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**Cold Stress**

Original: September 2002

Revised: December 2011

Revised: November 2022

BCMSA Cold Stress

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# REFERENCES

WorkSafeBC Regulations Part 7, Sections 7.33 to 7.38.

# PURPOSE

This program is designed to reduce cold stress whenever practicable and to eliminate the risk of the effects of cold stress to workers when performing tasks in the workplace.

# POLICY

[Organization]will maintain a Cold Stress Program to prevent or reduce the effects of cold stress in the workplace.

# SCOPE

This program applies to all workers, supervisors, contractors and other personnel who may be exposed to conditions that cause hypothermia or a cold-related injury to exposed skin.

# DEFINITIONS

|  |  |
| --- | --- |
| **Accidental Exposure** | Exposure to cold conditions as a result of an unplanned event. |
| **Artificial Cold Workplace** | Indoor work area where the thermal environment is affected by artificially cold means e.g. cold storage rooms, ice arenas. |
| **Cold-Related Injuries** | Examples of injuries include frostbite and frostnip. |
| **Cold Stress** | Condition affecting the human body caused by conditions that cause the core body temperature to fall below 36°C (96.8°F) or that cause cold-related injury to exposed skin. |

|  |  |
| --- | --- |
| **Conduction** | Transfer of heat through direct contact. Water conducts heat away from the body faster than air because it has a greater density, therefore greater heat capacity. Steel conducts heat away faster than water. |
| **Convection** | Heat loss from the surface of the body to moving air or water. |
| **Dry Bulb Temperature** | Temperature measured by a thermal sensor, such as an ordinary mercury-in-glass thermometer, that is shielded from direct radiant energy sources. |
| **Equivalent Temperature** | A temperature index that tells you how cold the temperature of the air feels because of the wind. Also known as equivalent chill temperature (See Appendix C). |
| **Heat Evaporation** | Heat loss through sweating and breathing. Evaporative heat loss accounts for 20% of the body’s normal total heat loss. |
| **Hypothermia** | A decrease in the core body temperature to a level at which normal muscular and cerebral functions are impaired. This process begins when the core body temperature drops below 36°C (96.8°F). |
| Radiation | The transfer of infrared, or heat radiation, from a hot object to a cold object without direct contact. In winter, with a normal body temperature of 37°C (98°F), we lose heat to the environment through radiation. |
| **Wind-chill** | An index measurement of the actual rate at which heat is lost because of the effect of the wind. Values for wind-chill are expressed in watts per m2. |
| **Vibration White Finger Disease**  **(Raynaud’s Disease or Raynaud’s Phenomenon)** | Prolonged exposure to vibrations (e.g. chainsaw or jackhammer) in cold conditions accelerates the onset of this disease. |

# RESPONSIBILITIES

## Employer

* Identify and assess areas, tasks, and occupations where there is potential for cold stress.
* Implement and/or provide controls (engineering, administrative, or personal protective equipment) to minimize cold stress.
* Provide training and education regarding cold stress, including early signs and symptoms of cold stress disorders.
* Maintain records of the cold stress assessments and worker training.
* Ensure that there is adequate first aid coverage and establish emergency procedures to deal with serious conditions such as hypothermia.

## Managers

* Ensure that a cold stress assessment is performed if a worker is exposed, or may be exposed, to conditions that could cause hypothermia or cold-related injuries.
* Provide administrative controls to reduce exposure to the risk of hypothermia or cold-related injuries when engineering controls are not practicable.
* Provide protective clothing for workers required to work in a controlled environment.
* Ensure that workers who are at risk of cold-related disorders are adequately educated and trained. Training must include recognition of signs and symptoms of cold-related disorders, rewarming procedures and first aid treatment, proper use of clothing, proper eating and drinking practices and safe work practices appropriate to the work that is to be performed.
* Post cold stress hazard warning signs in indoor work areas where a worker may be exposed to the effects of cold stress.
* Provide a heated shelter or heated vehicle for workers when work is required to be performed in an equivalent chill temperature less than -7°C.

## Supervisors

* Ensure that workers under their direct supervision are made aware of all known or reasonably foreseeable cold hazards in the area in which the task is to be performed.
* Ensure the health and safety of all workers under his/her direct supervision.
* Ensure that workers use safe work practices in relation to working in a cold environment.
* Increase the frequency of person-check intervals for any crews working in isolated areas at temperatures of less than minus 30°C.

## Workers

* Adhere to all control measures or work procedures that have been designed and implemented to reduce exposure to cold stress.
* Follow instructions to enter a heated shelter or heated vehicle if he/she exhibits signs and symptoms of impending hypothermia.
* Provide and wear adequately insulated outer clothing.
* Take precautions to avoid getting wet in winter.
* Wear eye protection if work takes place outdoors in snow or ice covered terrain and if there is excessive ultraviolet light, glare or blowing ice crystals that present a risk of injury to the eyes.
* Wear protective gloves, mittens, footwear, head covering and/or facemask appropriate to the hazard if there is a danger of frostbite to the extremities.

