Safety Procedures for Management of Thermal Stress

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Introduction

The Texas Transportation Institute (TTI) is committed to providing a safe and healthful work environment for its employees and visitors. All activities and work involve some level of risk to people and property. Many activities involve low level risks of a type and magnitude routinely encountered and accepted as requiring no special measures for mitigation. Other activities may involve increased levels of risks and require additional, appropriate measures be taken to mitigate such risks.

The success of any risk management program is dependent upon each affected person understanding, accepting and adhering to the policies and procedures of this program as well as other agency policies and programs.

Purpose

The purpose of this program is to enhance awareness of risk levels for employees working in extreme temperature environments and limit exposure of personnel and property to the lowest, practical level of risk through philosophy of risk management, training of personnel, engineering controls, and establishment of policies and procedures.

Definition

Thermal Stress is a temperature and humidity related phenomenon that can negatively impact the human body with immediate and/or long-term health effects. Thermal Stress normally occurs in varying degrees as heat cramps, heat exhaustion, heat stroke, or frostbite. Thermal Stress may also be brought on by work that alternates between hot and cold extremes. Advanced stages of thermal stress may represent a true medical emergency and should be handled as such.

Statistics


• In 2001 alone, 300 deaths were attributed to excessive heat in the United States.

• In 2002, 646 deaths were attributed to hypothermia in the United States.

• The elderly, the young, and individuals whose physical condition may not be optimal are generally the most susceptible to thermal injuries.

**Types of Body Heat Generation**

**Metabolic Heat**

Heat produced through work, exercise and the digestion of food.

**Environmental Heat**

Heat absorbed by the body from the surrounding environment.

**Controlling Body Temperature**

There are three mechanisms the body uses to control temperature:

**Convection**

The transfer of heat through the circulation of air.

**Evaporative Cooling**

The process by which liquid (perspiration) changes into vapor.

**Radiation**

The release of heat energy from the body to the surrounding environment.

**Factors Affecting Body Heating/Cooling**

**Acclimation**

The process by which the body adapts to the environment or “gets used to it.”
Air Temperature

Heat transfers from warmer objects to cooler objects or environments.

Air Movement

The flow of air helps to evaporate perspiration from the skin.

Humidity

The amount of water vapor present in the air affects the rate of evaporation of perspiration from the skin.

Clothing

The type of clothing affects the amount of heat the body absorbs and retains. “Breathable” fabrics such as 100% cotton promote improved body temperature.

Heat Stress

Types of Heat Stress

Heat Rash (Prickly Heat)

Heat rash is a skin irritation due to excessive perspiration in hot, humid weather.

How to recognize it:

Heat rash looks like a red cluster of pimples or small blisters. It commonly occurs on the neck, upper chest, in elbow creases and other areas of skin-to-skin contact.

How to treat it:

Move to a cool environment. Wash affected area with cool water. Do not use harsh soaps or lotions.

Sunburn

Sunburn is a “burn” to skin caused by overexposure to ultra-violet radiation (the sun).
How to recognize it:

Red, painful, abnormally warm skin after exposure to the sun.

How to treat it:

Allow the skin to heal and avoid further exposure to the sun while healing. Wash affected area with cool water. Do not use harsh soaps or lotions.

Heat Cramps

Heat cramps are muscle spasms in the body typically associated with individuals who tend to perspire profusely and/or may drink large amounts of water but do not replenish the body’s salt loss.

How to recognize it:

Muscle spasms generally in the abdomen, arms, or legs that may occur in association with strenuous activity.

How to treat it:

Move to a cool area, drink clear juice or sports beverages and do not continue strenuous activity for a few hours after cramps subside.

**CAUTION:** Individuals on a low-sodium diet or who have a heart condition and work in a hot environment should contact their physician for direction regarding these potential circumstances.

Heat Exhaustion

Heat exhaustion is the body’s response to excessive loss of water and salt contained in perspiration. Heat exhaustion can develop several days after exposure to high temperatures and unbalanced fluid replacement.

How to recognize it:

Skin is clammy and moist; paleness of complexion and body temperature may be normal or slightly higher than normal.

Other symptoms may include weakness, dizziness, headache, nausea, vomiting or fainting.
How to treat it:

Move to a cool area, loosen clothing (maintaining modesty), apply cool compress to body, elevate feet, and provide fluids.

Heat Stroke

Heat stroke occurs when the body is unable to regulate its temperature. The body’s temperature rises rapidly, the perspiration mechanism fails and the body is unable to cool down.

How to recognize it:

Skin will be hot and dry, pulse will be high, and blood pressure may decrease.

