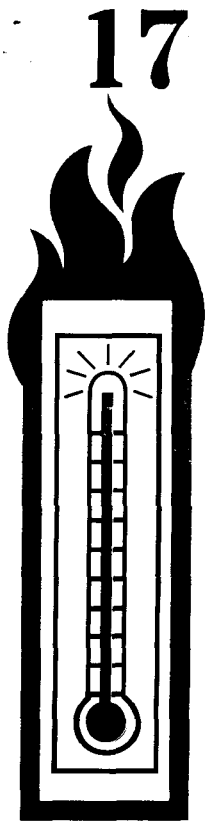
Let's beat the heat



Our bodies are like our car engines. They both have a need for a cooling fluid to assist in dissipating the heat. If the temperature is kept within reasonable limits, the internal parts last longer and the engine doesn't lock up and quit running. In the body sweat glands dispense warm liquids to cool internal parts. Radiators permit collected heat to be reduced so vital parts will not exceed the no-return temperature. In our body sweat glands also function to lower the core temperature. If the radiator or its connecting conducting path malfunctions, the engine is damaged.

The radiator is part of the cooling system for the internal combustion engine. The sweat glands are an integral component of the excretory system. The radiator represents several square feet of exposed area. There are 400 to 2,800 sweat glands per square inch over much of the body.

Excessive heat

Life and health depend on the body releasing excessive heat.

Exposure to extremes of heat is one of the major causes of shock. The shock may be revealed as a dazed look, pale color, upset stomach and/or vomiting, thirst, and dilated pupils. Disorientation, confusion and even unconsciousness may be present.

Both low and high levels of stress, due to heat, may cause discomfort and fatigue, and result in impairment of work performance. Exceeding the heat tolerance of any individual may be a health hazard. Exposure to excessive heat represents an extra load on the circulation of blood and other body functions. For instances, during high heat conditions, the blood has to carry oxygen to living cells, collect waste, and serve as a cooling fluid. With this extra load, the heart rate increases with a potential decrease in the physical work capacity.

Mental and intellectual performances deteriorate when the temperature exceeds the ability of an individual to adjust to the presented condition. Seldom, if ever, can one tolerate temperatures exceeding 95°F without an impairment to physical and mental capacity. Those not used to heat may suffer from reduced capacity at lesser temperatures. It requires a high level of motivation to counteract the detrimental effects of heat.

Associated with high temperatures are high sweat rates. Excessive loss of body fluids can initiate dehydration (known as anhydration, deaquatin, and hypohydration). Voluntary dehydration results when thirst does not stimulate sufficient replacement of water loss. Endurance is defined as the ability to withstand hardship or adverse stress. The standardized maximum exercise load is definitely reduced due to dehydration. It may be possible to temporarily handle a large work load but continued exposure will yield a reduced working ability.

Many ways have been proposed to establish safe guidelines on dehydration. However, there is a simple method of determining whether the fluid intake has been adequate. Weigh at different times during the work cycle and compare the weight differences. Even a small reduction of one to two percent may account for a difference in performance and health.

To minimize the effects of dehydration, the fluid loss should be replaced rapidly, perhaps as much as several times per hour under severe conditions. Fluid, such as water, is more favorably accepted if it is under 60°F. Since water doesn't contain electrolytes it's usage may need to be supplemented with salt tablets. The salt requirements may frequently range from 5 to 15 grams per day based on diet, amount of physical exertion, and temperatures, etc.

Age

Heat tolerance as a factor of age has to be taken in account. Older individuals do not sweat as fast as their younger counterparts. In addition, it takes longer for their body temperatures to return to normal.

Physical conditioning and acclimation

Trained workers adjust faster to heat than untrained. Physical training enhances the ability to utilize the sweating functions. Exposure to a hot environment is necessary in order to develop a tolerance to heat. The exposure yields an increased sweat production resulting in a lower skin temperature and reduced heart rate. This acclimatization process gained through exposure permits one to adapt to new temperatures, altitudes or climates. Acclimatizing permits the sweat gland to produce more sweat than under ordinary circumstances.

Acclimatizing

Acclimatizing many workers efficiently and rapidly poses practical problems. Daily exposure for even an hour for one week will account for some acclimatization. However, it generally requires 8 to 10 days exposure of up to at least half the shift before the person is acclimatized. Weekends and holidays makes this proposal very difficult to implement.

Physical response assessment

Various ways have been proposed to evaluate where heat is the major stress for industrial work places. However, because of the multitude of variables which includes sex, age, body dimensions, health, fuel and oxygen intake, motivation, and nature of the work, it is not simply possible to produce an accurate and universally applicable heat index. There is no single physical index involving a heated environment that includes all the workers all the time. Heart rates, oral and core temperatures, conditioning, skin temperature, sweat rate, and relative humidity are additional variables needing to be considered.

Since each individual is different, it is probably easier to weigh individuals several times a day and establish base line data from which decisions can be made. Dehydration based on actual body weight is easier than attempts to comprehend the entire spectrum of all parameters. Acute observations is frequently more revealing than absolute faith on theory.

