| ConocoPhillips Canada | COLD WEATHER EXPOSURE<br>ALL-HSE-PRC-145 | **Retention Code:** *CG01*<br>**Revised:** *February 2014* |
|---|---|---|
| **Owner:** *Technical Safety* | **Approved By:** *Manager, HSE Performance Assurance* | **Review Frequency:** *Five years or less* |



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## 1.0 Purpose

Workers exposed to extreme cold on a continual basis may be at risk of cold stress. The purpose of this procedure is to anticipate and identify potential cold stress situations, assist personnel in understanding the health risks associated with working in cold weather, provide guidance in mitigating the associated hazards and comply with the applicable legislation and regulations.

## 2.0 Context and Scope

This procedure applies to all ConocoPhillips Canada (CPC) employees and contractors working on CPC sites.

**Note:** Cold weather equipment operation and journey management is not included within the scope of this document.

For any outside work scheduled when the wind chill is in or above the “increasing hazard” range of the wind chill chart in Appendix A, a hazard assessment shall be conducted with the workers involved to determine if the work should be performed in such severe conditions. Cold weather hazards should be included in hazard assessment discussions and documented even when outside of the “increasing hazard” range.

## 3.0 Hazards

### 3.1. Potential Safety Hazards

- Slips, trips and falls.
- Restricted movement and visibility caused by winter clothing, head protection, gloves and boots used while working in the cold.
- Loss of dexterity and mobility, affecting skill and ease of use of the hands.
- Impacted mental skills and coordination in extremely cold conditions.
- Reduced grip force and muscle power.
- Reduced ability of the skin to sense temperature and pain.
- Restricted visibility caused by heavy snowfall and blizzard conditions.
- Cold exposure aggravates vibration, inducing white finger disease, which makes manual work painful.
- Response times for emergency personnel may be effected due to equipment operating limitations.
- Personal Protective Equipment (PPE), such as a self-contained breathing apparatus, may not function adequately at the ambient temperature.

**Note:** Exposed human flesh freezes within one minute at -29°C when wind speed is at 8 km/h. When the wind speed increases to 32 km/h, human flesh freezes at -12°C within one minute.

### 3.2. Potential Health Hazards

Cold will have initial physical and mental effects on personnel. Watching for the following signs can help prevent significant effects:

- Mental changes: loss of alertness, slurred speech, fatigue, lethargy or apathy
- Physical responses: general discomfort (feeling cold), loss of sensitivity and dexterity in fingers, hands and toes. Deep muscles can also be affected, reducing muscle strength and flexibility

Various cold related health conditions that may occur with exposure to cold temperatures are:

- Snow blindness
- Frostbite
- Hypothermia
- Trench foot (immersion foot)

## 4.0 Roles and Responsibilities

### 4.1. Supervisors

- When supervising jobs, be familiar with all jobs that have been identified as having potential risk of cold stress and their associated safe work procedures.
- Ensure hazard assessments are completed during cold weather conditions as required.
- Ensure adequate mitigation measures are implemented for identified hazards.

### 4.2. Employees

- Participate in the hazard assessment process.
- Be familiar with cold stress hazards, risks and preventative measures.
- Follow safe work procedures established to prevent cold stress-related injuries.
- Report all cold stress-related symptoms to work site supervisors.
- Follow recommended schedule of rest breaks, as advised by supervisors, to prevent cold stress-related injuries.

## 5.0 Procedure

### 5.1. Hazard Analysis

When the wind chill enters the “increasing hazard” range (-32$^{o}$C) of the equivalent chill temperature chart (Appendix A), the CPC Job Supervisor responsible for the work and the Work Crew Supervisor must include cold weather hazards in the hazard assessment and evaluate whether the work should be done or delayed until less hazardous conditions exist.

Supervisors must prioritize all outdoor activities when hazard assessments are required due to cold weather conditions. If it is necessary that the work be completed, the hazard analysis must include:

- Duration of outdoor activities to complete the work;

- Number of personnel required; and
- Cold-related hazards and mitigation measures including exposure times and rest/warm up breaks.

### *5.1.1. Engineering Controls*

- Provide a heated shelter for workers to work in where possible, but at a minimum as a shelter for work warm-up breaks.

  **Note**: Heated vehicles meet the requirements for a heated shelter.

| | |
|---|---|
| **B.C. OHS Reg. (7.36)** | If a worker is or may be exposed to a thermal environment with an equivalent chill temperature less than -7°C, a nearby heated shelter must be available to the worker. |

- Provide on-site heaters, if possible, to warm the immediate work area. Carbon monoxide and hot work must be considered when using this option.
- Shield work areas from drafts or winds as much as possible.
- Provide tools and equipment with thermally insulated handles.

