Martha S. Martin, CEF, CECM
Delta Chemicals & Equipment Co., Inc.
12466 E. 62nd St.
Indianapolis, IN 46236

Protecting Workers In Hot Environments

Many workers spend some part of their working day in a hot environment. Workers often face hot conditions that can pose special hazards to safety and health.

Heat Stress Causes Body Reactions

Heat stress is the body's physiological reaction when it accumulates heat faster than it can be dissipated. Four environmental factors affect the amount of stress a worker faces in a hot work area: Temperature, humidity, radiant heat (such as from the sun or a furnace) and air velocity. Perhaps most important to the level of stress an individual faces are personal characteristics, such as age, weight, fitness, medical condition and acclimatization to the heat.

When the body is exposed to heat faster than the heat can be dissipated, the internal temperature rises. The body reacts to high external temperature by circulating blood to the skin, which increases skin temperature and allows the body to give off its excess heat through the skin. If the muscles are being used for physical labor, however, less blood is available to flow to the skin and release the heat. The effects can range from discomfort to heat stroke and even death.

No one is immune to heat stress. There are, however, things that can be done to prevent heat stress before it becomes a problem. In order to protect ourselves from heat stress, we must first recognize the problem. Sweating is one means the body uses to maintain a stable internal body temperature in the face of heat. But sweating is effective only if the humidity level is low enough to permit evaporation, and if the fluids and salts lost are adequately replaced.

What Steps Can Be Taken To Dispose of Excess Body Heat?

Of course, there are many steps a person might take to reduce the risk of heat stress, such as moving to a cooler place, reducing the work pace or load, or removing/loosening some clothing. If the body cannot dispose of excess heat, however, it will store it. When this happens, the body's core temperature rises and the heart rate increases. As the body continues to store heat, the individual begins to lose concentration, has difficulty focusing on a task, may become irritable or sick, and often loses the desire to drink. The next stage is most often fainting, and even death is possible if the person is not removed from the heat stress.

Behavioral changes can often be observed during periods of heat stress. Workers may deviate from normal safe work practices to finish work quickly in order to leave the area. They may remove required personal protective equipment (PPE) in an effort to reduce body temperature, and irritable behavior can often be observed.

Heat Disorders

Heat Rash

Heat rash, also known as prickly heat, may occur in hot and humid environments where sweat is not easily removed from the surface of the skin by evaporation. In extensive cases or when complicated by infection, heat rash can be so uncomfortable that it inhibits sleep and impedes a worker's performance, and can even result in temporary total disability. It can be prevented by resting in a cool place and allowing the skin to dry.

Heat Cramps

Heat cramps, painful spasms of the muscles lasting one–three minutes, are caused when workers drink large quantities of water but fail to replace their bodies' salt loss. Tired muscles—those used for performing the work—are usually the ones most susceptible to cramps. Cramps may occur during or after working hours, and may be relieved by taking liquids by mouth (or saline solutions intravenously for quicker relief, if medically determined to be required).

Heat Syncope

Fainting (heat syncope) may be a problem for the worker unacclimatized to a hot environment whose job involves simply standing still in the heat. Victims usually recover quickly after a brief period of lying down. Moving around, rather than standing still, will usually reduce the possibility of fainting.

Heat Exhaustion

Heat exhaustion results from loss of fluid through sweating when a worker has failed to drink enough fluids, take in enough salt, or both. The worker with heat exhaustion still sweats, but experiences extreme weakness or fatigue, giddiness, nausea, or headache. The skin is clammy and moist, the complexion pale or flushed, and the body temperature normal or slightly higher.

Treatment is usually simple: The victim should rest in a cool place and drink an electrolyte solution (a beverage used by athletes to quickly restore potassium, calcium, and magnesium salts). Severe cases involving victims who vomit or lose consciousness may require longer treatment under medical supervision.