Extraneous cooling measures

Air conditioning and air movement devices may be considered for cooling. However, taking rest breaks, working in the shade, and/or supplying cool drinking fluids may also achieve substantial improvements. Before trying water-cooled hoods and Buck Roger's suits, utilize easier solutions. Maybe it is only necessary to provide shields from the heat source; introduce mechanical aids to eliminate strenuous physical work near the heat. The key points are to: (1) avoid conditions that prolong intense heat exposure leading to profuse sweating; (2) replace body fluids before they are lost; and (3) have the worker leave the workplace hydrated, not dehydrated.

Physical fitness

Maintaining a high level of physical fitness can provide more tolerance for working in the heat. A fit individual places less stress on their heart and produces smaller changes in their core temperatures.

Effect of respirators and face masks

In the performance of jobs such as firefighting or dusty atmosphere work some workers wear respirators or face masks. These devices increase the potential of heat stress even when used by trained personnel. Careful monitoring is necessary to prevent difficult or labored respiration.

Heat stress

Heat stress indicates the body is not removing sufficient heat. Several conditions can promote this phenomenon. A worker may be

working at a rate which exceeds the dispersal of heat. The temperature and/or the humidity can be so high that the body can not rid itself of the excessive heat. Clothing worn to protect one against the cold or other environment may prevent the evaporation of sweat.

No one is exempt from heat stress. Anyone can get it. People that are overweight, people having a high fat content, and people suffering from a hangover are all potential victims. But anyone can get stressed from heat—even athletes. Those having recent immunization shots, infections, or other illnesses are definitely at a risk.

Illnesses from heat

If one cannot get rid of produced heat, the body temperature has to rise. Heat exhaustion is the condition where the heart rate increases until there is not enough elapsed time to completely refill the heart. This results in not enough blood being pumped to the brain so the affected person experiences "heat exhaustion collapse." This is commonly referred to as "fainting" or "black out." Blood flow is restored by getting blood out of the skin and back into the central circulating system. Using cold water and massaging the legs and arms are helpful in restoring normal blood flow.

Exhaustion from dehydration

Dehydration exhaustion indicates the body is losing more water than is being replaced. Severe cases result in the victim collapsing. Heat stroke is a severe condition marked by dry skin, vertigo, headache, thirst, nausea, and muscular cramps. The body temperature may be dangerously elevated. If the temperature stays high long enough, permanent damage or death can result.

Heat cramps indicate the body has lost enough salt so that the muscles begin to get sore and cramp. These muscle cramps may occur in several muscles at the same time. Drinking lightly salted water or electrolytically-enhanced commercial beverages is one way to prevent heat cramps.

Dehydration

As inferred previously, one percent weight loss may indicate dehydration. Dehydration can occur in one shift or be a cumulative process. Painting the town red at night can contribute greatly to dehydration. The greater the weight loss, the more the damage. Dehydration exhaustion may occur with 5% loss and heat stroke with total incapacitation from a 10% loss is likely.

Physical work restriction

Maximum oxygen uptake is the ability of the body to deliver oxygen to the muscles. Heat stress establishes physiological limits to this uptake.

As a worker becomes hotter during a given task, more energy is required. The usual recourse is to slow down. The activity rate has to be reduced under severe condi-tions to prevent heat exhaustion.

Clothing vs heat stress

The thickness of the clothing and the air space between the skin and the outer environment insulate the wearer. The higher the value of insulation the less heat emitted to the environment. Ideally, sweat should evaporate but if it doesn't, the producer can become uncomfortable with consequential reduction of work output.

Thirst vs drinking

Thirst is not an adequate measure to indicate fluid is needed. Some individuals have lost 6 to 8% of their body weight before becoming thirsty. To be safe, take frequent cool drinks. Frequent drinks are more effective than taking only a single large drink.

Practical solutions for heat stress

Before large expenditures of time and money, review simple adjustments which can yield relief. Any measure that can reduce the work load and the heat stress should be considered. Some basic solutions would include:

- Provide shade
- Sit—if standing is not necessary
- Wear lighter colored and less clothing
- Wear less impermeable materials
- Provide cool drinking liquids close to the worksite
- Schedule harder jobs for cooler times
- Plan on rest breaks
- Acclimatize
- Use auxiliary cooling
- Warm up gradually
- Cool down by slowing down

Simple rule

The longer your shadow, the safer you are.

When one's shadow is less than their height, it is time to consider using protection against the sun's rays. When the sun is directly overhead, there is no shadow. The smaller the shadow, the greater the amount of ultraviolet radiation (UV) that reaches the earth. As the shadow increases in length, the sun's rays must penetrate more of the earth's atmosphere, including ozone.

Potential acclimatization schedule

The U.S. Department of Health, Education and Welfare recommends acclimatizing employees for 6 days. On the first day the worker starts with a work load of 50 percent and on each succeeding day an additional 10 percent load is added. This schedule results in a 100 percent

exposure on the sixth day.

Acclimatize employees missing at least nine days of work. They should start with a 50 percent work load exposure on their first day back to work. The second, third and fourth day exposures are 70, 90, and 100%, respectively. Workers experiencing four consecutive days of sickness should undergo the same acclimatization program.