

OVERVIEW

TITLE: Respirator protection factors

Part 8, Personal Protective Clothing and Equipment
Section 8.34, Protection factors

1. WHAT IS THE NATURE OF THE PROBLEM TO BE SOLVED?

The helmet/hood facepiece powered air-purifying respirator or “helmet/hood PAPR” is not a commonly used respiratory protection. Currently, the helmet/hood PAPR is not listed in the Occupational Health and Safety Regulation (“OHSR”) in Table 8-1 for respirator protection factors (“RPF”).

As stated in section 8.34 of the OHSR, the employer has the obligation to calculate the maximum use concentration for a respirator type using the RPF in order to assess that a worker will be adequately protected when wearing the respirator.

Recently, a major user of the helmet/hood facepiece PAPR asked WorkSafeBC for the RPF for this specific respirator. In the absence of an assigned RPF, Worker and Employer Services has assigned a provisional RPF of 100 to the helmet/hood PAPR until the issue is dealt with through the regulatory amendment process. However, stakeholders stated that WorkSafeBC’s provisional RPF has been incorrectly derived and is inconsistent with recognized standards and other jurisdictions.

Amendments are proposed to section 8.32 to define the types of exposure limits. These proposals also bring clarity to the requirements in section 8.34. In addition, new definitions are proposed in 8.34.

2. WHAT IS THE PURPOSE OF THE PROPOSED AMENDMENTS?

The purpose of the proposed amendment is to update Table 8.1 of section 8.34 by including the helmet/hood PAPR with an appropriately assigned RPF commensurate with *CSA Standard Z94.4-02 Selection, Use and Care of Respirators*. This will provide a level of certainty and consistency for both employers and workers as to the level of protection this device is designed to provide to workers working in conditions of high ambient concentrations of hazardous substances.

3. SOURCE OF REQUEST

Teck Cominco Metals Ltd.
3M Canada
WorkSafeBC Worker and Employer Services Division (Regulatory Practices)

PART 4: GENERAL CONDITIONS

WORK AREA REQUIREMENTS

Cleaning with compressed air

- 4.42
- (1) Compressed air or steam must not be used for blowing dust, chips, or other substances from equipment, materials and structures if any person could be exposed to the jet, or to the material it expels or propels and an injury or health hazard due to fire, explosion or other cause is likely to result.
 - (2) Subject to subsection (4) compressed air may not be used for blowing harmful or hazardous dusts or other harmful substances from clothing being worn by workers.
 - (3) If clothing is to be cleaned before leaving the work area, suitable cleaning equipment must be used.
 - (4) Compressed air may be used in specially designated areas for blowing dusts or other substances from clothing being worn by workers, provided that
 - (a) the substances have an exposure limit greater than 1.0 mg/m³, as established by section 5.48,
 - (b) ~~appropriate respiratory and eye protection is worn, and~~ **appropriate respirators and eye protection are worn, and**
 - (c) the compressed air supply pressure is limited to a pressure of 70 kPa gauge (10 psig), or safety nozzles which have the same pressure limiting effect are used.

EXPLANATORY NOTE:

It is proposed that this section be amended to refer to “appropriate respiratory protection” as “appropriate respirators” for consistency of terms throughout the OHSR.

PART 6: SUBSTANCE SPECIFIC REQUIREMENTS

Personal Protective Clothing and Equipment

- Respiratory protection** **6.29** (1) The employer must supply, and ensure that workers within a designated work area wear, ~~respiratory protection which is~~ **respirators which are** adequate for the anticipated level of exposure.
- (2) The employer must ensure that a single use respirator is not used for protection against asbestos.

LEAD

- Air monitoring in construction projects** **6.61** If there is a potential for hazardous exposure to airborne lead in a construction project, the employer must ensure that air monitoring is conducted
- (a) during the first shift of the construction project involving lead, and
(b) as necessary throughout the project to ensure that controls are effective and ~~respiratory protection is~~ **respirators are** adequate.

TOXIC PROCESS GASES

- Personal protective equipment** **6.127** (1) The employer must provide appropriate personal protective equipment and ensure that workers wear it.
- (2) A worker performing a hazardous work procedure on equipment or machinery where there is the risk of toxic process gas being released directly into the breathing zone, such as cylinder changing, system or line purging or draining, and leak detection and repair, must wear ~~appropriate respiratory protection~~ **an appropriate respirator**.