Heat Stroke

Heat stroke, the most serious health problem for workers in hot environ-

ments is caused by the failure of the body's internal mechanism to regulate its core temperature. Sweating stops and the body can no longer rid itself of excess heat. Signs of heat stroke include:

- Mental confusion, delirium, loss of consciousness, convulsions or coma
- A body temperature of 106 °F+
- Hot, dry skin that may appear red, mottled, or bluish

Victims of heat stroke will die unless treated promptly. While awaiting medical help, the victim must be removed to a cool area and his or her clothing soaked with cool water. The individual should be fanned vigorously to increase cooling. Prompt first aid can prevent permanent injury to the brain and other vital organs.

Preventing Heat Stress

Most heat-related health problems can be prevented, or the risk of developing them reduced. Following these few basic precautions should help:

1. A variety of engineering controls, including general ventilation and spot-cooling by local exhaust ventilation at points of high heat production, may be helpful. Shielding is required for protection from radiant heat sources. Evaporative cooling and mechanical refrigeration, as well as cooling fans, are other ways to reduce heat. If the air temperature is greater than 95 °F, the air velocity should be decreased. If cooling the entire area is not practical, then spot-cooling or enclosed-booth cooling can help. If air temperature is less than 95 °F, air velocity should be increased to reduce body heat. When air temperatures exceed 95 °F, clothing reduces exposed skin area and reduces convection heat gain. When air temperature is less than 95 °F, however, clothing can interfere with convection cooling.

Eliminating steam leaks will also help. Equipment modifications, the use of power tools to reduce manual labor, and personal cooling devices or protective clothing are other ways to reduce the hazards of heat exposure for workers. Avoidance of machine pacing in hot environments can reduce the risk of heat exposure to workers.

Anytime change is introduced in the workplace, consideration should be given to the potential for heat stress production. Some of the following conditions should be given special consideration:

- Hot process—the introduction of new or additional hot processes
- Modification of the ventilation equipment
- Changes or increased requirements for additional personal protective equipment
- Changes in the work/rest cycle

2. Work practices at the workplace, such as providing plenty of drinking water (as much as a quart per worker per hour), can help reduce the risk of heat disorders. Training first aid workers to recognize and treat heat stress disorders, and making the names of trained staff known to all workers is essential.

Employers should also consider an individual worker's physical condi-

tion when determining his or her fitness for working in hot environments. Older workers, obese workers and personnel on some types of medication are at greater risk. Bodies that are physically fit can tolerate a higher heat load. Heavier bodies must work harder and expend more energy, which drives up the body temperature. Illness can also negatively impact the body's ability to tolerate heat.

3. Alternating work and rest periods with longer rest periods in a cool area can help workers avoid heat stress. If possible, heavy work should be scheduled during the cooler parts of the day, and appropriate protective clothing provided. Supervisors should be trained to detect early signs of heat stress and should permit workers to interrupt their work if they are extremely uncomfortable.

4. Acclimatization to the heat through short exposures of work in the hot environment, followed by longer periods, can reduce heat stress. New employees and workers returning from an absence of two weeks or more should have a five-to-seven-day period of acclimatization. This period should begin with 50 percent of the normal workload and time exposure the first day, gradually building up to 100 percent on the fifth day.

5. Employee education is vital so that workers are aware of the need to replace fluids and salt lost through sweat, and so that they can recognize dehydration, exhaustion, fainting, heat cramps, salt deficiency, heat exhaustion, and heat stroke as heat disorders. Workers should also be informed of the importance of daily weighing before and after work to avoid dehydration.

Use Common Sense

Above all, use common sense. Avoid strenuous activity during the hottest part of the day and take frequent rest breaks as established by your company. Bring concerns about the work environment to the attention of management. Proper diet can also play an important role in managing heat stress. Eat lightly and avoid hot, heavy meals that just add heat to the body. Loose, lightweight, reflective clothing can aid in heat dissipation. In extreme cases, ice vests or water-cooled garments may be required.

There are many things one can do to control heat stress. Both administrative controls and engineering controls are essential. Administrative controls can also include job rotation during the shift, cross-training and rotation of workers between hot jobs and cooler work environments.

For More Information

A 15-page booklet, *Working in Hot Environments*, is available free from National Institute for Occupational Safety and Health Publications, 4676 Columbia Parkway, Cincinnati, OH 45226; phone: 513/533-8287. ***P&SF***

References

OSHA 29 CFR CD ROM, January 1996

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