



# In the HEAT of the Moment

Keeping heat stress at bay  
requires an arsenal of approaches.

Dying from heat stress on the job is a rare occurrence. The last fatality in Ontario was reported in 2001 and the latest figures from the Ontario Workplace Safety and Insurance Board for 2003 indicate 1,499 claims from workers exposed to temperature extremes. However, only 30 claims were for workers exposed to heat and light effects, including heatstroke, fatigue and syncope (fainting). So then why should companies keep a vigilant and relentless eye on its heat stress program?

Simply put, the numbers belie the real threat that heat stress can have on safety performance and productivity. Hot environments lower workers' mental alertness and physical performance. A single worker suffering from a heat-induced illness can jeopardize the safety of an entire crew, plant or community.

Direct physical reactions to heat include dizziness, sweaty palms, impaired vision from fogged-up safety glasses (moving from cold to hot environments), and accidental contact with hot surfaces (*see "Heat Stress Safety Hazards"*). How many employers track incidents or near misses as a factor of workers suffering from heat stress? How many incidents don't get reported by toughened and seasoned workers who consider it just part of their job?

Employers have a duty under occupational health and safety legislation to take every precaution reasonable in the circumstances for the protection of a worker. This includes developing policies and procedures to protect workers in hot environments due to hot processes or hot weather. For compliance purposes, most jurisdictions rely on the Threshold Limit Values (TLVs) for Heat Stress and Heat Strain published by the American Conference of Governmental Industrial Hygienists (ACGIH). These values are based on preventing unacclimatized workers' core temperatures from rising above 38°C.

B Y S U Z A N B U T Y N

## How our bodies cope with heat

“Heat stress” is the net (overall) heat burden on the body from a combination of

- body heat generated while working
- environmental sources (air temperature, humidity, air movement, radiation from the sun or hot surfaces/sources), and
- clothing requirements.

Most people feel comfortable when the air temperature is between 20°C and 27°C, and when relative humidity ranges from 35 to 60 percent. When air temperature or humidity is higher, people feel uncomfortable. Heat illness occurs when the body can’t adjust to additional heat.

As the environment warms up, the body tends to warm up with it. Our internal thermostat maintains constant inner body temperature by pumping more blood to the skin and by increasing sweat production. Under normal circumstances, the body increases the rate of heat loss to balance the heat burden created by the environment. In a very hot environment, the rate of “heat gain” exceeds the rate of “heat loss” and the body temperature begins to rise. A rise in the body temperature can result in the following heat illnesses, listed in order of severity (*for symptoms, treatment and precautions see “Heat Stress Illnesses.”*):

- heat edema
- heat rash

- sunburn (for outside workers)
- heat cramps
- fainting
- heat exhaustion, and
- heatstroke.

## Workplaces at risk

Operations more prone to heat stress than others include those featuring high temperatures, radiant heat sources (e.g., a furnace), high humidity, and direct physical contact with objects or strenuous physical activities while working in these conditions. Typical industrial workplaces include iron and steel foundries, nonferrous foundries, brick-firing and ceramic plants, glass products facilities, rubber products factories, chemical plants, and smelters.

The keys to keeping heat stress illness at bay are heat stress air monitoring, engineering controls, administrative controls and personal protective equipment. The latter needs special consideration because adding PPE to an already hot environment can add more heat stress to the worker.

## How hot is hot?

Monitoring heat in the workplace with technological equipment is arguably the best way to objectively know how hot it actually is.

Many people use the Humidex to gauge how hot it feels because it takes into account the effects of actual temperature and relative humidity. However, the Humidex is best used as a comfort factor, not a safety factor. It does not take into account wind speed, radiant heat from objects, or body cooling due to sweat evaporation — key factors used in the industry standard Wet Bulb Globe Temperature Index (WBGT). The WBGT was specifically developed for human safety in the 1950s by the military.

The WBGT is a complicated set of mathematical formulas. Unless you’re a mathematician, it’s not realistic or feasible to manually calculate the WBGT index every day. Heat stress monitors can do this job easily and quickly but they can be costly. For those workplaces without heat stress monitoring equipment, a simple

## Administrative Controls for Heat Stress

The following easy to implement, low- or no-cost administrative controls can offer workers added protection against heat stress.

