



Denison Mines Corp.  
Wheeler River Operation

## **Radiation Code of Practice**

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## Approval for Use

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1	15-Dec-2023	Draft for CNSC Review			
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## Revision History

Version	Date	Description of Revision
1	15 Dec 2023	Draft for CNSC Review
2	March 2025	2.2 Action and Administrative Levels for Dosimetry and Associated Actions – <i>added detail</i> . Table 1 – <i>added clarification to heading</i> . 2.3 Result Tracking, Notification and Reporting of Exceedances – <i>added clarification</i> . Table 3 – <i>added footnote</i> .
3	11-Aug-2025	Changed administrative and action levels

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## Acronyms and Abbreviations

Term	Definition
ALARA	As low as reasonably achievable
ALI	Annual limit on intake
AM	Area manager
APF	Assigned protection factors
CAM	Continuous air monitoring
CNSC	Canadian Nuclear Safety Commission
DAC	Derived air concentration
DIL	Derived investigation level
DRD	Direct reading dosimeter
ISR	In-situ recovery
LLRD	Long lived radioactive dust
LRWS	Labour Relations and Workplace Safety
NEW	Nuclear Energy Worker
OHC	Occupational Health Committee
PPE	Personal protective equipment
RnG	Radon gas
RnP	Radon progeny
RP	Radiation protection
RSO	Radiation safety officer
GM	General Manager
WL	Working level
LTPSC	License to prepare site and construct

# 1 Introduction

## 1.1 Background

This *Radiation Code of Practice* supports the *Radiation Protection Program* for the Wheeler River Operation. The *Radiation Code of Practice* defines dosimetry action levels and administrative levels for radiological exposure, and associated actions to be taken to control exposure and dose if those levels are exceeded. It also details the Radiation Work Permit process for control of new non-routine radiological exposure situations and criteria for use of respiratory protection devices.

This *Radiation Code of Practice* is intended to meet the expectations of the Canadian Nuclear Safety Commission (CNSC) with respect to radiation protection, as well as applicable regulatory requirements such as: REGDOC-2.7.1 (CNSC, 2021b) which provides guidance on use of action levels, administrative levels, and mentions Radiation Work Permits as an administrative control on exposure.

# 2 Action and Administrative Levels for Dosimetry

## 2.1 Purpose of Action and Administrative Levels for Dosimetry

Dosimetry action levels define the total dose for a worker which signify potential loss of control of the *Radiation Protection Program*. Total dose includes external radiation, long lived radioactive dust (LLRD), and radon components of effective dose, as applicable to the work area. Exceedance of an action level triggers corrective action to ensure that worker dose limits are not exceeded and triggers notification of regulatory authorities.

Dosimetry administrative levels are lower levels of total dose, which do not signify loss of control, and their exceedance does not trigger notification of regulatory authorities, but may still warrant certain actions, including internal notifications within the operating organization. Exceedance of an administrative level triggers action to ensure that doses are kept as low as reasonably achievable (ALARA) and that action levels are not exceeded.

## 2.2 Action and Administrative Levels for Dosimetry and Associated Actions

For Nuclear Energy Workers (NEWs), pregnant workers, and non-NEW workers dosimetry action and administrative levels and associated actions if they are exceeded, are outlined in **Table 1**. An exceedance is considered to occur at the time the dose value is calculated, and the radiation safety officer (RSO) becomes aware of the exceedance.

**Table 1** is applicable to NEWs during the construction phase. Drilling within the ore body is planned to commence during the LTPSC phase. Potential radiological hazards have been identified in both the wellfield and the core shack. Workers assigned to these areas are expected to be classified as Nuclear Energy Worker (NEWs). Additionally, non-NEW Personnel, such as workers in non-radiological areas during construction will also be present during this phase. As activities progress into other stages, additional worker classification will be identified.

