



Understanding and preventing Heat Stress





Understanding and preventing Heat Stress in the FR World



Extreme heat causes more deaths (100/yr.) than any other weather-related hazard; each year more than 65,000 people seek medical treatment for extreme heat exposure.



Fabrics Role In minimizing Heat Stress





Remember Heat Stress is -

- Measurable and has a medical definition
- Heat stress is actually several heat-induced illnesses
- We know what causes heat illness -
 - Poor hydration
 - Lack of rest breaks
 - Lack of shade
 - Poor health



Need to understand the Body's Cooling Mechanisms

The body is continuously generating heat, which must be released to maintain a core temperature of **98.6° F**.

Four Basic Cooling Mechanisms

- **Radiation** – Heat is radiated through the skin and absorbed by the surrounding cooler air
- **Conduction** – Direct contact with cooler objects like water
- **Convection** – Moving air from breeze, fans, etc.
- **Evaporative Cooling** – Water from our blood absorbs heat and rises to the skin surface via sweat glands so that it can evaporate and cool the body





How Fabrics can assist in Cooling....

Effective fabrics typically will be a combination of:

Light weight – Less insulating allows more heat release (radiation)

Open Weave – More air permeable allows more air to cool and evaporate moisture (convection)

Moisture Wicking – Moves more moisture to the surface for the evaporative cooling (evaporation)



The Challenge is....

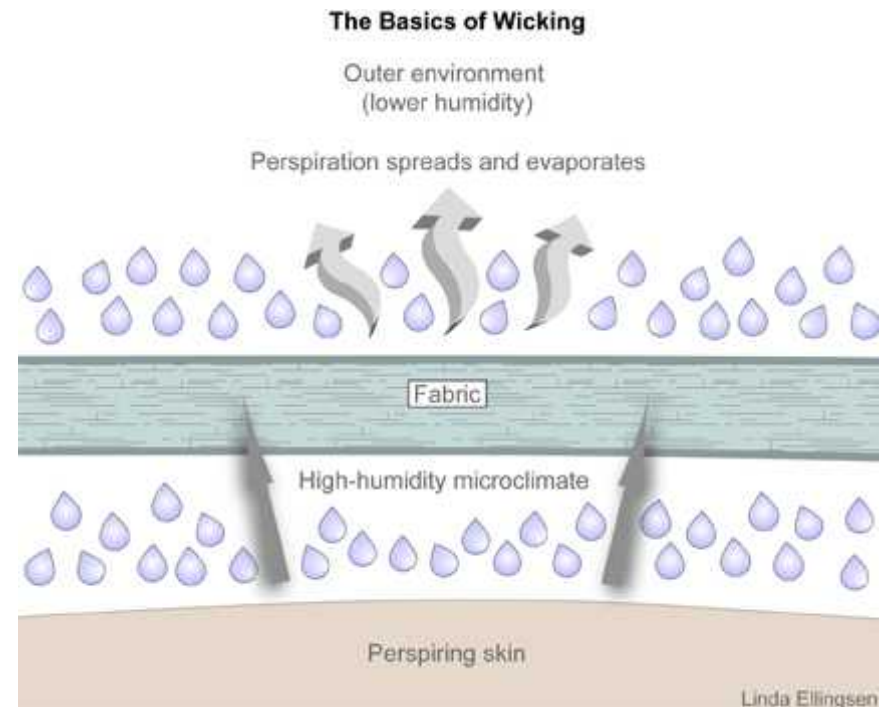
- When the ambient temperature is above body temperature, then radiation, conduction and convection struggle to cool the body.
- The only mechanism left to cool the body is evaporation of perspiration.





Fabric Wicking Assists Evaporative Cooling

- Wicking fabrics are typically a blend of hydrophobic and hydrophilic fibers
- Hydrophilic fibers readily absorb moisture while hydrophobic absorb very little
- Hydrophilic fibers absorb moisture from the skin surface, drawing heat away from the body
- Capillary action allows the moisture absorbed to spread to the other fibers that don't absorb the moisture, increasing the surface area for faster evaporation and cooling
- Some cases adding a moisture wicking finish to the hydrophobic fibers assists in evaporation





The Bottom Line.....

