



Radiation Safety
Institute of Canada
Institut de radioprotection du Canada

A Review of the Radiological Protection Landscape in Canada

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Webinar Functionality

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- Video, answers to questions, copy of the slides

Follow up email will be sent

- Topics covered, time of attendance



In This Session

Ionizing Radiation Effect Categories

International System of Radiological Protection

Regulatory Structure

- Nuclear
- X-Ray
- NORM
- Radon

Legislative Review

Movement break

- Charlmane Wong
- Ji Hong Tai Chi & Qi Gong Richmond Hill





Tissue Effects

- Also called deterministic effects
- Certain to occur over a threshold dose
- Dose can vary by individual
- If dose is increased, effect is worse



Steve & Jem Copley, CC BY-SA 2.0 <<https://creativecommons.org/licenses/by-sa/2.0/>>, via Wikimedia Commons



Stochastic Effects

- Radiation dose increases the risk of getting the effect
- Not a certainty; probabilistic
- As dose increases, risk increases

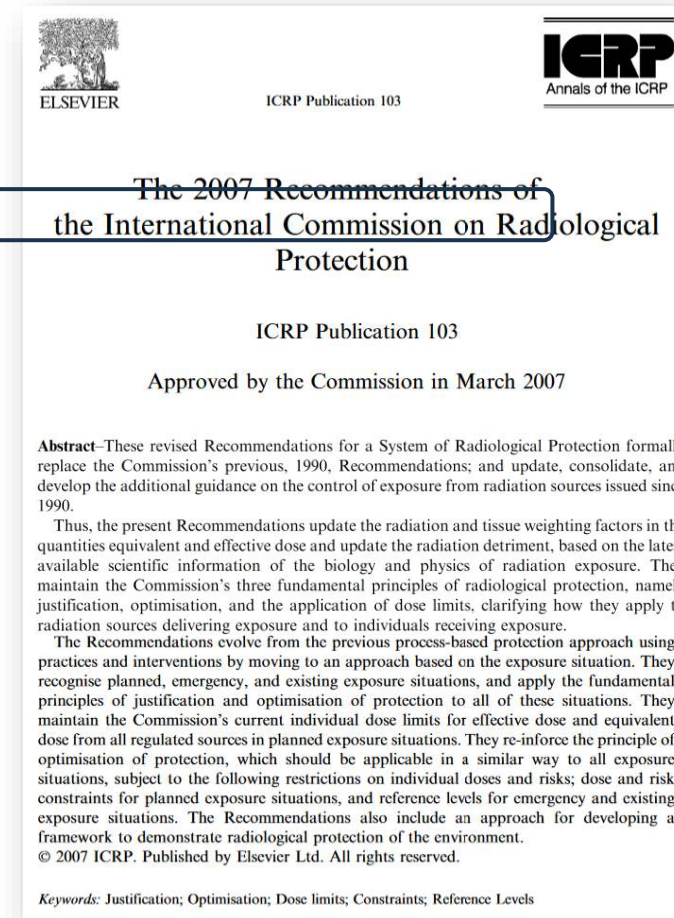
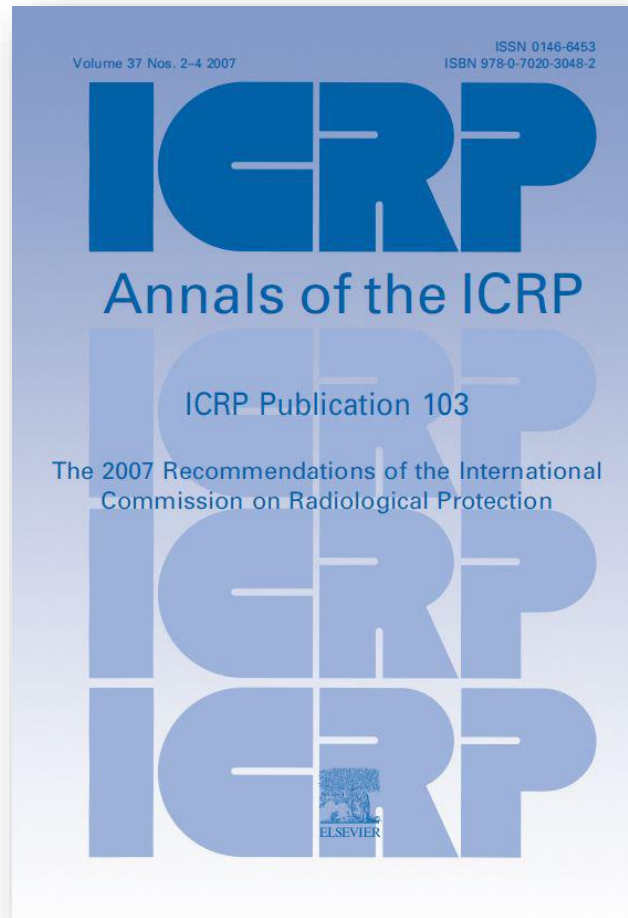


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System of Radiological Protection

<https://www.icrp.org/publication.asp?id=ICRP+Publication+103>





- Any decision that alters the radiation exposure situation should do more good than harm.

