

CHAPTER 11 THERMAL STRESS

11.1 INTRODUCTION

The purpose of this section is to determine guidelines for working in areas of extreme heat or cold.

11.2 SCOPE

This **Chapter** of the Environment, Safety and Health (ES&H) Manual applies to all work areas where employees may encounter conditions of heat or cold.

11.3 DEFINITIONS

Cold Stress - General term applied to strain on the body caused by prolonged exposure to cold air or water, or by a short-term exposure to extremely cold air or water.

Frost Bite - Caused when the fluid surrounding the cells becomes frozen when exposed to extremely low temperatures. The nose, ears, fingers, toes, and cheeks are most vulnerable. Symptoms: loss of color, hardness of tissues, numbness.

Heat Cramps - Painful cramping of the legs, arms, or stomach muscles, often occurring when relaxing after work. Caused by a loss of salts through sweating. Symptoms: sudden onset; hot, moist skin; normal pulse; normal to slightly high body temperature.

Heat Exhaustion - Extreme fatigue caused by a loss of body fluids and minerals. Symptoms: heavy sweating; intense thirst from dehydration; cool, moist skin (clammy and pale); weak and rapid pulse (120-200); low to normal blood pressure; fatigue; weakness or loss of coordination.

Heat Stress - General term applied to the strain placed on the body when its cooling system has to work too hard.

Heat Stroke - A serious medical emergency caused by a complete breakdown of the body's cooling system. Victim's temperature rises to dangerously high levels. Symptoms: high body temperature (above 103 degrees F); absence of sweating (in most cases); hot, red (flushed), dry skin; rapid pulse; difficult breathing; constricted pupils; high blood pressure; headache or dizziness; confusion or delirium; bizarre behavior; weakness; nausea or vomiting. Advanced symptoms: seizure or convulsions; collapse; loss of consciousness; deep coma; no detectable pulse; body temperature over 108 degrees F.

Hypothermia - Lowering of the body's core temperature caused by prolonged exposure to low temperatures. As the body temperature gets lower, the metabolic functions of the body slow down, causing shivering, incoherence, memory lapse, and drowsiness. Severe hypothermia may lead to death.

Trench Foot - Caused by long, continuous exposure to above freezing cold temperatures, while in contact with dampness or water. The affliction is characterized by swelling, tingling, itching, and severe pain, followed by tissue death, and ulceration.

Work Load - Level of heat produced by the body based on type of work being done. Work load may be divided into three categories based on type of operation or by estimating the metabolic rate of the workers in kilocalories per hour (kcal/hr) burned by the body. The three categories are:

- A. light work (up to 200 kcal/hr): e.g., sitting or standing to control machines, performing light hand or arm work,
- B. moderate work (200-350 kcal/hr): e.g., walking about with moderate lifting and pushing, and
- C. heavy work (350-500 kcal/hr): e.g., pick and shovel work.

11.4 RESPONSIBILITIES

11.4.1 Department /Division Heads are responsible for:

- A. Ensuring the implementation of this section.
- B. Informing Line Supervisors of thermal stress conditions based on expected weather conditions or as reported to them by the **Industrial Hygienist (IH)**.
- C. Planning environmentally affected work load in accordance with expected weather conditions as reported by any weather service or by the **IH** under extreme circumstances.

11.4.2 Line Supervisors are responsible for:

- A. Reviewing the work to be performed to determine if a potential exists for thermal stress injuries.
- B. Ensuring that employees take measures to prevent heat or cold stress injuries.
- C. Informing exposed contractors that dangerous conditions exist. After notification, no further action is required.
- D. Requesting thermal stress surveys from the **Industrial Hygienist** when temperature extremes are suspected.
- E. Instructing workers about the possible hazards associated with thermal stress.

11.4.3 The **Industrial Hygienist (IH)** is responsible for:

- A. Monitoring workplace conditions to determine if there is a potential for employees to develop heat or cold stress injuries using the current American Conference of Governmental Industrial Hygienists (ACGIH) recommended Threshold Limit Values (TLV's) as guidelines.
- B. Reporting the existence of non-weather related heat or cold stress conditions to the supervisors of personnel who may be affected by these conditions.
- C. Reporting the existence of extreme weather related thermal stress conditions to any affected personnel and their Division Heads.
- D. Providing training to Laboratory personnel which will explain heat and cold injuries, including their prevention, symptoms, and first aid response.

11.4.4 Employees are responsible for:

- A. Following the appropriate protective measures as specified by **the IH**, and by their supervisors.
- B. Watching co-workers for signs and symptoms of thermal stress injuries.
- C. Obtaining medical assistance for stricken co-workers. In case of emergencies, call extension 3333.

11.4.5 Emergency Services is responsible for responding to any call for first aid assistance for thermal stress injuries.

11.5 REQUIREMENTS

- 11.5.1 The IH will monitor environmental conditions during any periods of unusual or extreme weather.
- 11.5.2 If the IH determines that conditions exist in which thermal stress injuries can occur, the IH will notify the affected employees and their line supervisors of these conditions.
- 11.5.3 The IH will notify division heads only in cases where extreme or unexpected weather conditions exist which could affect any work to be done.
- 11.5.4 Division heads will pass information gained from the IH down to the supervisors of potentially affected personnel.

11.6 PRACTICES AND PROCEDURES

- 11.6.1 Employees should be aware of signs and symptoms in themselves. They should leave the area immediately, contact Emergency Services for emergency response, and obtain medical assistance if displaying symptoms.
- 11.6.2 Be aware of signs and symptoms in co-workers. Take the stricken person away from the heat or cold. Contact Emergency Services immediately.
- 11.6.3 The following are recommended practices for minimizing risk of thermal stress. Employees should use these recommendations as appropriate to the weather conditions or as required by the IH
 - A. Dress appropriately; when it is hot, wear light-weight clothing which will allow perspiration to evaporate; when it is cold, wear multiple layers of clothing, with an inner layer which will draw moisture away from the skin.
 - B. Become acclimated to the environment by gradually increasing lengths of stay and levels of activity.
 - C. Drink plenty of water, fruit juices, and, in hot environments, electrolyte replacement beverages.
 - D. In hot weather, eat cool, light meals.
 - E. Do not drink alcohol, coffee, or caffeinated sodas. These lower resistance to both heat and cold thermal stresses.
 - F. Do not take salt tablets except under the supervision of a physician.

11.7 REFERENCES

American Conference of Governmental Industrial Hygienists (ACGIH), TLV's - Threshold Limit Values and Biological Exposure Indices for 1998 or later edition, Cincinnati, OH.

National Safety Council, Fundamentals of Industrial Hygiene, Chicago, IL 1988.