EXPLANATORY NOTE:

It is proposed that these sections be amended to refer to “respiratory protection” as “respirators” for consistency of terms throughout the OHSR.

PART 8: PERSONAL PROTECTIVE CLOTHING AND EQUIPMENT

Definitions	8.1	(1) In this Part:
" <i>flame resistant</i> "		in reference to clothing, means made of a material that, due to its inherent properties or as a result of treatment by a flame retardant, will slow, terminate or prevent flaming combustion;
" <i>lifejacket</i> "		means a device that, when worn correctly, provides a specified buoyancy that will turn the wearer face-up on entering the water, and will keep the wearer in this position;
" <i>no significant hazard of rollover</i> "		means an area where there are no grades exceeding 10%, no operating areas with open edges, no open ramps, loading docks, ditches or similar hazards which might cause a rollover;
" <i>personal flotation device (PFD)</i> "		means a device that, when worn correctly, provides a specified buoyancy to support a conscious person in an upright or backward leaning position, but is not designed to turn a person from a face-down to a face-up position in the water;
" <i>specific location</i> "		means a yard, plant, or other clearly defined and limited area in which mobile equipment is operated, but does not include an entire municipality, district, transient forestry operation or construction site.

(2) In this Part, "8-hour TWA limit", "ACGIH", "ceiling limit" and "short-term exposure limit" have the same meaning as in section 5.1.

Program	8.5	If personal protective equipment is required to protect against a chemical exposure or an oxygen deficient atmosphere the employer must implement an effective protective equipment program at the workplace which includes <ol style="list-style-type: none">a statement of purpose and responsibilities,written procedures for selection, use, inspection, cleaning, maintenance and storage of protective equipment, when required,instruction and training in the correct use and maintenance of the equipment,for respiratory equipment for respirators, medical assessment of respirator wearers, when required,documentation when required, andprogram review.
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Annual review	8.6	<ol style="list-style-type: none">The personal protective equipment program must be reviewed annually by the employer in consultation with the joint committee or the worker health and safety representative, as applicable.The annual review must<ol style="list-style-type: none">assess exposure control measures to ensure their continued effectiveness,determine the need for further control,ensure the adequacy of instruction, andfor respiratory protection for respirators, assess the adequacy of exposure monitoring data and assess the need for further monitoring, and ensure the adequacy of the fit test program.
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RESPIRATORY PROTECTION RESPIRATORS

When required When respirator required	8.32	<p>The employer must provide appropriate respiratory protective equipment if a worker is or may be exposed to concentrations of an air contaminant in excess of an applicable exposure or excursion limit, or to an oxygen deficient atmosphere.</p> <p>If a worker is or might be exposed in a workplace to an air contaminant that exceeds</p> <ul style="list-style-type: none">(a) an 8-hour TWA limit, ceiling limit or short-term exposure limit set by ACGIH for the air contaminant,(b) a limit that is otherwise determined by the Board under section 5.48 for the air contaminant, or(c) a limit set by section 5.49 for the air contaminant, <p>the employer must provide an appropriate respirator and ensure that the worker uses an appropriate respirator in accordance with section 8.34.</p>
Selection	8.33	<ul style="list-style-type: none">(1) The employer, in consultation with the worker and the occupational health and safety committee, if any, or the worker health and safety representative, if any, must select appropriate respiratory protective equipment an appropriate respirator in accordance with <i>CSA Standard CAN/CSA-Z94.4-93, Selection, Use, and Care of Respirators</i>.(2) Only respiratory protective equipment a respirator which meets the requirements of a standard acceptable to the Board may be used for protection against airborne contaminants in the workplace.
Protection factors	8.34	<p>A respirator must not be used for protection against concentrations of an air contaminant greater than the maximum use concentration, which is the concentration determined by multiplying the exposure limit for the air contaminant by the appropriate respirator protection factor selected from Table 8-1, or as otherwise determined by the Board.</p> <p>(1) In subsection (2):</p> <p>means the 8-hour TWA limit set by the Board for an air contaminant, or if the Board has not set an 8-hour TWA limit for an air contaminant, the TWA limit set by ACGIH for the air contaminant;</p> <p>means a ceiling limit set by the Board for an air contaminant, or if the Board has not set a ceiling limit for an air contaminant, the ceiling limit set by ACGIH for the air contaminant;</p> <p>means the short-term exposure limit set by the Board for an air contaminant, or if the Board has not set a short-term exposure limit for an air contaminant, the short-term exposure limit set by ACGIH for the air contaminant.</p> <p>(2) In subsection (3)</p> <p>means the concentration of an air contaminant calculated in one of the following ways:</p> <ul style="list-style-type: none">(a) if an established 8-hour TWA limit applies to the air contaminant to which a worker is or might be exposed, by multiplying<ul style="list-style-type: none">(i) the established 8-hour TWA limit for the air contaminant, and(ii) the protection factor set out in Table 8-1 that applies to the respirator type that the worker is using;
Maximum use concentration		
"established 8-hour TWA limit"		
"established ceiling limit"		
"established short-term exposure limit"		
"maximum use concentration"		

