer goods, many of which are destined for consumption by high income countries, seldom have air conditioning or other effective cooling and ventilation systems. Heat stress and the same daily production targets in all parts of the year means that the workers have to work longer each day in the hot season than in cool seasons; but the salaries typically remain the same.

T.Kjellstrom photos

OVERVIEW

Excessive heat while working, generally at temperatures above 35° Celsius, creates occupational health risks and reduces work capacity and labour productivity (Parsons, 2014). Maintaining a core body temperature close to 37°C is essential for health and human performance, and large amounts of sweating as a result of high heat exposure while working creates a risk of dehydration. Excessive body temperature and/or dehydration causes "heat exhaustion", slower work, more mistakes while working, clinical heat effects (heat exhaustion, heat stroke, and even death; Bouchama and Knochel, 2002) and increased risk of accidental injuries (Schulte and Chun, 2009). These health effects lessen labour productivity, whether the worker is in paid work in a range of industries, in traditional subsistence agriculture or farming, or in other daily life activities (examples in Figure 1). Daily family activities, such as caring for children or the elderly, are equally affected.

The rapid increase of heat levels due to climate change is making such risks more severe for large shares of the global working population (Kjellstrom et al., 2009a). In January 2016, the World Meteorological Organization confirmed the likelihood that the average global temperature change had already reached 1 degree Celsius (or 1.8° Fahrenheit) (WMO, 2015). In West Africa, for

instance, the number of very hot days per year doubled since the 1960s, with an increase of approximately 10 additional hot days with each decade (McSweeney et al., 2010). Heat waves that are more prevalent as a result of climate change bring punctual spells of intense heat that are particularly dangerous for exposed workers. However, global warming is also altering the average climate experienced throughout the year (WMO, 2015).

This rising heat in the workplace is a significant concern to any person working out-of-doors or in indoor conditions without climate control or with ineffective control of ambient temperatures. Primary sectors of the economy, especially agriculture, are worst affected. It also presents challenges for the manufacturing sector, including construction and industrial work wherever heat is poorly controlled. Certain service sector professions are also affected, such as sports, tourism and transport. Work that involves high levels of physical exertion, such as heavy lifting and manual labour, are particularly affected since individuals tire faster and metabolise heat less effectively under exertion. However, even basic office and desk tasks are compromised at high levels of heat as exhaustion sets in. Physiological acclimatization provides some protection, but it has limits and requires 1-2 weeks of heat exposure to fully develop. During the hot season in hot countries workers have usually reached their acclimatization limit, and increased heat still creates the risks referred to in this paper.

As a challenge to Decent Work, this issue needs more attention. The workplace heat concern was first mentioned in the fourth (2005-07) assessment report of the Intergovernmental Panel on Climate Change (IPCC) and given a much stronger focus in the fifth (2013-15) IPCC assessment. Effective understanding of the issue required combining long-standing research into physiological responses to heat with the emerging science of climate change. Late recognition in science has delayed policy responses. No major international organization has established a programme of response to the challenges it presents. Trade Union materials on occupational health usually refer to heat as a hazard, but the link to climate change impact has not been pursued.

Because of the scale of the challenge, its impact is likely to be a major economic effect of climate change. Economic losses occur at worker and family level, enterprise level and community level. For heavily exposed economies, effects are meaningful enough to alter national output, affecting in turn the global outlook. The economic, social and health effects are a challenge for efforts to tackle poverty and promote human development including the global Sustainable Development Goals (SDGs) where it could undermine progress towards SDGs 1 (poverty), 2 (food), 3 (health), 4 (education), 5 (women), 8 (economy), 10 (inequality), 11 (cities) and 13 (climate). The shifting of the thermal conditions of many of the world's workplaces is leading to breaches of international

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ISO standards and International Labour Organization (ILO) Codes of Practice on hot workplace environments. It is also likely to amplify current migration patterns for the most vulnerable workers.

The impact analysis of different possible global temperature increases this century show that lost working hours have already been substantial and expand rapidly even for a 1.5° Celsius increase of global temperature (see analysis later in this paper). Impacts worsen much more considerably for 2 °C and for the 2.7°C level of warming implied by governments' existing commitments under the new UN Framework Convention on Climate Change (UNFCCC) Paris Agreement. Business-as-usual warming (4°C) could yield output reductions for some sectors in excess of 20% during the second half of the twentieth century.

Climate change is also among the root causes of migration, which was recognized by the UNFCCC Paris Agreement with the formal inclusion of "migrants" in the Preamble and 2015 UNFCCC Paris decision on Loss and Damage. Climate change and climate change-related environmental degradation is driving environmental migration with a potential to change labour migration patterns. Migrant workers are often among the most harshly affected by climate-related risks in a world where the importance of migrants in the global economy continues to grow. Migrant workers frequently find themselves–at origin, transit and destination–engaged in occupations that are highly exposed to rising heat, such as in the construction or agricultural sectors. Migration also represents a viable adaptation strategy to climate change with practical examples of temporary and circular labour migration.

