

White Paper

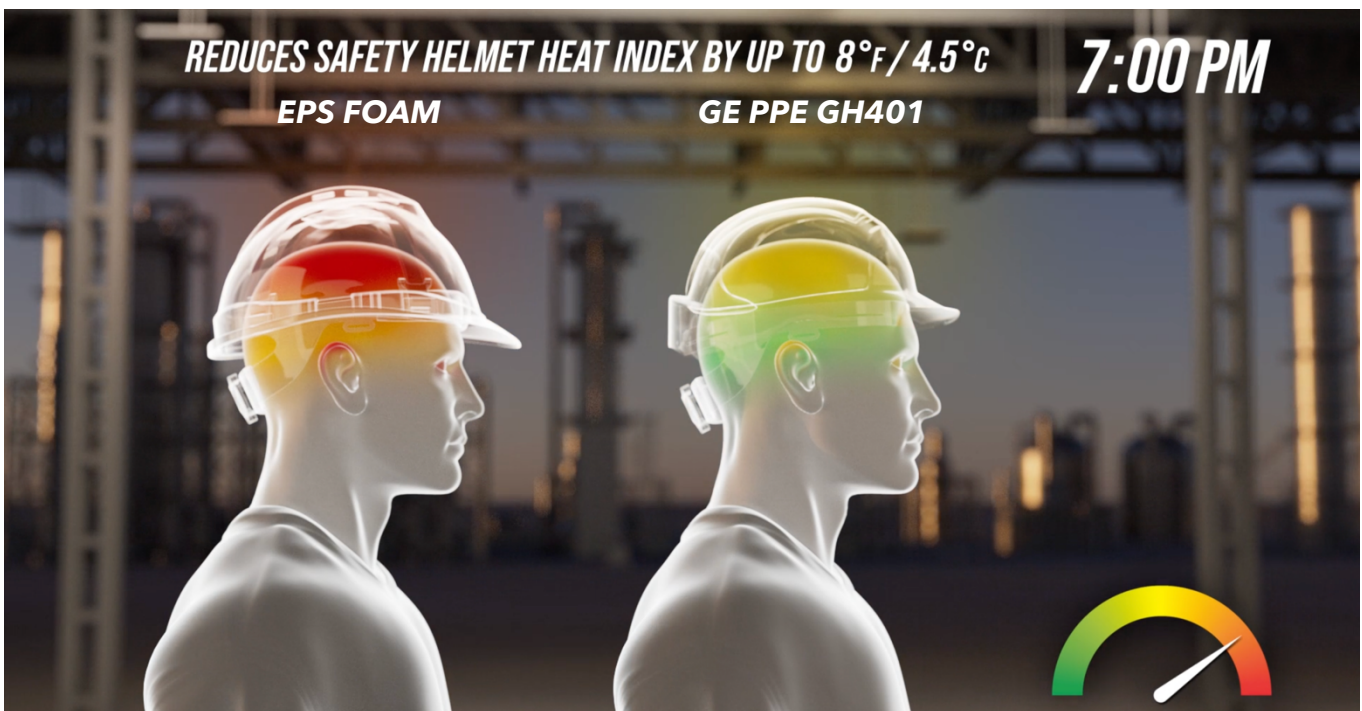
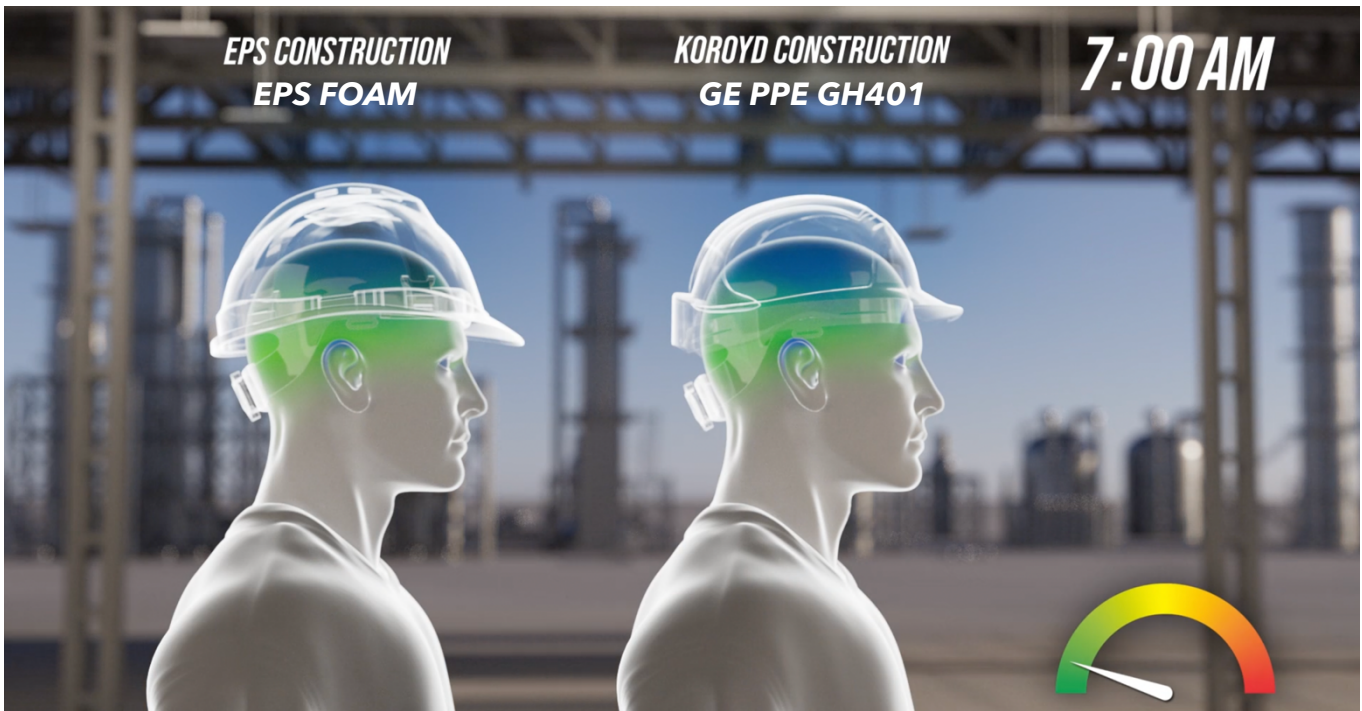
Heat-Reducing Workplace Helmets