- (b) if there is no established 8-hour TWA limit that applies to the air contaminant to which a worker is or might be exposed, by multiplying
 - (i) the established short-term exposure limit for that air contaminant, and
 - (ii) the protection factor set out in Table 8-1 that applies to the respirator type that the worker is using;
- (c) if there is no established 8-hour TWA limit or short-term exposure limit that applies to the air contaminant to which a worker is or might be exposed, by multiplying
 - (i) the established ceiling limit for that air contaminant, and
 - (ii) the protection factor set out in Table 8-1 that applies to the respirator type that the worker is using.
- (3) The employer must ensure that a worker does not use a respirator for protection against a concentration of an air contaminant in the workplace that is greater than the maximum use concentration.
- (4) The protection factor of 1 000 set out in Table 8-1: Respirator protection factors for a hood or helmet facepiece, powered (PAPR), and equipped with a HEPA filter or a sorbent cartridge or canister or both a HEPA filter and a sorbent cartridge or canister applies only if an employer who uses or wishes to use that respirator type has evidence from the manufacturer that demonstrates that
 - (a) the manufacturer has tested that type of respirator, and
 - (b) those tests demonstrate that a respirator of that type has a protection factor of at least 1 000.
- (5) The protection factor of 25 set out in Table 8-1: Respirator protection factors for a hood or helmet facepiece, powered (PAPR), and equipped with a HEPA filter or a sorbent cartridge or canister or both a HEPA filter and a sorbent cartridge or canister applies if the conditions set out in subsection (4) are not met.

Table 8-1: Respirator protection factors

Respirator type	Protection Factor
Air purifying	
Half facepiece, non-powered	10
Full facepiece, non-powered	50
Full facepiece, powered (PAPR), equipped with HEPA filters for exposure to asbestos	100
Full facepiece, powered (PAPR), equipped with HEPA filters and/or sorbent cartridge or canister for exposure to contaminants other than asbestos	1 000
Loose-fitting facepiece, powered (PAPR)	25
Hood or helmet facepiece, powered (PAPR), and equipped with a HEPA filter or a sorbent cartridge or canister or both a HEPA filter and a sorbent cartridge or canister, if section 8.34 (5) applies	25
Hood or helmet facepiece, powered (PAPR), and equipped with a HEPA filter or a sorbent cartridge or canister or both a HEPA filter and a	1 000

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sorbent cartridge or canister, if the conditions set out in section 8.34 (4) are met	
Air supplying	
Airline - demand (negative pressure)	
Half facepiece	10
Full facepiece	50
Airline - continuous flow	
Loose-fitting facepiece/hoods	25
Half facepiece	50
Full facepiece	1 000
Helmet/hood	1 000
Airline - pressure demand (positive pressure)	
Half facepiece	50
Full facepiece	1 000
Full facepiece, with egress bottle	10 000
Self-contained breathing apparatus (SCBA)	
Demand (negative pressure)	50
Pressure demand (positive pressure)	10 000
Other factors such as warning properties, IDLH levels, and cartridge/canister limitations must also be taken into account when determining the maximum use concentration. Refer to the manufacturer's instructions and standards acceptable to the Board for further information.	

Explanatory Note:

The powered air-purifying helmet/hood respirator or “helmet/hood PAPR” is not a commonly used respirator. Currently, the helmet/hood PAPR is not listed in the Occupational Health and Safety Regulation (“OHSR”) in Table 8-1 for respirator protection factors (“PF”). Respirator PF is the anticipated level of respiratory protection that would be provided by a properly functioning respirator or class of respirators to properly fitted and trained users.¹ The higher the PF, the greater the anticipated level of respirator protection provided to the worker.

The purpose of the proposed amendment is to update Table 8-1 of section 8.34 by including the helmet/hood PAPR with an assigned PF of 1000. This proposed amendment will provide certainty and consistency for both employers and workers for the level of protection this device is designed to provide to workers.