Justification Principle





Limitation Principle

- The total dose to any individual from regulated sources in planned exposure situations other than medical exposure of patients should not exceed the appropriate limits specified by the Commission.





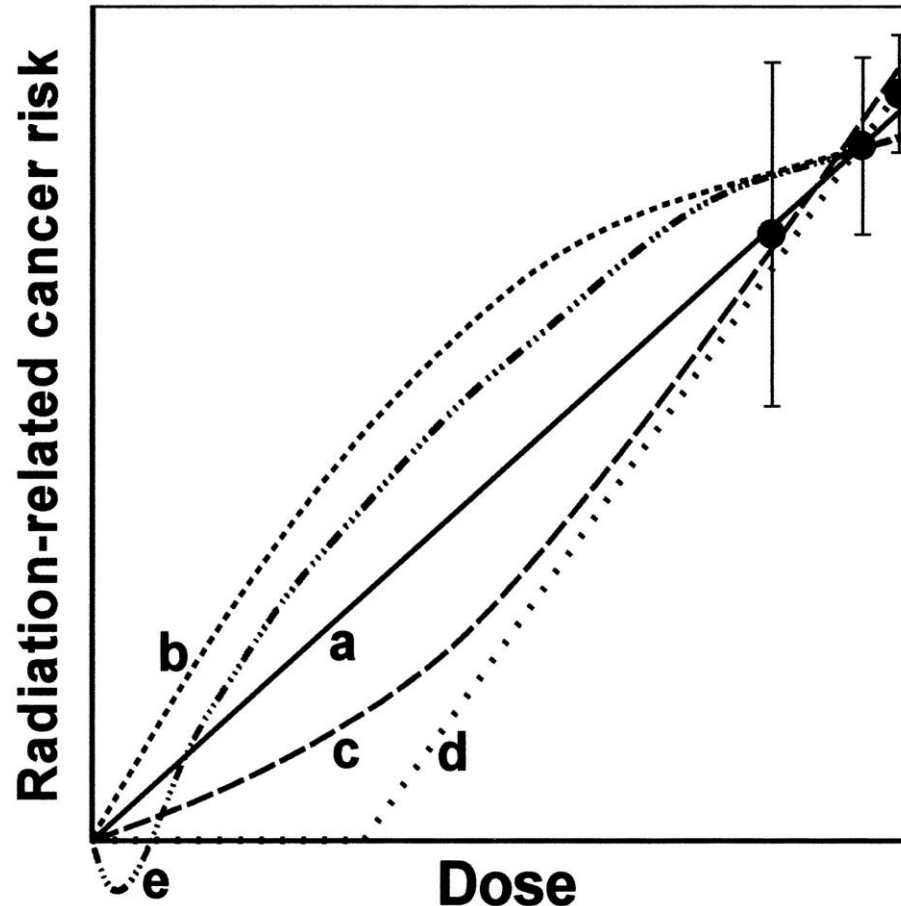
Optimization Principle

- The likelihood of incurring exposure, the number of people exposed, and the magnitude of their individual doses should all be kept as low as reasonably achievable, taking into account economic and societal factors.

**AS
LOW
AS
REASONABLY
ACHIEVABLE**



Linear Non-Threshold



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Theoretical model

Not known what happens at low doses

Assumes that linear risk from high doses goes all the way down to zero

No threshold

Little dose = small increase in risk



Exposure Categories

Planned

- Deliberate introduction and operation of sources
- May give rise both to anticipated to happen or not anticipated to happen

Emergency

- May occur during planned situations, malicious acts, or another other unexpected event


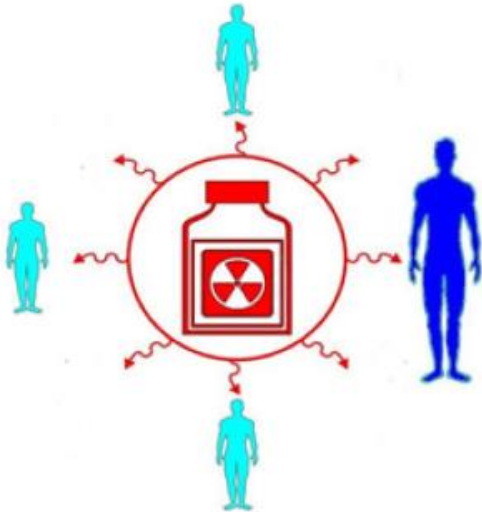
Existing

- Exposure situation already exists when a decision on control is to be taken



Levels of Radiological Protection


<https://www.icrp.org/publication.asp?id=ICRP%20Publication%20103>

Dose Limits	Constraints and Reference Levels
Protect individual workers from occupational exposure and the Representative Person from public exposure	
	