**Table 1: Dosimetry Action Levels for workers (Total Effective Dose)**

Interim Action Level	Dose Value (mSv)	Mitigative Action	Notifications
1(a) (monthly)	1.17 - NEW	<ul style="list-style-type: none"> <li>Identify elevated worker dose through worker exposure review process;</li> <li>Formally notify worker;</li> <li>Initiate formal review; and</li> <li>If twice in quarter, initiate formal review.</li> </ul>	RSO Radiation Dept AM
	0.3 - Pregnant NEW		
	0.08 - Non NEW		
1(b) (quarterly)	3.5 - NEW	<ul style="list-style-type: none"> <li>Identify elevated worker dose through worker exposure review process;</li> <li>Formally notify worker; and</li> <li>Initiate formal review and devise action plan</li> </ul>	As above plus GM OHC
	0.9 - Pregnant NEW		
	0.23 - Non NEW		
1(c) (annual)	14 - NEW	<ul style="list-style-type: none"> <li>Identify elevated worker dose through worker dose review process;</li> <li>Formally notify worker</li> <li>Initiate formal review and devise action plan; and</li> <li>Follow up with full report in accordance with required timelines and report content (Section 2.3).</li> </ul>	As above plus CNSC LRWS
	3.6 - Pregnant NEW		
	0.9 - Non NEW		

Note: OHC = Occupational Health Committee, LRWS = Labour Relations and Workplace Safety (Saskatchewan)

The action level for NEW workers is below the 5-year average dose limit of 20 mSv/y. In reporting to regulators, any doses exceeding a dose limit will be specifically flagged as such.

For workers who are NEWs, and have reported they are pregnant or breastfeeding, their administrative levels will become 0.3 mSv/mo and 0.9 mSv/quarter for the balance of the pregnancy or breastfeeding period. Their action level will become 3.6 mSv for the balance of this period. Mitigative actions and notifications at each level are otherwise as outlined in **Table 1**.

## 2.3 Result Tracking, Notification and Reporting of Exceedances

The RSO will be responsible for daily recording of worker doses, flagging exceedances of administrative and action levels, tracking exceedance frequencies, notifying managers and regulators, working with management on mitigative measures, as needed, and regularly reporting dose information to workers.

Reviews and action plans will be documented and appropriately stored for future access and review.

Regulatory notifications and reports in response to action level exceedances as described above will be within required timelines and will include required content. Any worker doses exceeding their applicable dose limit, will be specifically flagged in reports. An internal non-conformance report is also filed whenever an action level is exceeded, in accordance with DMC-QUA-105 *Non-Conformance Procedure* within the *Management System Program*.

When dose limits are exceeded, section 16 and 17 of the Radiation Protection Regulation will be activated by the RSO.

Guidance on the format and content of initial and full reports to the CNSC (and Labour Relations and Workplace Safety (LRWS)) when action levels are exceeded is provided in REGDOC 3.1.2, Volume I CNSC (2022). The process for determining reporting requirements and timeframes, and for initiating and managing the reporting, is detailed in the DMC-QUA-105 *Non-Conformance Procedure* within the *Management System Program*.

## 3 Action and Administrative Levels for Exposure

### 3.1 Purpose of Action and Administrative Levels for Exposure

Action levels for exposure define the levels of short-term exposure for a worker which signify potential loss of control of the *Radiation Protection Program*. The exposure values monitored include external radiation, radon progeny (RnP), LLRD, and uranium in urine, as applicable to the work area. Exceedance of an action level triggers corrective action to ensure that exposure conditions do not persist that could lead to dose limit exceedances and triggers notification of regulatory authorities.

Administrative levels are lower levels of short-term exposure which do not signify loss of control, and their exceedance does not trigger notification of regulatory authorities but may still warrant certain actions, including internal notifications within the operating organization. Exceedance of an administrative level triggers action to ensure that exposures are kept ALARA and that action levels are not exceeded.

### 3.2 Action and Administrative Levels for Exposure and Associated Actions

Action and administrative levels for the various measures of short-term exposure and associated actions, if they are exceeded, are outlined in the following sections.

