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G7.2 Exposure limits

Issued August 1999; Revised January 1, 2005; Retired April 9, 2019

This guideline is being retired due to duplication of resources available to employers through www.worksafebc.com.

G7.3-1 Noise measurement - When required and performance

Issued August 1999; Revised January 1, 2005; Revised April 4, 2007; Editorial Revision June 6, 2007; Retired April 9, 2019

This guideline is being retired due to duplication of resources available to employers through www.worksafebc.com.

G7.3-2 Noise exposure data collected by prevention officers

Issued August 1999; Revised January 1, 2005; Editorial Revision February 6, 2006; Retired November 29, 2021

This guideline has been retired as it contained outdated or redundant material.

G7.4 Exemption

Issued August 1999; Revised January 1, 2005; Editorial Revision October 2005; Editorial Revision February 6, 2006; Retired April 9, 2019

This guideline is being retired due to duplication of resources available to employers through www.worksafebc.com.

G7.5-1 Program - Education and training

Issued January 1, 2005; Retired April 9, 2019

This guideline is being retired due to duplication of resources available to employers through www.worksafebc.com.

G7.5-2 Annual program review

Issued August 1999; Revised January 1, 2005; Editorial Revision October 2005; Editorial Revision February 6, 2006; Retired April 9, 2019

This guideline is being retired due to duplication of resources available to employers through www.worksafebc.com.

G7.6-1 Investigating controls

Issued August 1999; Revised January 1, 2005; Revised January 1, 2005; Editorial Revision October 2005; Editorial Revision February 6, 2006; Retired April 9, 2019

This guideline is being retired due to duplication of resources available to employers through www.worksafebc.com.

G7.6-2 Implementing controls

Issued August 1999; Revised January 1, 2005; Retired April 9, 2019

This guideline is being retired due to duplication of resources available to employers through www.worksafebc.com.

G7.7-1 Selection of hearing protection

Issued August 1999; Revised January 1, 2005; Retired April 9, 2019

This guideline is being retired due to duplication of resources available to employers through www.worksafebc.com.

G7.7-2 Warning signs and hearing protection

Issued August 1999; Revised January 1, 2005; Retired April 9, 2019

This guideline is being retired due to duplication of resources available to employers through www.worksafebc.com.

G7.7(1)(c) Hearing protection

Issued June 3, 2019

Regulatory excerpt
Section 7.7(1)(c) of the *OHS Regulation* (*"Regulation"*) states:

> (c) give to affected workers hearing protection that meets the requirements of *CSA Standard Z94.2-02, Hearing Protection Devices - Performance, Selection, Care, and Use*, as amended from time to time, except as otherwise determined by the Board, and maintain the hearing protection so that it continues to meet those standards, and

Section 4.4(2) of the *Regulation*:

> (2) When this Regulation requires a person to comply with
>
> (a) a publication, code or standard of the Board or another agency, the person may, as an alternative, comply with another publication, code or standard acceptable to the Board...

Purpose of guideline
The purpose of this guideline is to specify, for the purpose of section 7.7(1)(c) an alternate standard acceptable to WorkSafeBC for hearing protection devices.

Acceptable standard
Section 4.4(2) permits WorkSafeBC to accept another standard as an alternative to one referred to in the *Regulation*. WorkSafeBC has determined that the *CSA Standard Z94.2-14, Hearing Protection Devices - Performance, Selection, Care, and Use*, is an acceptable alternative to the standard listed in section 7.7(1)(c).

G7.8-1 Annual hearing tests

Issued August 1999; Revised January 1, 2005; Editorial Revision April 4, 2007; Editorial Revision April 9, 2019

Regulatory excerpt
Section 7.8(1) of the *OHS Regulation* (*"Regulation"*) states:

The employer must give workers who are exposed to noise that exceeds noise exposure limits

(a) an initial hearing test as soon as practicable after employment starts, but not later than 6 months after the start of employment, and

(b) a test at least once every 12 months after the initial test.

Purpose of guideline
The purpose of this guideline is to describe the application of section 7.8(1) of the *Regulation* to industries in which workers may not be employed continuously for more than six months.

Background
There are a number of industries where noise levels are known to exceed the exposure limits in section 7.2 of the *Regulation* and in which workers may not be employed continuously for more than six months; however, workers are usually employed in these industries for many months each year. Examples of such industries are fish processing, shipbuilding, logging, construction, and oil and gas.

Level of risk

Some industries, such as agriculture, involve workforces that are a mix of established and seasonal workers, who may be exposed to a range of noise levels. Typically, fieldworkers who do not operate or consistently work near equipment with high noise levels, will be exposed to low noise levels and would not need to be tested. Persons most at risk would likely include those farmers, ranchers, and workers who operate equipment with high noise levels, and those who work in some indoor operations involving raising of animals or fowl.

Program options for testing workers
Section 7.8(1) of the *Regulation* establishes an obligation to test any new worker who is exposed above the noise exposure limits, not just those workers who stay for six months with the employer. If the employment lasts less than six months, the test should be done within that timeframe or period. In this context, the employer should have a reasonably effective program for testing workers. Two common ways of doing this are as follows:

- Arrange for a hearing testing provider to visit the place of workplace
- Set up an in-house testing program

With regard to the first option, the visits may be at regular intervals selected by the employer, such as every three months. Alternatively, the employer might arrange the visits for a convenient time in a project, such as before workers leave town to go to a remote area. In either case, if the employer sets up a reasonable program, WorkSafeBC will not be concerned if some workers missed the testing because they started work just after, or finished employment just before, a testing provider arrived.

In some situations, for example in rural agricultural operations, options other than the two listed above may be appropriate. For example, workers may be sent to a testing facility where available in a nearby town; or workers from a number of farms or ranches may be tested at a location common to them, or at another workplace in the area with an in-house testing program.

Out-of-province employers
A similar issue arises for out-of-province employers who operate in B.C. for short periods of time. If the workers are working in B.C. for a total of six months or more in a year, then hearing tests meeting the requirements of section 7.8 of the *Regulation* are required for those workers.

G7.8-2 Authorized hearing testers

Issued August 1999; Revised January 1, 2005; Editorial Revision April 9, 2019; Editorial Revision April 6, 2020

Regulatory excerpt

Section 7.8(2) of the *OHS Regulation ("Regulation")* states:

Hearing tests must be administered by a hearing tester authorized by the Board.

Purpose of guideline
The purpose of this guideline is to identify the facilities and industrial audiometric technicians who are authorized by WorkSafeBC as meeting minimum requirements for conducting hearing tests, and the employers' responsibilities around the maintenance of worker health records under this section.

Authorized testing facilities
A list of authorized hearing test providers is available on worksafebc.com.

Maintenance of medical history

The employer must not disclose or publish a worker's medical history information except as permitted by the Board, in accordance with section 53(1)(a) of the *Workers Compensation Act*. Section 53 states in part:

(1) A person must not disclose or publish the following information, except for the purpose of administering this Act and the regulations or as otherwise required by law:

(a) information obtained in a medical examination, test or X-ray of a worker made or taken under the OHS provisions, Part 7 *[Appeals to Appeal Tribunal]* or the regulations, unless the worker consents or the information is disclosed in a form calculated to prevent the information from being identified with a particular person or case;
…

An employer should also not retain a copy of a worker's medical history.

G7.8-3 Hearing test results

Issued August 1999; Revised January 1, 2005; Editorial Revision 2005; Editorial Revision February 6, 2006; Editorial Revision April 9, 2019

Regulatory excerpt

Section 7.8(3) of the *OHS Regulation* states:

The employer must ensure that the authorized hearing tester sends the test results to the Board.

Purpose of guideline
The purpose of this guideline is to describe the process by which hearing tests can be submitted to WorkSafeBC and accessed by employers.

Accessing hearing tests
Authorized testers are required to submit the hearing tests to WorkSafeBC in the manner prescribed by WorkSafeBC. WorkSafeBC maintains a database of hearing tests. Employers are able to access these test results and reports through the employer portal on worksafebc.com. It is expected that the employers will use this report to determine the rate and extent of occupational hearing loss in their workers when reviewing the hearing conservation program on an annual basis.

G7.8-4 Construction industry

Issued August 1999; Revised January 1, 2005; Editorial Revision April 9, 2019; Editorial Revision April 6, 2020

Regulatory excerpt

Section 7.8 of the *OHS Regulation* (*"Regulation"*) states:

(1) The employer must give workers who are exposed to noise that exceeds noise exposure limits

(a) an initial hearing test as soon as practicable after employment starts, but not later than 6 months after the start of employment, and

(b) a test at least once every 12 months after the initial test.

(2) Hearing tests must be administered by a hearing tester authorized by the Board.

(3) The employer must ensure that the authorized hearing tester sends the test results to the Board.

Purpose of guideline
The purpose of this guideline is to describe the application of hearing test programs in the construction industry.

Hearing test programs in the construction industry
In October 1987, an agreement was established between WorkSafeBC and the construction industry (joint worker/employer representation through the BC Construction Association) that workers employed in some construction industry classifications are routinely exposed to noise in excess of the exposure limits. The agreement applies to the classification units (CUs) beginning with 72.

A worker in a 72 CU should normally be part of a hearing test program meeting the requirements of section 7.8 of the *Regulation*. If any worker in a 72 CU is not part of a hearing test program, orders may be written on the employer without measuring noise exposure of the worker. There is an extensive noise database documenting exposures for these occupations; the database was established in the mid-1980s and updated in the late 1990s. However, the WorkSafeBC prevention officer will consider any evidence presented by the employer showing that a particular worker need not be on a hearing test program.

Payment for a construction worker's hearing tests
To assist construction industry employers in the above CUs to comply with the hearing test program requirements, WorkSafeBC has established the following:

- A central registry of hearing test results
- A card validation system so each construction workers can show when their hearing was tested
- A program to pay an authorized hearing test agency a fee per hearing test performed

WorkSafeBC sets the fee paid to the hearing test agency for each test. The funding for this program is collected from the construction industry as a whole by charging an additional assessment to the CUs referred to above. This is pursuant to section 107 of the *Workers Compensation Act*, which provides that WorkSafeBC may charge a class or subclass with the cost of investigations, inspections, and other services provided to the class or subclass for the prevention of injuries and illness.

An employer in one of the above CUs may comply with the requirements of section 7.8 of the *Regulation* without using the WorkSafeBC-administered program if the employer wishes. However, employers who participate in and comply with WorkSafeBC's program are exempt from the obligation to conduct noise exposure measurement under section 7.4 of the *Regulation*.

G7.9 Test records

Issued August 1999; Revised January 1, 2005; Editorial Revision October 2005; Editorial Revision February 6, 2006; Editorial Revision April 9, 2019

Regulatory excerpt
Section 7.9 of the *OHS Regulation* (*"Regulation"*) states:

The employer must keep records of

(a) the annual hearing test results for each worker, which must

(i) be kept as long as the worker is employed by the employer, and

(ii) be kept confidential and not released to anyone without the written permission of the worker, or as otherwise required by law,

(b) the education and training provided to workers, and

(c) the results of noise exposure measurements taken under section 7.3.

Purpose of guideline
The purpose of this guideline is to describe how employers should maintain and access hearing test records for their employees.

Hearing test records
The employer does not have to maintain the original hard-copy hearing test results, but must have access to them. Employers can access hearing test results online through the employer portal on worksafebc.com, or may choose to have the hearing testing business that conducted the tests maintain the hearing test records on behalf of the employer. Such arrangements should be set out in a written agreement and must be in accordance with *Freedom of Information and Protection of Privacy Act* requirements.

A prevention officer may ask for other evidence of compliance with section 7.8 of the *Regulation* (provision of annual hearing tests to noise exposed workers) such as a copy of the report from worksafebc.com. The report includes a list of all workers and a statistical breakdown of tests into various categories.

On construction sites, noise exposed workers should carry a current Record of Hearing Test card validating that they have been tested. The worker may be asked by a prevention officer to show the test record card.

A prevention officer may ask the employer to obtain actual copies of hearing tests from the hearing test provider if the prevention officer feels this is necessary to verify compliance. The provider should provide these to the employer on request.

G7.11-1 Exposure limits - Hand-arm vibration

Issued August 1999; Revised January 1, 2005; Revised October 30, 2018

Regulatory excerpt
Section 7.11(a) of the *OHS Regulation* states:

> The employer must ensure, to the extent practicable, that workers are not exposed to vibration in excess of the limits specified in
>
> (a) for hand-arm vibration, the American Conference of Governmental Industrial Hygienists publication entitled *Threshold Limit Values and Biological Exposure Indices*, dated 2003, as amended from time to time;
> …
>
> except as otherwise determined by the Board

Purpose of guideline
The purpose of this guideline is to outline the exposure limits for hand-arm vibration ("HAV") mentioned in section 7.11(a) as prescribed in the latest edition of the American Conference of Governmental Industrial Hygienists' publication entitled *Threshold Limit Values and Biological Exposure Indices*.

Potential health effects of hand-arm vibration
It is recognized that exposure to vibration may lead to Hand-Arm Vibration Syndrome, a set of upper extremity disorders that include vascular, sensorineural, and musculoskeletal signs and symptoms. Vibration induced health effects could occur both with acute exposures and chronic exposures over time. Some of the signs and symptoms of vibration exposures are tingling, numbness, pain, and reduced sensory perception and dexterity in the hand. Sources of exposure to HAV are commonly associated with rotating or percussive hand-held power tools, vibrating workpieces, and hand-held vibrating controls.

Hand-arm vibration exposure limit
The HAV exposure limit (8-hour energy equivalent total value) of 5 metres/sec^2 is expressed as an equation and in Figure 1 below. The ACGIH states that due to individual susceptibility, the exposure limit should not be regarded as defining a boundary between safe and unsafe exposure levels. The evaluation of vibration, including measurements, must be performed in accordance with the procedures and instructions specified by ISO 5349-1 and ISO 5349-2 as required by section 7.12 of the *Regulation*.

$t_{exp} = 8h(5ms^{-2}/a)^2$, *where a= acceleration*

Using the equation, the table below provides some examples of HAV exposure limits for different exposure durations, as reflected in Figure 1 below.

Exposure Duration (in hours)	HAV Exposure Limits in metres per second squared (m/s^2)
8	5
6	5.8
4	7.1
2	10
1	14.1
0.5	20

Source: ACGIH

For more information about evaluating HAV exposures, refer to the OHS Guideline G7.12, Evaluation.

The *Regulation recognizes*, in the phrase "to the extent practicable" in section 7.11, that there are circumstances with which the exposure limit cannot be fully complied. In such circumstances, section 7.11 requires the employer to reduce the exposure to the lowest extent using all practicable means currently available, even if the exposure limit cannot be achieved. Employers will be considered to have complied with section 7.11(a) if they can demonstrate that they have developed and implemented an exposure control plan in accordance with sections 7.13 and 5.54.

Refer to the OHS Guideline G7.13, Vibration exposure control obligations for more information about developing and implementing an exposure control plan for the exposure to vibration.

G7.11-2 Exposure limits - Whole-body vibration

Issued August 1999; Revised January 1, 2005; Editorial Revision January 17, 2022

Regulatory excerpt
Section 7.11 of the *OHS Regulation* states, in part:

> An employer must ensure, to the extent practicable, that workers are not exposed to vibration in excess of the limits specified in
>
> (b) whole-body vibration, ANSI Standard S3.18-2002/ISO 2631-1-1997, Mechanical Vibration and Shock - Evaluation of Human Exposure to Whole Body Vibration - Part 1: General Requirements, as amended from time to time;
>
> except as otherwise determined by the Board.

Purpose of guideline
The purpose of this guideline is to outline the exposure limits for whole-body vibration mentioned in section 7.11(b) of the *Regulation*, and specified in ANSI Standard S3.18-2002/ISO 2631-1-1997.

Whole-body vibration exposure limits
With respect to section 7.11(b), Annex B of *ANSI S3.18-2002/ISO 2631-1-1997, Mechanical Vibration and Shock - Evaluation of Human Exposure to Whole-Body Vibration - Part 1: General Requirements*, addresses the health effects of vibration on the human body and defines a "health caution guidance zone" for daily exposures of 4 to 8 hours, as follows:

- **In the zone** - caution is indicated with respect to potential risks for adverse health effects
- **Above the zone** - adverse health risks are likely
- **Below the zone** - adverse health effects have not been clearly documented and/or objectively observed

Whole-body vibration exposure limits in x, y, or z directions

Daily Exposure Duration	Values of the dominant, frequency-weighted (rms), component acceleration, ms^{-2}		
	No clear effects	Caution	Health risks likely
4 hours	Less than 0.6	0.6 to 1.1	Greater than 1.1
8 hours	Less than 0.5	0.5 to 0.9	Greater than 0.9

(rms = root mean square, ms^{-2} = metres per second squared)

The *OHS Regulation* recognizes, in the phrase "to the extent practicable" in section 7.11, that circumstances may arise in which the exposure limit cannot be fully complied with. In such circumstances, section 7.11 requires the employer to reduce the exposure using all practicable means currently available (refer to OHS Guideline G7.13 for information about developing and implementing an exposure control plan), even if the exposure limit cannot be achieved.

Assessment of whole-body vibration
Employers will be considered to have complied with section 7.11(b) if they can demonstrate that they have carried out an assessment of the risk of whole-body vibration (WBV) by:

1. Establishing a competent estimate of worker exposure in comparison with the exposure limits by using:

- Valid vibration databases and the technical or scientific literature
- Vibration data provided by the equipment manufacturer
- On-site vibration measurements made by a consultant, or competent person
- Relevant data obtained through an industry association
- Duration of daily vibration exposure

2. Identifying the main contributors to the worker's risk. This involves using the data collected in the estimate to rank-order the sources of WBV to which the worker is exposed.

3. Identifying and considering all available WBV risk controls. For example (refer to OHS Guideline G7.13):

- Selecting new vibration mitigating equipment (e.g., suspended cabs and suspended seats)
- Investigating alternative ways of working that reduce the magnitute of WBV exposure
- Ensuring workers always use equipment appropriately
- Ensuring surfaces on which vehicles operate are regularly graded and free of irregularities (potholes, bumps, etc.)
- Ensuring the equipment is maintained in accordance with the manufacturer's technical specifications
- Minimising the worker's daily exposure time by spreading the job over more days and by the use of job rotation with other workers

4. Monitoring the effects of the implemented risk control measures, and adjusting control measures as necessary.

5. Completing a written record of the above steps.

G7.12 Evaluation

Issued August 1999; Revised January 1, 2005; Revised October 30, 2018

Regulatory excerpt
Section 7.12 of the *OHS Regulation* states:

> The evaluation of hand-arm vibration and whole-body vibration must be conducted by the employer in accordance with
>
> (a) for hand-arm vibration, *ISO Standard 5349-1:2001, Mechanical Vibration - Measurement and Evaluation of Human Exposure to Hand-transmitted Vibration - Part 1: General Requirements* and *ISO Standard 5349-2:2001, Mechanical Vibration - Measurement and Evaluation of Human Exposure to Hand-transmitted Vibration - Part 2: Practical Guidance for Measurement at the Workplace*, as amended from time to time;
>
> (b) for whole-body vibration, *ANSI Standard S3.18-2002/ISO 2631-1-1997, Mechanical Vibration and Shock - Evaluation of Human Exposure to the Whole Body Vibration - Part 1: General Requirements*, as amended from time to time;
>
> except as otherwise determined by the Board.

Purpose of guideline
The exposure limits presented in OHS Guidelines G7.11-1 and G7.11-2 for hand-arm vibration (HAV) and whole-body vibration (WBV) acceleration limits are listed according to one or more axes. The reason for this is that the body's response to vibration depends on the direction along which vibration enters the body. For both HAV and WBV, three perpendicular "biodynamic" axes (the x-, y-, and z-axis) are defined. The directions of these axes are described as follows:

Axes of vibration

Axis	Hand-arm vibration (HAV)	Whole-body vibration (WBV)
x-axis	Through the hand, from top towards the palm	Through the body, from the back towards the chest
y-axis	From the right side to the left side, parallel to the knuckles	From the right side to the left side
z-axis	From the wrist through to fingers, parallel to top of the hand	From the feet (or buttocks) to the head

Usually acceleration is dominant along one axis; for whole-body vibration this is often the z-axis.