## JHS Committee or Worker Health and Safety Representative

* Advise the employer on procedures and effective systems to correct unsafe situations due to cold.
* Evaluate workplace conditions with workers and supervisors to determine the appropriate personal protective equipment required, as applicable.
* Deal with worker complaints regarding hazardous cold conditions.
* Attend and cooperate in incident investigations and worksite inspections.

# PROGRAM DETAILS

## Cold Stress Hazard Identification

[Organization]will conduct a cold stress hazard identification to determine whether a worker is or may be exposed to conditions that could cause hypothermia or cold-related injury. The hazard identification process is divided into 3 parts to identify risk factors:

* Part A: Environmental Hazards
* Part B: Job/Task-Related Hazards
* Part C: Personal Risk Hazards

Use the form located in Appendix A (Cold Stress Hazard Identification) to record the results.

## Cold Stress Risk Assessment

[Organization]will perform a risk assessment if hazards have been identified that may expose a worker to the risk of cold stress.

Environmental conditions may be obtained from Environment Canada providing that information is recent and up to date. Follow a 4-step risk assessment for cold stress. Refer to Appendix B (Cold Stress Risk Assessment) for the 4-step risk assessment procedure.

[Insert name of person responsible]will be responsible for conducting the cold stress risk assessment. The form located in Appendix B may be used to document the results of the risk assessment process.

A cold stress risk assessment will be completed when outdoor or workplace environments may put workers at risk of hypothermia or cold-related injuries. Outdoor and workplace conditions that may alert [insert name of person responsible]to conduct a cold stress risk assessment are:

* **Temperature**: Hypothermia can develop with prolonged exposure under 10°C.
* **Sweating/Precipitation at 10°C or less:** Sweating, rain or snow will make a worker’s clothing wet, and this increases a workers’ rate of cooling.
* **Wind at 10°C or less:** Increasing wind speed increases a workers’ rate of cooling.
* **Cold Equipment:** Workers working with refrigeration equipment or ice surfaces may be at risk.
* **Personal Factors:** Workers’ health status may influence their capacity to withstand cold environments (See Appendix A).

**Note:** Exposure to a cold thermal environment may also increase a worker’s risk to exposure of musculoskeletal injury (MSI). Refer to the separate Ergonomics Program for MSI hazard identification and risk assessment procedures.

## Working in Hazardous Wind-Chill Conditions

Wind-chill accounts for the loss of heat from workers by replacing the micro-layer of warm air surrounding the body with a layer of colder air. If there were no wind, the layer of warm air would act as an insulator. When that insulation layer is blown away, the body tries to heat up the new colder layer that causes the body to lose heat. This constant loss of heat causes the worker to feel like the temperature outside is cooler than the thermometer indicates. Refer to Appendix C (Equivalent Chill Temperature Table) for equivalent chill temperatures resulting from the effects of wind-chill.

If the cold stress risk assessment indicates that a worker is exposed to a thermal environment with an equivalent chill temperature less than -7°C, the following work practices will be followed:

* [Organization] will provide a heated shelter or heated vehicle near the exposed worker.
* Workers will be instructed to enter the shelter at the onset of symptoms of impending hypothermia or cold-related injury. Refer to Appendix D (Stages of Hypothermia), Appendix E (First Aid Treatment for Hypothermia) and Appendix F (Stages of Frostbite and First Aid Treatment).
* Workers must ensure they wear adequate protective clothing to prevent the risk of developing hypothermia.
* Where workers are working in temperatures of minus 30°C and colder, the frequency of person-check intervals for any crews working in isolated areas will be increased.

## Working in Contact with Cold Surfaces

When working in contact with cold surfaces there is a risk of developing contact frostbite or other cold-related injuries. [Organization] will take the following precautions to protect workers:

* Ensure that workers know their responsibility to supply their own clothing and equipment for protection against the natural elements.
* Ensure that workers wear protective gloves, mittens and footwear appropriate for the hazard to which they are exposed.
* Ensure workers wear insulated gloves when surfaces within their reach (especially metallic surfaces) are colder than -7°C. Workers will be warned to avoid skin contact with these surfaces.

## Working with Bare Hands in a Cold Environment

When a worker is required to perform tasks with bare hands and the risk of cold-related injury is present, [Organization] will implement the following procedures:

* Where there is a risk of cold-related injury to the hands, [Organization] will provide warm air jets, radiant heaters, or warm contact plates as a means for hand warming. This may be provided from an interior vehicle heater.
* Where practicable, tools and machine controls to be used in cold conditions will be designed for operation by gloved hands.