From all regulated sources in planned exposure situations	From a source in all exposure situations



Categories & Situations

http://icrpaedia.org/Exposure_Categories_and_Situations

	 Occupational Exposure <i>Exposure of workers incurred as a result of their work</i>	 Public Exposure <i>Exposure of members of the public other than occupational and medical exposures, and not including the normal local natural background radiation</i>	 Medical Exposure <i>Exposure of patients as part of their diagnosis or treatment, volunteers helping in the support and comfort of patients, and volunteers in biomedical research</i>
 Planned Exposure Situation <i>Situations where radiological protection can be planned in advance, and exposures can be reasonably predicted</i>	e.g. working in a hospital, uranium mine, or nuclear power plant	e.g. visiting a hospital, living near a nuclear power plant	e.g. getting an x-ray, CT scan, or radiation treatment
 Existing Exposure Situation <i>Situations that already exist when a decision on control has to be taken</i>	e.g. aircrew and astronauts exposed to cosmic radiation	e.g. radon gas in the home	n/a
 Emergency Exposure Situation <i>Unexpected situations that may require urgent protective actions</i>	e.g. in the immediate response to an accident	e.g. during a major accident	n/a



ICRP Dose Limit Recommendations

For planned occupational exposure situations.

Type of Limit	Occupational	Public
Effective dose	20 mSv per year averaged over defined periods of 5 years with no 1 year going over 50	1 mSv per year
Equivalent dose, lens of eye	20 mSv per year averaged over defined periods of 5 years with no 1 year going over 50	15 mSv per year
Equivalent dose, skin	500 mSv	50 mSv per year
Equivalent dose, hands and feet	500 mSv	-

From Table 6, [ICRP Publication 103](#)



General Radiation Protection Regulatory Structure in Canada

Radiation Source	Details	Jurisdiction	Regulator	Overarching Legislation
Nuclear X-Ray ≥ 1 MeV	Does not include NORM unless part of the nuclear fuel cycle, import/export	Federal	Canadian Nuclear Safety Commission Transport Canada	Nuclear Safety and Control Act Transportation of Dangerous Goods Act
X-Ray < 1 MeV	Being manufactured, sold, imported, or leased	Federal	Health Canada, Radiation Protection Bureau	Radiation Emitting Devices Act
X-Ray < 1 MeV	Once installed	Provincial, Territorial, or Federal	Province, Territory, or Employment and Social Development Canada	Typical OSHA, but some have standalone legislation
NORM	Handling and disposal, not part of nuclear fuel cycle	Provincial, Territorial, or Federal	Province, Territory, or Employment and Social Development Canada	Typically OSHA EPAs
NORM	Transport, not part of nuclear fuel cycle	Federal	Canadian Nuclear Safety Commission Transport Canada	Packaging and Transport of Nuclear Substances Regulations, 2015 Transportation of Dangerous Goods Act
Radon	For those not licenced with the CNSC	Provincial, Territorial, or Federal	Province, Territory, or Employment and Social Development Canada	Typical OSHA Some building codes



Canadian Nuclear Safety Commission

Legislation

- Nuclear Safety and Control Act

Protecting?

- People
- Environment
- National Security

Responsible Person

- Applicant Authority
- Radiation Safety Officer

Licence or Registration Required?

- Yes, licence

Person	Period	Effective Dose (mSv)
NEW (including a breastfeeding NEW and a pregnant NEW who has not informed)	1-yr dosimetry period	50
	5-yr dosimetry period	100
Pregnant NEW who has informed in writing	Balance of the pregnancy, from date of informing licensee	4
A person who is not a nuclear energy worker	1 calendar year	1



Canadian Nuclear Safety Commission

Legislation

- Nuclear Safety and Control Act

Protecting?

- People
- Environment
- National Security

Responsible Person

- Applicant Authority
- Radiation Safety Officer

Licence or Registration Required?

- Yes, licence

Organ or Tissue	Person	Period	Equivalent Dose (mSv)
Lens of an eye	NEW	1-yr dosimetry period	50
	Any other person	1 calendar year	15
Skin	NEW	1-yr dosimetry period	500
	Any other person	1 calendar year	50
Hands and feet	NEW	1-year dosimetry period	500
	Any other person	1 calendar year	50



Radiation Emitting Devices Act

Sets standards for all radiation emitting devices

- Manufacture, import, sale, resale lease of new equipment within Canada
- Devices that emit X-rays, microwaves, laser beams, radio waves
- Excludes those regulated by the CNSC and motor vehicles
- Labelling, emissions, construction, performance

The regulator is Health Canada, Radiation Protection Bureau

After initial acceptance:

- Provincial, Territorial ,or Federal jurisdiction for Federal workplaces



X-Ray Acts and Regulations

Province	Ministry / Department	Acts and Regulations
Alberta	Jobs, Economy, and Trade	Occupational Health and Safety Code AR 191/2021 Part 20
British Columbia	Labour WorkSafeBC	Occupational Health and Safety Regulation, Part 7, Division 3
Manitoba	Manitoba Labour and Immigration	Public Health Act X-Ray Safety Regulation, M.R. 341/88 R
New Brunswick	Post-Secondary Education, Training, and Labour WorkSafeNB	No specific regulation Occupational Health and Safety Act General Regulation
Newfoundland & Labrador	Employment and Labour	Radiation Health and Safety Act Radiation Health and Safety Regulations



X-Ray Acts and Regulations

Province	Ministry / Department	Acts and Regulations
Northwest Territories and Nunavut	Workers' Safety and Compensation Commission	Safety Act Northwest Territories / Nunavut Occupational Health and Safety Regulations Northwest Territories / Nunavut
Nova Scotia	Labour, Skills, and Immigration Worker's Compensation Board	No specific regulation Occupational Safety Act General Regulations Worker's Compensation Act General Regulations
Ontario	Ministry of Labour, Training, Immigration, and Skills Development Ministry of Health	Occupational Health and Safety Act Regulation 861 Regulation 420/21 Healing Arts Radiation Protection Act (HARP) Regulation 543



X-Ray Acts and Regulations

Province	Ministry / Department	Acts and Regulations
Prince Edward Island	Workforce, Advanced Learning, and Population	No specific regulation Occupational Safety Act General Regulations Worker's Compensation Act General Regulations
Québec	MSSS, Santé et Services sociaux Québec CNESST, Commission des norms, de l'équité, de la santé et de la sécurité du travail	L-0.2, r.1 Règlement d'application de la Loi sur les laboratoires médicaux et sur la conservation des organes et des tissus S-2.1, r.13 Règlement sur la santé et la sécurité du travail



X-Ray Acts and Regulations

Province	Ministry / Department	Acts and Regulations
Saskatchewan	Labour Relations and Workplace Safety	The Saskatchewan Employment Act Radiation Health and Safety Regulations
Yukon	Workers' Compensation Health and Safety Board	Occupational Health and Safety Act Radiation Protection Regulations
Federally Regulated Workplaces	Employment and Social Development Canada Health Canada's Radiation Protection Bureau	Canada Labour Code Canada Occupational Health and Safety Regulations Health Canada Safety Codes



X-Ray Regulation

Jurisdiction	Equipment Regulated
Alberta	Designated radiation equipment
British Columbia	Equipment producing ionizing radiation
Manitoba	X-ray equipment X-Ray machine
Newfoundland and Labrador	Radiation equipment
Northwest Territories	X-ray equipment Ionizing radiation equipment
Nunavut	X-ray equipment

Jurisdiction	Equipment Regulated
Ontario 861	X-ray machine X-ray source
Ontario 543	X-ray machine
Québec	d'appareils à rayons X
Saskatchewan	Ionizing radiation equipment
Yukon	X-ray equipment or source
Federally regulated Workplaces	X-ray equipment



X-Ray Regulation

Jurisdiction	Exposure Type	Registration*
Alberta	Occupational	Yes
British Columbia	Occupational	No
Manitoba	Occupational Medical	Yes
Newfoundland and Labrador	Occupational Medical	Yes
Northwest Territories	Occupational	Notification Plan submission
Nunavut	Occupational	Notification Plan submission

Jurisdiction	Exposure Type	Registration*
Ontario 861	Occupational	Yes
Ontario 543	Medical	Yes
Québec	Occupational Medical	Lab permit
Saskatchewan	Occupational Medical	Yes
Yukon	Occupational	No
Federally regulated Workplaces	Occupational Medical	No

*This refers to registration with the jurisdictional government in legislation. Some uses in some jurisdictions require registration with a professional association.



X-Ray Regulation

Jurisdiction	Health Canada Safety Code Reference
Alberta	Yes
British Columbia	Yes
Manitoba	No
Newfoundland and Labrador	No
Northwest Territories	Yes
Nunavut	Yes

Jurisdiction	Health Canada Safety Code Reference
Ontario 861	No
Ontario 543	Yes, for shielding
Québec	No
Saskatchewan	Yes
Yukon	Yes
Federally regulated Workplaces	Yes



X-Ray Regulation

Jurisdiction	Responsible for RPP
Alberta	Employer
British Columbia	Employer
Manitoba	Owner
Newfoundland and Labrador	Owner
Northwest Territories	Employer
Nunavut	Employer

Jurisdiction	Responsible for RPP
Ontario 861	Responsible Person
Ontario 543	Radiation Protection Officer
Québec	Not specific
Saskatchewan	Owner
Yukon	Owner
Federally regulated Workplaces	See applicable Safety Code