For the measurement of vibration (HAV and WBV), measured accelerations are frequency-weighted according to the frequency weightings defined in the latest ISO and ANSI standards. The frequency-weighted accelerations can then be compared with criterion values/exposure limits, which are also expressed in terms of frequency-weighted acceleration. (Refer to OHS Guidelines G7.11-1 and G7.11-2 for exposure limits for HAV and WBV, respectively.)

G7.13 Exposure control plan

Issued August 1999; Revised January 1, 2005; Editorial Revision April 27, 2010; Editorial Revision January 17, 2022

Regulatory excerpt
Section 7.13 of the *OHS Regulation* ("*Regulation*") states:

> The employer must, if a worker is or may be exposed to vibration in excess of the vibration exposure limits, develop and implement an exposure control plan that meets the requirements of section 5.54(2).

Purpose of guideline
The purpose of this guideline is to provide guidance on evaluating the potential for vibration hazards as well as suggested options to control the risk of exposure to vibrations.

Vibration hazards
A basic element of an exposure control plan is to determine the severity of the exposure to the agent. Not all equipment presents a hazard from vibration. Examples of equipment that may present a hazard to workers from either hand-arm vibration or whole-body vibration are listed below.

Some equipment that may present a vibration hazard

Hand-arm vibration	Whole-body vibration
• Chainsaws, brush cutters, mowers • Power saws for cutting metal, wood, and stone • Percussive tools (such as air-driven drills, wrenches, chisels, hammers, pavement breakers, and riveters; or in swaging and flanging) • Concrete vibrators • Concrete surface preparation equipment • Grinders, sanders, polishers, screwdrivers and other rotary tools • Sand and aggregate compactors	• Log decks • Operator cabs for heavy equipment commonly used in construction and forestry (e.g., construction and mine haul & logging trucks, skidders) • Forklift trucks, dump trucks • Tracked vehicles, excavators, bulldozers, backhoes, scrapers, graders, and front-end and log loaders • Snow removal vehicles • Farm tractors • Helicopters

When there is a reasonable expectation that vibration presents a significant hazard, the exposure limits in section 7.11 of the *Regulation* should be considered in the purchase and design of new equipment. In determining whether an exposure control plan is required, the duration of daily exposure and the operating conditions should be taken into consideration, as well as any reports of injury and disease from workers using existing equipment. Equipment that is used less than 0.5 hour per day is not likely to present a significant long-term hazard from vibration, except for the most highly vibrating equipment. It is prudent to regard regular prolonged use of any high-vibration tool or machine as hazardous, especially if it causes tingling or numbness in the user's fingers after about 5 to 10 minutes of continuous operation.

Some useful references in assessing equipment for vibration are the following publications by the Health Safety Executive in the United Kingdom: *Hand-arm vibration. The Control of Vibration at Work Regulations 2005* (L140) and *Vibration Solutions â€“ Practical Ways to Reduce the Risk of Hand-Arm Vibration Injury* (HSG170, 1997).

Evaluating equipment for potential for vibration

To evaluate the potential for vibration with respect to the exposure limits referred to in section 7.11, information on the vibration characteristics of the equipment or machinery is to be obtained. For example:

- *Obtaining information from the supplier of the equipment:* The employer should ask the following questions to obtain information from a supplier or designer:

    - Does the equipment meet the exposure limits in the referenced standards?
    - What is the frequency-weighted acceleration of the equipment?
    - Under what operating conditions were the measurements made?
    - Which published standard was used when conducting the evaluation?
- *Researching the relevant literature and available databases.*
- *Measuring frequency-weighted acceleration values of designed equipment or of equipment before purchase*: These determinations are to be conducted in accordance with a standard acceptable under section 7.12 of the *OHS Regulation*.

Options for control measures
When considering how to reduce the risk, there's a certain order that should be followed. This is called the hierarchy of controls. It's important to start by considering eliminating the hazard, or finding substitutes to replace the hazard, before considering engineering and administrative controls or personal protective equipment.

Control measures to protect against hand-arm vibration (HAV) may include the following:

- Substitute a process which eliminates or reduces the need for vibrating tools.
- Replace an old tool with a new tool having lower vibration.
- Ensure the tool is properly maintained, serviced, and adjusted, and anti-vibration mounts and suspended handles are replaced before they deteriorate.
- Keep tools (e.g., chisels) sharpened.
- Fit grinders with effective, balanced, grinding discs properly centred on the arbour.
- Ensure rotary tools are dynamically balanced.
- Reduce vibration entering the hand by suspending the tool's weight on a balancer.
- Control the length of a worker's daily exposure by job rotation.
- Grip the tool handle with the least hand strength practicable.
- Cover handles with a resilient wrapping layer. Wrapping handles can offer thermal insulation as well as vibration isolation - especially for steel handles.
- Wear full-fingered, "antivibration" gloves meeting the requirements of *ISO Standard 10819-1996, Mechanical Vibration and Shock - Hand-Arm Vibration - Method for the Measurement and Evaluation of the Vibration Transmissibility of Gloves at the Palm of the Hand.*

Control measures to protect against whole-body vibration (WBV) include the following:

- Choose a suspended seat containing a vibration-damping mechanism.
- Choose a suspended seat adjustable for the worker's weight.
- Isolate booths, cabs, etc., by setting them on their own separate foundations.
- Dynamically balance vehicle wheels.
- Fit tires with a low vibration tread pattern.
- Fit vibration-damping mechanisms where possible.
- Maintain shock absorbers on vehicles.
- Regularly grade the surface over which vehicles operate.
- Reduce speed when moving over bumpy surfaces.
- Avoid sudden load changes (pick up, drop off).
- Avoid bumping into obstacles while driving.
- Train workers not to jump in order to exit equipment, particularly from an elevation, as the intervertebral discs may have been softened by the vibrating equipment; jumping can more easily cause shock and damage to the body.

G7.14 Information on adverse effects

Issued January 1, 2005

Regulatory excerpt
Section 7.14 of the *OHS Regulation* ("*Regulation*") states:

> The employer must, if a worker is exposed to levels of vibration above the vibration exposure limits, inform the worker of the nature of the hazard and possible adverse effects.

Purpose of guideline
The purpose of this guideline is to provide background and educational information to enhance understanding of the hazard of vibrations and possible adverse effects.

Vibration hazards and adverse effects
Excessive exposure to hand-arm vibration (HAV) can cause vascular, neurological, and musculoskeletal damage to workers' fingers and hands. The symptoms of hand-arm vibration syndrome (HAVS) include circulatory pain (notably triggered by cold), loss of dexterity, and development of bone cysts and joint abnormalities. Workers may complain of episodes of pale, white fingers often triggered by exposure to cold. It is believed that vibration can adversely affect the blood circulation, making fingers sensitive to the vasoconstriction due to cold. Initially, only the tips of one or more fingers are "blanched," but more segments and fingers are affected with further vibration exposure.

Workers also may experience tingling or numbness in the fingers and hands. With continued exposure, the sensations worsen and can interfere with work and result in the loss of the normal sense of touch. Some vibration-exposed workers (rock drillers, forestry workers) may show signs of carpal tunnel syndrome (CTS) suggesting that vibration can combine with repetitive motion, forceful gripping, and awkward postures (all ergonomic stressors) to contribute to hand and wrist disorders.

Higher occurrences of osteoarthritis in the wrist and elbow have been observed in workers using hand-held, pneumatic percussive tools (miners, construction, metal workers). Workers may also complain of muscular weakness, pain in the hands and/or arms, and reduced grip strength. In some cases, muscle fatigue can cause disability. Other occupational disorders in vibration-exposed workers include tendonitis and tenosynovitis (inflammation of tendons and their sheaths) in the upper limbs.

Whole-body vibration (WBV) may be associated with an increased risk for low back pain, sciatic pain, and degenerative changes in the spinal column including lumbar intervertebral disc disorders.

For the vibration magnitudes in all but the most severe occupational situations, the adverse health conditions of WBV and HAV may not develop until there has been a prolonged period of time (measured in years) of regular daily exposure.

G7.15 Labels

Issued August 1999; Revised January 1, 2005

Regulatory excerpt
Section 7.15 of the *OHS Regulation* ("*Regulation*") states:

> If the manufacturer of equipment that produces levels of vibration in excess of the vibration exposure limits does not label the equipment to identify the hazard, the employer is responsible for doing so.

Purpose of guideline
The purpose of this guideline is to provide information about complying with legal requirements.

Labelling equipment
Section 7.15 of the *Regulation* requires that equipment producing levels of vibration in excess of recommended limits be labelled to identify the hazard. Ideally, this label will be permanently affixed by the equipment manufacturer during assembly. In many cases, however, the manufacturer will not have permanently affixed a label identifying the hazard. In these cases, the employer is required to affix the label.

The intent of section 7.15 of the *OHS Regulation* is to have the employer contact the manufacturer or supplier to obtain a label if one has not already been provided. The intent of section 7.15 is not to require the employer to measure the vibration level of the equipment.

There is no required format for the label. Any means that effectively communicates the vibration hazard is acceptable. For example, the employer could use a symbol instead of words as long as workers are trained to know what the symbol means.

It will be difficult for an employer to securely apply a label to some small pieces of equipment. For example, an adhesive label applied to a chainsaw used in the woods will likely be damaged beyond legibility before long. In such cases, where a label will likely not stay intact on a piece of equipment, it is acceptable for an employer to keep the label in a location where it will not easily be damaged or destroyed. The label is to be kept near the equipment and be readily available to the worker. Acceptable locations include the equipment's storage case or an accompanying operations manual.

Where the label cannot be applied directly to the equipment, workers should receive instruction in the location of the label.

G7.16 Exposure to cold

Issued January 1, 2005

Regulatory excerpt
Section 7.16 of the *OHS Regulation* ("*Regulation*") states:

> When a worker is exposed to hand-arm vibration, the employer, to the extent practicable, must ensure that the worker's hands or arms are not exposed to cold, either
>
> (a) from the environment in which the worker is working or as a result of using equipment, or
>
> (b) from coming into contact with cold objects.

Purpose of guideline
This guideline provides options for reducing worker exposure to cold when exposed to hand-arm vibration.

Hand-arm vibration syndrome
Hand-arm vibration can inflict vascular damage to workers' fingers - a condition known as hand-arm vibration syndrome (HAVS). To reduce the incidence of HAVS (and the onset of pain for workers who already have HAVS), workers using vibrating tools should keep their hands warm to

improve circulation. Refer to OHS Guideline G7.14 for further information about HAVS and exposure to cold.

The following examples are some ways for workers to keep their hands warm:

- Insulate handles of vibratory tools in cold environments.
- Redirect exhaust air from pneumatic tools away from the hands. Compressed air released from pneumatic tools' exhaust ports has a strong cooling effect as it expands to atmospheric pressure.
- Provide dry towels and a change of dry gloves for workers using vibratory tools when their hands may become wet from rain or perspiration.

G7.17 Definitions - Calculation of the equivalent dose and the effective dose

Issued January 1, 2005; Revised consequential to December 1, 2021 Regulatory Amendment

Regulatory excerpt
Section 7.17 of the *OHS Regulation* ("*Regulation*") states:

> In this Division:
>
> "*action level, ionizing radiation*" means an effective dose of 1 milliSievert (mSv) per year;
>
> "*action level, non-ionizing radiation*" means the exposure limits for the general public referred to in section 7.19(4), or if no public limit is referred to, it means the maximum exposure limit for workers in section 7.19(4);
>
> "*effective dose*" means the amount of ionizing radiation, measured in mSv, absorbed by the worker's whole body, adjusted for the energy level and type of radiation and the differing susceptibilities of the organs and tissues irradiated, and if only part of the body is exposed the effective dose is the sum of the weighted equivalent doses in all irradiated tissues and organs;
>
> "*equivalent dose*" means the amount of ionizing radiation, measured in mSv, absorbed by a specific body part and adjusted for the energy level and type of radiation.

Purpose of guideline
This guideline assists employers and qualified persons in calculating equivalent dose and effective dose as defined in section 7.17 of the *Regulation*.

Radiation and tissue weighting factors
The amount of ionizing radiation dose absorbed by a worker's body is expressed in effective dose and equivalent dose, as defined in section 7.17 of the *Regulation*. To calculate these doses, the radiation weighting factors (used in determining equivalent dose) and the tissue weighting factors (used in converting equivalent dose to effective dose) are needed. These weighting factors are found in *ICRP Publication 103, The 2007 Recommendations of the International Commission on Radiological Protection,* and are included here in Tables 1 and 2.

The *equivalent dose* (in mSv) is calculated by multiplying the absorbed dose (in milligrays) by the radiation weighting factor (see Table 1). A typical exposure may include more than one type of radiation, and the total equivalent dose is the sum of the components calculated for each type of radiation.

Table 1: Radiation weighting factors

Type of radiation	Radiation weighting factor (W_R)
Photons (e.g., x-rays or gamma)	1
Electrons	1
Protons and charged pions	2
Alpha particles, fission fragments, heavy ions	20
Neutrons	A continuous curve as a function of neutron energy (approximately 2.5 - 21; see ICRP document)

The *effective dose* (in mSv) is then calculated by adding up each tissue's equivalent dose multiplied by the tissue weighting factor (see Table 2) for the part of the body exposed.

Table 2: Tissue weighting factors

Organ or tissue	Tissue weighting factor (W_T)
Bone marrow (red), colon, lung, stomach, breast, remainder tissues[*,2]	0.12
Gonads	0.08
Bladder, esophagus, liver, thyroid	0.04

Bone surface, brain, salivary glands, skin[1]	0.01
Whole body	1

Special notes:

* Remainder tissues: Adrenals, extrathoracic (ET) region, gall bladder, heart, kidneys, lymphatic nodes, muscle, oral mucosa, pancreas, prostate, small intestine, spleen, thymus, uterus/cervix.

1. The weighting factor for skin only applies when the whole body is exposed.

2. Hands, feet, or lens of the eye have no tissue weighting factors.

Determining equivalent doses for hands, feet, or lens of the eye
In cases where the exposure to these parts of the body is anticipated to be substantially different from the equivalent dose quantities measured, the employer may use the methods described in recognized standards and guidance documents such as the following to assess worker exposures:

- Canadian Nuclear Safety Commission - REGDOC-2.7.2, *Dosimetry, Volume 1: Ascertaining Occupational Dose*
- IAEA TECDOC 1731, Implications for Occupational Radiation Protection of the New Dose Limit for the Lens of the Eye

G7.18 Application for ionizing and non-ionizing radiation - Agencies having jurisdiction

Issued August 1999; Revised January 1, 2005; Revised July 15, 2019

Regulatory excerpt
Section 7.18 of the *OHS Regulation* ("*Regulation*") states:

> (1) This Division applies to all sources of ultrasonic energy, non-ionizing and ionizing radiation, including radiation sources governed by the *Nuclear Safety and Control Act* (Canada), except as otherwise determined by the Board.
>
> (2) This Division does not apply to medical or dental radiation received by a patient, or to natural background radiation, except as specified by the Board.

Purpose of the guideline
Agencies having jurisdiction over exposure to radiation include WorkSafeBC and the Canadian Nuclear Safety Commission (CNSC). The mandates of these agencies with respect to radiation are briefly described within this guideline.

WorkSafeBC
WorkSafeBC administers the *Regulation*, which includes provisions for protecting workers from exposure to ionizing radiation, electromagnetic fields, lasers, ultraviolet radiation, and ultrasound. The *Regulation* does not differentiate between ionizing radiation in the form of x-rays or from radioactive sources - the requirements apply equally to both. This differs from the CNSC regulations, which only apply to ionizing radiation from radioactive materials or particle accelerators.

A WorkSafeBC inspection is not restricted to issues of radiation, but a WorkSafeBC prevention officer may also check for compliance with the other applicable sections of the *Regulation*, such as the requirement for an occupational health and safety program.

The prevention officer will normally review a radioisotope licence at the worksite in order to determine the nature and quantity of any radioactive materials at the workplace.

Canadian Nuclear Safety Commission (CNSC)
CNSC, previously known as the Atomic Energy Control Board of Canada, is a federal authority that focuses primarily on the control of the health, safety, and environmental consequences of nuclear activities. CNSC does not have a mandate for x-ray machines or for non-ionizing radiation such as radiofrequency, microwave, or ultraviolet radiation.

The CNSC replaced the Atomic Energy Control Board in May 2000 when the *Nuclear Safety and Control Act* and its regulations came into effect. The internet site for CNSC is nuclearsafety.gc.ca/.

CNSC inspectors perform routine compliance inspections of organizations (referred to as "licensees") that have received a licence from the CNSC to work with radioactive material. The licence will state what isotopes and devices can be possessed, as well as where and how they are to be handled and maintained. The licence will also list the prescribed (for example, radioactive) substances and devices to which the licence applies and may specify a number of conditions with which the licensee is required to comply. These may include conditions with respect to allowable radiation levels, signage, leak tests, dosimetry, disposal, and reporting of accidents.

The CNSC requires that the licence be available at any location where the prescribed substances are used or stored. A CNSC inspector's primary responsibility is to measure compliance with the conditions on the licence and with the regulations, which apply to the handling of radioactive material. These regulations include CNSC Transport of Nuclear Substances and Transportation of Dangerous Goods.

A routine inspection entails checking for and ensuring the accuracy of all records, such as inventory, leak tests, dosimetry, training, and shipping

documents. Inspectors would also check that the radioactive material is stored properly and that appropriate signs are posted, such as radiation warning signs and contact details. They also check to see that the appropriate monitoring equipment is available and that it is being properly maintained. Similar to the process followed by WorkSafeBC prevention officers, CNSC inspectors leave a report identifying items of non-compliance and then follow up to ensure compliance is achieved.

CNCS inspectors are also involved in investigating incidents. These investigations can lead to a variety of actions, including the suspension of a licence or prosecution.

G7.19-1 Exposure to ionizing radiation - Exposure limits and exposure period

Issued August 1999; Revised January 1, 2005; Revised consequential to December 1, 2021 Regulatory Amendment; Editorial Revision consequential to August 22, 2022 Regulatory Amendment

Regulatory excerpt
Section 7.19(1) to (3) of the *OHS Regulation* ("*Regulation*") state:

> (1) A worker's exposure to ionizing radiation must not exceed any of the following:
>
> (a) an effective dose of 20 mSv over any period of 12 consecutive months;
>
> (b) with respect to exposure to the lens of an eye,
>
> (i) an equivalent dose of 50 mSv over any period of 12 consecutive months that starts on or after December 1, 2021, and
>
> (ii) an equivalent dose of 100 mSv over any period of 60 consecutive months that starts on or after December 1, 2021;
>
> (c) with respect to exposure to the skin, averaged over any 1 cm^2 area at a nominal depth of 7 mg/cm^2, regardless of the area exposed, an equivalent dose of 500 mSv over any period of 12 consecutive months;
>
> (d) with respect to exposure to the hands and feet, an equivalent dose of 500 mSv over any period of 12 consecutive months.
>
> (2) If a worker declares the worker's pregnancy to the employer, the worker's effective dose of ionizing radiation, for the remainder of the pregnancy, from external and internal sources, must be limited by the employer to the lesser of
>
> (a) 4 mSv, or
>
> (b) the dose limit specified for pregnant workers under the *Nuclear Safety and Control Act* (Canada).
>
> (3) The employer must ensure that the exposure of workers to ionizing radiation is kept as low as reasonably achievable below the exposure limits.

Purpose of guideline
The purpose of the guideline is to provide clarity about the exposure periods associated with the dose limits prescribed in section 7.19.

Dose limits for ionizing radiation
Section 7.19(1) provides dose limits for all workers exposed to ionizing radiation over the specified exposure period. The time period for measurement is over any period of 12 consecutive months (and over 60 consecutive months for lens of the eye), and not a calendar year. As workers can begin their employment at any time of the year, the worker's exposure must not exceed the stated dose limits over any 12 consecutive months (and 60 consecutive months for the lens of the eye).

Dosimetry reports provided by a dosimetry service provider or by the National Dose Registry (NDR) typically provide dosimetry results for a calendar year. Where possible, employers and workers should request their dosimetry service providers to reflect the aforementioned exposure periods in the dosimetry reports.

Further information can be found on Health Canada's Radiation Protection Bureau (RPB) website.

Effective dose of pregnant workers
Section 7.19(2) provides the dose limits for pregnant workers. The external dose referred to in section 7.19(2) is measured at the abdomen. The time period over which the dose limits apply is the duration of the pregnancy from the date the pregnancy is declared. In order for an employer to ensure that a pregnant worker's dose is limited to the designated exposure limit for the remainder of the pregnancy, the employer needs to know the time period involved, which is from the date the worker declared the worker's pregnancy to the expected date of delivery.