A powered air-purifying respirator or PAPR works by filtering ambient air through approved air-purifying filters/cartridges by a battery-operated motor and blows the filtered air into the facepiece. The facepiece type determines whether the PAPR is considered “loose-fitting” or “helmet/hood” type. According to the CSA Z94.4-02 Standard, a loose-fitting facepiece is the portion of a respirator that forms a partial seal with the face, does not cover the neck and shoulders, and may or may not offer head and/or eye protection. On the other hand, a hood/helmet facepiece completely covers the head and neck, may cover portion of the shoulders, and may offer head and/or eye protection. By design, the hood/helmet facepiece PAPR has a higher anticipated level of respiratory protection than the loose-fitting facepiece PAPR and has similar level of protection as a full-facepiece PAPR.

¹ CSA Standard Z94.4-02 Selection, Use and Care of Respirators

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Loose-fitting facepiece²



Helmet facepiece²

As stated in the current wording of 8.34 of the regulation, the employer has the obligation to calculate the maximum use concentration (MUC) for a respirator type in order to assess that a worker will be adequately protected when wearing the respirator. The MUC is calculated by multiplying the applicable respirator protection factor for that respirator type as determined by Table 8-1 and the occupational exposure limit of the substance. Recently, a user of the helmet/hood PAPR asked WorkSafeBC about the PF for this type of respirator. Without the PF, users of the helmet/hood PAPR will not be able to calculate the MUC.

The proposed protection factor for the helmet/hood PAPR is consistent with Canadian Standards Association (“CSA”) Standard Z94.4-02, the American National Standards Institute (“ANSI”), and the US Occupational Safety and Health Administration (“OSHA”) as summarized in the table below:

Respirator Protection Factor for Hood/Helmet PAPR

CSA Z94.4-02	ANSI Z88.2-1992	US OSHA
1000	1000	1000

Canadian jurisdictions that have adopted the CSA Z94.4 standard for respiratory protection have also assigned a protection factor of 1000 to the helmet/hood PAPR.

In 2006, US OSHA completed a comprehensive review of the respiratory protection factors, including the helmet/hood PAPRs.³ OSHA concluded that the helmet/hood PAPRs will be assigned a PF of 1000 if certain conditions are met. OSHA’s caveat reads:

The employer must have evidence provided by the respiratory manufacturer that testing of these respirators demonstrates performance at a level of protection of 1000 or greater to receive an APF of 1000. This level of performance can best be demonstrated by performing a WPF or SWPF study or equivalent testing. Absent such testing, all other PAPRs with helmets/hoods are to be treated as loose-fitting facepiece respirators and receive an APF of 25.

WorkSafeBC agrees that the conditions set by OSHA, to distinguish loose-fitting PAPRs from helmet/hood PAPRs, confirm the anticipated respirator performance. Reputable respirator manufacturers routinely conduct workplace protection factor (“WPF”) or simulated workplace protection factor (“SWPF”) studies. Therefore, the requirement for employers to obtain published evidence of respirator performance from the manufacturer should be easily attainable. An accompanying guideline will be developed to explain what type of evidence would meet the conditions of the proposed section 8.34 (4).

The proposed amendment to section 8.32 is meant to clarify the intent of the proposed wording in section 8.34, but does not change the intent of the original regulatory language. The proposed

² Examples of loose-fitting and helmet facepieces: courtesy of 3M Canada

³ “Assigned Protection Factors: Final Rule”, Federal Register 71:164 (Aug 24, 2006)

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wording of 8.32 and 8.34 clarifies the two sources of occupational exposure limits for substances WorkSafeBC currently enforces— exposure limits set by American Conference of Governmental Industrial Hygienists (“ACGIH”) and exposure limits that are otherwise determined by the Board (listed in Prevention Policy R5.48-1).

The proposed wording of 8.32 imposes a duty on employers and workers to restrict the use of certain respirators in the proposed wording of 8.34. Also, the original wording in 8.32 was clarified to mean all 3 types of exposure limits (8-hour TWA, STEL, and Ceiling Limits) as well as exposure limits set by the Board in policy.

The original wording of section 8.32 included oxygen deficient atmosphere but it was determined that sections 8.2 and 8.35 cover the obligation of employers to provide and workers to use a specific type of respirator under those conditions. Also, maximum use concentration calculations are not to be used to determine adequacy of respirators for use in oxygen deficient atmospheres since there is no exposure limit for oxygen. The proposed wording of section 8.32 is intended to afford the same level of protection to workers as the current wording.

