

Mary Browning

From: "David Baird, Jr." <baird@fnal.gov>
To: "ESH_Admin" <esh_admin@fnal.gov>; "Mary Browning" <maryb@fnal.gov>
Sent: Friday, November 12, 2004 12:03 PM
Attach: 5065_1_041112.doc; 5071_041112.doc
Subject: Re: FESHM Chapters for minor changes

Liz and Mary,

Please post the two revised FESHM Chapters. No need for lab-wide review.

5065.1 Temperature Extremes (New Wind Chill Chart and grammer errors)
5071 Environmental Biological Hazards at Fermilab (grammer errors)

Thanks,

Dave

P.S. Please inform me when posted.

TEMPERATURE EXTREMES

Heat Stress and Cold Stress

HEAT STRESS

Introduction

Heat stress depends on work rate as well as environmental heat load. When the body cannot cope with an excess heat load, three heat illnesses may occur. The most severe is heat stroke, which is characterized by dry skin, rapidly rising body temperature, collapse and death unless there is a prompt reduction in body temperature. Heat exhaustion is characterized by clammy moist skin, weakness, nausea, headache, low blood pressure and a weak pulse. Collapse will occur unless there is prompt rest and replenishment of lost electrolyte. Heat cramps are characterized by painful muscle spasms that disappear with rest and electrolyte replacement. This chapter describes procedures for identifying and controlling occupational heat stress.

Definitions

Wet-Bulb Globe Temperature (WBGT) - an index used to quantify stress caused by radiant and convective heat, humidity, and wind.

Responsibilities

The supervisor of work in hot environments shall notify their division/section ES&H group prior to the start of work.

The division/section ES&H group shall perform all industrial hygiene testing needed to estimate the hazards of hot-weather work.

The ES&H Section shall calibrate and maintain industrial hygiene equipment used to quantify heat stress potential.

Procedures

1. Exposure to heat stress should be evaluated by the division/section safety personnel whenever there is a concern about this hazard. Assessment is based on Wet Bulb Globe Thermometer readings plus work levels and/or the effect(s) heat stress is having on the workers.

2. If heat stress is found to be a problem, then the following controls should be implemented.
 - a. The workload should be initially reduced and gradually increased over the first week of exposure. This should include newly assigned workers and those recently returning from a serious illness or long vacation.
 - b. Individuals should not work alone. In the event that one experiences heat illness, the other(s) present can arrange for help.
 - c. Individuals should drink a cup of cool water every 15-20 minutes.
 - d. Consider modification of work activities, schedules and locations.

3. The table for assessing and controlling heat exposures follows.

Table 1. Heat Exposure Threshold Limit Values

	Work Load		
	Light	Moderate	Heavy
Continuous work	86°F/30.0°C	80/26.7	77/25.0
45 min. work/hr.	87/30.6	82/28.0	78/25.9
30 min. work/hr.	89/31.4	85/29.4	82/27.9
15 min. work/hr.	90/32.2	88/31.1	86/30.0

- A. Values are given in °F (°C) WBGT. As workload increases, the heat stress impact on unacclimatized worker is increased. For unacclimatized workers performing a moderate level of work, the permissible heat exposure TLV should be reduced approximately 2.5°C.
- B. Light Work (up to 200kcal/hr or 800 Btu/hr): e.g., sitting or standing to control machines, performing light hand or arm work,
- C. Moderate Work (200-350 kcal/hr or 1400-2000Btu/hr): e.g., walking about with moderate lifting and pushing, or,
- D. Heavy Work (350-500 kcal/hr or 1400-2000Btu/hr): e.g. pick and shovel work.
- E. TLVs should be corrected for clothing as follows:

Summer work clothing	0
Cotton coveralls	-2
Winter work uniform	-4
Water Barrier, permeable	-6

COLD STRESS

Introduction

Cold stress standards are intended to prevent workers from the severest effects of cold stress (hypothermia) and cold injury, and to describe exposures to cold working conditions under which it is believed that nearly all workers can be repeatedly exposed without adverse health effects.

Fatal exposures to cold among workers have almost always resulted from accidental exposures involving failure to escape from low environmental air temperatures or immersion in low temperature water. Lower body temperatures often result in reduced mental alertness, reduction in rational decision-making, or loss of consciousness with the threat of fatal consequences.

Definitions

Equivalent Chill Temperature (ECT) - The perceived combined effect of cold and wind on exposed skin. Also known as *wind chill factor*.

Responsibilities

The supervisors of work in cold environments shall notify their division/section ES&H group prior to the start the work.

The division/section ES&H group shall perform all industrial hygiene testing needed to estimate hazards of extended cold-weather work.

The ES&H Section shall calibrate and maintain industrial hygiene equipment used to quantify cold hazards.

Procedures

1. Upon starting work in a very cold environment, the supervisor shall notify the division/section ES&H group, who shall decide if further consideration is necessary. The division/section ES&H group may, with the help of the ES&H Section, perform industrial hygiene sampling to determine the ECT in the work area. At the discretion of the ES&H Section, local weather broadcasts may be used to determine ECT.
2. For work in environments where the ECT is less than -25°F (-31.7°C), the supervisor shall impose the work/rest regimens shown in Table 2.

Table 2. Work/Warm-Up Schedule for Four-Hour Shift

Air Temp		Calm		5 mph wind		10 mph wind		15 mph wind		20 mph wind	
°C	°F	Max Work Period	Number of Breaks								
-26° to -28°	-15° to -19°	Normal Breaks	1	Normal Breaks	1	75 min.	2	55 min.	3	40 min.	4
-29° to -31°	-20° to -24°	Normal Breaks	1	75 min.	2	55 min.	3	40 min.	4	30 min.	5
-32° to -34°	-25° to -29°	75 min.	2	55 min.	3	40 min.	4	30 min.	5	Cease non-emerg. work	
-35° to -37°	-30° to -34°	55 min.	3	40 min.	4	30 in.	5	Cease non-emerg. work			
-38° to -39°	-35° to -39°	40 min.	4	30 min.	5	Cease non-emerg. work					
-40° to -42°	-40° to -44°	30 min.	5	Cease non-emerg. work							
-43° & below	-45° & below	Cease non-emerg. work									

- Supervisors shall halt all extended cold-weather work in environments of <-75°F (< 59.4°C) ECT.

Prevention of Cold Stress

- Adequate insulating of dry clothing to maintain core temperature above 36°C (96.8°F) must be provided to workers if it is performed at air temperatures below 4°C (40°F). The higher the wind speed and the lower the temperature in the work area, the greater the insulation value of the protective clothing required. An equivalent chill temperature can be computed using the air temperature and the wind velocity (see Table 3). "Wind chill factors" can also be heard on local weather broadcasts.
- For exposed skin, continuous exposure should not be permitted when the air speed and temperature results in an equivalent chill temperature of -3.2°C (25.6°F). Superficial or deep local freezing will occur only at temperatures below -1C (30.2F), regardless of wind speed.
- The recommended limits for properly clothed workers for periods of work at temperatures below freezing are found in Table 2. Older workers or workers with circulatory problems require special protection against cold injury.

Table 3. Wind Chill Chart



Wind Chill Chart



		Temperature (°F)																	
Wind (mph)		40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5	Calm	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10		34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15		32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20		30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25		29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30		28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35		28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40		27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45		26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50		26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55		25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60		25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Frostbite Times 30 minutes 10 minutes 5 minutes

Wind Chill (°F) = 35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})
 Where, T= Air Temperature (°F) V= Wind Speed (mph) Effective 11/01/01

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