#### 3.2.1 External Radiation Exposure

The relevant measures of external radiation exposure include ambient dose equivalent rates measured by the radiation protection department using a hand-held dose rate meter (average values for main work areas, 1 m above the floor), as well as personal dose equivalent rates recorded by real-time direct reading dosimeters (DRDs) worn by workers in higher gamma areas (where expected external dose is above 1 mSv/y).

The administrative levels for external radiation exposure and associated actions if they are exceeded are outlined in Table 2 and Table 3.

**Table 2: Ambient Dose Equivalent Rate Action and Administrative Levels (for all areas)**

Admin Level	Value	Mitigative Actions if Exceeded	Notifications
2(a)	2.5 $\mu\text{Sv/h}$	If reading is higher than expected, resample within 48 hours. If confirmed, determine cause, and mitigate if reasonably practicable.	RSO and RP department AM
2(b)	5 $\mu\text{Sv/h}$	If reading is higher than expected, resample within 24 hours. If confirmed, determine cause, and mitigate if reasonably practicable.	RSO and RP department AM GM
2(c)	10 $\mu\text{Sv/h}$	If reading is higher than expected, resample immediately. If confirmed, determine cause, mitigate if reasonably practicable. If readings are above 25 $\mu\text{Sv/h}$ , post “Gamma Radiation” signs and restrict access except for essential work under RWP.	RSO and RP department AM GM OHC

The 10  $\mu\text{Sv/h}$  value is a dose rate that, if it persists, could lead to a dose of 20 mSv/y. The 25  $\mu\text{Sv/h}$  value is a dose rate that, if it persists, could lead to a dose of 50 mSv/y.

**Table 3: Individual Worker DRD Administrative Levels (for workers in higher gamma exposure areas)**

Admin Level	Value	Mitigative Actions if Exceeded	Notifications
3(a)	50 $\mu\text{Sv/day}$	Worker to inform RP department and AM. Worker to record daily results until below this level for 7 consecutive working days.	RSO and RP department AM
3(b)	200 $\mu\text{Sv/day}$	As for 3(a), plus notify GM and OHC. Worker to leave area until approved to return, based on RP review and finding of unlikely to exceed 400 $\mu\text{Sv/week}$ .	RSO and RP department AM GM OHC



3(c)	400 μSv/week	As for 4(b), plus RP/AM to develop action plan for worker to remain below 400 uSv/week, approved by GM, report outcome at next Radiation Safety Review Meeting.	RSO and RP department AM GM OHC
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The 400 uSv/week value is an exposure level that, if it persists, could lead to a dose of 20 mSv/y.

DRD will be provided to any worker who enters an area where the dose rate exceeds 100 μSv/h.

### 3.2.2 Radon Progeny Exposure

The relevant measures of RnP exposure include air sampling by the radiation department and subsequent radiochemical analysis (RnP and radon gas (RnG)), as well as continuous air monitor (CAM) systems throughout the mill). The CAM system alerts workers when exposure levels exist that warrant exposure avoidance.

The administrative levels for RnP in air, and associated actions if they are exceeded, are outlined in Table 4 and Table 5.

**Table 4: Radon Progeny Action and Administrative Levels based on Area Air Sample Results**

Admin Level	Value	Mitigative Actions if Exceeded	Notifications
4(a)	0.03 WL	If result is higher than expected, resample within 24 hours. If confirmed, determine cause, and mitigate if reasonably practicable.	RSO and RP department AM
4(b)	0.06 WL	If result is higher than expected, resample within 24 hours. If confirmed, determine cause, and mitigate if reasonably practicable.	RSO and RP department AM GM
4(c)	0.1 WL	Resample immediately to confirm result. If confirmed, determine cause and mitigate. Post “Airborne Radiation” signs and restrict access except for essential work under RWP. Resample every 24 hours until levels are persistently below 0.1 WL.	RSO and RP department AM GM OHC
4(d)	1 WL	As for 5(c), plus RP to notify CNSC and LRWS and follow up with full report in accordance with required timelines and report content (Section 3.3).	RSO and RP department AM GM OHC, CNSC, LRWS

The 0.1 WL value corresponds to 370 Bq/m<sup>3</sup> of RnG in full equilibrium (F=1) with short-lived progeny. With design ventilation (6 air exchanges/hour) only partial equilibrium is expected (F= 0.18).