## Administrative Risk Controls for Working in Hazardous Cold Environments

Where practicable, [Organization] will implement the following procedures to reduce the risk of workers’ exposure to hypothermia or cold-related injury:

* Allow a period of adjustment to the cold before embarking on a full work schedule.
* Reduce as much as possible, the number of activities performed outdoors. When workers must work outdoors, select the warmest hours of the day and minimize activities that reduce circulation.
* Ensure that workers remain well hydrated.
* Ensure that workers eat properly according to the cold climate in which they are required to work.
* Establish a buddy system for working outdoors.

## Personal Protective Equipment for Hazardous Cold Conditions

Working in a cold environment exposes the worker to a risk of low core body temperature, known as hypothermia, and to a risk of cold-related injuries to body extremities and exposed skin. [Organization] will implement risk controls to reduce workers’ exposure to the harmful effects of cold environments. Personal protective equipment and clothing will be used only if:

* The tasks required to be performed cannot be eliminated or substituted with another that will provide the desired results
* Engineering controls are not practicable
* PPE is needed in addition to engineering controls for extra protection

### Protective Clothing

Personal protective clothing plays a major role in providing protection from the risk of exposure to hypothermia and cold-related injury. The following procedures will be followed:

* A worker who is at risk of developing hypothermia or cold-related injuries will wear adequately insulated outer clothing.
* For work in a controlled environment, e.g. a freezer, [Organization] will provide protective clothing that affords adequate protection against cold conditions.
* If clothing becomes wet so that its insulating value is impaired, [Organization] will provide the worker with the opportunity to change into dry clothing in a heated shelter.
* If a worker becomes immersed in water, [Organization] will immediately provide the worker with dry clothing and if necessary, treat for hypothermia.
* Workers will wear protective gloves, mittens, footwear, head covering and/or face masks if there is a danger of frostbite to the extremities.
* Workers will protect their hands from cold when operating vibrating tools. They should ensure extra gloves are available if their gloves get wet.

### Protective Equipment

If work is required outdoors in snow or ice covered terrain and the worker is exposed to ultraviolet light, glare or blowing ice crystals, workerswill ensure that they supply and wear eye protection appropriate to the hazards.

## Posting of Cold Stress Warning Signs

[Organization] will ensure that warning signs are posted in indoor work areas where there is a risk of hypothermia or cold-related injury.

## Accidental Exposure

Accidental exposure to hazardous outdoor cold conditions may occur to a worker as a result of an unplanned event. Such events may include, but are not limited to, breakdown in transportation, extension of the work-shift combined with deterioration in weather conditions or a requirement to perform a rescue operation.

If it can be reasonably anticipated that a worker may be exposed to hazardous outdoor cold conditions as a result of an unplanned event, [Organization] will provide the worker with sufficient clothing and equipment to permit his/her survival until such time that removal from the exposure is possible. Refer to Appendix G (Survival Kit)for a list of suggested items to be included in a survival kit.

In the event that a worker exhibits signs and symptoms of hypothermia as a result of accidental exposure, co-workers will follow procedures for the treatment of hypothermia or cold-related injuries. If a worker requires emergency treatment, a Level 2 or Level 3 first aid attendant, or a physician, if available, will assess the worker. If this is not practicable, call 911.

## Education and Training

All workers at risk of developing hypothermia or cold-related injury will be trained in the following areas:

**Personal Risk Factors**

Workers will receive training on the types of risk factors that may affect them, including:

* Poor physical fitness
* Not being acclimatized to working in the cold
* Having a cold or other flu like symptoms
* Chronic illness, especially heart disease, asthma/bronchitis, diabetes mellitus or chronic circulatory problems
* Using certain drugs or medication such as alcohol, nicotine, caffeine and medication that inhibit the body’s response to the cold or impairs judgement
* Exhibiting symptoms of fatigue
* Vibration/white finger disease (also known as Raynaud’s Disease or Raynaud’s Phenomenon)

**Hypothermia**

The quiet symptoms of potentially fatal cold-related disorders, including hypothermia, often go undetected until the worker’s health is endangered. The information listed in Appendix D (Stages of Hypothermia) and Appendix E (First Aid Treatment for Hypothermia) will be included in workers’ training to help prevent the occurrence of hypothermia.

**Frostbite**

Two factors, the external temperature and the body’s blood flow, affect tissue temperature in cold weather. All cold-related injuries are inherently affected by the dynamics of blood flow in the peripheral regions of the body. As peripheral circulation is reduced to prevent heat loss to the body core, cold-related injuries are more likely to occur. Refer to Appendix F (Stages of Frostbite & First Aid Treatment) for an overview of frostbite and appropriate first aid and rewarming techniques.