ALARA (as low as reasonably achievable)
The International Agency for Research on Cancer classifies ionizing radiation as a Group 1 carcinogen (i.e., causes cancer in humans). Although there are exposure limits prescribed, section 7.19(3) requires employers to ensure that exposure to workers to ionizing radiation is kept as low as reasonably achievable below the exposure limits.

G7.19-2 Notification of worker overexposure to ionizing radiation

Issued August 1999; Revised January 1, 2005; Revised April 30, 2015; Editorial Revision April 6, 2020; Revised consequential to December 1, 2021 Regulatory Amendment; Editorial Revision June 11, 2026

Regulatory excerpt
Section 7.19(1) of the *OHS Regulation* ("*Regulation*") states:

> (1) A worker's exposure to ionizing radiation must not exceed any of the following:
>
> (a) an effective dose of 20 mSv over any period of 12 consecutive months;
>
> (b) with respect to exposure to the lens of an eye,
>
> (i) an equivalent dose of 50 mSv over any period of 12 consecutive months that starts on or after December 1, 2021, and
>
> (ii) an equivalent dose of 100 mSv over any period of 60 consecutive months that starts on or after December 1, 2021;
>
> (c) with respect to exposure to the skin, averaged over any 1 cm^2 area at a nominal depth of 7 mg/cm^2, regardless of the area exposed, an equivalent dose of 500 mSv over any period of 12 consecutive months;
>
> (d) with respect to exposure to the hands and feet, an equivalent dose of 500 mSv over any period of 12 consecutive months.

Purpose of guideline
This guideline describes the process for notification to WorkSafeBC of high ionizing radiation exposures, and describes factors to consider when a worker is exposed to levels above the exposure limit.

Notification of high exposures
Reports of worker ionizing radiation overexposure (notifications) to WorkSafeBC may come from an incident investigation report, from the employer, from the National Dose Registry (NDR), or by other means. High Exposure Notifications reported by the NDR are sent by NDR to WorkSafeBC's OHS Science and Technical Service unit (OHS SATS) in the Prevention Practice, Quality, and Engineering department. In other situations, if a WorkSafeBC prevention officer receives notification of a worker exceeding the annual dose limit, the prevention officer will notify the manager of OHS SATS without delay. This applies to both the effective dose and to an equivalent dose to the skin, eyes, or limbs.

After a high exposure notification
The manager of OHS SATS may seek input from occupational health physicians and/or radiological medical advisors and will generally forward a request for an incident investigation to the local WorkSafeBC occupational hygiene officer who will discuss the matter with the employer. The information gathered during the investigation will be used to help determine the acceptability of the worker's continued employment in the same job category for the remainder of the exposure period (any consecutive 12 months, and 60 consecutive months for the lens of the eye).

Note that the investigation requested by WorkSafeBC for the high exposure incident is in addition to an employer's incident investigation required under section 69 of the *Workers Compensation Act*.

A worker whose effective dose exceeds 20 mSv over any period of 12 consecutive months, as noted under section 7.19(1)(a) of the *Regulation*, should be protected from further exposure until the following occurs:

- An investigation is completed into the causes of the overexposure
- Required corrective actions are determined and implemented
- A medical opinion is given as to the suitability of further work in the occupation during the control period (over 12 consecutive months)

In deciding the suitability of a worker continuing in the occupation after a reported overexposure, the employer (in conjunction with WorkSafeBC) should consider factors such as the following:

- **The reliability and accuracy of the reported result**. Dosimetry service providers offer different types of dosimeters for various exposure scenarios. Commonly used dosimeter types include optically stimulated luminescence (OSL) dosimeters and thermoluminescent dosimeters (TLDs). Consult with the dosimetry service providers for their dosimeters' performance specifications. Also, the incident investigation must determine whether the reading is a real dose to the worker (such as the worker being accidentally exposed to an industrial radiography source without protective equipment) or if the dosimeter measured a dose to which the worker was not exposed (such as improper storage of the dosimeter when not in use).
- **The magnitude of the dose received**. A worker with an effective dose exceeding 20 mSv in 12 consecutive months will be restricted from working further in the occupation that led to the high dose for the remainder of the control period. Similar restrictions will apply if a worker exceeds the stated equivalent doses for the hands and feet, skin, as well as the lens of the eye.
- The lifetime dose of the worker. This information can be obtained from the National Dose Registry.
- **The extent of any injury received from the overexposure and the degree of recovery**. It is important to establish any adverse health effects associated with the overexposure. Even if there is no indication of acute effects, workers should still be informed of the possibility of long-term adverse health effects resulting from this exposure.
- **Adequacy of control measures implemented by the employer**. These may include protective reassignment, implementation of more protective work procedures, and the increased use of dose monitoring and personal protective equipment.

For some dose levels, no other special restrictions may be required if WorkSafeBC is satisfied that the employer is able to adequately control

future exposures.

G7.19(4)-1 Exposure to non-ionizing radiation — Radiofrequency

Issued August 1999; Revised January 1, 2005; Revised April 30, 2015; Editorial Revision October 28, 2019

Regulatory excerpt
Section 7.19(4)(a) of the *OHS Regulation* ("*Regulation*") states:

> The employer must ensure that a worker's exposure to non-ionizing radiation does not exceed the exposure limits specified in
>
> (a) for radiofrequency:
>
> (i) *Health Canada Safety Code 25, Short-Wave Diathermy Guidelines for Limiting Radiofrequency Exposure*, 1983, as amended from time to time;
>
> (ii) *Health Canada Safety Code 26, Guidelines on Exposure to Electromagnetic Fields from Magnetic Resonance Clinical Systems*, 1987, as amended from time to time;
>
> (iii) *Health Canada Safety Code 6, Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz*, 1999, as amended from time to time, and
>
> …
>
> except as otherwise determined by the Board.

Purpose of guideline
This guideline describes exposure limits for radiofrequency radiation.

Radiofrequency (RF) radiation
Radiofrequency is the portion of the electromagnetic spectrum that is between 3 kHz and 300 GHz. This frequency range is below that of visible light and above that of extremely low frequency electromagnetic fields, and includes microwaves, radio, and radar.

In workplaces, RF fields are potentially produced by sources such as television and radio broadcasting facilities, rooftop transmitters, medical equipment, microwave ovens, and RF induction heaters.

Exposure limits
Section 7.19(4)(a) references Health Canada's Safety Codes for exposure limits. The Safety Codes are available on the Health Canada web site: http://www.hc-sc.gc.ca/ewh-semt/pubs/radiation/index-eng.php

The key exposure limits for RF radiation are the reference levels specified in Health Canada Safety Code 6, published in 2015. They are based on Health Canada's evaluation of the scientific literature related to thermal and non-thermal health effects of RF fields.

The measurement process for exposure to radiofrequency radiation is complex. Health Canada has published the *Technical Guide for Interpretation and Compliance Assessment of Health Canada's Radiofrequency Exposure Guidelines*.

Another guidance document for these measurements is the Industry Canada publication *Guidelines for the Measurement of Radio Frequency Fields at Frequencies From 3 kHz to 300 GHz*.

G7.19(4)-2 Exposure to non-ionizing radiation - Lasers

Issued August 1999; Revised January 1, 2005; Editorial Revision November 29, 2022

Regulatory excerpt
Section 7.19(4)(b) of the *OHS Regulation* ("*Regulation*") states:

> (4) The employer must ensure that a worker's exposure to non-ionizing radiation does not exceed the exposure limits specified in
> …
>
> (b) for lasers:
>
> (i) *ANSI Standard Z136.1-2000, Safe Use of Lasers*, as amended from time to time;
>
> (ii) *ANSI Standard Z136.2-1997, Safe Use of Optical Fiber Communication Systems Utilizing Laser Diode and LED Sources*, as amended from time to time;
>
> (iii) *ANSI Standard Z136.3-1996, Safe Use of Lasers in Health Care Facilities*, as amended from time to time;
>
> (iv) *CSA Standard Z386-01, Laser Safety in Health Care Facilities*, as amended from time to time,

except as otherwise determined by the Board.

Purpose of guideline
The purpose of this guideline is to provide information on how to assess worker exposure to non-ionizing radiation from lasers as required under section 7.19(4)(b) of the *Regulation*.

Determining compliance with exposure limits
The determination of worker exposure to non-ionizing radiation from lasers is very complex. Calculation of the exposure limit is dependent on the type of laser being assessed; there is no generic calculation covering all laser sources. Neither a WorkSafeBC prevention officer nor an employer would normally be expected to measure the radiation being emitted by a laser. Rather, compliance with this section will normally be determined by an evaluation of the controls in place to minimize worker exposure to laser energy, as required by the applicable standard.

For the purpose of determining compliance with section 7.19(4) of the Regulation, controls implemented in accordance with the applicable standard will be deemed equivalent to actually measuring exposures. If these controls are implemented effectively, overexposure to workers would not be expected.

Control of laser hazards
The employer should establish and maintain an adequate program for the control of laser hazards to the eyes and skin. For class 1M and 2M lasers and laser systems, applicable controls meeting the requirements of *ANSI Standard Z136.1-2014*, or a program providing an equivalent level of worker protection, constitutes compliance with section 7.20. For class 3B and 4 lasers and laser systems, a laser safety program meeting the requirements of *ANSI Standard Z136.1-2014* constitutes an effective exposure control plan. A summary of expected controls for each class of laser is outlined in Table 10 (a-d) of *ANSI Standard Z136.1-2014*.

G7.19(5) Exposure to non-ionizing radiation - Ultraviolet radiation

Issued August 1999; Revised January 1, 2005; Revised February 2, 2023

Regulatory excerpt
Section 7.19(5) of the *OHS Regulation* ("*Regulation*") states:

> A worker's exposure to ultraviolet radiation produced by equipment or industrial processes must not exceed the threshold limit values specified in the American Conference of Governmental Industrial Hygienists publication entitled *Threshold Limit Values and Biological Exposure Indices*, dated 2003, as amended from time to time.

Purpose of guideline
The purpose of this guideline is to provide guidance on ultraviolet radiation as required by section 7.19(5) of the *Regulation*.

Hazards of ultraviolet (UV) radiation
Ultraviolet (UV) radiation is non-ionizing electromagnetic energy between the wavelengths of 10 nm and 400 nm. UV radiation cannot be seen and is not felt immediately, but it is harmful to both the eyes and skin. Acute symptoms of UV exposure may occur 4 to 24 hours after exposure, while chronic effects of exposure may be long-lasting, cumulative, and may not appear for years. Health effects of excessive exposure to UV radiation include burns, eye irritation (photokeratitis), cataracts, skin aging, and skin cancer.

For these reasons, workers' exposure to sources of UV radiation should be minimized. Where worker exposure cannot be eliminated, controls such as shielding, interlocks, remote activation switches, timers, and/or personal protective equipment must be used to keep worker exposure below occupational exposure limits.

For more information on the hazards of UV radiation refer to the Radiation (non-ionizing) webpage on worksafebc.com and the Ultraviolet Radiation webpage on ccohs.ca.

Sources of UV radiation
There are many human-made sources of UV radiation, including lasers, welding arcs, medical devices, ozone generators, and lamps (e.g., grow-lights, black lights, tanning lamps, curing lamps, and germicidal lamps). These devices may emit high levels of UV radiation that may pose an exposure risk to workers.

UV germicidal lights and other devices
Irradiation with short-wave UV radiation is an established mean of disinfection, however not all devices that claim to use this technology are effective, and some may pose a significant risk of UV exposure to users if the devices are not used correctly or if proper precautions are not taken.

Employers who purchase UV-emitting devices that claim to disinfect surfaces, air, or water should ensure the device is certified by the Canadian Standards Association (CSA), Electrical Testing Laboratories/Intertek (ETL), Underwriters Laboratories Solutions (UL/ULC), or other certifying bodies accredited by the Standards Council of Canada (SCC) or registered with Health Canada.

Other UV-emitting devices sold, resold, leased, or imported into Canada must comply with the other requirements of the *Radiation Emitting Devices Act* (REDA). For more information about REDA requirements, contact the Consumer and Clinical Radiation Protection Bureau.

Angular considerations
When determining compliance with the occupational exposure limits specified in section 7.19(5) of the *Regulation*, the American Conference of

Governmental Industrial Hygienists (ACGIH) requires that the threshold limit values (TLVs) be applied to sources which subtend an angle of less than 80 degrees at the measuring instrument's detector (i.e., the source subtends less than an 80-degree cone with its vertex at the detector). Most industrial sources, such as lamps or welding arcs, subtend a much smaller arc, so the angular restriction does not apply to them. In these cases, the measurements are simply carried out with the detector at the position of the worker's eye or skin, and no further angular considerations are required.

This restriction becomes important when there is exposure to an extended source, such as a tanning bed or from a large reflective surface. In these situations, ACGIH prescribes that only the contributions within an 80-degree cone be considered. The reason for this is that most instruments use interference filters on their detectors, and these filters are inaccurate at large angles. The ultraviolet radiation from large angles contributes little to the effect on the eyes or skin because of geometric and physiological considerations.

Solar radiation
Ultraviolet radiation from the sun is not included within the scope of this requirement. Nevertheless, workers and employers should be aware of the hazards associated with solar radiation. Effective means to limit worker exposure include reducing exposure times, using shields or seeking shade, wearing appropriate clothing, and the use of sunblock creams. Additional information on sun and UV radiation is available on worksafebc.com

G7.20(1)-1 Exposure control plan – General requirements

Issued August 1999; Revised January 1, 2005; Revised September 22, 2015; Revised April 30, 2020; Revised consequential to December 1, 2021 Regulatory Amendment

Regulatory excerpt
Section 7.20(1) of the *OHS Regulation* ("*Regulation*") states:

> If a worker exceeds or may exceed an action level, ionizing radiation or action level, non-ionizing radiation, the employer must develop and implement an exposure control plan meeting the requirements of section 5.54(2).

Purpose of guideline
An exposure control plan is required if a worker's radiation exposure exceeds or may exceed the applicable action level. This guideline discusses ways to determine whether a worker's exposure exceeds or may exceed the action level for ionizing or non-ionizing radiation. For further information on exposure control plans, refer to OHS Guideline G5.54-1.

Exposure to ionizing radiation
The action level for ionizing radiation is defined in section 7.17 of the *Regulation* as "an effective dose of 1 milliSievert (mSv) per year." In order to determine whether a worker's effective dose exceeds or may exceed 1 mSv per year, an employer may use one or more of the following methods:

- Until it is determined with confidence whether a worker's effective dose could exceed 1 mSv per year, an employer must ensure that the worker is provided with and properly uses a personal dosimeter acceptable to WorkSafeBC. Refer also to section 7.22 of the *Regulation* and OHS Guideline G7.22 Monitoring exposure. When dosimetry has been conducted for at least one year and the incurred doses are properly documented, the employer can use the results to determine whether a worker's effective dose is likely to exceed 1 mSv per year.

- The National Dose Registry of the Radiation Protection Bureau (RPB) of Health Canada maintains records of occupational exposures to ionizing radiation in Canada based on dose information submitted to the RPB by approved dosimetry service providers for Canadian workplaces. The NDR publishes an annual *Report on Occupational Radiation Exposures in Canada* (Report) that could be used to determine a worker's general dose profile by job category where the equipment and work practices currently in use are likely the same as those in use when the Report was published.

  Using the Report, an employer could determine that exposure control plan would not be required if the effective dose incurred by a worker averaged less than 1 mSv per year (over the most recent five years). Note that there is a statistical spread of annual exposures for each job sector and category. Even if the average dose for an occupation is less than 1 mSv per year, a portion of the population may accumulate doses greater than 1 mSv. Therefore, if an employer's work practices or conditions are less protective with respect to radiation standards acceptable to WorkSafeBC (e.g., Health Canada Safety Codes), then the employer must develop and implement an exposure control plan.
- An evaluation of occupational exposures either by calculation or experimental simulation can be carried out by health physicists or other qualified persons and/or professionals, based on the characteristics of the radiation source being used, weekly workload, the worksite's exposure control strategy, and other relevant factors. The results of such evaluation can be used to determine whether a worker's exposure could exceed 1 mSv per year. Sample methodologies for conducting such calculations are described in some of the Health Canada Safety Codes (e.g., the addendum to *Safety Code 32 Safety Requirements and Guidance for Analytical X-ray Equipment*).

- An employer may rely on a determination made at another workplace setting provided that the workplaces are equivalent in terms of radiation sources used and potential for exposure (e.g., the same number and type of radiation-emitting units, substantially the same equipment parameters being used, workplace configuration and shielding plans, safe work procedures).

For the above methods, the determination of expected exposure levels only remains valid if the radiological conditions remain the same as they relate to radiation sources used, operational settings, workloads, and other relevant factors (e.g., worker practices and experience; worker training, supervision, and instruction). A new assessment of the radiological situation must be performed by a health physicist or other qualified person whenever the working conditions change.

Exposure hands, feet, and lens of the eye
If an exposure control plan is required for a worker, then the employer should also include considerations of equivalent dose limits to the tissue of concern for protection of the worker.

For more guidance in determining the ionizing radiation dose for the hands, feet, or lens of the eye, refer to the recognized standards and guidance documents such as the following to assess worker exposures:

- Canadian Nuclear Safety Commission - REGDOC-2.7.2, *Dosimetry, Volume 1: Ascertaining Occupational Dose*
- IAEA TECDOC 1731, Implications for Occupational Radiation Protection of the New Dose Limit for the Lens of the Eye

Exposure to non-ionizing radiation
The action level for non-ionizing radiation is defined in section 7.17 of the *Regulation* as "the exposure limits for the general public referred to in section 7.19(4) or, if no public limit is referred to, it means the maximum exposure limit for workers referred to in section 7.19(4)."

WorkSafeBC accepts that an exposure control plan is not required if any one of the following conditions is met:

- Equipment capable of emitting non-ionizing radiation is being used, maintained, and regularly controlled according to the manufacturer's instructions; and monitoring of field strengths, power densities, irradiance levels, radiant intensities, or ultrasonic sound pressure levels shows that these values cannot exceed the action level in the course of a worker's regular duties.
- Documentation from the equipment manufacturer demonstrates that the radiation exposures incurred by workers cannot exceed the action level.
- For lasers, the class of the laser or laser system is less than class 3, as defined in the latest edition of *ANSI Standard Z136.1, Safe Use of Lasers*.

G7.20(1)-2 Exposure control plan - Control measures

Issued August 1999; Revised January 1, 2005

Section 7.20(1) of the *OHS Regulation* ("*Regulation*") states:

> If a worker exceeds or may exceed an action level, ionizing radiation or action level, non-ionizing radiation, the employer must develop and implement an exposure control plan meeting the requirements of section 5.54(2).

Section 7.20(1) requires an exposure control plan if a worker's level of exposure exceeds or may exceed the applicable action level. For both ionizing and non-ionizing radiation, adequate engineering and administrative control measures, as specified in the applicable Safety Code or Standard, must be in place in order to control the radiation dose received by any worker to less than the action level. Applying these control measures ensures that the requirements for an exposure control plan are met. Note that under section 5.54(2)(b) of the *Regulation*, control measures are a required element of an exposure control plan.

In assessing the adequacy of control measures for ionizing radiation, the employer is to use all available exposure information (from personal dosimetry and radiation surveys) to compare the effectiveness of the controls with controls in similar industry facilities. If there is an indication of a single high-exposure situation (for one or more workers), a radiation survey under section 7.24(c) of the *Regulation* applies.

When reviewing the results of personal dosimetry, the employer will compare the exposure information with workers in similar groups. If there is a significantly higher dose profile than the industry averages indicate is achievable, the employer is to examine the work practices and other conditions of exposure at the workplace, and alter them to reduce the unusually high doses to the acceptable levels as per section 7.19(3). Data from the National Dose Registry (published annually by Health Canada) is available for the purpose of reviewing worker exposure information.

It should also be noted that section 7.19(3) of the *Regulation* states the "ALARA" principle: "The employer must ensure that the exposure of workers to ionizing radiation is kept as low as reasonably achievable below the exposure limits." For the purposes of section 7.19(3), an employer whose operation demonstrates a significantly higher dose profile than the industry average is expected to reduce worker exposure to the industry average, as that would be considered "reasonably achievable."