**Table 5: Radon Progeny Administrative Levels based on CAM Results (for all areas)**

Admin Level	Colour (WL)	Mitigative Actions if Colour Seen	Notifications
5(a)	Green/Yellow (0.1 to <0.2 WL)	Workers investigate, mitigate if possible. If > 2h, workers inform RP department. RP sample air to confirm > 0.1 WL. If > 8h, or if confirmed > 0.1 WL, stop routine work (see 5(c)).	RSO and RP department AM GM
5(b)	Yellow (0.2 to <0.5 WL)	Workers investigate, mitigate if possible. If > 1h, workers inform RP department. RP sample air to confirm > 0.1 WL. If > 2h, or if confirmed > 0.1 WL, stop routine work (see 5(c)).	RSO and RP department AM GM OHC
5(c)	Yellow/Red (0.5 to 1.0 WL)	Workers investigate, mitigate if possible. If no obvious quick fix, workers inform RP department. RP sample air to confirm > 0.1 WL. If > 2h, or if confirmed > 0.1 WL, stop routine work (see 5(c)).	RSO and RP department AM GM OHC

### 3.2.3 Long-lived Radioactive Dust Exposure

The relevant measures of LLRD exposure include particulate activity concentrations measured in air samples collected by the radiation department, as well as personal activity concentrations measured using dust pumps worn by workers in higher LLRD areas (where expected LLRD dose is above 1 mSv/y). Results from both types of samples are expressed as a fraction of the Derived Air Concentration (DAC).

The administrative levels for LLRD exposure, and associated actions if they are exceeded, are outlined in Table 6.

**Table 6: LLRD Action and Administrative Levels based on Area Air Sample Results**

Admin Level	Value	Mitigative Actions if Exceeded	Notifications
6(a)	0.05 fraction of DAC	If result is higher than expected, resample within 48 hours. If confirmed, determine cause and mitigate if reasonably practicable.	RSO and RP department AM
6(b)	0.10 fraction of DAC	If result is higher than expected, resample within 24 hours. If confirmed, determine cause and mitigate if reasonably practicable.	RSO and RP department AM
6(c)	0.20 fraction of DAC	If result is higher than expected, resample within 24 hours. If confirmed, determine cause and mitigate if reasonably practicable.	RSO and RP department AM GM OHC
6(d)	1.0 fraction of DAC	As for 7(c), plus Post “Airborne Radiation” signs and restrict access except for essential work under RWP, RP to notify CNSC and LRWS and follow up with full report in accordance with required timelines and report content (Section 3.3).	RSO and RP department AM GM OHC, CNSC, LRWS

The DAC represents an LLRD concentration that, if persistent, corresponds with 20 mSv/y for a given work area. It may be affected by the type of dust (uranium oxide or uranium ore) as well as the defined work hours per year for the work area. These considerations allow DAC to reflect a particular annual dose.

For a typical work year (2000 h/y) the DAC is defined as (CNSC, 2021):

$$\text{DAC (BqU-238/m}^3\text{)} = \text{Annual dose limit (0.02 Sv/y)} / \text{DCF (Sv/BqU-238)} / (2000 \text{ h/y} \times 1.1 \text{ m}^3/\text{h})$$

For uranium oxide (UO<sub>4</sub>) in the in-situ recovery (ISR) Plant, a DCF of 2.6E-06 Sv/BqU-238 is taken from ICRP 137 (2017). This value assumes U-234 to be present in secular equilibrium with U-238. The last term in the DAC equation is modified by (4/8) in the drying and packaging areas because the work shift in these areas is limited to 4 hours. The selected DCF is conservative for UO<sub>4</sub> because values for Type M were utilized, which are higher than Type F/M recommended for UO<sub>4</sub>. The DCF is sufficiently conservative to accommodate a mixture of dried and calcined product in the drying area. It exceeds the geomean of Type F and Type S values suggested by IAEA (2020) for dried and calcined product, respectively.