**Proper Use of Clothing**

Workers will comply with the regulatory requirements to wear protective clothing to protect them from the risk of exposure to cold-related disorders. Workers will be encouraged to wear several layers of clothing rather than one thick layer. Air captured between layers acts as an insulator, affording better heat conservation.

When working outdoors where there is the risk of exposure to hypothermia and cold-related injury, [Organization] will encourage the worker to wear adequate layers of clothing for optimal protection against the natural elements. These layers include:

|  |  |
| --- | --- |
| **Under Layer** | This is the layer closet to the skin. Ideally this layer should consist of clothing made of a material that wicks moisture away from the body (such as polypropylene). Cotton is a poor choice for this layer as cotton tends to absorb and hold moisture, which can cause the body to lose heat. |
| **Insulating Layer** | This next layer serves to insulate the body and conserve body heat. There are many new age materials available for use as an insulating layer, but the old standbys are wool and fleece. Wool is an excellent insulator and can conserve heat even when it is wet. A light weight wool sweater serves well as the insulating layer for the upper body. |
| **Outer Layer** | This final layer provides a barrier to wind and moisture, as well as helping to conserve body heat. The best material for the outer shell is a breathable, water-resistant material. |

**Hypothermia and Use of Shelters**

If the Equivalent Chill Temperature is -7°C or below, [Organization] will ensure that a heated shelter is located near the work area. Workers will be encouraged to use these shelters at regular intervals depending on the equivalent chill temperature. A heated vehicle is acceptable as a heated shelter.

Workers entering the shelter should remove their outer layer of clothing and loosen other clothing to let sweat evaporate. In some cases, a change of clothing may be necessary.

Workers exhibiting signs and symptoms of hypothermia or cold-related injuries will be evaluated by a Level 2 or Level 3 First Aid Attendant if available, or by a physician.

**Guidelines for Eating and Drinking**

Workers will understand the importance of high-caloric foods when working in cold environments such as warm, sweet drinks and soups to maintain caloric intake and fluid volume. It is important to maintain an adequate fluid balance, as working in cold environments can result in excessive sweating. Coffee should be discouraged because it increases water loss and blood flow to body extremities.

### Safe Work Practices

* Employ a “buddy system” to keep a regular watch on each other, including faces, cheeks, and ears for signs of frostnip, frostbite and behavior for indications of impending hypothermia.
* Keep a regular “self-check” for cold areas, wet feet, numbness or loss of sensation.
* If, at any time, a worker discovers a cold-related injury, he/she will stop work and re-warm the area, unless doing so places him/her at a greater risk.

## Investigating Incidents of Hypothermia and Cold-Related Injury

The Supervisor is responsible to conduct an investigation in response to a worker reporting or suffering hypothermia or a cold-related injury. The following elements will be included in the investigation:

* Description of cold stress problems that have been experienced
* Possible hazards that caused the condition to occur
* Sources of cold stress in the location
* Weather conditions on the day of the incident; were they typical?
* Description of clothing worn by the affected worker
* Records of instruction on cold stress, signs and symptoms and preventive action
* Description of risk controls that had been implemented on the worksite to prevent cold-related disorders
* Evidence of cold stress risk assessments being conducted
* Review of site documentation and, where appropriate, indications of prior cold stress problems

## Record keeping

[Organization] will maintain records of the following:

* Cold Stress Assessments
* Worker Education and Training

**TRAINING REQUIREMENTS**

## Goal

To ensure that all workers are aware of the Cold Stress Program and the policy and procedures that accompany it.

## Objectives

As a result of this training all workers and their supervisors will:

* Understand the effects of cold stress.
* Be knowledgeable of the temperatures associated with risks of cold stress and understand the hazards of working in a thermally cold environment.
* Know the requirements for cold stress assessments and the procedures to be followed.
* Understand the importance of adequate clothing for cold environments.
* Recognize the signs and symptoms of cold-related disorders and know the first aid procedures for workers exhibiting signs of cold-related disorders, including rewarming techniques.
* Know when to remove workers from cold environments.
* Understand the significance of warning signs when posted in indoor work areas and know the procedures that are to be followed if warning signs are in use.