- Separate studies by leading fabric suppliers agree fabric type and weight are generally unrelated or inconsequential in controlling heat stress
- Wear trials are the most effective way to judge comfort
- Hydration, rest breaks and shade are the most effective control methods, with hydration being by far the most important





Recommendations for Workers

Workers should avoid exposure to extreme heat, sun exposure, and high humidity when possible. When these exposures cannot be avoided, workers should take the following steps to prevent heat stress:

- Wear light-colored, loose-fitting, breathable clothing such as cotton
- Avoid non-breathing synthetic clothing
- Gradually build up to heavy work
- Schedule heavy work during the coolest parts of day
- Take more breaks in extreme heat and humidity
- Take breaks in the shade or a cool area when possible
- Drink water frequently
- Drink enough water that you never become thirsty. Approximately 1 cup every 15-20 minutes
- Avoid alcohol, and drinks with large amounts of caffeine or sugar
- Be aware that protective clothing or personal protective equipment may increase the risk of heat stress
- Monitor your physical condition and that of your coworkers



Recommendations for Employers

Employers should take the following steps to protect workers from heat stress:

- Schedule maintenance and repair jobs in hot areas for cooler months
- Schedule hot jobs for the cooler part of the day
- Acclimatize workers by exposing them for progressively longer periods to hot work environments
- Reduce the physical demands of workers
- Use relief workers or assign extra workers for physically demanding jobs
- Provide cool water or liquids to workers
- Avoid alcohol, and drinks with large amounts of caffeine or sugar
- Provide rest periods with water breaks
- Provide cool areas for use during break periods
- Monitor workers who are at risk of heat stress
- Provide heat stress training that includes information about:
 - Worker risk
 - Prevention
 - Symptoms
 - The importance of monitoring yourself and coworkers for symptoms
 - Treatment
 - Personal protective equipment



Remember the 3 Rs: Rehydrate, Rest and Recognize

Rehydrate: Drink cold water consistently throughout the day—even *before* you feel thirsty.

Rest: Take breaks in shaded/air-conditioned areas:

Especially in mid-afternoon, when daytime temps hit their peak and the sun is at its strongest. Shorter, more frequent work/rest cycles are best.

Recognize: Learn to recognize the symptoms of heat-related illness in yourself and others:

- Confusion
- Dizziness
- Fainting
- Fatigue
- Headache
- Muscle or abdominal cramps
- Nausea, vomiting, or diarrhea
- Pale skin
- Profuse sweating
- Rapid heartbeat



Equipment Trends to Beat the Heat

A lot of new summer safety equipment has hit the market in recent years. Consider equipping your workforce with these to keep them safe and cool when the heat index starts to climb.

While rest, shade, and water are still essential, these new trends in cooling equipment can help keep workers comfortable and reduce the risks associated with high temperatures. Be Cautious are they safe in an arc flash or flash fire???

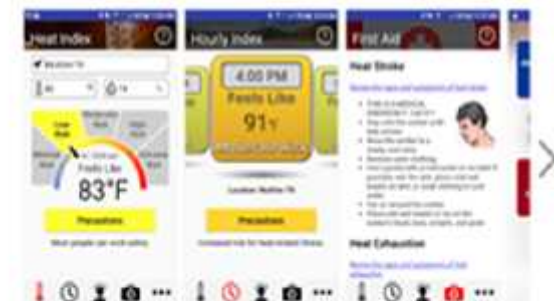
- *Hard Hat Neck Shades*
- *Hard Hat Cooling Pads*
- *Cooling Bandanas*
- *Cooling Towels and Wraps*
- *Pocket Heat Monitors – the new app is better*
- *Hydration Packs – camel back etc.*

Investing in some of the new trends in cooling equipment can go a long way to help beat the heat, they're not a substitute for the basics. In addition when it comes to FR protection many of these products could be an additional hazard .