Other symptoms may include headache, dizziness, nausea, disorientation, unconsciousness or convulsions (seizures).

How to treat it:

Call for emergency assistance immediately. Move to a cool area, loosen clothing (maintaining modesty), cover/immerse with cool (not iced) water and fan vigorously.

Heat Stress Prevention

- Wear lightweight, light-colored, loose-fitting clothing made of “breathable” fabrics such as 100% cotton.

- Wear a wide-brimmed hat to protect your head and face from sun exposure.

- Apply sunscreen to protect exposed skin from UV rays. Reapply as necessary.

- Eat light meals and avoid heavy foods.

- Increase fluid intake before and during work. Do not wait until you are thirsty. It may be too late. Try to drink at least one cup of low sugar liquid every 20 minutes.
CAUTION: Consult your physician if you are limited to the amount of water you should drink, if you are on a diuretic (water pills) or have a physical condition that requires limitation to heat exposure.

- Acclimate yourself to the hot environment before performing strenuous work.
- When possible, limit movement between hot and cold environments.
- Pace your work activities and allow for rest periods, preferably in a shaded area.

Cold Weather Stress

Types of Cold Weather Stress

Frostbite

Frostbite is an injury to the body that is caused by exposure to freezing temperatures. Most often, frostbite will affect areas of the body exposed to extreme cold temperatures such as the nose, ears, cheeks, chin, fingers or toes. If not properly treated, frostbite can cause permanent damage and in severe cases, amputation of the affected area.

How to recognize it:

Skin may have a white or grayish color. The skin feels firm or waxy, and numbness may be present in the affected areas.

How to treat it:

Move quickly to warm area. Be careful to not walk on frostbitten toes as this could cause more damage. To warm affected areas, immerse in warm (not hot) water.

Warning: Do not use a heating pad, heat lamp, stove or fireplace to warm affected areas. These areas are usually numb and could easily be burned.

Hypothermia

Hypothermia is the result of an abnormally low body temperature. Most often, hypothermia occurs in very cold temperatures but may also occur in cool temperatures if the affected person is chilled from rain, perspiration or submersion in cold water.
How to recognize it:

The individual may be shivering or display exhaustion, disorientation, decreased dexterity, slurred speech or drowsiness.

How to treat it:

Move to a warm room. Remove any wet clothing (maintaining modesty) and dry the skin. Begin warming the core of the body (chest, neck and head areas) by use of an electric blanket or through the use of body-to-body contact under a blanket or towel.

If person is conscious, give them warm beverages. Continue to keep person warm and dry and call for emergency assistance immediately.

Cold Weather Stress Prevention

- Dress appropriately for the environment. Dressing in layers allows you to remove clothing if you begin to perspire.
- Eat well balanced meals. This will increase the body’s production of metabolic heat.
- Limit consumption of caffeinated beverages as they tend to increase loss of body heat.
- Drink warm beverages or broth to help maintain your body temperature.
- Acclimate yourself to the cold environment before performing strenuous work.
- When possible, limit movement between hot and cold environments.
- Pace your work activities and allow for rest periods in a warm area.
- Exercise caution while performing strenuous work as your body is already working to keep warm.
- Do not ignore shivering as that is typically the first sign of decrease in body temperature.
When using ice covered walkways and steps, exercise caution due to the increased potential for slips and falls.

**Life Safety and Emergency Response**

Dial 911 for ambulance, fire and police. From a phone system that requires you to dial a “9” prefix, dial 9-911.

- **Provide the 911 dispatcher with the following information:**
  
  - Location of emergency
  - If there are any injuries, describe type of injury, if known
  - Brief description of injured person (gender, age, etc.)
  - Your name and phone number (in case you are disconnected or dispatcher needs additional information)

- **If an ambulance is not needed:**
  
  - Render first aid, only as trained.
  - Assist with transportation of employee to their personal physician, if appropriate.

- Make injured as comfortable as possible - do NOT move injured person unless directed by the 911 dispatcher (or if injured person is in immediate danger).

- Employees, an event witness or the employee’s supervisor shall complete an **Employer’s First Report of Injury or Illness** form to report any work injuries. Only facts, not opinions, should be stated on the form.

- Any time a safety issue arises, employees shall contact the appropriate supervisor immediately.

**Additional Information**

- The TTI Safety Office can assist with arrangements for personnel safety training in various areas and assist with written safety protocols.

- The TTI Safety Office shall review this program, at a minimum, on an annual basis.

- The TTI Safety Office is responsible for updating and maintaining this program with comments from the TTI Safety and Environmental Council.
Statistical References