Personal
Protective
Equipment

Caco America LLC

A practical solution for heat stress



Abstract

Heat stress poses significant risks to worker health and productivity, causing serious illnesses, injuries, and cognitive impairments. Ironically, the mandatory personal protective equipment (PPE) exacerbates the issue by trapping heat. Upon this dilemma, Caco America offers a compelling solution: state-of-the-art GH400 and GH500 helmets engineered to prevent heat build-up, while maintaining the highest protection standards. These helmets represent a call to action for the construction industry to prioritize worker safety—addressing the heat issue without loosening essential protection requirements.

Introduction

Heat stress is unfortunately becoming a common occurrence in both indoor and outdoor work environments. Rising temperatures, high humidity, strenuous physical demands and improper clothing can all lead to heat-related illness. The Centers for Disease Control and Prevention (CDC) reports that in an average year heat causes 67,512 emergency department visits, 9,235 hospitalizations, and 702 deaths [1]. On top of physical ailments, heat stress also leads to lost productivity. An international report projected that by 2030, more than 2 percent of total working hours will be lost every year across the globe because it's either too hot to work or because workers must work at a slower pace [2]. Between health hazards and lost productivity, heat stress is bad for business. With millions of U.S. workers exposed to heat in the workplace, it's critical for safety managers to prioritize heat safety.

Caco America attacks the problem using KORoyD technology: the heat inside the helmet is wicked away, reducing the heat stress felt in comparison with other EPS helmets from competitors.

What Exactly is Heat Stress?

Heat stress is the physiological stress experienced due to excessive heat when the body can't regulate its internal temperature properly. According to the World Health Organization (WHO), the amount of heat stored in the body is determined by a combination of factors which includes [3]:

- A person's inability to eliminate internally generated heat from metabolic processes due to environmental heat stress factors such as high temperatures, humidity, stagnant air and high thermal radiation

- Uniforms, personal protective equipment, and clothing that create a heat loss barrier
- External heat gain from the environment from factors including the sun and surrounding air

In addition to these environmental risk factors, vulnerability to heat can be caused by an individual's physiological factors including age, health conditions, weight, medications and hydration status.

Dangers of Heat Stress

While some may dismiss heat stress as trivial, it is a serious health condition that can lead to permanent disability and even death. Intense heat exposure in the workplace can result in:

- A series of conditions, including heat cramps, heat exhaustion, heat rash, and heat stroke, which can be fatal [4].
- An increase in the risk of injuries in the workplace due to issues such as sweaty palms, dizziness and foggy safety glasses.
- Cognitive impairments [5]: When working under intense heat stress, workers are more likely to commit errors due to slower mental processing and compromised judgement [6]. In addition, the likelihood of accidents increases, for heat stress negatively impacts brain function [7], as it impairs focus [8], reaction time [9], and decision-making abilities.