RPP = Radiation Protection Program



Designated Worker Dose Limits X-Ray

Jurisdiction	Whole Body Dose Limit
Alberta	50 mSv (1 yr) 100 mSv (5 yrs)
British Columbia	20 mSv (1 yr)
Manitoba	0.03 Gy (13 wks) 0.05 Gy (52 wks)
Newfoundland and Labrador*	3 rad (13 wks) 5 rad (52 wks)
Northwest Territories	50 mSv (1 yr) 100 mSv (5 yrs)
Nunavut	50 mSv (1 yr) 100 mSv (5 yrs)

Jurisdiction	Whole Body Dose Limit
Ontario 861	50 mSv (1 yr)
Québec*	3 rem (3 mo) 5 rem (1 yr)
Saskatchewan	50 mSv (1 yr) 100 mSv (5 yrs)
Yukon	
Federally regulated Workplaces	See applicable Safety Code

*Additional dose limits for people like medical students.



Public Dose Limits X-Ray

Jurisdiction	Whole Body Dose Limit
Alberta	1 mSv (1 yr)
British Columbia	Not directly addressed
Manitoba	0.005 Gy (1 yr)
Newfoundland and Labrador	0.5 rad (1 yr)
Northwest Territories	1 mSv (1 yr)
Nunavut	1 mSv (1 yr)

Jurisdiction	Whole Body Dose Limit
Ontario 861	5 mSv (1 yr)
Québec*	10 mrem (1 wk)
Saskatchewan	1 mSv
Yukon	
Federally regulated Workplaces	See applicable Safety Code

*Includes dose limits for workers who are not designated as working with x-rays.



Occupational Pregnancy Dose Limits X-Ray

Jurisdiction	Balance of Pregnancy
Alberta	4 mSv
British Columbia	4 mSv or dose limit under NSCA
Manitoba	0.01 Gy for pelvic and abdominal
Newfoundland and Labrador	0.5 rad for pelvic and abdominal
Northwest Territories	4 mSv
Nunavut	4 mSv

Jurisdiction	Balance of Pregnancy
Ontario 861	5 mSv during the pregnancy
Québec	1.5 rem (1 yr)
Saskatchewan	4 mSv
Yukon	0.1 rad / mo
Federally regulated Workplaces	See applicable Safety Code



Eye Dose Limits

Jurisdiction	Designated Worker	Other
Alberta	50 mSv (1 yr) 100 mSv (5 yrs)	1 mSv (1 yr)
British Columbia	50 mSv (1 yr) 100 mSv (5 yrs)	-
Manitoba*	0.08 Gy (13 wks) 0.15 Gy (52 wks)	0.015 Gy (1 yr)
Newfoundland and Labrador *	8 rad (13 wks) 15 rad (52 wks)	1.5 rads (1 yr)
Northwest Territories	150 mSv (1 yr)	15 mSv (1 yr)
Nunavut	150 mSv (1 yr)	15 mSv (1 yr)

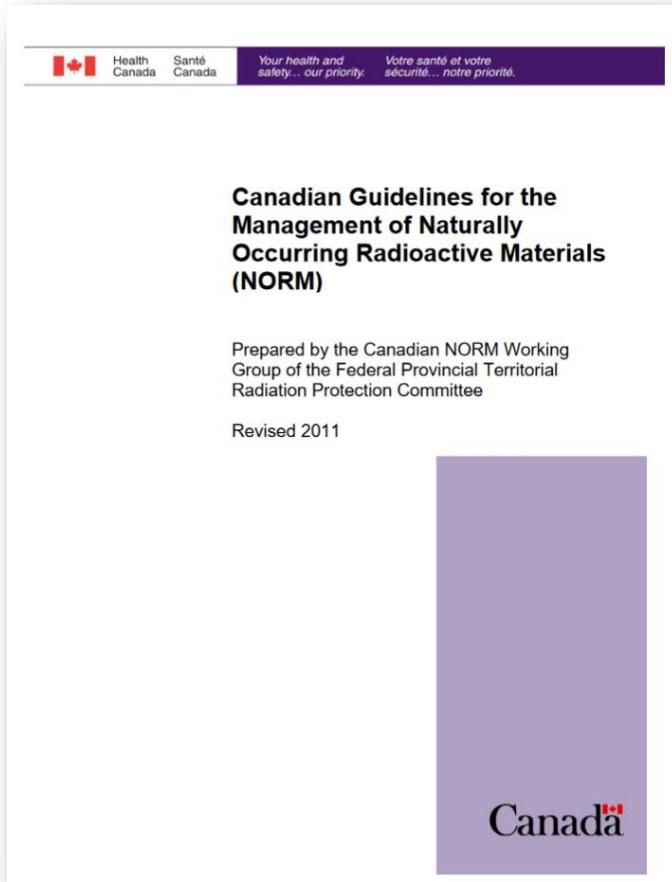
*Other single organ

Jurisdiction	Designated Worker	Other
Ontario 861	150 mSv (1 yr)	50 mSv (1 yr)
Québec	3 rem (3 mo) 5 rem (1 yr)	0.5 rem (1 yr)
Saskatchewan	Now: 150 mSv (1 yr) Aug 2024: 50 mSv (1 yr) 100 mSv (5 yrs)	15 mSv (1 yr)
Yukon		
Federally regulated Workplaces	See applicable Safety Code	

