South Central Task Force
Health and Safety Plan: Cold Weather Monitoring and Procedures

[Note: The attached cold weather protocol is contained within the current South Central Task Force Health and Safety Plan (HASP) (April 2017). It should be used in conjunction with all HASP components and implemented by trained personnel.]

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COLD EXPOSURE MONITORING AND SAFETY PROCEDURES:

This protocol is designed to protect deployed personnel from hypothermia and cold injuries, and describes conditions under which it is believed nearly all responders can be exposed to cold without adverse health effects[1] (i.e. prevention of core body temperature from falling below 96.8°F (36°C) and to prevent cold injuries to extremities, with no single exposure to a cold environment producing a drop in core body temperature below 95°F (35°C).[2]

The program details specific activities to evaluate work, perform site environmental monitoring, perform medical screening and workforce training, perform workforce monitoring and identify work assistance and restriction actions, when the potential for hypothermia and cold injuries exist.

Work regimens in cold environments are initially evaluated when temperatures below 60.8°F (16°C) are expected. This evaluation includes a determination of level of work (metabolic output) and sedentary state of responders, (as well as the need for fine manual dexterity). It requires an identification of special work conditions requiring protection, aside from those identified in this procedure.

Environmental conditions (temperature and wind speed) are subsequently monitored for all temperatures below 60.8°F (16°C) and both temperature and wind speed (and subsequent equivalent chill temperatures [ECT]) are recorded and used to implement this plan for all environments below 30.2°F (See Table 1, below).[3]

[1] This section is a substantive compilation of two (2) thermal stress programs; The Monitoring and Measurement Program of the National Oceanic and Atmospheric Administration (NOAA), U.S. Department of Commerce/ Meteorological Services of Canada (2001), and the Threshold Limit Values of the American Conference of Governmental Industrial Hygienists (2012). It additionally contains research information developed by the U.S. Army Research Institute of Environmental Medicine, Natick, MA.

[2] Maximum severe shivering develops when body temperature drops to 95°F (35°C), a dangerous condition requiring immediate termination of exposure to cold. Useful mental and physical work is limited when severe shivering occurs.

[3] Wind speed recordings are measured at a height of 5 feet per NOAA NWS protocol. All temperature readings are dry bulb.

TABLE 1[4]
COOLING POWER OF WIND ON EXPOSED FLESH EXPRESSED AS EQUIVALENT TEMPERATURE (UNDER CALM CONDITIONS)*

Estimated Wind Speed (in mph)	Actual Temperature Reading (°F)											
	50	40	30	20	10	0	–10	–20	–30	–40	–50	–60
	Equivalent Chill Temperature (°F)											
calm	50	40	30	20	10	0	–10	–20	–30	–40	–50	–60
5	48	37	27	16	6	–5	–15	–26	–36	–47	–57	–68
10	40	28	16	4	–9	–24	–33	–46	–58	–70	–83	–95
15	36	22	9	–5	–18	–32	–45	–58	–72	–85	–99	–112
20	32	18	4	–10	–25	–39	–53	–67	–82	–96	–110	–121
25	30	16	0	–15	–29	–44	–59	–74	–88	–104	–118	–133
30	28	13	–2	–18	–33	–48	–63	–79	–94	–109	–125	–140
35	27	11	–4	–20	–35	–51	–67	–82	–98	–113	–129	–145
40	26	10	–6	–21	–37	–53	–69	–85	–100	–116	–132	–148
(Wind speeds greater than 40 mph have little additional effect.)	*LITTLE DANGER* In < hr with dry skin. Maximum danger of false sense of security.				*INCREASING DANGER* Danger from freezing of exposed flesh within one minute.				*GREAT DANGER* Flesh may freeze within 30 seconds.			
	Trenchfoot and immersion foot may occur at any point on this chart.											

* Developed by U.S. Army Research Institute of Environmental Medicine, Natick, MA.

Equivalent chill temperature requiring dry clothing to maintain core body temperature above 36°C (96.8°F) per cold stress TLV®.

Subsequent actions found in Table 2 are implemented. A typical work regimen is defined as four (4) hours. Work and warm up schedules, when required to be adjusted, are described in Table 3, below. The Cold Work Management Process is described in Table 4, below.

TABLE 2
TEMPERATURE/ECT LEVELS AND ACTIONS

Temperature/ECT	Action[5]
60.8°F (16°C)	• Initiate workplace environmental temperature monitoring and perform work evaluation and identification of special work conditions. If fine work is performed with bare hands >20 minutes, establish procedures for hand warming. • Provide gloves for sedentary work. • Identify older responders or those with circulatory concerns and provide (extra) insulation or reduced work regimens between warming.

[4] Us Army Research Institute of Environmental Medicine, Natick, MA.

[5] Note: At all temperatures responders with extremity pain should have increased warming schedules and responders with severe shivering should have work terminated and warming initiated.