G7.20(1)-3 Exposure control plan - Personal protective equipment

Issued August 1999; Revised January 1, 2005; Editorial Revision March 11, 2009; Editorial Revision August 4, 2015

Regulatory excerpt
Section 7.20(1) of the *OHS Regulation* (*"Regulation"*) states:

> If a worker exceeds or may exceed an action level, ionizing radiation or action level, non-ionizing radiation, the employer must develop and implement an exposure control plan meeting the requirements of section 5.54(2).

Purpose of guideline
The purpose of this guideline is to clarify the requirements relating to radiation exposure control measures and to summarize the Health Canada Safety Code references to personal protective equipment.

Exposure control plan

Section 7.20(1) requires an exposure control plan if a worker's level of exposure exceeds or may exceed the applicable action level. Section 5.54(2)(d) addresses the need for written work procedures as part of the exposure control plan. Key to any written work procedure is specific information on any personal protective equipment that may be required to be supplied by the employer for worker protection while undertaking specific hazardous tasks. Section 8.2 of the *Regulation* specifies the responsibility for the employer to provide this type of personal protective equipment.

The preferred control measures for protecting workers from the hazards of radiation involve three key considerations: shielding, distance, and time. Shielding involves placing a mass (a shield) between the radiation source and the worker; the more mass that is placed, the less radiation that the worker receives. Distance also protects workers; the further away a worker is from the source of radiation, the less radiation the worker receives. The less time the worker is exposed to radiation, the smaller the dose of radiation received and the lesser chance for radiation injury. Where these protective measures cannot be used, or are insufficient, personal protective equipment is the minimum requirement.

Personal protective equipment

Section 7.23 of the *Regulation* requires compliance with a number of standards. For ease of reference, the personal shielding protective equipment required by these standards to protect against exposure to radiation is summarized in the table below. Where these standards describe personal protective equipment that is not intended for protection from the hazards of radiation (for example, hearing or respiratory protection), other sections of the *Regulation* apply. Refer to Part 8 of the OHS Guidelines for further information.

Table 1: Personal protective equipment listed in the standards referenced in section 7.23 of the *Regulation*

Standard	Recommended PPE (from Standard)	Relevant sections of the Standard	Additional notes or comments
Ionizing:			
Safety Code 20A (Medical X-ray equipment)[1]	Protective gauntlets, gonad shields, protective gloves, protective clothing, protective aprons, protective glasses	6.3.1; 6.3.2; 6.3.3; 8.1.5; 8.1.6; 8.2.1; 8.3.1; 8.3.2; 8.3.3; 8.4.4; 8.6.1; 8.6.2(2)	
Safety Code 27 (Industrial X-ray equipment)[2]			Discontinued
Safety Code 28 (Veterinary X-ray equipment)	Protective clothing, protective devices, protective aprons, gloves, thyroid shields	6.2; 7.1.5; 7.1.7; 7.1.8; 7.1.9; 7.1.12	Protective aprons, gloves, and thyroid shields used for veterinary X-ray examinations must provide attenuation equivalent to at least 0.5 mm of lead at X-ray tube for voltages up to 150 kVp. There are other labelling and design requirements in the Safety Code.
Safety Code 29 (Baggage-check X-ray equipment)	None identified		
Safety Code 30 (Dental X-ray equipment)	Protective devices	8.1.4	
Safety Code 31 (Computed tomography)[1]			Discontinued
Safety Code 32 (Analytical X-ray equipment)	Protective apparel	3.6.4	There is no reference in the Safety Code to a requirement for protective apparel. However, there is a cited requirement that all protective apparel and safeguards must be tested regularly.
Safety Code 33 (Mammography)	Protective clothing	9.1.3; 9.1.6	Discontinued
Safety Code 34 (Industrial x-ray equipment)[2]	None identified	2.2.1(3)	There is no reference in the Safety Code to specific items of personal protective equipment. The RSO "must ensure that all protective and safety equipment… are available."
Safety Code 35 (Large Facilities)[1]	Lead aprons, protective gowns, thyroid shields, protective and leaded glasses, gonad shields, gloves, gauntlets	Section B 4.1	

Safety Code 36 (Mammography)[3]	None identified		There is no reference in the Safety Code to specific items of personal protective equipment. Section 2.1(10) states that "when a protective apron is worn, the dosimeter must be worn underneath the apron." Section 2.1(5) states that "All personnel must use available protective devices."
Radiofrequency:			
Safety Code 26 (Magnetic resonance systems)	None identified		
Safety Code 6 (Radiofrequency fields)		Appendix IV	Electrical safety shoes are referenced, but not required, in Appendix IV.
Safety Code 25 (Short-wave diathermy)	None identified		
Lasers:			
ANSI Standard Z136.1-2014 (Lasers)	Protective equipment, laser eye protection, clothing, gloves, skin protection (such as skin covers or sunscreen creams), respirators, hearing protection	4.4.4; 4.4.4.1; 4.4.4.2; 4.4.4.3; 7.3.4.3; Table 11c; Appendix B8; Appendix D3	Laser eye protection to be used for Class 3B and Class 4 lasers or laser systems. Clothing and gloves that have been specifically selected for suitable protection against laser radiation should be considered for Class 3B and 4 lasers and laser systems. Note that PPE may have serious limitations when used with higher-power Class 4 lasers or laser systems; for example, the protective equipment may not adequately reduce or eliminate the hazard and may be damaged by the incident laser radiation.
ANSI Standard Z136.2 (Optical fibre systems)	Personal protective equipment to protect against non-laser hazards (such as glass fragments, solvents)		Refer to Part 8 of the *Occupational Health and Safety Regulation*.
ANSI Standard Z136.3-2011 (Safe Use of Lasers in Health Care) Also CSA Standard Z386-01 (Health Care lasers)	Protective equipment, face shields, laser protective eyewear (e.g., goggles, spectacles, face shields, barriers, windows, and similar protective devices), protective clothing, skin protection (e.g., clothing, gowns, gloves and other devices), shields, helmets, hearing protection	4.6.1; 4.6.2; 4.6.3; 4.6.4; 7.4.2.3 Appendix B: B1.6; B1.6.1; B1.6.2; B1.6.3; B1.6.5 Appendix C: C2.4.1; C6.3.2; C13.4.2	Laser protective eyewear (LPE) shall be accompanied by the following information: (1) Optical density at appropriate wavelengths; (2) Manufacturer's recommendations on shelf life, storage conditions, and appropriate cleaning methods. At present, there is no suitable half-mask respirator used for the specific purposes of excluding all laser generated air contaminants (LGAC). Surgical masks are not designed to provide protection from plume contents. Therefore, the health care facility shall rely on appropriate local exhaust ventilation (LEV) techniques as the first line of protection for occupational exposure to LGAC.

CSA Standard Z386-14 (Laser Safety in Health Care Facilities)	Protective equipment, ocular control measures (e.g., protective eye wear), skin control measures (e.g., applicable and appropriate control measures)	5.3.1.3, 5.3.2.3, 6.3.1.3.(f), 6.3.1.4.1.(c), 6.3.2.3.(b).(iii), 8.2.1.(c) Annex B: B.3 Annex F: F.1; F.2; F.3; F.4; F.5	The laser safety officer to assess potential ocular and skin exposure hazards and implement applicable and appropriate control measures for the application and practice setting. All protective eyewear and filters shall be selected with an optical density (OD) sufficiently high to protect against the wavelengths of the laser in use in the nominal ocular hazard area (NOHA). The protective eyewear shall be: (1) permanently labelled with the applicable OD and wavelengths; (2) worn by all personnel in the NOHA during laser use; (3) maintained according to manufacturer's instructions; (4) have side guards to protect against the beam entering between the eye and the eyewear; and (5) inspected prior to use.
Infrared and Ultraviolet:			
CSA Standard CAN/CSA-C22.2 (Non medical IR and UV lamps)	Protective eyewear	3.3; Appendix C1.1	General requirements: All tanning equipment must be accompanied by sufficient sets of protective eyewear that meet Clause 6.17 of this standard to at least equal the maximum number of persons exposed to UV radiation from the tanning equipment.
Ultrasound:			
Safety Code 23 (Medical ultrasound)	None identified		
Safety Code 24 (Industrial and commercial ultrasound)	None identified		

Notes:

1. Safety Code 35 has replaced Safety Code 20A (only as it relates to large medical radiological facilities) and Safety Code 31 (refer to OHS Guideline G7.23)
2. Safety Code 34 has replaced Safety Code 27 (refer to OHS Guideline G7.23)
3. Safety Code 36 has replaced Safety Code 33 (refer to OHS Guideline G7.23)

G7.20(1)-4 Exposure control plan - Education and training

Issued August 1999; Revised January 1, 2005

Section 7.20(1) of the *OHS Regulation* ("*Regulation*") states:

> If a worker exceeds or may exceed an action level, ionizing radiation or action level, non-ionizing radiation, the employer must develop and implement an exposure control plan meeting the requirements of section 5.54(2).

Section 7.20(1) requires an exposure control plan if a worker's level of exposure exceeds or may exceed the applicable action level. Section 5.54(2)(c) specifies that education and training are a component of an exposure control plan.

An employer or a WorkSafeBC prevention officer may choose to evaluate compliance with this section by asking the worker the following questions:

- What is the hazard?
- What precautions are required to protect against exposure?
- What do you do in the event of an emergency?
- Where do you get further information?

If the worker has received an acceptable level of education and training, the worker will be able to provide information such as following in response to the preceding questions.

The hazard

- Type of radiation, route of exposure, as well as general knowledge of the applicable exposure limits

- Potential health effects from overexposure to radiation, such as the potential for thermal and photochemical effects and skin cancer from ultraviolet radiation
- Any risks or hazards associated with the specific type of radiation to which the worker is exposed - for example, the risks associated with any contamination or leakage of ionizing radiation, the hazard associated with radiofrequency radiation near electro-explosives or flammable substances, and the fire hazard associated with class 4 lasers

How to protect against exposure

- Any shielding requirements
- Minimizing exposure time
- Maximizing distance from the source and staying clear of a collimated or directed beam
- Required safe work procedures
- Required personal protective equipment

What to do in the event of an emergency

For *ionizing* radiation, an emergency might be the uncontrolled release of radioactive material. Actions expected of a worker might include the following:

- Notify the employer.
- Control the spread of contamination.
- Evacuate the area as necessary.
- Notify the appropriate agencies as necessary.

For minor spills or releases, the worker might be expected to follow spill cleanup procedures.

For *non-ionizing* radiation, what constitutes an emergency depends on the type of radiation. For radiofrequency or microwave radiation, an emergency might be an extraordinarily high exposure that might be evident, for example, if a worker gets a severe shock through contact current or if a monitoring procedure shows immediately dangerous field strengths in an area where workers are, or may access. A worker complaining of eye pain should also be considered an emergency. For lasers and for ultraviolet or ultrasound radiation, an acute injury might constitute an emergency situation, such as an eye injury from ultraviolet radiation or a laser source.

In an emergency, actions expected of a worker should include the following:

- Notify the employer.
- Seek first aid and medical attention if necessary.
- Evacuate the area if necessary.
- Implement corrective procedures if necessary (for example, if appropriate, shut off the equipment).
- Notify appropriate agencies as required.

Where to get further information
Sources of information might include:

- Equipment operating instructions
- Written safe work procedures
- CNSC licence and regulations (for work with radioactive sources)
- Relevant standards (such as Health Canada Safety Codes or ANSI standards)
- Radiation Protection Services, WorkSafeBC, CNSC, Health Canada
- Supervisor or employer

G7.20(2) Exposure control plan - Posting of instructions

Issued January 1, 2005

Regulatory excerpt
Section 7.20(2) of the *OHS Regulation* ("*Regulation*") states:

> The instructions to workers developed under subsection (1) must be posted or otherwise available in the work area or near the applicable equipment controls.

Purpose of guidelines
The purpose of this guideline is to highlight the requirement for a written exposure plan to be posted or available in the work area.

Written instructions
If a worker's level of exposure exceeds or may exceed the applicable action level, the employer is to prepare written instructions and make them available in the work area. The written instructions should include written work procedures (such as the safe use of the equipment), emergency procedures, and specifications for personal protective equipment. The boundaries of the (radiation) hazard area are to be indicated through written instructions, signage, or other effective means.

G7.21 Reproductive hazards

Issued August 1999; Revised January 1, 2005; Revised May 11, 2023

Regulatory excerpt
Section 7.21 of the *OHS Regulation* ("*Regulation*") states:

> (1) The employer must ensure that every worker who exceeds, or may exceed, the action level, ionizing radiation is fully informed of any potential reproductive hazards associated with the worker's exposure to ionizing radiation.
>
> (2) When requested by a pregnant worker or by a worker intending to conceive a child, the employer must make counselling available with respect to the reproductive hazards associated with exposure to ionizing radiation.

Purpose of guidelines
The purpose of this guideline is to provide additional information on the expected content of information to be provided to workers with respect to the potential reproductive hazards associated with exposure to ionizing radiation.

Information provided to workers
General information on reproductive hazards must be provided to all workers who exceed or may exceed an effective dose of 1 mSv per year, the action level for ionizing radiation, as defined under section 7.17 of the Regulation. This information could be provided as part of the employer's exposure control plan (refer to OHS Guidelines for section 7.20 for additional information).

Information on reproductive hazards should address the following topics:

- Levels of radiation that may affect fetal development and cancer induction
- Levels of radiation that may cause sterility
- The specific exposure limits for pregnant workers, as specified by section 7.19(2) of the *Regulation*
- The importance of the ALARA (as low as reasonably achievable) principle for pregnant workers and for workers intending to conceive a child
- Control measures for preventing inhalation or ingestion of, or contamination by, radioactive materials
- Employer policies and procedures in place to protect pregnant workers or workers intending to conceive a child, which could include protective reassignment

Since information about the risks of ionizing radiation changes, the material used for informing workers should be reviewed annually and updated as necessary to incorporate accurate risk information.

Counselling provided to pregnant workers or those intending to conceive a child
On request of a worker who is occupationally exposed to ionizing radiation, and who advises the employer that they are pregnant or intending to conceive a child, additional counselling on the reproductive risks must be provided.

In addition to reviewing the general information provided to all workers, counselling to workers who are pregnant or intending to conceive should also include information on the relative risks of birth defects and childhood cancer associated with the worker's specific radiation exposure.

Once the worker has been fully informed of the potential risks, and a thorough review of the worker's current exposure risks reviewed, appropriate protective actions should be developed in consultation with the worker, to ensure the worker's effective dose of ionizing radiation is maintained below those required by section 7.19(2) of the *Regulation*.

G7.22 Monitoring exposure

Issued August 1999; Revised January 1, 2005; Editorial Revision June 8, 2011; Editorial Revision August 4, 2015; Editorial Revision December 1, 2021

Regulatory excerpt
Section 7.22 of the *OHS Regulation* ("*Regulation*") states:

> Unless exempted by the Board, if a worker exceeds or may exceed the action level, ionizing radiation, the employer must ensure that the worker is provided with and properly uses a personal dosimeter acceptable to the Board.

Purpose of guideline
The purpose of this guideline is to describe a personal dosimeter acceptable to WorkSafeBC.

Acceptable personal dosimeter
The standard method for monitoring *external* alpha, beta, gamma, x-radiation, and neutron radiation dose is to use a personal dosimeter, such as a whole-body or extremity badge worn by a worker. These devices are supplied by a dosimetry service provider who will also perform the post-exposure analysis of the device. Commonly used personal dosimeters for x-ray, beta, and gamma radiation include thermoluminescent dosimeters (TLDs) and optically stimulated luminescence (OSL) dosimeters.

Employers participating in a personal monitoring program, using dosimetry, are to ensure that the program is effectively managed. Workers must

wear the dosimeters correctly and return them to the employer for submission to the service provider for analysis. It is the responsibility of the service provider to submit the results to Health Canada's National Dose Registry (NDR), as well as to the employer.

A personal dosimeter supplied by a dosimetry service provider who submits the dosimetry data to the NDR is acceptable to WorkSafeBC. If an employer wants to use a different personal dosimeter, an application for acceptance must be made to WorkSafeBC's Prevention Practice, Quality, and Engineering department. Employers also need to verify that the personal dosimeter is acceptable to any other involved regulatory authority (e.g., Canadian Nuclear Safety Commission).

For detailed technical information on acceptable methods of detection and monitoring procedures, the employer should contact the dosimetry service provider, the Canadian Nuclear Safety Commission, or any successor agency, the Health Protection Branch of Health Canada (Radiation Protection Bureau).

Note: "Internal radiation dose" refers to the dose received by ingestion inhalation, or injection through the skin and would be monitored by such means as urinalysis or by thyroid scan.

G7.23 Acceptable standards

Issued August 1999; Revised January 1, 2005; Editorial Revision March 11, 2009; Editorial Revision March 9, 2012; Editorial Revision September 21, 2012; Editorial Revision March 31, 2015; Editorial Revision September 25, 2019

Regulatory excerpt
Section 7.23 of the *OHS Regulation* (*"Regulation"*) states:

> Equipment producing ionizing or non-ionizing radiation or ultrasonic energy must be installed, operated and maintained in accordance with the following:
>
> (a) for ionizing radiation:
>
> (i) *Health Canada Safety Code 20A, X-Ray Equipment in Medical Diagnosis Part A: Recommended Safety Procedures for Installation and Use*, 1980, as amended from time to time;
>
> (ii) *Health Canada Safety Code 27, Requirements for Industrial X-Ray Equipment Use and Installation*, 1987, as amended from time to time;
>
> (iii) *Health Canada Safety Code 28, Radiation Protection in Veterinary Medicine - Recommended Safety Procedures for Installation and Use of Veterinary X-Ray Equipment*, 1991, as amended from time to time;
>
> (iv) *Health Canada Safety Code 29, Requirements for the Safe Use of Baggage X Ray Inspection Systems*, 1993, as amended from time to time;
>
> (v) *Health Canada Safety Code 30, Radiation Protection in Dentistry - Recommended Safety Procedures for the Use of Dental X-Ray Equipment*, 1999, as amended from time to time;
>
> (vi) *Health Canada Safety Code 31, Radiation Protection in Computed Tomography Installation*, 1994, as amended from time to time;
>
> (vii) *Health Canada Safety Code 32, Safety Requirements and Guidance for Analytical X-Ray Equipment*, 1994, as amended from time to time;
>
> (viii) *Health Canada Safety Code 33, Radiation Protection in Mammography*, 1995, as amended from time to time;
>
> (b) for radiofrequency:
>
> (i) *Health Canada Safety Code 25, Guidelines for Limiting Radiofrequency Exposure - Short-Wave Diathermy*, 1983, as amended from time to time;
>
> (ii) *Health Canada Safety Code 26, Guidelines on Exposure to Electromagnetic Fields from Magnetic Resonance Clinical Systems*, 1987, as amended from time to time;
>
> (iii) *Health Canada Safety Code 6, Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz*, 1999, as amended from time to time;
>
> (c) for lasers:
>
> (i) *ANSI Standard Z136.1-2000, Safe Use of Lasers*, as amended from time to time;
>
> (ii) *ANSI Standard Z136.2-1997, Safe Use of Optical Fiber Communication Systems Utilizing Laser Diode and LED Sources*, as amended from time to time;

(iii) *ANSI Standard Z136.3-1996, Safe Use of Lasers in Health Care Facilities*, as amended from time to time;

(iv) *CSA Standard Z386-01, Laser Safety in Health Care Facilities*, as amended from time to time;

(d) for infrared and ultraviolet:

(i) *CSA Standard CAN/CSA-C22.2 No. 224-M89 (R1994), Radiant Heaters and Infrared and Ultraviolet Lamp Assemblies for Cosmetic or Hygienic Purposes in Nonmedical Applications*, as amended from time to time;

(e) for ultrasound:

(i) *Health Canada Guidelines for the Safe Use of Diagnostic Ultrasound*, 2001, as amended from time to time;

(ii) *Health Canada Safety Code 24, Guidelines for the Safe Use of Ultrasound: Part II - Industrial and Commercial Applications*, 1991, as amended from time to time,

except as otherwise determined by the Board.

Purpose of guideline
The purpose of this guideline is to provide general information regarding the safety codes and standards that must be complied as required by section 7.23 of the *Regulation*.

Safety codes and standards for the use of equipment
Unless otherwise stated in this guideline, the most recent edition of the safety code or standard listed under section 7.23 of the *Regulation* applies.

Health Canada Safety Codes
The Safety Codes are available on the Health Canada website.