## Summary of Training

* Definition of Cold Stress and terms used in the program
* Regulations that apply to Cold Stress
* Responsibilities of the employer, supervisors, workers and JHS committee or Worker Health and Safety Representative, as applicable
* Requirements for cold stress hazard identification and assessment procedures
* Requirements for the implementation of risk controls
* Requirements for providing hand warming devices
* Procedures for protecting workers at risk from accidental exposure
* Requirements for removing and treating workers exhibiting signs and symptoms of cold-related disorders
* Requirements for worker education and training
* Procedures for establishing indoor cold stress hazard areas
* Requirements for maintaining records

# PROGRAM MAINTENANCE

This program requires:

* Inspection and maintenance of cold stress measuring instruments
* Cold stress measurements
* Education of workers on recognizing cold-related disorders

# DOCUMENTATION

Documentation for this program includes:

* Records of Cold Stress Assessments
* Results of Worker Education and Training
* Records of Cold Stress Investigations

# APPENDICES

Appendix A – Cold Stress Hazard Identification

Appendix B – Cold Stress Risk Assessment

Appendix C – Equivalent Chill Temperature Table

Appendix D – Stages of Hypothermia

Appendix E – First Aid Treatment for Hypothermia

Appendix F – Stages of Frostbite and First Aid Treatment

Appendix G – Survival Kit

**Appendices**

## 

## Appendix A – Cold Stress Hazard Identification

|  |  |
| --- | --- |
| **Location of Hazard I.D:** | **Date/Time of Hazard I.D:** |
| **Name of Assessor:** | **Workers or Tasks being Evaluated:** |
| **Signature of Assessor:** |

The Cold Stress Hazard Identification process is divided into three parts:

**Part A:** Environmental Conditions

**Part B:** Task-Related Hazards

**Part C:** Personal Risk Factors

Repeat the hazard identification procedure if or when conditions (environmental or worker) that may present a new risk of cold stress change.

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| **Note:** A Cold Stress Risk Assessment is required only when hazards are identified in Part A. |

**PART A: Environmental Conditions**

**Instructions**

* Observe the environmental conditions and make notes in Part A of any hazards that may expose workers to a risk of cold-related disorders.
* Determine whether there is a risk of accidental exposure to hazardous cold conditions and make notes in Part A – Accidental Exposure.
* Determine whether there are previous records/history of exposure to cold stress relating to the job/tasks being performed and make notes in Part A – Review of Records & Statistics.
* If an environmental hazard is present, a Cold Stress Risk Assessment must be performed.

|  |  |  |  |
| --- | --- | --- | --- |
| **PART A**  **Environmental Conditions** | | | |
| **Hazard** | **Present in Work Area** | **Absent in Work Area** | **Details of Hazard/Conditions** |
| Known conditions that could cause hypothermia (core body temperature to fall below 36°C (96.8°F)) | 🞏 | 🞏 |  |
| Conditions exist where the air temperature feels cool and is being affected by the wind | 🞏 | 🞏 |  |
| Weather conditions have an equivalent chill temperature less then -7°C (19°F) | 🞏 | 🞏 |  |
| Environment where workers are continuously exposed to damp/wet conditions or are likely to be wearing wet clothing | 🞏 | 🞏 |  |
| **Accidental Exposure** | | | |
| Can it be reasonably anticipated that a worker may be exposed to hazardous cold conditions outdoors as a result of an unplanned event? | Yes  🞏 | No  🞏 |  |
| **Review of Records/Statistics** | | | |
| Work area and/or occupation have been previously identified as being hazardous | 🞏 | 🞏 |  |
| Areas or occupations about which workers have expressed concern | 🞏 | 🞏 |  |

**PART B: Task-Related Hazards**

* Observe the tasks being performed.
* Determine whether there are hazards that may expose workers to a risk of cold-related disorders.
* If a task-related hazard is present, implement appropriate risk controls.

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| **PART B**  **Task-Related Hazards** | | | |
| **Hazard** | **Present in Work Area** | **Absent in Work Area** | **Details of Hazard/Corrective Action Required** |
| Work requiring contact with cold surfaces/materials | 🞏 | 🞏 |  |
| Worker is required to perform work with bare hands | 🞏 | 🞏 |  |
| Work takes place outdoors in snow or ice covered terrain and there is excessive UV light, glare or blowing ice crystals | 🞏 | 🞏 |  |
| Hands and/or feet are continuously exposed to wet conditions | 🞏 | 🞏 |  |
| Other: | 🞏 | 🞏 |  |
| Other: | 🞏 | 🞏 |  |

**PART C – Personal Risk Factors**

* Each worker will complete a Personal Risk Factor Assessment in private.
* If a worker reports having a personal risk factor for exposure to cold stress, it will be reported to the supervisor to determine specific risk controls that may be required to reduce the risk of exposure.

|  |  |  |  |
| --- | --- | --- | --- |
| **PART C**  **Personal Risk Factors** | | | |
| **Personal Risk Factor** | **Present in Worker** | **Absent in Worker** | **Details of Risk Factor/Corrective Action Required** |
| Poor physical fitness | 🞏 | 🞏 |  |
| Not use to working in the cold | 🞏 | 🞏 |  |
| Having a cold or other flu like symptoms | 🞏 | 🞏 |  |
| Chronic illness, especially heart disease, asthma/bronchitis, diabetes mellitus or circulatory problems | 🞏 | 🞏 |  |
| Using certain drugs or medication such as alcohol, nicotine, caffeine and medication that inhibits the body’s response to the cold or impairs judgment | 🞏 | 🞏 |  |
| Exhibiting symptoms of fatigue | 🞏 | 🞏 |  |
| Vibration/white finger disease (also known as Raynaud’s Disease or Raynaud’s Phenomenon) | 🞏 | 🞏 |  |