### *5.1.2. Administrative Controls*

- Schedule work for the warmest part of the day where possible.
- Since individuals are less likely to notice their own symptoms, a buddy system approach may be utilized. This system allows for earlier recognition of signs and symptoms, such as frostbite to the ears, cheeks and nose.
- Schedule work warm-up breaks using the work warm-up schedule in Appendix B as a guide.
- Workers exhibiting the onset of heavy shivering, minor frostbite, the feeling of excessive fatigue, drowsiness, irritability or euphoria must return to the shelter.

### *5.1.3. Clothing/Personal Protective Equipment (PPE)*

Select protective clothing to suit the cold, the job and the level of physical activity. Wear several layers of clothing rather than one thick layer.

Important:

- The outer most layer of clothing on CPC leases must be fire-retardant as required by the ConocoPhillips Personal Protective Standard.
- Synthetic underclothing is not recommended for use under fire-retardant garments due to the reaction of the garment during fire.

**Footwear:** Use safety footwear that protects against the cold and dampness. Felt-lined, rubber bottomed, leather topped boots with removable insoles are best suited for heavy work in cold since leather is porous and allows for perspiration to evaporate. Operations may require the use of traction footwear be used on certain locations.

**Head, Face and Hands:** Keep your head covered (up to 40 to 50% of your body heat can be lost when the head is exposed). Use an appropriate hardhat liner with face shield, facemask or balaclava. Wear mittens instead of gloves when fine manual work is not required or

gloves with over-mitts that can be taken off. UVA/UVB tinted safety glasses should be worn where the hazard of snow blindness exists.

## Appendix A – Equivalent Chill Temperature (Wind Chill) Chart

| Estimated wind speed | Actual temperature reading (°C) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 10 | 5 | 0 | -5 | -10 | -15 | -20 | -25 | -30 | -35 | -40 | -45 | -50 |
| (in km/h) | Equivalent chill temperature (°C) | | | | | | | | | | | | |
| 0 (Calm) | 10 | 5 | 0 | -5 | -10 | -15 | -20 | -25 | -30 | -35 | -40 | -45 | -50 |
| 8 | 9 | 3 | -2 | -7 | -12 | -18 | -23 | -28 | -33 | -38 | -44 | -49 | -54 |
| 16 | 4 | -2 | -7 | -14 | -20 | -27 | -33 | -38 | -45 | -50 | -57 | -63 | -69 |
| 24 | 2 | -5 | -11 | -18 | -25 | -32 | -38 | -45 | -52 | -58 | -65 | -72 | -78 |
| 32 | 0 | -7 | -14 | -21 | -28 | -35 | -42 | -50 | -56 | -64 | -71 | -78 | -84 |
| 40 | -1 | -8 | -16 | -24 | -31 | -38 | -46 | -53 | -60 | -67 | -76 | -82 | -90 |
| 48 | -2 | -10 | -17 | -25 | -33 | -40 | -48 | -55 | -63 | -70 | -78 | -86 | -94 |
| 56 | -3 | -11 | -18 | -26 | -34 | -42 | -50 | -58 | -65 | -73 | -81 | -89 | -96 |
| 64 | -3 | -11 | -19 | -27 | -35 | -43 | -51 | -59 | -66 | -74 | -82 | -90 | -98 |
| (Wind speeds greater than 64 km/h have little additional effect.) | LOW HAZARD Risk of exposed, dry skin being affected in less than one hour. Awareness of hazard low. | | | | INCREASING HAZARD Danger from freezing of exposed flesh within one minute. | | | HIGH HAZARD Flesh may freeze within 30 seconds. | | | | | |

(Source: British Columbia's Cold Stress Regulation, Part 7)

The table was originally developed by the U.S. Army Research Institute of Environmental Medicine, Natick, MA, and is adapted from the 1995-1996 *Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices*, published by the ACGIH. The ACGIH publication provides the equivalent table with temperature in degrees Fahrenheit and wind speed in mph.

Equivalent chill temperatures for actual temperatures and wind speeds not listed in this chart may be calculated by interpolation. For example, at a wind speed of 16 km/h, an actual temperature reading of -23°C (3/5 of the difference between -20°C and -25°C) produces an equivalent chill temperature of -36°C (3/5 of the difference between -33°C and -38°C).

| Estimated Wind Speed (km/hr) | What to Look For |
|---|---|
| 10 | Wind felt on face; leaves rustle; wind vanes begin to move |
| 20 | Leaves and small twigs constantly move; small flags extend |
| 30 | Dust, leaves and loose paper lift; large flags flap; small tree branches move |
| 40 | Small trees begin to sway; large flags extend and flap |
| 50 | Larger tree branches move; large flags extend and flap more wildly; whistling heard in power lines |
| 60 | Whole trees move; resistance felt in walking again wind; large flags extend and flap only at end |