Resources - The updated app

- The National Institute for Occupational Safety and Health and OSHA have collaborated to update OSHA's original Heat Safety Tool. The updated app, available for both Android and iPhone, provides a clearer user interface, while still providing the same information to help keep workers safe when working outdoors in hot weather. Extreme heat causes more deaths than any other weather-related hazard; each year more than 65,000 people seek medical treatment for extreme heat exposure.
- Employers should encourage workers exposed to hot and humid conditions to use the app to check the heat index and relevant protective measures. The app displays the heat index in the user's location and shows the current risk level. The app also forecasts the hourly heat index throughout the entire workday, giving employers information they can use to adjust the work environment as needed to protect workers.



Take precautions against outdoor heat while at work with the OSHA-NIOSH Heat Safety Tool. Featuring real-time heat index and hourly forecasts specific to your location, as well as occupational safety and health recommendations from OSHA and NIOSH, the OSHA-NIOSH Heat Safety Tool is a useful resource for planning outdoor work activities based on how hot it feels throughout the day.



EXTREME HEAT - What You Can Do to Prepare

- <https://www.cdc.gov/climateandhealth/pubs/extreme-heat-guidebook.pdf>



Thank You



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Questions

Do the colors of a garment really make a difference.
Does black/navy really raise your body temp in run?

- The avg radiant heat differential between the dark blue and light gray fabric color is up to 9 degrees F
- The radiant heat temperature under the dark blue coverall fabric was 106 degrees F compared to 97 degrees F for the light gray
- The avg surface temperature differential between dark blue and Gray is 25 degrees F. between dark blue and White is 45 degrees F.
- The peak surface temperature in full sun of the dark blue coverall fabric was 129 degrees F compared to 109 degrees F for the light gray.





Questions

Does heat stress trump 1910.269 or vice versa?

Heat stress is a fancy way of saying “it’s hot in here”.

Do people in heat stress fall under ANY FR standard rules and regs as far as being mandated to wear FR?

No, there is no Heat Stress

- Drink cold water consistently throughout the day—even **before** you feel thirsty.
- Take breaks in shaded/air-conditioned areas:
- Especially in mid-afternoon, when daytime temps hit their peak and the sun is at its strongest.
- Shorter, more frequent work/rest cycles are best.





Citations for Heat Stress?

- Heat stress hazards are cited using the “General Duty Clause.”
- **General Duty Clause**
 - Each employer shall furnish to each of his employees conditions of employment *and* a place of employment that are free from recognized hazards that are causing or are likely to cause death or serious injury or serious physical harm to his employees.





The “General Duty Clause”

NCGS 95-129(1)

- The employer failed to keep the workplace free of a hazard to which employees of that employer were exposed ***and***:
 - The hazard was recognized in the industry,
 - The hazard was causing or likely to cause death or serious physical harm, ***and***
 - There was a feasible and useful method to correct the hazard.





A couple of questions/concerns I hear about heat stress and FR garments are:

- Can I wear a cooling vest over my FR garments? If not, what is the best way to use a cooling vest with FR garments? **Why??**
And No
- What is the best recommendation for keeping my guys who are working inside where there is no AC and it's 150 degrees inside cool, yet also provide them the proper FRCs? **Nothing to do with FR, Hydrate breaks, fans, cooling stations**
- Is there an FR cooling vest on the market? **I do not believe so**





I would like to see the conversation include “thermal stress” as we have both Cold and Heat stress to deal with.

Here’s my hot topics:

- Competitors who call cotton and cotton blends “moisture wicking”
- Definition of moisture wicking
- Testing for “breathability” cfm higher is good but.....Nomex!
- Cold weather temperature “ratings”, and why we don’t offer those
- Effects of fatigue caused by heat stress