To protect workers and create a safe workplace environment, it's essential to implement proactive measures and follow official heat stress prevention guidelines.

Occupational Safety and Health Administration (OSHA) Guidelines

The good news is that the negative health impacts from heat stress are predictable and mostly preventable when the right steps are taken in the workplace. Staying up-to-date and following the latest guidelines from OSHA is essential to ensure workers are properly protected.

OSHA recently issued a Notice of Proposed Rulemaking (NPRM) for Heat Injury and Illness Prevention in Outdoor and Indoor Work Settings—an important initiative to set a federal standard to protect U.S. workers from heat-related hazards [10]. The code would require employers to create a proactive plan to control heat dangers in the work environment to help prevent injury, illness and fatalities. To protect and help prevent workers from experiencing heat

related illnesses, the OSHA proposal urges implementing a heat injury and illness prevention plan (HIIP) to evaluate and control heat hazards specific to each specific work environment with emergency procedures and mitigation measures [11]. **While still in the proposal stage, the current guidelines are expected to take effect in the future; however, in some states, they are already the law, as with California's HIIP law [12].**

Training is also essential to enforce the prevention plan. OSHA prescribes implementing a thorough training program for all employees following OSHA's Heat Stress Guide [13]. Components to include are:

- Define the hazards of heat stress
- Outline predisposing factors, danger signs and symptoms
- Review first aid procedures and protocol if heat stroke occurs
- Educate employees to take preventative measures
- Remind employees regarding the dangers of drugs and alcohol
- Demonstrate the proper use of protective clothing and equipment
- Provide ongoing refresher trainings

Familiarizing oneself with OSHA's HIIP before it goes into effect is highly beneficial for any Health and Safety (H&S) manager not only because it ensures—mental and physical—safety of personnel, but also because preparing in advance is advantageous.

There are also many actions that employers can take to reduce heat impact: provide proper ventilation, portable exhaust systems for small areas, air treatment, air cooling and/or heat conduction blocking when applicable. In addition, OSHA recommends the following practices when necessary:

- *Acclimatize Workers* – Expose workers to a hot setting for progressively longer periods to enable their bodies to acclimate gradually avoid shocking the heart and other organs [14]. This can help workers tolerate high levels of heat stress and perform work with a lower core temperature and heart rate.
- *Encourage Fluid Intake* – Provide cool water and encourage workers to drink small amounts frequently to stay hydrated. Water should be easily accessible in the work area.

- *Reduce Extreme Physical Demand* - Consider reducing physical exertion such as excessive lifting or digging by spreading the work over more individuals and using relief workers to prevent overexertion.
- *Provide Recovery Areas* – Provide air-conditioned areas or rooms where workers can cool off and take a water break
- *Reschedule Hot Jobs* – Monitor the heat index, commonly referred to as the apparent temperature, and schedule hot work for the cooler part of the day. Schedule routine maintenance in hot areas early in the morning or during the cooler seasons.
- *Monitor Workers* – Keep an eye on workers prone to heat stress. Workers can also monitor themselves by checking their heart rate, recovery heart rate and temperature.

The Role of PPE and Safety Helmets in Preventing Heat Stress

PPE could, and should, play a critical role in preventing heat stress illness. Standards exist to ensure that PPE is effective at protecting workers against identified risks—falls, chemical burns, cuts—but no such standards exist to mitigate the perilous effects of heat stress. Hence, employers often find themselves in a difficult situation trying to properly protect employees from both occupational hazards and heat-related illness. Many traditional PPE materials are heavy and unbreathable which can trap heat and prevent the body from cooling down – increasing the risk of heat illness.

For example, safety helmets are an essential form of PPE for many industrial trades and construction sites. However, traditional hard hats lack the innovation to dissipate heat, often making the head feel warmer than the outside temperature and potentially contributing to heat-related illness. A recent survey on head protection practices and challenges conducted by J.J Keller & Associates, Inc. and the International Safety Equipment Association (ISEA) found that heat-related concerns are a top challenge when selecting and implementing head protection [15]. **With record-breaking temperatures, the survey revealed that heat has played a major role in employees deciding to take their head protection off or not even wear it at all. When asked about head protection innovation, self-cooling for heat-related comfort topped the list, with 47% of survey respondents noting that a "self-cooling" feature would be very valuable.** Fortunately, modern helmet designs with

features to combat heat stress are now available; they consistently cool the head and can reduce overall body temperature to keep workers comfortable and protected while working. Benefits of these novel helmets include:

- **Safety Compliance:** "self-cooling" helmets provide the same level of protection as "non-self-cooling" helmets while offering additional comfort benefits.
- **Improved Airflow:** Multiple air vents facilitate natural air circulation, helping to dissipate heat and keep the user's head cool.
- **Enhanced Comfort:** "Self-cooling" helmets reduce heat buildup, making it more comfortable for workers to wear for extended periods, promoting compliance with safety regulations, such as reducing helmet removal.
- **Increased Productivity:** A cooler, more comfortable worker is less likely to experience fatigue and dehydration, leading to higher productivity and fewer errors on the job site.