## Appendix B – Work Warm-Up Schedule (Four Hour Shift)

| Air temperature (sunny sky) | | No noticeable wind | | 8 km/h wind (5 mph) | | 16km/h wind (10 mph) | | 24 km/h wind (15mph) | | 32 km/h wind (20 mph) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| °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° | Normal breaks | 1 | Normal breaks | 1 | 75 minutes | 2 | 55 minutes | 3 | 40 minutes | 4 |
| -29° to -31° | -20° to -24° | Normal breaks | 1 | 75 minutes | 2 | 55 minutes | 3 | 40 minutes | 4 | 30 minutes | 5 |
| -32° to -34° | -25° to -29° | 75 minutes | 2 | 55 minutes | 3 | 40 minutes | 4 | 30 minutes | 5 | Non-emergency work should stop | |
| -35° to -37° | -30° to -34° | 55 minutes | 3 | 40 minutes | 4 | 30 minutes | 5 | Non-emergency work should stop | | | |
| -38° to -39° | -35° to -39° | 40 minutes | 4 | 30 minutes | 5 | Non-emergency work should stop | | | | | |
| -40° to -42° | -40° to -44° | 30 minutes | 5 | Non-emergency work should stop | | | | | | | |
| -43° and below | -45° and below | Non-emergency work should stop | | | | | | | | | |

*Source: Occupational Health and Safety Division, Saskatchewan Department of Labour*

### Notes

a) This table applies to any 4-hour work period of moderate-to-heavy work with warm-up periods of ten minutes in a warm location and with an extended break (e.g., lunch) at the end of the 4-hour work period in a warm location. For light-to-moderate work (limited physical movement) apply the schedule one step lower. For example, at -35°C (-30°F) with no noticeable wind (row 4), a worker at a job with little physical movement should have a maximum work period of 40 minutes with 4 breaks in a 4-hour period (row 5).

b) Here is a rough guideline for using the chart if only the wind-chill cooling rate is available: 1) initiate special warm-up breaks at a wind chill cooling rate of about 1750 W/m²; 2) cease all non-emergency work at or before a wind chill of 2250 W/m². In general, the warm-up schedule slightly undercompensates for the wind at the warmer temperatures, assuming acclimatization and clothing appropriate for winter work. On the other hand, the chart slightly overcompensates for the actual temperatures in the colder ranges because windy conditions rarely prevail at extremely low temperatures.

c) The chart applies only to workers in dry clothing.

## Appendix C – Frostbite Risk and Control Chart

**Frostbite Risk and Control Chart**

| Wind Chill | Risk of Frostbite | Health Concern | What to do |
|---|---|---|---|
| 0 to -9 ºC | Low | Slight increase in discomfort. | Dress warmly, with the outside temperature in mind. |
| -10 to -27 ºC | Low | Uncomfortable<br>Risk of hypothermia if outside for long periods without adequate protection. | Dress in layers of warm clothing, with an outer layer that is wind-resistant.<br>Wear a hat, mittens and scarf. Keep active. |
| -28 to -39 ºC | Increasing risk: Exposed skin can freeze in 10 to 30 minutes. | Check face and extremities (fingers, toes, ears and nose) for numbness or whiteness.<br>Risk of hypothermia if outside for long periods without adequate protection. | Dress in layers of warm clothing, with an outer layer that is wind-resistant.<br>Cover exposed skin: wear a hat, mittens and a scarf, neck tube or facemask.<br>Keep active. |
| -40 to -47 ºC | High risk: Exposed skin can freeze in 5 to 10 minutes. | Check face and extremities (fingers, toes, ears and nose) for numbness or whiteness (frostbite).<br>Risk of hypothermia if outside for long periods without adequate protection. | Dress in layers of warm clothing, with an outer layer that is wind-resistant.<br>Cover all exposed skin: wear a hat, mittens and a scarf, neck tube or face mask.<br>Keep active. |
| **WARNING LEVEL**<br>-48 to -54 ºC | High risk: Exposed skin can freeze in 2 to 5 minutes. | Check face and extremities frequently for numbness or whiteness (frostbite).<br>Serious risk of hypothermia if outside for long periods. | Be careful. Dress very warmly in layers of clothing, with an outer layer that is wind-resistant.<br>Cover all exposed skin: wear a hat, mittens and a scarf, neck tube or facemask.<br>Be ready to cut short or cancel outdoor activities.<br>Keep active. |
| -55 ºC and colder | High risk: Exposed skin can freeze in less than 2 minutes. | DANGER!<br>Outdoor conditions are hazardous. | Stay indoors. |