For uranium ore in the core shack, a DCF of 2.08E-05 Sv/BqU-238 is taken from ICRP 137 (2017). This value is a sum of DCFs over the decay chain, assuming all progeny to be present in secular equilibrium with U-238. The last term in the DAC equation is modified by (11/8) since the work shift in this area is 11 hours. The DCFs for individual radionuclides were either Type M values specifically recommended for the radionuclide in high grade uranium ore dust, or otherwise were Type M or Type S values recommended for unspecified forms.

**Table 7: LLRD Action and Administrative Levels based on Dust Pump Results (for higher LLRD areas)**

Admin Level	Value	Mitigative Actions if Exceeded	Notifications
7(a)	0.10 fraction of DAC	Worker to inform RP department and AM. RP to review daily results; if higher than expected, investigate cause, RP/AM develop action plan for worker to reduce exposure.	RSO and RP department AM
7(b)	0.20 fraction of DAC	As for 7(a), plus RP to notify GM and OHC.	RSO and RP department AM GM OHC
7(c)	1.0 fraction of DAC	As for 7(b), plus action plan to ensure worker remains below DAC, approved by GM, report outcome at next Monthly Exposure Meeting.	RSO and RP department AM GM OHC

### 3.2.4 Uranium in Urine

Routine bioassay measurements of uranium in urine provide a check on internal exposure to uranium. The internal exposure is expected to be mainly through inhalation of uranium dust. Any hand to mouth exposure should be minimal assuming good contamination control and good hygiene; however, an abnormal urine bioassay result warrants investigation of both inhalation and hand to mouth pathways.

Uranium in urine is measured chemically (in µg/L). The chemical measurement can be readily converted to U-238 activity (Bq/L) since the uranium mass is primarily U-238 (0.012356 BqU-238/ugU).

The administrative levels for uranium in urine, and associated actions if they are exceeded, are outlined in Table 8 and Table 9.

**Table 8: Administrative Levels for Uranium in Urine (for ISR Plant workers)**

Admin Level	Value	Mitigative Actions if Exceeded	Notifications
8(a)	10 µg/L	Resample to confirm the exceedance. If confirmed, RP department to investigate cause, RP/AM develop action plan for worker to reduce exposure if possible.	RSO and RP department AM
8(b)	100 µg/L	Resample to confirm exceedance. If confirmed, RP department to investigate cause, RP/AM develop action plan for	RSO and RP department AM GM OHC

		worker to reduce exposure. RP to notify GM and OHC.	
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The value of 10 µg/L is a bounding value for the Derived Investigation level (DIL) in the ISR Plant. The DIL is a uranium in urine concentration that triggers investigation and corrective action if possible. For a typical full work year, it is calculated as follows (CNSC, 2010):

$$\text{DIL (ug/L)} = 0.3 \times \text{ALI (BqU-238/y)} \times (30/365) \times \text{Bq/d excreted per Bq Intake} / 1.4 \text{ L/d} / 0.012356 \text{ Bq/ug}$$

The assumption is that an acute intake occurs at the beginning of the 30-day interval between samples and that the measurement of daily excretion occurs at the mid-point of the interval. This daily excretion is 4.3E-04 Bq/d per Bq intake of U-238 in uranium oxide (ICRP 78, Table A.10.8, Type M). The Annual Limit on Intake (ALI) is the annual dose limit (0.02 Sv/y) divided by the DCF (Sv/BqU-238).

For uranium oxide (UO<sub>4</sub>) in the ISR Plant, a DCF of 2.6E-06 Sv/BqU-238 is taken from ICRP 137 (2017). This value assumes U-234 to be present in secular equilibrium with U-238 (see Section 3.2.3).

The value of 100 µg/L a bounding value for both the drying area and the packaging/loading area, which are the two high LLRD areas in the ISR Plant. Other areas in the ISR Plant are expected to be well below 10 µg/L.