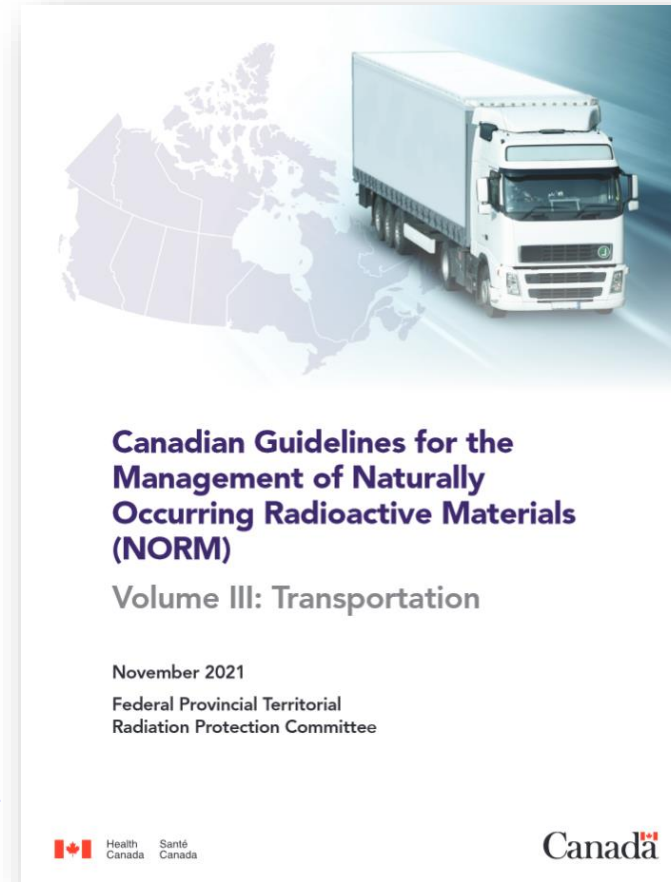


NORM

<https://www.canada.ca/en/health-canada/services/publications/health-risks-safety/canadian-guidelines-management-naturally-occurring-radioactive-materials.html>



<https://www.canada.ca/en/health-canada/services/publications/health-risks-safety/guidelines-managing-naturally-occurring-radioactive-material-volume-3-transportation.html>





From the Canadian Guidelines for the Management of Naturally Occurring Radioactive Materials (NORM)

**Table 2.1
Radiation Dose Limits**

Affected Group	Annual Effective Dose Limit (mSv)^(a)	Five Year Cumulative Dose Limit (mSv)
Occupationally Exposed Workers ^(b)	20 ^(c)	100
Incidentally Exposed Workers and Members of the Public	1	5

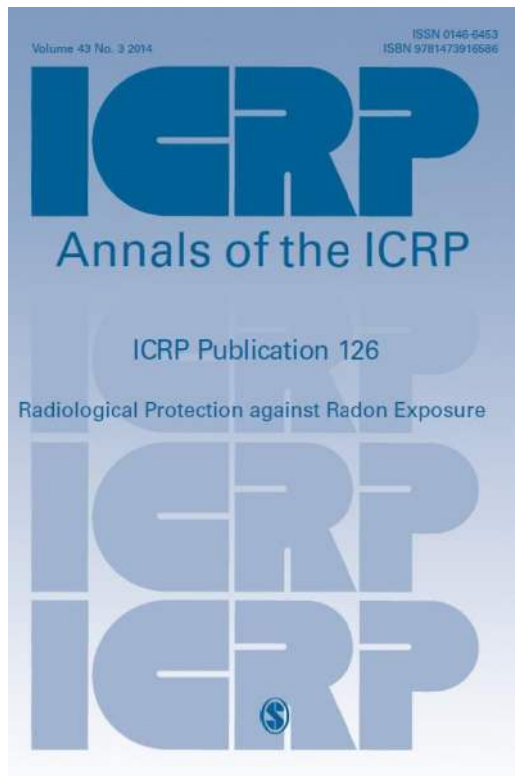
Notes

- a** These limits are exclusive of natural background and medical exposures. Refer to Appendix D for guidance on dose limit calculations.
- b** For the balance of a known pregnancy, the effective dose to an occupationally exposed worker must be limited to 4 mSv as stipulated in the "Radiation Protection Regulations", Canadian Nuclear Safety Act. This limit may differ from corresponding dose limits specified in current provincial legislation applicable for exposure to sources of x-rays..
- c** For occupationally exposed workers, a maximum dose of 50 mSv in one year is allowed, provided that the total effective dose of 100 mSv over a five-year period is maintained. This translates into an average limit of 20 mSv/a.