The Safety Codes can also be ordered from Health Canada (1-866-225-0709).

Safety Codes for ionizing radiation

- Health Canada has published *Safety Code 35, Safety Procedures for the Installation, Use and Control of X-Ray Equipment in Large Medical Radiological Facilities* to replace *Safety Code 20A, X-Ray Equipment in Medical Diagnosis Part A: Recommended Safety Procedures for Installation and Use* (only as it relates to large medical radiological facilities) and *Safety Code 31, Radiation Protection in Computed Tomography Installation*. *Safety Code 20A* continues to apply to small radiological facilities.
- *Safety Code 27, Requirements for Industrial X-Ray Equipment Use and Installation* has been replaced by *Safety Code 34, Radiation Protection and Safety for Industrial X-Ray Equipment*.
- Health Canada has published an addendum to *Safety Code 32*, dated 2014. This addendum is part of *Safety Code 32*.

As a result, equipment producing ionizing radiation must be installed, operated, and maintained in accordance with Safety Codes 20A, 28, 29, 30, 32, 33, 34, and 35, as applicable. The *Regulation* no longer requires compliance with Safety Codes 20A (for large medical radiological facilities), 27, or 31. As stated above, Safety Code 20A continues to apply to small radiological facilities.

Safety Code for radiofrequency
Safety Code 6, published in 1999, was rewritten in 2009 and 2015 to address current research regarding allowable limits for RF exposure. Allowable exposure limits defined in the 2015 version are significantly more conservative than those identified in both the 1999 and 2009 versions. The rewriting of the code involved moving the procedural specifications for installation, operation, and maintenance of radiation equipment into a Technical Guide for Interpretation and Compliance Assessment of Health Canada's Radiofrequency Exposure Guidelines, to assist users in understanding and assessing the safety of electromagnetic exposures in working and living environments. The employer is responsible for ensuring that the installation, operation, and maintenance of radiation equipment provides protection to workers from radiofrequency fields for Uncontrolled Environments defined by the 2015 Code. WorkSafeBC considers the information in the Technical Guide to be an acceptable means to provide this protection. Copies of the Technical Guide may be obtained from Health Canada through a request to:
HC.ccrpb-pcrpcc.SC@canada.ca

Or at:
https://www.canada.ca/en/health-canada/services/environmental-workplace-health/reports-publications/radiation/safety-code-6-health-canada-radiofrequency-exposure-guidelines-environmental-workplace-health-health-canada/technical-guide.html

Additional standards
Safe operating requirements for radioactive materials are specified under the licensing requirements of the Canadian Nuclear Safety Commission.

From time to time, Radiation Protection Services of the BC Centre for Disease Control issues standards and guidelines it has developed. It may also recommend standards and guidelines issued by other agencies related to installation, operation, or maintenance of radiation-producing equipment. WorkSafeBC will normally consider these to be a "standard acceptable to the Board." These additional documents may provide guidance to a WorkSafeBC prevention officer reviewing a particular facility for compliance. In such a situation, a prevention officer should consult with one of WorkSafeBC's subject matter experts before making a formal decision based on a non-referenced standard.

Issued December 21, 2009; Revised June 8, 2011; Editorial Revision April 6, 2020

Regulatory excerpt
Sections 7.23(a)(i) and (vi) of the *OHS Regulation* ("*Regulation*") state:

> Equipment producing ionizing or non-ionizing radiation or ultrasonic energy must be installed, operated and maintained in accordance with the following:
>
> (a) for ionizing radiation:
>
> (i) *Health Canada Safety Code 20A, X-Ray Equipment in Medical Diagnosis Part A: Recommended Safety Procedures for Installation and Use*, 1980, as amended from time to time;
>
> …
>
> (vi) *Health Canada Safety Code 31, Radiation Protection in Computed Tomography Installation*, 1994, as amended from time to time;
>
> …
>
> except as otherwise determined by the Board.

Purpose of guideline
Health Canada has published *Safety Code 35, Safety Procedures for the Installation, Use and Control of X-ray Equipment in Large Medical Radiological Facilities* to replace *Safety Code 20A, X-ray Equipment in Medical Diagnosis Part A: Recommended Safety Procedures for Installation and Use* (as it relates to large medical radiological facilities) and *Safety Code 31, Radiation Protection in Computed Tomography Installation*.

This guideline provides guidance on the application of the occupational health and safety requirements in Health Canada *Safety Code 35* (*SC35*) to large radiological facilities.

Facilities within the scope of *Safety Code 35*
SC35 applies to large medical radiological facilities where diagnostic and interventional radiological procedures are routinely performed using radiographic, radioscopic or computed tomography (CT) equipment. Large facilities are those that operate more than one type of radiological equipment, or have at least three suites of the same type of equipment. Most hospitals and CT facilities fall within this category.

The requirements of *SC35* do not apply to radiation therapy facilities and the equipment used in radiotherapy, including radiation therapy simulators, for localization and treatment planning. *SC35* does not apply to dental (addressed in *SC 30*) or mammography (addressed in *SC 33*) facilities.

SC35 does not apply to small radiological facilities such as most chiropractic, podiatry, physical therapy, and bone densitometry facilities.

> Note: Health Canada is preparing a safety code specific to small facilities. As described in OHS Guideline G7.23, *SC20A* continues to apply to small radiological facilities until the new safety code for small facilities is published.

Health and safety requirements of *SC35*
WorkSafeBC has consulted with the Diagnostic Accreditation Program, College of Physicians and Surgeons of BC, and the Ministry of Health, and has determined that only certain clauses of *SC35* are concerned with occupational health and safety and are requirements under *Regulation* sections 7.23(a)(i) and (vi). These clauses, and any necessary explanatory notes, are listed below in this guideline. The Table may be updated from time to time, based on further consultation with health care sector representatives and possible future amendments to *SC35*.

Table: Health Canada *Safety Code 35* occupational health and safety (OHS) requirements

Description	Clauses with OHS requirements administered by WorkSafeBC
***SC35* Section A - Responsibilities and Protection**	
Responsibility of Personnel	1.0, 1.1, 1.2, 1.2.1 (Refer to Note 1), 1.2.2 (Refer to Note 1), 1.2.4, 1.2.5 (Refer to Note 2), 1.2.6 - 1.2.11, 1.3, 1.3.1 (Refer to Note 3), 1.3.2 (Refer to Note 3), 1.3.3(i), 1.3.3(v), 1.3.4 - 1.3.7, 1.3.11, 1.4, 1.4.1 (Refer to Note 4), 1.4.2 (Refer to Note 4), 1.4.3(i), 1.4.3(ii) (Refer to Note 5), 1.4.3(iii), 1.4.4 - 1.4.15, 1.4.17
Procedures for Minimizing Radiation Exposure to Personnel	2.1.2 - 2.1.8, 2.1.11, 2.1.12, 2.2.2 - 2.2.4, 2.3.3, 2.4(1), 2.4.1, 2.4.1.1 - 2.4.1.4
***SC35* Section B - Facility and Equipment Requirements**	

Facility Requirements	1.1, 1.2.1, 1.2.2 (subclauses 1,2,5,6,7,9 - Refer to Note 6), 1.2.3 (Refer to Note 7), 1.3 (Refer to Note 8)
Medical X-ray Equipment Requirements	2.5.1 (Refer to Note 9), 2.5.2.3, 2.5.3.2, 2.5.3.3, 2.5.3.5, 2.5.3.7, 2.5.4.1
Other Equipment	4.0, 4.1.1, 4.1.5 - 4.1.11
Radiation Protection Surveys	5.0, 5.1 (Refer to Note 10), 5.2 Paragraph 1, 5.2.1 - 5.2.8, 5.2.11, 5.2.12, 5.2.14

Note 1: Clauses A1.2.1 and A1.2.2 set out requirements for qualification and re-qualification of a responsible user (RU). WorkSafeBC will accept qualifications as outlined in *Safety Code 35*. If the RU is a physician, WorkSafeBC will also accept qualifications that are acceptable to the Diagnostic Accreditation Program. For non-physicians, WorkSafeBC will consider the RU to be qualified if the RU has the authority to fulfill the duties outlined in *SC35* clause A1.2.

The RU is typically a person who is stationed on-site; for smaller facilities, an off-site RU may also be acceptable if the duties are being adequately fulfilled with the assistance of an on-site qualified and competent person. Assessment of compliance will include an assessment of whether the assigned duties are being fulfilled.

Note 2: There is currently no provision in B.C. for licensing or certification of x-ray equipment operators. WorkSafeBC will not require specific licensing or certification for x-ray equipment operators at this time. Adequate supervision, instruction, and training of staff are required under existing sections of the *Workers Compensation Act* (*"Act"*), including sections 21 and 23.

Note 3: Clauses A1.3.1 and A1.3.2 set out requirements for qualification and re-qualification of x-ray equipment operators. WorkSafeBC will accept qualifications as outlined in *Safety Code 35*. If the operator is a physician, WorkSafeBC will also accept qualifications that are acceptable to the Diagnostic Accreditation Program.

Note 4: Clauses A1.4.1 and A1.4.2 set out requirements for qualification and re-qualification of medical physicists and radiation safety officers (RSO). This typically needs to be a person who is stationed on-site; some duties can be contracted as required, and some duties can be done regionally or corporately.

Under these clauses, WorkSafeBC will accept qualifications for a medical physicist that are acceptable to the Diagnostic Accreditation Program.

Until a training course for RSOs in B.C. is readily available, qualifications for an RSO will be assessed as the person's knowledge of the work, the hazards, and the control measures necessary to perform the duties. This knowledge may be obtained by way of education, training, experience, or a combination thereof.

A responsible user can also be the RSO, if qualified as above.

Note 5: Clause A1.4.3(ii) refers to registration of new x-ray equipment. The Diagnostic Accreditation Program's (DAP) Radiation Safety Accreditation Standard specifies that new and replaced medical x-ray equipment be registered with the DAP. Registration forms are available on the DAP website, https://cpsbc.ca/programs/dap.

Note 6: Clause B1.2.2 sets out general recommendations that must be considered by the employer when designing the layout of an x-ray facility. The employer may be asked by a WorkSafeBC prevention officer to explain why a recommendation is not implemented. Evidence of consideration of a recommendation would include a written rationale explaining how the recommendation was incorporated or why the recommendation was rejected.

Note 7: Clause B1.2.3 sets out parameters that must be considered during calculation of barrier thicknesses. None of these parameters are mandatory for implementation, since they must only be considered. However, an employer may be asked to provide a rationale as to why a recommendation was not implemented. Evidence of consideration would include a written rationale explaining how the recommendation was incorporated or why the recommendation was rejected.

Note 8: Clause B1.3 sets out requirements for shielding calculations and requires submission of facility and installation plans as well as evidence of factor consideration to the appropriate government agency. WorkSafeBC does not require such submission to WorkSafeBC on a routine basis, but prevention officers may inquire into the determination and effectiveness of shielding in the event of an inquiry by an employer, a high exposure investigation, or a complaint.

Note 9: Clause B2.5.1 sets out construction and performance requirements for x-ray equipment. These requirements are administered by WorkSafeBC to the extent that they address worker health and safety. WorkSafeBC will not address these requirements as part of acceptance testing, which are under the scope of the Diagnostic Accreditation Program, but may assess them as part of the safe operation of the equipment.

Note 10: Clause B5.0 specifies that the survey is conducted by an expert. This is an individual who is qualified by education and experience to perform advanced or complex procedures in radiation protection that generally are beyond the capabilities of most personnel within the facility. These procedures include evaluation of the facility design to ensure adequate shielding is in place, inspection and evaluation of the performance of x-ray equipment and accessories, and evaluation of, and recommendations for, radiation protection programs.

Clause B5.1 requires the owner (or delegate) to contact WorkSafeBC to ascertain inspection (survey) procedures and inspection frequency. Inspection procedures are acceptable if they result in a survey report that covers all required information items described in clause B5.2. The required frequency for x-ray surveys is described in OHS Guideline G7.24(a).

G7.23(c)(iv) Standard for laser devices in health care

Issued May 8, 2025

Regulatory excerpt
Section 7.23 of the *OHS Regulation* ("*Regulation*") states, in part:

> Equipment producing ionizing or non-ionizing radiation or ultrasonic energy must be installed, operated and maintained in accordance with the following:
>
> …
> (c) for lasers:
> …
>
> (iv) *CSA Standard Z386-01, Laser Safety in Health Care Facilities*, as amended from time to time;

Purpose of guideline
The purpose of this guideline is to acknowledge that the Canadian Standards Association Group has replaced *CSA Standard Z386-01, Laser Safety in Health Care Facilities* with *CSA Standard Z7001-24, Safe use of energy-based medical and surgical devices in health care*.

Enforcement of CSA Standard Z7001-24
Section 7.23(c)(iv) of the *Regulation* requires that lasers used in health care must be installed, operated, and maintained in accordance with *CSA Standard Z386-01, Laser Safety in Health Care Facilities*, as amended from time to time.

In December 2024, The Canadian Standards Association Group issued *CSA Standard Z7001-24, Safe use of energy-based medical and surgical devices in health care*. This new standard supersedes *CSA Standard Z386 - Safe use of lasers in health care*, combining it with the requirements of *CSA Standard Z387 (electrosurgical devices)* and *CSA Standard Z305.13 (Plume scavenging)*. As *CSA Standard Z7001* effectively replaces *CSA Standard Z386*, *CSA Standard Z7001* should be treated as an amendment for the purpose of complying with sections 7.19(4)(b)(iv) and 7.23(c)(iv) of the *Regulation*. Only the mandatory sections of *CSA Standard Z7001* applicable to exposure limits, installation, operation, and maintenance of lasers must be followed under these provisions.

G7.24 Radiation surveys

Issued August 1999; Revised January 1, 2005; Editorial Revision March 11, 2009; Editorial Revision April 6, 2020

Regulatory excerpt
Section 7.24 of the *OHS Regulation* ("*Regulation*") states:

> Except as otherwise determined by the Board, the employer must conduct a radiation survey for ionizing radiation in accordance with the standard practice specified under the applicable Safety Code listed in section 7.23 (a) or the regulations under the *Nuclear Safety and Control Act* (Canada),
>
> (a) at the times required by the Safety Code or regulations, as the case requires,
>
> (b) if equipment has been damaged or modified, or
>
> (c) if there is an indication of an unusually high exposure of a worker to ionizing radiation.

Purpose of guideline
The purpose of this guideline is to clarify the requirement to conduct radiation surveys.

General survey requirements
For the purposes of section 7.24(b), the term *modified* includes moving the equipment from one permanent location to another. Exempt from this requirement is equipment that is designed to be mobile, such as a portable x-ray unit; a radiation survey is not required every time mobile equipment is moved.

For underground workings, the requirements for a radiation survey are specified in section 22.33 of the *Regulation*.

Specific survey requirements
The specific requirements for a radiation protection survey are listed in each Safety Code (codes are listed in section 7.23 of the *Regulation* and in OHS Guideline G7.23). Only those parts of the radiation protection survey that relate to worker protection are considered mandatory. Not completing the specific items listed for the protection of the patient and for the protection of the public will not be deemed to constitute non-compliance with section 7.24 of the *Regulation*. Table 1 lists the number of requirements in the relevant Safety Code.

Table 1: Requirements for a radiation protection survey

Safety Code	Application	Requirements for radiation survey	Radiation protection survey
20A	Medical[1]	5.1; 5.2	11 specific items
27	Industrial[2]		
28	Veterinary	5.1; 5.2	6 specific items
30	Dentistry[3]	4.3	3 specific items
31	Computed Tomography[1]		
32	Analytical	3.5	15 specific items
33	Mammography[3]	4.3	4 specific items
35	Large Facilities	5.1; 5.2	14 specific items

1. *Safety Code 35* has replaced Safety Code 20A (only as it relates to large medical radiological facilities) and Safety Code 31 (see OHS Guideline G7.23).
2. Safety Code 34 has replaced Safety Code 27 (see OHS Guideline G7.23).
3. While there is no specific section on "radiation protection survey" in Safety Codes 30 and 33, the general requirement for a "radiation protection inspection" is intended to cover the same situation. The expectation of the standard is that the employer will take the appropriate measurements to ensure that workers are not at risk of exposure to ionizing radiation resulting from damage to a piece of equipment.

In all cases, the radiation protection survey or the radiation protection inspection is intended to determine the extent of any damage to the equipment or the facility; thus it is part of an incident investigation. It should be noted that section 69(1)(c) of the *Workers Compensation Act* also applies, when a particular incident had the potential for serious injury (e.g., cancer development) to a worker. Any investigation of such an incident would be expected to include an inspection of the equipment and measurement of any possible leakage of radiation.

The survey should include leak testing, which is an assessment of potential points or areas for escape of ionizing radiation or radioactive material from a piece of equipment. For sealed sources, leakage tests meeting the requirements of the Canadian Nuclear Safety Commission ("CNSC") are acceptable to WorkSafeBC. One common such test is a wipe test, using a filter paper or a cotton-tipped swab to wipe possible areas of leakage, and then measuring the wipe sample for radiation. Situations involving spillage of radioisotopes or other radioactive materials are covered by the provisions of the CNSC licence held by the user. For X-ray equipment (diagnostic, analytical, etc.), a suitable survey meter can be used to identify any leak locations (e.g., an ion chamber monitoring device for accurate results or a Geiger-Mueller counter for estimations).

G7.24(a) Radiation surveys - Clarification of how often to conduct and who can conduct

Issued February 8, 2007; Editorial Revision December 1, 2021

Regulatory excerpt
Section 7.24(a) of the *OHS Regulation* ("*Regulation*") states:

> Except as otherwise determined by the Board, the employer must conduct a radiation survey for ionizing radiation in accordance with the standard practice specified under the applicable Safety Code listed in section 7.23(a) or the regulations under the Nuclear Safety and Control Act (Canada),
>
> (a) at the times required by the Safety Code or regulations, as the case requires,

Purpose of guideline
The purpose of this guideline is to provide information on how often to perform a radiation survey, and who can conduct a radiation survey.

Maximum intervals for radiation surveys
The Health Canada safety codes referenced in section 7.23(a) typically state that a radiation survey (called an inspection in some safety codes) is required at regular intervals. Safety Code 29 (*Requirements for the Safe Use of Baggage X-ray Inspection Systems*) is the only safety code that specifies a time period (2–3 years) between required surveys.

For all other x-ray equipment, the employer must determine the appropriate interval between radiation surveys of the x-ray equipment. In making this determination, the employer should consider the following factors:

- Manufacturer's specifications
- Requirements of the relevant professional association
- Nature of shielding used (e.g. lead or drywall)
- Frequency, nature, and conditions of use of the equipment
- Nature of patient (animal or human)
- Single or multiple users of the x-ray equipment
- Power levels used (kVp and mA settings)

- Results of personal exposure monitoring
- Type of x-ray unit (e.g. fixed or portable, radiographic, or fluoroscopic)
- Age and performance history of the equipment

It is expected that the interval between radiation surveys will not normally be more than three years, except in the case of a typical dental bite-wing x-ray unit operating only at or below 70 kVp, where a maximum period of five years between surveys is acceptable because of the low power levels and the nature of usage.

This guideline does not alter the requirements of *Regulation* sections 7.24(b) and (c) which require a survey to also be conducted if the equipment has been damaged or modified, or if there is an indication of an unusually high exposure of a worker to ionizing radiation.

Performance of a survey
Several of the safety codes state that the surveys should be done by the regulatory authority but in BC, the *Regulation* requires the employer to conduct the radiation surveys. The employer may contract with a specialist to perform the survey, but remains responsible for the survey being done with the required frequency and in accordance with accepted standard practice. WorkSafeBC prevention officers may review survey reports to ensure that the terms of the Safety Code and the *Regulation* have been met.

G7.25 Records

Issued August 1999; Revised January 1, 2005; Editorial Revision September 28, 2022

Regulatory excerpt
Section 7.25 of the *OHS Regulation* ("*Regulation*") states:

> The employer must
>
> (a) maintain and make available to the Board,
>
> (i) for at least 10 years, records of radiation surveys, and
>
> (ii) for the period that the worker is employed plus 10 years, records of exposure monitoring and personal dosimetry data, and
>
> (b) make the records available to workers.

Purpose of guidelines
The purpose of this guideline is to explain the record-keeping requirements for records of radiation surveys, exposure monitoring, and personal dosimetry data as required under section 7.25 of the *Regulation*.