The proposed amendment to section 8.34 is meant to clarify how the maximum use concentration is calculated. Currently, the pertinent instructions are located in the guideline for that part, but it was decided that these instructions should be brought into the regulations for clarity. The intent of 8.34 has not changed, other than to add the protection factor requirements for the hood/helmet PAPRs.

For consistency and clarity, the terms “respiratory protection” and “respiratory equipment” were amended throughout the OHSR to mean the same as “respirators”. As consequential amendments, word changes to sections 4.42 (4), 6.29, 6.61, 6.127, 8.5, 8.6, 8.33, 9.29, 12.111 (2), 12.124, 12.135, 23.83(2), and 31.19 are proposed.

PART 9: CONFINED SPACES

CLEANING, PURGING, VENTING AND INERTING

- Inerting** **9.29** (1) The employer must notify the Board in writing, and submit a copy of the proposed work procedures, at least 7 days before a worker enters a confined space which has been inerted.
- (2) The employer must follow any additional precautions that are prescribed by the Board after review of the notification.
- (3) If a confined space has been inerted
- (a) all entry precautions for high hazard atmospheres must be followed, except the requirement for continuous ventilation,
 - (b) every worker entering the confined space must be equipped with ~~supplied-air respiratory protection~~ **a supplied-air respirator** meeting the requirements of Part 8 (Personal Protective Clothing and Equipment),
 - (c) all ignition sources must be controlled, and
 - (d) the atmosphere inside the confined space must remain inerted while workers are inside.
- (4) Subsection (1) does not apply to entry for the purpose of performing emergency rescue duties.

EXPLANATORY NOTE:

It is proposed that this section be amended to refer to “respiratory protection” as “respirators” for consistency of terms throughout the OHSR.

PART 12: TOOLS, MACHINERY AND EQUIPMENT

ABRASIVE BLASTING AND HIGH PRESSURE WASHING

Personal protective equipment

- 12.111 (1) A nozzle or jetting gun operator must wear personal protective clothing and equipment on the body, hands, arms, legs and feet, including the metatarsal area, made of canvas, leather or other material which will protect the worker's skin from injury in the event of contact with the flow from the nozzle.
- (2) Unless the process is isolated from the operator in a separate cabinet, ~~suitable respiratory protective equipment~~ **a suitable respirator** must be provided and worn whenever abrasive blasting or a similar operation is conducted.

WELDING, CUTTING AND ALLIED PROCESSES

Respiratory protection

- 12.124 ~~Respiratory protective equipment~~ **A respirator** must be provided and worn if an effective means of natural, mechanical or local exhaust ventilation is not practicable
- (a) during short duration welding, burning or similar operations, and
- (b) during emergency work.

PAINTING, COATING AND WORK WITH PLASTICS AND RESINS

Respiratory protection

- 12.135 Each worker who is or may be exposed to an airborne contaminant generated by a spray operation involving a sensitizing agent referred to in section 5.57(1) must be provided with and wear ~~air-supplied respiratory protection~~ **a supplied-air respirator**.

EXPLANATORY NOTE:

It is proposed that these sections be amended to refer to "respiratory protective equipment" as a "respirator" for consistency of terms throughout the OHSR.

PART 23: OIL AND GAS

- Safety harnesses** **23.83** (1) If it is not practicable for a worker entering a confined space to use a lifeline due to internal piping or other obstructions, the worker must wear a full body harness.
- (2) If a lifeline is not used, 2 workers must be equipped with ~~respiratory protective equipment~~ **respirators** and capable of effecting a rescue if required, and stationed immediately outside the entrance to the confined space.
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EXPLANATORY NOTE:

It is proposed that section 23.83(2) be amended to refer to respiratory protective equipment as a “respirator” for consistency of terms throughout the OHSR.

PART 31: FIREFIGHTING

~~RESPIRATORY PROTECTION~~ RESPIRATORS

- General** **31.19** Firefighters who may be exposed to an oxygen deficient atmosphere or to harmful concentrations of air contaminants must wear a self-contained breathing apparatus of a positive pressure type having a rated minimum duration of 30 minutes.

EXPLANATORY NOTE:

It is proposed that the title for this section be amended to refer to respiratory protection as “respirators” for consistency of terms throughout the OHSR.

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