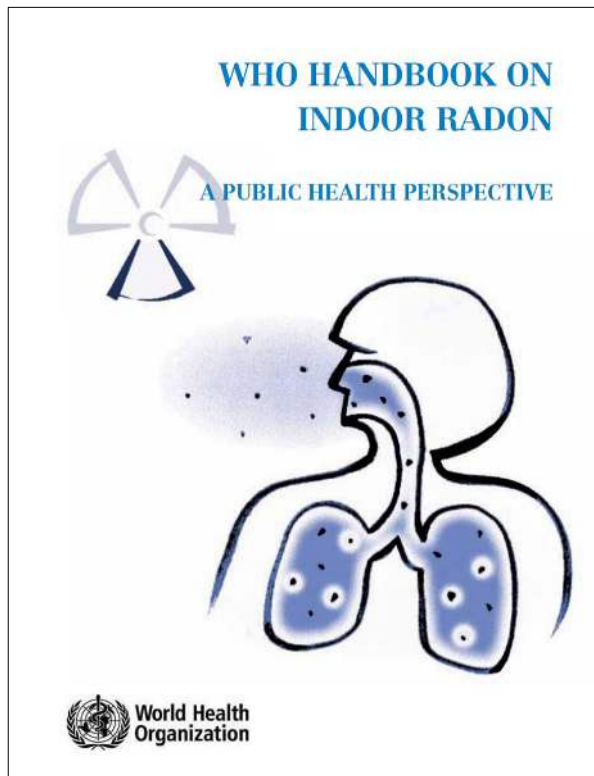
<https://www.canada.ca/en/health-canada/services/publications/health-risks-safety/canadian-guidelines-management-naturally-occurring-radioactive-materials.html>



Radon



<https://www.icrp.org/publication.asp?id=ICRP%20Publication%20126>



https://iris.who.int/bitstream/handle/10665/44149/9789241547673_eng.pdf?sequence=1



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Radon guideline

The Canadian guideline for radon is 200 becquerels per cubic metre (Bq/m³).

Health Canada collaborated with the [Federal Provincial Territorial Radiation Protection Committee \(FPTRPC\)](#) to review the health risk from exposure to radon. The risk assessment was based on scientific information and was the subject of broad public consultation. We developed the guideline for exposure to radon in indoor air using both the risk assessment and feedback obtained from the public consultation. We will review and update it as appropriate.

It's possible to reduce high levels of radon using [corrective actions](#). We recommend that:

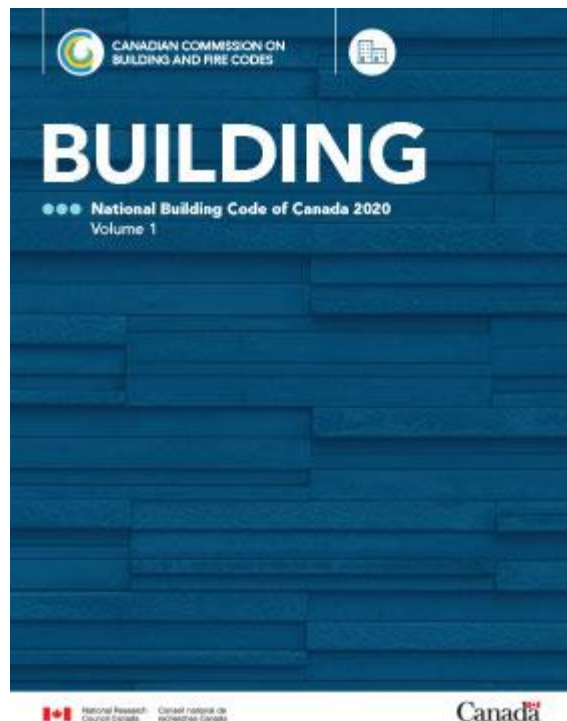
- you take corrective action if the average annual radon level exceeds 200 Bq/m³ in the normal occupancy area of a building
- you take corrective action sooner, the higher the radon level is
- the corrective action should reduce the radon concentration as much as is practicable
- the construction of new buildings use techniques that minimize radon entry and will help remove radon after the construction is finished, if necessary

<https://www.canada.ca/en/health-canada/services/environmental-workplace-health/radiation/radon/government-canada-radon-guideline.html>



Radon in Building Codes

- Summary of status of radon mitigation in building codes available on Canada.ca.
 - Soil gas barriers
 - Radon rough-in with stub
 - Passive sub-slab depressurization
 - Active sub-slab depressurization