WorkSafeBC's record-keeping requirements
WorkSafeBC's requirements for record keeping may be different from the time period required by other regulatory agencies, such as the Canadian Nuclear Safety Commission (CNSC). Where this is the case, the longer of the time periods will prevail in order to satisfy the regulatory requirement of that agency.

Personal information
Under protection of privacy legislation personal information cannot be made available to persons other than the monitored worker without express written consent from that worker. This applies to both medical records and the results obtained from dosimetry.

WorkSafeBC prevention officers may view or request copies of dosimetry records under this section, where doing so is deemed necessary to verify the employer's compliance with regulatory requirements. However, in accordance with *Freedom of Information and Protection of Privacy Act* (FIPPA) requirements, when exposure data is presented in an Inspection Report, specific persons will not be identified by name; only their positions will be indicated (except in exceptional circumstances).

G7.27(1) Heat exposure - Application

Issued August 1999; Revised January 1, 2005; Preliminary Revision March 12, 2026

Regulatory excerpt
Section 7.27(1) of the *OHS Regulation* ("*Regulation*") states:

> (1) Subject to subsection (2), sections 7.28 to 7.32 apply to a workplace if
>
> (a) a worker is or may be exposed to thermal conditions which could cause heat stress,
>
> (b) the thermal conditions could result in a worker's core body temperature exceeding 38°C (100°F), or
>
> (c) the thermal conditions are in excess of the levels listed in the screening criteria for heat stress exposure in the heat stress and strain section of the ACGIH Standard for unacclimatized workers.

Purpose of guideline

This guideline explains the hazards of heat stress and provides examples of when sections 7.28 to 7.32 of the *Regulation* apply. It also identifies common workplace conditions that increase risk and identifies workplaces where exposure to heat is likely to be a potential hazard.

Heat-related illnesses
The body functions best when its core temperature remains between 36°C and 38°C. As heat exposure increases, the body cools itself by increasing breathing and heart rate, dilating surface blood vessels (resulting in changes in blood pressure), and increasing sweating — all of which tend to increase heat exchange with the environment. These mechanisms can become less effective as temperature and humidity rise, physical effort increases, or clothing limits the evaporation of sweat.

Heat stress is the total heat load on a worker from the combined contributions of metabolic heat, environmental factors, and clothing requirements. Heat strain is the body's physiological response to heat stress.

The effects of heat stress may include reduced physical and cognitive performance, which in turn may lead to an increased risk of workplace incidents. Heat stress can also worsen pre-existing conditions (e.g., cardiovascular, respiratory, or cerebrovascular disease, and diabetes-related conditions).

Heat stroke can occur when heat stress overwhelms the body's cooling capacity and its core temperature rises rapidly. Heat stroke is a medical emergency and can cause permanent disability or death without immediate treatment.

Additional information on the signs and symptoms of heat stress can be found in the WorkSafeBC publication Preventing Heat Stress at Work.

When sections 7.28 to 7.32 of the Regulation apply
Sections 7.28 to 7.32 of the Regulation apply to any areas, tasks, or occupations that pose a risk of heat stress or heat strain, including those identified in section 7.27(1). Employers must assess conditions and implement effective controls as required by these sections.

Conditions and risk factors
Heat stress can occur when external temperatures exceed 23°C and one or more of the following conditions are present:

- Areas with high humidity
- Work activities that require heavy physical exertion for more than 30 minutes without rest
- Activities that require workers to wear protective clothing that stops the evaporation of sweat over most of their body for extended periods of time
- Areas, tasks, or occupations that have been identified as having a risk of heat-related disorders through accident investigation reports, first aid treatment records, and records of injury or disease
- Areas, tasks, or occupations about which employees have expressed concern about heat exposure

Examples of workplaces with potential for heat stress Some examples of workplaces or tasks that are likely to create a potential for heat stress or strain, and where a heat stress assessment and exposure control plan would normally be required, include:

- Work near hot processes or equipment, such as foundries, sawmills, pulp mills, smelters, cement kilns, and furnaces
- Outdoor work — such as construction, road repair, agriculture, or forestry — where seasonal heat (sun or radiant load) and workload increase risk
- Commercial kitchens, bakeries, breweries, canneries, and laundries without effective controls for process-related heat and humidity
- Asbestos abatement or hazardous materials cleanup, where heavy workload and protective clothing significantly increase heat load

Summer temperatures may also pose a risk in workplaces without effective or adequate air conditioning. In general, effective air conditioning should keep the temperature and humidity levels within a reasonable thermal comfort range consistent with the requirements of section 4.80 of the *Regulation*.

Heat stress during extreme heat events and the BC Heat Alert and Response System (BC HARS)
In 2022, the BC Centre for Disease Control, the B.C. Ministry of Health, and Health Emergency Management BC, in consultation with regional health authorities and other agencies, developed a heat alert system to warn the public about heat risk. The specific conditions for which alerts will be issued differs depending on the specific climatic region being impacted, and for each region there are two tiers of warning - Heat Warning and Extreme Heat Emergency.

Regional weather forecasts and seasonal-specific weather updates can be monitored using Weather Alerts for Canada, or with the WeatherCAN app for an immediate push notification to smartphones for pre-selected locations.

Although the warning levels of the BC HARS are based on heat risk to vulnerable populations and do not reflect occupational exposure limits, employers should be aware of these warnings and use them as a trigger to activate heat stress exposure control plans (ECP).

During extreme heat events, employers whose workers do not work in a climate-controlled environment must either conduct a heat stress assessment to confirm that conditions do not pose a risk, or implement an effective heat ECP to protect workers.

Refer to OHS Guideline G7.29-5 for more information about ECPs.

Issued January 1, 2005

Regulatory excerpt
Section 7.27(2) of the *OHS Regulation* ("*Regulation*") states:

> Subsection (1) does not apply to firefighting if special provisions satisfactory to the Board are in place to ensure that the firefighter's core body temperature is maintained below 38°C (100°F).

Purpose of guideline
The purpose of this guideline is to explain special provisions in which section 7.27(2) of the *Regulation* may apply.

Special provisions
Special provisions related to firefighting that fulfill the intent of this section include the following:

- Instruction and training
- Work procedures that address both the hazards and necessary controls
- Specialized personal protective equipment

G7.28(1) Exposure limits - Using the ACGIH Standard

Issued August 1999; Revised January 1, 2005; Revised February 12, 2008; Retired March 12, 2026

This guideline has been retired.

G7.28(1)-1 Heat stress exposure limits

Preliminary Issue March 12, 2026

Regulatory excerpt
Section 7.28(1) of the *OHS Regulation ("Regulation")* states:

> (1) A worker must not be exposed to levels that exceed those listed in the screening criteria for heat stress exposure in the heat stress and strain section of the ACGIH Standard

Purpose of guideline
The purpose of this guideline is to explain exposure limits for heat stress, and the limitations of exposure limits in the context of personal risk factors.

Exposure limits for heat
Heat stress results from a combination of factors including radiant heat, air temperature, humidity, air movement, metabolic workload, clothing, and acclimatization status. Measuring only ambient air temperature with a dry-bulb thermometer does not provide an accurate assessment of heat-stress risk because it ignores these additional environmental, work-related, and individual factors.

WorkSafeBC defines exposure limits for heat based upon the screening criteria established by the American Conference of Government Industrial Hygienists (ACGIH) for heat stress and strain. The goal of the ACGIH *Heat Stress and Strain Threshold Limit Values* (TLVs) (ACGIH Standard) is to maintain a normal core body temperature within one degree for nearly all workers. The ACGIH Standard outlines several methods that may be used to assess the level of heat stress or strain, when the various methods should be used, and the relevant exposure limits for each of the methods WorkSafeBC's publication Methods for Measuring Heat Strain or Stress for details on how to determine which method and relevant exposure limit to use for specific workplace conditions.

The exposure limits contained in the ACGIH Standard are expected to be protective for nearly all healthy, adequately hydrated workers. However, employers must be aware that individual risk factors such as dehydration, prior heat stroke, repeated heat exhaustion, pre-existing medical conditions, pregnancy, obesity, older age, and certain medications may put workers at a higher risk of heat-related illness. Workers who have known personal risk factors should be encouraged to consult a health care provider prior to working in hot environments, and employers must never ignore signs or symptoms of heat stress or strain even when heat stress screening criteria are not met. Workers who show signs or report symptoms of heat stress — including fatigue, nausea, dizziness, and lightheadedness — must be removed from the heat and provided medical attention as appropriate. Additional information on the signs, symptoms, and treatment of heat stress can be found in the WorkSafeBC resource Preventing Heat Stress at Work.

G7.28(1)-2 Unacclimatized workers

Preliminary Issue March 12, 2026

Regulatory excerpt
Section 7.26 of the *OHS Regulation ("Regulation")* states:

> *"unacclimatized worker"* means a worker who is not accustomed to working in a hot environment or who has been out of a hot environment for seven consecutive days.

Section 7.28(1) of the *Regulation* states:

> (1) A worker must not be exposed to levels that exceed those listed in the screening criteria for heat stress exposure in the heat stress and strain section of the ACGIH Standard.

Purpose of guideline
The American Conference of Government Industrial Hygienists (ACGIH) heat stress exposure limits differ for workers who are acclimatized versus those who are unacclimatized. This guideline outlines the factors that contribute to acclimatization and how to determine a worker's acclimatization status for selecting the correct exposure limit.

Acclimatization
Human bodies can adapt to working in hot environments through a process known as *acclimatization*. Acclimatization results in physiological changes that improve the body's ability to dissipate heat, thereby reducing the risk of heat stress. As a result, acclimatized workers can generally tolerate higher levels of heat exposure than workers who are unacclimatized. The ACGIH *Heat Stress and Strain Threshold Limit Values (TLVs)* reflect this by providing separate exposure limits for acclimatized and unacclimatized workers.

Determining if a worker is acclimatized
Healthy workers can normally acclimatize to working in hot environments when all the following factors are present:

- **Acclimatization period** — The body needs time to adjust to working in the heat. Exposure should increase gradually over 7 to 14 days to reduce the risk of heat-related illness. Personal risk factors may influence the amount of time needed to achieve full acclimatization.
- **Workload** — Exposure to heat alone does not lead to acclimatization. Workers must perform physical work in a hot environment, ideally for at least two hours per day throughout the acclimatization period. The body only acclimatizes to the level of work performed during this time, so workers should complete tasks similar to their normal job duties while acclimatizing.
- **Environmental conditions** — The body acclimatizes only to the heat and humidity levels experienced during the acclimatization period. If conditions become hotter or more humid, workers may again be at increased risk.

Acclimatization is temporary, and the adaptations gained are typically lost after a week or more away from hot conditions. Since many parts of British Columbia experience significant temperature fluctuations over the summer months, outdoor workers may find it difficult to develop and maintain acclimatization to high-heat conditions. These limitations apply regardless of a worker's background, including ethnicity or previous country of residence.

If employers plan to apply a heat stress exposure limit based on workers being acclimatized, they should be prepared to provide documented evidence supporting that assumption. This may include records of each worker's heat exposure and workload over the preceding 14 days.

G7.28(2) Clothing correction values

Issued January 1, 2005; Revised February 12, 2008; Retired March 12, 2026

This guideline has been retired.

G7.29-1 Heat stress assessment

Issued August 1999; Revised January 1, 2005; Editorial Revision June 8, 2011; Preliminary Revision March 12, 2026

Regulatory excerpt
Section 7.29(1) of the *OHS Regulation* ("*Regulation*") states:

> (1) If a worker is or may be exposed to the conditions specified in section 7.27, the employer must
>
> (a) conduct a heat stress assessment to determine the potential for hazardous exposure of workers, using measures and methods that are acceptable to the Board, and
>
> (b) develop and implement a heat stress exposure control plan meeting the requirements of section 5.54(2).

Purpose of guideline
The purpose of this guideline is to provide general information on the requirement to conduct heat stress assessments and to outline heat stress monitoring methods that are acceptable to WorkSafeBC. Detailed technical information on how to perform heat stress assessments has been moved to WorkSafeBC's publication Methods for Measuring Heat Strain or Stress.

Managing the risk of heat stress to workers
The risk of heat stress is best managed through a process of identification, assessment, control, and ongoing monitoring. OHS Guideline G7.27(1) Heat exposure - Application outlines conditions that may result in heat stress to workers. When these risk factors are present, employers must conduct a heat stress assessment using measures and methods acceptable to WorkSafeBC.

1. Assessing the risk of heat stress The first step in assessing the risk of heat exposure is to identify and evaluate the factors that may contribute to heat stress. Understanding these factors helps to determine where and when monitoring is required, which workers may be at higher risk, and which measurement methods may be appropriate. It also supports the selection of effective controls to reduce the risk of heat stress.

The factors that can contribute to a worker's heat load are grouped into three categories:

- Environmental factors
- Work and/or activity-related factors
- Personal factors

Environmental factors
Environmental factors are external conditions (e.g., temperature, humidity, radiant heat sources, and air movement) that contribute to a worker's heat exposure. When evaluating environmental conditions, consider the following questions:

- What are the temperature and humidity levels at the specific location where workers are performing their tasks?
- How long are workers exposed to environmental conditions that could contribute to heat stress?
- Have any heat warnings or advisories been issued or are they anticipated?
- Are there radiant heat sources (e.g., direct sunlight, ovens, kilns, equipment heat, molten materials) contributing to the heat load?
- Are there sources of water vapour or steam that may be increasing humidity in the work area?
- Are some areas of the workplace hotter or more humid than others?
- Is there air movement (e.g., fans, wind) that can support evaporative cooling?

Work and/or activity-related factors
These factors relate to the level of physical exertion required to perform the work, which directly affects a worker's metabolic heat production. When assessing work or task demands, consider the following questions:

- How hard are workers working, and for how long at a time?
- Do the tasks involve moderate to high physical exertion or forceful movements?
- Do workers have control over their work pace, or is it dictated by production demands or equipment?
- How frequently do workers take breaks, and are these breaks long enough to support recovery?
- Is a cooler or shaded area available for workers to rest in during breaks?

Personal factors
These are worker-specific factors that can affect an individual's risk of heat stress. When evaluating personal factors, consider the following questions:

- What clothing and/or PPE are workers wearing?
- Does the clothing increase heat load by limiting the worker's ability to sweat or lose heat? How much of this clothing is required for safety reasons?
- Do workers understand the importance of staying hydrated in hot conditions? Is cool drinking water readily available, and are workers drinking regularly?
- Have workers been trained to recognize the signs and symptoms of heat stress in themselves and others? Are they aware of personal factors (e.g., medications, health conditions) that may increase their risk of heat stress? Refer to Preventing Heat Stress at Work for more information on personal risk factors.
- Are workers used to working in these conditions (i.e., are they acclimatized)?
- Have workers expressed concerns about heat? Are they reporting symptoms of heat stress?

2. Determining the appropriate method for monitoring heat stress
Once the relevant risk factors have been identified, an appropriate method for evaluating and monitoring heat stress can be selected. WorkSafeBC accepts four methods for assessing heat stress or strain, which fall into two main categories:

- Environmental measures
- Physiological measures

Environmental measures
Most workplaces can use environmental conditions to evaluate heat stress. These methods estimate heat stress risk by measuring environmental factors and adjusting for clothing, work rate, and other relevant conditions.

Environmental methods require that conditions be measured accurately in the immediate area where workers are working. Using weather information reported by media sources or collected at remote locations (e.g., airports, Environment Canada monitoring stations) is not an acceptable alternative for conducting onsite measures but may be used as a preliminary trigger to activate the employer's exposure control plan.

WorkSafeBC accepts two environmental methods for assessing heat stress:

1) Using the ACGIH Standard method (WBGT) - which requires employers to obtain a device that can accurately measure dry-bulb temperature (ambient or air temperature), wet-bulb temperature, and black globe temperature

2) Using the Humidex method developed by the Occupational Health Clinics for Ontario Workers Inc. (OHCOW) - which requires employers to obtain a device that can accurately measure temperature and humidity

Employers should ensure that any devices used to assess heat stress are designed for occupational health and safety applications. Some commercially available "heat stress monitors" with built-in alarm set-points may not meet the measurement or performance requirements needed to

comply with section 7.29(1) of the *Regulation*.

For technical guidance on selecting and using these environmental methods to assess the risk of heat stress, refer to WorkSafeBC's publication Methods for Measuring Heat Strain or Stress. WorkSafeBC's heat stress screening tool can also help employers identify the appropriate monitoring method and evaluate the risk of heat stress once environmental measurements have been collected.

Environmental methods cannot be used under the following conditions:

- When workers are required to wear impermeable clothing or equipment that prevents sweat from evaporating, and no suitable clothing adjustment value (CAV) is available
- When workers must wear heat-protective or cooling clothing to counter environmental heat (e.g., anti-radiant heat, reflective clothing, or temperature-controlled suits)
- When work must be performed in conditions of extreme heat stress where safety margins are small

The Humidex method may not be used when any of the following conditions apply:

- There is industrial sources of radiant heat or humidity
- Where workers must wear PPE that prohibits the evaporation of sweat
- Where heavy workloads may cause exertional heat stress

Physiological measures
Physiological measurements must be used to assess the risk of heat stress when environmental methods are not appropriate or cannot be used. WorkSafeBC accepts the following physiological measures:

- Measuring heart rate
- Measuring body temperature

Measuring physiological responses requires worker consent and cooperation. Some physiological assessment methods may also require medical supervision to support appropriate measurement, analysis, and interpretation of the data. Health professionals (e.g., licensed physicians, other licensed or credentialed health care providers) who assist in planning or implementing heat stress monitoring programs should be knowledgeable about the effects of heat stress, as well as the limitations of the monitoring methods being used. Workers in roles where physiological monitoring is required should receive a pre-placement medical evaluation to ensure they can safely participate in heat stress monitoring and work in hot environments.

Ingestible sensors, infrared thermometers, and new technologies such as smart watches and other wearable devices may be effective for measuring physiological responses to heat. However, these devices must be validated for accuracy, reliability, and suitability before being used to assess heat stress in the workplace. Employers must also consider the privacy and protection of workers' personal medical information.

Methods for measuring heat stress or strain acceptable to WorkSafeBC
Table 1 provides a summary of the heat stress and heat strain monitoring methods acceptable to WorkSafeBC, the equipment required for each method, and examples of workplaces where each method is typically used. Physiological measures may be used in any workplace or for any task. The ACGIH Standard (WBGT) may also be used as an alternative to the Humidex method.

When selecting a monitoring method and equipment, employers should consider the full range of tasks and workplaces where heat stress assessments may be required.

Table 1: **Methods for measuring heat stress or strain acceptable to WorkSafeBC**

Method Number	Method Description	Measuring equipment required	Examples of industries or task where method can typically be used*
		Physiological Measures	
1	Directly Measuring Body Temperature	• Thermometer (rectal, oral, or tympanic**)	• Hazmat clean-up performed in chemical impervious suits • Special effect actors in full-body costumes • Workers must wear specialized cooling equipment to manage the risk of heat stress • Any industry or task requiring physiological monitoring
2	Assessing Heat Strain by Measuring Heart Rate	• Radial pulse check or chest straps**	
		Environmental Measures	

3	Assessment Using the ACGIH Standard (WBGT)	Wet Bulb Globe Thermometer (WBGT)	• Pulp mills and sawmills • Smelters • Cement kilns • Industrial kitchens (Manufacturing sector CUs beginning with 71) • Industrial laundries • Asbestos abatement
4	Assessing Heat stress using the Humidex index	Digital thermo-hygrometer OR Thermometer + sling psychometer OR Another combination of devices that can accurately measure air temperature and relative humidity	• Outdoor agricultural work • Tree planting • Landscaping • Construction • Office buildings • Retail facilities • Healthcare facilities • Commercial kitchens (Hospitality subsector CUs beginning with 761) • Hospitality industry • Warehouses • Lifeguard - Outdoor pool

* Industries listed are not exhaustive and are based on typical equipment and processes. Employers must consider the specific factors contributing to heat stress in their workplace to determine the appropriate method.

**Devices used to measure physiological responses must be certified for use on humans and may require medical supervision.

Refer to WorkSafeBC's publication Methods for Measuring Heat Strain or Stress for detailed information on methods.

For workplaces that are not listed in Table 1, or when determining an appropriate method for a specific task, refer to the flow chart under "Environmental measures" in Methods for Measuring Heat Strain or Stress.