**Table 9: Administrative Levels for Uranium in Urine (for core shack workers)**

Admin Level	Value	Mitigative Actions if Exceeded	Notifications
9(a)	1 µg/L	Resample to confirm the exceedance. If confirmed, RP department to investigate cause, RP/AM develop action plan for worker to reduce exposure if possible.	RSO and RP department AM
9(b)	10 µg/L	Resample to confirm exceedance. If confirmed, RP department to investigate cause, RP/AM develop action plan for worker to reduce exposure. RP to notify GM and OHC.	RSO and RP department AM GM OHC

The value of 1 µg/L is a bounding value for the Derived Investigation level (DIL) in the core shack. It is calculated as described above for the ISR Plant, but with a DCF for uranium ore.

For uranium ore in the core shack, a DCF of 2.08E-05 Sv/BqU-238 is taken from ICRP 137 (2017). This value is a sum of DCFs over the decay chain, assuming all progeny to be present in secular equilibrium with U-238 (see Section 3.2.3).

The value of 10 µg/L a bounding value for the core shack.

### 3.3 Result Tracking, Notification and Reporting of Exceedances

The RSO will be responsible for regular recording of monitored exposure levels as described above, flagging exceedances of administrative and action levels, tracking exceedance frequencies, notifying

managers and regulators, working with management on mitigative measures as needed, and regularly reporting exposure information to workers.

Reviews and action plans will be written reports, maintained in radiation protection (RP) and manager files.

Regulatory notifications and reports in response to action level exceedances as described above will be within required timelines and will include required content. An internal non-conformance report is also filed whenever an action level is exceeded, in accordance with DMC-QUA-105 *Non-Conformance Procedure* within the *Management System Program*.

Guidance on the format and content of initial and full reports to the CNSC (and LRWS) when action levels are exceeded is provided in REGDOC 3.1.2 Volume I CNSC (2022). The process for determining reporting requirements and timeframes and for initiating and managing the reporting is detailed in DMC-QUA-105 *Non-Conformance Procedure* within the *Management System Program*.

## **4 Administrative Levels for Surface Contamination**

### **4.1 Purpose of Administrative Levels for Surface Contamination**

The purpose of contamination control is to minimize potential for abnormal intake of uranium by hand to mouth transfer of LLRD deposited on work surfaces. Administrative levels for surface contamination are intended to define upper levels of deposited radioactivity for work areas so that decontamination effort can be applied if these levels are exceeded.

### **4.2 Administrative Levels for Contamination and Associated Actions**

Upper levels for non-fixed radioactive contamination in work areas are outlined in REGDOC 1.6.1 (CNSC, 2017) under the *Nuclear Substances and Radiation Devices Regulation*. For alpha emitting radionuclides, these levels are 3 Bq/cm<sup>2</sup> in areas where the substances are used or stored, and 0.3 Bq/cm<sup>2</sup> in all other work areas. In accordance with REGDOC 2.7.1 (CNSC, 2021b), lower levels should be defined for these areas if reasonably practicable based on operating experience. Transition zones between high and low LLRD areas will be established and personal decontamination procedures will be applied here to prevent transfer of radioactivity from high LLRD areas to other areas.

The relevant measure of non-fixed surface contamination is an activity measurement on a wipe that has been used to collect activity over a known area (100 cm<sup>2</sup> or less). A survey meter with a pancake probe or a benchtop instrument may be used for activity measurement. Guidance on sampling and instruments and activity measurement is provided in Appendix BB of REGDOC 1.6.1.

After an upper level of contamination for each work area is established by the RSO, the RP department will be responsible for monitoring surface contamination, informing area managers if upper levels are exceeded, and in that event, working with area managers to develop a corrective action plan.

## **5 Radiation Work Permits**

### **5.1 Purpose of Radiation Work Permits**

The purpose of radiation work permits is to provide planned control over new non-routine work situations such that exposures and doses are kept ALARA.

