Working in Winter Weather

PETROLEUM ORIENTED SAFETY TRAINING
POST

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Introduction

With winter here for most of us in Canada, POST would like to offer some tips for working in cold weather.

At very cold temperatures, the most serious concern is the risk of hypothermia or dangerous overcooling of the body. Another serious effect of cold exposure is frostbite or freezing of the exposed extremities such as fingers, toes, nose and ear lobes. Hypothermia could be fatal in absence of immediate medical attention.

The risk of cold injury can be minimized by

- ✓ **proper equipment design and maintenance**
- ✓ **safe work practices**
- ✓ **emergency plans and procedures and**
- ✓ **appropriate clothing**

Equipment

DESIGN

For work below the freezing point, metal handles and bars should be covered by thermal insulating material. Also, machines and tools should be designed so that they can be operated without having to remove mittens or gloves.

MAINTENANCE

Equipment is prone to mechanical breakdown during cold temperatures. In extreme weather conditions such a breakdown can be life threatening. It is, therefore, prudent to take care to ensure that equipment is in good working order. As the temperature decreases, more stringent standards of safety will apply:

Air Temperatures from 0°C to -20°C: To avoid accidents and breakdowns, all equipment must be checked at the start of each working day and every eight hours thereafter.

Air Temperatures from -20°C to -45°C: All equipment must be checked at the start of each working day and every four hours thereafter.

Air Temperatures -45°C and Below: Normally, all outdoor work will cease.

In the event of an emergency such as natural disasters, rescue operations and situations that threaten public safety, work must proceed with extreme caution. Equipment checks must be carried out hourly.

Use caution when handling gasoline. With a freezing point of -56°C (-70°F) and a high evaporation rate, contact with the skin can be very dangerous. Similarly, caution should

be exercised when handling metal objects. Always wear gloves or mitts rather than touch the object directly.

Safe Work Practices

SURVEILLANCE AND MONITORING

Every workplace where the temperature may fall below 16°C should be equipped with a suitable thermometer to monitor any further temperature changes. For colder workplaces with temperatures below the freezing point, the temperature should be monitored at least every 4 hours. For indoor workplaces, whenever the rate of air movement exceeds 2 meters per second (5 miles per hour) it should be recorded every 4 hours. In outdoor workplaces with air temperature below the freezing point, both air temperature and wind speed should be recorded.

Warm-up Breaks – The table in Appendix A on page 8 shows warm-up break schedules for outdoor work in cold conditions. It assumes that under normal warm weather working conditions, breaks are scheduled at two-hour intervals. The schedule provides for additional breaks as the wind velocity at the work site increases and/or the temperature decreases. If effective protection from the wind can be achieved by shields or screens or by modifying or relocating work, then temperature alone can be considered. Where the work itself generates wind (i.e. driving or riding on an unshielded vehicle), this should be taken into account.

The tolerance of individuals to cold varies widely. In all cases, common sense should be taken into consideration to determine individual limitations.

Awareness – A major defence against serous cold injury is awareness of the danger. When working with others watch for potential danger or signs of injury. In turn, make sure that your co-workers are looking out for you. Periodic checks of face and ears can identify a potential frostbite problem before it becomes serious. Look for disorientation or clumsiness in yourself or others, which could be a sign of hypothermia.

COMMUNICATIONS

Working alone should be avoided when cold weather is potentially a danger. However, if this is not possible a “buddy” system must be used. This means that a person working alone should be able to contact another person by radio or telephone on an open channel at all times. Supervisors are to clearly lay out the communications plan prior to starting work so everyone is clear on the work and what happens during an emergency.

Emergency Procedures & First Aid

Procedures for providing first aid and obtaining medical care should be clearly outlined. For each shift, at least one trained person should be assigned the responsibility of attending to emergencies.

First Aid Treatment

It is important to recognize the early symptoms of cold injury. As the body cools, discomfort is first felt at the extremities such as fingers and toes. Shivering follows this discomfort. This is a warning that the body must be warmed, either in a warm shelter or, in some circumstances, by more vigorous activity. The activity should not be so great as to cause sweating. If the warning is ignored then the result can be serious injury such as frostbite or hypothermia.

> ***Hypothermia*** *– Hypothermia is a condition that results from the cooling of the body at a rate that exceeds the body's ability to generate warmth. This can occur slowly, as in the case of a person who has put in a full day of work under cold conditions and is in need of food and rest to allow the body to restore normal body core temperature. It can also occur quickly, as in the case of a person who has fallen through ice into frigid water.*

Signs of hypothermia

Typical signs and symptoms of hypothermia include:

- Increasing slowness of physical and mental response;
- Stumbling, cramps and shivering;
- Slurring of speech;
- Impaired vision;
- Unreasonable behaviour or irritability; and
- Increased pulse and respiration as long as the body can still respond by shivering.

Education

Workers and supervisors involved with work in cold environments should be informed about symptoms of adverse effect exposure to cold, proper clothing habits, safe work practices, physical fitness requirements for work in cold, and emergency procedures in case of cold injury. While working in cold, a buddy system should be used. Look out for one another and be alert for the symptoms of hypothermia.