Additional information regarding these heat-stress indices is available in the WorkSafeBC publication Methods for Measuring Heat Strain or Stress and in the following publications:

- NIOSH. 2016. Criteria for a Recommended Standard: Occupational Exposure to Heat and Hot Environments. Published by the National Institute for Occupational Safety and Health
- Barbara A. Plog and Patricia J. Quinlan. 2002. Fundamentals of Industrial Hygiene, 5th edition. Published by the National Safety Council
- ISO 7933 Hot Environments - Analytical Determination and Interpretation of Thermal Stress Using Calculation of Required Sweat Rate
- The Occupational Environment: Its Evaluation and Control. 3rd Ed. Anna, Daniel H. Fairfax, VA: American Industrial Hygiene Association, 2011

For further information regarding these or other measures and methods acceptable to WorkSafeBC please contact the WorkSafeBC Prevention Information Line.

G7.29-2 Environmental parameters

Issued August 1999; Revised January 1, 2005; Editorial Revision September 25, 2019; Retired March 12, 2026

This guideline has been retired.

G7.29-3 Physiological measures

Issued August 1999; Revised January 1, 2005; Retired March 12, 2026

This guideline has been retired.

G7.29-4 Heat stress assessment using a dry bulb thermometer or Humidex index

Issued August 1999; Revised January 1, 2005; Revised February 12, 2008; Retired March 12, 2026

This guideline has been retired.

G7.29-5 Exposure control plan

Issued August 1999; Revised January 1, 2005; Preliminary Revision March 12, 2026

Regulatory excerpt

Section 7.29(1)(b) of the *OHS Regulation* ("*Regulation*") states:

> (1) If a worker is or may be exposed to the conditions specified in section 7.27, the employer must
>
> (b) develop and implement a heat stress exposure control plan meeting the requirements of section 5.54(2).

Purpose of guideline
The purpose of this guideline is to provide information on when an exposure control plan (ECP) for heat stress must be developed, and the elements that should be included as part of this plan.

Exposure control plan
An ECP for heat stress is required for all workplaces where any of the following apply:

- A worker is or may be exposed to thermal conditions which could cause heat stress (refer to OHS Guideline G7.27(1))
- The thermal conditions could result in a worker's core body temperature exceeding 38°C (100°F) (as determined by physiological monitoring, refer to OHS Guideline G7.29-1)
- The thermal conditions are in excess of the levels listed in the screening criteria for heat stress exposure in the heat stress and strain section of the ACGIH *Heat Stress and Strain Threshold Limit Values* (TLVs) for unacclimatized workers (as determined by environmental monitoring, refer to OHS Guideline G7.29-1)

If heat stress risk factors exist in the workplace, employers are expected to do one of the following:

- Provide written evidence of a heat stress assessment — conducted under "worse-case" conditions — that includes monitoring data demonstrating that the screening criteria for unacclimatized workers are not exceeded.
- Demonstrate that an effective exposure control plan has been developed and implemented to protect workers from heat stress.

For the general requirements of ECPs, refer to section 5.54(2) of the *Regulation* and OHS Guideline G5.54-1.

Elements of an exposure control plan
Heat stress ECPs should include the following elements:

Duties and responsibilities
All workplace parties have responsibilities for minimizing the risks of heat stress.

- Owners:
  - Ensure building HVAC systems are properly maintained and promptly repaired when necessary.
- Prime contractors:
  - Coordinate workplace activities to ensure employers implement heat stress exposure control plans.
- Employers:
  - Identify and assess areas, tasks, and occupations where workers may be exposed to heat stress.
  - Provide appropriate equipment to monitor heat stress conditions at the worksite.
  - Appoint and train personnel to conduct heat stress assessments and monitor workplace conditions.
  - Implement controls (engineering, administrative, and/or personal protective equipment) to minimize heat stress.
  - Provide workers, supervisors, and first aid attendants with training and education regarding heat stress, including early signs and symptoms of heat-related illnesses.
  - Ensure first aid and emergency response plans are in place so workers experiencing heat-related illness receive appropriate and timely treatment.
  - Investigate reports of heat stress or heat-related illness, identify appropriate corrective measures, and report to WorkSafeBC as required.
- Supervisors:
  - Provide adequate supervision of heat-exposed workers to ensure exposure control plans are implemented effectively.
  - Ensure workers have access to cool water and stay adequately hydrated. This may include actively encouraging workers to drink water at set intervals.
  - Recognize signs and symptoms of heat stress and ensure appropriate first aid is administered promptly.
  - Ensure workers understand the risks of heat stress and are trained in signs and symptoms.
  - Assign workers to work in pairs or provide other forms of supervision to ensure to early heat stress symptoms in workers do not go unnoticed.
- Workers:
  - Participate in environmental or physiological monitoring programs used to assess exposure to heat stress conditions.
  - Follow all control measures and safe work procedures implemented to minimize heat stress.
  - Report any signs or symptoms of heat-related disorders to the employer or supervisor immediately.
- Joint health and safety committees and worker health and safety representatives:
  - Assist in the development and review of heat stress exposure control plans.
  - Recommend and review heat stress training for workers who may be exposed to heat stress conditions.
  - Participate in investigations of heat stress incidents and recommend appropriate controls.

Risk identification, assessment, and control

This element should include:

- How the employer identified workers who may be at risk of heat-related disorders, including applicable heat stress risk factors apply.
- How heat stress risk will be assessed (including measurement methods or indices used).
- Who will conduct the heat stress assessments and ongoing monitoring. If specific personnel are not identified, this element should include clear instructions on how heat stress assessment will be conducted and what methods of control will be used.
- The frequency and method for ensuring heat-exposed workers have access to cool water and maintain hydration.
- The controls that will be used to eliminate or minimize worker exposure to heat stress (refer to OHS Guideline G7.30 Heat stress controls), including when and how the controls will be implemented.

Depending on the assessment method used, some controls may be dictated by the method. For example, the Humidex method specifies work-rest cycles based on the adjusted Humidex value. If the employer has selected to use this method in the ECP, these required controls should be reflected in the plan.

Education and training
This element should describe the initial and ongoing training provided to workers in areas, tasks, or occupations where there is a reasonable likelihood of heat stress.

Training for workers not previously exposed to heat stress conditions should include:

- Types of heat-related disorders (heat cramps, heat exhaustion, and heat stroke)
- Signs and symptoms of heat-related disorders
- Personal factors that increase the risk for heat-related disorders
- Potential health effects associated with excessive heat stress
- Safe work procedures and proper precautions for work in heat stress areas, including the importance of hydration and early reporting of symptoms
- Proper use of protective clothing and equipment, if required
- First aid procedures
- The process for investigating heat stress reports
- When heat-related illnesses must be reported to WorkSafeBC
- The purpose and description of the employer's heat stress ECP and ongoing monitoring programs, including the benefits of worker participation in these programs

For workers with ongoing exposure potential, refresher training should be provided regularly. Annual training is recommended.

For further information, consult the WorkSafeBC booklet Preventing Heat Stress at Work.

Written procedures
Written procedures should describe:

- How heat stress will be assessed, monitored, and documented
- How to use available control measures to minimize heat stress. For example:
  - Use and positioning of supplemental fans or portable air conditioning
  - When and how work-rest cycles will be implemented
  - Using and caring for radiant heat-reflective clothing or cooling suits
- Precautions and maintenance requirements for cooling equipment
- Requirement to report and investigate reports of heat-related illness or concerns

Documentation
Employers should maintain records of worksite heat stress assessments and monitoring data for at least one year. Where physiological monitoring is conducted, the resulting data must be treated as confidential medical information.

Additional records that should be retained include:

- Worker training records
- First aid records for heat-related illnesses
- Hazard reports involving heat
- Investigation reports relating to heat or heat-related illnesses
- Workplace inspection reports

G7.30 Heat stress controls

Preliminary Issue March 12, 2026

Regulatory excerpt
Section 7.30 of the *OHS Regulation* ("*Regulation*") states:

> (1) If a worker is or may be exposed to the conditions specified in section 7.27, the employer must implement engineering controls to

reduce the exposure of workers to levels below those listed in the screening criteria for heat stress exposure in the heat stress and strain section of the ACGIH Standard.

(2) If the action described in subsection (1) is not practicable, the employer must reduce the exposure of workers to levels below those listed in the screening criteria for heat stress exposure in the heat stress and strain section of the ACGIH Standard by providing

(a) administrative controls, including a work-rest cycle, acceptable to the Board, or

(b) personal protective equipment, if the equipment provides protection equally effective as administrative controls.

Purpose of guideline
The purpose of this guideline is to describe types of heat stress controls.

Types of control methods
Section 7.30 of the *Regulation* requires employers to reduce workers' exposure to heat stress conditions using a hierarchy of controls. A combination of controls may be necessary to reduce the risk of heat stress to levels below the screening criteria for heat stress exposure in the heat stress and strain section of the American Conference of Government Industrial Hygienists (ACGIH) *Heat Stress and Strain Threshold Limit Values* (TLVs) (ACGIH Standard).

Elimination: Employers should eliminate heat stress hazards wherever practicable. This may include rescheduling outdoor or strenuous work tasks, relocating work to climate-controlled areas, or cancelling work until environmental conditions improve.

Substitution: Employers should consider substituting tasks with significant heat stress risk factors for those with fewer risk factors (e.g., replacing highly strenuous work or tasks requiring heavy PPE with less strenuous activities when possible).

Engineering: With extreme heat events projected to become more frequent, longer, and hotter as the provincial climate changes, employers and owners should consider upgrading building environmental control systems where practicable. Engineering controls are the most effective means of reducing heat exposure and should be implemented before conducting heat stress assessments, as well as when assessments indicate that exposure levels are too high.

Even when engineering controls are implemented, a heat stress assessment may still be required if conditions meeting those outlined in OHS Guideline G7.27(1) remain. However, the advantages of engineering controls include that their effectiveness can be assessed using environmental parameters and they do not rely on worker compliance to remain effective — unlike administrative controls and protective equipment, which require ongoing supervision and monitoring.

Engineering controls (such as air conditioning) should be maintained regularly to avoid failure during extreme heat events. If an employer's exposure control plan relies on engineering controls that may fail, a contingency plan should identify alternative controls.

Administrative: If engineering controls are not practicable or are required only temporarily (such as during an extreme heat event, or when engineering controls fail), the use of administrative controls are permitted pursuant to section 7.30(2) of the *Regulation*. These may include training, work/recovery cycles, hydration protocols, and modifications to work practices to reduce worker exposure to below the screening criteria.

Personal protective equipment: Where engineering or administrative controls are not practicable or do not sufficiently reduce exposure, section 7.30(2)(b) of the *Regulation* permits the use of personal protective equipment (PPE).

PPE reduces heat load primarily through increasing conductive heat loss directly from the worker's body. As a result, physiological measurements (refer to Methods 1 and 2 in WorkSafeBC's publication Methods for Measuring Heat Strain or Stress) are the only effective means of verifying whether PPE adequately protects workers from heat stress.

Examples of specific controls that may be used to reduce heat exposure are provided in the WorkSafeBC publication Preventing Heat Stress at Work.

G7.30-1 Engineering controls

Issued August 1999; Revised January 1, 2005; Retired March 12, 2026

This guideline has been retired.

G7.30-2 Administrative controls

Issued August 1999; Revised January 1, 2005; Editorial Revision August 23, 2011; Retired March 12, 2026

This guideline has been retired.

G7.30-3 Personal protective equipment

Issued August 1999; Revised January 1, 2005; Retired March 12, 2026

This guideline has been retired.

G7.31 Provision of water

Preliminary Issue March 12, 2026

Regulatory excerpt
Section 7.31 of the *OHS Regulation* ("*Regulation*") states:

> If a worker is or may be exposed to the conditions specified in section 7.27, the employer must provide and maintain an adequate supply of cool potable water close to the work area for the use of a heat exposed worker.

Purpose of guideline
The purpose of this guideline is to clarify employer requirements for providing water when workers may be exposed to heat stress.

Provision of Water
The heat stress exposure limits specified in section 7.28 of the *Regulation* are expected to be protective for nearly all healthy, adequately hydrated workers. Many heat-related illnesses occur when workers become dehydrated or lose electrolytes, impairing the body's ability to cool itself through sweating. For this reason, access to water and active hydration management are essential components of any heat stress exposure control plan.

Section 7.31 of the *Regulation* requires employers to provide and maintain an adequate supply of cool drinking water close to the work area for heat exposed workers. "Cool water" is generally considered to be 10-15°C, which is generally more palatable to workers and easier to drink than very cold water. Providing cool water will assist workers in maintaining stable core body temperatures in hot conditions better than water that is left to warm to ambient temperatures.

Fluids that contain caffeine, alcohol, or high sugar content are not suitable because they may increase dehydration. Electrolytes can normally be replaced through the regular intake of food, and is preferable to salt tablets or electrolyte drinks, which may not be appropriate for all workers.

Because natural thirst is not sufficient to maintain hydration during heat stress conditions, employers and supervisors should actively encourage workers to drink small amounts of water frequently — such as one cup every 20 minutes.

Water alone will not control the risk to workers when heat stress conditions exceed certain thresholds. When heat stress conditions exceed the exposure limits in section 7.28 of the *Regulation*, additional controls must be implemented to reduce workers' exposure.

G7.33-1 Cold exposure - Application

Issued August 1999; Revised January 1, 2005; Editorial Revision January 1, 2023

Regulatory excerpt
Section 7.33 of the *OHS Regulation* ("*Regulation*") states:

> Sections 7.34 to 7.38 apply to a workplace if a worker is or may be exposed to
>
> (a) thermal conditions that could cause cold stress or injury,
>
> (b) thermal conditions that could cause a worker's core body temperature to fall below 36°C (96.8°F), or
>
> (c) thermal conditions that are below the levels classified as "little danger" to workers in the criteria for the cooling power of wind on exposed flesh in the cold stress section of the ACGIH Standard.

Purpose of guideline
The purpose of this guideline is to clarify the publication edition of the ACGIH Standard that is acceptable to WorkSafeBC under section 7.33(c) of the Regulation.

In addition, the guideline provides examples of cold exposure that apply to work environments as stated in section 7.33 of the Regulation.

ACGIH Standard
ACGIH Standard is defined in section 7.26 of the *Regulation* to mean "the American Conference of Governmental Industrial Hygienists publication entitled *Threshold Limit Values and Biological Exposure Indices*, dated 2003, as amended from time to time, except as otherwise determined by the Board."

In 2018, the ACGIH significantly revised the Cold Stress Threshold Limit Values (TLVs) that is referenced in section 7.33(c). Due to these changes, sections 7.33–7.38 of the *Regulation* pertaining to cold stress is currently under regulatory review. Until such time the *Regulation* is revised, the Cold Stress TLVs contained in the 2017 edition of the ACGIH Standard is deemed acceptable to WorkSafeBC. This also applies to sections 7.35 and 7.36 of the *Regulation* where the ACGIH Standard is also mentioned.

Artificial or natural cold state

The sections on cold exposure apply to work environments where workers may be exposed to either artificial or natural cold. Examples of artificially cold workplaces include cold storage rooms, freezers, and refrigerated transportation units. Examples of industries where workers may be exposed to natural cold include fishing, forestry, construction, and the petroleum industry.

Accidental or unplanned cold exposure
In the context of these sections, exposure is taken to mean exposure to cold air or water either as part of routine work procedures or as a result of an accidental or an unplanned event. Examples of accidental or unplanned events include a worker falling into water such as from a boat or breaking through ice (cold water immersion) or a worker becoming stranded outdoors in the cold.

Some examples of cold-related injuries include frostbite, frostnip, trenchfoot, and Raynaud's disorder.

G7.33-2 Cooling power of wind (imperial units)

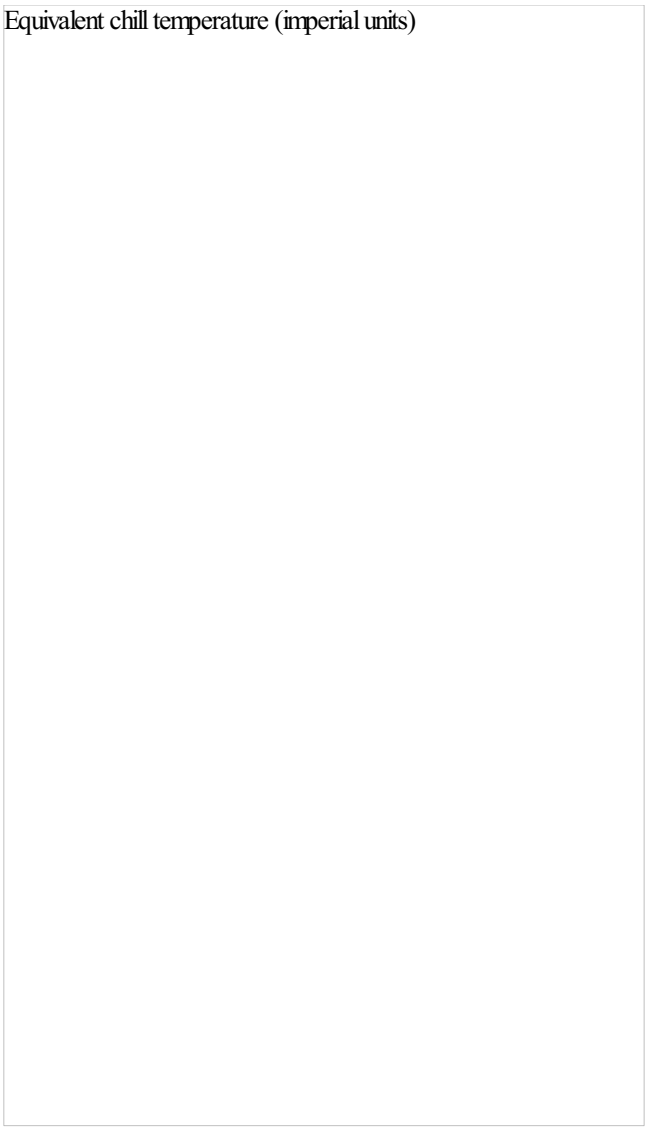
Issued January 1, 2005

Regulatory excerpt
Section 7.33(c) of the *OHS Regulation* ("*Regulation*") states:

> Sections 7.34 to 7.38 apply to a workplace if a worker is or may be exposed to …
>
> (c) thermal conditions that are below the levels classified as "little danger" to workers in the criteria for the cooling power of wind on exposed flesh in the cold stress section of the ACGIH Standard.

Purpose of guideline
The purpose of this guideline is to highlight the cooling power or wind in imperial units as it is referenced in section 7.33(c) of the *Regulation*.

Cooling power of wind (Fahrenheit scale)
The ACGIH criteria, in the Fahrenheit scale, are listed in the following table as it appears in "Cold Stress" of *Threshold Limit Values and Biological Exposure Indices* (the ACGIH Standard). Refer to OHS Guideline G7.33-3 for a table in metric units. The table shows the cooling power of wind on exposed flesh. If there is a wind, use the wind speed in the first column and the actual temperature across the top to find what the equivalent temperature would be under calm conditions.