## 5.2 The Radiation Work Permit Process

The planning for new non-routine work is based on anticipated radiation hazards, estimated worker exposures and doses, and selection of controls to optimize exposure and dose. Based on this information, a Radiation Work Plan is produced for review and approval by the RSO, who then issues a Radiation Work Permit. The permit outlines the new task and its anticipated hazards, exposures, doses and controls, as well as associated monitoring to verify that exposures are as expected and actions to be taken if they are not. On completion of the work, the information is added to the risk registry to document the experience.

The risk registry is consulted during development of the Radiation Work Plan, so that any previous experience in similar situations can be considered.

Although Radiation Work Permits are for unusual exposure situations, they can cover multiple entries into the same situation. However, there is a limit on total dose to an individual worker under a Radiation Work Permit. This administrative limit is 5 mSv/y.

The RSO will be responsible for tracking individual worker doses incurred under a Radiation Work Permit and will inform workers and their area managers when they approach this limit, and will exclude any worker from further participation who is likely to exceed this limit.

## 6 Respiratory Protection Criteria

### 6.1 Purpose of Respiratory Protection Criteria

The purpose of respiratory protection is to enable essential work to be performed safely under conditions of Airborne Radiation hazard. Under the hierarchy of controls, use of respiratory protection is a control of last resort, after in-design and administration controls have been applied. The purpose of respiratory protection criteria is to specifically define the conditions under which respiratory personal protective equipment (PPE) may be used and to outline appropriate types of respiratory PPE for different types of Airborne Radiation hazard.

As Airborne Radiation hazard conditions are non-routine work conditions, work under these conditions will only be performed under a Radiation Work Permit, supported by hazard and risk assessment.

### 6.2 Criteria for Use of Respiratory Protection

The general criteria for use of respiratory PPE are:

- The work is deemed essential;
- The work is considered unsafe to perform without respiratory protection; and

The work must be performed under a Radiation Work Permit.

Table 10 outlines the conditions for use of specific types of respiratory PPE, considering the airborne radiation hazards at site, along with Assigned Protection Factors (APF) for each type of PPE. The APF values may be used in estimation of worker exposure when wearing PPE.

**Table 10: Criteria for Use of Specific Types of Respiratory PPE**

Respirator Type	RnP Range (WL)	LLRD Range (DAC)	RnG Range (Bq/m <sup>3</sup> )	APF	Considerations
Filtering facepiece	n/a	n/a	n/a	n/a	May be used but no credit may be taken for exposure reduction.
Half-face elastomeric Air Purifying Respirator	0.2 - <1	1 - <2	n/a	10	Use for short duration tasks (<1h). Not used for protection from radon gas (RnG).
Full-face elastomeric Air Purifying Respirator	0.2 - <2	1 - <20	n/a	50	If radon progeny (RnP) < 1 WL time limitation may be used as an alternative. Device not used for protection from RnG.
Powered Air Purifying Respirator (Loose-fitting Hood)	0.2 - <2	1 - <10	n/a	25	If RnP < 1 WL time limitation may be used as an alternative. Device not used for protection from RnG.
Powered Air Purifying Respirator (Tight-fit facepiece)	2 - <20	10 - <50	n/a	1,000	Not used for protection from RnG.
Supplied Air Breathing Apparatus	2 - <20	10 - <50	20,000 or more	1,000	Assumes tight fit facepiece.
Self-contained Breathing Apparatus	20 or more	50 or more	20,000 or more	10,000	Assumes tight fit facepiece.

APF values are taken from CSA Z94.4-18 (CSA, 2018) and USNRC (2022). The values shown are the lowest among the two standards.



## 7 References

### 7.1 Internal

Document Number	Document Name
	Management System Program
	Radiation Protection Program
	ALARA Plan
	Radiation Code of Practice
DMC-QUA-105	<i>Non-Conformance Procedure</i>

### 7.2 External

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United States Nuclear Regulatory Commission (USNRC). 2022. Code of Federal Regulations. Title 10, Energy (revised as of January 1, 2022). Part 20 Standards for Protection Against Radiation. Appendix A, Assigned Protection Factors for Respirators.