## Appendix B – Cold Stress Risk Assessment

**Instructions**

* Complete Section 1, recording information on Assessor’s and Worker’s/Tasks being assessed.
* Complete Section 2, documenting the results of the risk assessment using information either from Environment Canada or from measurements that you record yourself.
* Include assessment of the risk of accidental exposure and effects of vibration in Section 2. (Procedures for accidental exposure and vibration assessment are located at the end of Section 2.)

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| --- | --- |
| **COLD STRESS RISK ASSESSMENT – SECTION 1** | |
| **Location of Risk Assessment:** | **Date/Time of Risk Assessment:** |
| **Name of Assessor:** | **Workers or Tasks being Assessed:** |
| **Signature of Assessor:** |
| **Others in Attendance:**  **Name:**  **Signature:**  **Name:**  **Signature:** |
| **Reason for Conducting Risk Assessment:** | |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **COLD STRESS RISK ASSESSMENT – SECTION 2** | | | | |
| **Type of Measurement** | **Reading** | **Source of Information** | | |
| **Ambient Air Temperature (°C)** |  |  | | |
| **Wind Speed (km/hr)** |  |  | | |
| **Equivalent Chill Temperature (°C)** |  | Appendix C | | |
| **Category of Hazard**  (Using Equivalent Chill Temperature Table in Appendix C, determine category of hazard) | * Low: risk of exposed, dry skin being affected in less than one hour * Equivalent chill temperature of -7°C (19°F) * Increasing: risk of exposed flesh freezing within one minute * High: risk that flesh may freeze within 30 seconds | | | |
| Are Risk Controls Required?  List Risk Controls to be Implemented: | * Yes | | * No | |
| * Heated shelter * PPE * Spare clothing * Provisions for hand warming | | | |
| Have Risk Controls been Implemented Prior to Commencing Work? | * Yes * No * N/A | | | |
| If no, give brief details of action being taken: | | | | |
| Does the task involve Hand-Arm Vibration? | * Yes * No | | | |
| Are additional risk controls required to protect the worker? | * Yes - Give Details: * No | | | |
| Is there a risk of Accidental Exposure of a worker to an outdoor environment that may result in the worker suffering hypothermia or cold-related injury? | | | | * Yes * No |
| Have provisions been made for the worker to ensure survival from accidental exposure until rescue can be effected?  Give Details: | | | | * Yes * No |

**Determine the Risk of Accidental Exposure**

Determine whether there is a risk of workers being exposed to hazardous cold conditions outdoors as a result of an unplanned event. Prior to commencing work, look for conditions or situations that may predispose workers to accidental exposure. Make a record on the risk assessment of steps taken to protect workers from exposure, as appropriate.

**Determine the Effects of Vibration**

The presence of vibration in a task will have some influence on the degree of risk of exposure to cold-related injury. Where a worker is exposed to the effects of vibration in a cold environment, [Organization]will comply with WorkSafeBC OHS Regulation Parts 7.10 to 7.16 where appropriate.

## Appendix C – Equivalent Chill

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Equivalent Chill Temperature** | | | | | | | | | | | | | |
| **Actual Temperature Reading (°C)** | | | | | | | | | | | | | |
| Estimated Wind Speed | 10 | 5 | 0 | -5 | -10 | -15 | -20 | -25 | -30 | -35 | -40 | -45 | -50 |
| (in km/hr) **Equivalent Chill Temperature (°C)** | | | | | | | | | | | | | |
| 0  8  16  24  32  40  48  56  64 | 10 | 5 | 0 | -5 | -10 | -15 | -20 | -25 | -30 | -35 | -40 | -45 | -50 |
| 9 | 3 | -2 | **-7** | -12 | -18 | -23 | -28 | -33 | -38 | -44 | -49 | -54 |
| 4 | -2 | **-7** | -14 | -20 | -27 | -33 | -38 | -45 | -50 | -57 | -63 | -69 |
| 2 | -5 | -11 | -18 | -25 | -32 | -38 | -45 | -52 | -58 | -65 | -72 | -78 |
| 0 | **-7** | -14 | -21 | -28 | -35 | -42 | -50 | -56 | -64 | -71 | -78 | -84 |
| -1 | -8 | -16 | -24 | -31 | -38 | -46 | -53 | -60 | -67 | -76 | -82 | -90 |
| -2 | -10 | -17 | -25 | -33 | -40 | -48 | -55 | -63 | -70 | -78 | -86 | -94 |
| -3 | -11 | -18 | -26 | -34 | -42 | -50 | -58 | -65 | -73 | -81 | -89 | -96 |
| -3 | -11 | -19 | -27 | -35 | -43 | -51 | -59 | -66 | -74 | -82 | -90 | -98 |
| (Wind speeds greater than 64km/hr 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. | | | | | |