More specifically, consider the award winning GH400 Safety Helmet from GE PPE—powered with KORROYD technology [16]. **Providing both protection and comfort, it is holistically designed to ensure that all features of the helmet work together to wick away hot, humid air from the wearer to refresh the head and reduce overall body temperature.** Even non-vented helmets (e.g., GE E-rated) with KORROYD are effective at combating this.

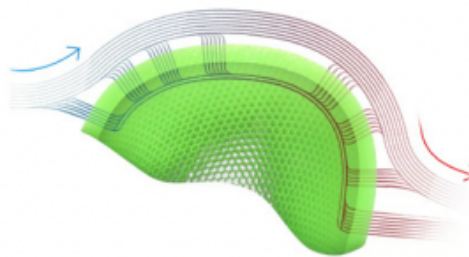


Figure 1: Visual representation of KORROYD's holistic approach to combating heat stress. Air cooler than inside removes the heat accumulation.

The helmet also offers maximum safety protection as it is lined with KORROYD's advanced impact absorbing technology as the inside protective layer [17]. While other helmets on the market use EPS foam which compresses during impact, KORROYD material crumples instantly during the impact. The material acts as an energy absorber rather

than a spring to protect the wearer from impact and serious injury.

Key features of the GH400 Safety Helmet include:

- **Heat-stress reduction:** As mentioned above, its cross-ventilation system—combined with KORROYD—enables heat and humidity to circulate and escape through 10 vents, allowing them to escape from the bottom of the shell.
- **Advanced Impact Technology:** The GH400 and GH500 are the only helmets which utilize KORROYD as their sole protective impact absorbing material.
- **ABS External Shell:** Ultra-light weight and usable in temperatures ranging from -30°C to 60°C.
- **Internal Padding:** Antimicrobial Wicking Memory Foam Sweat-Band Padding provides increased comfort and helps prevent sweat from dripping.
- **Accessory slots:** 10 slots can accommodate and securely attach different accessories in the front, rear, and sides. These can include flashlights, protective eye shield, full face visors and protective earmuffs.



Figure 2: Key features of the GH400 Safety Helmet.

A Spotlight on KORROYD Technology

KORROYD is an innovative welded tube structure used for over a decade in the sports industry to enhance safety for athletes in cycling, skiing, and motorbike racing. Recently, this high-standard, protective, and cooling material has been adapted to improve industrial safety helmets. Upon impact, the tubes instantly crumple to absorb maximum force and minimize energy transferred to the user's head. This helps protect the wearer from life threatening injuries.

Comprised of 95% air, it allows helmets to remain lightweight, while still providing maximum protection.

KOROYD has completed rigorous testing to evaluate thermal comfort in industrial helmets. The results revealed that KOROYD integrated helmets show a reduction of up to 8 degrees Fahrenheit or 4.5 degrees Celsius on the heat index compared to traditional helmets with EPS foam.¹ Heat and humidity can rise and evaporate through KOROYD's unique tubular structure, which is critical to reduce the risk of heat-related illness while wearing safety helmets in hot work environments.

Prioritizing Protection Against Heat Related Illness

Heat related illness is a common occurrence in industrial environments, but it doesn't have to be. Highly preventable, safety managers must take proactive steps to eliminate heat hazards. Following OSHA's guidelines, implementing a heat injury and illness prevention plan and taking measures to ensure workers stay cool and hydrated on the job is an essential first step. It's also critical to review the required PPE to ensure it is not contributing to heat stress. Implementing breathable, lightweight safety helmets can help reduce heat stress illness and encourage workers to keep helmets on to prevent other injuries. Prioritizing these safe work practices and new-age PPE will protect workers from heat hazards, improve productivity and provide a positive work environment.

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¹ Tested in a controlled climate chamber with an initial maintained temperature of 69.5 degrees Fahrenheit and 50% relative humidity. For more

information, please access: <https://www.geppe.cacoamerica.com/wp-content/uploads/2023/10/assessing-heat-stress-in-industrial-helmets.pdf>

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