The economic, health and social ramifications of rising heat in the workplace requires an urgent response to protect workers, families, businesses, and vulnerable economies through investment in appropriate climate change adaptation measures. A number of adaptation responses have been identified, including establishing or reinforcing worker rehydration regimes, shade, insulation and air conditioning. An immediate opportunity also exists with implementation of the 2015 ILO Guidelines for a just transition towards environmentally sustainable economies and societies for all, which include a focus on climate change and health, safety and social protection in the context of climate change. Nevertheless, the ability to manage the impact of climate change on labour diminishes at higher heat levels, while unavoidable losses and damage are an additional reason to pursue more ambitious emission control responses to mitigate climate change.

This Issue Paper explains the underlying mechanisms of the impact of climate change through altered thermal conditions in the workplace, shows examples of the current and likely future impacts and provides indications of policy response options to these challenges.

BASIC MECHANISMS FOR HOW HEAT IN THE WORKPLACE AFFECTS PRODUCTIVITY, HEALTH AND SAFETY

The conflict between health and productivity that workplace heat creates

It is well known that physical work creates heat inside the body and that this affects occupational health and performance when combined with excessive workplace heat (Parsons, 2014). The physiological mechanisms have been known for more than 100 years, and during the last 50 years hundreds of laboratory and field studies have documented heat risks and injury causing heat exhaustion and heat stroke (Bouchama and Knochel, 2002), and even deaths (MMWR, 2008). When heat exposed workers slow down or take more rest to avoid the health effects of heat, their hourly work output and productivity goes down (Kjellstrom et al., 2009a). This is the conflict between health and productivity that workers and employers face.

Climate change has and will continue to exacerbate workplace heat as highlighted in the latest IPCC assessment (Smith et al., 2014). For many middle and lower income countries, more than half of the work force is currently exposed to this type of hazard (DARA and the CVF, 2012). Figure 1 shows examples of agricultural and factory work that can be affected in locations with long hot seasons and expectations of high productivity.

The occupational and ergonomic sciences have long examined the effects of heat extremes on the safety, health and productivity of workers. Occupational guidelines for heat have existed in Europe and the United States since the 1980s (NIOSH, 2015). International ISO standards have also been in place since the 1980s (ISO, 1989a, b), complemented additionally now by ILO codes of practice (ILO 2001) among other guidelines. In particular, ISO 7243 (1989a) specifies the health based limits (body temperature) for heat stress on workers, and ISO 7933 (1989b), specifies a method for the analytical evaluation and interpretation of the thermal stress experienced by a subject (excessive sweating) in a hot environment. Moreover, the ILO Code of Practice on "Ambient Factors in the Workplace" deals with both heat and cold, including prevention and control measures in hot environments. Growing heat extremes for working people also undermine Decent Work as promoted by the International Labour Organization (ILO, 2013; UN, 2015).

Considerable industry-focused analysis exists, explaining, for example, how the climate conditioning of call centres can promote optimal worker productivity (Niemelä et al. 2002). Furthermore, many of today's military combat operations in regions with thermal extremes are guided by the latest knowledge of this field, such as the United States defence force (USDAAF 2003).

From the perspective of climate change, the most predictable and highest confidence outcome of global warming is the increase of local heat levels in most of the world, as demonstrated by the IPCC (Collins et al., 2013). This makes predicting the impacts of changing thermal conditions in the workplace more reliable than for estimates of changing storm patterns, rainfall regimes, wind and other aspects of the consequences of climate change.

"CLIMATE CHANGE HAS AND WILL CONTINUE TO EXACERBATE WORKPLACE HEAT"

The physiological foundation of the work-heat challenges

The core body temperature of every human needs to be kept close to 37°C in order to avoid serious health risks (Parsons, 2014). When the external temperature is higher than 37°C, the only way for the body to stay at a healthy temperature is through loss of heat via sweat evaporation. However, high external air humidity, and the clothes worn in some jobs, limit sweat evaporation and core body temperature goes up. In many situations the only way to avoid clinical "heat stroke" is to reduce the work rate, take more rest, and drink water frequently (Parsons, 2014). As mentioned earlier, acclimatization to

2015) highlights the considerable public health risks that environmental heat exposure effects on the heart and vascular system will create.

To quantify the workplace heat exposures and estimate associated health and economic risks, it is essential to find formulas that combine the four elements that contribute to the relevant external heat levels: temperature, humidity, air movement (wind speed) and heat radiation (outdoors mainly from solar radiation). During the last century more than 160 different heat indices were developed (De Freitas and Grigorieva,