Clothing

Protective Clothing

Protective clothing is needed for work at or below 4°C. Clothing should be selected to suit the temperature, weather conditions (e.g., wind speed, rain), the level and duration of activity, and job design. These factors are important to consider so that you can regulate the amount of heat and perspiration you generate while working. If the work pace is too fast or if the type and amount of clothing are not properly selected, excessive sweating may occur. The clothing next to body will become wet and the insulation value of the clothing will decrease dramatically. This increases the risk for cold injuries.

Clothing should be worn in multiple layers which provide better protection than a single thick garment.

The inner layer should provide insulation and be able to "wick" moisture away from the skin to help keep it dry.

The additional layers of clothing should provide adequate insulation for the weather conditions under which the work being done.

For work in wet conditions, the outer layer of clothing should be waterproof.

Almost 50 percent of body heat is lost through the head. A wool knit cap or a liner under a hard hat can reduce excessive heat loss.

Clothing should be kept clean since dirt fills air cells in fibres of clothing and destroys its insulating ability.

Clothing must be dry. Moisture should be kept off clothes by removing snow prior to entering heated shelters.

If fine manual dexterity is not required, gloves should be used below 4°C for light work and below -7°C for moderate work. For work below -17°C, mittens should be used.

Cotton is not recommended. It tends to get damp or wet quickly, and loses its insulating properties. Wool and synthetic fibres, on the other hand, do retain heat when wet.

Footwear

Felt-lined, rubber bottomed, leather-topped boots with removable felt insoles are best suited for heavy work in cold since leather is porous, allowing the boots to "breathe" and let perspiration evaporate. Leather boots can be "waterproofed" with some products that do not block the pores in the leather.

WINTER WALKING

We may not think about this but slippery conditions caused by ice and snow is as much of a hazard as slippery conditions caused by other elements you may be used to mitigating in your everyday working environment (e.g. oil, grease, water etc.).

Ice grips or ice cleats as they are both know by are a good way to mitigate the risk of a nasty slip and/or fall due to icy conditions. Ice grips should be part of a worker's PPE during the winter months if they are exposed to the risk.

Ice grips on footwear can help you walk on hard packed snow and ice. But be careful, as they become dangerously slippery and must be removed before walking on smooth surfaces such as stone, tile and ceramic. Before buying the grippers, be sure that you are able to attach and remove them from your boots.

Another option is to look for ice grippers that can be worn indoors as well. This is more convenient for maintenance and delivery personnel as it is not very practical to remove them at the door before entering a building.

SOCKS

You may prefer to wear one pair of thick, bulky socks or two pairs - one inner sock of silk, nylon, or thin wool and a slightly larger, thick outer sock. Liner socks made from polypropylene will help keep feet dry and warmer by wicking sweat away from the skin. However, as the outer sock becomes damper, its insulation properties decrease. If work conditions permit, have extra socks available so you can dry your feet and change socks during the day. If two pairs of socks are worn, the outer sock should be a larger size so that the inner sock is not compressed.

FACE AND EYE PROTECTION

In extremely cold conditions, where face protection is used, eye protection must be separated from the nose and mouth to prevent exhaled moisture from fogging and frosting eye shields or glasses. Select protective eye wear that is appropriate for the work you are doing, and for protection against ultraviolet light from the sun, glare from the snow, blowing snow/ice crystals, and high winds at cold temperatures.

Appendix A -Warm-up break schedule for outdoor work in cold conditions

Windchill (ºC) – Refer to chart on p.11	Outside Worker	Equipment Operator
-15 to -30	Warm-up breaks every hour.	Where warm shelter is provided by heated cab, breaks are every 2 hours, otherwise, same as outside worker.
	Persons working should be contacted every hour by visit or radio communication.	Same as outside worker.
-30 to -45	Warm-up breaks every ½ hour.	Where warm shelter is provided by heated cab, breaks are every 2 hours, otherwise, same as outside worker.
	Persons working should be contacted every ½ hour by visit or radio communication.	Same as outside worker.
	NON-EMERGENCY WORK SHOULD CEASE. Where work must proceed, warm-up breaks should be taken every ½ hour.	NON-EMERGENCY WORK SHOULD CEASE. Where work must proceed and where warm shelter is provided by heated cab, breaks are every hour, otherwise, same as outside worker.
Greater than -45	NON-EMERGENCY WORK SHOULD CEASE. Where work must proceed, persons working alone should be contacted every ½ hour by visit or radio communication.	NON-EMERGENCY WORK SHOULD CEASE. Where work must proceed, same as outside worker.

Important: This is a guideline only. Common sense should override strict application of this guide.