**Notes:**

* This table shows the cooling power of wind on exposed flesh expressed as equivalent temperature under calm conditions.
* Shaded areas denote an equivalent chill temperature requiring dry clothing to maintain core body temperature above 36°C (98.6°F).
* Equivalent chill temperatures for actual temperatures and wind speeds not listed in this chart may be calculated by interpolation.

## Appendix D – Stages of Hypothermia

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| **Stages of Hypothermia** | | |
| **Stage** | **Core Temperature** | **Signs and Symptoms** |
| **Mild Hypothermia** | Drops by 1-2 °C (1.8 or 3.6 °F) | * Feel chilled/cold sensation * Goose bumps * Unable to perform complex tasks with hands * Poor judgment, muddled thinking and abnormal behavior * Bouts of shivering * Hands may be numb |
| **Moderate Hypothermia** | Drops by 2-4 °C (3.8 or 7.6 °F) | * Violent shivering or shivering has stopped altogether * Inability to think and pay attention (e.g. victim cannot understand what is being said) * Mild confusion although may appear alert * Slow, shallow breathing * Slurred speech * Poor body co-ordination (e.g. stumbling gait) * Slow, weak pulse |
| **Severe Hypothermia** | < 32°C  (< 89.6°F) | * Shivering has stopped * Unconsciousness * Little or no breathing * Weak, irregular or non-existent pulse * Dilated (wide open) pupils * Exposed skin blue and/or puffy * Possible similarity of symptoms to clinical definition of death |

## 

## Appendix E – First Aid Treatment for Hypothermia

**Definitions**

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| **Afterdrop** | A situation in which the core temperature decreases during the rewarming of a hypothermic victim. Caused by peripheral vessels in the arms and legs dilating if they are re-warmed. |
| **Vasoconstriction** | Narrowing of blood vessels decreases the blood flow to periphery, thereby reducing the process of heat loss. |
| **Vasodilation** | Opening of blood vessels increases surface blood flow, thereby increasing the process of heat loss (when ambient temperature is less than body temperature). |

**General Tips for Handling Hypothermic Victims**

* Always handle the victim gently. Rough handling can cause heartbeat irregularities and death.
* Remove the victim from the cold environment and assess by Level 2 or Level 3 First Aid Attendant or by a physician, as soon as possible.
* Hot fluids may be given only if the victim is fully alert, without any signs of confusion. Victims with moderate and severe hypothermia have a high risk of vomiting and must not be given anything by mouth.
* Do not attempt to exercise victims. Take immediate measures to prevent further heat loss and continue to do so even if victim regains consciousness.
* Remember that the victim may still be alive even if there is little or no pulse or heart beat.

**Management/Rewarming of Mild Hypothermic Victims**

* Minimize his/her exertion.
* Remove wet clothing and get the victim into warm, dry clothes and wrap victim in warm blankets. Make sure the victim’s head is covered. Place something warm and dry under the victim. Move the victim to a warm environment. Do not make the victim exercise to warm up.
* Do not suppress shivering, even if violent. Shivering is the most effective way to generate body heat.
* Do not massage the extremities (hands, arms, legs, feet, etc.,) or the trunk.
* Do not place victim in a warm bath or shower.

**Management/Rewarming of Moderate to Severe Hypothermic Victims**

* Check for airway obstructions and breathing or circulation problems and perform appropriate action if there are any abnormalities in these areas.
* Remove all wet clothing, make sure victim is dry and replace with dry, multiple-layered coverings. If possible, the victim should have a polypropylene layer next to the skin to minimize sweating on the skin.
* Wrap the victim in warm blankets or a sleeping bag. If this is not possible, cover the victim with warm dry clothing or blankets, making sure that the victim’s head is covered and something warm and dry is also placed under the victim.
* Move the victim to a warm, dry environment.
* Do not suppress shivering, even if it is violent. Shivering generates body heat.
* Do not give anything by mouth, as there is a high risk of vomiting.
* Do not massage the trunk or extremities of the victim.
* Do not place the victim in a hot bath or shower.
* If available, heated, humidified air or oxygen should be administered.
* Continue first aid treatment even if the victim appears lifeless. The body sometimes survives for hours without signs of life at very low body temperatures.
* Know how to assess hypothermia and give help when it is needed, even if the victim resists help. The victim may be confused and unaware of what is happening and may deny assistance when it is needed.
* Arrange rapid transport to the nearest medical facility.