TABLE 2 TEMPERATURE/ECT LEVELS AND ACTIONS	
Temperature/ECT	**Action[5]**
40°F (4°C) ECT	• Ensure insulating, layered dry clothing impervious to water is used. • Provide gloves for light work (if manual dexterity is not required). • Provide windbreaker or windshield if windy (>5 mph). • Provide vapor barrier boots or change socks and felt insoles if they become wet. • Provide specialized procedures or protection if work will occur with evaporating liquids or those with a boiling point just above ambient temperatures. • Provide water repellent outer layer of clothing for MODERATE/HEAVY work in wet environments and change as it becomes wetted.[6]
35.6°F (2°C) ECT	• **IMMEDIATELY** change wet clothing and treat for hypothermia.
30.2°F (-1°C) ECT	• Measure and record ECT every four (4) hours. • Cover metal handles of tools/control bars.
19.4°F (-7°C) ECT	• Provide gloves for MODERATE work. • Provide warning to responders when cold surfaces are in reach. • Provide heated warming areas and utilize them per Table 2 and if indication of hypothermia is present. Outer layers of clothing should be removed in warming area and wet clothing changed. Warm fluids should be supplied (the intake of coffee (diuretic) should be limited).
10.4°F (-12°C) ECT	• Use of buddy system is required. • If HEAVY work is performed, adjust work/rest regimen to prevent heavy sweating and/or allow for wet clothes changes. • Develop acclimatization schedule lasting days, for new responders in cold environments. • Minimize sitting or standing still. • Ensure worker safety training occurs.
0°F (-17°C) ECT	• Provide mittens for deployed personnel.
-11°F (-23°C) ECT	• Provide medical certification for responders.
-25.6°F (-32°C) ECT	• No continuous skin exposure (i.e. lifesaving work only occurs).

[6] If areas of the body cannot be protected sufficiently to prevent sensations of excessive cold or frostbite, protective items should be provided in auxiliary heated versions OR work suspended until weather conditions improve.

TABLE 3
WORK/WARM-UP SCHEDULE FOR A 4 HOUR SHIFT

Air Temperature/Sunny Sky		No Noticeable Wind		5 mph Wind		10 mph Wind		15 mph Wind		20 mph Wind	
°C (approx.)	**°F (approx.)**	**Max. Work Period**	**No. of Breaks**	**Max. Work Period**	**No. of Breaks**	**Max. Work Period**	**No. of Breaks**	**Max. Work Period**	**No. of Breaks**	**Max. Work Period**	**No. of Breaks**
-26° to -28°	**-15° to -19°**	(Norm. Breaks)	1	(Norm. Breaks) 1		75 min	2	55 min	3	40 min	4
-29° to -31°	**-20° to -24°**	(Norm. 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	Non-emergency	
-35° to -37°	**-30° to -34°**	55 min	3	40 min	4	30 min	5	Non-emergency			
-38° to -39°	**-35° to -39°**	40 min	4	30 min	5	Non-emergency					
-40° to -42°	**-40° to -44°**	30 min	5	Non-emergency							
-43° & below	**-45° & below**	Non-emergency Work should cease		Work should cease		Work should cease		Work should cease		Work should cease	

WORK EVALUATION**:**

Work evaluations identify the metabolic rate (expressed in Watts [W]) of the activity to be performed, and subsequent actions (Table 2) are based on the work evaluation results. Work categories include:

Sedentary Work:	Metabolic Rate 115 W (sitting)
Light Work:	Metabolic Rate 180 W (light manual work, driving and occasional walking)
Moderate Work:	Metabolic Rate 300 W (sustained arm, hand, leg or trunk work and normal walking)
Heavy (Arduous) Work:	Metabolic Rate 415 W (manual labor, shoveling, pushing, pulling and fast walking)

MEDICAL MONITORING**:**

If initial evaluations of work identify concerns for older responders or those with circulatory system concerns, additional insulating clothing or increased warming regimens will be considered for these individuals.

Individuals who will work continuously (e.g. greater than one (1) hour) in temperatures of <-11°F (-23°C) ECT will be approved for work by a licensed healthcare professional.

At all temperatures, responders with extremity pain or other hypothermic symptomatology will have warming regimens increased. Responders with severe shivering will have work terminated and warming initiated, and will not return to work activities without a medical approval to do so.

SPECIAL WORK CONDITIONS**:**

Special work conditions may require actions aside from those identified in this protocol and include work in refrigerated rooms, and cold work performed in concert with toxic substances or vibration causing equipment.[7] It includes work with evaporative liquids,[8] cryogenic fluids or those with a boiling point just above ambient temperatures. An evaluation of the need for eye protection (UV – glare protection and ice/snow eye protection) should be performed, as a component of the initial work evaluation.[9]

WORKER TRAINING**:**

When Work Regimen, Cold, procedures are implemented worker/responder training occurs and includes:

- Safe work practices in cold environments, including the contents of this procedure and the results of the work evaluation performed.
- Recognition of frostbite, hypothermia or excessive cooling when shivering does not occur.
- Proper re-warming procedures and first aid.
- Clothing and protective equipment practices for cold environments.
- Proper eating/drinking habits for cold environments.
- Medical conditions which would increase risk of hypothermic events.
- Where to acquire additional information or ask questions about cold weather work activities.

[7] All work in refrigerated areas should be engineered to eliminate wind/drafts, or wind protection (e.g. shields or windbreakers) provided. Toxic substance exposure or vibration in concert with cold environments may require a reduction in Occupational Exposure Limits (OEL) or an adjustment to work regimens.

[8] Work with evaporative liquids requires special protection to avoid soaking of clothing or gloves.

[9] Eye protection, when provided should include UV-A/B protection and meet ANSI Z87.1 requirement for spectacles with side protection which are impact rated. These are labeled Z87+UV, glare.

ENVIRONMENTAL MONITORING AND RECORDING:

Workplace monitoring initiates at 60.8ºF (16ºC). At 30.2ºF (-1ºC), environmental monitoring occurs at 4-hour intervals, and ECT is calculated, recorded and used for all action points. All ECT below 19.4ºF (-7ºC) will be recorded/posted.

TABLE 4
COLD WORK MANAGEMENT PROCESS