- Assess the demands of all jobs, and have monitoring and control strategies in place for hot days and hot workplaces.
- Increase the frequency and length of rest breaks.
- Schedule strenuous jobs for cooler times of the day.
- Assign additional workers or slow down the pace of work.
- Make sure workers are properly acclimatized.
- Ensure that pregnant workers and workers with a medical condition discuss working in the heat with their doctor.
- Ensure first aid responders and an emergency response plan are in place in the event of a heat-related illness.
- Caution workers to avoid direct sunlight.
- Investigate any heat-related incidents.

response plan developed by the Occupational Health Clinics for Ontario Workers Inc. helps to gauge workplace heat and humidity range levels and identifies actions to take under these work conditions.

The Humidex Based Heat Response Plan uses specific WBGT ranges. It's important to note that it is not based on the outside Humidex reading but instead is based on the ACGIH Heat Stress TLV cited above. WBGT readings were translated into Humidex based on a "moderate" work load category and assumes that workers are unacclimatized. It simplifies and makes certain assumptions, and warns that the plan may not be applicable in all circumstances and/or workplaces.

Operations that involve consistently overbearing heat conditions such as foundries often rely on heat stress monitors to perform the calculations for them. Heat stress monitors range from personal monitors that measure heart rate and/or body temperature for the onset of heat stress to area heat stress monitors that can provide simultaneous protection for groups of workers. Area monitors can produce a series of data readings including:

- dry/wet bulb temperature
- globe temperature
- relative humidity
- air velocity
- core temperature
- heat index
- temperature strain index
- heart rate strain index
- indoor/outdoor WBGT index
- humidex
- stay time data
- time history data, and others.


Wayne Keayes, a distributor who has years of experience with and knowledge of heat stress technology, explains that "heat stress monitors give you an objective heat stress reading. Based on what the workers are doing it can quickly be determined if the environment is safe and, conversely, when companies should send its workers home."

Johnson Matthey Limited refines precious metals such as gold and silver into bars. The chemical processes involved produce high levels of humidity, and require front-line workers to be covered from head to toe in rubber personal protective equipment. Monitoring the heat and humidity levels is always a concern, and an integral component of the company's heat stress program.

The company recently calibrated a new area heat stress monitor and plans to roll it out in the spring. It will replace

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## Heat Stress Safety Hazards

How Heat Affects Us		
Temperature Range (°C)	Effects	
20–27°C as temperature increases...	Discomfort	Mental Problems
	<ul style="list-style-type: none"> <li>• Increased irritability</li> <li>• Loss of concentration</li> <li>• Loss of efficiency in mental tasks</li> </ul>	Psycho-physiological problems
	Increase in errors: <ul style="list-style-type: none"> <li>• Loss of efficiency in skilled tasks</li> <li>• More incidents</li> </ul>	
	Loss of performance of heavy work: <ul style="list-style-type: none"> <li>• Disturbed water and electrolyte balance</li> <li>• Heavy load on heart and circulation</li> <li>• Fatigue and threat of exhaustion</li> </ul>	Physiological problems
35–40°C	Limit of high temperature tolerance	

– Source: [www.ccohs.ca/oshanswers/phys\\_agents/heat\\_health.html](http://www.ccohs.ca/oshanswers/phys_agents/heat_health.html)

## Heat Stress Illnesses

Illness	Cause	Symptoms	Treatment	Prevention
Heat Rash	Hot humid environment; plugged sweat glands.	Red bumpy rash with severe itching.	Change into dry clothes and avoid hot environments.	Rinse skin with cool water. Wash regularly to keep skin clean and dry.
Heat Cramps	Heavy sweating drains a person's body of salt, which cannot be replaced just by drinking water.	Painful cramps in arms, legs or stomach which occur suddenly at work or later at home.  Heat cramps can be a warning of other more dangerous heat-induced illnesses.	Move to a cool area; loosen clothing and drink cool salted water (1 tsp. salt per gallon of water) or a commercial fluid replacement beverage. If the cramps are severe or don't go away, seek medical aid.	Reduce activity levels and/or heat exposure. Drink fluids regularly. Workers should check on each other to help spot the symptoms that often precede heatstroke.
Fainting	Fluid loss and inadequate water intake.	Sudden fainting after at least two hours of work; cool moist skin; weak pulse.	GET MEDICAL ATTENTION. Assess need for CPR. Move to a cool area; loosen clothing; make person lie down; if the person is conscious, offer sips of cool water. Fainting may also be due to other illnesses.	Reduce activity levels and/or heat exposure. Drink fluids regularly. Workers should check on each other to help spot the symptoms that often precede heatstroke.
Heat Exhaustion	Fluid loss and inadequate salt and water intake cause a person's cooling system to start breaking down.	Heavy sweating; cool moist skin; body temperature over 38°C; weak pulse; normal or low blood pressure; person is tired and weak, and has nausea and vomiting, is very thirsty, or is panting or breathing rapidly; vision may be blurred.	GET MEDICAL AID. This condition can lead to heatstroke, which can kill. Move the person to a cool shaded area; loosen or remove excess clothing; provide cool water to drink; fan and spray with cool water.	Reduce activity levels and/or heat exposure. Drink fluids regularly. Workers should check on each other to help spot the symptoms that often precede heatstroke.
Heatstroke	If a person's body has used up all its water and salt reserves, it will stop sweating. This can cause body temperature to rise. Heatstroke may develop suddenly or may follow from heat exhaustion.	High body temperature (over 41°C) and any of the following: the person is weak, confused, upset or acting strangely; has hot, dry, red skin; a fast pulse; headache or dizziness. In later stages, a person may pass out and have convulsions.	CALL AN AMBULANCE. This condition can kill a person quickly. Remove excess clothing; fan and spray the person with cool water; offer sips of cool water if the person is conscious.	Reduce activity levels and/or heat exposure. Drink fluids regularly. Workers should check on each other to help spot the symptoms that often precede heatstroke.