G7.33-3 Cooling power of wind (metric units)

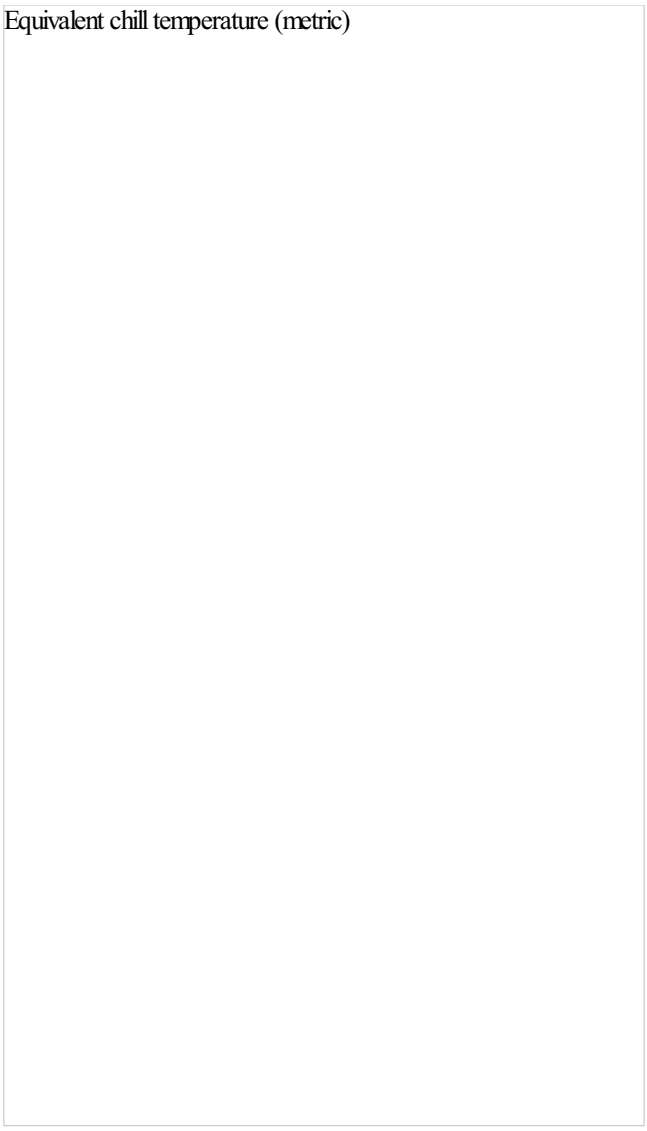
Issued January 1, 2005

Regulatory excerpt
Section 7.33(c) of the *OHS Regulation* ("*Regulation*") states:

> Sections 7.34 to 7.38 apply to a workplace if a worker is or may be exposed to …
>
> (c) thermal conditions are below the levels classified as "little danger" to workers in the criteria for the cooling power of wind on exposed flesh in the cold stress section of the ACGIH Standard.

Purpose of guideline
The purpose of this guideline is to highlight the cooling power or wind in metric units as it is referenced in section 7.33(c) of the *Regulation*.

Cooling power of wind (Celsius scale)
The ACGIH Standard provides values for the cooling power of wind on exposed flesh in the Fahrenheit scale. The following table has the same information, expressed in degrees Celsius and in km/h. Refer to OHS Guideline G7.33-2 for a table in imperial units. It is organized for actual temperature to decrease by intervals of 5°C, resulting in an additional column. The table shows the cooling power of wind on exposed flesh. If there is a wind, use the wind speed in the first column and the actual temperature across the top to find what the equivalent temperature would be under calm conditions.



G7.34-1 Cold stress assessment

Issued August 1999; Revised January 1, 2005; Editorial Revision August 23, 2011

Regulatory excerpt
Section 7.34(a) of the *OHS Regulation* ("*Regulation*") states:

> If a worker is or may be exposed to conditions specified in section 7.33, the employer must
>
> (a) conduct a cold stress assessment to determine the potential for hazardous exposure of workers, using measures and methods that are acceptable to the Board, and …

Purpose of guideline
The purpose of this guideline is to provide information on the measures and methods that are acceptable to WorkSafeBC regarding cold stress assessments.

Cold stress assessment acceptable to WorkSafeBC
Section 7.34(a) of the *Regulation* requires that a cold stress assessment be conducted if a worker is or may be exposed to conditions which could cause cold stress or injury, or could cause a worker's core body temperature to fall below 36°C (96.8°F), or fall below the "little danger" levels in the ACGIH table (see OHS Guidelines G7.33-2 and G7.33-3). Part of the cold stress assessment for hazardous exposure should include the potential for unplanned exposure.

The first step in a cold stress assessment is to determine the areas, occupations, or tasks that place workers at risk of hypothermia or cold-related injuries. Consider factors such as the following:

- Areas with an equivalent chill temperature below -7°C (see below)
- Fine dexterity tasks that require work with bare hands
- Contact with metal surfaces or use of evaporative liquids (gasoline, alcohol, or cleaning liquids)
- Working on or near bodies of water
- Areas or occupations that have been identified as high risk for cold-related disorders through accident investigation reports, first aid

treatment record books, and records of injury and disease
- Areas or occupations about which employees have expressed concern about cold stress

Once the areas, occupations, or tasks that should be monitored are determined, the risk of developing hypothermia or a cold-related injury should then be evaluated.

A cold stress assessment should include determining the air temperature and wind speed (to determine the "equivalent wind chill temperature"). This information is available by:

- Obtaining weather, temperature, and wind information from the local weather office (such as from Environment Canada) if there is a monitoring station close to the area in which the work is to be conducted.
- Taking a direct measurement of the ambient air temperature using a dry bulb thermometer (or electronic equivalent) and a direct reading of the wind velocity in km/h (or metres/sec) using a velometer, hot-wire thermometer, heated thermocouple, thermistor, or a thermocouple anemometer. Most air velocity instruments also provide a direct readout of air temperature.

Wind chill is a concern when the equivalent chill temperature is less than -7°C. From the metric table in OHS Guideline G7.33-3, the conditions when this occurs are:

- The air is calm and the temperature falls below -7°C
- The wind speed is 8 km/h or greater and the air temperature is -5°C
- The wind speed is 16 km/h or greater and the air temperature is 0°C
- The wind speed is 32 km/h or greater and the air temperature is 5°C

As part of the risk assessment, the potential for a worker's exposure to artificially generated air velocities should also be considered; for example when working in walk-in refrigerators and freezers, when riding all-terrain vehicles or snowmobiles, or when exposed to helicopter rotor downwash.

A general assessment of contact cooling for exposed skin, particularly the hands, should consider the following when workers are in contact with metal:

- Below 15°C - Prolonged contact may impair dexterity
- Below 7°C - Prolonged contact may induce numbness
- Below 0°C - Prolonged contact may induce frostnip or frostbite
- Below -7°C - Brief contact with may induce frostnip or frostbite

For materials other than metal, such as plastics and wood, the temperatures will be lower than those noted above since they are less conductive than metal. Any contact with liquids at subzero temperature is also of concern, particularly with cryogenic "fluids" (super-cooled liquefied gases).

Workers should be provided with gloves or other method of warming the hands when the air temperature is below:

- 16°C for sedentary work
- 4°C for light work
- -7°C for moderate work

If the above measures and methods are used, they will be considered acceptable to WorkSafeBC for the purpose of this section. If other methods are proposed, they are to be submitted to WorkSafeBC's Prevention Practice, Quality, and Engineering department for consideration and not to be used until written acceptance is given by that department.

G7.34-2 Conversion

Issued January 1, 2005

Regulatory excerpt
Section 7.34(a) of the *OHS Regulation* ("*Regulation*") states:

> If a worker is or may be exposed to conditions specified in section 7.33, the employer must
>
> (a) conduct a cold stress assessment to determine the potential for hazardous exposure of workers, using measures and methods that are acceptable to the Board, and …

Purpose of guideline
The purpose of this guideline is to explain the temperature conversion from Fahrenheit to Celsius.

Conversion
Temperature in degrees Fahrenheit can be converted to degrees Celsius using the following formula.

°Celsius = 5/9 x (°Farenheit - 32)

Wind velocity in miles per hour (mph) can be converted to kilometres per hour (km/h) using the following formula.

km/h = mph x 1.61

G7.34-3 Exposure control plan

Issued January 1, 2005

Regulatory excerpt
Section 7.34(b) of the *OHS Regulation* ("*Regulation*") states:

> If a worker is or may be exposed to conditions specified in section 7.33, the employer must
>
> (b) develop and implement a cold exposure control plan meeting the requirements of section 5.54(2).

Purpose of guideline
The purpose of this guideline is to outline the information that should be included in the education and training element of a cold exposure plan as required under section 7.34(b) of the *Regulation* if a worker has been exposed to the conditions specified in section 7.33.

Education and training
For the general requirements of an exposure control plan, refer to section 5.54(2) of the *Regulation* and OHS Guideline G5.54-1. Some specific components of a cold exposure control plan, as they relate to education and training of workers, are described below.

The cold exposure control plan should contain initial and ongoing training and education that will be provided to all workers who work in areas where there is a reasonable likelihood of exposure to conditions that could cause cold stress. The training and education material provided to workers who have not previously worked in a cold stress environment should include the following information:

- Recognition of the signs and symptoms of impending hypothermia or excessive cooling of the body even when shivering does not occur
- Recognition of impending frostbite
- Proper re-warming procedures and appropriate first aid treatment
- Proper use of clothing
- Proper eating and drinking practices
- Safe work practices appropriate to the work that is to be performed

For those workers exposed to cold stress environments, refresher training and education to ensure that workers remain knowledgeable about the above-mentioned items should be provided. It is recommended that continuing education be provided at least annually.

For further information, consult the WorkSafeBC webpage on Cold Stress.

G7.35-1 Engineering controls

Issued January 1, 2005

Regulatory excerpt
Section 7.35(1) of the *OHS Regulation* ("*Regulation*") states:

> (1) If a worker is or may be exposed to the conditions specified in section 7.33, the employer must implement effective engineering controls to reduce the exposure hazard to levels above those classified as "little danger" to workers in the criteria for the cooling power of wind on exposed flesh in the cold stress section of the ACGIH Standard.

Purpose of guideline
The purpose of this guideline is to provide examples of effective engineering controls to reduce cold exposure levels.

Engineering controls
Section 7.35 of the *OHS Regulation* requires an employer to reduce the exposure hazard of workers to thermal conditions that could cause cold stress or injury using a hierarchy of control methods: engineering controls, followed by administrative controls and, as a last resort, personal protective equipment.

The following are examples of engineering controls to reduce cold exposure levels:

- Isolate the worker from the environment, where possible.
- Use local heating for the body and especially bare hands (when fine work is required). This may include the use of warm air jets, radiant heaters, or contact warming plates.
- Provide barricades or other structures to block air or reduce air velocities at the work location.
- Provide heated metal tools and equipment handles or cover them with thermal insulating materials.
- Use machine controls and tools designed so that workers do not have to remove mittens or gloves to use them.

G7.35-2 Administrative controls

Issued January 1, 2005

Regulatory excerpt
Section 7.35(2)(a) of the *OHS Regulation* ("*Regulation*") states:

> (2) If the action described in subsection (1) is not practicable, the employer must reduce the exposure hazard by providing
>
> (a) effective administrative controls, or

Purpose of guideline
The purpose of this guideline is to provide examples of effective administrative controls to reduce the exposure hazard of workers to thermal conditions that could cause cold stress or injury if engineering controls are not practicable as stated in section 7.35(1) of the *Regulation*.

Administrative controls
Several administrative controls that are commonly used to reduce worker exposure to cold stress are described below:

- **Work/warm-up schedules**. A work/warm-up schedule refers to the period a worker spends working in a cold environment and the time spent in a warm area. See OHS Guideline G7.35-3 for sample schedules.
- **Scheduling and organization of work**. There are several ways to organize and to schedule tasks so as to minimize the length of time of exposure to the thermal conditions that could cause cold stress. For example:
  - When possible, schedule tasks for the warmest part of the day or when the wind is the most calm.
  - Schedule routine maintenance and repair work for warmer seasons of the year.
  - Postpone non-urgent tasks when equivalent chill temperatures are in the "great danger" portion of the "Cooling Power of Wind" ACGIH table provided in OHS Guideline G7.33-3.
  - Take the equivalent chill temperature into account when planning or scheduling work activities.
- **Fluid replacement and diet**. An ample supply of warm drinks or soup should be available, and workers should be encouraged to drink them in order to replace fluids lost through breathing and perspiration. Workers should restrict their intake of coffee because of diuretic and circulatory effects. A diet high in fats and carbohydrates may help to maintain body temperature.

G7.35-3 Work/warm-up schedule for a 4-hour shift

Issued January 1, 2005

Regulatory excerpt
Section 7.35(2)(a) of the *OHS Regulation* states:

> (2) If the action described in subsection (1) is not practicable, the employer must reduce the exposure hazard by providing
>
> (a) effective administrative controls, or

Purpose of guideline
The purpose of this guideline is to explain a work/warm-up schedule as an example of an administrative control that is required under section 7.35(2)(a) of the *Regulation*.

Work/warm-up schedule
A work/warm-up schedule is an example of an administrative control. The ACGIH Standard contains a work/warm-up schedule for a 4-hour shift for workers who are properly clothed. This schedule is acceptable to WorkSafeBC. Values in the ACGIH table have been converted to metric units in the table below.

Work/warm-up schedule for a 4-hour shift

G7.35-4 Personal protective equipment

Issued January 1, 2005

Regulatory excerpt
Section 7.35(2)(b) of the *OHS Regulation* ("*Regulation*") states:

> (2) If the action described in subsection (1) is not practicable, the employer must reduce the exposure hazard by providing
>
> (b) personal protective equipment, if the equipment provides protection equally effective as administrative controls.

Purpose of guideline
The purpose of this guideline is to explain that personal protective equipment, if the equipment provides protection equally effective as administrative controls, is required under section 7.35(2)(b) of the *Regulation*.

Personal protective equipments
Workers who are at risk of exposure to thermal conditions that could cause cold stress or injury due to unplanned or accidental events should be provided with clothing and equipment sufficient to permit survival from the natural elements until the worker can be removed from the exposure.

As a minimum, a worker should be provided with the following:

- Additional clothing selected in accordance with the anticipated overnight low temperatures for the region in which work or travel is conducted
- A sleeping bag rated for the anticipated overnight low temperatures for the region in which work or travel is conducted
- Survival equipment that will allow a worker to survive the natural elements until rescued

Examples of some typical items that should be included in a survival kit:

General:	**Signal:**
1 - backpack with pockets	1 - mini-flashlight and batteries
1 - 10 ft x 12 ft plastic tarp	1 - compass
1 - 5 ft x 6 ft polar fleece blanket	1 - survival whistle
2 - tarp straps	1 - set of flares
	1 - handheld flare launcher
Cooking:	
2 - large stainless steel cups	**Other:**
2 - sets of cutlery	2 - toilet tissue packets
1 - survival stove	1 - 50 foot parachute cord
1 - 500 mL water bottle	1 - sheathed knife
	1 - tube of lip balm and/or sunscreen
Food:	1 - container of insect repellent
4 - instant soup mix	1 - small folding saw
10 - tea bags	4 - garbage bags
1 - food ration	
10 - instant hot chocolate	**First aid:**
12 - food bars	1 - basic first aid kit
1 - water treatment kit	
Fire:	
1 - fire starting kit	

Selection of clothing and wearable personal protective equipment is discussed in OHS Guidelines G7.37-1 and G7.37-2.

G7.36 Heated shelters

Issued January 1, 2005

Regulatory excerpt
Section 7.36 of the *OHS Regulation* ("*Regulation*") states:

> If a worker is exposed to a thermal environment with an equivalent chill temperature less than -7°C (19°F), as determined using the criteria for the cooling power of wind on exposed flesh in the cold stress section of the ACGIH Standard, a nearby heated shelter must be available to the worker.

Purpose of guideline
The purpose of this guideline is to outline the requirement of section 7.36 of the *Regulation* that provides for heated shelters in environments with an equivalent chill temperature less than -7°C (19°F).

Heated shelter
The intent of a heated shelter is to allow workers the opportunity to come out of the cold and warm themselves. The outer layer of clothing should be removed, and remaining clothing should be loosened to permit sweat to evaporate. Workers should be encouraged to use the shelter at regular intervals. Signs and symptoms indicating that the shelter should be used are:

- Onset of heavy shivering
- Minor frostbite (frostnip)
- Feeling of excessive fatigue
- Drowsiness, irritability, or euphoria

A heated vehicle may be used as a heated shelter. In cases where workers are in remote or isolated areas without provision of vehicles capable of

being heated (such as all-terrain vehicles or snowmobiles) or in cases where workers are on foot, workers should carry adequate equipment and supplies to permit the timely assembly of a heated shelter, if necessary.

G7.37-1 Clothing (whole body)

Issued January 1, 2005

Regulatory excerpt
Section 7.37(1) of the *OHS Regulation* ("*Regulation*") states:

> (1) A worker who is or may be exposed to the conditions referred to in section 7.33 must wear adequate insulating clothing and personal protective equipment.

Purpose of guideline
The purpose of this guideline is to provide information about the insulative value for clothing worn by workers in cold exposure environments.

Layers of clothing
The most widely used approach to dressing for work in cold environments is to use multiple layers of clothing. Generally, three layers of clothing are used:

- An inner layer that absorbs moisture and keeps it away from the skin.
- A second insulating layer that helps keep a layer of air trapped around the body.
- An outer layer that keeps dust, dirt, wind, and moisture away from the previous layer and that can be easily removed to prevent the buildup of body heat. In wet environments, the outer layer should be waterproof.

Insulative value of clothing
The insulative value of clothing selected should be based upon the equivalent chill temperature of the work environment and the anticipated metabolic rate of the work activity. Wearing too much clothing can lead to sweating, and wet clothing causes greater heat loss and increases the risk of developing hypothermia.

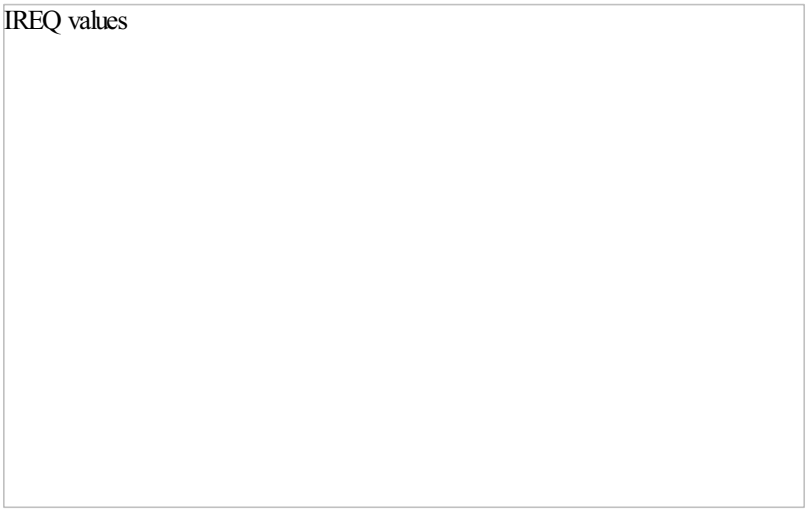
Many manufacturers of insulated garments provide guidance for recommended temperature and metabolic rate ranges for their clothing. There are also several standards that recommend the insulative value of clothing for use with a given temperature and metabolic rate.

An example of a standard for selecting clothing insulation for different occupational cold environments is the Required Clothing Insulation Index ("IREQ"). For more information on IREQ refer to the following:

Holmér, Ingvar. "Cold Stress: Part I - Guidelines for the Practitioner." *International Journal of Industrial Ergonomics* 14:139-149 (1994).

The IREQ value, in units of clo, is selected from the following chart based upon metabolic rate and ambient temperature. Once the IREQ is determined, clothing ensembles offering the same value of insulation should be selected. Examples of basic insulation values for different clothing ensembles are listed in the following table.

IREQ values needed to maintain low-level physiological strain



Examples of basic insulation values of clothing:

Clothing ensemble	Basic insulation value (clo)
Briefs, short-sleeved shirt, fitted trousers, calf-length socks, shoes	0.5

Briefs, undershirt, underpants, shirt, overalls, calf-length socks, shoes	1.0
Briefs, T-shirt, shirt, fitted trousers, insulated coveralls, calf-length socks, shoes	1.5
Underpants, undershirt, shirt, trousers, jacket, overjacket, overtrousers, socks, shoes, hat, gloves	2.0
Arctic clothing systems	3-4.5
Sleeping bags	3-8

For further information pertaining to IREQ or other standards that can be used to help select insulated clothing, please contact your local WorkSafeBC office.

G7.37-2 Clothing (extremities)

Issued January 1, 2005

Regulatory excerpt
Section 7.37(1) of the *OHS Regulation* ("*Regulation*") states:

> (1) A worker who is or may be exposed to the conditions referred to in section 7.33 must wear adequate insulating clothing and personal protective equipment.

Purpose of guideline
The purpose of this guideline is to provide examples of adequate clothing for extremities as required under section 7.37(1) of the *Regulation*.

Types of clothing
OHS Guideline G7.34-1 includes general assessment guidelines for protecting the hands. In addition, mittens rather than gloves should be worn when the air temperature is less than -17°C (0°F). Gloves and mittens should have removable liners so they can be effectively dried.

Footwear for use in cold environments should be insulated and have removable insoles for effective drying.

Exposed areas of the head and neck should be protected against heat loss and the danger of frostbite by use of adequate head covering and/or facemasks. This is extremely important when equivalent chill temperatures fall within the "increasing danger" portion of the "Cooling Power of Wind" ACGIH table provided in OHS Guideline G7.33-3.