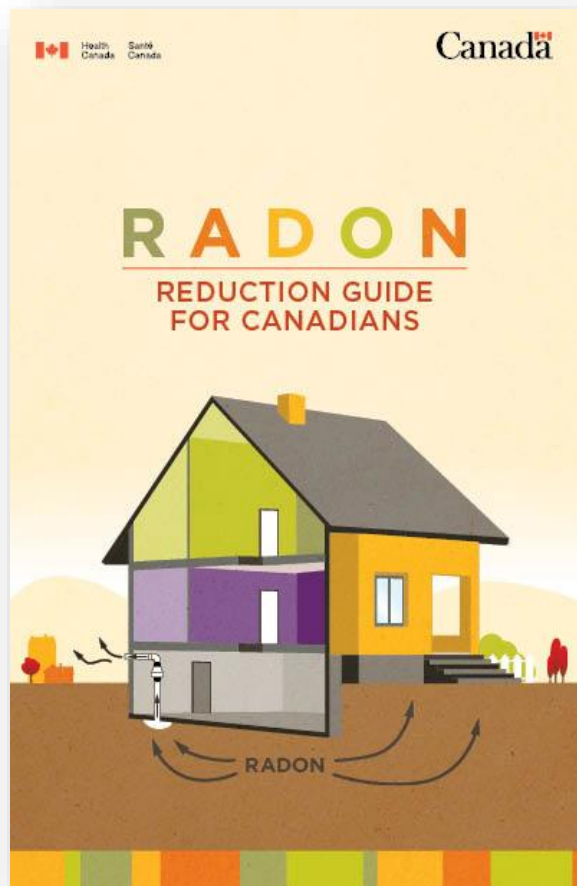


<https://nrc.canada.ca/en/certifications-evaluations-standards/codes-canada/codes-canada-publications/national-building-code-canada-2020>

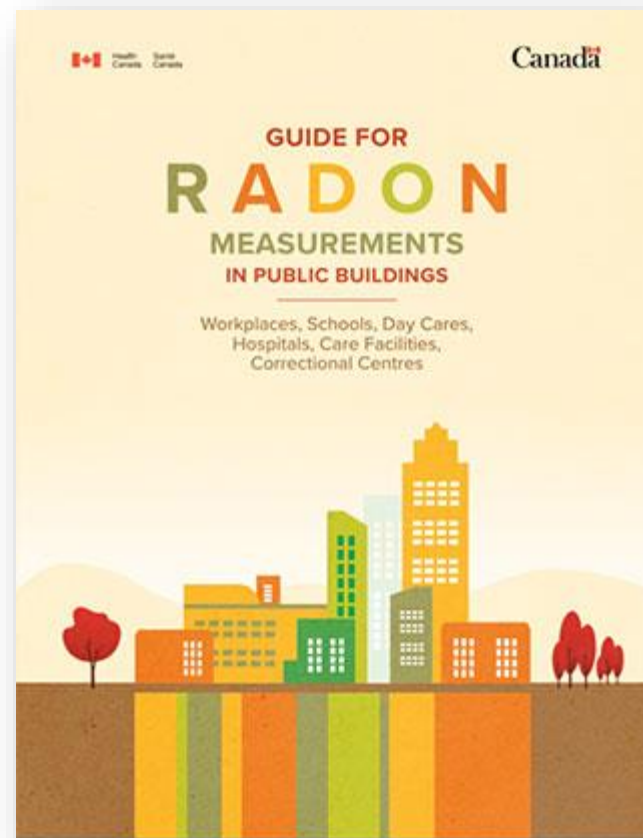


Health Canada Resources

<https://www.canada.ca/en/health-canada/services/environmental-workplace-health/reports-publications/radiation/radon-reduction-guide-canadians-health-canada.html>



<https://www.canada.ca/en/health-canada/services/environmental-workplace-health/reports-publications/radiation/guide-radon-measurements-public-buildings-schools-hospitals-care-facilities-detention-centres.html>





Questions?

- First addressing some questions sent during registration that weren't addressed in the presentation
- As time permits, we will address questions posted in the Q&A
- Questions we do not get to
 - Answers will be posted to our website and a link to resources emailed out





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Thank you for listening!

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Wellness Break

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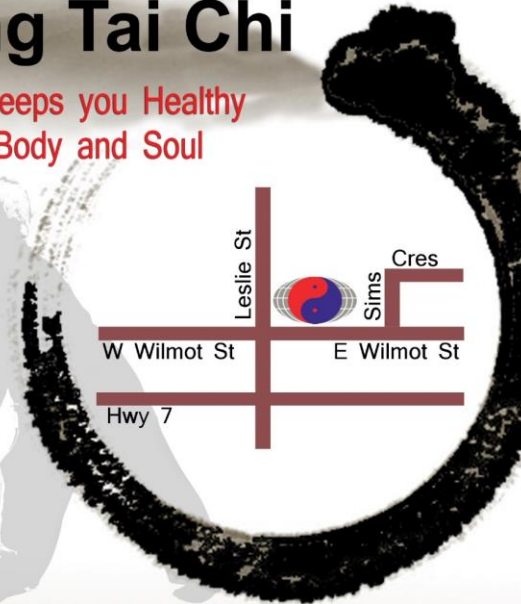
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