Adapted from [www.gov.on.ca/LAB/english/hs/guidelines/gl\\_heat.html](http://www.gov.on.ca/LAB/english/hs/guidelines/gl_heat.html).

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hand-held personal monitors because it is better equipped to provide data collection and information 24 hours a day. Says Linda Szelli, HR manager, “Individuals have their own tolerances to different temperatures but this equipment will allow us to hand over data to workers as part of our education process. We are very responsive to our workers, so if some are not tolerating the heat we make accommodations for them.”

James McGeough, health and safety and environmental manager, Grenville Castings Ltd., agrees that a flexible and responsive heat stress program is critical to keep employees safe and satisfied. “Maybe today the worker can’t take the heat. Is a reading of 28 good or bad? What is okay for you but not okay for me?”

For the uninitiated a foundry can be a hellish place to work — much like a fiery dragon bearing down on you. The double whammy of searing heat and high levels of humidity, explains McGeough, “will make you feel hotter than you ever thought possible.”

As part of its goal to keep workers as productive and comfortable as possible, Grenville Castings uses a number of engineering and administrative controls to keep heat stress hazards at bay:

- shields and reflective barriers from radiant sources of heat.

- reducing the temperature and humidity through air cooling.
- switching from winter mode to summer mode in early spring, which includes increasing the amount of ventilation and adding more floor fans. “We have so much ventilation,” confesses McGeough, “that you almost need seat belts.”
- providing air-conditioned rest areas.
- providing cool work areas.
- reducing physical demands of work task through mechanical assistance (e.g., hoists, lift-tables).
- posting clearly written standard operating policies on how to treat symptoms of heat stress.
- providing plenty of Gatorade and water stations for worker hydration. Workers should be drinking every 20 minutes. McGeough reminds the workers, “If you’re not peeing, you’re not drinking enough water.”
- acclimatizing workers. It usually takes workers eight weeks to become fully acclimatized.
- revving up the company’s educational program about heat stress to workers.
- providing lighter coloured uniforms.

The company also watches workers for sudden changes in behaviour. “A worker may not realize he’s being affected,” says McGeough. “If someone who is normally calm and cool becomes irrational and short-tempered, we must consider that he

might be suffering from heat stress and get him off the floor.” A speedy response is essential because, as McGeough notes, “it’s only a short time before the worker could be in serious trouble. Part of our vigilance includes the buddy system where supervisors and co-workers keep a close eye on one another.” (For additional control options, see “Administrative Controls for Heat Stress,” page 30.)

A proactive and comprehensive heat stress program is a good investment not only for the existing workforce but also for incoming workers. Johnson Matthey Limited’s Linda Szelli sees the addition of its new monitor as an important part of meeting the expectations of a younger work force. Szelli observes, “The amount of work going through the refinery is increasing and there are longer hours. We are mindful of a younger generation coming in who are very knowledgeable about their rights. We have to be responsive to a changing workplace.”

Education and responsiveness are the hallmarks of their successful heat stress program, which is indicative of the good relations the company shares with the unions. After all, slaying the dragon means closing ranks against the beast at hand.

*Suzan Butyn is a regular contributor to Accident Prevention. Her most recent article, “Can You Hear Me Now,” appeared in the January/February 2005 issue.*