Source: Worker's Safety & Compensation Commission Northwest Territories

## Appendix D – Signs and Symptoms of Cold Exposure (Hypothermia)

| Stage | Body Core Temperature | Signs & Symptoms |
|---|---|---|
| **Mild Hypothermia** | 37.2–36.1°C | Normal, shivering may begin. |
| | 36.1–35°C | "Feeling cold", goose bumps, unable to perform complex tasks with hands, shivering can be mild to severe, hands numb. |
| **Moderate Hypothermia** | 35–33.9°C | Shivering, intense loss of muscular coordination, movements slow and laboured, stumbling pace, mild confusion but may appear alert. Use a sobriety-like test - if unable to walk a 9 metre straight line, the person is likely hypothermic. |
| | 33.9–32.2°C | Violent shivering continues, difficulty speaking, sluggish thinking, amnesia starts to appear, gross muscle movements sluggish, unable to use hands, stumbles frequently, signs of depression or withdrawn. |
| **Severe Hypothermia** | 32.2–30°C | Shivering stops, exposed skin is blue or puffy, muscle coordination very poor, inability to walk, confusion, incoherent/irrational behaviour, but may be able to maintain posture and appearance of awareness. |
| | 30–27.8°C | Muscle rigidity, semiconscious, stupor, loss of awareness of others, pulse and respiration rate decrease, possible heart fibrillation. |
| | 27.8–25.6°C | Unconscious, heartbeat and breathing is erratic, a pulse may not be obvious. |
| | 25.6–23.9°C | Pulmonary edema, heart and breathing failure, death. Death may occur before this temperature is reached. |

## Appendix E – Definitions

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|---|---|
| **Wind Chill** | Wind chill is the cooling effect of the combination of temperature and air velocity. It is an important factor in the evaluation of the outdoor environment. For example, when the actual air temperature of the wind is 5°C and its velocity is 56 km/h, the exposed skin would perceive these conditions as if the equivalent still air temperature were -12°C. The equivalent chill (wind chill) chart (Appendix A) is the best known and the most used of the cold stress indices. |
| **Snow blindness** | Normally, a temporary loss of vision caused by exposure to bright sunlight reflected from snow or ice. It can occur on cloudy or overcast days or during snow storms. Snow blindness is painful, because the ultraviolet rays of the sun burn the cornea.<br><br>Symptoms of snow blindness can include:<br>• a sensation of grit in the eyes;<br>• pain in and over the eyes that increases with eyeball movement;<br>• inflammation;<br>• red and teary eyes; and/or<br>• a headache that intensifies with continued exposure to light<br><br>In most cases, snow blindness lasts no more than one day and goes away after a person relieves the fatigue of the retina by resting indoors and away from bright light. In rare cases, prolonged exposure to the reflected light can lead to permanent vision loss. |
| **Frostbite** | Frostbite is caused by exposure to extreme cold or by contact with extremely cold objects (e.g., metal). It may also occur at normal temperatures from contact with cooled or compressed gases. Frostbite occurs when tissue temperature falls below freezing (0°C) or when blood flow is obstructed under cold conditions. Blood vessels may be severely and permanently damaged, and blood circulation may stop in the affected tissue.<br><br>In mild cases, the symptoms include inflammation (redness and swelling) of the skin in patches accompanied by slight pain. In severe cases, tissue damage without pain, or burning or prickling sensations and blistering, can happen. Frostbitten skin is highly susceptible to infection and gangrene (local death of soft tissues due to loss of blood supply) may develop.<br><br>**SEE APPENDIX C FOR FROSTBITE RISK AND CONTROL CHART** |
| **Hypothermia** | Hypothermia occurs when the body is unable to compensate for its heat loss and the body's core temperature starts to fall. You first feel cold followed by pain in exposed parts of the body. As the body's core temperature continues to drop, the feeling of cold and pain starts to diminish because of increasing numbness (loss of sensation). If no pain can be felt, serious injury can occur without the victim noticing it.<br><br>As the body continues to cool, muscular weakness, an inability to think clearly and drowsiness are experienced. This condition usually occurs when the body's internal or core temperature falls below 33°C. Additional symptoms include shivering coming to a stop, diminished consciousness and dilated pupils.<br><br>**SEE APPENDIX D FOR SIGNS AND SYMPTOMS OF HYPOTHERMIA** |
| **Trench Foot (immersion foot)** | Trench foot is the swelling and pain of feet caused by immersion for long periods in cold weather.<br><br>**First Aid:** Clean the feet, if possible. Elevate the feet above the level of the person's heart while gently re-warming them with passive skin-to-skin contact. Do not rub or place feet near a heat source such as a fire or stove. Call for a first aid attendant. Advise the worker to take an over-the-counter anti-inflammatory drug (e.g., Ibuprofen) and follow the directions on the label. Seek medical attention in serious cases. |

## Appendix F – Revision Record

| Page# | January 1, 2014 | Previous Information | Risk Assessment |
|---|---|---|---|
| ALL | Treat as new document | Separated previous heat and cold stress document and extracted pertinent cold stress-related information. | **Low**<br>Improved clarity and separation from Heat Stress |