Appendix B - Guideline for preparing an Emergency Kit

All vehicles should be outfitted with emergency gear as a precaution against vehicle breakdown or sudden changes in weather or road conditions. Drivers should routinely check to see that their vehicles are equipped with:

- Reflectors or flares
- Shovel
- Hatchet, axe or saw
- Tow strap or rope
- Basic tool kit
- Jumper cables
- Flashlight, candle
- First aid kit
- Personal survival kit
- Food (rations)
- Maps
- Mirror
- Newspaper
- Toilet paper, paper towels
- Small metal can, jug
- Matches (strike anywhere)
- Knife
- Rope, wire
- Sleeping bag or blankets

Appendix C - If You Get Caught In A Winter Storm

It is advised to stay indoors during a winter storm at all costs. However, certain situations may arise that you have to go outdoors. If you do and get caught, below are some basic survival tips. Please review the tips for preparing before the storm to reduce your risks.

OUTSIDE

- Find shelter: try to stay dry, cover all exposed parts of the body.
- No shelter: prepare a lean-to, wind-break, or snow cave for protection from the wind.
- Build a fire for heat and to attract attention; place rocks around the fire to absorb and reflect heat.
- Do not eat snow: It will lower your body temperature. Melt it first.
- Watch for signs of frostbite and hypothermia.

IN A CAR OR TRUCK

- Stay in your car or truck. Do not leave the car to search for assistance unless help is visible within 100 yards. You may become disoriented and lost is blowing and drifting snow.
- Run the motor about ten minutes each hour for heat; open the window a little for fresh air to avoid carbon monoxide poisoning, make sure the exhaust pipe is not blocked.
- Make yourself visible to rescuers; turn on the dome light at night when running engine, tie a colored cloth (preferably red) to your antenna or door, raise the hood indicating trouble after snow stops falling.
- Exercise from time to time by vigorously moving arms, legs, fingers, and toes to keep blood circulating and to keep warm.
- Watch for signs of frostbite and hypothermia.
- For warmth, huddle together.
- Use newspapers, maps, and even the removable car mats for added insulation.

AT HOME OR IN A BUILDING

- Stay inside. When using ALTERNATIVE HEAT from a fireplace, wood stove, space heater, etc.; use fire safeguards, properly ventilate.
- No heat; close off unneeded rooms, stuff towels or rags in cracks under doors, cover windows at night.
- Eat and drink. Food provides the body with energy for producing its own heat. Keep the body replenished with fluids to prevent dehydration.
- Wear layers of loose-fitting, lightweight, warm clothing. Remove layers to avoid overheating, perspiration, and subsequent chill.

Appendix D – Wind Chill Chart

Environment Canada Wind Chill Chart

Actual Air Temperature T_{air} (°C)

Wind Speed $V_{10\,m}$ (km/h)	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45	-50
5	4	-2	-7	-13	-19	-24	-30	-36	-41	-47	-53	-58
10	3	-3	-9	-15	-21	-27	-33	-39	-45	-51	-57	-63
15	2	-4	-11	-17	-23	-29	-35	-41	-48	-54	-60	-66
20	1	-5	-12	-18	-24	-30	-37	-43	-49	-56	-62	-68
25	1	-6	-12	-19	-25	-32	-38	-44	-51	-57	-64	-70
30	0	-6	-13	-20	-26	-33	-39	-46	-52	-59	-65	-72
35	0	-7	-14	-20	-27	-33	-40	-47	-53	-60	-66	-73
40	-1	-7	-14	-21	-27	-34	-41	-48	-54	-61	-68	-74
45	-1	-8	-15	-21	-28	-35	-42	-48	-55	-62	-69	-75
50	-1	-8	-15	-22	-29	-35	-42	-49	-56	-63	-69	-76
55	-2	-8	-15	-22	-29	-36	-43	-50	-57	-63	-70	-77
60	-2	-9	-16	-23	-30	-36	-43	-50	-57	-64	-71	-78
65	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79
70	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-80
75	-3	-10	-17	-24	-31	-38	-45	-52	-59	-66	-73	-80
80	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81

where
T_{air} = Actual Air Temperature in °C
$V_{10\,m}$ = Wind Speed at 10 metres in km/h (as reported in weather observations)

Notes:

1. For a given combination of temperature and wind speed, the wind chill index corresponds roughly to the temperature that one would feel in a very light wind. For example, a temperature of -25°C and a wind speed of 20 km/h give a wind chill index of -37. This means that, with a wind of 20 km/h and a temperature of -25°C, one would feel as if it were -37°C in a very light wind.
2. Wind chill does *not* affect objects and does *not* lower the actual temperature. It only describe how a human being would feel in the wind at the ambient temperature.
3. The wind chill index does *not* take into account the effect of sunshine. Bright sunshine may reduce the effect of wind chill (make it feel warmer) by 6 to 10 units.

Frostbite Guide
Low risk of frostbite for most people
Increasing risk of frostbite for most people within 30 minutes of exposure
High risk for most people in 5 to 10 minutes of exposure
High risk for most people in 2 to 5 minutes of exposure
High risk for most people in 2 minutes of exposure or less

Petroleum Oriented Safety Training

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Resources:

Canadian Centre for Occupational Health and Safety

Environment Canada

Government of Northwest Territories