**CPR for Hypothermic Victims**

If a person is suffering from severe hypothermia they may exhibit many of the clinical signs of death:

* Cold
* Blue skin
* Fixed and dilated pupils
* No discernible pulse
* No discernible breathing
* Comatose and unresponsive to any stimuli
* Rigid muscles

Despite exhibiting these signs, the victim may still be alive and further steps should be taken to closely evaluate the victim’s condition:

1. Check for airway obstructions and breathing or circulation problems. Take appropriate action if there are any abnormalities in these areas.
2. Complete a full 1-minute assessment of the victim. The radial pulse may be absent if the victim is in severe hypothermia, therefore check the carotid pulse for a 1-minute period to ascertain if there is a slow heart beat. Although the heart rate may be as low as 2-3/minute and breathing rate 1/30 seconds, the heart will be filling completely and distributing blood fairly effectively. Due to the severely reduced demands of the hypothermic body, the reduced heartbeat may be able to satisfy circulatory needs with only 2-3 beats/minute.
3. If there is no pulse, commence CPR and continue to do so as the victim is re-warmed.
4. Although ventilation may have stopped, it is possible that the body may be able to survive for some time using only the oxygen that is already in the body. If ventilation has stopped, artificial ventilation should be commenced. In addition to making more oxygen available, blowing warm air into the person’s lungs may assist in internal rewarming.

**Note:** During severe hypothermia the heart is hyperexcitable and mechanical stimulation such as CPR, moving the victim or the effects of “afterdrop”, may result in fibrillation of the heart, leading to death. As a result, CPR may be contraindicated for some hypothermic victims.

## Appendix F – Stages of Frostbite & First Aid Treatment

Frostbite most typically affects the ears, cheeks, nose, fingers and toes. By using a “buddy system” it is possible to prevent frostbite injuries from occurring if co-workers are educated in the signs and symptoms of the disorder.

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| **First Aid Treatment for Frostbite** | | |
| **Stage of Frostbite** | **Signs and Symptoms** | **First-Aid Treatment** |
| **Frostnip** | * Freezing of the top layers of skin tissue * Skin appearance: white, waxy. Top layer of skin feels hard & rubbery * Deep tissue is still soft * Numbness | * Rewarm the area gently, generally by blowing warm air on it or placing the area against a warm body part * Do not rub the area – this causes damage to skin and tissue |
| **Superficial Frostbite** | * Skin appearance: white * To touch: wooden feeling throughout affected area * All layers of skin affected * Numbness, sensation may be absent | * Rewarm as for frostnip if affected area is only small * If area is large, use immersion method * Transport to hospital if necessary |
| **Deep Frostbite** | * Skin appearance: white * To touch: wooden feeling throughout affected area * Includes all layers of the skin * May include freezing of muscle and/or bone | * Begin rewarming techniques using immersion method * Transport to hospital as soon as possible |

**Rewarming Techniques for Frostbite Injury**

Treatment for frostbite should ideally be performed in a hospital. The following procedures may be followed if, for some reason, hospital treatment is not available:

* Monitor water temperature (38.9°C - 43.33°C) closely throughout the immersion period.
* Remove any wet or tight clothing.
* Gently place the affected area in a warm water bath. If warm water has to be added to maintain immersion temperature, do not pour directly on the affected area as this will cause the tissue to warm too fast causing further damage.
* Circulate the water frequently to maintain an even temperature.
* Immerse affected body area for 25-40 minutes as appropriate.
* Thawing is complete when the part is pliable and color and sensation has returned. Discontinue the warm water bath when thawing is complete.
* Do not use dry heat to re-warm.

After the affected area has been warmed, it may become puffy and blister with a burning feeling or numbness. When normal feeling, movement and skin color have returned, the affected area should be dried and wrapped in a sterile bandage to keep it clean and warm. Warning: once the area is re-warmed, there can be significant pain.

* If there is a chance that the affected area may get cold again, do not re-warm it as it will cause severe tissue damage.
* If the person is hypothermic and frost-bitten, the first concern is to re-warm the core body temperature. Do not re-warm the frost-bitten areas until the core temperature reaches 35.5°C.
* Refrain from consuming alcohol.
* Refrain from smoking, as nicotine constricts blood vessels thereby increasing the risk of developing frostbite.
* Seek medical attention as soon as possible.

## Appendix G – Survival Kit

A survival kit should contain the following items:

* Change of clothing including underlayer, insulating layer and outer layer garments
* Emergency supplies including flashlight, waterproof matches, energy snacks such as nuts and raisins, bottled water
* Light weight emergency rain poncho
* Spare gloves, footwear, head covering and face mask
* Protective eye wear
* Sleeping bag stored in plastic vapor-barrier wrapper
* Means of communication i.e. cell phone, 2-way radio